What’s new in HTCondor? What’s coming?

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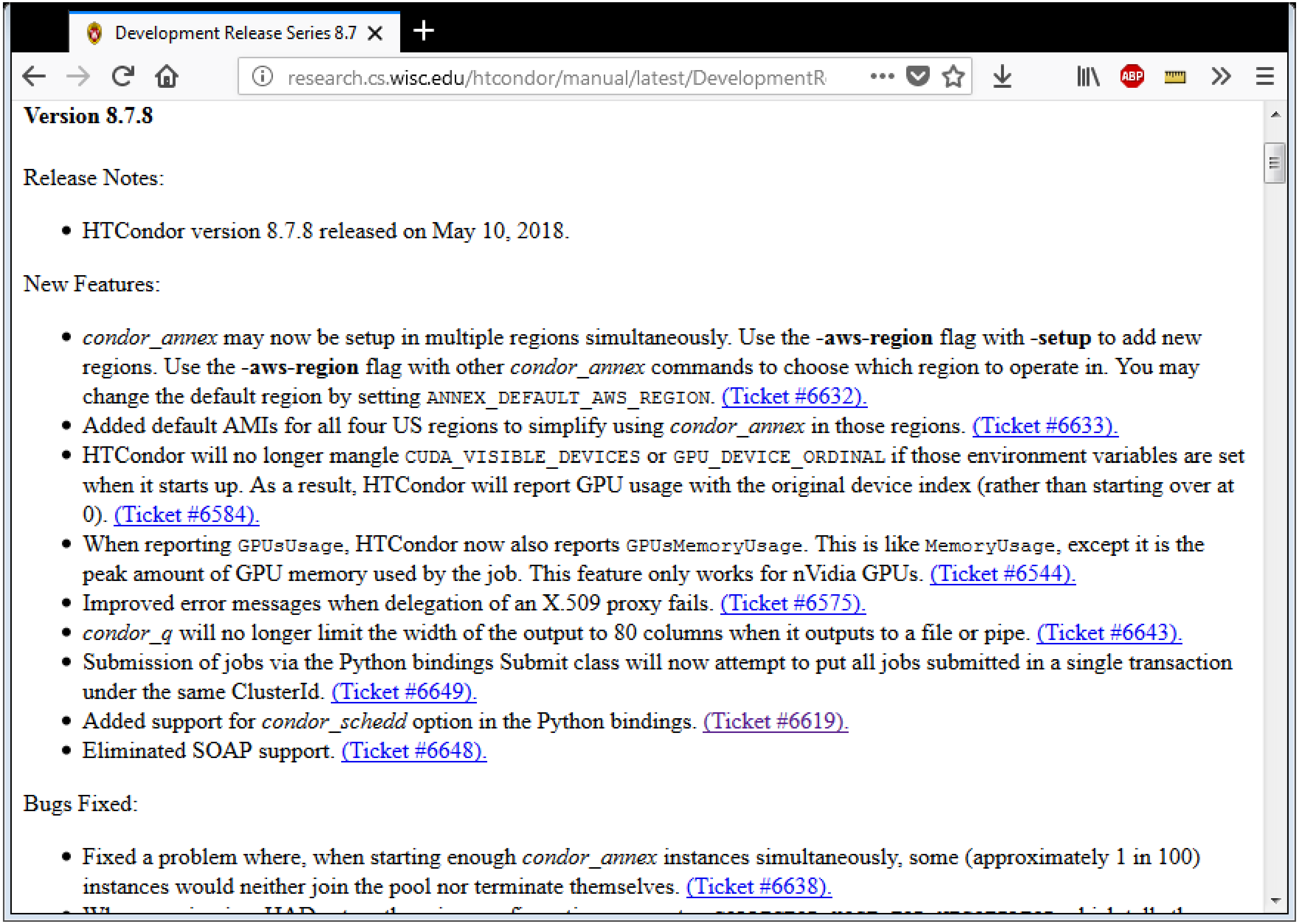
Release Timeline

- Stable Series
  - HTCondor v8.6.x - introduced Jan 2017

    Currently at v8.6.11
- Development Series (*should be 'new features' series)*
  - HTCondor v8.7.x

    Currently at v8.7.8
- New v8.8 stable series coming this summer
- Detailed Version History in the Manual
- http://htcondor.org/manual/latest/VersionHistoryandReleaseNotes.html


Development Release Series 8.7
research.cs.wisc.edu/htcondor/manual/latest/DevelopmentR

Version 8.7.8

Release Notes:

- HTCondor version 8.7.8 released on May 10, 2018.

New Features:

- *condor_annex* may now be setup in multiple regions simultaneously. Use the **-aws-region** flag with **-setup** to add new regions. Use the **-aws-region** flag with other *condor_annex* commands to choose which region to operate in. You may change the default region by setting `ANNEX_DEFAULT_AWS_REGION`. (Ticket #6632).
- Added default AMIs for all four US regions to simplify using *condor_annex* in those regions. (Ticket #6633).
- HTCondor will no longer mangle `CUDA_VISIBLE_DEVICES` or `GPU_DEVICE_ORDINAL` if those environment variables are set when it starts up. As a result, HTCondor will report GPU usage with the original device index (rather than starting over at 0). (Ticket #6584).
- When reporting `GPUsUsage`, HTCondor now also reports `GPUsMemoryUsage`. This is like `MemoryUsage`, except it is the peak amount of GPU memory used by the job. This feature only works for nVidia GPUs. (Ticket #6544).
- Improved error messages when delegation of an X.509 proxy fails. (Ticket #6575).
- *condor_q* will no longer limit the width of the output to 80 columns when it outputs to a file or pipe. (Ticket #6643).
- Submission of jobs via the Python bindings Submit class will now attempt to put all jobs submitted in a single transaction under the same ClusterId. (Ticket #6649).
- Added support for *condor_schedd* option in the Python bindings. (Ticket #6619).
- Eliminated SOAP support. (Ticket #6648).

Bugs Fixed:

- Fixed a problem where, when starting enough *condor_annex* instances simultaneously, some (approximately 1 in 100) instances would neither join the pool nor terminate themselves. (Ticket #6638).

Enhancements in HTCondor v8.4

- Scalability and stability
  - Goal: 200k slots in one pool, 10 schedds managing 400k jobs
- Introduced Docker Job Universe
- IPv6 support
- Tool improvements, esp condor_submit
- Encrypted Job Execute Directory
- Periodic application-layer checkpoint support in Vanilla Universe
- Submit requirements
- New RPM / DEB packaging
- Systemd / SELinux compatibility

Enhancements in HTCondor v8.6

- Enabled and configured by default: use single TCP port, cgroups, mixed IPv6 + IPv4, kernel tuning
- Made some common tasks easier
- Schedd Job Transforms
- Docker Universe enhancements: usage updates, volume mounts, conditionally drop capabilities
- Singularity Support

HTCondor Singularity Integration

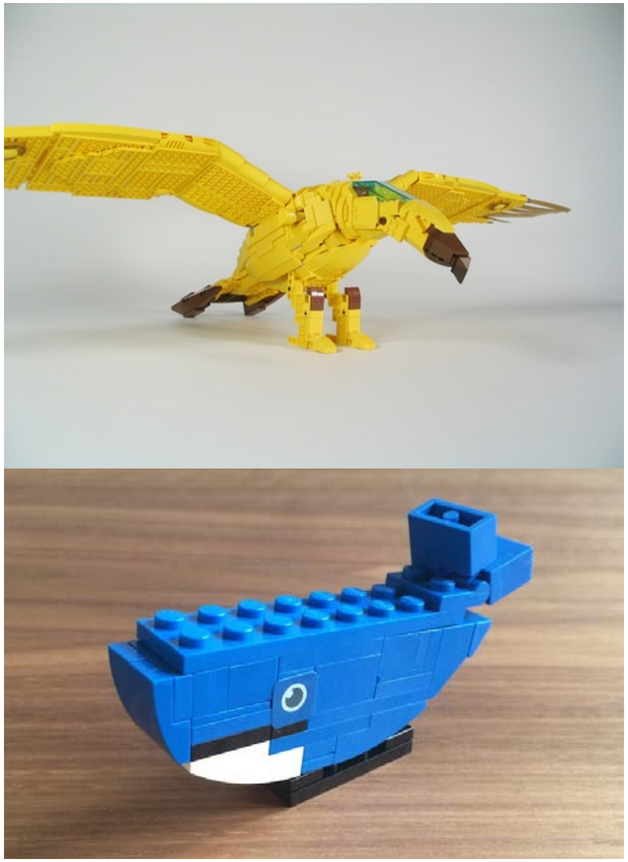
- What is Singularity?

  Like Docker but…
  - No root owned daemon process, just a setuid
  - No setuid required (post RHEL7)
  - Easy access to host resources incl GPU, network, file systems
- HTCondor allows admin to define a policy (with access to job and machine attributes) to control
  - Singularity image to use
  - Volume (bind) mounts
  - Location where HTCondor transfers files

Whats cooking in the kitchen for HTCondor v8.7 and beyond

Docker Job Enhancements

- Docker jobs get usage updates (i.e. network usage) reported in job classad
- Admin can add additional volumes
  - That all docker universe jobs get
- Condor Chirp support
- Conditionally drop capabilities
- Support for condor_ssh_to_job



Not just Batch - Interactive Sessions

- Two uses for condor_ssh_to_job
  - Interactive session alongside a batch job
    - Debugging job, monitoring job
  - Interactive session alone (no batch job)
    - Juptyer notebooks, schedule shell access
    - p.s. Jupyter Hub batchspawner supports HTCondor
- Can tell the schedd to run a specified job immediately! Interactive sessions, test jobs
  - No waiting for negotiation, scheduling
  - *condor_I_am _impatient_and_waiting ?*

HTCondor Python API

- HTCondor V8.7 eliminated web-service SOAP API, long live Python!
- Started with Python 2, now also support Python 3
- Packged into PyPI repository (Linux only)

```
pip install htcondor
```

- Several API improvements and simplifications, e.g. much easier to submit jobs
  - Can use condor_submit JDL directly, including queue for each
  - Starting to think about higher-level job submit abstractions
- MS Windows now supported

HTCondor "Annex"

- Instantiate an HTCondor Annex to dynamically add additional execute slots for jobs submitted at your site
  - Get status on an Annex
  - Control which jobs (or users, or groups) can use an Annex
- Want to launch an Annex on
  - Clouds
    - Via cloud API (or Kubernetes?)
  - HPC Centers / Supercomputers
    - Via edge service (HTCondor-CE)

Grid Universe

- Reliable, durable submission of a job to a remote scheduler
- Popular way to send pilot jobs (used by glideinWMS), key component of HTCondor-CE
- Supports many “back end” types:
  - HTCondor
  - PBS
  - LSF
  - Grid Engine
  - Google Compute Engine
  - Amazon AWS
  - OpenStack
  - Cream
  - NorduGrid ARC
  - BOINC
  - Globus: GT2, GT5
  - UNICORE

Added Grid Universe support for Azure. SLURM, Cobalt

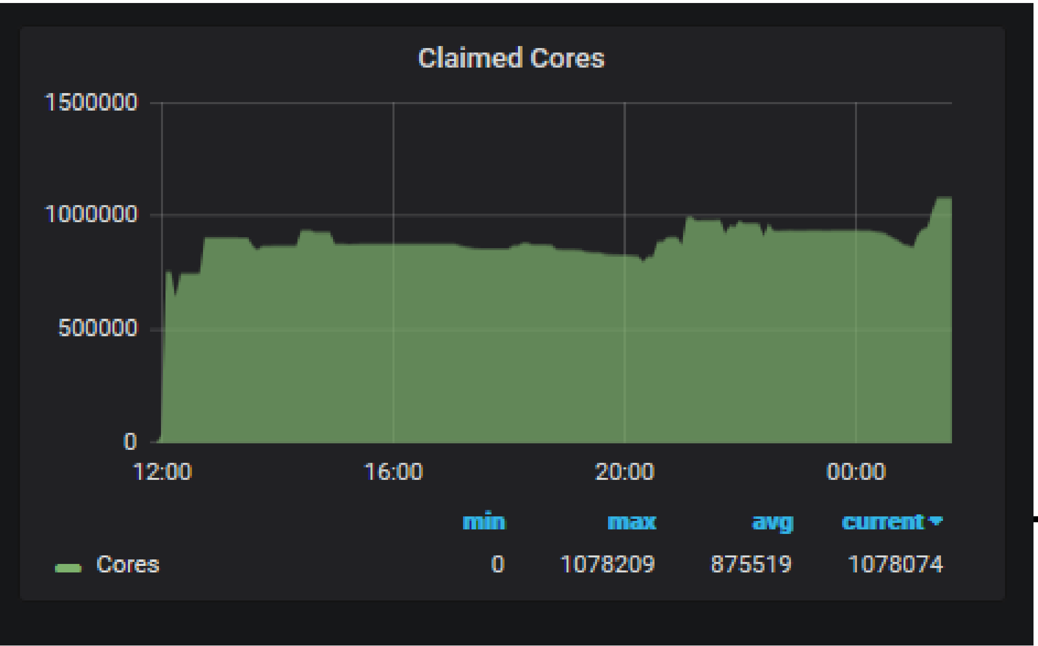
- Speak to Microsoft Azure
- Speak native SLURM protocol
- Speak to Cobalt Scheduler
  - Argonne Leadership Computing Facilities

Jaime:
Grid
Jedi

Also HTCondor-CE "native" package

- HTCondor-CE started as an OSG package
- IN2P3 wanted HTCondor-CE without all the OSG dependencies….
- Now HTCondor-CE available stand-alone in HTCondor repositories

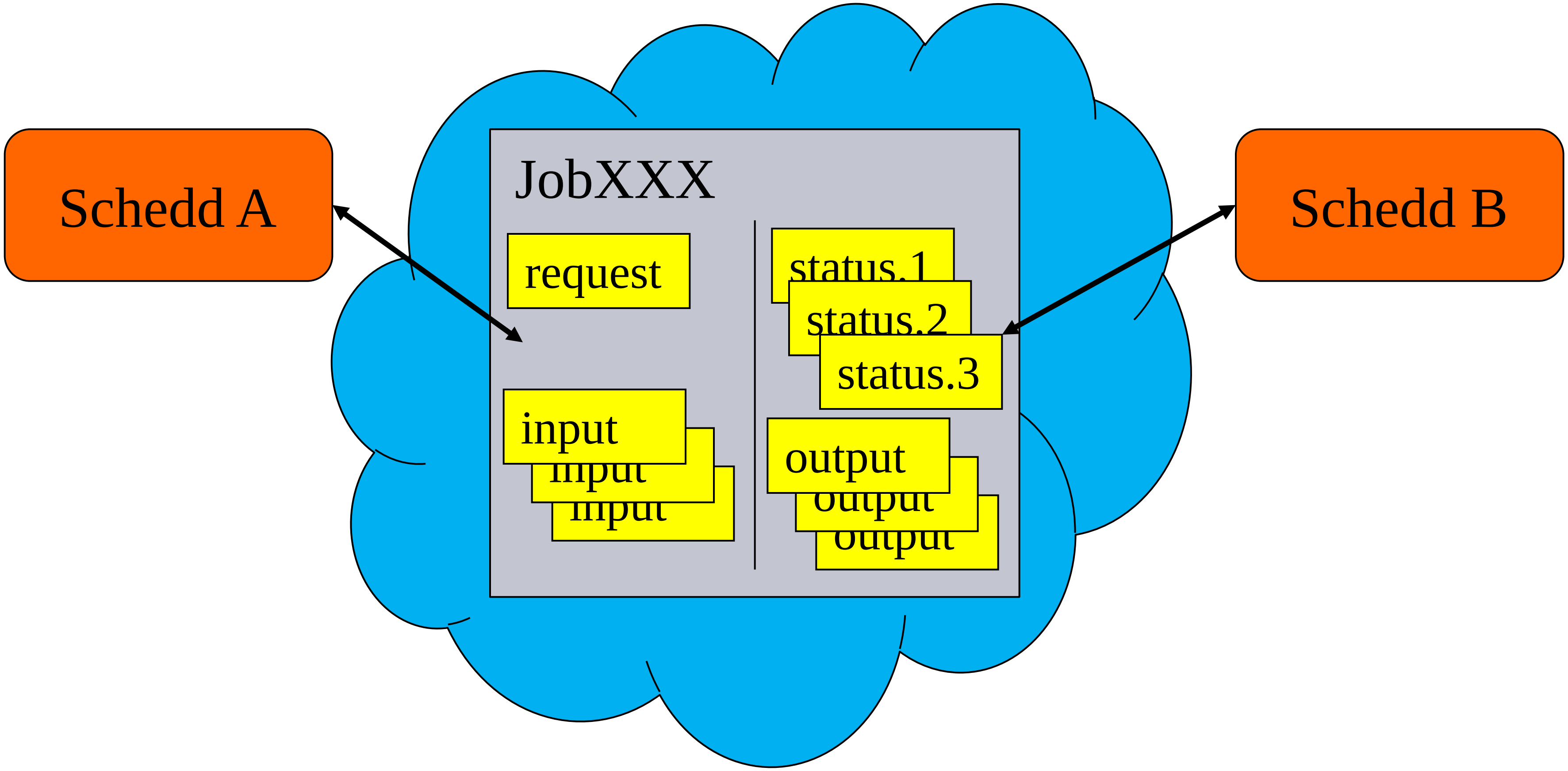
CPU cores!



	min	max	avg	current
🟩 Cores	0	1078209	875519	1078074

FNAL HEPCloud
NOvA Run
(via Annex at NERSC)
http://hepcloud.fnal.gov/

No internet access to HPC edge service? File-based Job Submission



condor_annex tool

- Start virtual machines as HTCondor execute nodes in public clouds that join your pool
- Leverage efficient AWS APIs such as Auto Scaling Groups and Spot Fleets
  - Other clouds (Google, Microsoft) coming
- Secure mechanism for cloud instances to join the HTCondor pool at home institution
- Shut down idle instances, detect instances that fail to start HTCondor
- Implement a fail-safe in the form of a lease to make sure the pool does eventually shut itself off.

Compute node management enhancements

- Work on Noisy Neighbor Challenges
  - Already use cgroups to manage CPU, Memory… what about CPU L3 cache? Memory bus bandwidth?
  - Working with CERN OpenLab and Intel on leveraging Intel Resource Directory Technology (RDT) in HTCondor
    - Monitor utilization
    - Assign shares

CERN openlab

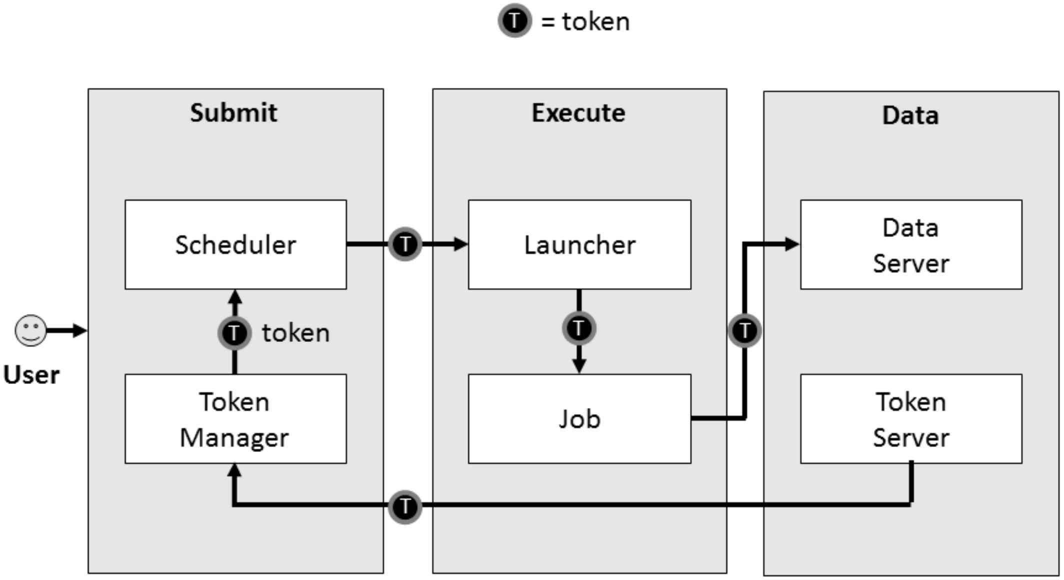
Compute node management enhancements, cont.

- Multi-core challenges. Low priority user submits millions of 1-core jobs; subsequently high priority user submit a 4-core job. What to do?
  - Option 1: Draining
    - *HTCondor can now backfill draining nodes with pre-emptible jobs*
  - Option 2: Preemption
    - *HTCondor can now preempt multiple jobs, combine their resources, and assign to a higher priority job*
    - Initial implementation to gain experience at BNL; however we are still working on a cleaner model

Compute node management enhancements, cont.

- GPU Devices
- HTCondor can detect GPU devices and schedule GPU jobs
- *New in v8.7:*
  - Monitor/report job GPU processor utilization
  - Monitor/report job GPU memory utilization
- Future work: simultaneously run multiple jobs on one GPU device
  - *Volta hardware-assisted Mutli-Process Service (MPS)*

Security: From identity certs to authorization tokens



SCI TOKENS

- HTCondor has long supported GSI certs
- Then added Kerberos/AFS tokens for CERN, DESY
- Now adding standardized token support
  - SciTokens (http://scitokens.org)
  - OAuth 2.0 Workflow → Box, Google Drive, Github, …

Security, cont.

- Planning for US Federal Information Processing Standard (**FIPS**) Compliance
  - Can do better than MD-5, 3DES, Blowfish
  - AES has hardware support in most Intel CPUs
- May motivate us to drop UDP communications in HTCondor
  - Almost all communication in HTCondor is now asynchronous TCP anyway
  - Anyone care if UDP support disappears?

Scalability Enhancements

- *Late materialization* of jobs in the schedd to enable submission of very large sets of jobs
  - More jobs materialized once number of idle jobs drops below a threshold (like DAGMan throttling)
- Central manager now manages queries
  - Queries (ie condor_status calls) are queued; priority is given to operational queries
- More performance metrics (e.g. in collector, DAGMan)

Data work

- Job input files normally transferred to execute node over CEDAR, now can be sent over HTTP
  - Enable caching (reverse and forward proxies), redirects
  - More info from Carl Vuosalo's talk: https://tinyurl.com/yd6mya96
- Proposed a project to manage data leases (size and time lease) for job output across HTCondor, Rucio, XRootD

Workflows

- Thinking about how to add "provisioning nodes" into a DAGMan workflow
  - Provision an annex, run work, shutdown annex
- Working with Toil team so Toil workflow engine can submit jobs into HTCondor

COMMON WORKFLOW LANGUAGE

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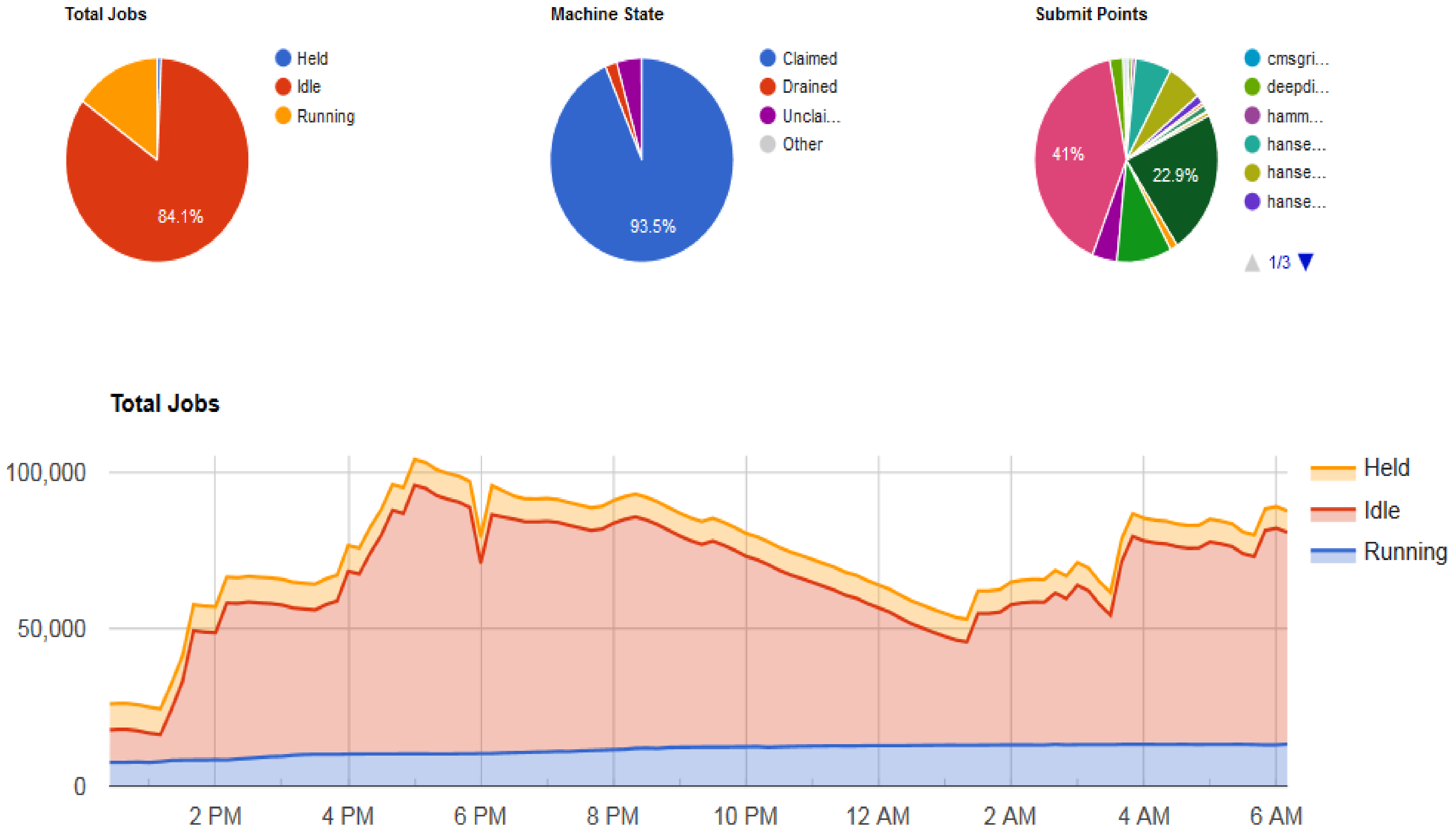
HTCondor View



Thank you!