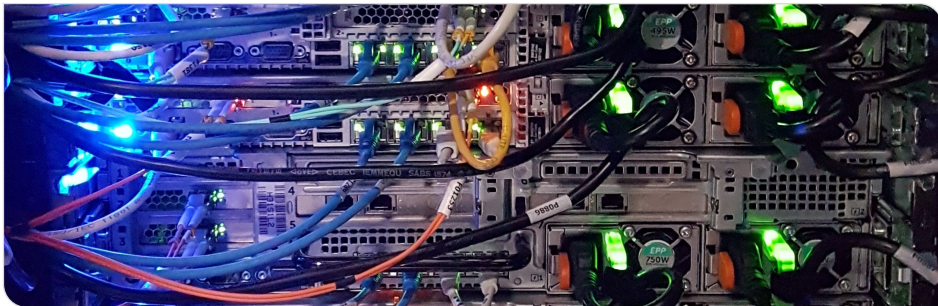


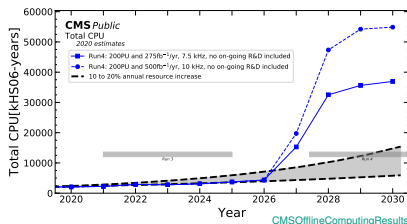
Opportunistic transparent extension of a WLCG Tier 2 center using HPC resources

R. F. von Cube, G. Quast, R. Caspart, M. Fischer, M. Giffels, E. Kuehn, M. J. Schnepf,
and our Aachen colleagues | vCHEP2021



The HEP Computing Challenge

- Clear challenge: Expect exploding demand for computing infrastructure
- Proposed solutions
 - Software improvements
 - **Integration of additional non-HEP resources**

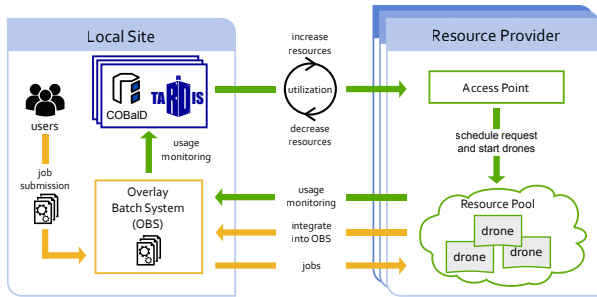


Access to multiple, heterogeneous resources

Difficult for experiments and users:

- Multiple identities, “submission types”
- Assessment which resource is available and suitable
- Experiments can’t negotiate with each resource provider

COBALD/TARDIS Resource Manager



Dynamic integration through single point of entry

- Provide resources transparent to experiments and users
- React on resource demand

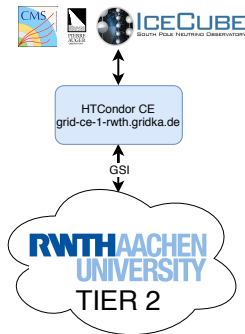
Lightweight Tier 2 Operations

- Compute elements (CEs) are entry points for users and experiments to grid sites
- Necessary to be operated for each site
- Major grid sites operate multiple CEs
- Deployment automated e.g. with puppet modules

Operate CE as a service for other sites

- Overhead is minimal to run additional CE
 - Only minor changes in “standard” HTCONDOR-CE configuration
- “Remote CE” implemented for the Aachen Tier 2 site

⇒ Aachen doesn't need to operate CE anymore



First Integration in a German CMS Tier 2 WLCG Site

- Aachen physics department operates standard WLCG tier 2 site
 - ~ 5100 cores pledged to CMS plus storage and grid services
- Aachen researchers have access to university HPC cluster CLAIX
- Resources integrated into WLCG tier 2 site
 - Bash script submitted to CLAIX' SLURM workload manager sets up and starts HTCONDOR in unprivileged user account
 - Jobs are started in SINGULARITY containers, providing WLCG environment
 - Usage completely transparent to experiments and users
- CLAIX dynamically made available through COBALD/TARDIS

Integration of CLAIX: Challenges and Solutions

Networking

- HTCONDOR daemons communicate using the “Condor Connection Broker”

Singularity

- Support for nested SINGULARITY containers for GlideInWMS-pilots
 - Activation of user namespaces, usage of sandbox-image
- Singularity bind mounts unset in container

CVMFS

- Config CMS_LOCAL_SITE is dangling symbolic link on host
- Local SITECONF is provided through bind mount within container

Integration of CLAIX: Challenges and Solutions

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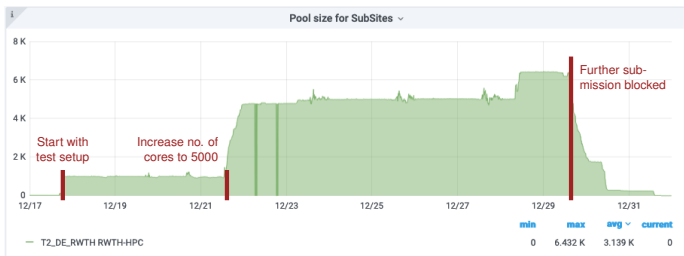
- Support for nested SINGULARITY containers for GlideinWMS-pilots
- Singularity bind mounts unset in container

To overcome some challenges, close communication
with CLAIX was essential, however, very productive!

CVMFS

- Config CMS_LOCAL_SITE is dangling symbolic link on host
- Local SITECONF is provided through bind mount within container

Aachen: Scaling up



- Smooth start of test setup after close communication with CLAIX and Aachen grid team
- Virtually doubled number of cores, available to experiment, for a week
- Submission blocked by HPC center after using ~ 7 times monthly quota

Summary

- COBALD/TARDIS allows for transparent usage of opportunistic resources
- Resources are integrated dynamically into one overlay batch system
- Aachen tier 2 CMS pledge was doubled for a week

Join us on on

- GitHub: github.com/MatterMiners
- Gitter: gitter.im/MatterMiners/community
- Twitter: twitter.com/matterminers



Many thanks to our Aachen colleagues for working with us on this!

Backup

Backup



Ressource Assessment with TARDIS and COBALD

TARDIS

Dynamically provisions and integrates resources into overlay batch system.

COBALD

Assesses the suitability of resources to the current job mix with metrics *allocation* and *utilization*.

