



# ESCAPE EB

## VRE+DIOS updates

Giovanni Guerrieri (CERN)

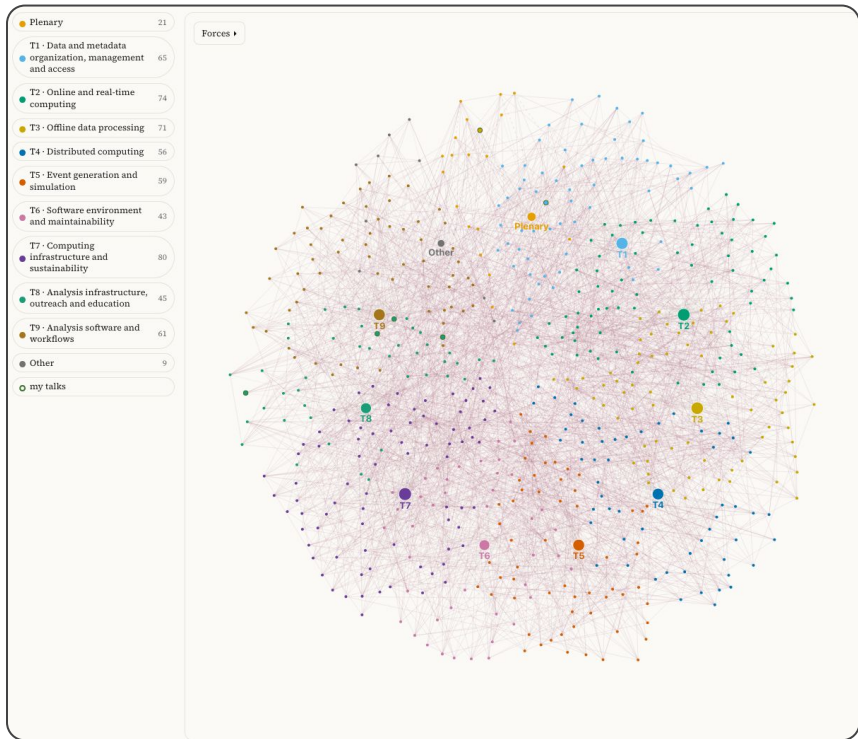
September 17<sup>th</sup> 2026

# CHEP 2026

## Retrospective

- Large-scale, data-intensive research is no longer exclusive to HEP. Astronomy, nuclear physics, and more scientific fields now face comparable challenges.
- FTS, Rucio, INDIGO IAM, DIRAC(X), PaNDA, REANA, CRIC, CVMFS are largely shared and co-developed solutions for scientific computing.
- These were the messages that were pushed through by CERN IT department head. **Great signal for collaboration.**

More info at [this link](#)



# CHEP 2026

## Proceedings

- Ready to submit

### From Quarks to Quasars: Unifying the Universe Through Scalable Computing

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**Abstract.** Large-scale, data-intensive research is no longer exclusive to high energy physics. Astronomy, gravitational wave physics, nuclear physics, and many more scientific fields now face comparable challenges in data management, distributed computing, and virtual research environments. With the technological landscape increasingly evolving towards centralised and specialised facilities, communities that rely on a distributed computing model must build bridges that enable sharing technical solutions while preserving their domain-specific needs. Driven by the challenges that research infrastructures will increasingly face, and inspired by the Worldwide LHC Computing Grid Data Challenges, more than five research infrastructures (including ET, SKAO, CTAO, and KM3NeT, with support from ATLAS and CMS) joined forces to create a forum for collective learning and shared experience. ESCAPE xRIDGE (European Science Cluster of Astronomy Particle Physics ESFRI Cross-RI Distributed Grand Exercise) is a coordinated series of data and analysis challenges designed around the scientific and technical priorities of each participating community. xRIDGE aims to enable infrastructures at different stages of maturity to advance their own goals while leveraging a partly shared infrastructure that

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# Directions

## Distributed Computing Roadmap

- Document published in Zenodo
- This should be treated as a reference for future developments, not a monolithic statement.
- The aim is to have a compass pointing us to the most relevant topics that can benefit from collaboration.
- The real work has to start yet.

[zenodo.20816562](https://zenodo.org/record/20816562)



### ESCAPE Collaboration Distributed Computing Roadmap

Position Statement for the Medium-Term Plan 2026–2030

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(Data Infrastructure for Open Science and Virtual Research Environments working groups)

# Data Challenges: xRIDGE feat. DC 2027

## Planning

Here are some details:

- Dates - 22nd February: 5th March 2027
- Confirmed participants: ALICE, ATLAS, CMS, LHCb, DUNE, JUNO, Belle II, SKA
  - EOSC and FCC pre-confirmed

The primary aim is to reach data transfer rates of 50% of the estimated Run-4 traffic, and identify current and future bottlenecks/optimisations.

It is expected that **all transfers will be authorised using tokens**, and not X509 certificates (some experiment-specific exceptions may apply).

**Please let us know if you plan to join!**

A dedicated presentation from WLCG folks expected for the next DIOS / VRE meetings

# Summer updates: VRE extensions

## Two more plugins developed

1. Zenodo/InvenioRDM Jupyter extension
  - Connect seamlessly with Zenodo or any InvenioRMD-based platform to browse, download and upload artifacts.
  - [vre-hub/inveniordm-jupyterlab-extension](https://github.com/zenodo-org/inveniordm-jupyterlab-extension)
  - <https://zenodo.org/records/22248411>
2. CVMFS extension
  - Navigate the CVMFS catalog in a user-friendly fashion, being able to activate and switch software stacks without restarting the Jupyter session
  - [vre-hub/cvmfs-jupyterlab-extension](https://github.com/zenodo-org/cvmfs-jupyterlab-extension)
  - <https://zenodo.org/records/22281080>

# Personnel situation

## Mostly funded via OSCARS / OSCARS2

- CERN
  - Hiring two junior software engineers to work on VREs, Competence Centres and AAI (24+12PMs each)
  - Hiring a technical student to develop the Zenodo authorpage to contribute to the OSCARS Data Stewardship program (12PM)
- CTAO
  - Plan to hire 24PMs dedicated to contribution to DIOS / VRE as per the roadmap
- INFN
  - Plan to hire 12PMs dedicated to contribution to DIOS / VRE as per the roadmap

# Next steps

- OSCARS 2 Cascading grants
  - Plan to rely on [zenodo.20816562](https://zenodo.org/record/20816562) to coordinate the submission of proposals
  - Would benefit from a broader meet up that also harmonises with the rest of the collaboration
- VRE evolution
  - Towards a Jupyter-detachable VRE, and a AAI gateway that manages access tokens for services
- AI
  - AI-friendly VREs
  - AI in operations for distributed computing
  - Federating AI infrastructure (feat the EOSC Federation)

# EOSC Federation (mostly CERN updates)

## Towards production

EOSC Federation to go live by mid-October

CERN Node on the way to be rolled out to production.

Developed 2 use cases for DIOS/VRE:

1. Genomics sensitive data analysis ft. the ORFEO HPC in Trieste, Italy
2. Access to AI factories at the ICSC, Italy

EOSC FEDERATION · FIRST WAVE NODE

## The CERN Node for Open Science

Integrating CERN's world-class research services and FAIR data into the European Open Science Cloud, enabling reproducible workflows, open datasets, and cross-disciplinary collaboration for researchers everywhere.

Get Started

Explore Services

Try an Analysis

# EOSC Federation (mostly CERN updates)

## Towards production

The CERN Node VRE largely shares the technology stack with the ESCAPE VRE and ETAP

### Virtual Research Environment

The CERN VRE for cross-disciplinary science

The CERN Virtual Research Environment is a modular, scalable platform that integrates software provisioning (CVMFS), data management (Rucio), reproducible workflows (REANA), and interactive analysis (Jupyter) into a unified workspace.

Unlike a generic cloud notebook (Google Colab, AWS SageMaker, Azure ML), the VRE ships pre-configured with the specialised toolchains scientific communities actually need: HEP software stacks via CVMFS, federated AAI, direct access to experiment data lakes, and analysis pipelines that run close to the data rather than shuttling petabytes across the public internet.



Access the VRE

Browse Analyses

