

HTCondor Python Bindings Tutorial

Brian Bockelman
HTCondor Week 2017

HTCondor Clients in 2012

Command Line Clients

Fully Featured!

Requires fork/exec and process handling

Outputs in multiple formats

Something
Missing
In
The
Middle

SOAP Clients

Features! (Some)

Language agnostic (everyone hates XML equally?)

Caveats with respect to scalability, security.

Python Bindings

- In late 2012, I wanted better integration between HTCondor and python.
 - Existing attempts made for awful libraries: as a rule, Unix libraries should not fork/exec.
 - Nothing handled ClassAds correctly.
 - Dan Bradley had previously mentioned that boost.python appeared to be a good way to integrate Python with C++ code.
- So, on December 26, I set off to see what could be done...

Design Philosophy

- **ClassAds**: Everything based on ClassAds; make these the “core” of the bindings.
- **pythonic**: Semantics and APIs should feel natural to a python programmer.
 - Use iterators, exceptions, guards. ClassAds behave as much like a dict as reasonable.
- **Backward compatible**: APIs are here to stay for as long as possible.
 - When we absolutely must, use standard python `DeprecationWarning` techniques.
- **Native code**: Call same HTCondor library code as CLI; identical in performance.
- **Complete**: If you can do it with the command line tools, you should be able to do it with python.

Not Our First Rodeo

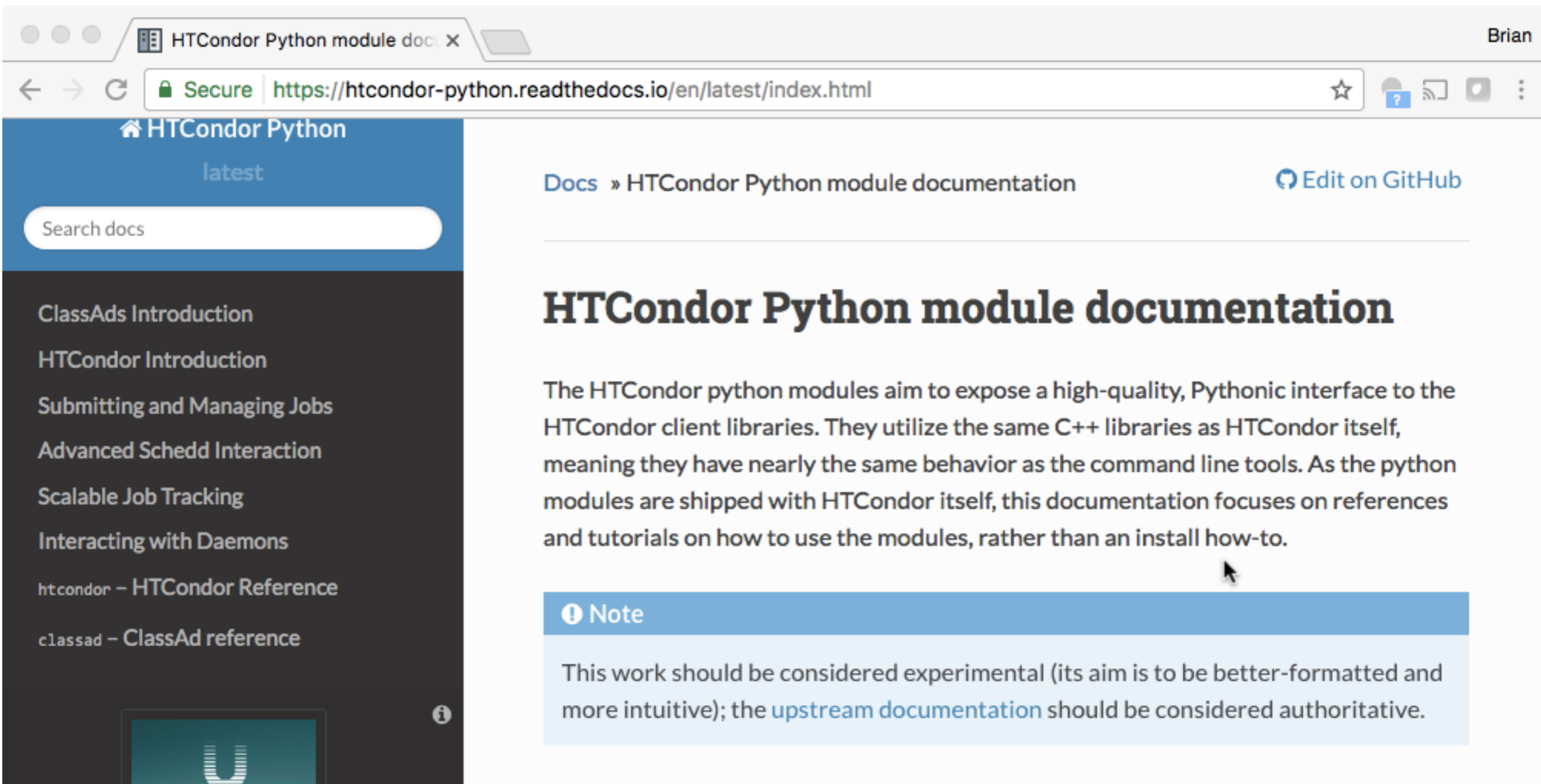
- We, uh, might have done a python bindings tutorial before:
 - http://research.cs.wisc.edu/htcondor/HTCondorWeek2013/presentations/Bockelman_Python.pdf
 - <http://research.cs.wisc.edu/htcondor/HTCondorWeek2014/presentations/TheisenT-Python.pdf>
 - https://research.cs.wisc.edu/htcondor/HTCondorWeek2016/presentations/Bockelman_Python-tutorial.pdf
- Goal for this year: **Overhaul the experience!**

Pythonic!

- Since *pythonic* is in our design philosophy, I decided the education should use the tools favored by the python community:
 - Sphinx-based documentation. Hosted on ReadTheDocs; looks / feels / smells like python documentation. Updated, more complete, and contains *tutorials*: not just a reference!
 - JupyterHub-based tutorials. Login with a university credential; spawns a Docker container with a private HTCondor instance. Interact via your browser.

Sphinx Docs

<https://htcondor-python.readthedocs.io>



The screenshot shows a web browser window with the following elements:

- Browser Tab:** HTCondor Python module doc
- Address Bar:** <https://htcondor-python.readthedocs.io/en/latest/index.html>
- Page Header:** HTCondor Python [latest](#) [Edit on GitHub](#)
- Search Bar:** Search docs
- Table of Contents (Left Sidebar):**
 - ClassAds Introduction
 - HTCondor Introduction
 - Submitting and Managing Jobs
 - Advanced Schedd Interaction
 - Scalable Job Tracking
 - Interacting with Daemons
 - htcondor – HTCondor Reference
 - cclassad – ClassAd reference
- Main Content:**

HTCondor Python module documentation

The HTCondor python modules aim to expose a high-quality, Pythonic interface to the HTCondor client libraries. They utilize the same C++ libraries as HTCondor itself, meaning they have nearly the same behavior as the command line tools. As the python modules are shipped with HTCondor itself, this documentation focuses on references and tutorials on how to use the modules, rather than an install how-to.
- Note Box:**

Note

This work should be considered experimental (its aim is to be better-formatted and more intuitive); the [upstream documentation](#) should be considered authoritative.

JupyterHub Tutorials

HTCondor+Python+Bindings+T x Brian

Secure <https://hcc-anvil-175-29.unl.edu/user/bockelman.unl.edu/notebooks/tutorials/HTCondor%2BPython%...>

jupyter HTCondor+Python+Bindings+Tutorial Last Checkpoint: an hour ago (autosaved) Control Panel Logout

File Edit View Insert Cell Kernel Widgets Help Python 2

CellToolbar

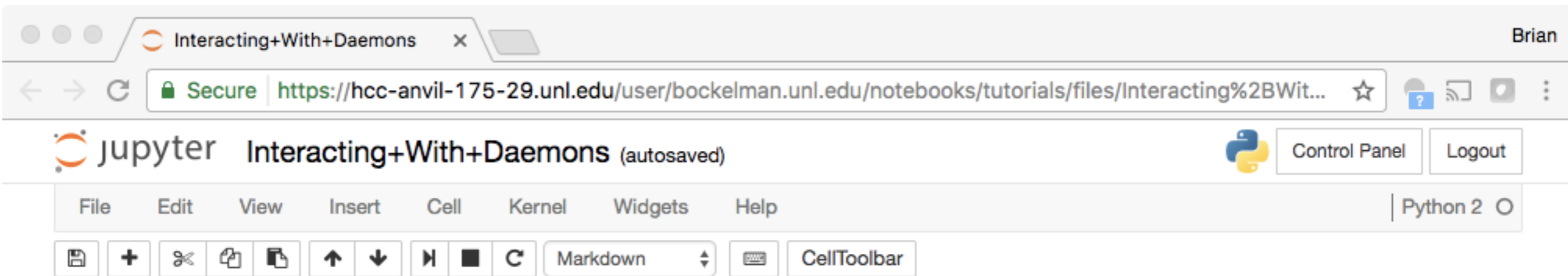
HTCondor

HTCondor Python Bindings Tutorial

The HTCondor python bindings provide a powerful mechanism to interact with HTCondor from a python program. They utilize the same C++ libraries as HTCondor itself, meaning they have nearly the same behavior as the command line tools.

Here, you will learn the basics of the python bindings and how to use them. This tutorial is broken down into two major

Notebook View



The screenshot shows a web browser window with a single tab titled "Interacting+With+Daemons". The address bar shows a secure connection to a URL. The Jupyter logo and the notebook title "Interacting+With+Daemons (autosaved)" are visible. On the right, there are buttons for "Control Panel" and "Logout". A menu bar includes "File", "Edit", "View", "Insert", "Cell", "Kernel", "Widgets", and "Help". Below the menu is a toolbar with icons for saving, adding, deleting, copying, pasting, undo, redo, and a dropdown menu currently set to "Markdown". A "CellToolbar" button is also present. The kernel name "Python 2" is shown in the top right corner of the notebook interface.

Interacting With Daemons

In this module, we'll look at how the HTCondor python bindings can be used to interact with running daemons.

Let's start by importing the correct modules:

```
In [2]: import htcondor
```

Configuration

The HTCondor configuration is exposed to Python in two ways:

- The local process's configuration is available in the module-level `param` object.
- A remote daemon's configuration may be queried using a `RemoteParam`

Terminal View

@331dd87f439f:~/work x

Secure | <https://hcc-anvil-175-29.unl.edu/user/bockelman.unl.edu/terminals/1>

jupyter Control Panel Logout Brian

```
[jovyan@331dd87f439f work]$ condor_q

-- Schedd: jovyan@331dd87f439f : <172.17.0.2:9618?... @ 04/29/17 19:42:45
OWNER BATCH_NAME          SUBMITTED   DONE    RUN    IDLE   HOLD   TOTAL JOB_IDS
0 jobs; 0 completed, 0 removed, 0 idle, 0 running, 0 held, 0 suspended
[jovyan@331dd87f439f work]$ condor_run echo "hello world"
hello world
[jovyan@331dd87f439f work]$ condor_status
Name           OpSys      Arch      State      Activity LoadAv Mem      ActvtyTime
331dd87f439f LINUX      X86_64 Unclaimed Idle        0.050 3539  0+00:00:02

      Machines Owner Claimed Unclaimed Matched Preempting Drain
      X86_64/LINUX      1      0      0      1      0      0      0
      Total            1      0      0      1      0      0      0
[jovyan@331dd87f439f work]$
```

You can help!

- The contents of the tutorials and documentation are kept on GitHub:
 - <https://github.com/bbockelm/htcondor-python/>
 - I am interested in partnering with someone to help make the Jupyter service Docker-ized also!
- Find a bug? Spot some missing content?
 - Simply send a pull request; Travis-CI will test and update the static content once merged.

Let's Proceed!

<https://hcc-htcondor-python.unl.edu>