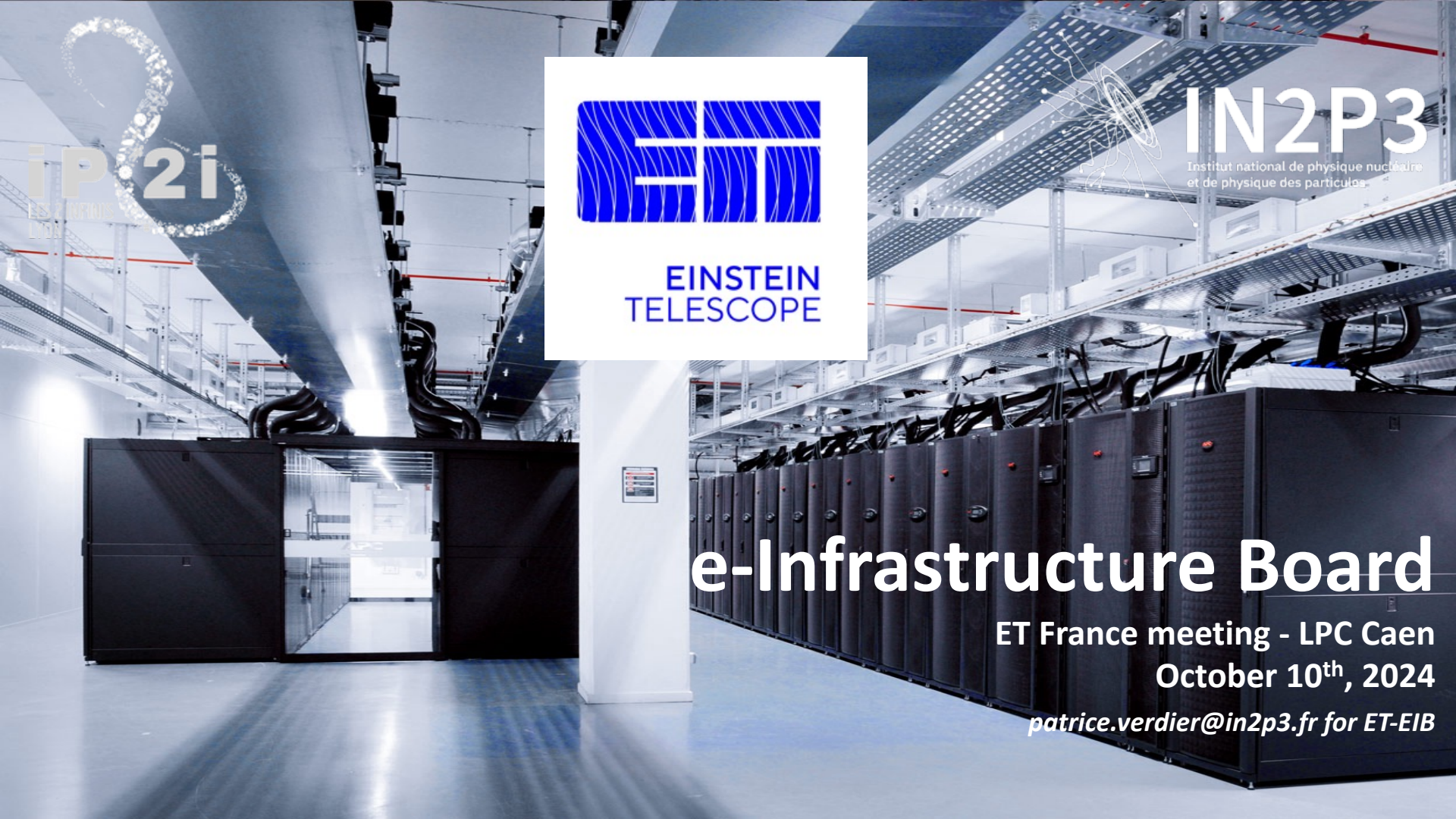


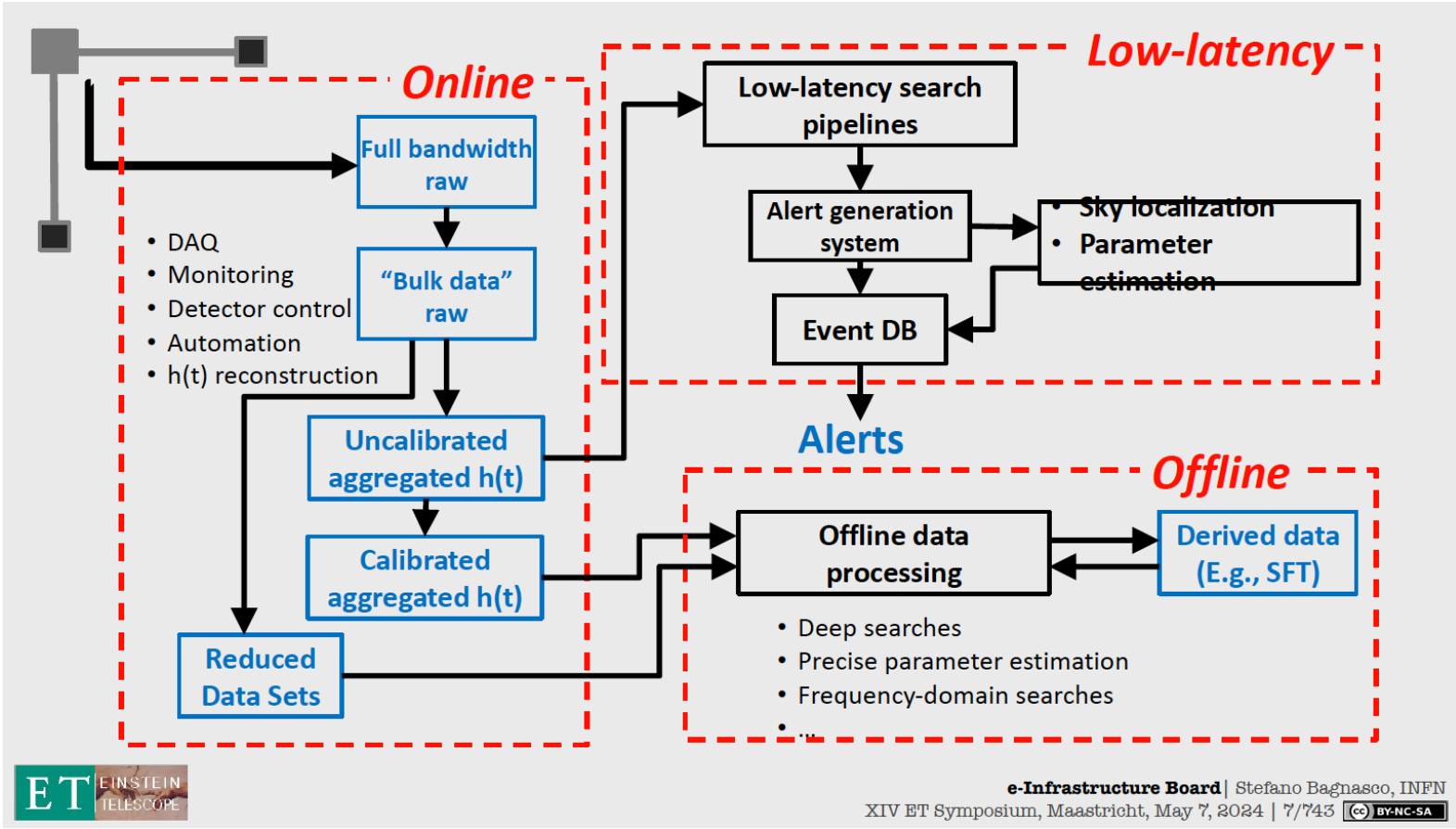
e-Infrastructure Board

ET France meeting - LPC Caen

October 10th, 2024

patrice.verdier@in2p3.fr for ET-EIB

The big Picture



Organization

EIB Chairs: Stefano Bagnasco (INFN), Patrice Verdier (IP2I Lyon - IN2P3)

ET-PP WP8 leaders: Achim Stahl (U. Aachen), Nadia Tonello (BSC)

Division 1: Software, frameworks, and data challenge support
Andres Tanasijczuk (Université Catholique de Louvain)
Division 2: Services and Collaboration Support
Antonella Bozzi (EGO)
Division 3: Computing and data model, Resource Estimation
Gonzalo Merino (PIC)
Division 4: Multimessenger alerts infrastructure
Steven Schramm (Université de Genève)
TTG: Technology Tracking working Group
Sara Vallero (INFN Torino)

Task 8.1: T0 data center
Leader: Patrice Verdier (IP2I-IN2P3)
Task 8.2: Computing and Data Model
Leader: Paul Laycock (U. Geneva)
Task 8.3: Resources
Leader: Silvio Pardi (INFN Napoli)
Task 8.4: Data Access Implementation
Leader: Nadia Tonello (BSC)

Liaison with OSB Div. 10: John Veitch (University of Glasgow), Elena Cuoco (EGO)

Joint WP8+EIB weekly call for coordination

Authentication and Autorization Infrastructure

ET Authentication and authorization infrastructure (AAI)

- Implementing the AAI solution developed within ESCAPE and supported by major European centers/labs in HEP and astroparticle phsyics (AAI solution adopted by CERN, CC-IN2P3, CNAF…) : **Indigo IAM: https://indigo-iam.github.io/v/v1.8.3/**

- **Working Group in place: CNAF, EGO, IJCLab**
  - Deploying an Indigo IAM instance for ET
  - Interface the ETMD with Indigo IAM

- **Agreement reached with CNAF to host the Indigo IAM instance for ET**
  - Michel Jouvin (IJCLab) is working on the implementation
  - Interface with Virgo Member Database at EGO
  - Next steps: implement first service/tool with this AAI system

ET-PP : WP8 Summary

WP8 Deliverables are well on track thanks to close collaboration between WP8 and EIB

ET-PP WP8 – ET EiB

ET-PP WP8 Computing and Data models

		Workshops	WPs	Due date	
WP8 milestones	M8.1	Workflows Requirements collection and constraints: computing and data		Sep 2023	Oct 2023
	M8.2	Computing Infrastructures availability for ET workflows, characteristics and sustainability	WP9	Aug 2024	July 2024
	M8.3	On site infrastructure, computing and data model	WP6	Aug 2025	
	M8.4	Low latency and offline workflows and computing model	WP6	Dec 2025	
	M8.5	Data management, access, policy and implementation	WP2, WP6	July 2026	

			Lead	Due date	
WP8 Deliverables	D8.1	Computing and Data Requirements	UniGe	Feb 2024	Feb 2024
	D8.2	Computing and Data Model	UniGe	Feb 2026	
	D8.3	Data Access Implementation Guidelines	IFAE	July 2026	

More collaboration & synergy to come between WP8 and WP9 on sustainability & durability studies

ET EINSTEIN TELESCOPE
ET-PP WP8 – ET EiB

Computing and data requirements (D8.1)

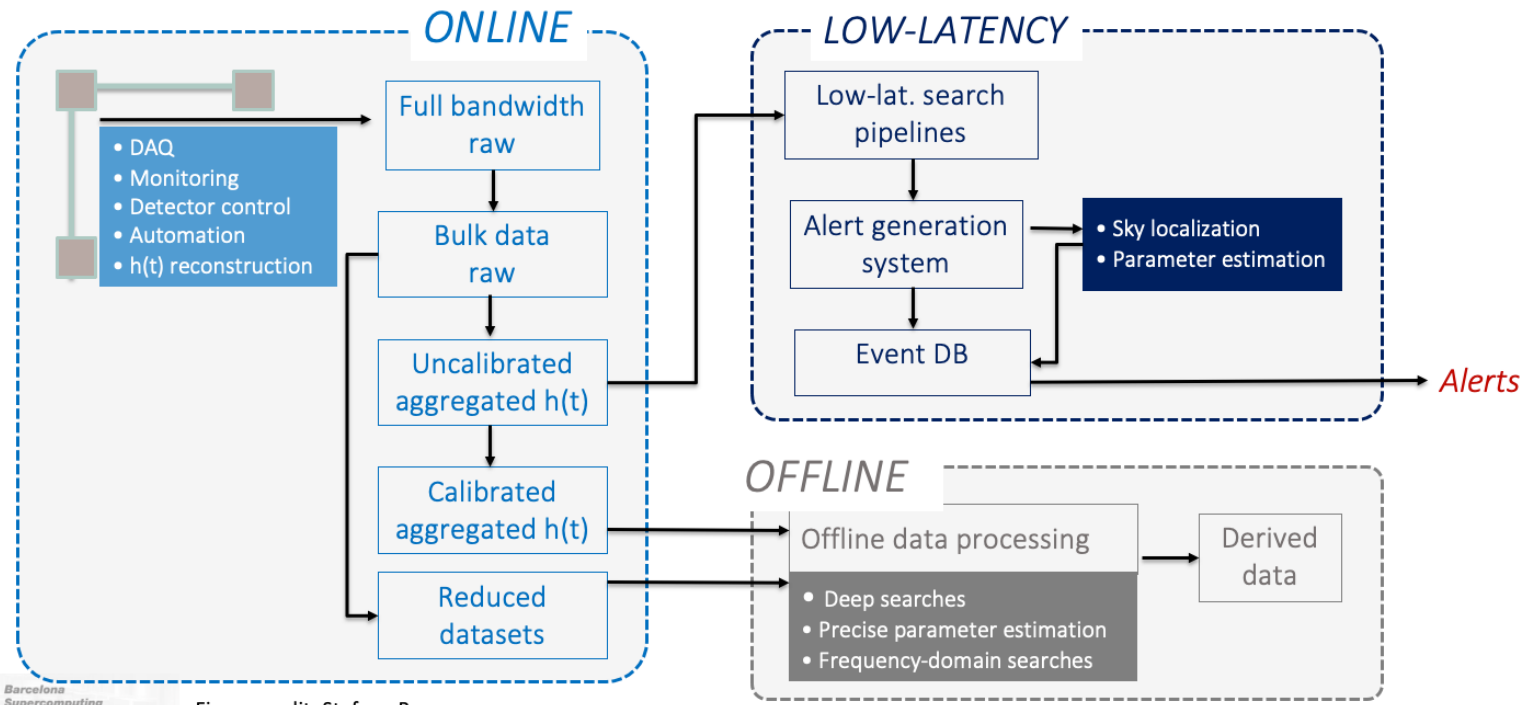


Figure credit: Stefano Bagnasco

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ET EINSTEIN TELESCOPE
ET-PP WP8 – ET EiB

Computing and data requirements (D8.1)

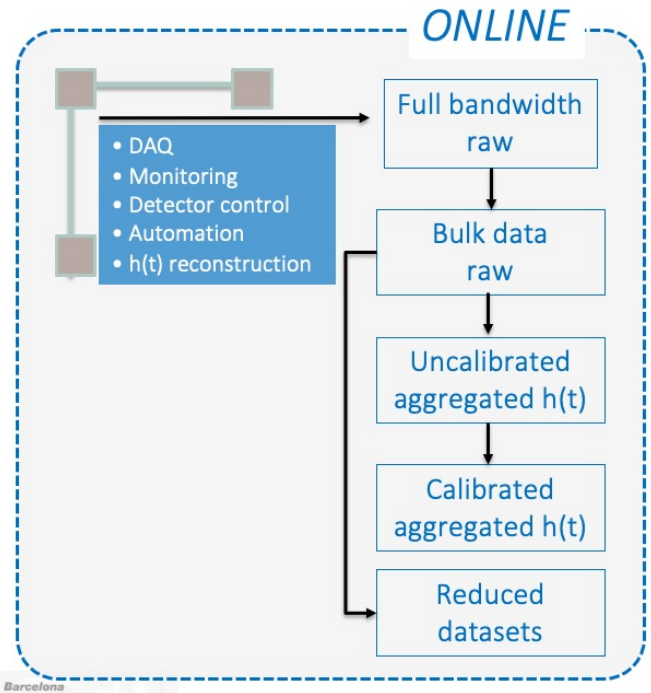

Figure credit: Stefano Bagnasco

	Minimal scenario	Operational safety margin
Operations storage buffer (TB)	800	1600
Long-term storage (PB)	20	40
CPU cores	2150	6450
RAM (GB)	3780	11340
Network	100 Gb/s	2 * 100 Gb/s

Table 7: Online computing requirements per ET interferometer for data storage capacity, processing power, RAM memory and network speed.

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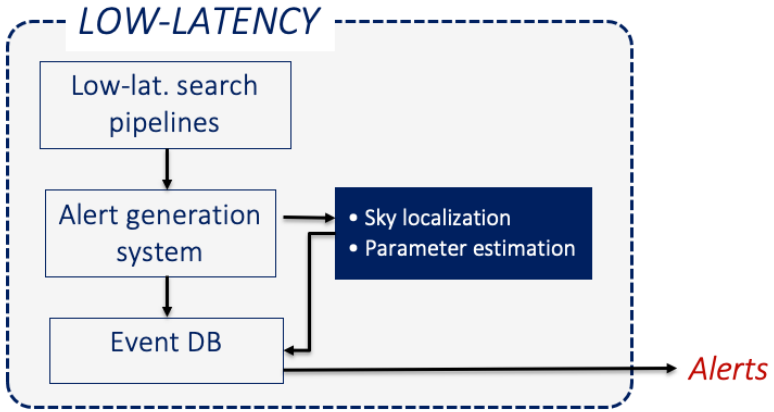
ET-PP WP8 – ET EiB

Computing and data requirements (D8.1)

Caching storage	Negligible
CPU	15000 cores
RAM (GB)	2GB/core
Latency	<10s

Table 8: Baseline low latency computing requirements. In addition to the CPU, a diverse set of GPUs are also used by LIGO and Virgo to accelerate computations. The usage of GPUs is expected to increase and will be particularly important for low latency computing.



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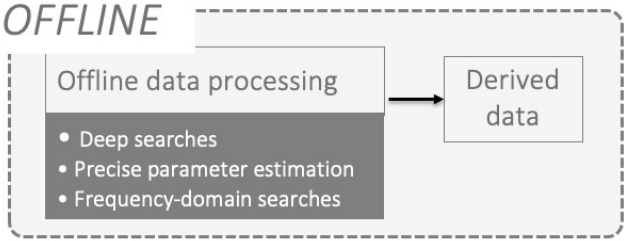
Computing and data requirements (D8.1)

Custodial storage	2 * 10 PB/ ET interferometer / year of observation
CPU	5×10^9 HS06 hours/year
RAM (GB)	2GB/core
Throughput to WNs	25 kbps per core

Table 9: Baseline offline computing requirements. Similarly to what happens for low latency, GPU acceleration is currently used by a growing number of pipelines and we expect this to increase in ET.



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Computing & Sustainability

Sustainability aspects of computing

Hardware sustainability

- Consider the carbon pollution emitted during the creation and disposal of ET on-premise computing devices.
- Maximize the lifespan of the ET-fully-dedicated hardware
- Maximize the utilization time of the shared devices (cloud)

Software efficiency

- Expertise for code optimization, parallelization and scalability
- Profiling and maintenance of code
- Adaptation to heterogenous technology and its evolution

Energy awareness

- Power Usage Effectiveness of computing centers
- Energy proportionality: energy consumption and effective work done (i.e. inefficient code)
- Baseline (Idle states) consumption awareness (i.e. disk data usage)
- Transparency regarding the sources of energy employed (clean, green, renewable).

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ET-PP WP8 – ET EiB

…coming soon
WP9 closer collaboration

Outcome of Napoli Workshop (M8.2)

- Initiate an independent analysis to assess the **suitability of cloud computing** for the Einstein Telescope project.
- Explore and possibly adopt strategic access models, leveraging frameworks like EuroHPC.

- Investigate and potentially implement a **trusted Workload Management System** (WMS).
- Prioritize the definition of **unified computing requirements** before implementing solutions.

- Collaborate with **WLCG** and **SPECTRUM** to adopt standardized solutions.
- Facilitate early, collaborative planning sessions with the scientific community to define computing infrastructure needs.

- Conduct further investigation into **reliable carbon cost metrics** and develop a sustainability strategy for hardware replacement.
- Commit to sustainability initiatives, starting with power usage analysis, code optimization, and promoting responsible computing practices.

- Start drafting a white paper for the ACME HORIZON grant, to be presented at the 2025 JENA symposium.

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

5th September 2024

5

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ESCAPE/OSCARs and Einstein Telescope

July 2023:
ET application to join the ESCAPE consortium was approved

CASCADING-GRANT CALLS FOR OPEN SCIENCE PROJECTS OSCARS

OSCARS

Open Call for Open Science Projects

Launch event

15 March 2024
Online

Funded by the European Union

GOAL:
Build on the science cluster approach to ensure the uptake of EOSC, i.e., consolidate FAIR services of the five Science Clusters and, more broadly, perform excellent science and pursue societal benefits by leveraging an Open Research approach.

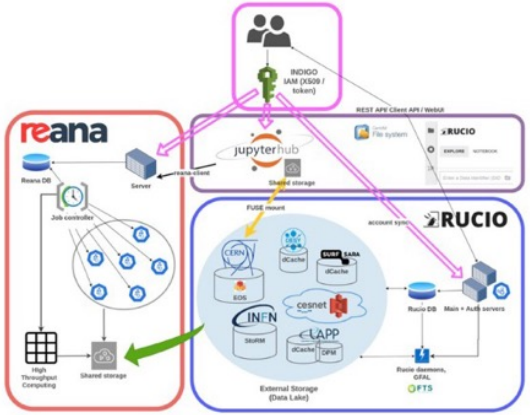
TARGET USER COMMUNITIES:
Science Clusters and wider community (RIs, Universities, Institutes, either consortia, or individual researchers)

- Opens: ~ March 2024 / Nov. 2024
- Submission within 60 days
- Project start: Sept-Dec. 2024 / Aug-Oct. 2025
- Budget: 100 - 250 k€ / project
- Duration: 1 - 2 years

Evaluation criteria for the independent expert panel

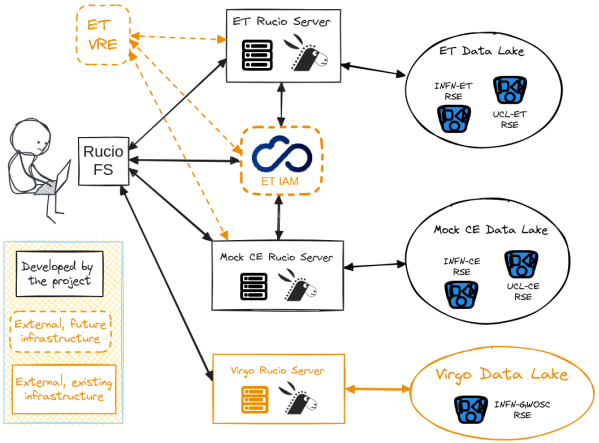
- Project description: clear objectives, towards FAIR and open
- Scientific impacts: multiple RIs / cross-cluster
- Digital resources: use of EOSC services / new EOSC service
- Implementation: realistic within budget

G.LAMANNA EVERSE & OSCARS Meeting – 13 March 2024 11



OSCARs call: MADDEN

MADDEN **M**ulti-RI **A**ccess and **D**iscovery of **D**ata for **E**xperiment **N**etworking



Participating organizations:

- INFN Torino (PI: Federica Legger)
- UC Louvain (coord.: Andres Tanasijczuk)

- Targeted start date: January 2025
- Duration of the project: 24 months
- Overall funding: 210 K€

The main objectives of this project are:

- Build a multi-RI Data Lake managed with Rucio.
- Develop and test RucioFS, a tool to provide a POSIX-like view of the Rucio catalogue in a multi-RI environment.
- Extend RucioFS to support advanced querying capabilities using metadata.

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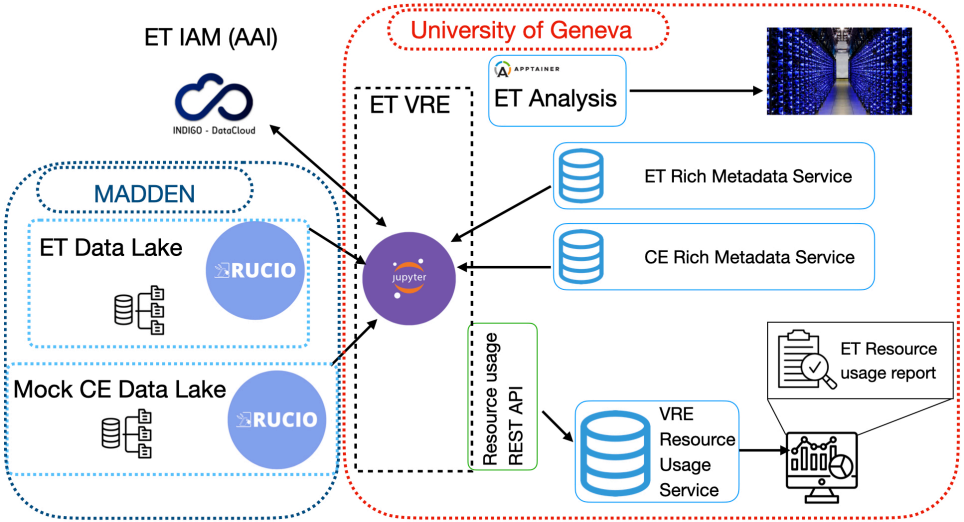
OSCARs call: ETAP

Einstein Telescope Analysis Portal (ETAP)



- Deploy the CERN ESCAPE VRE at University of Geneva
- Connect to multi-RI Data Lakes managed by Rucio (MADDEN)
- Deploy multi-RI Metadata services from the HEP Software Foundation (HSF)
- Design a flexible computing resource monitoring service

- University of Geneva
- Start date January 2025
- Duration 18 months
- Funding ~250k

Paul.Laycock@unige.ch

Conclusion and next steps

- **ET Representation and Collaboration**
  ET currently informally represented in WLCG through Virgo. Likely to evolve in a formal “general” GW representation (IGWN + ET)
  Effort to showcase ET computing case in major physics computing venues (CHEP, ACAT)
  https://www.epj-conferences.org/articles/epjconf/abs/2024/05/epjconf_chep2024_04015/epjconf_chep2024_04015.html

Computing Challenges for the Einstein Telescope project
CHEP2023 Proceeding, arXiv:2312.11103

- **ESCAPE/OSCARS:**
  EIB-WP8 collaboration, engage with various communities including Rucio developers, WLCG data challenge participants: 2 successful projects (MADDEN and ETAP) => Prepare 2nd call for November 2024

- **ET Open Source Policy:**
  Proposal Introduction and Discussion: Inspired by LIGO and Virgo, a draft proposing an open source policy was discussed to address licensing and authorship issues.

- **Code development Policy:**
  Preparation of a code development, management and quality “best practices” document to be proposed for all software development within the collaboration

To be included in ET Data Management Plan

Conclusion and next steps

- **With current and future Mock Data Challenges:**
  Iteratively improve infrastructure prototypes and usage data collection tools
  => Need to set clear goals and deliverables for future MDCs
  => Discussion in progress
  => Use CC-IN2P3 resources?

- **ET Unix group created at CC-IN2P3 (etgw) in 2024:** contact patrice.verdier@in2p3.fr to join etgw
  - allows to install and test software dedicated to ET
  - allows to pledge and monitor ET Computing resources (CC-IN2P3 request)
  - Very easy to switch from virgo to etgw unix group: *"newgroup –t etgw"*

- **Follow carefully the discussion on the evolution of the IGWN collaboration to prepare the 3G era with CE:**
  - Use existing LIGO/Virgo computing tools (mainly **US** tools & organization)
  - But we will want to use more and more "**European** tools & organization"

- **A common GW computing infrastructure and/or coordination body (as WLCG for LHC) seems like a good target**

- **Several proscpective survey/analysis in progress to support scientific roadmaps : JENA, Spectrum**
  - Contribute !

Backup

Introduction

«…to design, create and operate an evolving, efficient and functional e-infrastructure environment at a reasonable cost for the collaboration. Initially the focus will be the development of a Computing Model for the ET »

- Prepare a plan of the studies and activities that need to be undertaken for the development of the ET computing.
- Propose a computing model and its updates to the collaboration.
- Provide a software framework allowing traceability and reproducibility, efficient job submission and data access

Out of scope: actual science code, physics and engineering tools

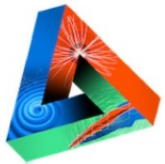
JENA - Joint ECFA, NUPECC, APPEC Activities

The JENA Symposium in May 2022 in Madrid (https://indico.cern.ch/event/1040535/) revealed an increased need for discussions on the strategy of EU federated computing at future large-scale research facilities.

Focused workshop on the strategy of computing in Bologna June 2023 aimed to define computing requirements in the next decade and to try and find synergies.

Outcome: creation of 5 WGs to generate input (whitepapers) for JENA Symposium in 2025:

- WG1: HTC, WLCG and HPC
- WG2: Software and Heterogeneous Architectures
- WG3: Federate Data Management, Virtual Research Environments and FAIR/Open Data
- WG4: Machine Learning and Artificial Intelligence
- WG5: Training, Dissemination, Education



JENAA
Joint ECFA-NuPECC-APPEC Activities

Gonzalo Merino