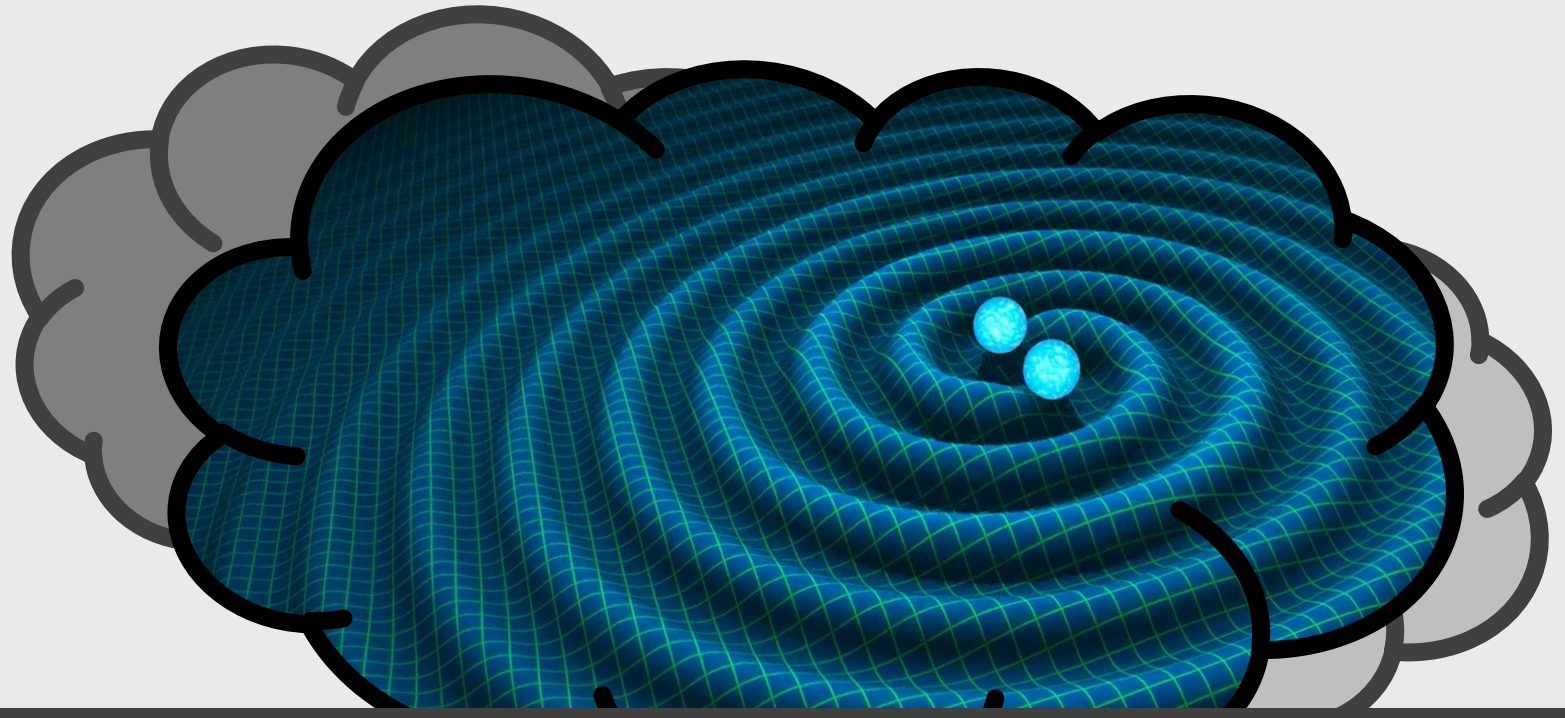

EIB GENERAL INTRODUCTION

Stefano Bagnasco, INFN

ET 4th Annual Meeting | Opatija, HR

EINSTEIN TELESCOPE | Nov 12, 2025

E-INFRASTRUCTURE BOARD

- Most activity in the last months on the Computing Model deliverable (D8.2)
  - See next slides and Paul's summary
- MDC activity dwindled in the same timeframe
  - We have a dedicated discussion with OSB in next session
  - Discussion on the basics: C++ vs. Python
  - Will need to prepare guidelines and best practices adapted to the community
  - ...and plan for future MDCs
- Responded to a survey on the future of ESCAPE
  - Together with Virgo and EGO, see ET-0522A-25 or VIR-1074A-25
  - There should be an "OSCARS-2" call next year (stay tuned!)

TOWARDS THE COMPUTING MODEL

Thanks!

Lorenzo	Asprea	INFN Torino
Stefano	Bagnasco	INFN
Luciano	Gaido	INFN
Oliver	Grabinski	University of Geneva
Gary	Hemming	EGO
Lia	Lavezzi	INFN Torino
Paul	Laycock	Université de Genève
Federica	Legger	INFN Turin
Duncan	Macleod	Cardiff University
Oscar	Reina Garcia	Barcelona Supercomputing Center
Sara	Vallero	INFN Torino

...and several more writers and reviewers that contributed after the workshop!

EINSTEIN TELESCOPE

WHAT'S IN A COMPUTING MODEL

- The **overall architecture of the e-Infrastructure**, either as a single integrated system or as a few separate systems (e.g. instrument control and DAQ, low-latency, and offline)
- A **documented way of evaluating the required computing power** and storage space from the evolving scientific program of the collaboration
- Estimates of the **involved costs** and **growth timelines**
- A **description of the data flows**, with estimates for the needed network performances
- A description of the **User Experience and workflows** for relevant activities
- A description of the **tools** to be chosen or developed to provide all the required functionalities (foundation libraries, frameworks, middleware,...)
- Subsequent "Work Breakdown Structure" and "Implementation Plan" documents

THE COMPUTING MODEL AS D8.2

- The **overall architecture of the e-Infrastructure**, either as a single integrated system or as a few separate systems (e.g. instrument control and DAQ, low-latency, and offline)

& a classification of resources according to latency

- A **documented way of evaluating the required computing power** and storage space from the evolving scientific program of the collaboration
- ~~Estimates of the **involved costs** and **growth timelines**~~
- A **description of the data flows**, with estimates for the needed network performances
- A description of the **User Experience and workflows** for relevant activities
- A description of ~~the **tools** to be chosen or developed to provide all~~ the required functionalities (foundation libraries, frameworks, middleware,...) (and gaps!)
- ~~Subsequent "**Work Breakdown Structure**" and "**Implementation Plan**" documents~~

◆ A really extensive treatment of all FAIR and Open Science things → Later

NEARLY THERE...

Contents

EINSTEIN TELESCOPE

TOWARDS A QUANTITATIVE COMPUTING MODEL

- Remember the “scary slide” from last Symposium?
- We still have no real estimate of the required computing power
  - Trivial scaling gives unphysical results
  - We all know that we can manage through better algorithms and mitigation strategies
- But we need to show the funding agencies that we’ll not bust because of computing!
- So, we need a well-defined plan of MDCs
  - Also for tesying the infrastructure
  - Including, sooner than later, “low-latency” end-to-end MDCs

EINSTEIN TELESCOPE

ET-PP WP8 & EiB Roadmap / Activities

4th ET Annual Meeting

Opatija, Croatia / 11th-14th November 2025

Deliverables

D8.1 Computing and Data requirements
Re-submitted 15-09-2025
EC Approved

D8.2 Computing and Data model
EC Due date: February 2026
Internal due date: End 2025
Currently In preparation

D8.3 Data access policy implementation guidelines
EC Due date: August 2026
Internal due date: May/June 2025

Milestones

M8.3 On site infrastructure, computing and data model
Jun 30 - Jul 01

M8.4 Low-latency and offline workflows
Due date: Dec 2025

M8.5 Data management access policy implementation
Due date: July 2026

Activities

1. Writing writing writing & editing D8.2 Computing model. See *https://indico.ego-gw.it/event/916/contributions/9095/*
2. OSCARS projects: See *https://indico.ego-gw.it/event/916/contributions/9096/*

- MADDEN: Rucio data lake, testing ET data lake + mock CE data lake.
- ETAP: Virtual Research Environment for ET, like CERN/ESCAPE-VRE.

3. Code support to MDC OSB Div10
ongoing (C++ recoding proposal), sharing best practices for software FAIR writing and management

4. Data & Metadata Glossary controlled vocabulary to be prepared for D8.3 Data access policy implementation guidelines

Fundamental to define Metadata schema and data model:
- for ET real and simulated data (MDC)
- Because [LVK] Gravitational Wave detectors analyze their data together"

5. Others: Collaboration with WP7 for workshop for industry engagement (computing session)

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Centro Nacional de Supercomputación
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EIB Division 1 activities

- MDC support: input data distribution
  - Currently using OSDF + CVMFS infrastructure from OSG (same system as in LVK, but without authentication)

  For more information, see presentations at previous ET symposiums and annual meetings
- Distributed Data Management (DDM) with Rucio
  - Envisioning ET's future DDM system – ET Rucio Data Lake inspired on ESCAPE
  - Expect to have a usable prototype available for MDC2

  For more information, see next presentation on MADDEN & ETAP projects
- Virtual Research Environment (VRE)
  - Installing a VRE for ET in Geneva, will help us to estimate computing resources needed
  - VRE will connect to the ET Rucio Data Lake
  - Expect to have a usable prototype available for MDC2

  For more information, see next presentation on MADDEN & ETAP projects
- Workflow management tools
  - Evaluating different workflow management tools (Snakemake, Pegasus, Nextflow)
- Rewriting of MDC data generation code used by OSB div10
  - Rewritting was done in C++, project in stand-by (or abandonned?)

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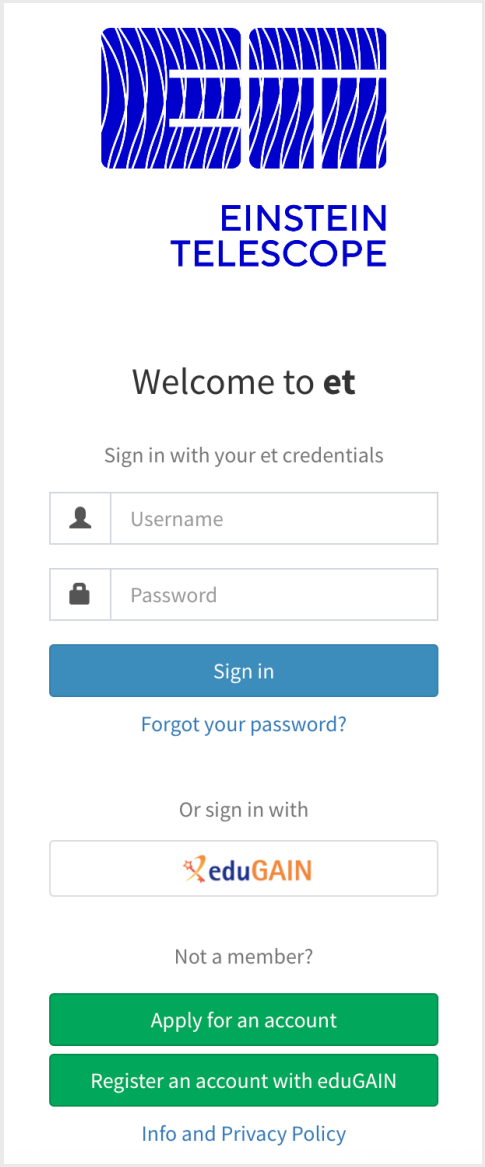
DIV2: SERVICES AND COLLABORATION SUPPORT

- Federated Authentication via INDIGO IAM + eduGAIN
  - Members authenticate using home institution credentials
  - OpenID Connect (OIDC) tokens for single sign-on across ET services
- Core Architecture
  - INDIGO IAM: Authentication provider & token issuer
  - ET Member Database (ETMD): Authoritative membership records (SoT)
  - SCIM: Automated synchronisation between systems
- Key Capabilities
  - Pre-provisioning workflows with RU leader oversight
  - Secure activation via time-limited tokens (72h validity)
  - Complete lifecycle management (onboarding -> active -> departure)
  - Research unit affiliation tracking with full history
  - Automated nightly reconciliation ensuring consistency
- Security & Privacy
  - GDPR-compliant data minimisation (minimal PII in tokens)
  - Comprehensive audit logging for all operations
  - Never delete member records (historical integrity)

DIV2: SERVICES AND COLLABORATION SUPPORT



- Current state of implementation:
  - INDIGO IAM pre-production instance ready at CNAF;
  - INDIGO IAM test instance in use at EGO;
  - ETMD integration on-going.

Fuller details available here:
https://apps.et-gw.eu/tds/ql/?c=18244

Div3: Computing and data model, Resource Estimation

Most of the activity related to the documents (ET-PP deliverables) D8.1 and D8.2, led by Paul Laycock

- D8.1 - Computing and Data Requirements
  - New version submitted including amendments to the comments from EC review (v1.4, Sep 9th)
- D8.2 - Computing and Data Model (detailed report today)
  - Writing workshop in Turin 14-16 Oct. Document draft delivered to the expert review team.

Aiming to start a process to track computing needs from the evolving scientific program of the collaboration.

- Had a kick-off meeting in June, with ISB, SCB and OSB representatives.
- First iteration of resource needs gathering during this meeting (EIB/OSB session).

Work by Georgy Skorobogatov on writing a GW workload to benchmark GPUs within HEPScore framework is stalled.

- Work for integrating RIFT as a HEPScore workload has been done.
- Missing “science” discussion with RIFT expert: revise the parameters that are currently used/hardcoded in the RIFT run and tune them to be more representative of a potential use case for ET.

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Division 4 summary

- Div4: multi-messenger alert infrastructure

- Computing requirements document (ET-PP D8.1)
  - Added multi-messenger computing requirements in February 2025
  - Naive scaling implies very significant requirements: requires significant algorithmic speedups
  - Lots of potential with machine learning / similar shown in the Blue Book, now must evaluate full workflow
- Hosted a multi-messenger / low-latency workshop in Geneva on May 21 and 22
  - Very productive discussion, leading to a preliminary computing model
  - Agreed there that “low-latency” is a confusing name for the topic; there are a mixture of latencies
  - Revised computing model nomenclature, multi-messenger falls under “time- and mission-critical” infrastructure
  - Followed up at the ET symposium on May 27 (joint EIB/OSB session) and 30 (plenary overview)
  - Lots of discussion, which has helped to reinforce the scale of the task ahead of us
- ET computing and data model document (ET-PP D8.2)
  - Multi-messenger alert infrastructure is one of the key contributions to the ET computing model
  - Need to prepare for future of multi-messenger infrastructure, not necessarily what we are familiar with today
  - Gathered all of the inputs received and requirements raised, combined into a first-draft model

- Important to emphasise that all of this work is joint between ET EIB and ET-PP WP8
  - Very much appreciate the ongoing close collaboration relating to preparations for ET computing

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TTG: TECHNOLOGY TRACKING WORKING GROUP

WORKSHOP TOPICS:

- AI-enabled algorithms, tools and approaches for data analysis
- AI tools for software development and more
- Evolution of processor architectures (accelerators, stream processors, neuromorphic…) incl. Quantum
- Storage and data management technologies
- Network technologies and cybersecurity
- Infrastructure and sustainability

*This Workshop is being organized by **ET-EIB and ET-PP WP8**, in collaboration with **WP7***

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THANKS!