universität freiburg

Plans and Status in Freiburg

Topic Area-I: Development of tools for integration of heterogeneous resources

FIDIUM Collaboration Meeting 2024

September 30th 2024

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Bundesministerium für Bildung und Forschung

FIDIUM

Physikalisches Institut
Albert-Ludwigs-Universität Freiburg

Planned contributions

- TA-I: Development of tools for integration of heterogeneous resources
  - WP-1: Exploration and efficient integration of opportunistic resources
  - WP-2: Accounting and Controlling of heterogeneous resources
- TA-III: Adopting, testing and optimization of production and analysis environments
  - WP-1: Integration, tests, optimization and deployment of services
  - WP-3: Support

- 2 FTEs funded: filled with post-docs from HEP/Computing community
  - $\sim$ 1 FTE in TA-I

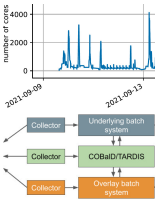
TA-I: Development of tools for integration of heterogeneous resources

WP-1: Exploration and efficient integration of opportunistic resources

MS1 Development of start-stop mechanism √

MS2 Development of plugins (interfaces) for the new accounting system √

MS3 Development and integration of a container solution √



WP-2: Accounting and Controlling of heterogeneous resources

MS1 Design, conception and technology selection √

MS2 Implementation of a accounting prototyp √

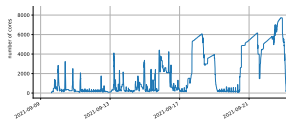
MS3 Further developments of the interfaces and quality assurance √

MS4 Consolidation and adjustments in production √

Achieved Milestones - WP-1

MS1 Automatic start-stop mechanism

- COBalD always keeps one drone running
- some use cases might have emtpy queues



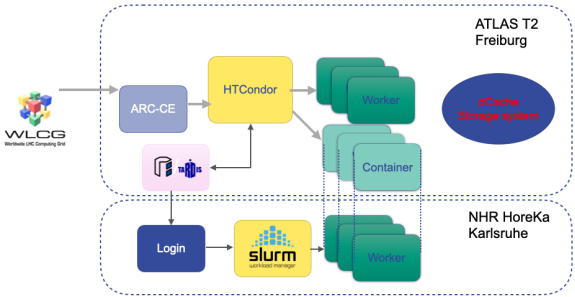
- prevents COBalD to start drones
  - if there are no pending jobs in the OBS
- available in COBalD: since v.0.12.1

MS2 Interface for accounting system (AUDITOR Plugin in TARDIS)

- AUDITOR retrieves drone info from TARDIS
- dedicated AUDITOR plugin in TARDIS project
- change of drone state triggers action
- available in TARDIS: since v.0.7.0

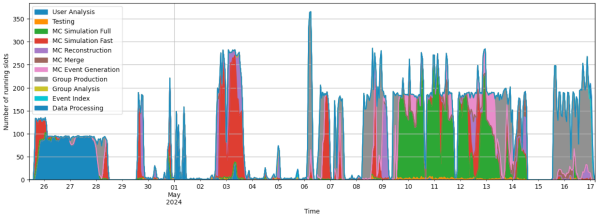
Achieved Milestones - WP-1

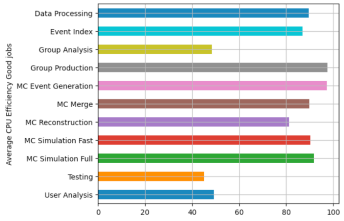
MS3 Development and integration of a container solution



- Setup dedicated Panda Queue (UNI-FREIBURG_NHR) with
  - ARC-CE
  - HTCondor
- connected to resource of NHR Cluster HoreKa for testing in May

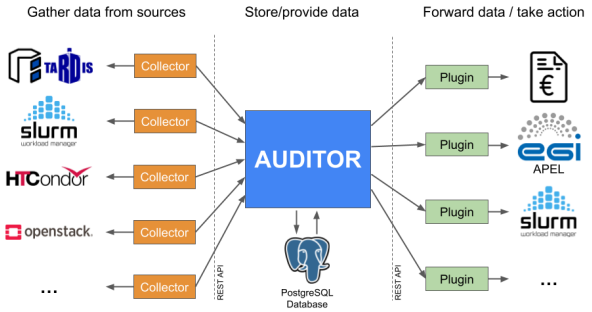
- Performed HammerCloud tests and processed





- Numbers in UserAnalysis and Testing dominated by HC tests (low CPU eff. expected)

Achieved Milestones - WP-2: The Auditor Accounting Ecosystem



AUDITOR: Acco**U**nting **D**ata handl**I**ng **T**oolbox for **O**pportunistic **R**esources

Modular accounting ecosystem

- **Collectors**
  - Accumulate data
- **Core component**
  - Accept data
  - Store data
  - Provide data
- **Plugins**
  - Take action based on stored data

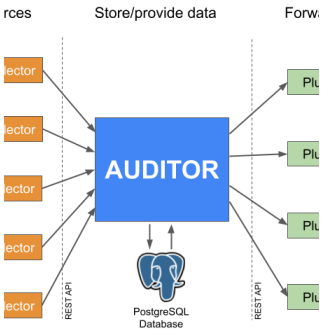
Documentation and code

https://github.com/ALU-Schumacher/AUDITOR

Presented at 26th International Conference on Computing in High Energy & Nuclear Physics (CHEP) May 8-12, 2023, Norfolk, VA, USA: AUDITOR: Accounting for opportunistic resources

Available Collectors and plugins

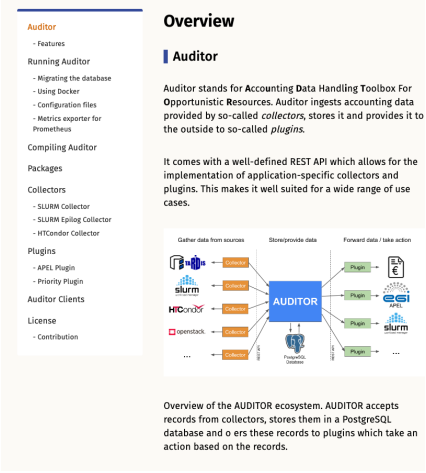
- **TARDIS Collector**
  - Collect drone information
- **SLURM Collectors** (2 types)
  - Collect information about SLURM jobs via SLURM CLI commands
- **HTCondor Collector** (dev @ KIT)
  - Equivalent of SLURM collector for HTCondor
- **Kubernetes Collector** (dev @ Wup)
  - accounts resources from kubernetes clusters
  - will be available with auditor v0.7.0



- **Priority plugin**
  - trigger command based on delivered resources (e.g. adjust group priority)
- **APEL accounting plugin**
  - Reports accounting data to the WLCG accounting service (APEL) - also sub clusters
- **Utilization report** (FIDIUM ext)
  - Analyse requested vs consumed resources of a user

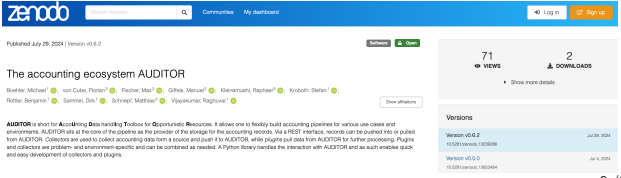
Numbers from AUDITOR git repo

- Extensive documentation



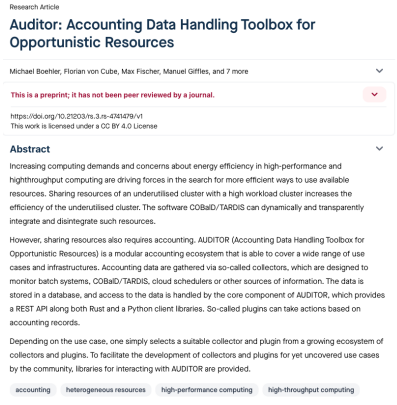
- 8 contributors
- from 3 universities
  - Freiburg (main developement), KIT, Uni Wuppertal
- 15 releases - latest v0.6.2
- Continuous improvements: Commits

- Also on https://zenodo.org/records/13239266



AUDITOR Paper

- AUDITOR paper submitted to Computing and Software for Big Science



Research Article

Auditor: Accounting Data Handling Toolbox for Opportunistic Resources

Michael Boehler, Florian von Cube, Max Fischer, Manuel Giffels, and 7 more

This is a preprint; it has not been peer reviewed by a journal.

https://doi.org/10.21203/rs.3.rs-4741479/v1
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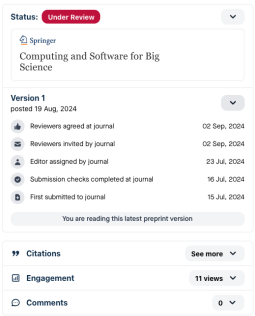
Abstract

Increasing computing demands and concerns about energy efficiency in high-performance and highthroughput computing are driving forces in the search for more efficient ways to use available resources. Sharing resources of an underutilised cluster with a high workload cluster increases the efficiency of the underutilised cluster. The software COBalD/TARDIS can dynamically and transparently integrate and disintegrate such resources.

However, sharing resources also requires accounting. AUDITOR (Accounting Data Handling Toolbox for Opportunistic Resources) is a modular accounting ecosystem that is able to cover a wide range of use cases and infrastructures. Accounting data are gathered via so-called collectors, which are designed to monitor batch systems, COBalD/TARDIS, cloud schedulers or other sources of information. The data is stored in a database, and access to the data is handled by the core component of AUDITOR, which provides a REST API along both Rust and a Python client libraries. So-called plugins can take actions based on accounting records.

Depending on the use case, one simply selects a suitable collector and plugin from a growing ecosystem of collectors and plugins. To facilitate the development of collectors and plugins for yet uncovered use cases by the community, libraries for interacting with AUDITOR are provided.

accounting heterogeneous resources high-performance computing high-throughput computing



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Submission checks completed at journal	16 Jul, 2024
First submitted to journal	15 Jul, 2024

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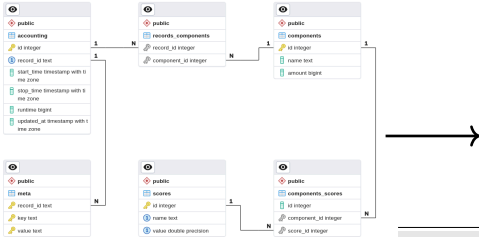
Schema adjustments - DB Perfomance improvements

MS4 Consolidation and adjustments in production

- reading and writing tests identified inefficiencies in the database structure

AUDITOR **v0.5.0** AUDITOR **v0.6.2**



- adjustments to the database schema fixed these performance losses

	10k		50k		100k		1 mil	
Query Type	**0.5.0**	**0.6.2**	**0.5.0**	**0.6.2**	**0.5.0**	**0.6.2**	**0.5.0**	**0.6.2**
All records	267.7	4.8	1007.3	25.0	2929.9	42.2	791457.6	421.1
Time range	100.5	0.6	686.6	2.5	1814.3	24.4	41948.1	188.7
Time range and site_id	88.8	1.0	814.6	4.1	2500.0	25.2	76142.9	232.6
Component	99.7	7.8	564.5	42.6	2366.5	31.1	41905.9	1648.8
Time range + meta + comp	77.0	0.5	499.6	3.2	1159.0	25.0	29114.5	496.0
Time range + 2 meta + comp	80.5	0.6	567.6	2.5	2285.6	25.7	23803.7	187.3
One record	92.3	0.1	1136.4	0.1	1164.6	0.1	34045.7	1.0

all numbers in milliseconds

Plans for extension Period - TA-I

WP-1: Exploration and efficient integration of opportunistic resources

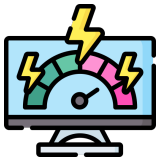
MS1 Development of an Utilization Report Plugin (Q3-2025)

- Analyse requested vs consumed resources of a local user
- Send a weekly report with possible savings and CO_2 footprint

WP-2: Accounting and Controlling of heterogeneous resources

MS1 Development of a stress test collector/plugin (Q4-2024)

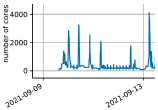
- Allows for stress testing and performance measurements
- Collector for testing uploads to AUDITOR
- Plugin for testing data access at AUDITOR



MS2 Further development and optimization of the auditor db (Q3-2025)

- Based on the results of the stress test analysis

Conclusion & Outlook



Conclusion

- all milestones achieved
- AUDITOR v0.6.2 is a stable accounting ecosystem ready for production
  - smaller open issues and user requests → work never ends...

Outlook

- still exciting milestones for FIDIUM extension period ahead
  - Utilization Report Plugin
  - AUDITOR Stress test Collector and Plugin

References

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