CMS Experience Provisioning Cloud Resources with GlideinWMS

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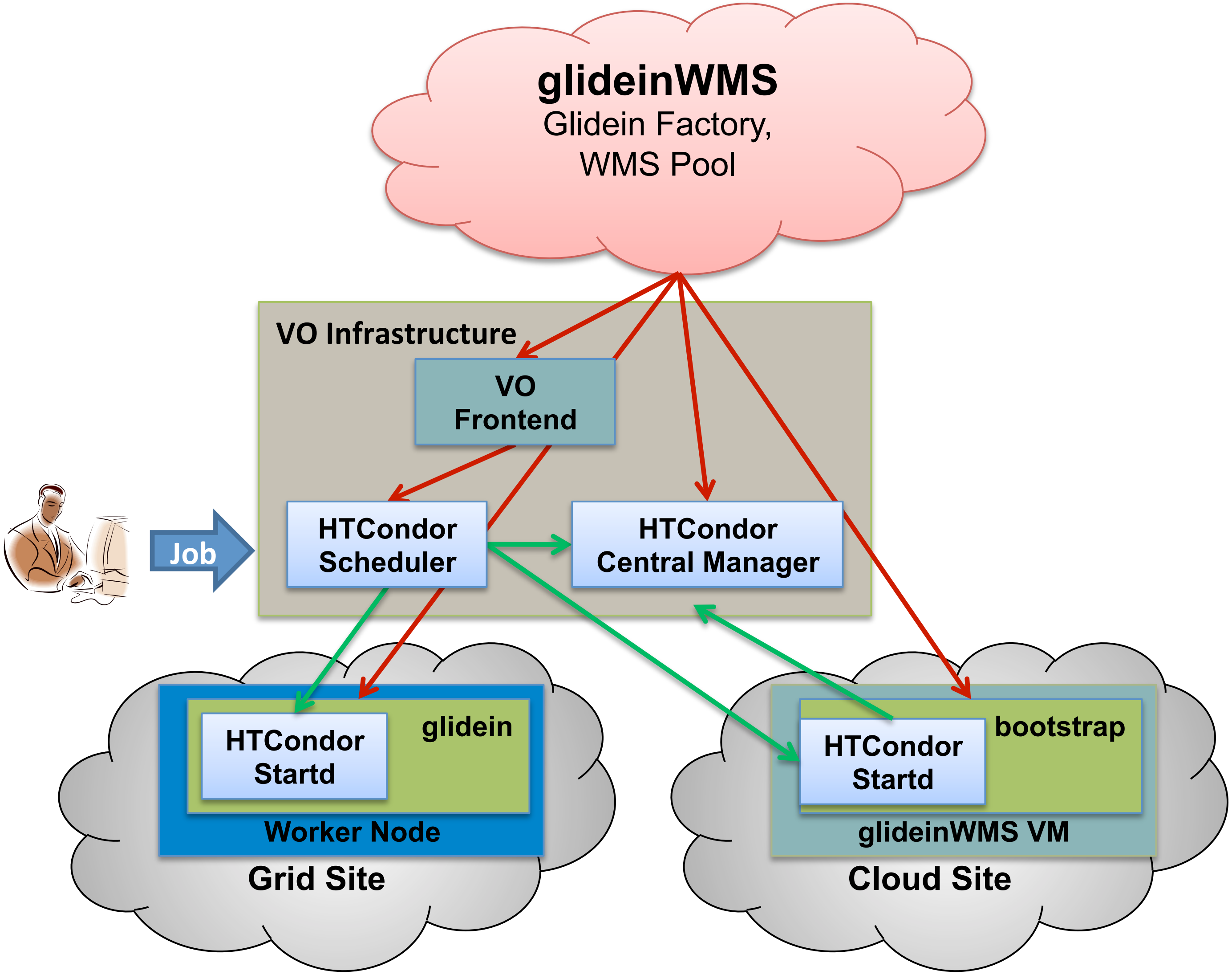
glideinWMS Quick Facts

- glideinWMS is an open-source Fermilab Computing Sector product driven by CMS
- Heavy reliance on HTCondor from UW Madison and we work closely with them
- http://tinyurl.com/glideinWMS

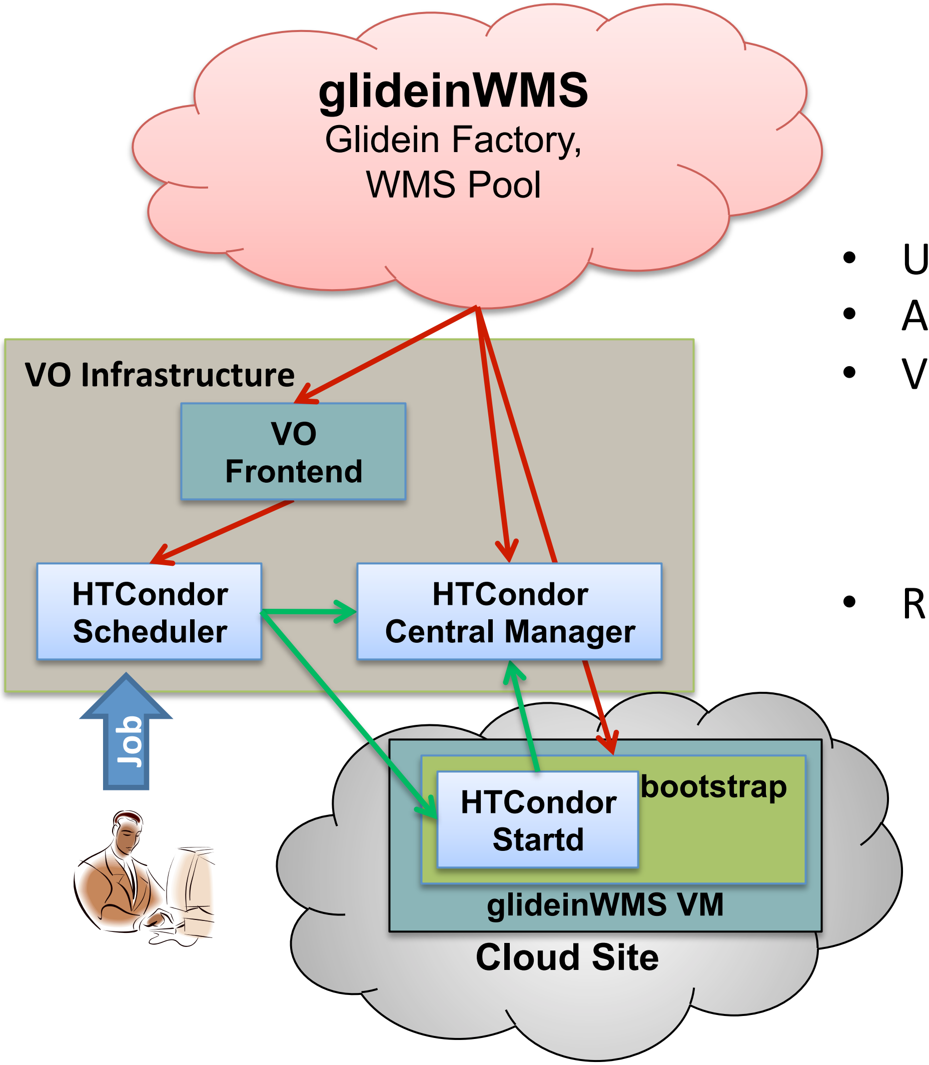
GlideinWMS Overview



CMS Use of CERN AI

- CERN AI: CERN Agile Infrasructure
- T0: (Tier-0) CERN Data Center traditionally where first pass data processing takes place (See Dave Mason’s talk for details)
- T0 completely moved from LSF to AI (OpenStack)
- Approximately 9000 cores now (-> 15000=~220 kHS06)
- 8 core/ 16GB VMs
- Images built by CMS, using CERN-IT automated build system.
- VM are not very dynamic but almost static (1 month duration)
- Resources are part of the T0 Pool and shared with other uses. However, T0 runs with very high priority and so will push out other users quickly if needed.

GlideinWMS & CERN AI



- Use The EC2 API
- AI had stability issues, mostly fixed now
- VMs have ~1 month lifetime
  - Still suffer from long ramp up times
  - Due to resource scarcity, danger of losing resources if they are released
- Results have been mostly favorable

CMS HLT as a Cloud

- HLT: High Level Trigger farm
- The HLT is a considerable CPU resource. At startup:
  - Dell C6100 : 288 nodes, type = 12 cores 24GB ram (will be decommissioned end of 2015 and replaced)
  - Dell C6220 : 256 nodes, type = 16 cores 32GB ram (will be decommissioned end of 2016 and replaced)
  - Megware : 360 nodes, type =24 cores 64GB ram (are the brand new machines)
- No usable disk mass storage (only local disk to each machine)
- 60Gb/s network connection to CERN IT
- When needed to be the HLT it must be the HLT and alternative use must not interfere
  - However when not the HLT this is an extremely valuable resource. Cloud solution chosen (based on OpenStack) with VMs that can be killed completely if needed.

CMS HLT as a Cloud

- Even with expected overheads we can expect typically ~6 hours of usable time between runs. But this time is randomly distributed.
- So anticipate running ~2hour jobs, but this will be adjusted as we gain experience.
- Even during fills use of the HLT is not constant so should be possible to sometimes use part of the HLT even during data taking.

CMS HLT as a Cloud

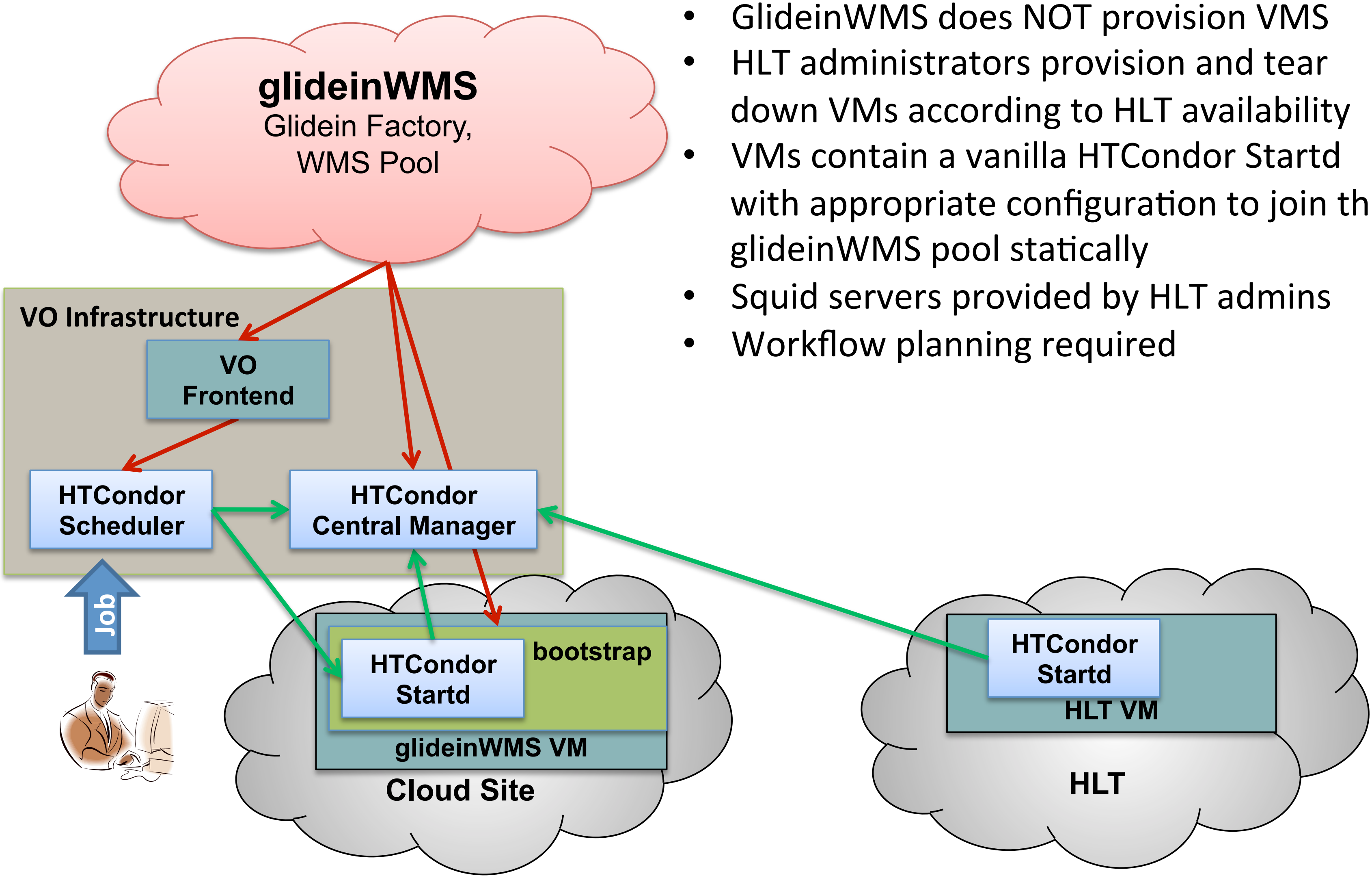
- So we have a 3 level plan:

- Start by using HLT as a Cloud during Technical stops. If that works …
- Start to use the HLT as a Cloud between fills. If that works …
- Start to use parts of the HLT as a Cloud during fills at low luminosity.

- However, in this model the HLT team must be in control.

- So a new tool, Cloud-igniter, used by the online team to start and kill VMs rather than requests from coming from the factory. New Vms connect to the Global pool.

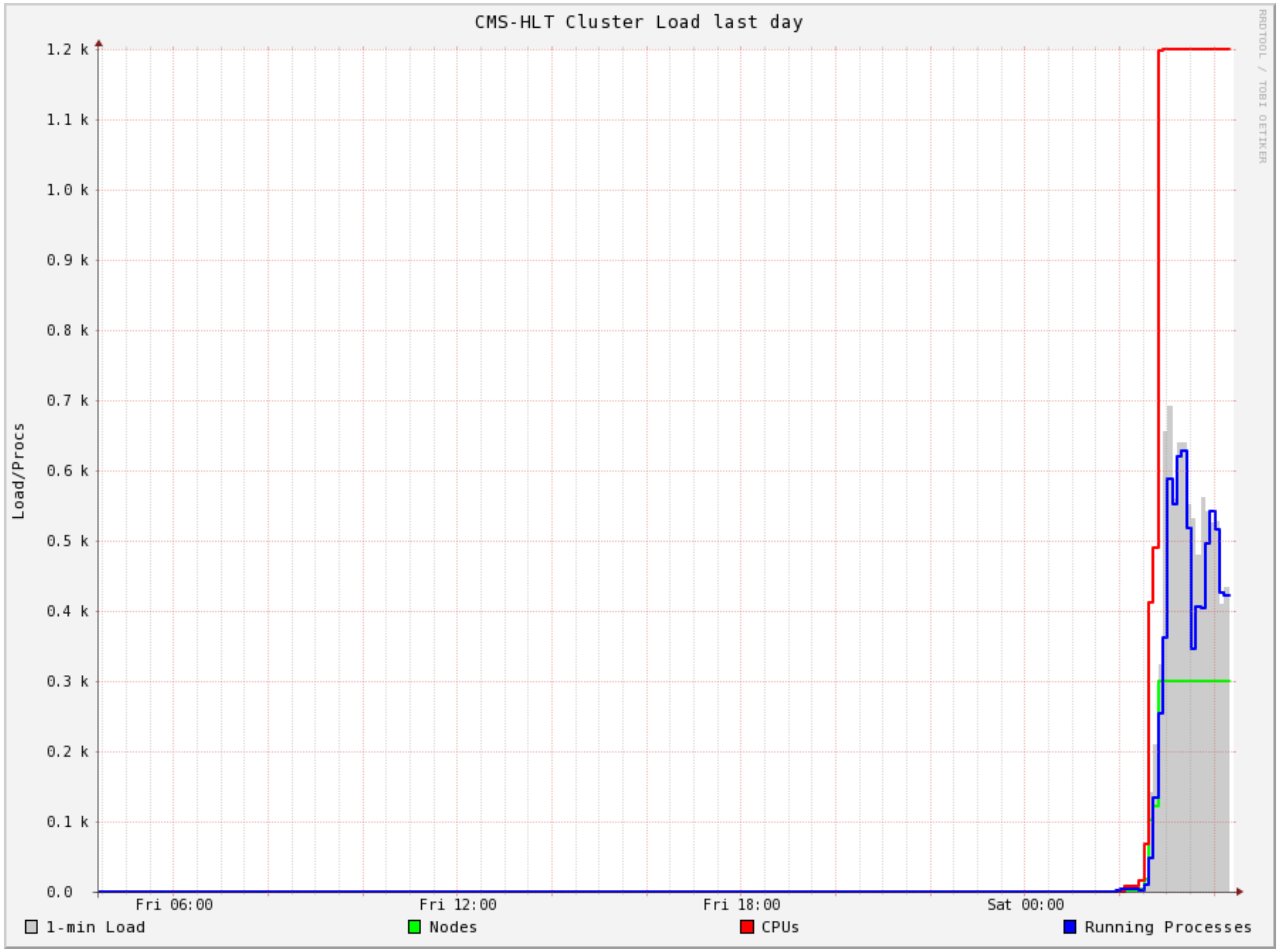
GlideinWMS & CMS HLT



- GlideinWMS does NOT provision VMS
- HLT administrators provision and tear down VMs according to HLT availability
- VMs contain a vanilla HTCondor Startd with appropriate configuration to join the glideinWMS pool statically
- Squid servers provided by HLT admins
- Workflow planning required

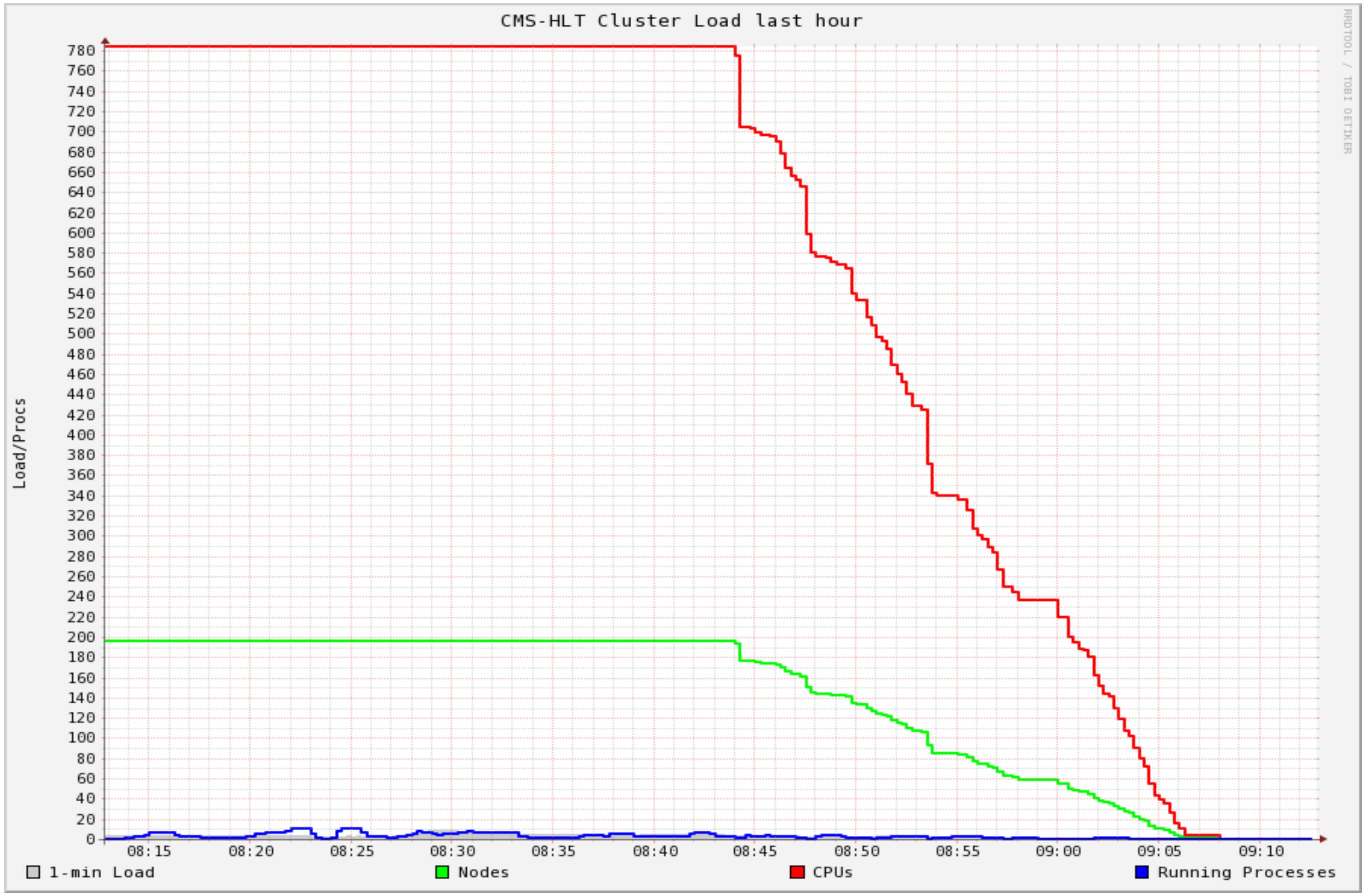
CMS HLT as a Cloud

- Can start 1200 cores in ~10 minutes with EC2 API
- EC2 API faster than NOVA API



CMS HLT as a Cloud

- Can shutdown 700 cores in ~20 minutes with EC2 API – in reality, HLT admins hard kill VMs.
- Takes ~1 minute for entire cluster



Institutional Clouds

- Have been working with clouds in China, Italy and the UK. All OpenStack.
- Have run user analysis using GlideinWMS installed in Italy and the UK.
- Have mainly tested Institutional Clouds using the “traditional” CMS cloud approach. However, have carried tests using other tools

Fermilab OneFacility Project

- The goal is to transparently incorporate all resources available to Fermilab into one coherent facility
- Experiments should be able to perform the full spectrum of computing work on resources regardless of the "location" of the resources.
- Include commercial and community cloud resources
- Include "allocation based" resources via BOSCO

Fermilab OneFacility Project

- Initial work will focus on several use cases:
  - Nova use case tests sustained data processing in the cloud over the course of several months
  - CMS use case tests bursting into the cloud using many resources for a short period
  - Other use cases will explore specialized hardware needs

Cloud Bursting

- Pilot project is to “burst” into AWS
- Want to use ~56K cores (m3.2xlarge) for a month (8 vCPUs, 30GiB RAM, 160GB SSD)
- Initial phase will be provisioned through the FNAL Tier-1 as part of the OneFacility project
- See Sanjay Padhi’s talk for more details
- Would like to acknowledge Michael Ernst and ATLAS for initial work with AWS and sharing lessons learned

Cloud Challenges

- Grid sites provide certain infrastructure
- Cloud sites provide the tools to build infrastructure
- Data placement
- Authentication/Authorization
- VM image management
- Cost management

HTCondor Wishlist

- Make network a first class citizen
  - Network bandwidth management one of the challenges facing the OneFacility project for all use cases
  - Counters for how much data is being transferred in and out, knobs to restrict traffic, etc.
- Native cloud protocols
  - Using EC2 API now
  - Native nova support for OpenStack (EC2 API moving out of the core and into third party development/support)
  - Google Compute Engine support
  - Microsoft Azure support?

HTCondor Wishlist

- Better integration with cloud tooling
  - EC2 API good if a longer ramp-up is tolerable
  - Not so good if you need to burst now
  - Need to build grid infrastructure in the cloud, would be nice to be able to “orchestrate” the architecture on demand (OpenStack Heat, AWS CloudFormation)
- Provide a better view of the total cloud usage orchestrated by HTCondor
  - Classads that contain (as reported by the cloud infrstructure):
    - total computing time
    - total storage usage
    - Total inbound and outbound network usage
    - Usage statistics from other services offered by the infrastructures
- LogStash filters for all HTCondor logs

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- glideinWMS team
- HTCondor Team

Questions?