UNIVERSITY OF NOTRE DAME

CMS connect

Kenyi Hurtado, Kevin Lannon, James Letts

OSG All-Hands Meeting 2016

March 15, 2016

khurtado@nd.edu

Motivation

- The Compact Muon Solenoid (CMS) is a multipurpose experiment collecting and analyzing data from proton-proton and heavy ion collisions at the Large Hadron Collider (LHC).

- **From the computing point of view, this translates into tons of data and simulation processes that need to be handled.**

CMS Detector

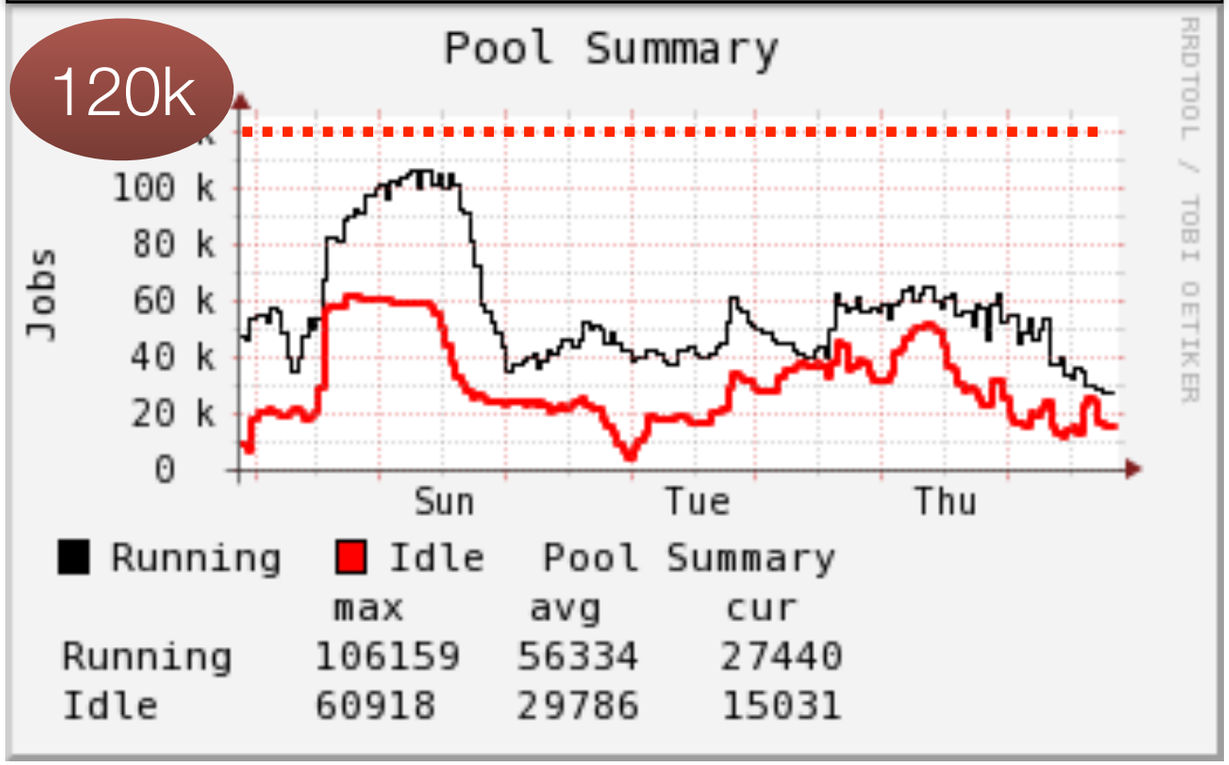
Motivation

Offline Data processing (frequently high throughput and batch-oriented) can in principle be divided in two categories:

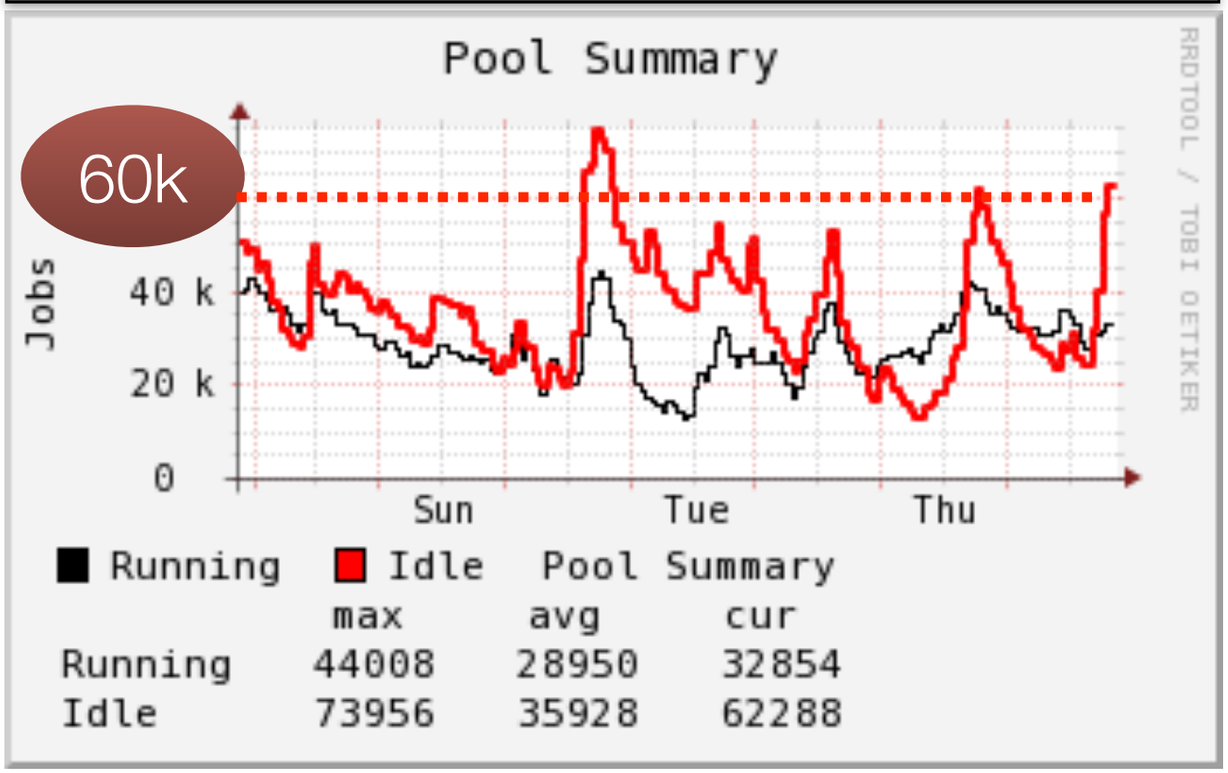
- **Production**: *Organized processing of data performed by a central **operations team***
- **(Offline) Data Processing**
  - **Analysis**: *Data analysis performed by **individual users***

Motivation

Production Summary



Analysis Summary



Over 100K cores globally distributed available for these two categories.

Motivation

Analysis jobs could also be divided in two different workflow sub-categories

Workflows using **cmsRun**: the CMSSW executable for e.g *event processing*

Analysis

*Data analysis performed by **individual users***

Late-stage analysis workflows: Regular condor-like jobs for e.g making histograms, plots, analyzing trees, etc.

Motivation

Analysis jobs could a
sub-categories

CRAB 3 handles this (CMS Remote Analysis Builder)

Workflows using **cmsRun**: the CMSSW executable for e.g *event processing*

Analysis

*Data analysis performed by **individual users***

CMS-Connect focuses on this category

Late-stage analysis workflows: Regular condor-like jobs for e.g making histograms, plots, analyzing trees, etc.

CMS Connect

CMS Connect in a nutshell:

A service to provide local-like CMS analysis cluster capability to Institutions for **non-CRAB** workflow jobs.

Status:

- We are in "alpha" stage
  - Can submit HTCondor-like jobs to all CMS resources, including International Sites.
  - **Looking for users familiarized with HTCondor to be the first wave of testers for this service.**

CMS Connect

You

+

HTCondor
High Throughput Computing

+

connect

=

Access to all computing resources connected to the Global Pool

This is a complement to the existing tools in CMS with access to the same CMS Global resources for condor-like workflows that are frequently submitted to local clusters like e.g the LPC CAF at Fermilab or local University CMS analysis clusters.

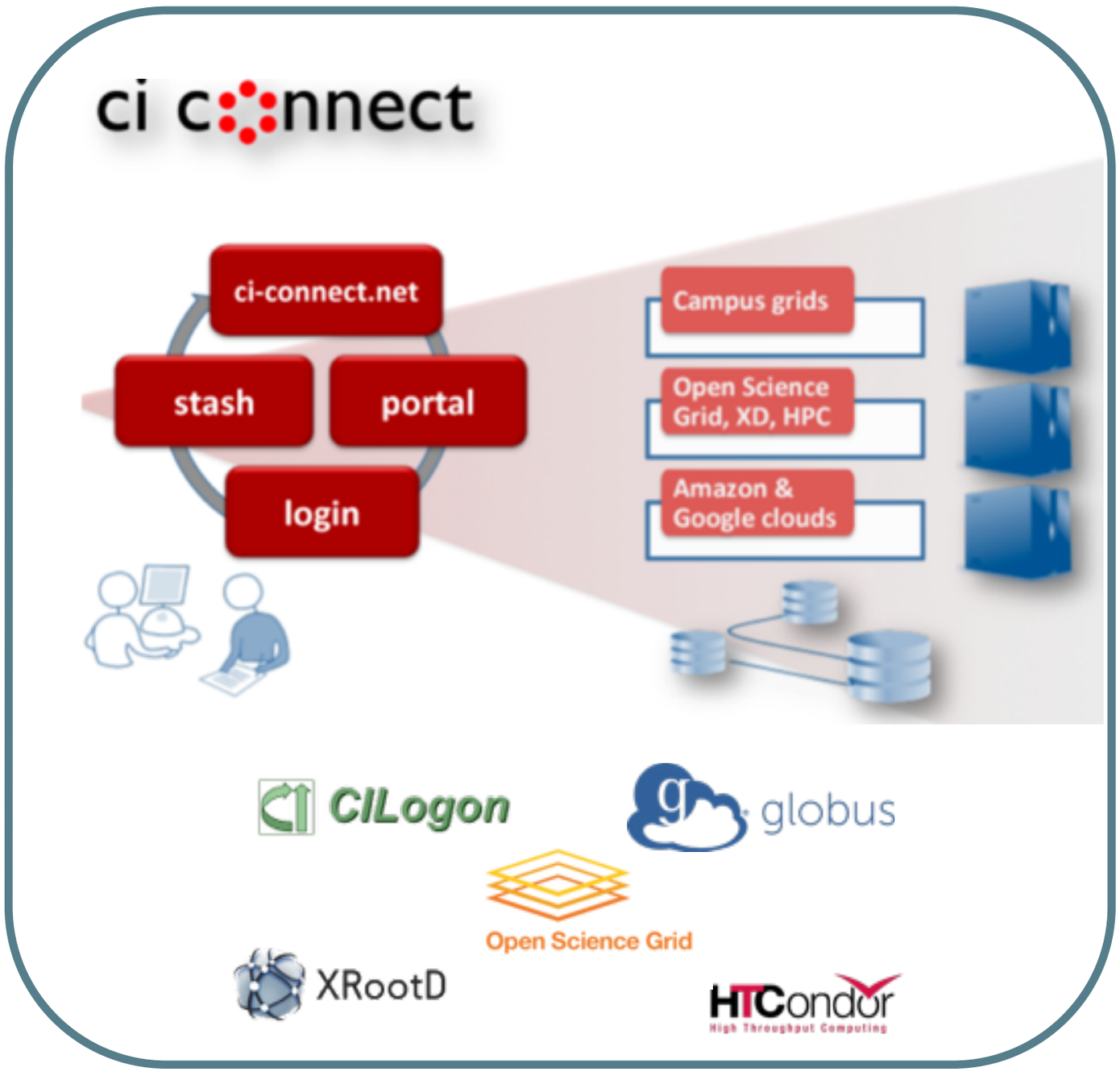
CI Connect

- Based on CI Connect Platform
  - Developed by OSG Area Coordinator of Campus Infrastructures Rob Gardner from U. Chicago.
- Computing services focused on batch-like analysis processing
- Minimal development
  - Use well supported technologies: HTCondor, Globus Online, XRootD, etc.

http://stash.osgconnect.net/@staff/ci-connect-brief.pdf

Technology behind CMS-Connect

- Based on CI Connect Platform

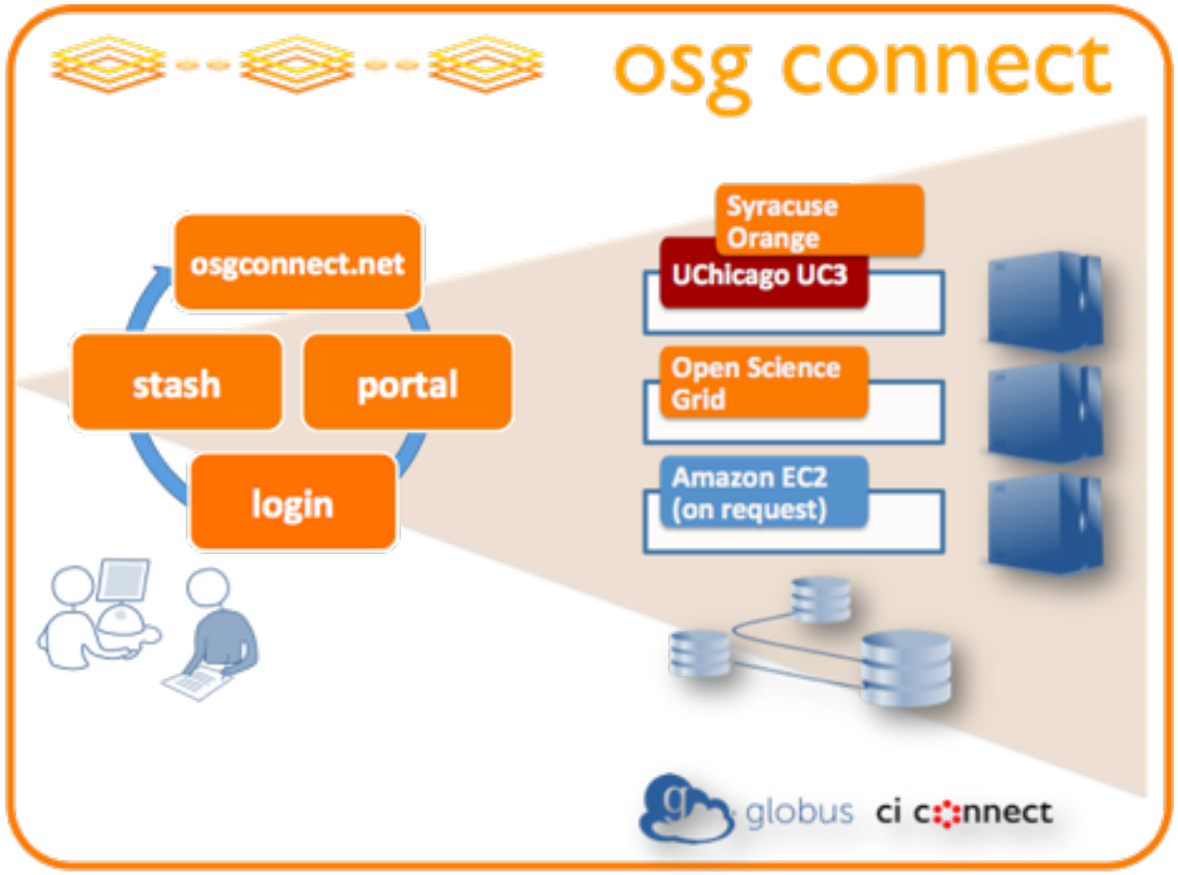


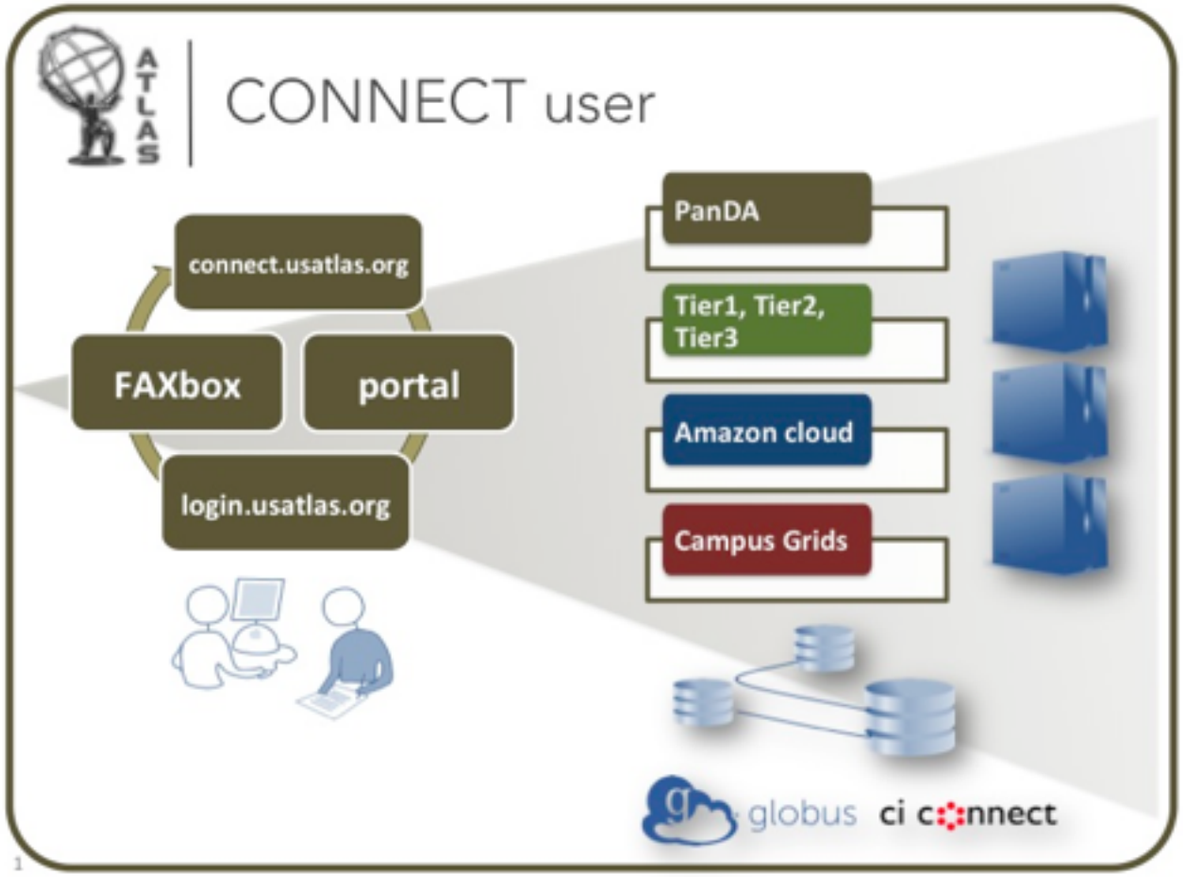
- Globus Platform [CILogon + InCommon + X509]
  - Identity Management.
  - Groups, Projects.
- Login Host
  - Auto provisioning of user accounts.
- Connecting CPU resources
  - HTCondor.
- Distributed Data Access
  - XRootD, Globus access, http.
- Distributed Software
  - cvmfs

https://goo.gl/J7VQtJ

Background

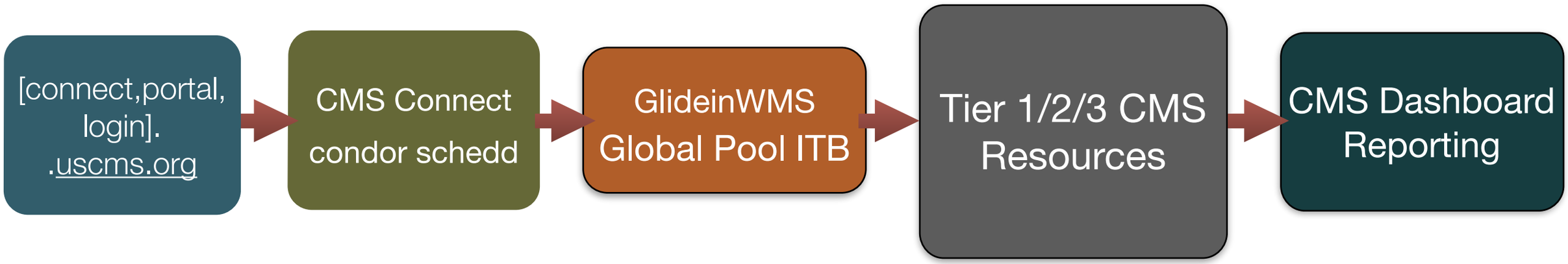
- OSG Connect: The Open Science Grid Connect service.
- ATLAS Connect user: Analysis service for the US ATLAS collaboration.
  - Similar to OSG Connect.
- CMS Connect is a clone of these.





https://goo.gl/64QftF

Overview



- **Features:**
  - User interacts using regular HTCondor commands
    - *It actually uses a wrapper around regular HTCondor to customize.*
  - Jobs are reported to standard CMS monitoring services.

Service Details: Signing up

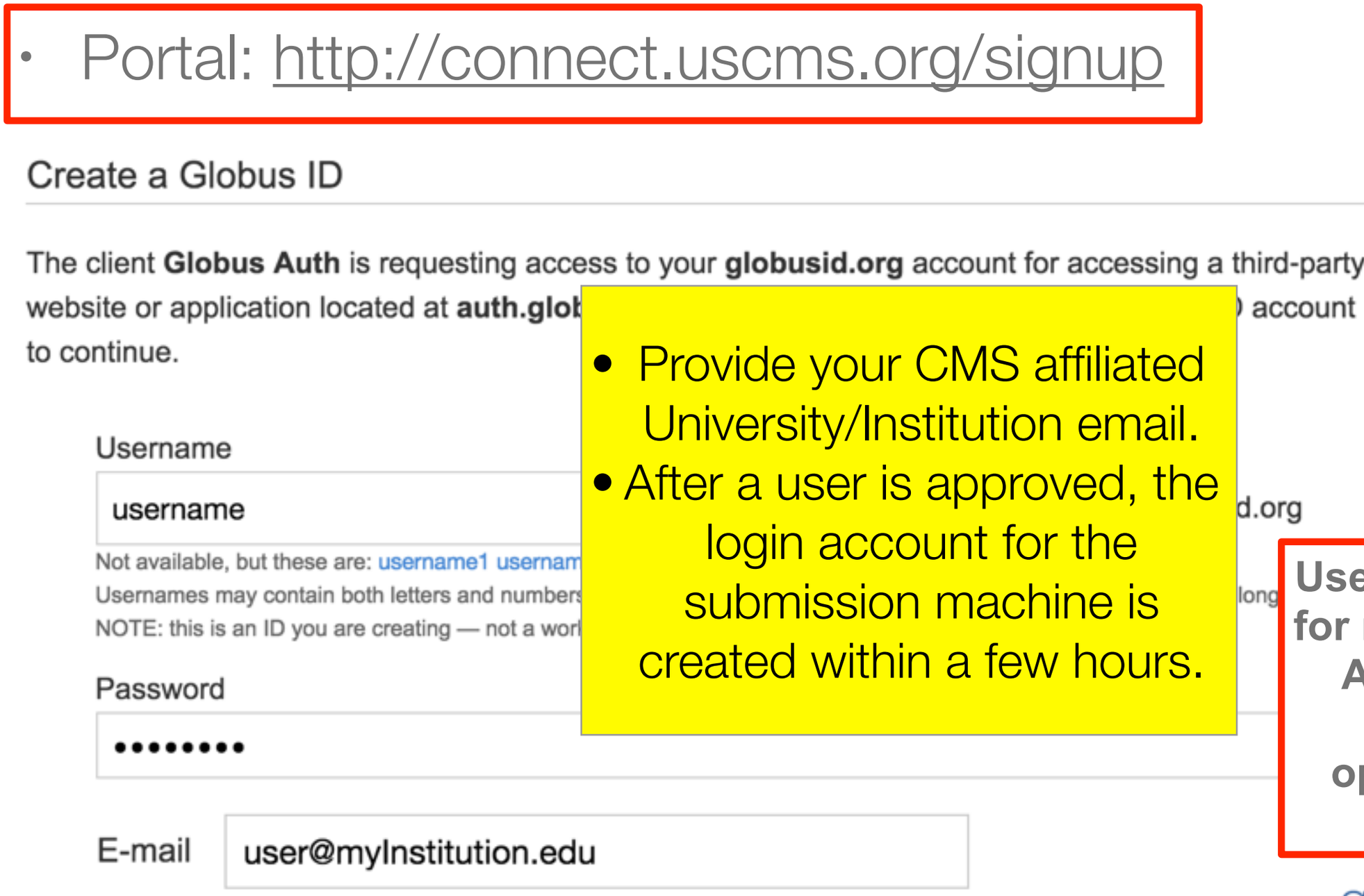
- Portal: http://connect.uscms.org/signup

Uses Globus ID for registration: An identity provider operated by Globus

globus ID

Service Details: Signing up

- Portal: http://connect.uscms.org/signup

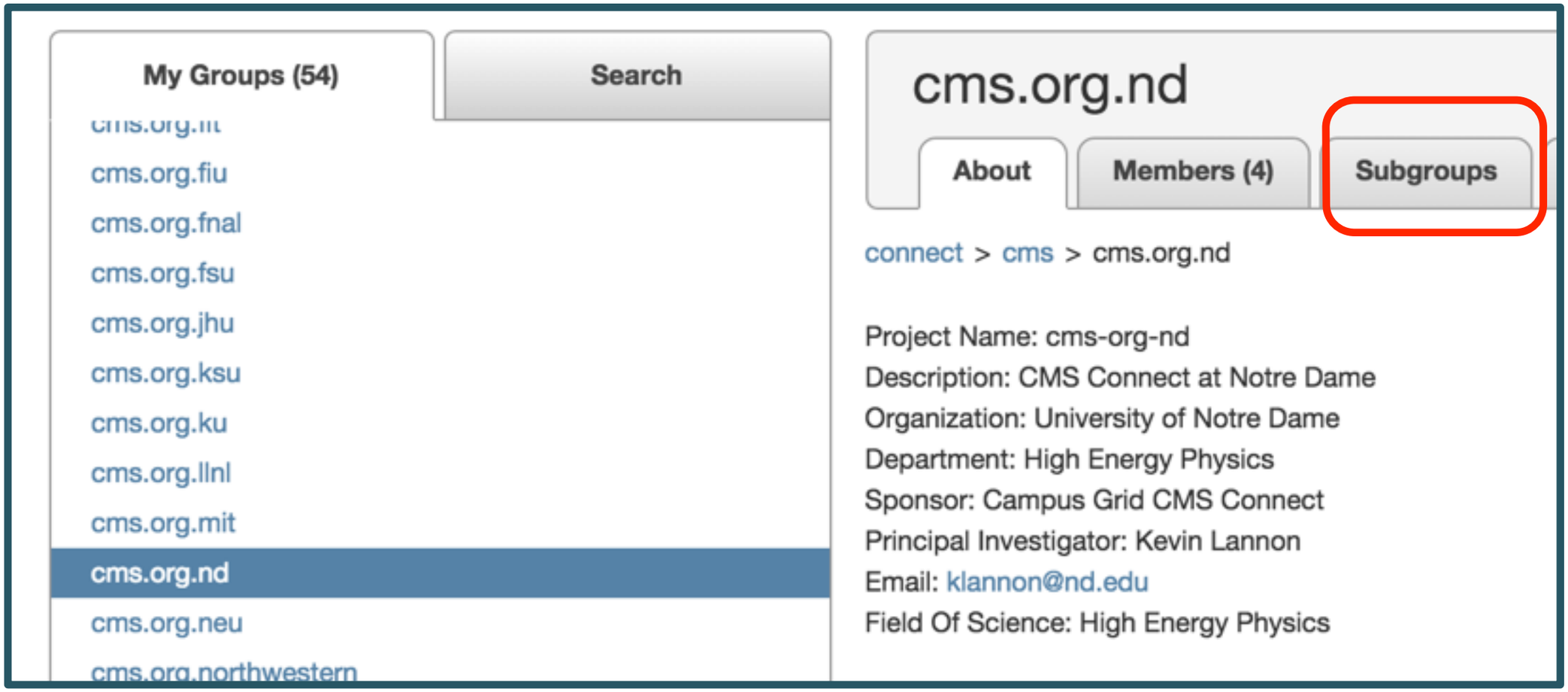


- Provide your CMS affiliated University/Institution email.
- After a user is approved, the login account for the submission machine is created within a few hours.

Uses Globus ID for registration: An identity provider operated by Globus

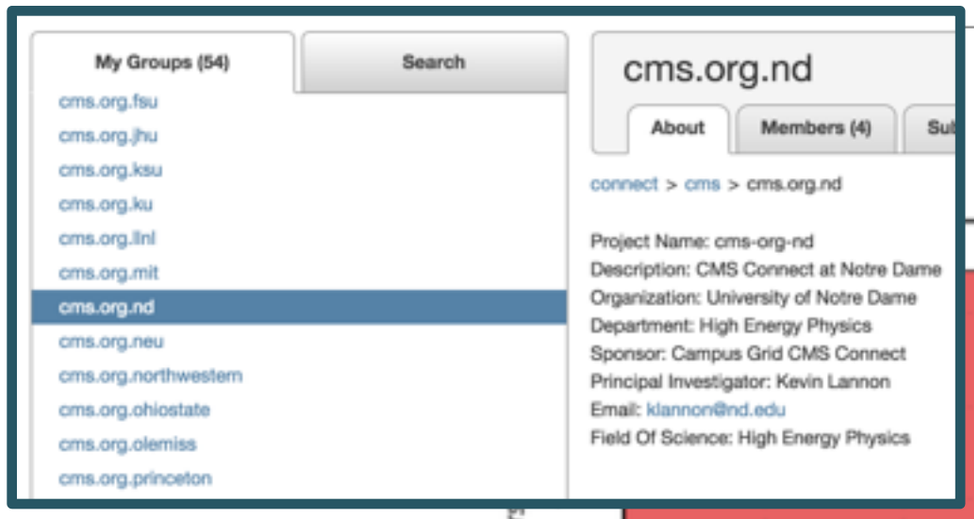
globus ID

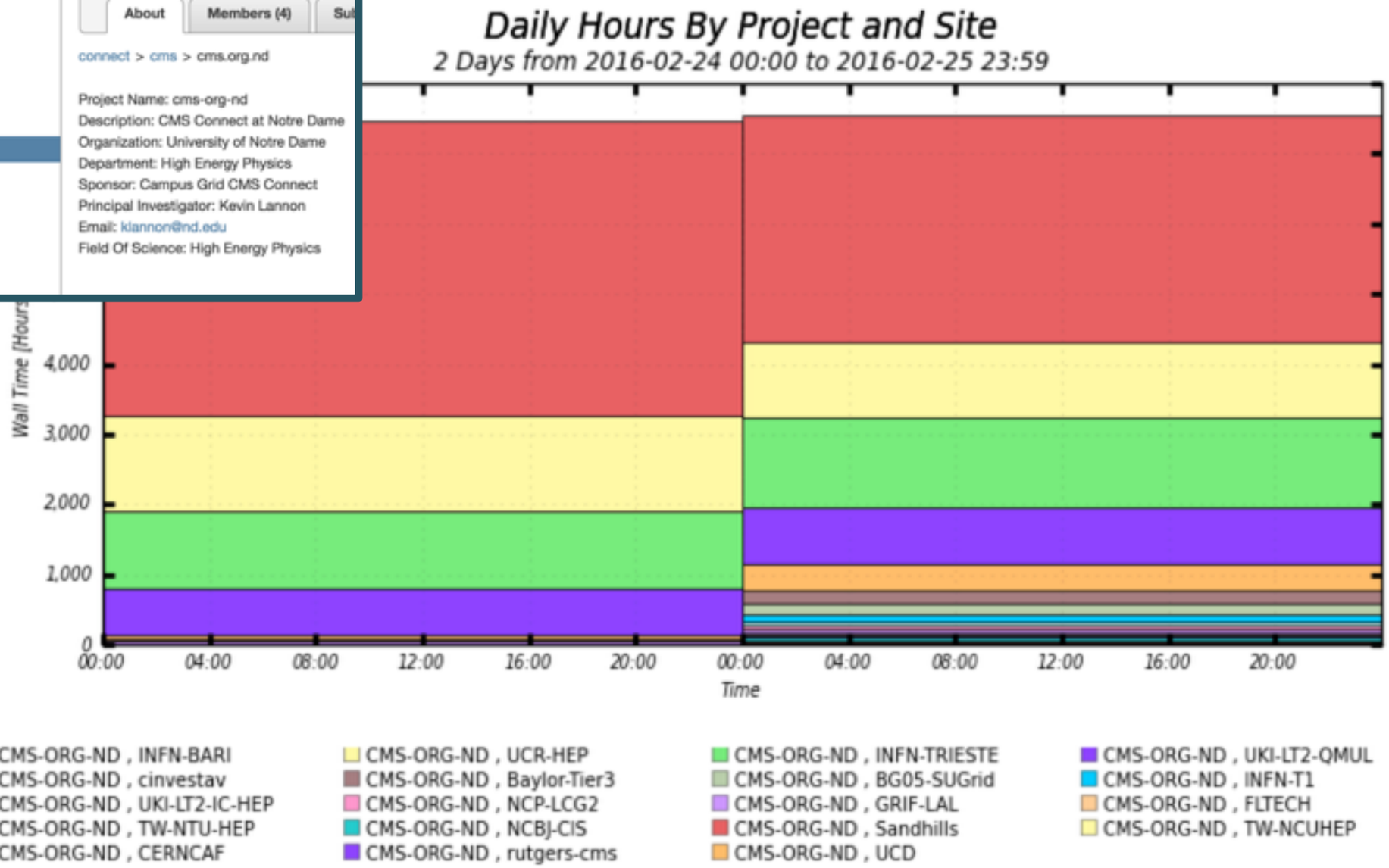
Service Details: Groups



- Institution groups can create their own e.g analysis groups for organization.
- You can see each group activity and resources reached, etc.

Service Details: Groups

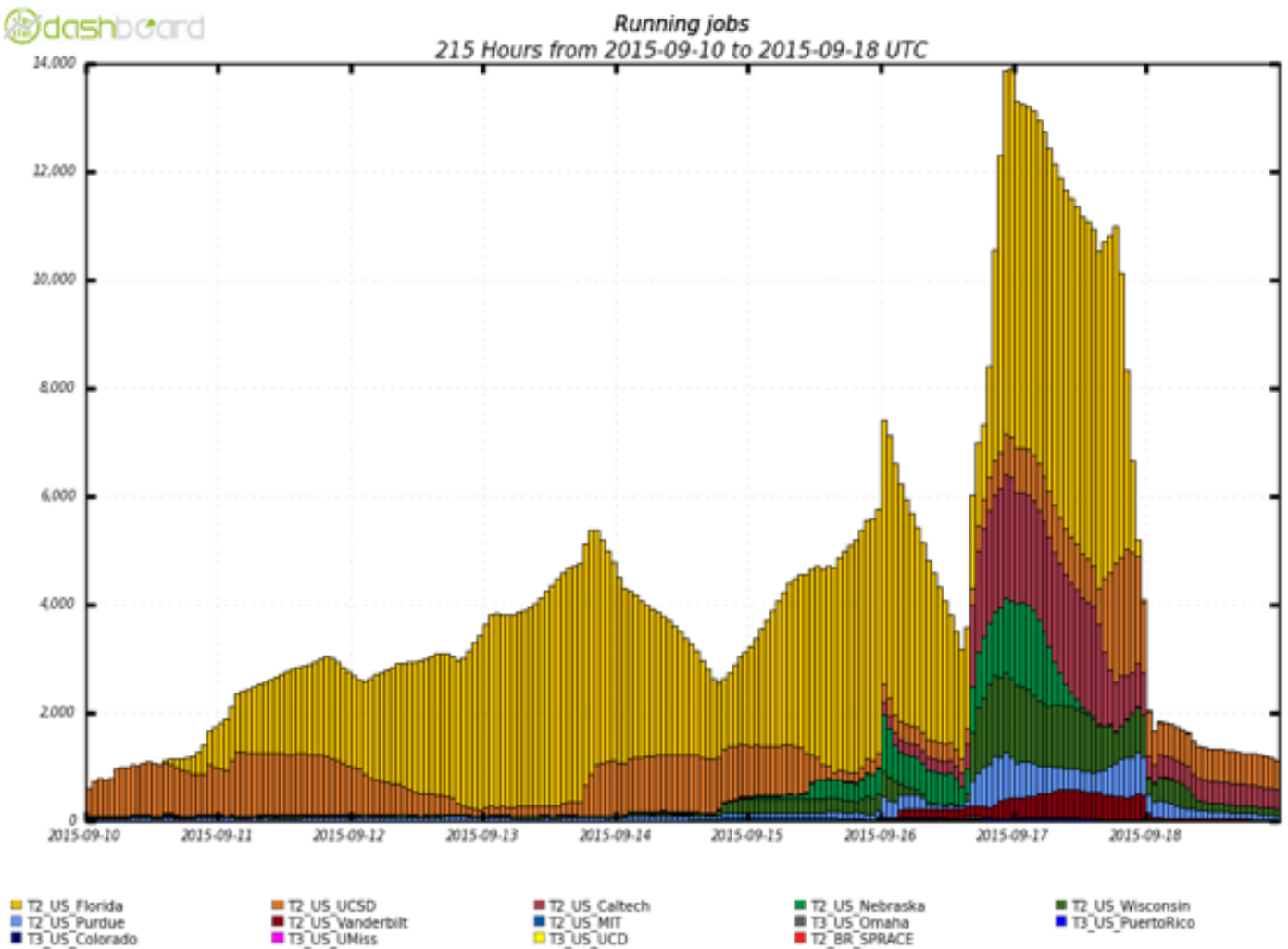


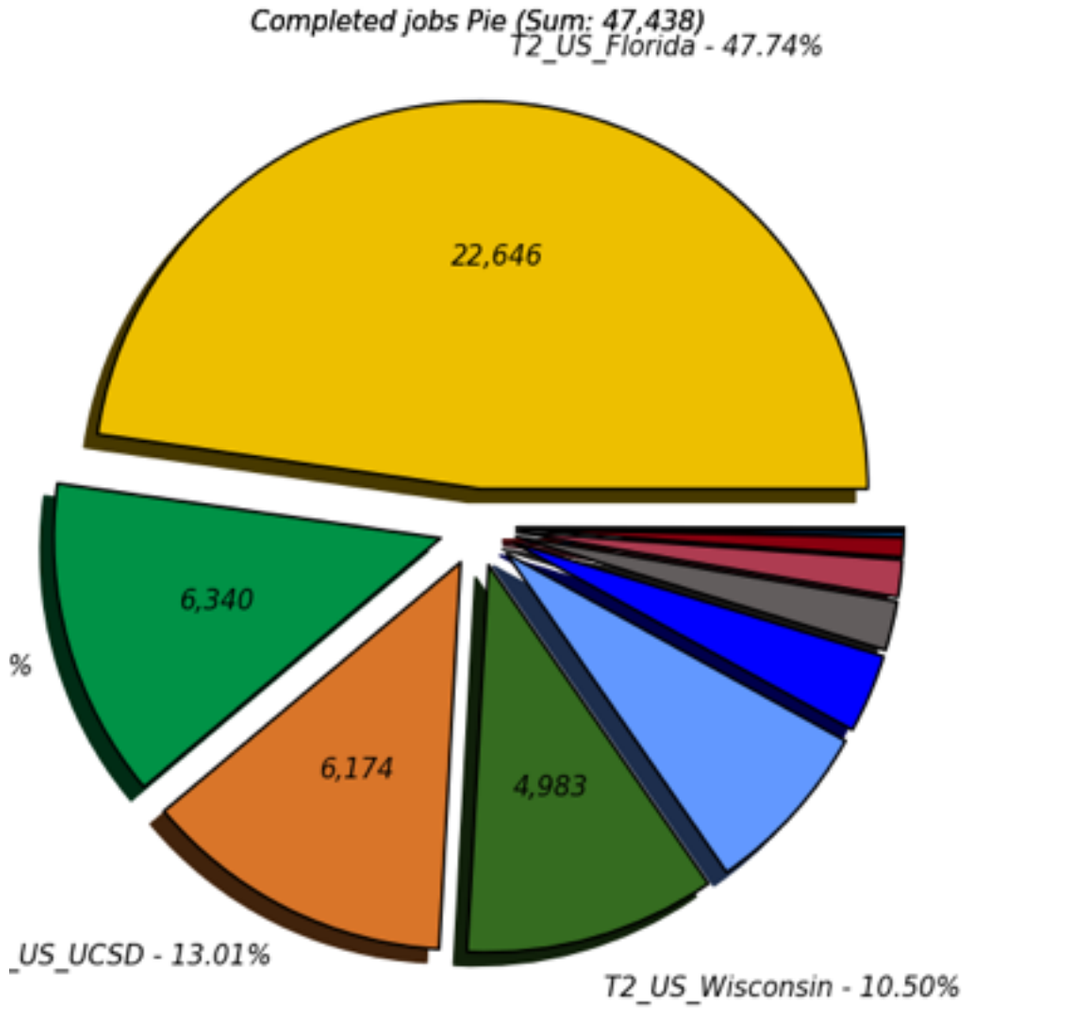


This is an example of CMS-ORG-ND using 19 different Site resources

CMS Dashboard Reporting

T2 US Sites historical view example





Integrated CMS Dashboard monitoring with condor job submission

A Submit Service

- It is “just Condor”.
  - Usual ClassAds and HTCondor submit scripts.
  - **Users are responsible in terms of workflow tools.**
  - Actually uses wrappers around HTCondor to customize.

A Virtual CMS analysis Cluster

- Users should not expect to run jobs with data or software stored in their home directories.
- Instead, use CVMFS, XRootD, HTCondor transfer mechanisms, etc to ensure the worker nodes can read them.

Summary and Future Plans

- At present:
  - CMS Connect provides users with a uniform virtual cluster for CMS analysis with access to global CMS resources.
  - The service is open for testing.
  - **Accepting alpha tester volunteers**

If you are interested in becoming an alpha tester, contact me: khurtado@nd.edu

Summary and Future Plans

- Future Plans:
  - Add resource targets
    - Institution CMS analysis clusters: T3 sites
      - Currently, we only have the ability to make resources available to anyone on CMS.
      - A mechanism to add a T3 with priority (or exclusive) access to their own users is under development. See this Twiki.
    - OSG Opportunistic resources
      - This is technically straightforward.
    - Campus off-grid resources.

If you are interested in connecting your T3 or off-grid campus resources to CMS Connect, please contact me too:
khurtado@nd.edu

Acknowledgements

- UChicago OSG Team:
  - Rob Gardner
  - Lincoln Bryant
  - Suchandra Thapa
  - Balamurugan Desinghu
  - David Champion

connect

CILogon

globus

Thank you

Open Science Grid

XRootD

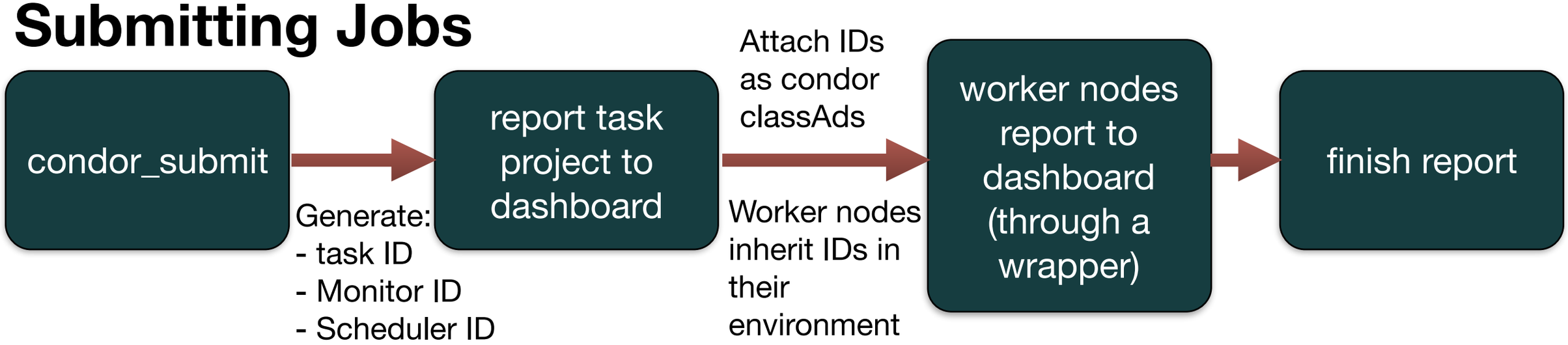
HTCondor
High Throughput Computing

Backup Slides

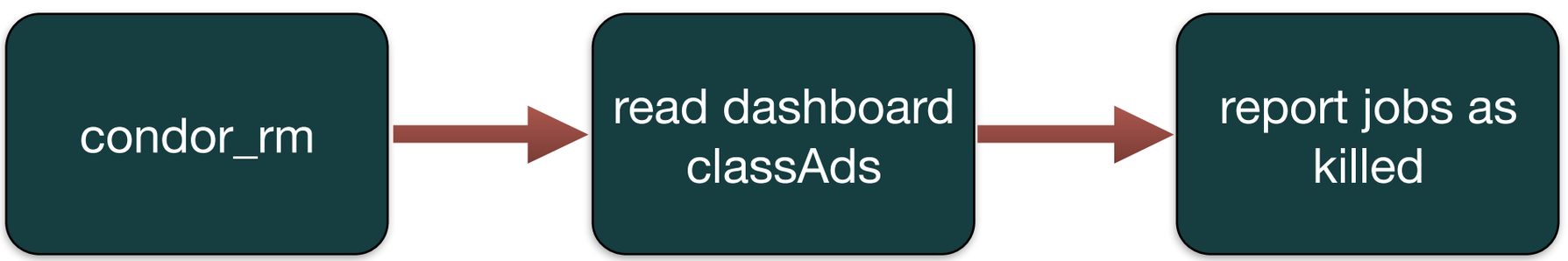
CMS Dashboard Reporting

- Current reporting model:

Submitting Jobs



Deleting Jobs



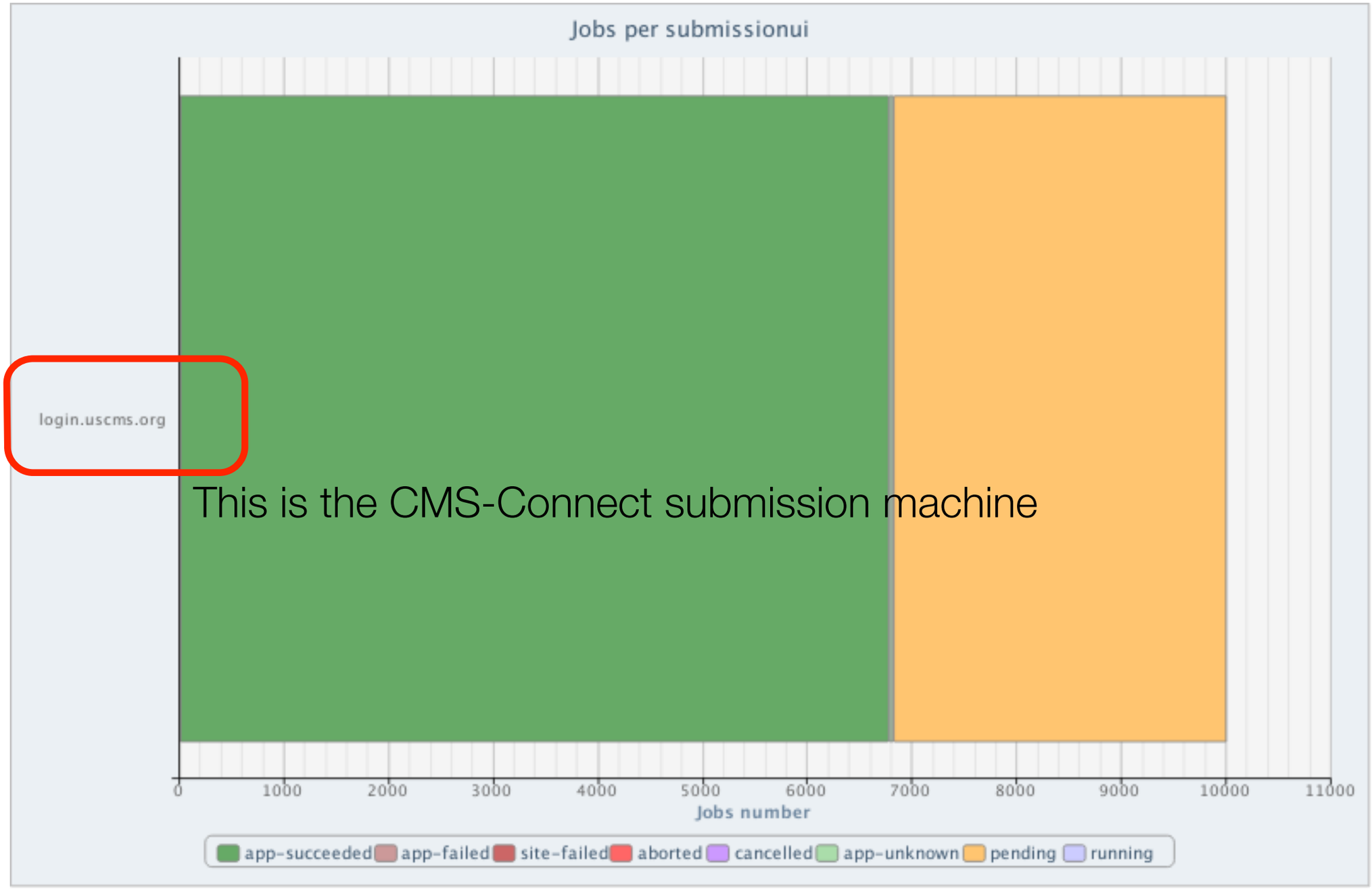
CMS Dashboard Reporting

- CRAB implements CMS dashboard reporting
- As mentioned before, CMS-Connect is oriented for non-CRAB job workflows though...
- But it is important to measure Site Activity coming from CMS-Connect to standard CMS monitoring services.

CMS Dashboard Reporting

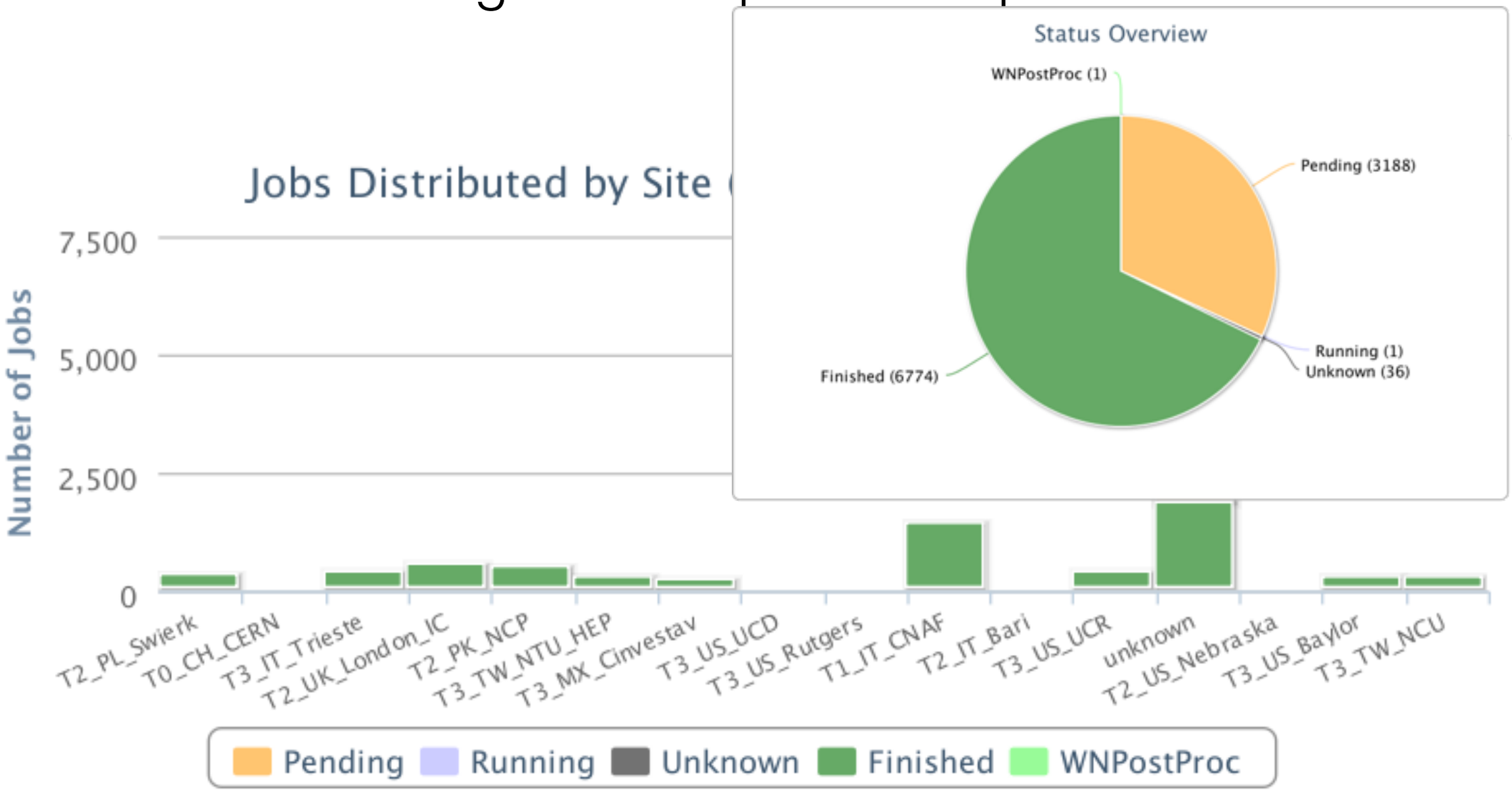
- **What can be reported?**
  - As opposed to regular CRAB workflows, users are responsible in terms of workflow tools, stage-out, error codes, etc.
  - To get the "full dashboard experience”, the user can include extra bits in their scripts to inform e.g the number of events in the job, storage element name, stage-out time and exit code, etc.
    - However, even **if the user doesn’t do anything, the basic level of details is still handled by the CMS-Connect wrappers**. E.g.- Application times and exit code, hostname, computing element name, etc.

CMS Dashboard Reporting



CMS Dashboard Reporting

Single task report example



CMS Dashboard Reporting

- Condor jobs are submitted with “cmsconnect" as the name of the submission tool.

- **Supporting other submission tools in CMS-Connect**

  - In principle, other submission tools could be used for the user’s convenience too (e.g. grid-control, farmout, lobster, etc).

  - The integrated dashboard would be disabled via the environment variable CONDOR_CMS_DASHBOARD=“False"

  - Such tools would report with their own tool names. A dashboard API would be created in order to see all jobs from all submission tools submitted from CMS-Connect in that case.

Service Details: Stash

- Stash: The OSG Connect storage service
  - Temporary data storage solution.
    - To assist with pre-stage job input data files, write output files for later use, etc
  - Currently no user quota. When space becomes tight, files are removed on a simple least-recently-used basis.

ci connect

Support ▾ Resources ▾ Connect ▾ Transfer ▾ khurtado ▾

Search:

Type ▲	Name	Kind	Changed	Size
	chart_pie_1730159.html	text/html	Sat, 03 Jan 2015 11:00	1956
	data_app.tar.gz	application/x-tar	Mon, 05 Jan 2015 13:13	250
	oasis_app.tar.gz	application/x-tar	Mon, 05 Jan 2015 14:51	511
	parrot.tar.gz	application/x-tar	Fri, 06 Mar 2015 18:46	4792.87 k
	pset_tutorial_MC_generation.py	text/x-python	Fri, 06 Mar 2015 18:44	5713
	pset_tutorial_analysis.py	text/x-python	Fri, 23 Jan 2015 17:08	756
	siteconfig.tar.gz	application/x-tar	Fri, 06 Mar 2015 18:49	887

Showing 1 to 7 of 7 entries

generated in 0.994s

Not like CRAB

- "Just condor" also means e.g stage in/out fallback methods depend on the user.

  - **Example:**
    Copied files via gfal-copy/srm to T2 Nebraska.
    Submitted jobs to read files locally at T2_US_Nebraska.

    T2_US_Nebraska has different gatekeepers:
    -tusker-gw1.unl.edu:9619: Nodes with store local files inside /panfs/panasas (recognized as T3_US_Omaha by dashboard)

    -red*.unl.edu:9619: Nodes with store local files in /mnt/hadoop

Not like CRAB

- **Example:**
  Copied files via gfal-copy/srm to T2 Nebraska.
  Submitted jobs to read files locally at T2_US_Nebraska.
  T2_US_Nebraska has different gatekeepers:
  -tusker-gw1.unl.edu:9619: Nodes with store local files inside /panfs/panasas (recognized as T3_US_Omaha by dashboard)
  -red*.unl.edu:9619: Nodes with store local files in /mnt/hadoop

  - Using hardcoded file paths to /mnt/hadoop will fail on tusker* worker nodes (in this case, could be avoided using DESIRED_Gatekeepers)

Jobs sent with DESIRED_Sites="T2_US_Nebraska"

Id in Task	Appl Status	Appl Exit Code	Grid End Status	Retries	Site
1	Appl Succeeded	0	Done	1	T2_US_Nebraska
2	Appl Succeeded	0	Done	1	T2_US_Nebraska
3	Appl Succeeded	0	Done	1	T2_US_Nebraska
4	Failed	200	Done	1	T3_US_Omaha
5	Failed	200	Done	1	T3_US_Omaha