Karlsruhe Institute of Technology

Transparent expansion of WLCG compute sites using HPC resources

R. Florian von Cube

FIDIUM Collaboration Meeting 2022

Computing in German HEP

- “Official” WLCG sites provide compute resources for user analysis and production jobs of the LHC experiments
- As of the newest prediction CMS does not expect a major shortfall in computing power

- However, situation in Germany complex:
  - WLCG resources, research HPC clusters, institutes resources

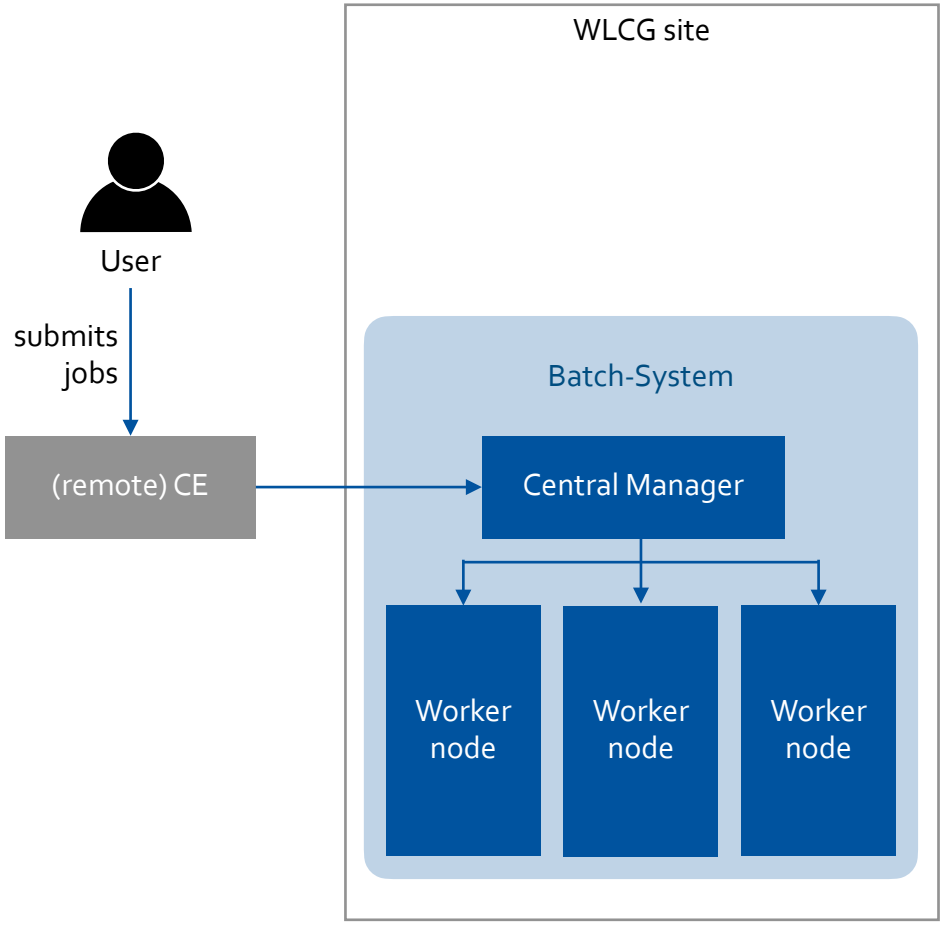
Diverse landscape for experiments
➡ Consolidate resources for streamlined access

COBaID / TARDIS

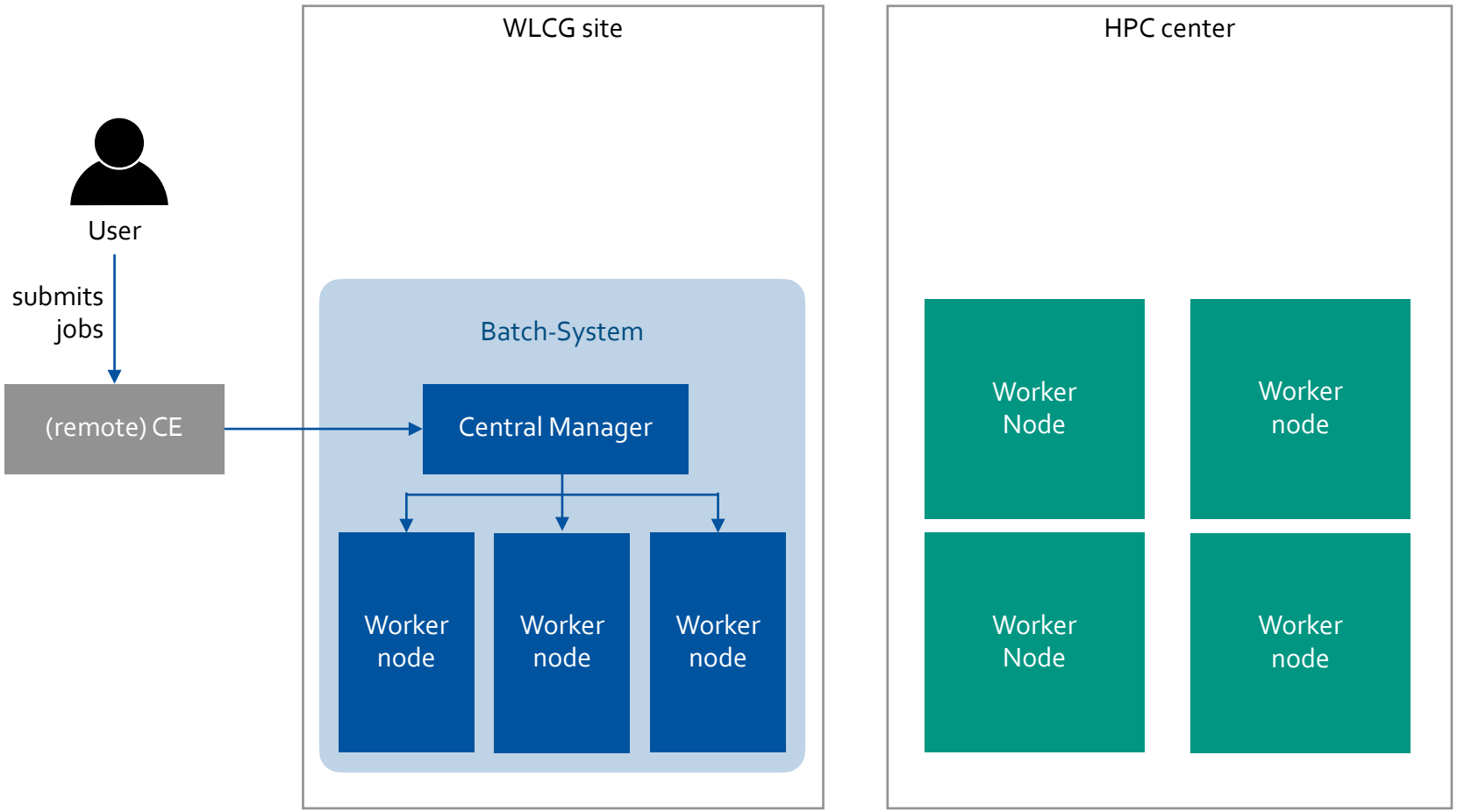
- COBaID/TARDIS are tools for dynamic resource scheduling developed at KIT and contributions from our partners in Freiburg and Bonn
- For transparent use, resources are integrated into common overlay batch system
- Compute elements (CE), established in the grid-context, act as single points of entry
  - Also perform authentication and authorisation

- Schedule resources based on current demand through proxy user
- Provide WLCG/experiment software through container layers

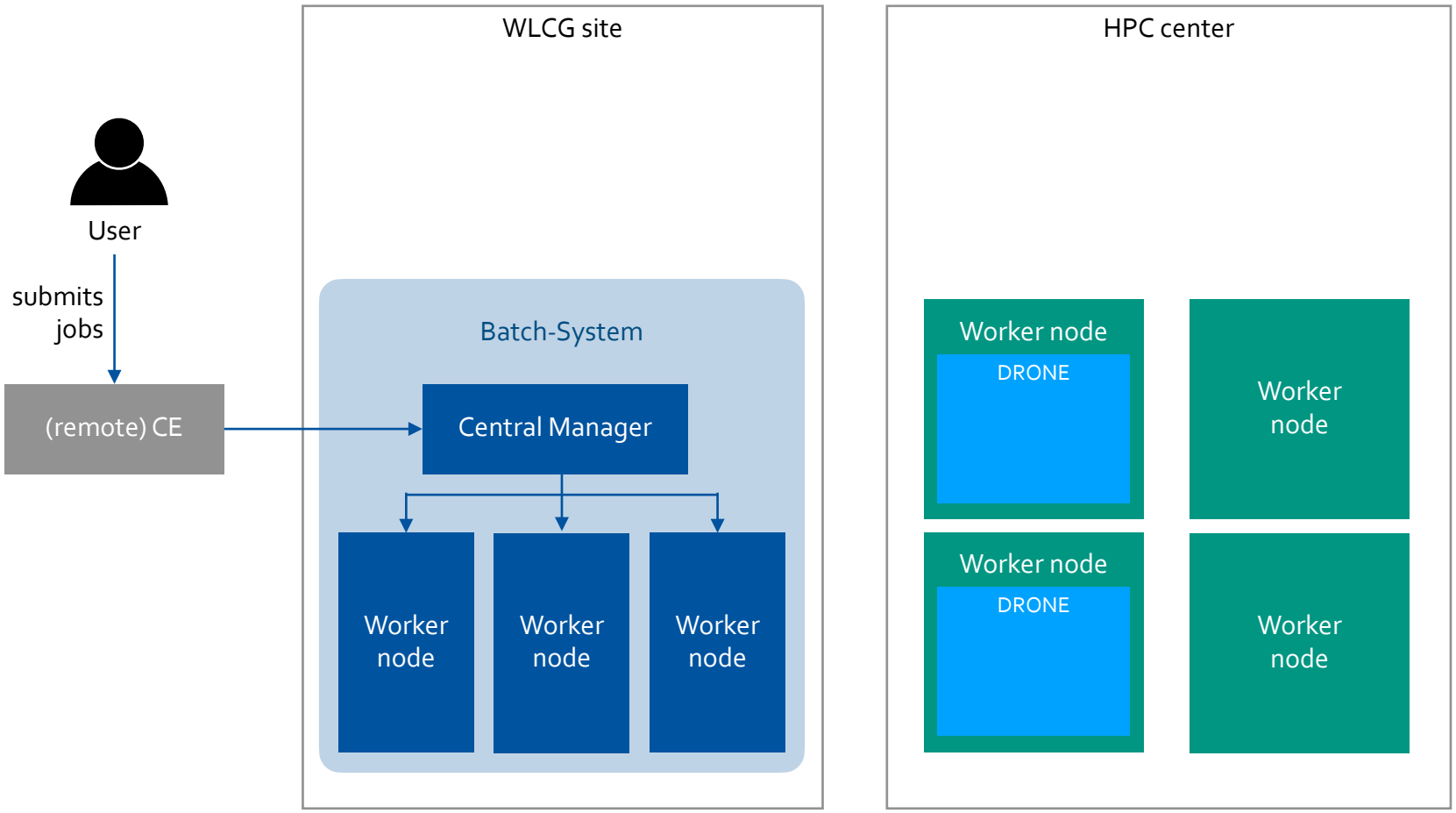
Ressource Integration using COBaID/TARDIS



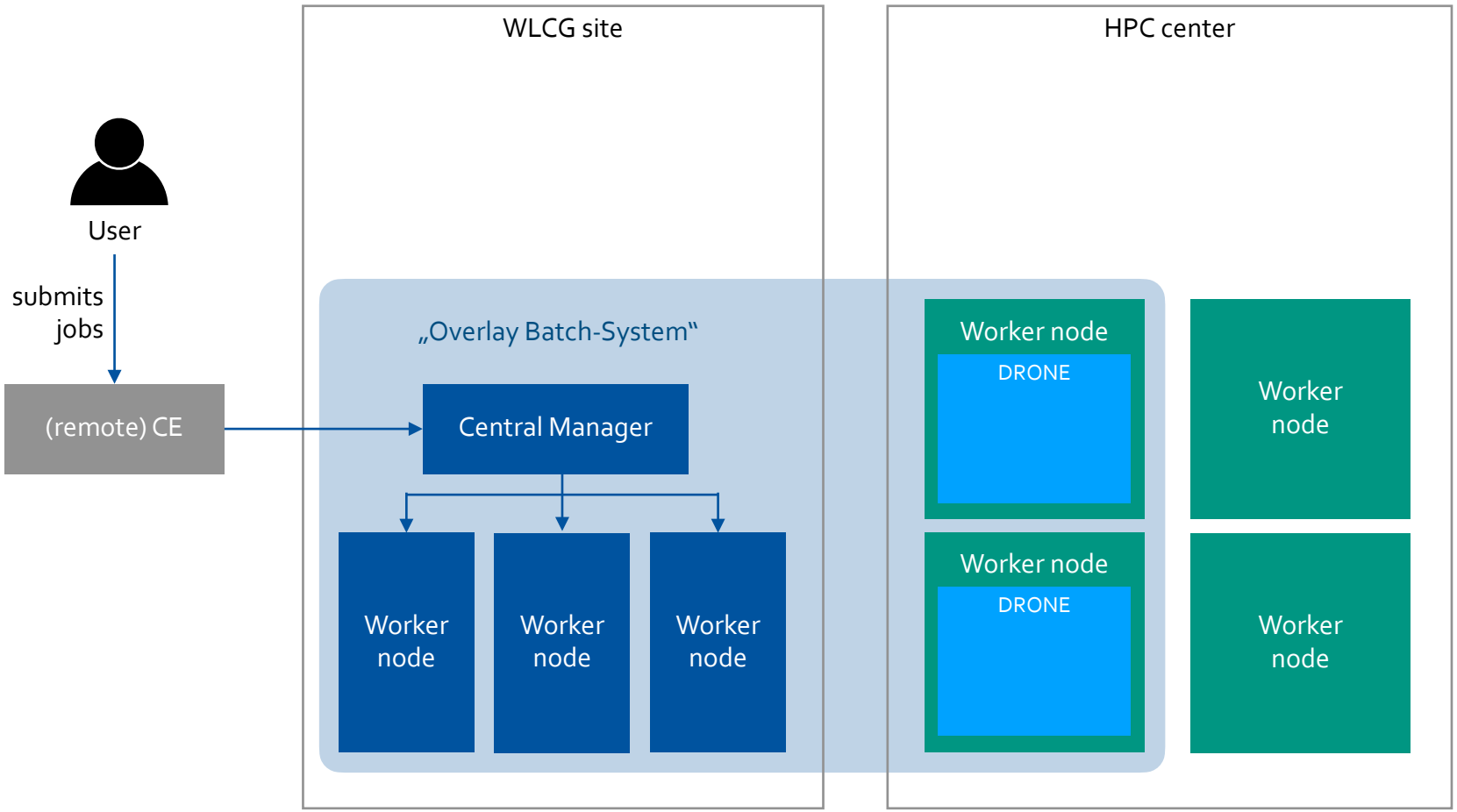
Ressource Integration using COBaID/TARDIS



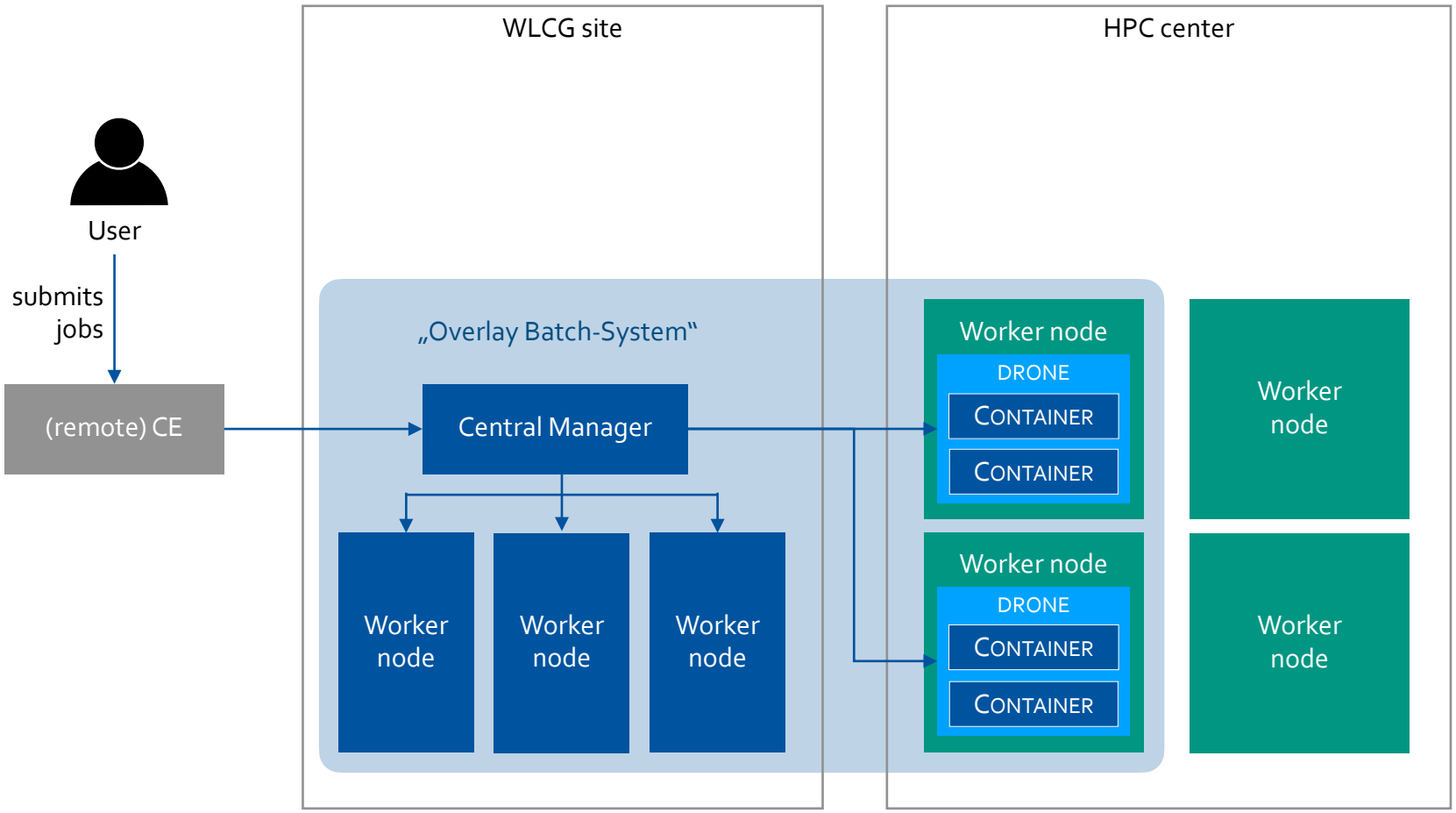
Ressource Integration using COBaID/TARDIS



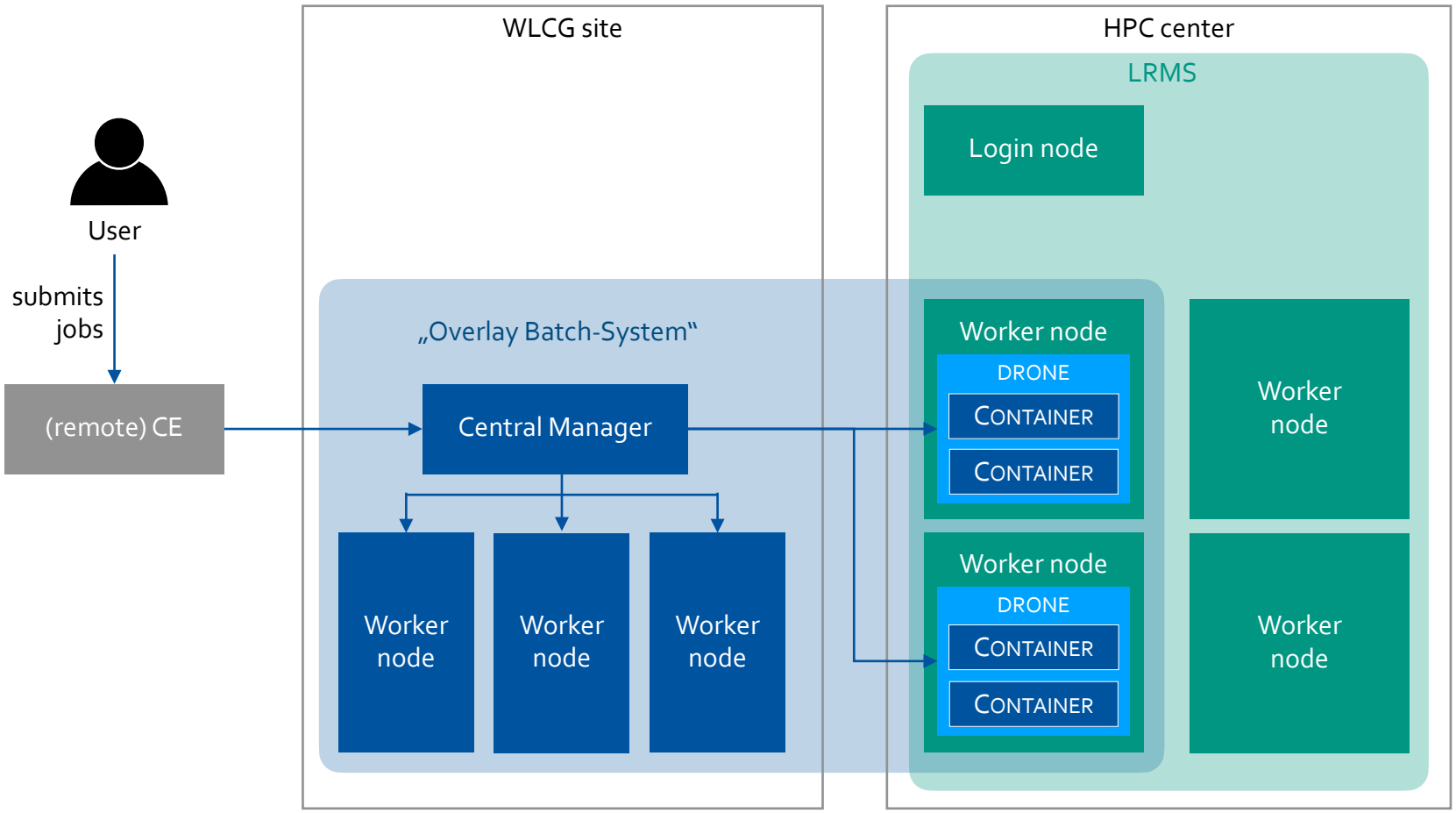
Ressource Integration using COBaID/TARDIS



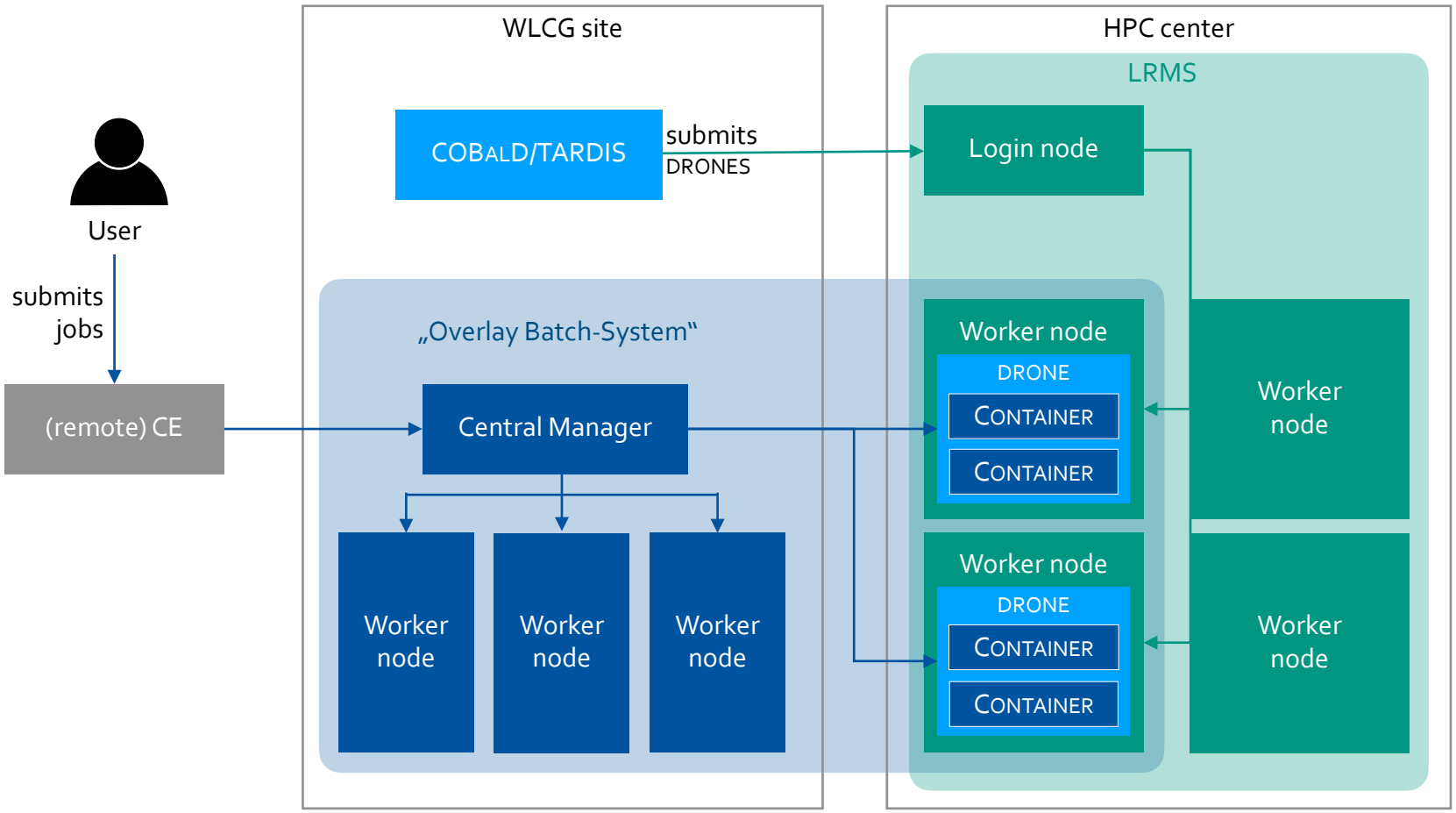
Ressource Integration using COBaID/TARDIS



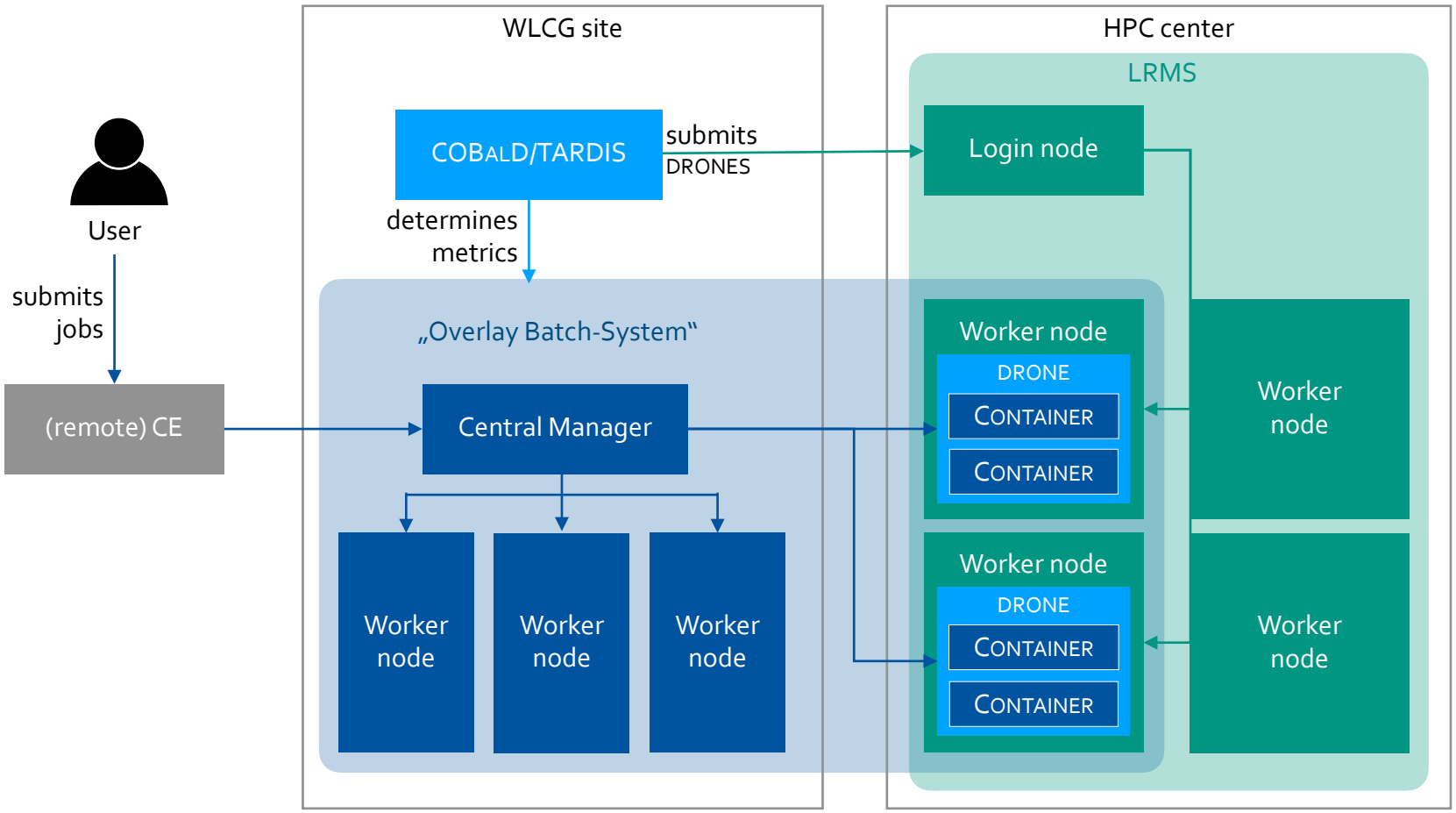
Ressource Integration using COBaID/TARDIS



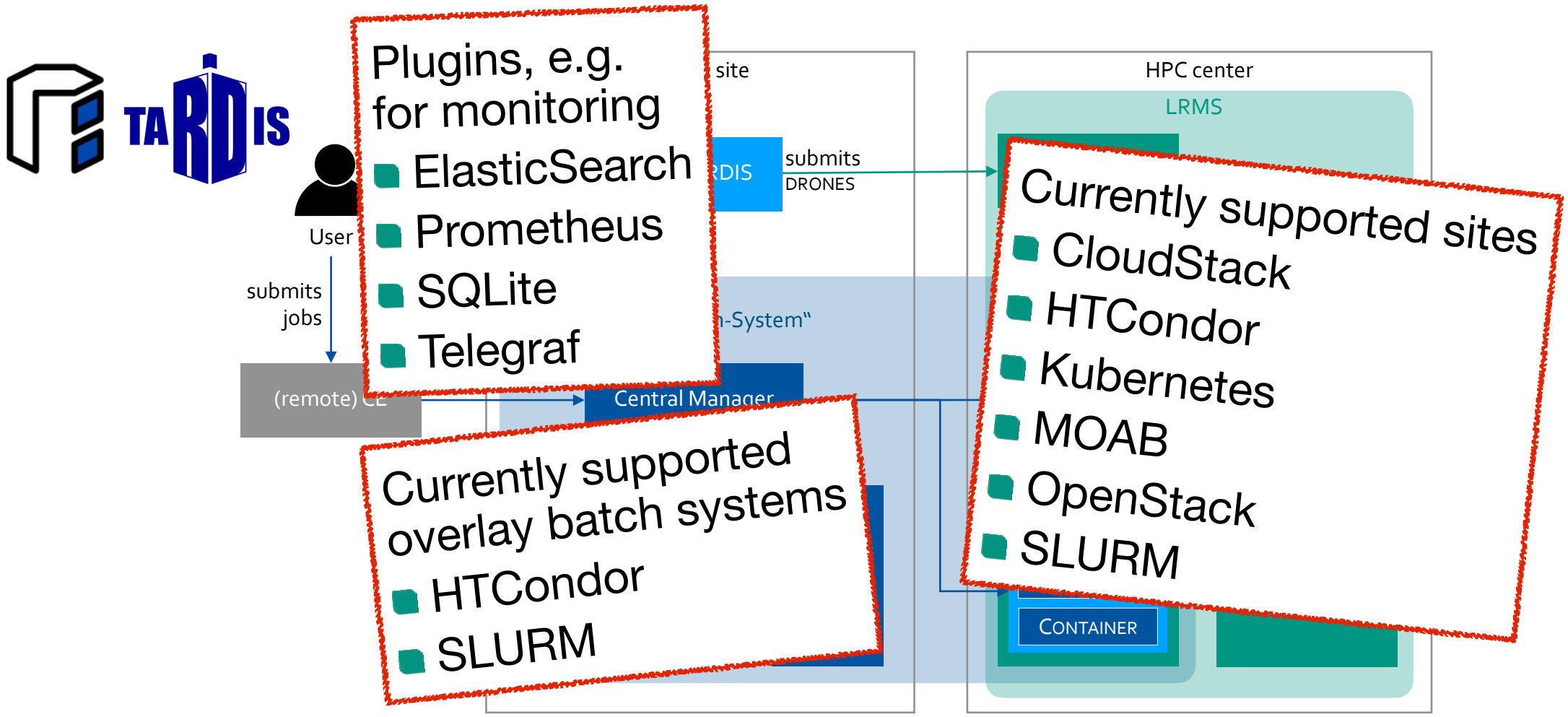
Ressource Integration using COBaID/TARDIS



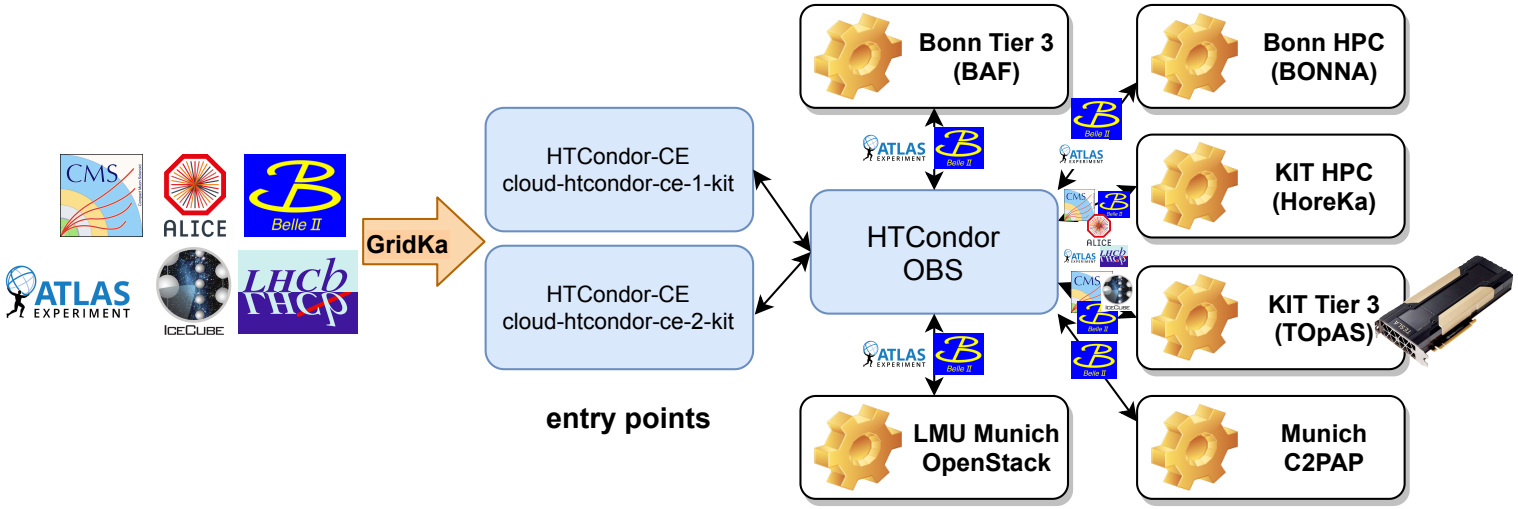
Ressource Integration using COBaID/TARDIS



Ressource Integration using COBalD/TARDIS



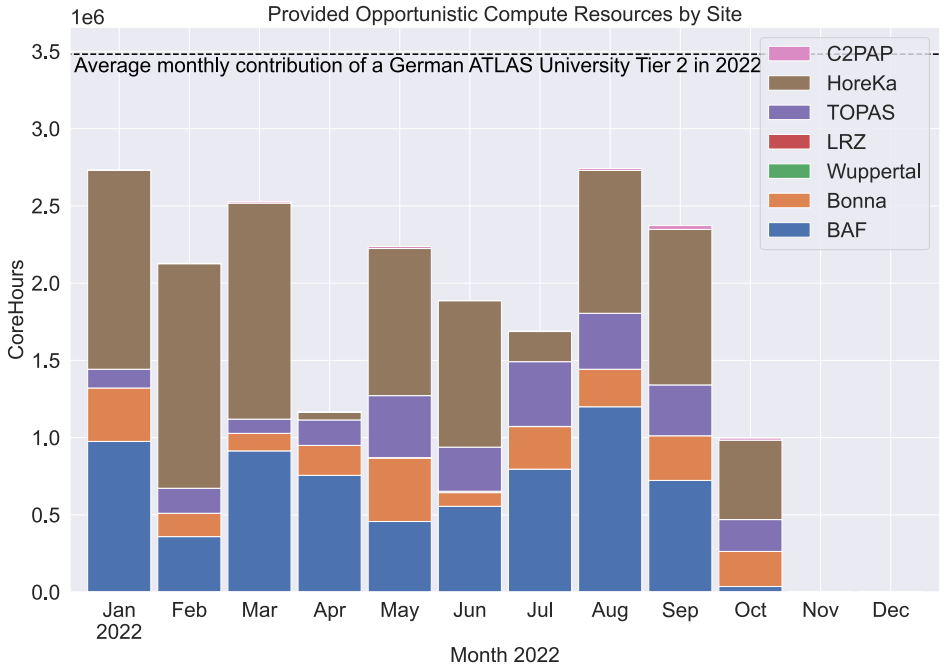
Federated Opportunistic Computing Infrastructure



- Opportunistic resources across Germany consolidated in setup at GridKa
- Provides VO-specific access to several resources through WLCG Tier 1 infrastructure
- Allows the use of specific hardware, eg. GPUs

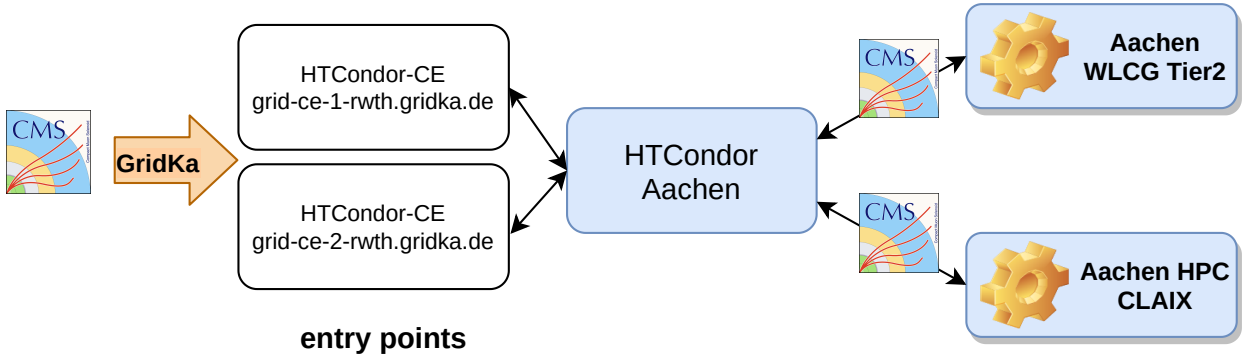
Federated Opportunistic Computing Infrastructure

Provided CPU Hours per Month in 2021



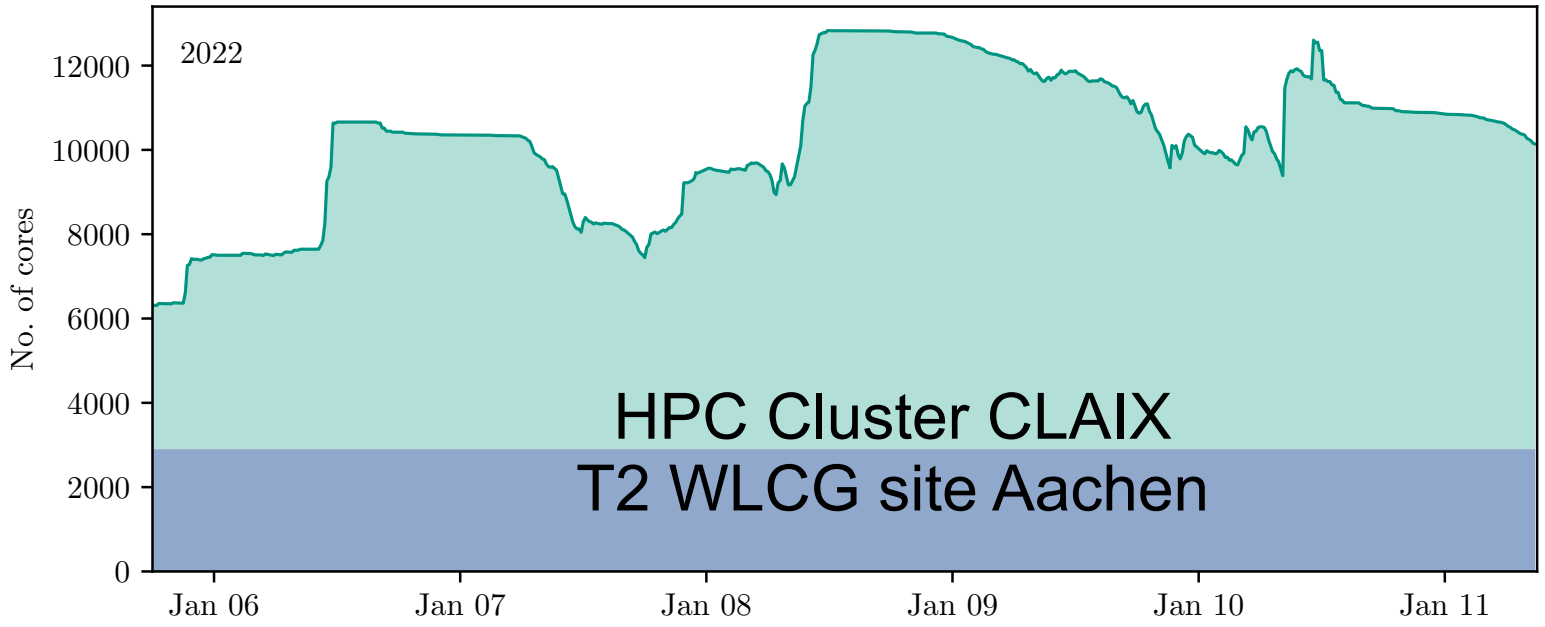
- The setup already provided more than 20 million additional core hours to the experiments this year

Lightweight Grid Operations



- COBalD/TARDIS also used in Aachen for integration of local HPC center into existing tier 2 infrastructure
- CE as access point to grid resource located in Aachen is operated at GridKa in Karlsruhe
- Modularising grid resources allows for lightweight operations
- “Remote CE” possible for other sites

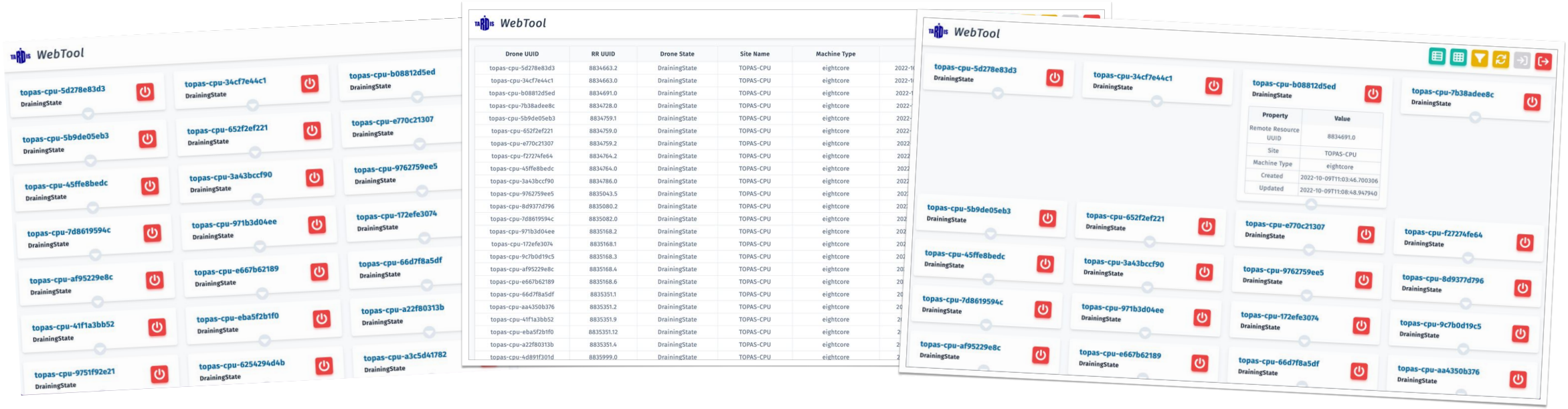
Aachen: Number of integrated cores



- The setup already delivered more than 10 million core-h to the CMS experiment in 2022 (and continues to do so…)

Web tool for resource management

- TARDIS now also ships with a web tool for resource management



- Allows for quick assessment of drone statuses and to shut them down

Broad Adaption and Support

- Suitable for all experiments and most resources
- Adaptable to specific setups:
  - E.g. ATLAS cache setup can be incorporated with additional ARC-CE
- Working with Göttingen on integrating the HLRN-HPC cluster into the local WLCG tier 2
- Working with Wuppertal on integrating the university HPC cluster into the WLCG through GridKa CEs
- Several other groups also on board

If interested, contact us:
We are available for kick-off workshops

Accounting on Heterogeneous Resources

See next talk by Stefan Kroboth on accounting

- New accounting software needed for use with opportunistic resources: AUDITOR
- Finalising first version of AUDITOR HTCondor collector using python client provided by AUDITOR
  - Uses condor_history to collect data
- Agreed on recurring accounting meeting with AUDITOR developers

Summary and Outlook

- COBalD/TARDIS allow for dynamic integration of heterogeneous resources through single point of entry
- Developing HTCondor AUDITOR collector for aggregating accounting data
- In production at several location, already provided substantial amount of computing resources to HEP experiments
- Development open to everyone:

  👨‍💻 https://github.com/MatterMiners 💬 https://chat.eudat.eu/matterminers/