

IPython Tutorial

PyCon 2012

Fernando Perez

Min Ragan-Kelley

Brian Granger

IPython Notebook

- Web based UI for IPython.
- Open document format for code, rich text, plots, images, video.
- Built on top of the IPython Kernel.
- Tornado+WebSocket+ZeroMQ based web server.
- Currently a single user application, but multi-user version in development.

IPython Notebook installation

- Requires:
 - Tornado 2.1 or higher
 - ZeroMQ+PyZMQ
 - Recent Chrome, Firefox, Safari (WebSockets, flexible box model).
- Works out of the box with EPD/EPD Free.
- Optional LaTeX math support using MathJax.
 - Install locally (recommended).
 - Use CDN version.

```
from IPython.external.mathjax import install_mathjax
install_mathjax()
```

Basic Notebook usage

- Project = directory.
- Notebooks = JSON files in the project directory (.ipynb).
- Starting the Notebook.
- Overview of the UI.
- Keyboard shortcuts.
- Code and Markdown cells.
- --no-browser

Notebook files

- Two formats
 - JSON (.ipynb)
 - Python (.py)
- Simple to read and manipulate

```
from IPython.nbformat import current
with open('mynb.ipynb') as f:
    nb = current.read(f, 'json')
```

Notebook files

- How to import and export.
- Using the `--script` flag.
- Using the `%notebook` magic to convert an IPython session to a Notebook.

```
%notebook -e mynb.ipynb
```

Notebook magics

- `--pylab` and `%pylab`
- `--profile=sympy` and `%load_ext sympyprinting`
- `%qtconsole`
- `%notebook`
- `%loadpy`

Running a secure public Notebook

- The Notebook is a single user application.
- But, you can secure it:
 - Password protect
 - SSL Encryption
- Create a profile.
- Create a password.
- Create an SSL certificate.
- Configure the profile.
- Start the secure notebook.

Create a profile

This step makes it easy to start the Notebook in secure mode by saving the configuration to a special profile.

```
ipython profile create nbserver
```

Create a password

- Create a password that users will have to enter to access the Notebook server.
- We will store the hash in a config file.

```
In [1]: from IPython.lib import passwd
In [2]: passwd()
Enter password:
Verify password:
Out[2]: 'sha1:67c9e60bb8b6:
9ffede0825894254b2e042ea597d771089e11aed'
```

Create an SSL certificate

- Using an SSL certificate will encrypt all network traffic between browser and server.
- We will just use a self-signed certificate.

```
openssl req -x509 -nodes -days 365 -newkey rsa:1024 -  
keyout mycert.pem -out mycert.pem
```

Configure the profile

- Tell our profile about the password and SSL certificate.
- Configure IP address and port.

```
c = get_config()
c.IPKernelApp.pylab = 'inline'
c.NotebookApp.certfile =
u'/absolute/path/to/your/certificate/mycert.pem'
c.NotebookApp.ip = '*'
c.NotebookApp.open_browser = False
c.NotebookApp.password = u'sha1:bcd259ccf...password hash'
c.NotebookApp.port = 9999
```

Start the secure notebook

Just use the profile you have created and configured:

```
ipython notebook --profile=nbserver
```

IPython display system

- Python has a "displayhook" that gets called to build and display the repr of an object that is returned by each command.
- IPython overrides displayhook with a powerful display system.
- Any Python object can declare different display representations.
- The Notebook knows how to handle those representations.
 - Plaintext, HTML, SVG, PNG, Javascript, etc.
- Make your objects pretty!

Displaying objects

- Automatically using displayhook.
- Manually using display functions:
 - display
 - display_pretty
 - display_html
 - display_png
 - display_svg
 - display_jpeg
 - display_latex
 - display_javascript
- Notebook will always display the richest representation.

Display special methods

- To create custom display representations of your objects create `_repr_foo_` methods.
- Or register a display function for your class.
- `foo = html, png, svg, latex, javascript, jpeg, pretty.`
- To display raw data, use our helper classes:
 - HTML
 - Image
 - Latex/Math
 - Javascript

Development version of the Notebook

- New UI with menubar and toolbar.
- New cell types: heading and plaintext.
- Incremented Notebook format: v3.
 - Older Notebooks will be upgraded.
 - v3 Notebooks cannot be opened with IPython 0.12.
- Integrated parallel computing support.