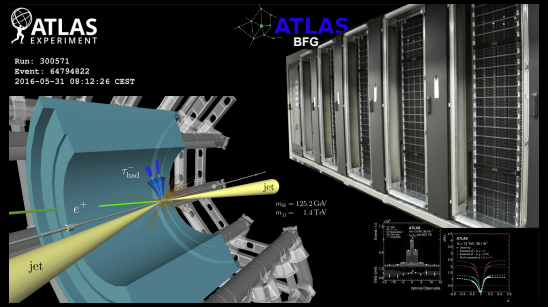
Annual Meeting of the BMBF-funded Research Compound - “Föderiertes Computing für die ATLAS- und CMS-Experimente am Large Hadron Collider in Run-3”

Weiterentwicklung und Optimierung des föderierten Computing für das ATLAS-Experiment am LHC



February 27th 2023

Michael Böhler

UNI FREIBURG

Tasks and Manpower

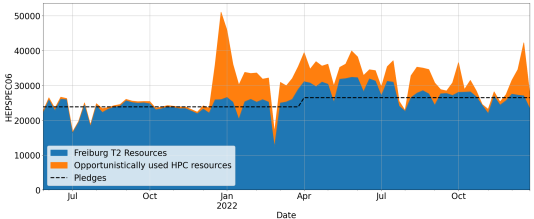
Planned contributions are broken down as follows:

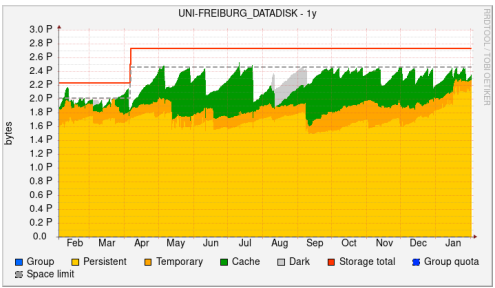
- **GridBasis:** Expansion and base operations of the ATLAS Tier-2 centre in Freiburg
- **GridCloud:** ATLAS specific tasks at the local Tier-2 center and in the *GridKa* cloud
- **HC Devel. :** Further development of the HammerCloud(HC) framework

	2021	2022		2023		2024
Arbeitspaket	2. HJ	1. HJ	2. HJ	1. HJ	2. HJ	1. HJ
GridBasis	0,0 (0,45)	0,0 (0,45)	0,0 (0,45)	0,0 (0,45)	0,0 (0,45)	0,0 (0,45)
Grid*Cloud*	0,7 (0,35)	0,7 (0,35)	0,7 (0,35)	0,7 (0,35)	0,7 (0,35)	0,7 (0,35)
*HamCloud*Ent.	0,3 (0,20)	0,3 (0,20)	0,3 (0,20)	0,3 (0,20)	0,3 (0,20)	0,3 (0,20)
Summe	1,0 (1,00)	1,0 (1,00)	1,0 (1,00)	1,0 (1,00)	1,0 (1,00)	1,0 (1,00)

- 1 FTE requested, 1 FTE in brackets employees funded by “Landesmittel”

Operation of ATLAS Tier2 Center at Freiburg





Compute:

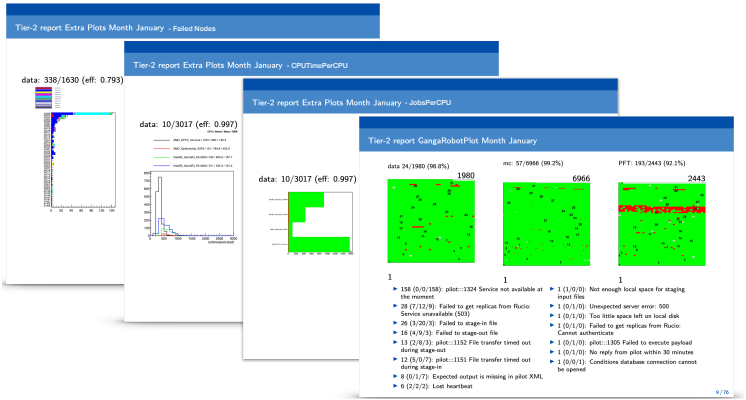
- Stable Operation of Tier2 in 2021/22
  - pledges fulfilled
- Puppet version upgrade: 3.8 → 6.14
- Scheduler upgrade: Slurm 17.11 → 21.08

Storage:

- New Hardware deployed
- Smooth operation
- dCache upgrade: 5.2 → 6.2.47

Space Token	Disk [TB]
UNI-FREIBURG_SCRATCHDISK	60
UNI-FREIBURG_DATADISK	2740
UNI-FREIBURG_LOCALGROUPDISK	650
Total	**3450**

ATLAS tasks around the Tier1 centre GridKa

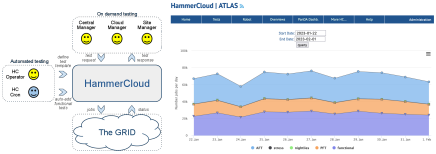


- Member of GridKa Squad (weekly/monthly meeting - presenting Tier-2 Report)
- Member of GridKa Technical Advisory Board - ATLAS Collaboration (2022-06 - today)

HammerCloud Infrastruction Migration and Containerization

HammerCloud(HC) in a Nutshell

- HC is testing and benchmarking framework used in ATLAS & CMS
- central service: submits thousands of test jobs per day to all WLCG grid sites

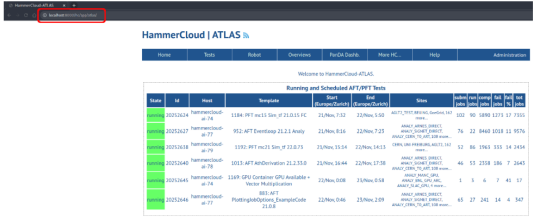


Python2 → Python 3 migration

- HC written in Django/Python
- both need to be upgraded:
  - Django: 1.7 → 4.1
  - Python 2.7 → 3.8

Containerization of HC infrastructure

- HC release deployment based on rpms
- code base is in CERN gitlab
- more agile code deployment and CI requires transformation to docker containers
- (web server) development much faster: → can be done via docker on any laptop



HC overview page running in local browser

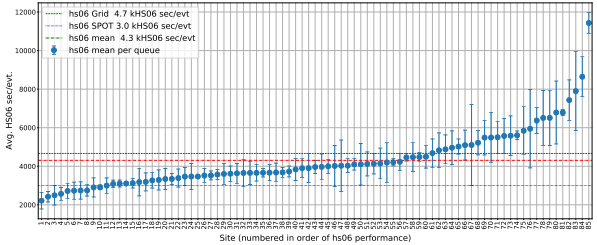
Will be presented @CHEP 2023: Bringing the ATLAS HammerCloud setup to the next level with containerization

Comparison HEPSPEC benchmark of ATLAS Grid-Sites vs ideal conditions

Objective

- Understand discrepancy of ideal conditions (SPOT) and performance on WLCG sites
  - SPOT measures (2020): **3 kHS06 sec/ event**
  - Average ATLAS jobs on WLCG (2020): **4.7 kHS06 sec / event**

Results



Method

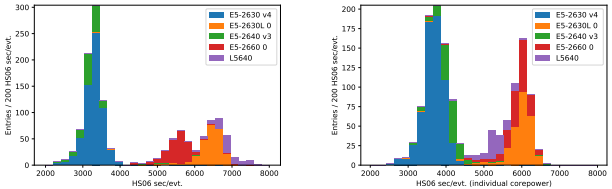
- Run **hundreds of identical** simulation **jobs** with HammerCloud (HC)

	Cut	Jobs	Sites	CPU types
0	total	102066	96	154
1	exclude TEST queues	98196	89	154
2	(nJobs per CPU & site) >= 25	96805	86	125
3	(total nJobs per site) >= 50	96757	85	125

$$\mathrm{hs06} = \frac{t_{walltime} \times n_{cores} \times corepower}{n_{events}}$$

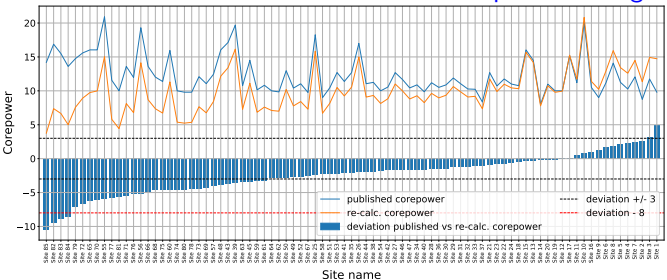
- Both SPOT and Grid values reproduced
- Major discrepancies: unpledged resources and jobs in bad state
- Heterogeneous hw and single/out-dated core-power values additional discrepancy

Different Hardware Generations do not scale linearly



- WLCG accounting based on one corepower value per queue
  → cannot correct for different CPUs
- individual corepower values shows double peak
  → do not correct hs06 properly

HammerCloud benchmarks can be used to spot misconfiguration



- Extract corepower value from HC jobs with fixed reference hs06 value (3kHS06)
- Calculated **optimal** corepower can be compared with **published** value (blue bars show deviation)

Presented @ACAT 2022: A comparison of HEPSPEC benchmark performance on ATLAS Grid-Sites versus ideal conditions

Conclusion

- Efficient and successful operation of ATLAS Tier2 centre in Freiburg
- Important contribution to ATLAS GridKa Cloud Operations
- Innovative developments to the HammerCloud Framework
  - "A comparison of HEPSPEC benchmark performance on ATLAS Grid-Sites versus ideal conditions" presented at the ACAT[1] conference
  - "Bringing the ATLAS HammerCloud setup to the next level with containerization" will be presented at the CHEP[2] conference

[1] 21st International Workshop on Advanced Computing and Analysis Techniques in Physics Research, 24-28th October, 2022, Bari, Italy

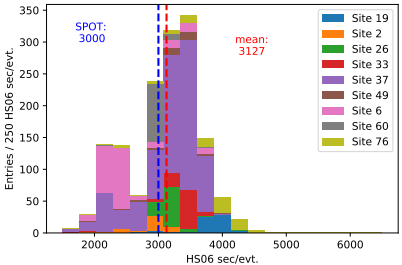
[2] 26th International Conference on Computing in High Energy and Nuclear Physics, 8-12th May, 2023, Norfolk VA, USA

Back-up

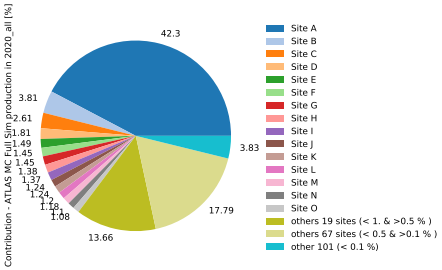
Comparison HEPSPEC benchmark of ATLAS Grid-Sites vs ideal conditions

Closure

SPOT ⇔ HC



HC ⇔ Grid Production



- HC jobs on identical hardware used by SPOT team show nice agreement

- Weight queues according to contribution to 2020 prod
  → values from HC tests agree with 2020 prod

Resources	ATLAS grid prod. 2020	HC benchmarks tot. frac	HC benchmarks hs06 w	rel dev [%]
all resources	4127	80.3	3906	5.4
Grid & Cloud	**3987**	90.5	3921	1.6
Grid	**3244**	83.3	3263	-0.6