

ERUM DATA IDT CLOUD MEETING NOV, 2020

INTRODUCTION

Manuel Giffels

GOALS OF THE MEETING

Discuss how to ...

- ▶ ... roll-out the Area A developments to further sites contributing to Area B
- ▶ ... proceed in last year of ErUM Data IDT-UM
- ▶ ... further strengthen our collaboration

TOPICS OF AREA A

Development of technologies to enable utilization of heterogeneous computing resources

Relevant for this meeting!

AP 1) Werkzeuge zur Einbindung

- Scheduling von Cloud - Jobs
- Container - Technologien
- Checkpointing
- Zugang zu Experiment-Datenbanken

AP 2) Effiziente Nutzung

- Steigerung der Effizienz von datenintensiven Anwendungen auf heterogenen Ressourcen mittels „on the fly“ Datencaches

AP 3) Workflow Steuerung

- Identifikation und Steuerung
- In - Pilot Job Monitoring
- Accounting
- Optimierung durch data - mining

TOPICS OF AREA B

Application and tests of software components in a heterogeneous environment

Relevant for this meeting!

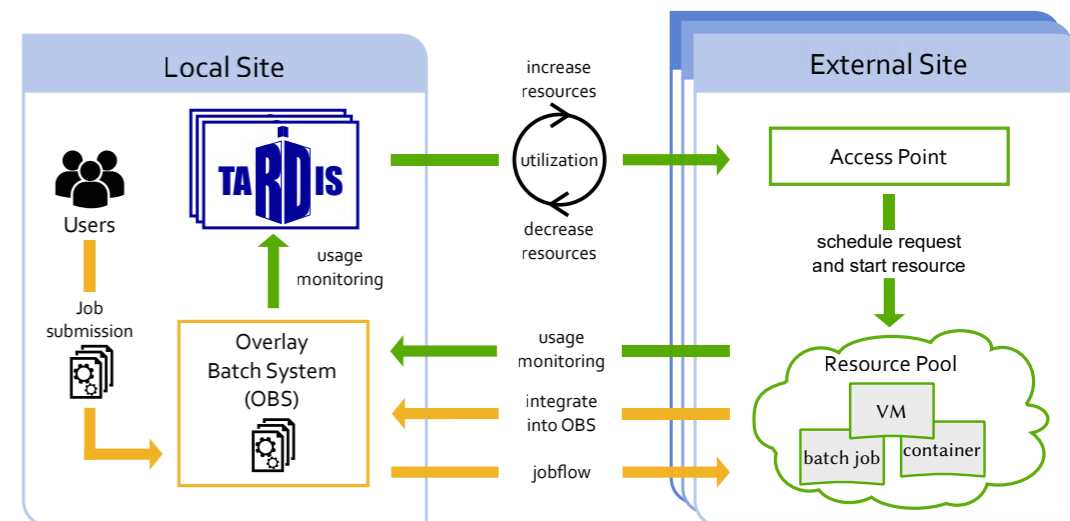
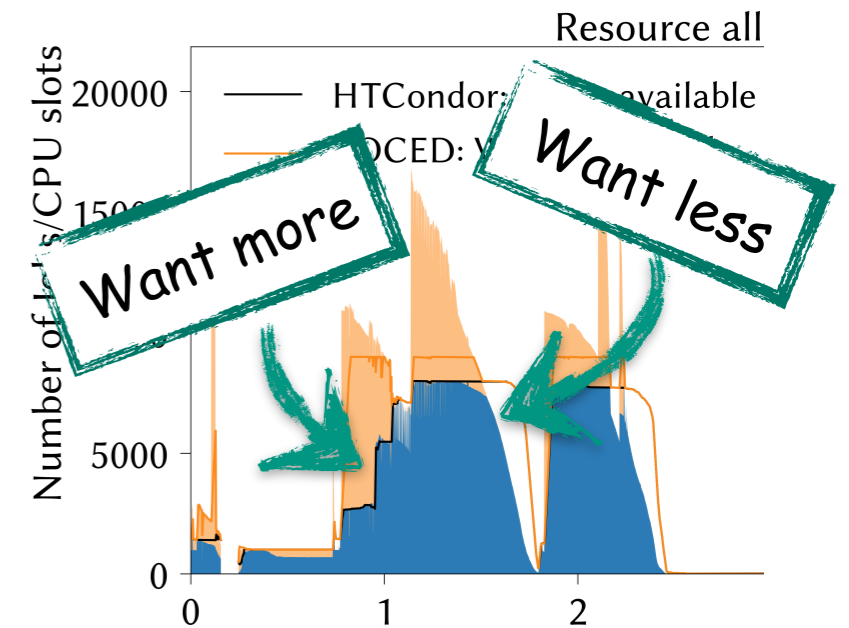
<p>1) Tests der Technologiekomponenten</p> <p>Implementierung und Tests auf verschiedenen Plattformen von</p> <ul style="list-style-type: none">• Speicher- und Cachinglösungen und• virtualisierter Dienste (Datenbanken, Monitoring, Accounting).	<p>2) Job- und Ressourcenmanagement</p> <p>Jobverteilung und Überwachung in der Umgebung heterogener Computingressourcen unter Einbeziehung von Containervirtualisierung.</p>
<p>3) Virtualisierung von Nutzerjobs</p> <ul style="list-style-type: none">• Erfassung der Anforderungen,• Bestimmung und Erzeugung der Laufzeitumgebung,• Erstellung des Containers und von Metadaten und• Checkpointing von Containervirtualisierung.	<p>4) Kombinierte Tests</p> <p>Testen von Gesamtsystemen (Speicher, Dienste, Ressourcenmanagement) auf verschiedenen Plattformen in Bezug auf</p> <ul style="list-style-type: none">• Installations- und Wartungsaufwand,• Performance,• Skalierbarkeit und• Robustheit.

ACHIEVEMENTS

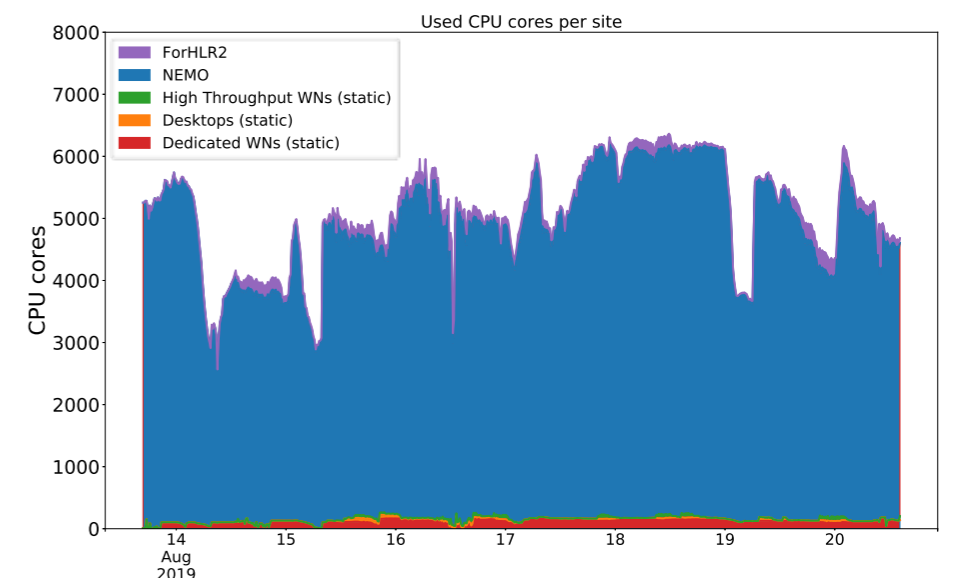
TAKEN FROM THE LAST COLLABORATION MEETINGS

DYNAMIC ON-DEMAND PROVISIONING

- ▶ COBaID/TARDIS resource manager developed at KIT
- ▶ Enables transparent and dynamic on-demand provisioning of opportunistic resources
- ▶ Enables backfilling of HPC/T3 resources
- ▶ Used at KIT-ETP, GridKa, Uni Bonn, LRZ and Uni Freiburg
- ▶ Production ready software at scale!

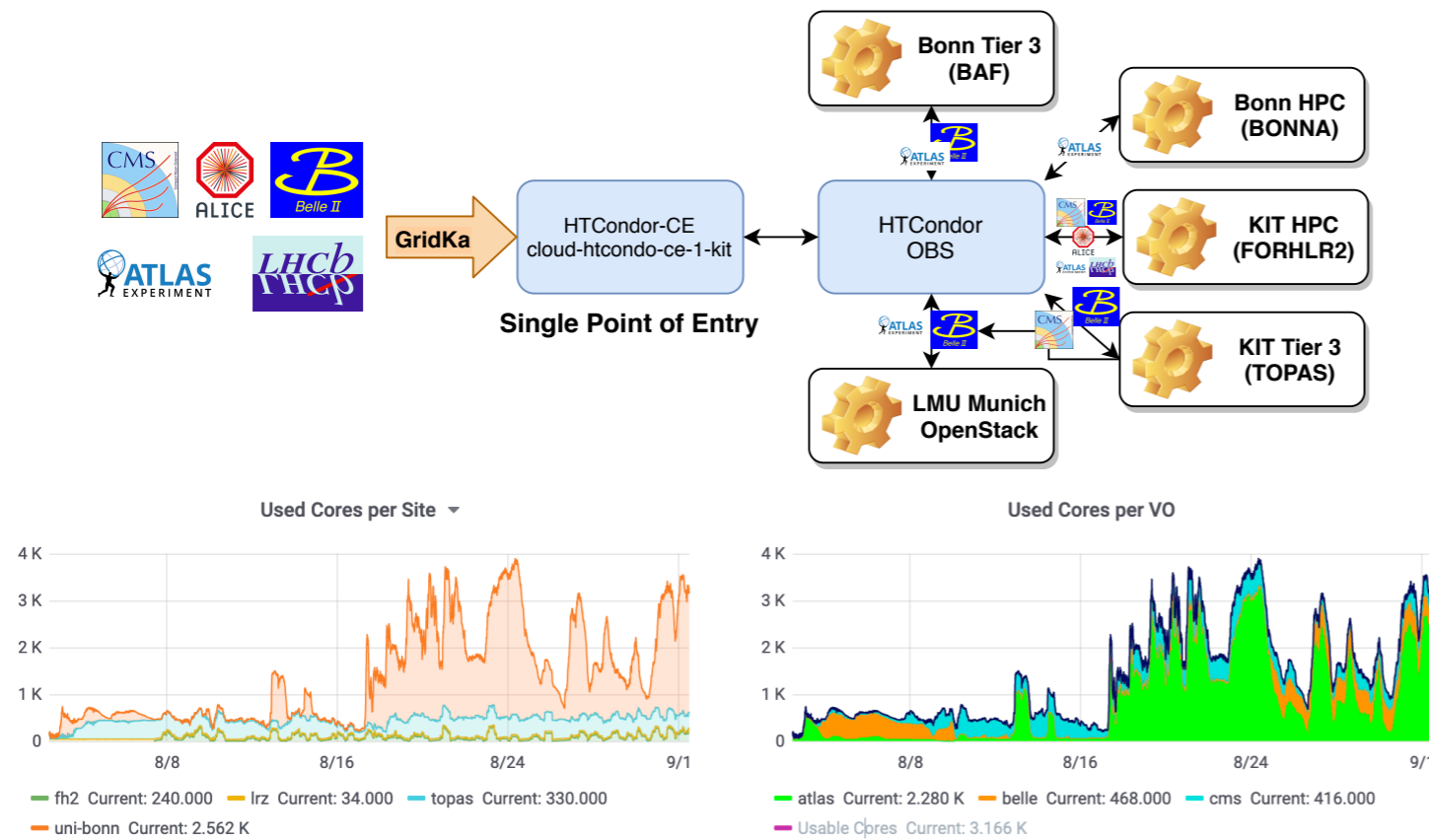


EXPERIMENT INDEPENDENT!

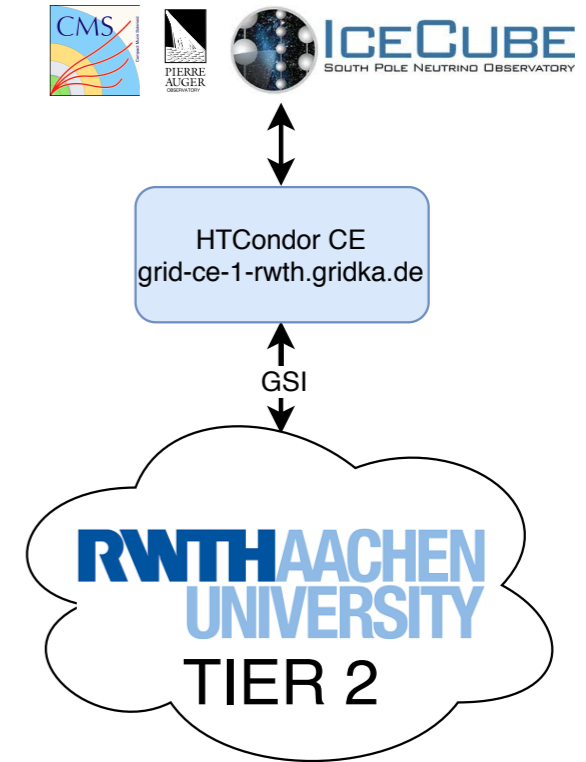


CLOUD ENABLING INFRASTRUCTURE

Dynamic and Transparent Integration of Opportunistic Resources



Lightweight Site Operations



- ▶ Built a **prototype** of a **federated infrastructure** (smooth operation since more than a year)
 - ▶ Dynamic, on demand **provisioning** and transparent integration of heterogeneous resources with COBaID/TARDIS
 - ▶ Single point of entry to plethora of resources
 - ▶ Opportunistic utilization of clouds, HPCs and T3s
- ▶ **Ready to add more parties from B2 (let us know)**

- ▶ Remote CEs at larger Grid sites allow for **lightweight T2/T3 operations**
- ▶ Reduces effort to contribute compute power
- ▶ **Proof-of-concept: RWTH-CE@GridKa**
- ▶ In **stable operation** since this summer



SUMMARY

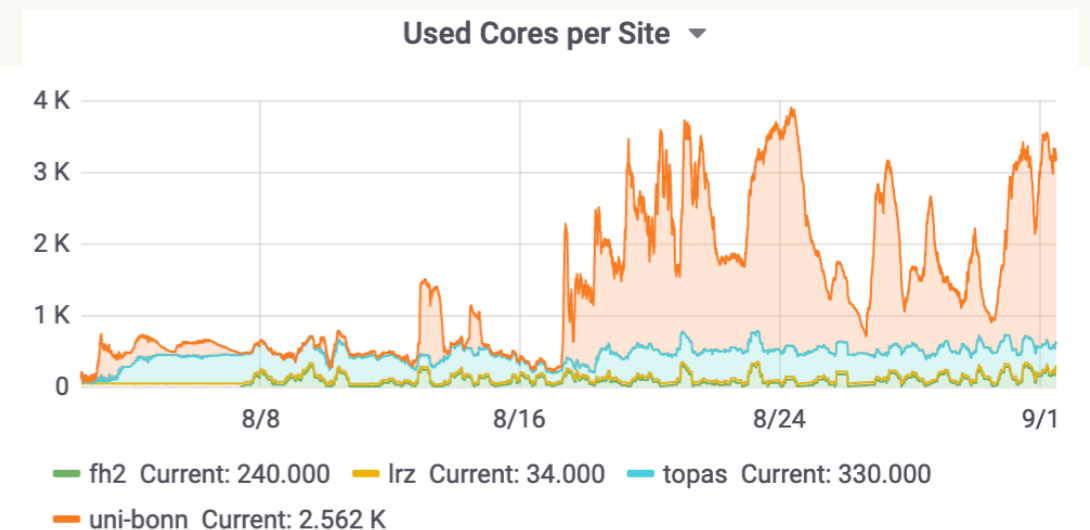
- COBalD/TARDIS successfully deployed a U Bonn, management fully puppetized
- Service feeds *two* clusters
 - local submission to physics cluster (BAF)
 - remote submission to university-wide HPC cluster
- Routinely run ATLAS production jobs
- Routinely run ~~Recently started to accept~~ Belle jobs

puppet-cobald

Puppet module for COBalD/TARDIS based opportunistic resource management

● Puppet Apache-2.0 2 2 1 1 Updated 4 days ago

<https://github.com/unibonn/puppet-cobald>



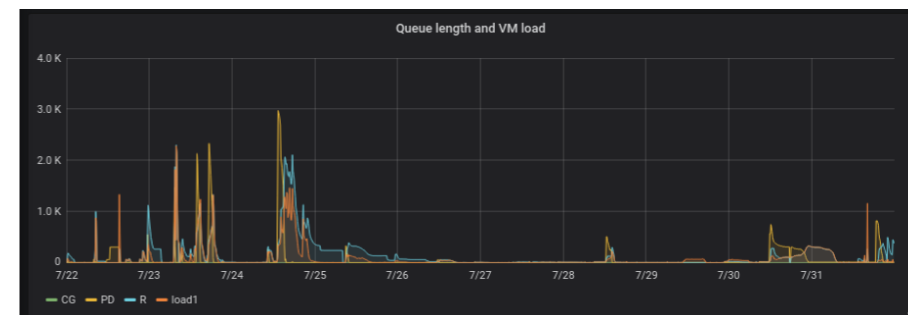
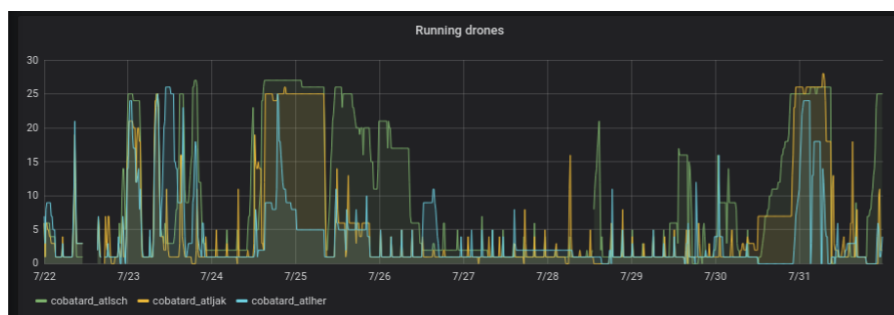
Largest opportunistic resource provider so far
(Up to 3.3 K cores)

Status report Freiburg

Opportunistic Resources - scheduling cloud-jobs

- ▶ COBaID/TARDIS batch system adapter for Slurm working and in production at Uni Freiburg
- ▶ Extended the monitoring capabilities of COBaID/TARDIS:
 - ▶ Prometheus Monitoring Plugin: Number of booting/running/deleted drones reported to Prometheus
 - ▶ Elasticsearch Monitoring Plugin: Every state change of a drone is pushed to Elasticsearch
 - ▶ Allows for continuous monitoring and retrospective analysis of performance and problems
- ▶ Next steps
 - ▶ Autonomous and continuous health monitoring and problem handling based on gathered data
 - ▶ Performance analysis of entire setup and parameter tuning

Thanks to Manuel Giffels, Max Fischer, Matthias Schnepf and Eileen Kuehn!



FRANKFURT/GSI

- Test for singularity container (accomplished)
 - Installation of singularity package
 - Slurm jobs running inside a singularity container at Goethe-HLR
- Combined Tests (in progress)
 - The sample Grid job analyzing data using DCOTF inside a singularity container at Goethe-HLR
 - Detailed results and documentation of the planned tests

Status and Activities in Wuppertal

- WP 1/3

- Stand-alone containers (network-less)

- Complexity of external dependencies (e.g. data bases with different APIs, CVMFS) make generalization difficult
 - Heavy activity within ATLAS production (simulation, reconstruction and more)

- Generalization to other experiments

- Need well defined software interfaces
 - Example: ATLAS/CMS plan for a common data base concept (CREST project)

- Containerized monitoring of user jobs is under development

CONTRIBUTIONS TO AREA A (CLOUD RELATED)

Aachen (friends):

- ▶ T2_DE_RWTH can be used for dynamic resource management tests [A1]



Bonn (associated partner):

- ▶ Dynamic resource management of T3 resources using (COBaID/TARDIS) [A1] ✓
- ▶ Site in a box concept [A1] (no funding, postponed to next proposal) ✗

Frankfurt/GSI:

- ▶ Singularity Containers to include HPC resources into Grid computing (e.g. ALICE T2@GSI) [A1] ✓

Freiburg:

- ▶ Dynamic resource management developments (COBaID/TARDIS) [A1] ✓
- ▶ Development of monitoring, accounting tools and benchmarks [A3]



Karlsruhe:

- ▶ Opportunistic resource manager COBaID/TARDIS ready to use [A1] ✓
- ▶ Workflow management in heterogenous environments [A1]



Wuppertal:

- ▶ Containerization of user jobs and services (VOMS, DB access, monitoring) focussing on lightweight solutions [A1, A3]



STATUS (CHRISTIAN'S TALK IN LAST COLLABORATION MEETING)

- Relation to TA A
 - Development of software component is by definition intertwined with testing
 - Activities in TA A contain a natural transition to some of the TA B work packages
- WP 1 – Test of Technology Components
 - Test of caching in production environment
 - Extensive tests of Xcache at LMU (storage at MPPMU)
 - tests of disk caching on the fly at F/GSI

Need large scale tests in production environment (e.g. at Tier-2/DESY/GSI)

◦ Virtualized services

- Some activities ongoing (monitoring, Data bases) at different institutes. Accounting?

Need combined tests by different experiments

- WP 2

◦ Larger scale application of COBaID/TARDIS (KIT)

- E.g. utilization in production environment in Aachen, Bonn and Freiburg hosted at KIT

Combine with components from other work packages. Need scalability tests

◦ Monitoring

- Extension of COBaID/TARDIS (FR)

STATUS (CHRISTIAN'S TALK IN LAST COLLABORATION MEETING)

- WP 3 – Virtualization of User Jobs

- Containerization of jobs

- Some independent activities
- In production: ATLAS stand-alone containers (simulation, reconstruction). Based on development in W (automatic extraction of DB and meta data into containers)

- Tests at F/GSI of containerized jobs with SLURM and test of analysis jobs

- Monitoring within containers is under development

Need combined projects (preferentially from different experiments) and tests

- WP 4 – Combined tests

- Current COBaID/TARDIS application are the first step towards combined tests

Need to plan larger combined tests

- Include more sites
- Include different site caching strategies
- Virtualization of different jobs (simulation, reconstruction, user jobs)

DISCUSSION