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One of Python’s most useful features is its interactive interpreter. It allows for very fast testing of ideas without the overhead of creating test files as is typical in most programming languages. However, the interpreter supplied with the standard Python distribution is somewhat limited for extended interactive use.

The goal of IPython is to create a comprehensive environment for interactive and exploratory computing. To support this goal, IPython has three main components:

- An enhanced interactive Python shell.
- A decoupled two-process communication model, which allows for multiple clients to connect to a computation kernel, most notably the web-based notebook provided with Jupyter.
- An architecture for interactive parallel computing now part of the ipyparallel package.

All of IPython is open source (released under the revised BSD license).

## 1.1 Enhanced interactive Python shell

IPython’s interactive shell (**ipython**), has the following goals, amongst others:

1. Provide an interactive shell superior to Python’s default. IPython has many features for tab-completion, object introspection, system shell access, command history retrieval across sessions, and its own special command system for adding functionality when working interactively. It tries to be a very efficient environment both for Python code development and for exploration of problems using Python objects (in situations like data analysis).

2. Serve as an embeddable, ready to use interpreter for your own programs. An interactive IPython shell can be started with a single call from inside another program, providing access to the current namespace. This can be very useful both for debugging purposes and for situations where a blend of batch-processing and interactive exploration are needed.

3. Offer a flexible framework which can be used as the base environment for working with other systems, with Python as the underlying bridge language. Specifically scientific environments like Mathematica, IDL and Matlab inspired its design, but similar ideas can be useful in many fields.
4. Allow interactive testing of threaded graphical toolkits. IPython has support for interactive, non-blocking control of GTK, Qt, WX, GLUT, and OS X applications via special threading flags. The normal Python shell can only do this for Tkinter applications.

1.1.1 Main features of the interactive shell

- Dynamic object introspection. One can access docstrings, function definition prototypes, source code, source files and other details of any object accessible to the interpreter with a single keystroke (? and using ?? provides additional detail).

- Searching through modules and namespaces with * wildcards, both when using the ? system and via the %psearch command.

- Completion in the local namespace, by typing TAB at the prompt. This works for keywords, modules, methods, variables and files in the current directory. This is supported via the prompt_toolkit library. Custom completers can be implemented easily for different purposes (system commands, magic arguments etc.)

- Numbered input/output prompts with command history (persistent across sessions and tied to each profile), full searching in this history and caching of all input and output.

- User-extensible ‘magic’ commands. A set of commands prefixed with % or %% is available for controlling IPython itself and provides directory control, namespace information and many aliases to common system shell commands.

- Alias facility for defining your own system aliases.

- Complete system shell access. Lines starting with ! are passed directly to the system shell, and using !! or var = !cmd captures shell output into python variables for further use.

- The ability to expand python variables when calling the system shell. In a shell command, any python variable prefixed with $ is expanded. A double $$ allows passing a literal $ to the shell (for access to shell and environment variables like PATH).

- Filesystem navigation, via a magic %cd command, along with a persistent bookmark system (using %bookmark) for fast access to frequently visited directories.

- A lightweight persistence framework via the %store command, which allows you to save arbitrary Python variables. These get restored when you run the %store -r command.

- Automatic indentation and highlighting of code as you type (through the prompt_toolkit library).

- Macro system for quickly re-executing multiple lines of previous input with a single name via the %macro command. Macros can be stored persistently via %store and edited via %edit.

- Session logging (you can then later use these logs as code in your programs). Logs can optionally timestamp all input, and also store session output (marked as comments, so the log remains valid Python source code).

- Session restoring: logs can be replayed to restore a previous session to the state where you left it.

- Verbose and colored exception traceback printouts. Easier to parse visually, and in verbose mode they produce a lot of useful debugging information (basically a terminal version of the cgitb module).

- Auto-parentheses via the %autocall command: callable objects can be executed without parentheses: sin 3 is automatically converted to sin(3)

- Auto-quoting: using ,, or ; as the first character forces auto-quoting of the rest of the line: , my_function a b becomes automatically my_function("a","b"), while ;my_function a b becomes my_function("a b").

- Extensible input syntax. You can define filters that pre-process user input to simplify input in special situations. This allows for example pasting multi-line code fragments which start with >>> or ... such as those from other python sessions or the standard Python documentation.
• **Flexible configuration system.** It uses a configuration file which allows permanent setting of all command-line options, module loading, code and file execution. The system allows recursive file inclusion, so you can have a base file with defaults and layers which load other customizations for particular projects.

• **Embeddable.** You can call IPython as a python shell inside your own python programs. This can be used both for debugging code or for providing interactive abilities to your programs with knowledge about the local namespaces (very useful in debugging and data analysis situations).

• **Easy debugger access.** You can set IPython to call up an enhanced version of the Python debugger (pdb) every time there is an uncaught exception. This drops you inside the code which triggered the exception with all the data live and it is possible to navigate the stack to rapidly isolate the source of a bug. The `%run` magic command (with the `-d` option) can run any script under pdb’s control, automatically setting initial breakpoints for you. This version of pdb has IPython-specific improvements, including tab-completion and traceback coloring support. For even easier debugger access, try `%debug` after seeing an exception.

• **Profiler support.** You can run single statements (similar to `profile.run()`) or complete programs under the profiler’s control. While this is possible with standard cProfile or profile modules, IPython wraps this functionality with magic commands (see `%prun` and `%run -p`) convenient for rapid interactive work.

• **Simple timing information.** You can use the `%timeit` command to get the execution time of a Python statement or expression. This machinery is intelligent enough to do more repetitions for commands that finish very quickly in order to get a better estimate of their running time.

```python
In [1]: %timeit 1+1
10000000 loops, best of 3: 25.5 ns per loop

In [2]: %timeit [math.sin(x) for x in range(5000)]
1000 loops, best of 3: 719 µs per loop
```

To get the timing information for more than one expression, use the `%%timeit` cell magic command.

• **Doctest support.** The special `%doctest_mode` command toggles a mode to use doctest-compatible prompts, so you can use IPython sessions as doctest code. By default, IPython also allows you to paste existing doctests, and strips out the leading `>>>` and `...` prompts in them.

### 1.2 Decoupled two-process model

IPython has abstracted and extended the notion of a traditional Read-Evaluate-Print Loop (REPL) environment by decoupling the evaluation into its own process. We call this process a kernel: it receives execution instructions from clients and communicates the results back to them.

This decoupling allows us to have several clients connected to the same kernel, and even allows clients and kernels to live on different machines. With the exclusion of the traditional single process terminal-based IPython (what you start if you run `ipython` without any subcommands), all other IPython machinery uses this two-process model. Most of this is now part of the Jupyter project, which includes jupyter console, jupyter qtconsole, and jupyter notebook.

As an example, this means that when you start jupyter qtconsole, you're really starting two processes, a kernel and a Qt-based client can send commands to and receive results from that kernel. If there is already a kernel running that you want to connect to, you can pass the `--existing` flag which will skip initiating a new kernel and connect to the most recent kernel, instead. To connect to a specific kernel once you have several kernels running, use the `%connect_info` magic to get the unique connection file, which will be something like `--existing kernel-19732.json` but with different numbers which correspond to the Process ID of the kernel.

You can read more about using jupyter qtconsole, and jupyter notebook. There is also a message spec which documents the protocol for communication between kernels and clients.
See also:
Frontend/Kernel Model example notebook

1.3 Interactive parallel computing

This functionality is optional and now part of the ipyparallel project.

1.3.1 Portability and Python requirements

As of the 2.0 release, IPython works with Python 2.7 and 3.3 or above. Version 1.0 additionally worked with Python 2.6 and 3.2. Version 0.12 was the first version to fully support Python 3.

IPython is known to work on the following operating systems:

- Linux
- Most other Unix-like OSs (AIX, Solaris, BSD, etc.)
- Mac OS X
- Windows (CygWin, XP, Vista, etc.)

See here for instructions on how to install IPython.
What's new in IPython

This section documents the changes that have been made in various versions of IPython. Users should consult these pages to learn about new features, bug fixes and backwards incompatibilities. Developers should summarize the development work they do here in a user friendly format.

2.1 5.x Series

2.1.1 IPython 5.9.0

IPython 5.9 is a release that accumulated fixes for Python 2 over the past 18 month. Please see source and version control history for more informations.

2.1.2 IPython 5.8.0

- Update inspecting function/methods for future-proofing. PR #11139

2.1.3 IPython 5.7

- Fix IPython trying to import non-existing matplotlib backends PR #11087
- fix for display hook not publishing object metadata PR #11101

2.1.4 IPython 5.6

- In Python 3.6 and above, dictionaries preserve the order items were added to them. On these versions, IPython will display dictionaries in their native order, rather than sorting by the keys (PR #10958).
- ProgressBar can now be used as an iterator (PR #10813).
• The shell object gains a `check_complete()` method, to allow a smoother transition to new input processing machinery planned for IPython 7 (PR #11044).
• IPython should start faster, as it no longer looks for all available pygments styles on startup (PR #10859).

You can see all the PR marked for the 5.6 milestone, and all the backport versions.

### 2.1.5 IPython 5.5

#### System Wide config

• IPython now looks for config files in `{sys.prefix}/etc/ipython` for environment-specific configuration.
• Startup files can be found in `/etc/ipython/startup` or `{sys.prefix}/etc/ipython/startup` in addition to the profile directory, for system-wide or env-specific startup files.

See PR #10644

#### ProgressBar

IPython now has built-in support for progressbars:

```
In[1]: from IPython.display import ProgressBar
    ...: pb = ProgressBar(100)
    ...: pb

In[2]: pb.progress = 50

# progress bar in cell 1 updates.
```

See PR #10755

#### Misc

• Fix IPython.core.display:Pretty._repr_pretty_ had the wrong signature. (PR #10625)
• `timeit` now give a correct SyntaxError if naked `return` used. (PR #10637)
• Prepare the `:ipython:` directive to be compatible with Sphinx 1.7. (PR #10668)
• Make IPython work with OpenSSL in FIPS mode; change hash algorithm of input from md5 to sha1. (PR #10696)
• Clear breakpoints before running any script with debugger. (PR #10699)
• Document that `profile` is deprecated, not to be confused with `prun`. (PR #10707)
• Limit default number of returned completions to 500. (PR #10743)

You can see all the PR marked for the 5.5 milestone, and all the backport versions.

### 2.1.6 IPython 5.4.1

Released a few hours after 5.4, fix a crash when `backports.shutil-get-terminal-size` is not installed. #10629
2.1.7 IPython 5.4

IPython 5.4-LTS is the first release of IPython after the release of the 6.x series which is Python 3 only. It backports most of the new exposed API additions made in IPython 6.0 and 6.1 and avoid having to write conditional logics depending of the version of IPython.

Please upgrade to pip 9 or greater before upgrading IPython. Failing to do so on Python 2 may lead to a broken IPython install.

Configurable TerminalInteractiveShell

Backported from the 6.x branch as an exceptional new feature. See PR #10373 and #10364
IPython gained a new `c.TerminalIPythonApp.interactive_shell_class` option that allow to customize the class used to start the terminal frontend. This should allow user to use custom interfaces, like reviving the former readline interface which is now a separate package not maintained by the core team.

Define `_repr_mimebundle_`

Object can now define `_repr_mimebundle_` in place of multiple `_repr_*` methods and return a full mime-bundle. This greatly simplify many implementation and allow to publish custom mimetypes (like geojson, plotly, dataframes...). See the Custom Display Logic example notebook for more informations.

Execution Heuristics

The heuristic for execution in the command line interface is now more biased toward executing for single statement. While in IPython 4.x and before a single line would be executed when enter is pressed, IPython 5.x would insert a new line. For single line statement this is not true anymore and if a single line is valid Python, IPython will execute it regardless of the cursor position. Use Ctrl-O to insert a new line. PR #10489

Implement Display IDs

Implement display id and ability to update a given display. This should greatly simplify a lot of code by removing the need for widgets and allow other frontend to implement things like progress-bars. See PR #10048

Display function

The `display()` function is now available by default in an IPython session, meaning users can call it on any object to see their rich representation. This should allow for better interactivity both at the REPL and in notebook environment.

Scripts and library that rely on display and may be run outside of IPython still need to import the display function using `from IPython.display import display`. See PR #10596

Miscs

- `_mp_main_` is not reloaded which fixes issues with multiprocessing. PR #10523
- Use user colorscheme in Pdb as well PR #10479
- Faster shutdown. PR #10408
- Fix a crash in reverse search. PR #10371
• added Completer.backslash_combining_completions boolean option to deactivate backslash-tab completion that may conflict with windows path.

2.1.8 IPython 5.3

Released on February 24th, 2017. Remarkable changes and fixes:

• Fix a bug in set_next_input leading to a crash of terminal IPython. PR #10231, #10296, #10229
• Always wait for editor inputhook for terminal IPython PR #10239, PR #10240
• Disable _ipython_display_ in terminal PR #10249, PR #10274
• Update terminal colors to be more visible by default on windows PR #10260, PR #10238, #10281
• Add Ctrl-Z shortcut (suspend) in terminal debugger PR #10254, #10273
• Indent on new line by looking at the text before the cursor PR #10264, PR #10275, #9283
• Update QtEventloop integration to fix some matplotlib integration issues PR #10201, PR #10311, #10201
• Respect completions display style in terminal debugger PR #10305, PR #10313
• Add a config option TerminalInteractiveShell.extra_open_editor_shortcuts to enable extra shortcuts to open the input in an editor. These are v in vi mode, and C-X C-E in emacs mode (PR #10330). The F2 shortcut is always enabled.

2.1.9 IPython 5.2.2

• Fix error when starting with IPCompleter.limit_to__all__ configured.

2.1.10 IPython 5.2.1

• Fix tab completion in the debugger. PR #10223

2.1.11 IPython 5.2

Released on January 29th, 2017. Remarkable changes and fixes:

• restore IPython’s debugger to raise on quit. PR #10009
• The configuration value c.TerminalInteractiveShell.highlighting_style can now directly take a class argument for custom color style. PR #9848
• Correctly handle matplotlib figures dpi PR #9868
• Deprecate -e flag for the %notebook magic that had no effects. PR #9872
• You can now press F2 while typing at a terminal prompt to edit the contents in your favourite terminal editor. Set the EDITOR environment variable to pick which editor is used. PR #9929
• sdists will now only be .tar.gz as per upstream PyPI requirements. PR #9925
• IPython.core.debugger have gained a set_trace() method for convenience. PR #9947
• The ‘smart command mode’ added to the debugger in 5.0 was removed, as more people preferred the previous behaviour. Therefore, debugger commands such as c will act as debugger commands even when c is defined as a variable. PR #10050
• Fixes OS X event loop issues at startup. PR #10150
• Deprecate the %autoindent magic. PR #10176
• Emit a DeprecationWarning when setting the deprecated limit_to_all option of the completer. PR #10198
• The capture magic can now capture the result of a cell (from an expression on the last line), as well as printed and displayed output. PR #9851.

Changes of behavior to InteractiveShellEmbed.

InteractiveShellEmbed interactive behavior have changed a bit in between 5.1 and 5.2. By default %kill_embedded magic will prevent further invocation of the current call location instead of preventing further invocation of the current instance creation location. For most use case this will not change much for you, though previous behavior was confusing and less consistent with previous IPython versions.

You can now deactivate instances by using %kill_embedded --instance flag, (or -i in short). The %kill_embedded magic also gained a --yes/-y option which skip confirmation step, and -x/--exit which also exit the current embedded call without asking for confirmation.

See PR #10207.

2.1.12 IPython 5.1

• Broken %timeit on Python2 due to the use of __qualname__. PR #9804
• Restore %gui qt to create and return a QApplication if necessary. PR #9789
• Don’t set terminal title by default. PR #9801
• Preserve indentation when inserting newlines with Ctrl-O. PR #9770
• Restore completion in debugger. PR #9785
• Deprecate IPython.core.debugger.Tracer() in favor of simpler, newer, APIs. PR #9731
• Restore NoOpContext context manager removed by mistake, and add DeprecationWarning. PR #9765
• Add option allowing Prompt_toolkit to use 24bits colors. PR #9736
• Fix for closing interactive matplotlib windows on OS X. PR #9854
• An embedded interactive shell instance can be used more than once. PR #9843
• More robust check for whether IPython is in a terminal. PR #9833
• Better pretty-printing of dicts on PyPy. PR #9827
• Some coloured output now looks better on dark background command prompts in Windows. PR #9838
• Improved tab completion of paths on Windows. PR #9826
• Fix tkinter event loop integration on Python 2 with future installed. PR #9824
• Restore Ctrl-\ as a shortcut to quit IPython.
• Make get_ipython() accessible when modules are imported by startup files. PR #9818
• Add support for running directories containing a __main__.py file with the ipython command. PR #9813

2.1. 5.x Series
**True Color feature**

`prompt_toolkit` uses pygments styles for syntax highlighting. By default, the colors specified in the style are approximated using a standard 256-color palette. `prompt_toolkit` also supports 24bit, a.k.a. “true”, a.k.a. 16-million color escape sequences which enable compatible terminals to display the exact colors specified instead of an approximation. This `true_color` option exposes that capability in `prompt_toolkit` to the IPython shell.

Here is a good source for the current state of true color support in various terminal emulators and software projects: https://gist.github.com/XVilka/8346728

### 2.1.13 IPython 5.0

Released July 7, 2016

**New terminal interface**

IPython 5 features a major upgrade to the terminal interface, bringing live syntax highlighting as you type, proper multiline editing and multiline paste, and tab completions that don’t clutter up your history.

These features are provided by the Python library `prompt_toolkit`, which replaces `readline` throughout our terminal interface.

Relying on this pure-Python, cross platform module also makes it simpler to install IPython. We have removed dependencies on `pyreadline` for Windows and `gnureadline` for Mac.

**Backwards incompatible changes**

- The `%install_ext` magic function, deprecated since 4.0, has now been deleted. You can distribute and install extensions as packages on PyPI.

- Callbacks registered while an event is being handled will now only be called for subsequent events; previously they could be called for the current event. Similarly, callbacks removed while handling an event will always get that event. See #9447 and PR #9453.

- Integration with pydb has been removed since pydb development has been stopped since 2012, and pydb is not installable from PyPI.
The autoedit_syntax option has apparently been broken for many years. It has been removed.

**New terminal interface**

The overhaul of the terminal interface will probably cause a range of minor issues for existing users. This is inevitable for such a significant change, and we’ve done our best to minimise these issues. Some changes that we’re aware of, with suggestions on how to handle them:

IPython no longer uses readline configuration (~/.inputrc). We hope that the functionality you want (e.g. vi input mode) will be available by configuring IPython directly (see Terminal IPython options). If something’s missing, please file an issue.

The PromptManager class has been removed, and the prompt machinery simplified. See Custom Prompts to customise prompts with the new machinery.

IPython.core.debugger now provides a plainer interface. IPython.terminal.debugger contains the terminal debugger using prompt_toolkit.

There are new options to configure the colours used in syntax highlighting. We have tried to integrate them with our classic --colors option and %colors magic, but there’s a mismatch in possibilities, so some configurations may produce unexpected results. See Terminal Colors for more information.

The new interface is not compatible with Emacs ‘inferior-shell’ feature. To continue using this, add the --simple-prompt flag to the command Emacs runs. This flag disables most IPython features, relying on Emacs to provide things like tab completion.

**Provisional Changes**

Provisional changes are experimental functionality that may, or may not, make it into a future version of IPython, and which API may change without warnings. Activating these features and using these API are at your own risk, and may have security implication for your system, especially if used with the Jupyter notebook.

When running via the Jupyter notebook interfaces, or other compatible client, you can enable rich documentation experimental functionality:

When the docrepr package is installed setting the boolean flag InteractiveShell.sphinxify_docstring to True, will process the various object through sphinx before displaying them (see the docrepr package documentation for more information.

You need to also enable the IPython pager display rich HTML representation using the InteractiveShell.enable_html_pager boolean configuration option. As usual you can set these configuration options globally in your configuration files, alternatively you can turn them on dynamically using the following snippet:

```python
ip = get_ipython()
ip.sphinxify_docstring = True
ip.enable_html_pager = True
```

You can test the effect of various combinations of the above configuration in the Jupyter notebook, with things example like:

```python
import numpy as np
np.histogram?
```

This is part of an effort to make Documentation in Python richer and provide in the long term if possible dynamic examples that can contain math, images, widgets... As stated above this is nightly experimental feature with a lot of (fun) problem to solve. We would be happy to get your feedback and expertise on it.
Deprecated Features

Some deprecated features are listed in this section. Don’t forget to enable `DeprecationWarning` as an error if you are using IPython in a Continuous Integration setup or in your testing in general:

```python
import warnings
warnings.filterwarnings('error', '.*', DeprecationWarning, module='yourmodule.*')
```

- `hooks.fix_error_editor` seems unused and is pending deprecation.
- `IPython.core/excolors.py:ExceptionColors` is deprecated.
- `IPython.core.InteractiveShell:write()` is deprecated; use `sys.stdout` instead.
- `IPython.core.InteractiveShell:write_err()` is deprecated; use `sys.stderr` instead.
- The `formatter` keyword argument to `Inspector.info` in `IPython.core.oinspect` has no effect.
- The `global_ns` keyword argument of IPython Embed was deprecated, and has no effect. Use `module` keyword argument instead.

Known Issues:

- `<Esc>` Key does not dismiss the completer and does not clear the current buffer. This is an on purpose modification due to current technical limitation. Cf PR #9572. Escape the control character which is used for other shortcut, and there is no practical way to distinguish. Use Ctr-G or Ctrl-C as an alternative.
- Cannot use `Shift-Enter` and `Ctrl-Enter` to submit code in terminal. Cf #9587 and #9401. In terminal there is no practical way to distinguish these key sequences from a normal new line return.
- `PageUp` and `pageDown` do not move through completion menu.
- Color styles might not adapt to terminal emulator themes. This will need new version of Pygments to be released, and can be mitigated with custom themes.

2.2 Issues closed in the 5.x development cycle

2.2.1 Issues closed in 5.6

GitHub stats for 2017/09/15 - 2018/04/02 (tag: 5.5.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 2 issues and merged 28 pull requests. The full list can be seen on GitHub

The following 10 authors contributed 47 commits.

- Benjamin Ragan-Kelley
- Henry Fredrick Schreiner
- Joris Van den Bossche
- Matthias Bussonnier
- Mradul Dubey
- Roshan Rao
- Samuel Lelièvre
• Teddy Rendahl
• Thomas A Caswell
• Thomas Kluyver

2.2.2 Issues closed in 5.5

GitHub stats for 2017/06/01 - 2017/09/15 (tag: 5.4.1)
These lists are automatically generated, and may be incomplete or contain duplicates.
We closed 5 issues and merged 43 pull requests. The full list can be seen on GitHub
The following 13 authors contributed 59 commits.
• Benjamin Ragan-Kelley
• Eren Halici
• Jeroen Demeyer
• jfbu
• Kyle Kelley
• Marius van Niekerk
• Matthias Bussonnier
• pepie34
• Ritesh Kadmawala
• ryan thielke
• Srinath
• Thomas A Caswell
• Thomas Kluyver

2.2.3 Issues closed in 5.4

GitHub stats for 2017/02/24 - 2017/05/30 (tag: 5.3.0)
These lists are automatically generated, and may be incomplete or contain duplicates.
We closed 8 issues and merged 43 pull requests. The full list can be seen on GitHub
The following 11 authors contributed 64 commits.
• Benjamin Ragan-Kelley
• Carol Willing
• Kyle Kelley
• Leo Singer
• Luke Pfister
• Lumir Balhar
• Matthias Bussonnier
• meeseeksdev[bot]
2.2.4 Issues closed in 5.3

GitHub stats for 2017/02/24 - 2017/05/30 (tag: 5.3.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 6 issues and merged 28 pull requests. The full list can be seen on GitHub

The following 11 authors contributed 53 commits.

- Benjamin Ragan-Kelley
- Carol Willing
- Justin Jent
- Kyle Kelley
- Lumir Balhar
- Matthias Bussonnier
- meeseeksdev[bot]
- Segev Finer
- Steven Maude
- Thomas A Caswell
- Thomas Kluyver

2.2.5 Issues closed in 5.2

GitHub stats for 2016/08/13 - 2017/01/29 (tag: 5.1.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 30 issues and merged 74 pull requests. The full list can be seen on GitHub

The following 40 authors contributed 434 commits.

- Adam Eury
- anantkaushik89
- anatoly techtonik
- Benjamin Ragan-Kelley
- Bibo Hao
- Carl Smith
- Carol Willing
- Chilaka Ramakrishna
- Christopher Welborn
- Denis S. Tereshchenko
• Diego Garcia
• fatData
• Fermi paradox
• Fernando Perez
• fuho
• Hassan Kibirige
• Jamshed Vesuna
• Jens Hedegaard Nielsen
• Jeroen Demeyer
• kaushikanant
• Kenneth Hoste
• Keshav Ramaswamy
• Kyle Kelley
• Matteo
• Matthias Bussonnier
• mbyt
• memeplex
• Moez Bouhlel
• Pablo Galindo
• Paul Ivanov
• pietvo
• Piotr Przetacznik
• Rounak Banik
• sachet-mittal
• Srinivas Reddy Thatiparthi
• Tamir Bahar
• Thomas A Caswell
• Thomas Kluyver
• tillahoffmann
• Yuri Numerov

2.2.6 Issues closed in 5.1

GitHub stats for 2016/07/08 - 2016/08/13 (tag: 5.0.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 33 issues and merged 43 pull requests. The full list can be seen on GitHub

The following 17 authors contributed 129 commits.

2.2. Issues closed in the 5.x development cycle
2.2.7 Issues closed in 5.0

GitHub stats for 2016/07/05 - 2016/07/07 (tag: 5.0.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 95 issues and merged 191 pull requests. The full list can be seen on GitHub.

The following 27 authors contributed 229 commits.

- Adam Greenhall
- Adrian
- Antony Lee
- Benjamin Ragan-Kelley
- Carlos Cordoba
- Carol Willing
- Chris
- Craig Citro
- Dmitry Zotikov
- Fernando Perez
- Gil Forsyth
- Jason Grout
- Jonathan Frederic
2.3 4.x Series

2.3.1 IPython 4.2

IPython 4.2 (April, 2016) includes various bugfixes and improvements over 4.1.

- Fix `ipython -i` on errors, which was broken in 4.1.
- The delay meant to highlight deprecated commands that have moved to jupyter has been removed.
- Improve compatibility with future versions of traitlets and matplotlib.
- Use stdlib `shutil.get_terminal_size()` to measure terminal width when displaying tracebacks (provided by `backports.shutil_get_terminal_size` on Python 2).

You can see the rest on GitHub.

2.3.2 IPython 4.1

IPython 4.1.2 (March, 2016) fixes installation issues with some versions of setuptools.

Released February, 2016. IPython 4.1 contains mostly bug fixes, though there are a few improvements.

- IPython debugger (IPdb) now supports the number of context lines for the `where` (and `w`) commands. The `context` keyword is also available in various APIs. See PR #9097
- YouTube video will now show thumbnail when exported to a media that do not support video. (PR #9086)
- Add warning when running `ipython <subcommand>` when subcommand is deprecated. `jupyter` should now be used.
- Code in `%pinfo` (also known as `??`) are now highlighter (PR #8947)
- `%aimport` now support module completion. (PR #8884)
- `ipdb` output is now colored! (PR #8842)
• Add ability to transpose columns for completion: (PR #8748)

Many many docs improvements and bug fixes, you can see the list of changes

2.3.3 IPython 4.0

Released August, 2015

IPython 4.0 is the first major release after the Big Split. IPython no longer contains the notebook, qtconsole, etc. which have moved to jupyter. IPython subprojects, such as IPython.parallel and widgets have moved to their own repos as well.

The following subpackages are deprecated:

• IPython.kernel (now jupyter_client and ipykernel)
• IPython.consoleapp (now jupyter_client.consoleapp)
• IPython.nbformat (now nbformat)
• IPython.nbconvert (now nbconvert)
• IPython.html (now notebook)
• IPython.parallel (now ipyparallel)
• IPython.utils.traitlets (now traitlets)
• IPython.config (now traitlets.config)
• IPython.qt (now qtconsole)
• IPython.terminal.console (now jupyter_console)

and a few other utilities.

Shims for the deprecated subpackages have been added, so existing code should continue to work with a warning about the new home.

There are few changes to the code beyond the reorganization and some bugfixes.

IPython highlights:

• Public APIs for discovering IPython paths is moved from IPython.utils.path to IPython.paths. The old function locations continue to work with deprecation warnings.
• Code raising DeprecationWarning entered by the user in an interactive session will now display the warning by default. See PR #8480 an #8478.
• The --deep-reload flag and the corresponding options to inject dreload or reload into the interactive namespace have been deprecated, and will be removed in future versions. You should now explicitly import reload from IPython.lib.deepreload to use it.

2.4 Issues closed in the 4.x development cycle

2.4.1 Issues closed in 4.2

GitHub stats for 2015/02/02 - 2016/04/20 (since 4.1)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 10 issues and merged 22 pull requests. The full list can be seen on GitHub
The following 10 authors contributed 27 commits.

- Benjamin Ragan-Kelley
- Carlos Cordoba
- Gökhan Karabulut
- Jonas Rauber
- Matthias Bussonnier
- Paul Ivanov
- Sebastian Bank
- Thomas A Caswell
- Thomas Kluyver
- Vincent Woo

### 2.4.2 Issues closed in 4.1

GitHub stats for 2015/08/12 - 2016/02/02 (since 4.0.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 60 issues and merged 148 pull requests. The full list can be seen on GitHub

The following 52 authors contributed 468 commits.

- Aaron Meurer
- Alexandre Avanian
- Anthony Sottile
- Antony Lee
- Arthur Loder
- Ben Kasel
- Ben Rousch
- Benjamin Ragan-Kelley
- bollwyvl
- Carol Willing
- Christopher Roach
- Douglas La Rocca
- Fairly
- Fernando Perez
- Frank Sachsenheim
- Guillaume DOUMENC
- Gábor Luk
- Hoyt Koepke
- Ivan Timokhin

**2.4. Issues closed in the 4.x development cycle**
• Jacob Niehus
• JamshedVesuna
• Jan Schulz
• Jan-Philip Gehrcke
• jc
• Jessica B. Hamrick
• jferrara
• John Bohannon
• John Kirkham
• Jonathan Frederic
• Kyle Kelley
• Lev Givon
• Lilian Besson
• lingxz
• Matthias Bussonnier
• memeplex
• Michael Droettboom
• naught101
• Peter Waller
• Pierre Gerold
• Rémy Léone
• Scott Sanderson
• Shanzhuo Zhang
• Sylvain Corlay
• Tayfun Sen
• Thomas A Caswell
• Thomas Ballinger
• Thomas Kluyver
• Vincent Legoll
• Wouter Bolsterlee
• xconverge
• Yuri Numerov
• Zachary Pincus
2.4.3 Issues closed in 4.0

GitHub stats for 2015/02/27 - 2015/08/11 (since 3.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 35 issues and merged 125 pull requests. The full list can be seen on GitHub.

The following 69 authors contributed 1186 commits.

- Abe Guerra
- Adal Chiriliuc
- Alexander Belopolsky
- Andrew Murray
- Antonio Russo
- Benjamin Ragan-Kelley
- Björn Linse
- Brian Drawert
- chebee7i
- Daniel Rocco
- Donny Winston
- Drekin
- Erik Hvatum
- Fernando Perez
- Francisco de la Peña
- Frazer McLean
- Gareth Elston
- Gert-Ludwig Ingold
- Giuseppe Venturini
- Ian Barfield
- Ivan Pozdeev
- Jakob Gager
- Jan Schulz
- Jason Grout
- Jeff Hussmann
- Jessica B. Hamrick
- Joe Borg
- Joel Nothman
- Johan Forsberg
- Jonathan Frederic
- Justin Tyberg
• Koen van Besien
• Kyle Kelley
• Lorena Pantano
• Lucretiel
• Marin Gilles
• mashenjun
• Mathieu
• Matthias Bussonnier
• Merlijn van Deen
• Mikhail Korobov
• Naveen Nathan
• Nicholas Bollweg
• nottaanibot
• Omer Katz
• onesandzeroes
• Patrick Snape
• patter001
• Peter Parente
• Pietro Battiston
• RickWinters
• Robert Smith
• Ryan Nelson
• Scott Sanderson
• Sebastiaan Mathot
• Sylvain Corlay
• thehomask
• Thomas A Caswell
• Thomas Adriaan Hellinger
• Thomas Kluyver
• Tianhui Michael Li
• tmtabor
• unknown
• Victor Ramirez
• Volker Braun
• Wieland Hoffmann
• Yuval Langer
• Zoltán Vörös
• Élie Michel

2.5 3.x Series

2.5.1 IPython 3.2.3

Fixes compatibility with Python 3.4.4.

2.5.2 IPython 3.2.2

Address vulnerabilities when files have maliciously crafted filenames (CVE-2015-6938), or vulnerability when opening text files with malicious binary content (CVE pending).

Users are strongly encouraged to upgrade immediately. There are also a few small unicode and nbconvert-related fixes.

2.5.3 IPython 3.2.1

IPython 3.2.1 is a small bugfix release, primarily for cross-site security fixes in the notebook. Users are strongly encouraged to upgrade immediately. There are also a few small unicode and nbconvert-related fixes.

See Issues closed in the 3.x development cycle for details.

2.5.4 IPython 3.2

IPython 3.2 contains important security fixes. Users are strongly encouraged to upgrade immediately.

Highlights:

• Address cross-site scripting vulnerabilities CVE-2015-4706, CVE-2015-4707
• A security improvement that set the secure attribute to login cookie to prevent them to be sent over http
• Revert the face color of matplotlib axes in the inline backend to not be transparent.
• Enable mathjax safe mode by default
• Fix XSS vulnerability in JSON error messages
• Various widget-related fixes

See Issues closed in the 3.x development cycle for details.

2.5.5 IPython 3.1

Released April 3, 2015

The first 3.x bugfix release, with 33 contributors and 344 commits. This primarily includes bugfixes to notebook layout and focus problems.

Highlights:

• Various focus jumping and scrolling fixes in the notebook.
• Various message ordering and widget fixes in the notebook.

• Images in markdown and output are confined to the notebook width. An .unconfined CSS class is added to disable this behavior per-image. The resize handle on output images is removed.

• Improved ordering of tooltip content for Python functions, putting the signature at the top.

• Fix UnicodeErrors when displaying some objects with unicode reprs on Python 2.

• Set the kernel’s working directory to the notebook directory when running nbconvert --execute, so that behavior matches the live notebook.

• Allow setting custom SSL options for the tornado server with NotebookApp.ssl_options, and protect against POODLE with default settings by disabling SSLv3.

• Fix memory leak in the IPython.parallel Controller on Python 3.

See Issues closed in the 3.x development cycle for details.

2.5.6 Release 3.0

Released February 27, 2015

This is a really big release. Over 150 contributors, and almost 6000 commits in a bit under a year. Support for languages other than Python is greatly improved, notebook UI has been significantly redesigned, and a lot of improvement has happened in the experimental interactive widgets. The message protocol and document format have both been updated, while maintaining better compatibility with previous versions than prior updates. The notebook webapp now enables editing of any text file, and even a web-based terminal (on Unix platforms).

3.x will be the last monolithic release of IPython, as the next release cycle will see the growing project split into its Python-specific and language-agnostic components. Language-agnostic projects (notebook, qtconsole, etc.) will move under the umbrella of the new Project Jupyter name, while Python-specific projects (interactive Python shell, Python kernel, IPython.parallel) will remain under IPython, and be split into a few smaller packages. To reflect this, IPython is in a bit of a transition state. The logo on the notebook is now the Jupyter logo. When installing kernels system-wide, they go in a jupyter directory. We are going to do our best to ease this transition for users and developers.

Big changes are ahead.
Using different kernels

You can now choose a kernel for a notebook within the user interface, rather than starting up a separate notebook server for each kernel you want to use. The syntax highlighting adapts to match the language you’re working in.

Information about the kernel is stored in the notebook file, so when you open a notebook, it will automatically start the correct kernel.

It is also easier to use the Qt console and the terminal console with other kernels, using the –kernel flag:

```bash
ipython qtconsole --kernel bash
ipython console --kernel bash

# To list available kernels
ipython kernelspec list
```

Kernel authors should see Kernel specs for how to register their kernels with IPython so that these mechanisms work.
Typing unicode identifiers

Complex expressions can be much cleaner when written with a wider choice of characters. Python 3 allows unicode identifiers, and IPython 3 makes it easier to type those, using a feature from Julia. Type a backslash followed by a LaTeX style short name, such as \alpha. Press tab, and it will turn into $\alpha$.

Widget migration guide

The widget framework has a lot of backwards incompatible changes. For information about migrating widget notebooks and custom widgets to 3.0 refer to the widget migration guide.

Other new features

- TextWidget and TextareaWidget objects now include a placeholder attribute, for displaying placeholder text before the user has typed anything.
- The load magic can now find the source for objects in the user namespace. To enable searching the namespace, use the -n option.

```
In [1]: %load -n my_module.some_function
```

- DirectView objects have a new use_cloudpickle() method, which works like view.use_dill(), but causes the cloudpickle module from PiCloud’s cloud library to be used rather than dill or the builtin pickle module.
- Added a .ipynb exporter to nbconvert. It can be used by passing --to notebook as a commandline argument to nbconvert.
- New nbconvert preprocessor called ClearOutputPreprocessor. This clears the output from IPython notebooks.
- New preprocessor for nbconvert that executes all the code cells in a notebook. To run a notebook and save its output in a new notebook:

```
ipython nbconvert InputNotebook --ExecutePreprocessor.enabled=True --to notebook -o output Executed
```

- Consecutive stream (stdout/stderr) output is merged into a single output in the notebook document. Previously, all output messages were preserved as separate output fields in the JSON. Now, the same merge is applied to the stored output as the displayed output, improving document load time for notebooks with many small outputs.

- NotebookApp.webapp_settings is deprecated and replaced with the more informatively named NotebookApp.tornado_settings.
- Using timeit prints warnings if there is atleast a 4x difference in timings between the slowest and fastest runs, since this might meant that the multiple runs are not independent of one another.
• It’s now possible to provide mechanisms to integrate IPython with other event loops, in addition to the ones we already support. This lets you run GUI code in IPython with an interactive prompt, and to embed the IPython kernel in GUI applications. See Integrating with GUI event loops for details. As part of this, the direct enable_* and disable_* functions for various GUIs in IPython.lib.inputhook have been deprecated in favour of enable_gui() and disable_gui().

• A ScrollManager was added to the notebook. The ScrollManager controls how the notebook document is scrolled using keyboard. Users can inherit from the ScrollManager or TargetScrollManager to customize how their notebook scrolls. The default ScrollManager is the SlideScrollManager, which tries to scroll to the nearest slide or sub-slide cell.

• The function interact_manual() has been added which behaves similarly to interact(), but adds a button to explicitly run the interacted-with function, rather than doing it automatically for every change of the parameter widgets. This should be useful for long-running functions.

• The %cython magic is now part of the Cython module. Use %load_ext Cython with a version of Cython >= 0.21 to have access to the magic now.

• The Notebook application now offers integrated terminals on Unix platforms, intended for when it is used on a remote server. To enable these, install the terminado Python package.

• The Notebook application can now edit any plain text files, via a full-page CodeMirror instance.

• Setting the default highlighting language for nbconvert with the config option NbConvertBase.default_language is deprecated. Nbconvert now respects metadata stored in the kernel spec.

• IPython can now be configured systemwide, with files in /etc/ipython or /usr/local/etc/ipython on Unix systems, or %PROGRAMDATA%\ipython on Windows.

• Added support for configurable user-supplied Jinja HTML templates for the notebook. Paths to directories containing template files can be specified via NotebookApp.extra_template_paths. User-supplied template directories searched first by the notebook, making it possible to replace existing templates with your own files.

For example, to replace the notebook’s built-in error.html with your own, create a directory like /home/my_templates and put your override template at /home/my_templates/error.html. To start the notebook with your custom error page enabled, you would run:

ipython notebook --extra_template_paths="[/home/my_templates/]"

It’s also possible to override a template while also inheriting from that template, by prepending templates/ to the {% extends %} target of your child template. This is useful when you only want to override a specific block of a template. For example, to add additional CSS to the built-in error.html, you might create an override that looks like:

{% extends "templates/error.html" %}

{% block stylesheet %}
{{super()}}
<style type="text/css">
/* My Awesome CSS */
</style>
{% endblock %}

• Added a widget persistence API. This allows you to persist your notebooks interactive widgets. Two levels of control are provided: 1. Higher level- WidgetManager.set_state_callbacks allows you to register callbacks for loading and saving widget state. The callbacks you register are automatically called when necessary. 2. Lower level- the WidgetManager Javascript class now has get_state and set_state methods that allow you to get and set the state of the widget runtime.
Example code for persisting your widget state to session data:

```javascript
%%javascript
require(['widgets/js/manager'], function(manager) {
    manager.WidgetManager.set_state_callbacks(function() { // Load
        return JSON.parse(sessionStorage.widgets_state || '{}');
    }, function(state) { // Save
        sessionStorage.widgets_state = JSON.stringify(state);
    });
});
```

- Enhanced support for `env` magic. As before, `env` with no arguments displays all environment variables and values. Additionally, `env` can be used to get or set individual environment variables. To display an individual value, use the `%%env var` syntax. To set a value, use `env var=val` or `env var=val`. Python value expansion using `$` works as usual.

**Backwards incompatible changes**

- The message protocol has been updated from version 4 to version 5. Adapters are included, so IPython frontends can still talk to kernels that implement protocol version 4.

- The notebook format has been updated from version 3 to version 4. Read-only support for v4 notebooks has been backported to IPython 2.4. Notable changes:
  - heading cells are removed in favor of markdown headings
  - notebook outputs and output messages are more consistent with each other
  - use `IPython.nbformat.read()` and `write()` to read and write notebook files instead of the deprecated `IPython.nbformat.current` APIs.

You can downgrade a notebook to v3 via nbconvert:

```
ipython nbconvert --to notebook --nbformat 3 <notebook>
```

which will create `notebook.v3.ipynb`, a copy of the notebook in v3 format.

- `IPython.core.oinspect.getsource()` call specification has changed:
  - `oname` keyword argument has been added for property source formatting
  - `is_binary` keyword argument has been dropped, passing `True` had previously short-circuited the function to return `None` unconditionally

- Removed the octavemagic extension: it is now available as `oct2py.ipython`.

- Creating PDFs with LaTeX no longer uses a post processor. Use `nbconvert --to pdf` instead of `nbconvert --to latex --post pdf`.

- Used https://github.com/jdfreder/bootstrap2to3 to migrate the Notebook to Bootstrap 3.

Additional changes:

- Set `.tab-content .row 0px;` left and right margin (bootstrap default is `-15px;`)
- Removed `height: @btn_mini_height;` from `.list_header>div, .list_item>div`
- Set `#header div margin-bottom: 0px;`
- Set `#menus to float: left;`
- Set `#maintoolbar .navbar-text to float: none;`
– Added no-padding convenience class.
– Set border of #maintoolbar to 0px

• Accessing the container DOM object when displaying javascript has been deprecated in IPython 2.0 in favor of accessing element. Starting with IPython 3.0 trying to access container will raise an error in browser javascript console.
• IPython.utils.py3compat.open was removed: io.open() provides all the same functionality.
• The NotebookManager and /api/notebooks service has been replaced by a more generic ContentsManager and /api/contents service, which supports all kinds of files.
• The Dashboard now lists all files, not just notebooks and directories.
• The --script hook for saving notebooks to Python scripts is removed, use ipython nbconvert --to python notebook instead.
• The rmagic extension is deprecated, as it is now part of rpy2. See rpy2.ipython.rmagic.
• start_kernel() and format_kernel_cmd() no longer accept a executable parameter. Use the kernelspec machinery instead.
• The widget classes have been renamed from *Widget to *. The old names are still functional, but are deprecated. i.e. IntSliderWidget has been renamed to IntSlider.
• The ContainerWidget was renamed to Box and no longer defaults as a flexible box in the web browser. A new FlexBox widget was added, which allows you to use the flexible box model.
• The notebook now uses a single websocket at /kernels/<kernel-id>/channels instead of separate /kernels/<kernel-id>/{shell|iopub|stdin} channels. Messages on each channel are identified by a channel key in the message dict, for both send and recv.

Content Security Policy

The Content Security Policy is a web standard for adding a layer of security to detect and mitigate certain classes of attacks, including Cross Site Scripting (XSS) and data injection attacks. This was introduced into the notebook to ensure that the IPython Notebook and its APIs (by default) can only be embedded in an iframe on the same origin.

Override headers['Content-Security-Policy'] within your notebook configuration to extend for alternate domains and security settings:

```python
c.NotebookApp.tornado_settings = {
    'headers': {
        'Content-Security-Policy': "frame-ancestors 'self'"
    }
}
```

Example policies:

```
Content-Security-Policy: default-src 'self' https://*.jupyter.org
```

Matches embeddings on any subdomain of jupyter.org, so long as they are served over SSL.

There is a report-uri endpoint available for logging CSP violations, located at /api/security/csp-report. To use it, set report-uri as part of the CSP:

```python
c.NotebookApp.tornado_settings = {
    'headers': {
        'Content-Security-Policy': "frame-ancestors 'self'; report-uri /api/security/csp-report"
    }
}
```

(continues on next page)
It simply provides the CSP report as a warning in IPython’s logs. The default CSP sets this report-uri relative to the `base_url` (not shown above).

For a more thorough and accurate guide on Content Security Policies, check out MDN’s Using Content Security Policy for more examples.

### 2.6 Issues closed in the 3.x development cycle

#### 2.6.1 Issues closed in 3.2.1

GitHub stats for 2015/06/22 - 2015/07/12 (since 3.2)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 1 issue and merged 3 pull requests. The full list can be seen on GitHub

The following 5 authors contributed 9 commits.

- Benjamin Ragan-Kelley
- Matthias Bussonnier
- Nitin Dahyabhai
- Sebastiaan Mathot
- Thomas Kluyver

#### 2.6.2 Issues closed in 3.2

GitHub stats for 2015/04/03 - 2015/06/21 (since 3.1)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 7 issues and merged 30 pull requests. The full list can be seen on GitHub

The following 15 authors contributed 74 commits.

- Benjamin Ragan-Kelley
- Brian Gough
- Damián Avila
- Ian Barfield
- Jason Grout
- Jeff Hussmann
- Jessica B. Hamrick
- Kyle Kelley
- Matthias Bussonnier
- Nicholas Bollweg
2.6.3 Issues closed in 3.1

GitHub stats for 2015/02/27 - 2015/04/03 (since 3.0)
These lists are automatically generated, and may be incomplete or contain duplicates.
We closed 46 issues and merged 133 pull requests. The full list can be seen on GitHub.
The following 33 authors contributed 344 commits:

- Abe Guerra
- Adal Chiriliuc
- Benjamin Ragan-Kelley
- Brian Drawert
- Fernando Perez
- Gareth Elston
- Gert-Ludwig Ingold
- Giuseppe Venturini
- Jakob Gager
- Jan Schulz
- Jason Grout
- Jessica B. Hamrick
- Jonathan Frederic
- Justin Tyberg
- Lorena Pantano
- mashenjun
- Mathieu
- Matthias Bussonnier
- Morten Enemark Lund
- Naveen Nathan
- Nicholas Bollweg
- onesandzeroes
- Patrick Snape
- Peter Parente
- RickWinter
2.6.4 Issues closed in 3.0

GitHub stats for 2014/04/02 - 2015/02/13 (since 2.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

We closed 469 issues and merged 925 pull requests. The full list can be seen on GitHub.

The following 155 authors contributed 5975 commits.

- A.J. Holyoake
- abalkin
- Adam Hodgen
- Adrian Price-Whelan
- Amin Bandali
- Andreas Amann
- Andrew Dawes
- Andrew Jesaitis
- Andrew Payne
- AnneTheAgile
- Aron Ahmadia
- Ben Duffield
- Benjamin ABEL
- Benjamin Ragan-Kelley
- Benjamin Schultz
- Björn Grüning
- Björn Linse
- Blake Griffith
- Boris Egorov
- Brian E. Granger
- bsvh
- Carlos Cordoba
2.6. Issues closed in the 3.x development cycle
• Jakob Gager
• James Goppert
• James Porter
• Jan Schulz
• Jason Goad
• Jason Gors
• Jason Grout
• Jason Newton
• j davidheiser
• Jean-Christophe Jaskula
• Jeff Hemmelgarn
• Jeffrey Bush
• Jeroen Demeyer
• Jessica B. Hamrick
• Jessica Frazelle
• jhemmelg
• Jim Garrison
• Joel Nothman
• Johannes Feist
• John Stowers
• John Zwinck
• jonasc
• Jonathan Frederic
• Juergen Hasch
• Julia Evans
• Justyna Ilczuk
• Jörg Dietrich
• K.-Michael Aye
• Kalibri
• Kester Tong
• Kyle Kelley
• Kyle Rawlins
• Lev Abalkin
• Manuel Riel
• Martin Bergtholdt
• Martin Spacek
• Mateusz Paprocki
• Mathieu
• Matthias Bussonnier
• Maximilian Albert
• mbyt
• MechCoder
• Mohan Raj Rajamanickam
• mvr
• Narahari
• Nathan Goldbaum
• Nathan Heijermans
• Nathaniel J. Smith
• ncornette
• Nicholas Bollweg
• Nick White
• Nikolay Koldunov
• Nile Geisinger
• Olga Botvinnik
• Osada Paranaliyanage
• Pankaj Pandey
• Pascal Bugnion
• patricktokeeffe
• Paul Ivanov
• Peter Odding
• Peter Parente
• Peter Würtz
• Phil Elson
• Phillip Nordwall
• Pierre Gerold
• Pierre Haessig
• Raffaele De Feo
• Ramiro Gómez
• Reggie Pierce
• Remi Rampin
• Renaud Richardet
• Richard Everson

2.6. Issues closed in the 3.x development cycle
2.7 Migrating Widgets to IPython 3

2.7.1 Upgrading Notebooks

1. The first thing you’ll notice when upgrading an IPython 2.0 widget notebook to IPython 3.0 is the “Notebook converted” dialog. Click “ok”.

2. All of the widgets distributed with IPython have been renamed. The “Widget” suffix was removed from the end of the class name. i.e. `ButtonWidget` is now `Button`.

3. `ContainerWidget` was renamed to `Box`. 
4. **PopupWidget** was removed from IPython. If you use the **PopupWidget**, try using a **Box** widget instead. If your notebook can’t live without the popup functionality, subclass the **Box** widget (both in Python and JS) and use JQuery UI’s `draggable()` and `resizable()` methods to mimic the behavior.

5. **add_class** and **remove_class** were removed. More often than not a new attribute exists on the widget that allows you to achieve the same explicitly. i.e. the **Button** widget now has a `button_style` attribute which you can set to ‘primary’, ‘success’, ‘info’, ‘warning’, ‘danger’, or ‘’ instead of using **add_class** to add the bootstrap class. **VBox** and **HBox** classes (flexible **Box** subclasses) were added that allow you to avoid using **add_class** and **remove_class** to make flexible box model layouts. As a last resort, if you can’t find a built in attribute for the class you want to use, a new _dom_classes list trait was added, which combines **add_class** and **remove_class** into one stateful list.

6. **set_css** and **get_css** were removed in favor of explicit style attributes - `visible`, `width`, `height`, `padding`, `margin`, `color`, `background_color`, `border_color`, `border_width`, `border_radius`, `border_style`, `font_style`, `font_weight`, `font_size`, and `font_family` are a few. If you can’t find a trait to see the css attribute you need, you can, in order of preference, (A) subclass to create your own custom widget, (B) use CSS and the _dom_classes trait to set _dom_classes, or (C) use the _css dictionary to set CSS styling like **set_css** and **get_css**.

7. For selection widgets, such as **Dropdown**, the **values** argument has been renamed to **options**.

### 2.7.2 Upgrading Custom Widgets

**Javascript**

1. If you are distributing your widget and decide to use the deferred loading technique (preferred), you can remove all references to the WidgetManager and the register model/view calls (see the Python section below for more information).

2. In 2.0 require.js was used incorrectly, that has been fixed and now loading works more like Python’s import. Requiring `widgets/js/widget` doesn’t import the WidgetManager class, instead it imports a dictionary that exposes the classes within that module:

   ```javascript
   {
      'WidgetModel': WidgetModel,
      'WidgetView': WidgetView,
      'DOMWidgetView': DOMWidgetView,
      'ViewList': ViewList,
   }
   ```

   If you decide to continue to use the widget registry (by registering your widgets with the manager), you can import a dictionary with a handle to the WidgetManager class by requiring `widgets/js/manager`. Doing so will import:

   ```javascript
   {'WidgetManager': WidgetManager}
   ```

3. Don’t rely on the IPython namespace for anything. To inherit from the DOMWidgetView, WidgetView, or WidgetModel, require `widgets/js/widget` as `widget`. If you were inheriting from DOMWidgetView, and the code looked like this:

   ```python
   IPython.DOMWidgetView.extend({...})
   ```

   It would become this:

   ```python
   widget.DOMWidgetView.extend({...})
   ```
4. Custom models are encouraged. When possible, it’s recommended to move your code into a custom model, so actions are performed 1 time, instead of N times where N is the number of displayed views.

**Python**

Generally, custom widget Python code can remain unchanged. If you distribute your custom widget, you may be using `display` and `Javascript` to publish the widget’s Javascript to the front-end. That is no longer the recommended way of distributing widget Javascript. Instead have the user install the Javascript to his/her notebook extension directory or their profile’s static directory. Then use the new `_view_module` and `_model_module` traitlets in combination with `_view_name` and `_model_name` to instruct `require.js` on how to load the widget’s Javascript. The Javascript is then loaded when the widget is used for the first time.

**2.7.3 Details**

**Asynchronous**

In the IPython 2.x series the only way to register custom widget views and models was to use the registry in the widget manager. Unfortunately, using this method made distributing and running custom widgets difficult. The widget maintainer had to either use the rich display framework to push the widget’s Javascript to the notebook or instruct the users to install the Javascript by hand in a custom profile. With the first method, the maintainer would have to be careful about when the Javascript was pushed to the front-end. If the Javascript was pushed on Python widget `import`, the widgets wouldn’t work after page refresh. This is because refreshing the page does not restart the kernel, and the Python `import` statement only runs once in a given kernel instance (unless you reload the Python modules, which isn’t straightforward). This meant the maintainer would have to have a separate `push_js()` method that the user would have to call after importing the widget’s Python code.

Our solution was to add support for loading widget views and models using `require.js` paths. Thus the `comm` and widget frameworks now support lazy loading. To do so, everything had to be converted to asynchronous code. HTML5 promises are used to accomplish that (#6818, #6914).

**Symmetry**

In IPython 3.0, widgets can be instantiated from the front-end (#6664). On top of this, a widget persistence API was added (#7163, #7227). With the widget persistence API, you can persist your widget instances using Javascript. This makes it easy to persist your widgets to your notebook document (with a small amount of custom JS). By default, the widgets are persisted to your web browser’s local storage which makes them reappear when you refresh the page.

**Smaller Changes**

- Latex math is supported in widget descriptions (#5937).
- Widgets can be display more than once within a single container widget (#5963, #6990).
- `FloatRangeSlider` and `IntRangeSlider` were added (#6050).
- “Widget” was removed from the ends of all of the widget class names (#6125).
- `ContainerWidget` was renamed to `Box` (#6125).
- `HBox` and `VBox` widgets were added (#6125).
- `add\_class` and `remove\_class` were removed in favor of a `_dom_classes` list (#6235).
- `get\_css` and `set\_css` were removed in favor of explicit traits for widget styling (#6235).
• **jslink** and **jsdlink** were added (#6454, #7468).

• An **Output** widget was added, which allows you to print and display within widgets (#6670).

• **PopupWidget** was removed (#7341).

• A visual cue was added for widgets with ‘dead’ comms (#7227).

• A **SelectMultiple** widget was added (a **Select** widget that allows multiple things to be selected at once) (#6890).

• A class was added to help manage children views (#6990).

• A warning was added that shows on widget import because it’s expected that the API will change again by IPython 4.0. This warning can be supressed (#7107, #7200, #7201, #7204).

### 2.7.4 Comm and Widget PR Index

Here is a chronological list of PRs affecting the widget and comm frameworks for IPython 3.0. Note that later PRs may revert changes made in earlier PRs:

• Add placeholder attribute to text widgets #5652

• Add latex support in widget labels, #5937

• Allow widgets to display more than once within container widgets. #5963

• use require.js, #5980

• Range widgets #6050

• Interact on_demand option #6051

• Allow text input on slider widgets #6106

• support binary buffers in comm messages #6110

• Embrace the flexible box model in the widgets #6125

• Widget trait serialization #6128

• Make Container widgets take children as the first positional argument #6153

• once-displayed #6168

• Validate slider value, when limits change #6171

• Unregistering comms in Comm Manager #6216

• Add EventfulList and EventfulDict trait types. #6228

• Remove add/remove_class and set/get_css. #6235

• avoid unregistering widget model twice #6250

• Widget property lock should compare json states, not python states #6332

• Strip the IPY_MODEL_ prefix from widget IDs before referencing them. #6377

• “event” is not defined error in Firefox #6437

• Javascript link #6454

• Bulk update of widget attributes #6463

• Creating a widget registry on the Python side. #6493

• Allow widget views to be loaded from require modules #6494
• Fix Issue #6530 #6532
• Make comm manager (mostly) independent of InteractiveShell #6540
• Add semantic classes to top-level containers for single widgets #6609
• Selection Widgets: forcing ‘value’ to be in ‘values’ #6617
• Allow widgets to be constructed from Javascript #6664
• Output widget #6670
• Minor change in widgets.less to fix alignment issue #6681
• Make Selection widgets respect values order. #6747
• Widget persistence API #6789
• Add promises to the widget framework. #6818
• SelectMultiple widget #6890
• Tooltip on toggle button #6923
• Allow empty text box *while typing* for numeric widgets #6943
• Ignore failure of widget MathJax typesetting #6948
• Refactor the do_diff and manual child view lists into a separate ViewList object #6990
• Add warning to widget namespace import. #7107
• lazy load widgets #7120
• Fix padding of widgets. #7139
• Persist widgets across page refresh #7163
• Make the widget experimental error a real python warning #7200
• Make the widget error message shorter and more understandable. #7201
• Make the widget warning brief and easy to filter #7204
• Add visual cue for widgets with dead comms #7227
• Widget values as positional arguments #7260
• Remove the popup widget #7341
• document and validate link, dlink #7468
• Document interact 5637 #7525
• Update some broken examples of using widgets #7547
• Use Output widget with Interact #7554
• don’t send empty execute_result messages #7560
• Validation on the python side #7602
• only show prompt overlay if there’s a prompt #7661
• Allow predictate to be used for comparison in selection widgets #7674
• Fix widget view persistence. #7680
• Revert “Use Output widget with Interact” #7703
2.8 2.x Series

2.8.1 Release 2.4

January, 2014

Note: Some of the patches marked for 2.4 were left out of 2.4.0. Please use 2.4.1.

- backport read support for nbformat v4 from IPython 3
- support for PyQt5 in the kernel (not QtConsole)
- support for Pygments 2.0

For more information on what fixes have been backported to 2.4, see our detailed release info.

2.8.2 Release 2.3.1

November, 2014

- Fix CRCRLF line-ending bug in notebooks on Windows

For more information on what fixes have been backported to 2.3.1, see our detailed release info.

2.8.3 Release 2.3.0

October, 2014

- improve qt5 support
- prevent notebook data loss with atomic writes

For more information on what fixes have been backported to 2.3, see our detailed release info.

2.8.4 Release 2.2.0

August, 2014

- Add CORS configuration

For more information on what fixes have been backported to 2.2, see our detailed release info.

2.8.5 Release 2.1.0

May, 2014

IPython 2.1 is the first bugfix release for 2.0. For more information on what fixes have been backported to 2.1, see our detailed release info.
2.8.6 Release 2.0.0

April, 2014

IPython 2.0 requires Python 2.7.2 or 3.3.0. It does not support Python 3.0, 3.1, 3.2, 2.5, or 2.6.

The principal milestones of 2.0 are:

- interactive widgets for the notebook
- directory navigation in the notebook dashboard
- persistent URLs for notebooks
- a new modal user interface in the notebook
- a security model for notebooks

Contribution summary since IPython 1.0 in August, 2013:

- ~8 months of work
- ~650 pull requests merged
- ~400 issues closed (non-pull requests)
- contributions from ~100 authors
- ~4000 commits

The amount of work included in this release is so large that we can only cover here the main highlights; please see our detailed release statistics for links to every issue and pull request closed on GitHub as well as a full list of individual contributors.

**New stuff in the IPython notebook**
The IPython notebook dashboard allows navigation into subdirectories. URLs are persistent based on the notebook’s path and name, so no more random UUID URLs.

Serving local files no longer needs the `files/` prefix. Relative links across notebooks and other files should work just as if notebooks were regular HTML files.
Interactive widgets

IPython 2.0 adds IPython.html.widgets, for manipulating Python objects in the kernel with GUI controls in the notebook. IPython comes with a few built-in widgets for simple data types, and an API designed for developers to build more complex widgets. See the widget docs for more information.

Modal user interface

The notebook has added separate Edit and Command modes, allowing easier keyboard commands and making keyboard shortcut customization possible. See the new User Interface notebook for more information.

You can familiarize yourself with the updated notebook user interface, including an explanation of Edit and Command modes, by going through the short guided tour which can be started from the Help menu.
Security

2.0 introduces a security model for notebooks, to prevent untrusted code from executing on users’ behalf when notebooks open. A quick summary of the model:

- Trust is determined by signing notebooks.
- Untrusted HTML output is sanitized.
- Untrusted Javascript is never executed.
- HTML and Javascript in Markdown are never trusted.

Dashboard “Running” tab

The dashboard now has a “Running” tab which shows all of the running notebooks.
Single codebase Python 3 support

IPython previously supported Python 3 by running 2to3 during setup. We have now switched to a single codebase which runs natively on Python 2.7 and 3.3.

For notes on how to maintain this, see Writing code for Python 2 and 3.

Selecting matplotlib figure formats

Deprecate single-format InlineBackend.figure_format configurable in favor of InlineBackend.figure_formats, which is a set, supporting multiple simultaneous figure formats (e.g. png, pdf).

This is available at runtime with the new API function IPython.display.set_matplotlib_formats().

clear_output changes

- There is no longer a 500ms delay when calling clear_output.
- The ability to clear stderr and stdout individually was removed.
- A new wait flag that prevents clear_output from being executed until new output is available. This eliminates animation flickering by allowing the user to double buffer the output.
- The output div height is remembered when the wait=True flag is used.

Extending configurable containers

Some configurable traits are containers (list, dict, set). Config objects now support calling extend, update, insert, etc. on traits in config files, which will ultimately result in calling those methods on the original object.

The effect being that you can now add to containers without having to copy/paste the initial value:

```python
c = get_config()
c.InlineBackend.rc.update({'figure.figsize': (6, 4)})
```

Changes to hidden namespace on startup

Previously, all names declared in code run at startup (startup files, ipython -i script.py, etc.) were added to the hidden namespace, which hides the names from tools like %whos. There are two changes to this behavior:

1. Scripts run on the command-line ipython -i script.py`now behave the same as if they were passed to ``%run, so their variables are never hidden.
2. A boolean config flag InteractiveShellApp.hide_initial_ns has been added to optionally disable the hidden behavior altogether. The default behavior is unchanged.

Using dill to expand serialization support

The new function use_dill() allows dill to extend serialization support in IPython.parallel (closures, etc.). A DirectView.use_dill() convenience method was also added, to enable dill locally and on all engines with one call.
New IPython console lexer

The IPython console lexer has been rewritten and now supports tracebacks and customized input/output prompts. See the new lexer docs for details.

DisplayFormatter changes

There was no official way to query or remove callbacks in the Formatter API. To remedy this, the following methods are added to BaseFormatter:

- `lookup(instance)` - return appropriate callback or a given object
- `lookup_by_type(type_or_str)` - return appropriate callback for a given type or 'mod.name' type string
- `pop(type_or_str)` - remove a type (by type or string). Pass a second argument to avoid KeyError (like dict).

All of the above methods raise a KeyError if no match is found.

And the following methods are changed:

- `for_type(type_or_str)` - behaves the same as before, only adding support for 'mod.name' type strings in addition to plain types. This removes the need for `for_type_by_name()`, but it remains for backward compatibility.

Formatters can now raise `NotImplementedError` in addition to returning None to indicate that they cannot format a given object.

Exceptions andWarnings

Exceptions are no longer silenced when formatters fail. Instead, these are turned into a `FormatterWarning`. A `FormatterWarning` will also be issued if a formatter returns data of an invalid type (e.g. an integer for 'image/png').

Other changes

- `%%capture` cell magic now captures the rich display output, not just stdout/stderr
- In notebook, Showing tooltip on tab has been disabled to avoid conflict with completion, Shift-Tab could still be used to invoke tooltip when inside function signature and/or on selection.
- `object_info_request` has been replaced by `object_info` for consistency in the javascript API. `object_info` is a simpler interface to register callback that is incompatible with `object_info_request`.
- Previous versions of IPython on Linux would use the XDG config directory, creating `~/.config/ipython` by default. We have decided to go back to `~/.ipython` for consistency among systems. IPython will issue a warning if it finds the XDG location, and will move it to the new location if there isn’t already a directory there.
- Equations, images and tables are now centered in Markdown cells.
- Multiline equations are now centered in output areas; single line equations remain left justified.
- IPython config objects can be loaded from and serialized to JSON. JSON config file have the same base name as their .py counterpart, and will be loaded with higher priority if found.
- Bash completion updated with support for all ipython subcommands and flags, including nbconvert.
- `ipython history trim: added --keep=<N>` as an alias for the more verbose `--HistoryTrim`. `keep=<N>`
• New `ipython history clear` subcommand, which is the same as the newly supported `ipython history trim --keep=0`.

• You can now run notebooks in an interactive session via `%run notebook.ipynb`.

• Print preview is back in the notebook menus, along with options to download the open notebook in various formats. This is powered by nbconvert.

• PandocMissing exceptions will be raised if Pandoc is unavailable, and warnings will be printed if the version found is too old. The recommended Pandoc version for use with nbconvert is 1.12.1.

• The InlineBackend.figure_format now supports JPEG output if PIL/Pillow is available.

• Input transformers (see Custom input transformation) may now raise `SyntaxError` if they determine that input is invalid. The input transformation machinery in IPython will handle displaying the exception to the user and resetting state.

• Calling `container.show()` on javascript display is deprecated and will trigger errors on future IPython notebook versions. `container` now show itself as soon as non-empty.

• Added `InlineBackend.print_figure_kwargs` to allow passing keyword arguments to matplotlib’s `Canvas.print_figure`. This can be used to change the value of `bbox_inches`, which is ‘tight’ by default, or set the quality of JPEG figures.

• A new callback system has been introduced. For details, see IPython Events.

• jQuery and require.js are loaded from CDNs in the default HTML template, so javascript is available in static HTML export (e.g. nbviewer).

Backwards incompatible changes

• Python 2.6 and 3.2 are no longer supported: the minimum required Python versions are now 2.7 and 3.3.

• The Transformer classes have been renamed to Preprocessor in nbconvert and their `call` methods have been renamed to `preprocess`.

• The `call` methods of nbconvert post-processors have been renamed to `postprocess`.

• The module `IPython.core.fakemodule` has been removed.

• The alias system has been reimplemented to use magic functions. There should be little visible difference while automagics are enabled, as they are by default, but parts of the `AliasManager` API have been removed.

• We fixed an issue with switching between matplotlib inline and GUI backends, but the fix requires matplotlib 1.1 or newer. So from now on, we consider matplotlib 1.1 to be the minimally supported version for IPython. Older versions for the most part will work, but we make no guarantees about it.

• The `pycolor` command has been removed. We recommend the much more capable `pygmentize` command from the Pygments project. If you need to keep the exact output of `pycolor`, you can still use `python -m IPython.utils.PyColorize foo.py`.

• `IPython.lib.irunner` and its command-line entry point have been removed. It had fallen out of use long ago.

• The `input_prefilter` hook has been removed, as it was never actually used by the code. The input transformer system offers much more powerful APIs to work with input code. See Custom input transformation for details.

• `IPython.core.inputsplitter.IPythonInputSplitter` no longer has a method `source_raw_reset()`, but gains `raw_reset()` instead. Use of `source_raw_reset` can be replaced with:
The Azure notebook manager was removed as it was no longer compatible with the notebook storage scheme.

Simplifying configurable URLs

- base_project_url is renamed to base_url (base_project_url is kept as a deprecated alias, for now)
- base_kernel_url configurable is removed (use base_url)
- websocket_url configurable is removed (use base_url)

2.9 Issues closed in the 2.x development cycle

2.9.1 Issues closed in 2.4.1

GitHub stats for 2014/11/01 - 2015/01/30

Note: IPython 2.4.0 was released without a few of the backports listed below. 2.4.1 has the correct patches intended for 2.4.0.

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 7 authors contributed 35 commits.

- Benjamin Ragan-Kelley
- Carlos Cordoba
- Damon Allen
- Jessica B. Hamrick
- Mateusz Paprocki
- Peter Würtz
- Thomas Kluyver

We closed 10 issues and merged 6 pull requests; this is the full list (generated with the script `tools/github_stats.py`):

Pull Requests (10):

- PR #7106: Changed the display order of rich output in the live notebook.
- PR #6878: Update pygments monkeypatch for compatibility with Pygments 2.0
- PR #6778: backport nbformat v4 to 2.x
- PR #6761: object_info_reply field is oname, not name
- PR #6653: Fix IPython.utils.ansispan() to ignore stray [0m
- PR #6706: Correctly display prompt numbers that are None
- PR #6634: don’t use contains in SelectWidget item_query
- PR #6593: note how to start the qtconsole
- PR #6281: more minor fixes to release scripts
• PR #5458: Add support for PyQt5.

Issues (6):
• #7272: qtconsole problems with pygments
• #7049: Cause TypeError: ‘NoneType’ object is not callable in qtconsole
• #6877: QtCore console doesn’t work with pygments 2.0rc1
• #6689: Problem with string containing two or more question marks
• #6702: Cell numbering after ClearOutput preprocessor
• #6633: selectwidget doesn’t display 1 as a selection choice when passed in as a member of values list

2.9.2 Issues closed in 2.3.1

Just one bugfix: fixed bad CRCRLF line-endings in notebooks on Windows

Pull Requests (1):
• PR #6911: don’t use text mode in mkstemp

Issues (1):
• #6599: Notebook.ipynb CR+LF turned into CR+CR+LF

2.9.3 Issues closed in 2.3.0

GitHub stats for 2014/08/06 - 2014/10/01

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 6 authors contributed 31 commits.

• Benjamin Ragan-Kelley
• David Hirschfeld
• Eric Firing
• Jessica B. Hamrick
• Matthias Bussonnier
• Thomas Kluyver

We closed 16 issues and merged 9 pull requests; this is the full list (generated with the script tools/github_stats.py):

Pull Requests (16):
• PR #6587: support %matplotlib qt5 and %matplotlib nbagg
• PR #6583: Windows symlink test fixes
• PR #6585: fixes #6473
• PR #6581: Properly mock winreg functions for test
• PR #6556: Use some more informative asserts in inprocess kernel tests
• PR #6514: Fix for copying metadata flags
• PR #6453: Copy file metadata in atomic save
• PR #6480: only compare host:port in Websocket.check_origin
• PR #6483: Trim anchor link in heading cells, fixes #6324
• PR #6410: Fix relative import in appnope
• PR #6395: update mathjax CDN url in nbconvert template
• PR #6269: Implement atomic save
• PR #6374: Rename abort_queues -> _abort_queues
• PR #6321: Use appnope in qt and wx gui support from the terminal; closes #6189
• PR #6318: use write_error instead of get_error_html
• PR #6303: Fix error message when failing to load a notebook

Issues (9):

• #6057: %matplotlib + qt5
• #6518: Test failure in atomic save on Windows
• #6473: Switching between “Raw Cell Format” and “Edit Metadata” does not work
• #6405: Creating a notebook should respect directory permissions; saving should respect prior permissions
• #6324: Anchors in Heading don’t work.
• #6409: No module named ‘_dummy’
• #6392: Mathjax library link broken
• #6329: IPython Notebook Server URL now requires “tree” at the end of the URL? (version 2.2)
• #6189: ipython console freezes for increasing no of seconds in %pylab mode

2.9.4 Issues closed in 2.2.0

GitHub stats for 2014/05/21 - 2014/08/06 (tag: rel-2.1.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 13 authors contributed 36 commits.

• Adam Hodgen
• Benjamin Ragan-Kelley
• Björn Grüning
• Dara Adib
• Eric Galloway
• Jonathan Frederic
• Kyle Kelley
• Matthias Bussonnier
• Paul Ivanov
• Shayne Hodge
• Steven Anton
• Thomas Kluyver
Zahari

We closed 23 issues and merged 11 pull requests; this is the full list (generated with the script `tools/github_stats.py`):

Pull Requests (23):

- PR #6279: minor updates to release scripts
- PR #6273: Upgrade default mathjax version.
- PR #6249: always use HTTPS getting mathjax from CDN
- PR #6114: update hmac signature comparison
- PR #6195: Close handle on new temporary files before returning filename
- PR #6143: pin tornado to < 4 on travis js tests
- PR #6134: remove rackcdn https workaround for mathjax cdn
- PR #6120: Only allow iframe embedding on same origin.
- PR #6117: Remove / from route of TreeRedirectHandler.
- PR #6105: only set allow_origin_pat if defined
- PR #6102: Add newline if missing to end of script magic cell
- PR #6077: allow unicode keys in dicts in json_clean
- PR #6061: make CORS configurable
- PR #6081: don’t modify dict keys while iterating through them
- PR #5803: unify visual line handling
- PR #6005: Changed right arrow key movement function to mirror left arrow key
- PR #6029: add pickleutil.PICKLE_PROTOCOL
- PR #6003: Set kernel_id before checking websocket
- PR #5994: Fix ssh tunnel for Python3
- PR #5973: Do not create checkpoint_dir relative to current dir
- PR #5933: fix qt_loader import hook signature
- PR #5944: Markdown rendering bug fix.
- PR #5917: use shutil.move instead of os.rename

Issues (11):

- #6246: Include MathJa by default or access the CDN over a secure connection
- #5525: Websocket origin check fails when used with Apache WS proxy
- #5901: 2 test failures in Python 3.4 in parallel group
- #5926: QT console: text selection cannot be made from left to right with keyboard
- #5998: use_dill does not work in Python 3.4
- #5964: Traceback on Qt console exit
- #5787: Error in Notebook-Generated latex (nbconvert)
- #5950: qtconsole truncates help
- #5943: 2.x: notebook fails to load when using HTML comments
- #5932: Qt ImportDenier Does Not Adhere to PEP302
- #5898: OSError when moving configuration file

### 2.9.5 Issues closed in 2.1.0

GitHub stats for 2014/04/02 - 2014/05/21 (since 2.0.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 35 authors contributed 145 commits.

- Adrian Price-Whelan
- Aron Ahmadia
- Benjamin Ragan-Kelley
- Benjamin Schultz
- Björn Linse
- Blake Griffith
- chebee7i
- Damián Avila
- Dav Clark
- dexterdev
- Erik Tollerud
- Grzegorz Roźniecki
- Jakob Gager
- jdavidheiser
- Jessica B. Hamrick
- Jim Garrison
- Jonathan Frederic
- Matthias Bussonnier
- Maximilian Albert
- Mohan Raj Rajamanickam
- ncornette
- Nikolay Koldunov
- Nile Geisinger
- Pankaj Pundey
- Paul Ivanov
- Pierre Haessig
- Raffaele De Feo
- Renaud Richardet
We closed a total of 129 issues, 92 pull requests and 37 regular issues; this is the full list (generated with the script `tools/github_stats.py --milestone 2.1`):

**Pull Requests (92):**

- PR #5871: specify encoding in msgpack.unpackb
- PR #5869: Catch more errors from clipboard access on Windows
- PR #5866: Make test robust against differences in line endings
- PR #5605: Two cell toolbar fixes.
- PR #5843: remove Firefox-specific CSS workaround
- PR #5845: Pass Windows interrupt event to kernels as an environment variable
- PR #5835: fix typo in v2 convert
- PR #5841: Fix writing history with output to a file in Python 2
- PR #5842: fix typo in nbconvert help
- PR #5846: Fix typos in Cython example
- PR #5839: Close graphics dev in finally clause
- PR #5837: pass on install docs
- PR #5832: Fixed example to work with python3
- PR #5826: allow notebook tour instantiation to fail
- PR #5560: Minor expansion of Cython example
- PR #5818: interpret any exception in getcallargs as not callable
- PR #5816: Add output to IPython directive when in verbatim mode.
- PR #5822: Don’t overwrite widget description in interact
- PR #5782: Silence exception thrown by completer when dir() does not return a list
- PR #5807: Drop log level to info for Qt console shutdown
- PR #5814: Remove -i options from mv, rm and cp aliases
- PR #5812: Fix application name when printing subcommand help.
- PR #5804: remove an inappropriate !
- PR #5805: fix engine startup files
- PR #5806: Don’t auto-move .config/ipython if symbolic link
- PR #5716: Add booktabs package to latex base.tplx
• PR #5669: allows threadsafe sys.stdout.flush from background threads
• PR #5668: allow async output on the most recent request
• PR #5768: fix cursor keys in long lines wrapped in markdown
• PR #5788: run cells with silent=True in %run nb.ipynb
• PR #5715: log all failed ajax API requests
• PR #5769: Don’t urlescape the text that goes into a title tag
• PR #5762: Fix check for pickling closures
• PR #5766: View.map with empty sequence should return empty list
• PR #5758: Applied bug fix: using fc and ec did not properly set the figure canvas...
• PR #5754: Format command name into subcommand_description at run time, not import
• PR #5744: Describe using PyPI/pip to distribute & install extensions
• PR #5712: monkeypatch inspect.findsource only when we use it
• PR #5708: create checkpoints dir in notebook subdirectories
• PR #5714: log error message when API requests fail
• PR #5732: Quick typo fix in nbformat/convert.py
• PR #5713: Fix a NameError in IPython.parallel
• PR #5704: Update nbconvertapp.py
• PR #5534: cleanup some pre css inheritance
• PR #5699: don’t use common names in require decorators
• PR #5692: Update notebook.rst fixing broken reference to notebook examples readme
• PR #5693: Update parallel_intro.rst to fix a broken link to examples
• PR #5486: disambiguate to location when no IPs can be determined
• PR #5574: Remove the outdated keyboard shortcuts from notebook docs
• PR #5568: Use __qualname__ in pretty reprs for Python 3
• PR #5678: Fix copy & paste error in docstring of ImageWidget class
• PR #5677: Fix %bookmark -l for Python 3
• PR #5670: nbconvert: Fix CWD imports
• PR #5647: Mention git hooks in install documentation
• PR #5671: Fix blank slides issue in Reveal slideshow pdf export
• PR #5657: use ‘localhost’ as default for the notebook server
• PR #5584: more semantic icons
• PR #5594: update components with marked-0.3.2
• PR #5500: check for Python 3.2
• PR #5582: reset readline after running PYTHONSTARTUP
• PR #5630: Fixed Issue #4012 Added Help menubar link to Github markdown doc
• PR #5613: Fixing bug #5607

2.9. Issues closed in the 2.x development cycle 55
• PR #5633: Provide more help if lessc is not found.
• PR #5620: fixed a typo in IPython.core.formatters
• PR #5619: Fix typo in storemagic module docstring
• PR #5592: add missing browser to notebook_aliases list
• PR #5506: Fix ipconfig regex pattern
• PR #5581: Fix rmagic for cells ending in comment.
• PR #5576: only process cr if it’s found
• PR #5478: Add git-hooks install script. Update README.md
• PR #5546: do not shutdown notebook if ‘n’ is part of answer
• PR #5527: Don’t remove upload items from nav tree unless explicitly requested.
• PR #5501: remove inappropriate wheel tag override
• PR #5548: FileNotebookManager: Use shutil.move() instead of os.rename()
• PR #5524: never use for (var i in array)
• PR #5459: Fix interact animation page jump FF
• PR #5559: Minor typo fix in “Cython Magics.ipynb”
• PR #5507: Fix typo in interactive widgets examples index notebook
• PR #5554: Make HasTraits pickleable
• PR #5535: fix n^2 performance issue in coalesce_streams preprocessor
• PR #5522: fix iteration over Client
• PR #5488: Added missing require and jquery from cdn.
• PR #5516: ENH: list generated config files in generated, and rm them upon clean
• PR #5493: made a minor fix to one of the widget examples
• PR #5512: Update tooltips to refer to shift-tab
• PR #5505: Make backport_pr work on Python 3
• PR #5503: check explicitly for ‘dev’ before adding the note to docs
• PR #5498: use milestones to indicate backport
• PR #5492: Polish whatsnew docs
• PR #5495: Fix various broken things in docs
• PR #5496: Exclude whatsnew/pr directory from docs builds
• PR #5489: Fix required Python versions

Issues (37):
• #5364: Horizontal scrollbar hides cell’s last line on Firefox
• #5192: horizontal scrollbar overlaps output or touches next cell
• #5840: Third-party Windows kernels don’t get interrupt signal
• #2412: print history to file using qtconsole and notebook
• #5703: Notebook doesn’t render with “ask me every time” cookie setting in Firefox
• #5817: calling mock object in IPython 2.0.0 under Python 3.4.0 raises AttributeError
• #5499: Error running widgets nbconvert example
• #5654: Broken links from ipython documentation
• #5019: print in QT event callback doesn’t show up in ipython notebook.
• #5800: Only last In prompt number set?
• #5801: startup_command specified in ipengine_config.py is not executed
• #5690: ipython 2.0.0 and pandoc 1.12.2.1 problem
• #5408: Add checking/flushing of background output from kernel in mainloop
• #5407: clearing message handlers on status=idle loses async output
• #5467: Incorrect behavior of up/down keyboard arrows in code cells on wrapped lines
• #3085: nicer notebook error message when lacking permissions
• #5765: map_sync over empty list raises IndexError
• #5553: Notebook matplotlib inline backend: can’t set figure facecolor
• #5710: inspect.findsource monkeypatch raises wrong exception for C extensions
• #5706: Multi-Directory notebooks overwrite each other’s checkpoints
• #5698: can’t require a function named _
• #5569: Keyboard shortcuts in documentation are out of date
• #5566: Function name printing should use __qualname__ instead of __name__ (Python 3)
• #5676: “bookmark -l” not working in ipython 2.0
• #5555: Differentiate more clearly between Notebooks and Folders in new UI
• #5590: Marked double escape
• #5514: import tab-complete fail with ipython 2.0 shell
• #4012: Notebook: link to markdown formatting reference
• #5611: Typo in ‘storemagic’ documentation
• #5589: Kernel start fails when using –browser argument
• #5491: Bug in Windows ipconfig ip address regular expression
• #5579: rmagic extension throws ‘Error while parsing the string.’ when last line is comment
• #5518: Ipython2 will not open ipynb in example directory
• #5561: New widget documentation has missing notebook link
• #5128: Page jumping when output from widget interaction replaced
• #5519: IPython.parallel.Client behavior as iterator
• #5510: Tab-completion for function argument list

2.9. Issues closed in the 2.x development cycle
2.9.6 Issues closed in 2.0.0

GitHub stats for 2013/08/09 - 2014/04/01 (since 1.0.0)

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 94 authors contributed 3949 commits.

- Aaron Meurer
- Abhinav Upadhyay
- Adam Riggall
- Alex Rudy
- Andrew Mark
- Angus Griffith
- Antony Lee
- Aron Ahmadia
- Arun Persaud
- Benjamin Ragan-Kelley
- Bing Xia
- Blake Griffith
- Bouke van der Bijl
- Bradley M. Froehle
- Brian E. Granger
- Carlos Cordoba
- chapmanb
- chebee7i
- Christoph Gohlke
- Christophe Pradal
- Cyrille Rossant
- Damián Avila
- Daniel B. Vasquez
- Dav Clark
- David Hirschfeld
- David P. Sanders
- David Wyde
- David Österberg
- Doug Blank
- Dražen Lučanin
- epifanio
- Fernando Perez
• Gabriel Becker
• Geert Barentsen
• Hans Meine
• Ingolf Becker
• Jake Vanderplas
• Jakob Gager
• James Porter
• Jason Grout
• Jeffrey Tratner
• Jonah Graham
• Jonathan Frederic
• Joris Van den Bossche
• Juergen Hasch
• Julian Taylor
• Katie Silverio
• Kevin Burke
• Kieran O’Mahony
• Konrad Hinsen
• Kyle Kelley
• Lawrence Fu
• Marc Molla
• Martín Gaitán
• Matt Henderson
• Matthew Brett
• Matthias Bussonnier
• Michael Droettboom
• Mike McKerns
• Nathan Goldbaum
• Pablo de Oliveira
• Pankaj Pandey
• Pascal Schetelat
• Paul Ivanov
• Paul Moore
• Pere Vilas
• Peter Davis
• Philippe Mallet-Ladeira
We closed a total of 1121 issues, 687 pull requests and 434 regular issues; this is the full list (generated with the script `tools/github_stats.py`):

**Pull Requests (687):**

- PR #5487: remove weird unicode space in the new copyright header
- PR #5476: For 2.0: Fix links in Notebook Help Menu
- PR #5337: Examples reorganization
- PR #5436: CodeMirror shortcuts in QuickHelp
- PR #5444: Fix numeric verification for Int and Float text widgets.
- PR #5449: Stretch keyboard shortcut dialog
- PR #5473: Minor corrections of git-hooks setup instructions
- PR #5471: Add coding magic comment to nbconvert Python template
- PR #5452: print_figure returns unicode for svg
- PR #5450: proposal: remove codename
- PR #5462: DOC: fixed minor error in using topological sort
- PR #5463: make spin_thread tests more forgiving of slow VMs
- PR #5464: Fix starting notebook server with file/directory at command line.
- PR #5453: remove gitwash
- PR #5454: Improve history API docs
- PR #5431: update github_stats and gh_api for 2.0
- PR #5290: Add dual mode JS tests
- PR #5451: check that a handler is actually registered in ShortcutManager.handles
- PR #5447: Add %%python2 cell magic
- PR #5439: Point to the stable SymPy docs, not the dev docs
- PR #5437: Install jquery-ui images
- PR #5434: fix check for empty cells in rst template
- PR #5432: update links in notebook help menu
- PR #5435: Update whatsnw (notebook tour)
- PR #5433: Document extraction of octave and R magics
- PR #5428: Update COPYING.txt
- PR #5426: Separate get_session_info between HistoryAccessor and HistoryManager
- PR #5419: move prompts from margin to main column on small screens
- PR #5430: Make sure element is correct in the context of displayed JS
- PR #5396: prevent saving of partially loaded notebooks
- PR #5429: Fix tooltip pager feature
- PR #5330: Updates to shell reference doc
- PR #5404: Fix broken accordion widget
- PR #5339: Don’t use fork to start the notebook in js tests
- PR #5320: Fix for Tooltip & completer click focus bug.
- PR #5421: Move configuration of Python test controllers into setup()
- PR #5418: fix typo in ssh launcher send_file
- PR #5403: remove alt– shortcut
- PR #5389: better log message in deprecated files/ redirect
- PR #5333: Fix filenbmanager.list_dirs fails for Windows user profile directory
- PR #5390: finish PR #5333
- PR #5326: Some gardening on iptest result reporting
- PR #5375: remove unnecessary onload hack from mathjax macro

2.9. Issues closed in the 2.x development cycle
• PR #5368: Flexbox classes specificity fixes
• PR #5331: fix raw_input CSS
• PR #5395: urlencode images for rst files
• PR #5049: update quickhelp on adding and removing shortcuts
• PR #5391: Fix Gecko (Netscape) keyboard handling
• PR #5387: Respect ‘r’ characters in nbconvert.
• PR #5399: Revert PR #5388
• PR #5388: Suppress output even when a comment follows ;. Fixes #4525.
• PR #5394: nbconvert doc update
• PR #5359: do not install less sources
• PR #5346: give hint on where to find custom.js
• PR #5357: catch exception in copystat
• PR #5380: Remove DefineShortVerb… line from latex base template
• PR #5376: elide long containers in pretty
• PR #5310: remove raw cell placeholder on focus, closes #5238
• PR #5332: semantic names for indicator icons
• PR #5386: Fix import of socketserver on Python 3
• PR #5360: remove some redundant font-family: monospace
• PR #5379: don’t instantiate Application just for default logger
• PR #5372: Don’t autoclose strings
• PR #5296: unify keyboard shortcut and codemirror interaction
• PR #5349: Make Hub.registration_timeout configurable
• PR #5340: install bootstrap-tour css
• PR #5335: Update docstring for depreload module
• PR #5321: Improve assignment regex to match more tuple unpacking syntax
• PR #5325: add NotebookNotary to NotebookApp’s class list
• PR #5313: avoid loading preprocessors twice
• PR #5308: fix HTML capitalization in Highlight2HTML
• PR #5295: OutputArea.append_type functions are not prototype methods
• PR #5318: Fix local import of select_figure_formats
• PR #5300: Fix NameError: name ‘_rl’ is not defined
• PR #5292: focus next cell on shift+enter
• PR #5291: debug occasional error in test_queue_status
• PR #5289: Finishing up #5274 (widget paths fixes)
• PR #5232: Make nbconvert html full output like notebook’s html.
• PR #5288: Correct initial state of kernel status indicator
• PR #5253: display any output from this session in terminal console
• PR #4802: Tour of the notebook UI (was UI elements inline with highlighting)
• PR #5285: Update signature presentation in pinfo classes
• PR #5268: Refactoring Notebook.command_mode
• PR #5226: Don’t run PYTHONSTARTUP file if a file or code is passed
• PR #5283: Remove Widget.closed attribute
• PR #5279: nbconvert: Make sure node is atleast version 0.9.12
• PR #5281: fix a typo introduced by a rebased PR
• PR #5280: append Firefox overflow-x fix
• PR #5277: check that PIL can save JPEG to BytesIO
• PR #5044: Store timestamps for modules to autoreload
• PR #5278: Update whatsnew doc from pr files
• PR #5276: Fix kernel restart in case connection file is deleted.
• PR #5272: allow highlighting language to be set from notebook metadata
• PR #5158: log refusal to serve hidden directories
• PR #5188: New events system
• PR #5265: Missing class def for TimeoutError
• PR #5267: normalize unicode in notebook API tests
• PR #5076: Refactor keyboard handling
• PR #5241: Add some tests for utils
• PR #5261: Don’t allow edit mode up arrow to continue past index == 0
• PR #5223: use on-load event to trigger resizable images
• PR #5252: make one strptime call at import of jsonutil
• PR #5153: Dashboard sorting
• PR #5169: Allow custom header
• PR #5242: clear _reply_content cache before using it
• PR #5194: require latex titles to be ascii
• PR #5244: try to avoid EADDRINUSE errors on travis
• PR #5245: support extracted output in HTML template
• PR #5209: make input_area css generic to cells
• PR #5246: less %pylab, more cowbell!
• PR #4895: Improvements to %run completions
• PR #5243: Add Javascript to base display priority list.
• PR #5175: Audit .html() calls take #2
• PR #5146: Dual mode bug fixes.
• PR #5207: Children fire event

2.9. Issues closed in the 2.x development cycle
• PR #5215: Dashboard “Running” Tab
• PR #5240: Remove unused IPython.nbconvert.utils.console module
• PR #5239: Fix exclusion of tests directories from coverage reports
• PR #5203: capture some logging/warning output in some tests
• PR #5216: fixup positional arg handling in notebook app
• PR #5229: get _ipython_display_ method safely
• PR #5234: DOC : modified docs is HasTraits.traits and HasTraits.class_traits
• PR #5221: Change widget children List to Tuple.
• PR #5231: don’t forget base_url when updating address bar in rename
• PR #5173: Moved widget files into static/widgets/*
• PR #5222: Unset PYTHONWARNINGS envvar before running subprocess tests.
• PR #5172: Prevent page breaks when printing notebooks via print-view.
• PR #4985: Add automatic Closebrackets function to Codemirror.
• PR #5220: Make traitlets notify check more robust against classes redefining equality and bool
• PR #5197: If there is an error comparing traitlet values when setting a trait, default to go ahead and notify of the new value.
• PR #5210: fix pyreadline import in rlineimpl
• PR #5212: Wrap nbconvert Markdown/Heading cells in live divs
• PR #5200: Allow to pass option to jinja env
• PR #5202: handle nodejs executable on debian
• PR #5112: band-aid for completion
• PR #5187: handle missing output metadata in nbconvert
• PR #5181: use gnureadline on OS X
• PR #5136: set default value from signature defaults in interact
• PR #5132: remove application/pdf->pdf transform in javascript
• PR #5116: reorganize who knows what about paths
• PR #5165: Don’t introspect __call__ for simple callables
• PR #5170: Added msg_throttle sync=True widget traitlet
• PR #5191: Translate markdown link to rst
• PR #5037: FF Fix: alignment and scale of text widget
• PR #5179: remove websocket url
• PR #5110: add InlineBackend.print_figure_kwargs
• PR #5147: Some template URL changes
• PR #5100: remove base_kernel_url
• PR #5163: Simplify implementation of TemporaryWorkingDirectory.
• PR #5166: remove mktemp usage
• PR #5133: don’t use combine option on ucs package
• PR #5089: Remove legacy azure nbmanager
• PR #5159: remove append_json reference
• PR #5059: handle image size metadata in nbconvert html
• PR #5156: fix IPython typo, closes #5155
• PR #5150: fix a link that was broken
• PR #5114: use non-breaking space for button with no description
• PR #4778: add APIs for installing notebook extensions
• PR #5125: Fix the display of functions with keyword-only arguments on Python 3.
• PR #5097: minor notebook logging changes
• PR #5047: only validate package_data when it might be used
• PR #5121: fix remove event in KeyboardManager.register_events
• PR #5119: Removed ‘list’ view from Variable Inspector example
• PR #4925: Notebook manager api fixes
• PR #4996: require print_method to be a bound method
• PR #5108: require specifying the version for gh-pages
• PR #5111: Minor typo in docstring of IPython.parallel DirectView
• PR #5098: mostly debugging changes for IPython.parallel
• PR #5087: trust cells with no output
• PR #5059: Fix incorrect Patch logic in widget code
• PR #5075: More flexible box model fixes
• PR #5091: Provide logging messages in ipcluster log when engine or controllers fail to start
• PR #5090: Print a warning when ipetest is run from the IPython source directory
• PR #5077: flush replies when entering an eventloop
• PR #5055: Minimal changes to import IPython from IronPython
• PR #5078: Updating JS tests README.md
• PR #5083: don’t create js test directories unless they are being used
• PR #5062: adjust some events in nb_roundtrip
• PR #5043: various unicode / url fixes
• PR #5066: remove (almost) all mentions of pylab from our examples
• PR #4977: ensure scp destination directories exist (with mkdir -p)
• PR #5053: Move&rename JS tests
• PR #5067: show traceback in widget handlers
• PR #4920: Adding PDFFormatter and kernel side handling of PDF display data
• PR #5048: Add edit/command mode indicator
• PR #5061: make execute button in menu bar match shift-enter

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• PR #5052: Add q to toggle the pager.
• PR #5070: fix flex: auto
• PR #5065: Add example of using annotations in interact
• PR #5063: another pass on Interact example notebooks
• PR #5051: FF Fix: code cell missing hscroll (2)
• PR #4960: Interact/Interactive for widget
• PR #5045: Clear timeout in multi-press keyboard shortcuts.
• PR #5060: Change ‘bind’ to ‘link’
• PR #5039: Expose kernel_info method on inprocess kernel client
• PR #5058: Fix iopubwatcher.py example script.
• PR #5035: FF Fix: code cell missing hscroll
• PR #5040: Polishing some docs
• PR #5001: Add directory navigation to dashboard
• PR #5042: Remove duplicated Channel ABC classes.
• PR #5036: FF Fix: ext link icon same line as link text in help menu
• PR #4975: setup.py changes for 2.0
• PR #4774: emit event on appended element on dom
• PR #5023: Widgets- add ability to pack and unpack arrays on JS side.
• PR #5003: Fix pretty reprs of super() objects
• PR #4974: make paste focus the pasted cell
• PR #5012: Make SelectionWidget.values a dict
• PR #5018: Prevent ‘iptest IPython’ from trying to run.
• PR #5025: citation2latex filter (using HTMLParser)
• PR #5027: pin lessc to 1.4
• PR #4952: Widget test inconsistencies
• PR #5014: Fix command mode & popup view bug
• PR #4842: more subtle kernel indicator
• PR #5017: Add notebook examples link to help menu.
• PR #5015: don’t write cell.trusted to disk
• PR #5007: Update whatsnew doc from PR files
• PR #5010: Fixes for widget alignment in FF
• PR #4901: Add a convenience class to sync traitlet attributes
• PR #5008: updated explanation of ‘pyin’ messages
• PR #5004: Fix widget vslider spacing
• PR #4933: Small Widget inconsistency fixes
• PR #4979: add versioning notes to small message spec changes
• PR #4893: add font-awesome 3.2.1
• PR #4982: Live readout for slider widgets
• PR #4813: make help menu a template
• PR #4939: Embed qtconsole docs (continued)
• PR #4964: remove shift-= merge keyboard shortcut
• PR #4504: Allow input transformers to raise SyntaxError
• PR #4929: Fixing various modal/focus related bugs
• PR #4971: Fixing issues with js tests
• PR #4972: Work around problem in doctest discovery in Python 3.4 with PyQt
• PR #4937: pickle arrays with dtype=object
• PR #4934: ipython profile create respects --ipython-dir
• PR #4954: generate unicode filename
• PR #4845: Add Origin Checking.
• PR #4916: Fine tuning the behavior of the modal UI
• PR #4966: Ignore sys.argv for NotebookNotary in tests
• PR #4967: Fix typo in warning about web socket being closed
• PR #4965: Remove mention of iplogger from setup.py
• PR #4962: Fixed typos in quick-help text
• PR #4953: add util.wait_for_idle in js tests
• PR #4870: ipython_directive, report except/warn in block and add :okexcept: :okwarning: options to suppress
• PR #4662: Menu cleanup
• PR #4824: sign notebooks
• PR #4943: Docs shotgun 4
• PR #4848: avoid import of nearby temporary with %edit
• PR #4950: Two fixes for file upload related bugs
• PR #4927: there shouldn’t be a ‘files/’ prefix in FileLink[s]
• PR #4928: use importlib.machinery when available
• PR #4949: Remove the docscape modules, which are part of numpydoc
• PR #4849: Various unicode fixes (mostly on Windows)
• PR #4932: always point py3compat.input to builtin_mod.input
• PR #4807: Correct handling of ansi colour codes when nbconverting to latex
• PR #4922: Python nbconvert output shouldn’t have output
• PR #4912: Skip some Windows io failures
• PR #4919: flush output before showing tracebacks
• PR #4915: ZMQCompleter inherits from IPCompleter
• PR #4890: better cleanup channel FDs

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• PR #4880: set profile name from profile_dir
• PR #4853: fix setting image height/width from metadata
• PR #4786: Reduce spacing of heading cells
• PR #4680: Minimal pandoc version warning
• PR #4908: detect builtin docstrings in oinspect
• PR #4911: Don’t use `python -m package` on Windows Python 2
• PR #4909: sort dictionary keys before comparison, ordering is not guaranteed
• PR #4374: IPEP 23: Backbone.js Widgets
• PR #4903: use https for all embeds
• PR #4894: Shortcut changes
• PR #4897: More detailed documentation about kernel_cmd
• PR #4891: Squash a few Sphinx warnings from nbconvert.utils.lexers docstrings
• PR #4679: JPG compression for inline pylab
• PR #4708: Fix indent and center
• PR #4789: fix IPython.embed
• PR #4655: prefer marked to pandoc for markdown2html
• PR #4876: don’t show tooltip if object is not found
• PR #4873: use ‘combine’ option to ucs package
• PR #4732: Accents in notebook names and in command-line (nbconvert)
• PR #4867: Update URL for Lawrence Hall of Science webcam image
• PR #4868: Static path fixes
• PR #4858: fix tb_offset when running a file
• PR #4826: some $.html( -> $.text()
• PR #4847: add js kernel_info request
• PR #4832: allow NotImplementedError in formatters
• PR #4803: BUG: fix cython magic support in ipython_directive
• PR #4865: build listed twice in .gitignore. Removing one.
• PR #4851: fix tooltip token regex for single-character names
• PR #4846: Remove some leftover traces of irunner
• PR #4820: fix regex for cleaning old logs with ipcluster
• PR #4844: adjustments to notebook app logging
• PR #4840: Error in Session.send_raw()
• PR #4819: update CodeMirror to 3.21
• PR #4823: Minor fixes for typos/inconsistencies in parallel docs
• PR #4811: document code mirror tab and shift-tab
• PR #4795: merge reveal templates
- PR #4796: update components
- PR #4806: Correct order of packages for unicode in nbconvert to LaTeX
- PR #4800: Qt frontend: Handle ‘aborted’ prompt replies.
- PR #4794: Compatibility fix for Python3 (Issue #4783)
- PR #4799: minor js test fix
- PR #4788: warn when notebook is started in pylab mode
- PR #4772: Notebook server info files
- PR #4797: be conservative about kernel_info implementation
- PR #4787: non-python kernels run python code with qtconsole
- PR #4565: various display type validations
- PR #4703: Math macro in jinja templates.
- PR #4781: Fix “Source” text for the “Other Syntax” section of the “Typesetting Math” notebook
- PR #4776: Manually document py3compat module.
- PR #4533: propagate display metadata to all mimetypes
- PR #4785: Replacing a for-in loop by an index loop on an array
- PR #4780: Updating CSS for UI example.
- PR #3605: Modal UI
- PR #4758: Python 3.4 fixes
- PR #4735: add some HTML error pages
- PR #4775: Update whatsnew doc from PR files
- PR #4760: Make examples and docs more Python 3 aware
- PR #4773: Don’t wait forever for notebook server to launch/die for tests
- PR #4768: Qt console: Fix _prompt_pos accounting on timer flush output.
- PR #4727: Remove Nbconvert template loading magic
- PR #4763: Set numpydoc options to produce fewer Sphinx warnings.
- PR #4770: alway define aliases, even if empty
- PR #4766: add python -m entry points for everything
- PR #4767: remove manpages for irunner, iplogger
- PR #4751: Added –post-serve explanation into the nbconvert docs.
- PR #4762: whitelist alphanumeric characters for cookie_name
- PR #4625: Deprecate %profile magic
- PR #4745: warn on failed formatter calls
- PR #4746: remove redundant cls alias on Windows
- PR #4749: Fix bug in determination of public ips.
- PR #4715: restore use of tornado static_url in templates
- PR #4748: fix race condition in profiledir creation.

2.9. Issues closed in the 2.x development cycle
• PR #4720: never use ssh multiplexer in tunnels
• PR #4658: Bug fix for #4643: Regex object needs to be reset between calls in tool...
• PR #4561: Add Formatter.pop(type)
• PR #4712: Docs shotgun 3
• PR #4713: Fix saving kernel history in Python 2
• PR #4744: don’t use lazily-evaluated rc.ids in wait_for_idle
• PR #4740: %env can’t set variables
• PR #4737: check every link when detecting virutalenv
• PR #4738: don’t inject help into user_ns
• PR #4739: skip html nbconvert tests when their dependencies are missing
• PR #4730: Fix stripping continuation prompts when copying from Qt console
• PR #4725: Doc fixes
• PR #4656: Nbconvert HTTP service
• PR #4710: make @interactive decorator friendlier with dill
• PR #4722: allow purging local results as long as they are not outstanding
• PR #4549: Updated IPython console lexers.
• PR #4570: Update IPython directive
• PR #4719: Fix comment typo in prefilter.py
• PR #4575: make sure to encode URL components for API requests
• PR #4718: Fixed typo in displaypub
• PR #4716: Remove input_prefilter hook
• PR #4691: survive failure to bind to localhost in zmq.iostream
• PR #4696: don’t do anything if add_anchor fails
• PR #4711: some typos in the docs
• PR #4700: use if main block in entry points
• PR #4692: setup.py symlink improvements
• PR #4265: JSON configuration file
• PR #4505: Nbconvert latex markdown images2
• PR #4608: transparent background match ... all colors
• PR #4678: allow ipython console to handle text/plain display
• PR #4706: remove irunner, iplogger
• PR #4701: Delete an old dictionary available for selecting the alignment of text.
• PR #4702: Making reveal font-size a relative unit.
• PR #4649: added a quiet option to %cpaste to suppress output
• PR #4690: Option to spew subprocess streams during tests
• PR #4688: Fixed various typos in docstrings.
• PR #4645: CasperJs utility functions.
• PR #4670: Stop bundling the numpydoc Sphinx extension
• PR #4675: common IPython prefix for ModIndex
• PR #4672: Remove unused ‘attic’ module
• PR #4671: Fix docstrings in utils.text
• PR #4669: add missing help strings to HistoryManager configurables
• PR #4668: Make non-ASCII docstring unicode
• PR #4650: added a note about sharing of nbconvert tempates
• PR #4646: Fixing various output related things:
• PR #4665: check for libedit in readline on OS X
• PR #4606: Make running PYTHONSTARTUP optional
• PR #4654: Fixing left padding of text cells to match that of code cells.
• PR #4306: add raw_mimetype metadata to raw cells
• PR #4576: Tighten up the vertical spacing on cells and make the padding of cells more consistent
• PR #4353: Don’t reset the readline completer after each prompt
• PR #4567: Adding prompt area to non-CodeCells to indent content.
• PR #4446: Use SVG plots in OctaveMagic by default due to lack of Ghostscript on Windows Octave
• PR #4613: remove configurable.created
• PR #4631: Use argument lists for command help tests
• PR #4633: Modifies test_get_long_path_name_winr32() to allow for long path names in temp dir
• PR #4642: Allow docs to build without PyQt installed.
• PR #4641: Don’t check for wx in the test suite.
• PR #4622: make QtConsole Lexer configurable
• PR #4594: Fixed #2923 Move Save Away from Cut in toolbar
• PR #4593: don’t interfere with set_next_input contents in qtconsole
• PR #4640: Support matplotlib’s Gtk3 backend in –pylab mode
• PR #4639: Minor import fix to get qtconsole with –pylab=qt working
• PR #4637: Fixed typo in links.txt.
• PR #4634: Fix nbrun in notebooks with non-code cells.
• PR #4632: Restore the ability to run tests from a function.
• PR #4624: Fix crash when $EDITOR is non-ASCII
• PR #4453: Play nice with App Nap
• PR #4541: relax ipconfig matching on Windows
• PR #4552: add pickleutil.use_dill
• PR #4590: Font awesome for IPython slides
• PR #4589: Inherit the width of pre code inside the input code cells.

2.9. Issues closed in the 2.x development cycle
• PR #4588: Update reveal.js CDN to 2.5.0.
• PR #4569: store cell toolbar preset in notebook metadata
• PR #4609: Fix bytes regex for Python 3.
• PR #4581: Writing unicode to stdout
• PR #4591: Documenting codemirror shortcuts.
• PR #4607: Tutorial doc should link to user config intro
• PR #4601: test that rename fails with 409 if it would clobber
• PR #4599: re-cast int/float subclasses to int/float in json_clean
• PR #4542: new ipython history clear subcommand
• PR #4568: don’t use lazily-evaluated rc.ids in wait_for_idle
• PR #4572: DOC: %profile docstring should reference %prun
• PR #4571: no longer need 3 suffix on travis, tox
• PR #4566: Fixing cell_type in CodeCell constructor.
• PR #4563: Specify encoding for reading notebook file.
• PR #4452: support notebooks in %run
• PR #4546: fix warning condition on notebook startup
• PR #4540: Apidocs3
• PR #4553: Fix Python 3 handling of urllib
• PR #4543: make hiding of initial namespace optional
• PR #4517: send shutdown_request on exit of ipython console
• PR #4528: improvements to bash completion
• PR #4532: Hide dynamically defined metaclass base from Sphinx.
• PR #4515: Spring Cleaning, and Load speedup
• PR #4529: note routing identities needed for input requests
• PR #4514: allow restart in %run -d
• PR #4527: add redirect for 1.0-style ‘files’ prefix links
• PR #4526: Allow unicode arguments to passwd_check on Python 2
• PR #4403: Global highlight language selection.
• PR #4250: outputarea.js: Wrap inline SVGs inside an iframe
• PR #4521: Read wav files in binary mode
• PR #4444: Css cleaning
• PR #4523: Use username and password for MongoDB on ShiningPanda
• PR #4510: Update whatsnew from PR files
• PR #4441: add setup.py jsversion
• PR #4518: Fix for race condition in url file decoding.
• PR #4497: don’t automatically unpack datetime objects in the message spec
• PR #4506: wait for empty queues as well as load-balanced tasks
• PR #4492: Configuration docs refresh
• PR #4508: Fix some uses of map() in Qt console completion code.
• PR #4498: Daemon StreamCapturer
• PR #4499: Skip clipboard test on unix systems if headless.
• PR #4460: Better clipboard handling, esp. with pywin32
• PR #4496: Pass nbformat object to write call to save .py script
• PR #4466: various pandoc latex fixes
• PR #4473: Setup for Python 2/3
• PR #4459: protect against broken repr in lib.pretty
• PR #4457: Use ~/.ipython as default config directory
• PR #4489: check realpath of env in init_virtualenv
• PR #4490: fix possible race condition in test_await_data
• PR #4476: Fix: Remove space added by display(JavaScript) on page reload
• PR #4398: [Notebook] Deactivate tooltip on tab by default.
• PR #4480: Docs shotgun 2
• PR #4488: fix typo in message spec doc
• PR #4479: yet another JS race condition fix
• PR #4477: Allow incremental builds of the html_noapi docs target
• PR #4470: Various Config object cleanups
• PR #4410: make close-and-halt work on new tabs in Chrome
• PR #4469: Python 3 & getcwd
• PR #4451: fix: allow JS test to run after shutdown test
• PR #4456: Simplify StreamCapturer for subprocess testing
• PR #4464: Correct description for Bytes traitlet type
• PR #4465: Clean up MANIFEST.in
• PR #4461: Correct TypeError message in svg2pdf
• PR #4458: use signalstatus if exit status is undefined
• PR #4438: Single codebase Python 3 support (again)
• PR #4198: Version conversion, support for X to Y even if Y < X (nbformat)
• PR #4415: More tooltips in the Notebook menu
• PR #4450: remove monkey patch for older versions of tornado
• PR #4423: Fix progress bar and scrolling bug.
• PR #4435: raise 404 on not found static file
• PR #4442: fix and add shim for change introduce by #4195
• PR #4436: allow require("nbextensions/extname") to load from IPYTHONDIR/nbextensions
• PR #4437: don’t compute etags in static file handlers
• PR #4427: notebooks should always have one checkpoint
• PR #4425: fix js pythonisme
• PR #4195: IPEP 21: widget messages
• PR #4434: Fix broken link for Dive Into Python.
• PR #4428: bump minimum tornado version to 3.1.0
• PR #4302: Add an Audio display class
• PR #4285: Notebook javascript test suite using CasperJS
• PR #4420: Allow checking for backports via milestone
• PR #4426: set kernel cwd to notebook’s directory
• PR #4389: By default, Magics inherit from Configurable
• PR #4393: Capture output from subprocess during test, and display on failure
• PR #4419: define InlineBackend configurable in its own file
• PR #4303: Multidirectory support for the Notebook
• PR #4371: Restored ipython profile locate dir and fixed typo. (Fixes #3708).
• PR #4414: Specify unicode type properly in rmagic
• PR #4413: don’t instantiate IPython shell as class attr
• PR #4400: Remove 5s wait on inactivity on GUI inputhook loops
• PR #4412: Fix traitlet _notify_trait by-ref issue
• PR #4378: split adds new cell above, rather than below
• PR #4405: Bring display of builtin types and functions in line with Py 2
• PR #4367: clean up of documentation files
• PR #4401: Provide a name of the HistorySavingThread
• PR #4384: fix menubar height measurement
• PR #4377: fix tooltip cancel
• PR #4293: Factorise code in tooltip for julia monkeypatching
• PR #4292: improve js-completer logic.
• PR #4363: set_next_input: keep only last input when repeatedly called in a single cell
• PR #4382: Use safe_hasattr in dir2
• PR #4379: fix (CTRL-M -) shortcut for splitting cell in FF
• PR #4380: Test and fixes for localinterfaces
• PR #4372: Don’t assume that SyntaxTB is always called with a SyntaxError
• PR #4342: Return value directly from the try block and avoid a variable
• PR #4154: Center LaTeX and figures in markdown
• PR #4311: %load -s to load specific functions or classes
• PR #4350: WinHPC launcher fixes
• PR #4345: Make irunner compatible with upcoming pexpect 3.0 interface
• PR #4276: Support container methods in config
• PR #4359: test_pylabtools also needs to modify matplotlib.rcParamsOrig
• PR #4355: remove hardcoded box-orient
• PR #4333: Add Edit Notebook Metadata to Edit menu
• PR #4349: Script to update What’s New file
• PR #4348: Call PDF viewer after latex compiling (nbconvert)
• PR #4346: getpass() on Windows & Python 2 needs bytes prompt
• PR #4304: use netifaces for faster IPython.utils.localinterfaces
• PR #4305: Add even more ways to populate localinterfaces
• PR #4313: remove strip_math_space
• PR #4325: Some changes to improve readability.
• PR #4281: Adjust tab completion widget if too close to bottom of page.
• PR #4347: Remove pycolor script
• PR #4322: Scroll to the top after change of slides in the IPython slides
• PR #4289: Fix scrolling output (not working post clear_output changes)
• PR #4343: Make parameters for kernel start method more general
• PR #4237: Keywords should shadow magic functions
• PR #4338: adjust default value of level in sync_imports
• PR #4328: Remove unused loop variable.
• PR #4340: fix mathjax download url to new GitHub format
• PR #4336: use simple replacement rather than string formatting in format_kernel_cmd
• PR #4264: catch unicode error listing profiles
• PR #4314: catch EACCES when binding notebook app
• PR #4324: Remove commented addthis toolbar
• PR #4327: Use the with statement to open a file.
• PR #4318: fix initial sys.path
• PR #4315: Explicitly state what version of Pandoc is supported in docs/install
• PR #4316: underscore missing on notebook_p4
• PR #4295: Implement boundary option for load magic (#1093)
• PR #4300: traits defauts are strings not object
• PR #4297: Remove an unreachable return statement.
• PR #4260: Use subprocess for system_raw
• PR #4277: add nbextentions
• PR #4294: don’t require tornado 3 in --post serve
• PR #4270: adjust Scheduler timeout logic

2.9. Issues closed in the 2.x development cycle
• PR #4278: add -a to easy_install command in libedit warning
• PR #4282: Enable automatic line breaks in MathJax.
• PR #4279: Fixing line-height of list items in tree view.
• PR #4253: fixes #4039.
• PR #4131: Add module’s name argument in %%cython magic
• PR #4269: Add mathletters option and longtable package to latex_base.tplx
• PR #4230: Switch correctly to the user’s default matplotlib backend after inline.
• PR #4271: Hopefully fix ordering of output on ShiningPanda
• PR #4239: more informative error message for bad serialization
• PR #4263: Fix excludes for IPython.testing
• PR #4112: nbconvert: Latex template refactor
• PR #4261: Fixing a formatting error in the custom display example notebook.
• PR #4259: Fix Windows test exclusions
• PR #4229: Clear_output: Animation & widget related changes.
• PR #4151: Refactor alias machinery
• PR #4153: make timeit return an object that contains values
• PR #4258: to-backport label is now 1.2
• PR #4242: Allow passing extra arguments to iptest through for nose
• PR #4257: fix unicode argy parsing
• PR #4166: avoid executing code in utils.localinterfaces at import time
• PR #4214: engine ID metadata should be unicode, not bytes
• PR #4232: no highlight if no language specified
• PR #4218: Fix display of SyntaxError when .py file is modified
• PR #4207: add setup.py css command
• PR #4224: clear previous callbacks on execute
• PR #4180: Iptest refactoring
• PR #4105: JS output area misaligned
• PR #4220: Various improvements to docs formatting
• PR #4187: Select adequate highlighter for cell magic languages
• PR #4228: update -dev docs to reflect latest stable version
• PR #4219: Drop bundled argparse
• PR #3851: Adds an explicit newline for pretty-printing.
• PR #3622: Drop fakemodule
• PR #4080: change default behavior of database task storage
• PR #4197: enable cython highlight in notebook
• PR #4225: Updated docstring for core.display.Image
• PR #4175: nbconvert: Jinjaless exporter base
• PR #4208: Added a lightweight “htmlcore” Makefile entry
• PR #4209: Magic doc fixes
• PR #4217: avoid importing numpy at the module level
• PR #4213: fixed dead link in examples/notebooks readme to Part 3
• PR #4183: ESC should be handled by CM if tooltip is not on
• PR #4193: Update for #3549: Append Firefox overflow-x fix
• PR #4205: use TextIOWrapper when communicating with pandoc subprocess
• PR #4204: remove some extraneous print statements from IPython.parallel
• PR #4201: HeadingCells cannot be split or merged
• PR #4048: finish up speaker-notes PR
• PR #4079: trigger Kernel.status_started after websockets open
• PR #4186: moved DummyMod to proper namespace to enable dill pickling
• PR #4190: update version-check message in setup.py and IPython.__init__
• PR #4188: Allow user_ns trait to be None
• PR #4189: always fire LOCAL_IPS.extend(PUBLIC_IPS)
• PR #4174: various issues in markdown and rst templates
• PR #4178: add missing data_javascript
• PR #4168: Py3 failing tests
• PR #4181: nbconvert: Fix, sphinx template not removing new lines from headers
• PR #4043: don’t ‘restore_bytes’ in from_JSON
• PR #4149: reuse more kernels in kernel tests
• PR #4163: Fix for incorrect default encoding on Windows.
• PR #4136: catch javascript errors in any output
• PR #4171: add nbconvert config file when creating profiles
• PR #4172: add ability to check what PRs should be backported in backport_pr
• PR #4167: –fast flag for test suite!
• PR #4125: Basic exercise of ipython [subcommand] -h and help-all
• PR #4085: nbconvert: Fix sphinx preprocessor date format string for Windows
• PR #4159: don’t split .cell and div.cell CSS
• PR #4165: Remove use of parametric tests
• PR #4158: generate choices for --gui configurable from real mapping
• PR #4083: Implement a better check for hidden values for %who etc.
• PR #4147: Reference notebook examples, fixes #4146.
• PR #4065: do not include specific css in embedable one
• PR #4092: nbconvert: Fix for unicode html headers, Windows + Python 2.x
- PR #4074: close Client sockets if connection fails
- PR #4064: Store default codemirror mode in only 1 place
- PR #4104: Add way to install MathJax to a particular profile
- PR #4161: Select name when renaming a notebook
- PR #4160: Add quotes around `.notebook` in readme
- PR #4144: `help_end` transformer shouldn’t pick up `?` in multiline string
- PR #4090: Add LaTeX citation handling to nbconvert
- PR #4143: update example custom.js
- PR #4142: DOC: unwrap openssl line in public_server doc
- PR #4126: update tox.ini
- PR #4141: add files with a separate add call in backport_pr
- PR #4137: Restore autoreset option for storemagic
- PR #4098: pass profile-dir instead of profile name to Kernel
- PR #4120: support `input` in Python 2 kernels
- PR #4088: nbconvert: Fix coalescestreams line with incorrect nesting causing strange behavior
- PR #4060: only strip continuation prompts if regular prompts seen first
- PR #4132: Fixed name error bug in function safe_unicode in module py3compat.
- PR #4121: move test_kernel from IPython.zmq to IPython.kernel
- PR #4118: ZMQ heartbeat channel: catch EINTR exceptions and continue.
- PR #4070: New changes should go into pr/ folder
- PR #4054: use unicode for HTML export
- PR #4106: fix a couple of default block values
- PR #4107: update parallel magic tests with capture_output API
- PR #4102: Fix clashes between debugger tests and coverage.py
- PR #4115: Update docs on declaring a magic function
- PR #4101: restore accidentally removed EngineError
- PR #4096: minor docs changes
- PR #4094: Update target branch before backporting PR
- PR #4069: Drop monkeypatch for pre-1.0 nose
- PR #4056: respect `pylab_import_all` when `--pylab` specified at the command-line
- PR #4091: Make Qt console banner configurable
- PR #4086: fix missing errno import
- PR #4084: Use msvcrtd.getwch() for Windows pager.
- PR #4073: rename `post_processors` submodule to `postprocessors`
- PR #4075: Update supported Python versions in tools/test_pr
- PR #4068: minor bug fix, define ‘cell’ in dialog.js.
• PR #4044: rename call methods to transform and postprocess
• PR #3744: capture rich output as well as stdout/err in capture_output
• PR #3969: “use strict” in most (if not all) our javascript
• PR #4030: exclude .git in MANIFEST.in
• PR #4047: Use istype() when checking if canned object is a dict
• PR #4031: don’t close_fds on Windows
• PR #4029: bson.Binary moved
• PR #3883: skip test on unix when x11 not available
• PR #3863: Added working speaker notes for slides.
• PR #4035: Fixed custom jinja2 templates being ignored when setting template_path
• PR #4002: Drop Python 2.6 and 3.2
• PR #4026: small doc fix in nbconvert
• PR #4016: Fix IPython.start_* functions
• PR #4021: Fix parallel.client.View map() on numpy arrays
• PR #4022: DOC: fix links to matplotlib, notebook docs
• PR #4018: Fix warning when running IPython.kernel tests
• PR #4017: Add REPL-like printing of final/return value to %%%R cell magic
• PR #4019: Test skipping without unicode paths
• PR #4008: Transform code before %prun/%%prun runs
• PR #4014: Fix typo in ipapp
• PR #3997: DOC: typos + rewording in examples/notebooks/Cell Magics.ipynb
• PR #3914: nbconvert: Transformer tests
• PR #3987: get files list in backport_pr
• PR #3923: nbconvert: Writer tests
• PR #3974: nbconvert: Fix app tests on Window7 w/ Python 3.3
• PR #3937: make tab visible in codemirror and light red background
• PR #3933: nbconvert: Post-processor tests
• PR #3978: fix --existing with non-localhost IP
• PR #3939: minor checkpoint cleanup
• PR #3955: complete on % for magic in notebook
• PR #3981: BF: fix nbconert rst input prompt spacing
• PR #3960: Don’t make sphinx a dependency for importing nbconvert
• PR #3973: logging.Formatter is not new-style in 2.6

Issues (434):
• #5476: For 2.0: Fix links in Notebook Help Menu
• #5337: Examples reorganization
• #5436: CodeMirror shortcuts in QuickHelp
• #5444: Fix numeric verification for Int and Float text widgets.
• #5443: Int and Float Widgets don’t allow negative signs
• #5449: Stretch keyboard shortcut dialog
• #5471: Add coding magic comment to nbconvert Python template
• #5470: UTF-8 Issue When Converting Notebook to a Script.
• #5369: FormatterWarning for SVG matplotlib output in notebook
• #5460: Can’t start the notebook server specifying a notebook
• #2918: CodeMirror related issues.
• #5431: update github_stats and gh_api for 2.0
• #4887: Add tests for modal UI
• #5290: Add dual mode JS tests
• #5448: Cmd+/ shortcut doesn’t work in IPython master
• #5447: Add %%python2 cell magic
• #5442: Make a “python2” alias or rename the “python”cell magic.
• #2495: non-ascii characters in the path
• #4554: dictDB: Exception due to str to datetime comparission
• #5006: Comm code is not run in the same context as notebook code
• #5118: Weird interact behavior
• #5401: Empty code cells in nbconvert rst output cause problems
• #5434: fix check for empty cells in rst template
• #4944: Trouble finding ipynb path in Windows 8
• #4605: Change the url of Editor Shorcuts in the notebook menu.
• #5425: Update COPYING.txt
• #5348: BUG: HistoryAccessor.get_session_info(0) - exception
• #5293: Javascript(“element.append()”) looks broken.
• #5363: Disable saving if notebook has stopped loading
• #5189: Tooltip pager mode is broken
• #5330: Updates to shell reference doc
• #5397: Accordion widget broken
• #5106: Flexbox CSS specificity bugs
• #5297: tooltip triggers focus bug
• #5417: scp checking for existence of directories: directory names are incorrect
• #5302: Parallel engine registration fails for slow engines
• #5334: notebook’s split-cell shortcut dangerous / incompatible with Neo layout (for instance)
• #5324: Style of raw_input UI is off in notebook
• #5350: Converting notebooks with spaces in their names to RST gives broken images
• #5049: update quickhelp on adding and removing shortcuts
• #4941: Eliminating display of intermediate stages in progress bars
• #5345: nbconvert to markdown does not use backticks
• #5357: catch exception in copystat
• #5351: Notebook saving fails on smb share
• #4946: TeX produced cannot be converted to PDF
• #5347: pretty print list too slow
• #5238: Raw cell placeholder is not removed when you edit the cell
• #5382: Qtconsole doesn’t run in Python 3
• #5378: Unexpected and new conflict between PyFileConfigLoader and IPythonQtConsoleApp
• #4945: Heading/cells positioning problem and cell output wrapping
• #5084: Consistent approach for HTML/JS output on nbviewer
• #4902: print preview does not work, custom.css not found
• #5336: TypeError in bootstrap-tour.min.js
• #5303: Changed Hub.registration_timeout to be a config input.
• #995: Paste-able mode in terminal
• #5305: Tuple unpacking for shell escape
• #5232: Make nbconvert html full output like notebook’s html.
• #5224: Audit nbconvert HTML output
• #5253: display any output from this session in terminal console
• #5251: ipython console ignoring some stream messages?
• #4802: Tour of the notebook UI (was UI elements inline with highlighting)
• #5103: Moving Constructor definition to the top like a Function definition
• #5264: Test failures on master with Anaconda
• #4833: Serve /usr/share/javascript at /_sysassets/javascript/ in notebook
• #5071: Prevent %pylab from clobbering interactive
• #5282: Exception in widget __del__ methods in Python 3.4.
• #5280: append Firefox overflow-x fix
• #5120: append Firefox overflow-x fix, again
• #4127: autoreload shouldn’t rely on .pyc modification times
• #5272: allow highlighting language to be set from notebook metadata
• #5050: Notebook cells truncated with Firefox
• #4839: Error in Session.send_raw()
• #5188: New events system
• #5076: Refactor keyboard handling

2.9. Issues closed in the 2.x development cycle
• #4886: Refactor and consolidate different keyboard logic in JavaScript code
• #5002: the green cell border moving forever in Chrome, when there are many code cells.
• #5259: Codemirror still active in command mode
• #5219: Output images appear as small thumbnails (Notebook)
• #4829: Not able to connect qtconsole in Windows 8
• #5152: Hide __pycache__ in dashboard directory list
• #5151: Case-insensitive sort for dashboard list
• #4603: Warn when overwriting a notebook with upload
• #4895: Improvements to %run completions
• #3459: Filename completion when run script with %run
• #5225: Add JavaScript to nbconvert HTML display priority
• #5034: Audit the places where we call .html(something)
• #5094: Dancing cells in notebook
• #4999: Notebook focus effects
• #5149: Clicking on a TextBoxWidget in FF completely breaks dual mode.
• #5207: Children fire event
• #5227: display_method of objects with custom __getattr__
• #5236: Cursor keys do not work to leave Markdown cell while it’s being edited
• #5205: Use CTuple traitlet for Widget children
• #5230: notebook rename does not respect url prefix
• #5218: Test failures with Python 3 and enabled warnings
• #5115: Page Breaks for Print Preview Broken by display: flex - Simple CSS Fix
• #5024: Make nbconvert HTML output smart about page breaking
• #4985: Add automatic Closebrackets function to Codemirror.
• #5184: print ‘xa’ crashes the interactive shell
• #5214: Downloading notebook as Python (.py) fails
• #5211: AttributeError: ‘module’ object has no attribute ‘_outputfile’
• #5206: [CSS?] Inconsistencies in nbconvert divs and IPython Notebook divs?
• #5201: node != nodejs within Debian packages
• #5112: band-aid for completion
• #4860: Completer As-You-Type Broken
• #5116: reorganize who knows what about paths
• #4973: Adding security.js with 1st attempt at is_safe
• #5164: test_oinspect.test_calltip_builtin failure with python3.4
• #5127: Widgets: skip intermediate callbacks during throttling
• #5013: Widget alignment differs between FF and Chrome
• #5141: tornado error static file
• #5160: TemporaryWorkingDirectory incompatible with python3.4
• #5140: WIP: %kernels magic
• #4987: Widget lifecycle problems
• #5129: UCS package break latex export on non-ascii
• #4986: Cell horizontal scrollbar is missing in FF but not in Chrome
• #4685: nbconvert ignores image size metadata
• #5155: Notebook logout button does not work (source typo)
• #2678: Ctrl-m keyboard shortcut clash on Chrome OS
• #5113: ButtonWidget without caption wrong height.
• #4778: add APIs for installing notebook extensions
• #5046: python setup.py failed vs git submodule update worked
• #4925: Notebook manager api fixes
• #5073: Cannot align widgets horizontally in the notebook
• #4996: require print_method to be a bound method
• #4990: _repr_html_ _exception reporting corner case when using type(foo)
• #5099: Notebook: Changing base_project_url results in failed WebSockets call
• #5096: Client.map is not fault tolerant
• #4997: Inconsistent %matplotlib qt behavior
• #5041: Remove more .html(...) calls.
• #5078: Updating JS tests README.md
• #4977: ensure scp destination directories exist (with mkdir -p)
• #3411: ipython parallel: scp failure.
• #5064: Errors during interact display at the terminal, not anywhere in the notebook
• #4921: Add PDF formatter and handling
• #4920: Adding PDFFormatter and kernel side handling of PDF display data
• #5048: Add edit/command mode indicator
• #4889: Add UI element for indicating command/edit modes
• #5052: Add q to toggle the pager.
• #5000: Closing pager with keyboard in modal UI
• #5069: Box model changes broke the Keyboard Shortcuts help modal
• #4960: Interact/Interactive for widget
• #4883: Implement interact/interactive for widgets
• #5038: Fix multiple press keyboard events
• #5054: UnicodeDecodeError: ‘ascii’ codec can’t decode byte 0xc6 in position 1: ordinal not in range(128)
• #5031: Bug during integration of IPython console in Qt application

2.9. Issues closed in the 2.x development cycle
• #5057: iopubwatcher.py example is broken.
• #4747: Add event for output_area adding an output
• #5001: Add directory navigation to dashboard
• #5016: Help menu external-link icons break layout in FF
• #4885: Modal UI behavior changes
• #5009: notebook signatures don’t work
• #4975: setup.py changes for 2.0
• #4774: emit event on appended element on dom
• #5020: Python Lists translated to javascript objects in widgets
• #5003: Fix pretty reprs of super() objects
• #5012: Make SelectionWidget.values a dict
• #4961: Bug when constructing a selection widget with both values and labels
• #4283: A < in a markdown cell strips cell content when converting to latex
• #4006: iptest IPython broken
• #4251: & escaped to &amp; in tex ?
• #5027: pin lesse to 1.4
• #4323: Take 2: citation2latex filter (using HTMLParser)
• #4196: Printing notebook from browser gives 1-page truncated output
• #4842: more subtle kernel indicator
• #4057: No path to notebook examples from Help menu
• #5015: don’t write cell.trusted to disk
• #4617: Changed url link in Help dropdown menu.
• #4976: Container widget layout broken on Firefox
• #4981: Vertical slider layout broken
• #4793: Message spec changes related to clear_output
• #4982: Live readout for slider widgets
• #4813: make help menu a template
• #4989: Filename tab completion completely broken
• #1380: Tab should insert 4 spaces in # comment lines
• #2888: spaces vs tabs
• #1193: Allow resizing figures in notebook
• #4504: Allow input transformers to raise SyntaxError
• #4697: Problems with height after toggling header and toolbar...
• #4951: TextWidget to code cell command mode bug.
• #4809: Arbitrary scrolling (jumping) in clicks in modal UI for notebook
• #4971: Fixing issues with js tests
2.9. Issues closed in the 2.x development cycle

- #4972: Work around problem in doctest discovery in Python 3.4 with PyQt
- #4892: IPython.qt test failure with python3.4
- #4863: BUG: cannot create an OBJECT array from memory buffer
- #4704: Subcommand profile ignores --ipython-dir
- #4845: Add Origin Checking.
- #4870: ipython_directive, report except/warn in block and add :okexcept: :okwarning: options to suppress
- #4956: Shift-Enter does not move to next cell
- #4662: Menu cleanup
- #4824: sign notebooks
- #4848: avoid import of nearby temporary with %edit
- #4731: %edit files mistakenly import modules in /tmp
- #4950: Two fixes for file upload related bugs
- #4871: Notebook upload fails after Delete
- #4825: File Upload URL set incorrectly
- #3867: display.FileLinks should work in the exported html version of a notebook
- #4948: reveal: ipython css overrides reveal themes
- #4947: reveal: slides that are too big?
- #4051: Test failures with Python 3 and enabled warnings
- #3633: outstanding issues over in ipython/nbconvert repo
- #4087: Sympy printing in the example notebook
- #4627: Document various QtConsole embedding approaches.
- #4849: Various unicode fixes (mostly on Windows)
- #3653: autocompletion in “from package import <tab>”
- #4583: overwrite? prompt gets EOFError in 2 process
- #4807: Correct handling of ansi colour codes when nbconverting to latex
- #4611: Document how to compile .less files in dev docs.
- #4618: “Editor Shortcuts” link is broken in help menu dropdown notebook
- #4522: DeprecationWarning: the sets module is deprecated
- #4368: No symlink from ipython to ipython3 when inside a python3 virtualenv
- #4234: Math without $$ doesn’t show up when converted to slides
- #4194: config.TerminalIPythonApp.nosep does not work
- #1491: prefilter not called for multi-line notebook cells
- #4001: Windows IPython executable /scripts/ipython not working
- #3959: think more carefully about text wrapping in nbconvert
- #4907: Test for traceback depth fails on Windows
- #4906: Test for IPython.embed() fails on Windows
• #4912: Skip some Windows io failures
• #3700: std旬/stderr should be flushed printing exception output...
• #1181: greedy completer bug in terminal console
• #2032: check for a few places we should be using DEFAULT_ENCODING
• #4882: Too many files open when starting and stopping kernel repeatedly
• #4880: set profile name from profile_dir
• #4238: parallel.Client() not using profile that notebook was run with?
• #4853: fix setting image height/width from metadata
• #4786: Reduce spacing of heading cells
• #4680: Minimal pandoc version warning
• #3707: nbconvert: Remove IPython magic commands from --format="python" output
• #4130: PDF figures as links from png or svg figures
• #3919: Allow --profile to be passed a dir.
• #2136: Handle hard newlines in pretty printer
• #4790: Notebook modal UI: “merge cell below” key binding, shift=, does not work with some keyboard layouts
• #4884: Keyboard shortcut changes
• #1184: slow handling of keyboard input
• #4913: Mathjax, Markdown, tex, env* and italic
• #3972: nbconvert: Template output testing
• #4903: use https for all embeds
• #4874: --debug does not work if you set .kernel_cmd
• #4679: JPG compression for inline pylab
• #4708: Fix indent and center
• #4789: fix IPython.embed
• #4759: Application._load_config_files log parameter default fails
• #3153: docs / file menu: explain how to exit the notebook
• #4791: Did updates to ipython_directive bork support for cython magic snippets?
• #4385: “Part 4 - Markdown Cells.ipynb” nbviever example seems not well referenced in current online documentation page http://ipython.org/ipython-doc/stable/interactive/notebook.htm
• #4655: prefer marked to pandoc for markdown2html
• #3441: Fix focus related problems in the notebook
• #3402: Feature Request: Save As (latex, html,.etc) as a menu option in Notebook rather than explicit need to invoke nbconvert
• #3224: Revisit layout of notebook area
• #2746: rerunning a cell with long output (exception) scrolls to much (html notebook)
• #2667: can’t save opened notebook if accidently delete the notebook in the dashboard
• #3026: Reporting errors from _repr_<type>_ methods
• #1844: Notebook does not exist and permalinks
• #2450: [closed PR] Prevent jumping of window to input when output is clicked.
• #3166: IPEP 16: Notebook multi directory dashboard and URL mapping
• #3691: Slight misalignment of Notebook menu bar with focus box
• #4875: Empty tooltip with object_found = false still being shown
• #4432: The SSL cert for the MathJax CDN is invalid and URL is not protocol agnostic
• #2633: Help text should leave current cell active
• #3976: DOC: Pandas link on the notebook help menu?
• #4082: /new handler redirect cached by browser
• #4298: Slow ipython –pylab and ipython notebook startup
• #4545: %store magic not working
• #4610: toolbar UI enhancements
• #4782: New modal UI
• #4732: Accents in notebook names and in command-line (nbconvert)
• #4752: link broken in docs/examples
• #4835: running ipython on python files adds an extra traceback frame
• #4792: repr_html exception warning on qtconsole with pandas #4745
• #4834: function tooltip issues
• #4808: Docstrings in Notebook not displayed properly and introspection
• #4846: Remove some leftover traces of irunner
• #4810: ipcluster bug in clean_logs flag
• #4812: update CodeMirror for the notebook
• #671: add migration guide for old IPython config
• #4783: ipython 2dev under windows / (win)python 3.3 experiment
• #4772: Notebook server info files
• #4765: missing build script for highlight.js
• #4787: non-python kernels run python code with qtconsole
• #4703: Math macro in jinja templates.
• #4595: ipython notebook XSS vulnerable
• #4776: Manually document py3compat module.
• #4686: For-in loop on an array in cell.js
• #3605: Modal UI
• #4769: IPython 2.0 will not startup on py27 on windows
• #4482: reveal.js converter not including CDN by default?
• #4761: ipv6 address triggers cookie exception

2.9. Issues closed in the 2.x development cycle
• #4580: rename or remove %profile magic
• #4643: Docstring does not open properly
• #4714: Static URLs are not auto-versioned
• #2573: document code mirror keyboard shortcuts
• #4717: hang in parallel.Client when using SSHAgent
• #4544: Clarify the requirement for pyreadline on Windows
• #3451: revisit REST /new handler to avoid systematic crawling.
• #2922: File => Save as `.py` saves magic as code
• #4728: Copy/Paste stripping broken in version > 0.13.x in QTConsole
• #4539: Nbconvert: Latex to PDF conversion fails on notebooks with accented letters
• #4721: purge_results with jobid crashing - looking for insight
• #4620: Notebook with ? in title defies autosave, renaming and deletion.
• #4574: Hash character in notebook name breaks a lot of things
• #4709: input_prefilter hook not called
• #1680: qtconsole should support --no-banner and custom banner
• #4689: IOStream IP address configurable
• #4698: Missing “if __name__ == ‘__main__’:” check in /usr/bin/ipython
• #4191: NBConvert: markdown inline and locally referenced files have incorrect file location for latex
• #2865: %%% does not display the shell execute docstring
• #1551: Notebook should be saved before printing
• #4612: remove Configurable.created?
• #4629: Lots of tests fail due to space in sys.executable
• #4644: Fixed URLs for notebooks
• #4621: IPython 1.1.0 Qtconsole syntax highlighting highlights python 2 only built-ins when using python 3
• #2923: Move Delete Button Away from Save Button in the HTML notebook toolbar
• #4615: UnicodeDecodeError
• #4431: ipython slow in os x mavericks?
• #4538: DOC: document how to change ipcontroller-engine.json in case controller was started with --ip="*"
• #4551: Serialize methods and closures
• #4081: [Nbconvert][reveal] link to font awesome?
• #4602: “icluster stop” fails after “icluster start –daemonize” using python3.3
• #4578: NBconvert fails with unicode errors when --stdout and file redirection is specified and HTML entities are present
• #4600: Renaming new notebook to an exist name silently deletes the old one
• #4598: Qtconsole docstring pop-up fails on method containing defaulted enum argument
• #951: Remove Tornado monkeypatch
• #4564: Notebook save failure
• #4562: nbconvert: Default encoding problem on OS X
• #1675: add file_to_run=file.ipynb capability to the notebook
• #4516: ipython console doesn’t send a shutdown_request
• #3043: can’t restart pdb session in ipython
• #4524: Fix bug with non ascii passwords in notebook login
• #1866: problems rendering an SVG?
• #4520: unicode error when trying Audio(‘data/Bach Cello Suite #3.wav’)
• #4493: Qtconsole cannot print an ISO8601 date at nanosecond precision
• #4502: intermittent parallel test failure test_purge_everything
• #4495: firefox 25.0: notebooks report “Notebook save failed”, .py script save fails, but .ipynb save succeeds
• #4245: nbconvert latex: code highlighting causes error
• #4486: Test for whether inside virtualenv does not work if directory is symlinked
• #4485: Incorrect info in “Messaging in IPython” documentation.
• #4447: Ipcontroller broken in current HEAD on windows
• #4241: Audio display object
• #4463: Error on empty c.Session.key
• #4454: UnicodeDecodeError when starting Ipython notebook on a directory containing a file with a non-ascii character
• #3801: Autocompletion: Fix issue #3723 – ordering of completions for magic commands and variables with same name
• #3723: Code completion: ‘matplotlib’ and ‘%matplotlib’
• #4396: Always checkpoint al least once ?
• #2524: [Notebook] Clear kernel queue
• #2292: Client side tests for the notebook
• #4424: Dealing with images in multidirectory environment
• #4388: Make writing configurable magics easier
• #852: Notebook should be saved before downloading
• #3708: ipython profile locate should also work
• #1349: ? may generate hundreds of cell
• #4381: Using hasattr for trait_names instead of just looking for it directly/using __dir__?
• #4361: Crash Ultratraceback/ session history
• #3044: IPython notebook autocomplete for filename string converts multiple spaces to a single space
• #3346: Up arrow history search shows duplicates in Qtconsole
• #3496: Fix import errors when running tests from the source directory
• #4114: If default profile doesn’t exist, can’t install mathjax to any location
• #4335: TestPylabSwitch.test_qt fails
• #4291: serve like option for nbconvert --to latex
• #1824: Exception before prompting for password during ssh connection
• #4309: Error in nbconvert - closing </code> tag is not inserted in HTML under some circumstances
• #4351: /parallel/apps/launcher.py error
• #3603: Upcoming issues with nbconvert
• #4296: sync_imports() fails in python 3.3
• #4339: local mathjax install doesn’t work
• #4334: NotebookApp.webapp_settings static_url_prefix causes crash
• #4308: Error when use “ipython notebook” in win7 64 with python2.7.3 64.
• #4317: Relative imports broken in the notebook (Windows)
• #3658: Saving Notebook clears “Kernel Busy” status from the page and titlebar
• #4312: Link broken on ipython-doc stable
• #1093: Add boundary options to %load
• #3619: Multi-dir webservice design
• #4299: Nbconvert, default_preprocessors to list of dotted name not list of obj
• #3210: IPython.parallel tests seem to hang on ShiningPanda
• #4280: MathJax Automatic Line Breaking
• #4039: Celltoolbar example issue
• #4247: nbconvert --to latex: error when converting greek letter
• #4273: %%capture not capturing rich objects like plots (IPython 1.1.0)
• #3866: Vertical offsets in LaTeX output for nbconvert
• #3631: xkcd mode for the IPython notebook
• #4243: Test exclusions not working on Windows
• #4256: IPython no longer handles unicode file names
• #3656: Audio displayobject
• #4223: Double output on Ctrl-enter-enter
• #4184: nbconvert: use r pygmentize backend when highlighting “%-%R” cells
• #3851: Adds an explicit newline for pretty-printing.
• #3622: Drop fakemodule
• #4122: Nbconvert [windows]: Inconsistent line endings in markdown cells exported to latex
• #3819: nbconvert add extra blank line to code block on Windows.
• #4203: remove spurious print statement from parallel annotated functions
• #4200: Notebook: merging a heading cell and markdown cell cannot be undone
• #3747: ipynb -> ipynb transformer
• #4024: nbconvert markdown issues
• #3903: on Windows, ‘ipython3 nbconvert “C:/blabla/first_try.ipynb” –to slides’ gives an unexpected result, and ‘–post serve’ fails
• #4095: Catch js error in append html in stream/pyerr
• #1880: Add parallelism to test_pr
• #4085: nbconvert: Fix sphinx preprocessor date format string for Windows
• #4156: Specifying --gui=tk at the command line
• #4146: Having to prepend ‘files/’ to markdown image paths is confusing
• #3818: nbconvert can’t handle Heading with Chinese characters on Japanese Windows OS.
• #4134: multi-line parser fails on ‘”’ in comment, qtconsole and notebook.
• #3998: sample custom.js needs to be updated
• #4078: StoreMagic.autorestore not working in 1.0.0
• #3990: Buitlin input doesn’t work over zmq
• #4015: nbconvert fails to convert all the content of a notebook
• #4059: Issues with Ellipsis literal in Python 3
• #2310: “ZMQError: Interrupted system call” from RichIPythonWidget
• #3807: qtconsole ipython 0.13.2 - html/xhtml export fails
• #4103: Wrong default argument of DirectView.clear
• #4100: parallel.client.client references undefined error.EngineError
• #484: Drop nosepatch
• #3350: Added longlist support in ipdb.
• #1591: Keying ‘q’ doesn’t quit the interactive help in Wins7
• #40: The tests in test_process fail under Windows
• #3744: capture rich output as well as stdout/err in capture_output
• #3742: %%capture to grab rich display outputs
• #3863: Added working speaker notes for slides.
• #4013: Iptest fails in dual python installation
• #4005: IPython.start_kernel doesn’t work.
• #4020: IPython parallel map fails on numpy arrays
• #3914: nbconvert: Transformer tests
• #3923: nbconvert: Writer tests
• #3945: nbconvert: commandline tests fail Win7x64 Py3.3
• #3937: make tab visible in codemirror and light red background
• #3935: No feedback for mixed tabs and spaces
• #3933: nbconvert: Post-processor tests
• #3977: unable to complete remote connections for two-process
• #3939: minor checkpoint cleanup

2.9. Issues closed in the 2.x development cycle
• #3955: complete on % for magic in notebook
• #3954: all magics should be listed when completing on %
• #3980: nbconvert rst output lacks needed blank lines
• #3968: TypeError: super() argument 1 must be type, not classobj (Python 2.6.6)
• #3880: nbconvert: R&D remaining tests
• #2440: IPEP 4: Python 3 Compatibility

2.10 1.0 Series

2.10.1 Release 1.0.0: An Afternoon Hack

IPython 1.0 requires Python 2.6.5 or 3.2.1. It does not support Python 3.0, 3.1, or 2.5.

This is a big release. The principal milestone is the addition of IPython.nbconvert, but there has been a great deal of work improving all parts of IPython as well.

The previous version (0.13) was released on June 30, 2012, and in this development cycle we had:

• ~12 months of work.
• ~700 pull requests merged.
• ~600 issues closed (non-pull requests).
• contributions from ~150 authors.
• ~4000 commits.

The amount of work included in this release is so large that we can only cover here the main highlights; please see our detailed release statistics for links to every issue and pull request closed on GitHub as well as a full list of individual contributors. It includes

Reorganization

There have been two major reorganizations in IPython 1.0:

• Added IPython.kernel for all kernel-related code. This means that IPython.zmq has been removed, and much of it is now in IPython.kernel.zmq, some of it being in the top-level IPython.kernel.

• We have removed the frontend subpackage, as it caused unnecessary depth. So what was IPython.frontend.qt is now IPython.qt, and so on. The one difference is that the notebook has been further flattened, so that IPython.frontend.html.notebook is now just IPython.html. There is a shim module, so IPython.frontend is still importable in 1.0, but there will be a warning.

• The IPython sphinx directives are now installed in IPython.sphinx, so they can be imported by other projects.

Public APIs

For the first time since 0.10 (sorry, everyone), there is an official public API for starting IPython:

```python
from IPython import start_ipython
start_ipython()
```
This is what packages should use that start their own IPython session, but don’t actually want embedded IPython (most cases). IPython.embed() is used for embedding IPython into the calling namespace, similar to calling Pdb.set_trace(), whereas start_ipython() will start a plain IPython session, loading config and startup files as normal.

We also have added:

```python
from IPython import get_ipython
```

Which is a library function for getting the current IPython instance, and will return None if no IPython instance is running. This is the official way to check whether your code is called from inside an IPython session. If you want to check for IPython without unnecessarily importing IPython, use this function:

```python
def get_ipython():
    """return IPython instance if there is one, None otherwise""
    import sys
    if "IPython" in sys.modules:
        import IPython
        return IPython.get_ipython()
```

Core

- The input transformation framework has been reworked. This fixes some corner cases, and adds more flexibility for projects which use IPython, like SymPy & SAGE. For more details, see Custom input transformation.
- Exception types can now be displayed with a custom traceback, by defining a _render_traceback_() method which returns a list of strings, each containing one line of the traceback.
- A new command, ipython history trim can be used to delete everything but the last 1000 entries in the history database.
- __file__ is defined in both config files at load time, and .ipy files executed with %run.
- %logstart and %logappend are no longer broken.
- Add glob expansion for %run, e.g. %run -g script.py *.txt.
- Expand variables ($foo) in Cell Magic argument line.
- By default, iptest will exclude various slow tests. All tests can be run with iptest --all.
- SQLite history can be disabled in the various cases that it does not behave well.
- %edit works on interactively defined variables.
- editor hooks have been restored from quarantine, enabling TextMate as editor, etc.
- The env variable PYTHONSTARTUP is respected by IPython.
- The %matplotlib magic was added, which is like the old %pylab magic, but it does not import anything to the interactive namespace. It is recommended that users switch to %matplotlib and explicit imports.
- The --matplotlib command line flag was also added. It invokes the new %matplotlib magic and can be used in the same way as the old --pylab flag. You can either use it by itself as a flag (--matplotlib), or you can also pass a backend explicitly (--matplotlib qt or --matplotlib=wx, etc).

Backwards incompatible changes

- Calling InteractiveShell.prefilter() will no longer perform static transformations - the processing of escaped commands such as %magic and !system, and stripping input prompts from code blocks. This
functionality was duplicated in `IPython.core.inputsplitter`, and the latter version was already what IPython relied on. A new API to transform input will be ready before release.

- Functions from `IPython.lib.ipythonhook` to control integration with GUI event loops are no longer exposed in the top level of `IPython.lib`. Code calling these should make sure to import them from `IPython.lib.ipythonhook`.

- For all kernel managers, the `sub_channel` attribute has been renamed to `iopub_channel`.

- Users on Python versions before 2.6.6, 2.7.1 or 3.2 will now need to call `IPython.utils.doctreeload.doctest_reload()` to make doctests run correctly inside IPython. Python releases since those versions are unaffected. For details, see PR #3068 and Python issue 8048.

- The `InteractiveShell.cache_main_mod()` method has been removed, and `new_main_mod()` has a different signature, expecting a filename where earlier versions expected a namespace. See PR #3555 for details.

- The short-lived plugin system has been removed. Extensions are the way to go.

**NbConvert**

The major milestone for IPython 1.0 is the addition of `IPython.nbconvert` - tools for converting IPython notebooks to various other formats.

**Warning:** nbconvert is a-level preview code in 1.0

To use nbconvert to convert various file formats:

```bash
ipython nbconvert --to html *.ipynb
```

See `ipython nbconvert --help` for more information. nbconvert depends on pandoc for many of the translations to and from various formats.

**Notebook**

Major changes to the IPython Notebook in 1.0:

- The notebook is now autosaved, by default at an interval of two minutes. When you press ‘save’ or Ctrl-S, a `checkpoint` is made, in a hidden folder. This checkpoint can be restored, so that the autosave model is strictly safer than traditional save. If you change nothing about your save habits, you will always have a checkpoint that you have written, and an autosaved file that is kept up to date.

- The notebook supports `raw_input()` / `input()`, and thus also `%debug`, and many other Python calls that expect user input.

- You can load custom javascript and CSS in the notebook by editing the files `$(ipython locate profile)/static/custom/custom.js,css`.

- Add `%%html,%%svg,%%javascript`, and `%%latex` cell magics for writing raw output in notebook cells.

- add a redirect handler and anchors on heading cells, so you can link across notebooks, directly to heading cells in other notebooks.

- Images support width and height metadata, and thereby 2x scaling (retina support).

- `_repr_foo_` methods can return a tuple of (data, metadata), where metadata is a dict containing metadata about the displayed object. This is used to set size, etc. for retina graphics. To enable retina matplotlib figures,
simply set `InlineBackend.figure_format = 'retina'` for 2x PNG figures, in your `IPython config file` or via the `%config` magic.

- Add `display.FileLink` and `FileLinks` for quickly displaying HTML links to local files.
- Cells have metadata, which can be edited via cell toolbars. This metadata can be used by external code (e.g. reveal.js or exporters), when examining the notebook.
- Fix an issue parsing LaTeX in markdown cells, which required users to type `\\`, instead of `\`
- Notebook templates are rendered with Jinja instead of Tornado.
- `%file` has been renamed `%writefile` (%file is deprecated).
- ANSI (and VT100) color parsing has been improved in both performance and supported values.
- The static files path can be found as `IPython.html.DEFAULT_STATIC_FILES_PATH`, which may be changed by package managers.
- IPython’s CSS is installed in `static/css/style.min.css` (all style, including bootstrap), and `static/css/ipython.min.css`, which only has IPython’s own CSS. The latter file should be useful for embedding IPython notebooks in other pages, blogs, etc.
- The Print View has been removed. Users are encouraged to test `ipython nbconvert` to generate a static view.

**Javascript Components**

The javascript components used in the notebook have been updated significantly.

- updates to jQuery (2.0) and jQueryUI (1.10)
- Update CodeMirror to 3.14
- Twitter Bootstrap (2.3) for layout
- Font-Awesome (3.1) for icons
- highlight.js (7.3) for syntax highlighting
- marked (0.2.8) for markdown rendering
- require.js (2.1) for loading javascript

Some relevant changes that are results of this:

- Markdown cells now support GitHub-flavored Markdown (GFM), which includes `'''python` code blocks and tables.
- Notebook UI behaves better on more screen sizes.
- Various code cell input issues have been fixed.

**Kernel**

The kernel code has been substantially reorganized.

New features in the kernel:

- Kernels support ZeroMQ IPC transport, not just TCP
- The message protocol has added a top-level metadata field, used for information about messages.
- Add a `data_pub` message that functions much like `display_pub`, but publishes raw (usually pickled) data, rather than representations.
• Ensure that `sys.stdout.encoding` is defined in Kernels.

• Stdout from forked subprocesses should be forwarded to frontends (instead of crashing).

**IPEP 13**

The KernelManager has been split into a `KernelManager` and a `KernelClient`. The Manager owns a kernel and starts / signals / restarts it. There is always zero or one KernelManager per Kernel. Clients communicate with Kernels via zmq channels, and there can be zero-to-many Clients connected to a Kernel at any given time.

The KernelManager now automatically restarts the kernel when it dies, rather than requiring user input at the notebook or QtConsole UI (which may or may not exist at restart time).

**In-process kernels**

The Python-language frontends, particularly the Qt console, may now communicate with in-process kernels, in addition to the traditional out-of-process kernels. An in-process kernel permits direct access to the kernel namespace, which is necessary in some applications. It should be understood, however, that the in-process kernel is not robust to bad user input and will block the main (GUI) thread while executing. Developers must decide on a case-by-case basis whether this tradeoff is appropriate for their application.

**Parallel**

IPython.parallel has had some refactoring as well. There are many improvements and fixes, but these are the major changes:

• Connections have been simplified. All ports and the serialization in use are written to the connection file, rather than the initial two-stage system.

• Serialization has been rewritten, fixing many bugs and dramatically improving performance serializing large containers.

• Load-balancing scheduler performance with large numbers of tasks has been dramatically improved.

• There should be fewer (hopefully zero) false-positives for engine failures.

• Increased compatibility with various use cases that produced serialization / argument errors with map, etc.

• The controller can attempt to resume operation if it has crashed, by passing `ipcontroller --restore`.

• Engines can monitor the Hub heartbeat, and shutdown if the Hub disappears for too long.

• add HTCondor support in launchers

**QtConsole**

Various fixes, including improved performance with lots of text output, and better drag and drop support. The initial window size of the qtconsole is now configurable via `IPythonWidget.width` and `IPythonWidget.height`.

**2.11 Issues closed in the 1.0 development cycle**

**2.11.1 Issues closed in 1.2**

GitHub stats for 2013/09/09 - 2014/02/21
These lists are automatically generated, and may be incomplete or contain duplicates.
The following 13 authors contributed 84 commits.

- Benjamin Ragan-Kelley
- Daryl Herzmann
- Doug Blank
- Fernando Perez
- James Porter
- Juergen Hasch
- Julian Taylor
- Kyle Kelley
- Lawrence Fu
- Matthias Bussonnier
- Paul Ivanov
- Pascal Schetelat
- Puneeth Chaganti
- Takeshi Kanmae
- Thomas Kluyver

We closed a total of 55 issues, 38 pull requests and 17 regular issues; this is the full list (generated with the script `tools/github_stats.py`):

**Pull Requests (38):**

1.2.1:
- PR #4372: Don’t assume that SyntaxTB is always called with a SyntaxError
- PR #5166: remove mktemp usage
- PR #5163: Simplify implementation of TemporaryWorkingDirectory.
- PR #5105: add index to format to support py2.6

1.2.0:
- PR #4972: Work around problem in doctest discovery in Python 3.4 with PyQt
- PR #4934: `ipython profile create respects --ipython-dir`
- PR #4845: Add Origin Checking.
- PR #4928: use importlib.machinery when available
- PR #4849: Various unicode fixes (mostly on Windows)
- PR #4880: set profile name from profile_dir
- PR #4908: detect builtin docstrings in oinspect
- PR #4909: sort dictionary keys before comparison, ordering is not guaranteed
- PR #4903: use https for all embeds
- PR #4868: Static path fixes
• PR #4820: fix regex for cleaning old logs with ipcluster
• PR #4840: Error in Session.send_raw()
• PR #4762: whitelist alphanumeric characters for cookie_name
• PR #4748: fix race condition in profiledir creation.
• PR #4720: never use ssh multiplexer in tunnels
• PR #4738: don’t inject help into user_ns
• PR #4722: allow purging local results as long as they are not outstanding
• PR #4668: Make non-ASCII docstring unicode
• PR #4639: Minor import fix to get qtconsole with --pylab=qt working
• PR #4453: Play nice with App Nap
• PR #4609: Fix bytes regex for Python 3.
• PR #4488: fix typo in message spec doc
• PR #4346: getpass() on Windows & Python 2 needs bytes prompt
• PR #4230: Switch correctly to the user’s default matplotlib backend after inline.
• PR #4214: engine ID metadata should be unicode, not bytes
• PR #4232: no highlight if no language specified
• PR #4218: Fix display of SyntaxError when .py file is modified
• PR #4217: avoid importing numpy at the module level
• PR #4213: fixed dead link in examples/notebooks readme to Part 3
• PR #4183: ESC should be handled by CM if tooltip is not on
• PR #4193: Update for #3549: Append Firefox overflow-x fix
• PR #4205: use TextIOWrapper when communicating with pandoc subprocess
• PR #4204: remove some extraneous print statements from IPython.parallel
• PR #4201: HeadingCells cannot be split or merged

1.2.1:
• #5101: IPython 1.2.0: notebook fail with “500 Internal Server Error”

1.2.0:
• #4892: IPython.qt test failure with python3.4
• #4810: ipcluster bug in clean_logs flag
• #4765: missing build script for highlight.js
• #4761: ipv6 address triggers cookie exception
• #4721: purge_results with jobid crashing - looking for insight
• #4602: “ipcluster stop” fails after “ipcluster start --daemonize” using python3.3
• #3386: Magic %paste not working in Python 3.3.2. TypeError: Type str doesn’t support the buffer API
• #4485: Incorrect info in “Messaging in IPython” documentation.
• #4351: /parallel/apps/launcher.py error
• #4334: NotebookApp.webapp_settings static_url_prefix causes crash
• #4039: Celltoolbar example issue
• #4256: IPython no longer handles unicode file names
• #4122: Nbconvert [windows]: Inconsistent line endings in markdown cells exported to latex
• #3819: nbconvert add extra blank line to code block on Windows.
• #4203: remove spurious print statement from parallel annotated functions
• #4200: Notebook: merging a heading cell and markdown cell cannot be undone

2.11.2 Issues closed in 1.1

GitHub stats for 2013/08/08 - 2013/09/09 (since 1.0)
These lists are automatically generated, and may be incomplete or contain duplicates.
The following 25 authors contributed 337 commits.
• Benjamin Ragan-Kelley
• Bing Xia
• Bradley M. Froehle
• Brian E. Granger
• Damián Avila
• dhirschfeld
• Dražen Lučanin
• gmbecker
• Jake Vanderplas
• Jason Grout
• Jonathan Frederic
• Kevin Burke
• Kyle Kelley
• Matt Henderson
• Matthew Brett
• Matthias Bussonnier
• Pankaj Pandey
• Paul Ivanov
• rossant
• Samuel Ainsworth
• Stephan Rave
• stonebig
• Thomas Kluyver
• Yaroslav Halchenko

2.11. Issues closed in the 1.0 development cycle
• Zachary Sailer

We closed a total of 76 issues, 58 pull requests and 18 regular issues; this is the full list (generated with the script `tools/github_stats.py`):

Pull Requests (58):

• PR #4188: Allow user_ns trait to be None
• PR #4189: always fire LOCAL_IPS.extend(PUBLIC_IPS)
• PR #4174: various issues in markdown and rst templates
• PR #4178: add missing data_javascript
• PR #4181: nbconvert: Fix, sphinx template not removing new lines from headers
• PR #4043: don’t ‘restore_bytes’ in from_JSON
• PR #4163: Fix for incorrect default encoding on Windows.
• PR #4136: catch javascript errors in any output
• PR #4171: add nbconvert config file when creating profiles
• PR #4125: Basic exercise of ipython [subcommand] -h and help-all
• PR #4085: nbconvert: Fix sphinx preprocessor date format string for Windows
• PR #4159: don’t split .cell and div.cell CSS
• PR #4158: generate choices for --gui configurable from real mapping
• PR #4065: do not include specific css in embedable one
• PR #4092: nbconvert: Fix for unicode html headers, Windows + Python 2.x
• PR #4074: close Client sockets if connection fails
• PR #4064: Store default codemirror mode in only 1 place
• PR #4104: Add way to install MathJax to a particular profile
• PR #4144: help_end transformer shouldn’t pick up ? in multiline string
• PR #4143: update example custom.js
• PR #4142: DOC: unwrap openssl line in public_server doc
• PR #4141: add files with a separate add call in backport_pr
• PR #4137: Restore autorestore option for storemagic
• PR #4098: pass profile-dir instead of profile name to Kernel
• PR #4120: support input in Python 2 kernels
• PR #4088: nbconvert: Fix coalescestreams line with incorrect nesting causing strange behavior
• PR #4060: only strip continuation prompts if regular prompts seen first
• PR #4132: Fixed name error bug in function safe_unicode in module py3compat.
• PR #4121: move test_kernel from IPython.zmq to IPython.kernel
• PR #4118: ZMQ heartbeat channel: catch EINVAL exceptions and continue.
• PR #4054: use unicode for HTML export
• PR #4106: fix a couple of default block values

Chapter 2. What’s new in IPython
• PR #4115: Update docs on declaring a magic function
• PR #4101: restore accidentally removed EngineError
• PR #4096: minor docs changes
• PR #4056: respect `pylab_import_all` when `--pylab` specified at the command-line
• PR #4091: Make Qt console banner configurable
• PR #4086: fix missing `errno` import
• PR #4030: exclude `.git` in MANIFEST.in
• PR #4047: Use istype() when checking if canned object is a dict
• PR #4031: don’t close `_fds` on Windows
• PR #4029: bson.Binary moved
• PR #4035: Fixed custom jinja2 templates being ignored when setting template_path
• PR #4026: small doc fix in nbconvert
• PR #4016: Fix IPython.start_* functions
• PR #4021: Fix parallel.client.View map() on numpy arrays
• PR #4022: DOC: fix links to matplotlib, notebook docs
• PR #4018: Fix warning when running IPython.kernel tests
• PR #4019: Test skipping without unicode paths
• PR #4008: Transform code before `%prun/%%prun` runs
• PR #4014: Fix typo in ipapp
• PR #3987: get files list in backport_pr
• PR #3974: nbconvert: Fix app tests on Window7 w/ Python 3.3
• PR #3978: fix `--existing` with non-localhost IP
• PR #3939: minor checkpoint cleanup
• PR #3981: BF: fix nbconvert rst input prompt spacing
• PR #3960: Don’t make sphinx a dependency for importing nbconvert
• PR #3973: logging.Formatter is not new-style in 2.6

Issues (18):

• #4024: nbconvert markdown issues
• #4095: Catch js error in append html in stream/pyerr
• #4156: Specifying `--gui=tk` at the command line
• #3818: nbconvert can’t handle Heading with Chinese characters on Japanese Windows OS.
• #4134: multi-line parser fails on ‘”’ in comment, qtconsole and notebook.
• #3998: sample custom.js needs to be updated
• #4078: StoreMagic.autorestore not working in 1.0.0
• #3990: Builtin `input` doesn’t work over zmq
• #4015: nbconvert fails to convert all the content of a notebook
• #4059: Issues with Ellipsis literal in Python 3
• #4103: Wrong default argument of DirectView.clear
• #4100: parallel.client.client references undefined error.EngineError
• #4005: IPython.start_kernel doesn’t work.
• #4020: IPython parallel map fails on numpy arrays
• #3945: nbconvert: commandline tests fail Win7x64 Py3.3
• #3977: unable to complete remote connections for two-process
• #3980: nbconvert rst output lacks needed blank lines
• #3968: TypeError: super() argument 1 must be type, not classobj (Python 2.6.6)

2.11.3 Issues closed in 1.0

GitHub stats for 2012/06/30 - 2013/08/08 (since 0.13)

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 155 authors contributed 4258 commits.

• Aaron Meurer
• Adam Davis
• Ahmet Bakan
• Alberto Valverde
• Allen Riddell
• Anders Hovmöller
• Andrea Bedini
• Andrew Spiers
• Andrew Vandever
• Anthony Scopatz
• Anton Akhmerov
• Anton I. Sipos
• Antony Lee
• Aron Ahmadia
• Benedikt Sauer
• Benjamin Jones
• Benjamin Ragan-Kelley
• Benjie Chen
• Boris de Laage
• Brad Reisfeld
• Bradley M. Froehle
• Brian E. Granger
• Cameron Bates
• Cavendish McKay
• chapmanb
• Chris Beaumont
• Chris Laumann
• Christoph Gohlke
• codebraker
• codespaced
• Corran Webster
• DamianHeard
• Damián Avila
• Dan Kilman
• Dan McDougall
• Danny Staple
• David Hirschfeld
• David P. Sanders
• David Warde-Farley
• David Wolever
• David Wyde
• debjan
• Diane Trout
• dkua
• Dominik Dabrowski
• Donald Curtis
• Dražen Lučanin
• drevicko
• Eric O. LEBIGOT
• Erik M. Bray
• Erik Tollerud
• Eugene Van den Bulke
• Evan Patterson
• Fernando Perez
• Francesco Montesano
• Frank Murphy
• Greg Caporaso
• Guy Haskin Fernald

2.11. Issues closed in the 1.0 development cycle
• guziy
• Hans Meine
• Harry Moreno
• henryiii
• Ivan Djokic
• Jack Feser
• Jake Vanderplas
• jakobgager
• James Booth
• Jan Schulz
• Jason Grout
• Jeff Knisley
• Jens Hedegaard Nielsen
• jeremiahbuddha
• Jerry Fowler
• Jessica B. Hamrick
• Jez Ng
• John Zwinck
• Jonathan Frederic
• Jonathan Taylor
• Joon Ro
• Joseph Lansdowne
• Juergen Hasch
• Julian Taylor
• Jussi Sainio
• Jörgen Stenarson
• kevin
• klonuo
• Konrad Hinsen
• Kyle Kelley
• Lars Solberg
• Lessandro Mariano
• Mark Sienkiewicz at STScI
• Martijn Vermaat
• Martin Spacek
• Matthias Bussonnier
• Maxim Grechkin
• Maximilian Albert
• MercuryRising
• Michael Droettboom
• Michael Shuffett
• Michał Górny
• Mikhail Korobov
• mr.Shu
• Nathan Goldbaum
• ocefpaf
• Ohad Ravid
• Olivier Grisel
• Olivier Verdier
• Owen Healy
• Pankaj Pandey
• Paul Ivanov
• Pawel Jasinski
• Pietro Berkes
• Piti Ongmongkolkul
• Puneeth Chaganti
• Rich Wareham
• Richard Everson
• Rick Lupton
• Rob Young
• Robert Kern
• Robert Marchman
• Robert McGibbon
• Rui Pereira
• Rustam Safin
• Ryan May
• s8weber
• Samuel Ainsworth
• Sean Vig
• Siyu Zhang
• Skylar Saveland
• slojo404

2.11. Issues closed in the 1.0 development cycle
We closed a total of 1484 issues, 793 pull requests and 691 regular issues; this is the full list (generated with the script tools/github_stats.py):

Pull Requests (793):

- PR #3958: doc update
- PR #3965: Fix ansi color code for background yellow
- PR #3964: Fix casing of message.
- PR #3942: Pass on install docs
- PR #3962: exclude IPython.lib.kernel in iptest
- PR #3961: Longpath test fix
- PR #3905: Remove references to 0.11 and 0.12 from config/overview.rst
- PR #3951: nbconvert: fixed latex characters not escaped properly in nbconvert
- PR #3949: log fatal error when PDF conversion fails
• PR #3947: nbconvert: Make writer & post-processor aliases case insensitive.
• PR #3938: Recompile css.
• PR #3948: sphinx and PDF tweaks
• PR #3943: nbconvert: Serve post-processor Windows fix
• PR #3934: nbconvert: fix logic of verbose flag in PDF post processor
• PR #3929: swallow enter event in rename dialog
• PR #3924: nbconvert: Backport fixes
• PR #3925: Replace –pylab flag with –matplotlib in usage
• PR #3910: Added explicit error message for missing configuration arguments.
• PR #3913: grfile to support spaces in notebook names
• PR #3918: added check_for_tornado, closes #3916
• PR #3917: change docs/examples refs to be just examples
• PR #3908: what’s new tweaks
• PR #3896: two column quickhelp dialog, closes #3895
• PR #3911: explicitly load python mode before IPython mode
• PR #3901: don’t force . relative path, fix #3897
• PR #3891: fix #3889
• PR #3892: Fix documentation of Kernel.stop_channels
• PR #3888: posixify paths for Windows latex
• PR #3882: quick fix for #3881
• PR #3877: don’t use shell=True in PDF export
• PR #3878: minor template loading cleanup
• PR #3855: nbconvert: Filter tests
• PR #3870: finish 3870
• PR #3870: Fix for converting notebooks that contain unicode characters.
• PR #3876: Update parallel_winhpcrest
• PR #3872: removing vim-ipython, since it has it’s own repo
• PR #3871: updating docs
• PR #3873: remove old examples
• PR #3868: update CodeMirror component to 3.15
• PR #3865: Escape filename for pdflatex in nbconvert
• PR #3861: remove old external.js
• PR #3864: add keyboard shortcut to docs
• PR #3834: This PR fixes a few issues with nbconvert tests
• PR #3840: prevent profile_dir from being undefined
• PR #3859: Add “An Afternoon Hack” to docs

2.11. Issues closed in the 1.0 development cycle

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• PR #3854: Catch errors filling readline history on startup
• PR #3857: Delete extra auto
• PR #3845: nbconvert: Serve from original build directory
• PR #3846: Add basic logging to nbconvert
• PR #3850: add missing store_history key to Notebook execute_requests
• PR #3844: update payload source
• PR #3830: mention metadata / display_data similarity in pyout spec
• PR #3848: fix incorrect empty-docstring
• PR #3836: Parse markdown correctly when mathjax is disabled
• PR #3849: skip a failing test on windows
• PR #3828: signature_scheme lives in Session
• PR #3831: update nbconvert doc with new CLI
• PR #3822: add output flag to nbconvert
• PR #3780: Added serving the output directory if html-based format are selected.
• PR #3764: Cleanup nbconvert templates
• PR #3829: remove now-duplicate ‘this is dev’ note
• PR #3814: add ConsoleWidget.execute_on_complete_input flag
• PR #3826: try rtfd
• PR #3821: add sphinx prolog
• PR #3817: relax timeouts in terminal console and tests
• PR #3825: fix more tests that fail when pandoc is missing
• PR #3824: don’t set target on internal markdown links
• PR #3816: s/pylab/matplotlib in docs
• PR #3812: Describe differences between start_ipython and embed
• PR #3805: Print View has been removed
• PR #3820: Make it clear that 1.0 is not released yet
• PR #3784: nbconvert: Export flavors & PDF writer (ipy dev meeting)
• PR #3800: semantic-versionify version number for non-releases
• PR #3802: Documentation .txt to .rst
• PR #3765: cleanup terminal console iopub handling
• PR #3720: Fix for #3719
• PR #3787: re-raise KeyboardInterrupt in raw_input
• PR #3770: Organizing reveal’s templates.
• PR #3751: Use link(2) when possible in nbconvert
• PR #3792: skip tests that require pandoc
• PR #3782: add Importing Notebooks example
• PR #3752: nbconvert: Add cwd to sys.path
• PR #3789: fix raw_input in qtconsole
• PR #3756: document the wire protocol
• PR #3749: convert IPython syntax to Python syntax in nbconvert python template
• PR #3793: Closes #3788
• PR #3794: Change logo link to ipython.org
• PR #3746: Raise a named exception when pandoc is missing
• PR #3781: comply with the message spec in the notebook
• PR #3779: remove bad if logged_in preventing new-notebook without login
• PR #3743: remove notebook read-only view
• PR #3732: add delay to autosave in beforeunload
• PR #3761: Added rm_math_space to markdown cells in the basichtml.tpl to be rendered ok by mathjax after the nbconversion.
• PR #3758: nbconvert: Filter names cleanup
• PR #3769: Add configurability to tabcompleton completion timeout
• PR #3771: Update px pylab test to match new output of pylab
• PR #3741: better message when notebook format is not supported
• PR #3753: document Ctrl-C not working in ipython kernel
• PR #3766: handle empty metadata in pyout messages more gracefully.
• PR #3736: my attempt to fix #3735
• PR #3759: nbconvert: Provide a more useful error for invalid use case.
• PR #3760: nbconvert: Allow notebook filenames without their extensions
• PR #3750: nbconvert: Add cwd to default templates search path.
• PR #3748: Update nbconvert docs
• PR #3734: Nbconvert: Export extracted files into nbname_files subdirectory
• PR #3733: Nicer message when pandoc is missing, closes #3730
• PR #3722: fix two failing test in IPython.lib
• PR #3704: Start what’s new for 1.0
• PR #3705: Complete rewrite of IPython Notebook documentation: docs/source/interactive/htmlnotebook.txt
• PR #3709: Docs cleanup
• PR #3716: raw_input fixes for kernel restarts
• PR #3683: use %matplotlib in example notebooks
• PR #3686: remove quarantine
• PR #3699: svg2pdf unicode fix
• PR #3695: fix SVG2PDF
• PR #3685: fix Pager.detach
• PR #3675: document new dependencies
• PR #3690: Fixing some css minors in full_html and reveal.
• PR #3671: nbconvert tests
• PR #3692: Fix rename notebook - show error with invalid name
• PR #3409: Prevent qtconsole frontend freeze on lots of output.
• PR #3660: refocus active cell on dialog close
• PR #3598: Statelessify mathjaxutils
• PR #3673: enable comment/uncomment selection
• PR #3677: remove special-case in get_home_dir for frozen dists
• PR #3674: add CONTRIBUTING.md
• PR #3670: use Popen command list for ipexec
• PR #3568: pylab import adjustments
• PR #3559: add create.Cell and delete.Cell js events
• PR #3606: push cell magic to the head of the transformer line
• PR #3607: NbConvert: Writers, No YAML, and stuff…
• PR #3665: Pywin32 skips
• PR #3669: set default client_class for QtKernelManager
• PR #3662: add strip_encoding_cookie transformer
• PR #3641: increase patience for slow kernel startup in tests
• PR #3651: remove a bunch of unused default_config_file assignments
• PR #3630: CSS adjustments
• PR #3645: Don’t require HistoryManager to have a shell
• PR #3643: don’t assume tested ipython is on the PATH
• PR #3654: fix single-result AsyncResults
• PR #3601: Markdown in heading cells (take 2)
• PR #3652: Remove old docs/examples
• PR #3621: catch any exception appending output
• PR #3585: don’t blacklist builtin names
• PR #3647: Fix frontend deprecation warnings in several examples
• PR #3649: fixAsyncResult.get_dict for single result
• PR #3648: Fix store magic test
• PR #3650: Fix, config_file_name was ignored
• PR #3640: Gcf.get_active() can return None
• PR #3571: Added shortcuts to split cell, merge cell above and merge cell below.
• PR #3635: Added missing slash to print-pdf call.
• PR #3487: Drop patch for compatibility with pyreadline 1.5
• PR #3338: Allow filename with extension in find_cmd in Windows.
• PR #3628: Fix test for Python 3 on Windows.
• PR #3642: Fix typo in docs
• PR #3627: use DEFAULT_STATIC_FILES_PATH in a test instead of package dir
• PR #3624: fix some unicode in zmqhandlers
• PR #3460: Set calling program to UNKNOWN, when argv not in sys
• PR #3632: Set calling program to UNKNOWN, when argv not in sys (take #2)
• PR #3629: Use new entry point for python -m IPython
• PR #3626: passing cell to showInPager, closes #3625
• PR #3618: expand terminal color support
• PR #3623: raise UsageError for unsupported GUI backends
• PR #3071: Add magic function %drun to run code in debugger
• PR #3608: a nicer error message when using %pylab magic
• PR #3592: add extra_config_file
• PR #3612: updated .mailmap
• PR #3616: Add examples for interactive use of MPL
• PR #3615: fix regular expression for ANSI escapes
• PR #3586: Corrected a typo in the format string for strftime the sphinx.py transformer of nbconvert
• PR #3611: check for markdown no longer needed, closes #3610
• PR #3555: Simplify caching of modules with %run
• PR #3583: notebook small things
• PR #3594: Fix duplicate completion in notebook
• PR #3600: parallel: Improved logging for errors during BatchSystemLauncher.stop
• PR #3595: Revert “allow markdown in heading cells”
• PR #3538: add IPython.start_ipython
• PR #3562: Allow custom nbconvert template loaders
• PR #3582: pandoc adjustments
• PR #3560: Remove max_msg_size
• PR #3591: Refer to setuptools instead of Distribute
• PR #3590: IPython.sphinxext needs an __init__.py
• PR #3581: Added the possibility to read a custom.css file for tweaking the final html in full_html and reveal templates.
• PR #3576: Added support for markdown in heading cells when they are nbconverted.
• PR #3575: tweak run -d message to ‘continue execution’
• PR #3569: add PYTHONSTARTUP to startup files
• PR #3567: Trigger a single event on js app initialized

2.11. Issues closed in the 1.0 development cycle
• PR #3565: style.min.css should always exist...
• PR #3531: allow markdown in heading cells
• PR #3577: Simplify codemirror ipython-mode
• PR #3495: Simplified regexp, and suggestions for clearer regexps.
• PR #3578: Use adjustbox to specify figure size in nbconvert -> latex
• PR #3572: Skip import irunner test on Windows.
• PR #3574: correct static path for CM modes autoload
• PR #3558: Add IPython.sphinxext
• PR #3561: mention double-control-C to stop notebook server
• PR #3566: fix event names
• PR #3564: Remove trivial nbconvert example
• PR #3540: allow cython cache dir to be deleted
• PR #3527: cleanup stale, unused exceptions in parallel.error
• PR #3529: ensure raw_input returns str in zmq shell
• PR #3541: respect image size metadata in qtconsole
• PR #3550: Fixing issue preventing the correct read of images by full_html and reveal exporters.
• PR #3557: open markdown links in new tabs
• PR #3556: remove mention of nonexistent _margv in macro
• PR #3552: set overflow-x: hidden on Firefox only
• PR #3554: Fix missing import os in latex exporter.
• PR #3546: Don’t hardcode latex posix paths in nbconvert
• PR #3551: fix path prefix in nbconvert
• PR #3533: Use a CDN to get reveal.js library.
• PR #3498: When a notebook is written to file, name the metadata name u’’.
• PR #3548: Change to standard save icon in Notebook toolbar
• PR #3539: Don’t hardcode posix paths in nbconvert
• PR #3508: notebook supports raw_input and %debug now
• PR #3526: ensure ‘default’ is first in cluster profile list
• PR #3525: basic timezone info
• PR #3532: include nbconvert templates in installation
• PR #3515: update CodeMirror component to 3.14
• PR #3513: add ‘No Checkpoints’ to Revert menu
• PR #3536: format positions are required in Python 2.6.x
• PR #3521: Nbconvert fix, silent fail if template doesn’t exist
• PR #3530: update %store magic docstring
• PR #3528: fix local mathjax with custom base_project_url
• PR #3518: Clear up unused imports
• PR #3506: %store -r restores saved aliases and directory history, as well as variables
• PR #3516: make css highlight style configurable
• PR #3523: Exclude frontend shim from docs build
• PR #3514: use bootstrap disabled instead of ui-state-disabled
• PR #3520: Added relative import of RevealExporter to __init__.py inside exporters module
• PR #3507: fix HTML capitalization in nbconvert exporter classes
• PR #3512: fix nbconvert filter validation
• PR #3511: Get Tracer working after ipapi.get replaced with get_ipython
• PR #3510: use window.onbeforeunload= for nav-away warning
• PR #3504: don’t use parent=self in handlers
• PR #3500: Merge nbconvert into IPython
• PR #3478: restore “unsaved changes” warning on unload
• PR #3493: add a dialog when the kernel is auto-restarted
• PR #3488: Add test suite for autoreload extension
• PR #3484: Catch some pathological cases inside inspect
• PR #3481: Display R errors without Python traceback
• PR #3468: fix %magic output
• PR #3430: add parent to Configurable
• PR #3491: Remove unexpected keyword parameter to remove_kernel
• PR #3485: SymPy has changed its recommended way to initialize printing
• PR #3486: Add test for non-ascii characters in docstrings
• PR #3483: Inputtransformer: Allow classic prompts without space
• PR #3482: Use an absolute path to iptest, because the tests are not always run from $IPYTHONDIR.
• PR #3381: enable 2x (retina) display
• PR #3450: Flatten IPython.frontend
• PR #3477: pass config to subapps
• PR #3466: Kernel fails to start when username has non-ascii characters
• PR #3465: Add HTCondor bindings to IPython.parallel
• PR #3463: fix typo, closes #3462
• PR #3456: Notice for users who disable javascript
• PR #3453: fix cell execution in firefox, closes #3447
• PR #3393: [WIP] bootstrapify
• PR #3440: Fix installing mathjax from downloaded file via command line
• PR #3431: Provide means for starting the Qt console maximized and with the menu bar hidden
• PR #3425: base IPClusterApp inherits from BaseIPythonApp

2.11. Issues closed in the 1.0 development cycle 113
• PR #3433: Update IPythonexternalpath__init__.py
• PR #3298: Some fixes in IPython Sphinx directive
• PR #3428: process escapes in mathjax
• PR #3420: thansk -> thanks
• PR #3416: Fix doc: “principle” not “principal”
• PR #3413: more unique filename for test
• PR #3364: Inject requirejs in notebook and start using it.
• PR #3390: Fix %paste with blank lines
• PR #3403: fix creating config objects from dicts
• PR #3401: rollback #3358
• PR #3373: make cookie_secret configurable
• PR #3307: switch default ws_url logic to js side
• PR #3392: Restore anchor link on h2-h6
• PR #3369: Use different treshold for (auto)scroll in output
• PR #3370: normalize unicode notebook filenames
• PR #3372: base default cookie name on request host+port
• PR #3378: disable CodeMirror drag/drop on Safari
• PR #3358: workaround spurious CodeMirror scrollbars
• PR #3371: make setting the notebook dirty flag an event
• PR #3366: remove long-dead zmq frontend.py and completer.py
• PR #3382: cull Session digest history
• PR #3330: Fix get_ipython_dir when $HOME is /
• PR #3319: IPEP 13: user-expressions and user-variables
• PR #3384: comments in tools/gitwash_dumper.py changed (’”’ to “’”’)
• PR #3387: Make submodule checks work under Python 3.
• PR #3357: move anchor-link off of heading text
• PR #3351: start basic tests of ipcluster Launchers
• PR #3377: allow class.__module__ to be None
• PR #3340: skip submodule check in package managers
• PR #3328: decode subprocess output in launchers
• PR #3368: Reenable bracket matching
• PR #3356: Mpr fixes
• PR #3336: Use new input transformation API in %time magic
• PR #3325: Organize the JS and less files by component.
• PR #3342: fix test_find_cmd_python
• PR #3354: catch socket.error in utils.localinterfaces
• PR #3341: fix default cluster count
• PR #3286: don’t use get_ipython from builtins in library code
• PR #3333: notebookapp: add missing whitespace to warnings
• PR #3323: Strip prompts even if the prompt isn’t present on the first line.
• PR #3321: Reorganize the python/server side of the notebook
• PR #3320: define __file__ in config files
• PR #3317: rename %%file to %writefile
• PR #3304: set unlimited HWM for all relay devices
• PR #3315: Update Sympy_printing extension load
• PR #3310: further clarify Image docstring
• PR #3285: load extensions in builtin trap
• PR #3308: Speed upAsyncResult._wait_for_outputs(0)
• PR #3294: fix callbacks as optional in js kernel.execute
• PR #3276: Fix: “python ABS/PATH/TO/ipython.py” fails
• PR #3301: allow python3 tests without python installed
• PR #3282: allow view.map to work with a few more things
• PR #3284: remove ipython.py entry point
• PR #3281: fix ignored IOPub messages with no parent
• PR #3275: improve submodule messages / git hooks
• PR #3239: Allow “x” icon and esc key to close pager in notebook
• PR #3290: Improved heartbeat controller to engine monitoring for long running tasks
• PR #3142: Better error message when CWD doesn’t exist on startup
• PR #3066: Add support for relative import to %run -m (fixes #2727)
• PR #3269: protect highlight.js against unknown languages
• PR #3267: add missing return
• PR #3101: use marked / highlight.js instead of pagedown and prettify
• PR #3264: use https url for submodule
• PR #3263: fix set_last_checkpoint when no checkpoint
• PR #3258: Fix submodule location in setup.py
• PR #3254: fix a few URLs from previous PR
• PR #3240: remove js components from the repo
• PR #3158: IPEP 15: autosave the notebook
• PR #3252: move images out of _static folder into _images
• PR #3251: Fix for cell magics in Qt console
• PR #3250: Added a simple __html__() method to the HTML class
• PR #3249: remove copy of sphinx inheritance_diagram.py
• PR #3235: Remove the unused print notebook view
• PR #3238: Improve the design of the tab completion UI
• PR #3242: Make changes of Application.log_format effective
• PR #3219: Workaround so only one CTRL-C is required for a new prompt in --gui=qt
• PR #3190: allow formatters to specify metadata
• PR #3231: improve discovery of public IPs
• PR #3233: check prefixes for swallowing kernel args
• PR #3234: Removing old autogrow JS code.
• PR #3232: Update to CodeMirror 3 and start to ship our components
• PR #3229: The HTML output type accidentally got removed from the OutputArea.
• PR #3228: Typo in IPython.Parallel documentation
• PR #3226: Text in rename dialog was way too big - making it <p>.
• PR #3225: Removing old restuctured text handler and web service.
• PR #3222: make BlockingKernelClient the default Client
• PR #3223: add missing mathjax_url to new settings dict
• PR #3089: add stdin to the notebook
• PR #3221: Remove references to HTMLCell (dead code)
• PR #3205: add ignored *args to HasTraits constructor
• PR #3088: cleanup IPython handler settings
• PR #3201: use much faster regexp for ansi coloring
• PR #3220: avoid race condition in profile creation
• PR #3011: IPEP 12: add KernelClient
• PR #3217: informative error when trying to load directories
• PR #3174: Simple class
• PR #2979: CM configurable Take 2
• PR #3215: Updates storemagic extension to allow for specifying variable name to load
• PR #3181: backport If-Modified-Since fix from tornado
• PR #3200: IFrame (VimeoVideo, ScribdDocument, . . .)
• PR #3186: Fix small inconsistency in nbconvert: etype -> ename
• PR #3212: Fix issue #2563, “core.profiledir.check_startup_dir() doesn’t work inside py2exe’d installation”
• PR #3211: Fix inheritance_diagram Sphinx extension for Sphinx 1.2
• PR #3208: Update link to extensions index
• PR #3203: Separate InputSplitter for transforming whole cells
• PR #3189: Improve completer
• PR #3194: finish up PR #3116
• PR #3188: Add new keycodes
• PR #2695: Key the root modules cache by sys.path entries.
• PR #3182: clarify %%file docstring
• PR #3163: BUG: Fix the set and frozenset pretty printer to handle the empty case correctly
• PR #3180: better UsageError for cell magic with no body
• PR #3184: Cython cache
• PR #3175: Added missing s
• PR #3173: Little bits of documentation cleanup
• PR #2635: Improve Windows start menu shortcuts (#2)
• PR #3172: Add missing import in IPython parallel magics example
• PR #3170: default application logger shouldn’t propagate
• PR #3159: Autocompletion for zsh
• PR #3105: move DEFAULT_STATIC_FILES_PATH to IPython.html
• PR #3144: minor bower tweaks
• PR #3141: Default color output for ls on OSX
• PR #3137: fix dot syntax error in inheritance diagram
• PR #3072: raise UnsupportedOperation on iostream.fileno()
• PR #3147: Notebook support for a reverse proxy which handles SSL
• PR #3152: make qtconsole size at startup configurable
• PR #3162: adding stream kwarg to current.new_output
• PR #2981: IPEP 10: kernel side filtering of display formats
• PR #3058: add redirect handler for notebooks by name
• PR #3041: support non-modules in @require
• PR #2447: Stateful line transformers
• PR #3108: fix some O(N) and O(N^2) operations in parallel.map
• PR #2791: forward stdout from forked processes
• PR #3157: use Python 3-style for pretty-printed sets
• PR #3148: closes #3045, #3123 for tornado < version 3.0
• PR #3143: minor heading-link tweaks
• PR #3136: Strip useless ANSI escape codes in notebook
• PR #3126: Prevent errors when pressing arrow keys in an empty notebook
• PR #3135: quick dev installation instructions
• PR #2889: Push pandas dataframes to R magic
• PR #3068: Don’t monkeypatch doctest during IPython startup.
• PR #3133: fix argparse version check
• PR #3102: set spellcheck=false in CodeCell inputarea
• PR #3064: add anchors to heading cells

2.11. Issues closed in the 1.0 development cycle
• PR #3097: PyQt 4.10: use self._document = self.document()
• PR #3117: propagate automagic change to shell
• PR #3118: don’t give up on weird os names
• PR #3115: Fix example
• PR #2640: fix quarantine/ipy_editors.py
• PR #3070: Add info make target that was missing in old Sphinx
• PR #3082: A few small patches to image handling
• PR #3078: fix regular expression for detecting links in stdout
• PR #3054: restore default behavior for automatic cluster size
• PR #3073: fix ipython usage text
• PR #3083: fix DisplayMagics.html docstring
• PR #3080: noted sub_channel being renamed to iopub_channel
• PR #3079: actually use IPKernelApp.kernel_class
• PR #3076: Improve notebook.js documentation
• PR #3063: add missing %%%html magic
• PR #3075: check for SIGUSR1 before using it, closes #3074
• PR #3051: add width:100% to vbox for webkit / FF consistency
• PR #2999: increase registration timeout
• PR #2997: fix DictDB default size limit
• PR #3033: on resume, print server info again
• PR #3062: test double pyximport
• PR #3046: cast kernel cwd to bytes on Python 2 on Windows
• PR #3038: remove xml from notebook magic docstrings
• PR #3032: fix time format to international time format
• PR #3022: Fix test for Windows
• PR #3024: changed instances of ‘outout’ to ‘output’ in alt texts
• PR #3013: py3 workaround for reload in cythonmagic
• PR #2961: time magic: shorten unnecessary output on windows
• PR #2987: fix local files examples in markdown
• PR #2998: fix css in .output_area pre
• PR #3003: add Sinclude /etc/inputrc to suggested ~/.inputrc
• PR #2957: Refactor qt import logic. Fixes #2955
• PR #2994: expanduser on %%%file targets
• PR #2983: fix run-all (that-> this)
• PR #2964: fix count when testing composite error output
• PR #2967: shows entire session history when only startsess is given
• PR #2942: Move CM IPython theme out of codemirror folder
• PR #2929: Cleanup cell insertion
• PR #2933: Minordocupdate
• PR #2968: fix notebook deletion.
• PR #2966: Added assert msg to extract_hist_ranges()
• PR #2959: Add command to trim the history database.
• PR #2681: Don’t enable pylab mode, when matplotlib is not importable
• PR #2901: Fix inputhook_wx on osx
• PR #2871: truncate potentially long CompositeErrors
• PR #2951: use istype on lists/tuples
• PR #2946: fix qtconsole history logic for end-of-line
• PR #2954: fix logic for append_javascript
• PR #2941: fix baseUrl
• PR #2903: Specify toggle value on cell line number
• PR #2911: display order in output area configurable
• PR #2897: Dont rely on BaseProjectUrl data in body tag
• PR #2894: Cm configurable
• PR #2927: next release will be 1.0
• PR #2932: Simplify using notebook static files from external code
• PR #2915: added small config section to notebook docs page
• PR #2924: safe_run_module: Silence SystemExit codes 0 and None.
• PR #2906: Unpatch/Monkey patch CM
• PR #2921: add menu item for undo delete cell
• PR #2917: Don’t add logging handler if one already exists.
• PR #2910: Respect DB_IP and DB_PORT in mongodb tests
• PR #2926: Don’t die if stderr/stdout do not support set_parent() #2925
• PR #2885: get monospace pager back
• PR #2886: fix celltoolbar layout on FF
• PR #2904: Skip remaining IPC test on Windows
• PR #2908: fix last remaining KernelApp reference
• PR #2905: fix a few remaining KernelApp/IPKernelApp changes
• PR #2900: Don’t assume test case for %time will finish in 0 time
• PR #2893: exclude fabfile from tests
• PR #2884: Correct import for kernelmanager on Windows
• PR #2882: Utils cleanup
• PR #2883: Don’t call ast.fix_missing_locations unless the AST could have been modified

2.11. Issues closed in the 1.0 development cycle
- PR #2855: time(it) magic: Implement minutes/hour formatting and "%%time" cell magic
- PR #2874: Empty cell warnings
- PR #2819: tweak history prefix search (up/^p) in qtconsole
- PR #2868: Import performance
- PR #2877: minor css fixes
- PR #2880: update examples docs with kernel move
- PR #2878: Pass host environment on to kernel
- PR #2599: func_kw_complete for builtin and cython with embededsignature=True using docstring
- PR #2792: Add key “unique” to history_request protocol
- PR #2872: fix payload keys
- PR #2869: Fixing styling of toolbar selects on FF.
- PR #2708: Less css
- PR #2854: Move kernel code into IPython.kernel
- PR #2864: Fix %run -t -N<N> TypeError
- PR #2852: future pyzmq compatibility
- PR #2863: whatsnenv/version0.9.txt: Fix ‘~/ipython’ -> ‘~/ipython’ typo
- PR #2861: add missing KernelManager to ConsoleApp class list
- PR #2850: Consolidate host IP detection in utils.localinterfaces
- PR #2859: Correct docstring of ipython.py
- PR #2831: avoid string version comparisons in external.qt
- PR #2844: this should address the failure in #2732
- PR #2849: utils/data: Use list comprehension for uniq_stable()
- PR #2839: add jinja to install docs / setup.py
- PR #2841: Miscellaneous docs fixes
- PR #2811: Still more KernelManager cleanup
- PR #2820: add ‘=’ to greedy completer delims
- PR #2818: log user tracebacks in the kernel (INFO-level)
- PR #2828: Clean up notebook Javascript
- PR #2829: avoid comparison error in dictdb hub history
- PR #2830: BUG: Opening parenthesis after non-callable raises ValueError
- PR #2718: try to fallback to pysqlite2.dbapi2 as sqlite3 in core.history
- PR #2816: in %edit, don’t save “last_call” unless last call succeeded
- PR #2817: change ol format order
- PR #2537: Organize example notebooks
- PR #2815: update release/authors
- PR #2808: improve patience for slow Hub in client tests
• PR #2812: remove nonfunctional -la short arg in cython magic
• PR #2810: remove dead utils.upgradedir
• PR #1671: __future__ environments
• PR #2804: skip ipc tests on Windows
• PR #2789: Fixing styling issues with CellToolbar.
• PR #2805: fix KeyError creating ZMQStreams in notebook
• PR #2775: General cleanup of kernel manager code.
• PR #2340: Initial Code to reduce parallel.Client caching
• PR #2799: Exit code
• PR #2800: use type(obj) is cls as switch when canning
• PR #2801: Fix a breakpoint bug
• PR #2795: Remove outdated code from extensions.autoreload
• PR #2796: P3K: fix cookie parsing under Python 3.x (+ duplicate import is removed)
• PR #2724: In-process kernel support (take 3)
• PR #2687: [WIP] Metaui slideshow
• PR #2788: Chrome frame awareness
• PR #2649: Add version_request/reply messaging protocol
• PR #2753: add %%px --local for local execution
• PR #2783: Prefilter shouldn’t touch execution_count
• PR #2333: UI For Metadata
• PR #2396: create a ipynbV3 json schema and a validator
• PR #2757: check for complete pySide presence before trying to import
• PR #2782: Allow the %run magic with ‘-b’ to specify a file.
• PR #2778: P3K: fix DeprecationWarning under Python 3.x
• PR #2776: remove non-functional View.kill method
• PR #2755: can interactively defined classes
• PR #2774: Removing unused code in the notebook MappingKernelManager.
• PR #2773: Fixed minor typo causing AttributeError to be thrown.
• PR #2609: Add ‘unique’ option to history_request messaging protocol
• PR #2769: Allow shutdown when no engines are registered
• PR #2766: Define __file__ when we %edit a real file.
• PR #2476: allow %edit <variable> to work when interactively defined
• PR #2763: Reset readline delimiters after loading rmagic.
• PR #2460: Better handling of __file__ when running scripts.
• PR #2617: Fix for units argument. Adds a res argument.
• PR #2738: Unicode content crashes the pager (console)
• PR #2749: Tell Travis CI to test on Python 3.3 as well
• PR #2744: Don’t show ‘try %paste’ message while using magics
• PR #2728: shift tab for tooltip
• PR #2741: Add note to %cython Black-Scholes example warning of missing erf.
• PR #2743: BUG: Octavemagic inline plots not working on Windows: Fixed
• PR #2740: Following #2737 this error is now a name error
• PR #2737: Rmagic: error message when moving an non-existant variable from python to R
• PR #2723: diverse fixes for project url
• PR #2731: %Rpush: Look for variables in the local scope first.
• PR #2544: Infinite loop when multiple debuggers have been attached.
• PR #2726: Add qthelp docs creation
• PR #2730: added blockquote CSS
• PR #2729: Fix Read the doc build, Again
• PR #2446: [alternate 2267] Offline mathjax
• PR #2716: remove unexisting headings level
• PR #2717: One liner to fix debugger printing stack traces when lines of context are larger than source.
• PR #2713: Doc bugfix: user_ns is not an attribute of Magic objects.
• PR #2690: Fix ‘import ‘… completion for py3 & egg files.
• PR #2691: Document OpenMP in %%cython magic
• PR #2699: fix jinja2 rendering for password protected notebooks
• PR #2700: Skip notebook testing if jinja2 is not available.
• PR #2692: Add %%%cython magics to generated documentation.
• PR #2685: Fix pretty print of types when __module__ is not available.
• PR #2686: Fix tox.ini
• PR #2604: Backslashes are misinterpreted as escape-sequences by the R-interpreter.
• PR #2689: fix error in doc (arg->kwarg) and pep-8
• PR #2683: for downloads, replaced window.open with window.location.assign
• PR #2659: small bugs in js are fixed
• PR #2363: Refactor notebook templates to use Jinja2
• PR #2662: qtconsole: wrap argument list in tooltip to match width of text body
• PR #2328: addition of classes to generate a link or list of links from files local to the IPython HTML notebook
• PR #2668: pylab_not_importable: Catch all exceptions, not just RuntimeErrors.
• PR #2663: Fix issue #2660: parsing of help and version arguments
• PR #2656: Fix irunner tests when $PYTHONSTARTUP is set
• PR #2312: Add bracket matching to code cells in notebook
• PR #2571: Start to document Javascript
• PR #2641: undefined that -> this
• PR #2638: Fix %paste in Python 3 on Mac
• PR #2301: Ast transformers
• PR #2616: Revamp API docs
• PR #2572: Make ‘Paste Above’ the default paste behavior.
• PR #2574: Fix #2244
• PR #2582: Fix displaying history when output cache is disabled.
• PR #2591: Fix for Issue #2584
• PR #2526: Don’t kill paramiko tunnels when receiving ^C
• PR #2559: Add psource, pfile, pinfo2 commands to ipdb.
• PR #2546: use 4 Pythons to build 4 Windows installers
• PR #2561: Fix display of plain text containing multiple carriage returns before line feed
• PR #2549: Add a simple ‘undo’ for cell deletion.
• PR #2525: Add event to kernel execution/shell reply.
• PR #2554: Avoid stopping in ipdb until we reach the main script.
• PR #2404: Option to limit search result in history magic command
• PR #2294: inputhook_qt4: Use QEventLoop instead of starting up the QCoreApplication
• PR #2233: Refactored Drag and Drop Support in Qt Console
• PR #1747: switch between hsplit and vsplit paging (request for feedback)
• PR #2530: Adding time offsets to the video
• PR #2542: Allow starting IPython as python -m IPython.
• PR #2534: Do not unescape backslashes in Windows (shellglob)
• PR #2517: Improved MathJax, bug fixes
• PR #2511: trigger default remote_profile_dir when profile_dir is set
• PR #2491: color is supported in ironpython
• PR #2462: Track which extensions are loaded
• PR #2464: Locate URLs in text output and convert them to hyperlinks.
• PR #2490: add ZMQInteractiveShell to IPEngineApp class list
• PR #2498: Don’t catch tab press when something selected
• PR #2527: Run All Above and Run All Below
• PR #2513: add GitHub uploads to release script
• PR #2529: Windows aware tests for shellglob
• PR #2478: Fix doctest_run_option_parser for Windows
• PR #2519: clear In[ ] prompt numbers again
• PR #2467: Clickable links
• PR #2500: Add encoding attribute to OutputStream class.

2.11. Issues closed in the 1.0 development cycle
• PR #2349: ENH: added StackExchange-style MathJax filtering
• PR #2503: Fix traceback handling of SyntaxErrors without line numbers.
• PR #2492: add missing 'qtconsole' extras_require
• PR #2480: Add deprecation warnings for sympyprinting
• PR #2334: Make the ipengine monitor the ipcontroller heartbeat and die if the ipcontroller goes down
• PR #2479: use new _winapi instead of removed _subprocess
• PR #2474: fix bootstrap name conflicts
• PR #2469: Treat __init__.pyc same as __init__.py in module_list
• PR #2165: Add -g option to %run to glob expand arguments
• PR #2468: Tell git to ignore __pycache__ directories.
• PR #2421: Some notebook tweaks.
• PR #2291: Remove old plugin system
• PR #2127: Ability to build toolbar in JS
• PR #2445: changes for ironpython
• PR #2420: Pass ipython_dir to __init__() method of TerminalInteractiveShell’s superclass.
• PR #2432: Revert #1831, the __file__ injection in safe_execfile / safe_execfile_ipy.
• PR #2216: Autochange highlight with cell magics
• PR #1946: Add image message handler in ZMQTerminalInteractiveShell
• PR #2424: skip find_cmd when setting up script magics
• PR #2389: Catch sqlite DatabaseErrors in more places when reading the history database
• PR #2395: Don’t catch ImportError when trying to unpack module functions
• PR #1868: enable IPC transport for kernels
• PR #2437: don’t let log cleanup prevent engine start
• PR #2441: sys.maxsize is the maximum length of a container.
• PR #2442: allow iptest to be interrupted
• PR #2240: fix message built for engine dying during task
• PR #2369: Block until kernel termination after sending a kill signal
• PR #2439: Py3k: Octal (0777 -> 0o777)
• PR #2326: Detachable pager in notebook.
• PR #2377: Fix installation of man pages in Python 3
• PR #2407: add IPython version to message headers
• PR #2408: Fix Issue #2366
• PR #2405: clarify TaskScheduler.hwm doc
• PR #2399: IndentationError display
• PR #2400: Add scroll_to_cell(cell_number) to the notebook
• PR #2401: unmock read-the-docs modules
• PR #2311: always perform requested trait assignments
• PR #2393: New option n to limit history search hits
• PR #2386: Adapt inline backend to changes in matplotlib
• PR #2392: Remove suspicious double quote
• PR #2387: Added -L library search path to cythonmagic cell magic
• PR #2370: qtconsole: Create a prompt newline by inserting a new block (w/o formatting)
• PR #1715: Fix for #1688, traceback-unicode issue
• PR #2378: use Singleton.instance() for embed() instead of manual global
• PR #2373: fix missing imports in core.interactiveshell
• PR #2368: remove notification widget leftover
• PR #2327: Parallel: Support get/set of nested objects in view (e.g. dv['a.b'])
• PR #2362: Clean up ProgressBar class in example notebook
• PR #2346: Extra xterm identification in set_term_title
• PR #2352: Notebook: Store the username in a cookie whose name is unique.
• PR #2358: add backport_pr to tools
• PR #2365: fix names of notebooks for download/save
• PR #2364: make clients use ‘location’ properly (fixes #2361)
• PR #2354: Refactor notebook templates to use Jinja2
• PR #2339: add bash completion example
• PR #2345: Remove references to ‘version’ no longer in argparse. Github issue #2343.
• PR #2347: adjust division error message checking to account for Python 3
• PR #2305: RemoteException._render_traceback_ calls self.render_traceback
• PR #2338: Normalize line endings for ipexec_validate, fix for #2315.
• PR #2192: Introduce Notification Area
• PR #2329: Better error messages for common magic commands.
• PR #2337: ENH: added StackExchange-style MathJax filtering
• PR #2331: update css for qtconsole in doc
• PR #2317: adding cluster_id to parallel.Client.__init__
• PR #2130: Add -l option to %R magic to allow passing in of local namespace
• PR #2196: Fix for bad command line argument to latex
• PR #2300: bug fix: was crashing when sqlite3 is not installed
• PR #2184: Expose store_history to execute_request messages.
• PR #2308: Add welcome_message option to enable_pylab
• PR #2302: Fix variable expansion on ‘self’
• PR #2299: Remove code from prefilter that duplicates functionality in inputsplitter
• PR #2295: allow pip install from github repository directly

2.11. Issues closed in the 1.0 development cycle

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• PR #2280: fix SSH passwordless check for OpenSSH
• PR #2290: nbmanager
• PR #2288: s/assertEquals/assertEqual (again)
• PR #2287: Removed outdated dev docs.
• PR #2218: Use redirect for new notebooks
• PR #2277: nb: up/down arrow keys move to begin/end of line at top/bottom of cell
• PR #2045: Refactoring notebook managers and adding Azure backed storage.
• PR #2271: use display instead of send_figure in inline backend hooks
• PR #2278: allow disabling SQLite history
• PR #2225: Add “--annotate” option to %%cython magic.
• PR #2246: serialize individual args/kwars rather than the containers
• PR #2274: CLN: Use name to id mapping of notebooks instead of searching.
• PR #2270: SSHLauncher tweaks
• PR #2269: add missing location when disambiguating controller IP
• PR #2263: Allow docs to build on http://readthedocs.io/
• PR #2256: Adding data publication example notebook.
• PR #2255: better flush iopub with AsyncResults
• PR #2261: Fix: longest_substr([]) -> ‘’
• PR #2260: fix mpr again
• PR #2242: Document globbing in %history -g <pattern>.
• PR #2250: fix html in notebook example
• PR #2245: Fix regression in embed() from pull-request #2096.
• PR #2248: track sha of master in test_pr messages
• PR #2238: Fast tests
• PR #2211: add data publication message
• PR #2236: minor test_pr tweaks
• PR #2231: Improve Image format validation and add html width,height
• PR #2232: Reapply monkeypatch to inspect.findsource()
• PR #2235: remove spurious print statement from setupbase.py
• PR #2222: adjust how canning deals with import strings
• PR #2224: fix css typo
• PR #2223: Custom tracebacks
• PR #2214: use KernelApp.exec_lines/files in IPEngineApp
• PR #2199: Wrap JS published by %%javascript in try/catch
• PR #2212: catch errors in markdown javascript
• PR #2190: Update code mirror 2.22 to 2.32

Chapter 2. What’s new in IPython
- PR #2200: documentation build broken in bb429da5b
- PR #2194: clean nan/inf in json_clean
- PR #2198: fix mpr for earlier git version
- PR #2175: add FileFindHandler for Notebook static files
- PR #1990: can func_defaults
- PR #2069: start improving serialization in parallel code
- PR #2202: Create a unique & temporary IPYTHONDIR for each testing group.
- PR #2204: Work around lack of os.kill in win32.
- PR #2148: win32 iptest: Use subprocess.Popen() instead of os.system().
- PR #2179: Pylab switch
- PR #2124: Add an API for registering magic aliases.
- PR #2169: ipdb: pdef, pdoc, pinfo magics all broken
- PR #2174: Ensure consistent indentation in %magic.
- PR #1930: add size-limiting to the DictDB backend
- PR #2189: Fix IPython.lib.latextools for Python 3
- PR #2186: removed references to h5py dependence in octave magic documentation
- PR #2183: Include the kernel object in the event object passed to kernel events
- PR #2185: added test for %store, fixed storemagic
- PR #2138: Use breqn.sty in dvipng backend if possible
- PR #2182: handle undefined param in notebooklist
- PR #1831: fix #1814 set __file__ when running .ipy files
- PR #2051: Add a metadata attribute to messages
- PR #1471: simplify IPython.parallel connections and enable Controller Resume
- PR #2181: add %=javascript, %=svg, and %=latex display magics
- PR #2116: different images in 00_notebook-tour
- PR #2092: %prun: Restore stats.stream after running print_stream.
- PR #2159: show message on notebook list if server is unreachable
- PR #2176: fix git mpr
- PR #2152: [qtconsole] Namespace not empty at startup
- PR #2177: remove numpy install from travis/tox scripts
- PR #2090: New keybinding for code cell execution + cell insertion
- PR #2160: Updating the parallel options pricing example
- PR #2168: expand line in cell magics
- PR #2170: Fix tab completion with IPython.embed_kernel().
- PR #2096: embed(): Default to the future compiler flags of the calling frame.
- PR #2163: fix ‘remote_profie_dir’ typo in SSH launchers

2.11. Issues closed in the 1.0 development cycle
• PR #2158: [2to3 compat] Tuple params in func defs
• PR #2089: Fix unittest DeprecationWarnings
• PR #2142: Refactor test_pr.py
• PR #2140: 2to3: Apply has_key fixer.
• PR #2131: Add option append (-a) to %save
• PR #2117: use explicit url in notebook example
• PR #2133: Tell git that *.py files contain Python code, for use in word-diffs.
• PR #2134: Apply 2to3 next fix.
• PR #2126: ipcluster broken with any batch launcher (PBS/LSF/SGE)
• PR #2104: Windows make file for Sphinx documentation
• PR #2074: Make BG color of inline plot configurable
• PR #2123: BUG: Look up the _repr_pretty_ method on the class within the MRO rath...
• PR #2100: [in progress] python 2 and 3 compatibility without 2to3, second try
• PR #2128: open notebook copy in different tabs
• PR #2073: allows password and prefix for notebook
• PR #1993: Print View
• PR #2086: re-alias %ed to %edit in qtconsole
• PR #2110: Fixes and improvements to the input splitter
• PR #2101: fix completer deleting newline
• PR #2102: Fix logging on interactive shell.
• PR #2088: Fix (some) Python 3.2 ResourceWarnings
• PR #2064: conform to pep 3110
• PR #2076: Skip notebook ‘static’ dir in test suite.
• PR #2063: Remove umlauts so py3 installations on LANG=C systems succeed.
• PR #2068: record sysinfo in sdist
• PR #2067: update tools/release_windows.py
• PR #2065: Fix parentheses typo
• PR #2062: Remove duplicates and auto-generated files from repo.
• PR #2061: use explicit tuple in exception
• PR #2060: change minus to - or (hy in manpages

Issues (691):
• #3940: Install process documentation overhaul
• #3946: The PDF option for --post should work with lowercase
• #3957: Notebook help page broken in Firefox
• #3894: nbconvert test failure
• #3887: 1.0.0a1 shows blank screen in both firefox and chrome (windows 7)
2.11. Issues closed in the 1.0 development cycle

- #3703: nbconvert: Output options – names and documentation
- #3931: Tab completion not working during debugging in the notebook
- #3936: Ipcluster plugin is not working with Ipython 1.0dev
- #3941: Ipython Notebook kernel crash on Win7x64
- #3926: Ending Notebook renaming dialog with return creates new-line
- #3932: Incorrect empty docstring
- #3928: Passing variables to script from the workspace
- #3774: Notebooks with spaces in their names breaks nbconvert latex graphics
- #3916: tornado needs its own check
- #3915: Link to Parallel examples “found on GitHub” broken in docs
- #3895: Keyboard shortcuts box in notebook doesn’t fit the screen
- #3912: IPython.utils fails automated test for RC1 1.0.0
- #3636: Code cell missing highlight on load
- #3897: under Windows, “ipython3 nbconvert “C:/blabla/first_try.ipynb” –to latex –post PDF” POST processing action fails because of a bad parameter
- #3900: python3 install syntax errors (OS X 10.8.4)
- #3899: nbconvert to latex fails on notebooks with spaces in file name
- #3881: Temporary Working Directory Test Fails
- #2750: A way to freeze code cells in the notebook
- #3893: Resize Local Image Files in Notebook doesn’t work
- #3823: nbconvert on windows: tex and paths
- #3885: under Windows, “ipython3 nbconvert “C:/blabla/first_try.ipynb” –to latex” write “” instead of “\” to reference file path in the .tex file
- #3889: test_qt fails due to assertion error ‘qt4’ != ‘qt’
- #3890: double post, disregard this issue
- #3689: nbconvert, remaining tests
- #3874: Up/Down keys don’t work to “Search previous command history” (besides Ctrl-p/Ctrl-n)
- #3853: CodeMirror locks up in the notebook
- #3862: can only connect to an ipcluster started with v1.0.0-dev (master branch) using an older ipython (v0.13.2), but cannot connect using ipython (v1.0.0-dev)
- #3869: custom css not working.
- #2960: Keyboard shortcuts
- #3795: ipcontroller process goes to 100% CPU, ignores connection requests
- #3553: Ipython and pylab crashes in windows and canopy
- #3837: Cannot set custom mathjax url, crash notebook server.
- #3808: “Naming” releases ?
- #2431: TypeError: must be string without null bytes, not str
• #3856: ? at end of comment causes line to execute
• #3731: nbconvert: add logging for the different steps of nbconvert
• #3835: Markdown cells do not render correctly when mathjax is disabled
• #3843: nbconvert to rst: leftover “In[ ]”
• #3799: nbconvert: Ability to specify name of output file
• #3726: Document when IPython.start_ipython() should be used versus IPython.embed()
• #3778: Add no more readonly view in what’s new
• #3754: No Print View in Notebook in 1.0dev
• #3798: IPython 0.12.1 Crashes on autocompleting sqlalchemy.func.row_number properties
• #3811: Opening notebook directly from the command line with multi-directory support installed
• #3775: Annoying behavior when clicking on cell after execution (Ctrl+Enter)
• #3809: Possible to add some bpython features?
• #3810: Printing the contents of an image file messes up shell text
• #3702: nbconvert: Default help message should be that of –help
• #3735: Nbconvert 1.0.0a1 does not take into account the pdf extensions in graphs
• #3719: Bad strftime format, for windows, in nbconvert exporter
• #3786: Zmq errors appearing with Ctrl-C in console/qtconsole
• #3019: disappearing scrollbar on tooltip in Chrome 24 on Ubuntu 12.04
• #3785: ipdb completely broken in Qt console
• #3796: Document the meaning of milestone/issues-tags for users.
• #3788: Do not auto show tooltip if docstring empty.
• #1366: [Web page] No link to front page from documentation
• #3739: nbconvert (to slideshow) misses some of the math in markdown cells
• #3768: increase and make timeout configurable in console completion.
• #3724: ipcluster only running on one cpu
• #1592: better message for unsupported nbformat
• #2049: Can not stop “ipython kernel” on windows
• #3757: Need direct entry point to given notebook
• #3745: ImportError: cannot import name check_linecache_ipython
• #3701: nbconvert: Final output file should be in same directory as input file
• #3738: history -o works but history with -n produces identical results
• #3740: error when attempting to run ‘make’ in docs directory
• #3737: ipython nbconvert crashes with ValueError: Invalid format string.
• #3730: nbconvert: unhelpful error when pandoc isn’t installed
• #3718: markdown cell cursor misaligned in notebook
• #3710: mutiple input fields for %debug in the notebook after resetting the kernel
• #3713: PyCharm has problems with IPython working inside PyPy created by virtualenv
• #3712: Code completion: Complete on dictionary keys
• #3680: --pylab and --matplotlib flag
• #3698: nbconvert: Unicode error with minus sign
• #3693: nbconvert does not process SVGs into PDFs
• #3688: nbconvert, figures not extracting with Python 3.x
• #3542: note new dependencies in docs / setup.py
• #2556: [pagedown] do not target_blank anchor link
• #3684: bad message when %pylab fails due import other than matplotlib
• #3682: ipython notebook pylab inline import_all=False
• #3596: MathjaxUtils race condition?
• #1540: Comment/uncomment selection in notebook
• #2702: frozen setup: permission denied for default ipython_dir
• #3672: allow_none on Number-like traits.
• #2411: add CONTRIBUTING.md
• #481: IPython terminal issue with Qt4Agg on XP SP3
• #2664: How to preserve user variables from import clashing?
• #3436: enable_pylab(import_all=False) still imports np
• #2630: lib.pylabtools.figsize : NameError when using Qt4Agg backend and %pylab magic.
• #3154: Notebook: no event triggered when a Cell is created
• #3579: Nbconvert: SVG are not transformed to PDF anymore
• #3604: MathJax rendering problem in %%latex cell
• #3668: AttributeError: ‘BlockingKernelClient’ object has no attribute ‘started_channels’
• #3245: SyntaxError: encoding declaration in Unicode string
• #3639: %pylab inline in IPYTHON notebook throws “RuntimeError: Cannot activate multiple GUI eventloops”
• #3663: frontend deprecation warnings
• #3661: run -m not behaving like python -m
• #3597: re-do PR #3531 - allow markdown in Header cell
• #3053: Markdown in header cells is not rendered
• #3655: IPython finding its way into pasted strings.
• #3620: uncaught errors in HTML output
• #3646: get_dict() error
• #3004: %load_ext rmagic fails when legacy ipy_user_conf.py is installed (in ipython 0.13.1 / OSX 10.8)
• #3638: setp() issue in ipython notebook with figure references
• #3634: nbconvert reveal to pdf conversion ignores styling, prints only a single page.
• #1307: Remove pyreadline workarounds, we now require pyreadline >= 1.7.1

2.11. Issues closed in the 1.0 development cycle
• #3316: find_cmd test failure on Windows
• #3494: input() in notebook doesn’t work in Python 3
• #3427: Deprecate $ as mathjax delimiter
• #3625: Pager does not open from button
• #3149: Miscellaneous small nbconvert feedback
• #3617: 256 color escapes support
• #3609: %pylab inline blows up for single process ipython
• #2934: Publish the Interactive MPI Demo Notebook
• #3614: ansi escapes broken in master (ls --color)
• #3610: If you don’t have markdown, python setup.py install says no pygments
• #3547: %run modules clobber each other
• #3602: import_item fails when one tries to use DottedObjectName instead of a string
• #3563: Duplicate tab completions in the notebook
• #3599: Problems trying to run IPython on python3 without installing . . .
• #2937: too long completion in notebook
• #3479: Write empty name for the notebooks
• #3505: nbconvert: Failure in specifying user filter
• #1537: think a bit about namespaces
• #3124: Long multiline strings in Notebook
• #3464: run -d message unclear
• #2706: IPython 0.13.1 ignoring $PYTHONSTARTUP
• #3587: LaTeX escaping bug in nbconvert when exporting to HTML
• #3213: Long running notebook died with a coredump
• #3580: Running ipython with pypy on windows
• #3573: custom.js not working
• #3544: IPython.lib test failure on Windows
• #3352: Install Sphinx extensions
• #2971: [notebook] user needs to press ctrl-c twice to stop notebook server should be put into terminal window
• #2413: ipython3 qtconsole fails to install: ipython 0.13 has no such extra feature ‘qtconsole’
• #2618: documentation is incorrect for install process
• #2595: mac 10.8 qtconsole export history
• #2586: cannot store aliases
• #2714: ipython qtconsole print unittest messages in console instead his own window.
• #2669: cython magic failing to work with openmp.
• #3256: Vagrant pandas instance of iPython Notebook does not respect additional plotting arguments
• #3010: cython magic fail if cache dir is deleted while in session
• #2044: prune unused names from parallel.error
• #1145: Online help utility broken in QtConsole
• #3439: Markdown links no longer open in new window (with change from pagedown to marked)
• #3476: _margv for macros seems to be missing
• #3499: Add reveal.js library (version 2.4.0) inside IPython
• #2771: Wiki Migration to GitHub
• #2887: ipcontroller purging some engines during connect
• #626: Enable Resuming Controller
• #2824: Kernel restarting after message “Kernel XXXX failed to respond to heartbeat”
• #2823: %cython magic gives ImportError: dlerror(long_file_name.so, 2): image not found
• #2891: In IPython for Python 3, system site-packages comes before user site-packages
• #2928: Add magic “watch” function (example)
• #2931: Problem rendering pandas dataframe in Firefox for Windows
• #2939: [notebook] Figure legend not shown in inline backend if outside the box of the axes
• #2972: [notebook] in Markdown mode, press Enter key at the end of <some http link>, the next line is indented unexpectedly
• #3069: Instructions for installing IPython notebook on Windows
• #3444: Encoding problem: cannot use if user’s name is not ascii?
• #3335: Reenable bracket matching
• #3386: Magic %paste not working in Python 3.3.2. TypeError: Type str doesn’t support the buffer API
• #3543: Exception shutting down kernel from notebook dashboard (0.13.1)
• #3549: Codecell size changes with selection
• #3445: Adding newlines in %%latex cell
• #3237: [notebook] Can’t close a notebook without errors
• #2916: colon invokes auto(un)indent in markdown cells
• #2167: Indent and dedent in htmlnotebook
• #3545: Notebook save button icon not clear
• #3534: nbconvert incompatible with Windows?
• #3489: Update example notebook that raw_input is allowed
• #3396: Notebook checkpoint time is displayed an hour out
• #3261: Empty revert to checkpoint menu if no checkpoint...
• #2984: “print” magic does not work in Python 3
• #3524: Issues with pyzmq and ipython on EPD update
• #2434: %store magic not auto-restoring
• #2720: base_url and static path
• #2234: Update various low resolution graphics for retina displays

2.11. Issues closed in the 1.0 development cycle

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• #2842: Remember passwords for pw-protected notebooks
• #3244: qtconsole: ValueError('close_fds is not supported on Windows platforms if you redirect stdin/stdout/stderr'.)
• #2215: AsyncResult.wait(0) can hang waiting for the client to get results?
• #2268: provide mean to retrieve static data path
• #1905: Expose UI for worksheets within each notebook
• #2380: Qt inputhook prevents modal dialog boxes from displaying
• #3185: prettify on double //
• #2821: Test failure: IPython.parallel.tests.test_client.test_resubmit_header
• #2475: [Notebook] Line is deindented when typing eg a colon in markdown mode
• #2470: Do not destroy valid notebooks
• #860: Allow the standalone export of a notebook to HTML
• #2652: notebook with qt backend crashes at save image location popup
• #1587: Improve kernel restarting in the notebook
• #2710: Saving a plot in Mac OS X backend crashes IPython
• #2596: notebook “Last saved:” is misleading on file opening.
• #2671: TypeError :NoneType when executed “ipython qtconsole” in windows console
• #2703: Notebook scrolling breaks after pager is shown
• #2803: KernelManager and KernelClient should be two separate objects
• #2693: TerminalIPythonApp configuration fails without ipython_config.py
• #2531: IPython 0.13.1 python 2 32-bit installer includes 64-bit ipython*.exe launchers in the scripts folder
• #2520: Control-C kills port forwarding
• #2279: Setting __file__ to None breaks Mayavi import
• #2161: When logged into notebook, long titles are incorrectly positioned
• #1292: Notebook, Print view should not be editable…
• #1731: test parallel launchers
• #3227: Improve documentation of ipcontroller and possible BUG
• #2896: IPController very unstable
• #3517: documentation build broken in head
• #3522: UnicodeDecodeError: ‘ascii’ codec can’t decode byte on Pycharm on Windows
• #3448: Please include MathJax fonts with IPython Notebook
• #3519: IPython Parallel map mysteriously turns pandas Series into numpy ndarray
• #3345: IPython embedded shells ask if I want to exit, but I set confirm_exit = False
• #3509: IPython won’t close without asking “Are you sure?” in Firefox
• #3471: Notebook jinja2/markupsafe depeendecies in manual
• #3502: Notebook broken in master
• #3302: autoreload does not work in ipython 0.13.x, python 3.3
• #3475: no warning when leaving/closing notebook on master without saved changes
• #3490: No obvious feedback when kernel crashes
• #1912: Move all autoreload tests to their own group
• #2577: sh.py and ipython for python 3.3
• #3467: %magic doesn’t work
• #3501: Editing markdown cells that wrap has off-by-one errors in cursor positioning
• #3492: IPython for Python3
• #3474: unexpected keyword argument to remove_kernel
• #2283: TypeError when using ‘?’ after a string in a %logstart session
• #2787: rmagic and pandas DataFrame
• #2605: Ellipsis literal triggers AttributeError
• #1179: Test unicode source in pinfo
• #2055: drop Python 3.1 support
• #2293: IPEP 2: Input transformations
• #2790: %paste and %cpaste not removing “…” lines
• #3480: Testing fails because iptest.py cannot be found
• #2580: will not run within PIL build directory
• #2797: RMagic, Dataframe Conversion Problem
• #2838: Empty lines disappear from triple-quoted literals.
• #3050: Broken link on IPython.core.display page
• #3473: Config not passed down to subcommands
• #3462: Setting log_format in config file results in error (and no format changes)
• #3311: Notebook (occasionally) not working on windows (Sophos AV)
• #3461: Cursor positioning off by a character in auto-wrapped lines
• #3454: _repr_html_error
• #3457: Space in long Paragraph Markdown cell with Chinese or Japanese
• #3447: Run Cell Does not Work
• #1373: Last lines in long cells are hidden
• #1504: Revisit serialization in IPython.parallel
• #1459: Can’t connect to 2 HTTPS notebook servers on the same host
• #678: Input prompt stripping broken with multiline data structures
• #3001: IPython.notebook.dirty flag is not set when a cell has unsaved changes
• #3077: Multiprocessing semantics in parallel.view.map
• #3056: links across notebooks
• #3120: Tornado 3.0

2.11. Issues closed in the 1.0 development cycle
• #3156: update pretty to use Python 3 style for sets
• #3197: Can’t escape multiple dollar signs in a markdown cell
• #3309: `Image()` signature/doc improvements
• #3415: Bug in IPython/external/path/__init__.py
• #3446: Feature suggestion: Download matplotlib figure to client browser
• #3295: autoexported notebooks: only export explicitly marked cells
• #3442: Notebook: Summary table extracted from markdown headers
• #3438: Zooming notebook in chrome is broken in master
• #1378: Implement autosave in notebook
• #3437: Highlighting matching parentheses
• #3435: module search segfault
• #3424: ipcluster --version
• #3434: 0.13.2 Ipython/genutils.py doesn’t exist
• #3426: Feature request: Save by cell and not by line #: IPython %save magic
• #3412: Non Responsive Kernel: Running a Django development server from an IPython Notebook
• #3408: Save cell toolbar and slide type metadata in notebooks
• #3246: %paste regression with blank lines
• #3404: Weird error with $variable and grep in command line magic (!command)
• #3405: Key auto-completion in dictionaries?
• #3259: Codemirror linenumber css broken
• #3397: Vertical text misalignment in Markdown cells
• #3391: Revert #3358 once fix integrated into CM
• #3360: Error 500 while saving IPython notebook
• #3375: Frequent Safari/Webkit crashes
• #3365: zmq frontend
• #2654: User_expression issues
• #3389: Store history as plain text
• #3388: Ipython parallel: open TCP connection created for each result returned from engine
• #3385: setup.py failure on Python 3
• #3376: Setting __module__ to None breaks pretty printing
• #3374: ipython qtconsole does not display the prompt on OSX
• #3380: simple call to kernel
• #3379: TaskRecord key ‘started’ not set
• #3241: notebook conection time out
• #3334: magic interpreter interpretes non magic commands?
• #3326: python3.3: Type error when launching SGE cluster in IPython notebook
• #3349: pip3 doesn’t run 2to3?
• #3347: Longlist support in ipdb
• #3343: Make pip install / easy_install faster
• #3337: git submodules broke nightly PPA builds
• #3206: Copy/Paste Regression in QtConsole
• #3329: Buggy linewrap in Mac OSX Terminal (Mountain Lion)
• #3327: Qt version check broken
• #3303: parallel tasks never finish under heavy load
• #1381: “” for equation continuations require an extra “” in markdown cells
• #3314: Error launching iPython
• #3306: Test failure when running on a Vagrant VM
• #3280: IPython.utils.process.getoutput returns stderr
• #3299: variables named _ or __ exhibit incorrect behavior
• #3196: add an “x” or similar to htmlnotebook pager
• #3293: Several 404 errors for js files Firefox
• #3292: syntax highlighting in chrome on OSX 10.8.3
• #3288: Latest dev version hangs on page load
• #3283: ipython dev retains directory information after directory change
• #3279: custom.css is not overridden in the dev IPython (1.0)
• #2727: %run -m doesn’t support relative imports
• #3268: GFM triple backquote and unknown language
• #3273: Suppressing all plot related outputs
• #3272: Backspace while completing load previous page
• #3260: Js error in savewidget
• #3247: scrollbar in notebook when not needed?
• #3243: notebook: option to view json source from browser
• #3265: 404 errors when running IPython 1.0dev
• #3257: setup.py not finding submodules
• #3253: Incorrect Qt and PySide version comparison
• #3248: Cell magics broken in Qt console
• #3012: Problems with the less based style.min.css
• #2390: Image width/height don’t work in embedded images
• #3236: cannot set TerminalIPythonApp.log_format
• #3214: notebook kernel dies if started with invalid parameter
• #2980: Remove HTMLCell ?
• #3128: qtconsole hangs on importing pylab (using X forwarding)
• #3198: Hitting recursive depth causing all notebook pages to hang
• #3218: race conditions in profile directory creation
• #3177: OverflowError exception in handlers.py
• #2563: core.profiledir.check_startup_dir() doesn’t work inside py2exe’d installation
• #3207: [Feature] folders for ipython notebook dashboard
• #3178: cell magics do not work with empty lines after #2447
• #3204: Default plot() colors unsuitable for red-green colorblind users
• #1789: :\n/*foo turns into :\n*(foo) in triple-quoted strings.
• #3202: File cell magic fails with blank lines
• #3199: %cython -a stopped working?
• #2688: obsolete imports in import autocompletion
• #3192: Python2, Unhandled exception, __builtin__.True = False
• #3179: script magic error message loop
• #3009: use XDG_CACHE_HOME for cython objects
• #3059: Bugs in 00_notebook_tour example.
• #3104: Integrate a javascript file manager into the notebook front end
• #3176: Particular equation not rendering (notebook)
• #1133: [notebook] readonly and upload files/UI
• #2975: [notebook] python file and cell toolbar
• #3017: SciPy.weave broken in IPython notebook/ qtconsole
• #3161: paste macro not reading spaces correctly
• #2835: %paste not working on WinXpSP3/ipython-0.13.1.py2-win32-PROPER.exe/python27
• #2628: Make transformers work for lines following decorators
• #2612: Multiline String containing “\n?foon” confuses interpreter to replace ?foo with
get_ipython().magic(u’pinfo foo’)
• #2539: Request: Enable cell magics inside of .ipy scripts
• #2507: Multiline string does not work (includes . . . ) with doctest type input in IPython notebook
• #2164: Request: Line breaks in line magic command
• #3106: poor parallel performance with many jobs
• #2438: print inside multiprocessing crashes Ipython kernel
• #3155: Bad md5 hash for package 0.13.2
• #3045: [Notebook] Ipython Kernel does not start if disconnected from internet(/network?)
• #3146: Using celery in python 3.3
• #3145: The notebook viewer is down
• #2385: grep –color not working well with notebook
• #3131: Quickly install from source in a clean virtualenv?
• #3139: Rolling log for ipython
• #3127: notebook with pylab=inline appears to call figure.draw twice
• #3129: Walking up and down the call stack
• #3123: Notebook crashed if unplugged ethernet cable
• #3121: NB should use normalize.css? was #3049
• #3087: Disable spellchecking in notebook
• #3084: ipython pyqt 4.10 incompatibility, QTextBlockUserData
• #3113: Fails to install under Jython 2.7 beta
• #3110: Render of h4 headers is not correct in notebook (error in renderedhtml.css)
• #3109: BUG: read_csv: dtype={'id' : np.str}: Datatype not understood
• #3107: Autocompletion of object attributes in arrays
• #3103: Reset locale setting in qtconsole
• #3090: python3.3 Entry Point not found
• #3081: UnicodeDecodeError when using Image(data="some.jpeg")
• #2834: url regexp only finds one link
• #3091: qtconsole breaks doctest.testmod() in Python 3.3
• #3074: SIGUSR1 not available on Windows
• #2996: registration::purging stalled registration high occurrence in small clusters
• #3065: diff-ability of notebooks
• #3067: Crash with pygit2
• #3061: Bug handling Ellipsis
• #3049: NB css inconsistent behavior between ff and webkit
• #3039: unicode errors when opening a new notebook
• #3048: Installling ipython qtConsole should be easier at Windows
• #3042: Profile creation fails on 0.13.2 branch
• #3035: docstring typo/inconsistency: mention of an xml notebook format?
• #3031: HDF5 library segfault (possibly due to mismatching headers?)
• #2991: In notebook importing sympy closes ipython kernel
• #3027: f.__globals__ causes an error in Python 3.3
• #3020: Failing test test_interactiveshell.TestAstTransform on Windows
• #3023: alt text for “click to expand output” has typo in alt text
• #2963: %history to print all input history of a previous session when line range is omitted
• #3018: IPython installed within virtualenv. WARNING “Please install IPython inside the virtualenv”
• #2484: Completion in Emacs Python buffer causes prompt to be increased.
• #3014: Ctrl-C finishes notebook immediately
• #3007: cython_pyximport reload broken in python3
• #2955: Incompatible Qt imports when running inprocess_qtconsole
• #3006: [IPython 0.13.1] The check of PyQt version is wrong
• #3005: Renaming a notebook to an existing notebook name overwrites the other file
• #2940: Abort trap in IPython Notebook after installing matplotlib
• #3000: issue #3000
• #2995: ipython_directive.py fails on multiline when prompt number < 100
• #2993: File magic (%file) does not work with paths beginning with tilde (e.g., ~/anaconda/stuff.txt)
• #2992: Cell-based input for console and qt frontends?
• #2425: Liaise with Spyder devs to integrate newer IPython
• #2986: requesting help in a loop can damage a notebook
• #2978: v1.0-dev build errors on Arch with Python 3.
• #2557: [refactor] Insert_cell_at_index()
• #2969: ipython command does not work in terminal
• #2762: OSX wxPython (osx_cocoa, 64bit) command “%gui wx” blocks the interpreter
• #2956: Silent importing of submodules differs from standard Python3.2 interpreter’s behavior
• #2943: Up arrow key history search gets stuck in QTConsole
• #2953: using ‘nonlocal’ declaration in global scope causes ipython3 crash
• #2952: qtconsole ignores exec_lines
• #2949: ipython crashes due to atexit()
• #2947: From rmagic to an R console
• #2938: docstring pane not showing in notebook
• #2936: Tornado assumes invalid signature for parse_qs on Python 3.1
• #2935: unable to find python after easy_install / pip install
• #2920: Add undo-cell deletion menu
• #2914: BUG:saving a modified .py file after loading a module kills the kernel
• #2925: BUG: kernel dies if user sets sys.stderr or sys.stdout to a file object
• #2909: LaTeX sometimes fails to render in markdown cells with some curly bracket + underscore combinations
• #2898: Skip ipc tests on Windows
• #2902: ActiveState attempt to build ipython 0.12.1 for python 3.2.2 for Mac OS failed
• #2899: Test failure in IPython.core.tests.test_magic.test_time
• #2890: Test failure when fabric not installed
• #2892: IPython tab completion bug for paths
• #1340: Allow input cells to be collapsed
• #2881: ? command in notebook does not show help in Safari
• #2751: ‰%timeit should use minutes to format running time in long running cells
• #2879: When importing a module with a wrong name, ipython crashes
2.11. Issues closed in the 1.0 development cycle

- #2862: %%timeit should warn of empty contents
- #2485: History navigation breaks in qtconsole
- #2785: gevent input hook
- #2843: Sliently running code in clipboard (with paste, cpaste and variants)
- #2784: %run -t -N<N> error
- #2732: Test failure with FileLinks class on Windows
- #2860: ipython help notebook -> KeyError: ‘KernelManager’
- #2858: Where is the installed ipython script?
- #2856: Edit code entered from ipython in external editor
- #2722: IPC transport option not taking effect?
- #2473: Better error messages in ipengine/ipcontroller
- #2836: Cannot send builtin module definitions to IP engines
- #2833: Any reason not to use super()?
- #2781: Cannot interrupt infinite loops in the notebook
- #2150: clippath_demo.py in matplotlib example does not work with inline backend
- #2634: Numbered list in notebook markdown cell renders with Roman numerals instead of numbers
- #2230: IPython crashing during startup with “AttributeError: ‘NoneType’ object has no attribute ‘rstrip’”
- #2483: nbviewer bug? with multi-file gists
- #2466: mistyping ed -p breaks ed -p
- #2477: Glob expansion tests fail on Windows
- #2622: doc issue: notebooks that ship with Ipython .13 are written for python 2.x
- #2626: Add “Cell -> Run All Keep Going” for notebooks
- #1223: Show last modification date of each notebook
- #2621: user request: put link to example notebooks in Dashboard
- #2564: grid blanks plots in ipython pylab inline mode (interactive)
- #2532: Django shell (IPython) gives NameError on dict comprehensions
- #2188: ipython crashes on ctrl-c
- #2391: Request: nbformat API to load/save without changing version
- #2355: Restart kernel message even though kernel is perfectly alive
- #2306: Garbled input text after reverse search on Mac OS X
- #2297: ipdb with separate kernel/client pushing stdout to kernel process only
- #2180: Have [kernel busy] overridden only by [kernel idle]
- #1188: Pylab with OSX backend keyboard focus issue and hang
- #2107: test_octavemagic.py[everything] fails
- #1212: Better understand/document browser compatibility
- #1585: Refactor notebook templates to use Jinja2 and make each page a separate directory
• #1443: xticks scaling factor partially obscured with qtconsole and inline plotting
• #1209: can’t make %result work as in doc.
• #1200: IPython 0.12 Windows install fails on Vista
• #1127: Interactive test scripts for Qt/nb issues
• #959: Matplotlib figures hide
• #2071: win32 installer issue on Windows XP
• #2610: ZMQInteractiveShell.colors being ignored
• #2505: Markdown Cell incorrectly highlighting after “<”
• #165: Installer fails to create Start Menu entries on Windows
• #2356: failing traceback in terminal ipython for first exception
• #2145: Have dashboard show when server disconnect
• #2098: Do not crash on kernel shutdown if json file is missing
• #2813: Offline MathJax is broken on 0.14dev
• #2807: Test failure: IPython.parallel.tests.test_client.TestClient.test_purge_everything
• #2486: Readline’s history search in ipython console does not clear properly after cancellation with Ctrl+C
• #2709: Cython -la doesn’t work
• #2767: What is IPython.utils.upgradedir?
• #2210: Placing matplotlib legend outside axis bounds causes inline display to clip it
• #2553: IPython Notebooks not robust against client failures
• #2536: ImageDraw in Ipython notebook not drawing lines
• #2264: Feature request: Versioning messaging protocol
• #2589: Creation of ~300+ MPI-spawned engines causes instability in ipcluster
• #2672: notebook: inline option without pylab
• #2673: Indefinite Articles & Traitlets
• #2705: Notebook crashes Safari with select and drag
• #2721: dreload kills ipython when it hits zmq
• #2806: ipython.parallel doesn’t discover globals under Python 3.3
• #2794: _exit_code behaves differently in terminal vs ZMQ frontends
• #2793: IPython.parallel issue with pushing pandas TimeSeries
• #1085: In process kernel for Qt frontend
• #2760: IndexError: list index out of range with Python 3.2
• #2780: Save and load notebooks from github
• #2772: AttributeError: ‘Client’ object has no attribute ‘kill’
• #2754: Fail to send class definitions from interactive session to engines namespaces
• #2764: TypeError while using ‘cd’
• #2765: name ‘__file__’ is not defined
• #2540: Wrap tooltip if line exceeds threshold?
• #2394: Startup error on ipython qtconsole (version 0.13 and 0.14-dev
• #2440: IPEP 4: Python 3 Compatibility
• #1814: __file__ is not defined when file end with .py
• #2759: R magic extension interferes with tab completion
• #2615: Small change needed to rmagic extension.
• #2748: collapse parts of a html notebook
• #1661: %paste still bugs about IndentationError and says to use %paste
• #2742: Octavemagic fails to deliver inline images in IPython (on Windows)
• #2739: wiki.ipython.org contaminated with prescription drug spam
• #2588: Link error while executing code from cython example notebook
• #2550: Rpush magic doesn’t find local variables and doesn’t support comma separated lists of variables
• #2675: Markdown/html blockquote need css.
• #2419: TerminalInteractiveShell.__init__() ignores value of ipython_dir argument
• #1523: Better LaTeX printing in the qtconsole with the sympy profile
• #2719: ipython fails with pkg_resources.DistributionNotFound: ipython==0.13
• #2715: url crashes nbviewer.ipython.org
• #2555: “import” module completion on MacOSX
• #2707: Problem installing the new version of IPython in Windows
• #2696: SymPy magic bug in IPython Notebook
• #2684: pretty print broken for types created with PyType_FromSpec
• #2533: rmagic breaks on Windows
• #2661: Qtconsole tooltip is too wide when the function has many arguments
• #2679: ipython3 qtconsole via Homebrew on Mac OS X 10.8 - pyqt/pyside import error
• #2646: pylab_not_importable
• #2587: cython magic pops 2 CLI windows upon execution on Windows
• #2660: Certain arguments (-h, –help, –version) never passed to scripts run with ipython
• #2665: Missing docs for rmagic and some other extensions
• #2611: Travis wants to drop 3.1 support
• #2658: Incorrect parsing of raw multiline strings
• #2655: Test fails if from __future__ import print_function in .pythonrc.py
• #2651: nonlocal with no existing variable produces too many errors
• #2645: python3 is a pain (minor unicode bug)
• #2637: %paste in Python 3 on Mac doesn’t work
• #2624: Error on launching IPython on Win 7 and Python 2.7.3
• #2608: disk IO activity on cursor press

2.11. Issues closed in the 1.0 development cycle
• #1275: Markdown parses LaTeX math symbols as its formatting syntax in notebook
• #2613: display(Math(\ldots)) doesn’t render tau correctly
• #925: Tab-completion in Qt console needn’t use pager
• #2607: %load_ext sympy.interactive.ipythonprinting dammaging output
• #2593: Toolbar button to open qtconsole from notebook
• #2602: IPython html documentation for downloading
• #2598: ipython notebook –pylab=inline replaces built-in any()
• #2244: small issue: wrong printout
• #2590: add easier way to execute scripts in the current directory
• #2581: %hist does not work when InteractiveShell.cache_size = 0
• #2584: No file COPYING
• #2578: AttributeError: ‘module’ object has no attribute ‘TestCase’
• #2576: One of my notebooks won’t load any more – is there a maximum notebook size?
• #2560: Notebook output is invisible when printing strings with rrn line endings
• #2566: if pyside partially present ipython qtconsole fails to load even if pyqt4 present
• #1308: ipython qtconsole –ssh=server –existing … hangs
• #1679: List command doesn’t work in ipdb debugger the first time
• #2545: pypi win32 installer creates 64bit executibles
• #2080: Event loop issues with IPython 0.12 and PyQt4 (QDialog.exec_ and more)
• #2541: Allow python -m IPython
• #2508: subplots_adjust() does not work correctly in ipython notebook
• #2289: Incorrect mathjax rendering of certain arrays of equations
• #2487: Selecting and indenting
• #2521: more fine-grained ‘run’ controls, such as ‘run from here’ and ‘run until here’
• #2535: Funny bounding box when plot with text
• #2523: History not working
• #2514: Issue with zooming in qtconsole
• #2220: No sys.stdout.encoding in kernel based IPython
• #2512: ERROR: Internal Python error in the inspect module.
• #2496: Function passwd does not work in QtConsole
• #1453: make engines reconnect/die when controller was restarted
• #2481: ipython notebook – clicking in a code cell’s output moves the screen to the top of the code cell
• #2488: Undesired plot outputs in Notebook inline mode
• #2482: ipython notebook – download may not get the latest notebook
• #2471: _subprocess module removed in Python 3.3
• #2374: Issues with man pages
• #2316: parallel.Client.__init__ should take cluster_id kwarg
• #2457: Can a R library wrapper be created with Rmagic?
• #1575: Fallback frontend for console when connecting pylab=inline-enabled kernel?
• #2097: Do not crash if history db is corrupted
• #2435: ipengines fail if clean_logs enabled
• #2429: Using warnings.warn() results in TypeError
• #2422: Multiprocessing in ipython notebook kernel crash
• #2426: ipython crashes with the following message. I do not what went wrong. Can you help me identify the problem?
• #2423: Docs typo?
• #2257: pip install -e fails
• #2418: rmagic can’t run R’s read.csv on data files with NA data
• #2417: HTML notebook: Backspace sometimes deletes multiple characters
• #2275: notebook: “Down_Arrow” on last line of cell should move to end of line
• #2414: 0.13.1 does not work with current EPD 7.3-2
• #2409: there is a redundant None
• #2410: Use /usr/bin/python3 instead of /usr/bin/python
• #2366: Notebook Dashboard –notebook-dir and fullpath
• #2406: Inability to get docstring in debugger
• #2398: Show line number for IndentationErrors
• #2314: HTML lists seem to interfere with the QtConsole display
• #1688: unicode exception when using %run with failing script
• #1884: IPython.embed changes color on error
• #2381: %time doesn’t work for multline statements
• #1435: Add size keywords in Image class
• #2372: interactiveshell.py misses urllib and io_open imports
• #2371: iPython not working
• #2367: Tab expansion moves to next cell in notebook
• #2359: nbtviewer alters the order of print and display() output
• #2227: print name for IPython Notebooks has become uninformative
• #2361: client doesn’t use connection file’s ‘location’ in disambiguating ‘interface’
• #2357: failing traceback in terminal ipython for first exception
• #2343: Installing in a python 3.3b2 or python 3.3rc1 virtual environment.
• #2315: Failure in test: “Test we’re not loading modules on startup that we shouldn’t.”
• #2351: Multiple Notebook Apps: cookies not port specific, clash with each other
• #2350: running unittest from qconsole prints output to terminal
• #2303: remote tracebacks broken since 952d0d6 (PR #2223)
• #2330: qtconsole does not highlight tab-completion suggestion with custom stylesheet
• #2325: Parsing Tex formula fails in Notebook
• #2324: Parsing Tex formula fails
• #1474: Add argument to run -n for custom namespace
• #2318: C-m n/p don’t work in Markdown cells in the notebook
• #2309: time.time() in ipython notebook producing impossible results
• #2307: schedule tasks on newly arrived engines
• #2313: Allow Notebook HTML/JS to send messages to Python code
• #2304: ipengine throws KeyError: url
• #1878: shell access using ! will not fill class or function scope vars
• #2253: %paste does not retrieve clipboard contents under screen/tmux on OS X
• #1510: Add-on (or Monkey-patch) infrastructure for HTML notebook
• #2273: triple quote and %s at beginning of line with %paste
• #2243: Regression in .embed()
• #2266: SSH passwordless check with OpenSSH checks for the wrong thing
• #2217: Change NewNotebook handler to use 30x redirect
• #2276: config option for disabling history store
• #2239: can’t use parallel.Reference in view.map
• #2272: Sympy piecewise messed up rendering
• #2252: %paste throws an exception with empty clipboard
• #2259: git-mpr is currently broken
• #2247: Variable expansion in shell commands should work in substrings
• #2026: Run ‘fast’ tests only
• #2241: read a list of notebooks on server and bring into browser only notebook
• #2237: please put python and text editor in the web only ipython
• #2053: Improvements to the IPython.display.Image object
• #1456: ERROR: Internal Python error in the inspect module.
• #2221: Avoid importing from IPython.parallel in core
• #2213: Can’t trigger startup code in Engines
• #1464: Strange behavior for backspace with lines ending with more than 4 spaces in notebook
• #2187: NaN in object_info_reply JSON causes parse error
• #214: system command requiring administrative privileges
• #2195: Unknown option no-edit in git-mpr
• #2201: Add documentation build to tools/test_pr.py
• #2205: Command-line option for default Notebook output collapsing behavior
• #1927: toggle between inline and floating figures
• #2171: Can’t start StarCluster after upgrading to IPython 0.13
• #2173: oct2py v >= 0.3.1 doesn’t need h5py anymore
• #2099: storemagic needs to use self.shell
• #2166: DirectView map_sync() with Lambdas Using Generators
• #2091: Unable to use print_stats after %prun -r in notebook
• #2132: Add fail-over for pastebin
• #2156: Make it possible to install ipython without nasty gui dependencies
• #2154: Scrolled long output should be off in print view by default
• #2162: Tab completion does not work with IPython.embed_kernel()
• #2157: iPython 0.13 / github-master cannot create logfile from scratch
• #2151: missing newline when a magic is called from the qtconsole menu
• #2139: 00_notebook_tour Image example broken on master
• #2143: Add a %%%cython_annotate magic
• #2135: Running IPython from terminal
• #2093: Makefile for building Sphinx documentation on Windows
• #2122: Bug in pretty printing
• #2120: Notebook “Make a Copy…” keeps opening duplicates in the same tab
• #1997: password cannot be used with url prefix
• #2129: help/doc displayed multiple times if requested in loop
• #2121: ipdb does not support input history in qtconsole
• #2114: %logstart doesn’t log
• #2085: %ed magic fails in qtconsole
• #2119: iPython fails to run on MacOS Lion
• #2052: %pylab inline magic does not work on windows
• #2111: Ipython won’t start on W7
• #2112: Strange internal traceback
• #2108: Backslash () at the end of the line behavior different from default Python
• #1425: Ampersands can’t be typed sometimes in notebook cells
• #1513: Add expand/collapse support for long output elements like stdout and tracebacks
• #2087: error when starting ipython
• #2103: Ability to run notebook file from commandline
• #2082: Qt Console output spacing
• #2083: Test failures with Python 3.2 and PYTHONWARNINGS="d"
• #2094: about inline
• #2077: Starting IPython3 on the terminal
• #1760: easy_install ipython fails on py3.2-win32
• #2075: Local Mathjax install causes iptest3 error under python3
• #2057: setup fails for python3 with LANG=C
• #2070: shebang on Windows
• #2054: sys_info missing git hash in sdists
• #2059: duplicate and modified files in documentation
• #2056: except-shadows-builtin osm.py:687
• #2058: hyphen-used-as-minus-sign in manpages

2.12 0.13 Series

2.12.1 Release 0.13

IPython 0.13 contains several major new features, as well as a large amount of bug and regression fixes. The previous version (0.12) was released on December 19 2011, and in this development cycle we had:

• ~6 months of work.
• 373 pull requests merged.
• 742 issues closed (non-pull requests).
• contributions from 62 authors.
• 1760 commits.
• a diff of 114226 lines.

The amount of work included in this release is so large, that we can only cover here the main highlights; please see our detailed release statistics for links to every issue and pull request closed on GitHub as well as a full list of individual contributors.

Major Notebook improvements: new user interface and more

The IPython Notebook, which has proven since its release to be wildly popular, has seen a massive amount of work in this release cycle, leading to a significantly improved user experience as well as many new features.

The first user-visible change is a reorganization of the user interface; the left panel has been removed and was replaced by a real menu system and a toolbar with icons. Both the toolbar and the header above the menu can be collapsed to leave an unobstructed working area:
The notebook handles very long outputs much better than before (this was a serious usability issue when running processes that generated massive amounts of output). Now, in the presence of outputs longer than ~100 lines, the notebook will automatically collapse to a scrollable area and the entire left part of this area controls the display: one click in this area will expand the output region completely, and a double-click will hide it completely. This figure shows both the scrolled and hidden modes:

**Note:** The auto-folding of long outputs is disabled in Firefox due to bugs in its scrolling behavior. See PR #2047 for details.

Uploading notebooks to the dashboard is now easier: in addition to drag and drop (which can be finicky sometimes), you can now click on the upload text and use a regular file dialog box to select notebooks to upload. Furthermore, the notebook dashboard now auto-refreshes its contents and offers buttons to shut down any running kernels (PR #1739):
Cluster management

The notebook dashboard can now also start and stop clusters, thanks to a new tab in the dashboard user interface:

This interface allows, for each profile you have configured, to start and stop a cluster (and optionally override the default number of engines corresponding to that configuration). While this hides all error reporting, once you have a configuration that you know works smoothly, it is a very convenient interface for controlling your parallel resources.

New notebook format

The notebooks saved now use version 3 of our format, which supports heading levels as well as the concept of ‘raw’ text cells that are not rendered as Markdown. These will be useful with converters we are developing, to pass raw markup (say LaTeX). That conversion code is still under heavy development and not quite ready for prime time, but we welcome help on this front so that we can merge it for full production use as soon as possible.

Note: v3 notebooks can not be read by older versions of IPython, but we provide a simple script that you can use in case you need to export a v3 notebook to share with a v2 user.

JavaScript refactoring

All the client-side JavaScript has been decoupled to ease reuse of parts of the machinery without having to build a full-blown notebook. This will make it much easier to communicate with an IPython kernel from existing web pages and to integrate single cells into other sites, without loading the full notebook document-like UI. PR #1711.

This refactoring also enables the possibility of writing dynamic javascript widgets that are returned from Python code and that present an interactive view to the user, with callbacks in Javascript executing calls to the Kernel. This will enable many interactive elements to be added by users in notebooks.
An example of this capability has been provided as a proof of concept in `examples/widgets` that lets you directly communicate with one or more parallel engines, acting as a mini-console for parallel debugging and introspection.

**Improved tooltips**

The object tooltips have gained some new functionality. By pressing tab several times, you can expand them to see more of a docstring, keep them visible as you fill in a function’s parameters, or transfer the information to the pager at the bottom of the screen. For the details, look at the example notebook `01_notebook_introduction.ipynb`.

![Fig. 1: The new notebook tooltips.](image)

**Other improvements to the Notebook**

These are some other notable small improvements to the notebook, in addition to many bug fixes and minor changes to add polish and robustness throughout:

- The notebook pager (the area at the bottom) is now resizeable by dragging its divider handle, a feature that had been requested many times by just about anyone who had used the notebook system. PR #1705.
• It is now possible to open notebooks directly from the command line; for example: `ipython notebook path/` will automatically set `path/` as the notebook directory, and `ipython notebook path/foo.ipynb` will further start with the `foo.ipynb` notebook opened. PR #1686.

• If a notebook directory is specified with `--notebook-dir` (or with the corresponding configuration flag `NotebookManager.notebook_dir`), all kernels start in this directory.

• Fix codemirror clearing of cells with `Ctrl-Z`; PR #1965.

• Text (markdown) cells now line wrap correctly in the notebook, making them much easier to edit PR #1330.

• PNG and JPEG figures returned from plots can be interactively resized in the notebook, by dragging them from their lower left corner. PR #1832.

• Clear `In []` prompt numbers on “Clear All Output”. For more version-control-friendly `.ipynb` files, we now strip all prompt numbers when doing a “Clear all output”. This reduces the amount of noise in commit-to-commit diffs that would otherwise show the (highly variable) prompt number changes. PR #1621.

• The notebook server now requires two consecutive `Ctrl-C` within 5 seconds (or an interactive confirmation) to terminate operation. This makes it less likely that you will accidentally kill a long-running server by typing `Ctrl-C` in the wrong terminal. PR #1609.

• Using `Ctrl-S` (or `Cmd-S` on a Mac) actually saves the notebook rather than providing the fairly useless browser html save dialog. PR #1334.

• Allow accessing local files from the notebook (in urls), by serving any local file as the url `files/relativepath`. This makes it possible to, for example, embed local images in a notebook. PR #1211.

Cell magics

We have completely refactored the magic system, finally moving the magic objects to standalone, independent objects instead of being the mixin class we’d had since the beginning of IPython (PR #1732). Now, a separate base class is provided in `IPython.core.magic.Magics` that users can subclass to create their own magics. Decorators are also provided to create magics from simple functions without the need for object orientation. Please see the `Magic command system` docs for further details.

All builtin magics now exist in a few subclasses that group together related functionality, and the new `IPython.core.magics` package has been created to organize this into smaller files.

This cleanup was the last major piece of deep refactoring needed from the original 2001 codebase.

We have also introduced a new type of magic function, prefixed with `%%` instead of `%`, which operates at the whole-cell level. A cell magic receives two arguments: the line it is called on (like a line magic) and the body of the cell below it.

Cell magics are most natural in the notebook, but they also work in the terminal and qt console, with the usual approach of using a blank line to signal cell termination.

For example, to time the execution of several statements:

```python
%%timeit x = 0  # setup
for i in range(100000):
    x += i**2
```

This is particularly useful to integrate code in another language, and cell magics already exist for shell scripts, Cython, R and Octave. Using `%%script /usr/bin/foo`, you can run a cell in any interpreter that accepts code via stdin.

Another handy cell magic makes it easy to write short text files: `%%file ~/save/to/here.txt`.

The following cell magics are now included by default; all those that use special interpreters (Perl, Ruby, bash, etc.) assume you have the requisite interpreter installed:

• `%%!`: run cell body with the underlying OS shell; this is similar to prefixing every line in the cell with `!`. 152
• %%bash: run cell body under bash.
• %%capture: capture the output of the code in the cell (and stderr as well). Useful to run codes that produce too much output that you don’t even want scrolled.
• %%file: save cell body as a file.
• %%perl: run cell body using Perl.
• %%prun: run cell body with profiler (cell extension of %prun).
• %%python3: run cell body using Python 3.
• %%ruby: run cell body using Ruby.
• %%script: run cell body with the script specified in the first line.
• %%sh: run cell body using sh.
• %%sx: run cell with system shell and capture process output (cell extension of %sx).
• %%system: run cell with system shell (%%! is an alias to this).
• %%timeit: time the execution of the cell (extension of %timeit).

This is what some of the script-related magics look like in action:

```
In [4]: %%ruby
puts "Hello from Ruby #{RUBY_VERSION}"
Hello from Ruby 1.8.7

In [5]: %%bash
echo "hello from $BASH"
hello from /usr/local/bin/bash
```

In addition, we have also a number of extensions that provide specialized magics. These typically require additional software to run and must be manually loaded via %load_ext <extension name>, but are extremely useful. The following extensions are provided:

**Cython magics (extension cythonmagic)** This extension provides magics to automatically build and compile Python extension modules using the Cython language. You must install Cython separately, as well as a C compiler, for this to work. The examples directory in the source distribution ships with a full notebook demonstrating these capabilities:
The %cython magic

Probably the most important magic is the %cython magic. This is similar to the %cython_pyximport magic, but doesn’t require you to specify a module name. Instead, the %cython magic uses manages everything using temporary files in the ~/.cython/magic directory. All of the symbols in the Cython module are imported automatically by the magic.

Here is a simple example of a Black-Scholes options pricing algorithm written in Cython:

```
In [6]: %cython
cimport cython
from libc.math import exp, sqrt, pow, log, erf

@cython.cdivision(True)
cdef double std_norm_cdf(double x) nogil:
    return 0.5*(1+erf(x/sqrt(2.0)))

@cython.cdivision(True)
def black_scholes(double s, double k, double t, double v, 
                  double rf, double div, double cp):
    """Price an option using the Black-Scholes model."

    s : initial stock price
    k : strike price
    t : expiration time
    v : volatility
    rf : risk-free rate
    div : dividend
    cp : +1/-1 for call/put
    """
    cdef double d1, d2, optprice
    with nogil:
        d1 = (log(s/k) - (rf - div + 0.5 * pow(v,2)) * t) / (v * sqrt(t))
        d2 = d1 - v * sqrt(t)
        optprice = cp * s * exp(-div * t) * std_norm_cdf(cp * d1) - 
                   cp * k * exp(-rf * t) * std_norm_cdf(cp * d2)
    return optprice

In [7]: black_scholes(100.0, 100.0, 1.0, 0.3, 0.03, 0.0, -1)
Out[7]: 10.327861752731728

In [8]: %%timeit black_scholes(100.0, 100.0, 1.0, 0.3, 0.03, 0.0, -1)
1000000 loops, best of 3: 821 ns per loop
```

Octave magics (extension octavemagic)  This extension provides several magics that support calling code written in the Octave language for numerical computing. You can execute single-lines or whole blocks of Octave code, capture both output and figures inline (just like matplotlib plots), and have variables automatically converted between the two languages. To use this extension, you must have Octave installed as well as the oct2py package. The examples directory in the source distribution ships with a full notebook demonstrating these capabilities:
R magics (extension rmagic) This extension provides several magics that support calling code written in the R language for statistical data analysis. You can execute single-lines or whole blocks of R code, capture both output and figures inline (just like matplotlib plots), and have variables automatically converted between the two languages. To use this extension, you must have R installed as well as the rpy2 package that bridges Python and R. The examples directory in the source distribution ships with a full notebook demonstrating these capabilities:
Tab completer improvements

Useful tab-completion based on live inspection of objects is one of the most popular features of IPython. To make this process even more user-friendly, the completers of both the Qt console and the Notebook have been reworked.

The Qt console comes with a new ncurses-like tab completer, activated by default, which lets you cycle through the available completions by pressing tab, or select a completion with the arrow keys (PR #1851).

In the notebook, completions are now sourced both from object introspection and analysis of surrounding code, so limited completions can be offered for variables defined in the current cell, or while the kernel is busy (PR #1711).

We have implemented a new configurable flag to control tab completion on modules that provide the `__all__` attribute:
IPCompleter.limit_to__all__ = Boolean

This instructs the completer to honor __all__ for the completion. Specifically, when completing on object. <tab>, if True: only those names in obj.__all__ will be included. When False [default]: the __all__ attribute is ignored. PR #1529.

**Improvements to the Qt console**

The Qt console continues to receive improvements and refinements, despite the fact that it is by now a fairly mature and robust component. Lots of small polish has gone into it, here are a few highlights:

- A number of changes were made to the underlying code for easier integration into other projects such as Spyder (PR #2007, PR #2024).
- Improved menus with a new Magic menu that is organized by magic groups (this was made possible by the reorganization of the magic system internals). PR #1782.
- Allow for restarting kernels without clearing the qtconsole, while leaving a visible indication that the kernel has restarted. PR #1681.
- Allow the native display of jpeg images in the qtconsole. PR #1643.

**Parallel**

The parallel tools have been improved and fine-tuned on multiple fronts. Now, the creation of an IPython.parallel.Client object automatically activates a line and cell magic function px that sends its code to all the engines. Further magics can be easily created with the Client.activate() method, to conveniently execute code on any subset of engines. PR #1893.

The %%px cell magic can also be given an optional targets argument, as well as a --out argument for storing its output.

A new magic has also been added, %pxconfig, that lets you configure various defaults of the parallel magics. As usual, type %pxconfig? for details.

The exception reporting in parallel contexts has been improved to be easier to read. Now, IPython directly reports the remote exceptions without showing any of the internal execution parts:
The parallel tools now default to using `NoDB` as the storage backend for intermediate results. This means that the default usage case will have a significantly reduced memory footprint, though certain advanced features are not available with this backend.

The parallel magics now display all output, so you can do parallel plotting or other actions with complex display. The `px` magic has now both line and cell modes, and in cell mode finer control has been added about how to collate output from multiple engines. PR #1768.

There have also been incremental improvements to the SSH launchers:

- add to_send/fetch steps for moving connection files around.
- add SSHProxyEngineSetLauncher, for invoking to `ipcluster` engines on a remote host. This can be used to start a set of engines via PBS/SGE/MP1 remotely.

This makes the SSHLauncher usable on machines without shared filesystems.

A number of `sugar` methods/properties were added to AsyncResult that are quite useful (PR #1548) for everyday work:

- `ar.wall_time` = received - submitted
- `ar.serial_time` = sum of serial computation time
- `ar.elapsed` = time since submission (wall_time if done)
- `ar.progress` = (int) number of sub-tasks that have completed
- `len(ar)` = # of tasks
- `ar.wait_interactive()`: prints progress

Added `Client.spin_thread()` / `stop_spin_thread()` for running spin in a background thread, to keep zmq queue clear. This can be used to ensure that timing information is as accurate as possible (at the cost of having a background thread active).

Set TaskScheduler.hwm default to 1 instead of 0. 1 has more predictable/intuitive behavior, if often slower, and thus a more logical default. Users whose workloads require maximum throughput and are largely homogeneous in time per task can make the optimization themselves, but now the behavior will be less surprising to new users. PR #1294.

**Kernel/Engine unification**

This is mostly work `under the hood`, but it is actually a `major` achievement for the project that has deep implications in the long term: at last, we have unified the main object that executes as the user’s interactive shell (which we refer to as the *IPython kernel*) with the objects that run in all the worker nodes of the parallel computing facilities (the *IPython*...
engines). Ever since the first implementation of IPython’s parallel code back in 2006, we had wanted to have these two roles be played by the same machinery, but a number of technical reasons had prevented that from being true.

In this release we have now merged them, and this has a number of important consequences:

- It is now possible to connect any of our clients (qtconsole or terminal console) to any individual parallel engine, with the exact behavior of working at a ‘regular’ IPython console/qtconsole. This makes debugging, plotting, etc. in parallel scenarios vastly easier.

- Parallel engines can always execute arbitrary ‘IPython code’, that is, code that has magics, shell extensions, etc. In combination with the %%px magics, it is thus extremely natural for example to send to all engines a block of Cython or R code to be executed via the new Cython and R magics. For example, this snippet would send the R block to all active engines in a cluster:

  ```
  %%px
  %%R
  ... R code goes here
  ```

- It is possible to embed not only an interactive shell with the IPython.embed() call as always, but now you can also embed a kernel with IPython.embed_kernel(). Embedding an IPython kernel in an application is useful when you want to use IPython.embed() but don’t have a terminal attached on stdin and stdout.

- The new IPython.parallel.bind_kernel() allows you to promote Engines to listening Kernels, and connect QtConsoles to an Engine and debug it directly.

In addition, having a single core object through our entire architecture also makes the project conceptually cleaner, easier to maintain and more robust. This took a lot of work to get in place, but we are thrilled to have this major piece of architecture finally where we’d always wanted it to be.

**Official Public API**

We have begun organizing our API for easier public use, with an eye towards an official IPython 1.0 release which will firmly maintain this API compatible for its entire lifecycle. There is now an IPython.display module that aggregates all display routines, and the traitlets.config namespace has all public configuration tools. We will continue improving our public API layout so that users only need to import names one level deeper than the main IPython package to access all public namespaces.

**IPython notebook file icons**

The directory docs/resources in the source distribution contains SVG and PNG versions of our file icons, as well as an Info.plist.example file with instructions to install them on Mac OSX. This is a first draft of our icons, and we encourage contributions from users with graphic talent to improve them in the future.

**New top-level locate command**

Add locate entry points; these would be useful for quickly locating IPython directories and profiles from other (non-Python) applications. PR #1762.

Examples:

```
$> ipython locate
/Users/me/.ipython

$> ipython locate profile foo
/Users/me/.ipython/profile_foo
```
Other new features and improvements

- `%install_ext`: A new magic function to install an IPython extension from a URL. E.g. `%install_ext https://bitbucket.org/birkenfeld/ipython-physics/raw/default/physics.py`.

- The `%loadpy` magic is no longer restricted to Python files, and has been renamed `%load`. The old name remains as an alias.

- New command line arguments will help external programs find IPython folders: `ipython locate` finds the user’s IPython directory, and `ipython locate profile foo` finds the folder for the ‘foo’ profile (if it exists).

- The `IPYTHON_DIR` environment variable, introduced in the Great Reorganization of 0.11 and existing only in versions 0.11-0.13, has been deprecated. As described in PR #1167, the complexity and confusion of migrating to this variable is not worth the aesthetic improvement. Please use the historical `IPYTHONDIR` environment variable instead.

- The default value of `interactivity` passed from `run_cell()` to `run_ast_nodes()` is now configurable.

- New `%alias_magic` function to conveniently create aliases of existing magics, if you prefer to have shorter names for personal use.

- We ship unminified versions of the JavaScript libraries we use, to better comply with Debian’s packaging policies.

- Simplify the information presented by `obj?/obj??` to eliminate a few redundant fields when possible. PR #2038.

- Improved continuous integration for IPython. We now have automated test runs on Shining Panda and Travis-CI, as well as Tox support.

- The `vim-ipython` functionality (externally developed) has been updated to the latest version.

- The `%save` magic now has a `-f` flag to force overwriting, which makes it much more usable in the notebook where it is not possible to reply to interactive questions from the kernel. PR #1937.

- Use dvipng to format sympy.Matrix, enabling display of matrices in the Qt console with the sympy printing extension. PR #1861.

- Our messaging protocol now has a reasonable test suite, helping ensure that we don’t accidentally deviate from the spec and possibly break third-party applications that may have been using it. We encourage users to contribute more stringent tests to this part of the test suite. PR #1627.

- Use LaTeX to display, on output, various built-in types with the SymPy printing extension. PR #1399.

- Add Gtk3 event loop integration and example. PR #1588.

- `clear_output` improvements, which allow things like progress bars and other simple animations to work well in the notebook (PR #1563):
  - `clear_output()` clears the line, even in terminal IPython, the QtConsole and plain Python as well, by printing `r` to streams.
- `clear_output()` avoids the flicker in the notebook by adding a delay, and firing immediately upon the next actual display message.
- `display_javascript` hides its `output_area` element, so using `display` to run a bunch of javascript doesn’t result in ever-growing vertical space.

- Add simple support for running inside a virtualenv. While this doesn’t supplant proper installation (as users should do), it helps ad-hoc calling of IPython from inside a virtualenv. PR #1388.

**Major Bugs fixed**

In this cycle, we have closed over 740 issues, but a few major ones merit special mention:

- The `%pastebin` magic has been updated to point to gist.github.com, since unfortunately http://paste.pocoo.org has closed down. We also added a `-d` flag for the user to provide a gist description string. PR #1670.
- Fix `%paste` that would reject certain valid inputs. PR #1258.
- Fix sending and receiving of Numpy structured arrays (those with composite dtypes, often used as recarrays). PR #2034.
- Reconnect when the websocket connection closes unexpectedly. PR #1577.
- Fix truncated representation of objects in the debugger by showing at least 80 characters’ worth of information. PR #1793.
- Fix logger to be Unicode-aware: logging could crash ipython if there was unicode in the input. PR #1792.
- Fix images missing from XML/SVG export in the Qt console. PR #1449.
- Fix deepreload on Python 3. PR #1625, as well as having a much cleaner and more robust implementation of deepreload in general. PR #1457.

**Backwards incompatible changes**

- The exception `IPython.core.error.TryNext` previously accepted arguments and keyword arguments to be passed to the next implementation of the hook. This feature was removed as it made error message propagation difficult and violated the principle of loose coupling.

**2.13 Issues closed in the 0.13 development cycle**

**2.13.1 Issues closed in 0.13**

GitHub stats since IPython 0.12 (2011/12/19 - 2012/06/30)

These lists are automatically generated, and may be incomplete or contain duplicates.

The following 62 authors contributed 1760 commits.

- Aaron Culich
- Aaron Meurer
- Alex Kramer
- Andrew Giessel
- Andrew Straw
- André Matos
• Aron Ahmadia
• Ben Edwards
• Benjamin Ragan-Kelley
• Bradley M. Froehle
• Brandon Parsons
• Brian E. Granger
• Carlos Cordoba
• David Hirschfeld
• David Zderic
• Ernie French
• Fernando Perez
• Ian Murray
• Jason Grout
• Jens H Nielsen
• Jez Ng
• Jonathan March
• Jonathan Taylor
• Julian Taylor
• Jörgen Stenarson
• Kent Inverarity
• Marc Abramowitz
• Mark Wiebe
• Matthew Brett
• Matthias BUSSONNIER
• Michael Droettboom
• Mike Hansen
• Nathan Rice
• Pankaj Pandey
• Paul
• Paul Ivanov
• Piotr Zolnierczuk
• Piti Ongmongkolkul
• Puneeth Chaganti
• Robert Kern
• Ross Jones
• Roy Hyunjin Han
We closed a total of 1115 issues, 373 pull requests and 742 regular issues; this is the full list (generated with the script `tools/github_stats.py`):

Pull Requests (373):

- PR #1943: add screenshot and link into releasenotes
- PR #1954: update some example notebooks
- PR #2048: move _encode_binary to jsonutil.encode_images
- PR #2050: only add quotes around xunit-file on Windows
- PR #2047: disable auto-scroll on mozilla
- PR #2015: Fixes for %paste with special transformations
- PR #2046: Iptest unicode
- PR #1939: Namespaces
- PR #2042: increase auto-scroll threshold to 100 lines
- PR #2043: move RemoteError import to top-level
- PR #2036: %alias_magic
- PR #1968: Proposal of icons for .ipynb files
- PR #2037: remove ipython-qtconsole gui-script
• PR #2038: add extra clear warning to shell doc
• PR #2029: Ship unminified js
• PR #2007: Add custom_control and custom_page_control variables to override the Qt widgets used by qtconsole
• PR #2034: fix&test push/pull recarrays
• PR #2028: Reduce unhelpful information shown by pinfo
• PR #2030: check wxPython version in inputhook
• PR #2024: Make interactive_usage a bit more rst friendly
• PR #2031: disable ^C^C confirmation on Windows
• PR #2027: match stdin encoding in frontend readline test
• PR #2025: Fix parallel test on WinXP - wait for resource cleanup.
• PR #2016: BUG: test runner fails in Windows if filenames contain spaces.
• PR #2020: Fix home path expansion test in Windows.
• PR #2021: Fix Windows pathname issue in ‘odd encoding’ test.
• PR #2022: don’t check writability in test for get_home_dir when HOME is undefined
• PR #1996: frontend test tweaks
• PR #2014: relax profile regex in notebook
• PR #2012: Mono cursor offset
• PR #2004: Clarify generic message spec vs. Python message API in docs
• PR #2010: notebook: Print a warning (but do not abort) if no webbrowser can be found.
• PR #2002: Refactor %magic into a lsmagic_docs API function.
• PR #1999: %magic help: display line and cell magics in alphabetical order.
• PR #1981: Clean BG processes created by %script on kernel exit
• PR #1994: Fix RST misformatting.
• PR #1951: minor notebook startup/notebook-dir adjustments
• PR #1974: Allow path completion on notebook.
• PR #1964: allow multiple instances of a Magic
• PR #1991: fix _ofind attr in %page
• PR #1988: check for active frontend in update_restart_checkbox
• PR #1979: Add support for tox (https://tox.readthedocs.io/) and Travis CI (http://travis-ci.org/)
• PR #1970: dblclick to restore size of images
• PR #1978: Notebook names truncating at the first period
• PR #1825: second attempt at scrolled long output
• PR #1934: Cell/Worksheet metadata
• PR #1746: Confirm restart (configuration option, and checkbox UI)
• PR #1944: [qtconsole] take %,%% prefix into account for completion
• PR #1973: fix another FreeBSD $HOME symlink issue
• PR #1967: Fix psums example description in docs
• PR #1965: fix for #1678, undo no longer clears cells
• PR #1952: avoid duplicate “Websockets closed” dialog on ws close
• PR #1962: Support unicode prompts
• PR #1955: update to latest version of vim-ipython
• PR #1945: Add –proc option to %script
• PR #1956: move import RemoteError after get_exc_info
• PR #1950: Fix for copy action (Ctrl+C) when there is no pager defined in qtconsole
• PR #1948: Fix help string for InteractiveShell.ast_node_interactivity
• PR #1942: swallow stderr of which in utils.process.find_cmd
• PR #1940: fix completer css on some Chrome versions
• PR #1938: remove remaining references to deprecated XREP/XREQ names
• PR #1925: Fix styling of superscripts and subscripts. Closes #1924.
• PR #1936: increase duration of save messages
• PR #1937: add %save -f
• PR #1935: add version checking to pyreadline import test
• PR #1849: Octave magics
• PR #1759: github, merge PR(s) just by number(s)
• PR #1931: Win py3fixes
• PR #1933: oinspect.find_file: Additional safety if file cannot be found.
• PR #1932: Fix adding functions to CommandChainDispatcher with equal priority on Py 3
• PR #1928: Select NoDB by default
• PR #1923: Add IPython syntax support to the %timeit magic, in line and cell mode
• PR #1926: Make completer recognize escaped quotes in strings.
• PR #1893: Update Parallel Magics and Exception Display
• PR #1921: magic_arguments: dedent but otherwise preserve indentation.
• PR #1919: Use oinspect in CodeMagics._find_edit_target
• PR #1918: don’t warn in iptest if deathrow/quarantine are missing
• PR #1917: Fix for %pdef on Python 3
• PR #1913: Fix for #1428
• PR #1911: temporarily skip autoreload tests
• PR #1909: Fix for #1908, use os.path.normcase for safe filename comparisons
• PR #1907: py3compat fixes for %script and tests
• PR #1906: ofind finds non-unique cell magics
• PR #1845: Fixes to inspection machinery for magics
• PR #1902: Workaround fix for gh-1632; minimal revert of gh-1424

2.13. Issues closed in the 0.13 development cycle
• PR #1900: Cython libs
• PR #1899: add ScriptMagics to class list for generated config
• PR #1898: minimize manpages
• PR #1897: use glob for bad exclusion warning
• PR #1855: %%script and %%file magics
• PR #1870: add %capture for capturing stdout/err
• PR #1861: Use dvipng to format sympy.Matrix
• PR #1867: Fix 1px margin bouncing of selected menu item.
• PR #1889: Reconnect when the websocket connection closes unexpectedly
• PR #1886: Fix a bug in renaming notebook
• PR #1895: Fix error in test suite with ip.system()
• PR #1762: add locate entry points
• PR #1883: Fix vertical offset due to bold/italics, and bad browser fonts.
• PR #1875: re-write columnize, with intermediate step.
• PR #1851: new completer for qtconsole.
• PR #1892: Remove suspicious quotes in interactiveshell.py
• PR #1864: Rmagic exceptions
• PR #1829: [notebook] don’t care about leading prct in completion
• PR #1832: Make svg, jpeg and png images resizable in notebook.
• PR #1674: HTML Notebook carriage-return handling, take 2
• PR #1882: Remove importlib dependency which not available in Python 2.6.
• PR #1879: Correct stack depth for variable expansion in !system commands
• PR #1841: [notebook] deduplicate completion results
• PR #1850: Remove args/kwarg handling in TryNext, fix %paste error messages.
• PR #1663: Keep line-endings in ipynb
• PR #1815: Make : invalid in filenames in the Notebook JS code.
• PR #1819: doc: cleanup the parallel psums example a little
• PR #1839: External cleanup
• PR #1782: fix Magic menu in qtconsole, split in groups
• PR #1862: Minor bind_kernel improvements
• PR #1857: Prevent jumping of window to input when output is clicked.
• PR #1856: Fix 1px jumping of cells and menus in Notebook.
• PR #1852: fix chained resubmissions
• PR #1780: Rmagic extension
• PR #1847: add InlineBackend to ConsoleApp class list
• PR #1836: preserve header for resubmitted tasks
• PR #1828: change default extension to .ipy for %save -r
• PR #1800: Reintroduce recall
• PR #1830: lsmagic lists magics in alphabetical order
• PR #1773: Update SymPy profile: SymPy’s latex() can now print set and frozenset
• PR #1761: Edited documentation to use IPYTHONDIR in place of ~/.ipython
• PR #1822: aesthetics pass on AsyncResult.display_outputs
• PR #1821: ENTER submits the rename notebook dialog.
• PR #1820: NotebookApp: Make the number of ports to retry user configurable.
• PR #1816: Always use filename as the notebook name.
• PR #1813: Add assert_in method to nose for Python 2.6
• PR #1711: New Tooltip, New Completer and JS Refactor
• PR #1798: a few simple fixes for docs/parallel
• PR #1812: Ensure AsyncResult.display_outputs doesn’t display empty streams
• PR #1811: warn on nonexistent exclusions in iptest
• PR #1810: fix for #1809, failing tests in IPython.zmq
• PR #1808: Reposition alternate upload for firefox [need cross browser/OS/language test]
• PR #1742: Check for custom_exceptions only once
• PR #1807: add missing cython exclusion in iptest
• PR #1805: Fixed a vcvarsall.bat error on win32/PY2.7 when trying to compile with m...
• PR #1739: Dashboard improvement (necessary merge of #1658 and #1676 + fix #1492)
• PR #1770: Cython related magic functions
• PR #1707: Accept --gui=<...> switch in IPython qtconsole.
• PR #1797: Fix comment which breaks Emacs syntax highlighting.
• PR #1795: fix %gui magic
• PR #1793: Raise repr limit for strings to 80 characters (from 30).
• PR #1794: don’t use XDG path on OS X
• PR #1792: Unicode-aware logger
• PR #1791: update zmqshell magics
• PR #1787: DOC: Remove regression from qt-console docs.
• PR #1758: test_pr, fallback on http if git protocol fail, and SSL errors...
• PR #1748: Fix some tests for Python 3.3
• PR #1755: test for pygments before running qt tests
• PR #1771: Make default value of interactivity passed to run_ast_nodes configurable
• PR #1784: restore loadpy to load
• PR #1768: Update parallel magics
• PR #1779: Tidy up error raising in magic decorators.

2.13. Issues closed in the 0.13 development cycle
• PR #1769: Allow cell mode timeit without setup code.
• PR #1716: Fix for fake filenames in verbose traceback
• PR #1763: [qtconsole] fix append_plain_html -> append_html
• PR #1732: Refactoring of the magics system and implementation of cell magics
• PR #1630: Merge divergent Kernel implementations
• PR #1705: [notebook] Make pager resizable, and remember size...
• PR #1606: Share code for %pycat and %loadpy, make %pycat aware of URLs
• PR #1757: Open IPython notebook hyperlinks in a new window using target=_blank
• PR #1754: Fix typo encouters->encounters
• PR #1753: Clear window title when kernel is restarted
• PR #1449: Fix for bug #735 : Images missing from XML/SVG export
• PR #1743: Tooltip completer js refactor
• PR #1681: add qt config option to clear_on_kernel_restart
• PR #1733: Tooltip completer js refactor
• PR #1727: terminate kernel after embed_kernel tests
• PR #1737: add HistoryManager to ipapp class list
• PR #1686: ENH: Open a notebook from the command line
• PR #1709: fixes #1708, failing test in arg_split on windows
• PR #1718: Use CRegExp trait for regular expressions.
• PR #1729: Catch failure in repr() for %whos
• PR #1726: use eval for command-line args instead of exec
• PR #1724: fix scatter/gather with targets='all'
• PR #1725: add --no-ff to git pull in test_pr
• PR #1721: Tooltip completer js refactor
• PR #1657: Add wait optional argument to hooks.editor
• PR #1717: Define generic sys.ps{1,2,3}, for use by scripts.
• PR #1691: Finish PR #1446
• PR #1710: update MathJax CDN url for https
• PR #1713: Make autocall regexp’s configurable.
• PR #1703: Allow TryNext to have an error message without it affecting the command chain
• PR #1714: minor adjustments to test_pr
• PR #1704: ensure all needed qt parts can be imported before settling for one
• PR #1706: Mark test_push_numpy_nocopy as a known failure for Python 3
• PR #1698: fix tooltip on token with number
• PR #1245: pythonw py3k fixes for issue #1226
• PR #1685: Add script to test pull request
• PR #1693: deprecate IPYTHON_DIR in favor of IPYTHONDIR
• PR #1695: Avoid deprecated warnings from ipython-qtconsole.desktop.
• PR #1694: Add quote to notebook to allow it to load
• PR #1689: Fix sys.path missing ‘’ as first entry in ipython kernel.
• PR #1687: import Binary from bson instead of pymongo
• PR #1616: Make IPython.core.display.Image less notebook-centric
• PR #1684: CLN: Remove redundant function definition.
• PR #1670: Point %pastebin to gist
• PR #1669: handle pyout messages in test_message_spec
• PR #1295: add binary-tree engine interconnect example
• PR #1642: Cherry-picked commits from 0.12.1 release
• PR #1659: Handle carriage return characters (“\r”) in HTML notebook output.
• PR #1656: ensure kernels are cleaned up in embed_kernel tests
• PR #1664: InteractiveShell.run_code: Update docstring.
• PR #1662: Delay flushing softspace until after cell finishes
• PR #1643: handle jpg/jpeg in the qtconsole
• PR #1652: add patch_pyzmq() for backporting a few changes from newer pyzmq
• PR #1650: DOC: moving files with SSH launchers
• PR #1357: add IPython.embed_kernel()
• PR #1640: Finish up embed_kernel
• PR #1651: Remove bundled Itpl module
• PR #1634: incremental improvements to SSH launchers
• PR #1649: move examples/test_embed into examples/tests/embed
• PR #1633: Fix installing extension from local file on Windows
• PR #1645: Exclude UserDict when deep reloading NumPy.
• PR #1637: Removed a ‘:’ which shouldn’t have been there
• PR #1631: TST: QApplication doesn’t quit early enough with PySide.
• PR #1629: evaluate a few dangling validate_message generators
• PR #1621: clear In[] prompt numbers on “Clear All Output”
• PR #1627: Test the Message Spec
• PR #1624: Fixes for byte-compilation on Python 3
• PR #1615: Add show() method to figure objects.
• PR #1625: Fix deepreload on Python 3
• PR #1620: pyin message now have execution_count
• PR #1457: Update deepreload to use a rewritten knee.py. Fixes dreload(numpy).
• PR #1613: allow map / parallel function for single-engine views

2.13. Issues closed in the 0.13 development cycle 169
- PR #1609: exit notebook cleanly on SIGINT, SIGTERM
- PR #1607: cleanup sqlitedb temporary db file after tests
- PR #1608: don’t rely on timedelta.total_seconds in AsyncResult
- PR #1599: Fix for %run -d on Python 3
- PR #1602: Fix %env magic on Python 3.
- PR #1603: Remove python3 profile
- PR #1604: Exclude IPython.quarantine from installation
- PR #1600: Specify encoding for io.open in notebook_reformat tests
- PR #1605: Small fixes for Animation and Progress notebook
- PR #1529: __all__ feature, improvement to dir2, and tests for both
- PR #1548: add sugar methods/properties to AsyncResult
- PR #1535: Fix pretty printing dispatch
- PR #1399: Use LaTeX to print various built-in types with the SymPy printing extension
- PR #1597: re-enter kernel.eventloop after catching SIGINT
- PR #1490: rename plaintext cell -> raw cell
- PR #1480: Fix %notebook magic, etc. nbformat unicode tests and fixes
- PR #1588: Gtk3 integration with ipython works.
- PR #1595: Examples syntax (avoid errors installing on Python 3)
- PR #1526: Find encoding for Python files
- PR #1594: Fix writing git commit ID to a file on build with Python 3
- PR #1556: shallow-copy DictDB query results
- PR #1502: small changes in response to pyflakes pass
- PR #1445: Don’t build sphinx docs for sdists
- PR #1538: store git commit hash in utils._sysinfo instead of hidden data file
- PR #1546: attempt to suppress exceptions in channel threads at shutdown
- PR #1559: update tools/github_stats.py to use GitHub API v3
- PR #1563: clear_output improvements
- PR #1560: remove obsolete discussion of Twisted/trial from testing docs
- PR #1569: BUG: qtconsole – non-standard handling of a and b. [Fixes #1561]
- PR #1573: BUG: Ctrl+C crashes wx pylab kernel in qtconsole.
- PR #1568: fix PR #1567
- PR #1567: Fix: openssh_tunnel did not parse port in server
- PR #1565: fix AsyncResult.abort
- PR #1552: use os.getcwdu in NotebookManager
- PR #1541: display_pub flushes stdout/err
- PR #1544: make MultiKernelManager.kernel_manager_class configurable
• PR #1517: Fix indentation bug in IPython/lib/pretty.py
• PR #1519: BUG: Include the name of the exception type in its pretty format.
• PR #1489: Fix zero-copy push
• PR #1477: fix dangling buffer in IPython.parallel.util
• PR #1514: DOC: Fix references to IPython.lib.pretty instead of the old location
• PR #1481: BUG: Improve placement of CallTipWidget
• PR #1496: BUG: LBYL when clearing the output history on shutdown.
• PR #1508: fix sorting profiles in clustermanager
• PR #1495: BUG: Fix pretty-printing for overzealous objects
• PR #1472: more general fix for #662
• PR #1483: updated magic_history docstring
• PR #1383: First version of cluster web service.
• PR #1398: BUG: Improve placement of CallTipWidget
• PR #1440: Fix for failing testsuite when using –with-xml-coverage on windows.
• PR #1419: Add %install_ext magic function.
• PR #1424: Win32 shell interactivity
• PR #1468: Simplify structure of a Job in the TaskScheduler
• PR #1447: 1107 - Tab autocompletion can suggest invalid syntax
• PR #1469: Fix typo in comment (insert space)
• PR #1463: Fix completion when importing modules in the cwd.
• PR #1466: Fix for issue #1437, unfriendly windows qtconsole error handling
• PR #1432: Fix ipython directive
• PR #1465: allow ipython help subcommand syntax
• PR #1416: Conditional import of ctypes in inputhook
• PR #1462: expedite parallel tests
• PR #1410: Add javascript library and css stylesheet loading to JS class.
• PR #1448: Fix for #875 Never build unicode error messages
• PR #1458: use eval to uncan References
• PR #1450: load mathjax from CDN via https
• PR #1451: include heading level in JSON
• PR #1444: Fix python -> python typos
• PR #1414: ignore errors in shell.var_expand
• PR #1430: Fix for tornado check for tornado < 1.1.0
• PR #1413: get_home_dir expands symlinks, adjust test accordingly
• PR #1385: updated and prettified magic doc strings
• PR #1406: Browser selection

2.13. Issues closed in the 0.13 development cycle
• PR #1377: Saving non-ascii history
• PR #1402: fix symlinked /home issue for FreeBSD
• PR #1405: Only monkeypatch xunit when the tests are run using it.
• PR #1395: Xunit & KnownFailure
• PR #1396: Fix for %tb magic.
• PR #1386: Jsd3
• PR #1388: Add simple support for running inside a virtualenv
• PR #1391: Improve Hub/Scheduler when no engines are registered
• PR #1369: load header with engine id when engine dies in TaskScheduler
• PR #1353: Save notebook as script using unicode file handle.
• PR #1352: Add `-m mod : run library module as a script` option.
• PR #1363: Fix some minor color/style config issues in the qtconsole
• PR #1371: Adds a quiet keyword to sync_imports
• PR #1387: Fixing Cell menu to update cell type select box.
• PR #1296: Wx gui example: fixes the broken example for `%gui wx`.
• PR #1372: ipcontroller cleans up connection files unless reuse=True
• PR #1374: remove calls to meaningless ZMQStream.on_err
• PR #1370: allow draft76 websockets (Safari)
• PR #1368: Ensure handler patterns are str, not unicode
• PR #1361: Notebook bug fix branch
• PR #1364: avoid jsonlib returning Decimal
• PR #1362: Don’t log complete contents of history replies, even in debug
• PR #1347: fix weird magic completion in notebook
• PR #1346: fixups for alternate URL prefix stuff
• PR #1336: crack at making notebook.html use the layout.html template
• PR #1331: RST and heading cells
• PR #1247: fixes a bug causing extra newlines after comments.
• PR #1332: notebook - allow prefixes in URL path.
• PR #1341: Don’t attempt to tokenize binary files for tracebacks
• PR #1334: added key handler for control-s to notebook, seems to work pretty well
• PR #1338: Fix see also in docstrings so API docs build
• PR #1335: Notebook toolbar UI
• PR #1299: made notebook.html extend layout.html
• PR #1318: make Ctrl-D in qtconsole act same as in terminal (ready to merge)
• PR #1328: Coverage
• PR #1206: don’t preserve fixConsole output in json
• PR #1330: Add linewrapping to text cells (new feature in CodeMirror).
• PR #1309: Inoculate clearcmd extension into %reset functionality
• PR #1327: Updatecm2
• PR #1326: Removing Ace edit capability.
• PR #1325: forgotten selected_cell -> get_selected_cell
• PR #1316: Pass subprocess test runners a suitable location for xunit output
• PR #1303: Updatecm
• PR #1312: minor heartbeat tweaks
• PR #1306: Fix %prun input parsing for escaped characters (closes #1302)
• PR #1301: New “Fix for issue #1202” based on current master.
• PR #1289: Make autoreload extension work on Python 3.
• PR #1288: Don’t ask for confirmation when stdin isn’t available
• PR #1294: TaskScheduler.hwm default to 1 instead of 0
• PR #1283: HeartMonitor.period should be an Integer
• PR #1264: Aceify
• PR #1284: a fix for GH 1269
• PR #1213: BUG: Minor typo in history_console_widget.py
• PR #1267: add NoDB for non-recording Hub
• PR #1222: allow Reference as callable in map/apply
• PR #1257: use self.kernel_manager_class in qtconsoleapp
• PR #1253: set auto_create flag for notebook apps
• PR #1262: Heartbeat no longer shares the app’s Context
• PR #1229: Fix display of SyntaxError in Python 3
• PR #1256: Dewijmoize
• PR #1246: Skip tests that require X, when importing pylab results in RuntimeError.
• PR #1211: serve local files in notebook-dir
• PR #1224: edit text cells on double-click instead of single-click
• PR #1187: misc notebook: connection file cleanup, first heartbeat, startup flush
• PR #1207: fix loadpy duplicating newlines
• PR #1129: Unified setup.py
• PR #1199: Reduce IPython.external.*
• PR #1218: Added -q option to %prun for suppression of the output, along with editing the dochelp string.
• PR #1217: Added -q option to %prun for suppression of the output, along with editing the dochelp string
• PR #1175: core.completer: Clean up excessive and unused code.
• PR #1196: docs: looks like a file path might have been accidentally pasted in the middle of a word
• PR #1190: Fix link to Chris Fonnesbeck blog post about 0.11 highlights.

2.13. Issues closed in the 0.13 development cycle
Issues (742):

- #1943: add screenshot and link into releasenotes
- #1570: [notebook] remove ‘left panel’ references from example.
- #1954: update some example notebooks
- #2048: move _encode_binary to jsonutil.encode_images
- #2050: only add quotes around xunit-file on Windows
- #2047: disable auto-scroll on mozilla
- #1258: Magic %paste error
- #2015: Fixes for %paste with special transformations
- #760: Windows: test runner fails if repo path contains spaces
- #2046: Iptest unicode
- #1939: Namespaces
- #2042: increase auto-scroll threshold to 100 lines
- #2043: move RemoteError import to top-level
- #641: In %magic help, remove duplicate aliases
- #2036: %alias_magic
- #1968: Proposal of icons for .ipynb files
- #825: keyboardinterrupt crashes gtk gui when gtk.set_interactive is not available
- #1971: Remove duplicate magics docs
- #2040: Namespaces for cleaner public APIs
- #2039: ipython parallel import exception
- #2035: Getdefaultencoding test error with sympy 0.7.1_git
- #2037: remove ipython-qtconsole gui-script
- #1516: ipython-qtconsole script isn’t installed for Python 2.x
- #1297: “ipython -p sh” is in documentation but doesn’t work
- #2038: add extra clear warning to shell doc
- #1265: please ship unminified js and css sources
- #2029: Ship unminified js
- #1920: Provide an easy way to override the Qt widget used by qtconsole
- #2007: Add custom_control and custom_page_control variables to override the Qt widgets used by qtconsole
- #2009: In %magic help, remove duplicate aliases
- #2033: ipython parallel pushing and pulling recarrays
- #2034: fix&test push/pull recarrays
- #2028: Reduce unhelpful information shown by pinfo
- #1992: Tab completion fails with many spaces in filename
- #1885: handle too old wx
• #2030: check wxPython version in inputhook
• #2024: Make interactive_usage a bit more rst friendly
• #2031: disable ^C^C confirmation on Windows
• #2023: Unicode test failure on OS X
• #2027: match stdin encoding in frontend readline test
• #1901: Windows: parallel test fails assert, leaves 14 python processes alive
• #2025: Fix parallel test on WinXP - wait for resource cleanup.
• #1986: Line magic function %R not found. (Rmagic)
• #1712: test failure in ubuntu package daily build
• #1183: 0.12 testsuite failures
• #2016: BUG: test runner fails in Windows if filenames contain spaces.
• #1806: Alternate upload methods in firefox
• #2019: Windows: home directory expansion test fails
• #2020: Fix home path expansion test in Windows.
• #2017: Windows core test error - filename quoting
• #2021: Fix Windows pathname issue in ‘odd encoding’ test.
• #1998: call to nt.assert_true(path._writable_dir(home)) returns false in test_path.py
• #2022: don’t check writability in test for get_home_dir when HOME is undefined
• #1589: Test failures and docs don’t build on Mac OS X Lion
• #1996: frontend test tweaks
• #2011: Notebook server can’t start cluster with hyphen-containing profile name
• #2014: relax profile regex in notebook
• #2013: brew install pyqt
• #2005: Strange output artifacts in footer of notebook
• #2012: Mono cursor offset
• #2004: Clarify generic message spec vs. Python message API in docs
• #2006: Don’t crash when starting notebook server if runnable browser not found
• #2010: notebook: Print a warning (but do not abort) if no webbrowser can be found.
• #2008: pip install virtualenv
• #2003: Wrong case of rmagic in docs
• #2002: Refactor %magic into a lsmagic_docs API function.
• #2000: kernel.js consistency with generic IPython message format.
• #1999: %magic help: display line and cell magics in alphabetical order.
• #1635: test_prun_quotes fails on Windows
• #1984: Cannot restart Notebook when using %script --bg
• #1981: Clean BG processes created by %script on kernel exit

2.13. Issues closed in the 0.13 development cycle
• #1994: Fix RST misformatting.
• #1949: Introduce Notebook Magics
• #1985: Kernels should start in notebook dir when manually specified
• #1980: Notebook should check that –notebook-dir exists
• #1985: minor notebook startup/notebook-dir adjustments
• #1969: tab completion in notebook for paths not triggered
• #1974: Allow path completion on notebook.
• #1964: allow multiple instances of a Magic
• #1960: %page not working
• #1991: fix _ofind attr in %page
• #1982: Shutdown qtconsole problem?
• #1988: check for active frontend in update_restart_checkbox
• #1979: Add support for tox (https://tox.readthedocs.io/) and Travis CI (http://travis-ci.org/)
• #1989: Parallel: output of %px and %px${suffix} is inconsistent
• #1966: ValueError: packer could not serialize a simple message
• #1987: Notebook: MathJax offline install not recognized
• #1970: dblclick to restore size of images
• #1983: Notebook does not save heading level
• #1978: Notebook names truncating at the first period
• #1553: Limited size of output cells and provide scroll bars for such output cells
• #1825: second attempt at scrolled long output
• #1915: add cell-level metadata
• #1934: Cell/Worksheet metadata
• #1746: Confirm restart (configuration option, and checkbox UI)
• #1790: Commenting function.
• #1767: Tab completion problems with cell magics
• #1944: [qtconsole] take %,%% prefix into account for completion
• #1973: fix another FreeBSD SHOME symlink issue
• #1972: Fix completion of ‘%tim’ in the Qt console
• #1887: Make it easy to resize jpeg/png images back to original size.
• #1967: Fix psums example description in docs
• #1678: ctrl-z clears cell output in notebook when pressed enough times
• #1965: fix for #1678, undo no longer clears cells
• #1952: avoid duplicate “Websockets closed” dialog on ws close
• #1961: UnicodeDecodeError on directory with unicode chars in prompt
• #1963: styling prompt, {color.Normal} excepts
2.13. Issues closed in the 0.13 development cycle

- #1962: Support unicode prompts
- #1959: %page not working on qtconsole for Windows XP 32-bit
- #1955: update to latest version of vim-ipython
- #1945: Add –proc option to %%%script
- #1957: fix indentation in kernel.js
- #1956: move import RemoteError after get_exc_info
- #1950: Fix for copy action (Ctrl+C) when there is no pager defined in qtconsole
- #1948: Fix help string for InteractiveShell.ast_node_interactivity
- #1941: script magics cause terminal spam
- #1942: swallow stderr of which in utils.process.find_cmd
- #1833: completer draws slightly too small on Chrome
- #1940: fix completer css on some Chrome versions
- #1938: remove remaining references to deprecated XREP/XREQ names
- #1924: HTML superscripts not shown raised in the notebook
- #1925: Fix styling of superscripts and subscripts. Closes #1924.
- #1461: User notification if notebook saving fails
- #1936: increase duration of save messages
- #1542: %save magic fails in clients without stdin if file already exists
- #1937: add %save -f
- #1572: pyreadline version dependency not correctly checked
- #1935: add version checking to pyreadline import test
- #1849: Octave magics
- #1759: github, merge PR(s) just by number(s)
- #1931: Win py3fixes
- #1646: Meaning of restart parameter in client.shutdown() unclear
- #1933: oinspect.find_file: Additional safety if file cannot be found.
- #1916: %paste doesn’t work on py3
- #1932: Fix adding functions to CommandChainDispatcher with equal priority on Py 3
- #1928: Select NoDB by default
- #1923: Add IPython syntax support to the %timeit magic, in line and cell mode
- #1926: Make completer recognize escaped quotes in strings.
- #1929: Ipython-qtconsole (0.12.1) hangs with Python 2.7.3, Windows 7 64 bit
- #1409: [qtconsole] forward delete bring completion into current line
- #1922: py3k compatibility for setupegg.py
- #1598: document that sync_imports() can’t handle “import foo as bar”
- #1893: Update Parallel Magics and Exception Display
• #1890: Docstrings for magics that use @magic_arguments are rendered wrong
• #1921: magic_arguments: dedent but otherwise preserve indentation.
• #1919: Use oinspect in CodeMagics._find_edit_target
• #1918: don’t warn in iptest if deathrow/quarantine are missing
• #1914: %pdef failing on python3
• #1917: Fix for %pdef on Python 3
• #1428: Failing test that prun does not clobber string escapes
• #1913: Fix for #1428
• #1911: temporarily skip autoreload tests
• #1549: autoreload extension crashes ipython
• #1908: find_file errors on windows
• #1909: Fix for #1908, use os.path.normcase for safe filename comparisons
• #1907: py3compat fixes for %script and tests
• #1904: %px? doesn’t work, shows info for %px, general cell magic problem
• #1906: ofind finds non-unique cell magics
• #1894: Win64 binary install fails
• #1799: Source file not found for magics
• #1845: Fixes to inspection machinery for magics
• #1774: Some magics seems broken
• #1586: Clean up tight coupling between Notebook, CodeCell and Kernel Javascript objects
• #1632: Win32 shell interactivity apparently broke qtconsole “cd” magic
• #1902: Workaround fix for gh-1632; minimal revert of gh-1424
• #1900: Cython libs
• #1503: Cursor is offset in notebook in Chrome 17 on Linux
• #1426: Qt console doesn’t handle the --gui flag correctly.
• #1180: Can’t start IPython kernel in Spyder
• #581: test IPython.zmq
• #1593: Name embedded in notebook overrides filename
• #1899: add ScriptMagics to class list for generated config
• #1618: generate or minimize manpages
• #1898: minimize manpages
• #1896: Windows: apparently spurious warning ‘Excluding nonexistent file’ ... test_exampleip
• #1897: use glob for bad exclusion warning
• #1215: updated %quickref to show short-hand for %sc and %sx
• #1855: %script and %file magics
• #1863: Ability to silence a cell in the notebook

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• #1870: add % capture for capturing stdout/err
• #1861: Use dvipng to format sympy.Matrix
• #1867: Fix 1px margin bouncing of selected menu item.
• #1889: Reconnect when the websocket connection closes unexpectedly
• #1577: If a notebook loses its network connection WebSockets won’t reconnect
• #1886: Fix a bug in renaming notebook
• #1895: Fix error in test suite with ip.system()
• #1762: add locate entry points
• #1883: Fix vertical offset due to bold/italics, and bad browser fonts.
• #1875: re-write columnize, with intermediate step.
• #1860: IPython.utils.columnize sometime wrong…
• #1851: new completer for qtconsole.
• #1892: Remove suspicious quotes in interactiveshell.py
• #1854: Class %hierarchy and graphiz %%dot magics
• #1827: Sending tracebacks over ZMQ should protect against unicode failure
• #1864: Rmagic exceptions
• #1829: [notebook] don’t care about leading prct in completion
• #1832: Make svg, jpeg and png images resizable in notebook.
• #1674: HTML Notebook carriage-return handling, take 2
• #1874: cython_magic uses importlib, which doesn’t ship with py2.6
• #1882: Remove importlib dependency which not available in Python 2.6.
• #1878: shell access using ! will not fill class or function scope vars
• #1879: Correct stack depth for variable expansion in !system commands
• #1840: New JS completer should merge completions before display
• #1841: [notebook] deduplicate completion results
• #1736: no good error message on missing tkinter and %paste
• #1741: Display message from TryNext error in magic_paste
• #1850: Remove args/kwars handling in TryNext, fix %paste error messages.
• #1663: Keep line-endings in ipynb
• #1872: Matplotlib window freezes using interractive plot in qtconsole
• #1869: Improve CodeMagics._find_edit_target
• #1781: Colons in notebook name causes notebook deletion without warning
• #1815: Make : invalid in filenames in the Notebook JS code.
• #1819: doc: cleanup the parallel psums example a little
• #1838: externals cleanup
• #1839: External cleanup

2.13. Issues closed in the 0.13 development cycle
• #1782: fix Magic menu in qtconsole, split in groups
• #1862: Minor bind_kernel improvements
• #1859: kernmagic during console startup
• #1857: Prevent jumping of window to input when output is clicked.
• #1856: Fix 1px jumping of cells and menus in Notebook.
• #1848: task fails with “AssertionError: not enough buffers!” after second resubmit
• #1852: fix chained resubmissions
• #1780: Rmagic extension
• #1853: Fix jumpy notebook behavior
• #1842: task with UnmetDependency error still owned by engine
• #1847: add InlineBackend to ConsoleApp class list
• #1846: Exceptions within multiprocessing crash Ipython notebook kernel
• #1843: Notebook does not exist and permalinks
• #1837: edit magic broken in head
• #1834: resubmitted tasks doesn’t have same session name
• #1836: preserve header for resubmitted tasks
• #1776: fix magic menu in qtconsole
• #1828: change default extension to .ipy for %save -r
• #1800: Reintroduce recall
• #1671: __future__ environments
• #1830: Ismagic lists magics in alphabetical order
• #1835: Use Python import in ipython profile config
• #1773: Update SymPy profile: SymPy’s latex() can now print set and frozenset
• #1761: Edited documentation to use IPYTHONDIR in place of ~/.ipython
• #1772: notebook autocomplete fail when typing number
• #1822: aesthetics pass onAsyncResult.display_outputs
• #1460: Redirect http to https for notebook
• #1287: Refactor the notebook tab completion/tooltip
• #1596: In rename dialog, <return> should submit
• #1821: ENTER submits the rename notebook dialog.
• #1750: Let the user disable random port selection
• #1820: NotebookApp: Make the number of ports to retry user configurable.
• #1816: Always use filename as the notebook name.
• #1775: assert_in not present on Python 2.6
• #1813: Add assert_in method to nose for Python 2.6
• #1498: Add tooltip keyboard shortcuts
• #1711: New Tooltip, New Completer and JS Refactor
• #1798: a few simple fixes for docs/parallel
• #1818: possible bug with latex / markdown
• #1647: Aborted parallel tasks can’t be resubmitted
• #1817: Change behavior of ipython notebook –port=...
• #1738: IPython.embed_kernel issues
• #1610: Basic bold and italic in HTML output cells
• #1576: Start and stop kernels from the notebook dashboard
• #1515: impossible to shutdown notebook kernels
• #1812: EnsureAsyncResult.display_outputs doesn’t display empty streams
• #1811: warn on nonexistent exclusions in ipetest
• #1809: test suite error in IPython.zmq on windows
• #1810: fix for #1809, failing tests in IPython.zmq
• #1808: Reposition alternate upload for firefox [need cross browser/OS/language test]
• #1742: Check for custom_exclusions only once
• #1802: cythonmagic tests should be skipped if Cython not available
• #1062: warning message in IPython.extensions test
• #1807: add missing cython exclusion in ipetest
• #1805: Fixed a vcvarsall.bat error on win32/Py2.7 when trying to compile with m...
• #1803: MPI parallel %px bug
• #1804: Fixed a vcvarsall.bat error on win32/Py2.7 when trying to compile with mingw.
• #1492: Drag target very small if IPython Dashboard has no notebooks
• #1562: Offer a method other than drag-n-drop to upload notebooks
• #1739: Dashboard improvement (necessary merge of #1658 and #1676 + fix #1492)
• #1770: Cython related magic functions
• #1532: qtconsole does not accept –gui switch
• #1707: Accept –gui=<...> switch in IPython qtconsole.
• #1797: Fix comment which breaks Emacs syntax highlighting.
• #1796: %gui magic broken
• #1795: fix %gui magic
• #1788: extreme truncating of return values
• #1793: Raise repr limit for strings to 80 characters (from 30).
• #1794: don’t use XDG path on OS X
• #1777: ipython crash on wrong encoding
• #1792: Unicode-aware logger
• #1791: update zmqshell magics

2.13. Issues closed in the 0.13 development cycle
• #1787: DOC: Remove regression from qt-console docs.
• #1785: IPython.utils.tests.test_process.SubProcessTestCase
• #1758: test_pr, fallback on http if git protocol fail, and SSL errors...
• #1786: Make notebook save failures more salient
• #1748: Fix some tests for Python 3.3
• #1755: test for pygments before running qt tests
• #1771: Make default value of interactivity passed to run_ast_nodes configurable
• #1783: part of PR #1606 (loadpy -> load) erased by magic refactoring.
• #1784: restore loadpy to load
• #1768: Update parallel magics
• #1778: string exception in IPython/core/magic.py:232
• #1779: Tidy up error raising in magic decorators.
• #1769: Allow cell mode timeit without setup code.
• #1716: Fix for fake filenames in verbose traceback
• #1763: [qtconsole] fix append_plain_html -> append_html
• #1766: Test failure in IPython.parallel
• #1611: IPEP1: Cell magics and general cleanup of the Magic system
• #1732: Refactoring of the magics system and implementation of cell magics
• #1765: test_pr should clean PYTHONPATH for the subprocesses
• #1630: Merge divergent Kernel implementations
• #1705: [notebook] Make pager resizable, and remember size...
• #1606: Share code for %pycat and %loadpy, make %pycat aware of URLs
• #1720: Adding interactive inline plotting to notebooks with flot
• #1701: [notebook] Open HTML links in a new window by default
• #1757: Open IPython notebook hyperlinks in a new window using target=_blank
• #1735: Open IPython notebook hyperlinks in a new window using target=_blank
• #1754: Fix typo encounters->encounters
• #1753: Clear window title when kernel is restarted
• #735: Images missing from XML/SVG export (for me)
• #1449: Fix for bug #735: Images missing from XML/SVG export
• #1752: Reconnect Websocket when it closes unexpectedly
• #1751: Reconnect Websocket when it closes unexpectedly
• #1749: Load MathJax.js using HTTPS when IPython notebook server is HTTPS
• #1743: Tooltip completer js refactor
• #1700: A module for sending custom user messages from the kernel.
• #1745: htmlnotebook: Cursor is off
• #1728: ipython crash with matplotlib during picking
• #1681: add qt config option to clear_on_kernel_restart
• #1733: Tooltip completer js refactor
• #1676: Kernel status/shutdown from dashboard
• #1658: Alternate notebook upload methods
• #1727: terminate kernel after embed_kernel tests
• #1737: add HistoryManager to ipapp class list
• #945: Open a notebook from the command line
• #1686: ENH: Open a notebook from the command line
• #1709: fixes #1708, failing test in arg_split on windows
• #1718: Use CRegExp trait for regular expressions.
• #1729: Catch failure in repr() for %whos
• #1726: use eval for command-line args instead of exec
• #1723: scatter/gather fail with targets='all'
• #1724: fix scatter/gather with targets='all'
• #1725: add --no-ff to git pull in test_pr
• #1722: unicode exception when evaluating expression with non-ascii characters
• #1721: Tooltip completer js refactor
• #1657: Add wait optional argument to hooks.editor
• #123: Define sys.ps{1,2}
• #1717: Define generic sys.ps{1,2,3}, for use by scripts.
• #1442: cache-size issue in qtconsole
• #1691: Finish PR #1446
• #1446: Fixing Issue #1442
• #1710: update MathJax CDN url for https
• #81: Autocall fails if first function argument begins with “-” or “+”
• #1713: Make autocall regexp’s configurable.
• #211: paste command not working
• #1703: Allow TryNext to have an error message without it affecting the command chain
• #1714: minor adjustments to test_pr
• #1509: New tooltip for notebook
• #1697: Major refactoring of the Notebook, Kernel and CodeCell JavaScript.
• #788: Progress indicator in the notebook (and perhaps the Qt console)
• #1034: Single process Qt console
• #1557: magic function conflict while using --pylab
• #1476: Pylab figure objects not properly updating

2.13. Issues closed in the 0.13 development cycle
• #1704: ensure all needed qt parts can be imported before settling for one
• #1708: test failure in arg_split on windows
• #1706: Mark test_push_numpy_nocopy as a known failure for Python 3
• #1696: notebook tooltip fail on function with number
• #1698: fix tooltip on token with number
• #1226: Windows GUI only (pythonw) bug for IPython on Python 3.x
• #1245: pythonw py3k fixes for issue #1226
• #1417: Notebook Completer Class
• #1690: [Bogus] Deliberately make a test fail
• #1685: Add script to test pull request
• #1167: Settle on a choice for $IPYTHONDIR
• #1693: deprecate IPython_DIR in favor of IPYTHONDIR
• #1672: ipython-qtconsole.desktop is using a deprecated format
• #1695: Avoid deprecated warnings from ipython-qtconsole.desktop.
• #1694: Add quote to notebook to allow it to load
• #1240: sys.path missing '' as first entry when kernel launched without interface
• #1689: Fix sys.path missing '' as first entry in ipython kernel.
• #1683: Parallel controller failing with Pymongo 2.2
• #1687: import Binary from bson instead of pymongo
• #1614: Display Image in Qtconsole
• #1616: Make IPython.core.display.Image less notebook-centric
• #1684: CLN: Remove redundant function definition.
• #1655: Add %open magic command to open editor in non-blocking manner
• #1677: middle-click paste broken in notebook
• #1670: Point %pastebin to gist
• #1667: Test failure in test_message_spec
• #1668: Test failure in IPython.zmq.tests.test_message_spec.test_complete ‘‘pyout’ != ‘status’’
• #1669: handle pyout messages in test_message_spec
• #1295: add binary-tree engine interconnect example
• #1642: Cherry-picked commits from 0.12.1 release
• #1659: Handle carriage return characters (“r”) in HTML notebook output.
• #1313: Figure out MathJax 2 support
• #1653: Test failure in IPython.zmq
• #1656: ensure kernels are cleaned up in embed_kernel tests
• #1666: pip install ipython==dev installs version 0.8 from an old svn repo
• #1664: InteractiveShell.run_code: Update docstring.
2.13. Issues closed in the 0.13 development cycle

- #1512: print stuff, should avoid newline
- #1662: Delay flushing softspace until after cell finishes
- #1643: handle jpg/jpeg in the qtconsole
- #966: dreload fails on Windows XP with iPython 0.11 “Unexpected Error”
- #1500: dreload doesn’t seem to exclude numpy
- #1520: kernel crash when showing tooltip (?)
- #1652: add patch_pyzmq() for backporting a few changes from newer pyzmq
- #1650: DOC: moving files with SSH launchers
- #1357: add IPython.embed_kernel()
- #1640: Finish up embed_kernel
- #1651: Remove bundled Itpl module
- #1634: incremental improvements to SSH launchers
- #1649: move examples/test_embed into examples/tests/embed
- #1171: Recognise virtualenvs
- #1479: test_extension failing in Windows
- #1633: Fix installing extension from local file on Windows
- #1644: Update copyright date to 2012
- #1636: Test_depreload breaks pylab irunner tests
- #1645: Exclude UserDict when deep reloading NumPy.
- #1454: make it possible to start engine in ‘disabled’ mode and ‘enable’ later
- #1641: Escape code for the current time in PromptManager
- #1638: ipython console clobbers custom sys.path
- #1637: Removed a ‘:’ which shouldn’t have been there
- #1536: ipython 0.12 embed shell won’t run startup scripts
- #1628: error: QApplication already exists in TestKillRing
- #1631: TST: QApplication doesn’t quit early enough with PySide.
- #1629: evaluate a few dangling validate_message generators
- #1621: clear In[] prompt numbers on “Clear All Output”
- #1627: Test the Message Spec
- #1470: SyntaxError on setup.py install with Python 3
- #1624: Fixes for byte-compilation on Python 3
- #1612: pylab=inline fig.show() non-existent in notebook
- #1615: Add show() method to figure objects.
- #1622: depreload fails on Python 3
- #1625: Fix depreload on Python 3
- #1626: Failure in new dreload tests under Python 3.2
• #1623: iPython / matplotlib Memory error with imshow
• #1619: pyin messages should have execution_count
• #1620: pyin message now have execution_count
• #32: dreload produces spurious traceback when numpy is involved
• #1457: Update deepreload to use a rewritten knee.py. Fixes dreload(numpy).
• #1613: allow map / parallel function for single-engine views
• #1609: exit notebook cleanly on SIGINT, SIGTERM
• #1531: Function keyword completion fails if cursor is in the middle of the complete parentheses
• #1607: cleanup sqlitedb temporary db file after tests
• #1608: don’t rely on timedelta.total_seconds in AsyncResult
• #1421: ipython32 %run -d breaks with NameError name ‘execfile’ is not defined
• #1599: Fix for %run -d on Python 3
• #1201: %env magic fails with Python 3.2
• #1602: Fix %env magic on Python 3.
• #1603: Remove python3 profile
• #1604: Exclude IPython.quarantine from installation
• #1601: Security file is not removed after shutdown by Ctrl+C or kill -INT
• #1600: Specify encoding for io.open in notebook_reformat tests
• #1605: Small fixes for Animation and Progress notebook
• #1452: Bug fix for approval
• #13: Improve robustness and debuggability of test suite
• #70: IPython should prioritize __all__ during tab completion
• #1529: __all__ feature, improvement to dir2, and tests for both
• #1475: Custom namespace for %run
• #1564: calling .abort on AsyncMapResult results in traceback
• #1548: add sugar methods/properties to AsyncResult
• #1535: Fix pretty printing dispatch
• #1522: Discussion: some potential Qt console refactoring
• #1399: Use LaTeX to print various built-in types with the SymPy printing extension
• #1597: re-enter kernel.eventloop after catching SIGINT
• #1490: rename plaintext cell -> raw cell
• #1487: %notebook magic fails in qtconsole
• #1545: trailing newline not preserved in splitline ipynb
• #1480: Fix %notebook magic, etc. nbformat unicode tests and fixes
• #1588: Gtk3 integration with ipython works.
• #1595: Examples syntax (avoid errors installing on Python 3)
• #1526: Find encoding for Python files
• #1594: Fix writing git commit ID to a file on build with Python 3
• #1556: shallow-copy DictDB query results
• #1499: various pyflakes issues
• #1502: small changes in response to pyflakes pass
• #1445: Don’t build sphinx docs for sdists
• #1484: unhide .git_commit_info.ini
• #1538: store git commit hash in utilst._sysinfo instead of hidden data file
• #1546: attempt to suppress exceptions in channel threads at shutdown
• #1524: unhide git_commit_info.ini
• #1559: update tools/github_stats.py to use GitHub API v3
• #1563: clear_output improvements
• #1558: Ipython testing documentation still mentions twisted and trial
• #1560: remove obsolete discussion of Twisted/trial from testing docs
• #1561: Qtconsole - nonstandard a and b
• #1569: BUG: qtconsole – non-standard handling of a and b. [Fixes #1561]
• #1574: BUG: Ctrl+C crashes wx ptylab kernel in qtconsole
• #1573: BUG: Ctrl+C crashes wx ptylab kernel in qtconsole.
• #1590: ‘IPython3 qtconsole’ doesn’t work in Windows 7
• #602: User test the html notebook
• #613: Implement Namespace panel section
• #879: How to handle Javascript output in the notebook
• #1255: figure.show() raises an error with the inline backend
• #1467: Document or bundle a git-integrated facility for stripping VCS-unfriendly binary data
• #1237: Kernel status and logout button overlap
• #1319: Running a cell with ctrl+Enter selects text in cell
• #1571: module member autocomplete should respect __all__
• #1566: ipython3 doesn’t run in Win7 with Python 3.2
• #1568: fix PR #1567
• #1567: Fix: openssh_tunnel did not parse port in server
• #1565: fixAsyncResult.abort
• #1550: Crash when starting notebook in a non-ascii path
• #1552: use os.getcwdu in NotebookManager
• #1554: wrong behavior of the all function on iterators
• #1541: display_pub flushes stdout/err
• #1539: Asynchronous issue when using clear_display and print x,y,z

2.13. Issues closed in the 0.13 development cycle
• #1544: make MultiKernelManager.kernel_manager_class configurable
• #1494: Untrusted Secure Websocket broken on latest chrome dev
• #1521: only install ipython-qtconsole gui script on Windows
• #1528: Tab completion optionally respects __all__ (+ dir2() cleanup)
• #1527: Making a progress bar work in IPython Notebook
• #1497: __all__ functionality added to dir2(obj)
• #1518: Pretty printing exceptions is broken
• #811: Fixes for ipython unhandled OSError exception on failure of os.getcwdu()
• #1517: Fix indentation bug in IPython/lib/pretty.py
• #1519: BUG: Include the name of the exception type in its pretty format.
• #1525: A hack for auto-complete numpy recarray
• #1489: Fix zero-copy push
• #1401: numpy arrays cannot be used with View.apply() in Python 3
• #1477: fix dangling buffer in IPython.parallel.util
• #1514: DOC: Fix references to IPython.lib.pretty instead of the old location
• #1511: Version comparison error ( ‘2.1.11’ < ‘2.1.4’ ==> True)
• #1506: “Fixing” the Notebook scroll to help in visually comparing outputs
• #1481: BUG: Improve placement of CallTipWidget
• #1241: When our debugger class is used standalone __oh key errors are thrown
• #676: IPython.embed() from ipython crashes twice on exit
• #1496: BUG: LBYL when clearing the output history on shutdown.
• #1507: python3 notebook: TypeError: unorderedable types
• #1508: fix sorting profiles in clustermanager
• #1495: BUG: Fix pretty-printing for overzealous objects
• #1505: SQLite objects created in a thread can only be used in that same thread
• #1482: %history documentation out of date?
• #1501: dreload doesn’t seem to exclude numpy
• #1472: more general fix for #662
• #1486: save state of qtconsole
• #1485: add history search to qtconsole
• #1483: updated magic_history docstring
• #1383: First version of cluster web service.
• #482: test_run.test_tclass fails on Windows
• #1398: fix %tb after SyntaxError
• #1478: key function or lambda in sorted function doesn’t find global variables
• #1415: handle exit/quit/exit()/quit() variants in zmqconsole
• #1440: Fix for failing testsuite when using --with-xml-coverage on windows.
• #1419: Add %install_ext magic function.
• #1424: Win32 shell interactivity
• #1434: Controller should schedule tasks of multiple clients at the same time
• #1268: notebook %reset magic fails with StdinNotImplementedError
• #1438: from cherrypy import expose fails when running script form parent directory
• #1468: Simplify structure of a Job in the TaskScheduler
• #875: never build unicode error messages
• #1107: Tab autocompletion can suggest invalid syntax
• #1447: 1107 - Tab autocompletion can suggest invalid syntax
• #1469: Fix typo in comment (insert space)
• #1463: Fix completion when importing modules in the cwd.
• #1437: unfriendly error handling with pythonw and ipython-qtconsole
• #1466: Fix for issue #1437, unfriendly windows qtconsole error handling
• #1432: Fix ipython directive
• #1465: allow ipython help subcommand syntax
• #1394: Wishlist: Remove hard dependency on ctypes
• #1416: Conditional import of ctypes in inputhook
• #1462: expedite parallel tests
• #1418: Strict mode in javascript
• #1410: Add javascript library and css stylesheet loading to JS class.
• #1427: #922 again
• #1448: Fix for #875 Never build unicode error messages
• #1458: use eval to uncan References
• #1455: Python3 install fails
• #1450: load mathjax from CDN via https
• #1182: Qtconsole, multiwindow
• #1439: Notebook not storing heading celltype information
• #1451: include heading level in JSON
• #1444: Fix pyton -> python typos
• #1412: Input parsing issue with %prun
• #1414: ignore errors in shell.var_expand
• #1441: (1) Enable IPython.notebook.kernel.execute to publish display_* even it is not called with a code cell and (2) remove empty html element when execute “display_*”
• #1431: Beginner Error: ipython qtconsole
• #1436: “ipython-qtconsole –gui qt” hangs on 64-bit win7

2.13. Issues closed in the 0.13 development cycle
• #1433: websocket connection fails on Chrome
• #1430: Fix for tornado check for tornado < 1.1.0
• #1408: test_get_home_dir_3 failed on Mac OS X
• #1413: get_home_dir expands symlinks, adjust test accordingly
• #1420: fixes #922
• #823: KnownFailure tests appearing as errors
• #1385: updated and prettified magic doc strings
• #1406: Browser selection
• #1411: ipcluster starts 8 engines “successfully” but Client only finds two
• #1375: %history -g -f file encoding issue
• #1377: Saving non-ascii history
• #797: Source introspection needs to be smarter in python 3.2
• #846: Autoreload extension doesn’t work with Python 3.2
• #1360: IPython notebook not starting on winXP
• #1407: Qtconsole segfaults on OSX when displaying some pop-up function tooltips
• #1402: fix symlink /home issue for FreeBSD
• #1403: pyreadline cyclic dependency with pdb++/pdbpp module
• #1405: Only monkeypatch xunit when the tests are run using it.
• #1404: Feature Request: List/Dictionary tab completion
• #1395: Xunit & KnownFailure
• #1396: Fix for %tb magic.
• #1397: Stay or leave message not working, Safari session lost.
• #1389: pylab=inline inoperant through ssh tunnelling?
• #1386: Jsd3
• #1388: Add simple support for running inside a virtualenv
• #826: Add support for creation of parallel task when no engine is running
• #1391: Improve Hub/Scheduler when no engines are registered
• #1369: load header with engine id when engine dies in TaskScheduler
• #1345: notebook can’t save unicode as script
• #1353: Save notebook as script using unicode file handle.
• #1352: Add ‘-m mod : run library module as a script’ option.
• #1363: Fix some minor color/style config issues in the qtconsole
• #1371: Adds a quiet keyword to sync_imports
• #1390: Blank screen for notebooks on Safari
• #1387: Fixing Cell menu to update cell type select box.
• #645: Standalone WX GUI support is broken
• #1296: Wx gui example: fixes the broken example for %gui wx.
• #1254: typo in notebooklist.js breaks links
• #781: Users should be able to clone a notebook
• #1372: ipcontroller cleans up connection files unless reuse=True
• #1374: remove calls to meaningless ZMQStream.on_err
• #1382: Update RO for Notebook
• #1370: allow draft76 websockets (Safari)
• #1368: Ensure handler patterns are str, not unicode
• #1379: Sage link on website homepage broken
• #1376: FWIW does not work with Chrome 16.0.912.77 Ubuntu 10.10
• #1358: Cannot install ipython on Windows 7 64-bit
• #1367: Ctrl - m t does not toggle output in chrome
• #1359: [sympyprinting] MathJax can’t render root{m}{n}
• #1337: Tab in the notebook after ( should not indent, only give a tooltip
• #1339: Notebook printing broken
• #1344: Ctrl + M + L does not toggle line numbering in htmlnotebook
• #1348: Ctrl + M + M does not switch to markdown cell
• #1361: Notebook bug fix branch
• #1364: avoid jsonlib returning Decimal
• #1362: Don’t log complete contents of history replies, even in debug
• #888: ReST support in notebooks
• #1205: notebook stores HTML escaped text in the file
• #1351: add IPython.embed_kernel()
• #1243: magic commands without % are not completed properly in htmlnotebook
• #1347: fix weird magic completion in notebook
• #1355: notebook.html extends layout.html now
• #1354: min and max in the notebook
• #1346: fixups for alternate URL prefix stuff
• #1336: crack at making notebook.html use the layout.html template
• #1331: RST and heading cells
• #1350: Add ‘-m mod : run library module as a script’ option
• #1247: fixes a bug causing extra newlines after comments.
• #1329: add base_url to notebook configuration options
• #1332: notebook - allow prefixes in URL path.
• #1317: Very slow traceback construction from Cython extension
• #1341: Don’t attempt to tokenize binary files for tracebacks

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• #1300: Cell Input collapse
• #1334: added key handler for control-s to notebook, seems to work pretty well
• #1338: Fix see also in docstrings so API docs build
• #1335: Notebook toolbar UI
• #1299: made notebook.html extend layout.html
• #1318: make Ctrl-D in qtconsole act same as in terminal (ready to merge)
• #873: ReST support in notebook frontend
• #1139: Notebook webkit notification
• #1314: Insertcell
• #1328: Coverage
• #1306: don’t preserve fixConsole output in json
• #1330: Add linewrapping to text cells (new feature in CodeMirror).
• #1309: Inoculate clearcmd extension into %reset functionality
• #1327: Updatecm2
• #1326: Removing Ace edit capability.
• #1325: forgotten selected_cell -> get_selected_cell
• #1316: Pass subprocess test runners a suitable location for xunit output
• #1315: Collect results from subprocess runners and spit out Xunit XML output.
• #1233: Update CodeMirror to the latest version
• #1234: Refactor how the notebook focuses cells
• #1235: After upgrading CodeMirror check the status of some bugs
• #1236: Review how select is called when notebook cells are inserted
• #1303: Updatecm
• #1311: Fixing CM related indentation problems.
• #1304: controller/server load can disrupt heartbeat
• #1312: minor heartbeat tweaks
• #1302: Input parsing with %prun clobbers escapes
• #1306: Fix %prun input parsing for escaped characters (closes #1302)
• #1251: IPython-0.12 can’t import map module on Python 3.1
• #1202: Pyreadline install exclusion for 64 bit windows no longer required, version dependency not correctly specified.
• #1301: New “Fix for issue #1202” based on current master.
• #1242: changed key map name to match changes to python mode
• #1203: Fix for issue #1202
• #1289: Make autoreload extension work on Python 3.
• #1263: Different ‘C-x’ for shortcut, ‘C-m c’ not toCodeCell anymore
• #1259: Replace “from (..) import” with absolute imports.
• #1278: took a crack at making notebook.html extend layout.html
• #1210: Add ‘quiet’ option to suppress screen output during %prun calls, edited dochelp
• #1288: Don’t ask for confirmation when stdin isn’t available
• #1290: Cell-level cut & paste overwrites multiple cells
• #1291: Minor, but important fixes to cut/copy/paste.
• #1293: TaskScheduler.hwm default value
• #1294: TaskScheduler.hwm default to 1 instead of 0
• #1281: in Hub: registration_timeout must be an integer, but heartmonitor.period is CFloat
• #1283: HeartMonitor.period should be an Integer
• #1162: Allow merge/split adjacent cells in notebook
• #1264: Aceify
• #1261: Mergesplit
• #1269: Another strange input handling error
• #1284: a fix for GH 1269
• #1232: Dead kernel loop
• #1279: ImportError: cannot import name S1 (from logging)
• #1276: notebook menu item to send a KeyboardInterrupt to the kernel
• #1213: BUG: Minor typo in history_console_widget.py
• #1248: IPython notebook doesn’t work with lastest version of tornado
• #1267: add NoDB for non-recording Hub
• #1222: allow Reference as callable in map/apply
• #1257: use self.kernel_manager_class in qtconsoleapp
• #1220: Open a new notebook while connecting to an existing kernel (opened by qtconsole or terminal or stand-alone)
• #1253: set auto_create flag for notebook apps
• #1260: heartbeat failure on long gil-holding operation
• #1262: Heartbeat no longer shares the app’s Context
• #1225: SyntaxError display broken in Python 3
• #1229: Fix display of SyntaxError in Python 3
• #1256: Dewijmoize
• #1246: Skip tests that require X, when importing pylab results in RuntimeError.
• #1250: Wijmoize
• #1244: can not input chinese word “” , exit right now
• #1194: Adding Opera 11 as a compatible browser for ipython notebook
• #1198: Kernel Has Died error in Notebook

2.13. Issues closed in the 0.13 development cycle
• #1211: serve local files in notebook-dir
• #1224: edit text cells on double-click instead of single-click
• #1187: misc notebook: connection file cleanup, first heartbeat, startup flush
• #1207: fix loadpy duplicating newlines
• #1060: Always save the .py file to disk next to the .ipynb
• #1066: execute cell in place should preserve the current insertion-point in the notebook
• #1141: “In” numbers are not invalidated when restarting kernel
• #1231: pip on OSX tries to install files in /System directory.
• #1129: Unified setup.py
• #1199: Reduce IPython.external.*
• #1219: Make all the static files path absolute.
• #1218: Added -q option to %prun for suppression of the output, along with editing the dochelp string.
• #1217: Added -q option to %prun for suppression of the output, along with editing the dochelp string
• #1216: Pdb tab completion does not work in QtConsole
• #1197: Interactive shell trying to: from … import history
• #1175: core.completer: Clean up excessive and unused code.
• #1208: should dv.sync_import print failed imports ?
• #1186: payloadpage.py not used by qtconsole
• #1204: double newline from %loadpy in python notebook (at least on mac)
• #1192: Invalid JSON data
• #1196: docs: looks like a file path might have been accidentally pasted in the middle of a word
• #1189: Right justify of ‘in’ prompt in variable prompt size configurations
• #1185: ipython console not work proper with stdout…
• #1191: profile/startup files not executed with “notebook”
• #1190: Fix link to Chris Fonnesbeck blog post about 0.11 highlights.
• #1174: Remove %install_default_config and %install_profiles

2.14 0.12 Series

2.14.1 Release 0.12.1

IPython 0.12.1 is a bugfix release of 0.12, pulling only bugfixes and minor cleanup from 0.13, timed for the Ubuntu 12.04 LTS release.

See the list of fixed issues for specific backported issues.
2.14.2 Release 0.12

IPython 0.12 contains several major new features, as well as a large amount of bug and regression fixes. The 0.11 release brought with it a lot of new functionality and major refactorings of the codebase; by and large this has proven to be a success as the number of contributions to the project has increased dramatically, proving that the code is now much more approachable. But in the refactoring inevitably some bugs were introduced, and we have also squashed many of those as well as recovered some functionality that had been temporarily disabled due to the API changes.

The following major new features appear in this version.

An interactive browser-based Notebook with rich media support

A powerful new interface puts IPython in your browser. You can start it with the command `ipython notebook`:

![Image of IPython Notebook]

Fig. 3: The new IPython notebook showing text, mathematical expressions in LaTeX, code, results and embedded figures created with Matplotlib.

This new interface maintains all the features of IPython you are used to, as it is a new client that communicates with the same IPython kernels used by the terminal and Qt console. But the web notebook provides for a different workflow where you can integrate, along with code execution, also text, mathematical expressions, graphics, video, and virtually any content that a modern browser is capable of displaying.

You can save your work sessions as documents that retain all these elements and which can be version controlled, emailed to colleagues or saved as HTML or PDF files for printing or publishing statically on the web. The internal storage format is a JSON file that can be easily manipulated for manual exporting to other formats.

This Notebook is a major milestone for IPython, as for years we have tried to build this kind of system. We were inspired originally by the excellent implementation in Mathematica, we made a number of attempts using older technologies in earlier Summer of Code projects in 2005 (both students and Robert Kern developed early prototypes), and in recent years we have seen the excellent implementation offered by the Sage <http://sagemath.org> system. But we continued to work on something that would be consistent with the rest of IPython’s design, and it is clear now that the effort was worth it: based on the ZeroMQ communications architecture introduced in version 0.11, the notebook can now retain 100% of the features of the real IPython. But it can also provide the rich media support and high quality Javascript libraries that were not available in browsers even one or two years ago (such as high-quality mathematical rendering or built-in video).

The notebook has too many useful and important features to describe in these release notes; our documentation now contains a directory called `examples/notebooks` with several notebooks that illustrate various aspects of the system. You should start by reading those named `00_notebook_tour.ipynb` and `01_notebook_introduction.ipynb` first, and then can proceed to read the others in any order you want.
To start the notebook server, go to a directory containing the notebooks you want to open (or where you want to create new ones) and type:

```
ipython notebook
```

You can see all the relevant options with:

```
ipython notebook --help
ipython notebook --help-all  # even more
```

and just like the Qt console, you can start the notebook server with pylab support by using:

```
ipython notebook --pylab
```

for floating matplotlib windows or:

```
ipython notebook --pylab inline
```

for plotting support with automatically inlined figures. Note that it is now possible also to activate pylab support at runtime via `%pylab`, so you do not need to make this decision when starting the server.

### Two-process terminal console

Based on the same architecture as the notebook and the Qt console, we also have now a terminal-based console that can connect to an external IPython kernel (the same kernels used by the Qt console or the notebook, in fact). While this client behaves almost identically to the usual IPython terminal application, this capability can be very useful to attach an interactive console to an existing kernel that was started externally. It lets you use the interactive `%debug` facilities in a notebook, for example (the web browser can’t interact directly with the debugger) or debug a third-party code where you may have embedded an IPython kernel.

This is also something that we have wanted for a long time, and which is a culmination (as a team effort) of the work started last year during the 2010 Google Summer of Code project.

### Tabbed QtConsole

The QtConsole now supports starting multiple kernels in tabs, and has a menubar, so it looks and behaves more like a real application. Keyboard enthusiasts can disable the menubar with ctrl-shift-M (PR #887).

### Full Python 3 compatibility

IPython can now be installed from a single codebase on Python 2 and Python 3. The installation process for Python 3 automatically runs 2to3. The same ‘default’ profile is now used for Python 2 and 3 (the previous version had a separate ‘python3’ profile).

### Standalone Kernel

The `ipython kernel` subcommand has been added, to allow starting a standalone kernel, that can be used with various frontends. You can then later connect a Qt console or a terminal console to this kernel by typing e.g.:

```
ipython qtconsole --existing
```

if it’s the only one running, or by passing explicitly the connection parameters (printed by the kernel at startup).
Fig. 4: The improved Qt console for IPython, now with tabs to control multiple kernels and full menu support.

**PyPy support**

The terminal interface to IPython now runs under PyPy. We will continue to monitor PyPy’s progress, and hopefully before long at least we’ll be able to also run the notebook. The Qt console may take longer, as Qt is a very complex set of bindings to a huge C++ library, and that is currently the area where PyPy still lags most behind. But for everyday interactive use at the terminal, with this release and PyPy 1.7, things seem to work quite well from our admittedly limited testing.

**Other important new features**

- **SSH Tunnels**: In 0.11, the IPython.parallel Client could tunnel its connections to the Controller via ssh. Now, the QtConsole supports ssh tunneling, as do parallel engines.

- **relaxed command-line parsing**: 0.11 was released with overly-strict command-line parsing, preventing the ability to specify arguments with spaces, e.g. ipython --pylab qt or ipython --c "print 'hi'". This has been fixed, by using argparse. The new parsing is a strict superset of 0.11, so any commands in 0.11 should still work in 0.12.

- **HistoryAccessor**: The HistoryManager class for interacting with your IPython SQLite history database has been split, adding a parent HistoryAccessor class, so that users can write code to access and search their IPython history without being in an IPython session (PR #824).

- **kernel %gui and %pylab**: The %gui and %pylab magics have been restored to the IPython kernel (e.g. in the qtconsole or notebook). This allows activation of pylab-mode, or eventloop integration after starting the kernel, which was unavailable in 0.11. Unlike in the terminal, this can be set only once, and cannot be changed.
• **%config**: A new `%config` magic has been added, giving easy access to the IPython configuration system at runtime (PR #923).

• **Multiline History**: Multiline readline history has been restored to the Terminal frontend by default (PR #838).

• **%store**: The `%store` magic from earlier versions has been updated and re-enabled (`storemagic`; PR #1029). To autorestore stored variables on startup, specify `c.StoreMagic.autorestore = True` in `ipython_config.py`.

### Major Bugs fixed

In this cycle, we have *closed over 500 issues*, but a few major ones merit special mention:

• Simple configuration errors should no longer crash IPython. In 0.11, errors in config files, as well as invalid trait values, could crash IPython. Now, such errors are reported, and help is displayed.

• Certain SyntaxErrors no longer crash IPython (e.g. just typing keywords, such as `return`, `break`, etc.). See #704.

• IPython path utils, such as `get_ipython_dir()` now check for write permissions, so IPython should function on systems where the default path resolution might point to a read-only location, such as `HOMESHARE` on Windows (#669).

• `raw_input()` now works in the kernel when multiple frontends are in use. The request will be sent to the frontend that made the request, and an exception is raised if that frontend does not support stdin requests (e.g. the notebook) (#673).

• `zmq` version detection no longer uses simple lexicographical comparison to check minimum version, which prevents 0.11 from working with `pyzmq-2.1.10` (PR #758).

• A bug in PySide < 1.0.7 caused crashes on OSX when tooltips were shown (#711). These tooltips are now disabled on old PySide (PR #963).

• IPython no longer crashes when started on recent versions of Python 3 in Windows (#737).

• Instances of classes defined interactively can now be pickled (#29; PR #648). Note that pickling saves a reference to the class definition, so unpickling the instances will only work where the class has been defined.

### Backwards incompatible changes

• IPython connection information is no longer specified via `ip/port` directly, rather via json connection files. These files are stored in the security directory, and enable us to turn on HMAC message authentication by default, significantly improving the security of kernels. Various utility functions have been added to `IPython.lib.kernel`, for easier connecting to existing kernels.

• `KernelManager` now has one `ip`, and several `port` traits, rather than several `ip/port` pair `_addr` traits. This better matches the rest of the code, where the ip cannot not be set separately for each channel.

• Custom prompts are now configured using a new class, `PromptManager`, which has traits for `in_template`, `in2_template` (the `...: continuation prompt`), `out_template` and `rewrite_template`. This uses Python's string formatting system, so you can use `{time}` and `{cwd}`, although we have preserved the abbreviations from previous versions, e.g. `\#` (prompt number) and `\w` (working directory). For the list of available fields, refer to the source of `IPython/core/prompts.py`.

• The class inheritance of the Launchers in `IPython.parallel.apps.launcher` used by `ipcluster` has changed, so that trait names are more consistent across batch systems. This may require a few renames in your config files, if you customized the command-line args for launching controllers and engines. The configurable
names have also been changed to be clearer that they point to class names, and can now be specified by name only, rather than requiring the full import path of each class, e.g.:

```python
IPClusterEngines.engine_launcher = 'IPython.parallel.apps.launcher.
→MPIExecEngineSetLauncher'
IPClusterStart.controller_launcher = 'IPython.parallel.apps.launcher.
→SSHControllerLauncher'
```

would now be specified as:

```python
IPClusterEngines.engine_launcher_class = 'MPI'
IPClusterStart.controller_launcher_class = 'SSH'
```

The full path will still work, and is necessary for using custom launchers not in IPython’s launcher module.

Further, MPIExec launcher names are now prefixed with just MPI, to better match other batch launchers, and be generally more intuitive. The MPIExec names are deprecated, but continue to work.

- For embedding a shell, note that the parameters `user_global_ns` and `global_ns` have been deprecated in favour of `user_module` and `module` respectively. The new parameters expect a module-like object, rather than a namespace dict. The old parameters remain for backwards compatibility, although `user_global_ns` is now ignored. The `user_ns` parameter works the same way as before, and calling `embed()` with no arguments still works as before.

**Development summary and credits**

The previous version (IPython 0.11) was released on July 31 2011, so this release cycle was roughly 4 1/2 months long, we closed a total of 515 issues, 257 pull requests and 258 regular issues (a detailed list is available).

Many users and developers contributed code, features, bug reports and ideas to this release. Please do not hesitate in contacting us if we’ve failed to acknowledge your contribution here. In particular, for this release we have had commits from the following 45 contributors, a mix of new and regular names (in alphabetical order by first name):

- Alcides <alcides-at-do-not-span-me.com>
- Ben Edwards <bedwards-at-cs.unm.edu>
- Benjamin Ragan-Kelley <benjaminrk-at-gmail.com>
- Benjamin Thyreau <benjamin.thyreau-at-gmail.com>
- Bernardo B. Marques <bernardo.fire-at-gmail.com>
- Bernard Paulus <bprecyclebin-at-gmail.com>
- Bradley M. Froehle <brad.froehle-at-gmail.com>
- Brian E. Granger <ellisonbg-at-gmail.com>
- Christian Boos <cboos-at-bct-technology.com>
- Daniel Velkov <danielv-at-mylife.com>
- Erik Tollerud <erik.tollerud-at-gmail.com>
- Evan Patterson <epatters-at-enthought.com>
- Felix Werner <Felix.Werner-at-kit.edu>
- Fernando Perez <Fernando.Perez-at-berkeley.edu>
- Gabriel <g2p.code-at-gmail.com>
• Grahame Bowland <grahame-at-angrygoats.net>
• Hannes Schulz <schulz-at-ais.uni-bonn.de>
• Jens Hedegaard Nielsen <jenshnielsen-at-gmail.com>
• Jonathan March <jmarch-at-enthought.com>
• Jörgen Stenarson <jorgen.stenarson-at-bostream.nu>
• Julian Taylor <jtaylor.debian-at-googlemail.com>
• Kefu Chai <tchaikov-at-gmail.com>
• macgyver <neil.rabinowitz-at-merton.ox.ac.uk>
• Matt Cottingham <matt.cottingham-at-gmail.com>
• Matthew Brett <matthew.brett-at-gmail.com>
• Matthias BUSSONNIER <bussonniermatthias-at-gmail.com>
• Michael Droettboom <mdboom-at-gmail.com>
• Nicolas Rougier <Nicolas.Rougier-at-inria.fr>
• Olivier Verdier <olivier.verdier-at-gmail.com>
• Omar Andres Zapata Mesa <andresete.chaos-at-gmail.com>
• Pablo Winant <pablo.winant-at-gmail.com>
• Paul Ivanov <pivanov314-at-gmail.com>
• Pauli Virtanen <pav-at-iki.fi>
• Pete Aykroyd <aykroyd-at-gmail.com>
• Prabhu Ramachandran <prabhu-at-enthought.com>
• Puneeth Chaganti <punchagan-at-gmail.com>
• Robert Kern <robert.kern-at-gmail.com>
• Satrajit Ghosh <satra-at-mit.edu>
• Stefan van der Walt <stefan-at-sun.ac.za>
• Szabolcs Horvát <szhorvat-at-gmail.com>
• Thomas Kluyver <takowl-at-gmail.com>
• Thomas Spura <thomas.spura-at-gmail.com>
• Timo Paulssen <timonator-at-perpetuum-immobile.de>
• Valentin Haenel <valentin.haenel-at-gmx.de>
• Yaroslav Halchenko <debian-at-onerussian.com>

Note: This list was generated with the output of `git log rel-0.11..HEAD --format='* %aN <%aE>'` | `sed 's/@//g' | sed 's/<>/\/' | sort -u after some cleanup. If you should be on this list, please add yourself.
2.15 Issues closed in the 0.12 development cycle

2.15.1 Issues closed in 0.12.1

GitHub stats for bugfix release 0.12.1 (12/28/2011-04/16/2012), backporting pull requests from 0.13.

We closed a total of 71 issues: 44 pull requests and 27 issues; this is the full list (generated with the script tools/github_stats.py).

This list is automatically generated, and may be incomplete:

Pull Requests (44):

- PR #1175: core.completer: Clean up excessive and unused code.
- PR #1187: misc notebook: connection file cleanup, first heartbeat, startup flush
- PR #1190: Fix link to Chris Fonnesbeck blog post about 0.11 highlights.
- PR #1196: docs: looks like a file path might have been accidentally pasted in the middle of a word
- PR #1206: don’t preserve fixConsole output in json
- PR #1207: fix loadpy duplicating newlines
- PR #1213: BUG: Minor typo in history_console_widget.py
- PR #1218: Added -q option to %prun for suppression of the output, along with editing the dochelp string.
- PR #1222: allow Reference as callable in map/apply
- PR #1229: Fix display of SyntaxError in Python 3
- PR #1246: Skip tests that require X, when importing pylab results in RuntimeError.
- PR #1253: set auto_create flag for notebook apps
- PR #1257: use self.kernel_manager_class in qtconsoleapp
- PR #1262: Heartbeat no longer shares the app’s Context
- PR #1283: HeartMonitor.period should be an Integer
- PR #1284: a fix for GH 1269
- PR #1289: Make autoreload extension work on Python 3.
- PR #1306: Fix %prun input parsing for escaped characters (closes #1302)
- PR #1312: minor heartbeat tweaks
- PR #1318: make Ctrl-D in qtconsole act same as in terminal (ready to merge)
- PR #1341: Don’t attempt to tokenize binary files for tracebacks
- PR #1353: Save notebook as script using unicode file handle.
- PR #1363: Fix some minor color/style config issues in the qtconsole
- PR #1364: avoid jsonlib returning Decimal
- PR #1369: load header with engine id when engine dies in TaskScheduler
- PR #1370: allow draft76 websockets (Safari)
- PR #1374: remove calls to meaningless ZMQStream.on_err
- PR #1377: Saving non-ascii history
• PR #1396: Fix for %tb magic.
• PR #1402: fix symlinked /home issue for FreeBSD
• PR #1413: get_home_dir expands symlinks, adjust test accordingly
• PR #1414: ignore errors in shell.var_expand
• PR #1430: Fix for tornado check for tornado < 1.1.0
• PR #1445: Don’t build sphinx docs for sdists
• PR #1463: Fix completion when importing modules in the cwd.
• PR #1477: fix dangling buffer in IPython.parallel.util
• PR #1495: BUG: Fix pretty-printing for overzealous objects
• PR #1496: BUG: LBYL when clearing the output history on shutdown.
• PR #1514: DOC: Fix references to IPython.lib.pretty instead of the old location
• PR #1517: Fix indentation bug in IPython/lib/pretty.py
• PR #1538: store git commit hash in utils._sysinfo instead of hidden data file
• PR #1599: Fix for %run -d in Python 3
• PR #1602: Fix %env for Python 3
• PR #1607: cleanup sqlitedb temporary db file after tests

Issues (27):

• #676: IPython.embed() from ipython crashes twice on exit
• #846: Autoreload extension doesn’t work with Python 3.2
• #1187: misc notebook: connection file cleanup, first heartbeat, startup flush
• #1191: profile/startup files not executed with “notebook”
• #1197: Interactive shell trying to: from . . . import history
• #1198: Kernel Has Died error in Notebook
• #1201: %env magic fails with Python 3.2
• #1204: double newline from %loadpy in python notebook (at least on mac)
• #1208: should dv.sync_import print failed imports ?
• #1225: SyntaxError display broken in Python 3
• #1232: Dead kernel loop
• #1241: When our debugger class is used standalone __oh key errors are thrown
• #1254: typo in notebooklist.js breaks links
• #1260: heartbeat failure on long gil-holding operation
• #1268: notebook %reset magic fails with StdinNotImplementedError
• #1269: Another strange input handling error
• #1281: in Hub: registration_timeout must be an integer, but heartmonitor.period is CFloat
• #1302: Input parsing with %prun clobbers escapes
• #1304: controller/server load can disrupt heartbeat
• #1317: Very slow traceback construction from Cython extension
• #1345: notebook can’t save unicode as script
• #1375: %history -g -f file encoding issue
• #1401: numpy arrays cannot be used with View.apply() in Python 3
• #1408: test_get_home_dir_3 failed on Mac OS X
• #1412: Input parsing issue with %prun
• #1421: ipython32 %run -d breaks with NameError name ‘execfile’ is not defined
• #1484: unhide .git_commit_info.ini

2.15.2 Issues closed in 0.12

In this cycle, from August 1 to December 28 2011, we closed a total of 515 issues, 257 pull requests and 258 regular issues; this is the full list (generated with the script tools/github_stats.py).

Pull requests (257):
• 1174: Remove %install_default_config and %install_profiles
• 1178: Correct string type casting in pinfo.
• 1096: Show class init and call tooltips in notebook
• 1176: Modifications to profile list
• 1173: don’t load gui/pylab in console frontend
• 1168: Add --script flag as shorthand for notebook save_script option.
• 1165: encode image_tag as utf8 in [x]html export
• 1161: Allow %loadpy to load remote URLs that don’t end in .py
• 1158: Add coding header when notebook exported to .py file.
• 1160: don’t ignore ctrl-C during %gui qt
• 1159: Add encoding header to Python files downloaded from notebooks.
• 1155: minor post-execute fixes (#1154)
• 1153: Pager tearing bug
• 1152: Add support for displaying matplotlib axes directly.
• 1079: Login/out button cleanups
• 1151: allow access to user_ns in prompt_manager
• 1120: updated vim-ipython (pending)
• 1150: BUG: Scrolling pager in vsplit on Mac OSX tears.
• 1149: #1148 (win32 arg_split)
• 1147: Put qtconsole foreground when launching
• 1146: allow saving notebook.py next to notebook.ipynb
• 1128: fix pylab StartMenu item
• 1140: Namespaces for embedding
• 1132: [notebook] read-only: disable name field
• 1125: notebook: update logo
• 1135: allow customized template and static file paths for the notebook web app
• 1122: BUG: Issue #755 qt IPythonWidget.execute_file fails if filename contains . . .
• 1137: rename MPIExecLaunchers to MPILaunchers
• 1130: optionally ignore shlex’s ValueError in arg_split
• 1116: Shlex unicode
• 1073: Storemagic plugin
• 1143: Add post_install script to create start menu entries in Python 3
• 1138: Fix tests to work when ~/.config/ipython contains a symlink.
• 1121: Don’t transform function calls on IPyAutocall objects
• 1118: protect CRLF from carriage-return action
• 1105: Fix for prompts containing newlines.
• 1126: Totally remove pager when read only (notebook)
• 1091: qtconsole: allow copy with shortcut in pager
• 1114: fix magics history in two-process ipython console
• 1113: Fixing #1112 removing failing asserts for test_carriage_return and test_beep
• 1089: Support carriage return (‘r’) and beep (‘b’) characters in the qtconsole
• 1108: Completer usability 2 (rebased of pr #1082)
• 864: Two-process terminal frontend (ipython core branch)
• 1082: usability and cross browser compat for completer
• 1053: minor improvements to text placement in qtconsole
• 1106: Fix display of errors in compiled code on Python 3
• 1077: allow the notebook to run without MathJax
• 1072: If object has a getdoc() method, override its normal docstring.
• 1059: Switch to simple __IPYTHON__ global
• 1070: Execution count after SyntaxError
• 1098: notebook: config section UI
• 1101: workaround spawnb missing from pexpect.__all__
• 1097: typo, should fix #1095
• 1099: qtconsole export xhtml/utf8
• 1083: Prompts
• 1081: Fix wildcard search for updated namespaces
• 1084: write busy in notebook window title . . .
• 1078: PromptManager fixes
• 1064: Win32 shlex
• 1069: As you type completer, fix on Firefox
• 1039: Base of an as you type completer.
• 1065: Qtconsole fix racecondition
• 507: Prompt manager
• 1056: Warning in code. qtconsole ssh -X
• 1036: Clean up javascript based on js2-mode feedback.
• 1052: Pylab fix
• 648: Usermod
• 969: Pexpect-u
• 1007: Fix paste/cpaste bug and refactor/cleanup that code a lot.
• 506: make ENTER on a previous input field replace current input buffer
• 1040: json/jsonapi cleanup
• 1042: fix firefox (windows) break line on empty prompt number
• 1015: emacs freezes when tab is hit in ipython with latest python-mode
• 1023: flush stdout/stderr at the end of kernel init
• 956: Generate “All magics…” menu live
• 1038: Notebook: don’t change cell when selecting code using shift+up/down.
• 987: Add Tooltip to notebook.
• 1028: Cleaner minimum version comparison
• 998: defer to stdlib for path.get_home_dir()
• 1033: update copyright to 2011/20xx-2011
• 1032: Intercept <esc> avoid closing websocket on Firefox
• 1030: use pyzmq tools where appropriate
• 1029: Restore pspersistence, including %store magic, as an extension.
• 1025: Dollar escape
• 999: Fix issue #880 - more useful message to user when %paste fails
• 938: changes to get ipython.el to work with the latest python-mode.el
• 1012: Add logout button.
• 1020: Dollar formatter for ! shell calls
• 1019: Use repr() to make quoted strings
• 1008: don’t use crash_handler by default
• 1003: Drop consecutive duplicates when refilling readline history
• 997: don’t unregister interrupted post-exec functions
• 996: add Integer traitlet
• 1016: Fix password hashing for Python 3
• 1014: escape minus signs in manpages
• 1013: [NumPyExampleDocstring] link was pointing to raw file
• 1011: Add hashed password support.
• 1005: Quick fix for os.system requiring str parameter
• 994: Allow latex formulas in HTML output
• 955: Websocket Adjustments
• 979: use system_raw in terminal, even on Windows
• 989: fix arguments for commands in _process_posix
• 991: Show traceback, continuing to start kernel if pylab init fails
• 981: Split likely multiline text when writing JSON notebooks
• 957: allow change of png DPI in inline backend
• 968: add wantDirectory to ipdoctest, so that directories will be checked for e
• 984: Do not expose variables defined at startup to %who etc.
• 985: Fixes for parallel code on Python 3
• 963: disable calltips in PySide < 1.0.7 to prevent segfault
• 976: Getting started on what’s new
• 929: Multiline history
• 964: Default profile
• 961: Disable the pager for the test suite
• 953: Physics extension
• 950: Add directory for startup files
• 940: allow setting HistoryManager.hist_file with config
• 948: Monkeypatch Tornado 2.1.1 so it works with Google Chrome 16.
• 916: Run p ( https://github.com/ipython/ipython/pull/901 )
• 923: %config magic
• 920: unordered iteration of AsyncMapResults (+ a couple fixes)
• 941: Follow-up to 387dcd6a, __r1.__doc__ is None with pyreadline
• 931: read-only notebook mode
• 921: Show invalid config message on TraitErrors during init
• 815: Fix #481 using custom qt4 input hook
• 936: Start webbrowser in a thread. Prevents lockup with Chrome.
• 937: add dirty trick for readline import on OSX
• 913: Py3 tests2
• 933: Cancel in qt console closeevent should trigger event.ignore()
• 930: read-only notebook mode
• 910: Make import checks more explicit in %whos
• 926: reincarnate -V cmdline option

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• 928: BUG: Set context for font size change shortcuts in ConsoleWidget
• 901: - There is a bug when running the profiler in the magic command (prun) with python3
• 912: Add magic for cls on windows. Fix for #181.
• 905: enable %gui/%pylab magics in the Kernel
• 909: Allow IPython to run without sqlite3
• 887: Qtconsole menu
• 895: notebook download implies save
• 896: Execfile
• 899: Brian’s Notebook work
• 892: don’t close figures every cycle with inline matplotlib backend
• 893: Adding clear_output to kernel and HTML notebook
• 789: Adding clear_output to kernel and HTML notebook.
• 898: Don’t pass unicode sys.argv with %run or ipython script.py
• 897: Add tooltips to the notebook via 'title' attr.
• 877: partial fix for issue #678
• 838: reenable multiline history for terminals
• 872: The constructor of Client() checks for AssertionError in validate_url to open a file instead of connection to a URL if it fails.
• 884: Notebook usability fixes
• 883: User notification if notebook saving fails
• 889: Add drop_by_id method to shell, to remove variables added by extensions.
• 891: Ability to open the notebook in a browser when it starts
• 813: Create menu bar for qtconsole
• 876: protect IPython from bad custom exception handlers
• 856: Backgroundjobs
• 868: Warn user if MathJax can’t be fetched from notebook closes #744
• 878: store_history=False default for run_cell
• 824: History access
• 850: Update codemirror to 2.15 and make the code internally more version-agnostic
• 861: Fix for issue #56
• 819: Adding -m option to %run, similar to -m for python interpreter.
• 855: promote aliases and flags, to ensure they have priority over config files
• 862: BUG: Completion widget position and pager focus.
• 847: Allow connection to kernels by files
• 708: Two-process terminal frontend
• 857: make sdist flags work again (e.g. --manifest-only)
• 835: Add Tab key to list of keys that scroll down the paging widget.
• 859: Fix for issue #800
• 848: Python3 setup.py install failure
• 845: Tests on Python 3
• 802: DOC: extensions: add documentation for the bundled extensions
• 830: contiguous stdout/stderr in notebook
• 761: Windows: test runner fails if repo path (e.g. home dir) contains spaces
• 801: Py3 notebook
• 809: use CFRunLoop directly in ipython kernel --pylab osx
• 841: updated old scipy.org links, other minor doc fixes
• 837: remove all trailling spaces
• 834: Issue https://github.com/ipython/ipython/issues/832 resolution
• 746: ENH: extensions: port autoreload to current API
• 828: fixed permissions (sub-modules should not be executable) + added shebang for run_ipy_in_profiler.py
• 798: pexpect & Python 3
• 804: Magic ‘range’ crash if greater than len(input_hist)
• 821: update tornado dependency to 2.1
• 807: Facilitate ssh tunnel sharing by announcing ports
• 795: Add cluster-id for multiple cluster instances per profile
• 742: Glut
• 668: Greedy completer
• 776: Reworking qtconsole shortcut, add fullscreen
• 790: TST: add future unicode_literals test (#786)
• 775: redirect_in/redirect_out should be constrained to windows only
• 793: Don’t use readline in the ZMQShell
• 743: Pyglet
• 774: basic/initial .mailmap for nice shortlog summaries
• 770: #769 (reopened)
• 784: Parse user code to AST using compiler flags.
• 783: always use StringIO, never cStringIO
• 782: flush stdout/stderr on displayhook call
• 622: Make pylab import all configurable
• 745: Don’t assume history requests succeed in qtconsole
• 725: don’t assume cursor.selectedText() is a string
• 778: don’t override execfile on Python 2
• 663: Python 3 compatibility work
• 762: qtconsole ipython widget’s execute_file fails if filename contains spaces or quotes
• 763: Set context for shortcuts in ConsoleWidget
• 722: PyPy compatibility
• 757: ipython.el is broken in 0.11
• 764: fix “–colors=color” option in py-python-command-args.
• 758: use ROUTER/DEALER socket names instead of XREP/XREQ
• 736: enh: added authentication ability for webapp
• 748: Check for tornado before running frontend.html tests.
• 754: restore msg_id/msg_type aliases in top level of msg dict
• 769: Don’t treat bytes objects as json-safe
• 753: DOC: msg[‘msg_type’] removed
• 766: fix “–colors=color” option in py-python-command-args.
• 765: fix “–colors=color” option in py-python-command-args.
• 741: Run PyOs_InputHook in pager to keep plot windows interactive.
• 664: Remove ipythonrc references from documentation
• 750: Tiny doc fixes
• 433: ZMQ terminal frontend
• 734: Allow %magic argument filenames with spaces to be specified with quotes under win32
• 731: respect encoding of display data from urls
• 730: doc improvements for running notebook via secure protocol
• 729: use null char to start markdown cell placeholder
• 727: Minor fixes to the htmlnotebook
• 726: use bundled argpase if system argpase is < 1.1
• 705: Htmlnotebook
• 723: Add ‘import time’ to IPython/parallel/apps/launcher.py as time.sleep is called without time being imported
• 714: Install mathjax for offline use
• 718: Underline keyboard shortcut characters on appropriate buttons
• 717: Add source highlighting to markdown snippets
• 716: update EvalFormatter to allow arbitrary expressions
• 712: Reset execution counter after cache is cleared
• 713: Align colons in html notebook help dialog
• 709: Allow usage of ‘.’ in notebook names
• 706: Implement static publishing of HTML notebook
• 674: use argpase to parse aliases & flags
• 679: HistoryManager.get_session_info()
• 696: Fix columnize bug, where tab completion with very long filenames would crash Qt console

2.15. Issues closed in the 0.12 development cycle
• 686: add ssh tunnel support to qtconsole
• 685: Add SSH tunneling to engines
• 384: Allow pickling objects defined interactively.
• 647: My fix rpmlint
• 587: don’t special case for py3k+numpy
• 703: make config-loading debug messages more explicit
• 699: make calltips configurable in qtconsole
• 666: parallel tests & extra readline escapes
• 683: BF - allow nose with-doctest setting in environment
• 689: Protect ipkernel from bad messages
• 702: Prevent ipython.py launcher from being imported.
• 701: Prevent ipython.py from being imported by accident
• 670: check for writable dirs, not just existence, in utils.path
• 579: Sessionwork
• 687: add ipython kernel for starting just a kernel
• 627: Qt Console history search
• 646: Generate package list automatically in find_packages
• 660: i658
• 659: don’t crash on bad config files

Regular issues (258):
• 1177: UnicodeDecodeError in py3compat from “xlrd??”
• 1094: Tooltip doesn’t show constructor docstrings
• 1170: double pylab greeting with c.InteractiveShellApp.pylab = “tk” in zmqconsole
• 1166: E-mail cpaste broken
• 1164: IPython qtconsole (0.12) can’t export to html with external png
• 1103: %loadpy should cut out encoding declaration
• 1156: Notebooks downloaded as Python files require a header stating the encoding
• 1157: Ctrl-C not working when GUI/pylab integration is active
• 1154: We should be less aggressive in de-registering post-execution functions
• 1134: “select-all, kill” leaves qtconsole in unusable state
• 1148: A lot of testerrors
• 803: Make doctests work with Python 3
• 1119: Start menu shortcuts not created in Python 3
• 1136: The embedding machinery ignores user_ns
• 607: Use the new IPython logo/font in the notebook header
• 755: qtconsole ipython widget’s execute_file fails if filename contains spaces or quotes
• 1115: shlex_split should return unicode
• 1109: timeit with string ending in space gives “ValueError: No closing quotation”
• 1142: Install problems
• 700: Some SVG images render incorrectly in htmlnotebook
• 1117: quit() doesn’t work in terminal
• 1111: ls broken after merge of #1089
• 1104: Prompt spacing weird
• 1124: Seg Fault 11 when calling PySide using “run” command
• 1088: QtConsole : can’t copy from pager
• 568: Test error and failure in IPython.core on windows
• 1112: testfailure in IPython.frontend on windows
• 1102: magic in IPythonDemo fails when not located at top of demo file
• 629: r and b in qtconsole don’t behave as expected
• 1080: Notebook: tab completion should close on “(“
• 973: Qt Console close dialog and on-top Qt Console
• 1087: QtConsole xhtml/Svg export broken ?
• 1067: Parallel test suite hangs on Python 3
• 1018: Local mathjax breaks install
• 993: raw_input redirection to foreign kernels is extremely brittle
• 1100: ipython3 traceback unicode issue from extensions
• 1071: Large html-notebooks hang on load on a slow machine
• 89: %pdoc np.ma.compress shows docstring twice
• 22: Include improvements from anythingipython.el
• 633: Execution count & SyntaxError
• 1095: Uncaught TypeError: Object has no method ‘remove_and_cancell_tooltip’
• 1075: We’re ignoring prompt customizations
• 1086: Can’t open qtconsole from outside source tree
• 1076: namespace changes broke foo.*bar*? syntax
• 1074: pprinting old-style class objects fails (TypeError: ‘tuple’ object is not callable)
• 1063: IPython.utils test error due to missing unicodedata module
• 592: Bug in argument parsing for %run
• 378: Windows path escape issues
• 1068: Notebook tab completion broken in Firefox
• 75: No tab completion after “/”
• 103: customizable cpaste
• 324: Remove code in IPython.testing that is not being used

2.15. Issues closed in the 0.12 development cycle
• 131: Global variables not seen by cprofile.run()
• 851: IPython shell swallows exceptions in certain circumstances
• 882: ipython freezes at start if IPYTHONDIR is on an NFS mount
• 1057: Blocker: Qt console broken after “all magics” menu became dynamic
• 1027: ipython does not like white space at end of file
• 1058: New bug: Notebook asks for confirmation to leave even saved pages.
• 1061: rep (magic recall) under pypy
• 1047: Document the notebook format
• 102: Properties accessed twice for classes defined interactively
• 16: %store raises exception when storing compiled regex
• 67: tab expansion should only take one directory level at the time
• 62: Global variables undefined in interactive use of embedded ipython shell
• 57: debugging with ipython does not work well outside ipython
• 38: Line entry edge case error
• 980: Update parallel docs for new parallel architecture
• 1017: Add small example about ipcluster/ssh startup
• 1041: Proxy Issues
• 967: KernelManagers don’t use zmq eventloop properly
• 1055: “All Magics” display on Ubuntu
• 1054: ipython explodes on syntax error
• 1051: ipython3 set_next_input() failure
• 693: “run -i” no longer works after %reset in terminal
• 29: cPickle works in standard interpreter, but not in IPython
• 1050: ipython3 broken by commit 8bb887c8c2c447bf7
• 1048: Update docs on notebook password
• 1046: Searies of questions/issues?
• 1045: crash when exiting - previously launched embedded sub-shell
• 1043: pylab doesn’t work in qtconsole
• 1044: run -p doesn’t work in python 3
• 1010: emacs freezes when ipython-complete is called
• 82: Update devel docs with discussion about good changelogs
• 116: Update release management scripts and release.revision for git
• 1022: Pylab banner shows up with first cell to execute
• 787: Keyboard selection of multiple lines in the notebook behaves inconsistently
• 1037: notepad + jsonlib: TypeError: Only whitespace may be used for indentation.
• 970: Default home not writable, %HOME% does not help (windows)
• 747: HOMESHARE not a good choice for “writable homedir” on Windows
• 810: cleanup util.path.get_home_dir
• 2: Fix the copyright statement in source code files to be accurate
• 1031: <esc> on Firefox crash websocket
• 684: %Store eliminated in configuration and magic commands in 0.11
• 1026: BUG: wrong default parameter in ask_yes_no
• 880: Better error message if %paste fails
• 1024: autopx magic broken
• 822: Unicode bug in Itpl when expanding shell variables in sysext with !
• 1009: Windows: regression in cd magic handling of paths
• 833: Crash python with matplotlib and unequal length arrays
• 695: Crash handler initialization is too aggressive
• 1000: Remove duplicates when refilling readline history
• 992: Interrupting certain matplotlib operations leaves the inline backend ‘wedged’
• 942: number traits should cast if value doesn’t change
• 1006: ls crashes when run on a UNC path or with non-ascii args
• 944: Decide the default image format for inline figures: SVG or PNG?
• 842: Python 3 on Windows (pyreadline) - expected an object with the buffer interface
• 1002: ImportError due to incorrect version checking
• 1001: Ipython “source” command?
• 954: IPython embed doesn’t respect namespaces
• 681: pdb freezes inside qtconsole
• 698: crash report “TypeError: can only concatenate list (not “unicode”) to list”
• 978: ipython 0.11 buffers external command output till the cmd is done
• 952: Need user-facing warning in the browser if websocket connection fails
• 988: Error using idsavc
• 990: ipython notebook - kernel dies if matplotlib is not installed
• 752: Matplotlib figures showed only once in notebook
• 54: Exception hook should be optional for embedding IPython in GUIs
• 918: IPython.frontend tests fail without tornado
• 986: Views created with t.direct_view() fail
• 697: Filter out from %who names loaded at initialization time
• 932: IPython 0.11 quickref card has superfluous ”%recall and”
• 982: png files with executable permissions
• 914: Simpler system for running code after InteractiveShell is initialised
• 911: ipython crashes on startup if readline is missing

2.15. Issues closed in the 0.12 development cycle
- 971: bookmarks created in 0.11 are corrupt in 0.12
- 974: object feature tab-completion crash
- 939: ZMQShell always uses default profile
- 946: Multi-tab Close action should offer option to leave all kernels alone
- 949: Test suite must not require any manual interaction
- 643: enable gui eventloop integration in ipkernel
- 965: ipython is crashed without launch.(python3.2)
- 958: Can’t use os X clipboard on with qtconsole
- 962: Don’t require tornado in the tests
- 960: crash on syntax error on Windows XP
- 934: The latest ipython branch doesn’t work in Chrome
- 870: zmq version detection
- 943: HISTIGNORE for IPython
- 947: qtconsole segfaults at startup
- 903: Expose a magic to control config of the inline pylab backend
- 908: bad user config shouldn’t crash IPython
- 935: Typing break causes IPython to crash.
- 869: Tab completion of ~/ shows no output post 0.10.x
- 904: whos under pypy1.6
- 773: check_security_dir() and check_pid_dir() fail on network filesystem
- 915: OS X Lion Terminal.app line wrap problem
- 886: Notebook kernel crash when specifying –notebook-dir on commandline
- 636: debugger.py: pydb broken
- 808: Ctrl+C during %reset confirm message crash Qtconsole
- 927: Using return outside a function crashes ipython
- 919: Pop-up segfault when moving cursor out of qtconsole window
- 181: cls command does not work on windows
- 917: documentation typos
- 818: %run does not work with non-ascii characters in path
- 907: Errors in custom completer functions can crash IPython
- 867: doc: notebook password authentication howto
- 211: paste command not working
- 900: Tab key should insert 4 spaces in qt console
- 513: [Qt console] cannot insert new lines into console functions using tab
- 906: qtconsoleapp ‘parse_command_line’ doesn’t like –existing anymore
- 638: Qt console –pylab=inline and getfigs(), etc.
2.15. Issues closed in the 0.12 development cycle

- 710: unwanted unicode passed to args
- 436: Users should see tooltips for all buttons in the notebook UI
- 207: ipython crashes if atexit handler raises exception
- 692: use of Tracer() when debugging works but gives error messages
- 690: debugger does not print error message by default in 0.11
- 571: history of multiline entries
- 749: IPython.parallel test failure under Windows 7 and XP
- 890: ipclusterapp.py - helep
- 885: ws-hostname alias not recognized by notebook
- 881: Missing manual.pdf?
- 744: cannot create notebook in offline mode if mathjax not installed
- 865: Make tracebacks from %paste show the code
- 535: exception unicode handling in %run is faulty in qtconsole
- 817: iPython crashed
- 799: %edit magic not working on windows xp in qtconsole
- 732: QTConsole wrongly promotes the index of the input line on which user presses Enter
- 662: ipython test failures on Mac OS X Lion
- 650: Handle bad config files better
- 829: We should not insert new lines after all print statements in the notebook
- 874: ipython-qtconsole: pyzmq Version Comparison
- 640: matplotlib macosx windows don’t respond in qtconsole
- 624: ipython intermittently segfaults when figure is closed (Mac OS X)
- 871: Notebook crashes if a profile is used
- 56: Have %cpaste accept also Ctrl-D as a termination marker
- 849: Command line options to not override profile options
- 806: Provide single-port connection to kernels
- 691: [wishlist] Automatically find existing kernel
- 688: local security vulnerability: all ports visible to any local user.
- 866: DistributionNotFound on running ipython 0.11 on Windows XP x86
- 673: raw_input appears to be round-robin for qtconsole
- 863: Graceful degradation when home directory not writable
- 800: Timing scripts with run -t -N <N> fails on report output
- 858: Typing ‘continue’ makes ipython0.11 crash
- 840: all processes run on one CPU core
- 843: “import braces” crashes ipython
- 836: Strange Output after IPython Install
• 839: Qtconsole segfaults when mouse exits window with active tooltip
• 827: Add support for checking several limits before running task on engine
• 826: Add support for creation of parallel task when no engine is running
• 832: Improve error message for %logstop
• 831: %logstart in read-only directory forbid any further command
• 814: ipython does not start – DistributionNotFound
• 794: Allow >1 controller per profile
• 820: Tab Completion feature
• 812: Qt console crashes on Ubuntu 11.10
• 816: Import error using Python 2.7 and dateutil2.0 No module named _thread
• 756: qtconsole Windows fails to print error message for ‘%run nonexistent_file’
• 651: Completion doesn’t work on element of a list
• 617: [qtconsole] %hist doesn’t show anything in qtconsole
• 786: from __future__ import unicode_literals does not work
• 779: Using ipunner from virtual env uses systemwide ipython
• 768: codepage handling of output from scripts and shellcommands are not handled properly by qtconsole
• 785: Don’t strip leading whitespace in repr() in notebook
• 737: in pickleshare.py line52 should be “if not os.path.isdir(self.root):”?
• 738: in ipthon_win_post_install.py line 38
• 777: print(…, sep=…) raises SyntaxError
• 728: ipcontroller crash with MPI
• 780: qtconsole Out value prints before the print statements that precede it
• 632: IPython Crash Report (0.10.2)
• 253: Unable to install ipython on windows
• 80: Split IPClusterApp into multiple Application subclasses for each subcommand
• 34: non-blocking pendingResult partial results
• 739: Tests fail if tornado not installed
• 719: Better support Pypy
• 667: qtconsole problem with default pylab profile
• 661: ipythonrc referenced in magic command in 0.11
• 665: Source introspection with ?? is broken
• 724: crash - ipython qtconsole, %quickref
• 655: ipython with qtconsole crashes
• 593: HTML Notebook Prompt can be deleted . . .
• 563: use argparse instead of kvloader for flags&aliases
• 751: Tornado version greater than 2.0 needed for firefox 6
• 720: Crash report when importing easter egg
• 740: Ctrl-Enter clears line in notebook
• 772: ipengine fails on Windows with “XXX lineno: 355, opcode: 0”
• 771: Add python 3 tag to setup.py
• 767: non-ascii in __doc__ string crashes qtconsole kernel when showing tooltip
• 733: In Windows, %run fails to strip quotes from filename
• 721: no completion in emacs by ipython(ipython.el)
• 669: Do not accept an ipython_dir that’s not writeable
• 711: segfault on mac os x
• 500: “RuntimeError: Cannot change input buffer during execution” in console_widget.py
• 707: Copy and paste keyboard shortcuts do not work in Qt Console on OS X
• 478: PyZMQ’s use of memoryviews breaks reconstruction of numpy arrays
• 694: Turning off callout tips in qtconsole
• 704: return kills IPython
• 442: Users should have intelligent autoindenting in the notebook
• 615: Wireframe and implement a project dashboard page
• 614: Wireframe and implement a notebook dashboard page
• 606: Users should be able to use the notebook to import/export a notebook to .py or .rst
• 604: A user should be able to leave a kernel running in the notebook and reconnect
• 298: Users should be able to save a notebook and then later reload it
• 649: ipython qtconsole (v0.11): setting “c.IPythonWidget.in_prompt = ‘>>> ‘ crashes
• 672: What happened to Exit?
• 658: Put the InteractiveShellApp section first in the auto-generated config files
• 656: [suggestion] dependency checking for pyqt for Windows installer
• 654: broken documentation link on download page
• 653: Test failures in IPython.parallel

2.16 0.11 Series

2.16.1 Release 0.11

IPython 0.11 is a major overhaul of IPython, two years in the making. Most of the code base has been rewritten or at least reorganized, breaking backward compatibility with several APIs in previous versions. It is the first major release in two years, and probably the most significant change to IPython since its inception. We plan to have a relatively quick succession of releases, as people discover new bugs and regressions. Once we iron out any significant bugs in this process and settle down the new APIs, this series will become IPython 1.0. We encourage feedback now on the core APIs, which we hope to maintain stable during the 1.0 series.

Since the internal APIs have changed so much, projects using IPython as a library (as opposed to end-users of the application) are the most likely to encounter regressions or changes that break their existing use patterns. We will
make every effort to provide updated versions of the APIs to facilitate the transition, and we encourage you to contact us on the development mailing list with questions and feedback.

Chris Fonnesbeck recently wrote an excellent post that highlights some of our major new features, with examples and screenshots. We encourage you to read it as it provides an illustrated, high-level overview complementing the detailed feature breakdown in this document.

A quick summary of the major changes (see below for details):

• **Standalone Qt console**: a new rich console has been added to IPython, started with `ipython qtconsole`. In this application we have tried to retain the feel of a terminal for fast and efficient workflows, while adding many features that a line-oriented terminal simply can not support, such as inline figures, full multiline editing with syntax highlighting, graphical tooltips for function calls and much more. This development was sponsored by Enthought Inc.. See below for details.

• **High-level parallel computing with ZeroMQ**. Using the same architecture that our Qt console is based on, we have completely rewritten our high-level parallel computing machinery that in prior versions used the Twisted networking framework. While this change will require users to update their codes, the improvements in performance, memory control and internal consistency across our codebase convinced us it was a price worth paying. We have tried to explain how to best proceed with this update, and will be happy to answer questions that may arise. A full tutorial describing these features was presented at SciPy'11, more details below.

• **New model for GUI/plotting support in the terminal**. Now instead of the various `--Xthread` flags we had before, GUI support is provided without the use of any threads, by directly integrating GUI event loops with Python’s `PyOS_InputHook` API. A new command-line flag `--gui` controls GUI support, and it can also be enabled after IPython startup via the new `%gui` magic. This requires some changes if you want to execute GUI-using scripts inside IPython, see the GUI support section for more details.

• **A two-process architecture**. The Qt console is the first use of a new model that splits IPython between a kernel process where code is executed and a client that handles user interaction. We plan on also providing terminal and web-browser based clients using this infrastructure in future releases. This model allows multiple clients to interact with an IPython process through a well-documented messaging protocol using the ZeroMQ networking library.

• **Refactoring**. The entire codebase has been refactored, in order to make it more modular and easier to contribute to. IPython has traditionally been a hard project to participate because the old codebase was very monolithic. We hope this (ongoing) restructuring will make it easier for new developers to join us.

• **Vim integration**. Vim can be configured to seamlessly control an IPython kernel, see the files in `docs/examples/vim` for the full details. This work was done by Paul Ivanov, who prepared a nice video demonstration of the features it provides.

• **Integration into Microsoft Visual Studio**. Thanks to the work of the Microsoft Python Tools for Visual Studio team, this version of IPython has been integrated into Microsoft Visual Studio’s Python tools open source plugin. Details below.

• **Improved unicode support**. We closed many bugs related to unicode input.

• **Python 3**. IPython now runs on Python 3.x. See Python 3 support for details.

• **New profile model**. Profiles are now directories that contain all relevant information for that session, and thus better isolate IPython use-cases.

• **SQLite storage for history**. All history is now stored in a SQLite database, providing support for multiple simultaneous sessions that won’t clobber each other as well as the ability to perform queries on all stored data.

• **New configuration system**. All parts of IPython are now configured via a mechanism inspired by the Enthought Traits library. Any configurable element can have its attributes set either via files that now use real Python syntax or from the command-line.
• **Pasting of code with prompts.** IPython now intelligently strips out input prompts, be they plain Python ones (```>>>``` and `...`) or IPython ones (`In [N]:` and `...:`). More details [here](#).

**Authors and support**

Over 60 separate authors have contributed to this release, see [below](#) for a full list. In particular, we want to highlight the extremely active participation of two new core team members: Evan Patterson implemented the Qt console, and Thomas Kluyver started with our Python 3 port and by now has made major contributions to just about every area of IPython.

We are also grateful for the support we have received during this development cycle from several institutions:

• **Enthought Inc** funded the development of our new Qt console, an effort that required developing major pieces of underlying infrastructure, which now power not only the Qt console but also our new parallel machinery. We’d like to thank Eric Jones and Travis Oliphant for their support, as well as Ilan Schnell for his tireless work integrating and testing IPython in the Enthought Python Distribution.

• **Nipy/NIH:** funding via the NiPy project (NIH grant 5R01MH081909-02) helped us jumpstart the development of this series by restructuring the entire codebase two years ago in a way that would make modular development and testing more approachable. Without this initial groundwork, all the new features we have added would have been impossible to develop.

• **Sage/NSF:** funding via the grant Sage: Unifying Mathematical Software for Scientists, Engineers, and Mathematicians (NSF grant DMS-1015114) supported a meeting in spring 2011 of several of the core IPython developers where major progress was made integrating the last key pieces leading to this release.

• **Microsoft’s team working on Python Tools for Visual Studio** developed the integration of IPython into the Python plugin for Visual Studio 2010.

• **Google Summer of Code:** in 2010, we had two students developing prototypes of the new machinery that is now maturing in this release: [Omar Zapata](#) and [Gerardo Gutiérrez](#).

**Development summary: moving to Git and Github**

In April 2010, after one breakage too many with bzr, we decided to move our entire development process to Git and Github.com. This has proven to be one of the best decisions in the project’s history, as the combination of git and github have made us far, far more productive than we could be with our previous tools. We first converted our bzr repo to a git one without losing history, and a few weeks later ported all open Launchpad bugs to github issues with their comments mostly intact (modulo some formatting changes). This ensured a smooth transition where no development history or submitted bugs were lost. Feel free to use our little Launchpad to Github issues porting script if you need to make a similar transition.

These simple statistics show how much work has been done on the new release, by comparing the current code to the last point it had in common with the 0.10 series. A huge diff and ~2200 commits make up this cycle:

```
$ git diff $(git merge-base 0.10.2 HEAD) | wc -l
288019

$ git log $(git merge-base 0.10.2 HEAD)..HEAD --oneline | wc -l
2200
```

Since our move to github, 511 issues were closed, 226 of which were pull requests and 285 regular issues ([a full list with links](#) is available for those interested in the details). Github’s pull requests are a fantastic mechanism for reviewing code and building a shared ownership of the project, and we are making enthusiastic use of it.
Note: This undercounts the number of issues closed in this development cycle, since we only moved to github for issue tracking in May 2010, but we have no way of collecting statistics on the number of issues closed in the old Launchpad bug tracker prior to that.

Qt Console

IPython now ships with a Qt application that feels very much like a terminal, but is in fact a rich GUI that runs an IPython client but supports inline figures, saving sessions to PDF and HTML, multiline editing with syntax highlighting, graphical calltips and much more:

We hope that many projects will embed this widget, which we’ve kept deliberately very lightweight, into their own environments. In the future we may also offer a slightly more featureful application (with menus and other GUI elements), but we remain committed to always shipping this easy to embed widget.

See the Jupyter Qt Console site for a detailed description of the console’s features and use.

High-level parallel computing with ZeroMQ

We have completely rewritten the Twisted-based code for high-level parallel computing to work atop our new ZeroMQ architecture. While we realize this will break compatibility for a number of users, we hope to make the transition as easy as possible with our docs, and we are convinced the change is worth it. ZeroMQ provides us with much tighter control over memory, higher performance, and its communications are impervious to the Python Global Interpreter Lock because they take place in a system-level C++ thread. The impact of the GIL in our previous code was something we could simply not work around, given that Twisted is itself a Python library. So while Twisted is a very capable framework, we think ZeroMQ fits our needs much better and we hope you will find the change to be a significant improvement in the long run.

Our manual contains a full description of how to use IPython for parallel computing, and the tutorial presented by Min Ragan-Kelley at the SciPy 2011 conference provides a hands-on complement to the reference docs.

Refactoring

As of this release, a signifiant portion of IPython has been refactored. This refactoring is founded on a number of new abstractions. The main new classes that implement these abstractions are:

- `traitlets.HasTraits`
- `traitlets.config.configurable.Configurable`
- `traitlets.config.application.Application`
- `traitlets.config.loader.ConfigLoader`
- `traitlets.config.loader.Config`

We are still in the process of writing developer focused documentation about these classes, but for now our configuration documentation contains a high level overview of the concepts that these classes express.

The biggest user-visible change is likely the move to using the config system to determine the command-line arguments for IPython applications. The benefit of this is that all configurable values in IPython are exposed on the command-line, but the syntax for specifying values has changed. The gist is that assigning values is pure Python assignment. Simple flags exist for commonly used options, these are always prefixed with `--`

The IPython command-line help has the details of all the options (via `ipython --help`), but a simple example should clarify things; the `pylab` flag can be used to start in pylab mode with the qt4 backend:
Fig. 5: The Qt console for IPython, using inline matplotlib plots.
ipython --pylab=qt

which is equivalent to using the fully qualified form:

ipython --TerminalIPythonApp.pylab=qt

The long-form options can be listed via ipython --help-all.

**ZeroMQ architecture**

There is a new GUI framework for IPython, based on a client-server model in which multiple clients can communicate with one IPython kernel, using the ZeroMQ messaging framework. There is already a Qt console client, which can be started by calling ipython qtconsole. The protocol is documented.

The parallel computing framework has also been rewritten using ZMQ. The protocol is described here, and the code is in the new IPython.parallel module.

**Python 3 support**

A Python 3 version of IPython has been prepared. For the time being, this is maintained separately and updated from the main codebase. Its code can be found here. The parallel computing components are not perfect on Python3, but most functionality appears to be working. As this work is evolving quickly, the best place to find updated information about it is our Python 3 wiki page.

**Unicode**

Entering non-ascii characters in unicode literals (u"Cø") now works properly on all platforms. However, entering these in byte/string literals ("Cø") will not work as expected on Windows (or any platform where the terminal encoding is not UTF-8, as it typically is for Linux & Mac OS X). You can use escape sequences ("\xe9\xe8") to get bytes above 128, or use unicode literals and encode them. This is a limitation of Python 2 which we cannot easily work around.

**Integration with Microsoft Visual Studio**

IPython can be used as the interactive shell in the Python plugin for Microsoft Visual Studio, as seen here:

The Microsoft team developing this currently has a release candidate out using IPython 0.11. We will continue to collaborate with them to ensure that as they approach their final release date, the integration with IPython remains smooth. We'd like to thank Dino Viehland and Shahrokh Mortazavi for the work they have done towards this feature, as well as Wenming Ye for his support of our WinHPC capabilities.

**Additional new features**

- Added Bytes traitlet, removing Str. All `string` traitlets should either be Unicode if a real string, or Bytes if a C-string. This removes ambiguity and helps the Python 3 transition.
- New magic `%loadpy` loads a python file from disk or web URL into the current input buffer.
- New magic `%pastebin` for sharing code via the ‘Lodge it’ pastebin.
- New magic `%precision` for controlling float and numpy pretty printing.
• IPython applications initiate logging, so any object can gain access to the logger of the currently running Application with:

```python
from traitlets.config.application import Application
logger = Application.instance().log
```

• You can now get help on an object halfway through typing a command. For instance, typing `a = zip?` shows the details of `zip()`. It also leaves the command at the next prompt so you can carry on with it.

• The input history is now written to an SQLite database. The API for retrieving items from the history has also been redesigned.

• The `IPython.extensions.pretty` extension has been moved out of quarantine and fully updated to the new extension API.

• New magics for loading/unloading/reloading extensions have been added: `%load_ext`, `%unload_ext` and `%reload_ext`.

• The configuration system and configuration files are brand new. See the configuration system documentation for more details.

• The `InteractiveShell` class is now a `Configurable` subclass and has traitlets that determine the defaults and runtime environment. The `__init__` method has also been refactored so this class can be instantiated and run without the old `ipmaker` module.

• The methods of `InteractiveShell` have been organized into sections to make it easier to turn more sections of functionality into components.

• The embedded shell has been refactored into a truly standalone subclass of `InteractiveShell` called `InteractiveShellEmbed`. All embedding logic has been taken out of the base class and put into the embedded subclass.

• Added methods of `InteractiveShell` to help it cleanup after itself. The `cleanup()` method controls this. We couldn’t do this in `__del__()` because we have cycles in our object graph that prevent it from being called.
• Created a new module `IPython.utils.importstring` for resolving strings like `foo.bar.Bar` to the actual class.

• Completely refactored the `IPython.core.prefilter` module into `Configurable` subclasses. Added a new layer into the prefilter system, called “transformations” that all new prefilter logic should use (rather than the older “checker/handler” approach).

• Aliases are now components (`IPython.core.alias`).

• New top level `embed()` function that can be called to embed IPython at any place in user’s code. On the first call it will create an `InteractiveShellEmbed` instance and call it. In later calls, it just calls the previously created `InteractiveShellEmbed`.

• Created a configuration system (`traitlets.config.configurable`) that is based on `traitlets`. Configurables are arranged into a runtime containment tree (not inheritance) that i) automatically propagates configuration information and ii) allows singletons to discover each other in a loosely coupled manner. In the future all parts of IPython will be subclasses of `Configurable`. All IPython developers should become familiar with the config system.

• Created a new `Config` for holding configuration information. This is a dict like class with a few extras: i) it supports attribute style access, ii) it has a merge function that merges two `Config` instances recursively and iii) it will automatically create sub-`Config` instances for attributes that start with an uppercase character.

• Created new configuration loaders in `traitlets.config.loader`. These loaders provide a unified loading interface for all configuration information including command line arguments and configuration files. We have two default implementations based on `argparse` and plain python files. These are used to implement the new configuration system.

• Created a top-level `Application` class in `IPython.core.application` that is designed to encapsulate the starting of any basic Python program. An application loads and merges all the configuration objects, constructs the main application, configures and initiates logging, and creates and configures any `Configurable` instances and then starts the application running. An extended `BaseIPythonApplication` class adds logic for handling the IPython directory as well as profiles, and all IPython entry points extend it.

• The `Type` and `Instance` traitlets now handle classes given as strings, like `foo.bar.Bar`. This is needed for forward declarations. But, this was implemented in a careful way so that string to class resolution is done at a single point, when the parent `HasTraitlets` is instantiated.

• `IPython.utils.ipstruct` has been refactored to be a subclass of dict. It also now has full docstrings and doctests.

• Created a Traits like implementation in `traitlets`. This is a pure Python, lightweight version of a library that is similar to Enthought’s Traits project, but has no dependencies on Enthought’s code. We are using this for validation, defaults and notification in our new component system. Although it is not 100% API compatible with Enthought’s Traits, we plan on moving in this direction so that eventually our implementation could be replaced by a (yet to exist) pure Python version of Enthought Traits.

• Added a new module `IPython.lib.inputhook` to manage the integration with GUI event loops using `PyOS_InputHook`. See the docstrings in this module or the main IPython docs for details.

• For users, GUI event loop integration is now handled through the new `%gui` magic command. Type `%gui?` at an IPython prompt for documentation.

• For developers `IPython.lib.inputhook` provides a simple interface for managing the event loops in their interactive GUI applications. Examples can be found in our `examples/lib` directory.

**Backwards incompatible changes**

• The Twisted-based `IPython.kernel` has been removed, and completely rewritten as `IPython.parallel`, using ZeroMQ.
• Profiles are now directories. Instead of a profile being a single config file, profiles are now self-contained directories. By default, profiles get their own IPython history, log files, and everything. To create a new profile, do `ipython profile create <name>`.

• All IPython applications have been rewritten to use `KeyValueConfigLoader`. This means that command-line options have changed. Now, all configurable values are accessible from the command-line with the same syntax as in a configuration file.

• The command line options `-wthread`, `-qthread` and `-gthread` have been removed. Use `--gui=wx`, `--gui=qt`, `--gui=gtk` instead.

• The extension loading functions have been renamed to `load_ipython_extension()` and `unload_ipython_extension()`.

• `InteractiveShell` no longer takes an embedded argument. Instead just use the `InteractiveShellEmbed` class.

• `__IPYTHON__` is no longer injected into `__builtin__`.

• `Struct.__init__()` no longer takes `None` as its first argument. It must be a `dict` or `Struct`.

• `immagic()` has been renamed ()

• The functions `ipmagic()` and `ipalias()` have been removed from `__builtins__`.

• The references to the global `InteractiveShell` instance (`_ip` and `__IP`) have been removed from the user’s namespace. They are replaced by a new function called `get_ipython()` that returns the current `InteractiveShell` instance. This function is injected into the user’s namespace and is now the main way of accessing the running IPython.

• Old style configuration files `ipythonrc` and `ipy_user_conf.py` are no longer supported. Users should migrate there configuration files to the new format described here and here.

• The old IPython extension API that relied on `ipapi()` has been completely removed. The new extension API is described here.

• Support for `qt3` has been dropped. Users who need this should use previous versions of IPython.

• Removed `shellglobals` as it was obsolete.

• Removed all the threaded shells in `IPython.core.shell`. These are no longer needed because of the new capabilities in `IPython.lib.inputhook`.

• New top-level sub-packages have been created: `IPython.core`, `IPython.lib`, `IPython.utils`, `IPython.deathrow`, `IPython.quarantine`. All existing top-level modules have been moved to appropriate sub-packages. All internal import statements have been updated and tests have been added. The build system (`setup.py` and friends) have been updated. See The IPython API for details of these new sub-packages.

• `IPython.ipapi` has been moved to `IPython.core.ipapi`. `IPython.Shell` and `IPython.iplib` have been split and removed as part of the refactor.

• Extensions has been moved to `extensions` and all existing extensions have been moved to either `IPython.quarantine` or `IPython.deathrow`. `IPython.quarantine` contains modules that we plan on keeping but that need to be updated. `IPython.deathrow` contains modules that are either dead or that should be maintained as third party libraries.

• Previous IPython GUIS in `IPython.frontend` and `IPython.gui` are likely broken, and have been removed to `IPython.deathrow` because of the refactoring in the core. With proper updates, these should still work.
Known Regressions

We do our best to improve IPython, but there are some known regressions in 0.11 relative to 0.10.2. First of all, there are features that have yet to be ported to the new APIs, and in order to ensure that all of the installed code runs for our users, we have moved them to two separate directories in the source distribution, quarantine and deathrow. Finally, we have some other miscellaneous regressions that we hope to fix as soon as possible. We now describe all of these in more detail.

Quarantine

These are tools and extensions that we consider relatively easy to update to the new classes and APIs, but that we simply haven’t had time for. Any user who is interested in one of these is encouraged to help us by porting it and submitting a pull request on our development site.

Currently, the quarantine directory contains:

<table>
<thead>
<tr>
<th>clearcmd.py</th>
<th>ipy_fsops.py</th>
<th>ipy_signals.py</th>
</tr>
</thead>
<tbody>
<tr>
<td>envpersist.py</td>
<td>ipy_gnuglobal.py</td>
<td>ipy_synchronize_with.py</td>
</tr>
<tr>
<td>ext_rescapture.py</td>
<td>ipy_greedycompleter.py</td>
<td>ipy_system_conf.py</td>
</tr>
<tr>
<td>InterpreterExec.py</td>
<td>ipy_jot.py</td>
<td>ipy_which.py</td>
</tr>
<tr>
<td>ipy_app_completers.py</td>
<td>ipy_lookfor.py</td>
<td>ipy_winpdb.py</td>
</tr>
<tr>
<td>ipy_autoreload.py</td>
<td>ipy_profile_doctest.py</td>
<td>ipy_workdir.py</td>
</tr>
<tr>
<td>ipy_completers.py</td>
<td>ipy_pydb.py</td>
<td>jobctrl.py</td>
</tr>
<tr>
<td>ipy_editors.py</td>
<td>ipy_rehashdir.py</td>
<td>ledit.py</td>
</tr>
<tr>
<td>ipy_exportdb.py</td>
<td>ipy_render.py</td>
<td>pspersistence.py</td>
</tr>
<tr>
<td>ipy_extutil.py</td>
<td>ipy_server.py</td>
<td>win32clip.py</td>
</tr>
</tbody>
</table>

Deathrow

These packages may be harder to update or make most sense as third-party libraries. Some of them are completely obsolete and have been already replaced by better functionality (we simply haven’t had the time to carefully weed them out so they are kept here for now). Others simply require fixes to code that the current core team may not be familiar with. If a tool you were used to is included here, we encourage you to contact the dev list and we can discuss whether it makes sense to keep it in IPython (if it can be maintained).

Currently, the deathrow directory contains:

| astyle.py | ipy_defaults.py | ipy_vimserver.py |
| dtutils.py | ipy_kitcfg.py | numeric_formats.py |
| Gnuplot2.py | ipy_legacy.py | numutils.py |
| GnuplotInteractive.py | ipy_p4.py | outputtrap.py |
| GnuplotRuntime.py | ipy_profile_none.py | PhysicalQInput.py |
| ibrowse.py | ipy_profile_numpy.py | PhysicalQInteractive.py |
| igrid.py | ipy_profile_scipy.py | quitter.py |
| ipipe.py | ipy_profile_sh.py | scitedirector.py |
| iplib.py | ipy_profile_zope.py | Shell.py |
| ipy_constants.py | ipy_traits_completer.py | twshell.py |

Other regressions

- The machinery that adds functionality to the ‘sh’ profile for using IPython as your system shell has not been updated to use the new APIs. As a result, only the aesthetic (prompt) changes are still implemented. We intend to fix this by 0.12. Tracked as issue 547.
• The installation of scripts on Windows was broken without setuptools, so we now depend on setuptools on Windows. We hope to fix setuptools-less installation, and then remove the setuptools dependency. Issue 539.
• The directory history _dh is not saved between sessions. Issue 634.

Removed Features

As part of the updating of IPython, we have removed a few features for the purposes of cleaning up the codebase and interfaces. These removals are permanent, but for any item listed below, equivalent functionality is available.

• The magics Exit and Quit have been dropped as ways to exit IPython. Instead, the lowercase forms of both work either as a bare name (exit) or a function call (exit()). You can assign these to other names using exec_lines in the config file.

Credits

Many users and developers contributed code, features, bug reports and ideas to this release. Please do not hesitate in contacting us if we’ve failed to acknowledge your contribution here. In particular, for this release we have contribution from the following people, a mix of new and regular names (in alphabetical order by first name):

• Aenugu Sai Kiran Reddy <saikrn08-at-gmail.com>
• andy wilson <wilson.andrew.j+github-at-gmail.com>
• Antonio Cuni <antocuni>
• Barry Wark <barrywark-at-gmail.com>
• Beetoju Anuradha <canu.beethoju-at-gmail.com>
• Benjamin Ragan-Kelley <minrk-at-Mercury.local>
• Brad Reisfeld
• Brian E. Granger <ellisonbg-at-gmail.com>
• Christoph Gohlke <cogohlke-at-uci.edu>
• Cody Precord
• dan.milstein
• Darren Dale <dsdale24-at-gmail.com>
• Dav Clark <davclark-at-berkeley.edu>
• David Warde-Farley <wardefar-at-iro.umontreal.ca>
• epatters <ejpatters-at-gmail.com>
• epatters <epatters-at-caltech.edu>
• epatters <epatters-at-enthought.com>
• Eric Firing <efiring-at-hawaii.edu>
• Erik Tollerud <erik.tollerud-at-gmail.com>
• Evan Patterson <epatters-at-enthought.com>
• Fernando Perez <Fernando.Perez-at-berkeley.edu>
• Gael Varoquaux <gael.varoquaux-at-normalesup.org>
• Gerardo <muzgash-at-Muzpelheim>
• Jason Grout <jason.grout-at-drake.edu>
• John Hunter <jdh2358-at-gmail.com>
• Jens Hedegaard Nielsen <jenshnielsen-at-gmail.com>
• Johann Cohen-Tanugi <johann.cohantanugi-at-gmail.com>
• Jörgen Stenarson <jorgen.stenarson-at-bostream.nu>
• Justin Riley <justin.t.riley-at-gmail.com>
• Kiorky
• Laurent Dufrechou <laurent.dufrechou-at-gmail.com>
• Luis Pedro Coelho <lpc-at-cmu.edu>
• Mani chandra <mchandra-at-iitk.ac.in>
• Mark E. Smith
• Mark Voorhies <mark.voorhies-at-ucsf.edu>
• Martin Spacek <git-at-mspacek.mm.st>
• Michael Droettboom <mdroe-at-stsci.edu>
• MinRK <benjaminrk-at-gmail.com>
• muzuiget <muzuiget-at-gmail.com>
• Nick Tarleton <nick-at-quikey.com>
• Nicolas Rougier <Nicolas.rougier-at-inria.fr>
• Omar Andres Zapata Mesa <andresete.chaos-at-gmail.com>
• Paul Ivanov <pivanov314-at-gmail.com>
• Pauli Virtanen <pauli.virtanen-at-iki.fi>
• Prabhu Ramachandran
• Ramana <sramana9-at-gmail.com>
• Robert Kern <robert.kern-at-gmail.com>
• Sathesh Chandra <satheshchandra88-at-gmail.com>
• Satrajit Ghosh <satra-at-mit.edu>
• Sebastian Busch
• Skipper Seabold <jsseabold-at-gmail.com>
• Stefan van der Walt <bzw-at-mentat.za.net>
• Stephan Peijnik <debian-at-sp.or.at>
• Steven Bethard
• Thomas Kluyver <takowl-at-gmail.com>
• Thomas Spura <tomsipur-at-fedoraproject.org>
• Tom Fetherston <tfetherston-at-aol.com>
• Tom MacWright
• tzanko
2.17 Issues closed in the 0.11 development cycle

In this cycle, we closed a total of 511 issues, 226 pull requests and 285 regular issues; this is the full list (generated with the script tools/github_stats.py). We should note that a few of these were made on the 0.10.x series, but we have no automatic way of filtering the issues by branch, so this reflects all of our development over the last two years, including work already released in 0.10.2:

Pull requests (226):

- 620: Release notes and updates to GUI support docs for 0.11
- 642: fix typo in docs/examples/vim/README.rst
- 631: two-way vim-ipython integration
- 637: print is a function, this allows to properly exit ipython
- 635: support html representations in the notebook frontend
- 639: Updating the credits file
- 628: import pexpect from IPython.external in irunner
- 596: Irunner
- 598: Fix templates for CrashHandler
- 590: Desktop
- 600: Fix bug with non-ascii reprs inside pretty-printed lists.
- 618: I617
- 599: Gui Qt example and docs
- 619: manpage update
- 582: Updating sympy profile to match the exec_lines of isympy.
- 578: Check to see if correct source for decorated functions can be displayed
- 589: issue 588
- 591: simulate shell expansion on %run arguments, at least tilde expansion
- 576: Show message about %paste magic on an IndentationError
- 574: Getcwd
• 565: don’t move old config files, keep nagging the user
• 575: Added more docstrings to IPython.zmq.session.
• 567: fix trailing whitespace from resetting indentation
• 564: Command line args in docs
• 560: reorder qt support in kernel
• 561: command-line suggestions
• 556: qt_for_kernel: use matplotlib rcParams to decide between PyQt4 and PySide
• 557: Update usage.py to newapp
• 555: Rm default old config
• 552: update parallel code for py3k
• 504: Updating string formatting
• 551: Make pylab import all configurable
• 496: Qt editing keybindings
• 550: Support v2 PyQt4 APIs and PySide in kernel’s GUI support
• 546: doc update
• 548: Fix sympy profile to work with sympy 0.7.
• 542: issue 440
• 533: Remove unused configobj and validate libraries from externals.
• 538: fix various tests on Windows
• 540: support --pylab flag with deprecation warning
• 537: Docs update
• 536: setup.py install depends on setuptools on Windows
• 480: Get help mid-command
• 462: Str and Bytes traitlets
• 534: Handle unicode properly in IPython.zmq.iostream
• 527: ZMQ displayhook
• 526: Handle asynchronous output in Qt console
• 528: Do not import deprecated functions from external decorators library.
• 454: New BaseIPythonApplication
• 532: Zmq unicode
• 531: Fix Parallel test
• 525: fallback on lsof if otool not found in libedit detection
• 517: Merge IPython.parallel.streamsession into IPython.zmq.session
• 521: use dict.get(key) instead of dict[key] for safety from KeyErrors
• 492: add QtConsoleApp using newapplication
• 485: terminal IPython with newapp
• 486: Use newapp in parallel code
• 511: Add a new line before displaying multiline strings in the Qt console.
• 509: i508
• 501: ignore EINTR in channel loops
• 495: Better selection of Qt bindings when QT_API is not specified
• 498: Check for .pyd as extension for binary files.
• 494: QtConsole zoom adjustments
• 490: fix UnicodeEncodeError writing SVG string to .svg file, fixes #489
• 491: add QtConsoleApp using newapplication
• 479: embed() doesn’t load default config
• 483: Links launchpad -> github
• 419: %xdel magic
• 477: Add n to lines in the log
• 459: use os.system for shell.system in Terminal frontend
• 475: i473
• 471: Add test decorator onlyif_unicode_paths.
• 474: Fix support for raw GTK and WX matplotlib backends.
• 472: Kernel event loop is robust against random SIGINT.
• 460: Share code for magic_edit
• 469: Add exit code when running all tests with iptest.
• 464: Add home directory expansion to IPYTHON_DIR environment variables.
• 455: Bugfix with logger
• 448: Separate out skip_doctest decorator
• 453: Draft of new main BaseIPythonApplication.
• 452: Use list/tuple/dict/set subclass’s overridden __repr__ instead of the pretty
• 398: allow toggle of svg/png inline figure format
• 381: Support inline PNGs of matplotlib plots
• 413: Retries and Resubmit (#411 and #412)
• 370: Fixes to the display system
• 449: Fix issue 447 - inspecting old-style classes.
• 423: Allow type checking on elements of List,Tuple,Set traits
• 400: Config5
• 421: Generalise mechanism to put text at the next prompt in the Qt console.
• 443: pinfo code duplication
• 429: add check_pid, and handle stale PID info in ipcluster.
• 431: Fix error message in test_irunner

2.17. Issues closed in the 0.11 development cycle
• 427: handle different SyntaxError messages in test_irunner
• 424: Irunner test failure
• 430: Small parallel doc typo
• 422: Make ipython-qtconsole a GUI script
• 420: Permit kernel std* to be redirected
• 408: History request
• 388: Add Emacs-style kill ring to Qt console
• 414: Warn on old config files
• 415: Prevent prefilter from crashing IPython
• 418: Minor configuration doc fixes
• 407: Update What’s new documentation
• 410: Install notebook frontend
• 406: install IPython.zmq.gui
• 393: ipdir unicode
• 397: utils.io.Term.cin/out/err -> utils.io.stdin/out/err
• 389: DB fixes and Scheduler HWM
• 374: Various Windows-related fixes to IPython.parallel
• 362: fallback on defaultencoding if filesystemencoding is None
• 382: Shell’s reset method clears namespace from last %run command.
• 385: Update iptest exclusions (fix #375)
• 383: Catch errors in querying readline which occur with pyreadline.
• 373: Remove runlines etc.
• 364: Single output
• 372: Multiline input push
• 363: Issue 125
• 361: don’t rely on setuptools for readline dependency check
• 349: Fix %autopx magic
• 355: History save thread
• 356: Usability improvements to history in Qt console
• 357: Exit autocall
• 353: Rewrite quit()/exit()/Quit()/Exit() calls as magic
• 354: Cell tweaks
• 345: Attempt to address (partly) issue ipython/#342 by rewriting quit(), exit(), etc.
• 352: #342: Try to recover as intelligently as possible if user calls magic().
• 346: Dedent prefix bugfix + tests: #142
• 348: %reset doesn’t reset prompt number.
• 347: Make ip.reset() work the same in interactive or non-interactive code.
• 343: make readline a dependency on OSX
• 344: restore auto debug behavior
• 339: fix for issue 337: incorrect/phantom tooltips for magics
• 254: newparallel branch (add zmq.parallel submodule)
• 334: Hard reset
• 316: Unicode win process
• 332: AST splitter
• 325: Removetwisted
• 330: Magic pastebin
• 331: Tweak config loader for PyPy compatibility.
• 319: Rewrite code to restore readline history after an action
• 329: Do not store file contents in history when running a .ipy file.
• 179: Html notebook
• 323: Add missing external.pexpect to packages
• 295: Magic local scope
• 315: Unicode magic args
• 310: allow Unicode Command-Line options
• 313: Readline shortcuts
• 311: Qtconsole exit
• 312: History memory
• 294: Issue 290
• 292: Issue 31
• 252: Unicode issues
• 235: Fix history magic command’s bugs wrt to full history and add -O option to display full history
• 236: History minus p flag
• 261: Adapt magic commands to new history system.
• 282: SQLite history
• 191: Unbundle external libraries
• 199: Magic arguments
• 204: Emacs completion bugfix
• 293: Issue 133
• 249: Writing unicode characters to a log file. (IPython 0.10.2.git)
• 283: Support for 256-color escape sequences in Qt console

2.17. Issues closed in the 0.11 development cycle
• 281: Refactored and improved Qt console’s HTML export facility
• 237: Fix185 (take two)
• 251: Issue 129
• 278: add basic XDG_CONFIG_HOME support
• 275: inline pylab cuts off labels on log plots
• 280: Add %precision magic
• 259: Pyside support
• 193: Make ipython cProfile-able
• 272: Magic examples
• 219: Doc magic pycat
• 221: Doc magic alias
• 230: Doc magic edit
• 224: Doc magic cpaste
• 229: Doc magic pdef
• 273: Docs build
• 228: Doc magic who
• 233: Doc magic cd
• 226: Doc magic pwd
• 218: Doc magic history
• 231: Doc magic reset
• 225: Doc magic save
• 222: Doc magic timeit
• 223: Doc magic colors
• 203: Small typos in zmq/blockingkernelmanager.py
• 227: Doc magic logon
• 232: Doc magic profile
• 264: Kernel logging
• 220: Doc magic edit
• 268: PyZMQ >= 2.0.10
• 267: GitHub Pages (again)
• 266: OSX-specific fixes to the Qt console
• 255: Gitwash typo
• 265: Fix string input2
• 260: Kernel crash with empty history
• 243: New display system
• 242: Fix terminal exit
• 250: always use Session.send
• 239: Makefile command & script for GitHub Pages
• 244: My exit
• 234: Timed history save
• 217: Doc magic lsmagic
• 215: History fix
• 195: Formatters
• 192: Ready colorize bug
• 198: Windows workdir
• 174: Whitespace cleanup
• 188: Version info: update our version management system to use git.
• 158: Ready for merge
• 187: Resolved Print shortcut collision with ctrl-P emacs binding
• 183: cleanup of exit/quit commands for qt console
• 184: Logo added to sphinx docs
• 180: Cleanup old code
• 171: Expose Pygments styles as options
• 170: HTML Fixes
• 172: Fix del method exit test
• 164: Qt frontend shutdown behavior fixes and enhancements
• 167: Added HTML export
• 163: Execution refactor
• 159: Ipy3 preparation
• 155: Ready startup fix
• 152: 0.10.1 sge
• 151: mk_object_info -> object_info
• 149: Simple bug-fix

Regular issues (285):
• 630: new.py in pwd prevents ipython from starting
• 623: Execute DirectView commands while running LoadBalancedView tasks
• 437: Users should have autocompletion in the notebook
• 583: update manpages
• 594: irunner command line options defer to file extensions
• 603: Users should see colored text in tracebacks and the pager
• 597: UnicodeDecodeError: ‘ascii’ codec can’t decode byte 0xc2
• 608: Organize and layout buttons in the notebook panel sections

2.17. Issues closed in the 0.11 development cycle
• 609: Implement controls in the Kernel panel section
• 611: Add kernel status widget back to notebook
• 610: Implement controls in the Cell section panel
• 612: Implement Help panel section
• 621: [qtconsole] on windows xp, cannot PageUp more than once
• 616: Store exit status of last command
• 605: Users should be able to open different notebooks in the cwd
• 302: Users should see a consistent behavior in the Out prompt in the html notebook
• 435: Notebook should not import anything by default
• 595: qtconsole command issue
• 588: ipython-qtconsole uses 100% CPU
• 586: ? + plot() Command B0rks QTConsole Strangely
• 585: %pdoc throws Errors for classes without __init__ or docstring
• 584: %pdoc throws TypeError
• 580: Client instantiation AssertionError
• 569: UnicodeDecodeError during startup
• 572: Indented command hits error
• 573: -wthread breaks indent top-level statements
• 570: “–pylab inline” vs. “–pylab=inline”
• 566: Can’t use exec_file in config file
• 562: update docs to reflect ‘–args=values’
• 558: triple quote and %s at beginning of line
• 554: Update 0.11 docs to explain Qt console and how to do a clean install
• 553: embed() fails if config files not installed
• 8: Ensure %gui qt works with new Mayavi and pylab
• 269: Provide compatibility api for IPython.Shell().start().mainloop()
• 66: Update the main What’s New document to reflect work on 0.11
• 549: Don’t check for ‘linux2’ value in sys.platform
• 505: Qt windows created within imported functions won’t show()
• 545: qtconsole ignores exec_lines
• 371: segfault in qtconsole when kernel quits
• 377: Failure: error (nothing to repeat)
• 544: Ipython qtconsole pylab config issue.
• 543: RuntimeError in completer
• 440: %run filename autocompletion “The kernel heartbeat has been inactive . . . ” error
• 541: log_level is broken in the ipython Application
• 369: windows source install doesn’t create scripts correctly
• 351: Make sure that the Windows installer handles the top-level IPython scripts.
• 512: Two displayhooks in zmq
• 340: Make sure that the Windows HPC scheduler support is working for 0.11
• 98: Should be able to get help on an object mid-command
• 529: unicode problem in qtconsole for windows
• 476: Separate input area in Qt Console
• 175: Qt console needs configuration support
• 156: Key history lost when debugging program crash
• 470: decorator: uses deprecated features
• 30: readline in OS X does not have correct key bindings
• 503: merge IPython.parallel.streamsession and IPython.zmq.session
• 456: pathname in document punctuated by dots not slashes
• 451: Allow switching the default image format for inline mpl backend
• 79: Implement more robust handling of config stages in Application
• 522: Encoding problems
• 524: otool should not be unconditionally called on osx
• 523: Get profile and config file inheritance working
• 519: qtconsole –pure: “TypeError: string indices must be integers, not str”
• 516: qtconsole –pure: “KeyError: ‘ismagic’”
• 520: qtconsole –pure: “TypeError: string indices must be integers, not str”
• 450: resubmitted tasks sometimes stuck as pending
• 518: JSON serialization problems with ObjectId type (MongoDB)
• 178: Channels should be named for their function, not their socket type
• 515: [ipcluster] termination on os x
• 510: qtconsole: indentation problem printing numpy arrays
• 508: “AssertionError: Missing message part.” in ipython-qtconsole –pure
• 499: “ZMQError: Interrupted system call” when saving inline figure
• 426: %edit magic fails in qtconsole
• 497: Don’t show info from .pyd files
• 493: QFont::setPointSize: Point size <= 0 (0), must be greater than 0
• 489: UnicodeEncodeError in qt.svg.save_svg
• 458: embed() doesn’t load default config
• 488: Using IPython with RubyPython leads to problems with IPython.parallel.client.client.Client.__init()
• 401: Race condition when running lbview.apply() fast multiple times in loop
• 168: Scrub Launchpad links from code, docs

2.17. Issues closed in the 0.11 development cycle 237
• 141: garbage collection problem (revisited)
• 59: test_magic.test_obj_del fails on win32
• 457: Backgrounded Tasks not Allowed? (but easy to slip by . . . )
• 297: Shouldn’t use pexpect for subprocesses in in-process terminal frontend
• 110: magic to return exit status
• 473: OSX readline detection fails in the debugger
• 466: tests fail without unicode filename support
• 468: iptest script has 0 exit code even when tests fail
• 465: client.db_query() behaves different with SQLite and MongoDB
• 467: magic_install_default_config test fails when there is no .ipython directory
• 463: IPYTHON_DIR (and IPYTHONDIR) don’t expand tilde to ‘~’ directory
• 446: Test machinery is imported at normal runtime
• 438: Users should be able to use Up/Down for cell navigation
• 439: Users should be able to copy notebook input and output
• 291: Rename special display methods and put them lower in priority than display functions
• 447: Instantiating classes without __init__ function causes kernel to crash
• 444: Ctrl + t in WxIPython Causes Unexpected Behavior
• 445: qt and console Based Startup Errors
• 428: ipcluster doesn’t handle stale pid info well
• 434: 10.0.2 seg fault with rpy2
• 441: Allow running a block of code in a file
• 432: Silent request fails
• 409: Test failure in IPython.lib
• 402: History section of messaging spec is incorrect
• 88: Error when inputting UTF8 CJK characters
• 366: Ctrl-K should kill line and store it, so that Ctrl-y can yank it back
• 425: typo in %gui magic help
• 304: Persistent warnings if old configuration files exist
• 216: crash of ipython when alias is used with %s and echo
• 412: add support to automatic retry of tasks
• 411: add support to continue tasks
• 417: IPython should display things unsorted if it can’t sort them
• 416: wrong encode when printing unicode string
• 376: Failing InputsplitterTest
• 405: TraitError in traitlets.py(332) on any input
• 392: UnicodeEncodeError on start
2.17. Issues closed in the 0.11 development cycle

- 137: `sys.getfilesystemencoding` return value not checked
- 300: Users should be able to manage kernels and kernel sessions from the notebook UI
- 301: Users should have access to working Kernel, Tabs, Edit, Help menus in the notebook
- 396: Cursor move triggers a lot of IO access
- 379: Minor doc nit: –paging argument
- 399: Add task queue limit in engine when load-balancing
- 78: `StringTask` won’t take unicode code strings
- 391: `MongoDB.add_record()` does not work in 0.11dev
- 365: `newparallel` on Windows
- 386: FAIL: test that pushed functions have access to globals
- 387: Interactively defined functions can’t access user namespace
- 118: Snow Leopard `ipy_vimserver` POLL error
- 394: System escape interpreted in multi-line string
- 26: `find_job_cmd` is too hasty to fail on Windows
- 368: Installation instructions in dev docs are completely wrong
- 380: `qtconsole` pager RST - HTML not happening consistently
- 367: Qt console doesn’t support ibus input method
- 375: Missing libraries cause `ImportError` in tests
- 71: temp file errors in iptest IPython.core
- 350: Decide how to handle `displayhook` being triggered multiple times
- 360: Remove `runlines` method
- 125: Exec lines in config should not contribute to line numbering or history
- 20: Robust readline support on OS X’s built-in Python
- 147: On Windows, `%page` is being too restrictive to split line by `rn` only
- 326: Update docs and examples for parallel stuff to reflect movement away from Twisted
- 341: Fix Parallel Magics for `newparallel`
- 338: Usability improvements to Qt console
- 142: Unexpected auto-indenting when variables names that start with ‘pass’
- 296: Automatic PDB via `%pdb` doesn’t work
- 337: `exit()` and `quit()` in Qt console produces phantom signature/docstring popup, even though `quit()` or `exit()` raises `NameError`
- 318: `%debug` broken in master: invokes missing `save_history()` method
- 307: Lines ending with semicolon should not go to cache
- 104: have `ipengine` run start-up scripts before registering with the controller
- 33: The `skip_doctest` decorator is failing to work on `Shell.MatplotlibShellBase.magic_run`
- 336: Missing figure development/figs/iopubfade.png for docs
• 49: %clear should also delete _NN references and Out[NN] ones
• 335: using setuptools installs every script twice
• 306: multiline strings at end of input cause noop
• 327: PyPy compatibility
• 328: %run script.ipyn raises “ERROR! Session/line number was not unique in database.”
• 7: Update the changes doc to reflect the kernel config work
• 303: Users should be able to scroll a notebook w/o moving the menu/buttons
• 322: Embedding an interactive IPython shell
• 321: %debug broken in master
• 287: Crash when using %macros in sqlite-history branch
• 55: Can’t edit files whose names begin with numbers
• 284: In variable no longer works in 0.11
• 92: Using multiprocessing module crashes parallel IPython
• 262: Fail to recover history after force-kill.
• 320: Tab completing re.search objects crashes IPython
• 317: IPython.kernel: parallel map issues
• 197: ipython-qtconsole unicode problem in magic ls
• 305: more readline shortcuts in qtconsole
• 314: Multi-line, multi-block cells can’t be executed.
• 308: Test suite should set sqlite history to work in :memory:
• 202: Matplotlib native ‘MacOSX’ backend broken in ‘-pylab’ mode
• 196: IPython can’t deal with unicode file name.
• 25: unicode bug - encoding input
• 290: try/except/else clauses can’t be typed, code input stops too early.
• 43: Implement SSH support in ipcluster
• 6: Update the Sphinx docs for the new ipcluster
• 9: Getting “DeadReferenceError: Calling Stale Broker” after ipcontroller restart
• 132: Ipython prevent south from working
• 27: generics.complete_object broken
• 60: Improve absolute import management for iptest.py
• 31: Issues in magic_whos code
• 52: Document testing process better
• 44: Merge history from multiple sessions
• 182: ipython q4thread in version 10.1 not starting properly
• 143: Ipython.gui.wx.ipython_view.IPShellWidget: ignores user*ns arguments
• 127: %edit does not work on filenames consisted of pure numbers
• 126: Can’t transfer command line argument to script
• 28: Offer finer control for initialization of input streams
• 58: ipython change char ‘0xe9’ to 4 spaces
• 68: Problems with Control-C stopping ipcluster on Windows/Python2.6
• 24: ipcluster does not start all the engines
• 240: Incorrect method displayed in %psource
• 120: inspect.getsource fails for functions defined on command line
• 212: IPython ignores exceptions in the first evaluation of class attrs
• 108: ipython disables python logger
• 100: Overzealous introspection
• 18: %cpaste freeze sync frontend
• 200: Unicode error when starting ipython in a folder with non-ascii path
• 130: Deadlock when importing a module that creates an IPython client
• 134: multiline block scrolling
• 46: Input to %timeit is not preparsed
• 285: ipcluster local -n 4 fails
• 205: In the Qt console, Tab should insert 4 spaces when not completing
• 145: Bug on MSW sytems: idle can not be set as default IPython editor. Fix Suggested.
• 77: ipython oops in cygwin
• 121: If plot windows are closed via window controls, no more plotting is possible.
• 111: Iterator version of TaskClient.map() that returns results as they become available
• 109: WinHPCLauncher is a hard dependency that causes errors in the test suite
• 86: Make IPython work with multiprocessing
• 15: Implement SGE support in ipcluster
• 3: Implement PBS support in ipcluster
• 53: Internal Python error in the inspect module
• 74: Manager() [from multiprocessing module] hangs ipythonx but not ipython
• 51: Out not working with ipythonx
• 201: use session.send throughout zmq code
• 115: multiline specials not defined in 0.11 branch
• 93: when looping, cursor appears at leftmost point in newline
• 133: whitespace after Source introspection
• 50: Ctrl-C with -gthread on Windows, causes uncaught IOError
• 65: Do not use .message attributes in exceptions, deprecated in 2.6
• 76: syntax error when raise is inside except process
• 107: bdist_rpm causes traceback looking for a non-existant file

2.17. Issues closed in the 0.11 development cycle 241
• 113: initial magic ? (question mark) fails before wildcard
• 128: Pdb instance has no attribute ‘curframe’
• 139: running with -pylab pollutes namespace
• 140: malloc error during tab completion of numpy array member functions starting with ‘c’
• 153: ipy_vimserver traceback on Windows
• 154: using ipython in Slicer3 show how os.environ[‘HOME’] is not defined
• 185: show() blocks in pylab mode with ipython 0.10.1
• 189: Crash on tab completion
• 274: bashism in sshx.sh
• 276: Calling sip.setapi does not work if app has already imported from PyQt4
• 277: matplotlib.image imgshow from 10.1 segfault
• 288: Incorrect docstring in zmq/kernelmanager.py
• 286: Fix IPython.Shell compatibility layer
• 99: blank lines in history
• 129: psearch: TypeError: expected string or buffer
• 190: Add option to format float point output
• 246: Application not conforms XDG Base Directory Specification
• 48: IPython should follow the XDG Base Directory spec for configuration
• 176: Make client-side history persistence readline-independent
• 279: Backtraces when using ipdb do not respect -colour LightBG setting
• 119: Broken type filter in magic_who_ls
• 271: Intermittent problem with print output in Qt console.
• 270: Small typo in IPython developer’s guide
• 166: Add keyboard accelerators to Qt close dialog
• 173: asymmetrical ctrl-A/ctrl-E behavior in multiline
• 45: Autosave history for robustness
• 162: make command history persist in ipythonqt
• 161: make ipythonqt exit without dialog when exit() is called
• 263: [ipython + numpy] Some test errors
• 256: reset docstring ipython 0.10
• 258: allow caching to avoid matplotlib object references
• 248: Can’t open and read files after upgrade from 0.10 to 0.10.0
• 247: ipython + Stackless
• 245: Magic save and macro missing newlines, line ranges don’t match prompt numbers.
• 241: “exit” hangs on terminal version of IPython
• 213: ipython -pylab no longer plots interactively on 0.10.1
• 4: wx frontend don’t display well commands output
• 5: ls command not supported in ipython wx frontend
• 1: Document winhpcjob.py and launcher.py
• 83: Usage of testing.util.DeferredTestCase should be replace with twisted.trial.unittest.TestCase
• 117: Redesign how Component instances are tracked and queried
• 47: IPython.kernel.client cannot be imported inside an engine
• 105: Refactor the task dependencies system
• 210: 0.10.1 doc mistake - New IPython Sphinx directive error
• 209: can’t activate IPython parallel magics
• 206: Buggy linewrap in Mac OSX Terminal
• 194: !sudo <command> displays password in plain text
• 186: %edit issue under OS X 10.5 - IPython 0.10.1
• 11: Create a daily build PPA for ipython
• 144: logo missing from sphinx docs
• 181: cls command does not work on windows
• 169: Kernel can only be bound to localhost
• 36: tab completion does not escape ()
• 177: Report tracebacks of interactively entered input
• 148: dictionary having multiple keys having frozenset fails to print on iPython
• 160: magic_gui throws TypeError when gui magic is used
• 150: History entries ending with parentheses corrupt command line on OS X 10.6.4
• 146: -ipythondir - using an alternative .ipython dir for rc type stuff
• 114: Interactive strings get mangled with “_ip.magic”
• 135: crash on invalid print
• 69: Usage of “mycluster” profile in docs and examples
• 37: Fix colors in output of ResultList on Windows

2.18 0.10 series

2.18.1 Release 0.10.2

IPython 0.10.2 was released April 9, 2011. This is a minor bugfix release that preserves backward compatibility. At this point, all IPython development resources are focused on the 0.11 series that includes a complete architectural restructuring of the project as well as many new capabilities, so this is likely to be the last release of the 0.10.x series. We have tried to fix all major bugs in this series so that it remains a viable platform for those not ready yet to transition to the 0.11 and newer codebase (since that will require some porting effort, as a number of APIs have changed).

Thus, we are not opening a 0.10.3 active development branch yet, but if the user community requires new patches and is willing to maintain/release such a branch, we’ll be happy to host it on the IPython github repositories.
Highlights of this release:

- The main one is the closing of github ticket #185, a major regression we had in 0.10.1 where pylab mode with GTK (or gthread) was not working correctly, hence plots were blocking with GTK. Since this is the default matplotlib backend on Unix systems, this was a major annoyance for many users. Many thanks to Paul Ivanov for helping resolve this issue.
- Fix IOError bug on Windows when used with -gthread.
- Work robustly if $HOME is missing from environment.
- Better POSIX support in ssh scripts (remove bash-specific idioms).
- Improved support for non-ascii characters in log files.
- Work correctly in environments where GTK can be imported but not started (such as a linux text console without X11).

For this release we merged 24 commits, contributed by the following people (please let us know if we omitted your name and we’ll gladly fix this in the notes for the future):

- Fernando Perez
- MinRK
- Paul Ivanov
- Pieter Cristiaan de Groot
- TvrtkoM

2.18.2 Release 0.10.1

IPython 0.10.1 was released October 11, 2010, over a year after version 0.10. This is mostly a bugfix release, since after version 0.10 was released, the development team’s energy has been focused on the 0.11 series. We have nonetheless tried to backport what fixes we could into 0.10.1, as it remains the stable series that many users have in production systems they rely on.

Since the 0.11 series changes many APIs in backwards-incompatible ways, we are willing to continue maintaining the 0.10.x series. We don’t really have time to actively write new code for 0.10.x, but we are happy to accept patches and pull requests on the IPython github site. If sufficient contributions are made that improve 0.10.1, we will roll them into future releases. For this purpose, we will have a branch called 0.10.2 on github, on which you can base your contributions.

For this release, we applied approximately 60 commits totaling a diff of over 7000 lines:

```
(0.10.1)amirbar[dist] $ git diff --oneline rel-0.10.. | wc -l
7296
```

Highlights of this release:

- The only significant new feature is that IPython’s parallel computing machinery now supports natively the Sun Grid Engine and LSF schedulers. This work was a joint contribution from Justin Riley, Satra Ghosh and Matthieu Brucher, who put a lot of work into it. We also improved traceback handling in remote tasks, as well as providing better control for remote task IDs.
- New IPython Sphinx directive contributed by John Hunter. You can use this directive to mark blocks in reStructuredText documents containing IPython syntax (including figures) and the will be executed during the build:
In [2]: plt.figure()  # ensure a fresh figure

@savefig psimple.png width=4in
In [3]: plt.plot([1,2,3])
Out[3]: [<matplotlib.lines.Line2D object at 0x9b74d8c>]

- Various fixes to the standalone ipython-wx application.
- We now ship internally the excellent argparse library, graciously licensed under BSD terms by Steven Bethard. Now (2010) that argparse has become part of Python 2.7 this will be less of an issue, but Steven’s relicensing allowed us to start updating IPython to using argparse well before Python 2.7. Many thanks!
- Robustness improvements so that IPython doesn’t crash if the readline library is absent (though obviously a lot of functionality that requires readline will not be available).
- Improvements to tab completion in Emacs with Python 2.6.
- Logging now supports timestamps (see %logstart? for full details).
- A long-standing and quite annoying bug where parentheses would be added to print statements, under Python 2.5 and 2.6, was finally fixed.
- Improved handling of libreadline on Apple OSX.
- Fix reload method of IPython demos, which was broken.
- Fixes for the ipipe/ibrowse system on OSX.
- Fixes for Zope profile.
- Fix %timeit reporting when the time is longer than 1000s.
- Avoid lockups with ? or ?? in SunOS, due to a bug in termios.
- The usual assortment of miscellaneous bug fixes and small improvements.

The following people contributed to this release (please let us know if we omitted your name and we’ll gladly fix this in the notes for the future):

- Beni Cherniavsky
- Boyd Waters.
- David Warde-Farley
- Fernando Perez
- Gökhan Sever
- John Hunter
- Justin Riley
- Kiorky
- Laurent Dufrechou
- Mark E. Smith
- Matthieu Brucher
- Satrajit Ghosh
- Sebastian Busch
- Václav Šmilauer
2.18.3 Release 0.10

This release brings months of slow but steady development, and will be the last before a major restructuring and cleanup of IPython’s internals that is already under way. For this reason, we hope that 0.10 will be a stable and robust release so that while users adapt to some of the API changes that will come with the refactoring that will become IPython 0.11, they can safely use 0.10 in all existing projects with minimal changes (if any).

IPython 0.10 is now a medium-sized project, with roughly (as reported by David Wheeler’s slocount utility) 40750 lines of Python code, and a diff between 0.9.1 and this release that contains almost 28000 lines of code and documentation. Our documentation, in PDF format, is a 495-page long PDF document (also available in HTML format, both generated from the same sources).

Many users and developers contributed code, features, bug reports and ideas to this release. Please do not hesitate in contacting us if we’ve failed to acknowledge your contribution here. In particular, for this release we have contribution from the following people, a mix of new and regular names (in alphabetical order by first name):

- Alexander Clausen: fix #341726.
- Brian Granger: lots of work everywhere (features, bug fixes, etc).
- Daniel Ashbrook: bug report on MemoryError during compilation, now fixed.
- Darren Dale: improvements to documentation build system, feedback, design ideas.
- Fernando Perez: various places.
- Gaël Varoquaux: core code, ipythonx GUI, design discussions, etc. Lots…
- Jorgen Stenarson: work on many fronts, tests, fixes, win32 support, etc.
- Laurent Dufréchou: many improvements to ipython-wx standalone app.
- Lukasz Pankowski: prefilter, %edit, demo improvements.
- Matt Foster: TextMate support in %edit.
- Nathaniel Smith: fix #237073.
- Pauli Virtanen: fixes and improvements to extensions, documentation.
- Prabhu Ramachandran: improvements to %timeit.
- Robert Kern: several extensions.
- Sameer D’Costa: help on critical bug #269966.
- Stephan Peijnik: feedback on Debian compliance and many man pages.
- Steven Bethard: we are now shipping his argparse module.
- Tom Fetherston: many improvements to IPython.demo module.
- Ville Vainio: lots of work everywhere (features, bug fixes, etc).
- Vishal Vasta: ssh support in ipcluster.
- Walter Doerwald: work on the IPython.ipipe system.

Below we give an overview of new features, bug fixes and backwards-incompatible changes. For a detailed account of every change made, feel free to view the project log with bzr log.
New features

- **New %paste magic** automatically extracts current contents of clipboard and pastes it directly, while correctly handling code that is indented or prepended with `>>>` or `...` python prompt markers. A very useful new feature contributed by Robert Kern.

- IPython 'demos', created with the `IPython.demo` module, can now be created from files on disk or strings in memory. Other fixes and improvements to the demo system, by Tom Fetherston.

- **Added find_cmd() function to IPython.platutils module**, to find commands in a cross-platform manner.

- Many improvements and fixes to Gaël Varoquaux’s `ipythonx`, a WX-based lightweight IPython instance that can be easily embedded in other WX applications. These improvements have made it possible to now have an embedded IPython in Mayavi and other tools.

- **MultiengineClient objects now have a benchmark() method.**

- The manual now includes a full set of auto-generated API documents from the code sources, using Sphinx and some of our own support code. We are now using the Numpy Documentation Standard for all docstrings, and we have tried to update as many existing ones as possible to this format.

- The new `IPython.Extensions.ipy_pretty` extension by Robert Kern provides configurable pretty-printing.

- Many improvements to the `ipython-wx` standalone WX-based IPython application by Laurent Dufréchou. It can optionally run in a thread, and this can be toggled at runtime (allowing the loading of Matplotlib in a running session without ill effects).

- IPython includes a copy of Steven Bethard’s `argparse` in the `IPython.external` package, so we can use it internally and it is also available to any IPython user. By installing it in this manner, we ensure zero conflicts with any system-wide installation you may already have while minimizing external dependencies for new users. In IPython 0.10, We ship argparse version 1.0.

- An improved and much more robust test suite, that runs groups of tests in separate subprocesses using either Nose or Twisted’s `trial` runner to ensure proper management of Twisted-using code. The test suite degrades gracefully if optional dependencies are not available, so that the `iptest` command can be run with only Nose installed and nothing else. We also have more and cleaner test decorators to better select tests depending on runtime conditions, do setup/teardown, etc.

- The new ipcluster now has a fully working ssh mode that should work on Linux, Unix and OS X. Thanks to Vishal Vatsa for implementing this!

- The wonderful TextMate editor can now be used with `%edit` on OS X. Thanks to Matt Foster for this patch.

- The documentation regarding parallel uses of IPython, including MPI and PBS, has been significantly updated and improved.

- The developer guidelines in the documentation have been updated to explain our workflow using `bzr` and Launchpad.

- Fully refactored `ipcluster` command line program for starting IPython clusters. This new version is a complete rewrite and 1) is fully cross platform (we now use Twisted’s process management), 2) has much improved performance, 3) uses subcommands for different types of clusters, 4) uses argparse for parsing command line options, 5) has better support for starting clusters using `mpirun`, 6) has experimental support for starting engines using PBS. It can also reuse FURL files, by appropriately passing options to its subcommands. However, this new version of ipcluster should be considered a technology preview. We plan on changing the API in significant ways before it is final.

- Full description of the security model added to the docs.

- cd completer: show bookmarks if no other completions are available.
• sh profile: easy way to give ‘title’ to prompt: assign to variable ‘_prompt_title’. It looks like this:

```
[~]|1> _prompt_title = 'sudo!'
sudo!|2>
```

• %edit: If you do ‘%edit pasted_block’, pasted_block variable gets updated with new data (so repeated editing makes sense)

**Bug fixes**

• Fix #368719, removed top-level debian/ directory to make the job of Debian packagers easier.
• Fix #291143 by including man pages contributed by Stephan Peijnik from the Debian project.
• Fix #358202, effectively a race condition, by properly synchronizing file creation at cluster startup time.
• %timeit now handles correctly functions that take a long time to execute even the first time, by not repeating them.
• Fix #239054, releasing of references after exiting.
• Fix #341726, thanks to Alexander Clausen.
• Fix #269966. This long-standing and very difficult bug (which is actually a problem in Python itself) meant long-running sessions would inevitably grow in memory size, often with catastrophic consequences if users had large objects in their scripts. Now, using %run repeatedly should not cause any memory leaks. Special thanks to John Hunter and Sameer D’Costa for their help with this bug.
• Fix #295371, bug in %history.
• Improved support for py2exe.
• Fix #270856: IPython hangs with PyGTK
• Fix #270998: A magic with no docstring breaks the ‘%magic magic’
• fix #271684: -c startup commands screw up raw vs. native history
• Numerous bugs on Windows with the new ipcluster have been fixed.
• The ipengine and ipcontroller scripts now handle missing furl files more gracefully by giving better error messages.
• %rehashx: Aliases no longer contain dots. python3.0 binary will create alias python30. Fixes: #259716 “commands with dots in them don’t work”
• %cpaste: %cpaste -r repeats the last pasted block. The block is assigned to pasted_block even if code raises exception.
• Bug #274067 ‘The code in get_home_dir is broken for py2exe’ was fixed.
• Many other small bug fixes not listed here by number (see the bzr log for more info).

**Backwards incompatible changes**

• ipykit and related files were unmaintained and have been removed.
• The IPython.genutils.doctest_reload() does not actually call reload(doctest) anymore, as this was causing many problems with the test suite. It still resets doctest.master to None.
• While we have not deliberately broken Python 2.4 compatibility, only minor testing was done with Python 2.4, while 2.5 and 2.6 were fully tested. But if you encounter problems with 2.4, please do report them as bugs.
• The `ipcluster` now requires a mode argument; for example to start a cluster on the local machine with 4 engines, you must now type:

```bash
$ ipcluster local -n 4
```

• The controller now has a `-r` flag that needs to be used if you want to reuse existing furl files. Otherwise they are deleted (the default).

• Remove `ipy_leo.py`. You can use `easy_install ipython-extension` to get it. (done to decouple it from ipython release cycle)

### 2.19 0.9 series

#### 2.19.1 Release 0.9.1

This release was quickly made to restore compatibility with Python 2.4, which version 0.9 accidentally broke. No new features were introduced, other than some additional testing support for internal use.

#### 2.19.2 Release 0.9

**New features**

• All furl files and security certificates are now put in a read-only directory named `~/.ipython/security`.

• A single function `get_ipython_dir()`, in `IPython.genutils` that determines the user’s IPython directory in a robust manner.

• Laurent’s WX application has been given a top-level script called `ipython-wx`, and it has received numerous fixes. We expect this code to be architecturally better integrated with Gael’s WX ‘ipython widget’ over the next few releases.

• The Editor synchronization work by Vivian De Smedt has been merged in. This code adds a number of new editor hooks to synchronize with editors under Windows.

• A new, still experimental but highly functional, WX shell by Gael Varoquaux. This work was sponsored by Enthought, and while it’s still very new, it is based on a more cleanly organized architecture of the various IPython components. We will continue to develop this over the next few releases as a model for GUI components that use IPython.

• Another GUI frontend, Cocoa based (Cocoa is the OSX native GUI framework), authored by Barry Wark. Currently the WX and the Cocoa ones have slightly different internal organizations, but the whole team is working on finding what the right abstraction points are for a unified codebase.

• As part of the frontend work, Barry Wark also implemented an experimental event notification system that various ipython components can use. In the next release the implications and use patterns of this system regarding the various GUI options will be worked out.

• IPython finally has a full test system, that can test docstrings with IPython-specific functionality. There are still a few pieces missing for it to be widely accessible to all users (so they can run the test suite at any time and report problems), but it now works for the developers. We are working hard on continuing to improve it, as this was probably IPython’s major Achilles heel (the lack of proper test coverage made it effectively impossible to do large-scale refactoring). The full test suite can now be run using the `iptest` command line program.

• The notion of a task has been completely reworked. An `ITask` interface has been created. This interface defines the methods that tasks need to implement. These methods are now responsible for things like submitting tasks and processing results. There are two basic task types: `IPython.kernel.task.StringTask` (this
is the old Task object, but renamed) and the new IPython.kernel.task.MapTask, which is based on a function.

- A new interface, IPython.kernel.mapper.IMapper has been defined to standardize the idea of a map method. This interface has a single map method that has the same syntax as the built-in map. We have also defined a mapper factory interface that creates objects that implement IPython.kernel.mapper.IMapper for different controllers. Both the multiengine and task controller now have mapping capabilities.

- The parallel function capabilities have been reworks. The major changes are that i) there is now an @parallel magic that creates parallel functions, ii) the syntax for multiple variable follows that of map, iii) both the multiengine and task controller now have a parallel function implementation.

- All of the parallel computing capabilities from ipython1-dev have been merged into IPython proper. This resulted in the following new subpackages: IPython.kernel, IPython.kernel.core, traitlets.config, IPython.tools and IPython.testing.

- As part of merging in the ipython1-dev stuff, the setup.py script and friends have been completely refactored. Now we are checking for dependencies using the approach that matplotlib uses.

- The documentation has been completely reorganized to accept the documentation from ipython1-dev.

- We have switched to using Foolscap for all of our network protocols in IPython.kernel. This gives us secure connections that are both encrypted and authenticated.

- We have a brand new COPYING.txt files that describes the IPython license and copyright. The biggest change is that we are putting “The IPython Development Team” as the copyright holder. We give more details about exactly what this means in this file. All developer should read this and use the new banner in all IPython source code files.

- sh profile: ./foo runs foo as system command, no need to do !./foo anymore

- String lists now support sort(field, nums = True) method (to easily sort system command output). Try it with a = !ls -l ; a.sort(1, nums=1).

- ‘%cpaste foo’ now assigns the pasted block as string list, instead of string

- The ipcluster script now run by default with no security. This is done because the main usage of the script is for starting things on localhost. Eventually when ipcluster is able to start things on other hosts, we will put security back.

- ‘cd –foo’ searches directory history for string foo, and jumps to that dir. Last part of dir name is checked first. If no matches for that are found, look at the whole path.

### Bug fixes

- The Windows installer has been fixed. Now all IPython scripts have .bat versions created. Also, the Start Menu shortcuts have been updated.

- The colors escapes in the multiengine client are now turned off on win32 as they don’t print correctly.

- The IPython.kernel.scripts.ipengine script was exec’ing mpi_import_statement incorrectly, which was leading the engine to crash when mpi was enabled.

- A few subpackages had missing __init__.py files.

- The documentation is only created if Sphinx is found. Previously, the setup.py script would fail if it was missing.

- Greedy cd completion has been disabled again (it was enabled in 0.8.4) as it caused problems on certain platforms.
Backwards incompatible changes

- The `clusterfile` options of the `ipcluster` command has been removed as it was not working and it will be replaced soon by something much more robust.
- The `IPython.kernel` configuration now properly finds the user’s `IPython` directory.
- In `ipapi`, the `make_user_ns()` function has been replaced with `make_user_namespaces()`, to support dict subclasses in namespace creation.
- `IPython.kernel.client.Task` has been renamed `IPython.kernel.client.StringTask` to make way for new task types.
- The keyword argument `style` has been renamed `dist` in `scatter`, `gather` and `map`.
- Renamed the values that the rename `dist` keyword argument can have from 'basic' to 'b'.
- `IPython` has a larger set of dependencies if you want all of its capabilities. See the `setup.py` script for details.
- The constructors for `IPython.kernel.client.MultiEngineClient` and `IPython.kernel.client.TaskClient` no longer take the (ip,port) tuple. Instead they take the filename of a file that contains the FURL for that client. If the FURL file is in your `IPYTHONDIR`, it will be found automatically and the constructor can be left empty.
- The asynchronous clients in `IPython.kernel.asyncclient` are now created using the factory functions `get_multiengine_client()` and `get_task_client()`. These return a `Deferred` to the actual client.
- The command line options to `ipcontroller` and `ipengine` have changed to reflect the new Foolscap network protocol and the FURL files. Please see the help for these scripts for details.
- The configuration files for the kernel have changed because of the Foolscap stuff. If you were using custom config files before, you should delete them and regenerate new ones.

Changes merged in from `IPython1`

New features

- Much improved `setup.py` and `setupegg.py` scripts. Because Twisted and `zope.interface` are now easy installable, we can declare them as dependencies in our `setupegg.py` script.
- `IPython` is now compatible with Twisted 2.5.0 and 8.x.
- Added a new example of how to use `ipython1.kernel.asyncclient`.
- Initial draft of a process daemon in `ipython1.daemon`. This has not been merged into `IPython` and is still in `ipython1-dev`.
- The `TaskController` now has methods for getting the queue status.
- The `TaskResult` objects not have information about how long the task took to run.
- We are attaching additional attributes to exceptions (`_ipython_*`) that we use to carry additional info around.
- New top-level module `asyncclient` that has asynchronous versions (that return `Deferred`s) of the client classes. This is designed to users who want to run their own Twisted reactor.
- All the clients in `client` are now based on Twisted. This is done by running the Twisted reactor in a separate thread and using the `blockingCallFromThread()` function that is in recent versions of Twisted.
- Functions can now be pushed/pulled to/from engines using `MultiEngineClient.push_function()` and `MultiEngineClient.pull_function()`. 
• Gather/scatter are now implemented in the client to reduce the work load of the controller and improve performance.

• Complete rewrite of the IPython documentation. All of the documentation from the IPython website has been moved into docs/source as restructured text documents. PDF and HTML documentation are being generated using Sphinx.

• New developer oriented documentation: development guidelines and roadmap.

• Traditional ChangeLog has been changed to a more useful changes.txt file that is organized by release and is meant to provide something more relevant for users.

Bug fixes

• Created a proper MANIFEST.in file to create source distributions.

• Fixed a bug in the MultiEngine interface. Previously, multi-engine actions were being collected with a DeferredList with fireononeerrback=1. This meant that methods were returning before all engines had given their results. This was causing extremely odd bugs in certain cases. To fix this problem, we have 1) set fireononeerrback=0 to make sure all results (or exceptions) are in before returning and 2) introduced a CompositeError exception that wraps all of the engine exceptions. This is a huge change as it means that users will have to catch CompositeError rather than the actual exception.

Backwards incompatible changes

• All names have been renamed to conform to the lowercase_with_underscore convention. This will require users to change references to all names like queueStatus to queue_status.

• Previously, methods like MultiEngineClient.push() and MultiEngineClient.push() used *args and **kwargs. This was becoming a problem as we weren’t able to introduce new keyword arguments into the API. Now these methods simple take a dict or sequence. This has also allowed us to get rid of the *All methods like pushAll() and pullAll(). These things are now handled with the targets keyword argument that defaults to 'all'.

• The MultiEngineClient.magicTargets has been renamed to MultiEngineClient.targets.

• All methods in the MultiEngine interface now accept the optional keyword argument block.

• Renamed RemoteController to MultiEngineClient and TaskController to TaskClient.

• Renamed the top-level module from api to client.

• Most methods in the multiengine interface now raise a CompositeError exception that wraps the user’s exceptions, rather than just raising the raw user’s exception.

• Changed the setupNS and resultNames in the Task class to push and pull.

2.20 0.8 series

2.20.1 Release 0.8.4

This was a quick release to fix an unfortunate bug that slipped into the 0.8.3 release. The --twisted option was disabled, as it turned out to be broken across several platforms.
2.20.2 Release 0.8.3

- pydb is now disabled by default (due to %run -d problems). You can enable it by passing -pydb command line argument to IPython. Note that setting it in config file won’t work.

2.20.3 Release 0.8.2

- %pushd/%popd behave differently; now “pushd /foo” pushes CURRENT directory and jumps to /foo. The current behaviour is closer to the documented behaviour, and should not trip anyone.

2.20.4 Older releases

Changes in earlier releases of IPython are described in the older file ChangeLog. Please refer to this document for details.
3.1 Installing IPython

IPython requires Python 2.7 or 3.3.

3.1.1 Quick Install

With pip already installed:

```bash
$ pip install ipython
```

This installs IPython as well as its dependencies.

If you want to use IPython with notebooks or the Qt console, you should also install Jupyter `pip install jupyter`.

3.1.2 Overview

This document describes in detail the steps required to install IPython. For a few quick ways to get started with package managers or full Python distributions, see the install page of the IPython website.

Please let us know if you have problems installing IPython or any of its dependencies.

IPython and most dependencies should be installed via `pip`. In many scenarios, this is the simplest method of installing Python packages. More information about `pip` can be found on its PyPI page.

More general information about installing Python packages can be found in Python’s documentation.

Dependencies

IPython relies on a number of other Python packages. Installing using a package manager like pip or conda will ensure the necessary packages are installed. Manual installation without dependencies is possible, but not recommended. The
dependencies can be viewed with package manager commands, such as `pip show ipython` or `conda info ipython`.

### Installing IPython itself

IPython requires several dependencies to work correctly, it is not recommended to install IPython and all its dependencies manually as this can be quite long and troublesome. You should use the python package manager `pip`.

### Installation using pip

Make sure you have the latest version of `pip` (the Python package manager) installed. If you do not, head to Pip documentation and install pip first.

The quickest way to get up and running with IPython is to install it with pip:

```bash
$ pip install ipython
```

That's it.

### Installation from source

To install IPython from source, grab the latest stable tarball of IPython from PyPI. Then do the following:

```bash
tar -xzf ipython-5.1.0.tar.gz
cd ipython-5.1.0
# The [test] extra ensures test dependencies are installed too:
pip install .[test]
```

Do not invoke `setup.py` directly as this can have undesirable consequences for further upgrades. We do not recommend using easy_install either.

If you are installing to a location (like `/usr/local`) that requires higher permissions, you may need to run the last command with `sudo`. You can also install in user specific location by using the `--user` flag in conjunction with pip.

To run IPython’s test suite, use the `iptest` command from outside of the IPython source tree:

```bash
$ iptest
```

### Installing the development version

It is also possible to install the development version of IPython from our Git source code repository. To do this you will need to have Git installed on your system.

Then do:

```bash
$ git clone https://github.com/ipython/ipython.git
$ cd ipython
$ pip install -e .[test]
```

The `pip install -e .` command allows users and developers to follow the development branch as it changes by creating links in the right places and installing the command line scripts to the appropriate locations.

Then, if you want to update your IPython at any time, do:
3.2 Installing the IPython kernel

See also:

**Installing Jupyter** The IPython kernel is the Python execution backend for Jupyter.

The Jupyter Notebook and other frontends automatically ensure that the IPython kernel is available. However, if you want to use a kernel with a different version of Python, or in a virtualenv or conda environment, you’ll need to install that manually.

### 3.2.1 Kernels for Python 2 and 3

If you’re running Jupyter on Python 3, you can set up a Python 2 kernel like this:

```bash
python2 -m pip install ipykernel
python2 -m ipykernel install --user
```

Or using conda, create a Python 2 environment:

```bash
conda create -n ipykernel_py2 python=2 ipykernel
source activate ipykernel_py2  # On Windows, remove the word 'source'
python -m ipykernel install --user
```

If you’re running Jupyter on Python 2 and want to set up a Python 3 kernel, follow the same steps, replacing 2 with 3.

The last command installs a kernel spec file for the current python installation. Kernel spec files are JSON files, which can be viewed and changed with a normal text editor.

### 3.2.2 Kernels for different environments

If you want to have multiple IPython kernels for different virtualenvs or conda environments, you will need to specify unique names for the kernelspecs.

For example, using conda environments:

```bash
source activate myenv
python -m ipykernel install --user --name myenv --display-name "Python (myenv)"
source activate other-env
python -m ipykernel install --user --name other-env --display-name "Python (other-env)"
```

The --name value is used by Jupyter internally. These commands will overwrite any existing kernel with the same name. --display-name is what you see in the notebook menus.

This sections will guide you through installing IPython itself, and installing kernels for Jupyter if you wish to work with multiple version of Python, or multiple environments.
3.3 Quick install reminder

Here is a quick reminder of the commands needed for installation if you are already familiar with IPython and are just searching to refresh your memory:

Install IPython:

```
$ pip install ipython
```

Install and register an IPython kernel with Jupyter:

```
$ python -m pip install ipykernel
$ python -m ipykernel install [--user] [--name <machine-readable-name>] [--display-name <"User Friendly Name">]
```

for more help see

```
$ python -m ipykernel install --help
```

See also:

**Installing Jupyter** The Notebook, nbconvert, and many other former pieces of IPython are now part of Project Jupyter.
This section of IPython documentation walk you through most of the IPython functionality. You do not need to have any deep knowledge of Python to read this tutorial, though some section might make slightly more sens if you have already done some work in the REPL.

Note: Some part of this documentation are more than a decade old so might be out of date, we welcome any report of inaccuracy, and Pull Requests that make that up to date.

4.1 Introducing IPython

You don’t need to know anything beyond Python to start using IPython – just type commands as you would at the standard Python prompt. But IPython can do much more than the standard prompt. Some key features are described here. For more information, check the tips page, or look at examples in the IPython cookbook.

If you’ve never used Python before, you might want to look at the official tutorial or an alternative, Dive into Python.

4.1.1 The four most helpful commands

The four most helpful commands, as well as their brief description, is shown to you in a banner, every time you start IPython:

<table>
<thead>
<tr>
<th>command</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>Introduction and overview of IPython’s features.</td>
</tr>
<tr>
<td>%quickref</td>
<td>Quick reference.</td>
</tr>
<tr>
<td>help</td>
<td>Python’s own help system.</td>
</tr>
<tr>
<td>object?</td>
<td>Details about ‘object’, use ‘object??’ for extra details.</td>
</tr>
</tbody>
</table>
4.1.2 Tab completion

Tab completion, especially for attributes, is a convenient way to explore the structure of any object you’re dealing with. Simply type `object_name.<TAB>` to view the object’s attributes. Besides Python objects and keywords, tab completion also works on file and directory names.

4.1.3 Exploring your objects

Typing `object_name?` will print all sorts of details about any object, including docstrings, function definition lines (for call arguments) and constructor details for classes. To get specific information on an object, you can use the magic commands `%pdoc, %pdef, %psource and %pfile`

4.1.4 Magic functions

IPython has a set of predefined ‘magic functions’ that you can call with a command line style syntax. There are two kinds of magics, line-oriented and cell-oriented. **Line magic**s are prefixed with the `%` character and work much like OS command-line calls: they get as an argument the rest of the line, where arguments are passed without parentheses or quotes. **Lines magic**s can return results and can be used in the right hand side of an assignment. **Cell magics** are prefixed with a double `%%`, and they are functions that get as an argument not only the rest of the line, but also the lines below it in a separate argument.

Magics are useful as convenient functions where Python syntax is not the most natural one, or when one want to embed invalid python syntax in their work flow.

The following examples show how to call the builtin `timeit` magic, both in line and cell mode:

```
In [1]: %timeit range(1000)
100000 loops, best of 3: 7.76 us per loop

In [2]: %%timeit x = range(10000)
   ...: max(x)
   ...:
1000 loops, best of 3: 223 us per loop
```

The builtin magics include:

- Functions that work with code: `run, edit, save, macro, recall`, etc.
- Functions which affect the shell: `colors, xmode, autoindent, automagic`, etc.
- Other functions such as `reset, timeit, writefile, load, or paste`.

You can always call magics using the `%` prefix, and if you’re calling a line magic on a line by itself, as long as the identifier is not defined in your namespace, you can omit even that:

```
run thescript.py
```

You can toggle this behavior by running the `automagic` magic. Cell magics must always have the `%%` prefix.

A more detailed explanation of the magic system can be obtained by calling `%magic`, and for more details on any magic function, call `%somemagic?` to read its docstring. To see all the available magic functions, call `%lsmagic`.

See also:

The Magic command system section of the documentation goes more in depth into how the magics works and how to define your own, and Built-in magic commands for a list of built-in magics.

Cell magics example notebook
Running and Editing

The `run` magic command allows you to run any python script and load all of its data directly into the interactive namespace. Since the file is re-read from disk each time, changes you make to it are reflected immediately (unlike imported modules, which have to be specifically reloaded). IPython also includes `dreload`, a recursive reload function.

`%run` has special flags for timing the execution of your scripts (-t), or for running them under the control of either Python's pdb debugger (-d) or profiler (-p).

The `edit` command gives a reasonable approximation of multiline editing, by invoking your favorite editor on the spot. IPython will execute the code you type in there as if it were typed interactively. Note that for `edit` to work, the call to startup your editor has to be a blocking call. In a GUI environment, your editor likely will have such an option.

Debugging

After an exception occurs, you can call `debug` to jump into the Python debugger (pdb) and examine the problem. Alternatively, if you call `pdb`, IPython will automatically start the debugger on any uncaught exception. You can print variables, see code, execute statements and even walk up and down the call stack to track down the true source of the problem. This can be an efficient way to develop and debug code, in many cases eliminating the need for print statements or external debugging tools.

You can also step through a program from the beginning by calling `%run -d theprogram.py`.

4.1.5 History

IPython stores both the commands you enter, and the results it produces. You can easily go through previous commands with the up- and down-arrow keys, or access your history in more sophisticated ways.

Input and output history are kept in variables called `In` and `Out`, keyed by the prompt numbers, e.g. `In[4]`. The last three objects in output history are also kept in variables named `__`, `___` and `_____`.

You can use the `%history` magic function to examine past input and output. Input history from previous sessions is saved in a database, and IPython can be configured to save output history.

Several other magic functions can use your input history, including `%edit`, `%rerun`, `%recall`, `%macro`, `%save` and `%pastebin`. You can use a standard format to refer to lines:

```
%pastebin 3 18-20 ~1/1-5
```

This will take line 3 and lines 18 to 20 from the current session, and lines 1-5 from the previous session.

4.1.6 System shell commands

To run any command at the system shell, simply prefix it with `!`, e.g.:

```
!ping www.bbc.co.uk
```

You can capture the output into a Python list, e.g.: `files = !ls`. To pass the values of Python variables or expressions to system commands, prefix them with `$`: `!grep -rF $pattern ipython/*`. See our shell section for more details.
Define your own system aliases

It’s convenient to have aliases to the system commands you use most often. This allows you to work seamlessly from inside IPython with the same commands you are used to in your system shell. IPython comes with some pre-defined aliases and a complete system for changing directories, both via a stack (see `pushd`, `popd` and `dhist`) and via direct `cd`. The latter keeps a history of visited directories and allows you to go to any previously visited one.

4.1.7 Configuration

Much of IPython can be tweaked through configuration. To get started, use the command `ipython profile create` to produce the default config files. These will be placed in `~/.ipython/profile_default`, and contain comments explaining what the various options do.

Profiles allow you to use IPython for different tasks, keeping separate config files and history for each one. More details in the profiles section.

Startup Files

If you want some code to be run at the beginning of every IPython session, the easiest way is to add Python (.py) or IPython (.ipy) scripts to your `profile_default/startup/` directory. Files here will be executed as soon as the IPython shell is constructed, before any other code or scripts you have specified. The files will be run in order of their names, so you can control the ordering with prefixes, like `10-myimports.py`.

4.2 Rich Outputs

One of the main features of IPython when used as a kernel is its ability to show rich output. This means that objects that can be represented as images, sounds, animation, etc... can be shown this way if the frontend supports it.

In order for this to be possible, you need to use the `display()` function, that should be available by default on IPython 5.4+ and 6.1+, or that you can import with `from IPython.display import import display`. Then use `display(<your object>)` instead of `print()`, and if possible your object will be displayed with a richer representation. In the terminal of course, there won’t be much difference as objects are most of the time represented by text, but in notebook and similar interface you will get richer outputs.

4.3 Plotting

Note: Starting with IPython 5.0 and matplotlib 2.0 you can avoid the use of IPython’s specific magic and use `matplotlib.pyplot.ion()`/`matplotlib.pyplot.ioff()` which have the advantages of working outside of IPython as well.

One major feature of the IPython kernel is the ability to display plots that are the output of running code cells. The IPython kernel is designed to work seamlessly with the `matplotlib` plotting library to provide this functionality.

To set this up, before any plotting or import of `matplotlib` is performed you must execute the `%matplotlib magic command`. This performs the necessary behind-the-scenes setup for IPython to work correctly hand in hand with `matplotlib`; it does not, however, actually execute any Python `import` commands, that is, no names are added to the namespace.
If the `%matplotlib` magic is called without an argument, the output of a plotting command is displayed using the default `matplotlib` backend in a separate window. Alternatively, the backend can be explicitly requested using, for example:

```
%matplotlib gtk
```

A particularly interesting backend, provided by IPython, is the `inline` backend. This is available only for the Jupyter Notebook and the Jupyter QtConsole. It can be invoked as follows:

```
%matplotlib inline
```

With this backend, the output of plotting commands is displayed `inline` within frontends like the Jupyter notebook, directly below the code cell that produced it. The resulting plots will then also be stored in the notebook document.

**See also:**

Plotting with Matplotlib example notebook

The `matplotlib` library also ships with `%matplotlib notebook` command that allows interactive figures if your environment allows it.

See the `matplotlib` documentation for more information.

### 4.4 IPython reference

#### 4.4.1 Command-line usage

You start IPython with the command:

```
$ ipython [options] files
```

If invoked with no options, it executes all the files listed in sequence and exits. If you add the `-i` flag, it drops you into the interpreter while still acknowledging any options you may have set in your `ipython_config.py`. This behavior is different from standard Python, which when called as `python -i` will only execute one file and ignore your configuration setup.

Please note that some of the configuration options are not available at the command line, simply because they are not practical here. Look into your configuration files for details on those. There are separate configuration files for each profile, and the files look like `ipython_config.py` or `ipython_config_frontend_name.py`. Profile directories look like `profile frontline` and are typically installed in the `IPYTHONDIR` directory, which defaults to `$HOME/.ipython`. For Windows users, `HOME` resolves to `C:\Users\{YourUserName}\` in most instances.

**Command-line Options**

To see the options IPython accepts, use `ipython --help` (and you probably should run the output through a pager such as `ipython --help | less` for more convenient reading). This shows all the options that have a single-word alias to control them, but IPython lets you configure all of its objects from the command-line by passing the full class name and a corresponding value; type `ipython --help-all` to see this full list. For example:

```
$ ipython --help-all
<...snip...>
--matplotlib=CaselessStrEnum (InteractiveShellApp.matplotlib)
    Default: None
```

(continues on next page)
Indicate that the following:

```
$ ipython --matplotlib qt
```

is equivalent to:

```
$ ipython --TerminalIPythonApp.matplotlib='qt'
```

Note that in the second form, you must use the equal sign, as the expression is evaluated as an actual Python assignment. While in the above example the short form is more convenient, only the most common options have a short form, while any configurable variable in IPython can be set at the command-line by using the long form. This long form is the same syntax used in the configuration files, if you want to set these options permanently.

### 4.4.2 Interactive use

IPython is meant to work as a drop-in replacement for the standard interactive interpreter. As such, any code which is valid python should execute normally under IPython (cases where this is not true should be reported as bugs). It does, however, offer many features which are not available at a standard python prompt. What follows is a list of these.

#### Caution for Windows users

Windows, unfortunately, uses the ‘\’ character as a path separator. This is a terrible choice, because ‘\’ also represents the escape character in most modern programming languages, including Python. For this reason, using ‘/’ character is recommended if you have problems with \. However, in Windows commands ‘/’ flags options, so you can not use it for the root directory. This means that paths beginning at the root must be typed in a contrived manner like: `%copy \opt/foo/bar.txt \tmp`

#### Magic command system

IPython will treat any line whose first character is a % as a special call to a ‘magic’ function. These allow you to control the behavior of IPython itself, plus a lot of system-type features. They are all prefixed with a % character, but parameters are given without parentheses or quotes.

Lines that begin with % signal a cell magic: they take as arguments not only the rest of the current line, but all lines below them as well, in the current execution block. Cell magics can in fact make arbitrary modifications to the input they receive, which need not even be valid Python code at all. They receive the whole block as a single string.

As a line magic example, the `cd` magic works just like the OS command of the same name:

```
In [8]: %cd
/home/fperez
```

The following uses the builtin `timeit` in cell mode:
In this case, \[x = \text{range}(10000)\] is called as the line argument, and the block with \[\text{min}(x)\] and \[\text{max}(x)\] is called as the cell body. The \texttt{timeit} magic receives both.

If you have ‘automagic’ enabled (as it is by default), you don’t need to type in the single \%% explicitly for line magics; IPython will scan its internal list of magic functions and call one if it exists. With automagic on you can then just type \texttt{cd mydir} to go to directory ‘mydir’:

In [9]: cd mydir
/home/fperez/mydir

Cell magics always require an explicit %% prefix, automagic calling only works for line magics.

The automagic system has the lowest possible precedence in name searches, so you can freely use variables with the same names as magic commands. If a magic command is ‘shadowed’ by a variable, you will need the explicit %% prefix to use it:

In [1]: cd ipython  # %%cd is called by automagic
/home/fperez/ipython
In [2]: cd=1  # now cd is just a variable
In [3]: cd ..  # and doesn't work as a function anymore
File "<ipython-input-3-9fedb3aff56c>"", line 1
   cd ..
^  
SyntaxError: invalid syntax

In [4]: %cd ..  # but %cd always works
/home/fperez
In [5]: del cd  # if you remove the cd variable, automagic works again
In [6]: cd ipython
/home/fperez/ipython

Line magics, if they return a value, can be assigned to a variable using the syntax \[l = \%sx \text{ls}\] (which in this particular case returns the result of \texttt{ls} as a python list). See below for more information.

Type %magic for more information, including a list of all available magic functions at any time and their docstrings. You can also type %magic\_function\_name? (see below for information on the ‘?’ system) to get information about any particular magic function you are interested in.

The API documentation for the \texttt{IPython.core.magic} module contains the full docstrings of all currently available magic commands.

See also:

\textbf{Built-in magic commands} A list of the line and cell magics available in IPython by default

\textbf{Defining custom magics} How to define and register additional magic functions

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Access to the standard Python help

Simply type `help()` to access Python’s standard help system. You can also type `help(object)` for information about a given object, or `help('keyword')` for information on a keyword. You may need to configure your PYTHONDOCS environment variable for this feature to work correctly.

Dynamic object information

Typing `?word` or `word?` prints detailed information about an object. If certain strings in the object are too long (e.g. function signatures) they get snipped in the center for brevity. This system gives access variable types and values, docstrings, function prototypes and other useful information.

If the information will not fit in the terminal, it is displayed in a pager (`less` if available, otherwise a basic internal pager).

Typing `??word` or `word??` gives access to the full information, including the source code where possible. Long strings are not snipped.

The following magic functions are particularly useful for gathering information about your working environment:

- `pdoc <object>`: Print (or run through a pager if too long) the docstring for an object. If the given object is a class, it will print both the class and the constructor docstrings.
- `pdef <object>`: Print the call signature for any callable object. If the object is a class, print the constructor information.
- `psource <object>`: Print (or run through a pager if too long) the source code for an object.
- `pfile <object>`: Show the entire source file where an object was defined via a pager, opening it at the line where the object definition begins.
- `who / whos`: These functions give information about identifiers you have defined interactively (not things you loaded or defined in your configuration files). `%who` just prints a list of identifiers and `%whos` prints a table with some basic details about each identifier.

The dynamic object information functions (`?`, `??`, `pdoc`, `psource`) work on object attributes, as well as directly on variables. For example, after doing `import os`, you can use `os.path.abspath??`.

Command line completion

At any time, hitting TAB will complete any available python commands or variable names, and show you a list of the possible completions if there’s no unambiguous one. It will also complete filenames in the current directory if no python names match what you’ve typed so far.

Search command history

IPython provides two ways for searching through previous input and thus reduce the need for repetitive typing:

1. Start typing, and then use the up and down arrow keys (or Ctrl-p and Ctrl-n) to search through only the history items that match what you’ve typed so far.

2. Hit Ctrl-r to open a search prompt. Begin typing and the system searches your history for lines that contain what you’ve typed so far, completing as much as it can.

IPython will save your input history when it leaves and reload it next time you restart it. By default, the history file is named `.ipython/profile_name/history.sqlite`.
Autoindent

Starting with 5.0, IPython uses prompt_toolkit in place of readline, it thus can recognize lines ending in ‘:’ and indent the next line, while also un-indenting automatically after ‘raise’ or ‘return’, and support real multi-line editing as well as syntactic coloration during edition.

This feature does not use the readline library anymore, so it will not honor your ~/.inputrc configuration (or whatever file your INPUTRC environment variable points to).

In particular if you want to change the input mode to vi, you will need to set the TerminalInteractiveShell.editing_mode configuration option of IPython.

Session logging and restoring

You can log all input from a session either by starting IPython with the command line switch --logfile=foo.py (see here) or by activating the logging at any moment with the magic function logstart.

Log files can later be reloaded by running them as scripts and IPython will attempt to ‘replay’ the log by executing all the lines in it, thus restoring the state of a previous session. This feature is not quite perfect, but can still be useful in many cases.

The log files can also be used as a way to have a permanent record of any code you wrote while experimenting. Log files are regular text files which you can later open in your favorite text editor to extract code or to ‘clean them up’ before using them to replay a session.

The logstart function for activating logging in mid-session is used as follows:

```text
%logstart [log_name [log_mode]]
```

If no name is given, it defaults to a file named ‘ipython_log.py’ in your current working directory, in ‘rotate’ mode (see below).

‘%logstart name’ saves to file ‘name’ in ‘backup’ mode. It saves your history up to that point and then continues logging.

%logstart takes a second optional parameter: logging mode. This can be one of (note that the modes are given unquoted):

- [over:] overwrite existing log_name.
- [backup:] rename (if exists) to log_name~ and start log_name.
- [append:] well, that says it.
- [rotate:] create rotating logs log_name.1~, log_name.2~, etc.

The logoff and logon functions allow you to temporarily stop and resume logging to a file which had previously been started with %logstart. They will fail (with an explanation) if you try to use them before logging has been started.

System shell access

Any input line beginning with a ! character is passed verbatim (minus the !, of course) to the underlying operating system. For example, typing !ls will run ‘ls’ in the current directory.

Manual capture of command output and magic output

You can assign the result of a system command to a Python variable with the syntax `myfiles = !ls`. Similarly, the result of a magic (as long as it returns a value) can be assigned to a variable. For example, the syntax `myfiles`
= %sx ls is equivalent to the above system command example (the sx magic runs a shell command and captures the output). Each of these gets machine readable output from stdout (e.g. without colours), and splits on newlines. To explicitly get this sort of output without assigning to a variable, use two exclamation marks (!!ls) or the sx magic command without an assignment. (However, !! commands cannot be assigned to a variable.)

The captured list in this example has some convenience features. myfiles.n or myfiles.s returns a string delimited by newlines or spaces, respectively. myfiles.p produces path objects from the list items. See String lists for details.

IPython also allows you to expand the value of python variables when making system calls. Wrap variables or expressions in {braces}:

```
In [1]: pyvar = 'Hello world'
In [2]: !echo "A python variable: {pyvar}" 
A python variable: Hello world
In [3]: import math
In [4]: x = 8
In [5]: !echo {math.factorial(x)} 
40320
```

For simple cases, you can alternatively prepend $ to a variable name:

```
In [6]: !echo $$sys.argv
[/home/fperez/usr/bin/ipython]
In [7]: !echo "A system variable: $$HOME" # Use $$ for literal $
A system variable: /home/fperez
```

Note that $$ is used to represent a literal $.

### System command aliases

The alias magic function allows you to define magic functions which are in fact system shell commands. These aliases can have parameters.

%alias alias_name cmd defines ‘alias_name’ as an alias for ‘cmd’

Then, typing `alias_name` params will execute the system command ‘cmd params’ (from your underlying operating system).

You can also define aliases with parameters using %s specifiers (one per parameter). The following example defines the parts function as an alias to the command echo first %s second %s where each %s will be replaced by a positional parameter to the call to %parts:

```
In [1]: %alias parts echo first %s second %s
In [2]: parts A B
first A second B
In [3]: parts A
ERROR: Alias <parts> requires 2 arguments, 1 given.
```

If called with no parameters, alias prints the table of currently defined aliases.

The rehashx magic allows you to load your entire SPATH as ipython aliases. See its docstring for further details.

### Recursive reload

The IPython.lib.deepreload module allows you to recursively reload a module: changes made to any of its dependencies will be reloaded without having to exit. To start using it, do:
from IPython.lib.deepreload import reload as dreload

### Verbose and colored exception traceback printouts

IPython provides the option to see very detailed exception tracebacks, which can be especially useful when debugging large programs. You can run any Python file with the %run function to benefit from these detailed tracebacks. Furthermore, both normal and verbose tracebacks can be colored (if your terminal supports it) which makes them much easier to parse visually.

See the magic `xmode` and `colors` functions for details.

These features are basically a terminal version of Ka-Ping Yee’s cgitb module, now part of the standard Python library.

### Input caching system

IPython offers numbered prompts (In/Out) with input and output caching (also referred to as ‘input history’). All input is saved and can be retrieved as variables (besides the usual arrow key recall), in addition to the `rep` magic command that brings a history entry up for editing on the next command line.

The following variables always exist:

- `_i, _ii, _iii`: store previous, next previous and next-next previous inputs.
- `In, _ih`: a list of all inputs; `_ih[n]` is the input from line `n`. If you overwrite `In` with a variable of your own, you can remake the assignment to the internal list with a simple `In=_ih`.

Additionally, global variables named `_i<n>` are dynamically created (`<n>` being the prompt counter), so `_i<n> == _ih[n] == In[n]`.

For example, what you typed at prompt 14 is available as `_i14, _ih[14]` and `In[14]`.

This allows you to easily cut and paste multi line interactive prompts by printing them out: they print like a clean string, without prompt characters. You can also manipulate them like regular variables (they are strings), modify or exec them.

You can also re-execute multiple lines of input easily by using the magic `rerun` or `macro` functions. The macro system also allows you to re-execute previous lines which include magic function calls (which require special processing). Type `%macro?` for more details on the macro system.

A history function `history` allows you to see any part of your input history by printing a range of the `_i` variables.

You can also search (‘grep’) through your history by typing `%hist -g somestring`. This is handy for searching for URLs, IP addresses, etc. You can bring history entries listed by `%hist -g` up for editing with the `%recall` command, or run them immediately with `rerun`.

### Output caching system

For output that is returned from actions, a system similar to the input cache exists but using `_` instead of `_i`. Only actions that produce a result (NOT assignments, for example) are cached. If you are familiar with Mathematica, IPython’s `_` variables behave exactly like Mathematica’s `%` variables.

The following variables always exist:

- `[]` (a single underscore): stores previous output, like Python’s default interpreter.
- `[]` (two underscores): next previous.
- `[]` (three underscores): next-next previous.
Additionally, global variables named _<n> are dynamically created (<n> being the prompt counter), such that the result of output <n> is always available as _<n> (don’t use the angle brackets, just the number, e.g. _21).

These variables are also stored in a global dictionary (not a list, since it only has entries for lines which returned a result) available under the names _oh and Out (similar to _ih and In). So the output from line 12 can be obtained as _12, Out[12] or _oh[12]. If you accidentally overwrite the Out variable you can recover it by typing Out=_oh at the prompt.

This system obviously can potentially put heavy memory demands on your system, since it prevents Python’s garbage collector from removing any previously computed results. You can control how many results are kept in memory with the configuration option InteractiveShell.cache_size. If you set it to 0, output caching is disabled. You can also use the reset and xdel magics to clear large items from memory.

Directory history

Your history of visited directories is kept in the global list _dh, and the magic cd command can be used to go to any entry in that list. The dhist command allows you to view this history. Do cd -<TAB> to conveniently view the directory history.

Automatic parentheses and quotes

These features were adapted from Nathan Gray’s LazyPython. They are meant to allow less typing for common situations.

Callable objects (i.e. functions, methods, etc) can be invoked like this (notice the commas between the arguments):

```
In [1]: callable_ob arg1, arg2, arg3
     -------> callable_ob(arg1, arg2, arg3)
```

**Note:** This feature is disabled by default. To enable it, use the %autocall magic command. The commands below with special prefixes will always work, however.

You can force automatic parentheses by using ‘/’ as the first character of a line. For example:

```
In [2]: /globals # becomes 'globals()'
```

Note that the ‘/’ MUST be the first character on the line! This won’t work:

```
In [3]: print /globals # syntax error
```

In most cases the automatic algorithm should work, so you should rarely need to explicitly invoke /. One notable exception is if you are trying to call a function with a list of tuples as arguments (the parenthesis will confuse IPython):

```
In [4]: zip (1,2,3),(4,5,6) # won't work
```

but this will work:

```
In [5]: /zip (1,2,3),(4,5,6)
     -------> zip ((1,2,3),(4,5,6))
Out[5]: [(1, 4), (2, 5), (3, 6)]
```

IPython tells you that it has altered your command line by displaying the new command line preceded by --->.

You can force automatic quoting of a function’s arguments by using , or ; as the first character of a line. For example:
In [1]: ,my_function /home/me  # becomes my_function("/home/me")

If you use `;` the whole argument is quoted as a single string, while `,’ splits on whitespace:

In [2]: ,my_function a b c  # becomes my_function("a","b","c")
In [3]: ;my_function a b c  # becomes my_function("a b c")

Note that the `,’ or `;’ MUST be the first character on the line! This won’t work:

In [4]: x = ,my_function /home/me  # syntax error

4.4.3 IPython as your default Python environment

Python honors the environment variable `PYTHONSTARTUP` and will execute at startup the file referenced by this variable. If you put the following code at the end of that file, then IPython will be your working environment anytime you start Python:

```python
import os, IPython
os.environ['PYTHONSTARTUP'] = ''  # Prevent running this again
IPython.start_ipython()
raise SystemExit
```

The `raise SystemExit` is needed to exit Python when it finishes, otherwise you’ll be back at the normal Python `>>>` prompt.

This is probably useful to developers who manage multiple Python versions and don’t want to have correspondingly multiple IPython versions. Note that in this mode, there is no way to pass IPython any command-line options, as those are trapped first by Python itself.

4.4.4 Embedding IPython

You can start a regular IPython session with

```python
import IPython
IPython.start_ipython(argv=[])  
```

at any point in your program. This will load IPython configuration, startup files, and everything, just as if it were a normal IPython session.

It is also possible to embed an IPython shell in a namespace in your Python code. This allows you to evaluate dynamically the state of your code, operate with your variables, analyze them, etc. Note however that any changes you make to values while in the shell do not propagate back to the running code, so it is safe to modify your values because you won’t break your code in bizarre ways by doing so.

**Note:** At present, embedding IPython cannot be done from inside IPython. Run the code samples below outside IPython.

This feature allows you to easily have a fully functional python environment for doing object introspection anywhere in your code with a simple function call. In some cases a simple print statement is enough, but if you need to do more detailed analysis of a code fragment this feature can be very valuable.

It can also be useful in scientific computing situations where it is common to need to do some automatic, computationally intensive part and then stop to look at data, plots, etc. Opening an IPython instance will give you full access to

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your data and functions, and you can resume program execution once you are done with the interactive part (perhaps to stop again later, as many times as needed).

The following code snippet is the bare minimum you need to include in your Python programs for this to work (detailed examples follow later):

```python
from IPython import embed
embed()  # this call anywhere in your program will start IPython
```

You can also embed an IPython kernel, for use with qtconsole, etc. via `IPython.embed_kernel()`. This should function work the same way, but you can connect an external frontend (`ipython qtconsole` or `ipython console`), rather than interacting with it in the terminal.

You can run embedded instances even in code which is itself being run at the IPython interactive prompt with `%run <filename>`. Since it’s easy to get lost as to where you are (in your top-level IPython or in your embedded one), it’s a good idea in such cases to set the in/out prompts to something different for the embedded instances. The code examples below illustrate this.

You can also have multiple IPython instances in your program and open them separately, for example with different options for data presentation. If you close and open the same instance multiple times, its prompt counters simply continue from each execution to the next.

Please look at the docstrings in the `embed` module for more details on the use of this system.

The following sample file illustrating how to use the embedding functionality is provided in the examples directory as `embed_class_long.py`. It should be fairly self-explanatory:

```python
#!/usr/bin/env python
"""An example of how to embed an IPython shell into a running program.

Please see the documentation in the IPython.Shell module for more details.

The accompanying file embed_class_short.py has quick code fragments for embedding which you can cut and paste in your code once you understand how things work.

The code in this file is deliberately extra-verbose, meant for learning."""

from __future__ import print_function

# The basics to get you going:
# IPython injects get_ipython into builtins, so you can know if you have nested copies running.

# Try running this code both at the command line and from inside IPython (with %run example-embed.py)

from IPython.terminal.prompts import Prompts, Token

class CustomPrompt(Prompts):
    def in_prompt_tokens(self, cli=None):
        return [
            (Token.Prompt, 'In <'),
            (Token.PromptNum, str(self.shell.execution_count)),
            (Token.Prompt, ': ')
        ]
```
```python
def out_prompt_tokens(self):
    return [
        (Token.OutPrompt, 'Out<'),
        (Token.OutPromptNum, str(self.shell.execution_count)),
        (Token.OutPrompt, '>: '),
    ]
```

```python
from traitlets.config.loader import Config
try:
    get_ipython
except NameError:
    nested = 0
    cfg = Config()
    cfg.TerminalInteractiveShell.prompts_class=CustomPrompt
else:
    print("Running nested copies of IPython.")
    print("The prompts for the nested copy have been modified")
    cfg = Config()
    nested = 1

# First import the embeddable shell class
from IPython.terminal.embed import InteractiveShellEmbed

# Now create an instance of the embeddable shell. The first argument is a
# string with options exactly as you would type them if you were starting
# IPython at the system command line. Any parameters you want to define for
# configuration can thus be specified here.
ipshell = InteractiveShellEmbed(config=cfg,
    banner1 = 'Dropping into IPython',
    exit_msg = 'Leaving Interpreter, back to program.')

# Make a second instance, you can have as many as you want.
ipshell2 = InteractiveShellEmbed(config=cfg,
    banner1 = 'Second IPython instance.')

print('\nHello. This is printed from the main controller program.\n')

# You can then call ipshell() anywhere you need it (with an optional
# message):
ipshell('***Called from top level. '
    'Hit Ctrl-D to exit interpreter and continue program.\n'    'Note that if you use %kill_embedded, you can fully deactivate\n    'This embedded instance so it will never turn on again')

print('\nBack in caller program, moving along...\n')
```

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# - A global startup banner.

# - A call-specific header string, which you can use to indicate where in the
# execution flow the shell is starting.

# They also print an exit message every time they exit.

# Both the startup banner and the exit message default to None, and can be set
# either at the instance constructor or at any other time with the
# by setting the banner and exit_msg attributes.

# The shell instance can be also put in 'dummy' mode globally or on a per-call
# basis. This gives you fine control for debugging without having to change
# code all over the place.

# The code below illustrates all this.

# This is how the global banner and exit_msg can be reset at any point
ipshell.banner2 = 'Entering interpreter - New Banner'
ipshell.exit_msg = 'Leaving interpreter - New exit_msg'

def foo(m):
    s = 'spam'
ipshell('***In foo(). Try %whos, or print s or m:"
    print('foo says m = ',m)

def bar(n):
    s = 'eggs'
ipshell('***In bar(). Try %whos, or print s or n:"
    print('bar says n = ',n)

# Some calls to the above functions which will trigger IPython:
print('Main program calling foo("eggs")
foo('eggs')

# The shell can be put in 'dummy' mode where calls to it silently return. This
# allows you, for example, to globally turn off debugging for a program with a
# single call.
ipshell.dummy_mode = True
print('Trying to call IPython which is now "dummy":')
ipshell()
ipshell('Nothing happened...')
# The global 'dummy' mode can still be overridden for a single call
print('Overriding dummy mode manually:')
ipshell(dummy=False)

# Reactivate the IPython shell
ipshell.dummy_mode = False

print('You can even have multiple embedded instances:')
ipshell2()

print('Main program calling bar("spam")
bar('spam')
Once you understand how the system functions, you can use the following code fragments in your programs which are ready for cut and paste:

```python
print('Main program finished. Bye!')
```

4.4.5 Using the Python debugger (pdb)
Running entire programs via pdb

pdb, the Python debugger, is a powerful interactive debugger which allows you to step through code, set breakpoints, watch variables, etc. IPython makes it very easy to start any script under the control of pdb, regardless of whether you have wrapped it into a `main()` function or not. For this, simply type `%run -d myscript` at an IPython prompt. See the `run` command’s documentation for more details, including how to control where pdb will stop execution first.

For more information on the use of the pdb debugger, see Debugger Commands in the Python documentation.

IPython extends the debugger with a few useful additions, like coloring of tracebacks. The debugger will adopt the color scheme selected for IPython.

The `where` command has also been extended to take as argument the number of context line to show. This allows to a many line of context on shallow stack trace:

```python
In [5]: def foo(x):
    ...: 1
    ...: 2
    ...: 3
    ...: return 1/x+foo(x-1)
    ...: 5
    ...: 6
    ...: 7
    ...

In[6]: foo(1)
# ...
ipdb> where 8
<ipython-input-6-9e45007b2b59>(1)<module>()
----> 1 foo(1)

<ipython-input-5-7baadc3d1465> (5) foo()
  1 def foo(x):
  2     1
  3     2
  4     3
  ---> 5     return 1/x+foo(x-1)
  6     5
  7     6
  8     7

> <ipython-input-5-7baadc3d1465> (5) foo()
  1 def foo(x):
  2     1
  3     2
  4     3
  ---> 5     return 1/x+foo(x-1)
  6     5
  7     6
  8     7
```

And less context on shallower Stack Trace:

```python
ipdb> where 1
<ipython-input-13-afa180a57233> (1)<module>()
----> 1 foo(7)

<ipython-input-5-7baadc3d1465> (5) foo()
```

(continues on next page)
Post-mortem debugging

Going into a debugger when an exception occurs can be extremely useful in order to find the origin of subtle bugs, because pdb opens up at the point in your code which triggered the exception, and while your program is at this point ‘dead’, all the data is still available and you can walk up and down the stack frame and understand the origin of the problem.

You can use the \texttt{debug} magic after an exception has occurred to start post-mortem debugging. IPython can also call debugger every time your code triggers an uncaught exception. This feature can be toggled with the \texttt{pdb} magic command, or you can start IPython with the \texttt{--pdb} option.

For a post-mortem debugger in your programs outside IPython, put the following lines toward the top of your ‘main’ routine:

\begin{verbatim}
import sys
from IPython.core import ultratb
sys.excepthook = ultratb.FormattedTB(mode='Verbose',
    color_scheme='Linux', call_pdb=1)
\end{verbatim}

The mode keyword can be either ‘Verbose’ or ‘Plain’, giving either very detailed or normal tracebacks respectively. The color_scheme keyword can be one of ‘NoColor’, ‘Linux’ (default) or ‘LightBG’. These are the same options which can be set in IPython with \texttt{--colors} and \texttt{--xmode}.

This will give any of your programs detailed, colored tracebacks with automatic invocation of pdb.

4.4.6 Pasting of code starting with Python or IPython prompts

IPython is smart enough to filter out input prompts, be they plain Python ones (\texttt{>>>} and \ldots) or IPython ones (\texttt{In [N]}: and \ldots). You can therefore copy and paste from existing interactive sessions without worry.

The following is a ‘screenshot’ of how things work, copying an example from the standard Python tutorial:

\begin{verbatim}
In [1]: >>> # Fibonacci series:

In [2]: ... # the sum of two elements defines the next

In [3]: ... a, b = 0, 1

In [4]: >>> while b < 10:
    ...:     ... print(b)
    ...:     ... a, b = b, a+b
    ...
\end{verbatim}

(continues on next page)
And pasting from IPython sessions works equally well:

```
In [1]: In [5]: def f(x):
    ...:     "A simple function"
    ...:     return x**2
    ...:
In [2]: f(3)
Out[2]: 9
```

### 4.4.7 GUI event loop support

IPython has excellent support for working interactively with Graphical User Interface (GUI) toolkits, such as wxPython, PyQt4/PySide, PyGTK and Tk. This is implemented by running the toolkit’s event loop while IPython is waiting for input.

For users, enabling GUI event loop integration is simple. You simple use the `gui` magic as follows:

```
%gui [GUINAME]
```

With no arguments, `%gui` removes all GUI support. Valid `GUINAME` arguments include `wx`, `qt`, `qt5`, `gtk`, `gtk3` and `tk`.

Thus, to use wxPython interactively and create a running `wx.App` object, do:

```
%gui wx
```

You can also start IPython with an event loop set up using the `--gui` flag:

```
$ ipython --gui=qt
```

For information on IPython’s `matplotlib` integration (and the `matplotlib` mode) see this section.

For developers that want to integrate additional event loops with IPython, see Integrating with GUI event loops.

When running inside IPython with an integrated event loop, a GUI application should *not* start its own event loop. This means that applications that are meant to be used both in IPython and as standalone apps need to have special code to detect how the application is being run. We highly recommend using IPython’s support for this. Since the details vary slightly between toolkits, we point you to the various examples in our source directory `examples/IPython Kernel/gui/` that demonstrate these capabilities.

#### PyQt and PySide

When you use `--gui=qt` or `--matplotlib=qt`, IPython can work with either PyQt4 or PySide. There are three options for configuration here, because PyQt4 has two APIs for QString and QVariant: v1, which is the default on Python 2, and the more natural v2, which is the only API supported by PySide. v2 is also the default for PyQt4 on Python 3. IPython’s code for the QtConsole uses v2, but you can still use any interface in your code, since the Qt frontend is in a different process.
The default will be to import PyQt4 without configuration of the APIs, thus matching what most applications would expect. It will fall back to PySide if PyQt4 is unavailable.

If specified, IPython will respect the environment variable QT_API used by ETS. ETS 4.0 also works with both PyQt4 and PySide, but it requires PyQt4 to use its v2 API. So if QT_API=pyside PySide will be used, and if QT_API=pyqt then PyQt4 will be used with the v2 API for QString and QVariant, so ETS codes like MayaVi will also work with IPython.

If you launch IPython in matplotlib mode with ipython --matplotlib=qt, then IPython will ask matplotlib which Qt library to use (only if QT_API is not set), via the ‘backend.qt4’ rcParam. If matplotlib is version 1.0.1 or older, then IPython will always use PyQt4 without setting the v2 APIs, since neither v2 PyQt nor PySide work.

**Warning:** Note that this means for ETS 4 to work with PyQt4, QT_API must be set to work with IPython’s qt integration, because otherwise PyQt4 will be loaded in an incompatible mode.

It also means that you must not have QT_API set if you want to use --gui=qt with code that requires PyQt4 API v1.

### 4.4.8 Plotting with matplotlib

matplotlib provides high quality 2D and 3D plotting for Python. matplotlib can produce plots on screen using a variety of GUI toolkits, including Tk, PyGTK, PyQt4 and wxPython. It also provides a number of commands useful for scientific computing, all with a syntax compatible with that of the popular Matlab program.

To start IPython with matplotlib support, use the --matplotlib switch. If IPython is already running, you can run the matplotlib magic. If no arguments are given, IPython will automatically detect your choice of matplotlib backend. You can also request a specific backend with %matplotlib backend, where backend must be one of: ‘tk’, ‘qt’, ‘wx’, ‘gtk’, ‘osx’. In the web notebook and Qt console, ‘inline’ is also a valid backend value, which produces static figures inlined inside the application window instead of matplotlib’s interactive figures that live in separate windows.

### 4.4.9 Interactive demos with IPython

IPython ships with a basic system for running scripts interactively in sections, useful when presenting code to audiences. A few tags embedded in comments (so that the script remains valid Python code) divide a file into separate blocks, and the demo can be run one block at a time, with IPython printing (with syntax highlighting) the block before executing it, and returning to the interactive prompt after each block. The interactive namespace is updated after each block is run with the contents of the demo’s namespace.

This allows you to show a piece of code, run it and then execute interactively commands based on the variables just created. Once you want to continue, you simply execute the next block of the demo. The following listing shows the markup necessary for dividing a script into sections for execution as a demo:

```python
# -*- coding: utf-8 -*-
"""A simple interactive demo to illustrate the use of IPython's Demo class.

Any python script can be run as a demo, but that does little more than showing it on-screen, syntax-highlighted in one shot. If you add a little simple markup, you can stop at specified intervals and return to the ipython prompt, resuming execution later.

This is a unicode test, åäö
""
from __future__ import print_function
```

(continues on next page)
print('Hello, welcome to an interactive IPython demo.
')
print('Executing this block should require confirmation before proceeding,
')
print('unless auto_all has been set to true in the demo object')

# The mark below defines a block boundary, which is a point where IPython will
# stop execution and return to the interactive prompt.
# <demo> --- stop ---

x = 1
y = 2

# <demo> --- stop ---

# the mark below makes this block as silent
# <demo> silent

print('This is a silent block, which gets executed but not printed.
')

# <demo> --- stop ---

# <demo> auto
print('This is an automatic block.
')
print('It is executed without asking for confirmation, but printed.
')
z = x+y

print('z=', x)

# <demo> --- stop ---

# This is just another normal block.

print('z is now:', z)

print('bye!)

In order to run a file as a demo, you must first make a Demo object out of it. If the file is named myscript.py, the
following code will make a demo:

```python
from IPython.lib.demo import Demo
mydemo = Demo('myscript.py')
```

This creates the mydemo object, whose blocks you run one at a time by simply calling the object with no arguments.
Then call it to run each step of the demo:

```python
mydemo()
```

Demo objects can be restarted, you can move forward or back skipping blocks, re-execute the last block, etc. See the
IPython.lib.demo module and the Demo class for details.

Limitations: These demos are limited to fairly simple uses. In particular, you cannot break up sections within indented
code (loops, if statements, function definitions, etc.) Supporting something like this would basically require tracking
the internal execution state of the Python interpreter, so only top-level divisions are allowed. If you want to be able to
open an IPython instance at an arbitrary point in a program, you can use IPython’s embedding facilities.

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4.5 IPython as a system shell

4.5.1 Overview

It is possible to adapt IPython for system shell usage. In the past, IPython shipped a special ‘sh’ profile for this purpose, but it had been quarantined since 0.11 release, and in 1.0 it was removed altogether. Nevertheless, much of this section relies on machinery which does not require a custom profile.

You can set up your own ‘sh’ profile to be different from the default profile such that:

• Prompt shows the current directory (see Prompt customization)
• Make system commands directly available (in alias table) by running the %rehashx magic. If you install new programs along your PATH, you might want to run %rehashx to update the alias table
• turn %autocall to full mode

4.5.2 Environment variables

Rather than manipulating os.environ directly, you may like to use the magic %env command. With no arguments, this displays all environment variables and values. To get the value of a specific variable, use %env var. To set the value of a specific variable, use %env foo bar, %env foo=bar. By default values are considered to be strings so quoting them is unnecessary. However, Python variables are expanded as usual in the magic command, so %env foo=$bar means "set the environment variable foo to the value of the Python variable bar".

4.5.3 Aliases

Once you run %rehashx, all of your $PATH has been loaded as IPython aliases, so you should be able to type any normal system command and have it executed. See %alias? and %unalias? for details on the alias facilities. See also %rehashx? for details on the mechanism used to load $PATH.

4.5.4 Directory management

Since each command passed by IPython to the underlying system is executed in a subshell which exits immediately, you can NOT use cd to navigate the filesystem.

IPython provides its own builtin %cd magic command to move in the filesystem (the % is not required with automagic on). It also maintains a list of visited directories (use %dhist to see it) and allows direct switching to any of them. Type cd? for more details.

%pushd, %popd and %dirs are provided for directory stack handling.

4.5.5 Prompt customization

See Custom Prompts.

4.5.6 String lists

String lists (IPython.utils.text.SList) are handy way to process output from system commands. They are produced by

var = !cmd syntax.

First, we acquire the output of ‘ls -l’: 
Now, let’s take a look at the contents of ‘lines’ (the first number is the list element number):

Now, let’s filter out the ‘embed’ lines:

Now, we want strings having just file names and permissions:

Note how the line with ‘total’ does not raise IndexError.

If you want to split these (yielding lists), call fields() without arguments:

(continues on next page)
If you want to pass these separated with spaces to a command (typical for lists if files), use the .s property:

```python
files = l2.fields(8).s
files
```

```bash
example-demo.py example-gnuplot.py extension.py seteditor.py
˓→seteditor.pyc
```

```bash
ls $files
```

```bash
example-demo.py example-gnuplot.py extension.py seteditor.py seteditor.pyc
```

SLists are inherited from normal Python lists, so every list method is available:

```python
lines.append('hey')
```

**Real world example: remove all files outside version control**

First, capture output of “hg status”:

```bash
out = !hg status
```

```bash
['M IPython\extensions\ipy_kitcfg.py',
'M IPython\extensions\ipy_rehashdir.py',
...
'? build\lib\IPython\Debugger.py',
'? build\lib\IPython\extensions\InterpreterExec.py',
'? build\lib\IPython\extensions\InterpreterPasteInput.py',
...
```

(lines starting with ? are not under version control).

```python
junk = out.grep(r'^\?').fields(1)
```

```python
junk
```

```python
SList (.p, .n, .l, .s, .grep(), .fields() available
...
```

```bash
10: build\bdist.win32\winexe\temp\_ctypes.py
11: build\bdist.win32\winexe\temp\_hashlib.py
12: build\bdist.win32\winexe\temp\_socket.py
```

Now we can just remove these files by doing ‘rm $junk.s’.

**The .s, .n, .p properties**

The .s property returns one string where lines are separated by single space (for convenient passing to system commands). The .n property return one string where the lines are separated by a newline (i.e. the original output of the function). If the items in string list are file names, .p can be used to get a list of “path” objects for convenient file manipulation.
4.6 IPython Tips & Tricks

The IPython cookbook details more things you can do with IPython.

4.6.1 Embed IPython in your programs

A few lines of code are enough to load a complete IPython inside your own programs, giving you the ability to work with your data interactively after automatic processing has been completed. See the embedding section.

4.6.2 Run doctests

Run your doctests from within IPython for development and debugging. The special %doctest_mode command toggles a mode where the prompt, output and exceptions display matches as closely as possible that of the default Python interpreter. In addition, this mode allows you to directly paste in code that contains leading ‘>>>’ prompts, even if they have extra leading whitespace (as is common in doctest files). This combined with the %history -t call to see your translated history allows for an easy doctest workflow, where you can go from doctest to interactive execution to pasting into valid Python code as needed.

4.6.3 Use IPython to present interactive demos

Use the IPython.lib.demo.Demo class to load any Python script as an interactive demo. With a minimal amount of simple markup, you can control the execution of the script, stopping as needed. See here for more.

4.6.4 Suppress output

Put a ‘;’ at the end of a line to suppress the printing of output. This is useful when doing calculations which generate long output you are not interested in seeing. It also keeps the object out of the output cache, so if you’re working with large temporary objects, they’ll be released from memory sooner.

4.6.5 Lightweight ‘version control’

When you call %edit with no arguments, IPython opens an empty editor with a temporary file, and it returns the contents of your editing session as a string variable. Thanks to IPython’s output caching mechanism, this is automatically stored:

```python
In [1]: %edit

IPython will make a temporary file named: /tmp/ipython_edit_yR-HCN.py

Editing... done. Executing edited code...

hello - this is a temporary file

Out[1]: "print('hello - this is a temporary file')
```

Now, if you call %edit -p, IPython tries to open an editor with the same data as the last time you used %edit. So if you haven’t used %edit in the meantime, this same contents will reopen; however, it will be done in a new file. This means that if you make changes and you later want to find an old version, you can always retrieve it by using its output number, via ‘%edit _NN’, where NN is the number of the output prompt.

Continuing with the example above, this should illustrate this idea:
In [2]: edit -p
IPython will make a temporary file named: /tmp/ipython_edit_nA9Qk.py
Editing... done. Executing edited code...
hello - now I made some changes
Out[2]: "print('hello - now I made some changes')\n"

In [3]: edit _1
IPython will make a temporary file named: /tmp/ipython_edit_gy6-zD.py
Editing... done. Executing edited code...
hello - this is a temporary file
IPython version control at work :)
Out[3]: "print('hello - this is a temporary file')\nprint('IPython version control at work :')\n"

This section was written after a contribution by Alexander Belchenko on the IPython user list.

### 4.7 Python vs IPython

This document is meant to highlight the main differences between the Python language and what are the specific construct you can do only in IPython.

Unless expressed otherwise all of the construct you will see here will raise a `SyntaxError` if run in a pure Python shell, or if executing in a Python script.

Each of these features are describe more in details in further part of the documentation.

#### 4.7.1 Quick overview:

All the following construct are valid IPython syntax:

In [1]: ?
In [1]: ?object
In [1]: object?
In [1]: *pattern*?
In [1]: %shell like --syntax
In [1]: !ls
Each of these constructs is compiled by IPython into valid Python code and will do most of the time what you expect it will do. Let see each of these example in more detail.

### 4.7.2 Accessing help

As IPython is mostly an interactive shell, the question mark is a simple shortcut to get help. A question mark alone will bring up the IPython help:

```python
In [1]: ?
```

IPython -- An enhanced Interactive Python
==========================================

IPython offers a combination of convenient shell features, special commands and a history mechanism for both input (command history) and output (results caching, similar to Mathematica). It is intended to be a fully compatible replacement for the standard Python interpreter, while offering vastly improved functionality and flexibility.

At your system command line, type `ipython --h` to see the command line options available. This document only describes interactive features.

**MAIN FEATURES**
------------------

A single question mark before, or after an object available in current namespace will show help relative to this object:

```python
In [6]: object?
```

Docstring: The most base type
Type:      type

A double question mark will try to pull out more information about the object, and if possible display the Python source code of this object.

```python
In[1]: import collections
In[2]: collection.Counter??
```

Init signature: collections.Counter(*args, **kwds)
Source:
class Counter(dict):
    r"""Dict subclass for counting hashable items. Sometimes called a bag or multiset. Elements are stored as dictionary keys and their counts are stored as dictionary values."
    >>> c = Counter('abcdeabcdabcaba')  # count elements from a string
```

(continues on next page)
>>> c.most_common(3)  # three most common elements
[('a', 5), ('b', 4), ('c', 3)]
>>> sorted(c)  # list all unique elements
['a', 'b', 'c', 'd', 'e']
>>> ''.join(sorted(c.elements()))  # list elements with repetitions
'aaaaabbbbcccdde'
...

If you are looking for an object, the use of wildcards * in conjunction with question mark will allow you to search current namespace for object with matching names:

```
In [24]: *int*?
FloatingPointError
int
print
```

### 4.7.3 Shell Assignment

When doing interactive computing it is common to need to access the underlying shell. This is doable through the use of the exclamation mark ! (or bang).

This allow you to execute simple command when present in beginning of line:

```
In[1]: !pwd
/User/home/
```

Change directory:

```
In[1]: !cd /var/etc
```

Or edit file:

```
In[1]: !mvim myfile.txt
```

The line after the bang can call any program installed in the underlying shell, and support variable expansion in the form of `$variable` or `{variable}`. The later form of expansion supports arbitrary python expression:

```
In[1]: file = 'myfile.txt'
In[2]: !mv $file {file.upper()}
```

The bang can also be present in the right hand side of an assignment, just after the equal sign, or separated from it by a white space. In which case the standard output of the command after the bang ! will be split out into lines in a list-like object and assign to the left hand side.

This allow you for example to put the list of files of the current working directory in a variable:

```
In[1]: my_files = !ls
```

You can combine the different possibilities in for loops, condition, functions…:

```
my_files = !ls ~/
b = "backup file"
for i,file in enumerate(my_file):
```

(continues on next page)
raw = !echo $backup $file
!cp $file {file.split('.',0)+'.bak'}

Magics

Magics function are often present in the form of shell-like syntax, but are under the hood python function. The syntax and assignment possibility are similar to the one with the bang (!) syntax, but with more flexibility and power. Magic function start with a percent sign (%) or double percent (%%).

A magic call with a sign percent will act only one line:

```
In[1]: %xmode
Exception reporting mode: Verbose
```

And support assignment:

```
In [1]: results = %timeit -r1 -n1 -o list(range(1000))
1 loops, best of 1: 21.1 µs per loop
In [2]: results
Out[2]: <TimeitResult : 1 loops, best of 1: 21.1 µs per loop>
```

Magic with two percent sign can spread over multiple lines, but do not support assignment:

```
In[1]: %%bash
... : echo "My shell is:" $SHELL
... : echo "My disk usage is:"
... : df -h
My shell is: /usr/local/bin/bash
My disk usage is:
Filesystem   Size  Used   Avail  Capacity    iused    ifree  %iused Mounted on
/dev/disk1   233Gi  216Gi  16Gi    94%      56788108 4190706  93%   /
devfs        190Ki  190Ki  0Bi     100%     656       0    0   /dev
map -hosts   0Bi   0Bi   0Bi     100%      0        0    0   /net
map auto_home 0Bi  0Bi   0Bi     100%      0        0    0   /hom
```

Combining it all

```
find a snippet that combine all that into one thing!
```

4.8 Built-in magic commands

**Note:** To Jupyter users: Magics are specific to and provided by the IPython kernel. Whether magics are available on a kernel is a decision that is made by the kernel developer on a per-kernel basis. To work properly, Magics must use a syntax element which is not valid in the underlying language. For example, the IPython kernel uses the % syntax element for magics as % is not a valid unary operator in Python. While, the syntax element has meaning in other languages.

Here is the help auto generated from the docstrings of all the available magics function that IPython ships with.
You can create an register your own magics with IPython. You can find many user defined magics on PyPI. Feel free to publish your own and use the Framework :: IPython trove classifier.

### 4.8.1 Line magics

%alias

Define an alias for a system command.

```
%alias alias_name cmd
```

Then, typing ‘alias_name params’ will execute the system command ‘cmd params’ (from your underlying operating system).

Aliases have lower precedence than magic functions and Python normal variables, so if ‘foo’ is both a Python variable and an alias, the alias can not be executed until ‘del foo’ removes the Python variable.

You can use the %l specifier in an alias definition to represent the whole line when the alias is called. For example:

```
In [2]: alias bracket echo "Input in brackets: <%l>"
In [3]: bracket hello world
Input in brackets: <hello world>
```

You can also define aliases with parameters using %s specifiers (one per parameter):

```
In [1]: alias parts echo first %s second %s
In [2]: %parts A B
test A second B
In [3]: %parts A
Incorrect number of arguments: 2 expected.
parts is an alias to: 'echo first %s second %s'
```

Note that %l and %s are mutually exclusive. You can only use one or the other in your aliases.

Aliases expand Python variables just like system calls using ! or !!: all expressions prefixed with ‘$’ get expanded. For details of the semantic rules, see PEP-215: http://www.python.org/peps/pep-0215.html. This is the library used by IPython for variable expansion. If you want to access a true shell variable, an extra $ is necessary to prevent its expansion by IPython:

```
In [6]: alias show echo
In [7]: PATH='A Python string'
In [8]: show $PATH
A Python string
In [9]: show $$PATH
/usr/local/lf9560/bin:/usr/local/intel/compiler70/ia32/bin:...
```

You can use the alias facility to access all of $PATH. See the %rehashx function, which automatically creates aliases for the contents of your $PATH.

If called with no parameters, %alias prints the current alias table.

%alias_magic

Create an alias for an existing line or cell magic.

Examples
In 

1: %alias_magic t timeit
Created `%t` as an alias for ` %timeit`.
Created `%%t` as an alias for `%%timeit`.

In 2: %t -n1 pass
1 loops, best of 3: 954 ns per loop

In 3: %t -n
...: pass
...:
1 loops, best of 3: 954 ns per loop

In 4: %alias_magic --cell whereami pwd
UsageError: Cell magic function `%%pwd` not found.
In 5: %alias_magic --line whereami pwd
Created `whereami` as an alias for `pwd`.

In 6: %whereami
Out[6]: u'/home/testuser'

**positional arguments:** name Name of the magic to be created. target Name of the existing line or cell magic.

**optional arguments:**

- `-l`, `--line` Create a line magic alias.
- `-c`, `--cell` Create a cell magic alias.

%autocall
Make functions callable without having to type parentheses.

Usage:

```
%autocall [mode]
```

The mode can be one of: 0->Off, 1->Smart, 2->Full. If not given, the value is toggled on and off (remembering the previous state).

In more detail, these values mean:

0 -> fully disabled
1 -> active, but do not apply if there are no arguments on the line.

In this mode, you get:

In [1]: callable
Out[1]: <built-in function callable>

In [2]: callable 'hello'
------> callable('hello')
Out[2]: False

2 -> Active always. Even if no arguments are present, the callable object is called:

In [2]: float
------> float()
Out[2]: 0.0

Note that even with autocall off, you can still use `/` at the start of a line to treat the first argument on the command line as a function and add parentheses to it:
In [8]: /str 43
------> str(43)
Out[8]: '43'

# all-random (note for auto-testing)

%automagic
Make magic functions callable without having to type the initial %.
Without arguments it toggles on/off (when off, you must call it as %automagic, of course). With arguments it sets the value, and you can use any of (case insensitive):
  • on, 1, True: to activate
  • off, 0, False: to deactivate.
Note that magic functions have lowest priority, so if there’s a variable whose name collides with that of a magic fn, automagic won’t work for that function (you get the variable instead). However, if you delete the variable (del var), the previously shadowed magic function becomes visible to automagic again.

%bookmark
Manage IPython’s bookmark system.
%bookmark <name> - set bookmark to current dir %bookmark <name> <dir> - set bookmark to <dir> %bookmark -l - list all bookmarks %bookmark -d <name> - remove bookmark %bookmark -r - remove all bookmarks
You can later on access a bookmarked folder with:

%cd -b <name>

or simply ‘%cd <name>’ if there is no directory called <name> AND there is such a bookmark defined.
Your bookmarks persist through IPython sessions, but they are associated with each profile.

%cd
Change the current working directory.
This command automatically maintains an internal list of directories you visit during your IPython session, in the variable _dh. The command %dhist shows this history nicely formatted. You can also do ‘cd -<tab>’ to see directory history conveniently.
Usage:
  cd ‘dir’: changes to directory ‘dir’.
  cd -: changes to the last visited directory.
  cd -<n>: changes to the n-th directory in the directory history.
  cd –foo: change to directory that matches ‘foo’ in history
  cd -b <bookmark_name>: jump to a bookmark set by %bookmark
    (note: cd <Bookmark_name> is enough if there is no directory <bookmark_name>, but a bookmark with the name exists.) ‘cd -b <tab>’ allows you to tab-complete bookmark names.

Options:
-q: quiet. Do not print the working directory after the cd command is executed. By default IPython’s cd command does print this directory, since the default prompts do not display path information.
Note that !cd doesn’t work for this purpose because the shell where !command runs is immediately discarded after executing ‘command’.
Examples

4.8. Built-in magic commands 291
%colors
Switch color scheme for prompts, info system and exception handlers.
Currently implemented schemes: NoColor, Linux, LightBG.
Color scheme names are not case-sensitive.
Examples
To get a plain black and white terminal:

%colors nocolor

%config
configure IPython

%config Class.trait=value
This magic exposes most of the IPython config system. Any Configurable class should be able to be configured with the simple line:

%config Class.trait=value

Where value will be resolved in the user’s namespace, if it is an expression or variable name.
Examples
To see what classes are available for config, pass no arguments:

In [1]: %config
Available objects for config:
   TerminalInteractiveShell
   HistoryManager
   PrefilterManager
   AliasManager
   IPCompleter
   DisplayFormatter

To view what is configurable on a given class, just pass the class name:

In [2]: %config IPCompleter
IPCompleter options
IPCompleter.omit__names=<Enum>
   Current: 2
   Choices: (0, 1, 2)
   Instruct the completer to omit private method names
   Specifically, when completing on ``object.<tab>``.
   When 2 [default]: all names that start with '_' will be excluded.
   When 1: all 'magic' names ('__foo__') will be excluded.
   When 0: nothing will be excluded.
IPCompleter.merge_completions=<CBool>
   Current: True
   Whether to merge completion results into a single list
   If False, only the completion results from the first non-empty completer will be returned.
IPCompleter.limit_to__all__=<CBool>

(continues on next page)
but the real use is in setting values:

```
In [3]: %config IPCompleter.greedy = True
```

and these values are read from the user_ns if they are variables:

```
In [4]: feeling_greedy=False
In [5]: %config IPCompleter.greedy = feeling_greedy
```

### %debug

```
%debug [--breakpoint FILE:LINE] [statement [statement ...]]
```

Activate the interactive debugger.

This magic command support two ways of activating debugger. One is to activate debugger before executing code. This way, you can set a break point, to step through the code from the point. You can use this mode by giving statements to execute and optionally a breakpoint.

The other one is to activate debugger in post-mortem mode. You can activate this mode simply running %debug without any argument. If an exception has just occurred, this lets you inspect its stack frames interactively. Note that this will always work only on the last traceback that occurred, so you must call this quickly after an exception that you wish to inspect has fired, because if another one occurs, it clobbers the previous one.

If you want IPython to automatically do this on every exception, see the %pdb magic for more details.

**positional arguments:**

statement : Code to run in debugger. You can omit this in cell magic mode.

**optional arguments:**

--breakpoint <FILE:LINE>, -b <FILE:LINE> : Set break point at LINE in FILE.

### %dhist

```
%dhist
```

Print your history of visited directories.

```
%dhist -r : print full history
%dhist n -r : print last n entries only
%dhist n1 n2 -r : print entries between n1 and n2 (n2 not included)
```

This history is automatically maintained by the %cd command, and always available as the global list variable _dh. You can use %cd -<n> to go to directory number <n>.

Note that most of time, you should view directory history by entering cd -<TAB>.

### %dirs

```
%dists
```

Return the current directory stack.
%doctest_mode

Toggle doctest mode on and off.

This mode is intended to make IPython behave as much as possible like a plain Python shell, from the perspective of how its prompts, exceptions and output look. This makes it easy to copy and paste parts of a session into doctests. It does so by:

- Changing the prompts to the classic ‘>>>’ ones.
- Changing the exception reporting mode to ‘Plain’.
- Disabling pretty-printing of output.

Note that IPython also supports the pasting of code snippets that have leading ‘>>>’ and ‘...’ prompts in them. This means that you can paste doctests from files or docstrings (even if they have leading whitespace), and the code will execute correctly. You can then use ‘%history -t’ to see the translated history; this will give you the input after removal of all the leading prompts and whitespace, which can be pasted back into an editor.

With these features, you can switch into this mode easily whenever you need to do testing and changes to doctests, without having to leave your existing IPython session.

%edit

Bring up an editor and execute the resulting code.

Usage: %edit [options] [args]

%edit runs IPython’s editor hook. The default version of this hook is set to call the editor specified by your $EDITOR environment variable. If this isn’t found, it will default to vi under Linux/Unix and to notepad under Windows. See the end of this docstring for how to change the editor hook.

You can also set the value of this editor via the TerminalInteractiveShell.editor option in your configuration file. This is useful if you wish to use a different editor from your typical default with IPython (and for Windows users who typically don’t set environment variables).

This command allows you to conveniently edit multi-line code right in your IPython session.

If called without arguments, %edit opens up an empty editor with a temporary file and will execute the contents of this file when you close it (don’t forget to save it!).

Options:

- -n <number>: open the editor at a specified line number. By default, the IPython editor hook uses the unix syntax ‘editor +N filename’, but you can configure this by providing your own modified hook if your favorite editor supports line-number specifications with a different syntax.

- -p: this will call the editor with the same data as the previous time it was used, regardless of how long ago (in your current session) it was.

- -r: use ‘raw’ input. This option only applies to input taken from the user’s history. By default, the ‘processed’ history is used, so that magics are loaded in their transformed version to valid Python. If this option is given, the raw input as typed as the command line is used instead. When you exit the editor, it will be executed by IPython’s own processor.

- -x: do not execute the edited code immediately upon exit. This is mainly useful if you are editing programs which need to be called with command line arguments, which you can then do using %run.

Arguments:

If arguments are given, the following possibilities exist:

- If the argument is a filename, IPython will load that into the editor. It will execute its contents with execfile() when you exit, loading any code in the file into your interactive namespace.
• The arguments are ranges of input history, e.g. “7 ~1/4-6”. The syntax is the same as in the %history magic.
• If the argument is a string variable, its contents are loaded into the editor. You can thus edit any string which contains python code (including the result of previous edits).
• If the argument is the name of an object (other than a string), IPython will try to locate the file where it was defined and open the editor at the point where it is defined. You can use %edit function to load an editor exactly at the point where ‘function’ is defined, edit it and have the file be executed automatically.
• If the object is a macro (see %macro for details), this opens up your specified editor with a temporary file containing the macro’s data. Upon exit, the macro is reloaded with the contents of the file.

Note: opening at an exact line is only supported under Unix, and some editors (like kedit and gedit up to Gnome 2.8) do not understand the ‘+NUMBER’ parameter necessary for this feature. Good editors like (X)Emacs, vi, jed, pico and joe all do.

After executing your code, %edit will return as output the code you typed in the editor (except when it was an existing file). This way you can reload the code in further invocations of %edit as a variable, via _<NUMBER> or Out[<NUMBER>], where <NUMBER> is the prompt number of the output.

Note that %edit is also available through the alias %ed.

This is an example of creating a simple function inside the editor and then modifying it. First, start up the editor:

```
In [1]: edit
Editing... done. Executing edited code...
Out[1]: 'def foo():
    print "foo() was defined in an editing session"
'
```

We can then call the function foo():

```
In [2]: foo()
foo() was defined in an editing session
```

Now we edit foo. IPython automatically loads the editor with the (temporary) file where foo() was previously defined:

```
In [3]: edit foo
Editing... done. Executing edited code...
```

And if we call foo() again we get the modified version:

```
In [4]: foo()
foo() has now been changed!
```

Here is an example of how to edit a code snippet successive times. First we call the editor:

```
In [5]: edit
Editing... done. Executing edited code...
hello
Out[5]: "print 'hello'"
```

Now we call it again with the previous output (stored in _):

```
In [6]: edit _
Editing... done. Executing edited code...
hello world
Out[6]: "print 'hello world'"
```
Now we call it with the output #8 (stored in _8, also as Out[8]):

```
In [7]: edit _8
Editing... done. Executing edited code...
hello again
Out[7]: "print 'hello again'\n"
```

Changing the default editor hook:

If you wish to write your own editor hook, you can put it in a configuration file which you load at startup time. The default hook is defined in the IPython.core.hooks module, and you can use that as a starting example for further modifications. That file also has general instructions on how to set a new hook for use once you’ve defined it.

```
%env
Get, set, or list environment variables.
Usage:
%env: lists all environment variables/values
%env var: get value for var
%env var val: set value for var
%env var=val: set value for var
%env var=$val: set value for var, using python expansion if possible
```

```
%gui
Enable or disable IPython GUI event loop integration.
%gui [GUINAME]
This magic replaces IPython’s threaded shells that were activated using the (pylab/wthread/etc.) command line flags. GUI toolkits can now be enabled at runtime and keyboard interrupts should work without any problems. The following toolkits are supported: wxPython, PyQt4, PyGTK, Tk and Cocoa (OSX):

```
%gui wx       # enable wxPython event loop integration
%gui qt4|qt    # enable PyQt4 event loop integration
%gui qt5      # enable PyQt5 event loop integration
%gui gtk      # enable PyGTK event loop integration
%gui gtk3     # enable Gtk3 event loop integration
%gui tk       # enable Tk event loop integration
%gui osx      # enable Cocoa event loop integration
            # (requires $matplotlib 1.1)
%gui          # disable all event loop integration
```

WARNING: after any of these has been called you can simply create an application object, but DO NOT start the event loop yourself, as we have already handled that.

```
%history
Print input history (_i<n> variables), with most recent last.
By default, input history is printed without line numbers so it can be directly pasted into an editor. Use -n to show them.
By default, all input history from the current session is displayed. Ranges of history can be indicated using the syntax:
4 Line 4, current session
```
4–6 Lines 4-6, current session

243/1–5 Lines 1-5, session 243

~2/7 Line 7, session 2 before current

~8/1–~6/5 From the first line of 8 sessions ago, to the fifth line of 6 sessions ago.

Multiple ranges can be entered, separated by spaces

The same syntax is used by %macro, %save, %edit, %rerun

Examples

```
In [6]: %history -n 4-6
4:a = 12
5:print a**2
6:%history -n 4-6
```

**positional arguments:** range

**optional arguments:**

- `-n` print line numbers for each input. This feature is only available if numbered prompts are in use.

- `-o` also print outputs for each input.

- `-p` print classic ‘>>>’ python prompts before each input. This is useful for making documentation, and in conjunction with -o, for producing doctest-ready output.

- `-t` print the ‘translated’ history, as IPython understands it. IPython filters your input and converts it all into valid Python source before executing it (things like magics or aliases are turned into function calls, for example). With this option, you’ll see the native history instead of the user-entered version: ‘%cd /’ will be seen as ‘get_ipython().magic(“%cd /”)’ instead of ‘%cd /’.

- `-f FILENAME` FILENAME: instead of printing the output to the screen, redirect it to the given file. The file is always overwritten, though *when it can*, IPython asks for confirmation first. In particular, running the command ‘history -f FILENAME’ from the IPython Notebook interface will replace FILENAME even if it already exists *without* confirmation.

- `-g <[PATTERN [PATTERN …]]>` treat the arg as a glob pattern to search for in (full) history. This includes the saved history (almost all commands ever written). The pattern may contain ‘?’ to match one unknown character and ‘*’ to match any number of unknown characters. Use ‘%hist -g’ to show full saved history (may be very long).

- `-l <[LIMIT]>` get the last n lines from all sessions. Specify n as a single arg, or the default is the last 10 lines.

- `-u` when searching history using -g, show only unique history.

%killbgscripts
Kill all BG processes started by %%script and its family.

%load
Load code into the current frontend.

4.8. Built-in magic commands
**Usage:** `%load [options] source`

where source can be a filename, URL, input history range, macro, or element in the user namespace

**Options:**

- `-r <lines>`: Specify lines or ranges of lines to load from the source. Ranges could be specified as x-y (x..y) or in python-style x:y (x..(y-1)). Both limits x and y can be left blank (meaning the beginning and end of the file, respectively).

- `-s <symbols>`: Specify function or classes to load from python source.

- `-y`: Don’t ask confirmation for loading source above 200 000 characters.

- `-n`: Include the user’s namespace when searching for source code.

This magic command can either take a local filename, a URL, an history range (see `%history`) or a macro as argument, it will prompt for confirmation before loading source with more than 200 000 characters, unless `-y` flag is passed or if the frontend does not support raw_input:

```bash
%load myscript.py
%load 7-27
%load myMacro
%load http://www.example.com/myscript.py
%load -r 5-10 myscript.py
%load -r 10-20,30,40: foo.py
%load -s MyClass,wonder_function myscript.py
%load -n MyClass
%load -n my_module.wonder_function
```

### `%load_ext`

Load an IPython extension by its module name.

### `%loadpy`

Alias of `%load`

%loadpy has gained some flexibility and dropped the requirement of a `.py` extension. So it has been renamed simply into `%load`. You can look at `%load`’s docstring for more info.

### `%logoff`

Temporarily stop logging.

You must have previously started logging.

### `%logon`

Restart logging.

This function is for restarting logging which you’ve temporarily stopped with `%logoff`. For starting logging for the first time, you must use the `%logstart` function, which allows you to specify an optional log filename.

### `%logstart`

Start logging anywhere in a session.

%logstart [-olrt] [log_name [log_mode]]

If no name is given, it defaults to a file named ‘ipython_log.py’ in your current directory, in ‘rotate’ mode (see below).

‘%logstart name’ saves to file ‘name’ in ‘backup’ mode. It saves your history up to that point and then continues logging.

%logstart takes a second optional parameter: logging mode. This can be one of (note that the modes are given unquoted):
**append**  Keep logging at the end of any existing file.

**backup**  Rename any existing file to name~ and start name.

**global**  Append to a single logfile in your home directory.

**over**  Overwrite any existing log.

**rotate**  Create rotating logs: name.1~, name.2~, etc.

Options:

- **-o**  log also IPython’s output. In this mode, all commands which generate an Out[NN] prompt are recorded to the logfile, right after their corresponding input line. The output lines are always prepended with a ‘#[Out]#’ marker, so that the log remains valid Python code.

Since this marker is always the same, filtering only the output from a log is very easy, using for example a simple awk call:

```
awk -F'#\[Out\]#' '{if($2) {print $2}}' ipython_log.py
```

- **-r**  log ‘raw’ input. Normally, IPython’s logs contain the processed input, so that user lines are logged in their final form, converted into valid Python. For example, %Exit is logged as _ip.magic("Exit"). If the -r flag is given, all input is logged exactly as typed, with no transformations applied.

- **-t**  put timestamps before each input line logged (these are put in comments).

**%logstate**

Print the status of the logging system.

**%logstop**

Fully stop logging and close log file.

In order to start logging again, a new %logstart call needs to be made, possibly (though not necessarily) with a new filename, mode and other options.

**%lsmagic**

List currently available magic functions.

**%macro**

Define a macro for future re-execution. It accepts ranges of history, filenames or string objects.

*Usage:*  %macro [options] name n1-n2 n3-n4 . . . n5 .. n6 . . .

Options:

- **-r:** use ‘raw’ input. By default, the ‘processed’ history is used, so that magics are loaded in their transformed version to valid Python. If this option is given, the raw input as typed at the command line is used instead.

- **-q:** quiet macro definition. By default, a tag line is printed to indicate the macro has been created, and then the contents of the macro are printed. If this option is given, then no printout is produced once the macro is created.

This will define a global variable called name which is a string made of joining the slices and lines you specify (n1,n2,... numbers above) from your input history into a single string. This variable acts like an automatic
function which re-executes those lines as if you had typed them. You just type `name` at the prompt and the code executes.

The syntax for indicating input ranges is described in `%history`.

Note: as a ‘hidden’ feature, you can also use traditional python slice notation, where N:M means numbers N through M-1.

For example, if your history contains (print using `%hist -n`):

```
44: x=1
45: y=3
46: z=x+y
47: print x
48: a=5
49: print 'x',x,'y',y
```

you can create a macro with lines 44 through 47 (included) and line 49 called my_macro with:

```
In [55]: %macro my_macro 44-47 49
```

Now, typing `my_macro` (without quotes) will re-execute all this code in one pass.

You don’t need to give the line-numbers in order, and any given line number can appear multiple times. You can assemble macros with any lines from your input history in any order.

The macro is a simple object which holds its value in an attribute, but IPython’s display system checks for macros and executes them as code instead of printing them when you type their name.

You can view a macro’s contents by explicitly printing it with:

```
print macro_name
```

---

**%magic**

Print information about the magic function system.

Supported formats: -latex, -brief, -rest

**%matplotlib**

Set up matplotlib to work interactively.

This function lets you activate matplotlib interactive support at any point during an IPython session. It does not import anything into the interactive namespace.

If you are using the inline matplotlib backend in the IPython Notebook you can set which figure formats are enabled using the following:

```
In [1]: from IPython.display import set_matplotlib_formats
In [2]: set_matplotlib_formats('pdf', 'svg')
```

The default for inline figures sets `bbox_inches` to ‘tight’. This can cause discrepancies between the displayed image and the identical image created using `savefig`. This behavior can be disabled using the `%config` magic:

```
In [3]: %config InlineBackend.print_figure_kwargs = {'bbox_inches':None}
```
In addition, see the docstring of `IPython.display.set_matplotlib_formats` and `IPython.display.set_matplotlib_close` for more information on changing additional behaviors of the inline backend.

Examples

To enable the inline backend for usage with the IPython Notebook:

```
In [1]: %matplotlib inline
```

In this case, where the matplotlib default is TkAgg:

```
In [2]: %matplotlib
Using matplotlib backend: TkAgg
```

But you can explicitly request a different GUI backend:

```
In [3]: %matplotlib qt
```

You can list the available backends using the `-l/--list` option:

```
In [4]: %matplotlib --list
Available matplotlib backends: ['osx', 'qt4', 'qt5', 'gtk3', 'notebook', 'wx', 'qt', 'nbagg', 'gtk', 'tk', 'inline']
```

### positional arguments:


### optional arguments:

- `-l`, `--list` Show available matplotlib backends

### %notebook

```
%notebook filename
```

Export and convert IPython notebooks.

This function can export the current IPython history to a notebook file. For example, to export the history to “foo.ipynb” do “%notebook foo.ipynb”.

The `-e` or `--export` flag is deprecated in IPython 5.2, and will be removed in the future.

### positional arguments: filename Notebook name or filename

### %page

```
%page [options] OBJECT
```

Pretty print the object and display it through a pager.

If no object is given, use _ (last output).

Options:

- `-r`: `page str(object)`, don’t pretty-print it.
%pastebin
  Upload code to Github's Gist paste bin, returning the URL.
  
  **Usage:** %pastebin [-d “Custom description”] 1-7
  
  The argument can be an input history range, a filename, or the name of a string or macro.
  
  **Options:**

  -d: Pass a custom description for the gist. The default will say “Pasted from IPython”.

%pdb
  Control the automatic calling of the pdb interactive debugger.

  Call as `%%%pdb on`, `%%%pdb 1`, `%%%pdb off` or `%%%pdb 0`. If called without argument it works as a toggle.

  When an exception is triggered, IPython can optionally call the interactive pdb debugger after the traceback printout. %pdb toggles this feature on and off.

  The initial state of this feature is set in your configuration file (the option is `InteractiveShell.pdb`).

  If you want to just activate the debugger AFTER an exception has fired, without having to type `%%%pdb on` and rerunning your code, you can use the `%debug` magic.

%pdef
  Print the call signature for any callable object.

  If the object is a class, print the constructor information.

  **Examples**

  ```
  In [3]: %pdef urllib.urlopen
     urllib.urlopen(url, data=\texttt{None}, proxies=\texttt{None})
  ```

%pdoc
  Print the docstring for an object.

  If the given object is a class, it will print both the class and the constructor docstrings.

%pfile
  Print (or run through pager) the file where an object is defined.

  The file opens at the line where the object definition begins. IPython will honor the environment variable PAGER if set, and otherwise will do its best to print the file in a convenient form.

  If the given argument is not an object currently defined, IPython will try to interpret it as a filename (automatically adding a .py extension if needed). You can thus use %pfile as a syntax highlighting code viewer.

%pinfo
  Provide detailed information about an object.

  `%%%pinfo object` is just a synonym for `object?` or `?object`.

%pinfo2
  Provide extra detailed information about an object.

  `%%%pinfo2 object` is just a synonym for `object??` or `??object`.

%popd
  Change to directory popped off the top of the stack.

%pprint
  Toggle pretty printing on/off.
%precision

Set floating point precision for pretty printing.

Can set either integer precision or a format string.

If numpy has been imported and precision is an int, numpy display precision will also be set, via numpy.set_printoptions.

If no argument is given, defaults will be restored.

Examples

```python
In [1]: from math import pi
In [2]: %precision 3
Out[2]: u'%.3f'
In [3]: pi
Out[3]: 3.142
In [4]: %precision %i
Out[4]: u'\%i'
In [5]: pi
Out[5]: 3
In [6]: %precision %e
Out[6]: u'\%e'
In [7]: pi**10
Out[7]: 9.364805e+04
In [8]: %precision
Out[8]: u'\%r'
In [9]: pi**10
Out[9]: 93648.047476082982
```

%profile

DEPRECATED since IPython 2.0.

Raise UsageError. To profile code use the prun magic.

See Also

prun : run code using the Python profiler (prun)

%prun

Run a statement through the python code profiler.

Usage, in line mode: %prun [options] statement

Usage, in cell mode: %prun [options] [statement] code... code...

In cell mode, the additional code lines are appended to the (possibly empty) statement in the first line. Cell mode allows you to easily profile multiline blocks without having to put them in a separate function.

The given statement (which doesn’t require quote marks) is run via the python profiler in a manner similar to the profile.run() function. Namespaces are internally managed to work correctly; profile.run cannot be used in IPython because it makes certain assumptions about namespaces which do not hold under IPython.

Options:
you can place restrictions on what or how much of the profile gets printed. The limit value can be:

- A string: only information for function names containing this string is printed.
- An integer: only these many lines are printed.
- A float (between 0 and 1): this fraction of the report is printed (for example, use a limit of 0.4 to see the topmost 40% only).

You can combine several limits with repeated use of the option. For example, `-l __init__ -l 5` will print only the topmost 5 lines of information about class constructors.

- `r` return the pstats.Stats object generated by the profiling. This object has all the information about the profile in it, and you can later use it for further analysis or in other functions.

- `s <key>` sort profile by given key. You can provide more than one key by using the option several times: `-s key1 -s key2 -s key3...`. The default sorting key is `time`.

The following is copied verbatim from the profile documentation referenced below:

When more than one key is provided, additional keys are used as secondary criteria when there is equality in all keys selected before them.

Abbreviations can be used for any key names, as long as the abbreviation is unambiguous. The following are the keys currently defined:

<table>
<thead>
<tr>
<th>Valid Arg</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;calls&quot;</td>
<td>call count</td>
</tr>
<tr>
<td>&quot;cumulative&quot;</td>
<td>cumulative time</td>
</tr>
<tr>
<td>&quot;file&quot;</td>
<td>file name</td>
</tr>
<tr>
<td>&quot;module&quot;</td>
<td>file name</td>
</tr>
<tr>
<td>&quot;pcalls&quot;</td>
<td>primitive call count</td>
</tr>
<tr>
<td>&quot;line&quot;</td>
<td>line number</td>
</tr>
<tr>
<td>&quot;name&quot;</td>
<td>function name</td>
</tr>
<tr>
<td>&quot;nfl&quot;</td>
<td>name/file/line</td>
</tr>
<tr>
<td>&quot;stdname&quot;</td>
<td>standard name</td>
</tr>
<tr>
<td>&quot;time&quot;</td>
<td>internal time</td>
</tr>
</tbody>
</table>

Note that all sorts on statistics are in descending order (placing most time consuming items first), where as name, file, and line number searches are in ascending order (i.e., alphabetical). The subtle distinction between “nfl” and “stdname” is that the standard name is a sort of the name as printed, which means that the embedded line numbers get compared in an odd way. For example, lines 3, 20, and 40 would (if the file names were the same) appear in the string order “20” “3” and “40”. In contrast, “nfl” does a numeric compare of the line numbers. In fact, sort_stats("nfl") is the same as sort_stats("name", "file", "line").

- `T <filename>` save profile results as shown on screen to a text file. The profile is still shown on screen.

- `D <filename>` save (via dump_stats) profile statistics to given filename. This data is in a format understood by the pstats module, and is generated by a call to
the dump_stats() method of profile objects. The profile is still shown on
screen.

-q
suppress output to the pager. Best used with -T and/or -D above.

If you want to run complete programs under the profiler’s control, use %run -p [prof_opts]
filename.py [args to program] where prof_opts contains profiler specific options as described here.

You can read the complete documentation for the profile module with:

In [i]: import profile; profile.help()

%psearch
Search for object in namespaces by wildcard.

%psearch [options] PATTERN [OBJECT TYPE]

Note: ? can be used as a synonym for %psearch, at the beginning or at the end: both a*? and ?a* are equivalent
to ‘%psearch a*’. Still, the rest of the command line must be unchanged (options come first), so for example
the following forms are equivalent

%psearch -i a* function -i a* function? ?-i a* function

Arguments:

PATTERN
where PATTERN is a string containing * as a wildcard similar to its use in a shell. The pattern is
matched in all namespaces on the search path. By default objects starting with a single _ are not
matched, many IPython generated objects have a single underscore. The default is case insensitive
matching. Matching is also done on the attributes of objects and not only on the objects in a module.

[OBJECT TYPE]
Is the name of a python type from the types module. The name is given in lowercase without the
ending type, ex. StringType is written string. By adding a type here only objects matching the given
type are matched. Using all here makes the pattern match all types (this is the default).

Options:

-a: makes the pattern match even objects whose names start with a single underscore. These names
are normally omitted from the search.

-i/-c: make the pattern case insensitive/sensitive. If neither of these options are given,
the default is read from your configuration file, with the option InteractiveShell.
wildcards_case_sensitive. If this option is not specified in your configuration file,
IPython’s internal default is to do a case sensitive search.

-e/-s NAMESPACE: exclude/search a given namespace. The pattern you specify can be searched in
any of the following namespaces: ‘builtin’, ‘user’, ‘user_global’, ‘internal’, ‘alias’, where ‘builtin’
and ‘user’ are the search defaults. Note that you should not use quotes when specifying namespaces.

‘Builtin’ contains the python module builtin, ‘user’ contains all user data, ‘alias’ only contain the
shell aliases and no python objects, ‘internal’ contains objects used by IPython. The ‘user_global’
namespace is only used by embedded IPython instances, and it contains module-level globals. You
can add namespaces to the search with -s or exclude them with -e (these options can be given more
than once).

Examples

%psearch a* -> objects beginning with an a
%psearch -e builtin a* -> objects NOT in the builtin space starting in a

(continues on next page)
%psearch a* function -> all functions beginning with an a
%psearch re.e* -> objects beginning with an e in module re
%psearch r*e* -> objects that start with e in modules starting in r
%psearch r*.* string -> all strings in modules beginning with r

Case sensitive search:
%psearch -c a* list all object beginning with lower case a

Show objects beginning with a single _:
%psearch -a _* list objects beginning with a single underscore

%psource
Print (or run through pager) the source code for an object.

%pushd
Place the current dir on stack and change directory.
Usage: %pushd ['dirname']

%pwd
Return the current working directory path.

Examples

In [9]: pwd
Out[9]: '/home/tsuser/sprint/ipython'

%pycat
Show a syntax-highlighted file through a pager.
This magic is similar to the cat utility, but it will assume the file to be Python source and will show it with syntax highlighting.
This magic command can either take a local filename, an url, an history range (see %history) or a macro as argument

%pycat myscript.py
%pycat 7-27
%pycat myMacro
%pycat http://www.example.com/myscript.py

%pylab

%pylab [--no-import-all] [gui]

Load numpy and matplotlib to work interactively.
This function lets you activate pylab (matplotlib, numpy and interactive support) at any point during an IPython session.
%pylab makes the following imports:

import numpy
import matplotlib
from matplotlib import pylab, mlab, pyplot
If you pass `--no-import-all`, the last two `*` imports will be excluded.

See the `%matplotlib` magic for more details about activating matplotlib without affecting the interactive namespace.

**Positional arguments:**

- `gui` Name of the matplotlib backend to use (`'agg'`, `'gtk'`, `'gtk3'`, `'inline'`, `'ipympl'`, `'nbagg'`, `'notebook'`, `'osx'`, `'pdf'`, `'ps'`, `'qt'`, `'qt4'`, `'qt5'`, `'svg'`, `'tk'`, `'widget'`, `'wx'`). If given, the corresponding matplotlib backend is used, otherwise it will be matplotlib’s default (which you can set in your matplotlib config file).

**Optional arguments:**

- `--no-import-all` Prevent IPython from performing `import *` into the interactive namespace. You can govern the default behavior of this flag with the InteractiveShellApp.pylab_import_all configurable.

---

### `%quickref`

Show a quick reference sheet

### `%recall`

Repeat a command, or get command to input line for editing.

- `%recall` and `%rep` are equivalent.

  - `%recall` (no arguments):

    Place a string version of last computation result (stored in the special `_` variable) to the next input prompt. Allows you to create elaborate command lines without using copy-paste:

    ```
    In[1]: l = ['hei', 'vaan']
    In[2]: ''.join(l)
    Out[2]: heivaan
    In[3]: %recall
    In[4]: heivaan_ <= cursor blinking
    ```

- `%recall 45`

  Place history line 45 on the next input prompt. Use `%hist` to find out the number.

- `%recall 1-4`

  Combine the specified lines into one cell, and place it on the next input prompt. See `%history` for the slice syntax.

- `%recall foo+bar`

  If foo+bar can be evaluated in the user namespace, the result is placed at the next input prompt. Otherwise, the history is searched for lines which contain that substring, and the most recent one is placed at the next input prompt.
%rehashx
Update the alias table with all executable files in $PATH.

rehashx explicitly checks that every entry in $PATH is a file with execute access (os.X_OK).

Under Windows, it checks executability as a match against a ‘|’-separated string of extensions, stored in the
IPython config variable win_exec_ext. This defaults to ‘exe|com|bat’.

This function also resets the root module cache of module completer, used on slow filesystems.

%reload_ext
Reload an IPython extension by its module name.

%rerun
Re-run previous input

By default, you can specify ranges of input history to be repeated (as with %history). With no arguments, it will
repeat the last line.

Options:
-1 <n> : Repeat the last n lines of input, not including the current command.
-g foo : Repeat the most recent line which contains foo

%reset
Resets the namespace by removing all names defined by the user, if called without arguments, or by removing
some types of objects, such as everything currently in IPython’s In[] and Out[] containers (see the parameters
for details).

Parameters
-f : force reset without asking for confirmation.
-s ['Soft’ reset: Only clears your namespace, leaving history intact.] References to objects may be kept. By
default (without this option), we do a ‘hard’ reset, giving you a new session and removing all references to
objects from the current session.

in : reset input history
out : reset output history
dhist : reset directory history
array : reset only variables that are NumPy arrays

See Also
reset_selective : invoked as %reset_selective

Examples

In [6]: a = 1
In [7]: a
Out[7]: 1
In [8]: 'a' in _ip.user_ns
Out[8]: True
In [9]: %reset -f
In [1]: 'a' in _ip.user_ns
Out[1]: False

(continues on next page)
In [2]: %reset -f in
Flushing input history

In [3]: %reset -f dhist in
Flushing directory history
Flushing input history

Notes
Calling this magic from clients that do not implement standard input, such as the ipython notebook interface, will reset the namespace without confirmation.

%reset_selective
Resets the namespace by removing names defined by the user.
Input/Output history are left around in case you need them.
%reset_selective [-f] regex
No action is taken if regex is not included

Options  -f: force reset without asking for confirmation.

See Also
reset: invoked as %reset

Examples
We first fully reset the namespace so your output looks identical to this example for pedagogical reasons; in practice you do not need a full reset:

In [1]: %reset -f

Now, with a clean namespace we can make a few variables and use %reset_selective to only delete names that match our regexp:

In [2]: a=1; b=2; c=3; b4m=4; b3m=5; b2m=6; b4m=7; b2s=8
In [3]: who_ls
Out[3]: ['a', 'b', 'b4m', 'b3m', 'b2s', 'b2m', 'c']
In [4]: %reset_selective -f b[2-3]m
In [5]: who_ls
Out[5]: ['a', 'b', 'b4m', 'b2s', 'c']
In [6]: %reset_selective -f d
In [7]: who_ls
Out[7]: ['a', 'b', 'b4m', 'b2s', 'c']
In [8]: %reset_selective -f c
In [9]: who_ls
Out[9]: ['a', 'b', 'b4m', 'b2s']
In [10]: %reset_selective -f b
In [11]: who_ls
Out[11]: ['a']

Notes
Calling this magic from clients that do not implement standard input, such as the ipython notebook interface, will reset the namespace without confirmation.

%run
Run the named file inside IPython as a program.

Usage:

%run [-n -i -e -G]

\[( -t [-N<N>] | -d [-b<N>] | -p [profile options] )\]

\( ( -m mod | file ) \) [args]

Parameters after the filename are passed as command-line arguments to the program (put in sys.argv). Then, control returns to IPython’s prompt.

This is similar to running at a system prompt python file args, but with the advantage of giving you IPython’s tracebacks, and of loading all variables into your interactive namespace for further use (unless -p is used, see below).

The file is executed in a namespace initially consisting only of __name__=='__main__' and sys.argv constructed as indicated. It thus sees its environment as if it were being run as a stand-alone program (except for sharing global objects such as previously imported modules). But after execution, the IPython interactive namespace gets updated with all variables defined in the program (except for __name__ and sys.argv). This allows for very convenient loading of code for interactive work, while giving each program a ‘clean sheet’ to run in.

Arguments are expanded using shell-like glob match. Patterns ‘*’, ‘?’, ‘[seq]’ and ‘[!seq]’ can be used. Additionally, tilde ‘~’ will be expanded into user’s home directory. Unlike real shells, quotation does not suppress expansions. Use two back slashes (e.g. `\` *) to suppress expansions. To completely disable these expansions, you can use -G flag.

Options:

- **-n** __name__ is NOT set to ‘__main__’, but to the running file’s name without extension (as python does under import). This allows running scripts and reloading the definitions in them without calling code protected by an if __name__ == "__main__" clause.

- **-i** run the file in IPython’s namespace instead of an empty one. This is useful if you are experimenting with code written in a text editor which depends on variables defined interactively.

- **-e** ignore sys.exit() calls or SystemExit exceptions in the script being run. This is particularly useful if IPython is being used to run unittests, which always exit with a sys.exit() call. In such cases you are interested in the output of the test results, not in seeing a traceback of the unittest module.

- **-t** print timing information at the end of the run. IPython will give you an estimated CPU time consumption for your script, which under Unix uses the resource module to avoid the wraparound problems of time.clock(). Under Unix, an estimate of time spent on system tasks is also given (for Windows platforms this is reported as 0.0).
If `-t` is given, an additional `-N<N>` option can be given, where `<N>` must be an integer indicating how many times you want the script to run. The final timing report will include total and per run results.

For example (testing the script `uniq_stable.py`):

```
In [1]: run -t uniq_stable
IPython CPU timings (estimated):
   User :  0.19597 s.
   System:  0.0 s.
In [2]: run -t -N5 uniq_stable
IPython CPU timings (estimated):
Total runs performed: 5
   Times : Total       Per run
   User :  0.910862 s,  0.1821724 s.
   System:  0.0 s,       0.0 s.
```

-d  
run your program under the control of pdb, the Python debugger. This allows you to execute your program step by step, watch variables, etc. Internally, what IPython does is similar to calling:

```
pdb.run('execfile("YOURFILENAME")')
```

with a breakpoint set on line 1 of your file. You can change the line number for this automatic breakpoint to be `<N>` by using the `-bN` option (where `N` must be an integer). For example:

```
%run -d -b40 myscript
```

will set the first breakpoint at line 40 in myscript.py. Note that the first breakpoint must be set on a line which actually does something (not a comment or docstring) for it to stop execution.

Or you can specify a breakpoint in a different file:

```
%run -d -b myotherfile.py:20 myscript
```

When the pdb debugger starts, you will see a (Pdb) prompt. You must first enter ‘c’ (without quotes) to start execution up to the first breakpoint.

Entering ‘help’ gives information about the use of the debugger. You can easily see pdb’s full documentation with “import pdb;pdb.help()” at a prompt.

-p  
run program under the control of the Python profiler module (which prints a detailed report of execution times, function calls, etc).

You can pass other options after `-p` which affect the behavior of the profiler itself. See the docs for `%prun` for details.

In this mode, the program’s variables do NOT propagate back to the IPython interactive namespace (because they remain in the namespace where the profiler executes them).

Internally this triggers a call to `%prun`, see its documentation for details on the options available specifically for profiling.

4.8. Built-in magic commands
There is one special usage for which the text above doesn’t apply: if the filename ends with .ipy[nb], the file is run as ipython script, just as if the commands were written on IPython prompt.

-m specify module name to load instead of script path. Similar to the -m option for the python interpreter. Use this option last if you want to combine with other %run options. Unlike the python interpreter only source modules are allowed no .pyc or .pyo files. For example:

```
%run -m example
```

will run the example module.

-G disable shell-like glob expansion of arguments.

%save
Save a set of lines or a macro to a given filename.

**Usage:** %save [options] filename n1-n2 n3-n4 . . . n5 .. n6 . . .

**Options:**
- `-r`: use ‘raw’ input. By default, the ‘processed’ history is used, so that magics are loaded in their transformed version to valid Python. If this option is given, the raw input as typed as the command line is used instead.
- `-f`: force overwrite. If file exists, %save will prompt for overwrite unless -f is given.
- `-a`: append to the file instead of overwriting it.

This function uses the same syntax as %history for input ranges, then saves the lines to the filename you specify. It adds a ‘.py’ extension to the file if you don’t do so yourself, and it asks for confirmation before overwriting existing files.

If -r option is used, the default extension is .ipy.

%sc
Shell capture - run shell command and capture output (DEPRECATED use !).

DEPRECATED. Suboptimal, retained for backwards compatibility.

You should use the form ‘var = !command’ instead. Example:

```
"%sc -l myfiles = ls ~" should now be written as
"myfiles = !ls ~"
```

myfiles.s, myfiles.l and myfiles.n still apply as documented below.

%sc [options] varname=command

IPython will run the given command using commands.getoutput(), and will then update the user’s interactive namespace with a variable called varname, containing the value of the call. Your command can contain shell wildcards, pipes, etc.

The ‘=’ sign in the syntax is mandatory, and the variable name you supply must follow Python’s standard conventions for valid names.

(A special format without variable name exists for internal use)

**Options:**
- `-l`: list output. Split the output on newlines into a list before assigning it to the given variable. By default the output is stored as a single string.
- `-v`: verbose. Print the contents of the variable.
In most cases you should not need to split as a list, because the returned value is a special type of string which can automatically provide its contents either as a list (split on newlines) or as a space-separated string. These are convenient, respectively, either for sequential processing or to be passed to a shell command.

For example:

```python
# Capture into variable a
In [1]: sc a=ls *py

# a is a string with embedded newlines
In [2]: a
Out[2]: 'setup.py
win32_manual_post_install.py'

# which can be seen as a list:
In [3]: a.l
Out[3]: ['setup.py', 'win32_manual_post_install.py']

# or as a whitespace-separated string:
In [4]: a.s
Out[4]: 'setup.py win32_manual_post_install.py'

# a.s is useful to pass as a single command line:
In [5]: !wc -l $a.s
   146 setup.py
   130 win32_manual_post_install.py
   276 total

# while the list form is useful to loop over:
In [6]: for f in a.l:
   ...: !wc -l $f
   ...:
   146 setup.py
   130 win32_manual_post_install.py

Similarly, the lists returned by the -l option are also special, in the sense that you can equally invoke the .s attribute on them to automatically get a whitespace-separated string from their contents:

```python
In [7]: sc -l b=ls *py

In [8]: b
Out[8]: ['setup.py', 'win32_manual_post_install.py']

In [9]: b.s
Out[9]: 'setup.py win32_manual_post_install.py'
```

In summary, both the lists and strings used for output capture have the following special attributes:

- `.l` (or `.list`): value as list.
- `.n` (or `.nlstr`): value as newline-separated string.
- `.s` (or `.spstr`): value as space-separated string.

%set_env

Set environment variables. Assumptions are that either “val” is a name in the user namespace, or val is something that evaluates to a string.

Usage: `%set_env var val`: set value for var `%set_env var=val`: set value for var `%set_env var=$val`: set value for var, using python expansion if possible

%sx
Shell execute - run shell command and capture output (!! is short-hand).

%sx command

IPython will run the given command using commands.getoutput(), and return the result formatted as a list (split on ‘n’). Since the output is _returned_, it will be stored in ipython’s regular output cache Out[N] and in the ‘_N’ automatic variables.

Notes:
1) If an input line begins with ‘!!’, then %sx is automatically invoked. That is, while:

```python
!ls
```

causes ipython to simply issue system(‘ls’), typing:

```python
!!ls
```

is a shorthand equivalent to:

```python
%sx ls
```

2) %sx differs from %sc in that %sx automatically splits into a list, like ‘%sc -l’. The reason for this is to make it as easy as possible to process line-oriented shell output via further python commands. %sc is meant to provide much finer control, but requires more typing.

3) Just like %sc -l, this is a list with special attributes:

```
.l (or .list): value as list.
.n (or .nlstr): value as newline-separated string.
.s (or .spstr): value as whitespace-separated string.
```

This is very useful when trying to use such lists as arguments to system commands.

%system

Shell execute - run shell command and capture output (!! is short-hand).

%sx command

IPython will run the given command using commands.getoutput(), and return the result formatted as a list (split on ‘n’). Since the output is _returned_, it will be stored in ipython’s regular output cache Out[N] and in the ‘_N’ automatic variables.

Notes:
1) If an input line begins with ‘!!’, then %sx is automatically invoked. That is, while:

```python
!ls
```

causes ipython to simply issue system(‘ls’), typing:

```python
!!ls
```

is a shorthand equivalent to:

```python
%sx ls
```

2) %sx differs from %sc in that %sx automatically splits into a list, like ‘%sc -l’. The reason for this is to make it as easy as possible to process line-oriented shell output via further python commands. %sc is meant to provide much finer control, but requires more typing.

3) Just like %sc -l, this is a list with special attributes:
This is very useful when trying to use such lists as arguments to system commands.

%tb
Print the last traceback with the currently active exception mode.
See %xmode for changing exception reporting modes.

%time
Time execution of a Python statement or expression.
The CPU and wall clock times are printed, and the value of the expression (if any) is returned. Note that under
Win32, system time is always reported as 0, since it can not be measured.
This function can be used both as a line and cell magic:
• In line mode you can time a single-line statement (though multiple ones can be chained with using semi-
colons).
• In cell mode, you can time the cell body (a directly following statement raises an error).
This function provides very basic timing functionality. Use the timeit magic for more control over the measure-
ment.
Examples

In [1]: %time 2**128
CPU times: user 0.00 s, sys: 0.00 s, total: 0.00 s
Wall time: 0.00
Out[1]: 340282366920938463463374607431768211456L

In [2]: n = 1000000

In [3]: %time sum(range(n))
CPU times: user 1.20 s, sys: 0.05 s, total: 1.25 s
Wall time: 1.37
Out[3]: 499999500000L

In [4]: %time print 'hello world'
hello world
CPU times: user 0.00 s, sys: 0.00 s, total: 0.00 s
Wall time: 0.00

Note that the time needed by Python to compile the given expression
will be reported if it is more than 0.1s. In this example, the
actual exponentiation is done by Python at compilation time, so while
the expression can take a noticeable amount of time to compute, that
time is purely due to the compilation:

In [5]: %time 3**9999;
CPU times: user 0.00 s, sys: 0.00 s, total: 0.00 s
Wall time: 0.00 s

In [6]: %time 3**999999;
CPU times: user 0.00 s, sys: 0.00 s, total: 0.00 s
Wall time: 0.00 s
Compiler : 0.78 s
%timeit
Time execution of a Python statement or expression

Usage, in line mode:  %timeit [-n<N> -r<R> [-t|-c] -q -p<P> -o] statement

or in cell mode:   %timeit [-n<N> -r<R> [-t|-c] -q -p<P> -o] setup_code code code...

Time execution of a Python statement or expression using the timeit module. This function can be used both as a
line and cell magic:

• In line mode you can time a single-line statement (though multiple ones can be chained with using semi-
  colons).

• In cell mode, the statement in the first line is used as setup code (executed but not timed) and the body of
  the cell is timed. The cell body has access to any variables created in the setup code.

Options:
- n<N>: execute the given statement <N> times in a loop. If this value is not given, a fitting value is
  chosen.
- r<R>: repeat the loop iteration <R> times and take the best result. Default: 3
- t: use time.time to measure the time, which is the default on Unix. This function measures wall time.
- c: use time.clock to measure the time, which is the default on Windows and measures wall time. On Unix,
  resource.getrusage is used instead and returns the CPU user time.
- p<P>: use a precision of <P> digits to display the timing result. Default: 3
- q: Quiet, do not print result.
- o: return a TimeitResult that can be stored in a variable to inspect  the result in more details.

Examples

| In [1]: | %timeit pass |
| 10000000 loops, best of 3: 53.3 ns per loop |

| In [2]: | u = None |

| In [3]: | %timeit u is None |
| 10000000 loops, best of 3: 184 ns per loop |

| In [4]: | %timeit -r 4 u == None |
| 10000000 loops, best of 4: 242 ns per loop |

| In [5]: | import time |

| In [6]: | %timeit -nl time.sleep(2) |
| 1 loop, best of 3: 2 s per loop |

The times reported by %timeit will be slightly higher than those reported by the timeit.py script when variables
are accessed. This is due to the fact that %timeit executes the statement in the namespace of the shell, compared
with timeit.py, which uses a single setup statement to import function or create variables. Generally, the bias
does not matter as long as results from timeit.py are not mixed with those from %timeit.

%unalias
Remove an alias

%unload_ext
Unload an IPython extension by its module name.

Not all extensions can be unloaded, only those which define an unload_ipython_extension function.
%who

Print all interactive variables, with some minimal formatting.

If any arguments are given, only variables whose type matches one of these are printed. For example:

```
%who function str
```

will only list functions and strings, excluding all other types of variables. To find the proper type names, simply use `type(var)` at a command line to see how Python prints type names. For example:

```
In [1]: type('hello')
Out[1]: <type 'str'>
```

indicates that the type name for strings is `str`.

%who always excludes executed names loaded through your configuration file and things which are internal to IPython.

This is deliberate, as typically you may load many modules and the purpose of %who is to show you only what you've manually defined.

Examples

Define two variables and list them with who:

```
In [1]: alpha = 123
In [2]: beta = 'test'
In [3]: %who
alpha  beta
In [4]: %who int
alpha
In [5]: %who str
beta
```

%who_ls

Return a sorted list of all interactive variables.

If arguments are given, only variables of types matching these arguments are returned.

Examples

Define two variables and list them with who_ls:

```
In [1]: alpha = 123
In [2]: beta = 'test'
In [3]: %who_ls
Out[3]: ['alpha', 'beta']
In [4]: %who_ls int
Out[4]: ['alpha']
In [5]: %who_ls str
Out[5]: ['beta']
```
%whos

Like %who, but gives some extra information about each variable.

The same type filtering of %who can be applied here.

For all variables, the type is printed. Additionally it prints:

- For {},[],(): their length.
- For numpy arrays, a summary with shape, number of elements, typecode and size in memory.
- Everything else: a string representation, snipping their middle if too long.

Examples

Define two variables and list them with whos:

```
In [1]: alpha = 123
In [2]: beta = 'test'
In [3]: %whos
Variable      Type  Data/Info
alpha         int   123
beta          str   test
```

%xdel

Delete a variable, trying to clear it from anywhere that IPython’s machinery has references to it. By default, this uses the identity of the named object in the user namespace to remove references held under other names. The object is also removed from the output history.

**Options**

- `n` : Delete the specified name from all namespaces, without checking their identity.

%mode

Switch modes for the exception handlers.

Valid modes: Plain, Context and Verbose.

If called without arguments, acts as a toggle.

### 4.8.2 Cell magics

%bash

`%%bash` script magic

Run cells with bash in a subprocess.

This is a shortcut for `%%script bash`

%capture

```
%capture [--no-stderr] [--no-stdout] [--no-display] [output]
```

run the cell, capturing stdout, stderr, and IPython’s rich display() calls.

**positional arguments:**

output The name of the variable in which to store output. This is a `utils.io.CapturedIO` object with stdout/err attributes for the text of the captured output. CapturedOutput also has a show() method
for displaying the output, and __call__ as well, so you can use that to quickly display the output. If unspecified, captured output is discarded.

**optional arguments:**

- `--no-stderr` Don’t capture stderr.
- `--no-stdout` Don’t capture stdout.
- `--no-display` Don’t capture IPython’s rich display.

```html
%%html
Render the cell as a block of HTML
```

```javascript
%%javascript
Run the cell block of Javascript code
```

```js
%%js
Run the cell block of Javascript code
Alias of %%javascript
```

```latex
%%latex
Render the cell as a block of latex
The subset of latex which is support depends on the implementation in the client. In the Jupyter Notebook, this magic only renders the subset of latex defined by MathJax [here](https://docs.mathjax.org/en/v2.5-latest/tex.html).
```

```perl
%%perl
%%perl script magic
Run cells with perl in a subprocess.
This is a shortcut for %%script perl
```

```pypy
%%pypy
%%pypy script magic
Run cells with pypy in a subprocess.
This is a shortcut for %%script pypy
```

```python
%%python
%%python script magic
Run cells with python in a subprocess.
This is a shortcut for %%script python
```

```python2
%%python2
%%python2 script magic
Run cells with python2 in a subprocess.
This is a shortcut for %%script python2
```

```python3
%%python3
%%python3 script magic
Run cells with python3 in a subprocess.
This is a shortcut for %%script python3
```

```ruby
%%ruby
%%ruby script magic
```
Run cells with ruby in a subprocess.

This is a shortcut for `%%script ruby`

```
%script

%shebang [--proc PROC] [--bg] [--err ERR] [--out OUT]
```

Run a cell via a shell command

The `%script` line is like the `#!` line of script, specifying a program (bash, perl, ruby, etc.) with which to run. The rest of the cell is run by that program.

Examples

```
In [1]: %%script bash
   ...: for i in 1 2 3; do
   ...:   echo $i
   ...: done
1
2
3
```

optional arguments:

- `--proc PROC` The variable in which to store Popen instance. This is used only when --bg option is given.
- `--bg` Whether to run the script in the background. If given, the only way to see the output of the command is with --out/err.
- `--err ERR` The variable in which to store stderr from the script. If the script is backgrounded, this will be the stderr pipe, instead of the stderr text itself.
- `--out OUT` The variable in which to store stdout from the script. If the script is backgrounded, this will be the stdout pipe, instead of the stderr text itself.

```
%%sh

%%sh script magic

Run cells with sh in a subprocess.

This is a shortcut for `%%script sh`

```
%%svg

Render the cell as an SVG literal

```
%%writefile

```
%writefile [-a] filename

Write the contents of the cell to a file.

The file will be overwritten unless the -a (–append) flag is specified.

positional arguments: filename file to write

optional arguments:
-a, --append

Append contents of the cell to an existing file. The file will be created if it does not exist.

See also:

A Qt Console for Jupyter The Jupyter Notebook
CHAPTER 5

Configuration and customization

5.1 Configuring IPython

5.1.1 Introduction to IPython configuration

Setting configurable options

Many of IPython’s classes have configurable attributes (see IPython options for the list). These can be configured in several ways.

Python config files

To create the blank config files, run:

ipython profile create [profilename]

If you leave out the profile name, the files will be created for the default profile (see Profiles). These will typically be located in ~/.ipython/profile_default/, and will be named ipython_config.py, ipython_notebook_config.py, etc. The settings in ipython_config.py apply to all IPython commands.

The files typically start by getting the root config object:

```python
c = get_config()
```

You can then configure class attributes like this:

```python
c.InteractiveShell.automagic = False
```

Be careful with spelling–incorrect names will simply be ignored, with no error.

To add to a collection which may have already been defined elsewhere, you can use methods like those found on lists, dicts and sets: append, extend, prepend() (like extend, but at the front), add and update (which works both for dicts and sets):
c.InteractiveShellApp.extensions.append('Cython')

New in version 2.0: list, dict and set methods for config values

Example config file

```
# sample ipython_config.py

from IPython.config import get_config

c = get_config()

c.TerminalIPythonApp.display_banner = True

# config values

c.InteractiveShellApp.log_level = 20

c.InteractiveShellApp.extensions = ['myextension']

c.InteractiveShellApp.exec_lines = ['import numpy', 'import scipy']

c.InteractiveShellApp.exec_files = ['mycode.py', 'fancy.ipy']

c.InteractiveShell.autoindent = True

# settings

c.InteractiveShell.colors = 'LightBG'

c.InteractiveShell.confirm_exit = False

c.InteractiveShell.editor = 'nano'

c.InteractiveShell.xmode = 'Context'

c.PrefilterManager.multi_line_specials = True

# user aliases

c.AliasManager.user_aliases = [('la', 'ls -al')]
```

Command line arguments

Every configurable value can be set from the command line, using this syntax:

```
ipython --ClassName.attribute=value
```

Many frequently used options have short aliases and flags, such as `--matplotlib` (to integrate with a matplotlib GUI event loop) or `--pdb` (automatic post-mortem debugging of exceptions).

To see all of these abbreviated options, run:

```
ipython --help
ipython notebook --help
# etc.
```

Options specified at the command line, in either format, override options set in a configuration file.
The config magic

You can also modify config from inside IPython, using a magic command:

```
%config IPCompleter.greedy = True
```

At present, this only affects the current session - changes you make to config are not saved anywhere. Also, some options are only read when IPython starts, so they can’t be changed like this.

Profiles

IPython can use multiple profiles, with separate configuration and history. By default, if you don’t specify a profile, IPython always runs in the default profile. To use a new profile:

```
ipython profile create foo  # create the profile foo
ipython --profile=foo       # start IPython using the new profile
```

Profiles are typically stored in *The IPython directory*, but you can also keep a profile in the current working directory, for example to distribute it with a project. To find a profile directory on the filesystem:

```
ipython locate profile foo
```

The IPython directory

IPython stores its files—config, command history and extensions—in the directory `~/.ipython/` by default.

**IPYTHONDIR**

If set, this environment variable should be the path to a directory, which IPython will use for user data. IPython will create it if it does not exist.

```
--ipython-dir=<path>
```

This command line option can also be used to override the default IPython directory.

To see where IPython is looking for the IPython directory, use the command `ipython locate`, or the Python function `IPython.paths.get_ipython_dir()`.

5.1.2 IPython options

Any of the options listed here can be set in config files, at the command line, or from inside IPython. See *Setting configurable options* for details.

Terminal IPython options

**InteractiveShellApp.code_to_run** [Unicode] Default: ''

Execute the given command string.

**InteractiveShellApp.exec_PYTHONSTARTUP** [Bool] Default: True

Run the file referenced by the PYTHONSTARTUP environment variable at IPython startup.

**InteractiveShellApp.exec_files** [List] Default: []

List of files to run at IPython startup.
**InteractiveShellApp.exec_lines** [List] Default: []

- lines of code to run at IPython startup.

**InteractiveShellApp.extensions** [List] Default: []

- A list of dotted module names of IPython extensions to load.

**InteractiveShellApp.extra_extension** [Unicode] Default: ''

- dotted module name of an IPython extension to load.

**InteractiveShellApp.file_to_run** [Unicode] Default: ''

- A file to be run

**InteractiveShellApp.gui** ['glut'|'gtk'|'gtk2'|'gtk3'|'osx'|'pyglet'|'qt'|'qt4'|'qt5'|'tk'|'wx'|'gtk2'|'qt4']


**InteractiveShellApp.hide_initial_ns** [Bool] Default: True

- Should variables loaded at startup (by startup files, exec_lines, etc.) be hidden from tools like %who?

**InteractiveShellApp.matplotlib** ['auto'|'agg'|'gtk'|'gtk3'|'inline'|'ipympl'|'nbagg'|'notebook'|'osx'|'pdf'|'ps'|'qt'|'qt4'|'qt5'|'svg'|'tk'|'widget'|'wx']

- Configure matplotlib for interactive use with the default matplotlib backend.

**InteractiveShellApp.module_to_run** [Unicode] Default: ''

- Run the module as a script.

**InteractiveShellApp.pylab** ['auto'|'agg'|'gtk'|'gtk3'|'inline'|'ipympl'|'nbagg'|'notebook'|'osx'|'pdf'|'ps'|'qt'|'qt4'|'qt5'|'svg'|'tk'|'widget'|'wx']

- Pre-load matplotlib and numpy for interactive use, selecting a particular matplotlib backend and loop integration.

**InteractiveShellApp.pylab_import_all** [Bool] Default: True

- If true, IPython will populate the user namespace with numpy, pylab, etc. and an import * is done from numpy and pylab, when using pylab mode.

- When False, pylab mode should not import any names into the user namespace.

**InteractiveShellApp.reraise_ipython_extension.failures** [Bool] Default: False

- Reraise exceptions encountered loading IPython extensions?

**Application.log_datefmt** [Unicode] Default: '%%Y-%m-%d %H:%M:%S'

- The date format used by logging formatters for %(asctime)s

**Application.log_format** [Unicode] Default: '%(name)s%(highlevel)s%(message)s'

- The Logging format template

**Application.log_level** [0|10|20|30|40|50|'DEBUG'|'INFO'|'WARN'|'ERROR'|'CRITICAL'] Default: 30

- Set the log level by value or name.

**BaseIPythonApplication.auto_create** [Bool] Default: False

- Whether to create profile dir if it doesn’t exist
BaseIPythonApplication.copy_config_files [Bool] Default: False
Whether to install the default config files into the profile dir. If a new profile is being created, and IPython contains config files for that profile, then they will be staged into the new directory. Otherwise, default config files will be automatically generated.

BaseIPythonApplication.extra_config_file [Unicode] Default: ''
Path to an extra config file to load.
If specified, load this config file in addition to any other IPython config.

BaseIPythonApplication.ipython_dir [Unicode] Default: ''
The name of the IPython directory. This directory is used for logging configuration (through profiles), history storage, etc. The default is usually $HOME/.ipython. This option can also be specified through the environment variable IPYTHONDIR.

BaseIPythonApplication.overwrite [Bool] Default: False
Whether to overwrite existing config files when copying

BaseIPythonApplication.profile [Unicode] Default: 'default'
The IPython profile to use.

BaseIPythonApplication.verbose_crash [Bool] Default: False
Create a massive crash report when IPython encounters what may be an internal error. The default is to append a short message to the usual traceback

TerminalIPythonApp.display_banner [Bool] Default: True
Whether to display a banner upon starting IPython.

TerminalIPythonApp.force_interact [Bool] Default: False
If a command or file is given via the command-line, e.g. ‘ipython foo.py’, start an interactive shell after executing the file or command.

TerminalIPythonApp.interactive_shell_class [Type] Default: 'IPython.terminal.interactiveshell.TerminalInteractiveShell'
Class to use to instantiate the TerminalInteractiveShell object. Useful for custom Frontends

TerminalIPythonApp.quick [Bool] Default: False
Start IPython quickly by skipping the loading of config files.

InteractiveShell.ast_node_interactivity ['all'|'last'|'last_expr'|'none'] Default: 'last_expr'
'all’, 'last’, ‘last_expr’ or ‘none’, specifying which nodes should be run interactively (displaying output from expressions).

InteractiveShell.ast_transformers [List] Default: []
A list of ast.NodeTransformer subclass instances, which will be applied to user input before code is run.

InteractiveShell.autocall [0|1|2] Default: 0
Make IPython automatically call any callable object even if you didn’t type explicit parentheses. For example, ‘str 43’ becomes ‘str(43)’ automatically. The value can be ‘0’ to disable the feature, ‘1’ for ‘smart’ autocall, where it is not applied if there are no more arguments on the line, and ‘2’ for ‘full’ autocall, where all callable objects are automatically called (even if no arguments are present).

InteractiveShell.autoindent [Bool] Default: True
Autoindent IPython code entered interactively.

5.1. Configuring IPython
InteractiveShell.automagic [Bool] Default: True

Enable magic commands to be called without the leading %.

\nType "copyri...

The part of the banner to be printed before the profile

InteractiveShell.banner2 [Unicode] Default: '

The part of the banner to be printed after the profile

InteractiveShell.cache_size [Int] Default: 1000

Set the size of the output cache. The default is 1000, you can change it permanently in your config file. Setting it to 0 completely disables the caching system, and the minimum value accepted is 20 (if you provide a value less than 20, it is reset to 0 and a warning is issued). This limit is defined because otherwise you’ll spend more time re-flushing a too small cache than working

InteractiveShell.color_info [Bool] Default: True

Use colors for displaying information about objects. Because this information is passed through a pager (like ‘less’), and some pagers get confused with color codes, this capability can be turned off.

InteractiveShell.colors ['Neutral'|'NoColor'|'LightBG'|'Linux'] Default: 'Neutral'

Set the color scheme (NoColor, Neutral, Linux, or LightBG).

InteractiveShell.debug [ Bool] Default: False

No description

InteractiveShell.deep_reload [Bool] Default: False

Deprecated

Enable deep (recursive) reloading by default. IPython can use the deep_reload module which reloads changes in modules recursively (it replaces the reload() function, so you don’t need to change anything to use it). deep_reload forces a full reload of modules whose code may have changed, which the default reload() function does not. When deep_reload is off, IPython will use the normal reload(), but deep_reload will still be available as dreload().

InteractiveShell.disable_failing_post_execute [Bool] Default: False

Don’t call post-execute functions that have failed in the past.

InteractiveShell.display_page [Bool] Default: False

If True, anything that would be passed to the pager will be displayed as regular output instead.

InteractiveShell.enable_html_pager [Bool] Default: False

(Provisional API) enables html representation in mime bundles sent to pagers.

InteractiveShell.history_length [Int] Default: 10000

Total length of command history

InteractiveShell.history_load_length [Int] Default: 1000

The number of saved history entries to be loaded into the history buffer at startup.

InteractiveShell.ipython_dir [Unicode] Default: ''

No description
InteractiveShell.logappend  [Unicode] Default: ''
Start logging to the given file in append mode. Use logfile to specify a log file to overwrite logs to.

InteractiveShell.logfile  [Unicode] Default: ''
The name of the logfile to use.

InteractiveShell.logstart  [Bool] Default: False
Start logging to the default log file in overwrite mode. Use logappend to specify a log file to append logs to.

InteractiveShell.object_info_string_level  [0|1|2] Default: 0
No description

InteractiveShell.pdb  [Bool] Default: False
Automatically call the pdb debugger after every exception.

InteractiveShell.prompt_in1  [Unicode] Default: 'In [\#]: '
Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

InteractiveShell.prompt_out  [Unicode] Default: 'Out[\#]: '
Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

InteractiveShell.prompts_pad_left  [Bool] Default: True
Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

InteractiveShell.quiet  [Bool] Default: False
No description

InteractiveShell.separate_in  [SeparateUnicode] Default: '\n'
No description

InteractiveShell.separate_out  [SeparateUnicode] Default: ''
No description

InteractiveShell.separate_out2  [SeparateUnicode] Default: ''
No description

InteractiveShell.show_rewritten_input  [Bool] Default: True
Show rewritten input, e.g. for autocall.

InteractiveShell.sphinxify_docstring  [Bool] Default: False
Enables rich html representation of docstrings. (This requires the docrepr module).

InteractiveShell.wildcards_case_sensitive  [Bool] Default: True
No description

InteractiveShell.xmode  ['Context'|'Plain'|'Verbose'] Default: 'Context'
No description

5.1. Configuring IPython
TerminalInteractiveShell.confirm_exit [Bool] Default: True

Set to confirm when you try to exit IPython with an EOF (Control-D in Unix, Control-Z/Enter in Windows). By typing ‘exit’ or ‘quit’, you can force a direct exit without any confirmation.

TerminalInteractiveShell.display_completions ['column'|'multicolumn'|'readlinelike'] Default: 'multicolumn'

Options for displaying tab completions, ‘column’, ‘multicolumn’, and ‘readlinelike’. These options are for prompt_toolkit, see prompt_toolkit documentation for more information.

TerminalInteractiveShell.editing_mode [Unicode] Default: 'emacs'

Shortcut style to use at the prompt. ‘vi’ or ‘emacs’.

TerminalInteractiveShell.editor [Unicode] Default: 'vi'

Set the editor used by IPython (default to $EDITOR/vi/notepad).

TerminalInteractiveShell.extra_open_editor_shortcuts [Bool] Default: False

Enable vi (v) or Emacs (C-X C-E) shortcuts to open an external editor. This is in addition to the F2 binding, which is always enabled.

TerminalInteractiveShell.highlight_matching_brackets [Bool] Default: True

Highlight matching brackets.

TerminalInteractiveShell.highlighting_style [Union] Default: traitlets.Undefined

The name or class of a Pygments style to use for syntax highlighting. To see available styles, run pygmentize -L styles.

TerminalInteractiveShell.highlighting_style_overrides [Dict] Default: {}

Override highlighting format for specific tokens

TerminalInteractiveShell.mouse_support [Bool] Default: False

Enable mouse support in the prompt

TerminalInteractiveShell.prompts_class [Type] Default: 'IPython.terminal.prompts.Prompts'

Class used to generate Prompt token for prompt_toolkit

TerminalInteractiveShell.simple_prompt [Bool] Default: True

Use raw_input for the REPL, without completion and prompt colors.

Useful when controlling IPython as a subprocess, and piping STDIN/OUT/ERR. Known usage are: IPython own testing machinery, and emacs inferior-shell integration through elpy.

This mode default to True if the IPY_TEST_SIMPLE_PROMPT environment variable is set, or the current terminal is not a tty.

TerminalInteractiveShell.space_for_menu [Int] Default: 6

Number of line at the bottom of the screen to reserve for the completion menu

TerminalInteractiveShell.term_title [Bool] Default: True

Automatically set the terminal title

TerminalInteractiveShell.true_color [Bool] Default: False

Use 24bit colors instead of 256 colors in prompt highlighting. If your terminal supports true color, the following command should print ‘TRUECOLOR’ in orange: printf “x1b[38;2;255;100;0mTRUECOLORx1b[0mn”
**HistoryAccessor.connection_options** [Dict] Default: {}

Options for configuring the SQLite connection

These options are passed as keyword args to sqlite3.connect when establishing database connections.

**HistoryAccessor.enabled** [Bool] Default: True

enable the SQLite history

set enabled=False to disable the SQLite history, in which case there will be no stored history, no SQLite connection, and no background saving thread. This may be necessary in some threaded environments where IPython is embedded.

**HistoryAccessor.hist_file** [Unicode] Default: ''

Path to file to use for SQLite history database.

By default, IPython will put the history database in the IPython profile directory. If you would rather share one history among profiles, you can set this value in each, so that they are consistent.

Due to an issue with fcntl, SQLite is known to misbehave on some NFS mounts. If you see IPython hanging, try setting this to something on a local disk, e.g:

```bash
ipython --HistoryManager.hist_file=/tmp/ipython_hist.sqlite
```

you can also use the specific value :memory: (including the colon at both end but not the back ticks), to avoid creating an history file.

**HistoryManager.db_cache_size** [Int] Default: 0

Write to database every x commands (higher values save disk access & power). Values of 1 or less effectively disable caching.

**HistoryManager.db_log_output** [Bool] Default: False

Should the history database include output? (default: no)

**ProfileDir.location** [Unicode] Default: ''

Set the profile location directly. This overrides the logic used by the profile option.

**BaseFormatter.deferred_printers** [Dict] Default: {}

No description

**BaseFormatter.enabled** [Bool] Default: True

No description

**BaseFormatter.singleton_printers** [Dict] Default: {}

No description

**BaseFormatter.type_printers** [Dict] Default: {}

No description

**PlainTextFormatter.float_precision** [CUnicode] Default: ''

No description

**PlainTextFormatter.max_seq_length** [Int] Default: 1000

Truncate large collections (lists, dicts, tuples, sets) to this size.

Set to 0 to disable truncation.
**PlainTextFormatter.max_width**  [Int] Default: 79

No description

**PlainTextFormatter.newline**  [Unicode] Default:  '\n'

No description

**PlainTextFormatter.pprint**  [Bool] Default: True

No description

**PlainTextFormatter.verbose**  [Bool] Default: False

No description

**Completer.backslash_combining_completions**  [Bool] Default: True

Enable unicode completions, e.g. alpha<tab> . Includes completion of latex commands, unicode names, and expanding unicode characters back to latex commands.

**Completer.greedy**  [Bool] Default: False

Activate greedy completion PENDING DEPRECTION. this is now mostly taken care of with Jedi.

This will enable completion on elements of lists, results of function calls, etc., but can be unsafe because the code is actually evaluated on TAB.

**IPCompleter.limit_to__all__**  [Bool] Default: False

DEPRECATED as of version 5.0.

Instruct the completer to use __all__ for the completion

Specifically, when completing on object.<tab>.

When True: only those names in obj.__all__ will be included.

When False [default]: the __all__ attribute is ignored

**IPCompleter.merge_completions**  [Bool] Default: True

Whether to merge completion results into a single list

If False, only the completion results from the first non-empty completer will be returned.

**IPCompleter.omit__names**  [0|1|2] Default: 2

Instruct the completer to omit private method names

Specifically, when completing on object.<tab>.

When 2 [default]: all names that start with '_' will be excluded.

When 1: all ‘magic’ names (__foo__) will be excluded.

When 0: nothing will be excluded.

**ScriptMagics.script_magics**  [List] Default: []

Extra script cell magics to define

This generates simple wrappers of %%script foo as %%foo.

If you want to add script magics that aren’t on your path, specify them in script_paths

**ScriptMagics.script_paths**  [Dict] Default: {}

Dict mapping short ‘ruby’ names to full paths, such as ’/opt/secret/bin/ruby’

Only necessary for items in script_magics where the default path will not find the right interpreter.
**StoreMagics.autorestore** [Bool] Default: False

If True, any %store-d variables will be automatically restored when IPython starts.

### IPython kernel options

These options can be used in `ipython_kernel_config.py`. The kernel also respects any options in `ipython_config.py`.

**ConnectionFileMixin.connection_file** [Unicode] Default: ''

JSON file in which to store connection info [default: kernel-<pid>.json]

This file will contain the IP, ports, and authentication key needed to connect clients to this kernel. By default, this file will be created in the security dir of the current profile, but can be specified by absolute path.

**ConnectionFileMixin.control_port** [Int] Default: 0

set the control (ROUTER) port [default: random]

**ConnectionFileMixin.hh_port** [Int] Default: 0

set the heartbeat port [default: random]

**ConnectionFileMixin.iopub_port** [Int] Default: 0

set the iopub (PUB) port [default: random]

**ConnectionFileMixin.ip** [Unicode] Default: ''

Set the kernel’s IP address [default localhost]. If the IP address is something other than localhost, then Consoles on other machines will be able to connect to the Kernel, so be careful!

**ConnectionFileMixin.shell_port** [Int] Default: 0

set the shell (ROUTER) port [default: random]

**ConnectionFileMixin.stdin_port** [Int] Default: 0

set the stdin (ROUTER) port [default: random]

**ConnectionFileMixin.transport** ['tcp'|'ipc'] Default: 'tcp'

No description

**InteractiveShellApp.code_to_run** [Unicode] Default: ''

Execute the given command string.

**InteractiveShellApp.exec_PYTHONSTARTUP** [Bool] Default: True

Run the file referenced by the PYTHONSTARTUP environment variable at IPython startup.

**InteractiveShellApp.exec_files** [List] Default: []

List of files to run at IPython startup.

**InteractiveShellApp.exec_lines** [List] Default: []

lines of code to run at IPython startup.

**InteractiveShellApp.extensions** [List] Default: []

A list of dotted module names of IPython extensions to load.

**InteractiveShellApp.extra_extension** [Unicode] Default: ''

dotted module name of an IPython extension to load.
InteractiveShellApp.file_to_run [Unicode] Default: ''
A file to be run

InteractiveShellApp.gui ['glut'|'gtk'|'gtk2'|'gtk3'|'osx'|'pyglet'|'qt'|'qt4'|'qt5'|'tk'|'wx'|'gtk2'|'qt4'] Default: None
Enable GUI event loop integration with any of ('glut', 'gtk', 'gtk2', 'gtk3', 'osx', 'pyglet', 'qt', 'qt4', 'qt5', 'tk', 'wx', 'gtk2', 'qt4').

InteractiveShellApp.hide_initial_ns [Bool] Default: True
Should variables loaded at startup (by startup files, exec_lines, etc.) be hidden from tools like %who?

InteractiveShellApp.matplotlib ['auto'|'agg'|'gtk'|'gtk3'|'inline'|'ipympl'|'nbagg'|'notebook'|'osx'|'pdf'|'ps'|'qt'|'qt4'|'qt5'|'svg'|'tk'|'widget'|'wx'] Default: None
Configure matplotlib for interactive use with the default matplotlib backend.

InteractiveShellApp.module_to_run [Unicode] Default: ''
Run the module as a script.

InteractiveShellApp.pylab ['auto'|'agg'|'gtk'|'gtk3'|'inline'|'ipympl'|'nbagg'|'notebook'|'osx'|'pdf'|'ps'|'qt'|'qt4'|'qt5'|'svg'|'tk'|'widget'|'wx'] Default: None
Pre-load matplotlib and numpy for interactive use, selecting a particular matplotlib backend and loop integration.

InteractiveShellApp.pylab_import_all [Bool] Default: True
If true, IPython will populate the user namespace with numpy, pylab, etc. and an import * is done from numpy and pylab, when using pylab mode.
When False, pylab mode should not import any names into the user namespace.

InteractiveShellApp.reraise_ipython_extension_failures [Bool] Default: False
Reraise exceptions encountered loading IPython extensions?

Application.log_datefmt [Unicode] Default: '%Y-%m-%d %H:%M:%S'
The date format used by logging formatters for %(asctime)s

Application.log_format [Unicode] Default: '{%(name)s}%(highlevel)s %(message)s'
The Logging format template

Application.log_level [0|10|20|30|40|50|'DEBUG'|'INFO'|'WARN'|'ERROR'|'CRITICAL'] Default: 30
Set the log level by value or name.

BaseIPythonApplication.auto_create [Bool] Default: False
Whether to create profile dir if it doesn’t exist

BaseIPythonApplication.copy_config_files [Bool] Default: False
Whether to install the default config files into the profile dir. If a new profile is being created, and IPython contains config files for that profile, then they will be staged into the new directory. Otherwise, default config files will be automatically generated.

BaseIPythonApplication.extra_config_file [Unicode] Default: ''
Path to an extra config file to load.
If specified, load this config file in addition to any other IPython config.
**BaseIPythonApplication.ipython_dir** [Unicode] Default: ''

The name of the IPython directory. This directory is used for logging configuration (through profiles), history storage, etc. The default is usually $HOME/.ipython. This option can also be specified through the environment variable IPYTHONDIR.

**BaseIPythonApplication.overwrite** [Bool] Default: False

Whether to overwrite existing config files when copying

**BaseIPythonApplication.profile** [Unicode] Default: 'default'

The IPython profile to use.

**BaseIPythonApplication.verbose_crash** [Bool] Default: False

Create a massive crash report when IPython encounters what may be an internal error. The default is to append a short message to the usual traceback

**IPKernelApp.displayhook_class** [DottedObjectName] Default: 'ipykernel.displayhook.ZMQDisplayHook'

The importstring for the DisplayHook factory

**IPKernelApp.interrupt** [Int] Default: 0

ONLY USED ON WINDOWS Interrupt this process when the parent is signaled.

**IPKernelApp.kernel_class** [Type] Default: 'ipykernel.ipkernel.IPythonKernel'

The Kernel subclass to be used.

This should allow easy re-use of the IPKernelApp entry point to configure and launch kernels other than IPython's own.

**IPKernelApp.no_stderr** [Bool] Default: False

redirect stderr to the null device

**IPKernelApp.no_stdout** [Bool] Default: False

redirect stdout to the null device

**IPKernelApp.outstream_class** [DottedObjectName] Default: 'ipykernel.iostream.OutStream'

The importstring for the OutStream factory

**IPKernelApp.parent_handle** [Int] Default: 0

kill this process if its parent dies. On Windows, the argument specifies the HANDLE of the parent process, otherwise it is simply boolean.

**IPKernelApp.quiet** [Bool] Default: True

Only send stdout/stderr to output stream

**Kernel._darwin_app_nap** [Bool] Default: True

Whether to use appnope for compatibility with OS X App Nap.

Only affects OS X >= 10.9.

**Kernel._execute_sleep** [Float] Default: 0.0005

No description

**Kernel._poll_interval** [Float] Default: 0.01

No description

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Kernel.stop_on_error_timeout  [Float] Default: 0.1

time (in seconds) to wait for messages to arrive when aborting queued requests after an error.
Requests that arrive within this window after an error will be cancelled.
Increase in the event of unusually slow network causing significant delays, which can manifest as e.g. “Run all” in a notebook aborting some, but not all, messages after an error.

No description

IPythonKernel.use_experimental_completions  [Bool] Default: True
Set this flag to False to deactivate the use of experimental IPython completion APIs.

InteractiveShell.ast_node_interactivity  ['all'|'last'|'last_expr'|'none'] Default: 'last_expr'
'all', 'last', 'last_expr' or 'none', specifying which nodes should be run interactively (displaying output from expressions).

InteractiveShell.ast_transformers  [List] Default: []
A list of ast.NodeTransformer subclass instances, which will be applied to user input before code is run.

InteractiveShell.autocall  [0|1|2] Default: 0
Make IPython automatically call any callable object even if you didn’t type explicit parentheses. For example, ‘str 43’ becomes ‘str(43)’ automatically. The value can be ‘0’ to disable the feature, ‘1’ for ‘smart’ autocall, where it is not applied if there are no more arguments on the line, and ‘2’ for ‘full’ autocall, where all callable objects are automatically called (even if no arguments are present).

InteractiveShell.autoindent  [Bool] Default: True
Autoindent IPython code entered interactively.

InteractiveShell.automagic  [Bool] Default: True
Enable magic commands to be called without the leading %.

\nType "copyright...'
The part of the banner to be printed before the profile

InteractiveShell.banner2  [Unicode] Default: ''
The part of the banner to be printed after the profile

InteractiveShell.cache_size  [Int] Default: 1000
Set the size of the output cache. The default is 1000, you can change it permanently in your config file. Setting it to 0 completely disables the caching system, and the minimum value accepted is 20 (if you provide a value less than 20, it is reset to 0 and a warning is issued). This limit is defined because otherwise you’ll spend more time re-flushing a too small cache than working

InteractiveShell.color_info  [Bool] Default: True
Use colors for displaying information about objects. Because this information is passed through a pager (like ‘less’), and some pagers get confused with color codes, this capability can be turned off.

InteractiveShell.colors  ['Neutral'|'NoColor'|'LightBG'|'Linux'] Default: 'Neutral'
Set the color scheme (NoColor, Neutral, Linux, or LightBG).
**InteractiveShell.debug**  [Bool] Default: False

No description

**InteractiveShell.deep_reload**  [Bool] Default: False

Deprecated

Will be removed in IPython 6.0

Enable deep (recursive) reloading by default. IPython can use the deep_reload module which reloads changes in modules recursively (it replaces the reload() function, so you don’t need to change anything to use it). deep_reload forces a full reload of modules whose code may have changed, which the default reload() function does not. When deep_reload is off, IPython will use the normal reload(), but deep_reload will still be available as dreload().

**InteractiveShell-disable_failing_post_execute**  [Bool] Default: False

Don’t call post-execute functions that have failed in the past.

**InteractiveShell.display_page**  [Bool] Default: False

If True, anything that would be passed to the pager will be displayed as regular output instead.

**InteractiveShell.enable_html_pager**  [Bool] Default: False

(Provisional API) enables html representation in mime bundles sent to pagers.

**InteractiveShell.history_length**  [Int] Default: 10000

Total length of command history

**InteractiveShell.history_load_length**  [Int] Default: 1000

The number of saved history entries to be loaded into the history buffer at startup.

**InteractiveShell.ipython_dir**  [Unicode] Default: ''

No description

**InteractiveShell.logappend**  [Unicode] Default: ''

Start logging to the given file in append mode. Use logfile to specify a log file to overwrite logs to.

**InteractiveShelllogfile**  [Unicode] Default: ''

The name of the logfile to use.

**InteractiveShell.logstart**  [Bool] Default: False

Start logging to the default log file in overwrite mode. Use logappend to specify a log file to append logs to.

**InteractiveShell.object_info_string_level**  [0|1|2] Default: 0

No description

**InteractiveShell.pdb**  [Bool] Default: False

Automatically call the pdb debugger after every exception.

**InteractiveShell.prompt_in1**  [Unicode] Default: 'In [\#]: '

Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

**InteractiveShell.prompt_in2**  [Unicode] Default: ' .\D.: '

Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.
InteractiveShell.prompt_out [Unicode] Default: 'Out[\#]: '
  Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

InteractiveShell.prompts_pad_left [Bool] Default: True
  Deprecated since IPython 4.0 and ignored since 5.0, set TerminalInteractiveShell.prompts object directly.

InteractiveShell.quiet [Bool] Default: False
  No description

InteractiveShell.separate_in [SeparateUnicode] Default: '
  No description

InteractiveShell.separate_out [SeparateUnicode] Default: '
  No description

InteractiveShell.separate_out2 [SeparateUnicode] Default: '
  No description

InteractiveShell.show_rewritten_input [Bool] Default: True
  Show rewritten input, e.g. for autocall.

InteractiveShell.sphinxify_docstring [Bool] Default: False
  Enables rich html representation of docstrings. (This requires the docrepr module).

InteractiveShell.wildcards_case_sensitive [Bool] Default: True
  No description

InteractiveShell.xmode ['Context'|'Plain'|'Verbose'] Default: 'Context'
  No description

ProfileDir.location [Unicode] Default: ''
  Set the profile location directly. This overrides the logic used by the profile option.

Session.buffer_threshold [Int] Default: 1024
  Threshold (in bytes) beyond which an object’s buffer should be extracted to avoid pickling.

Session.check_pid [Bool] Default: True
  Whether to check PID to protect against calls after fork.
  This check can be disabled if fork-safety is handled elsewhere.

Session.copy_threshold [Int] Default: 65536
  Threshold (in bytes) beyond which a buffer should be sent without copying.

Session.debug [Bool] Default: False
  Debug output in the Session

Session.digest_history_size [Int] Default: 65536
  The maximum number of digests to remember.
  The digest history will be culled when it exceeds this value.
Session.item_threshold [Int] Default: 64
The maximum number of items for a container to be introspected for custom serialization. Containers larger than this are pickled outright.

Session.key [CBytes] Default: b''
execution key, for signing messages.

Session.keyfile [Unicode] Default: ''
path to file containing execution key.

Session.metadata [Dict] Default: {}
Metadata dictionary, which serves as the default top-level metadata dict for each message.

Session.packer [DottedObjectName] Default: 'json'
The name of the packer for serializing messages. Should be one of ‘json’, ‘pickle’, or an import name for a custom callable serializer.

Session.session [CUnicode] Default: ''
The UUID identifying this session.

Session.signature_scheme [Unicode] Default: 'hmac-sha256'
The digest scheme used to construct the message signatures. Must have the form ‘hmac-HASH’.

Session.unpacker [DottedObjectName] Default: 'json'
The name of the unpacker for unserializing messages. Only used with custom functions for packer.

Session.username [Unicode] Default: 'username'
Username for the Session. Default is your system username.

### 5.1.3 IPython shortcuts

Available shortcut in IPython terminal.

**Warning:** This list is automatically generated, and may not hold all the available shortcut. In particular, it may depends on the version of prompt_toolkit installed during the generation of this page.

#### Single Filtered shortcuts

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<thead>
<tr>
<th>Shortcut</th>
<th>Filter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;PageDown&gt;</td>
<td>(Not: HasSelection)</td>
<td>Move forward through the history list, fetching the next command</td>
</tr>
<tr>
<td>&lt;PageUp&gt;</td>
<td>(Not: HasSelection)</td>
<td>Move back through the history list, fetching the previous command</td>
</tr>
<tr>
<td>&lt;Bracketed-Paste&gt;</td>
<td>Always</td>
<td>Pasting from clipboard</td>
</tr>
<tr>
<td>&lt;C-C&gt;</td>
<td>Always</td>
<td>Abort when Control-C has been pressed</td>
</tr>
<tr>
<td>&lt;C-Down&gt;</td>
<td>Always</td>
<td>Move forward through the history list, fetching the next command</td>
</tr>
<tr>
<td>&lt;C-L&gt;</td>
<td>Always</td>
<td>Clear the screen and redraw everything at the top of the screen</td>
</tr>
<tr>
<td>&lt;C-Up&gt;</td>
<td>Always</td>
<td>Move back through the history list, fetching the previous command</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Shortcut</th>
<th>Filter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;C-Z&gt;</code></td>
<td>Always</td>
<td>By default, control-Z should literally insert Ctrl-Z</td>
</tr>
<tr>
<td><code>&lt;Cursor-Position-Response&gt;</code></td>
<td>Always</td>
<td>Handle incoming Cursor-Position-Request response</td>
</tr>
<tr>
<td><code>&lt;End&gt;</code></td>
<td>Always</td>
<td>Move to the end of the line</td>
</tr>
<tr>
<td><code>&lt;Home&gt;</code></td>
<td>Always</td>
<td>Move to the start of the current line</td>
</tr>
<tr>
<td><code>&lt;Left&gt;</code></td>
<td>Always</td>
<td>Move back a character</td>
</tr>
<tr>
<td><code>&lt;Right&gt;</code></td>
<td>Always</td>
<td>Move forward a character</td>
</tr>
<tr>
<td><code>&lt;Vt100-Mouse-Event&gt;</code></td>
<td>Always</td>
<td>Handling of incoming mouse event</td>
</tr>
<tr>
<td><code>&lt;Windows-Mouse-Event&gt;</code></td>
<td>Always</td>
<td>Handling of mouse events for Windows</td>
</tr>
<tr>
<td><code>&lt;Any&gt;</code></td>
<td>Condition</td>
<td>Handle quoted insert</td>
</tr>
<tr>
<td><code>&lt;C-D&gt;</code></td>
<td>Condition</td>
<td>Exit</td>
</tr>
<tr>
<td><code>&lt;C-E&gt;</code></td>
<td>Condition</td>
<td>Accept suggestion</td>
</tr>
<tr>
<td><code>&lt;C-F&gt;</code></td>
<td>Condition</td>
<td>Accept suggestion</td>
</tr>
<tr>
<td><code>&lt;Right&gt;</code></td>
<td>Condition</td>
<td>Accept suggestion</td>
</tr>
<tr>
<td><code>&lt;C-A&gt;</code></td>
<td>EmacsMode</td>
<td>Move to the start of the current line</td>
</tr>
<tr>
<td><code>&lt;C-B&gt;</code></td>
<td>EmacsMode</td>
<td>Move back a character</td>
</tr>
<tr>
<td><code>&lt;C-E&gt;</code></td>
<td>EmacsMode</td>
<td>Move to the end of the line</td>
</tr>
<tr>
<td><code>&lt;C-F&gt;</code></td>
<td>EmacsMode</td>
<td>Move forward a character</td>
</tr>
<tr>
<td><code>&lt;C-Left&gt;</code></td>
<td>EmacsMode</td>
<td>Move back to the start of the current or previous word</td>
</tr>
<tr>
<td><code>&lt;C-N&gt;</code></td>
<td>EmacsMode</td>
<td>Next line</td>
</tr>
<tr>
<td><code>&lt;C-0&gt;</code></td>
<td>EmacsMode</td>
<td>Accept the current line for execution and fetch the next line relative to the current line from the history for editing</td>
</tr>
<tr>
<td><code>&lt;C-P&gt;</code></td>
<td>EmacsMode</td>
<td>Previous line</td>
</tr>
<tr>
<td><code>&lt;C-Right&gt;</code></td>
<td>EmacsMode</td>
<td>Move forward to the end of the next word</td>
</tr>
<tr>
<td><code>&lt;C-Space&gt;</code></td>
<td>EmacsMode</td>
<td>Start of the selection (if the current buffer is not empty)</td>
</tr>
<tr>
<td><code>&lt;C-SquareClose&gt;</code></td>
<td>EmacsMode</td>
<td>When Ctl-] + a character is pressed</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> (</td>
<td>EmacsMode</td>
<td>Begin saving the characters typed into the current keyboard macro</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> )</td>
<td>EmacsMode</td>
<td>Stop saving the characters typed into the current keyboard macro and save the definition</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> <code>&lt;C-X&gt;</code></td>
<td>EmacsMode</td>
<td>Move cursor back and forth between the start and end of the current line</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> e</td>
<td>EmacsMode</td>
<td>Re-execute the last keyboard macro defined, by making the characters in the macro appear as if typed at the keyboard</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code></td>
<td>EmacsMode</td>
<td>By default, ignore escape key</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;C-SquareClose&gt;</code></td>
<td>EmacsMode</td>
<td>Like Ctl-, but backwards</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;Any&gt;</code></td>
<td>EmacsMode</td>
<td>Cursor to start of previous word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;Left&gt;</code></td>
<td>EmacsMode</td>
<td>Cursor to start of next word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;Right&gt;</code></td>
<td>EmacsMode</td>
<td>Previous sentence</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> a</td>
<td>EmacsMode</td>
<td>Move back to the start of the current or previous word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> b</td>
<td>EmacsMode</td>
<td>Move to end of sentence</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> e</td>
<td>EmacsMode</td>
<td>Move forward to the end of the next word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> f</td>
<td>EmacsMode</td>
<td></td>
</tr>
<tr>
<td>!</td>
<td>Never</td>
<td>‘!’ opens the system prompt</td>
</tr>
<tr>
<td><code>&lt;C-B&gt;</code></td>
<td>Never</td>
<td>Scroll window up</td>
</tr>
<tr>
<td><code>&lt;C-D&gt;</code></td>
<td>Never</td>
<td>Same as ControlF, but only scroll half a page</td>
</tr>
<tr>
<td><code>&lt;C-E&gt;</code></td>
<td>Never</td>
<td>scroll_offset += 1</td>
</tr>
<tr>
<td><code>&lt;C-F&gt;</code></td>
<td>Never</td>
<td>Scroll window down</td>
</tr>
</tbody>
</table>

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<th>Shortcut</th>
<th>Filter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;C-J&gt;</td>
<td>Never</td>
<td>Run system command</td>
</tr>
<tr>
<td>&lt;C-U&gt;</td>
<td>Never</td>
<td>Same as ControlB, but only scroll half a page</td>
</tr>
<tr>
<td>&lt;C-V&gt;</td>
<td>Never</td>
<td>Scroll page down</td>
</tr>
<tr>
<td>&lt;C-X&gt; &lt;C-E&gt;</td>
<td>Never</td>
<td>Invoke an editor on the current command line, and accept the result</td>
</tr>
<tr>
<td>&lt;C-Z&gt;</td>
<td>Never</td>
<td>Suspend process to background</td>
</tr>
<tr>
<td>&lt;Escape&gt;!</td>
<td>Never</td>
<td>M-‘!’ opens the system prompt</td>
</tr>
<tr>
<td>&lt;Escape&gt;v</td>
<td>Never</td>
<td>Scroll page up</td>
</tr>
<tr>
<td>&lt;PageDown&gt;</td>
<td>Never</td>
<td>Scroll page down</td>
</tr>
<tr>
<td>&lt;PageUp&gt;</td>
<td>Never</td>
<td>Scroll page up</td>
</tr>
<tr>
<td>v</td>
<td>Never</td>
<td>Invite an editor on the current command line, and accept the result</td>
</tr>
<tr>
<td>&lt;Escape&gt;</td>
<td>ViMode</td>
<td>Escape goes to vi navigation mode</td>
</tr>
</tbody>
</table>

Multi Filtered shortcuts

<table>
<thead>
<tr>
<th>Shortcut</th>
<th>Filter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;C-J&gt;</td>
<td>(And: (Not: Condition), Condition)</td>
<td>Enter, accept input</td>
</tr>
<tr>
<td>&lt;C-D&gt;</td>
<td>(And: Condition, (Or: ViInsertMode, EmacsInsertMode))</td>
<td>Delete character before the cursor</td>
</tr>
<tr>
<td>&lt;C-J&gt;</td>
<td>(And: Condition, (Or: ViInsertMode, EmacsInsertMode))</td>
<td>Newline (in case of multiline input</td>
</tr>
<tr>
<td>&lt;Escape&gt;-</td>
<td>(And: EmacsMode, (Not: HasArg))</td>
<td>Control + G: Cancel completion menu and validation state</td>
</tr>
<tr>
<td>&lt;C-G&gt;</td>
<td>(And: EmacsMode, (Not: HasSelection))</td>
<td>Control + G: Cancel completion menu and validation state</td>
</tr>
<tr>
<td>&lt;C-Q&gt;</td>
<td>(And: EmacsMode, (Not: HasSelection))</td>
<td>Add the next character typed to the line verbatim</td>
</tr>
<tr>
<td>&lt;Escape&gt;&lt;</td>
<td>(And: EmacsMode, (Not: HasSelection))</td>
<td>Move to the first line in the history</td>
</tr>
<tr>
<td>&lt;Escape&gt;&gt;</td>
<td>(And: EmacsMode, (Not: HasSelection))</td>
<td>Move to the end of the input history, i</td>
</tr>
<tr>
<td>-</td>
<td>(And: EmacsMode, Condition)</td>
<td>When ‘-’ is typed again, after exactly ‘-’ has been given as an argument, ignore this</td>
</tr>
<tr>
<td>&lt;C-Delete&gt;</td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Kill from point to the end of the current word, or if between words, to the end of the next word</td>
</tr>
<tr>
<td>&lt;C-Underscore&gt;</td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Incremental undo</td>
</tr>
</tbody>
</table>

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Table 2 – continued from previous page

<table>
<thead>
<tr>
<th>Shortcut</th>
<th>Filter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;C-X&gt;</code> <code>&lt;C-U&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Incremental undo</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> <code>&lt;r&gt;</code> <code>&lt;y&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Paste before cursor</td>
</tr>
<tr>
<td><code>&lt;C-Y&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Paste before cursor</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;#&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Without numeric argument, comment all lines</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;*&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>meta-*: Insert all possible completions of the preceding text</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;.</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Like <code>yank_nth_arg</code>, but if no argument has been given, yank the last word of each line</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;/&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>M-/: Complete</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;Backspace&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Kills the word before point, using “not a letter nor a digit” as a word boundary</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;C-H&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Kills the word before point, using “not a letter nor a digit” as a word boundary</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;C-Y&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Insert the first argument of the previous command</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;\&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Delete all spaces and tabs around point</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>&lt;_&gt;</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Like <code>yank_nth_arg</code>, but if no argument has been given, yank the last word of each line</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>c</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Capitalize the current (or following) word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>d</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Kill from point to the end of the current word, or if between words, to the end of the next word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>l</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Lowercase the current (or following) word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code> <code>t</code></td>
<td>(And: EmacsMode, EmacsInsertMode)</td>
<td>Swap the last two words before the cursor</td>
</tr>
<tr>
<td>Shortcut</td>
<td>Filter</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>--------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td><code>&lt;Escape&gt; u</code></td>
<td></td>
<td>Uppercase the current (or following) word</td>
</tr>
<tr>
<td><code>&lt;Escape&gt; y</code></td>
<td></td>
<td>Rotate the kill ring, and yank the new top</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>&lt;C-J&gt;</code></td>
<td></td>
<td>Accept the line regardless of where the cursor is</td>
</tr>
<tr>
<td><code>&lt;C-C&gt;</code></td>
<td></td>
<td>Abort an incremental search and restore the original line</td>
</tr>
<tr>
<td><code>&lt;C-G&gt;</code></td>
<td></td>
<td>Abort an incremental search and restore the original line</td>
</tr>
<tr>
<td><code>&lt;C-J&gt;</code></td>
<td></td>
<td>When enter pressed in isearch, quit isearch mode</td>
</tr>
<tr>
<td><code>&lt;Escape&gt;</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>&lt;C-C&gt;</code> &lt;</td>
<td></td>
<td>Unindent selected text</td>
</tr>
<tr>
<td><code>&lt;C-C&gt;</code> &gt;</td>
<td></td>
<td>Indent selected text</td>
</tr>
<tr>
<td><code>&lt;C-G&gt;</code></td>
<td></td>
<td>Cancel selection</td>
</tr>
<tr>
<td><code>&lt;C-W&gt;</code></td>
<td></td>
<td>Cut selected text</td>
</tr>
<tr>
<td><code>&lt;C-X&gt;</code> r k</td>
<td></td>
<td>Cut selected text</td>
</tr>
<tr>
<td><code>&lt;Escape&gt; w</code></td>
<td></td>
<td>Copy selected text</td>
</tr>
<tr>
<td><code>&lt;C-R&gt;</code></td>
<td></td>
<td>Vi-style backward search</td>
</tr>
<tr>
<td><code>&lt;C-S&gt;</code></td>
<td></td>
<td>Vi-style forward search</td>
</tr>
<tr>
<td><code>&lt;C-K&gt;</code></td>
<td></td>
<td>Go into digraph mode</td>
</tr>
<tr>
<td><code>z +</code></td>
<td></td>
<td>Scrolls the window to makes the current line the first line in the visible region</td>
</tr>
</tbody>
</table>

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<tr>
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<tbody>
<tr>
<td><code>z -</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode))</td>
<td>Scrolls the window to make the current line the last line in the visible region</td>
</tr>
<tr>
<td><code>z &lt;C-J&gt;</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode))</td>
<td>Scrolls the window to make the current line the first line in the visible region</td>
</tr>
<tr>
<td><code>z b</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode))</td>
<td>Scrolls the window to make the current line the last line in the visible region</td>
</tr>
<tr>
<td><code>z t</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode))</td>
<td>Scrolls the window to make the current line the first line in the visible region</td>
</tr>
<tr>
<td><code>z z</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode))</td>
<td>Center Window vertically around cursor</td>
</tr>
<tr>
<td><code>/</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode), (Not: Condition))</td>
<td>Vi-style forward search</td>
</tr>
<tr>
<td><code>?</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode), (Not: Condition))</td>
<td>Vi-style backward search</td>
</tr>
<tr>
<td><code>/</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode), Condition)</td>
<td>Vi-style backward search</td>
</tr>
<tr>
<td><code>?</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode), Condition)</td>
<td>Vi-style forward search</td>
</tr>
<tr>
<td><code>0</code></td>
<td>(And: ViMode, (Or: ViNavigationMode, ViSelectionMode, ViWaitingForTextObjectMode), HasArg)</td>
<td>Zero when an argument was already given</td>
</tr>
<tr>
<td><code>I</code></td>
<td>(And: ViMode, Condition, (Not: IsReadOnly))</td>
<td>Insert in block selection mode</td>
</tr>
</tbody>
</table>

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<tr>
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</thead>
<tbody>
<tr>
<td>G</td>
<td>(And: ViMode, HasArg)</td>
<td>If an argument is given, move to this line in the history</td>
</tr>
<tr>
<td>&lt;C-C&gt;</td>
<td>(And: ViMode, HasFocus)</td>
<td>Cancel search</td>
</tr>
<tr>
<td>&lt;C-J&gt;</td>
<td>(And: ViMode, HasFocus)</td>
<td>Apply the search</td>
</tr>
<tr>
<td>&lt;Escape&gt;</td>
<td>(And: ViMode, HasFocus)</td>
<td>Apply the search</td>
</tr>
<tr>
<td>&lt;Backspace&gt;</td>
<td>(And: ViMode, HasFocus, Condition)</td>
<td>Cancel search</td>
</tr>
<tr>
<td>&lt;C-H&gt;</td>
<td>(And: ViMode, HasFocus, Condition)</td>
<td>Cancel search</td>
</tr>
<tr>
<td>&lt;Any&gt;</td>
<td>(And: ViMode, ViDigraphMode, Condition)</td>
<td>Insert digraph</td>
</tr>
<tr>
<td>&lt;C-E&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Cancel completion</td>
</tr>
<tr>
<td>&lt;C-P&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Control-P: To previous completion</td>
</tr>
<tr>
<td>&lt;C-V&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Add the next character typed to the line verbatim</td>
</tr>
<tr>
<td>&lt;C-X&gt; &lt;C-F&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Complete file names</td>
</tr>
<tr>
<td>&lt;C-X&gt; &lt;C-L&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Pressing the ControlX - ControlL sequence in Vi mode does line completion based on the other lines in the document and the history</td>
</tr>
<tr>
<td>&lt;C-Y&gt;</td>
<td>(And: ViMode, ViInsertMode)</td>
<td>Accept current completion</td>
</tr>
<tr>
<td>&lt;Any&gt;</td>
<td>(And: ViMode, ViInsertMultipleMode)</td>
<td>Insert data at multiple cursor positions at once</td>
</tr>
<tr>
<td>&lt;Backspace&gt;</td>
<td>(And: ViMode, ViInsertMultipleMode)</td>
<td>Backspace, using multiple cursors</td>
</tr>
<tr>
<td>&lt;Delete&gt;</td>
<td>(And: ViMode, ViInsertMultipleMode)</td>
<td>Delete, using multiple cursors</td>
</tr>
<tr>
<td>&quot; &lt;Any&gt; P</td>
<td>(And: ViMode, ViNavigationMode)</td>
<td>Paste (before) from named register</td>
</tr>
<tr>
<td>&quot; &lt;Any&gt; p</td>
<td>(And: ViMode, ViNavigationMode)</td>
<td>Paste from named register</td>
</tr>
<tr>
<td>#</td>
<td>(And: ViMode, ViNavigationMode)</td>
<td>Go to previous occurrence of this word</td>
</tr>
<tr>
<td>*</td>
<td>(And: ViMode, ViNavigationMode)</td>
<td>Go to next occurrence of this word</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
<td>+</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Move to first non whitespace of next line</td>
</tr>
<tr>
<td>–</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Move to first non whitespace of previous line</td>
</tr>
<tr>
<td>&lt; &lt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Unindent lines</td>
</tr>
<tr>
<td>&lt;Backspace&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>In navigation-mode, move cursor</td>
</tr>
<tr>
<td>&lt;C-H&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>In navigation-mode, move cursor</td>
</tr>
<tr>
<td>&lt;C-J&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>In navigation mode, pressing enter will always return the input</td>
</tr>
<tr>
<td>&lt;C-N&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Arrow down and Control-N in navigation mode</td>
</tr>
<tr>
<td>&lt;C-P&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Arrow up and ControlP in navigation mode go up</td>
</tr>
<tr>
<td>&lt;C-V&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Enter block selection mode</td>
</tr>
<tr>
<td>&lt;Down&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Arrow down and Control-N in navigation mode</td>
</tr>
<tr>
<td>&lt;Insert&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Pressing the Insert key</td>
</tr>
<tr>
<td>&lt;Up&gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Arrow up and ControlP in navigation mode go up</td>
</tr>
<tr>
<td>&gt; &gt;</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Indent lines</td>
</tr>
<tr>
<td>N</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Search previous in navigation mode</td>
</tr>
<tr>
<td>P</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Paste before</td>
</tr>
<tr>
<td>R</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Go to ‘replace’-mode</td>
</tr>
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<tbody>
<tr>
<td>V</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Start lines selection</td>
</tr>
<tr>
<td>Y</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Yank the whole line</td>
</tr>
<tr>
<td>d d</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Delete line</td>
</tr>
<tr>
<td>j</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Go down, but if we enter a new history entry, go to the start of the line</td>
</tr>
<tr>
<td>k</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Go up, but if we enter a new history entry, move to the start of the line</td>
</tr>
<tr>
<td>n</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Search next in navigation mode</td>
</tr>
<tr>
<td>p</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Paste after</td>
</tr>
<tr>
<td>r Any</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Replace single character under cursor</td>
</tr>
<tr>
<td>v</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Enter character selection mode</td>
</tr>
<tr>
<td>x</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Delete character</td>
</tr>
<tr>
<td>y y</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Yank the whole line</td>
</tr>
<tr>
<td>~</td>
<td>(And: ViMode, ViNavigation-Mode)</td>
<td>Reverse case of current character and move cursor forward</td>
</tr>
<tr>
<td>C</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td># Change to end of line</td>
</tr>
<tr>
<td>J</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Join lines</td>
</tr>
<tr>
<td>O</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Open line above and enter insertion mode</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<tbody>
<tr>
<td>S</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Change current line</td>
</tr>
<tr>
<td>c c</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Change current line</td>
</tr>
<tr>
<td>g J</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Join lines without space</td>
</tr>
<tr>
<td>g U U</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Uppercase current line</td>
</tr>
<tr>
<td>g u u</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Lowercase current line</td>
</tr>
<tr>
<td>g ~ ~</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Swap case of the current line</td>
</tr>
<tr>
<td>o</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Open line below and enter insertion mode</td>
</tr>
<tr>
<td>s</td>
<td>(And: ViMode, ViNavigation-Mode, (Not: IsReadOnly))</td>
<td>Substitute with new text (Delete character(s) and go to insert mode)</td>
</tr>
<tr>
<td>&lt;Any&gt;</td>
<td>(And: ViMode, ViReplaceMode)</td>
<td>Insert data at cursor position</td>
</tr>
<tr>
<td>&lt;C-V&gt;</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Exit block selection mode, or go from non block selection mode to block selection mode</td>
</tr>
<tr>
<td>V</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Exit line selection mode, or go from non line selection mode to line selection mode</td>
</tr>
<tr>
<td>a W</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Switch from visual linewise mode to visual characterwise mode</td>
</tr>
<tr>
<td>a w</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Switch from visual linewise mode to visual characterwise mode</td>
</tr>
<tr>
<td>j</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Arrow down in selection mode</td>
</tr>
<tr>
<td>k</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Arrow up in selection mode</td>
</tr>
<tr>
<td>v</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Exit character selection mode, or go from non-character-selection mode to character selection mode</td>
</tr>
<tr>
<td>x</td>
<td>(And: ViMode, ViSelectionMode)</td>
<td>Cut selection</td>
</tr>
</tbody>
</table>

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<tr>
<td>J</td>
<td>(And: ViMode, ViSelectionMode, (Not: IsReadOnly))</td>
<td>Join selected lines</td>
</tr>
<tr>
<td>g J</td>
<td>(And: ViMode, ViSelectionMode, (Not: IsReadOnly))</td>
<td>Join selected lines without space</td>
</tr>
<tr>
<td>&lt;Any&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Insert yourself</td>
</tr>
<tr>
<td>&lt;BackTab&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Move backward through the list of possible completions</td>
</tr>
<tr>
<td>&lt;Backspace&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Delete the character behind the cursor</td>
</tr>
<tr>
<td>&lt;C-H&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Delete the character behind the cursor</td>
</tr>
<tr>
<td>&lt;C-I&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Generate completions, or go to the next completion</td>
</tr>
<tr>
<td>&lt;C-K&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Kill the text from the cursor to the end of the line</td>
</tr>
<tr>
<td>&lt;C-T&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Emulate Emacs transpose-char behavior: at the beginning of the buffer, do nothing</td>
</tr>
<tr>
<td>&lt;C-U&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Kill backward from the cursor to the beginning of the current line</td>
</tr>
<tr>
<td>&lt;C-W&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Kill the word behind point, using whitespace as a word boundary</td>
</tr>
<tr>
<td>&lt;Delete&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Delete character before the cursor</td>
</tr>
<tr>
<td>&lt;ShiftDelete&gt;</td>
<td>(Or: ViInsertMode, EmacsInsertMode)</td>
<td>Delete character before the cursor</td>
</tr>
</tbody>
</table>

### 5.1.4 Specific config details

#### Custom Prompts

Changed in version 5.0.

From IPython 5, prompts are produced as a list of Pygments tokens, which are tuples of (token_type, text). You can customise prompts by writing a method which generates a list of tokens.

There are four kinds of prompt:
• The in prompt is shown before the first line of input (default like In [1]:).
• The continuation prompt is shown before further lines of input (default like ...:).
• The rewrite prompt is shown to highlight how special syntax has been interpreted (default like ------>).
• The out prompt is shown before the result from evaluating the input (default like Out[1]):.

Custom prompts are supplied together as a class. If you want to customise only some of the prompts, inherit from IPython.terminal.prompts.Prompts, which defines the defaults. The required interface is like this:

```python
class MyPrompts(shell):
    Prompt style definition. shell is a reference to the TerminalInteractiveShell instance.

    in_prompt_tokens(cli=None)
    continuation_prompt_tokens(self, cli=None, width=None)
    rewrite_prompt_tokens()
    out_prompt_tokens()
```

Return the respective prompts as lists of (token_type, text) tuples.

For continuation prompts, width is an integer representing the width of the prompt area in terminal columns.

cli, where used, is the prompt_toolkit CommandLineInterface instance. This is mainly for compatibility with the API prompt_toolkit expects.

Here is an example Prompt class that will show the current working directory in the input prompt:

```python
from IPython.terminal.prompts import Prompts, Token
import os

class MyPrompt(Prompts):
    def in_prompt_tokens(self, cli=None):
        return [(Token, os.getcwd()),
                (Token.Prompt, ' >>>')]
```

To set the new prompt, assign it to the prompts attribute of the IPython shell:

```python
In [2]: ip = get_ipython()
    ...: ip.prompts = MyPrompt(ip)

/home/bob >>> # it works
```

See IPython/example/utils/cwd_prompt.py for an example of how to write an extensions to customise prompts.

Inside IPython or in a startup script, you can use a custom prompts class by setting get_ipython().prompts to an instance of the class. In configuration, TerminalInteractiveShell.prompts_class may be set to either the class object, or a string of its full importable name.

To include invisible terminal control sequences in a prompt, use Token.ZeroWidthEscape as the token type. Tokens with this type are ignored when calculating the width.

Colours in the prompt are determined by the token types and the highlighting style; see below for more details. The tokens used in the default prompts are Prompt, PromptNum, OutPrompt and OutPromptNum.

**Terminal Colors**

Changed in version 5.0.

There are two main configuration options controlling colours.
InteractiveShell.colors sets the colour of tracebacks and object info (the output from e.g. `zip`). It may also affect other things if the option below is set to 'legacy'. It has four case-insensitive values: 'nocolor', 'neutral', 'linux', 'lightbg'. The default is neutral, which should be legible on either dark or light terminal backgrounds. linux is optimised for dark backgrounds and lightbg for light ones.

TerminalInteractiveShell.highlighting_style determines prompt colours and syntax highlighting. It takes the name (as a string) or class (as a subclass of `pygments.style.Style`) of a Pygments style, or the special value 'legacy' to pick a style in accordance with InteractiveShell.colors.

You can see the Pygments styles available on your system by running:

```
import pygments
list(pygments.styles.get_all_styles())
```

Additionally, TerminalInteractiveShell.highlighting_style_overrides can override specific styles in the highlighting. It should be a dictionary mapping Pygments token types to strings defining the style. See Pygments’ documentation for the language used to define styles.

**Colors in the pager**

On some systems, the default pager has problems with ANSI colour codes. To configure your default pager to allow these:

1. Set the environment PAGER variable to less.
2. Set the environment LESS variable to -r (plus any other options you always want to pass to less by default).
   This tells less to properly interpret control sequences, which is how color information is given to your terminal.

**Editor configuration**

IPython can integrate with text editors in a number of different ways:

- Editors (such as (X)Emacs, vim and TextMate) can send code to IPython for execution.
- IPython’s %edit magic command can open an editor of choice to edit a code block.

The %edit command (and its alias %ed) will invoke the editor set in your environment as EDITOR. If this variable is not set, it will default to vi under Linux/Unix and to notepad under Windows. You may want to set this variable properly and to a lightweight editor which doesn’t take too long to start (that is, something other than a new instance of Emacs). This way you can edit multi-line code quickly and with the power of a real editor right inside IPython.

You can also control the editor by setting TerminalInteractiveShell.editor in ipython_config.py.

**Vim**

Paul Ivanov’s vim-ipython provides powerful IPython integration for vim.

**(X)Emacs**

If you are a dedicated Emacs user, and want to use Emacs when IPython’s %edit magic command is called you should set up the Emacs server so that new requests are handled by the original process. This means that almost no time is spent in handling the request (assuming an Emacs process is already running). For this to work, you need to set your EDITOR environment variable to ‘emacsclient’. The code below, supplied by Francois Pinard, can then be used in your .emacs file to enable the server:
Thanks to the work of Alexander Schmolck and Prabhu Ramachandran, currently (X)Emacs and IPython get along very well in other ways.

With (X)EMacs >= 24, You can enable IPython in python-mode with:

```
(requiring 'python)
(setq python-shell-interpreter "ipython")
```

### Keyboard Shortcuts

Changed in version 5.0.

You can customise keyboard shortcuts for terminal IPython. Put code like this in a startup file:

```
from IPython import get_ipython
from prompt_toolkit.enums import DEFAULT_BUFFER
from prompt_toolkit.keys import Keys
from prompt_toolkit.filters import HasFocus, HasSelection, ViInsertMode,
                               EmacsInsertMode

ip = get_ipython()
insert_mode = ViInsertMode() | EmacsInsertMode()

def insert_unexpected(event):
    buf = event.current_buffer
    buf.insert_text('The Spanish Inquisition')

# Register the shortcut if IPython is using prompt_toolkit
if getattr(ip, 'pt_cli'):
    registry = ip.pt_cli.application.key_bindings_registry
    registry.add_binding(Keys.ControlN,
                         filter=(HasFocus(DEFAULT_BUFFER)
                                 & ~HasSelection()
                                 & insert_mode))(insert_unexpected)
```

For more information on filters and what you can do with the `event` object, see the prompt_toolkit docs.

See also:

- **Overview of the IPython configuration system** Technical details of the config system.

### 5.2 Extending and integrating with IPython

#### 5.2.1 IPython extensions

A level above configuration are IPython extensions, Python modules which modify the behaviour of the shell. They are referred to by an importable module name, and can be placed anywhere you’d normally import from, or in `.ipython/extensions/`.
**Getting extensions**

A few important extensions are *bundled with IPython*. Others can be found on the *extensions index* on the wiki, and the *Framework :: IPython* tag on PyPI.

Extensions on PyPI can be installed using `pip`, like any other Python package.

**Using extensions**

To load an extension while IPython is running, use the `%load_ext` magic:

```
In [1]: %load_ext myextension
```

To load it each time IPython starts, list it in your configuration file:

```
c.InteractiveShellApp.extensions = ['myextension']
```

**Writing extensions**

An IPython extension is an importable Python module that has a couple of special functions to load and unload it. Here is a template:

```python
# myextension.py

def load_ipython_extension(ipython):
    # The `ipython` argument is the currently active `InteractiveShell`
    # instance, which can be used in any way. This allows you to register
    # new magics or aliases, for example.

def unload_ipython_extension(ipython):
    # If you want your extension to be unloadable, put that logic here.
```

This `load_ipython_extension()` function is called after your extension is imported, and the currently active `InteractiveShell` instance is passed as the only argument. You can do anything you want with IPython at that point.

`load_ipython_extension()` will not be called again if the user use `%load_extension`. The user have to explicitly ask the extension to be reloaded (with `%reload_extension`). In case where the user ask the extension to be reloaded, the extension will be unloaded (with `unload_ipython_extension()`), and loaded again.

Useful `InteractiveShell` methods include `register_magic_function()`, `push()` (to add variables to the user namespace) and `drop_by_id()` (to remove variables on unloading).

**See also:**

*Defining custom magics*

You can put your extension modules anywhere you want, as long as they can be imported by Python’s standard import mechanism. However, to make it easy to write extensions, you can also put your extensions in `extensions/` within the `IPython` directory. This directory is added to `sys.path` automatically.

When your extension is ready for general use, please add it to the *extensions index*. We also encourage you to upload it to PyPI and use the *Framework :: IPython* classifier, so that users can install it with standard packaging tools.
Extensions bundled with IPython

autoreload

IPython extension to reload modules before executing user code.

autoreload reloads modules automatically before entering the execution of code typed at the IPython prompt. This makes for example the following workflow possible:

```
In [1]: %load_ext autoreload

In [2]: %autoreload 2

In [3]: from foo import some_function

In [4]: some_function()
Out[4]: 42

In [5]: # open foo.py in an editor and change some_function to return 43

In [6]: some_function()
Out[6]: 43
```

The module was reloaded without reloading it explicitly, and the object imported with from foo import ... was also updated.

Usage

The following magic commands are provided:

%autoreload

   Reload all modules (except those excluded by %aimport) automatically now.

%autoreload 0

   Disable automatic reloading.

%autoreload 1

   Reload all modules imported with %aimport every time before executing the Python code typed.

%autoreload 2

   Reload all modules (except those excluded by %aimport) every time before executing the Python code typed.

%aimport

   List modules which are to be automatically imported or not to be imported.

%aimport foo

   Import module ‘foo’ and mark it to be autoreloaded for %autoreload 1

%aimport -foo

   Mark module ‘foo’ to not be autoreloaded.
Caveats

Reloading Python modules in a reliable way is in general difficult, and unexpected things may occur. `%autoreload` tries to work around common pitfalls by replacing function code objects and parts of classes previously in the module with new versions. This makes the following things to work:

- Functions and classes imported via ‘from xxx import foo’ are upgraded to new versions when ‘xxx’ is reloaded.
- Methods and properties of classes are upgraded on reload, so that calling ‘c.foo()’ on an object ‘c’ created before the reload causes the new code for ‘foo’ to be executed.

Some of the known remaining caveats are:

- Replacing code objects does not always succeed: changing a @property in a class to an ordinary method or a method to a member variable can cause problems (but in old objects only).
- Functions that are removed (eg. via monkey-patching) from a module before it is reloaded are not upgraded.
- C extension modules cannot be reloaded, and so cannot be autoreloaded.

storemagic

%store magic for lightweight persistence.

Stores variables, aliases and macros in IPython’s database.

To automatically restore stored variables at startup, add this to your `ipython_config.py` file:

```python
StoreMagics.autorestore = True
```

Usage:

- `%store` - Show list of all variables and their current values
- `%store spam` - Store the current value of the variable `spam` to disk
- `%store -d spam` - Remove the variable and its value from storage
- `%store -z` - Remove all variables from storage
- `%store -r` - Refresh all variables from store (overwrite current vals)
- `%store -r spam bar` - Refresh specified variables from store (delete current val)
• %store foo >a.txt - Store value of foo to new file a.txt
• %store foo >>a.txt - Append value of foo to file a.txt

It should be noted that if you change the value of a variable, you need to %store it again if you want to persist the new value.

Note also that the variables will need to be pickleable; most basic python types can be safely %store’d.

Also aliases can be %store’d across sessions.
• octavemagic used to be bundled, but is now part of oct2py. Use %load_ext oct2py.ipython to load it.
• rmagic is now part of rpy2. Use %load_ext rpy2.ipython to load it, and see rpy2.ipython. rmagic for details of how to use it.
• cythonmagic used to be bundled, but is now part of cython Use %load_ext Cython to load it.
• sympyprinting used to be a bundled extension, but you should now use sympy.init_printing() instead.

5.2.2 Integrating your objects with IPython

Tab completion

To change the attributes displayed by tab-completing your object, define a __dir__(self) method for it. For more details, see the documentation of the built-in dir() function.

You can also customise key completions for your objects, e.g. pressing tab after obj["a. To do so, define a method _ipython_key_completions_(), which returns a list of objects which are possible keys in a subscript expression obj[key].

New in version 5.0: Custom key completions

Rich display

The notebook and the Qt console can display richer representations of objects. To use this, you can define any of a number of _repr_*_() methods. Note that these are surrounded by single, not double underscores.

Both the notebook and the Qt console can display svg, png and jpeg representations. The notebook can also display html, javascript, and latex. If the methods don’t exist, or return None, it falls back to a standard repr().

For example:

```python
class Shout(object):
    def __init__(self, text):
        self.text = text

    def __repr_html__(self):
        return "<h1>" + self.text + "</h1>"
```

Custom exception tracebacks

Rarely, you might want to display a custom traceback when reporting an exception. To do this, define the custom traceback using _render_traceback_(self) method which returns a list of strings, one string for each line of the traceback. For example, the ipyparallel a parallel computing framework for IPython, does this to display errors from multiple engines.
Please be conservative in using this feature; by replacing the default traceback you may hide important information from the user.

### 5.2.3 Defining custom magics

There are two main ways to define your own magic functions: from standalone functions and by inheriting from a base class provided by IPython: `IPython.core.magic.Magics`. Below we show code you can place in a file that you load from your configuration, such as any file in the `startup` subdirectory of your default IPython profile.

First, let us see the simplest case. The following shows how to create a line magic, a cell one and one that works in both modes, using just plain functions:

```python
from IPython.core.magic import (register_line_magic, register_cell_magic,
                                 register_line_cell_magic)

@register_line_magic
def lmagic(line):
    "my line magic"
    return line

@register_cell_magic
def cmagic(line, cell):
    "my cell magic"
    return line, cell

@register_line_cell_magic
def lcmagic(line, cell=None):
    if cell is None:
        print("Called as line magic")
        return line
    else:
        print("Called as cell magic")
        return line, cell
```

You can also create magics of all three kinds by inheriting from the `IPython.core.magic.Magics` class. This lets you create magics that can potentially hold state in between calls, and that have full access to the main IPython object:

```python
# This code can be put in any Python module, it does not require IPython
# itself to be running already. It only creates the magics subclass but
# doesn't instantiate it yet.
from future import print_function
from IPython.core.magic import (Magics, magics_class, line_magic,
                                 cell_magic, line_cell_magic)

# The class MUST call this class decorator at creation time
@magics_class
class MyMagics(Magics):
    @line_magic
    def lmagic(self, line):
        (continues on next page)
```
"my line magic"
print("Full access to the main IPython object:", self.shell)
print("Variables in the user namespace:", list(self.shell.user_ns.keys()))
return line

cell_magic

@cell_magic
def cmagic(self, line, cell):
    "my cell magic"
    return line, cell

@line_cell_magic
def lcmagic(self, line, cell=None):
    "Magic that works both as %lc magic and as %%lcmagic"
    if cell is None:
        print("Called as line magic")
        return line
    else:
        print("Called as cell magic")
        return line, cell

# In order to actually use these magics, you must register them with a
# running IPython. This code must be placed in a file that is loaded once
# IPython is up and running:
ip = get_ipython()
# You can register the class itself without instantiating it. IPython will
# call the default constructor on it.
ip.register_magics(MyMagics)

If you want to create a class with a different constructor that holds additional state, then you should always call the parent constructor and instantiate the class yourself before registration:

@magics_class
class StatefulMagics(Magics):
    "Magics that hold additional state"
    def __init__(self, shell, data):
        # You must call the parent constructor
        super(StatefulMagics, self).__init__(shell)
        self.data = data

        # etc...

    # This class must then be registered with a manually created instance,
    # since its constructor has different arguments from the default:
ip = get_ipython()
magics = StatefulMagics(ip, some_data)
ip.register_magics(magics)

Note: In early IPython versions 0.12 and before the line magics were created using a define_magic() API function. This API has been replaced with the above in IPython 0.13 and then completely removed in IPython 5. Maintainers of IPython extensions that still use the define_magic() function are advised to adjust their code for the current API.
5.2.4 Custom input transformation

IPython extends Python syntax to allow things like magic commands, and help with the ? syntax. There are several ways to customise how the user’s input is processed into Python code to be executed.

These hooks are mainly for other projects using IPython as the core of their interactive interface. Using them carelessly can easily break IPython!

String based transformations

When the user enters a line of code, it is first processed as a string. By the end of this stage, it must be valid Python syntax.

These transformers all subclass `IPython.core.inputtransformer.InputTransformer`, and are used by `IPython.core.inputsplitter.IPythonInputSplitter`.

These transformers act in three groups, stored separately as lists of instances in attributes of `IPythonInputSplitter`:

- `physical_line_transforms` act on the lines as the user enters them. For example, these strip Python prompts from examples pasted in.
- `logical_line_transforms` act on lines as connected by explicit line continuations, i.e. \ at the end of physical lines. They are skipped inside multiline Python statements. This is the point where IPython recognises %magic commands, for instance.
- `python_line_transforms` act on blocks containing complete Python statements. Multi-line strings, lists and function calls are reassembled before being passed to these, but note that function and class definitions are still a series of separate statements. IPython does not use any of these by default.

An InteractiveShell instance actually has two `IPythonInputSplitter` instances, as the attributes `input_splitter`, to tell when a block of input is complete, and `input_transformer_manager`, to transform complete cells. If you add a transformer, you should make sure that it gets added to both, e.g.:

```python
ip.input_splitter.logical_line_transforms.append(my_transformer())
ip.input_transformer_manager.logical_line_transforms.append(my_transformer())
```

These transformers may raise `SyntaxError` if the input code is invalid, but in most cases it is clearer to pass unrecognised code through unmodified and let Python’s own parser decide whether it is valid.

Changed in version 2.0: Added the option to raise `SyntaxError`.

Stateless transformations

The simplest kind of transformations work one line at a time. Write a function which takes a line and returns a line, and decorate it with `StatelessInputTransformer.wrap()`:

```python
@StatelessInputTransformer.wrap
def my_special_commands(line):
    if line.startswith("¬"):
        return "specialcommand(" + repr(line) + ")"
    return line
```

The decorator returns a factory function which will produce instances of `StatelessInputTransformer` using your function.
Coroutine transformers

More advanced transformers can be written as coroutines. The coroutine will be sent each line in turn, followed by None to reset it. It can yield lines, or None if it is accumulating text to yield at a later point. When reset, it should give up any code it has accumulated.

This code in IPython strips a constant amount of leading indentation from each line in a cell:

```python
@CoroutineInputTransformer.wrap
def leading_indent():
    """Remove leading indentation.
    
    If the first line starts with a spaces or tabs, the same whitespace will be removed from each following line until it is reset.
    ""
    space_re = re.compile(r'^[ \t]+')
    line = ''
    while True:
        line = (yield line)

        if line is None:
            continue

        m = space_re.match(line)
        if m:
            space = m.group(0)
            while line is not None:
                if line.startswith(space):
                    line = line[len(space):]
                line = (yield line)
        else:
            # No leading spaces - wait for reset
            while line is not None:
                line = (yield line)

leading_indent.look_in_string = True
```

Token-based transformers

There is an experimental framework that takes care of tokenizing and untokenizing lines of code. Define a function that accepts a list of tokens, and returns an iterable of output tokens, and decorate it with TokenInputTransformer.wrap(). These should only be used in python_line_transforms.

AST transformations

After the code has been parsed as Python syntax, you can use Python’s powerful Abstract Syntax Tree tools to modify it. Subclass ast.NodeTransformer, and add an instance to shell.ast_transformers.

This example wraps integer literals in an Integer class, which is useful for mathematical frameworks that want to handle e.g. 1/3 as a precise fraction:

```python
class IntegerWrapper(ast.NodeTransformer):
    """Wraps all integers in a call to Integer()""
    def visit_Num(self, node):
        if isinstance(node.n, int):
```
5.2.5 IPython Events

Extension code can register callbacks functions which will be called on specific events within the IPython code. You can see the current list of available callbacks, and the parameters that will be passed with each, in the callback prototype functions defined in IPython.core.callbacks.

To register callbacks, use `IPython.core.events.EventManager.register()`. For example:

```python
class VarWatcher(object):
    def __init__(self, ip):
        self.shell = ip
        self.last_x = None

    def pre_execute(self):
        self.last_x = self.shell.user_ns.get('x', None)

    def post_execute(self):
        if self.shell.user_ns.get('x', None) != self.last_x:
            print("x changed!")

def load_ipython_extension(ip):
    vw = VarWatcher(ip)
    ip.events.register('pre_execute', vw.pre_execute)
    ip.events.register('post_execute', vw.post_execute)
```

Events

These are the events IPython will emit. Callbacks will be passed no arguments, unless otherwise specified.

shell_initialzied

```python
def shell_initialzied(ipython):
    ...
```

This event is triggered only once, at the end of setting up IPython. Extensions registered to load by default as part of configuration can use this to execute code to finalize setup. Callbacks will be passed the InteractiveShell instance.

pre_run_cell

pre_run_cell fires prior to interactive execution (e.g. a cell in a notebook). It can be used to note the state prior to execution, and keep track of changes.

pre_execute

pre_execute is like pre_run_cell, but is triggered prior to any execution. Sometimes code can be executed by libraries, etc. which skipping the history/display mechanisms, in which cases pre_run_cell will not fire.
**post_run_cell**

*post_run_cell* runs after interactive execution (e.g., a cell in a notebook). It can be used to cleanup or notify or perform operations on any side effects produced during execution. For instance, the inline matplotlib backend uses this event to display any figures created but not explicitly displayed during the course of the cell.

**post_execute**

The same as *pre_execute*, *post_execute* is like *post_run_cell*, but fires for all executions, not just interactive ones.

**See also:**

Module *IPython.core.hooks* The older ‘hooks’ system allows end users to customise some parts of IPython’s behaviour.

*Custom input transformation* By registering input transformers that don’t change code, you can monitor what is being executed.

### 5.2.6 Integrating with GUI event loops

When the user types `%gui qt`, IPython integrates itself with the Qt event loop, so you can use both a GUI and an interactive prompt together. IPython supports a number of common GUI toolkits, but from IPython 3.0, it is possible to integrate other event loops without modifying IPython itself.

Terminal IPython handles event loops very differently from the IPython kernel, so different steps are needed to integrate with each.

#### Event loops in the terminal

Changed in version 5.0: There is a new API for event loop integration using prompt_toolkit.

In the terminal, IPython uses prompt_toolkit to prompt the user for input. prompt_toolkit provides hooks to integrate with an external event loop.

To integrate an event loop, define a function which runs the GUI event loop until there is input waiting for prompt_toolkit to process. There are two ways to detect this condition:

```python
# Polling for input.
def inputhook(context):
    while not context.input_is_ready():
        # Replace this with the appropriate call for the event loop:
        iterate_loop_once()

# Using a file descriptor to notify the event loop to stop.
def inputhook2(context):
    fd = context.fileno()
    # Replace the functions below with those for the event loop.
    add_file_reader(fd, callback=stop_the_loop)
    run_the_loop()
```

Once you have defined this function, register it with IPython:

```python
IPython.terminal.pt_inputhooks.register(name, inputhook)
```

Register the function *inputhook* as the event loop integration for the GUI *name*. If *name*='foo', then the user can enable this integration by running `%gui foo`. 

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Event loops in the kernel

The kernel runs its own event loop, so it’s simpler to integrate with others. IPython allows the other event loop to take control, but it must call `IPython.kernel.zmq.kernelbase.Kernel.do_one_iteration()` periodically.

To integrate with this, write a function that takes a single argument, the IPython kernel instance, arranges for your event loop to call `kernel.do_one_iteration()` at least every `kernel._poll_interval` seconds, and starts the event loop.

Decorate this function with `IPython.kernel.zmq.eventloops.register_integration()`, passing in the names you wish to register it for. Here is a slightly simplified version of the Tkinter integration already included in IPython:

```python
@register_integration('tk')
def loop_tk(kernel):
    """Start a kernel with the Tk event loop."""
    from tkinter import Tk

    # Tk uses milliseconds
    poll_interval = int(1000*kernel._poll_interval)
    # For Tkinter, we create a Tk object and call its withdraw method.
    class Timer(object):
        def __init__(self, func):
            self.app = Tk()
            self.app.withdraw()
            self.func = func

        def on_timer(self):
            self.func()
            self.app.after(poll_interval, self.on_timer)

        def start(self):
            self.on_timer()  # Call it once to get things going.
            self.app.mainloop()

    kernel.timer = Timer(kernel.do_one_iteration)
    kernel.timer.start()
```

Some event loops can go one better, and integrate checking for messages on the kernel’s ZMQ sockets, making the kernel more responsive than plain polling. How to do this is outside the scope of this document; if you are interested, look at the integration with Qt in `IPython.kernel.zmq.eventloops`.

5.2. Extending and integrating with IPython
Developer’s guide for third party tools and libraries

**Important:** This guide contains information for developers of third party tools and libraries that use IPython. Alternatively, documentation for core IPython development can be found in the *Guide for IPython core Developers*.

### 6.1 How IPython works

#### 6.1.1 Terminal IPython

When you type `ipython`, you get the original IPython interface, running in the terminal. It does something like this:

```python
while True:
    code = input(">>> ")
    exec(code)
```

Of course, it’s much more complex, because it has to deal with multi-line code, tab completion using `readline`, magic commands, and so on. But the model is like that: prompt the user for some code, and when they’ve entered it, exec it in the same process. This model is often called a REPL, or Read-Eval-Print-Loop.

#### 6.1.2 The IPython Kernel

All the other interfaces—the Notebook, the Qt console, `ipython console` in the terminal, and third party interfaces—use the IPython Kernel. This is a separate process which is responsible for running user code, and things like computing possible completions. Frontends communicate with it using JSON messages sent over ZeroMQ sockets; the protocol they use is described in *Messaging in Jupyter*.

The core execution machinery for the kernel is shared with terminal IPython:
A kernel process can be connected to more than one frontend simultaneously. In this case, the different frontends will have access to the same variables.

This design was intended to allow easy development of different frontends based on the same kernel, but it also made it possible to support new languages in the same frontends, by developing kernels in those languages, and we are refining IPython to make that more practical.

Today, there are two ways to develop a kernel for another language. Wrapper kernels reuse the communications machinery from IPython, and implement only the core execution part. Native kernels implement execution and communications in the target language:
Wrapper kernels are easier to write quickly for languages that have good Python wrappers, like octave_kernel, or languages where it's impractical to implement the communications machinery, like bash_kernel. Native kernels are likely to be better maintained by the community using them, like IJulia or IHaskell.

See also:

- Making kernels for Jupyter
- Making simple Python wrapper kernels

### 6.2 Making simple Python wrapper kernels

New in version 3.0.

You can now re-use the kernel machinery in IPython to easily make new kernels. This is useful for languages that have Python bindings, such as Octave (via Oct2Py), or languages where the REPL can be controlled in a tty using pexpect, such as bash.

See also:
bash_kernel A simple kernel for bash, written using this machinery

6.2.1 Required steps

Subclass ipykernel.kernelbase.Kernel, and implement the following methods and attributes:

```python
class MyKernel

    implementation
    implementation_version
    language
    language_version
    banner

    Information for Kernel info replies. ‘Implementation’ refers to the kernel (e.g. IPython), and ‘language’ refers to the language it interprets (e.g. Python). The ‘banner’ is displayed to the user in console UIs before the first prompt. All of these values are strings.

    language_info

    Language information for Kernel info replies, in a dictionary. This should contain the key mimetype with the mimetype of code in the target language (e.g. ‘text/x-python’), and file_extension (e.g. ‘.py’). It may also contain keys codemirror_mode and pygments_lexer if they need to differ from language.

    Other keys may be added to this later.

    do_execute (code, silent, store_history=True, user_expressions=None, allow_stdin=False)

    Execute user code.

    Parameters

        • code (str) – The code to be executed.
        • silent (bool) – Whether to display output.
        • store_history (bool) – Whether to record this code in history and increase the execution count. If silent is True, this is implicitly False.
        • user_expressions (dict) – Mapping of names to expressions to evaluate after the code has run. You can ignore this if you need to.
        • allow_stdin (bool) – Whether the frontend can provide input on request (e.g. for Python’s raw_input()).

    Your method should return a dict containing the fields described in Execution results. To display output, it can send messages using send_response(). See messaging for details of the different message types.
```

To launch your kernel, add this at the end of your module:

```python
if __name__ == '__main__':
    from ipykernel.kernelapp import IPKernelApp
    IPKernelApp.launch_instance(kernel_class=MyKernel)
```

6.2.2 Example

echokernel.py will simply echo any input it’s given to stdout:
from ipykernel.kernelbase import Kernel

class EchoKernel(Kernel):
    implementation = 'Echo'
    implementation_version = '1.0'
    language = 'no-op'
    language_version = '0.1'
    language_info = {'mimetype': 'text/plain'}
    banner = "Echo kernel - as useful as a parrot"

    def do_execute(self, code, silent, store_history=True, user_expressions=None,
                   allow_stdin=False):
        if not silent:
            stream_content = {'name': 'stdout', 'text': code}
            self.send_response(self.iopub_socket, 'stream', stream_content)
        return {'status': 'ok',
                # The base class increments the execution count
                'execution_count': self.execution_count,
                'payload': [],
                'user_expressions': {}},

    if __name__ == '__main__':
        from ipykernel.kernelapp import IPKernelApp
        IPKernelApp.launch_instance(kernel_class=EchoKernel)

Here's the Kernel spec kernel.json file for this:

```json
{"argv": ["python", "-m", "echokernel", "-f", "{connection_file}"],
 "display_name": "Echo"}
```

### 6.2.3 Optional steps

You can override a number of other methods to improve the functionality of your kernel. All of these methods should return a dictionary as described in the relevant section of the messaging spec.

```python
class MyKernel

    do_complete (code, cursor_pos)
    Code completion

    Parameters

    • code (str) – The code already present
    • cursor_pos (int) – The position in the code where completion is requested

    See also:
    Completion messages

    do_inspect (code, cursor_pos, detail_level=0)
    Object introspection

    Parameters

    • code (str) – The code
```
• `cursor_pos(int)` – The position in the code where introspection is requested

• `detail_level(int)` – 0 or 1 for more or less detail. In IPython, 1 gets the source code.

See also:

Introspection messages

`do_history(hist_access_type, output, raw, session=None, start=None, stop=None, n=None, pattern=None, unique=False)`

History access. Only the relevant parameters for the type of history request concerned will be passed, so your method definition must have defaults for all the arguments shown with defaults here.

See also:

History messages

`do_is_complete(code)`

Is code entered in a console-like interface complete and ready to execute, or should a continuation prompt be shown?

Parameters `code(str)` – The code entered so far - possibly multiple lines

See also:

Code completeness messages

`do_shutdown(restart)`

Shutdown the kernel. You only need to handle your own clean up - the kernel machinery will take care of cleaning up its own things before stopping.

Parameters `restart(bool)` – Whether the kernel will be started again afterwards

See also:

Kernel shutdown messages

### 6.3 Execution semantics in the IPython kernel

The execution of use code consists of the following phases:

1. Fire the `pre_execute` event.
2. Fire the `pre_run_cell` event unless silent is True.
3. Execute the `code` field, see below for details.
4. If execution succeeds, expressions in `user_expressions` are computed. This ensures that any error in the expressions don’t affect the main code execution.
5. Fire the `post_execute` event.

See also:

**IPython Events**

To understand how the `code` field is executed, one must know that Python code can be compiled in one of three modes (controlled by the `mode` argument to the `compile()` builtin):

*single* Valid for a single interactive statement (though the source can contain multiple lines, such as a for loop). When compiled in this mode, the generated bytecode contains special instructions that trigger the calling of `sys.displayhook()` for any expression in the block that returns a value. This means that a single statement
can actually produce multiple calls to `sys.displayhook()`, if for example it contains a loop where each iteration computes an unassigned expression would generate 10 calls:

```python
for i in range(10):
    i**2
```

**exec** An arbitrary amount of source code, this is how modules are compiled. `sys.displayhook()` is *never* implicitly called.

**eval** A single expression that returns a value. `sys.displayhook()` is *never* implicitly called.

The `code` field is split into individual blocks each of which is valid for execution in ‘single’ mode, and then:

- If there is only a single block: it is executed in ‘single’ mode.
- If there is more than one block:
  - if the last one is a single line long, run all but the last in ‘exec’ mode and the very last one in ‘single’ mode. This makes it easy to type simple expressions at the end to see computed values.
  - if the last one is no more than two lines long, run all but the last in ‘exec’ mode and the very last one in ‘single’ mode. This makes it easy to type simple expressions at the end to see computed values. Otherwise (last one is also multiline), run all in ‘exec’ mode
  - otherwise (last one is also multiline), run all in ‘exec’ mode as a single unit.

### 6.4 New IPython Console Lexer

New in version 2.0.0.

The IPython console lexer has been rewritten and now supports tracebacks and customized input/output prompts. An entire suite of lexers is now available at `IPython.lib.lexers`. These include:

**IPythonLexer & IPython3Lexer** Lexers for pure IPython (python + magic/shell commands)

**IPythonPartialTracebackLexer & IPythonTracebackLexer** Supports 2.x and 3.x via the keyword `python3`. The partial traceback lexer reads everything but the Python code appearing in a traceback. The full lexer combines the partial lexer with an IPython lexer.

**IPythonConsoleLexer** A lexer for IPython console sessions, with support for tracebacks. Supports 2.x and 3.x via the keyword `python3`.

**IPyLexer** A friendly lexer which examines the first line of text and from it, decides whether to use an IPython lexer or an IPython console lexer. Supports 2.x and 3.x via the keyword `python3`.

Previously, the `IPythonConsoleLexer` class was available at `IPython.sphinxext.ipython_console_highlight`. It was inserted into Pygments’ list of available lexers under the name `ipython`. It should be mentioned that this name is inaccurate, since an IPython console session is not the same as IPython code (which itself is a superset of the Python language).

Now, the Sphinx extension inserts two console lexers into Pygments’ list of available lexers. Both are `IPyLexer` instances under the names: `ipython` and `ipython3`. Although the names can be confusing (as mentioned above), their continued use is, in part, to maintain backwards compatibility and to aid typical usage. If a project needs to make Pygments aware of more than just the `IPyLexer` class, then one should not make the `IPyLexer` class available under the name `ipython` and use `ipy` or some other non-conflicting value.

Code blocks such as:
.. code-block:: ipython

    In [1]: 2**2
    Out[1]: 4

will continue to work as before, but now, they will also properly highlight tracebacks. For pure IPython code, the same
lexer will also work:

.. code-block:: ipython

    x = ''.join(map(str, range(10)))
    !echo $x

Since the first line of the block did not begin with a standard IPython console prompt, the entire block is assumed to
consist of IPython code instead.

## 6.5 Writing code for Python 2 and 3

IPython.utils.py3compat.PY3

Boolean indicating whether we’re currently in Python 3.

### 6.5.1 Iterators

Many built in functions and methods in Python 2 come in pairs, one returning a list, and one returning an iterator (e.g.
`range()` and `xrange`). In Python 3, there is usually only the iterator form, but it has the name which gives a list in
Python 2 (e.g. `range()`).

The way to write compatible code depends on what you need:

- A list, e.g. for serialisation, or to test if something is in it.
- Iteration, but it will never be used for very many items, so efficiency isn’t especially important.
- Iteration over many items, where efficiency is important.

<table>
<thead>
<tr>
<th>list</th>
<th>iteration (small)</th>
<th>iteration (large)</th>
</tr>
</thead>
<tbody>
<tr>
<td>list(range(n))</td>
<td>range(n)</td>
<td>py3compat.xrange(n)</td>
</tr>
<tr>
<td>list(zip(a, b))</td>
<td>zip(a, b)</td>
<td>–</td>
</tr>
<tr>
<td>list(d.items())</td>
<td>d.items()</td>
<td>py3compat.iternextitems(d)</td>
</tr>
<tr>
<td>list(d.values())</td>
<td>d.values()</td>
<td>py3compat.itervalues(d)</td>
</tr>
</tbody>
</table>

Iterating over a dictionary yields its keys, so there is rarely a need to use `dict.keys()` or `dict.iterkeys()`.

Avoid using `map()` to cause function side effects. This is more clearly written with a simple for loop.

IPython.utils.py3compat.xrange

A reference to `range` on Python 3, and `xrange` on Python 2.

IPython.utils.py3compat.iteritems(d)

Iterate over (key, value) pairs of a dictionary, or just over values. `iterkeys` is not defined: iterating over the
dictionary yields its keys.
6.5.2 Changed standard library locations

Several parts of the standard library have been renamed and moved. This is a short list of things that we’re using. A couple of them have names in IPython.utils.py3compat, so you don’t need both imports in each module that uses them.

<table>
<thead>
<tr>
<th>Python 2</th>
<th>Python 3</th>
<th>py3compat</th>
</tr>
</thead>
<tbody>
<tr>
<td>raw_input()</td>
<td>input</td>
<td>input</td>
</tr>
<tr>
<td><strong>builtin</strong></td>
<td>builts</td>
<td>builtin_mod</td>
</tr>
<tr>
<td>StringIO</td>
<td>io</td>
<td></td>
</tr>
<tr>
<td>Queue</td>
<td>queue</td>
<td></td>
</tr>
<tr>
<td>cPickle</td>
<td>pickle</td>
<td></td>
</tr>
<tr>
<td>thread</td>
<td>_thread</td>
<td></td>
</tr>
<tr>
<td>copy_reg</td>
<td>copyreg</td>
<td></td>
</tr>
<tr>
<td>urlparse</td>
<td>urllib.parse</td>
<td></td>
</tr>
<tr>
<td>repr</td>
<td>reprlib</td>
<td></td>
</tr>
<tr>
<td>Tkinter</td>
<td>tkinter</td>
<td></td>
</tr>
<tr>
<td>Cookie</td>
<td>http.cookie</td>
<td></td>
</tr>
<tr>
<td>_winreg</td>
<td>winreg</td>
<td></td>
</tr>
</tbody>
</table>

Be careful with StringIO: io.StringIO is available in Python 2.7, but it behaves differently from StringIO. StringIO, and much of our code assumes the use of the latter on Python 2. So a try/except on the import may cause problems.

IPython.utils.py3compat.input()

Behaves like raw_input on Python 2.

IPython.utils.py3compat.builts

IPython.utils.py3compat.builts_name

A reference to the module containing builts, and its name as a string.

6.5.3 Unicode

Always be explicit about what is text (unicode) and what is bytes. Encoding goes from unicode to bytes, and decoding goes from bytes to unicode.

To open files for reading or writing text, use io.open(), which is the Python 3 builtin open function, available on Python 2 as well. We almost always need to specify the encoding parameter, because the default is platform dependent.

We have several helper functions for converting between string types. They all use the encoding from IPython.utils.encoding.getdefaultencoding() by default, and the errors='replace' option to do best-effort conversions for the user’s system.

IPython.utils.py3compat.unicode_to_str(u, encoding=None)

IPython.utils.py3compat.str_to_unicode(s, encoding=None)

Convert between unicode and the native str type. No-ops on Python 3.

IPython.utils.py3compat.str_to_bytes(s, encoding=None)

IPython.utils.py3compat.bytes_to_str(u, encoding=None)

Convert between bytes and the native str type. No-ops on Python 2.

IPython.utils.py3compat.cast_unicode(s, encoding=None)

IPython.utils.py3compat.cast_bytes(s, encoding=None)

Convert strings to unicode/bytes when they may be of either type.

IPython.utils.py3compat.cast_unicode_py2(s, encoding=None)
IPython.utils.py3compat.cast_bytes_py2(s, encoding=None)
Convert strings to unicode/bytes when they may be of either type on Python 2, but return them unaltered on Python 3 (where string types are more predictable).

IPython.utils.py3compat.unicode_type
A reference to str on Python 3, and to unicode on Python 2.

IPython.utils.py3compat.string_types
A tuple for isinstance checks: (str,) on Python 3, (str, unicode) on Python 2.

6.5.4 Relative imports

```python
# This makes Python 2 behave like Python 3:
from __future__ import absolute_import

import io  # Imports the standard library io module
from . import io  # Import the io module from the package containing the current module
from .io import foo  # foo from the io module next to this module
from IPython.utils import io  # This still works
```

6.5.5 Print function

```python
# Support the print function on Python 2:
from __future__ import print_function

print(a, b)
print(foo, file=sys.stderr)
print(bar, baz, sep='\t', end='')
```

6.5.6 Metaclasses

The syntax for declaring a class with a metaclass is different in Python 2 and 3. A helper function works for most cases:

IPython.utils.py3compat.with_metaclass()
Create a base class with a metaclass. Copied from the six library.

Used like this:

```python
class FormatterABC(with_metaclass(abc.ABCMeta, object)):
...
```

Combining inheritance between Qt and the traitlets system, however, does not work with this. Instead, we do this:

```python
class QtKernelClientMixin(MetaQObjectHasTraits('NewBase', (HasTraits, SuperQObject), \n{})):  # This gives the new class a metaclass of MetaQObjectHasTraits, and the parent classes HasTraits and SuperQObject.
...
```
6.5.7 Doctests

IPython.utils.py3compat.doctest_refactor_print(func_or_str)
Refactors print statements in doctests in Python 3 only. Accepts a string or a function, so it can be used as a decorator.

IPython.utils.py3compat.u_format(func_or_str)
Handle doctests written with \{u\}'abcþ', replacing the \{u\} with u for Python 2, and removing it for Python 3.
Accepts a string or a function, so it can be used as a decorator.

6.5.8 Execfile

IPython.utils.py3compat.execfile(fname, glob, loc=None)
Equivalent to the Python 2 execfile builtin. We redefine it in Python 2 to better handle non-ascii filenames.

6.5.9 Miscellaneous

IPython.utils.py3compat.safe_unicode(e)
unicode(e) with various fallbacks. Used for exceptions, which may not be safe to call unicode() on.

IPython.utils.py3compat.isidentifier(s, dotted=False)
Checks whether the string s is a valid identifier in this version of Python. In Python 3, non-ascii characters are allowed. If dotted is True, it allows dots (i.e. attribute access) in the string.

IPython.utils.py3compat.getcwd()
Return the current working directory as unicode, like os.getcwd() on Python 2.

IPython.utils.py3compat.MethodType()
Constructor for types.MethodType that takes two arguments, like the real constructor on Python 3.

6.6 Overview of the IPython configuration system

This section describes the IPython configuration system. This is based on traitlets.config; see that documentation for more information about the overall architecture.

6.6.1 Configuration file location

So where should you put your configuration files? IPython uses “profiles” for configuration, and by default, all profiles will be stored in the so called “IPython directory”. The location of this directory is determined by the following algorithm:

- If the ipython-dir command line flag is given, its value is used.
- If not, the value returned by IPython.paths.get_ipython_dir() is used. This function will first look at the IPYTHONDIR environment variable and then default to ~/.ipython. Historical support for the IPYTHON_DIR environment variable will be removed in a future release.

For most users, the configuration directory will be ~/.ipython.

Previous versions of IPython on Linux would use the XDG config directory, creating ~/.config/ipython by default. We have decided to go back to ~/.ipython for consistency among systems. IPython will issue a warning if it finds the XDG location, and will move it to the new location if there isn’t already a directory there.
Once the location of the IPython directory has been determined, you need to know which profile you are using. For users with a single configuration, this will simply be ‘default’, and will be located in `<IPYTHONDIR>/profile_default`.

The next thing you need to know is what to call your configuration file. The basic idea is that each application has its own default configuration filename. The default named used by the `ipython` command line program is `ipython_config.py`, and all IPython applications will use this file. The IPython kernel will load its own config file after `ipython_config.py`. To load a particular configuration file instead of the default, the name can be overridden by the `config_file` command line flag.

To generate the default configuration files, do:

```
$ ipython profile create
```

and you will have a default `ipython_config.py` in your IPython directory under `profile_default`... note:

IPython configuration options are case sensitive, and IPython cannot catch misnamed keys or invalid values.

By default IPython will also ignore any invalid configuration files.

New in version 5.0: IPython can be configured to abort in case of invalid configuration file. To do so set the environment variable `IPYTHON_SUPPRESS_CONFIG_ERRORS` to '1' or 'true'.

Locating these files

From the command-line, you can quickly locate the `IPYTHONDIR` or a specific profile with:

```
$ ipython locate
/home/you/.ipython

$ ipython locate profile foo
/home/you/.ipython/profile_foo
```

These map to the utility functions: `IPython.utils.path.get_ipython_dir()` and `IPython.utils.path.locate_profile()` respectively.

### 6.6.2 Profiles

A profile is a directory containing configuration and runtime files, such as logs, connection info for the parallel apps, and your IPython command history.

The idea is that users often want to maintain a set of configuration files for different purposes: one for doing numerical computing with NumPy and SciPy and another for doing symbolic computing with SymPy. Profiles make it easy to keep a separate configuration files, logs, and histories for each of these purposes.

Let’s start by showing how a profile is used:

```
$ ipython --profile=sympy
```

This tells the `ipython` command line program to get its configuration from the “sympy” profile. The file names for various profiles do not change. The only difference is that profiles are named in a special way. In the case above, the “sympy” profile means looking for `ipython_config.py` in `<IPYTHONDIR>/profile_sympy`.

The general pattern is this: simply create a new profile with:
$ ipython profile create <name>

which adds a directory called profile_<name> to your IPython directory. Then you can load this profile by adding --profile=<name> to your command line options. Profiles are supported by all IPython applications.

IPython ships with some sample profiles in IPython/config/profile. If you create profiles with the name of one of our shipped profiles, these config files will be copied over instead of starting with the automatically generated config files.

IPython extends the config loader for Python files so that you can inherit config from another profile. To do this, use a line like this in your Python config file:

```python
load_subconfig('ipython_config.py', profile='default')
```

## 6.7 IPython GUI Support Notes

IPython allows GUI event loops to be run in an interactive IPython session. This is done using Python’s PyOS_InputHook hook which Python calls when the `raw_input()` function is called and waiting for user input. IPython has versions of this hook for wx, pyqt4 and pygtk.

When a GUI program is used interactively within IPython, the event loop of the GUI should *not* be started. This is because, the PyOS_Inputhook itself is responsible for iterating the GUI event loop.

IPython has facilities for installing the needed input hook for each GUI toolkit and for creating the needed main GUI application object. Usually, these main application objects should be created only once and for some GUI toolkits, special options have to be passed to the application object to enable it to function properly in IPython.

We need to answer the following questions:

- Who is responsible for creating the main GUI application object, IPython or third parties (matplotlib, enthought.traits, etc.)?
- What is the proper way for third party code to detect if a GUI application object has already been created? If one has been created, how should the existing instance be retrieved?
- In a GUI application object has been created, how should third party code detect if the GUI event loop is running. It is not sufficient to call the relevant function methods in the GUI toolkits (like IsMainLoopRunning) because those don’t know if the GUI event loop is running through the input hook.
- We might need a way for third party code to determine if it is running in IPython or not. Currently, the only way of running GUI code in IPython is by using the input hook, but eventually, GUI based versions of IPython will allow the GUI event loop in the more traditional manner. We will need a way for third party code to distinguish between these two cases.

Here is some sample code I have been using to debug this issue:

```python
from matplotlib import pyplot as plt
from enthought.traits import api as traits

class Foo(traits.HasTraits):
   a = traits.Float()

f = Foo()
f.configure_traits()
plt.plot(range(10))
```
CHAPTER 7

Guide for IPython core Developers

This guide documents the development of IPython itself. Alternatively, developers of third party tools and libraries that use IPython should see the *Developer’s guide for third party tools and libraries*.

For instruction on how to make a developer install see *Installing the development version*.

### 7.1 IPython release process

This document contains the process that is used to create an IPython release.

Conveniently, the *release* script in the *tools* directory of the IPython repository automates most of the release process. This document serves as a handy reminder and checklist for the release manager.

During the release process, you might need the extra following dependencies:

- **keyring** to access your GitHub authentication tokens
- **graphviz** to generate some graphs in the documentation

Make sure you have all the required dependencies to run the tests as well.

#### 7.1.1 1. Set Environment variables

Set environment variables to document previous release tag, current release milestone, current release version, and git tag.

These variables may be used later to copy/paste as answers to the script questions instead of typing the appropriate command when the time comes. These variables are not used by the scripts directly; therefore, there is no need to export them. The format for bash is as follows, but note that these values are just an example valid only for the 5.0 release; you’ll need to update them for the release you are actually making:

```
PREV_RELEASE=4.2.1
MILESTONE=5.0
```
7.1.2 2. Create GitHub stats and finish release note

Note: This step is optional if making a Beta or RC release.

Note: Before generating the GitHub stats, verify that all closed issues and pull requests have appropriate milestones. This search should return no results before creating the GitHub stats.

If a major release:

- merge any pull request notes into what’s new:

  ```
  python tools/update_whatsnew.py
  ```

- update docs/source/whatsnew/development.rst, to ensure it covers the major release features

- move the contents of development.rst to versionX.rst where X is the numerical release version

- generate summary of GitHub contributions, which can be done with:

  ```
  python tools/github_stats.py --milestone $MILESTONE > stats.rst
  ```

  which may need some manual cleanup of stats.rst. Add the cleaned stats.rst results to docs/source/whatsnew/github-stats-X.rst where X is the numerical release version (don’t forget to add it to the git repo as well). If creating a major release, make a new github-stats-X.rst file; if creating a minor release, the content from stats.rst may simply be added to the top of an existing github-stats-X.rst file. Finally, edit docs/source/whatsnew/index.rst to list the new github-stats-X.rst file you just created and remove temporarily the first entry called development (you’ll need to add it back after release).

  Make sure that the stats file has a header or it won’t be rendered in the final documentation.

To find duplicates and update .mailmap, use:

```
git log --format="%aN <%aE>" $PREV_RELEASE... | sort -u -f
```

7.1.3 3. Make sure the repository is clean

of any file that could be problematic. Remove all non-tracked files with:

```
git clean -xfdi
```

This will ask for confirmation before removing all untracked files. Make sure the dist/ folder is clean to avoid any stale builds from previous build attempts.
7.1.4 4. Update the release version number

Edit IPython/core/release.py to have the current version.

in particular, update version number and _version_extra content in IPython/core/release.py.

Step 5 will validate your changes automatically, but you might still want to make sure the version number matches pep440.

In particular, rc and beta are not separated by . or the sdist and bdist will appear as different releases. For example, a valid version number for a release candidate (rc) release is: 1.3rc1. Notice that there is no separator between the ‘3’ and the ‘r’. Check the environment variable $VERSION as well.

You will likely just have to modify/comment/uncomment one of the lines setting _version_extra

7.1.5 5. Run the tools/build_release script

Running tools/build_release does all the file checking and building that the real release script will do. This makes test installations, checks that the build procedure runs OK, and tests other steps in the release process.

The build_release script will in particular verify that the version number match PEP 440, in order to avoid surprise at the time of build upload.

We encourage creating a test build of the docs as well.

7.1.6 6. Create and push the new tag

Commit the changes to release.py:

```bash
git commit -am "release $VERSION"
git push origin $BRANCH
```

Create and push the tag:

```bash
git tag -am "release $VERSION" "$VERSION"
git push origin --tags
```

Update release.py back to x.y-dev or x.y-maint, and re-add the development entry in docs/source/whatsnew/index.rst and push:

```bash
git commit -am "back to development"
git push origin $BRANCH
```

7.1.7 7. Get a fresh clone

Get a fresh clone of the tag for building the release:

```bash
cd /tmp
git clone --depth 1 https://github.com/ipython/IPython.git -b "$VERSION"
cd IPython
```

Note: You can also cleanup the current working repository with `git clean -xfdi`

7.1. IPython release process
7.1.8 8. Run the release script

Run the release script, this step requires having a current wheel, Python >=3.4 and Python 2.7:

```
./tools/release
```

This makes the tarballs, zipfiles, and wheels, and put them under the dist/ folder. Be sure to test the wheels and the sdist locally before uploading them to PyPI. We do not use an universal wheel as each wheel installs an ipython2 or ipython3 script, depending on the version of Python it is built for. Using an universal wheel would prevent this.

Use the following to actually upload the result of the build:

```
./tools/release upload
```

It should posts them to archive.ipython.org and to PyPI.

PyPI/Warehouse will automatically hide previous releases. If you are uploading a non-stable version, make sure to log-in to PyPI and un-hide previous version.

7.1.9 9. Draft a short release announcement

The announcement should include:

- release highlights
- a link to the html version of the What’s new section of the documentation
- a link to upgrade or installation tips (if necessary)

Post the announcement to the mailing list and or blog, and link from Twitter.

**Note:** If you are doing a RC or Beta, you can likely skip the next steps.

7.1.10 10. Update milestones on GitHub

These steps will bring milestones up to date:

- close the just released milestone
- open a new milestone for the next release (x, y+1), if the milestone doesn’t exist already

7.1.11 11. Update the IPython website

The IPython website should document the new release:

- add release announcement (news, announcements)
- update current version and download links
- update links on the documentation page (especially if a major release)
7.1.12 12. Update readthedocs

Make sure to update readthedocs and set the latest tag as stable, as well as checking that previous release is still building under its own tag.

7.1.13 13. Celebrate!

Celebrate the release and please thank the contributors for their work. Great job!

7.2 Old Documentation

Out of date documentation is still available and have been kept for archival purposes.

Note: Developers documentation used to be on the IPython wiki, but are now out of date. The wiki is though still available for historical reasons: Old IPython GitHub Wiki.
### CHAPTER 8

The IPython API

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<td>Hooks for IPython.</td>
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<td>IPython.core.inputsplitter</td>
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<td>IPython.core.interactiveshell</td>
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<td>IPython.core.profiledir</td>
<td>An object for managing IPython profile directories.</td>
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<td>IPython.core.prompts</td>
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<td>IPython.core.pylabtools</td>
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<tr>
<td>IPython.core.shellapp</td>
<td>A mixin for Application classes that launch InteractiveShell instances, load extensions, etc.</td>
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<td>IPython.core.splitinput</td>
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<td>IPython.core.ultratb</td>
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<td>IPython.lib.demo</td>
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<td>IPython.lib.editorhooks</td>
<td>‘editor’ hooks for common editors that work well with ipython</td>
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<td>IPython.lib.guisupport</td>
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<td>IPython.lib.linthook</td>
<td>Deprecated since IPython 5.0</td>
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<td>IPython.lib.latextools</td>
<td>Tools for handling LaTeX.</td>
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<td>IPython.lib.lexers</td>
<td>Defines a variety of Pygments lexers for highlighting IPython code.</td>
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<tr>
<td>IPython.lib.pretty</td>
<td>Python advanced pretty printer.</td>
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<td>IPython.lib.security</td>
<td>Password generation for the IPython notebook.</td>
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<td>IPython.paths</td>
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<td>IPython.terminal.debugger</td>
<td>An embedded IPython shell.</td>
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<td>IPython.terminal.embed</td>
<td>IPython terminal interface using prompt_toolkit</td>
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<tr>
<td>IPython.terminal.interactiveshell</td>
<td>The Application object for the command line ipython program.</td>
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<td>IPython.terminal.magics</td>
<td>Extra magics for terminal use.</td>
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<td>IPython.terminal.prompts</td>
<td>Terminal input and output prompts.</td>
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<td>IPython.terminal.shortcuts</td>
<td>Testing support (tools to test IPython itself).</td>
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<td>IPython.testing.decorators</td>
<td>Decorators for labeling test objects.</td>
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<td>IPython.testing.globalipapp</td>
<td>Global IPython app to support test running.</td>
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<td>IPython.testing.ipptest</td>
<td>Experimental code for cleaner support of IPython syntax with unittest.</td>
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<td>IPython.testing.skipdoctest</td>
<td>Decorators marks that a doctest should be skipped, for both python 2 and 3.</td>
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<tr>
<td>IPython.testing.tools</td>
<td>Generic testing tools.</td>
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<thead>
<tr>
<th>Module Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>IPython.utils.PyColorize</td>
<td>Class and program to colorize python source code for ANSI terminals.</td>
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<tr>
<td>IPython.utils.capture</td>
<td>IO capturing utilities.</td>
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<td>Tools for coloring text in ANSI terminals.</td>
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<tr>
<td>IPython.utils.coloransi</td>
<td>Miscellaneous context managers.</td>
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<tr>
<td>IPython.utils.data</td>
<td>Utilities for working with data structures like lists, dicts and tuples.</td>
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<tr>
<td>IPython.utils.decorators</td>
<td>Decorators that don’t go anywhere else.</td>
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<tr>
<td>IPython.utils.dir2</td>
<td>A fancy version of Python’s built-in <code>dir()</code> function.</td>
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<tr>
<td>IPython.utils.encoding</td>
<td>Utilities for dealing with text encodings.</td>
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<tr>
<td>IPython.utils.frame</td>
<td>Utilities for working with stack frames.</td>
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<tr>
<td>IPython.utils.generics</td>
<td>Generic functions for extending IPython.</td>
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<tr>
<td>IPython.utils.importstring</td>
<td>A simple utility to import something by its string name.</td>
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<tr>
<td>IPython.utils.io</td>
<td>IO related utilities.</td>
</tr>
<tr>
<td>IPython.utils.module_paths</td>
<td>A dict subclass that supports attribute style access.</td>
</tr>
<tr>
<td>IPython.utils.openpy</td>
<td>Utility functions for finding modules.</td>
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<tr>
<td>IPython.utils.path</td>
<td>Tools to open .py files as Unicode, using the encoding specified within the file, as per PEP 263.</td>
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<tr>
<td>IPython.utils.process</td>
<td>Utility functions for working with external processes.</td>
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<td>IPython.utils.rlineimpl</td>
<td>Imports and provides the ‘correct’ version of readline for the platform.</td>
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<td>IPython.utils.sentinel</td>
<td>Sentinel class for constants with useful reprs.</td>
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<td>IPython.utils.shimmodule</td>
<td>A shim module for deprecated imports.</td>
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<td>IPython.utils.strdispatch</td>
<td>String dispatch class to match regexps and dispatch commands.</td>
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<td>Utilities for getting information about IPython and the system it’s running in.</td>
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<td>TemporaryDirectory class, copied from Python 3.2.</td>
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<td>IPython.utils.terminal</td>
<td>Utilities for working with terminals.</td>
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<td>IPython.utils.text</td>
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<td>Utilities for timing code execution.</td>
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<td>IPython.utils.tokenutil</td>
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<td>IPython.utils.tz</td>
<td>Timezone utilities.</td>
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<td>IPython.utils.ulinecache</td>
<td>Wrapper around linecache which decodes files to unicode according to PEP 263.</td>
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<tr>
<td>IPython.utils.version</td>
<td>Utilities for version comparison.</td>
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<tr>
<td>IPython.utils.wildcard</td>
<td>Support for wildcard pattern matching in object inspection.</td>
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</tbody>
</table>

### 8.1 IPython

IPython: tools for interactive and parallel computing in Python.

http://ipython.org
8.1.1 3 Functions

IPython.embed_kernel(module=None, local_ns=None, **kwargs)
Embed and start an IPython kernel in a given scope.

If you don’t want the kernel to initialize the namespace from the scope of the surrounding function, and/or you want to load full IPython configuration, you probably want IPython.start_kernel() instead.

Parameters

- **module** (ModuleType, optional) – The module to load into IPython globals (default: caller)
- **local_ns** (dict, optional) – The namespace to load into IPython user namespace (default: caller)
- **kwargs** (various, optional) – Further keyword args are relayed to the IPKernelApp constructor, allowing configuration of the Kernel. Will only have an effect on the first embed_kernel call for a given process.

IPython.start_ipython(argv=None, **kwargs)
Launch a normal IPython instance (as opposed to embedded)
IPython.embed() puts a shell in a particular calling scope, such as a function or method for debugging purposes, which is often not desirable.
start_ipython() does full, regular IPython initialization, including loading startup files, configuration, etc. much of which is skipped by embed().

This is a public API method, and will survive implementation changes.

Parameters

- **argv** (list or None, optional) – If unspecified or None, IPython will parse command-line options from sys.argv. To prevent any command-line parsing, pass an empty list: argv=[].
- **user_ns** (dict, optional) – specify this dictionary to initialize the IPython user namespace with particular values.
- **kwargs** (various, optional) – Any other kwargs will be passed to the Application constructor, such as config.

IPython.start_kernel(argv=None, **kwargs)
Launch a normal IPython kernel instance (as opposed to embedded)
IPython.embed_kernel() puts a shell in a particular calling scope, such as a function or method for debugging purposes, which is often not desirable.
start_kernel() does full, regular IPython initialization, including loading startup files, configuration, etc. much of which is skipped by embed().

Parameters

- **argv** (list or None, optional) – If unspecified or None, IPython will parse command-line options from sys.argv. To prevent any command-line parsing, pass an empty list: argv=[].
- **user_ns** (dict, optional) – specify this dictionary to initialize the IPython user namespace with particular values.
- **kwargs** (various, optional) – Any other kwargs will be passed to the Application constructor, such as config.
8.2 Module: core.alias

System command aliases.

Authors:

• Fernando Perez
• Brian Granger

8.2.1 4 Classes

class IPython.core.alias.AliasError
    Bases: Exception

class IPython.core.alias.InvalidAliasError
    Bases: IPython.core.alias.AliasError

class IPython.core.alias.Alias(shell, name, cmd)
    Bases: object
    Callable object storing the details of one alias.
    Instances are registered as magic functions to allow use of aliases.
    __init__(shell, name, cmd)
        Initialize self. See help(type(self)) for accurate signature.
    validate()
        Validate the alias, and return the number of arguments.

class IPython.core.alias.AliasManager(shell=None, **kwargs)
    Bases: traitlets.config.configurable.Configurable
    __init__(shell=None, **kwargs)
        Create a configurable given a config config.

        Parameters

            • config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

            • parent (Configurable instance, optional) – The parent Configurable instance of this object.

    Notes

    Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

    ```python
    class MyConfigurable(Configurable):
        def __init__(self, config=None):
            super(MyConfigurable, self).__init__(config=config)
            # Then any other code you need to finish initialization.
    ```

    This ensures that instances will be configured properly.
**define_alias** (*name*, *cmd*)

Define a new alias after validating it.

This will raise an *AliasError* if there are validation problems.

**get_alias** (*name*)

Return an alias, or None if no alias by that name exists.

**is_alias** (*name*)

Return whether or not a given name has been defined as an alias

**retrieve_alias** (*name*)

Retrieve the command to which an alias expands.

**soft_define_alias** (*name*, *cmd*)

Define an alias, but don’t raise on an *AliasError*.

### 8.2.2 1 Function

**IPython.core.alias.default_aliases**()

Return list of shell aliases to auto-define.

### 8.3 Module: `core.application`

An application for IPython.

All top-level applications should use the classes in this module for handling configuration and creating configurables.

The job of an *Application* is to create the master configuration object and then create the configurable objects, passing the config to them.

### 8.3.1 2 Classes

**class** *IPython.core.application.ProfileAwareConfigLoader* (*filename*, *path=None*, **kw**)

* Bases: `traitlets.config.loader.PyFileConfigLoader`

A Python file config loader that is aware of IPython profiles.

**load_subconfig** (*fname*, *path=None*, *profile=None*)

Injected into config file namespace as load_subconfig

**class** *IPython.core.application.BaseIPythonApplication* (**kwargs**)

* Bases: `traitlets.config.application.Application`

**__init__** (**kwargs**)

Create a configurable given a config config.

**Parameters**

- **config** (*Config*) – If this is empty, default values are used. If config is a *Config* instance, it will be used to configure the instance.

- **parent** (*Configurable instance, optional*) – The parent Configurable instance of this object.
Notes

Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

`excepthook (etype, evalue, tb)`

This is `sys.excepthook` after `init_crashhandler` set `self.verbose_crash=True` to use our full crashhandler, instead of a regular traceback with a short message (crash_handler_lite)

`init_config_files()`  
[optionally] copy default config files into profile dir.

`init_crash_handler()`  
Create a crash handler, typically setting `sys.excepthook` to it.

`init_profile_dir()`  
initialize the profile dir

`initialize (argv=None)`  
Do the basic steps to configure me.  
Override in subclasses.

`initialize_subcommand(subc, argv=None)`  
Initialize a subcommand with argv.

`load_config_file(suppress_errors=None)`  
Load the config file.  
By default, errors in loading config are handled, and a warning printed on screen. For testing, the suppress_errors option is set to False, so errors will make tests fail.

`supress_errors` default value is to be `None` in which case the behavior default to the one of `traitlets.Application`.

The default value can be set:

- to `False` by setting `IPYTHON_SUPPRESS_CONFIG_ERRORS` environment variable to `'0'`, or `'false'` (case insensitive).
- to `True` by setting `IPYTHON_SUPPRESS_CONFIG_ERRORS` environment variable to `'1'` or `'true'` (case insensitive).
- to `None` by setting `IPYTHON_SUPPRESS_CONFIG_ERRORS` environment variable to `''` (empty string) or leaving it unset.

Any other value are invalid, and will make IPython exit with a non-zero return code.

`python_config_loader_class`  
alias of `ProfileAwareConfigLoader`

`stage_default_config_file()`  
auto generate default config file, and stage it into the profile.
8.4 Module: core.autocall

Autocall capabilities for IPython.core.

Authors:

- Brian Granger
- Fernando Perez
- Thomas Kluyver

Notes

8.4.1 3 Classes

class IPython.core.autocall.IPyAutocall(ip=None)
   Bases: object

   Instances of this class are always autocalled

   This happens regardless of ‘autocall’ variable state. Use this to develop macro-like mechanisms.

   __init__(ip=None)
       Initialize self. See help(type(self)) for accurate signature.

   set_ip(ip)
       Will be used to set _ip point to current ipython instance b/f call

       Override this method if you don’t want this to happen.

class IPython.core.autocall.ExitAutocall(ip=None)
   Bases: IPython.core.autocall.IPyAutocall

   An autocallable object which will be added to the user namespace so that exit, exit(), quit or quit() are all valid ways to close the shell.

class IPython.core.autocall.ZMQExitAutocall(ip=None)
   Bases: IPython.core.autocall.ExitAutocall

   Exit IPython. Autocallable, so it needn’t be explicitly called.

       Parameters keep_kernel (bool) – If True, leave the kernel alive. Otherwise, tell the kernel to exit too (default).

8.5 Module: core.builtin_trap

A context manager for managing things injected into __builtins__.

Authors:

- Brian Granger
- Fernando Perez
8.5.1 1 Class

class IPython.core.builtin_trap.BuiltinTrap(shell=None)
Bases: traitlets.config.configurable.Configurable

__init__ (shell=None)
Create a configurable given a config config.

Parameters

  • config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

  • parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

activate()
Store ipython references in the __builtin__ namespace.

add_builtin (key, value)
Add a builtin and save the original.

deactivate()
Remove any builtins which might have been added by add_builtins, or restore overwritten ones to their previous values.

remove_builtin (key, orig)
Remove an added builtin and re-set the original.

8.6 Module: core.compilerop

Compiler tools with improved interactive support.
Provides compilation machinery similar to codeop, but with caching support so we can provide interactive tracebacks.

8.6.1 Authors

  • Robert Kern
  • Fernando Perez
  • Thomas Kluyver
### 8.6.2 1 Class

```python
class IPython.core.compilerop.CachingCompiler
    Bases: codeop.Compile

    A compiler that caches code compiled from interactive statements.

    __init__()
        Initialize self. See help(type(self)) for accurate signature.

    ast_parse(source, filename='<unknown>', symbol='exec')
        Parse code to an AST with the current compiler flags active.
        Arguments are exactly the same as ast.parse (in the standard library), and are passed to the built-in compile function.

    cache(code, number=0)
        Make a name for a block of code, and cache the code.

        Parameters
            • code (str) – The Python source code to cache.
            • number (int) – A number which forms part of the code’s name. Used for the execution counter.

        Returns
            • The name of the cached code (as a string). Pass this as the filename argument to compilation, so that tracebacks are correctly hooked up.

    compiler_flags
        Flags currently active in the compilation process.

    reset_compiler_flags()
        Reset compiler flags to default state.
```

### 8.6.3 2 Functions

```python
IPython.core.compilerop.code_name(code, number=0)
    Compute a (probably) unique name for code for caching.
    This now expects code to be unicode.

IPython.core.compilerop.check_linecache_ipython(*args)
    Call linecache.checkcache() safely protecting our cached values.
```

### 8.7 Module: core.completer

Word completion for IPython.

This module started as fork of the rlcompleter module in the Python standard library. The original enhancements made to rlcompleter have been sent upstream and were accepted as of Python 2.3.
8.7.1 3 Classes

class IPython.core.completer.CompletionSplitter(delims=None)
    Bases: object

An object to split an input line in a manner similar to readline.

By having our own implementation, we can expose readline-like completion in a uniform manner to all front-
tends. This object only needs to be given the line of text to be split and the cursor position on said line, and it
returns the ‘word’ to be completed on at the cursor after splitting the entire line.

What characters are used as splitting delimiters can be controlled by setting the delims attribute (this is a
property that internally automatically builds the necessary regular expression)

    __init__(delims=None)
    Initialize self. See help(type(self)) for accurate signature.

delims
    Return the string of delimiter characters.

split_line(line, cursor_pos=None)
    Split a line of text with a cursor at the given position.

class IPython.core.completer.Completer(namespace=None, global_namespace=None, **kwargs)
    Bases: traitlets.config.configurable.Configurable

    __init__(namespace=None, global_namespace=None, **kwargs)
    Create a new completer for the command line.

    Completer(namespace=ns, global_namespace=ns2) -> completer instance.

    If unspecified, the default namespace where completions are performed is __main__ (technically,
    __main__.__dict__). Namespaces should be given as dictionaries.

    An optional second namespace can be given. This allows the completer to handle cases where both the
    local and global scopes need to be distinguished.

    Completer instances should be used as the completion mechanism of readline via the set_completer() call:
     readline.set_completer(Completer(my_namespace).complete)

    attr_matches(text)
    Compute matches when text contains a dot.

    Assuming the text is of the form NAME.NAME...[NAME], and is evaluatable in self.namespace or
    self.global_namespace, it will be evaluated and its attributes (as revealed by dir()) are used as possible
    completions. (For class instances, class members are are also considered.)

    WARNING: this can still invoke arbitrary C code, if an object with a __getattr__ hook is evaluated.

    complete(text, state)
    Return the next possible completion for ‘text’.

    This is called successively with state == 0, 1, 2, ... until it returns None. The completion should begin
    with ‘text’.

    global_matches(text)
    Compute matches when text is a simple name.

    Return a list of all keywords, built-in functions and names currently defined in self.namespace or
    self.global_namespace that match.
class IPython.core.completer.IPCompleter(
    shell=None, namespace=None,
global_namespace=None, use_readline=True,
config=None, **kwargs)

Bases: IPython.core.completer.Completer

Extension of the completer class with IPython-specific features

__init__(shell=None, namespace=None, global_namespace=None, use_readline=True, config=None, **kwargs)
IPCompleter() -> completer

Return a completer object suitable for use by the readline library via readline.set_completer().

Inputs:

• shell: a pointer to the ipython shell itself. This is needed because this completer knows about magic functions, and those can only be accessed via the ipython instance.

• namespace: an optional dict where completions are performed.

• global_namespace: secondary optional dict for completions, to handle cases (such as IPython embedded inside functions) where both Python scopes are visible.

use_readline [bool, optional] If true, use the readline library. This completer can still function without readline, though in that case callers must provide some extra information on each call about the current line.

all_completions (text)
Wrapper around the complete method for the benefit of emacs.

complete (text=None, line_buffer=None, cursor_pos=None)
Find completions for the given text and line context.

Note that both the text and the line_buffer are optional, but at least one of them must be given.

Parameters

• text (string, optional) – Text to perform the completion on. If not given, the line buffer is split using the instance’s CompletionSplitter object.

• line_buffer (string, optional) – If not given, the completer attempts to obtain the current line buffer via readline. This keyword allows clients which are requesting for text completions in non-readline contexts to inform the completer of the entire text.

• cursor_pos (int, optional) – Index of the cursor in the full line buffer. Should be provided by remote frontends where kernel has no access to frontend state.

Returns

• text (str) – Text that was actually used in the completion.

• matches (list) – A list of completion matches.

dict_key_matches (text)
Match string keys in a dictionary, after e.g. ‘foo’

file_matches (text)
Match filenames, expanding ~USER type strings.

Most of the seemingly convoluted logic in this completer is an attempt to handle filenames with spaces in them. And yet it’s not quite perfect, because Python’s readline doesn’t expose all of the GNU readline details needed for this to be done correctly.
For a filename with a space in it, the printed completions will be only the parts after what’s already been typed (instead of the full completions, as is normally done). I don’t think with the current (as of Python 2.3) Python readline it’s possible to do better.

**latex_matches**(text)
Match Latex syntax for unicode characters.
This does both alp -> alpha and alpha -> α
Used on Python 3 only.

**magic_matches**(text)
Match magics

**python_func_kw_matches**(text)
Match named parameters (kwargs) of the last open function

**python_matches**(text)
Match attributes or global python names

**unicode_name_matches**(text)
Match Latex-like syntax for unicode characters base on the name of the character.
This does GREEK SMALL LETTER ETA -> η
Works only on valid python 3 identifier, or on combining characters that will combine to form a valid identifier.
Used on Python 3 only.

### 8.7.2 9 Functions

**IPython.core.completer.has_open_quotes**(s)
Return whether a string has open quotes.
This simply counts whether the number of quote characters of either type in the string is odd.

Returns
- If there is an open quote, the quote character is returned. Else, return False.

**IPython.core.completer.protect_filename**(s)
Escape a string to protect certain characters.

**IPython.core.completer.expand_user**(path)
Expand ‘~’-style usernames in strings.
This is similar to `os.path.expanduser()`, but it computes and returns extra information that will be useful if the input was being used in computing completions, and you wish to return the completions with the original ‘~’ instead of its expanded value.

Parameters
- **path**(str) – String to be expanded. If no ~ is present, the output is the same as the input.

Returns
- **newpath**(str) – Result of ~ expansion in the input path.
- **tilde_expand**(bool) – Whether any expansion was performed or not.
- **tilde_val**(str) – The value that ~ was replaced with.
IPython.core.completer.\texttt{compress_user}(\textit{path}, \textit{tilde\_expand}, \textit{tilde\_val})
Does the opposite of expand\_user, with its outputs.

IPython.core.completer.\texttt{completions\_sorting\_key}(\textit{word})
\hspace{1em}key for sorting completions
This does several things:
• Lowercase all completions, so they are sorted alphabetically with upper and lower case words mingled
• Demote any completions starting with underscores to the end
• Insert any \texttt{%magic} and \texttt{%cellmagic} completions in the alphabetical order by their name

IPython.core.completer.\texttt{get\_all\_entries}(\textit{obj})
\hspace{1em}returns the strings in the \underline{\texttt{\_all\_}} attribute

IPython.core.completer.\texttt{match\_dict\_keys}(\textit{keys}, \textit{prefix}, \textit{delims})
\hspace{1em}Used by \texttt{dict\_key\_matches}, matching the prefix to a list of keys

IPython.core.completer.\texttt{back\_unicode\_name\_matches}(\textit{text})
\hspace{1em}Match unicode characters back to unicode name
\hspace{1em}This does -> snowman
\hspace{1em}Note that snowman is not a valid python3 combining character but will be expanded. Though it will not recombine back to the snowman character by the completion machinery.
\hspace{1em}This will not either back-complete standard sequences like n, b...
\hspace{1em}Used on Python 3 only.

IPython.core.completer.\texttt{back\_latex\_name\_matches}(\textit{text})
\hspace{1em}Match latex characters back to unicode name
\hspace{1em}This does ->sqrt
\hspace{1em}Used on Python 3 only.

8.8 Module: \texttt{core.completerlib}

Implementations for various useful completers.
These are all loaded by default by IPython.

8.8.1 10 Functions

IPython.core.completerlib.\texttt{module\_list}(\textit{path})
\hspace{1em}Return the list containing the names of the modules available in the given folder.

IPython.core.completerlib.\texttt{get\_root\_modules}()
\hspace{1em}Returns a list containing the names of all the modules available in the folders of the pythonpath.
\hspace{1em}ip.db[\texttt{\_rootmodules\_cache}] maps sys.path entries to list of modules.

IPython.core.completerlib.\texttt{is\_importable}(\textit{module}, \textit{attr}, \textit{only\_modules})

IPython.core.completerlib.\texttt{try\_import}(\textit{mod}, \textit{only\_modules}=False)
IPython.core.completerlib.quick_completer(cmd, completions)
Easily create a trivial completer for a command.
Takes either a list of completions, or all completions in string (that will be split on whitespace).
Example:

```
[d:\ipython]\1> import ipy_completers
[d:\ipython]\2> ipy_completers.quick_completer('foo', ['bar', 'baz'])
[d:\ipython]\3> foo b<TAB>
bar baz
[d:\ipython]\3> foo ba
```

IPython.core.completerlib.module_completion(line)
Returns a list containing the completion possibilities for an import line.
The line looks like this: ‘import xml.d’ ‘from xml.dom import’

IPython.core.completerlib.module_completer(self, event)
Give completions after user has typed ‘import ...’ or ‘from ...’

IPython.core.completerlib.magic_run_completer(self, event)
Complete files that end in .py or .ipy or .ipynb for the %run command.

IPython.core.completerlib.cd_completer(self, event)
Completer function for cd, which only returns directories.

IPython.core.completerlib.reset_completer(self, event)
A completer for %reset magic

8.9 Module: core.crashhandler

sys.excepthook for IPython itself, leaves a detailed report on disk.

Authors:
- Fernando Perez
- Brian E. Granger

8.9.1 1 Class

class IPython.core.crashhandler.CrashHandler(app, contact_name=None, contact_email=None, bug_tracker=None, show_crash_traceback=True, call_pdb=False)

Bases: object

Customizable crash handlers for IPython applications.

Instances of this class provide a __call__() method which can be used as a sys.excepthook. The __call__() signature is:

```
def __call__(self, etype, evalue, etb)
```

__init__(app, contact_name=None, contact_email=None, bug_tracker=None, show_crash_traceback=True, call_pdb=False)
Create a new crash handler
Parameters

- **app** (*Application*) – A running *Application* instance, which will be queried at crash time for internal information.
- **contact_name** (*str*) – A string with the name of the person to contact.
- **contact_email** (*str*) – A string with the email address of the contact.
- **bug_tracker** (*str*) – A string with the URL for your project’s bug tracker.
- **show_crash_traceback** (*bool*) – If false, don’t print the crash traceback on stderr, only generate the on-disk report
- **instance attributes** (*Non-argument*) –

  - instances contain some non-argument attributes which allow for
    customization of the crash handler’s behavior. Please see
    the
    (further)
- **for further details.** (*source*) –

  **make_report** (*traceback*)

  Return a string containing a crash report.

### 8.9.2 1 Function

**IPython.core.crashhandler.crash_handler_lite**(*etype*, *evalue*, *tb*)

A light excepthook, adding a small message to the usual traceback

### 8.10 Module: core.debugger

**Pdb debugger class.**

Modified from the standard *pdb.Pdb* class to avoid including readline, so that the command line completion of other programs which include this isn’t damaged.

In the future, this class will be expanded with improvements over the standard *pdb*.

The code in this file is mainly lifted out of *cmd.py* in Python 2.2, with minor changes. Licensing should therefore be under the standard Python terms. For details on the PSF (Python Software Foundation) standard license, see:

https://docs.python.org/2/license.html

### 8.10.1 2 Classes

**class** IPython.core.debugger.Tracer(*colors=None*)

  **Bases:** object

  **DEPRECATED**

  Class for local debugging, similar to *pdb.set_trace*.

  Instances of this class, when called, behave like *pdb.set_trace*, but providing IPython’s enhanced capabilities.

  This is implemented as a class which must be initialized in your own code and not as a standalone function because we need to detect at runtime whether IPython is already active or not. That detection is done in the
constructor, ensuring that this code plays nicely with a running IPython, while functioning acceptably (though with limitations) if outside of it.

```python
__init__(colors=None)
```

DEPRECATED

Create a local debugger instance.

**Parameters**

**colors** *(str, optional)* — The name of the color scheme to use, it must be one of IPython's valid color schemes. If not given, the function will default to the current IPython scheme when running inside IPython, and to ‘NoColor’ otherwise.

**Examples**

```python
from IPython.core.debugger import Tracer; debug_here = Tracer()
```

Later in your code:

```python
debug_here()  # -> will open up the debugger at that point.
```

Once the debugger activates, you can use all of its regular commands to step through code, set breakpoints, etc. See the pdb documentation from the Python standard library for usage details.

```python
class IPython.core.debugger.Pdb(color_scheme=None, completekey=None, stdin=None, stdout=None, context=5)
```

**Bases:** pdb.Pdb

Modified Pdb class, does not load readline.

for a standalone version that uses prompt_toolkit, see IPython.terminal.debugger.TerminalPdb and IPython.terminal.debugger.set_trace()

```python
__init__(color_scheme=None, completekey=None, stdin=None, stdout=None, context=5)
```

Instantiate a line-oriented interpreter framework.

The optional argument ‘completekey’ is the readline name of a completion key; it defaults to the Tab key. If completekey is not None and the readline module is available, command completion is done automatically. The optional arguments stdin and stdout specify alternate input and output file objects; if not specified, sys.stdin and sys.stdout are used.

```python
do_d(**kw)
```

```python
do_down(**kw)
```

```python
do_l(arg)
```

```python
do_list(arg)
```

```python
do_ll(arg)
```

```python
do_longlist(arg)
```

8.10. Module: core.debugger
Shows more lines than 'list' does.

**do_pdef**(arg)
Print the call signature for any callable object.
The debugger interface to %pdef

**do_pdoc**(arg)
Print the docstring for an object.
The debugger interface to %pdoc.

**do_pfile**(arg)
Print (or run through pager) the file where an object is defined.
The debugger interface to %pfile.

**do_pinfo**(arg)
Provide detailed information about an object.
The debugger interface to %pinfo, i.e., obj?.

**do_pinfo2**(arg)
Provide extra detailed information about an object.
The debugger interface to %pinfo2, i.e., obj??.

**do_psource**(arg)
Print (or run through pager) the source code for an object.

**do_q**(**kw**)
q(uit) exit
Quit from the debugger. The program being executed is aborted.

**do_quit**(**kw**)
q(uit) exit
Quit from the debugger. The program being executed is aborted.

**do_u**(**kw**)
u(p) [count] Move the current frame count (default one) levels up in the stack trace (to an older frame).

**do_up**(**kw**)
u(p) [count] Move the current frame count (default one) levels up in the stack trace (to an older frame).

**do_w**(arg)
w(here) Print a stack trace, with the most recent frame at the bottom. An arrow indicates the “current frame”, which determines the context of most commands. ‘bt’ is an alias for this command.
Take a number as argument as an (optional) number of context line to print

**do_where**(arg)
w(here) Print a stack trace, with the most recent frame at the bottom. An arrow indicates the “current frame”, which determines the context of most commands. ‘bt’ is an alias for this command.
Take a number as argument as an (optional) number of context line to print

**format_stack_entry**(frame_lineno, lprefix=': ', context=None)
Return a string with information about a stack entry.
The stack entry frame_lineno is a (frame, lineno) tuple. The return string contains the canonical filename, the function name or ‘<lambda>’, the input arguments, the return value, and the line of code (if it exists).

**new_do_restart**(arg)
Restart command. In the context of ipython this is exactly the same thing as ‘quit’.
print_list_lines(filename, first, last)
The printing (as opposed to the parsing part of a ‘list’ command.

set_colors(scheme)
Shorthand access to the color table scheme selector method.

8.10.2 5 Functions

IPython.core.debugger.make_arrow(pad)
generate the leading arrow in front of traceback or debugger

IPython.core.debugger.BdbQuit_excepthook(et, ev, tb, excepthook=None)
Exception hook which handles BdbQuit exceptions.
All other exceptions are processed using the excepthook parameter.

IPython.core.debugger.BdbQuit_IPython_excepthook(self, et, ev, tb, tb_offset=None)

IPython.core.debugger.decorate_fn_with_doc(new_fn, old_fn, additional_text="")
Make new_fn have old_fn’s doc string. This is particularly useful for the do... commands that hook into the help system. Adapted from from a comp.lang.python posting by Duncan Booth.

IPython.core.debugger.set_trace(frame=None)
Start debugging from frame.
If frame is not specified, debugging starts from caller’s frame.

8.11 Module: core.error

Global exception classes for IPython.core.

Authors:
• Brian Granger
• Fernando Perez
• Min Ragan-Kelley

Notes

8.11.1 5 Classes

class IPython.core.error.IPythonCoreError
   Bases: Exception

class IPython.core.error.TryNext
   Bases: IPython.core.error.IPythonCoreError
   Try next hook exception.
   Raise this in your hook function to indicate that the next hook handler should be used to handle the operation.

class IPython.core.error.UsageError
   Bases: IPython.core.error.IPythonCoreError
   Error in magic function arguments, etc.
   Something that probably won’t warrant a full traceback, but should nevertheless interrupt a macro / batch file.
**8.12 Module: core.events**

Infrastructure for registering and firing callbacks on application events.

Unlike `IPython.core.hooks`, which lets end users set single functions to be called at specific times, or a collection of alternative methods to try, callbacks are designed to be used by extension authors. A number of callbacks can be registered for the same event without needing to be aware of one another.

The functions defined in this module are no-ops indicating the names of available events and the arguments which will be passed to them.

**Note:** This API is experimental in IPython 2.0, and may be revised in future versions.

**8.12.1 1 Class**

```python
class IPython.core.events.EventManager(shell, available_events)
    Bases: object

Manage a collection of events and a sequence of callbacks for each.

This is attached to `InteractiveShell` instances as an `events` attribute.

**Note:** This API is experimental in IPython 2.0, and may be revised in future versions.
```

```python
__init__(shell, available_events)
    Initialise the CallbackManager.

Parameters

- `shell` -- The `InteractiveShell` instance
- `available_callbacks` -- An iterable of names for callback events.

**register** (event, function)
    Register a new event callback

Parameters

- `event` (str) -- The event for which to register this callback.
- `function` (callable) -- A function to be called on the given event. It should take the same parameters as the appropriate callback prototype.
```
8.12.2 5 Functions

**IPython.core.events.pre_execute()**
Fires before code is executed in response to user/frontend action.

This includes comm and widget messages and silent execution, as well as user code cells.

**IPython.core.events.pre_run_cell()**
Fires before user-entered code runs.

**IPython.core.events.post_execute()**
Fires after code is executed in response to user/frontend action.

This includes comm and widget messages and silent execution, as well as user code cells.

**IPython.core.events.post_run_cell()**
Fires after user-entered code runs.

**IPython.core.events.shell_initialized(ip)**
Fires after initialisation of `InteractiveShell`.

This is before extensions and startup scripts are loaded, so it can only be set by subclassing.

**Parameters**

- `ip (InteractiveShell)` – The newly initialised shell.

### 8.13 Module: core.excolors

Color schemes for exception handling code in IPython.

#### 8.13.1 1 Class

**class IPython.core.excolors.Deprec(wrapped_obj)**

**Bases:** `object`

**__init__(wrapped_obj)**

Initialize self. See `help(type(self))` for accurate signature.

#### 8.13.2 1 Function

**IPython.core.excolors.exception_colors()**

Return a color table with fields for exception reporting.
The table is an instance of ColorSchemeTable with schemes added for ‘Neutral’, ‘Linux’, ‘LightBG’ and ‘No-Color’ and fields for exception handling filled in.

Examples:

```python
>>> ec = exception_colors()
>>> ec.active_scheme_name
''
>>> print(ec.active_colors)
None
```

Now we activate a color scheme:

```python
>>> ec.set_active_scheme('NoColor')
>>> ec.active_scheme_name
'No-Color'
>>> sorted(ec.active_colors.keys())
['Normal', 'caret', 'em', 'excName', 'filename', 'filenameEm', 'line', 'lineno', 'linenoEm', 'name', 'nameEm', 'normalEm', 'topline', 'vName', 'val', 'valEm']
```

## 8.14 Module: `core.extensions`

A class for managing IPython extensions.

### 8.14.1 1 Class

```python
class IPython.core.extensions.ExtensionManager(shell=None, **kwargs):
    Bases: traitlets.config.configurable.Configurable

    A class to manage IPython extensions.

    An IPython extension is an importable Python module that has a function with the signature:

    ```python
def load_ipython_extension(ipython):
        # Do things with ipython
    ```
```

This function is called after your extension is imported and the currently active `InteractiveShell` instance is passed as the only argument. You can do anything you want with IPython at that point, including defining new magic and aliases, adding new components, etc.

You can also optionally define an `unload_ipython_extension(ipython)` function, which will be called if the user unloads or reloads the extension. The extension manager will only call `load_ipython_extension()` again if the extension is reloaded.

You can put your extension modules anywhere you want, as long as they can be imported by Python’s standard import mechanism. However, to make it easy to write extensions, you can also put your extensions in `os.path.join(self.ipython_dir, 'extensions')`. This directory is added to `sys.path` automatically.

```python
__init__(shell=None, **kwargs)
    Create a configurable given a config config.
```

**Parameters**

- `config (Config)` – If this is empty, default values are used. If config is a `Config` instance, it will be used to configure the instance.
- `parent (Configurable instance, optional)` – The parent Configurable instance of this object.
Notes

Subclasses of Configurable must call the \_\_init\_\_() method of Configurable before doing anything else and using super():

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

**install_extension**(url, filename=None)

Download and install an IPython extension.

If filename is given, the file will be so named (inside the extension directory). Otherwise, the name from the URL will be used. The file must have a .py or .zip extension; otherwise, a ValueError will be raised.

Returns the full path to the installed file.

**load_extension**(module_str)

Load an IPython extension by its module name.

Returns the string "already loaded" if the extension is already loaded, “no load function” if the module doesn’t have a load_ipython_extension function, or None if it succeeded.

**reload_extension**(module_str)

Reload an IPython extension by calling reload.

If the module has not been loaded before, InteractiveShell.load_extension() is called. Otherwise reload() is called and then the load_ipython_extension() function of the module, if it exists is called.

**unload_extension**(module_str)

Unload an IPython extension by its module name.

This function looks up the extension’s name in sys.modules and simply calls mod.unload_ipython_extension(self).

Returns the string "no unload function” if the extension doesn’t define a function to unload itself, “not loaded” if the extension isn’t loaded, otherwise None.

### 8.15 Module: core.formatters

Display formatters.

Inheritance diagram:
8.15.1 16 Classes

```python
class IPython.core.formatters.DisplayFormatter(**kwargs)
Bases: traitlets.config.configurable.Configurable

format(obj, include=None, exclude=None)
Return a format data dict for an object.

By default all format types will be computed.

The following MIME types are usually implemented:

- text/plain
- text/html
- text/markdown
- text/latex
- application/json
- application/javascript
- application/pdf
- image/png
- image/jpeg
- image/svg+xml

Parameters

- **obj** (object) – The Python object whose format data will be computed.
- **include** (list, tuple or set; optional) – A list of format type strings (MIME types) to include in the format data dict. If this is set only the format types included in this list will be computed.
```
**exclude** *(list, tuple or set; optional)* – A list of format type string (MIME types) to exclude in the format data dict. If this is set all format types will be computed, except for those included in this argument. Mimetypes present in exclude will take precedence over the ones in include

**Returns**

*(format_dict, metadata_dict)* – format_dict is a dictionary of key/value pairs, one of each format that was generated for the object. The keys are the format types, which will usually be MIME type strings and the values and JSON’able data structure containing the raw data for the representation in that format.

metadata_dict is a dictionary of metadata about each mime-type output. Its keys will be a strict subset of the keys in format_dict.

**Return type** tuple of two dicts

**Notes**

If an object implements **_repr_mimebundle_** as well as various **_repr_*_**, the data returned by **_repr_mimebundle_** will take precedence and the corresponding **_repr_*_** for this mimetype will not be called.

**format_types**

Return the format types (MIME types) of the active formatters.

class IPython.core.formatters.FormatterWarning
   Bases: UserWarning

Warning class for errors in formatters

class IPython.core.formatters.FormatterABC
   Bases: abc._NewBase

Abstract base class for Formatters.

A formatter is a callable class that is responsible for computing the raw format data for a particular format type (MIME type). For example, an HTML formatter would have a format type of **text/html** and would return the HTML representation of the object when called.

class IPython.core.formatters.BaseFormatter(**kwargs)
   Bases: traitlets.config.configurable.Configurable

A base formatter class that is configurable.

This formatter should usually be used as the base class of all formatters. It is a treated Configurable class and includes an extensible API for users to determine how their objects are formatted. The following logic is used to find a function to format an given object.

1. The object is introspected to see if it has a method with the name **print_method**. If is does, that object is passed to that method for formatting.

2. If no print method is found, three internal dictionaries are consulted to find print method: **singleton_printers**, **type_printers** and **deferred_printers**.

Users should use these dictionaries to register functions that will be used to compute the format data for their objects (if those objects don’t have the special print methods). The easiest way of using these dictionaries is through the **for_type()** and **for_type_by_name()** methods.

If no function/callable is found to compute the format data, **None** is returned and this format type is not used.
for_type(*, func=*)
Add a format function for a given type.

Parameters

- **typ** *(type or '__module__.__name__' string for a type)* – The class of the object that will be formatted using func.

- **func** *(callable)* – A callable for computing the format data. func will be called with the object to be formatted, and will return the raw data in this formatter’s format. Subclasses may use a different call signature for the func argument.

If func is None or not specified, there will be no change, only returning the current value.

Returns **oldfunc** – The currently registered callable. If you are registering a new formatter, this will be the previous value (to enable restoring later).

Return type **callable**

for_type_by_name(*, func=*)
Add a format function for a type specified by the full dotted module and name of the type, rather than the type of the object.

Parameters

- **type_module** *(str)* – The full dotted name of the module the type is defined in, like numpy.

- **type_name** *(str)* – The name of the type (the class name), like dtype

- **func** *(callable)* – A callable for computing the format data. func will be called with the object to be formatted, and will return the raw data in this formatter’s format. Subclasses may use a different call signature for the func argument.

If func is None or unspecified, there will be no change, only returning the current value.

Returns **oldfunc** – The currently registered callable. If you are registering a new formatter, this will be the previous value (to enable restoring later).

Return type **callable**

lookup(*, obj*)
Look up the formatter for a given instance.

Parameters **obj** *(object instance)* –

Returns **f** – The registered formatting callable for the type.

Return type **callable**

Raises **KeyError** if the type has not been registered.

lookup_by_type(*, typ*)
Look up the registered formatter for a type.

Parameters **typ** *(type or '__module__.__name__' string for a type)* –

Returns **f** – The registered formatting callable for the type.

Return type **callable**

Raises **KeyError** if the type has not been registered.

pop(*, default=IPython.core.formatters.raise_key_error*)
Pop a formatter for the given type.

Parameters
• **typ**(type or '__module__.__name__' string for a type) –
• **default**(object) – value to be returned if no formatter is registered for typ.

Returns **obj** – The last registered object for the type.

Return type **object**

Raises **KeyError** if the type is not registered and default is not specified.

class IPython.core.formatters.PlainTextFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

The default pretty-printer.

This uses **IPython.lib.pretty** to compute the format data of the object. If the object cannot be pretty printed, **repr()** is used. See the documentation of **IPython.lib.pretty** for details on how to write pretty printers. Here is a simple example:

```python
def dtype_pprinter(obj, p, cycle):
    if cycle:
        return p.text('dtype(...)')
    if hasattr(obj, 'fields'):
        if obj.fields is None:
            p.text(repr(obj))
        else:
            p.begin_group(7, 'dtype([')
            for i, field in enumerate(obj.descr):
                if i > 0:
                    p.text(',')
                p.breakable()
                p.pretty(field)
            p.end_group(7, ']'))
```

class IPython.core.formatters.HTMLFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

An HTML formatter.

To define the callables that compute the HTML representation of your objects, define a **_repr_html_()** method or use the **for_type()** or **for_type_by_name()** methods to register functions that handle this.

The return value of this formatter should be a valid HTML snippet that could be injected into an existing DOM. It should **not** include the `<html>`, `<head>`, or `<body>` tags.

class IPython.core.formatters.MarkdownFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

A Markdown formatter.

To define the callables that compute the Markdown representation of your objects, define a **_repr_markdown_()** method or use the **for_type()** or **for_type_by_name()** methods to register functions that handle this.

The return value of this formatter should be a valid Markdown.

class IPython.core.formatters.SVGFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

An SVG formatter.

To define the callables that compute the SVG representation of your objects, define a **_repr_svg_()** method or use the **for_type()** or **for_type_by_name()** methods to register functions that handle this.
The return value of this formatter should be valid SVG enclosed in `\<svg>` tags, that could be injected into an existing DOM. It should not include the `\<html>` or `\<body>` tags.

```python
class IPython.core.formatters.PNGFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A PNG formatter.

    To define the callables that compute the PNG representation of your objects, define a `_repr_png_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be raw PNG data, not base64 encoded.
```

```python
class IPython.core.formatters.JPEGFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A JPEG formatter.

    To define the callables that compute the JPEG representation of your objects, define a `_repr_jpeg_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be raw JPEG data, not base64 encoded.
```

```python
class IPython.core.formatters.LatexFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A LaTeX formatter.

    To define the callables that compute the LaTeX representation of your objects, define a `_repr_latex_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be a valid LaTeX equation, enclosed in either `$`, `$$`, or another LaTeX equation environment.
```

```python
class IPython.core.formatters.JSONFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A JSON string formatter.

    To define the callables that compute the JSONable representation of your objects, define a `_repr_json_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be a JSONable list or dict. JSON scalars (None, number, string) are not allowed, only dict or list containers.
```

```python
class IPython.core.formatters.JavascriptFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A Javascript formatter.

    To define the callables that compute the Javascript representation of your objects, define a `_repr_javascript_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be valid Javascript code and should not be enclosed in `\<script>` tags.
```

```python
class IPython.core.formatters.PDFFormatter(**kwargs)
    Bases: IPython.core.formatters.BaseFormatter

    A PDF formatter.

    To define the callables that compute the PDF representation of your objects, define a `_repr_pdf_()` method or use the `for_type()` or `for_type_by_name()` methods to register functions that handle this.

    The return value of this formatter should be raw PDF data, not base64 encoded.
```
class IPython.core.formatters.IPythonDisplayFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

An escape-hatch Formatter for objects that know how to display themselves.

To define the callables that compute the representation of your objects, define a \_ipython_display\_ method or use the \for_type\() or \for_type_by_name\() methods to register functions that handle this. Unlike mime-type displays, this method should not return anything, instead calling any appropriate display methods itself.

This display formatter has highest priority. If it fires, no other display formatter will be called.

Prior to IPython 6.1, \_ipython_display\_ was the only way to display custom mime-types without registering a new Formatter.

IPython 6.1 introduces \_repr_mimebundle\_ for displaying custom mime-types, so \_ipython_display\_ should only be used for objects that require unusual display patterns, such as multiple display calls.

class IPython.core.formatters.MimeBundleFormatter(**kwargs)
Bases: IPython.core.formatters.BaseFormatter

A Formatter for arbitrary mime-types.

Unlike other \_repr_<mimetype>\_ methods, \_repr_mimebundle\_ should return mime-bundle data, either the mime-keyed data dictionary or the tuple (data, metadata). Any mime-type is valid.

To define the callables that compute the mime-bundle representation of your objects, define a \_repr_mimebundle\_ method or use the \for_type\() or \for_type_by_name\() methods to register functions that handle this.

New in version 6.1.

### 8.15.2 2 Functions

IPython.core.formatters.catch_format_error(method, self, *args, **kwargs)
show traceback on failed format call

IPython.core.formatters.format_display_data(obj, include=None, exclude=None)
Return a format data dict for an object.

By default all format types will be computed.

The following MIME types are currently implemented:

- text/plain
- text/html
- text/markdown
- text/latex
- application/json
- application/javascript
- application/pdf
- image/png
- image/jpeg
- image/svg+xml
Parameters `obj (object)` – The Python object whose format data will be computed.

Returns

• `format_dict (dict)` – A dictionary of key/value pairs, one or each format that was generated for the object. The keys are the format types, which will usually be MIME type strings and the values and JSON-able data structure containing the raw data for the representation in that format.

• `include (list or tuple, optional)` – A list of format type strings (MIME types) to include in the format data dict. If this is set only the format types included in this list will be computed.

• `exclude (list or tuple, optional)` – A list of format type string (MIME types) to exclude in the format data dict. If this is set all format types will be computed, except for those included in this argument.

8.16 Module: `core.getipython`

Simple function to call to get the current InteractiveShell instance

8.16.1 1 Function

IPython.core.getipython.get_ipython()

Get the global InteractiveShell instance.

Returns None if no InteractiveShell instance is registered.

8.17 Module: `core.history`

History related magics and functionality

8.17.1 4 Classes

`class` IPython.core.history.HistoryAccessorBase(**kwargs)

Bases: traitlets.config.configurable.LoggingConfigurable

An abstract class for History Accessors

`class` IPython.core.history.HistoryAccessor (profile='default', hist_file='', **traits)

Bases: IPython.core.history.HistoryAccessorBase

Access the history database without adding to it.

This is intended for use by standalone history tools. IPython shells use HistoryManager, below, which is a subclass of this.

`__init__` (profile='default', hist_file='', **traits)

Create a new history accessor.

Parameters

• `profile (str)` – The name of the profile from which to open history.

• `hist_file (str)` – Path to an SQLite history database stored by IPython. If specified, hist_file overrides profile.
- `config (Config)` – Config object. hist_file can also be set through this.

**get_last_session_id()**
Get the last session ID currently in the database.
Within IPython, this should be the same as the value stored in `HistoryManager.session_number`.

**get_range (session, start=1, stop=None, raw=True, output=False)**
Retrieve input by session.

- `session (int)` – Session number to retrieve.
- `start (int)` – First line to retrieve.
- `stop (int)` – End of line range (excluded from output itself). If None, retrieve to the end of the session.
- `raw (bool)` – If True, return untranslated input
- `output (bool)` – If True, attempt to include output. This will be ‘real’ Python objects for the current session, or text reprs from previous sessions if db_log_output was enabled at the time. Where no output is found, None is used.

**Returns**
An iterator over the desired lines. Each line is a 3-tuple, either (session, line, input) if output is False, or (session, line, (input, output)) if output is True.

**Return type**
`entries`

**get_range_by_str (rangestr, raw=True, output=False)**
Get lines of history from a string of ranges, as used by magic commands `%hist`, `%save`, `%macro`, etc.

- `rangestr (str)` – A string specifying ranges, e.g. “5 ~2/1-4”. See `magic_history()` for full details.
- `output (raw)` – As `get_range()`

**Returns**

**Return type**
Tuples as `get_range()`

**get_session_info (session)**
Get info about a session.

- `session (int)` – Session number to retrieve.

**Returns**

- `session_id (int)` – Session ID number
- `start (datetime)` – Timestamp for the start of the session.
- `end (datetime)` – Timestamp for the end of the session, or None if IPython crashed.
- `num_cmds (int)` – Number of commands run, or None if IPython crashed.
- `remark (unicode)` – A manually set description.

**get_tail (n=10, raw=True, output=False, include_latest=False)**
Get the last n lines from the history database.

- `n (int)` – The number of lines to get
• **output** (**raw,**) – See **get_range()**

• **include_latest** (**bool**) – If False (default), n+1 lines are fetched, and the latest one is discarded. This is intended to be used where the function is called by a user command, which it should not return.

Returns

Return type: Tuples as **get_range()**

`init_db()`

Connect to the database, and create tables if necessary.

`search(**pattern='*', raw=True, search_raw=True, output=False, n=None, unique=False)**`

Search the database using unix glob-style matching (wildcards * and ?).

Parameters

• **pattern** (**str**) – The wildcarded pattern to match when searching

• **search_raw** (**bool**) – If True, search the raw input, otherwise, the parsed input

• **output** (**raw,**) – See **get_range()**

• **n** (**None or int**) – If an integer is given, it defines the limit of returned entries.

• **unique** (**bool**) – When it is true, return only unique entries.

Returns

Return type: Tuples as **get_range()**

`writeout_cache()`

Overridden by HistoryManager to dump the cache before certain database lookups.

class IPython.core.history.HistoryManager(**shell=None, config=None, **traits**)

Bases: IPython.core.history.HistoryAccessor

A class to organize all history-related functionality in one place.

__init__(**shell=None, config=None, **traits**)

Create a new history manager associated with a shell instance.

`end_session()`

Close the database session, filling in the end time and line count.

`get_range(**session=0, start=1, stop=None, raw=True, output=False)**`

Retrieve input by session.

Parameters

• **session** (**int**) – Session number to retrieve. The current session is 0, and negative numbers count back from current session, so -1 is previous session.

• **start** (**int**) – First line to retrieve.

• **stop** (**int**) – End of line range (excluded from output itself). If None, retrieve to the end of the session.

• **raw** (**bool**) – If True, return untranslated input

• **output** (**bool**) – If True, attempt to include output. This will be ‘real’ Python objects for the current session, or text reprs from previous sessions if db_log_output was enabled at the time. Where no output is found, None is used.

Returns An iterator over the desired lines. Each line is a 3-tuple, either (session, line, input) if output is False, or (session, line, (input, output)) if output is True.
Return type  entries

get_session_info(session=0)
Get info about a session.

Parameters session (int) – Session number to retrieve. The current session is 0, and negative numbers count back from current session, so -1 is the previous session.

Returns

• session_id (int) – Session ID number
• start (datetime) – Timestamp for the start of the session.
• end (datetime) – Timestamp for the end of the session, or None if IPython crashed.
• num_cmds (int) – Number of commands run, or None if IPython crashed.
• remark (unicode) – A manually set description.

name_session(name)
Give the current session a name in the history database.

new_session(conn=None)
Get a new session number.

reset(new_session=True)
Clear the session history, releasing all object references, and optionally open a new session.

store_inputs(line_num, source, source_raw=None)
Store source and raw input in history and create input cache variables _i*.

Parameters

• line_num (int) – The prompt number of this input.
• source (str) – Python input.
• source_raw (str, optional) – If given, this is the raw input without any IPython transformations applied to it. If not given, source is used.

store_output(line_num)
If database output logging is enabled, this saves all the outputs from the indicated prompt number to the database. It’s called by run_cell after code has been executed.

Parameters line_num (int) – The line number from which to save outputs

writeout_cache(conn=None)
Write any entries in the cache to the database.

class IPython.core.history.HistorySavingThread(history_manager)
Bases: threading.Thread
This thread takes care of writing history to the database, so that the UI isn’t held up while that happens.

It waits for the HistoryManager’s save_flag to be set, then writes out the history cache. The main thread is responsible for setting the flag when the cache size reaches a defined threshold.

__init__(history_manager)
This constructor should always be called with keyword arguments. Arguments are:

• group should be None; reserved for future extension when a ThreadGroup class is implemented.
• target is the callable object to be invoked by the run() method. Defaults to None, meaning nothing is called.
name is the thread name. By default, a unique name is constructed of the form “Thread-N” where N is a small decimal number.

args is the argument tuple for the target invocation. Defaults to ()

kwargs is a dictionary of keyword arguments for the target invocation. Defaults to {}.

If a subclass overrides the constructor, it must make sure to invoke the base class constructor (Thread.__init__()) before doing anything else to the thread.

run()
Method representing the thread’s activity.

You may override this method in a subclass. The standard run() method invokes the callable object passed to the object’s constructor as the target argument, if any, with sequential and keyword arguments taken from the args and kwargs arguments, respectively.

stop()
This can be called from the main thread to safely stop this thread.

Note that it does not attempt to write out remaining history before exiting. That should be done by calling the HistoryManager’s end_session method.

8.17.2 3 Functions

IPython.core.history.needs_sqlite (f, self, *a, **kw)
Decorator: return an empty list in the absence of sqlite.

IPython.core.history.catch_corrupt_db (f, self, *a, **kw)
A decorator which wraps HistoryAccessor method calls to catch errors from a corrupt SQLite database, move the old database out of the way, and create a new one.

We avoid clobbering larger databases because this may be triggered due to filesystem issues, not just a corrupt file.

IPython.core.history.extract_hist_ranges (ranges_str)
Turn a string of history ranges into 3-tuples of (session, start, stop).

Examples

```python
>>> list(extract_hist_ranges("~8/5--~7/4 2"))
[(-8, 5, None), (-7, 1, 5), (0, 2, 3)]
```

8.18 Module: core.historyapp

An application for managing IPython history.

To be invoked as the ipython history subcommand.

8.18.1 3 Classes

class IPython.core.historyapp.HistoryTrim(**kwargs)
Bases: IPython.core.application.BaseIPythonApplication
start()
    Start the app mainloop.
    Override in subclasses.

class IPython.core.historyapp.HistoryClear(**kwargs)
    Bases: IPython.core.historyapp.HistoryTrim
    start()
    Start the app mainloop.
    Override in subclasses.

class IPython.core.historyapp.HistoryApp(**kwargs)
    Bases: traitlets.config.application.Application
    start()
    Start the app mainloop.
    Override in subclasses.

8.19 Module: core.hooks

Hooks for IPython.

In Python, it is possible to overwrite any method of any object if you really want to. But IPython exposes a few ‘hooks’, methods which are designed to be overwritten by users for customization purposes. This module defines the default versions of all such hooks, which get used by IPython if not overridden by the user.

Hooks are simple functions, but they should be declared with self as their first argument, because when activated they are registered into IPython as instance methods. The self argument will be the IPython running instance itself, so hooks have full access to the entire IPython object.

If you wish to define a new hook and activate it, you can make an extension or a startup script. For example, you could use a startup file like this:

```python
import os

def calljed(self, filename, linenum):
    "My editor hook calls the jed editor directly."
    print "Calling my own editor, jed ..."
    if os.system('jed +$d $s' % (linenum, filename)) != 0:
        raise TryNext()

def load_ipython_extension(ip):
    ip.set_hook('editor', calljed)
```

8.19.1 1 Class

class IPython.core.hooks.CommandChainDispatcher(commands=None)
    Bases: object
    Dispatch calls to a chain of commands until some func can handle it
    Usage: instantiate, execute “add” to add commands (with optional priority), execute normally via f() calling mechanism.

8.19. Module: core.hooks
__init__(commands=None)
    Initialize self. See help(type(self)) for accurate signature.

add(func, priority=0)
    Add a func to the cmd chain with given priority

8.19.2 9 Functions

IPython.core.hooks.editor(self, filename, linenumber=None, wait=True)
    Open the default editor at the given filename and linenumber.

    This is IPython’s default editor hook, you can use it as an example to write your own modified one. To set your
    own editor function as the new editor hook, call ip.set_hook('editor',yourfunc).

IPython.core.hooks.fix_error_editor(self, filename, linenumber, column, msg)
    DEPRECATED
    Open the editor at the given filename, linenumber, column and show an error message. This is used for correcting
    syntax errors. The current implementation only has special support for the VIM editor, and falls back on the
    ‘editor’ hook if VIM is not used.

    Call ip.set_hook('fix_error_editor',yourfunc) to use your own function,

IPython.core.hooks.synchronize_with_editor(self, filename, linenumber, column)

IPython.core.hooks.shutdown_hook(self)
    default shutdown hook

    Typically, shutdown hooks should raise TryNext so all shutdown ops are done

IPython.core.hooks.late_startup_hook(self)
    Executed after ipython has been constructed and configured

IPython.core.hooks.show_in_pager(self, data, start, screen_lines)
    Run a string through pager

IPython.core.hooks.pre_prompt_hook(self)
    Run before displaying the next prompt

    Use this e.g. to display output from asynchronous operations (in order to not mess up text entry)

IPython.core.hooks.pre_run_code_hook(self)
    Executed before running the (prefiltered) code in IPython

IPython.core.hooks.clipboard_get(self)
    Get text from the clipboard.

8.20 Module: core.inputsplitter

Input handling and transformation machinery.

The first class in this module, InputSplitter, is designed to tell when input from a line-oriented frontend is
complete and should be executed, and when the user should be prompted for another line of code instead. The name
‘input splitter’ is largely for historical reasons.

A companion, IPythonInputSplitter, provides the same functionality but with full support for the extended
IPython syntax (magics, system calls, etc). The code to actually do these transformations is in IPython.core.
inputtransformer. IPythonInputSplitter feeds the raw code to the transformers in order and stores the
results.
For more details, see the class docstrings below.

### 8.20.1 2 Classes

```python
class IPython.core.inputsplitter.InputSplitter
    Bases: object

    An object that can accumulate lines of Python source before execution.

    This object is designed to be fed python source line-by-line, using `push()`. It will return on each push whether the currently pushed code could be executed already. In addition, it provides a method called `push_accepts_more()` that can be used to query whether more input can be pushed into a single interactive block.

    This is a simple example of how an interactive terminal-based client can use this tool:
    ```
    isp = InputSplitter()
    while isp.push_accepts_more():
        indent = ' ' * isp.indent_spaces
        prompt = '>>>' + indent
        line = indent + raw_input(prompt)
        isp.push(line)
    print 'Input source was:

    ', isp.source_reset(),
    ```

    __init__
    Create a new InputSplitter instance.

    check_complete(source)
    Return whether a block of code is ready to execute, or should be continued
    This is a non-stateful API, and will reset the state of this InputSplitter.

    Parameters
    source (string) – Python input code, which can be multiline.

    Returns
    status (str) – One of ‘complete’, ‘incomplete’, or ‘invalid’ if source is not a prefix of valid code.
    indent_spaces (int or None) – The number of spaces by which to indent the next line of code. If status is not ‘incomplete’, this is None.

    push(lines)
    Push one or more lines of input.

    This stores the given lines and returns a status code indicating whether the code forms a complete Python block or not.

    Any exceptions generated in compilation are swallowed, but if an exception was produced, the method returns True.

    Parameters
    lines (string) – One or more lines of Python input.

    Returns
    is_complete – True if the current input source (the result of the current input plus prior inputs) forms a complete Python execution block. Note that this value is also stored as a private attribute (_is_complete), so it can be queried at any time.

    Return type
    boolean

    push_accepts_more()
    Return whether a block of interactive input can accept more input.
```
This method is meant to be used by line-oriented frontends, who need to guess whether a block is complete or not based solely on prior and current input lines. The InputSplitter considers it has a complete interactive block and will not accept more input when either:

- A SyntaxError is raised
- The code is complete and consists of a single line or a single non-compound statement
- The code is complete and has a blank line at the end

If the current input produces a syntax error, this method immediately returns False but does *not* raise the syntax error exception, as typically clients will want to send invalid syntax to an execution backend which might convert the invalid syntax into valid Python via one of the dynamic IPython mechanisms.

**reset()**
Reset the input buffer and associated state.

**source_reset()**
Return the input source and perform a full reset.

```python
class IPython.core.inputsplitter.IPythonInputSplitter
```

Bases: `IPython.core.inputsplitter.InputSplitter`

An input splitter that recognizes all of IPython’s special syntax.

```python
__init__ (line_input_checker=True, physical_line_transforms=None, logical_line_transforms=None, python_line_transforms=None)
```

Create a new InputSplitter instance.

**push(lines)**
Push one or more lines of IPython input.

This stores the given lines and returns a status code indicating whether the code forms a complete Python block or not, after processing all input lines for special IPython syntax.

Any exceptions generated in compilation are swallowed, but if an exception was produced, the method returns True.

**Parameters lines (string)** – One or more lines of Python input.

**Returns is_complete** – True if the current input source (the result of the current input plus prior inputs) forms a complete Python execution block. Note that this value is also stored as a private attribute (`_is_complete`), so it can be queried at any time.

**Return type** boolean

**push_accepts_more()**
Return whether a block of interactive input can accept more input.

This method is meant to be used by line-oriented frontends, who need to guess whether a block is complete or not based solely on prior and current input lines. The InputSplitter considers it has a complete interactive block and will not accept more input when either:

- A SyntaxError is raised
- The code is complete and consists of a single line or a single non-compound statement
- The code is complete and has a blank line at the end
If the current input produces a syntax error, this method immediately returns False but does not raise the syntax error exception, as typically clients will want to send invalid syntax to an execution backend which might convert the invalid syntax into valid Python via one of the dynamic IPython mechanisms.

```
raw_reset()
```
Return raw input only and perform a full reset.

```
reset()
```
Reset the input buffer and associated state.

```
source_reset()
```
Return the input source and perform a full reset.

```
transform_cell(cell)
```
Process and translate a cell of input.

```
transforms
```
Quick access to all transformers.

```
transforms_in_use
```
Transformers, excluding logical line transformers if we’re in a Python line.

### 8.20.2 5 Functions

**IPython.core.inputsplitter.num_ini_spaces(s)**
Return the number of initial spaces in a string.

Note that tabs are counted as a single space. For now, we do not support mixing of tabs and spaces in the user’s input.

**Parameters**

- **s** *(string)*

**Returns**

- **n** *int*

**IPython.core.inputsplitter.last_blank(src)**
Determine if the input source ends in a blank.

A blank is either a newline or a line consisting of whitespace.

**Parameters**

- **src** *(string)* – A single or multiline string.

**IPython.core.inputsplitter.last_two_blanks(src)**
Determine if the input source ends in two blanks.

A blank is either a newline or a line consisting of whitespace.

**Parameters**

- **src** *(string)* – A single or multiline string.

**IPython.core.inputsplitter.remove_comments(src)**
Remove all comments from input source.

Note: comments are NOT recognized inside of strings!

**Parameters**

- **src** *(string)* – A single or multiline input string.

**Returns**

- **String** with all Python comments removed.

**IPython.core.inputsplitter.get_input_encoding()**
Return the default standard input encoding.

If sys.stdin has no encoding, ‘ascii’ is returned.
8.21 Module: core.inputtransformer

Input transformer classes to support IPython special syntax.
This includes the machinery to recognise and transform %magic commands, !system commands, help? querying, prompt stripping, and so forth.

8.21.1 5 Classes

```python
class IPython.core.inputtransformer.InputTransformer
   Bases: abc._NewBase
   Abstract base class for line-based input transformers.
   
   push(line)
      Send a line of input to the transformer, returning the transformed input or None if the transformer is waiting for more input.
      Must be overridden by subclasses.
      Implementations may raise SyntaxError if the input is invalid. No other exceptions may be raised.

   reset()
      Return, transformed any lines that the transformer has accumulated, and reset its internal state.
      Must be overridden by subclasses.

   classmethod wrap(func)
      Can be used by subclasses as a decorator, to return a factory that will allow instantiation with the decorated object.
```

class IPython.core.inputtransformer.StatelessInputTransformer(func)
   Bases: IPython.core.inputtransformer.InputTransformer
   Wrapper for a stateless input transformer implemented as a function.
   
   __init__(func)
      Initialize self. See help(type(self)) for accurate signature.

   push(line)
      Send a line of input to the transformer, returning the transformed input.

   reset()
      No-op - exists for compatibility.

class IPython.core.inputtransformer.CoroutineInputTransformer(coro, **kwargs)
   Bases: IPython.core.inputtransformer.InputTransformer
   Wrapper for an input transformer implemented as a coroutine.
   
   __init__(coro, **kwargs)
      Initialize self. See help(type(self)) for accurate signature.

   push(line)
      Send a line of input to the transformer, returning the transformed input or None if the transformer is waiting for more input.

   reset()
      Return, transformed any lines that the transformer has accumulated, and reset its internal state.
```
class IPython.core.inputtransformer.TokenInputTransformer(func)
    Bases: IPython.core.inputtransformer.InputTransformer

Wrapper for a token-based input transformer.
func should accept a list of tokens (5-tuples, see tokenize docs), and return an iterable which can be passed to tokenize.untokenize().

__init__(func)
    Initialize self. See help(type(self)) for accurate signature.

push(line)
    Send a line of input to the transformer, returning the transformed input or None if the transformer is waiting for more input.
    Must be overridden by subclasses.
    Implementations may raise SyntaxError if the input is invalid. No other exceptions may be raised.

reset()
    Return, transformed any lines that the transformer has accumulated, and reset its internal state.
    Must be overridden by subclasses.

class IPython.core.inputtransformer.assemble_python_lines
    Bases: IPython.core.inputtransformer.TokenInputTransformer

__init__()
    Initialize self. See help(type(self)) for accurate signature.

8.21.2 12 Functions

IPython.core.inputtransformer.assemble_logical_lines()
Join lines following explicit line continuations()

IPython.core.inputtransformer.escaped_commands(line)
Transform escaped commands - %magic, !system, ?help + various autocalls.

IPython.core.inputtransformer.has_comment(src)
Indicate whether an input line has (i.e. ends in, or is) a comment.
This uses tokenize, so it can distinguish comments from # inside strings.

Parameters src (string) – A single line input string.
Returns comment – True if source has a comment.
Return type bool

IPython.core.inputtransformer.ends_in_comment_or_string(src)
Indicates whether or not an input line ends in a comment or within a multiline string.

Parameters src (string) – A single line input string.
Returns comment – True if source ends in a comment or multiline string.
Return type bool

IPython.core.inputtransformer.help_end(line)
Translate lines with ?? at the end

IPython.core.inputtransformer.cellmagic(extend_on_blank_line=False)
Captures & transforms cell magics.
After a cell magic is started, this stores up any lines it gets until it is reset (sent None).
IPython.core.inputtransformer.\texttt{classic\_prompt}()  
Strip the >>>/. . . prompts of the Python interactive shell.

IPython.core.inputtransformer.\texttt{ipy\_prompt}()  
Strip IPython’s In [1]/...: prompts.

IPython.core.inputtransformer.\texttt{leading\_indent}()  
Remove leading indentation.

\begin{small}
If the first line starts with a spaces or tabs, the same whitespace will be removed from each following line until it is reset.
\end{small}

IPython.core.inputtransformer.\texttt{strip\_encoding\_cookie}()  
Remove encoding comment if found in first two lines

\begin{small}
If the first or second line has the \texttt{# coding: utf-8} comment, it will be removed.
\end{small}

IPython.core.inputtransformer.\texttt{assign\_from\_system}(\texttt{line})  
Transform assignment from system commands (e.g. files = !ls)

IPython.core.inputtransformer.\texttt{assign\_from\_magic}(\texttt{line})  
Transform assignment from magic commands (e.g. a = %who_ls)

\section*{8.22 Module: \texttt{core.interactiveshell}}

Main IPython class.

\subsection*{8.22.1 6 Classes}

\begin{description}
\item[\texttt{class IPython.core.interactiveshell.ProvisionalWarning}]
    \texttt{Bases: DeprecationWarning}  
    Warning class for unstable features

\item[\texttt{class IPython.core.interactiveshell.SpaceInInput}]
    \texttt{Bases: Exception}  

\item[\texttt{class IPython.core.interactiveshell.SeparateUnicode}](default_value=traitlets.Undefined, allow_none=False, read_only=None, help=None, config=None, **kwargs)
    Bases: \texttt{traitlets.traitlets.Unicode}  
    A Unicode subclass to validate separate_in, separate_out, etc.
    This is a Unicode based trait that converts ‘0’->” and ‘\n’->’\n’.

\item[\texttt{class IPython.core.interactiveshell.ExecutionResult}]
    \texttt{Bases: object}  
    The result of a call to \texttt{InteractiveShell.run\_cell()}  
    Stores information about what took place.
    \texttt{raise\_error}()
    Reraises error if \texttt{success} is \texttt{False}, otherwise does nothing
\end{description}
class IPython.core.interactiveshell.InteractiveShell (ipython_dir=None, profile_dir=None, user_module=None, user_ns=None, custom_exceptions=((), None), **kwargs)

Bases: traitlets.config.configurable.SingletonConfigurable

An enhanced, interactive shell for Python.

__init__ (ipython_dir=None, profile_dir=None, user_module=None, user_ns=None, custom_exceptions=((), None), **kwargs)

Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__ () method of Configurable before doing anything else and using super ():

class MyConfigurable (Configurable):
    def __init__ (self, config=None):
        super (MyConfigurable, self).__init__ (config=config)
        # Then any other code you need to finish initialization.

This ensures that instances will be configured properly.

all_ns_refs

Get a list of references to all the namespace dictionaries in which IPython might store a user-created object.

Note that this does not include the displayhook, which also caches objects from the output.

atexit_operations ()

This will be executed at the time of exit.

Cleanup operations and saving of persistent data that is done unconditionally by IPython should be performed here.

For things that may depend on startup flags or platform specifics (such as having readline or not), register a separate atexit function in the code that has the appropriate information, rather than trying to clutter

auto_rewrite_input (cmd)

Print to the screen the rewritten form of the user’s command.

This shows visual feedback by rewriting input lines that cause automatic calling to kick in, like:

```
/f x
```

into:

```
------> f(x)
```

after the user’s input prompt. This helps the user understand that the input line was transformed automatically by IPython.
call_pdb
Control auto-activation of pdb at exceptions

check_complete(code)
Return whether a block of code is ready to execute, or should be continued

Parameters

source (string) – Python input code, which can be multiline.

Returns

• status (str) – One of ‘complete’, ‘incomplete’, or ‘invalid’ if source is not a prefix of valid code.
• indent (str) – When status is ‘incomplete’, this is some whitespace to insert on the next line of the prompt.

clear_main_mod_cache()
Clear the cache of main modules.
Mainly for use by utilities like %reset.

Examples

In [15]: import IPython
In [16]: m = _ip.new_main_mod(IPython.__file__, ‘IPython’)  
In [17]: len(_ip._main_mod_cache) > 0  
Out[17]: True
In [18]: _ip.clear_main_mod_cache()  
In [19]: len(_ip._main_mod_cache) == 0  
Out[19]: True

complete(text, line=None, cursor_pos=None)
Return the completed text and a list of completions.

Parameters

• text (string) – A string of text to be completed on. It can be given as empty and instead a line/position pair are given. In this case, the completer itself will split the line like readline does.
• line (string, optional) – The complete line that text is part of.
• cursor_pos (int, optional) – The position of the cursor on the input line.

Returns

• text (string) – The actual text that was completed.
• matches (list) – A sorted list with all possible completions.

The optional arguments allow the completion to take more context into account, and are part of the low-level completion API.

This is a wrapper around the completion mechanism, similar to what readline does at the command line when the TAB key is hit. By exposing it as a method, it can be used by other non-readline environments (such as GUIs) for text completion.

Simple usage example:
In [1]: x = ‘hello’  
In [2]: _ip.complete(‘x.l’)  
Out[2]: (‘x.l’, [‘x.ljust’, ‘x.lower’, ‘x.lstrip’])
**debugger** *(force=**False**)*

Call the pdb debugger.

**Keywords:**

- **force**(*bool*) — by default, this routine checks the instance `call_pdb` flag and does not actually invoke the debugger if the flag is false. The ‘force’ option forces the debugger to activate even if the flag is false.

**debugger_cls**

alias of `IPython.core.debugger.Pdb`

**define_macro** *(name, themacro)*

Define a new macro

**Parameters**

- **name**(*str*) — The name of the macro.
- **themacro**(*str* or `Macro`) — The action to do upon invoking the macro. If a string, a new `Macro` object is created by passing the string to it.

**del_var** *(varname, by_name=**False**)*

Delete a variable from the various namespaces, so that, as far as possible, we’re not keeping any hidden references to it.

**Parameters**

- **varname**(*str*) — The name of the variable to delete.
- **by_name**(*bool*) — If True, delete variables with the given name in each namespace. If False (default), find the variable in the user namespace, and delete references to it.

**drop_by_id** *(variables)*

Remove a dict of variables from the user namespace, if they are the same as the values in the dictionary.

This is intended for use by extensions: variables that they’ve added can be taken back out if they are unloaded, without removing any that the user has overwritten.

**Parameters**

- **variables**(*dict*) — A dictionary mapping object names (as strings) to the objects.

**enable_matplotlib** *(gui=None)*

Enable interactive matplotlib and inline figure support.

This takes the following steps:

1. select the appropriate eventloop and matplotlib backend
2. set up matplotlib for interactive use with that backend
3. configure formatters for inline figure display
4. enable the selected gui eventloop

**Parameters**

- **gui**(*optional, string*) — If given, dictates the choice of matplotlib GUI backend to use (should be one of IPython’s supported backends, ‘qt’, ‘osx’, ‘tk’, ‘gtk’, ‘wx’ or ‘inline’), otherwise we use the default chosen by matplotlib (as dictated by the matplotlib build-time options plus the user’s matplotlibrc configuration file). Note that not all backends make sense in all contexts, for example a terminal ipython can’t display figures inline.

**enable_pylab** *(gui=None, import_all=True, welcome_message=False)*

Activate pylab support at runtime.
This turns on support for matplotlib, preloads into the interactive namespace all of numpy and pylab, and configures IPython to correctly interact with the GUI event loop. The GUI backend to be used can be optionally selected with the optional \texttt{gui} argument.

This method only adds preloading the namespace to InteractiveShell.enable_matplotlib.

**Parameters**

- \texttt{gui} (optional, string) – If given, dictates the choice of matplotlib GUI backend to use (should be one of IPython’s supported backends, ‘qt’, ‘osx’, ‘tk’, ‘gtk’, ‘wx’ or ‘inline’), otherwise we use the default chosen by matplotlib (as dictated by the matplotlib build-time options plus the user’s matplotlibrc configuration file). Note that not all backends make sense in all contexts, for example a terminal ipython can’t display figures inline.

- \texttt{import_all} (optional, bool, default: True) – Whether to do \texttt{from numpy import *} and \texttt{from pylab import *} in addition to module imports.

- \texttt{welcome_message} (deprecated) – This argument is ignored, no welcome message will be displayed.

\texttt{ev(expr)}

Evaluate python expression \texttt{expr} in user namespace.

Returns the result of evaluation

\texttt{ex(cmd)}

Execute a normal python statement in user namespace.

\texttt{excepthook(etype, value, tb)}

One more defense for GUI apps that call sys.excepthook.

GUI frameworks like wxPython trap exceptions and call sys.excepthook themselves. I guess this is a feature that enables them to keep running after exceptions that would otherwise kill their mainloop. This is a bother for IPython which excepts to catch all of the program exceptions with a try: except: statement.

Normally, IPython sets sys.excepthook to a CrashHandler instance, so if any app directly invokes sys.excepthook, it will look to the user like IPython crashed. In order to work around this, we can disable the CrashHandler and replace it with this excepthook instead, which prints a regular traceback using our InteractiveTB. In this fashion, apps which call sys.excepthook will generate a regular-looking exception from IPython, and the CrashHandler will only be triggered by real IPython crashes.

This hook should be used sparingly, only in places which are not likely to be true IPython errors.

\texttt{extract_input_lines(range_str, raw=False)}

Return as a string a set of input history slices.

**Parameters**

- \texttt{range_str} (string) – The set of slices is given as a string, like “~5/6-~4/2 4:8 9”, since this function is for use by magic functions which get their arguments as strings. The number before the / is the session number: ~n goes n back from the current session.

- \texttt{raw} (bool, optional) – By default, the processed input is used. If this is true, the raw input history is used instead.

**Notes**

Slices can be described with two notations:

- \texttt{N:M} -> standard python form, means including items \texttt{N}…\texttt{(M-1)}.
- \texttt{N–M} -> include items \texttt{N}..\texttt{M} (closed endpoint).
**find_cell_magic** *(magic_name)*
Find and return a cell magic by name.
Returns None if the magic isn’t found.

**find_line_magic** *(magic_name)*
Find and return a line magic by name.
Returns None if the magic isn’t found.

**find_magic** *(magic_name, magic_kind='line')*
Find and return a magic of the given type by name.
Returns None if the magic isn’t found.

**find_user_code** *(target, raw=True, py_only=False, skip_encoding_cookie=True, search_ns=False)*
Get a code string from history, file, url, or a string or macro.
This is mainly used by magic functions.

**Parameters**

- **target** *(str)* – A string specifying code to retrieve. This will be tried respectively as:
  - ranges of input history (see %history for syntax), url, corresponding .py file, filename, or
  - an expression evaluating to a string or Macro in the user namespace.
- **raw** *(bool)* – If true (default), retrieve raw history. Has no effect on the other retrieval
  - mechanisms.
- **py_only** *(bool (default False))* – Only try to fetch python code, do not try
  - alternative methods to decode file if unicode fails.

**Returns**

- A string of code.
- ValueError is raised if nothing is found, and TypeError if it evaluates
  - to an object of another type. In each case, .args[0] is a printable
  - message.

**get_exception_only** *(exc_tuple=None)*
Return as a string (ending with a newline) the exception that just occurred, without any traceback.

**get_ipython** ()
Return the currently running IPython instance.

**getoutput** *(cmd, split=True, depth=0)*
Get output (possibly including stderr) from a subprocess.

**Parameters**

- **cmd** *(str)* – Command to execute (can not end in ‘&’, as background processes are not
  - supported.
- **split** *(bool, optional)* – If True, split the output into an IPython SList. Otherwise,
  - an IPython LSString is returned. These are objects similar to normal lists and strings, with
  - a few convenience attributes for easier manipulation of line-based output. You can use ‘?’
  - on them for details.
- **depth** *(int, optional)* – How many frames above the caller are the local variables
  - which should be expanded in the command string? The default (0) assumes that the ex-
  - pansion variables are in the stack frame calling this function.
**init_completer()**
Initialize the completion machinery.

This creates completion machinery that can be used by client code, either interactively in-process (typically triggered by the readline library), programmatically (such as in test suites) or out-of-process (typically over the network by remote frontends).

**init_deprecation_warnings()**
register default filter for deprecation warning.

This will allow deprecation warning of function used interactively to show warning to users, and still hide deprecation warning from libraries import.

**init_environment()**
Any changes we need to make to the user’s environment.

**init_history()**
Sets up the command history, and starts regular autosaves.

**init_logstart()**
Initialize logging in case it was requested at the command line.

**init_readline()**
DEPRECATED
Moved to terminal subclass, here only to simplify the init logic.

**init_user_ns()**
Initialize all user-visible namespaces to their minimum defaults.

Certain history lists are also initialized here, as they effectively act as user namespaces.

**Notes**

All data structures here are only filled in, they are NOT reset by this method. If they were not empty before, data will simply be added to them.

**init_virtualenv()**
Add a virtualenv to sys.path so the user can import modules from it. This isn’t perfect: it doesn’t use the Python interpreter with which the virtualenv was built, and it ignores the --no-site-packages option. A warning will appear suggesting the user installs IPython in the virtualenv, but for many cases, it probably works well enough.

Adapted from code snippets online.


**magic(** *arg_s**)
DEPRECATED. Use run_line_magic() instead.

Call a magic function by name.

Input: a string containing the name of the magic function to call and any additional arguments to be passed to the magic.

magic(‘name -opt foo bar’) is equivalent to typing at the ipython prompt:

In[1]: %name -opt foo bar

To call a magic without arguments, simply use magic(‘name’).

This provides a proper Python function to call IPython’s magics in any valid Python code you can type at the interpreter, including loops and compound statements.
**mktempfile** (:data:`None`, :prefix:`ipython_edit_`)  
Make a new tempfile and return its filename.

This makes a call to `tempfile.mkstemp` (created in a `tempfile.mkdtemp`), but it registers the created filename internally so `ipython` cleans it up at exit time.

Optional inputs:

- :data:`None`: if data is given, it gets written out to the temp file immediately, and the file is closed again.

**new_main_mod** (:filename:, :modname:)  
Return a new `main` module object for user code execution.

**filename** should be the path of the script which will be run in the module. Requests with the same `filename` will get the same module, with its namespace cleared.

**modname** should be the module name - normally either `__main__` or the basename of the file without the extension.

When scripts are executed via `%run`, we must keep a reference to their `__main__` module around so that Python doesn’t clear it, rendering references to module globals useless.

This method keeps said reference in a private dict, keyed by the absolute path of the script. This way, for multiple executions of the same script we only keep one copy of the namespace (the last one), thus preventing memory leaks from old references while allowing the objects from the last execution to be accessible.

**object_inspect** (:oname:, :detail_level=0)  
Get object info about `oname`

**object_inspect_mime** (:oname:, :detail_level=0)  
Get object info as a mimebundle of formatted representations.

A mimebundle is a dictionary, keyed by mime-type. It must always have the key `'text/plain'`.

**object_inspect_text** (:oname:, :detail_level=0)  
Get object info as formatted text

**prepare_user_module** (:user_module=None, :user_ns=None)  
Prepare the module and namespace in which user code will be run.

When IPython is started normally, both parameters are `None`: a new module is created automatically, and its __dict__ used as the namespace.

If only `user_module` is provided, its __dict__ is used as the namespace. If only `user_ns` is provided, a dummy module is created, and `user_ns` becomes the global namespace. If both are provided (as they may be when embedding), `user_ns` is the local namespace, and `user_module` provides the global namespace.

**Parameters**

- **user_module** (:module, optional) – The current user module in which IPython is being run. If None, a clean module will be created.

- **user_ns** (:dict, optional) – A namespace in which to run interactive commands.

**Returns**

**Return type** A tuple of `user_module` and `user_ns`, each properly initialised.

**push** (:variables:, :interactive=True)  
Inject a group of variables into the IPython user namespace.

**Parameters**

---

8.22. Module: `core.interactive Shell`  
433
• **variables** *(dict, str or list/tuple of str)* – The variables to inject into the user’s namespace. If a dict, a simple update is done. If a str, the string is assumed to have variable names separated by spaces. A list/tuple of str can also be used to give the variable names. If just the variable names are give (list/tuple/str) then the variable values looked up in the callers frame.

• **interactive** *(bool)* – If True (default), the variables will be listed with the **who** magic.

**register_magic_function** *(func, magic_kind='line', magic_name=None)*

Expose a standalone function as magic function for IPython.

This will create an IPython magic (line, cell or both) from a standalone function. The functions should have the following signatures:

* For line magics: `def f(line)`
* For cell magics: `def f(line, cell)`
* For a function that does both: `def f(line, cell=None)`

In the latter case, the function will be called with `cell==None` when invoked as `%f`, and with cell as a string when invoked as `%%f`.

**Parameters**

• **func** *(callable)* – Function to be registered as a magic.

• **magic_kind** *(str)* – Kind of magic, one of ‘line’, ‘cell’ or ‘line_cell’

• **magic_name** *(optional str)* – If given, the name the magic will have in the IPython namespace. By default, the name of the function itself is used.

**register_post_execute** *(func)*

DEPRECATED: Use `ip.events.register('post_run_cell', func)`

Register a function for calling after code execution.

**reset** *(new_session=True)*

Clear all internal namespaces, and attempt to release references to user objects.

If new_session is True, a new history session will be opened.

**reset_selective** *(regex=None)*

Clear selective variables from internal namespaces based on a specified regular expression.

**Parameters** **regex** *(string or compiled pattern, optional)* – A regular expression pattern that will be used in searching variable names in the users namespaces.

**restore_sys_module_state** ()

Restore the state of the sys module.

**run_ast_nodes** *(nodelist, cell_name, interactivity='last_expr', compiler=<built-in function compile>, result=None)*

Run a sequence of AST nodes. The execution mode depends on the interactivity parameter.

**Parameters**

• **nodelist** *(list)* – A sequence of AST nodes to run.

• **cell_name** *(str)* – Will be passed to the compiler as the filename of the cell. Typically the value returned by `ip.compile.cache(cell)`.

• **interactivity** *(str)* – ‘all’, ‘last’, ‘last_expr’ or ‘none’, specifying which nodes should be run interactively (displaying output from expressions). ‘last_expr’ will run the
last node interactively only if it is an expression (i.e. expressions in loops or other blocks are not displayed. Other values for this parameter will raise a ValueError.

- **compiler** *(callable)* – A function with the same interface as the built-in `compile()`, to turn the AST nodes into code objects. Default is the built-in `compile()`.

- **result** *(ExecutionResult, optional)* – An object to store exceptions that occur during execution.

Returns

- **True if an exception occurred while running code, False if it finished running.**

**run_cell** *(raw_cell, store_history=False, silent=False, shell_futures=True)*

Run a complete IPython cell.

**Parameters**

- **raw_cell** *(str)* – The code (including IPython code such as %magic functions) to run.

- **store_history** *(bool)* – If True, the raw and translated cell will be stored in IPython’s history. For user code calling back into IPython’s machinery, this should be set to False.

- **silent** *(bool)* – If True, avoid side-effects, such as implicit displayhooks and and logging. silent=True forces store_history=False.

- **shell_futures** *(bool)* – If True, the code will share future statements with the interactive shell. It will both be affected by previous __future__ imports, and any __future__ imports in the code will affect the shell. If False, __future__ imports are not shared in either direction.

**Returns** result

**Return type** *ExecutionResult*

**run_cell_magic** *(magic_name, line, cell)*

Execute the given cell magic.

**Parameters**

- **magic_name** *(str)* – Name of the desired magic function, without ‘%’ prefix.

- **line** *(str)* – The rest of the first input line as a single string.

- **cell** *(str)* – The body of the cell as a (possibly multiline) string.

**run_code** *(code_obj, result=None)*

Execute a code object.

When an exception occurs, self.showtraceback() is called to display a traceback.

**Parameters**

- **code_obj** *(code object)* – A compiled code object, to be executed

- **result** *(ExecutionResult, optional)* – An object to store exceptions that occur during execution.

**Returns**

- **False** *(successful execution.)*

- **True** *(an error occurred.)*
run_line_magic(magic_name, line)

Execute the given line magic.

Parameters

- **magic_name** (str) – Name of the desired magic function, without ‘%’ prefix.
- **line** (str) – The rest of the input line as a single string.

runcode(code_obj, result=None)

Execute a code object.

When an exception occurs, self.showtraceback() is called to display a traceback.

Parameters

- **code_obj** (code object) – A compiled code object, to be executed
- **result** (ExecutionResult, optional) – An object to store exceptions that occur during execution.

Returns

- **False** (successful execution)
- **True** (an error occurred)

safe_execfile(fname, *where, **kw)

A safe version of the builtin execfile().

This version will never throw an exception, but instead print helpful error messages to the screen. This only works on pure Python files with the .py extension.

Parameters

- **fname** (string) – The name of the file to be executed.
- **where** (tuple) – One or two namespaces, passed to execfile() as (globals,locals). If only one is given, it is passed as both.
- **exit_ignore** (bool (False)) – If True, then silence SystemExit for non-zero status (it is always silenced for zero status, as it is so common).
- **raise_exceptions** (bool (False)) – If True raise exceptions everywhere. Meant for testing.
- **shell_futures** (bool (False)) – If True, the code will share future statements with the interactive shell. It will both be affected by previous __future__ imports, and any __future__ imports in the code will affect the shell. If False, __future__ imports are not shared in either direction.

safe_execfile_ipy(fname, shell_futures=False, raise_exceptions=False)

Like safe_execfile, but for .ipy or .ipynb files with IPython syntax.

Parameters

- **fname** (str) – The name of the file to execute. The filename must have a .ipy or .ipynb extension.
- **shell_futures** (bool (False)) – If True, the code will share future statements with the interactive shell. It will both be affected by previous __future__ imports, and any __future__ imports in the code will affect the shell. If False, __future__ imports are not shared in either direction.
- **raise_exceptions** (bool (False)) – If True raise exceptions everywhere. Meant for testing.
safe_run_module (mod_name, where)
A safe version of runpy.run_module().

This version will never throw an exception, but instead print helpful error messages to the screen.
SystemExit exceptions with status code 0 or None are ignored.

Parameters
  • mod_name (string) – The name of the module to be executed.
  • where (dict) – The globals namespace.

save_sys_module_state()
Save the state of hooks in the sys module.
This has to be called after self.user_module is created.

set_autoindent (value=None)
Set the autoindent flag.
If called with no arguments, it acts as a toggle.

set_completer_frame (frame=None)
Set the frame of the completer.

set_custom_completer (completer, pos=0)
Adds a new custom completer function.
The position argument (defaults to 0) is the index in the completers list where you want the completer to be inserted.

set_custom_exc (exc_tuple, handler)
Set a custom exception handler, which will be called if any of the exceptions in exc_tuple occur in the
mainloop (specifically, in the run_code() method).

Parameters
  • exc_tuple (tuple of exception classes) – A tuple of exception classes, for
    which to call the defined handler. It is very important that you use a tuple, and NOT A
    LIST here, because of the way Python’s except statement works. If you only want to trap
    a single exception, use a singleton tuple:

      exc_tuple == (MyCustomException,)

  • handler (callable) – handler must have the following signature:

    def my_handler(self, etype, value, tb, tb_offset=None):
      ...
    return structured_traceback

Your handler must return a structured traceback (a list of strings), or None.

This will be made into an instance method (via types.MethodType) of IPython itself, and it
will be called if any of the exceptions listed in the exc_tuple are caught. If the handler is
None, an internal basic one is used, which just prints basic info.

To protect IPython from crashes, if your handler ever raises an exception or returns an
invalid result, it will be immediately disabled.

• WARNING (by putting in your own exception handler into
  IPython's main) –
• loop, you run a very good chance of nasty crashes. This
  (execution) –
• should only be used if you really know what you are doing.
  (facility) –

**set_hook** *(name, hook) → sets an internal IPython hook.*

IPython exposes some of its internal API as user-modifiable hooks. By adding your function to one of these hooks, you can modify IPython’s behavior to call at runtime your own routines.

**set_next_input** *(s, replace=False)*

Sets the ‘default’ input string for the next command line.

Example:

```python
In [1]: _ip.set_next_input("Hello World")
In [2]: Hello Word_  # cursor is here
```

**show_usage** *( )*

Show a usage message

**show_usage_error** *(exc)*

Show a short message for UsageErrors

These are special exceptions that shouldn’t show a traceback.

**showindentationerror** *( )*

Called by run_cell when there’s an IndentationError in code entered at the prompt.

This is overridden in TerminalInteractiveShell to show a message about the `%paste` magic.

**showsyntaxerror** *(filename=None)*

Display the syntax error that just occurred.

This doesn’t display a stack trace because there isn’t one.

If a filename is given, it is stuffed in the exception instead of what was there before (because Python’s parser always uses “<string>” when reading from a string).

**showtraceback** *(exc_tuple=None, filename=None, tb_offset=None, exception_only=False)*

Display the exception that just occurred.

If nothing is known about the exception, this is the method which should be used throughout the code for presenting user tracebacks, rather than directly invoking the InteractiveTB object.

A specific showsyntaxerror() also exists, but this method can take care of calling it if needed, so unless you are explicitly catching a SyntaxError exception, don’t try to analyze the stack manually and simply call this method.

**system** *(cmd)*

Call the given cmd in a subprocess, piping stdout/err

**system_piped** *(cmd)*

Call the given cmd in a subprocess, piping stdout/err

**system_raw** *(cmd)*

Call the given cmd in a subprocess using os.system on Windows or subprocess.call using the system shell on other platforms.
Parameters `cmd` *(str)* – Command to execute.

**transform_ast** *(node)*

Apply the AST transformations from self.ast_transformers

Parameters `node` *(ast.Node)* – The root node to be transformed. Typically called with the ast.Module produced by parsing user input.

Returns

- An ast.Node corresponding to the node it was called with. Note that it
- may also modify the passed object, so don’t rely on references to the
- original AST.

**user_expressions** *(expressions)*

Evaluate a dict of expressions in the user’s namespace.

Parameters `expressions` *(dict)* – A dict with string keys and string values. The expression values should be valid Python expressions, each of which will be evaluated in the user namespace.

Returns

- A dict, keyed like the input expressions dict, with the rich mime-typed
- display_data of each value.

**var_expand** *(cmd, depth=0, formatter=<IPython.utils.text.DollarFormatter object>)*

Expand python variables in a string.

The depth argument indicates how many frames above the caller should be walked to look for the local namespace where to expand variables.

The global namespace for expansion is always the user’s interactive namespace.

**write** *(data)*

DEPRECATED: Write a string to the default output

**write_err** *(data)*

DEPRECATED: Write a string to the default error output

**class** : IPython.core.interactiveshell.InteractiveShellABC

Bases: abc._NewBase

An abstract base class for InteractiveShell.

### 8.22.2 2 Functions

IPython.core.interactiveshell.sphinxify()

IPython.core.interactiveshell.get_default_colors()

DEPRECATED

### 8.23 Module: core.logger

Logger class for IPython’s logging facilities.
8.23.1 1 Class

```python
class IPython.core.logger.Logger (home_dir, logfname='Logger.log', loghead='', logmode='over')
```

Bases: object

A Logfile class with different policies for file creation

```python
__init__ (home_dir, logfname='Logger.log', loghead='', logmode='over')
```

Initialize self. See help(type(self)) for accurate signature.

```python
close_log ()
```

Fully stop logging and close log file.

In order to start logging again, a new logstart() call needs to be made, possibly (though not necessarily) with a new filename, mode and other options.

```python
log (line_mod, line_ori)
```

Write the sources to a log.

Inputs:

- line_mod: possibly modified input, such as the transformations made by input prefilters or input handlers of various kinds. This should always be valid Python.
- line_ori: unmodified input line from the user. This is not necessarily valid Python.

```python
log_write (data, kind='input')
```

Write data to the log file, if active

```python
logstart (logfname=None, loghead=None, logmode=None, log_output=False, timestamp=False, log_raw_input=False)
```

Generate a new log-file with a default header.

Raises RuntimeError if the log has already been started

```python
logstate ()
```

Print a status message about the logger.

```python
logstop ()
```

Fully stop logging and close log file.

In order to start logging again, a new logstart() call needs to be made, possibly (though not necessarily) with a new filename, mode and other options.

```python
switch_log (val)
```

Switch logging on/off. val should be ONLY a boolean.

8.24 Module: core.macro

Support for interactive macros in IPython

8.24.1 1 Class

```python
class IPython.core.macro.Macro (code)
```

Bases: object

Simple class to store the value of macros as strings.

Macro is just a callable that executes a string of IPython input when called.
__init__(code)
store the macro value, as a single string which can be executed

8.25 Module: core.magic

Magic functions for InteractiveShell.

8.25.1 4 Classes

class IPython.core.magic.Bunch
    Bases: object

class IPython.core.magic.MagicsManager
    (shell=\texttt{None}, config=\texttt{None}, user_magics=\texttt{None}, **traits)
    Bases: traitlets.config.configurable.Configurable
    Object that handles all magic-related functionality for IPython.

__init__(shell=\texttt{None}, config=\texttt{None}, user_magics=\texttt{None}, **traits)
Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the \texttt{__init__() method} of Configurable before doing anything else and using super():

\begin{verbatim}
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
# Then any other code you need to finish initialization.
\end{verbatim}

This ensures that instances will be configured properly.

auto_status()
Return descriptive string with automagic status.

lsmagic()
Return a dict of currently available magic functions.

The return dict has the keys ‘line’ and ‘cell’, corresponding to the two types of magics we support. Each value is a list of names.

lsmagic_docs (brief=False, missing= ”)
Return dict of documentation of magic functions.

The return dict has the keys ‘line’ and ‘cell’, corresponding to the two types of magics we support. Each value is a dict keyed by magic name whose value is the function docstring. If a docstring is unavailable, the value of missing is used instead.

If brief is True, only the first line of each docstring will be returned.
**register** (*magic_objects*)

Register one or more instances of Magics.

Take one or more classes or instances of classes that subclass the main `core.Magic` class, and register them with IPython to use the magic functions they provide. The registration process will then ensure that any methods that have decorated to provide line and/or cell magics will be recognized with the `%x`/`%%x` syntax as a line/cell magic respectively.

If classes are given, they will be instantiated with the default constructor. If your classes need a custom constructor, you should instantiate them first and pass the instance.

The provided arguments can be an arbitrary mix of classes and instances.

**Parameters**

`magic_objects` *(one or more classes or instances)*

**register_alias**(alias_name, magic_name, magic_kind='line')

Register an alias to a magic function.

The alias is an instance of `MagicAlias`, which holds the name and kind of the magic it should call. Binding is done at call time, so if the underlying magic function is changed the alias will call the new function.

**Parameters**

- `alias_name` *(str)* – The name of the magic to be registered.
- `magic_name` *(str)* – The name of an existing magic.
- `magic_kind` *(str)* – Kind of magic, one of ‘line’ or ‘cell’

**register_function**(func, magic_kind='line', magic_name=None)

Expose a standalone function as magic function for IPython.

This will create an IPython magic (line, cell or both) from a standalone function. The functions should have the following signatures:

- For line magics: `def f(line)`
- For cell magics: `def f(line, cell)`
- For a function that does both: `def f(line, cell=None)`

In the latter case, the function will be called with `cell==None` when invoked as `%f`, and with `cell` as a string when invoked as `%%f`.

**Parameters**

- `func` *(callable)* – Function to be registered as a magic.
- `magic_kind` *(str)* – Kind of magic, one of ‘line’, ‘cell’ or ‘line_cell’
- `magic_name` *(optional str)* – If given, the name the magic will have in the IPython namespace. By default, the name of the function itself is used.

class IPython.core.magic.Magics(shell=None, **kwargs)

Base class for implementing magic functions.

Shell functions which can be reached as `%function_name`. All magic functions should accept a string, which they can parse for their own needs. This can make some functions easier to type, eg `%cd ..` vs. `%cd("../")`

Classes providing magic functions need to subclass this class, and they MUST:
• Use the method decorators `@line_magic` and `@cell_magic` to decorate individual methods as magic functions, AND

• Use the class decorator `@magics_class` to ensure that the magic methods are properly registered at the instance level upon instance initialization.

See `magic_functions` for examples of actual implementation classes.

```python
__init__(shell=None, **kwargs)
Create a configurable given a config config.

Parameters

• `config (Config)` – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• `parent (Configurable instance, optional)` – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

`arg_err(func)`
Print docstring if incorrect arguments were passed

`default_option(fn, optstr)`
Make an entry in the options_table for fn, with value optstr

`format_latex(strng)`
Format a string for latex inclusion.

`parse_options(arg_str, opt_str, *long_opts, **kw)`
Parse options passed to an argument string.

The interface is similar to that of `getopt.getopt()`, but it returns a `Struct` with the options as keys and the stripped argument string still as a string.

arg_str is quoted as a true sys.argv vector by using shlex.split. This allows us to easily expand variables, glob files, quote arguments, etc.

Parameters

• `arg_str(str)` – The arguments to parse.

• `opt_str(str)` – The options specification.

• `mode(str, default 'string')` – If given as ‘list’, the argument string is returned as a list (split on whitespace) instead of a string.

• `list_all(bool, default False)` – Put all option values in lists. Normally only options appearing more than once are put in a list.

• `posix(bool, default True)` – Whether to split the input line in POSIX mode or not, as per the conventions outlined in the shlex module from the standard library.
class IPython.core.magic.MagicAlias(shell, magic_name, magic_kind)
Bases: object

An alias to another magic function.

An alias is determined by its magic name and magic kind. Lookup is done at call time, so if the underlying magic changes the alias will call the new function.

Use the MagicsManager.register_alias() method or the %alias_magic magic function to create and register a new alias.

__init__(shell, magic_name, magic_kind)
Initialize self. See help(type(self)) for accurate signature.

8.25.2 6 Functions

IPython.core.magic.on_off(tag)
Return an ON/OFF string for a 1/0 input. Simple utility function.

IPython.core.magic.compress_dhist(dh)
Compress a directory history into a new one with at most 20 entries.

Return a new list made from the first and last 10 elements of dhist after removal of duplicates.

IPython.core.magic.needs_local_scope(func)
Decorator to mark magic functions which need to local scope to run.

IPython.core.magic.magics_class(cls)
Class decorator for all subclasses of the main Magics class.

Any class that subclasses Magics must also apply this decorator, to ensure that all the methods that have been decorated as line/cell magics get correctly registered in the class instance. This is necessary because when method decorators run, the class does not exist yet, so they temporarily store their information into a module global. Application of this class decorator copies that global data to the class instance and clears the global.

Obviously, this mechanism is not thread-safe, which means that the creation of subclasses of Magic should only be done in a single-thread context. Instantiation of the classes has no restrictions. Given that these classes are typically created at IPython startup time and before user application code becomes active, in practice this should not pose any problems.

IPython.core.magic.record_magic(dct, magic_kind, magic_name, func)
Utility function to store a function as a magic of a specific kind.

Parameters

- dct (dict) – A dictionary with ‘line’ and ‘cell’ subdicts.
- magic_kind (str) – Kind of magic to be stored.
- magic_name (str) – Key to store the magic as.
- func (function) – Callable object to store.

IPython.core.magic.validate_type(magic_kind)
Ensure that the given magic_kind is valid.

Check that the given magic_kind is one of the accepted spec types (stored in the global magic_spec), raise ValueError otherwise.
8.26 Module: `core.magic_arguments`

A decorator-based method of constructing IPython magics with `argparse` option handling.

New magic functions can be defined like so:

```python
from IPython.core.magic_arguments import (argument, magic_arguments, parse_argstring)

@magic_arguments()
@argument('-o', '--option', help='An optional argument.')
@argument('arg', type=int, help='An integer positional argument.')
def magic_cool(self, arg):
    """ A really cool magic command.
    """
    args = parse_argstring(magic_cool, arg)
    ...
```

The `@magic_arguments` decorator marks the function as having `argparse` arguments. The `@argument` decorator adds an argument using the same syntax as `argparse`’s `add_argument()` method. More sophisticated uses may also require the `@argument_group` or `@kwds` decorator to customize the formatting and the parsing.

Help text for the magic is automatically generated from the docstring and the arguments:

```bash
In[1]: %cool?
%cool [-o OPTION] arg
A really cool magic command.
positional arguments:
   arg An integer positional argument.
optional arguments:
   -o OPTION, --option OPTION
       An optional argument.
```

Inheritance diagram:
8.26.1 8 Classes

```python
class IPython.core.magic_arguments.MagicArgumentParser
```

Bases: argparse.ArgumentParser

An ArgumentParser tweaked for use by IPython magics.

```python
__init__(prog=None, usage=None, description=None, epilog=None, parents=None, formatter_class=<class 'IPython.core.magic_arguments.MagicHelpFormatter'>, prefix_chars='-', argument_default=None, conflict_handler='error', add_help=False)
```

Initialize self. See help(type(self)) for accurate signature.

```python
def error(message)
```

Raise a catchable error instead of exiting.

```python
def parse_argstring(argstring)
```

Split a string into an argument list and parse that argument list.

```python
class IPython.core.magic_arguments.ArgDecorator
```

Bases: object

Base class for decorators to add ArgumentParser information to a method.

```python
add_to_parser(parser, group)
```

Add this object’s information to the parser, if necessary.

```python
class IPython.core.magic_arguments.magic_arguments(name=None)
```

Bases: IPython.core.magic_arguments.ArgDecorator

Mark the magic as having argparser arguments and possibly adjust the name.

```python
__init__(name=None)
```

Initialize self. See help(type(self)) for accurate signature.

```python
class IPython.core.magic_arguments.ArgMethodWrapper(*args, **kwds)
```

Bases: IPython.core.magic_arguments.ArgDecorator

Base class to define a wrapper for ArgumentParser method.

Child class must define either _method_name or add_to_parser.

```python
__init__(*args, **kwds)
```

Initialize self. See help(type(self)) for accurate signature.

```python
add_to_parser(parser, group)
```

Add this object’s information to the parser.

```python
class IPython.core.magic_arguments.argument(*args, **kwds)
```

Bases: IPython.core.magic_arguments.ArgMethodWrapper

Store arguments and keywords to pass to add_argument().

Instances also serve to decorate command methods.

```python
class IPython.core.magic_arguments.defaults(*args, **kwds)
```

Bases: IPython.core.magic_arguments.ArgMethodWrapper

```
Store arguments and keywords to pass to set_defaults().
Instances also serve to decorate command methods.

```python
class IPython.core.magic_arguments.argument_group(*args, **kwds)
    Bases: IPython.core.magic_arguments.ArgMethodWrapper

Store arguments and keywords to pass to add_argument_group().
Instances also serve to decorate command methods.

    add_to_parser (parser, group)
        Add this object’s information to the parser.
```

class IPython.core.magic_arguments.kwds(**kwds)
    Bases: IPython.core.magic_arguments.ArgDecorator

Provide other keywords to the sub-parser constructor.

    __init__ (**kwds)
        Initialize self. See help(type(self)) for accurate signature.
```

8.26.2 3 Functions

IPython.core.magic_arguments.construct_parser (magic_func)
Construct an argument parser using the function decorations.

IPython.core.magic_arguments.parse_argstring (magic_func, argstring)
Parse the string of arguments for the given magic function.

IPython.core.magic_arguments.real_name (magic_func)
Find the real name of the magic.
```

8.27 Module: core.oinspect

Tools for inspecting Python objects.
Uses syntax highlighting for presenting the various information elements.
Similar in spirit to the inspect module, but all calls take a name argument to reference the name under which an object is being read.
### 8.27.1 1 Class

```python
class IPython.core.oinspect.Inspector(
    color_table={": <IPython.utils.coloransi.ColorScheme object>},
    'LightBG': <IPython.utils.coloransi.ColorScheme object>,
    'Linux': <IPython.utils.coloransi.ColorScheme object>,
    'Neutral': <IPython.utils.coloransi.ColorScheme object>,
    'NoColor': <IPython.utils.coloransi.ColorScheme object>,
    code_color_table={": <IPython.utils.coloransi.ColorScheme object>},
    'LightBG': <IPython.utils.coloransi.ColorScheme object>,
    'Linux': <IPython.utils.coloransi.ColorScheme object>,
    'Neutral': <IPython.utils.coloransi.ColorScheme object>,
    'NoColor': <IPython.utils.coloransi.ColorScheme object>,
    scheme='NoColor', str_detail_level=0, parent=None,
    config=None)
```

**Bases:** `IPython.utils.colorable.Colorable`

```python
__init__(color_table={": <IPython.utils.coloransi.ColorScheme object>},
    'LightBG': <IPython.utils.coloransi.ColorScheme object>,
    'Linux': <IPython.utils.coloransi.ColorScheme object>,
    'Neutral': <IPython.utils.coloransi.ColorScheme object>,
    'NoColor': <IPython.utils.coloransi.ColorScheme object>,
    code_color_table={": <IPython.utils.coloransi.ColorScheme object>},
    'LightBG': <IPython.utils.coloransi.ColorScheme object>,
    'Linux': <IPython.utils.coloransi.ColorScheme object>,
    'Neutral': <IPython.utils.coloransi.ColorScheme object>,
    'NoColor': <IPython.utils.coloransi.ColorScheme object>,
    scheme='NoColor', str_detail_level=0, parent=None, config=None)
```

Create a configurable given a config `config`.

**Parameters**

- `config` (`Config`) – If this is empty, default values are used. If `config` is a `Config` instance, it will be used to configure the instance.
- `parent` (`Configurable instance, optional`) – The parent `Configurable` instance of this object.

**Notes**

Subclasses of `Configurable` must call the `__init__() method of `Configurable before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

```python
info(obj, oname=", formatter=None, info=None, detail_level=0)
```

DEPRECATED. Compute a dict with detailed information about an object.
**noinfo** *(msg, oname)*
Generic message when no information is found.

**pdef** *(obj, oname="")*
Print the call signature for any callable object.
If the object is a class, print the constructor information.

**pdoc** *(obj, oname="", formatter=None)*
Print the docstring for any object.
Optional: -`formatter`: a function to run the docstring through for specially formatted docstrings.

### Examples

In [1]: class NoInit: ...: pass
In [2]: class NoDoc: ...: def __init__(self): ...: pass

In [3]: %pdoc NoDoc No documentation found for NoDoc
In [4]: %pdoc NoInit No documentation found for NoInit
In [5]: obj = NoInit()
In [6]: %pdoc obj No documentation found for obj
In [5]: obj2 = NoDoc()
In [6]: %pdoc obj2 No documentation found for obj2

**pfile** *(obj, oname="")*
Show the whole file where an object was defined.

**pinfo** *(obj, oname="", formatter=None, info=None, detail_level=0, enable_html_pager=True)*
Show detailed information about an object.
Optional arguments:
- `oname`: name of the variable pointing to the object.
- **`formatter`: callable (optional)** A special formatter for docstrings.
  The formatter is a callable that takes a string as an input and returns either a formatted string or a mime type bundle in the form of a dictionary.
  Although the support of custom formatter returning a string instead of a mime type bundle is deprecated.
- `info`: a structure with some information fields which may have been precomputed already.
- `detail_level`: if set to 1, more information is given.

**psearch** *(pattern, ns_table, ns_search=[], ignore_case=False, show_all=False)*
Search namespaces with wildcards for objects.
Arguments:
- `pattern`: string containing shell-like wildcards to use in namespace searches and optionally a type specification to narrow the search to objects of that type.
- `ns_table`: dict of name->namespaces for search.
Optional arguments:
- `ns_search`: list of namespace names to include in search.
• ignore_case(False): make the search case-insensitive.
• show_all(False): show all names, including those starting with underscores.

```
psource (obj, oname="")
```

Print the source code for an object.

## 8.27.2 11 Functions

**IPython.core.oinspect.pylight**(code)

**IPython.core.oinspect.object_info**(**kw**)

Make an object info dict with all fields present.

**IPython.core.oinspect.get_encoding**(obj)

Get encoding for python source file defining obj

Returns None if obj is not defined in a sourcefile.

**IPython.core.oinspect.getdoc**(obj)

Stable wrapper around inspect.getdoc.

This can’t crash because of attribute problems.

It also attempts to call a getdoc() method on the given object. This allows objects which provide their docstrings via non-standard mechanisms (like Pyro proxies) to still be inspected by ipython’s `?` system.

**IPython.core.oinspect.getsource**(obj, oname="")

Wrapper around inspect.getsource.

This can be modified by other projects to provide customized source extraction.

**Parameters**

• obj (object) – an object whose source code we will attempt to extract
• oname (str) – (optional) a name under which the object is known

**Returns**

src

**Return type**

unicode or None

**IPython.core.oinspect.is_simple_callable**(obj)

True if obj is a function ()

**IPython.core.oinspect.getargspec**(obj)


In addition to functions and methods, this can also handle objects with a `__call__` attribute.

**IPython.core.oinspect.format_argspec**(argspec)

Format argspec, convenience wrapper around inspect’s.

This takes a dict instead of ordered arguments and calls inspect.format_argspec with the arguments in the necessary order.

**IPython.core.oinspect.call_tip**(oinfo, format_call=True)

Extract call tip data from an oinfo dict.

**Parameters**

• oinfo (dict) –
• format_call (bool, optional) – If True, the call line is formatted and returned as a string. If not, a tuple of (name, argspec) is returned.
8.28 Module: core.page

Paging capabilities for IPython.core

Notes

For now this uses IPython hooks, so it can’t be in IPython.utils. If we can get rid of that dependency, we could move it there. ——

8.28.1 10 Functions

IPython.core.page.display_page(strng, start=0, screen_lines=25)
Just display, no paging. screen_lines is ignored.

IPython.core.page.as_hook(page_func)
Wrap a pager func to strip the self arg
so it can be called as a hook.

IPython.core.page.page_dumb(strng, start=0, screen_lines=25)
Very dumb ‘pager’ in Python, for when nothing else works.
Only moves forward, same interface as page(), except for pager_cmd and mode.
**IPython.core.page.pager_page** *(strng, start=0, screen_lines=0, pager_cmd=None)*

Display a string, piping through a pager after a certain length.

- strng can be a mime-bundle dict, supplying multiple representations, keyed by mime-type.
- The screen_lines parameter specifies the number of usable lines of your terminal screen (total lines minus lines you need to reserve to show other information).
- If you set screen_lines to a number <=0, page() will try to auto-determine your screen size and will only use up to (screen_size+screen_lines) for printing, paging after that. That is, if you want auto-detection but need to reserve the bottom 3 lines of the screen, use screen_lines = -3, and for auto-detection without any lines reserved simply use screen_lines = 0.
- If a string won’t fit in the allowed lines, it is sent through the specified pager command. If none given, look for PAGER in the environment, and ultimately default to less.
- If no system pager works, the string is sent through a ‘dumb pager’ written in python, very simplistic.

**IPython.core.page.page** *(data, start=0, screen_lines=0, pager_cmd=None)*

Display content in a pager, piping through a pager after a certain length.

- data can be a mime-bundle dict, supplying multiple representations, keyed by mime-type, or text.
- Pager is dispatched via the show_in_pager IPython hook. If no hook is registered, pager_page will be used.

**IPython.core.page.page_file** *(fname, start=0, pager_cmd=None)*

Page a file, using an optional pager command and starting line.

**IPython.core.page.get_pager_cmd** *(pager_cmd=None)*

Return a pager command.

- Makes some attempts at finding an OS-correct one.

**IPython.core.page.get_pager_start** *(pager, start)*

Return the string for paging files with an offset.

- This is the ‘+N’ argument which less and more (under Unix) accept.

**IPython.core.page.page_more** ()

**IPython.core.page.snip_print** *(str, width=75, print_full=0, header=”)*

Print a string snipping the midsection to fit in width.

- print_full: mode control:
  - 0: only snip long strings
  - 1: send to page() directly.
  - 2: snip long strings and ask for full length viewing with page()

Return 1 if snipping was necessary, 0 otherwise.

### 8.29 Module: core.payload

Payload system for IPython.

Authors:

- Fernando Perez
- Brian Granger
8.29.1 1 Class

class IPython.core.payload.PayloadManager(**kwargs)
    Bases: traitlets.config.configurable.Configurable

write_payload (data, single=True)
    Include or update the specified data payload in the PayloadManager.
    If a previous payload with the same source exists and single is True, it will be overwritten with the new one.

8.30 Module: core.payloadpage

A payload based version of page.

8.30.1 2 Functions

IPython.core.payloadpage.page (strng, start=0, screen_lines=0, pager_cmd=None)
    Print a string, piping through a pager.
    This version ignores the screen_lines and pager_cmd arguments and uses IPython’s payload system instead.

    Parameters

    • strng (str or mime-dict) – Text to page, or a mime-type keyed dict of already formatted data.

    • start (int) – Starting line at which to place the display.

IPython.core.payloadpage.install_payload_page ()
    DEPRECATED, use show_in_pager hook
    Install this version of page as IPython.core.page.page.

8.31 Module: core.prefilter

Prefiltering components.

Prefilters transform user input before it is exec’d by Python. These transforms are used to implement additional syntax such as !ls and %magic.

8.31.1 16 Classes

class IPython.core.prefilter.PrefilterError
    Bases: Exception

class IPython.core.prefilter.PrefilterManager (shell=None, **kwargs)
    Bases: traitlets.config.configurable.Configurable

    Main prefilter component.

    The IPython prefilter is run on all user input before it is run. The prefilter consumes lines of input and produces transformed lines of input.

    The implementation consists of two phases:
1. Transformers
2. Checkers and handlers

Over time, we plan on deprecating the checkers and handlers and doing everything in the transformers.

The transformers are instances of `PrefilterTransformer` and have a single method `transform()` that takes a line and returns a transformed line. The transformation can be accomplished using any tool, but our current ones use regular expressions for speed.

After all the transformers have been run, the line is fed to the checkers, which are instances of `PrefilterChecker`. The line is passed to the `check()` method, which either returns `None` or a `PrefilterHandler` instance. If `None` is returned, the other checkers are tried. If an `PrefilterHandler` instance is returned, the line is passed to the `handle()` method of the returned handler and no further checkers are tried.

Both transformers and checkers have a `priority` attribute, that determines the order in which they are called. Smaller priorities are tried first.

Both transformers and checkers also have `enabled` attribute, which is a boolean that determines if the instance is used.

Users or developers can change the priority or `enabled` attribute of transformers or checkers, but they must call the `sort_checkers()` or `sort_transformers()` method after changing the priority.

```python
__init__(shell=None, **kwargs)

Create a configurable given a config config.

Parameters

- `config` (Config) – If this is empty, default values are used. If config is a `Config` instance, it will be used to configure the instance.
- `parent` (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

`checkers`
Return a list of checkers, sorted by priority.

`find_handler(line_info)`
Find a handler for the `line_info` by trying checkers.

`get_handler_by_esc(esc_str)`
Get a handler by its escape string.

`get_handler_by_name(name)`
Get a handler by its name.

`handlers`
Return a dict of all the handlers.
init_checkers()
    Create the default checkers.

init_handlers()
    Create the default handlers.

init_transformers()
    Create the default transformers.

prefilter_line(line, continue_prompt=False)
    Prefilter a single input line as text.
    This method prefilters a single line of text by calling the transformers and then the checkers/handlers.

prefilter_line_info(line_info)
    Prefilter a line that has been converted to a LineInfo object.
    This implements the checker/handler part of the prefilter pipe.

prefilter_lines(lines, continue_prompt=False)
    Prefilter multiple input lines of text.
    This is the main entry point for prefiltering multiple lines of input. This simply calls prefilter_line() for each line of input.
    This covers cases where there are multiple lines in the user entry, which is the case when the user goes back to a multiline history entry and presses enter.

register_checker(checker)
    Register a checker instance.

register_handler(name, handler, esc_strings)
    Register a handler instance by name with esc_strings.

register_transformer(transformer)
    Register a transformer instance.

sort_checkers()
    Sort the checkers by priority.
    This must be called after the priority of a checker is changed. The register_checker() method calls this automatically.

sort_transformers()
    Sort the transformers by priority.
    This must be called after the priority of a transformer is changed. The register_transformer() method calls this automatically.

transform_line(line, continue_prompt)
    Calls the enabled transformers in order of increasing priority.

transformers
    Return a list of checkers, sorted by priority.

unregister_checker(checker)
    Unregister a checker instance.

unregister_handler(name, handler, esc_strings)
    Unregister a handler instance by name with esc_strings.

unregister_transformer(transformer)
    Unregister a transformer instance.
class IPython.core.prefilter.PrefilterTransformer(
    shell=None, prefilter_manager=None, **kwargs)

Bases: traitlets.config.configurable.Configurable

Transform a line of user input.

__init__(shell=None, prefilter_manager=None, **kwargs)
Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.

This ensures that instances will be configured properly.

transform(line, continue_prompt)
Transform a line, returning the new one.

class IPython.core.prefilter.PrefilterChecker(
    shell=None, prefilter_manager=None, **kwargs)

Bases: traitlets.config.configurable.Configurable

Inspect an input line and return a handler for that line.

__init__(shell=None, prefilter_manager=None, **kwargs)
Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.

This ensures that instances will be configured properly.
check (line_info)
Inspect line_info and return a handler instance or None.

class IPython.core.prefilter.EmacsChecker (shell=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
Emacs ipython-mode tags certain input lines.

class IPython.core.prefilter.MacroChecker (shell=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
Inspect line_info and return a handler instance or None.

class IPython.core.prefilter.IPyAutocallChecker (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
Instances of IPyAutocall in user_ns get autocalled immediately

class IPython.core.prefilter.AssignmentChecker (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
Check to see if user is assigning to a var for the first time, in which case we want to avoid any sort of 
automagic / autocall games.

This allows users to assign to either alias or magic names true python variables (the magic/alias systems 
always take second seat to true python code). E.g. ls='hi', or ls,that=1,2

class IPython.core.prefilter.AutoMagicChecker (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
If the ifun is magic, and automagic is on, run it. Note: normal, non-auto magic would already have been 
triggered via '%' in check_esc_chars. This just checks for automagic. Also, before triggering the magic 
handler, make sure that there is nothing in the user namespace which could shadow it.

class IPython.core.prefilter.PythonOpsChecker (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
If the 'rest' of the line begins with a function call or pretty much any python operator, we should simply 
execute the line (regardless of whether or not there's a possible autocall expansion). This avoids spurious 
(and very confusing) geattr() accesses.

class IPython.core.prefilter.AutocallChecker (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: IPython.core.prefilter.PrefilterChecker 
check (line_info)
Check if the initial word/function is callable and autocall is on.

class IPython.core.prefilter.PrefilterHandler (shell=None, 
prefilter_manager=None, 
**kwargs) 
Bases: traitlets.config.configurable.Configurable

8.31. Module: core.prefilter 457
__init__ (shell=None, prefilter_manager=None, **kwargs)
Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

handle (line_info)
Handle normal input lines. Use as a template for handlers.

class IPython.core.prefilter.MacroHandler (shell=None,
                                           **kwargs)
    Bases: IPython.core.prefilter.PrefilterHandler
handle (line_info)
Handle normal input lines. Use as a template for handlers.

class IPython.core.prefilter.MagicHandler (shell=None,
                                          **kwargs)
    Bases: IPython.core.prefilter.PrefilterHandler
handle (line_info)
Execute magic functions.

class IPython.core.prefilter.AutoHandler (shell=None,
                                         **kwargs)
    Bases: IPython.core.prefilter.PrefilterHandler
handle (line_info)
Handle lines which can be auto-executed, quoting if requested.

class IPython.core.prefilter.EmacsHandler (shell=None,
                                          **kwargs)
    Bases: IPython.core.prefilter.PrefilterHandler
handle (line_info)
Handle input lines marked by python-mode.

8.31.2 1 Function

IPython.core.prefilter.is_shadowed (identifier, ip)
Is the given identifier defined in one of the namespaces which shadow the alias and magic namespaces? Note that an identifier is different than ifun, because it can not contain a ‘.’ character.
8.32 Module: core.profileapp

An application for managing IPython profiles.
To be invoked as the ipython profile subcommand.
Authors:
  • Min RK

8.32.1 4 Classes

class IPython.core.profileapp.ProfileLocate(**kwargs)
    Bases: IPython.core.application.BaseIPythonApplication

    parse_command_line(argv=None)
    Parse the command line arguments.

    start()
    Start the app mainloop.
    Override in subclasses.

class IPython.core.profileapp.ProfileList(**kwargs)
    Bases: traitlets.config.application.Application

    start()
    Start the app mainloop.
    Override in subclasses.

class IPython.core.profileapp.ProfileCreate(**kwargs)
    Bases: IPython.core.application.BaseIPythonApplication

    init_config_files()
    [optionally] copy default config files into profile dir.

    parse_command_line(argv)
    Parse the command line arguments.

    stage_default_config_file()
    auto generate default config file, and stage it into the profile.

class IPython.core.profileapp.ProfileApp(**kwargs)
    Bases: traitlets.config.application.Application

    start()
    Start the app mainloop.
    Override in subclasses.

8.32.2 2 Functions

IPython.core.profileapp.list_profiles_in(path)
list profiles in a given root directory

IPython.core.profileapp.list_bundled_profiles()
list profiles that are bundled with IPython.
8.33 Module: core.profiledir

An object for managing IPython profile directories.

8.33.1 2 Classes

class IPython.core.profiledir.ProfileDirError
   Bases: Exception

class IPython.core.profiledir.ProfileDir(**kwargs)
   Bases: traitlets.config.configurable.LoggingConfigurable

   An object to manage the profile directory and its resources.
   The profile directory is used by all IPython applications, to manage configuration, logging and security.
   This object knows how to find, create and manage these directories. This should be used by any code that wants to handle profiles.

   copy_config_file(config_file, path=None, overwrite=False)
   Copy a default config file into the active profile directory.

   Default configuration files are kept in IPython.core.profile. This function moves these from that location to the working profile directory.

   classmethod create_profile_dir(profile_dir, config=None)
   Create a new profile directory given a full path.

   Parameters
   profile_dir (str) – The full path to the profile directory. If it does exist, it will be used. If not, it will be created.

   classmethod create_profile_dir_by_name(path, name='default', config=None)
   Create a profile dir by profile name and path.

   Parameters
   • path (unicode) – The path (directory) to put the profile directory in.
   • name (unicode) – The name of the profile. The name of the profile directory will be "profile_<profile>".

   classmethod find_profile_dir(profile_dir, config=None)
   Find/create a profile dir and return its ProfileDir.

   This will create the profile directory if it doesn’t exist.

   Parameters
   profile_dir (unicode or str) – The path of the profile directory.

   classmethod find_profile_dir_by_name(ipython_dir, name='default', config=None)
   Find an existing profile dir by profile name, return its ProfileDir.

   This searches through a sequence of paths for a profile dir. If it is not found, a ProfileDirError exception will be raised.

   The search path algorithm is: 1. py3compat.getcwd() 2. ipython_dir

   Parameters
   • ipython_dir (unicode or str) – The IPython directory to use.
   • name (unicode or str) – The name of the profile. The name of the profile directory will be "profile_<profile>".
8.34 Module: core.prompts

Being removed

8.34.1 1 Class

class IPython.core.prompts.LazyEvaluate(func, *args, **kwargs)
   Bases: object

   This is used for formatting strings with values that need to be updated at that time, such as the current time or working directory.

   __init__ (func, *args, **kwargs)
       Initialize self. See help(type(self)) for accurate signature.

8.35 Module: core.pylabtools

Pylab (matplotlib) support utilities.

8.35.1 10 Functions

IPython.core.pylabtools.getfigs(*fig_nums)
   Get a list of matplotlib figures by figure numbers.

   If no arguments are given, all available figures are returned. If the argument list contains references to invalid figures, a warning is printed but the function continues pasting further figures.

   Parameters figs (tuple) – A tuple of ints giving the figure numbers of the figures to return.

IPython.core.pylabtools.figsize(sizex, sizey)
   Set the default figure size to be [sizex, sizey].

   This is just an easy to remember, convenience wrapper that sets:

   matplotlib.rcParams['figure.figsize'] = [sizex, sizey]

IPython.core.pylabtools.print_figure(fig, fmt='png', bbox_inches='tight', **kwargs)
   Print a figure to an image, and return the resulting file data

   Returned data will be bytes unless fmt='svg', in which case it will be unicode.

   Any keyword args are passed to fig.canvas.print_figure, such as quality or bbox_inches.

IPython.core.pylabtools.retina_figure(fig, **kwargs)
   Format a figure as a pixel-doubled (retina) PNG

IPython.core.pylabtools.mpl_runner(safe_execfile)
   Factory to return a matplotlib-enabled runner for %run.

   Parameters safe_execfile (function) – This must be a function with the same interface as the safe_execfile() method of IPython.

   Returns

   • A function suitable for use as the runner argument of the %run magic
   • function.

8.34. Module: core.prompts
IPython.core.pylabtools.select_figure_formats (shell, formats, **kwargs)
Select figure formats for the inline backend.

Parameters
- **shell** (InteractiveShell) – The main IPython instance.
- **kwargs** (any) – Extra keyword arguments to be passed to fig.canvas.print_figure.

IPython.core.pylabtools.find_gui_and_backend (gui=None, gui_select=None)
Given a gui string return the gui and mpl backend.

Parameters
- **gui_select** (str) – Can be one of (‘tk’, ‘gtk’, ‘wx’, ‘qt’, ‘qt4’, ‘inline’). This is any gui already selected by the shell.

Returns
- A tuple of (gui, backend) where backend is one of (‘TkAgg’, ‘GTKAgg’, ‘WXAgg’, ‘Qt4Agg’, ‘module (//ipykernel.pylab.backend_inline’).

IPython.core.pylabtools.activate_matplotlib (backend)
Activate the given backend and set interactive to True.

IPython.core.pylabtools.import_pylab (user_ns, import_all=True)
Populate the namespace with pylab-related values.
Imports matplotlib, pylab, numpy, and everything from pylab and numpy.
Also imports a few names from IPython (figsize, display, getfigs)

IPython.core.pylabtools.configure_inline_support (shell, backend)
Configure an IPython shell object for matplotlib use.

Parameters
- **shell** (InteractiveShell instance)
- **backend** (matplotlib backend)

8.36 Module: core.shellapp

A mixin for Application classes that launch InteractiveShell instances, load extensions, etc.

8.36.1 1 Class

class IPython.core.shellapp.InteractiveShellApp (**kwargs)
Bases: traitlets.config.configurable.Configurable
A Mixin for applications that start InteractiveShell instances.
Provides configurables for loading extensions and executing files as part of configuring a Shell environment.
The following methods should be called by the initialize() method of the subclass:
- **init_path()**
- `init_shell()` (to be implemented by the subclass)
- `init_gui_pylab()`
- `init_extensions()`
- `init_code()`

`init_code()`
run the pre-flight code, specified via `exec_lines`

`init_extensions()`
Load all IPython extensions in `IPythonApp.extensions`.
This uses the `ExtensionManager.load_extensions()` to load all the extensions listed in `self.extensions`.

`init_gui_pylab()`
Enable GUI event loop integration, taking `pylab` into account.

`init_path()`
Add current working directory, '', to `sys.path`

### 8.37 Module: core.splitinput

Simple utility for splitting user input. This is used by both `inputsplitter` and `prefilter`.

Authors:
- Brian Granger
- Fernando Perez

#### 8.37.1 1 Class

class IPython.core.splitinput.LineInfo(line, continue_prompt=False)

**Bases:** object

A single line of input and associated info.
Includes the following as properties:

- `line` The original, raw line
- `continue_prompt` Is this line a continuation in a sequence of multiline input?
- `pre` Any leading whitespace.
- `esc` The escape character(s) in `pre` or the empty string if there isn’t one. Note that ‘!!’ and ‘??’ are possible values for `esc`. Otherwise it will always be a single character.
- `ifun` The ‘function part’, which is basically the maximal initial sequence of valid python identifiers and the ‘.’ character. This is what is checked for alias and magic transformations, used for auto-calling, etc. In contrast to Python identifiers, it may start with “%” and contain “*”.
- `the_rest` Everything else on the line.

___init___(line, continue_prompt=False)
Initialize self. See `help(type(self))` for accurate signature.
ofind(ip)
    Do a full, attribute-walking lookup of the ifun in the various namespaces for the given IPython InteractiveShell instance.

    Return a dict with keys: {found, obj, ospace, ismagic}

    Note: can cause state changes because of calling getattr, but should only be run if autocall is on and if the line hasn’t matched any other, less dangerous handlers.

    Does cache the results of the call, so can be called multiple times without worrying about further damaging state.

8.37.2 1 Function

IPython.core.splitinput.split_user_input(line, pattern=None)
    Split user input into initial whitespace, escape character, function part and the rest.

8.38 Module: core.ultratb

Verbose and colourful traceback formatting.

ColorTB

I’ve always found it a bit hard to visually parse tracebacks in Python. The ColorTB class is a solution to that problem. It colors the different parts of a traceback in a manner similar to what you would expect from a syntax-highlighting text editor.

Installation instructions for ColorTB:

```python
import sys, ultratb
sys.excepthook = ultratb.ColorTB()
```

VerboseTB

I’ve also included a port of Ka-Ping Yee’s “cgitb.py” that produces all kinds of useful info when a traceback occurs. Ping originally had it spit out HTML and intended it for CGI programmers, but why should they have all the fun? I altered it to spit out colored text to the terminal. It’s a bit overwhelming, but kind of neat, and maybe useful for long-running programs that you believe are bug-free. If a crash does occur in that type of program you want details. Give it a shot–you’ll love it or you’ll hate it.

Note: The Verbose mode prints the variables currently visible where the exception happened (shortening their strings if too long). This can potentially be very slow, if you happen to have a huge data structure whose string representation is complex to compute. Your computer may appear to freeze for a while with cpu usage at 100%. If this occurs, you can cancel the traceback with Ctrl-C (maybe hitting it more than once).

If you encounter this kind of situation often, you may want to use the Verbose_novars mode instead of the regular Verbose, which avoids formatting variables (but otherwise includes the information and context given by Verbose).

Note: The verbose mode print all variables in the stack, which means it can potentially leak sensitive information like access keys, or unencrypted password.

Installation instructions for VerboseTB:
import sys, ultratb
sys.excepthook = ultratb.VerboseTB()

Note: Much of the code in this module was lifted verbatim from the standard library module ‘traceback.py’ and Ka-Ping Yee’s ‘cgitb.py’.

### 8.38.1 Color schemes

The colors are defined in the class TBTools through the use of the ColorSchemeTable class. Currently the following exist:

- **NoColor**: allows all of this module to be used in any terminal (the color escapes are just dummy blank strings).
- **Linux**: is meant to look good in a terminal like the Linux console (black or very dark background).
- **LightBG**: similar to Linux but swaps dark/light colors to be more readable in light background terminals.
- **Neutral**: a neutral color scheme that should be readable on both light and dark background.

You can implement other color schemes easily, the syntax is fairly self-explanatory. Please send back new schemes you develop to the author for possible inclusion in future releases.

Inheritance diagram:

---

### 8.38.2 7 Classes

**class IPython.core.ultratb.TBTools** *(color_scheme='NoColor', call_pdb=False, ostream=None, parent=None, config=None)*

**Bases**: IPython.utils.colorable.Colorable

Basic tools used by all traceback printer classes.

**__init__**(color_scheme='NoColor', call_pdb=False, ostream=None, parent=None, config=None)

Create a configurable given a config config.

**Parameters**

- **config** *(Config)*: If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

- **parent** *(Configurable instance, optional)*: The parent Configurable instance of this object.

**Notes**

Subclasses of Configurable must call the **__init__()** method of Configurable **before** doing anything else and using **super()**.
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.

This ensures that instances will be configured properly.

color_toggle()
    Toggle between the currently active color scheme and NoColor.

ostream
    Output stream that exceptions are written to.

Valid values are:

- None: the default, which means that IPython will dynamically resolve to sys.stdout. This ensures compatibility with most tools, including Windows (where plain stdout doesn’t recognize ANSI escapes).
- Any object with ‘write’ and ‘flush’ attributes.

set_colors(*args, **kw)
    Shorthand access to the color table scheme selector method.

stb2text(stb)
    Convert a structured traceback (a list) to a string.

structured_traceback(etype, evalue, tb, tb_offset=None, context=5, mode=None)
    Return a list of traceback frames.

Must be implemented by each class.

text(etype, value, tb, tb_offset=None, context=5)
    Return formatted traceback.

Subclasses may override this if they add extra arguments.

class IPython.core.ultratb.ListTB(color_scheme='NoColor', call_pdb=False, ostream=None, parent=None)
    Bases: IPython.core.ultratb.TBTools

Print traceback information from a traceback list, with optional color.

Calling requires 3 arguments: (etype, evalue, elist) as would be obtained by:

```python
etype, evalue, tb = sys.exc_info()
if tb:
    elist = traceback.extract_tb(tb)
else:
    elist = None
```

It can thus be used by programs which need to process the traceback before printing (such as console replacements based on the code module from the standard library).

Because they are meant to be called without a full traceback (only a list), instances of this class can’t call the interactive pdb debugger.

__init__(color_scheme='NoColor', call_pdb=False, ostream=None, parent=None)
    Create a configurable given a config config.

Parameters

- config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.
• **parent** *(Configurable instance, optional)* – The parent Configurable instance of this object.

**Notes**

Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

**get_exception_only** *(etype, value)*

Only print the exception type and message, without a traceback.

**Parameters**

• **etype** *(exception type)* –

• **value** *(exception value)* –

**show_exception_only** *(etype, value)*

Only print the exception type and message, without a traceback.

**Parameters**

• **etype** *(exception type)* –

• **value** *(exception value)* –

**structured_traceback** *(etype, value, elist, tb_offset=None, context=5)*

Return a color formatted string with the traceback info.

**Parameters**

• **etype** *(exception type)* – Type of the exception raised.

• **value** *(object)* – Data stored in the exception

• **elist** *(list)* – List of frames, see class docstring for details.

• **tb_offset** *(int, optional)* – Number of frames in the traceback to skip. If not given, the instance value is used (set in constructor).

• **context** *(int, optional)* – Number of lines of context information to print.

**Returns**

**Return type** String with formatted exception.

```python
class IPython.core.ultratb.VerboseTB(color_scheme='Linux', call_pdb=False, ostream=None, tb_offset=0, long_header=False, include_vars=True, check_cache=None, debugger_cls=None)
```

**Bases:** `IPython.core.ultratb.TBTools`

A port of Ka-Ping Yee’s cgitb.py module that outputs color text instead of HTML. Requires inspect and pydoc.

Crazy, man.

Modified version which optionally strips the topmost entries from the traceback, to be used with alternate interpreters (because their own code would appear in the traceback).
__init__(color_scheme='Linux', call_pdb=False, ostream=None, tb_offset=0, long_header=False,
         include_vars=True, check_cache=None, debugger_cls=None)

Specify traceback offset, headers and color scheme.

Define how many frames to drop from the tracebacks. Calling it with tb_offset=1 allows use of this handler in interpreters which will have their own code at the top of the traceback (VerboseTB will first remove that frame before printing the traceback info).

debugger (force=False)

Call up the pdb debugger if desired, always clean up the tb reference.

Keywords:

• force(False): by default, this routine checks the instance call_pdb flag and does not actually invoke the debugger if the flag is false. The ‘force’ option forces the debugger to activate even if the flag is false.

If the call_pdb flag is set, the pdb interactive debugger is invoked. In all cases, the self.tb reference to the current traceback is deleted to prevent lingering references which hamper memory management.

Note that each call to pdb() does an ‘import readline’, so if your app requires a special setup for the readline completers, you’ll have to fix that by hand after invoking the exception handler.

format_exception_as_a_whole(etype, evalue, etb, number_of_lines_of_context, tb_offset)

Formats the header, traceback and exception message for a single exception.

This may be called multiple times by Python 3 exception chaining (PEP 3134).

format_record(frame, file, lnum, func, lines, index)

Format a single stack frame

format_records(records, last_unique, recursion_repeat)

Format the stack frames of the traceback

structured_traceback(etype, evalue, etb, tb_offset=None, number_of_lines_of_context=5)

Return a nice text document describing the traceback.

class IPython.core.ultratb.FormattedTB(mode='Plain', color_scheme='Linux',
                                         call_pdb=False, ostream=None, tb_offset=0,
                                         long_header=False, include_vars=False,
                                         check_cache=None, debugger_cls=None)

Bases: IPython.core.ultratb.VerboseTB, IPython.core.ultratb.ListTB

Subclass ListTB but allow calling with a traceback.

It can thus be used as a sys.excepthook for Python > 2.1.

Also adds ‘Context’ and ‘Verbose’ modes, not available in ListTB.

Allows a tb_offset to be specified. This is useful for situations where one needs to remove a number of topmost frames from the traceback (such as occurs with python programs that themselves execute other python code, like Python shells).

__init__(mode='Plain', color_scheme='Linux', call_pdb=False, ostream=None, tb_offset=0,
         long_header=False, include_vars=False, check_cache=None, debugger_cls=None)

Specify traceback offset, headers and color scheme.

Define how many frames to drop from the tracebacks. Calling it with tb_offset=1 allows use of this handler in interpreters which will have their own code at the top of the traceback (VerboseTB will first remove that frame before printing the traceback info).

set_mode (mode=None)

Switch to the desired mode.
If mode is not specified, cycles through the available modes.

```python
stb2text(stb)
```

Convert a structured traceback (a list) to a string.

```python
structured_traceback(etype, value, tb, tb_offset=None, number_of_lines_of_context=5)
```

Return a nice text document describing the traceback.

```python
class IPython.core.ultratb.AutoFormattedTB
```

Bases: IPython.core.ultratb.FormattedTB

A traceback printer which can be called on the fly.

It will find out about exceptions by itself.

A brief example:

```python
AutoTB = AutoFormattedTB(mode = 'Verbose',color_scheme='Linux')
try:
...
except:
    AutoTB()  # or AutoTB(out=logfile) where logfile is an open file object
```

```python
structured_traceback(etype=None, value=None, tb=None, tb_offset=None, number_of_lines_of_context=5)
```

Return a nice text document describing the traceback.

```python
class IPython.core.ultratb.ColorTB(color_scheme='Linux', call_pdb=0, **kwargs)
```

Bases: IPython.core.ultratb.FormattedTB

Shorthand to initialize a FormattedTB in Linux colors mode.

```python
__init__(color_scheme='Linux', call_pdb=0, **kwargs)
```

Specify traceback offset, headers and color scheme.

Define how many frames to drop from the tracebacks. Calling it with tb_offset=1 allows use of this handler in interpreters which will have their own code at the top of the traceback (VerboseTB will first remove that frame before printing the traceback info).

```python
class IPython.core.ultratb.SyntaxTB(color_scheme='NoColor')
```

Bases: IPython.core.ultratb.ListTB

Extension which holds some state: the last exception value

```python
__init__(color_scheme='NoColor')
```

Create a configurable given a config config.

**Parameters**

- `config` (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

- `parent` (Configurable instance, optional) – The parent Configurable instance of this object.

**Notes**

Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.

This ensures that instances will be configured properly.

clear_err_state()  
Return the current error state and clear it

stb2text(stb)  
Convert a structured traceback (a list) to a string.

structured_traceback(etype, value, elist, tb_offset=None, context=5)  
Return a color formatted string with the traceback info.

Parameters

- etype (exception type) – Type of the exception raised.
- value (object) – Data stored in the exception
- elist (list) – List of frames, see class docstring for details.
- tb_offset (int, optional) – Number of frames in the traceback to skip. If not given, the instance value is used (set in constructor).
- context (int, optional) – Number of lines of context information to print.

Returns

Return type String with formatted exception.

8.38.3 10 Functions

IPython.core.ultratb.inspect_error()  
Print a message about internal inspect errors.

These are unfortunately quite common.

IPython.core.ultratb.findsource(object)  
Return the entire source file and starting line number for an object.

The argument may be a module, class, method, function, traceback, frame, or code object. The source code is returned as a list of all the lines in the file and the line number indexes a line in that list. An IOError is raised if the source code cannot be retrieved.

FIXED version with which we monkeypatch the stdlib to work around a bug.

IPython.core.ultratb.getargs(co)  
Get information about the arguments accepted by a code object.

Three things are returned: (args, varargs, varkw), where ‘args’ is a list of argument names (possibly containing nested lists), and ‘varargs’ and ‘varkw’ are the names of the * and ** arguments or None.

IPython.core.ultratb.with_patch_inspect(f)  
Decorator for monkeypatching inspect.findsource

IPython.core.ultratb.fix_frame_records_filenames(records)  
Try to fix the filenames in each record from inspect.getinnerframes().

Particularly, modules loaded from within zip files have useless filenames attached to their code object, and inspect.getinnerframes() just uses it.
IPython.core.ultratb.is_recursion_error(etype, value, records)

Identify the repeating stack frames from a RecursionError traceback

'records' is a list as returned by VerboseTB.get_records()

Returns (last_unique, repeat_length)

IPython.core.ultratb.find_recursion(etype, value, records)

IPython.core.ultratb.text_repr(value)

Hopefully pretty robust repr equivalent.

IPython.core.ultratb.eqrepr(value, repr=<function text_repr>)

IPython.core.ultratb.nullrepr(value, repr=<function text_repr>)

8.39 Module: display

Public API for display tools in IPython.

8.39.1 20 Classes

class IPython.display.Audio(data=None, filename=None, url=None, embed=None, rate=None, autoplay=False)

Bases: IPython.core.display.DisplayObject

Create an audio object.

When this object is returned by an input cell or passed to the display function, it will result in Audio controls
being displayed in the frontend (only works in the notebook).

Parameters

- **data** (numpy array, list, unicode, str or bytes) – Can be one of
  - Numpy 1d array containing the desired waveform (mono)
  - Numpy 2d array containing waveforms for each channel. Shape=(NCHAN, NSAMPLES). For the standard channel order, see http://msdn.microsoft.com/en-us/library/windows/hardware/dn653308(v=vs.85).aspx
  - List of float or integer representing the waveform (mono)
  - String containing the filename
  - Bytestring containing raw PCM data or
  - URL pointing to a file on the web.

If the array option is used the waveform will be normalized.

If a filename or url is used the format support will be browser dependent.

- **url** (unicode) – A URL to download the data from.
- **filename** (unicode) – Path to a local file to load the data from.
- **embed** (boolean) – Should the audio data be embedded using a data URI (True) or should
  the original source be referenced. Set this to True if you want the audio to playable later
  with no internet connection in the notebook.

Default is True, unless the keyword argument url is set, then default value is False.
• **rate (integer)** – The sampling rate of the raw data. Only required when data parameter is being used as an array

• **autoplay (bool)** – Set to True if the audio should immediately start playing. Default is False.

## Examples

```python
# Generate a sound
import numpy as np
t = np.linspace(0, 5, framerate*5)
data = np.sin(2*np.pi*220*t) + np.sin(2*np.pi*224*t))
Audio(data, rate=framerate)

# Can also do stereo or more channels
dataleft = np.sin(2*np.pi*220*t)
dataright = np.sin(2*np.pi*224*t)
Audio([dataleft, dataright], rate=framerate)

Audio("http://www.nch.com.au/acm/8kl6bitpcm.wav")  # From URL
Audio(url="http://www.w3schools.com/html/horse.ogg")

Audio('/path/to/sound.wav')  # From file
Audio(filename='/path/to/sound.ogg')

Audio(b'RAW_WAV_DATA..)  # From bytes
Audio(data=b'RAW_WAV_DATA..)
```

__init__ (data=None, filename=None, url=None, embed=None, rate=None, autoplay=False)

Create a display object given raw data.

When this object is returned by an expression or passed to the display function, it will result in the data being displayed in the frontend. The MIME type of the data should match the subclasses used, so the Png subclass should be used for ‘image/png’ data. If the data is a URL, the data will first be downloaded and then displayed. If

Parameters

• **data (unicode, str or bytes)** – The raw data or a URL or file to load the data from

• **url (unicode)** – A URL to download the data from.

• **filename (unicode)** – Path to a local file to load the data from.

reload()

Reload the raw data from file or URL.

class IPython.display.DisplayHandle (display_id=None)

Bases: object

A handle on an updatable display

Call .update (obj) to display a new object.

Call .display (obj) to add a new instance of this display, and update existing instances.

__init__ (display_id=None)

Initialize self. See help(type(self)) for accurate signature.
**display** *(obj, **kwargs)*

Make a new display with my id, updating existing instances.

**Parameters**

- **obj** – object to display
- **kwargs** – additional keyword arguments passed to display

**update** *(obj, **kwargs)*

Update existing displays with my id

**Parameters**

- **obj** – object to display
- **kwargs** – additional keyword arguments passed to update_display

**class** **IPython.display.DisplayObject**( *data=None, url=None, filename=None*)

**Bases:** **object**

An object that wraps data to be displayed.

**__init__** *(data=None, url=None, filename=None)*

Create a display object given raw data.

When this object is returned by an expression or passed to the display function, it will result in the data being displayed in the frontend. The MIME type of the data should match the subclasses used, so the Png subclass should be used for ‘image/png’ data. If the data is a URL, the data will first be downloaded and then displayed. If

**Parameters**

- **data** *(unicode, str or bytes)* – The raw data or a URL or file to load the data from
- **url** *(unicode)* – A URL to download the data from.
- **filename** *(unicode)* – Path to a local file to load the data from.

**reload** *

Reload the raw data from file or URL.

**class** **IPython.display.FileLink**( *path, url_prefix='', result_html_prefix='', result_html_suffix='<br>\'*)

**Bases:** **object**

Class for embedding a local file link in an IPython session, based on path

e.g. to embed a link that was generated in the IPython notebook as my/data.txt

you would do:

```python
local_file = FileLink("my/data.txt")
display(local_file)
```

or in the HTML notebook, just:

```python
FileLink("my/data.txt")
```

**__init__** *(path, url_prefix='', result_html_prefix='', result_html_suffix='<br>')*

**Parameters**

- **path** *(str)* – path to the file or directory that should be formatted
• `url_prefix (str)` – prefix to be prepended to all files to form a working link [default: ‘’]

• `result_html_prefix (str)` – text to append to beginning to link [default: ‘’]

• `result_html_suffix (str)` – text to append at the end of link [default: ‘<br>’]

```python
class IPython.display.FileLinks(path, url_prefix='', result_html_prefix='', result_html_suffix='<br>',
                                       notebook_display_formatter=None, terminal_display_formatter=None, recursive=True)
```

Bases: `IPython.lib.display.FileLink`

Class for embedding local file links in an IPython session, based on path
e.g. to embed links to files that were generated in the IPython notebook under `my/data`, you would do:

```python
local_files = FileLinks("my/data")
display(local_files)
```

or in the HTML notebook, just:

```python
FileLinks("my/data")
```

__init__(path, url_prefix='', included_suffixes=None, result_html_prefix='', result_html_suffix='\n',
                                       notebook_display_formatter=None, terminal_display_formatter=None, recursive=True)

See `FileLink` for the `path`, `url_prefix`, `result_html_prefix` and `result_html_suffix`
parameters.

`included_suffixes` [list] Filename suffixes to include when formatting output [default: include all files]

`notebook_display_formatter` [function] Used to format links for display in the notebook. See discussion
of formatter functions below.

`terminal_display_formatter` [function] Used to format links for display in the terminal. See discussion
of formatter functions below.

Formatter functions must be of the form:

```
f(dirname, fnames, included_suffixes)
```

`dirname` [str] The name of a directory

`fnames` [list] The files in that directory

`included_suffixes` [list] The file suffixes that should be included in the output (passing None meansto
include all suffixes in the output in the built-in formatters)

`recursive` [boolean] Whether to recurse into subdirectories. Default is True.

The function should return a list of lines that will be printed in the notebook (if passing notebook_display_formatter) or the terminal (if passing terminal_display_formatter). This function is iterated over for each directory in self.path. Default formatters are in place, can be passed here to support alternative formatting.

```python
class IPython.display.HTML(data=None, url=None, filename=None)
Bases: IPython.core.display.TextDisplayObject
```

```python
class IPython.display.IFrame(src, width, height, **kwargs)
Bases: object
```
Generic class to embed an iframe in an IPython notebook

```python
__init__(src, width, height, **kwargs)
Initialize self. See help(type(self)) for accurate signature.
```

```python
class IPython.display.Image(data=None, url=None, filename=None, format=None, embed=None, width=None, height=None, retina=False, unconfined=False, metadata=None)
Bases: IPython.core.display.DisplayObject
__init__(data=None, url=None, filename=None, format=None, embed=None, width=None, height=None, retina=False, unconfined=False, metadata=None)
Create a PNG/JPEG image object given raw data.
```

When this object is returned by an input cell or passed to the display function, it will result in the image being displayed in the frontend.

**Parameters**

- **data** *(unicode, str or bytes)* – The raw image data or a URL or filename to load the data from. This always results in embedded image data.
- **url** *(unicode)* – A URL to download the data from. If you specify url=, the image data will not be embedded unless you also specify embed=True.
- **filename** *(unicode)* – Path to a local file to load the data from. Images from a file are always embedded.
- **format** *(unicode)* – The format of the image data (png/jpeg/jpg). If a filename or URL is given for format will be inferred from the filename extension.
- **embed** *(bool)* – Should the image data be embedded using a data URI (True) or be loaded using an `<img>` tag. Set this to True if you want the image to be viewable later with no internet connection in the notebook.
  
  Default is True, unless the keyword argument url is set, then default value is False.

  Note that QtConsole is not able to display images if embed is set to False.
- **width** *(int)* – Width in pixels to which to constrain the image in html
- **height** *(int)* – Height in pixels to which to constrain the image in html
- **retina** *(bool)* – Automatically set the width and height to half of the measured width and height. This only works for embedded images because it reads the width/height from image data. For non-embedded images, you can just set the desired display width and height directly.
- **unconfined** *(bool)* – Set unconfined=True to disable max-width confinement of the image.
- **metadata** *(dict)* – Specify extra metadata to attach to the image.

**Examples**

```
# embedded image data, works in qtconsole and notebook # when passed positionally, the first arg can be any of raw image data, # a URL, or a filename from which to load image data. # The result is always embedding image data for inline images. Image('http://www.google.fr/images/srpr/logo3w.png') Image('/path/to/image.jpg') Image(b'RAW_PNG_DATA...')
```

```
# Specifying Image(url=...) does not embed the image data. # it only generates <img> tag with a link to the source. # This will not work in the qtconsole or offline. Image(url='http://www.google.fr/images/srpr/logo3w.png')
```
reload()
    Reload the raw data from file or URL.

class IPython.display.JSON (data=None, url=None, filename=None)
    Bases: IPython.core.display.DisplayObject
    JSON expects a JSON-able dict or list
    not an already-serialized JSON string.

    Scalartypess (None, number, string) are not allowed, only dict or list containers.

class IPython.display.Javascript (data=None, url=None, filename=None, lib=None, css=None)
    Bases: IPython.core.display.TextDisplayObject
    __init__ (data=None, url=None, filename=None, lib=None, css=None)
    Create a Javascript display object given raw data.
    When this object is returned by an expression or passed to the display function, it will result in the data being displayed in the frontend. If the data is a URL, the data will first be downloaded and then displayed.
    In the Notebook, the containing element will be available as element, and jQuery will be available. Content appended to element will be visible in the output area.

    Parameters
    • data (unicode, str or bytes) – The Javascript source code or a URL to download it from.
    • url (unicode) – A URL to download the data from.
    • filename (unicode) – Path to a local file to load the data from.
    • lib (list or str) – A sequence of Javascript library URLs to load asynchronously before running the source code. The full URLs of the libraries should be given. A single Javascript library URL can also be given as a string.
    • css (: list or str) – A sequence of css files to load before running the source code. The full URLs of the css files should be given. A single css URL can also be given as a string.

class IPython.display.Latex (data=None, url=None, filename=None)
    Bases: IPython.core.display.TextDisplayObject

class IPython.display.Markdown (data=None, url=None, filename=None)
    Bases: IPython.core.display.TextDisplayObject

class IPython.display.Math (data=None, url=None, filename=None)
    Bases: IPython.core.display.TextDisplayObject

class IPython.display.Pretty (data=None, url=None, filename=None)
    Bases: IPython.core.display.TextDisplayObject

class IPython.display.ProgressBar (total)
    Bases: IPython.core.display.DisplayObject
    Progressbar supports displaying a progressbar like element
    __init__ (total)
    Creates a new progressbar

    Parameters total (int) – maximum size of the progressbar

    next ()
    Python 2 compatibility
class IPython.display.SVG(data=None, url=None, filename=None)
    Bases: IPython.core.display.DisplayObject

class IPython.display.ScribdDocument(id, width=400, height=300, **kwargs)
    Bases: IPython.lib.display.IFrame

    Class for embedding a Scribd document in an IPython session

    Use the start_page params to specify a starting point in the document
    Use the view_mode params to specify display type one off scroll | slideshow | book

    e.g to Display Wes’ foundational paper about PANDAS in book mode from page 3
    ScribdDocument(71048089, width=800, height=400, start_page=3, view_mode=”book”)

    __init__(id, width=400, height=300, **kwargs)
        Initialize self. See help(type(self)) for accurate signature.

class IPython.display.TextDisplayObject(data=None, url=None, filename=None)
    Bases: IPython.core.display.DisplayObject

    Validate that display data is text

class IPython.display.VimeoVideo(id, width=400, height=300, **kwargs)
    Bases: IPython.lib.display.IFrame

    Class for embedding a Vimeo video in an IPython session, based on its video id.

    __init__(id, width=400, height=300, **kwargs)
        Initialize self. See help(type(self)) for accurate signature.

class IPython.display.YouTubeVideo(id, width=400, height=300, **kwargs)
    Bases: IPython.lib.display.IFrame

    Class for embedding a YouTube Video in an IPython session, based on its video id.

    e.g. to embed the video from https://www.youtube.com/watch?v=foo, you would do:

    ```python
    vid = YouTubeVideo("foo")
    display(vid)
    ```

    To start from 30 seconds:

    ```python
    vid = YouTubeVideo("abc", start=30)
    display(vid)
    ```

    To calculate seconds from time as hours, minutes, seconds use `datetime.timedelta`:

    ```python
    start=int(timedelta(hours=1, minutes=46, seconds=40).total_seconds())
    ```

    Other parameters can be provided as documented at https://developers.google.com/youtube/player_parameters#

    Parameters

    When converting the notebook using nbconvert, a jpeg representation of the video will be inserted in the docu-

    __init__(id, width=400, height=300, **kwargs)
        Initialize self. See help(type(self)) for accurate signature.

8.39. Module: display
8.39.2 16 Functions

IPython.display.clear_output(wait=False)
Clear the output of the current cell receiving output.

Parameters

wait (bool [default: false]) – Wait to clear the output until new output is available to replace it.

IPython.display.display(*objs, **kwargs)
Display a Python object in all frontends.

By default all representations will be computed and sent to the frontends. Frontends can decide which representation is used and how.

In terminal IPython this will be similar to using \texttt{print()}, for use in richer frontends see Jupyter notebook examples with rich display logic.

Parameters

• \texttt{objs (tuple of objects)} – The Python objects to display.

• \texttt{raw (bool, optional)} – Are the objects to be displayed already mimetype-keyed dicts of raw display data, or Python objects that need to be formatted before display? [default: False]

• \texttt{include (list, tuple or set, optional)} – A list of format type strings (MIME types) to include in the format data dict. If this is set only the format types included in this list will be computed.

• \texttt{exclude (list, tuple or set, optional)} – A list of format type strings (MIME types) to exclude in the format data dict. If this is set all format types will be computed, except for those included in this argument.

• \texttt{metadata (dict, optional)} – A dictionary of metadata to associate with the output. mime-type keys in this dictionary will be associated with the individual representation formats, if they exist.

• \texttt{transient (dict, optional)} – A dictionary of transient data to associate with the output. Data in this dict should not be persisted to files (e.g. notebooks).

• \texttt{display_id (str, bool optional)} – Set an id for the display. This id can be used for updating this display area later via \texttt{update_display}. If given as \texttt{True}, generate a new \texttt{display_id}

• \texttt{kwargs (additional keyword-args, optional)} – Additional keyword-arguments are passed through to the display publisher.

Returns \texttt{handle} – Returns a handle on updatable displays for use with \texttt{update_display()}, if \texttt{display_id} is given. Returns \texttt{None} if no \texttt{display_id} is given (default).

Return type \texttt{DisplayHandle}

Examples

```python
>>> class Json(object):
...     def __init__(self, json):
...         self.json = json
...     def __repr_pretty__(self, pp, cycle):
...         import json
...         pp.text(json.dumps(self.json, indent=2))
```
... def __repr__(self):
    return str(self.json)
...

>>> d = Json({1:2, 3: {4:5}})

>>> print(d)
{1: 2, 3: {4: 5}}

>>> display(d)
{
   "1": 2,
   "3": {
      "4": 5
   }
}

>>> def int_formatter(integer, pp, cycle):
    ...     pp.text('I'*integer)

>>> plain = get_ipython().display_formatter.formatters['text/plain']
>>> plain.for_type(int, int_formatter)
<function _repr_pprint at 0x...>

>>> display(7-5)
II

>>> del plain.type_printers[int]

>>> display(7-5)
2

See also:
update_display()

Notes

In Python, objects can declare their textual representation using the __repr__ method. IPython expands on this idea and allows objects to declare other, rich representations including:

- HTML
- JSON
- PNG
- JPEG
- SVG
- LaTeX

A single object can declare some or all of these representations; all are handled by IPython’s display system.

The main idea of the first approach is that you have to implement special display methods when you define your class, one for each representation you want to use. Here is a list of the names of the special methods and the values they must return:
• `_repr_html_`: return raw HTML as a string
• `_repr_json_`: return a JSONable dict
• `_repr_jpeg_`: return raw JPEG data
• `_repr_png_`: return raw PNG data
• `_repr_svg_`: return raw SVG data as a string
• `_repr_latex_`: return LaTeX commands in a string surrounded by “$”.
• `_repr_mimebundle_`: return a full mimebundle containing the mapping from all mimetypes to data

When you are directly writing your own classes, you can adapt them for display in IPython by following the above approach. But in practice, you often need to work with existing classes that you can’t easily modify.

You can refer to the documentation on IPython display formatters in order to register custom formatters for already existing types.

New in version 5.4: display available without import
New in version 6.1: display available without import

Since IPython 5.4 and 6.1 `display()` is automatically made available to the user without import. If you are using display in a document that might be used in a pure python context or with older version of IPython, use the following import at the top of your file:

```python
from IPython.display import display
```

**IPython.display.display_html(*objs, **kwargs)**
Display the HTML representation of an object.

Note: If raw=False and the object does not have a HTML representation, no HTML will be shown.

**Parameters**

• `objs (tuple of objects)` – The Python objects to display, or if raw=True raw HTML data to display.
• `raw (bool)` – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]
• `metadata (dict (optional))` – Metadata to be associated with the specific mimetype output.

**IPython.display.displayJavascript(*objs, **kwargs)**
Display the Javascript representation of an object.

**Parameters**

• `objs (tuple of objects)` – The Python objects to display, or if raw=True raw Javascript data to display.
• `raw (bool)` – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]
• `metadata (dict (optional))` – Metadata to be associated with the specific mimetype output.

**IPython.display.display_jpeg(*objs, **kwargs)**
Display the JPEG representation of an object.

**Parameters**
• **objs** (*tuple of objects*) – The Python objects to display, or if raw=True raw JPEG data to display.

• **raw** (*bool*) – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata** (*dict (optional]*) – Metadata to be associated with the specific mimetype output.

```python
IPython.display.display_json(*objs, **kwargs)
```

Display the JSON representation of an object.

Note that not many frontends support displaying JSON.

Parameters

• **objs** (*tuple of objects*) – The Python objects to display, or if raw=True raw json data to display.

• **raw** (*bool*) – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata** (*dict (optional]*) – Metadata to be associated with the specific mimetype output.

```python
IPython.display.display_latex(*objs, **kwargs)
```

Display the LaTeX representation of an object.

Parameters

• **objs** (*tuple of objects*) – The Python objects to display, or if raw=True raw latex data to display.

• **raw** (*bool*) – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata** (*dict (optional]*) – Metadata to be associated with the specific mimetype output.

```python
IPython.display.display_markdown(*objs, **kwargs)
```

Displays the Markdown representation of an object.

Parameters

• **objs** (*tuple of objects*) – The Python objects to display, or if raw=True raw markdown data to display.

• **raw** (*bool*) – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata** (*dict (optional]*) – Metadata to be associated with the specific mimetype output.

```python
IPython.display.display_pdf(*objs, **kwargs)
```

Display the PDF representation of an object.

Parameters

• **objs** (*tuple of objects*) – The Python objects to display, or if raw=True raw javascript data to display.

• **raw** (*bool*) – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]
• **metadata (dict (optional))** – Metadata to be associated with the specific mimetype output.

**IPython.display.display_png (**objs, **kwargs)**

Display the PNG representation of an object.

**Parameters**

• **objs (tuple of objects)** – The Python objects to display, or if raw=True raw png data to display.

• **raw (bool)** – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata (dict (optional))** – Metadata to be associated with the specific mimetype output.

**IPython.display.display_pretty (**objs, **kwargs)**

Display the pretty (default) representation of an object.

**Parameters**

• **objs (tuple of objects)** – The Python objects to display, or if raw=True raw text data to display.

• **raw (bool)** – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata (dict (optional))** – Metadata to be associated with the specific mimetype output.

**IPython.display.display_svg (**objs, **kwargs)**

Display the SVG representation of an object.

**Parameters**

• **objs (tuple of objects)** – The Python objects to display, or if raw=True raw svg data to display.

• **raw (bool)** – Are the data objects raw data or Python objects that need to be formatted before display? [default: False]

• **metadata (dict (optional))** – Metadata to be associated with the specific mimetype output.

**IPython.display.publish_display_data (data, metadata=None, source=None, **kwargs)**

Publish data and metadata to all frontends.

See the **display_data** message in the messaging documentation for more details about this message type.

The following MIME types are currently implemented:

• text/plain

• text/html

• text/markdown

• text/latex

• application/json

• application/javascript

• image/png

• image/jpeg
• image/svg+xml

**Parameters**

- **data (dict)** – A dictionary having keys that are valid MIME types (like ‘text/plain’ or ‘image/svg+xml’) and values that are the data for that MIME type. The data itself must be a JSON'able data structure. Minimally all data should have the ‘text/plain’ data, which can be displayed by all frontends. If more than the plain text is given, it is up to the frontend to decide which representation to use.

- **metadata (dict)** – A dictionary for metadata related to the data. This can contain arbitrary key, value pairs that frontends can use to interpret the data. mime-type keys matching those in data can be used to specify metadata about particular representations.

- **source (str, deprecated)** – Unused.

- **transient (dict, keyword-only)** – A dictionary of transient data, such as display_id.

IPython.display.set_matplotlib_close(close=True)

Set whether the inline backend closes all figures automatically or not.

By default, the inline backend used in the IPython Notebook will close all matplotlib figures automatically after each cell is run. This means that plots in different cells won’t interfere. Sometimes, you may want to make a plot in one cell and then refine it in later cells. This can be accomplished by:

```python
In [1]: set_matplotlib_close(False)
```

To set this in your config files use the following:

```python
c.InlineBackend.close_figures = False
```

**Parameters**

- **close (bool)** – Should all matplotlib figures be automatically closed after each cell is run?

IPython.display.set_matplotlib_formats(*formats, **kwargs)

Select figure formats for the inline backend. Optionally pass quality for JPEG.

For example, this enables PNG and JPEG output with a JPEG quality of 90%:

```python
In [1]: set_matplotlib_formats('png', 'jpeg', quality=90)
```

To set this in your config files use the following:

```python
c.InlineBackend.figure_formats = {'png', 'jpeg'}
c.InlineBackend.print_figure_kwargs.update({'quality' : 90})
```

**Parameters**


- ****kwargs** – Keyword args will be relayed to figure.canvas.print_figure.

IPython.display.update_display(obj, **kwargs)

Update an existing display by id

**Parameters**
• **obj** – The object with which to update the display

• **display_id** (*keyword-only*) – The id of the display to update

See also:

*display()*

### 8.40 Module: `lib.backgroundjobs`

Manage background (threaded) jobs conveniently from an interactive shell.

This module provides a `BackgroundJobManager` class. This is the main class meant for public usage, it implements an object which can create and manage new background jobs.

It also provides the actual job classes managed by these `BackgroundJobManager` objects, see their docstrings below.

This system was inspired by discussions with B. Granger and the `BackgroundCommand` class described in the book *Python Scripting for Computational Science*, by H. P. Langtangen:

http://folk.uio.no/hpl/scripting

(although ultimately no code from this text was used, as IPython’s system is a separate implementation).

An example notebook is provided in our documentation illustrating interactive use of the system.

#### 8.40.1 4 Classes

class `IPython.lib.backgroundjobs.BackgroundJobManager`

**Bases**: `object`

Class to manage a pool of backgrounded threaded jobs.

Below, we assume that ‘jobs’ is a `BackgroundJobManager` instance.

Usage summary (see the method docstrings for details):

- `jobs.new(...)` - start a new job
- `jobs()` or `jobs.status()` - print status summary of all jobs
- `jobs[N]` - returns job number N.
- `foo = jobs[N].result` - assign to variable foo the result of job N
- `jobs[N].traceback()` - print the traceback of dead job N
- `jobs.remove(N)` - remove (finished) job N
- `jobs.flush()` - remove all finished jobs

As a convenience feature, `BackgroundJobManager` instances provide the utility `result` and `traceback` methods which retrieve the corresponding information from the jobs list:

- `jobs.result(N) <--> jobs[N].result` jobs.traceback(N) <--> jobs[N].traceback()

While this appears minor, it allows you to use tab completion interactively on the job manager instance.

```
def __init__(self):
    Initialize self. See help(type(self)) for accurate signature.
```
flush()
Flush all finished jobs (completed and dead) from lists.
Running jobs are never flushed.
It first calls _status_new(), to update info. If any jobs have completed since the last _status_new() call, the
flush operation aborts.

dead
new(func_or_exp, *args, **kwargs)
Add a new background job and start it in a separate thread.

There are two types of jobs which can be created:
1. Jobs based on expressions which can be passed to an eval() call. The expression must be given as a
   string. For example:

   job_manager.new('myfunc(x,y,z=1)',[glob],[loc])

   The given expression is passed to eval(), along with the optional global/local dicts provided. If no dicts are
given, they are extracted automatically from the caller’s frame.

   A Python statement is NOT a valid eval() expression. Basically, you can only use as an eval() argument
something which can go on the right of an ‘=’ sign and be assigned to a variable.

   For example,”print ‘hello’” is not valid, but ‘2+3’ is.

2. Jobs given a function object, optionally passing additional positional arguments:

   job_manager.new(myfunc, x, y)

   The function is called with the given arguments.

   If you need to pass keyword arguments to your function, you must supply them as a dict named kw:

   job_manager.new(myfunc, x, y, kw=dict(z=1))

   The reason for this assymmetry is that the new() method needs to maintain access to its own keywords,
and this prevents name collisions between arguments to new() and arguments to your own functions.

   In both cases, the result is stored in the job.result field of the background job object.

   You can set daemon attribute of the thread by giving the keyword argument daemon.

Notes and caveats:
1. All threads running share the same standard output. Thus, if your background jobs generate output, it
will come out on top of whatever you are currently writing. For this reason, background jobs are best used
with silent functions which simply return their output.

2. Threads also all work within the same global namespace, and this system does not lock interactive
variables. So if you send job to the background which operates on a mutable object for a long time, and
start modifying that same mutable object interactively (or in another backgrounded job), all sorts of bizarre
behaviour will occur.

3. If a background job is spending a lot of time inside a C extension module which does not release the
Python Global Interpreter Lock (GIL), this will block the IPython prompt. This is simply because the
Python interpreter can only switch between threads at Python bytecodes. While the execution is inside C
code, the interpreter must simply wait unless the extension module releases the GIL.

4. There is no way, due to limitations in the Python threads library, to kill a thread once it has started.

remove(num)
Remove a finished (completed or dead) job.

result(N) → return the result of job N.
status (verbose=0)
Print a status of all jobs currently being managed.

class IPython.lib.backgroundjobs.BackgroundJobBase
Bases: threading.Thread
Base class to build BackgroundJob classes.
The derived classes must implement:
• Their own __init__, since the one here raises NotImplementedError. The derived constructor must call
  self._init() at the end, to provide common initialization.
• A strform attribute used in calls to __str__.
• A call() method, which will make the actual execution call and must return a value to be held in the ‘result’
  field of the job object.
__init__()
Must be implemented in subclasses.
Subclasses must call _init() for standard initialisation.
run()
Method representing the thread’s activity.
You may override this method in a subclass. The standard run() method invokes the callable object passed
  to the object’s constructor as the target argument, if any, with sequential and keyword arguments taken
  from the args and kwargs arguments, respectively.

class IPython.lib.backgroundjobs.BackgroundJobExpr (expression,            
glob=None,                                           
loc=None)
Bases: IPython.lib.backgroundjobs.BackgroundJobBase
Evaluate an expression as a background job (uses a separate thread).
__init__ (expression, glob=None, loc=None)
Create a new job from a string which can be fed to eval().
  global/locals dicts can be provided, which will be passed to the eval call.

class IPython.lib.backgroundjobs.BackgroundJobFunc (func, *args, **kwargs)
Bases: IPython.lib.backgroundjobs.BackgroundJobBase
Run a function call as a background job (uses a separate thread).
__init__ (func, *args, **kwargs)
Create a new job from a callable object.
  Any positional arguments and keyword args given to this constructor after the initial callable are passed
directly to it.

8.41 Module: lib.clipboard

Utilities for accessing the platform’s clipboard.

8.41.1 1 Class

class IPython.lib.clipboard.ClipboardEmpty
Bases: ValueError
8.41.2 3 Functions

IPython.lib.clipboard.win32_clipboard_get()
    Get the current clipboard’s text on Windows.
    Requires Mark Hammond’s pywin32 extensions.
IPython.lib.clipboard.osx_clipboard_get()
    Get the clipboard’s text on OS X.
IPython.lib.clipboard.tkinter_clipboard_get()
    Get the clipboard’s text using Tkinter.
    This is the default on systems that are not Windows or OS X. It may interfere with other UI toolkits and should be replaced with an implementation that uses that toolkit.

8.42 Module: lib.deepreload

Provides a reload() function that acts recursively.

Python’s normal reload function only reloads the module that it’s passed. The reload() function in this module also reloads everything imported from that module, which is useful when you’re changing files deep inside a package.

To use this as your default reload function, type this for Python 2:

```python
import __builtin__
from IPython.lib import deepreload
__builtin__.reload = deepreload.reload
```

Or this for Python 3:

```python
import builtins
from IPython.lib import deepreload
builtins.reload = deepreload.reload
```

A reference to the original reload is stored in this module as original_reload, so you can restore it later.

This code is almost entirely based on knee.py, which is a Python re-implementation of hierarchical module import.

8.42.1 9 Functions

IPython.lib.deepreload.replace_import_hook(new_import)

IPython.lib.deepreload.get_parent(globals, level)
    parent, name = get_parent(globals, level)
    Return the package that an import is being performed in. If globals comes from the module foo.bar.bat (not itself a package), this returns the sys.modules entry for foo.bar. If globals is from a package’s __init__.py, the package’s entry in sys.modules is returned.
    If globals doesn’t come from a package or a module in a package, or a corresponding entry is not found in sys.modules, None is returned.

IPython.lib.deepreload.load_next(mod, altmod, name, buf)
    mod, name, buf = load_next(mod, altmod, name, buf)
    altmod is either None or same as mod
IPython.lib.deepreload.import_submodule(mod, subname, fullname)  
    m = import_submodule(mod, subname, fullname)

IPython.lib.deepreload.add_submodule(mod, submod, fullname, subname)  
    mod.{subname} = submod

IPython.lib.deepreload.ensure_fromlist(mod, fromlist, buf, recursive)  
    Handle 'from module import a, b, c' imports.

IPython.lib.deepreload.deep_import_hook(name, globals=None, locals=None, fromlist=None, level=-1)  
    Replacement for __import__()

IPython.lib.deepreload.deep_reload_hook(m)  
    Replacement for reload().

IPython.lib.deepreload.reload(module, exclude=('sys', 'os.path', 'builtins', '__main__', 'numpy', 'numpy.__globals__'))  
    Recursively reload all modules used in the given module. Optionally takes a list of modules to exclude from reloading. The default exclude list contains sys, __main__, and __builtins__, to prevent, e.g., resetting display, exception, and io hooks.

8.43 Module: lib.demo

Module for interactive demos using IPython.

This module implements a few classes for running Python scripts interactively in IPython for demonstrations. With very simple markup (a few tags in comments), you can control points where the script stops executing and returns control to IPython.

8.43.1 Provided classes

The classes are (see their docstrings for further details):

- Demo: pure python demos
- IPythonDemo: demos with input to be processed by IPython as if it had been typed interactively (so magics work, as well as any other special syntax you may have added via input prefilters).
- LineDemo: single-line version of the Demo class. These demos are executed one line at a time, and require no markup.
- IPythonLineDemo: IPython version of the LineDemo class (the demo is executed a line at a time, but processed via IPython).
- ClearMixin: mixin to make Demo classes with less visual clutter. It declares an empty marquee and a pre_cmd that clears the screen before each block (see Subclassing below).
- ClearDemo, ClearIPDemo: mixin-enabled versions of the Demo and IPythonDemo classes.
### 8.43.2 Subclassing

The classes here all include a few methods meant to make customization by subclassing more convenient. Their docstrings below have some more details:

- **marquee()**: generates a marquee to provide visible on-screen markers at each block start and end.
- **pre_cmd()**: run right before the execution of each block.
- **post_cmd()**: run right after the execution of each block. If the block raises an exception, this is NOT called.

### 8.43.3 Operation

The file is run in its own empty namespace (though you can pass it a string of arguments as if in a command line environment, and it will see those as `sys.argv`). But at each stop, the global IPython namespace is updated with the current internal demo namespace, so you can work interactively with the data accumulated so far.

By default, each block of code is printed (with syntax highlighting) before executing it and you have to confirm execution. This is intended to show the code to an audience first so you can discuss it, and only proceed with execution once you agree. There are a few tags which allow you to modify this behavior.

The supported tags are:

# `<demo>` stop

Defines block boundaries, the points where IPython stops execution of the file and returns to the interactive prompt.

You can optionally mark the stop tag with extra dashes before and after the word `‘stop’`, to help visually distinguish the blocks in a text editor:

# `<demo> — stop —`

# `<demo>` silent

Make a block execute silently (and hence automatically). Typically used in cases where you have some boilerplate or initialization code which you need executed but do not want to be seen in the demo.

# `<demo>` auto
Make a block execute automatically, but still being printed. Useful for simple code which does not warrant discussion, since it avoids the extra manual confirmation.

# <demo> auto_all

This tag can _only_ be in the first block, and if given it overrides the individual auto tags to make the whole demo fully automatic (no block asks for confirmation). It can also be given at creation time (or the attribute set later) to override what’s in the file.

While _any_ python file can be run as a Demo instance, if there are no stop tags the whole file will run in a single block (no different that calling first %pycat and then %run). The minimal markup to make this useful is to place a set of stop tags; the other tags are only there to let you fine-tune the execution.

This is probably best explained with the simple example file below. You can copy this into a file named ex_demo.py, and try running it via:

```python
from IPython.lib.demo import Demo
d = Demo('ex_demo.py')
d()
```

Each time you call the demo object, it runs the next block. The demo object has a few useful methods for navigation, like again(), edit(), jump(), seek() and back(). It can be reset for a new run via reset() or reloaded from disk (in case you’ve edited the source) via reload(). See their docstrings below.

Note: To make this simpler to explore, a file called “demo-exercizer.py” has been added to the “docs/examples/core” directory. Just cd to this directory in an IPython session, and type:

```bash
%run demo-exercizer.py
```

and then follow the directions.

**Example**

The following is a very simple example of a valid demo file.

```python
# A simple interactive demo to illustrate the use of IPython's Demo class.''
print 'Hello, welcome to an interactive IPython demo.'

# The mark below defines a block boundary, which is a point where IPython will stop execution and return to the interactive prompt. The dashes are actually optional and used only as a visual aid to clearly separate blocks while editing the demo code.
#<demo> stop
x = 1
y = 2

#<demo> stop

# the mark below makes this block as silent
#<demo> silent
print 'This is a silent block, which gets executed but not printed.'

#<demo> stop
#<demo> auto
```

(continues on next page)
print 'This is an automatic block.'
print 'It is executed without asking for confirmation, but printed.'
z = x+y
print 'z=',x

# <demo> stop
# This is just another normal block.
print 'z is now:', z

print 'bye!

#%%%%%%%%%%%%%%%% END EXAMPLE DEMO <ex_demo.py> %%%%%%%%%%%%%%%%%

8.43.4 8 Classes

class IPython.lib.demo.DemoError
    Bases: Exception

class IPython.lib.demo.Demo (src, title='', arg_str='', auto_all=None)
    Bases: object

    __init__(src, title='', arg_str='', auto_all=None)
        Make a new demo object. To run the demo, simply call the object.
        See the module docstring for full details and an example (you can use IPython.Demo? in IPython to see it).
        Inputs:
        • src is either a file, or file-like object, or a string that can be resolved to a filename.
        Optional inputs:
        • title: a string to use as the demo name. Of most use when the demo you are making comes from an object that has no filename, or if you want an alternate denotation distinct from the filename.
        • arg_str(''): a string of arguments, internally converted to a list just like sys.argv, so the demo script can see a similar environment.
        • auto_all(None): global flag to run all blocks automatically without confirmation. This attribute overrides the block-level tags and applies to the whole demo. It is an attribute of the object, and can be changed at runtime simply by reassigning it to a boolean value.

    again()
        Move the seek pointer back one block and re-execute.

    back (num=1)
        Move the seek pointer back num blocks (default is 1).

    edit (index=None)
        Edit a block.
        If no number is given, use the last block executed.
        This edits the in-memory copy of the demo, it does NOT modify the original source file. If you want to do that, simply open the file in an editor and use reload() when you make changes to the file. This method is meant to let you change a block during a demonstration for explanatory purposes, without damaging your original script.
```
reload()
Reload source from disk and initialize state.
reset()
Reset the namespace and seek pointer to restart the demo
run_cell(source)
Execute a string with one or more lines of code
seek(index)
Move the current seek pointer to the given block.
    You can use negative indices to seek from the end, with identical semantics to those of Python lists.
show(index=None)
Show a single block on screen
show_all()
Show entire demo on screen, block by block
```

**class** IPython.lib.demo.IPythonDemo(src, title='', arg_str='', auto_all=None)

**Bases:** IPython.lib.demo.Demo

Class for interactive demos with IPython’s input processing applied.

This subclasses Demo, but instead of executing each block by the Python interpreter (via exec), it actually calls
IPython on it, so that any input filters which may be in place are applied to the input block.

If you have an interactive environment which exposes special input processing, you can use this class instead
to write demo scripts which operate exactly as if you had typed them interactively. The default Demo class
requires the input to be valid, pure Python code.

```
run_cell(source)
Execute a string with one or more lines of code
```

**class** IPython.lib.demo.LineDemo(src, title='', arg_str='', auto_all=None)

**Bases:** IPython.lib.demo.Demo

Demo where each line is executed as a separate block.

The input script should be valid Python code.

This class doesn’t require any markup at all, and it’s meant for simple scripts (with no nesting or any kind of
indentation) which consist of multiple lines of input to be executed, one at a time, as if they had been typed in
the interactive prompt.

Note: the input can not have any indentation, which means that only single-lines of input are accepted, not even
function definitions are valid.
**reload**
Reload source from disk and initialize state.

**class** IPython.lib.demo.IPythonLineDemo(src, title='', arg_str='', auto_all=None)
**Bases:** IPython.lib.demo.IPythonDemo, IPython.lib.demo.LineDemo

Variant of the LineDemo class whose input is processed by IPython.

**class** IPython.lib.demo.ClearMixin
**Bases:** object

Use this mixin to make Demo classes with less visual clutter.
Demos using this mixin will clear the screen before every block and use blank marquees.
Note that in order for the methods defined here to actually override those of the classes it's mixed with, it must go /first/ in the inheritance tree. For example:

class ClearIPDemo(ClearMixin,IPythonDemo): pass
will provide an IPythonDemo class with the mixin's features.

**marquee**(txt='', width=78, mark='*')
Blank marquee that returns '' no matter what the input.

**pre_cmd**
Method called before executing each block.
This one simply clears the screen.

**class** IPython.lib.demo.ClearDemo(src, title='', arg_str='', auto_all=None)
**Bases:** IPython.lib.demo.ClearMixin, IPython.lib.demo.Demo

**class** IPython.lib.demo.ClearIPDemo(src, title='', arg_str='', auto_all=None)
**Bases:** IPython.lib.demo.ClearMixin, IPython.lib.demo.IPythonDemo

8.43.5 1 Function

IPython.lib.demo.re_mark(mark)

8.44 Module: lib.editorhooks

‘editor’ hooks for common editors that work well with ipython
They should honor the line number argument, at least.
Contributions are very welcome.

8.44.1 11 Functions

IPython.lib.editorhooks.install_editor(template, wait=False)
Installs the editor that is called by IPython for the %edit magic.
This overrides the default editor, which is generally set by your EDITOR environment variable or is notepad (windows) or vi (linux). By supplying a template string run_template, you can control how the editor is invoked by IPython – (e.g. the format in which it accepts command line options)

Parameters
• **template** *(basestring)* – run_template acts as a template for how your editor is invoked by the shell. It should contain ‘{filename}’, which will be replaced on invocation with the file name, and ‘{line}’, Sline by line number (or 0) to invoke the file with.

• **wait** *(bool)* – If wait is true, wait until the user presses enter before returning, to facilitate non-blocking editors that exit immediately after the call.

```python
IPython.lib.editorhooks.komodo(exe='komodo')  # Activestate Komodo [Edit]
IPython.lib.editorhooks.scite(exe='scite')     # SciTE or Sc1
IPython.lib.editorhooks.notepadplusplus(exe='notepad++')  # Notepad++ http://notepad-plus.sourceforge.net
IPython.lib.editorhooks.jed(exe='jed')         # JED, the lightweight emacsish editor
IPython.lib.editorhooks.idle(exe='idle')       # Idle, the editor bundled with python
IPython.lib.editorhooks.mate(exe='mate')       # TextMate, the missing editor
IPython.lib.editorhooks.emacs(exe='emacs')     # IPython.lib.editorhooks.gnuclient(exe='gnuclient')
IPython.lib.editorhooks.crimson_editor(exe='cedt.exe')
IPython.lib.editorhooks.kate(exe='kate')
```

## 8.45 Module: **lib.guisupport**

Support for creating GUI apps and starting event loops.

IPython’s GUI integration allows interactive plotting and GUI usage in IPython session. IPython has two different types of GUI integration:

1. The terminal based IPython supports GUI event loops through Python’s PyOS_InputHook. PyOS_InputHook is a hook that Python calls periodically whenever raw_input is waiting for a user to type code. We implement GUI support in the terminal by setting PyOS_InputHook to a function that iterates the event loop for a short while. It is important to note that in this situation, the real GUI event loop is NOT run in the normal manner, so you can’t use the normal means to detect that it is running.

2. In the two process IPython kernel/frontend, the GUI event loop is run in the kernel. In this case, the event loop is run in the normal manner by calling the function or method of the GUI toolkit that starts the event loop.

In addition to starting the GUI event loops in one of these two ways, IPython will always create an appropriate GUI application object when GUI integration is enabled.

If you want your GUI apps to run in IPython you need to do two things:

1. Test to see if there is already an existing main application object. If there is, you should use it. If there is not an existing application object you should create one.

2. Test to see if the GUI event loop is running. If it is, you should not start it. If the event loop is not running you may start it.
This module contains functions for each toolkit that perform these things in a consistent manner. Because of how PyOS_InputHook runs the event loop you cannot detect if the event loop is running using the traditional calls (such as `wx.GetApp.IsMainLoopRunning()` in wxPython). If PyOS_InputHook is set These methods will return a false negative. That is, they will say the event loop is not running, when is actually is. To work around this limitation we proposed the following informal protocol:

- Whenever someone starts the event loop, they must set the `_in_event_loop` attribute of the main application object to True. This should be done regardless of how the event loop is actually run.
- Whenever someone stops the event loop, they must set the `_in_event_loop` attribute of the main application object to False.
- If you want to see if the event loop is running, you must use `hasattr` to see if `_in_event_loop` attribute has been set. If it is set, you must use its value. If it has not been set, you can query the toolkit in the normal manner.
- If you want GUI support and no one else has created an application or started the event loop you must do this. We don’t want projects to attempt to defer these things to someone else if they themselves need it.

The functions below implement this logic for each GUI toolkit. If you need to create custom application subclasses, you will likely have to modify this code for your own purposes. This code can be copied into your own project so you don’t have to depend on IPython.

### 8.45.1 6 Functions

```python
IPython.lib.guisupport.get_app_wx(*args, **kwargs)
Create a new wx app or return an exiting one.
```

```python
IPython.lib.guisupport.is_event_loop_running_wx(app=None)
Is the wx event loop running.
```

```python
IPython.lib.guisupport.start_event_loop_wx(app=None)
Start the wx event loop in a consistent manner.
```

```python
IPython.lib.guisupport.get_app_qt4(*args, **kwargs)
Create a new qt4 app or return an existing one.
```

```python
IPython.lib.guisupport.is_event_loop_running_qt4(app=None)
Is the qt4 event loop running.
```

```python
IPython.lib.guisupport.start_event_loop_qt4(app=None)
Start the qt4 event loop in a consistent manner.
```

### 8.46 Module: lib.inputhook

Deprecated since IPython 5.0

Inputhook management for GUI event loop integration.

#### 8.46.1 11 Classes

```python
class IPython.lib.inputhook.InputHookManager
    Bases: object
    DEPRECATED since IPython 5.0
    Manage PyOS_InputHook for different GUI toolkits.
```
This class installs various hooks under `PyOSInputHook` to handle GUI event loop integration.

```python
__init__()  
Initialize self. See help(type(self)) for accurate signature.

clear_app_refs(gui=None)  
DEPRECATED since IPython 5.0
Clear IPython’s internal reference to an application instance.
Whenever we create an app for a user on qt4 or wx, we hold a reference to the app. This is needed because in some cases bad things can happen if a user doesn’t hold a reference themselves. This method is provided to clear the references we are holding.

Parameters
- gui (optional, string or None) – If None, clear all app references. If (‘wx’, ‘qt4’) clear the app for that toolkit. References are not held for gtk or tk as those toolkits don’t have the notion of an app.

clear_inputhook(app=None)  
DEPRECATED since IPython 5.0
Set PyOS_InputHook to NULL and return the previous one.

Parameters
- app (optional, ignored) – This parameter is allowed only so that clear_inputhook() can be called with a similar interface as all the enable_* methods. But the actual value of the parameter is ignored. This uniform interface makes it easier to have user-level entry points in the main IPython app like enable_gui().

current_gui()  
DEPRECATED since IPython 5.0
Return a string indicating the currently active GUI or None.

disable_gui()  
DEPRECATED since IPython 5.0
Disable GUI event loop integration.
If an application was registered, this sets its _in_event_loop attribute to False. It then calls clear_inputhook().

enable_gui(gui=None, app=None)  
DEPRECATED since IPython 5.0
Switch amongst GUI input hooks by name.
This is a higher level method than set_inputhook() - it uses the GUI name to look up a registered object which enables the input hook for that GUI.

Parameters
- gui (optional, string or None) – If None (or ‘none’), clears input hook, otherwise it must be one of the recognized GUI names (see GUI_* constants in module).
- app (optional, existing application object.) – For toolkits that have the concept of a global app, you can supply an existing one. If not given, the toolkit will be probed for one, and if none is found, a new one will be created. Note that GTK does not have this concept, and passing an app if gui="GTK" will raise an error.

Returns
- The output of the underlying gui switch routine, typically the actual
- PyOS_InputHook wrapper object or the GUI toolkit app created, if there was
get_pyos_inputhook()
DEPRECATED since IPython 5.0
Return the current PyOS_InputHook as a ctypes.c_void_p.

get_pyos_inputhook_as_func()
DEPRECATED since IPython 5.0
Return the current PyOS_InputHook as a ctypes.PYFUNCYPE.

register (toolkitname, *aliases)
DEPRECATED since IPython 5.0
Register a class to provide the event loop for a given GUI.
This is intended to be used as a class decorator. It should be passed the names with which to register this GUI integration. The classes themselves should subclass InputHookBase.

```python
@inputhook_manager.register('qt')
class QtInputHook(InputHookBase):
    def enable(self, app=None):
        ...
```

set_inputhook (callback)
DEPRECATED since IPython 5.0
Set PyOS_InputHook to callback and return the previous one.

class IPython.lib.inputhook.InputHookBase (manager)
Bases: object
DEPRECATED since IPython 5.0
Base class for input hooks for specific toolkits.
Subclasses should define an enable() method with one argument, app, which will either be an instance of the toolkit’s application class, or None. They may also define a disable() method with no arguments.

```python
__init__ (manager)
Initialize self. See help(type(self)) for accurate signature.
```

class IPython.lib.inputhook.NullInputHook (manager)
Bases: IPython.lib.inputhook.InputHookBase
DEPRECATED since IPython 5.0
A null inputhook that doesn’t need to do anything

class IPython.lib.inputhook.WxInputHook (manager)
Bases: IPython.lib.inputhook.InputHookBase

disable()
DEPRECATED since IPython 5.0
Disable event loop integration with wxPython.
This restores appnapp on OS X

enable (app=None)
DEPRECATED since IPython 5.0
Enable event loop integration with wxPython.
Parameters **app** (*WX Application, optional.*) – Running application to use. If not given, we probe WX for an existing application object, and create a new one if none is found.

Notes

This method sets the PyOS_InputHook for wxPython, which allows the wxPython to integrate with terminal based applications like IPython.

If **app** is not given we probe for an existing one, and return it if found. If no existing app is found, we create an *wx.App* as follows:

```python
import wx
app = wx.App(redirect=False, clearSigInt=False)
```

class IPython.lib.inputhook.Qt4InputHook(*manager*)

Bases: IPython.lib.inputhook.InputHookBase

**disable_qt4** ()

DEPRECATED since IPython 5.0

Disable event loop integration with PyQt4.

This restores appnapp on OS X

**enable**(**app=None**)

DEPRECATED since IPython 5.0

Enable event loop integration with PyQt4.

Parameters **app** (*Qt Application, optional.*) – Running application to use. If not given, we probe Qt for an existing application object, and create a new one if none is found.

Notes

This method sets the PyOS_InputHook for PyQt4, which allows the PyQt4 to integrate with terminal based applications like IPython.

If **app** is not given we probe for an existing one, and return it if found. If no existing app is found, we create an QApplication as follows:

```python
from PyQt4 import QtCore
app = QtGui.QApplication(sys.argv)
```

class IPython.lib.inputhook.Qt5InputHook(*manager*)

Bases: IPython.lib.inputhook.Qt4InputHook

**enable**(**app=None**)

DEPRECATED since IPython 5.0

Enable event loop integration with PyQt4.

Parameters **app** (*Qt Application, optional.*) – Running application to use. If not given, we probe Qt for an existing application object, and create a new one if none is found.
Notes

This method sets the PyOS_InputHook for PyQt4, which allows the PyQt4 to integrate with terminal based applications like IPython.

If `app` is not given we probe for an existing one, and return it if found. If no existing app is found, we create an QApplication as follows:

```python
from PyQt4 import QtCore
app = QtGui.QApplication(sys.argv)
```

class IPython.lib.inputhook.GtkInputHook(manager)
Bases: IPython.lib.inputhook.InputHookBase

def enable(app=None)
    DEPRECATED since IPython 5.0
    Enable event loop integration with PyGTK.

    Parameters
    app (ignored) -- Ignored, it's only a placeholder to keep the call signature of all gui activation methods consistent, which simplifies the logic of supporting magics.

Notes

This method sets the PyOS_InputHook for PyGTK, which allows the PyGTK to integrate with terminal based applications like IPython.

class IPython.lib.inputhook.TkInputHook(manager)
Bases: IPython.lib.inputhook.InputHookBase

def enable(app=None)
    DEPRECATED since IPython 5.0
    Enable event loop integration with Tk.

    Parameters
    app (toplevel Tkinter.Tk widget, optional.) -- Running toplevel widget to use.
    If not given, we probe Tk for an existing one, and create a new one if none is found.

Notes

If you have already created a Tkinter.Tk object, the only thing done by this method is to register with the InputHookManager, since creating that object automatically sets PyOS_InputHook.

class IPython.lib.inputhook.GlutInputHook(manager)
Bases: IPython.lib.inputhook.InputHookBase

def disable()
    DEPRECATED since IPython 5.0
    Disable event loop integration with glut.

    This sets PyOS_InputHook to NULL and set the display function to a dummy one and set the timer to a dummy timer that will be triggered very far in the future.

def enable(app=None)
    DEPRECATED since IPython 5.0
    Enable event loop integration with GLUT.
Parameters **app** *(ignored)* – Ignored, it’s only a placeholder to keep the call signature of all gui activation methods consistent, which simplifies the logic of supporting magics.

Notes

This method sets the `PyOS_InputHook` for GLUT, which allows the GLUT to integrate with terminal based applications like IPython. Due to GLUT limitations, it is currently not possible to start the event loop without first creating a window. You should thus not create another window but use instead the created one. See ‘gui-glut.py’ in the docs/examples/lib directory.

The default screen mode is set to: `glut.GLUT_DOUBLE | glut.GLUT_RGBA | glut.GLUT_DEPTH`

```python
class IPython.lib.inputhook.PygletInputHook(manager)
    Bases: IPython.lib.inputhook.InputHookBase
    enable(app=None)
        DEPRECATED since IPython 5.0
        Enable event loop integration with pyglet.
        Parameters **app** *(ignored)* – Ignored, it’s only a placeholder to keep the call signature of all gui activation methods consistent, which simplifies the logic of supporting magics.

Notes

This method sets the `PyOS_InputHook` for pyglet, which allows pyglet to integrate with terminal based applications like IPython.

```python
class IPython.lib.inputhook.Gtk3InputHook(manager)
    Bases: IPython.lib.inputhook.InputHookBase
    enable(app=None)
        DEPRECATED since IPython 5.0
        Enable event loop integration with Gtk3 (gir bindings).
        Parameters **app** *(ignored)* – Ignored, it’s only a placeholder to keep the call signature of all gui activation methods consistent, which simplifies the logic of supporting magics.

Notes

This method sets the `PyOS_InputHook` for Gtk3, which allows the Gtk3 to integrate with terminal based applications like IPython.

**8.47 Module: lib.latextools**

Tools for handling LaTeX.

**8.47.1 1 Class**

```python
class IPython.lib.latextools.LaTeXTool(**kwargs)
    Bases: traitlets.config.configurable.SingletonConfigurable
    An object to store configuration of the LaTeX tool.
```
8.47.2 6 Functions

IPython.lib.latextools.latex_to_png \(s\), \(encode=\text{False}\), \(backend=\text{None}\), \(wrap=\text{False}\)

Render a LaTeX string to PNG.

Parameters

- \(s\) (str) – The raw string containing valid inline LaTeX.
- \(encode\) (bool, optional) – Should the PNG data be base64 encoded to make it JSON’able.
- \(backend\) (matplotlib, dvipng) – Backend for producing PNG data.
- \(wrap\) (bool) – If true, automatically wrap \(s\) as a LaTeX equation.

is returned when the backend cannot be used. (None) –

IPython.lib.latextools.latex_to_png_mpl \(s\), \(wrap\)

IPython.lib.latextools.latex_to_png_dvipng \(s\), \(wrap\)

IPython.lib.latextools.kpsewhich \(filename\)
Invoke kpsewhich command with an argument \(filename\).

IPython.lib.latextools.genelatex \(body\), \(wrap\)
Generate LaTeX document for dvipng backend.

IPython.lib.latextools.latex_to_html \(s\), \(alt=\text{image}\)
Render LaTeX to HTML with embedded PNG data using data URIs.

Parameters

- \(s\) (str) – The raw string containing valid inline LaTeX.
- \(alt\) (str) – The alt text to use for the HTML.

8.48 Module: lib.lexers

Defines a variety of Pygments lexers for highlighting IPython code.

This includes:

- IPythonLexer, IPython3Lexer – Lexers for pure IPython (python + magic/shell commands)
- IPythonPartialTracebackLexer, IPythonTracebackLexer – Supports 2.x and 3.x via keyword python3. The partial traceback lexer reads everything but the Python code appearing in a traceback. The full lexer combines the partial lexer with an IPython lexer.
- IPythonConsoleLexer – A lexer for IPython console sessions, with support for tracebacks.
- IPyLexer – A friendly lexer which examines the first line of text and from it, decides whether to use an IPython lexer or an IPython console lexer. This is probably the only lexer that needs to be explicitly added to Pygments.

8.48.1 4 Classes

class IPython.lib.lexers.IPythonPartialTracebackLexer(**options)
Bases: pygments.lexer.RegexLexer
Partial lexer for IPython tracebacks.
Handles all the non-python output. This works for both Python 2.x and 3.x.

class IPython.lib.lexer.IPythonTracebackLexer(**options)
Bases: pygments.lexer.DelegatingLexer

IPython traceback lexer.

For doctests, the tracebacks can be snipped as much as desired with the exception to the lines that designate a traceback. For non-syntax error tracebacks, this is the line of hyphens. For syntax error tracebacks, this is the line which lists the File and line number.

__init__(**options)
Initialize self. See help(type(self)) for accurate signature.

class IPython.lib.lexer.IPythonConsoleLexer(**options)
Bases: pygments.lexer.Lexer

An IPython console lexer for IPython code-blocks and doctests, such as:

```
.. code-block:: ipythonconsole

    In [1]: a = 'foo'
    In [2]: a
    Out[2]: 'foo'
    In [3]: print a
    foo
    In [4]: 1 / 0
```

Support is also provided for IPython exceptions:

```
.. code-block:: ipythonconsole

    In [1]: raise Exception

    Traceback (most recent call last)
    <ipython-input-1-fca2ab0ca76b> in <module>()
    ----> 1 raise Exception

    Exception:
```

__init__(**options)
Initialize the IPython console lexer.

Parameters

- **python3** (bool) – If True, then the console inputs are parsed using a Python 3 lexer. Otherwise, they are parsed using a Python 2 lexer.
- **in1_regex** (RegexObject) – The compiled regular expression used to detect the start of inputs. Although the IPython configuration setting may have a trailing whitespace, do not include it in the regex. If None, then the default input prompt is assumed.
- **in2_regex** (RegexObject) – The compiled regular expression used to detect the continuation of inputs. Although the IPython configuration setting may have a trailing whitespace, do not include it in the regex. If None, then the default input prompt is assumed.
- **out_regex** (RegexObject) – The compiled regular expression used to detect outputs. If None, then the default output prompt is assumed.
**buffered_tokens** ()
Generator of unprocessed tokens after doing insertions and before changing to a new state.

**get_mci**(line)
Parses the line and returns a 3-tuple: (mode, code, insertion).

mode is the next mode (or state) of the lexer, and is always equal to ‘input’, ‘output’, or ‘tb’.

code is a portion of the line that should be added to the buffer corresponding to the next mode and eventually lexed by another lexer. For example, code could be Python code if mode were ‘input’.

insertion is a 3-tuple (index, token, text) representing an unprocessed “token” that will be inserted into the stream of tokens that are created from the buffer once we change modes. This is usually the input or output prompt.

In general, the next mode depends on current mode and on the contents of line.

**get_tokens_unprocessed**(text)
Return an iterable of (index, tokentype, value) pairs where “index” is the starting position of the token within the input text.

In subclasses, implement this method as a generator to maximize effectiveness.

```python
ipytb_start = re.compile('^(\^C)?(-+\n)|^( File)(.*)(, line )(\d+\n)')
The regex to determine when a traceback starts.
```

**class** IPython.lib.lexers.IPyLexer(**options**)
Bases: pygments.lexer.Lexer
Primary lexer for all IPython-like code.

This is a simple helper lexer. If the first line of the text begins with “In [[0-9]+]:”, then the entire text is parsed with an IPython console lexer. If not, then the entire text is parsed with an IPython lexer.

The goal is to reduce the number of lexers that are registered with Pygments.

```python
__init__(**options)
Initialize self. See help(type(self)) for accurate signature.
```

```python
get_tokens_unprocessed(text)
Return an iterable of (index, tokentype, value) pairs where “index” is the starting position of the token within the input text.

In subclasses, implement this method as a generator to maximize effectiveness.
```

### 8.48.2 1 Function

**IPython.lib.lexers.build_ipylexer**(python3)
Builds IPython lexers depending on the value of python3.

The lexer inherits from an appropriate Python lexer and then adds information about IPython specific keywords (i.e. magic commands, shell commands, etc.)

**Parameters** python3 (bool) – If True, then build an IPython lexer from a Python 3 lexer.

### 8.49 Module: lib.pretty

Python advanced pretty printer. This pretty printer is intended to replace the old pprint python module which does not allow developers to provide their own pretty print callbacks.
This module is based on ruby's `prettyprint.rb` library by Tanaka Akira.

### 8.49.1 Example Usage

To directly print the representation of an object use `pprint`:

```python
from pretty import pprint
pprint(complex_object)
```

To get a string of the output use `pretty`:

```python
from pretty import pretty
string = pretty(complex_object)
```

### 8.49.2 Extending

The pretty library allows developers to add pretty printing rules for their own objects. This process is straightforward. All you have to do is to add a `__repr_pretty__` method to your object and call the methods on the pretty printer passed:

```python
class MyObject(object):
    def __repr_pretty__(self, p, cycle):
        ...
```

Here is an example implementation of a `__repr_pretty__` method for a list subclass:

```python
class MyList(list):
    def __repr_pretty__(self, p, cycle):
        if cycle:
            p.text('MyList(...)')
        else:
            with p.group(8, 'MyList([', ']'):
                for idx, item in enumerate(self):
                    if idx:
                        p.text(',')
                        p.breakable()
                    p.pretty(item)
```

The `cycle` parameter is `True` if pretty detected a cycle. You *have* to react to that or the result is an infinite loop. `p.text()` just adds non-breaking text to the output, `p.breakable()` either adds a whitespace or breaks here. If you pass it an argument it's used instead of the default space. `p.pretty` prettyprints another object using the pretty print method.

The first parameter to the `group` function specifies the extra indentation of the next line. In this example the next item will either be on the same line (if the items are short enough) or aligned with the right edge of the opening bracket of `MyList`.

If you just want to indent something you can use the group function without open / close parameters. You can also use this code:

```python
with p.indent(2):
    ...
```
Inheritance diagram:

- lib.pretty.PrettyPrinter
- lib.pretty.RepresentationPrinter
- lib.pretty.GroupQueue
- lib.pretty.Breakable
- lib.pretty.Printable
- lib.pretty.Text

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### 8.49.3 8 Classes

**IPython.lib.pretty.CUnicodeIO**

alias of _io.StringIO

**class IPython.lib.pretty.PrettyPrinter**

```py
class IPython.lib.pretty.PrettyPrinter(output, max_width=79, newline='n', max_seq_length=1000)
```

Bases: IPython.lib.pretty._PrettyPrinterBase

Baseclass for the RepresentationPrinter prettyprinter that is used to generate pretty reprs of objects. Contrary to the RepresentationPrinter this printer knows nothing about the default pprinters or the `_repr_pretty_` callback method.

**__init__**(output, max_width=79, newline='n', max_seq_length=1000)

Initialize self. See help(type(self)) for accurate signature.

**begin_group**(indent=0, open='')

Begin a group. If you want support for python < 2.5 which doesn’t has the with statement this is the preferred way:

```
p.begin_group(1, '{') ... p.end_group(1, '}
```

The python 2.5 expression would be this:

```
with p.group(1, '{', '}'): ... 
```

The first parameter specifies the indentation for the next line (usually the width of the opening text), the second the opening text. All parameters are optional.

**break_**()

Explicitly insert a newline into the output, maintaining correct indentation.

**breakable**(sep=’ ’)

Add a breakable separator to the output. This does not mean that it will automatically break here. If no breaking on this position takes place the sep is inserted which default to one space.
end_group(dedent=0, close="")
End a group. See begin_group for more details.

flush()
Flush data that is left in the buffer.

text(obj)
Add literal text to the output.

class IPython.lib.pretty.RepresentationPrinter(output, verbose=False, max_width=79, newline='n', singleton_pprinters=None, type_pprinters=None, deferred_pprinters=None, max_seq_length=1000)
Bases: IPython.lib.pretty.PrettyPrinter
Special pretty printer that has a pretty method that calls the pretty printer for a python object.
This class stores processing data on self so you must never use this class in a threaded environment. Always lock it or reinstanciate it.
Instances also have a verbose flag callbacks can access to control their output. For example the default instance repr prints all attributes and methods that are not prefixed by an underscore if the printer is in verbose mode.

__init__(output, verbose=False, max_width=79, newline='n', singleton_pprinters=None, type_pprinters=None, deferred_pprinters=None, max_seq_length=1000)
Initialize self. See help(type(self)) for accurate signature.

pretty(obj)
Pretty print the given object.

class IPython.lib.pretty.Printable
Bases: object

class IPython.lib.pretty.Text
Bases: IPython.lib.pretty.Printable

__init__()
Initialize self. See help(type(self)) for accurate signature.

class IPython.lib.pretty.Breakable(seq, width, pretty)
Bases: IPython.lib.pretty.Printable

__init__(seq, width, pretty)
Initialize self. See help(type(self)) for accurate signature.

class IPython.lib.pretty.Group(depth)
Bases: IPython.lib.pretty.Printable

__init__(depth)
Initialize self. See help(type(self)) for accurate signature.

class IPython.lib.pretty.GroupQueue(*groups)
Bases: object

__init__(*groups)
Initialize self. See help(type(self)) for accurate signature.
8.49.4 4 Functions

IPython.lib.pretty.pretty(obj, verbose=False, max_width=79, newline='\n', max_seq_length=1000)

Pretty print the object’s representation.

IPython.lib.pretty.pprint(obj, verbose=False, max_width=79, newline='\n', max_seq_length=1000)

Like pretty but print to stdout.

IPython.lib.pretty.for_type(typ, func)

Add a pretty printer for a given type.

IPython.lib.pretty.for_type_by_name(type_module, type_name, func)

Add a pretty printer for a type specified by the module and name of a type rather than the type object itself.

8.50 Module: lib.security

Password generation for the IPython notebook.

8.50.1 2 Functions

IPython.lib.security.password(passphrase=None, algorithm='sha1')

Generate hashed password and salt for use in notebook configuration.

In the notebook configuration, set c.NotebookApp.password to the generated string.

Parameters

• passphrase (str) – Password to hash. If unspecified, the user is asked to input and verify a password.

• algorithm (str) – Hashing algorithm to use (e.g., 'sha1' or any argument supported by hashlib.new()).

Returns hashed_passphrase – Hashed password, in the format 'hash_algorithm:salt:passphrase_hash'.

Return type str

Examples

>>> passwd('mypassword')
'sha1:7cf3:6a294ee9592a9480c8f52e63cd42cfd9dd12'

IPython.lib.security.password_check(hashed_passphrase, passphrase)

Verify that a given passphrase matches its hashed version.

Parameters

• hashed_passphrase (str) – Hashed password, in the format returned by passwd.

• passphrase (str) – Passphrase to validate.

Returns valid – True if the passphrase matches the hash.

Return type bool
Examples

```python
>>> from IPython.lib.security import passwd_check
>>> passwd_check('sha1:0e112c3ddfce:a68df677475c2b47b6e86d0467eec97ac5f4b85a', ...
...   'mypassword')
True
```

```python
>>> passwd_check('sha1:0e112c3ddfce:a68df677475c2b47b6e86d0467eec97ac5f4b85a', ...
...   'anotherpassword')
False
```

8.51 Module: paths

Find files and directories which IPython uses.

8.51.1 5 Functions

IPython.paths.get_ipython_dir()
Get the IPython directory for this platform and user.

This uses the logic in get_home_dir to find the home directory and then adds .ipython to the end of the path.

IPython.paths.get_ipython_cache_dir()
Get the cache directory it is created if it does not exist.

IPython.paths.get_ipython_package_dir()
Get the base directory where IPython itself is installed.

IPython.paths.get_ipython_module_path(module_str)
Find the path to an IPython module in this version of IPython.

This will always find the version of the module that is in this importable IPython package. This will always return the path to the .py version of the module.

IPython.paths.locate_profile(profile='default')
Find the path to the folder associated with a given profile.

I.e. find $IPYTHONDIR/profile_whatever.

8.52 Module: terminal.debugger

8.52.1 1 Class

class IPython.terminal.debugger.TerminalPdb(*args, **kwargs)
Bases: IPython.core.debugger.Pdb

__init__(*args, **kwargs)
Instantiate a line-oriented interpreter framework.

The optional argument `completekey` is the readline name of a completion key; it defaults to the Tab key. If completekey is not None and the readline module is available, command completion is done automatically.

The optional arguments stdin and stdout specify alternate input and output file objects; if not specified, sys.stdin and sys.stdout are used.
cmdloop(intro=None)
    Repeatedly issue a prompt, accept input, parse an initial prefix off the received input, and dispatch to action
    methods, passing them the remainder of the line as argument.

    override the same methods from cmd.Cmd to provide prompt toolkit replacement.

8.52.2 1 Function

IPython-terminal.debugger.set_trace(frame=None)
    Start debugging from frame.

    If frame is not specified, debugging starts from caller's frame.

8.53 Module: terminal.embed

An embedded IPython shell.

8.53.1 3 Classes

class IPython-terminal.embed.KillEmbedded
    Bases: Exception

class IPython-terminal.embed.EmbeddedMagics(shell=None, **kwargs)
    Bases: IPython-core.magic.Magics

    exit_raise(parameter_s="")
        %exit_raise Make the current embedded kernel exit and raise an exception.

        This function sets an internal flag so that an embedded IPython will raise a IPython-terminal.
        embed.KillEmbedded Exception on exit, and then exit the current I. This is useful to permanently exit
        a loop that create IPython embed instance.

    kill_embedded(parameter_s="")

        %kill_embedded [-i] [-x] [-y]

        %kill_embedded : deactivate for good the current embedded IPython

        This function (after asking for confirmation) sets an internal flag so that an embedded IPython will never
        activate again for the given call location. This is useful to permanently disable a shell that is being called
        inside a loop: once you've figured out what you needed from it, you may then kill it and the program will
        then continue to run without the interactive shell interfering again.

        If for some reasons you need to kill the location where the instance is created and not called, for example
        if you create a single instance in one place and debug in many locations, you can use the --instance
        option to kill this specific instance. Like for the call location killing an "instance" should work even
        if it is recreated within a loop.

        Note: This was the default behavior before IPython 5.2

        optional arguments:

            -i, --instance          Kill instance instead of call location
INI Configuration

-x, --exit
Also exit the current session

-y, --yes
Do not ask confirmation

class IPython.terminal.embed.InteractiveShellEmbed(**kw)
Bases: IPython.terminal.interactiveshell.TerminalInteractiveShell

__init__(**kw)
Create a configurable given a config config.

Parameters

• config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

• parent (Configurable instance, optional) – The parent Configurable instance of this object.

Notes

Subclasses of Configurable must call the __init__() method of Configurable before doing anything else and using super():

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

init_sys_modules()
Explicitly overwrite IPython.core.interactiveshell to do nothing.

mainloop (local_ns=None, module=None, stack_depth=0, display_banner=None, global_ns=None, compile_flags=None)
Embeds IPython into a running python program.

Parameters

• module (local_ns,) – Working local namespace (a dict) and module (a module or similar object). If given as None, they are automatically taken from the scope where the shell was called, so that program variables become visible.

• stack_depth (int) – How many levels in the stack to go to looking for namespaces (when local_ns or module is None). This allows an intermediate caller to make sure that this function gets the namespace from the intended level in the stack. By default (0) it will get its locals and globals from the immediate caller.

• compile_flags – A bit field identifying the __future__ features that are enabled, as passed to the built-in compile() function. If given as None, they are automatically taken from the scope where the shell was called.

8.53.2 1 Function

IPython.terminal.embed.embed(**kwargs)
Call this to embed IPython at the current point in your program.

The first invocation of this will create an InteractiveShellEmbed instance and then call it. Consecutive calls just call the already created instance.
If you don’t want the kernel to initialize the namespace from the scope of the surrounding function, and/or you want to load full IPython configuration, you probably want `IPython.start_ipython()` instead.

Here is a simple example:

```python
from IPython import embed
a = 10
b = 20
embed(header='First time')
c = 30
d = 40
embed()
```

Full customization can be done by passing a `Config` in as the config argument.

### 8.54 Module: `terminal.interactiveshell`

IPython terminal interface using prompt_toolkit

#### 8.54.1 1 Class

```python
class IPython.terminal.interactiveshell.TerminalInteractiveShell(*args, **kwargs):
Bases: IPython.core.interactiveshell.InteractiveShell
__init__(*args, **kwargs)
    Create a configurable given a config config.

    Parameters
    • config (Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.
    • parent (Configurable instance, optional) – The parent Configurable instance of this object.

    Notes
    Subclasses of Configurable must call the `__init__()` method of Configurable before doing anything else and using `super()`:

    ```python
class MyConfigurable(Configurable):
        def __init__(self, config=None):
            super(MyConfigurable, self).__init__(config=config)
            # Then any other code you need to finish initialization.
    ```

This ensures that instances will be configured properly.

**auto_rewrite_input**(cmd)
Overridden from the parent class to use fancy rewriting prompt

**debugger_cls**
Modified Pdb class, does not load readline.

for a standalone version that uses prompt_toolkit, see IPython.terminal.debugger.TerminalPdb and IPython.terminal.debugger.set_trace()
switch_doctest_mode (mode)
Switch prompts to classic for %doctest_mode

system (cmd)
Call the given cmd in a subprocess using os.system on Windows or subprocess.call using the system shell on other platforms.

Parameters cmd (str) – Command to execute.

8.54.2 1 Function
IPython.terminal.interactiveshell.get_default_editor()

8.55 Module: terminal.ipapp
The Application object for the command line ipython program.

8.55.1 3 Classes

class IPython.terminal.ipapp.IPAppCrashHandler (app)
Bases: IPython.core.crashhandler.CrashHandler

sys.excepthook for IPython itself, leaves a detailed report on disk.

__init__ (app)
Create a new crash handler

Parameters

• app (Application) – A running Application instance, which will be queried at crash time for internal information.

• contact_name (str) – A string with the name of the person to contact.

• contact_email (str) – A string with the email address of the contact.

• bug_tracker (str) – A string with the URL for your project’s bug tracker.

• show_crash_traceback (bool) – If false, don’t print the crash traceback on stderr, only generate the on-disk report

• instance attributes (Non-argument) –

• instances contain some non-argument attributes which allow for (These) –

• customization of the crash handler’s behavior. Please see the (further) –

• for further details. (source) –

make_report (traceback)
Return a string containing a crash report.

class IPython.terminal.ipapp.LocateIPythonApp (**kwars)
Bases: IPython.core.application.BaseIPythonApplication
**start()**

Start the app mainloop.

Override in subclasses.

class IPython.terminal.ipapp.TerminalIPythonApp(**kwargs)

Bases: IPython.core.application.BaseIPythonApplication, IPython.core.shellapp.InteractiveShellApp

**crash_handler_class**

alias of IPAppCrashHandler

**init_banner()**

optionally display the banner

**init_shell()**

initialize the InteractiveShell instance

**initialize**(argv=None)

Do actions after construct, but before starting the app.

**parse_command_line**(argv=None)

override to allow old ‘-pylab’ flag with deprecation warning

**start()**

Start the app mainloop.

Override in subclasses.

### 8.55.2 1 Function

IPython.terminal.ipapp.load_default_config(ipython_dir=None)

Load the default config file from the default ipython_dir.

This is useful for embedded shells.

### 8.56 Module: terminal.magics

Extra magics for terminal use.

### 8.56.1 1 Class

class IPython.terminal.magics.TerminalMagics(shell)

Bases: IPython.core.magic.Magics

**__init__**(shell)

Create a configurable given a config config.

**Parameters**

- **config**(Config) – If this is empty, default values are used. If config is a Config instance, it will be used to configure the instance.

- **parent**(Configurable instance, optional) – The parent Configurable instance of this object.
Notes

Subclasses of `Configurable` must call the `__init__()` method of `Configurable` before doing anything else and using `super()`:

```python
class MyConfigurable(Configurable):
    def __init__(self, config=None):
        super(MyConfigurable, self).__init__(config=config)
        # Then any other code you need to finish initialization.
```

This ensures that instances will be configured properly.

`autoindent (parameter_s=“")`
Toggle autoindent on/off (deprecated)

`cpaste (parameter_s=“")`
Paste & execute a pre-formatted code block from clipboard.

You must terminate the block with ‘--’ (two minus-signs) or Ctrl-D alone on the line. You can also provide your own sentinel with ‘%cpaste -s %%’ (‘%%’ is the new sentinel for this operation).

The block is dedented prior to execution to enable execution of method definitions. ‘>’ and ‘+’ characters at the beginning of a line are ignored, to allow pasting directly from e-mails, diff files and doctests (the ‘…’ continuation prompt is also stripped). The executed block is also assigned to variable named ‘pasted_block’ for later editing with ‘%edit pasted_block’.

You can also pass a variable name as an argument, e.g. ‘%cpaste foo’. This assigns the pasted block to variable ‘foo’ as string, without dedenting or executing it (preceding >>> and + is still stripped)

‘%cpaste -r’ re-executes the block previously entered by cpaste. ‘%cpaste -q’ suppresses any additional output messages.

Do not be alarmed by garbled output on Windows (it’s a readline bug). Just press enter and type – (and press enter again) and the block will be what was just pasted.

IPython statements (magics, shell escapes) are not supported (yet).

See also:

`paste()` automatically pull code from clipboard.

Examples

```
In [8]: %cpaste
Pastng code; enter '---' alone on the line to stop.
:>>> a = ["world!", "Hello"]
:>>> print " ".join(sorted(a))
:--
Hello world!
```

`paste (parameter_s=“")`
Paste & execute a pre-formatted code block from clipboard.

The text is pulled directly from the clipboard without user intervention and printed back on the screen before execution (unless the -q flag is given to force quiet mode).

The block is dedented prior to execution to enable execution of method definitions. ‘>’ and ‘+’ characters at the beginning of a line are ignored, to allow pasting directly from e-mails, diff files and doctests
(the ‘...’ continuation prompt is also stripped). The executed block is also assigned to variable named ‘pasted_block’ for later editing with ‘%edit pasted_block’.

You can also pass a variable name as an argument, e.g. ‘%paste foo’. This assigns the pasted block to variable ‘foo’ as string, without executing it (preceding >>> and + is still stripped).

Options:
- -r: re-executes the block previously entered by cpaste.
- -q: quiet mode: do not echo the pasted text back to the terminal.

IPython statements (magics, shell escapes) are not supported (yet).

See also:

cpaste() manually paste code into terminal until you mark its end.

rerun_pasted(name='pasted_block')
Rerun a previously pasted command.

store_or_execute(block, name)
Execute a block, or store it in a variable, per the user’s request.

8.56.2 1 Function

IPython.terminal.magics.get_pasted_lines(sentinel, l_input=<function input>, quiet=False)
Yield pasted lines until the user enters the given sentinel value.

8.57 Module: terminal.prompts

Terminal input and output prompts.

8.57.1 3 Classes

class IPython.terminal.prompts.Prompts(shell)
Bases: object
    __init__(shell)
    Initialize self. See help(type(self)) for accurate signature.

class IPython.terminal.prompts.ClassicPrompts(shell)
Bases: IPython.terminal.prompts.Prompts

class IPython.terminal.prompts.RichPromptDisplayHook(shell=None, cache_size=1000, **kwargs)
Bases: IPython.core.displayhook.DisplayHook
    Subclass of base display hook using coloured prompt
    write_output_prompt()
    Write the output prompt.
    The default implementation simply writes the prompt to sys.stdout.
8.58 Module: `terminal.shortcuts`

8.58.1 13 Functions

IPython.terminal.shortcuts.cursor_in_leading_ws(*a, **kw)

Turn any callable (which takes a cli and returns a boolean) into a Filter.

This can be used as a decorator:

```python
@Condition
def feature_is_active(cli):
    # `feature_is_active` becomes a Filter.
    return True
```

Parameters `func` – Callable which takes either a CommandLineInterface or nothing and returns a boolean. (Depending on what it takes, this will become a Filter or CLIFilter.)

IPython.terminal.shortcuts.register_ipython_shortcuts(registry, shell)

Set up the prompt_toolkit keyboard shortcuts for IPython

IPython.terminal.shortcuts.newline_or_execute_outer(shell)

IPython.terminal.shortcuts.previous_history_or_previous_completion(event)

Control-P in vi edit mode on readline is history next, unlike default prompt toolkit.

If completer is open this still select previous completion.

IPython.terminal.shortcuts.next_history_or_next_completion(event)

Control-N in vi edit mode on readline is history previous, unlike default prompt toolkit.

If completer is open this still select next completion.

IPython.terminal.shortcuts.dismiss_completion(event)

IPython.terminal.shortcuts.reset_buffer(event)

IPython.terminal.shortcuts.reset_search_buffer(event)

IPython.terminal.shortcuts.suspend_to_bg(event)

IPython.terminal.shortcuts.force_exit(event)

Force exit (with a non-zero return value)

IPython.terminal.shortcuts.indent_buffer(event)

IPython.terminal.shortcuts.newline_with_copy_margin(event)

Preserve margin and cursor position when using Control-O to insert a newline in EMACS mode

IPython.terminal.shortcuts.open_input_in_editor(event)

8.59 Module: `testing`

Testing support (tools to test IPython itself).

8.59.1 1 Function

IPython.testing.test(**kwargs)

Run the entire IPython test suite.
Any of the options for run_iptestall() may be passed as keyword arguments.
For example:

```
IPython.test(testgroups=['lib', 'config', 'utils'], fast=2)
```

will run those three sections of the test suite, using two processes.

### 8.60 Module: `testing.decorators`

Decorators for labeling test objects.

Decorators that merely return a modified version of the original function object are straightforward. Decorators that return a new function object need to use nose.tools.make_decorator(original_function)(decorator) in returning the decorator, in order to preserve metadata such as function name, setup and teardown functions and so on - see nose.tools for more information.

This module provides a set of useful decorators meant to be ready to use in your own tests. See the bottom of the file for the ready-made ones, and if you find yourself writing a new one that may be of generic use, add it here.

Included decorators:

Lightweight testing that remains unittest-compatible.

- An `@as_unittest` decorator can be used to tag any normal parameter-less function as a unittest TestCase. Then, both nose and normal unittest will recognize it as such. This will make it easier to migrate away from Nose if we ever need/want to while maintaining very lightweight tests.

NOTE: This file contains IPython-specific decorators. Using the machinery in IPython.external.decorators, we import either numpy.testing.decorators if numpy is available, OR use equivalent code in IPython.external._decorators, which we’ve copied verbatim from numpy.

### 8.60.1 11 Functions

**IPython.testing.decorators.as_unittest**(func)

Decorator to make a simple function into a normal test via unittest.

**IPython.testing.decorators.apply_wrapper**(wrapper, func)

Apply a wrapper to a function for decoration.

This mixes Michele Simionato’s decorator tool with nose’s make_decorator, to apply a wrapper in a decorator so that all nose attributes, as well as function signature and other properties, survive the decoration cleanly. This will ensure that wrapped functions can still be well introspected via IPython, for example.

**IPython.testing.decorators.make_label_dec**(label, ds=None)

Factory function to create a decorator that applies one or more labels.

**Parameters**

- `label` *(string or sequence)* - at least one more labels that will be applied by the decorator to the functions.

- `ds` : string An optional docstring for the resulting decorator. If not given, a default docstring is auto-generated.
Returns

Return type  A decorator.

Examples

A simple labeling decorator:

```python
>>> slow = make_label_dec('slow')
>>> slow.__doc__
"Labels a test as 'slow'."
```

And one that uses multiple labels and a custom docstring:

```python
>>> rare = make_label_dec(['slow','hard'],
... "Mix labels 'slow' and 'hard' for rare tests.")
>>> rare.__doc__
"Mix labels 'slow' and 'hard' for rare tests."
```

Now, let’s test using this one: >>> @rare ... def f(): pass ... >>> f.slow True >>> f.hard True

IPython.testing.decorators.skipif(skip_condition, msg=None)
Make function raise SkipTest exception if skip_condition is true

Parameters

- **skip_condition** (bool or callable) – Flag to determine whether to skip test. If the condition is a callable, it is used at runtime to dynamically make the decision. This is useful for tests that may require costly imports, to delay the cost until the test suite is actually executed.

- **msg** (string) – Message to give on raising a SkipTest exception.

Returns decorator – Decorator, which, when applied to a function, causes SkipTest to be raised when the skip_condition was True, and the function to be called normally otherwise.

Return type  function

Notes

You will see from the code that we had to further decorate the decorator with the nose.tools.make_decorator function in order to transmit function name, and various other metadata.

IPython.testing.decorators.skip(msg=None)
Decorator factory - mark a test function for skipping from test suite.

Parameters  msg (string) – Optional message to be added.

Returns decorator – Decorator, which, when applied to a function, causes SkipTest to be raised, with the optional message added.

Return type  function

IPython.testing.decorators.onlyif(condition, msg)
The reverse from skipif, see skipif for details.

IPython.testing.decorators.module_not_available(module)
Can module be imported? Returns true if module does NOT import.

This is used to make a decorator to skip tests that require module to be available, but delay the ‘import numpy’ to test execution time.
IPython.testing.decorators\texttt{.decorated\_dummy}(dec, name)

Return a dummy function decorated with dec, with the given name.

**Examples**

```python
import IPython.testing.decorators as dec
go = dec.decorated_dummy(dec.skip_if_no_x11, __name__)
```

- **IPython.testing.decorators\texttt{.skip\_file\_no\_x11}(name)**
- **IPython.testing.decorators\texttt{.onlyif\_cmds\_exist}(\*commands)**
  - Decorator to skip test when at least one of commands is not found.
- **IPython.testing.decorators\texttt{.onlyif\_any\_cmd\_exists}(\*commands)**
  - Decorator to skip test unless at least one of commands is found.

### 8.61 Module: testing.globalipapp

Global IPython app to support test running.

We must start our own ipython object and heavily muck with it so that all the modifications IPython makes to system behavior don’t send the doctest machinery into a fit. This code should be considered a gross hack, but it gets the job done.

#### 8.61.1 1 Class

```python
class IPython.testing.globalipapp.StreamProxy(name):
    Bases: IPython.utils.io.IOStream

    Proxy for sys.stdout/err. This will request the stream at call time allowing for nose’s Capture plugin’s redirection of sys.stdout/err.

    Parameters
    ----------
    name : str
        The name of the stream. This will be requested anew at every call

    __init__(name)
        Initialize self. See help(type(self)) for accurate signature.
```

#### 8.61.2 3 Functions

- **IPython.testing.globalipapp.get_ipython()**
- **IPython.testing.globalipapp.xsys(self, cmd)**
  - Replace the default system call with a capturing one for doctest.
- **IPython.testing.globalipapp.start_ipython()**
  - Start a global IPython shell, which we need for IPython-specific syntax.
8.62 Module: testing.iptest

8.62.1 4 Classes

8.62.2 5 Functions

8.63 Module: testing.iptestcontroller

8.63.1 3 Classes

8.63.2 7 Functions

8.64 Module: testing.ipunittest

Experimental code for cleaner support of IPython syntax with unittest.

In IPython up until 0.10, we’ve used very hacked up nose machinery for running tests with IPython special syntax, and this has proved to be extremely slow. This module provides decorators to try a different approach, stemming from a conversation Brian and I (FP) had about this problem Sept/09.

The goal is to be able to easily write simple functions that can be seen by unittest as tests, and ultimately for these to support doctests with full IPython syntax. Nose already offers this based on naming conventions and our hackish plugins, but we are seeking to move away from nose dependencies if possible.

This module follows a different approach, based on decorators.

- A decorator called @ipdoctest can mark any function as having a docstring that should be viewed as a doctest, but after syntax conversion.

8.64.1 Authors

- Fernando Perez <Fernando.Perez@berkeley.edu>

8.64.2 2 Classes

```python
class IPython.testing.ipunittest.IPython2PythonConverter
    Bases: object
    Convert IPython ‘syntax’ to valid Python.
    Eventually this code may grow to be the full IPython syntax conversion implementation, but for now it only does prompt conversion.

    __init__()
    Initialize self. See help(type(self)) for accurate signature.

class IPython.testing.ipunittest.Doc2UnitTester(verbos=False)
    Bases: object
    Class whose instances act as a decorator for docstring testing.
    In practice we’re only likely to need one instance ever, made below (though no attempt is made at turning it into a singleton, there is no need for that).
```
**8.64.3 2 Functions**

**IPython.testing.ipunittest.count_failures** *(runner)*

Count number of failures in a doctest runner.

Code modeled after the summarize() method in doctest.

**IPython.testing.ipunittest.ipdocstring** *(func)*

Change the function docstring via ip2py.

**8.65 Module: testing.skipdoctest**

Decorators marks that a doctest should be skipped, for both python 2 and 3.

The IPython.testing.decorators module triggers various extra imports, including numpy and sympy if they’re present. Since this decorator is used in core parts of IPython, it’s in a separate module so that running IPython doesn’t trigger those imports.

**8.65.1 3 Functions**

**IPython.testing.skipdoctest.skip_doctest** *(f)*

Decorator - mark a function or method for skipping its doctest.

This decorator allows you to mark a function whose docstring you wish to omit from testing, while preserving the docstring for introspection, help, etc.

**IPython.testing.skipdoctest.skip_doctest_py3** *(f)*

Decorator - skip the doctest under Python 3.

**IPython.testing.skipdoctest.skip_doctest_py2** *(f)*

Decorator - skip the doctest under Python 3.

**8.66 Module: testing.tools**

Generic testing tools.

**8.66.1 Authors**

- Fernando Perez <Fernando.Perez@berkeley.edu>
### 8.66.2 4 Classes

class IPython.testing.tools.TempFileMixin

    Bases: object

    Utility class to create temporary Python/IPython files.
    Meant as a mixin class for test cases.

    \texttt{mktmp} (src, \texttt{ext}='.py')
    
    Make a valid python temp file.

IPython.testing.tools.MyStringIO

    alias of \_io.StringIO

class IPython.testing.tools.AssertPrints(s, channel='stdout', suppress=True)

    Bases: object

    Context manager for testing that code prints certain text.

    \textbf{Examples}

    >>> with AssertPrints("abc", suppress=False):
    ...    print("abcd")
    ...    print("def")
    ...

    def

    \texttt{__init__} (s, channel='stdout', suppress=True)
    
    Initialize self. See help(type(self)) for accurate signature.

class IPython.testing.tools.AssertNotPrints(s, channel='stdout', suppress=True)

    Bases: IPython.testing.tools.AssertPrints

    Context manager for checking that certain output isn’t produced.
    Counterpart of AssertPrints

### 8.66.3 13 Functions

IPython.testing.tools.full_path(startPath, files)

    Make full paths for all the listed files, based on startPath.

    Only the base part of startPath is kept, since this routine is typically used with a script’s __file__ variable as startPath. The base of startPath is then prepended to all the listed files, forming the output list.

    \textbf{Parameters}

    • \texttt{startPath} (string) – Initial path to use as the base for the results. This path is split using os.path.split() and only its first component is kept.

    • \texttt{files} (string or list) – One or more files.

    \textbf{Examples}

    >>> full_path('/foo/bar.py', ['a.txt', 'b.txt'])
    ['/foo/a.txt', '/foo/b.txt']
If a single file is given, the output is still a list:

```
>>> full_path('/foo','a.txt')
['/a.txt']
```

**IPython.testing.tools.parse_test_output (txt)**

Parse the output of a test run and return errors, failures.

**Parameters**
- **txt** (str) – Text output of a test run, assumed to contain a line of one of the following forms:

  - 'FAILED (errors=1)'
  - 'FAILED (failures=1)'
  - 'FAILED (errors=1, failures=1)'

**Returns**
- number of errors and failures.

**Return type**
- nerr, nfail

**IPython.testing.tools.default_argv()**

Return a valid default argv for creating testing instances of ipython

**IPython.testing.tools.default_config()**

Return a config object with good defaults for testing.

**IPython.testing.tools.get_ipython_cmd (as_string=False)**

Return appropriate IPython command line name. By default, this will return a list that can be used with subprocess.Popen, for example, but passing as_string=True allows for returning the IPython command as a string.

**Parameters**
- **as_string** (bool) – Flag to allow to return the command as a string.

**IPython.testing.tools.ipexec (fname, options=None, commands=())**

Utility to call ‘ipython filename’.

Starts IPython with a minimal and safe configuration to make startup as fast as possible.

Note that this starts IPython in a subprocess!

**Parameters**
- **fname** (str) – Name of file to be executed (should have .py or .ipy extension).
- **options** (optional, list) – Extra command-line flags to be passed to IPython.
- **commands** (optional, list) – Commands to send in on stdin

**Returns**
- (stdout, stderr) of ipython subprocess.

**IPython.testing.tools.ipexec_validate (fname, expected_out, expected_err="", options=None, commands=())**

Utility to call ‘ipython filename’ and validate output/error.

This function raises an AssertionError if the validation fails.

Note that this starts IPython in a subprocess!

**Parameters**
- **fname** (str) – Name of the file to be executed (should have .py or .ipy extension).
• **expected_out** (*str*) – Expected stdout of the process.

• **expected_err** (*optional, str*) – Expected stderr of the process.

• **options** (*optional, list*) – Extra command-line flags to be passed to IPython.

**Returns**

**Return type** None

IPython.testing.tools.check_pairs(*func, pairs*)

Utility function for the common case of checking a function with a sequence of input/output pairs.

**Parameters**

• **func** (*callable*) – The function to be tested. Should accept a single argument.

• **pairs** (*iterable*) – A list of (input, expected_output) tuples.

**Returns**

• None. Raises an AssertionError if any output does not match the expected value.

IPython.testing.tools.mute_warn()

IPython.testing.tools.make_tempfile(*name*)

Create an empty, named, temporary file for the duration of the context.

IPython.testing.tools.fake_input(*inputs*)

Temporarily replace the input() function to return the given values

Use as a context manager:

```python
with fake_input([`result1`, `result2`]): ...  
```

Values are returned in order. If input() is called again after the last value was used, EOFError is raised.

IPython.testing.tools.help_output_test(*subcommand=*")

test that ipython [subcommand] -h works

IPython.testing.tools.help_all_output_test(*subcommand=*")

test that ipython [subcommand] --help-all works

### 8.67 Module: utils.PyColorize

Class and program to colorize python source code for ANSI terminals.

Based on an HTML code highlighter by Jurgen Hermann found at: [http://aspn.activestate.com/ASPN/Cookbook/Python/Recipe/52298](http://aspn.activestate.com/ASPN/Cookbook/Python/Recipe/52298)

Modifications by Fernando Perez (fperez@colorado.edu).

Information on the original HTML highlighter follows:

MoinMoin - Python Source Parser

Title: Colorize Python source using the built-in tokenizer

Submitter: Jurgen Hermann Last Updated: 2001/04/06

Version no: 1.2

Description:
This code is part of MoinMoin (http://moin.sourceforge.net/) and converts Python source code to HTML markup, rendering comments, keywords, operators, numeric and string literals in different colors.

It shows how to use the built-in keyword, token and tokenize modules to scan Python source code and re-emit it with no changes to its original formatting (which is the hard part).

### 8.67.1 1 Class

class IPython.utils.PyColorize.Parser(color_table=None, out=<_io.TextIOWrapper name='<stdout>' mode='w' encoding='UTF-8'>, parent=None, style=None)

Bases: IPython.utils.colorable.Colorable

Format colored Python source.

__init__ (color_table=None, out=<_io.TextIOWrapper name='<stdout>' mode='w' encoding='UTF-8'>, parent=None, style=None)

Create a parser with a specified color table and output channel.

Call format() to process code.

format2 (raw, out=None, scheme='')

Parse and send the colored source.

If out and scheme are not specified, the defaults (given to constructor) are used.

out should be a file-type object. Optionally, out can be given as the string ‘str’ and the parser will automatically return the output in a string.

### 8.67.2 1 Function

IPython.utils.PyColorize.main(argv=None)

Run as a command-line script: colorize a python file or stdin using ANSI color escapes and print to stdout.

Inputs:

- argv(None): a list of strings like sys.argv[1:] giving the command-line arguments. If None, use sys.argv[1:].

### 8.68 Module: utils.capture

IO capturing utilities.

### 8.68.1 3 Classes

class IPython.utils.capture.RichOutput(data=None, metadata=None, transient=None, update=False)

Bases: object

__init__ (data=None, metadata=None, transient=None, update=False)

Initialize self. See help(type(self)) for accurate signature.

class IPython.utils.capture.CapturedIO(stdout, stderr, outputs=None)

Bases: object

Simple object for containing captured stdout/err and rich display StringIO objects
Each instance `c` has three attributes:

- `c.stdout`: standard output as a string
- `c.stderr`: standard error as a string
- `c.outputs`: a list of rich display outputs

Additionally, there's a `c.show()` method which will print all of the above in the same order, and can be invoked simply via `c()`.

```python
__init__(stdout, stderr, outputs=None)
```

Initialize self. See help(type(self)) for accurate signature.

`outputs`

A list of the captured rich display outputs, if any.

If you have a CapturedIO object `c`, these can be displayed in IPython using:

```python
from IPython.display import display
for o in c.outputs:
    display(o)
```

`show()`
write my output to sys.stdout/err as appropriate

`stderr`
Captured standard error

`stdout`
Captured standard output

```python
class IPython.utils.capture.capture_output (stdout=True, stderr=True, display=True)
```

Bases: `object`

context manager for capturing stdout/err

```python
__init__(stdout=True, stderr=True, display=True)
```

Initialize self. See help(type(self)) for accurate signature.

### 8.69 Module: `utils.colorable`

#### 8.69.1 1 Class

```python
class IPython.utils.colorable.Colorable (**kwargs)
```

Bases: `traitlets.config.configurable.Configurable`

A subclass of configurable for all the classes that have a `default_scheme`

### 8.70 Module: `utils.coloransi`

Tools for coloring text in ANSI terminals.
8.70.1 5 Classes

class IPython.utils.coloransi.TermColors
    Bases: object
    Color escape sequences.
    This class defines the escape sequences for all the standard (ANSI?) colors in terminals. Also defines a NoColor escape which is just the null string, suitable for defining ‘dummy’ color schemes in terminals which get confused by color escapes.
    This class should be used as a mixin for building color schemes.

class IPython.utils.coloransi.InputTermColors
    Bases: object
    Color escape sequences for input prompts.
    This class is similar to TermColors, but the escapes are wrapped in \ and so that readline can properly know the length of each line and can wrap lines accordingly. Use this class for any colored text which needs to be used in input prompts, such as in calls to raw_input().
    This class defines the escape sequences for all the standard (ANSI?) colors in terminals. Also defines a NoColor escape which is just the null string, suitable for defining ‘dummy’ color schemes in terminals which get confused by color escapes.
    This class should be used as a mixin for building color schemes.

class IPython.utils.coloransi.NoColors
    Bases: object
    This defines all the same names as the colour classes, but maps them to empty strings, so it can easily be substituted to turn off colours.

class IPython.utils.coloransi.ColorScheme
    Bases: object
    Generic color scheme class. Just a name and a Struct.
    __init__(ColorScheme__scheme_name__, color_dict=None, **colormap)
    Initialize self. See help(type(self)) for accurate signature.

copy(name=None)
    Return a full copy of the object, optionally renaming it.

class IPython.utils.coloransi.ColorSchemeTable
    Bases: dict
    General class to handle tables of color schemes.
    It’s basically a dict of color schemes with a couple of shorthand attributes and some convenient methods.
    active_scheme_name -> obvious active_colors -> actual color table of the active scheme
    __init__(scheme_list=None, default_scheme="")
    Create a table of color schemes.
    The table can be created empty and manually filled or it can be created with a list of valid color schemes AND the specification for the default active scheme.
    add_scheme(new_scheme)
    Add a new color scheme to the table.
copy()
    Return full copy of object

set_active_scheme (scheme, case_sensitive=0)
    Set the currently active scheme.
    Names are by default compared in a case-insensitive way, but this can be changed by setting the parameter
    case_sensitive to true.

8.70.2 1 Function

IPython.utils.coloransi.make_color_table (in_class)
    Build a set of color attributes in a class.
    Helper function for building the TermColors and :class `InputTermColors`.

8.71 Module: utils.contexts

Miscellaneous context managers.

8.71.1 2 Classes

**class** IPython.utils.contexts.preserve_keys (dictionary, *keys)
    **Bases:** object
    Preserve a set of keys in a dictionary.
    Upon entering the context manager the current values of the keys will be saved. Upon exiting, the dictionary
    will be updated to restore the original value of the preserved keys. Preserved keys which did not exist when
    entering the context manager will be deleted.

**Examples**

```python
>>> d = {'a': 1, 'b': 2, 'c': 3}
>>> with preserve_keys(d, 'b', 'c', 'd'):
...     del d['a']
...     del d['b']  # will be reset to 2
...     d['c'] = None  # will be reset to 3
...     d['d'] = 4  # will be deleted
...     d['e'] = 5
...     print(sorted(d.items()))
[(c, None), (d, 4), (e, 5)]
>>> print(sorted(d.items()))
[(b, 2), (c, 3), (e, 5)]
```

**__init__** (dictionary, *keys)
    Initialize self. See help(type(self)) for accurate signature.

**class** IPython.utils.contexts.NoOpContext
    **Bases:** object
    Deprecated
    Context manager that does nothing.
__init__

Initialize self. See help(type(self)) for accurate signature.

8.72 Module: utils.data

Utilities for working with data structures like lists, dicts and tuples.

8.72.1 3 Functions

IPython.utils.data.uniq_stable(elems) → list
Return from an iterable, a list of all the unique elements in the input, but maintaining the order in which they first appear.
Note: All elements in the input must be hashable for this routine to work, as it internally uses a set for efficiency reasons.

IPython.utils.data.flatten(seq)
Flatten a list of lists (NOT recursive, only works for 2d lists).

IPython.utils.data.chop(seq, size)
Chop a sequence into chunks of the given size.

8.73 Module: utils.decorators

Decorators that don’t go anywhere else.

This module contains misc. decorators that don’t really go with another module in IPython.utils. Before putting something here please see if it should go into another topical module in IPython.utils.

8.73.1 2 Functions

IPython.utils.decorators.flag_calls(func)
Wrap a function to detect and flag when it gets called.
This is a decorator which takes a function and wraps it in a function with a ‘called’ attribute. wrapper.called is initialized to False.
The wrapper.called attribute is set to False right before each call to the wrapped function, so if the call fails it remains False. After the call completes, wrapper.called is set to True and the output is returned.
Testing for truth in wrapper.called allows you to determine if a call to func() was attempted and succeeded.

IPython.utils.decorators.undoc(func)
Mark a function or class as undocumented.
This is found by inspecting the AST, so for now it must be used directly as @undoc, not as e.g. @decorators.undoc

8.74 Module: utils.dir2

A fancy version of Python’s builtin dir() function.
8.74.1 3 Functions

**IPython.utils.dir2.safe_hasattr** *(obj, attr)*
In recent versions of Python, hasattr() only catches AttributeError. This catches all errors.

**IPython.utils.dir2.dir2** *(obj) → list of strings*
Extended version of the Python builtin dir(), which does a few extra checks.

This version is guaranteed to return only a list of true strings, whereas dir() returns anything that objects inject into themselves, even if they are later not really valid for attribute access (many extension libraries have such bugs).

**IPython.utils.dir2.get_real_method** *(obj, name)*
Like getattr, but with a few extra sanity checks:

- If obj is a class, ignore its methods
- Check if obj is a proxy that claims to have all attributes
- Catch attribute access failing with any exception
- Check that the attribute is a callable object

Returns the method or None.

8.75 Module: **utils.encoding**

Utilities for dealing with text encodings

8.75.1 2 Functions

**IPython.utils.encoding.get_stream_enc** *(stream, default=None)*
Return the given stream’s encoding or a default.

There are cases where sys.std* might not actually be a stream, so check for the encoding attribute prior to returning it, and return a default if it doesn’t exist or evaluates as False. default is None if not provided.

**IPython.utils.encoding.getdefaultencoding** *(prefer_stream=True)*
Return IPython’s guess for the default encoding for bytes as text.

If prefer_stream is True (default), asks for stdin.encoding first, to match the calling Terminal, but that is often None for subprocesses.

Then fall back on locale.getpreferredencoding(), which should be a sensible platform default (that respects LANG environment), and finally to sys.getdefaultencoding() which is the most conservative option, and usually ASCII on Python 2 or UTF8 on Python 3.

8.76 Module: **utils.frame**

Utilities for working with stack frames.
8.76.1 4 Functions

IPython.utils.frame.extract_vars(*names, **kw)
Extract a set of variables by name from another frame.

Parameters

- *names (str) – One or more variable names which will be extracted from the caller’s frame.
- depth (integer, optional) – How many frames in the stack to walk when looking for your variables. The default is 0, which will use the frame where the call was made.

Examples

In [2]: def func(x):
...:     y = 1
...:     print(sorted(extract_vars('x','y').items()))
...

In [3]: func('hello')
[('x', 'hello'), ('y', 1)]

IPython.utils.frame.extract_vars_above(*names)
Extract a set of variables by name from another frame.

Similar to extractVars(), but with a specified depth of 1, so that names are extracted exactly from above the caller.

This is simply a convenience function so that the very common case (for us) of skipping exactly 1 frame doesn’t have to construct a special dict for keyword passing.

IPython.utils.frame.debugx(expr, pre_msg=“”)
Print the value of an expression from the caller’s frame.

Takes an expression, evaluates it in the caller’s frame and prints both the given expression and the resulting value (as well as a debug mark indicating the name of the calling function. The input must be of a form suitable for eval().

An optional message can be passed, which will be prepended to the printed expr->value pair.

IPython.utils.frame.extract_module_locals(depth=0)
Returns (module, locals) of the function depth frames away from the caller

8.77 Module: utils.generics

Generic functions for extending IPython.

See http://pypi.python.org/pypi/simplegeneric.

8.77.1 2 Functions

IPython.utils.generics.inspect_object(*args, **kw)
Called when you do obj?
IPython.utils.generics.complete_object(*args, **kw)

Custom completer dispatching for python objects.

Parameters

- `obj (object)` – The object to complete.
- `prev_completions (list)` – List of attributes discovered so far.
- `should return the list of attributes in obj. If you only wish to (This)` –
- `to the attributes already discovered normally, return (add)` –
- `+ prev_completions. (own attrs)` –

8.78 Module: `utils.importstring`

A simple utility to import something by its string name.

8.78.1 1 Function

IPython.utils.importstring.import_item(name)

Import and return bar given the string foo.bar.

Calling `bar = import_item("foo.bar")` is the functional equivalent of executing the code from foo import bar.

Parameters `name (string)` – The fully qualified name of the module/package being imported.

Returns `mod` – The module that was imported.

Return type `module object`

8.79 Module: `utils.io`

IO related utilities.

8.79.1 1 Class

class IPython.utils.io.Tee (file_or_name, mode='w', channel='stdout')

A class to duplicate an output stream to stdout/err.

This works in a manner very similar to the Unix ‘tee’ command.

When the object is closed or deleted, it closes the original file given to it for duplication.

__init__ (file_or_name, mode='w', channel='stdout')

Construct a new Tee object.

Parameters

- `file_or_name (filename or open filehandle (writable))` – File that will be duplicated
• **mode** *(optional, valid mode for open())*—If a filename was given, open with this mode.

• **channel** *(str, one of ['stdout', 'stderr'])*—

`close()`
Close the file and restore the channel.

`flush()`
Flush both channels.

`write(data)`
Write data to both channels.

### 8.79.2 6 Functions

*IPython.utils.io.*`ask_yes_no(prompt, default=None, interrupt=None)`
Asks a question and returns a boolean (y/n) answer.

If default is given (one of ‘y’, ‘n’), it is used if the user input is empty. If interrupt is given (one of ‘y’, ‘n’), it is used if the user presses Ctrl-C. Otherwise the question is repeated until an answer is given.

An EOF is treated as the default answer. If there is no default, an exception is raised to prevent infinite loops.

Valid answers are: y/yes/n/no (match is not case sensitive).

*IPython.utils.io.*`temp_pyfile(src, ext='.py')`
Make a temporary python file, return filename and filehandle.

**Parameters**

• **src** *(string or list of strings (no need for ending newlines if list))*—Source code to be written to the file.

• **ext** *(optional, string)*—Extension for the generated file.

**Returns** It is the caller’s responsibility to close the open file and unlink it.

**Return type** *(filename, open filehandle)*

*IPython.utils.io.*`atomic_writing(*args, **kwargs)`
DEPRECATED: moved to notebook.services.contents.fileio

*IPython.utils.io.*`raw_print(*args, **kw)`
Raw print to sys.__stdout__, otherwise identical interface to print().

*IPython.utils.io.*`raw_print_err(*args, **kw)`
Raw print to sys.__stderr__, otherwise identical interface to print().

*IPython.utils.io.*`unicode_std_stream(stream='stdout')`
DEPRECATED, moved to nbconvert.utils.io

### 8.80 Module: `utils.ipstruct`

A dict subclass that supports attribute style access.

**Authors:**

• Fernando Perez (original)

• Brian Granger (refactoring to a dict subclass)
8.80.1 1 Class

```python
class IPython.utils.ipstruct.Struct(*args, **kw):
    Bases: dict

    A dict subclass with attribute style access.
    This dict subclass has a few extra features:
    • Attribute style access.
    • Protection of class members (like keys, items) when using attribute style access.
    • The ability to restrict assignment to only existing keys.
    • Intelligent merging.
    • Overloaded operators.

    __init__(*args, **kw)
    Initialize with a dictionary, another Struct, or data.

    Parameters
    • `args (dict, Struct)` – Initialize with one dict or Struct
    • `kw (dict)` – Initialize with key, value pairs.

Examples

```python
>>> s = Struct(a=10, b=30)
>>> s.a
10
>>> s.b
30
>>> s2 = Struct(s, c=30)
>>> sorted(s2.keys())
['a', 'b', 'c']
```

```
allow_new_attr(allow=True)
Set whether new attributes can be created in this Struct.
This can be used to catch typos by verifying that the attribute user tries to change already exists in this Struct.

`copy()`
Return a copy as a Struct.

Examples

```python
>>> s = Struct(a=10, b=30)
>>> s2 = s.copy()
>>> type(s2) is Struct
True
```

`hasattr(key)`
`hasattr` function available as a method.
Implemented like `has_key`.
Examples

```python
>>> s = Struct(a=10)
>>> s.hasattr('a')
True
>>> s.hasattr('b')
False
>>> s.hasattr('get')
False
```

```python
merge(__loc_data__/=None, __conflict_solve__/=None, **kw)
```

Merge two Structs with customizable conflict resolution.

This is similar to update(), but much more flexible. First, a dict is made from data+key=value pairs. When merging this dict with the Struct S, the optional dictionary ‘conflict’ is used to decide what to do. If conflict is not given, the default behavior is to preserve any keys with their current value (the opposite of the update() method’s behavior).

Parameters

- `__loc_data__ (dict, Struct)` – The data to merge into self
- `__conflict_solve__ (dict)` – The conflict policy dict. The keys are binary functions used to resolve the conflict and the values are lists of strings naming the keys the conflict resolution function applies to. Instead of a list of strings a space separated string can be used, like ‘a b c’.
- `kw (dict)` – Additional key, value pairs to merge in

Notes

The `__conflict_solve` dict is a dictionary of binary functions which will be used to solve key conflicts. Here is an example:

```python
__conflict_solve = dict(
    func1=['a', 'b', 'c'],
    func2=['d', 'e']
)
```

In this case, the function `func1()` will be used to resolve keys ‘a’, ‘b’ and ‘c’ and the function `func2()` will be used for keys ‘d’ and ‘e’. This could also be written as:

```python
__conflict_solve = dict(func1='a b c', func2='d e')
```

These functions will be called for each key they apply to with the form:

```python
func1(self['a'], other['a'])
```

The return value is used as the final merged value.

As a convenience, merge() provides five (the most commonly needed) pre-defined policies: preserve, update, add, add_flip and add_s. The easiest explanation is their implementation:

```python
preserve = lambda old, new: old
update = lambda old, new: new
add = lambda old, new: old + new
```

(continues on next page)
You can use those four words (as strings) as keys instead of defining them as functions, and the merge method will substitute the appropriate functions for you.

For more complicated conflict resolution policies, you still need to construct your own functions.

**Examples**

This shows the default policy:

```python
>>> s = Struct(a=10,b=30)
>>> s2 = Struct(a=20,c=40)
>>> s.merge(s2)
>>> sorted(s.items())
[('a', 10), ('b', 30), ('c', 40)]
```

Now, show how to specify a conflict dict:

```python
>>> s = Struct(a=10,b=30)
>>> s2 = Struct(a=20,b=40)
>>> conflict = {'update':'a','add':'b'}
>>> s.merge(s2,conflict)
>>> sorted(s.items())
[('a', 20), ('b', 70)]
```

### 8.81 Module: `utils.module_paths`

Utility functions for finding modules

Utility functions for finding modules on `sys.path`.

`find_mod` finds named module on `sys.path`.

`get_init` helper function that finds `__init__` file in a directory.

`find_module` variant of `imp.find_module` in `std_lib` that only returns path to module and not an open file object as well.

#### 8.81.1 3 Functions

`IPython.utils.module_paths.find_module(name, path=None)`

`imp.find_module` variant that only return path of module.

The `imp.find_module` returns a filehandle that we are not interested in. Also we ignore any bytecode files that `imp.find_module` finds.

**Parameters**

- `name (str)` – name of module to locate
- `path (list of str)` – list of paths to search for `name`. If `path=None` then search `sys.path`
Returns filename – Return full path of module or None if module is missing or does not have .py or .pyw extension

Return type str

IPython.utils.module_paths.get_init(dirname)
Get __init__ file path for module directory

Parameters dirname (str) – Find the __init__ file in directory dirname

Returns init_path – Path to __init__ file

Return type str

IPython.utils.module_paths.find_mod(module_name)
Find module module_name on sys.path

Returns modulepath – Path to module module_name.

Return type str

8.82 Module: utils.openpy

Tools to open .py files as Unicode, using the encoding specified within the file, as per PEP 263.

Much of the code is taken from the tokenize module in Python 3.2.

8.82.1 8 Functions

IPython.utils.openpy.detect_encoding(readline)
The detect_encoding() function is used to detect the encoding that should be used to decode a Python source file. It requires one argument, readline, in the same way as the tokenize() generator.

It will call readline a maximum of twice, and return the encoding used (as a string) and a list of any lines (left as bytes) it has read in.

It detects the encoding from the presence of a utf-8 bom or an encoding cookie as specified in pep-0263. If both a bom and a cookie are present, but disagree, a SyntaxError will be raised. If the encoding cookie is an invalid charset, raise a SyntaxError. Note that if a utf-8 bom is found, ‘utf-8-sig’ is returned.

If no encoding is specified, then the default of ‘utf-8’ will be returned.

IPython.utils.openpy.open(filename)
Open a file in read only mode using the encoding detected by detect_encoding().

IPython.utils.openpy.source_to_unicode(txt, errors='replace', skip_encoding_cookie=True)
Converts a bytes string with python source code to unicode.

Unicode strings are passed through unchanged. Byte strings are checked for the python source file encoding cookie to determine encoding. txt can be either a bytes buffer or a string containing the source code.

IPython.utils.openpy.strip_encoding_cookie(filelike)
Generator to pull lines from a text-mode file, skipping the encoding cookie if it is found in the first two lines.
IPython.utils.openpy.read_py_file(filename, skip_encoding_cookie=True)

Read a Python file, using the encoding declared inside the file.

Parameters

- **filename** (*str*) – The path to the file to read.
- **skip_encoding_cookie** (*bool*) – If True (the default), and the encoding declaration is found in the first two lines, that line will be excluded from the output - compiling a unicode string with an encoding declaration is a SyntaxError in Python 2.

Returns

**Return type** A unicode string containing the contents of the file.

IPython.utils.openpy.read_py_url(url, errors='replace', skip_encoding_cookie=True)

Read a Python file from a URL, using the encoding declared inside the file.

Parameters

- **url** (*str*) – The URL from which to fetch the file.
- **errors** (*str*) – How to handle decoding errors in the file. Options are the same as for bytes.decode(), but here ‘replace’ is the default.
- **skip_encoding_cookie** (*bool*) – If True (the default), and the encoding declaration is found in the first two lines, that line will be excluded from the output - compiling a unicode string with an encoding declaration is a SyntaxError in Python 2.

Returns

**Return type** A unicode string containing the contents of the file.

IPython.utils.openpy.source_from_cache(path)

Given the path to a .pyc file, return the path to its .py file.

The .pyc file does not need to exist; this simply returns the path to the .py file calculated to correspond to the .pyc file. If path does not conform to PEP 3147/488 format, ValueError will be raised. If sys.implementation.cache_tag is None then NotImplementedError is raised.

IPython.utils.openpy.cache_from_source(path, debug_override=None, *, optimization=None)

Given the path to a .py file, return the path to its .pyc file.

The .py file does not need to exist; this simply returns the path to the .pyc file calculated as if the .py file were imported.

The ’optimization’ parameter controls the presumed optimization level of the bytecode file. If ‘optimization’ is not None, the string representation of the argument is taken and verified to be alphanumeric (else Value Error is raised).

The debug_override parameter is deprecated. If debug_override is not None, a True value is the same as setting ‘optimization’ to the empty string while a False value is equivalent to setting ‘optimization’ to ‘1’.

If sys.implementation.cache_tag is None then Not Implemented Error is raised.

### 8.83 Module: utils.path

Utilities for path handling.
8.83.1 1 Class

```python
class IPython.utils.path.HomeDirError
    Bases: Exception
```

8.83.2 16 Functions

**IPython.utils.path.get_long_path_name(path)**
- Expand a path into its long form.
  - On Windows this expands any ~ in the paths. On other platforms, it is a null operation.

**IPython.utils.path.unquote_filename(name, win32=False)**
- On Windows, remove leading and trailing quotes from filenames.
  - This function has been deprecated and should not be used any more: unquoting is now taken care of by IPython.utils.process.arg_split().

**IPython.utils.path.compress_user(path)**
- Reverse of os.path.expanduser()

**IPython.utils.path.get_py_filename(name, force_win32=None)**
- Return a valid python filename in the current directory.
  - If the given name is not a file, it adds ‘.py’ and searches again. Raises IOError with an informative message if the file isn’t found.

**IPython.utils.path.filefind(filename, path_dirs=None)**
- Find a file by looking through a sequence of paths.
  - This iterates through a sequence of paths looking for a file and returns the full, absolute path of the first occurrence of the file. If no set of path dirs is given, the filename is tested as is, after running through expandvars() and expanduser(). Thus a simple call:

```python
filefind('myfile.txt')
```
- will find the file in the current working dir, but:

```python
filefind('~/myfile.txt')
```
- Will find the file in the users home directory. This function does not automatically try any paths, such as the cwd or the user’s home directory.

**Parameters**

- **filename (str)** – The filename to look for.
- **path_dirs (str, None or sequence of str)** – The sequence of paths to look for the file in. If None, the filename need to be absolute or be in the cwd. If a string, the string is put into a sequence and the searched. If a sequence, walk through each element and join with filename, calling expandvars() and expanduser() before testing for existence.

**Returns**

**Return type** Raises IOError or returns absolute path to file.

**IPython.utils.path.get_home_dir(require_writable=False)**
- Return the ‘home’ directory, as a unicode string.
  - Uses os.path.expanduser(‘~’), and checks for writability.
See stdlib docs for how this is determined. $HOME is first priority on ALL platforms.

**Parameters**

- `require_writable (bool [default: False])`
  - if True: guarantees the return value is a writable directory, otherwise raises `HomeDirError`
  - if False: The path is resolved, but it is not guaranteed to exist or be writable.

**Examples**

```python
In [2]: os.environ['FOO']='test'
In [3]: expand_path('variable FOO is $FOO')
```

```
Out[3]: 'variable FOO is test'
```

**Examples**

```python
In [2]: os.environ['FOO']='test'
In [3]: expand_path('variable FOO is $FOO')
```

```
Out[3]: 'variable FOO is test'
```
8.84 Module: `utils.process`

Utilities for working with external processes.

8.84.1 1 Class

```python
class IPython.utils.process.FindCmdError
    Bases: Exception
```

8.84.2 4 Functions

**IPython.utils.process.find_cmd(cmd)**

Find absolute path to executable cmd in a cross platform manner.

This function tries to determine the full path to a command line program using `which` on Unix/Linux/OS X and `win32api` on Windows. Most of the time it will use the version that is first on the users `PATH`.

Warning, don’t use this to find IPython command line programs as there is a risk you will find the wrong one. Instead find those using the following code and looking for the application itself:

```python
from IPython.utils.path import get_ipython_module_path
from IPython.utils.process import pycmd2argv
argv = pycmd2argv(get_ipython_module_path('IPython.terminal.ipapp'))
```

**Parameters**

- `cmd (str)` – The command line program to look for.

**IPython.utils.process.is_cmd_found(cmd)**

Check whether executable `cmd` exists or not and return a bool.

**IPython.utils.process.pycmd2argv(cmd)**

Take the path of a python command and return a list (argv-style).

This only works on Python based command line programs and will find the location of the `python` executable using `sys.executable` to make sure the right version is used.

For a given path `cmd`, this returns `[cmd]` if `cmd`’s extension is `.exe`, `.com` or `.bat`, and `[, cmd]` otherwise.

**Parameters**

- `cmd (string)` – The path of the command.

**Returns**

**Return type**

argv-style list.

**IPython.utils.process.abbrev_cwd()**

Return abbreviated version of cwd, e.g. `d:mydir`

8.85 Module: `utils.rlineimpl`

Imports and provides the ‘correct’ version of readline for the platform.

Readline is used throughout IPython as:

```python
import IPython.utils.rlineimpl as readline
```
In addition to normal readline stuff, this module provides have_readline boolean and _outputfile variable used in IPython.utils.

8.85.1 1 Function

IPython.utils.rlineimpl.clear_history() → None
Clear the current readline history.

8.86 Module: utils.sentinel

Sentinel class for constants with useful reprs

8.86.1 1 Class

class IPython.utils.sentinel.Sentinel (name, module, docstring=None)
    Bases: object
    __init__(name, module, docstring=None)
        Initialize self. See help(type(self)) for accurate signature.

8.87 Module: utils.shimmodule

A shim module for deprecated imports

8.87.1 3 Classes

class IPython.utils.shimmodule.ShimWarning
    Bases: Warning
    A warning to show when a module has moved, and a shim is in its place.

class IPython.utils.shimmodule.ShimImporter (src, mirror)
    Bases: object
    Import hook for a shim.
    This ensures that submodule imports return the real target module, not a clone that will confuse is and isinstance checks.
    __init__(src, mirror)
        Initialize self. See help(type(self)) for accurate signature.
    find_module (fullname, path=None)
        Return self if we should be used to import the module.
    load_module (fullname)
        Import the mirrored module, and insert it into sys.modules

class IPython.utils.shimmodule.ShimModule (*args, **kwargs)
    Bases: module
    __init__(*args, **kwargs)
        Initialize self. See help(type(self)) for accurate signature.
8.88 Module: `utils.strdispatch`

String dispatch class to match regexps and dispatch commands.

8.88.1 1 Class

class `IPython.utils.strdispatch.StrDispatch`

    Bases: object

    Dispatch (lookup) a set of strings / regexps for match.

    Example:

    ```python
    >>> dis = StrDispatch()
    >>> dis.add_s('hei', 34, priority = 4)
    >>> dis.add_s('hei', 123, priority = 2)
    >>> dis.add_re('h.i', 686)
    >>> print(list(dis.flat_matches('hei')))
    [123, 34, 686]
    ```

    __init__()

        Initialize self. See help(type(self)) for accurate signature.

    add_re(regex, obj, priority=0)

        Adds a target regexp for dispatching

    add_s(s, obj, priority=0)

        Adds a target ’string’ for dispatching

    dispatch(key)

        Get a seq of Commandchain objects that match key

    flat_matches(key)

        Yield all ’value’ targets, without priority

8.89 Module: `utils.sysinfo`

Utilities for getting information about IPython and the system it’s running in.

8.89.1 5 Functions

`IPython.utils.sysinfo.pkg_commit_hash(pkg_path)`

    Get short form of commit hash given directory pkg_path

    We get the commit hash from (in order of preference):

    • IPython.utils.sysinfo.commit

    • git output, if we are in a git repository

    If these fail, we return a not-found placeholder tuple

    Parameters pkg_path (str) – directory containing package only used for getting commit from active repo

    Returns
- `hash_from` *(str)* – Where we got the hash from - description
- `hash_str` *(str)* – short form of hash

`IPython.utils.sysinfo.pkg_info(pkg_path)`  
Return dict describing the context of this package

**Parameters**  
`pkg_path` *(str)* – path containing __init__.py for package

**Returns**  
`context` – with named parameters of interest

**Return type**  
dict

`IPython.utils.sysinfo.get_sys_info()`  
Return useful information about IPython and the system, as a dict.

`IPython.utils.sysinfo.sys_info()`  
Return useful information about IPython and the system, as a string.

**Examples**

```python
In [2]: print(sys_info())
{'commit_hash': '144fdae', # random
 'commit_source': 'repository',
 'ipython_path': '/home/fperez/\usr/lib/python2.6/site-packages/IPython',
 'ipython_version': '0.11.dev',
 'os_name': 'posix',
 'platform': 'Linux-2.6.35-22-generic-i686-with-Ubuntu-10.10-maverick',
 'sys_executable': '/usr/bin/python',
 'sys_platform': 'linux2',
 'sys_version': '2.6.6 (r266:84292, Sep 15 2010, 15:52:39) \n[GCC 4.4.5]'
```

`IPython.utils.sysinfo.num_cpus()`  
Return the effective number of CPUs in the system as an integer.

This cross-platform function makes an attempt at finding the total number of available CPUs in the system, as returned by various underlying system and python calls.

If it can’t find a sensible answer, it returns 1 (though an error *may* make it return a large positive number that’s actually incorrect).

### 8.90 Module: *utils.syspathcontext*

Context managers for adding things to sys.path temporarily.

**Authors:**

- Brian Granger

### 8.90.1 2 Classes

```python
class IPython.utils.syspathcontext.appended_to_syspath(dir)
    Bases: object

    A context for appending a directory to sys.path for a second.

    __init__(dir)
    Initialize self. See help(type(self)) for accurate signature.
```
### 8.91 Module: `utils.tempdir`

TemporaryDirectory class, copied from Python 3.2.

This is copied from the stdlib and will be standard in Python 3.2 and onwards.

#### 8.91.1 3 Classes

**class IPython.utils.tempdir.TemporaryDirectory** *(suffix=None, prefix=None, dir=None)*

Bases: `object`

Create and return a temporary directory. This has the same behavior as mkdtemp but can be used as a context manager. For .. rubric:: Example

```python
with TemporaryDirectory() as tmpdir: ...
```

Upon exiting the context, the directory and everything contained in it are removed.

__init__(suffix=None, prefix=None, dir=None)

Initialize self. See help(type(self)) for accurate signature.

**class IPython.utils.tempdir.NamedFileInTemporaryDirectory** *(filename, mode='w+b', bufsize=-1, **kwds)*

Bases: `object`

__init__(filename, mode='w+b', bufsize=-1, **kwds)

Open a file named filename in a temporary directory. This context manager is preferred over NamedTemporaryFile in stdlib tempfile when one needs to reopen the file.

Arguments mode and bufsize are passed to open. Rest of the arguments are passed to TemporaryDirectory.

**class IPython.utils.tempdir.TemporaryWorkingDirectory** *(suffix=None, prefix=None, dir=None)*

Bases: `tempfile.TemporaryDirectory`

Creates a temporary directory and sets the cwd to that directory. Automatically reverts to previous cwd upon cleanup. Usage example:

```python
with TemporaryWorkingDirectory() as tmpdir: ...
```

### 8.92 Module: `utils.terminal`

Utilities for working with terminals.

Authors:

- Brian E. Granger
8.92.1 4 Functions

IPython.utils.terminal.toggle_set_term_title(val)
Control whether set_term_title is active or not.

set_term_title() allows writing to the console titlebar. In embedded widgets this can cause problems, so this call can be used to toggle it on or off as needed.

The default state of the module is for the function to be disabled.

Parameters

val (bool) – If True, set_term_title() actually writes to the terminal (using the appropriate platform-specific module). If False, it is a no-op.

IPython.utils.terminal.set_term_title(title)
Set terminal title using the necessary platform-dependent calls.

IPython.utils.terminal.freeze_term_title()

IPython.utils.terminal.get_terminal_size(defaultx=80, defaulty=25)

8.93 Module: utils.text

Utilities for working with strings and text.

Inheritance diagram:

```
utils.text.SList
```

```
utils.text.LSString
```

```
utils.text.FullEvalFormatter
```

```
utils.text.DollarFormatter
```

```
utils.text.EvalFormatter
```

```
string.Formatter
```

```
utils.text.LSString
```

```
utils.text.FullEvalFormatter
```

```
utils.text.DollarFormatter
```

```
utils.text.EvalFormatter
```

8.93.1 5 Classes

class IPython.utils.text.LSString

Bases: str

String derivative with a special access attributes.

These are normal strings, but with the special attributes:
.l (or .list) : value as list (split on newlines). .n (or .nlstr): original value (the string itself). .s (or .spstr): value as whitespace-separated string. .p (or .paths): list of path objects (requires path.py package)

Any values which require transformations are computed only once and cached.

Such strings are very useful to efficiently interact with the shell, which typically only understands whitespace-separated options for commands.

class IPython.utils.text.SList
Bases: list

List derivative with a special access attributes.

These are normal lists, but with the special attributes:
- .l (or .list) : value as list (the list itself).
- .n (or .nlstr): value as a string, joined on newlines.
- .s (or .spstr): value as a string, joined on spaces.
- .p (or .paths): list of path objects (requires path.py package)

Any values which require transformations are computed only once and cached.

fields (*fields)
Collect whitespace-separated fields from string list

Allows quick awk-like usage of string lists.

Example data (in var a, created by 'a = !ls -l'):

<table>
<thead>
<tr>
<th>Mode</th>
<th>User</th>
<th>Group</th>
<th>Size</th>
<th>Date</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>-rwxrwxrwx</td>
<td>ville</td>
<td>None</td>
<td>18 Dec 14 2006</td>
<td>ChangeLog</td>
<td></td>
</tr>
<tr>
<td>drwxrwxrwx+</td>
<td>ville</td>
<td>None</td>
<td>0 Oct 24 18:05</td>
<td>IPython</td>
<td></td>
</tr>
</tbody>
</table>

- a.fields(0) is ['-rwxrwxrwx', 'drwxrwxrwx+']
- a.fields(1,0) is ['1 -rwxrwxrwx', '6 drwxrwxrwx+'] (note the joining by space).
- a.fields(-1) is ['ChangeLog', 'IPython']

IndexErrors are ignored.

Without args, fields() just split()’s the strings.

grep (pattern, prune=False, field=None)
Return all strings matching ‘pattern’ (a regex or callable)

This is case-insensitive. If prune is true, return all items NOT matching the pattern.

If field is specified, the match must occur in the specified whitespace-separated field.

Examples:

```python
a.grep( lambda x: x.startswith('C') )
a.grep('Ch.*log', prune=True)
a.grep('chm', field=-1)
```

sort (field=None, nums=False)

sort by specified fields (see fields())

Example:
```python
a.sort(1, nums = True)
```

Sorts a by second field, in numerical order (so that 21 > 3)

class IPython.utils.text.EvalFormatter
Bases: string.Formatter

A String Formatter that allows evaluation of simple expressions.

Note that this version interprets a : as specifying a format string (as per standard string formatting), so if slicing is required, you must explicitly create a slice.

This is to be used in templating cases, such as the parallel batch script templates, where simple arithmetic on arguments is useful.

**Examples**

```python
In [1]: f = EvalFormatter()
In [2]: f.format('{n//4}', n=8)
Out[2]: '2'

In [3]: f.format("{greeting[slice(2,4)]}", greeting="Hello")
Out[3]: 'll'
```

class IPython.utils.text.FullEvalFormatter
Bases: string.Formatter

A String Formatter that allows evaluation of simple expressions.

Any time a format key is not found in the kwargs, it will be tried as an expression in the kwargs namespace.

Note that this version allows slicing using [1:2], so you cannot specify a format string. Use `EvalFormatter` to permit format strings.

**Examples**

```python
In [1]: f = FullEvalFormatter()
In [2]: f.format('{n//4}', n=8)
Out[2]: u'2'

In [3]: f.format("\[list(range(5))[2:4]\]")
Out[3]: u'[2, 3]'

In [4]: f.format('{3*2}')
Out[4]: u'6'
```

class IPython.utils.text.DollarFormatter
Bases: IPython.utils.text.FullEvalFormatter

Formatter allowing Itpl style $foo replacement, for names and attribute access only. Standard {foo} replacement also works, and allows full evaluation of its arguments.

**Examples**
In [1]: f = DollarFormatter()
In [2]: f.format('{n//4}', n=8)
Out[2]: u'2'
In [3]: f.format('23 * 76 is $result', result=23*76)
Out[3]: u'23 * 76 is 1748'
In [4]: f.format('$a or {b}', a=1, b=2)
Out[4]: u'1 or 2'

8.93.2 13 Functions

IPython.utils.text.indent (instr, nspaces=4, ntabs=0, flatten=False)
Indent a string a given number of spaces or tabstops.
indent(str,nspaces=4,ntabs=0) -> indent str by ntabs+nspaces.

Parameters

- instr (basestring) – The string to be indented.
- nspaces (int (default: 4)) – The number of spaces to be indented.
- ntabs (int (default: 0)) – The number of tabs to be indented.
- flatten (bool (default: False)) – Whether to scrub existing indentation. If True, all lines will be aligned to the same indentation. If False, existing indentation will be strictly increased.

Returns str|unicode

Return type string indented by ntabs and nspaces.

IPython.utils.text.list_strings (arg)
Always return a list of strings, given a string or list of strings as input.

Examples

In [7]: list_strings('A single string')
Out[7]: ['A single string']
In [8]: list_strings(['A single string in a list'])
Out[8]: ['A single string in a list']
In [9]: list_strings(['A', 'list', 'of', 'strings'])
Out[9]: ['A', 'list', 'of', 'strings']

IPython.utils.text.marquee (txt=", width=78, mark='*')
Return the input string centered in a 'marquee'.

Examples

In [16]: marquee('A test', 40)
Out[16]: '*************** A test ***************'
In [17]: marquee('A test',40,'-')
Out[17]: '---------------- A test ----------------'

In [18]: marquee('A test',40,' ')
Out[18]: ' A test '

IPython.utils.text.num_ini_spaces(strng)
Return the number of initial spaces in a string

IPython.utils.text.format_screen(strng)
Format a string for screen printing.
This removes some latex-type format codes.

IPython.utils.text.dedent(text)
Equivalent of textwrap.dedent that ignores unindented first line.
This means it will still dedent strings like: ""foo is a bar ""
For use in wrap_paragraphs.

IPython.utils.text.wrap_paragraphs(text, ncols=80)
Wrap multiple paragraphs to fit a specified width.
This is equivalent to textwrap.wrap, but with support for multiple paragraphs, as separated by empty lines.

Returns
Return type list of complete paragraphs, wrapped to fill ncols columns.

IPython.utils.text.long_substr(data)
Return the longest common substring in a list of strings.

Credit: http://stackoverflow.com/questions/2892931/longest-common-substring-from-more-than-two-strings-python

IPython.utils.text.strip_email_quotes(text)
Strip leading email quotation characters ('>').
Removes any combination of leading ‘>’ interspersed with whitespace that appears identically in all lines of the input text.

Parameters text (str) –

Examples
Simple uses:

In [2]: strip_email_quotes('> > text')
Out[2]: 'text'

In [3]: strip_email_quotes('> > text\n> more')
Out[3]: 'text\nmore'

Note how only the common prefix that appears in all lines is stripped:

In [4]: strip_email_quotes('> > text\n> more\n> more...')
Out[4]: '> text\n> more\nmore...'

So if any line has no quote marks (‘>’), then none are stripped from any of them.
In [5]: strip_email_quotes('> > text
> > more
last different')
Out[5]: '> > text
> > more
last different'

IPython.utils.text.

strip_ansi(source)

Remove ansi escape codes from text.

Parameters

source (str) – Source to remove the ansi from

IPython.utils.text.

compute_item_matrix(items, row_first=False, empty=None, *args,

**kwargs)

Returns a nested list, and info to columnize items

Parameters

• items – list of strings to columnize

• row_first ((default False)) – Whether to compute columns for a row-first matrix instead of column-first (default).

• empty ((default None)) – default value to fill list if needed

• separator_size (int (default=2)) – How much caracters will be used as a separation between each columns.

• displaywidth (int (default=80)) – The width of the area onto wich the columns should enter

Returns

• strings_matrix – nested list of string, the outer most list contains as many list as rows, the innermost lists have each as many element as columns. If the total number of elements in items does not equal the product of rows*columns, the last element of some lists are filled with None.

• dict_info – some info to make columnize easier:

  num_columns number of columns

  max_rows maximum number of rows (final number may be less)

  column_widths list of with of each columns

  optimal_separator_width best separator width between columns

Examples

In [1]: l = ['aaa','b','cc','d','eeeeee','f','g','h','i','j','k','l']
   ...: compute_item_matrix(l, displaywidth=12)
Out[1]:
  [[[aaa', 'f', 'k'],
     ['b', 'g', 'l'],
     ['cc', 'h', None],
     ['d', 'i', None],
     ['eeeeee', 'j', None],
     ['num_columns': 3,
      'column_widths': [5, 1, 1],
      'optimal_separator_width': 2,
      'max_rows': 5}}
IPython.utils.text.columnize(items, row_first=False, separator=' ', displaywidth=80, spread=False)
Transform a list of strings into a single string with columns.

Parameters

- **items**: (sequence of strings) – The strings to process.
- **row_first**: (default False) – Whether to compute columns for a row-first matrix instead of column-first (default).
- **separator**: (str, optional [default is two spaces]) – The string that separates columns.
- **displaywidth**: (int, optional [default is 80]) – Width of the display in number of characters.

Returns

The formatted string.

IPython.utils.text.get_text_list(list_, last_sep=' and ', sep=' , ', wrap_item_with='`')
Return a string with a natural enumeration of items

```python
>>> get_text_list(['a', 'b', 'c', 'd'])
'a, b, c and d'
>>> get_text_list(['a', 'b', 'c'], ' or ')
'a, b or c'
>>> get_text_list(['a', 'b', 'c'], ' , ')
'a, b, c'
>>> get_text_list(['a', 'b'], ' or ')
'a or b'
>>> get_text_list(['a'])
'a'
>>> get_text_list([])
'`
>>> get_text_list(['a', 'b'], wrap_item_with='``')
'``a and `b'
>>> get_text_list(['a', 'b', 'c', 'd'], " = ", sep=" + ")
'a + b + c = d'
```

8.94 Module: utils.timing

Utilities for timing code execution.

8.94.1 7 Functions

IPython.utils.timing.clocku() → floating point number
Return the USER CPU time in seconds since the start of the process. This is done via a call to resource.getusage, so it avoids the wraparound problems in time.clock().

IPython.utils.timing.clocks() → floating point number
Return the SYSTEM CPU time in seconds since the start of the process. This is done via a call to resource.getusage, so it avoids the wraparound problems in time.clock().

IPython.utils.timing.clock() → floating point number
Return the TOTAL USER+SYSTEM CPU time in seconds since the start of the process. This is done via a call to resource.getusage, so it avoids the wraparound problems in time.clock().
IPython.utils.timing.clock2() -> (t_user, t_system)
Similar to clock(), but return a tuple of user/system times.

IPython.utils.timing.timings_out(reps, func, *args, **kw) -> (t_total, t_per_call, output)
Execute a function reps times, return a tuple with the elapsed total CPU time in seconds, the time per call and the function’s output.
Under Unix, the return value is the sum of user+system time consumed by the process, computed via the resource module. This prevents problems related to the wraparound effect which the time.clock() function has.
Under Windows the return value is in wall clock seconds. See the documentation for the time module for more details.

IPython.utils.timing.timings(reps, func, *args, **kw) -> (t_total, t_per_call)
Execute a function reps times, return a tuple with the elapsed total CPU time in seconds and the time per call. These are just the first two values in timings_out().

IPython.utils.timing.timing(func, *args, **kw) → t_total
Execute a function once, return the elapsed total CPU time in seconds. This is just the first value in timings_out().

8.95 Module: utils.tokenutil

Token-related utilities

8.95.1 3 Functions

IPython.utils.tokenutil.generate_tokens(readline)
wrap generate_tokens to catch EOF errors

IPython.utils.tokenutil.line_at_cursor(cell, cursor_pos=0)
Return the line in a cell at a given cursor position
Used for calling line-based APIs that don’t support multi-line input, yet.

Parameters

- **cell** (str) – multiline block of text
- **cursor_pos** (integer) – the cursor position

Returns (line, offset) – The line with the current cursor, and the character offset of the start of the line.

Return type (text, integer)

IPython.utils.tokenutil.token_at_cursor(cell, cursor_pos=0)
Get the token at a given cursor
Used for introspection.
Function calls are prioritized, so the token for the callable will be returned if the cursor is anywhere inside the call.

Parameters

- **cell** (unicode) – A block of Python code
- **cursor_pos** (int) – The location of the cursor in the block where the token should be found
8.96 Module: utils.tz

Timezone utilities
Just UTC-awareness right now

8.96.1 1 Class

```python
class IPython.utils.tz.tzUTC
    Bases: datetime.tzinfo
    tzinfo object for UTC (zero offset)
    dst(d)
        datetime -> DST offset as timedelta positive east of UTC.
    utcoffset(d)
        datetime -> timedelta showing offset from UTC, negative values indicating West of UTC
```

8.96.2 1 Function

```python
IPython.utils.tz.utc_aware(unaware)
    decorator for adding UTC tzinfo to datetime’s utcfoo methods
```

8.97 Module: utils.ulinecache

Wrapper around linecache which decodes files to unicode according to PEP 263.
This is only needed for Python 2 - linecache in Python 3 does the same thing itself.

8.97.1 2 Functions

```python
IPython.utils.ulinecache.getlines(filename, module_globals=None)
    Get the lines for a Python source file from the cache. Update the cache if it doesn’t contain an entry for this file already.

IPython.utils.ulinecache.getline(filename, lineno, module_globals=None)
```

8.98 Module: utils.version

Utilities for version comparison
It is a bit ridiculous that we need these.

8.98.1 1 Function

```python
IPython.utils.version.check_version(v, check)
    check version string v >= check
    If dev/prerelease tags result in TypeError for string-number comparison, it is assumed that the dependency is satisfied. Users on dev branches are responsible for keeping their own packages up to date.
```
8.99 Module: utils.wildcard

Support for wildcard pattern matching in object inspection.

8.99.1 Authors

- Jörgen Stenarson <jorgen.stenarson@bostream.nu>
- Thomas Kluyver

8.99.2 6 Functions

IPython.utils.wildcard.create_typestr2type_dicts (dont_include_in_type2typestr=[‘lambda’])
Return dictionaries mapping lower case typename (e.g. ‘tuple’) to type objects from the types package, and vice versa.

IPython.utils.wildcard.is_type (obj, typestr_or_type)
is_type(obj, typestr_or_type) verifies if obj is of a certain type. It can take strings or actual python types for the second argument, i.e. ‘tuple’<->TupleType. ‘all’ matches all types.
TODO: Should be extended for choosing more than one type.

IPython.utils.wildcard.show_hidden (str, show_all=False)
Return true for strings starting with single _ if show_all is true.

IPython.utils.wildcard.dict_dir (obj)
Produce a dictionary of an object’s attributes. Builds on dir2 by checking that a getattr() call actually succeeds.

IPython.utils.wildcard.filter_ns (ns, name_pattern=’*’, type_pattern=’all’, ignore_case=True, show_all=True)
Filter a namespace dictionary by name pattern and item type.

IPython.utils.wildcard.list_namespace (namespace, type_pattern, filter, ignore_case=False, show_all=False)
Return dictionary of all objects in a namespace dictionary that match type_pattern and filter.
IPython provides an extension for Sphinx to highlight and run code. This directive allows pasting of entire interactive IPython sessions, prompts and all, and their code will actually get re-executed at doc build time, with all prompts renumbered sequentially. It also allows you to input code as a pure python input by giving the argument python to the directive. The output looks like an interactive ipython section.

To enable this directive, simply list it in your Sphinx conf.py file (making sure the directory where you placed it is visible to sphinx, as is needed for all Sphinx directives). For example, to enable syntax highlighting and the IPython directive:

```python
extensions = ['IPython.sphinxext.ipython_console_highlighting',
              'IPython.sphinxext.ipython_directive']
```

The IPython directive outputs code-blocks with the language ‘ipython’. So if you do not have the syntax highlighting extension enabled as well, then all rendered code-blocks will be uncolored. By default this directive assumes that your prompts are unchanged IPython ones, but this can be customized. The configurable options that can be placed in conf.py are:

- **ipython_savefig_dir**: The directory in which to save the figures. This is relative to the Sphinx source directory. The default is html_static_path.
- **ipython_rxin**: The compiled regular expression to denote the start of IPython input lines. The default is `re.compile('In \[(d+)]:s?([^s]*)'). You shouldn’t need to change this.
- **ipython_rgxout**: The compiled regular expression to denote the start of IPython output lines. The default is `re.compile('Out\[(d+)]:s?([^s]*)'). You shouldn’t need to change this.
- **ipython_promptin**: The string to represent the IPython input prompt in the generated ReST. The default is ‘In [%d]:' This expects that the line numbers are used in the prompt.
- **ipython_promptout**: The string to represent the IPython prompt in the generated ReST. The default is ‘Out [%d]:' This expects that the line numbers are used in the prompt.
- **ipython_mplbackend**: The string which specifies if the embedded Sphinx shell should import Matplotlib and set the backend. The value specifies a backend that is passed to matplotlib.use() before any lines in
ipython_execlines are executed. If not specified in conf.py, then the default value of ‘agg’ is used. To use the IPython directive without matplotlib as a dependency, set the value to None. It may end up that matplotlib is still imported if the user specifies so in ipython_execlines or makes use of the @savefig pseudo decorator.

**ipython_execlines**: A list of strings to be exec’d in the embedded Sphinx shell. Typical usage is to make certain packages always available. Set this to an empty list if you wish to have no imports always available. If specified in conf.py as None, then it has the effect of making no imports available. If omitted from conf.py altogether, then the default value of ['import numpy as np', 'import matplotlib.pyplot as plt'] is used.

**ipython_holdcount** When the @suppress pseudo-decorator is used, the execution count can be incremented or not. The default behavior is to hold the execution count, corresponding to a value of True. Set this to False to increment the execution count after each suppressed command.

As an example, to use the IPython directive when matplotlib is not available, one sets the backend to None:

```plaintext
ipython_mplbackend = None
```

An example usage of the directive is:

```plaintext
.. ipython::

    In [1]: x = 1
    In [2]: y = x**2
    In [3]: print(y)
```

See http://matplotlib.org/sampledoc/ipython_directive.html for additional documentation.

### 9.1 Pseudo-Decorators

Note: Only one decorator is supported per input. If more than one decorator is specified, then only the last one is used.

In addition to the Pseudo-Decorators/options described at the above link, several enhancements have been made. The directive will emit a message to the console at build-time if code-execution resulted in an exception or warning. You can suppress these on a per-block basis by specifying the :okexcept: or :okwarning: options:

```plaintext
.. ipython::
    :okexcept:
    :okwarning:

    In [1]: 1/0
    In [2]: # raise warning.
```

### 9.1.1 To Do

- Turn the ad-hoc test() function into a real test suite.
- Break up ipython-specific functionality from matplotlib stuff into better separated code.

### 9.1.2 Authors

- John D Hunter: original author.
• Fernando Perez: refactoring, documentation, cleanups, port to 0.11.
• Václav Šmilauer <eudoxos-AT-arcig.cz>: Prompt generalizations.
• Skipper Seabold, refactoring, cleanups, pure python addition
10.1 History

10.1.1 Origins

IPython was starting in 2001 by Fernando Perez while he was a graduate student at the University of Colorado, Boulder. IPython as we know it today grew out of the following three projects:

- ipython by Fernando Pérez. Fernando began using Python and ipython began as an outgrowth of his desire for things like Mathematica-style prompts, access to previous output (again like Mathematica’s `%` syntax) and a flexible configuration system (something better than `PYTHONSTARTUP`).

- IPP by Janko Hauser. Very well organized, great usability. Had an old help system. IPP was used as the “container” code into which Fernando added the functionality from ipython and LazyPython.

- LazyPython by Nathan Gray. Simple but very powerful. The quick syntax (auto parens, auto quotes) and verbose/colored tracebacks were all taken from here.

Here is how Fernando describes the early history of IPython:

> When I found out about IPP and LazyPython I tried to join all three into a unified system. I thought this could provide a very nice working environment, both for regular programming and scientific computing: shell-like features, IDL/Matlab numerics, Mathematica-type prompt history and great object introspection and help facilities. I think it worked reasonably well, though it was a lot more work than I had initially planned.

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10.2.2 About the IPython Development Team

Fernando Perez began IPython in 2001 based on code from Janko Hauser <jhauser-AT-zscout.de> and Nathaniel Gray <n8gray-AT-caltech.edu>. Fernando is still the project lead.

The IPython Development Team is the set of all contributors to the IPython project. This includes all of the IPython subprojects. See the release notes for a list of people who have contributed to each release.

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