



ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

The ESCAPE Project

2nd ESFRI-EOSC Workshop

Giovanni Lamanna, LAPP/CNRS

7th October 2020

<https://projectescape.eu/>



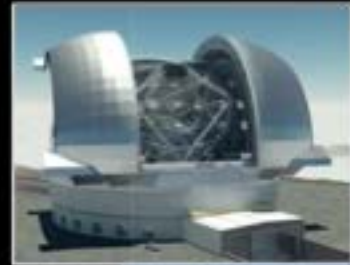
Radio



SKA

JIVE-VLBI

Visible light



ELT

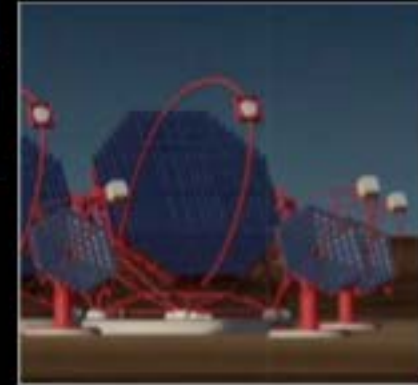


ESO



EST

Gamma rays



CTA

Accelerator-based Particle Physics

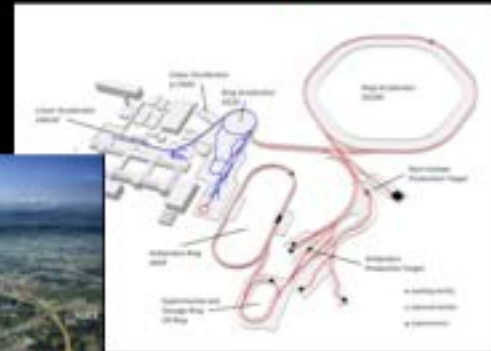


HL-LHC



CERN

Accelerator-based Nuclear Physics



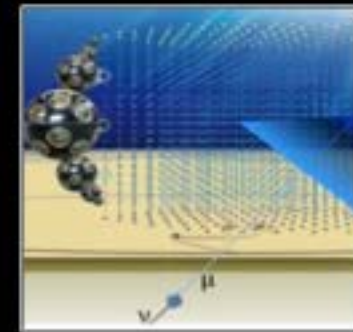
FAIR

Gravitational Waves



EGO-VIRGO

Cosmic-rays Neutrinos



KM3NeT



ESCAPE: Astronomy and Particle Physics ESFRIs

- ❑ Builds on communities' complementary excellences in data stewardship:
 - Astronomy Virtual Observatory infrastructure
 - HENP expertise in Exabyte-scale data management and large-scale distributed computing

- ❑ Builds on existing inter-RI synergies, intersections.

- ❑ Recognises that ESCAPE communities will be Exascale data generators, early adopters of ICT and data management innovations, push state-of-the-art.

- ❑ Both Observatory- and Facility- operations require global, open access to data, long term curation, and sustainability.



ESCAPE consortium

ESCAPE convenes a large scientific community

- 31 partners (including 2 SMEs)
- 7 ESFRI projects & landmarks: CTA, ELT, EST, FAIR, HL-LHC, KM3NeT, SKA
- 2 pan-European International Organizations: CERN, ESO (with their world-class established infrastructures, experiments and observatories).
- 4 supporting thematic national consortia : HEP (CERN) and ECFA, NuPECC, ASTRONET, APPEC
- 1 involved initiative/infrastructure: EURO-VO
- 2 European research infrastructures: EGO and JIV-ERIC
- Budget: **15.98 M€**
- Started: **1/2/2019**
- Duration: **48 months** (end date 31/1/2023)
- Coordinator: **CNRS**



☐ Data Lake:

- Build a scalable, federated, data infrastructure as the basis of open science for the ESFRI projects within ESCAPE. Enable connection to compute and storage resources.

☐ Software Repository:

- Repository of "scientific software" as a major component of the "data" to be curated in EOSC. Implementation of a community-based approach for the continuous development of shared software and for training of researchers and data scientists.

☐ Virtual Observatory:

- Extend FAIR standards, methods, tools of the Virtual Observatory to a broader scientific context; demonstrate EOSC ability to include existing platforms

☐ Science Platforms:

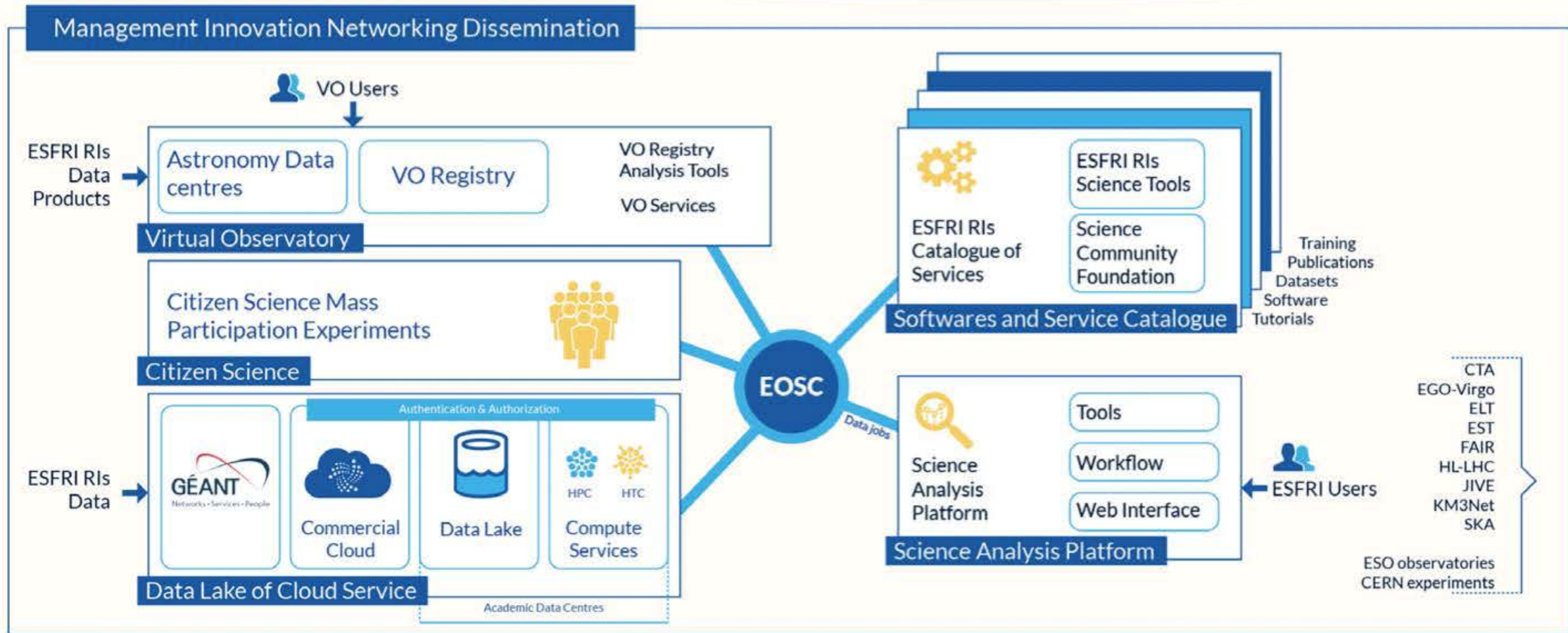
- Flexible science platforms to enable the analysis of open access data

☐ Citizen Science:

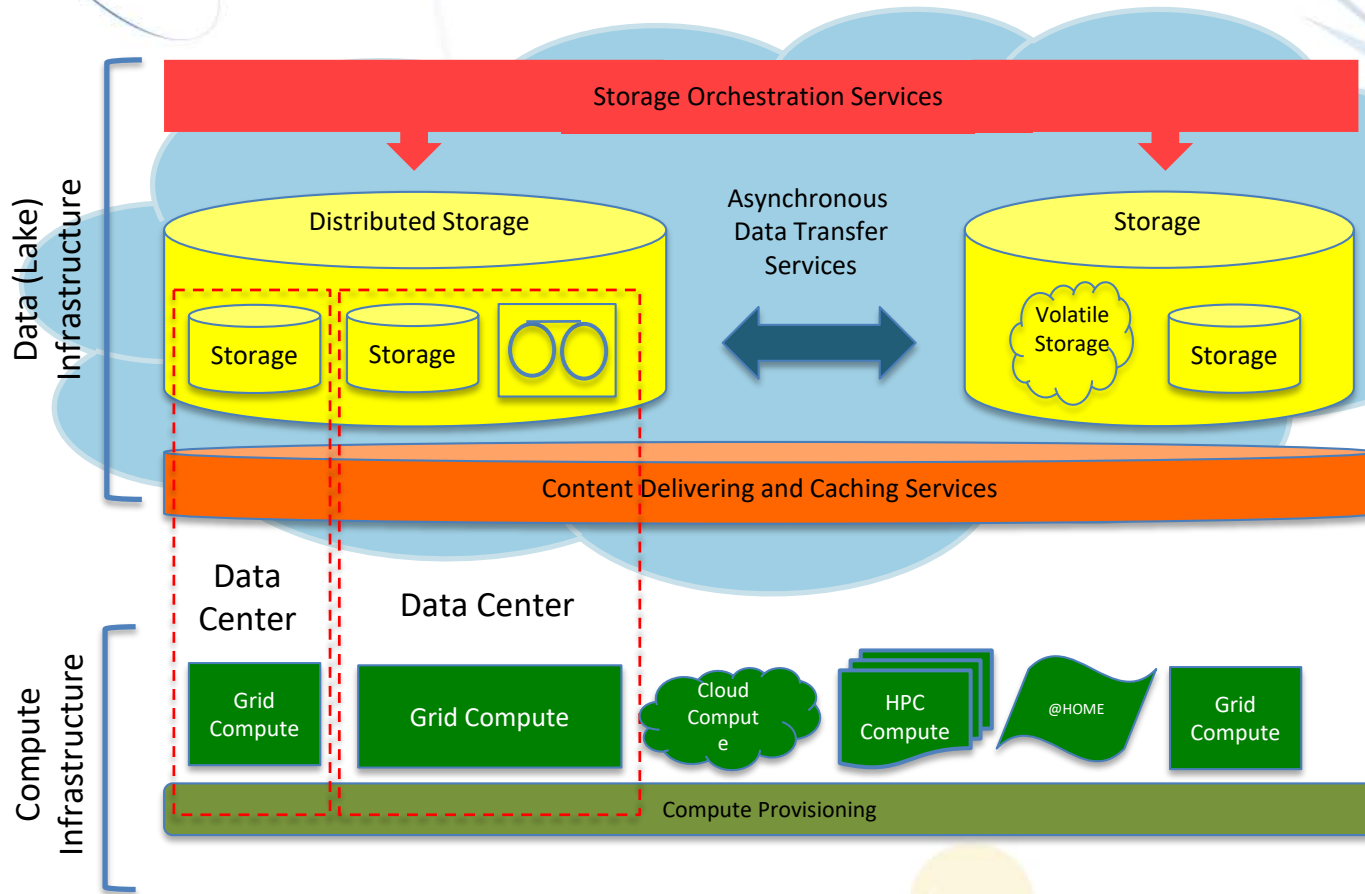
- Open gateway for citizen science on ESCAPE data archives and ESFRI community CS projects



ESCAPE contributions : building a thematic EOSC cell



Data Lake concept

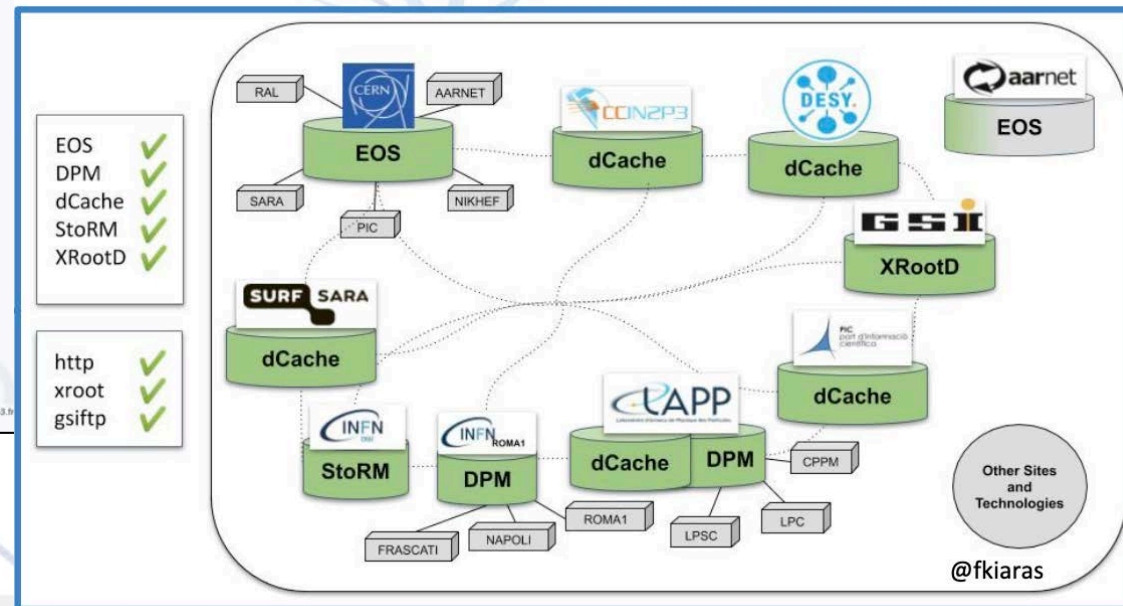
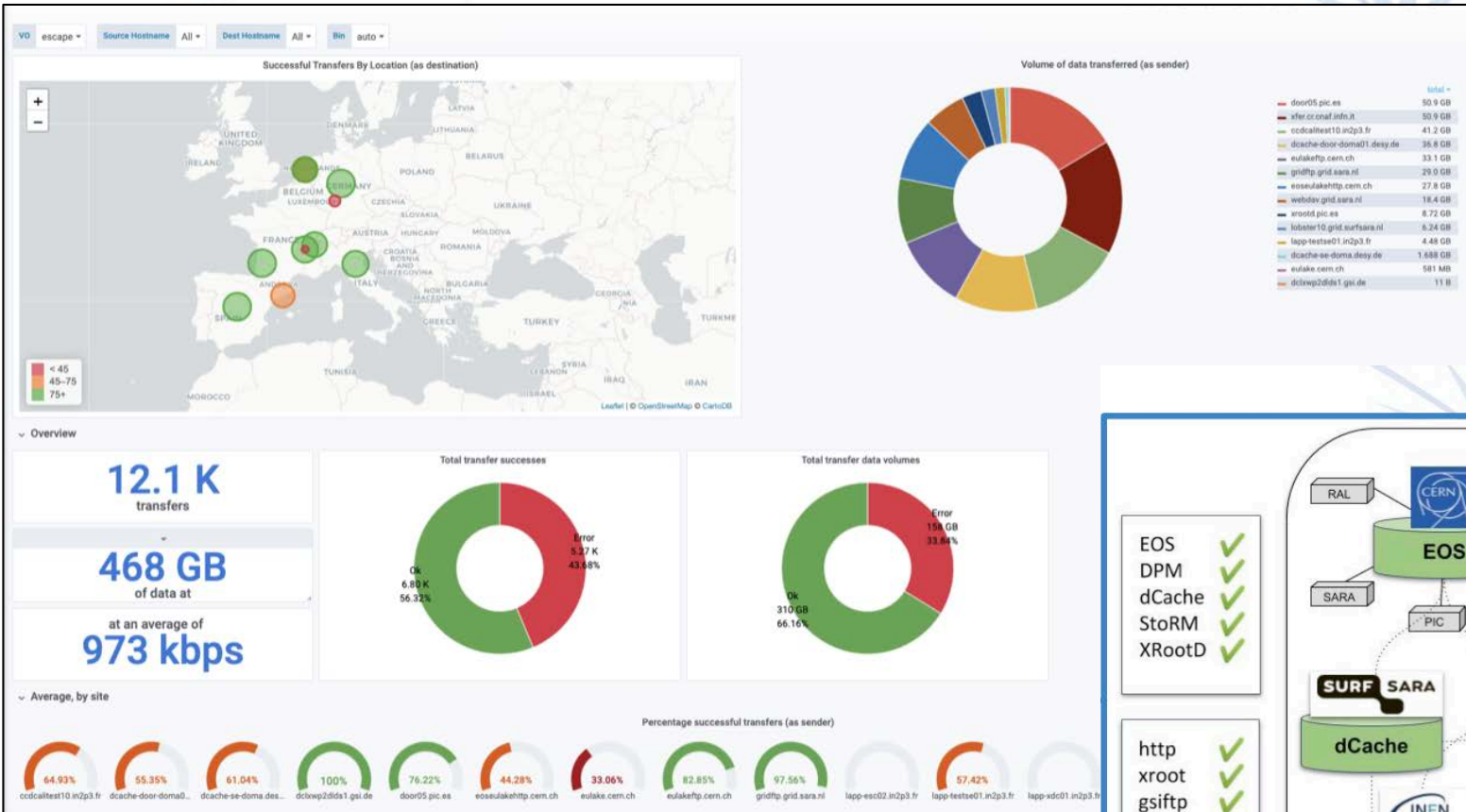


- Federation through token-based AAI
- Policy-driven data replication and distribution
- Distributed storage for reliability, accessibility, sustainability
- Serving data, remote, cached, streaming, to heterogeneous compute facilities
- Hide complexity – transparent access to data



Data Lake status

In progress: data injection and replication demonstrators, soon followed by pipeline data analysis tests with **LHC, CTA, LOFAR, LSST, SKA, Virgo**.



ESCAPE Virtual Observatory

ESFRI-VO-EOSC connection:

- ❑ Map VO framework into EOSC
- ❑ VO Registry in EOSC
- ❑ Portfolio of Astronomy VO services
- ❑ Contribution to EOSC hybrid cloud
- ❑ Containerised domain-specific services
- ❑ Training – interoperable data schools
- ❑ Ensuring EOSC connects with VO and astronomy needs

Built from VO Registry

1000s All-Sky data sets

Largest catalogues: PanSTARRS, Gaia etc.

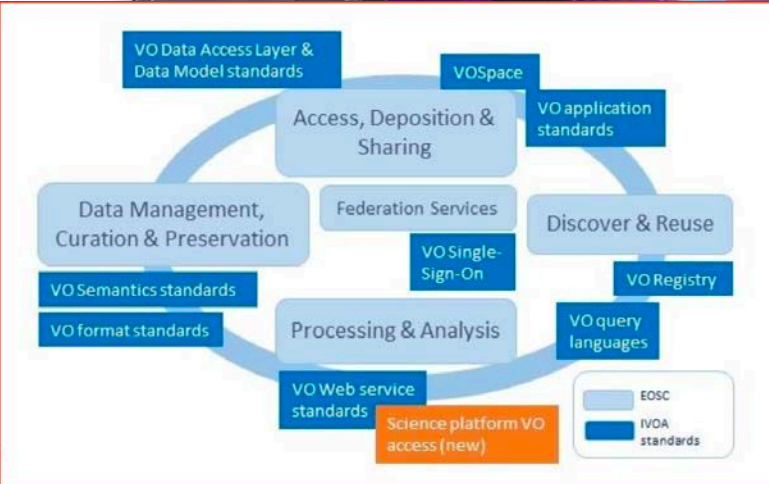
Complex ADQL queries

Multi-resolution techniques for Big Data

Interoperability of data

Interoperability between applications

Data from many observatories and missions



G. Lamanna

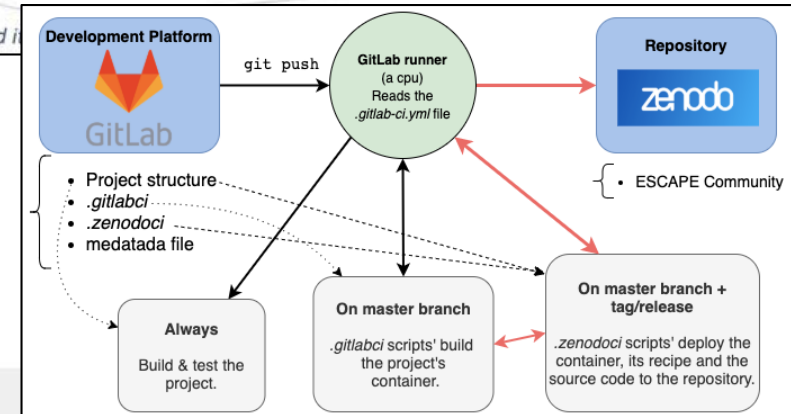
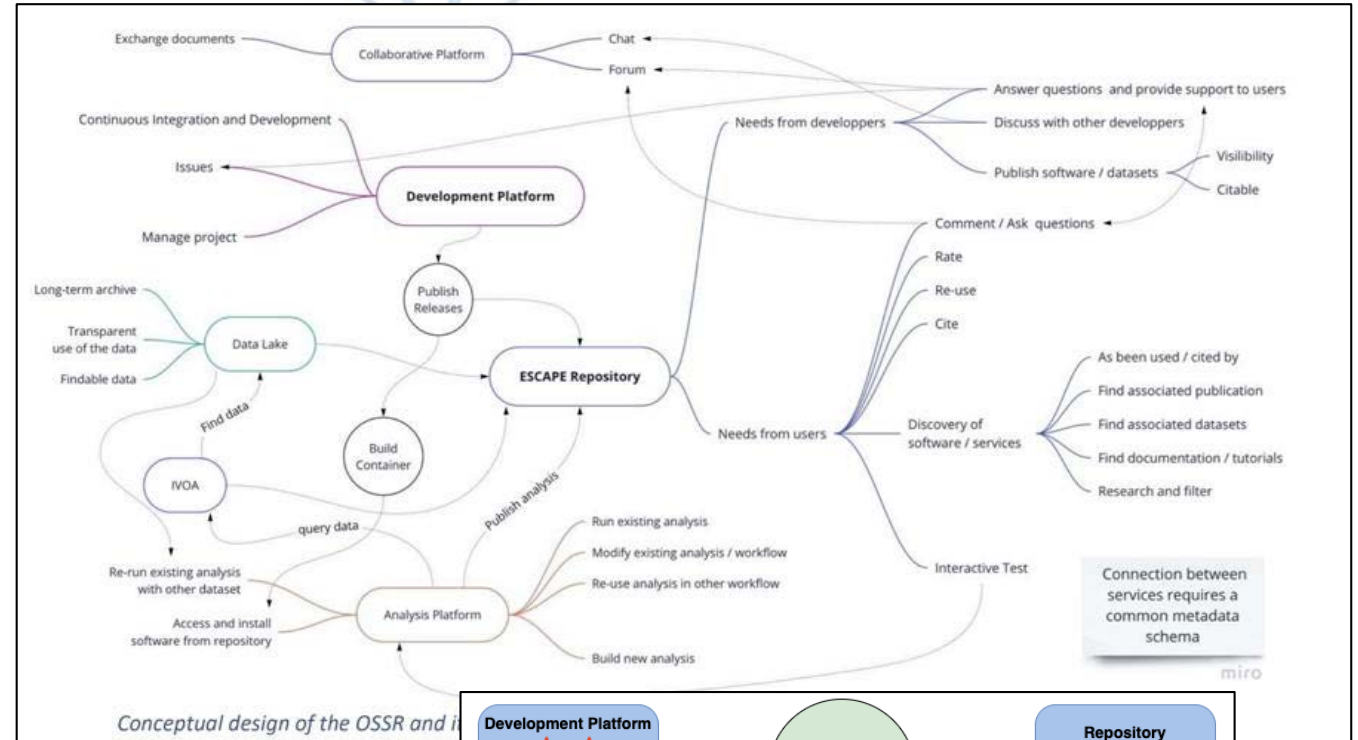


ESCAPE repository: building up a Virtual Research Environment

❑ Aim: expose the tools of the ESCAPE ESFRI projects in a repository under the EOSC catalogue of services

❑ Objectives:

- continuous development, deployment, exposure and preservation of software/tools/services
- interoperability, software re-use and cross-fertilisation
- open innovation environment for open standards, common regulation and shared (novel) software for multi-messenger & multi-probe data



□ TSPs are proposed to demonstrate multi-domain science integration across ESCAPE

- demonstrate new cutting edge open science capabilities, making use of the services implemented within ESCAPE
- feedback on the capabilities delivered by ESCAPE
- benefit real science goals in exploring synergies between the ESFRIs and largely among three scientific communities Astrophysics/Astroparticle, accelerator-based Particle and Nuclear Physics (supported by consortia of EU member states research agencies and institutes within JENAA)

A top-down endorsement for a bottom-up approach based on Expression of Interests (Eoi) subscribed by researchers



Dark Matter TSP:

- understand the nature of dark matter by collecting data, analysis pipelines and results from complementary astronomy, particle and nuclear physics sources on a broad platform that will be ultimately be hosted on the EOSC Portal.
- exploit synergies and complementarities across different communities, creating a unique link between dark matter as a fundamental science question and the Open Science ESCAPE services needed to answer it.

Extreme Universe & Gravitational waves TSP:

- do ‘frontier’ multi-messenger science to understand extreme matter and particle processes in strongly curved space-time.
- combine astronomy and e-infrastructures and focus on data organisation
- organise data from different wavelengths/messengers - and different types of extreme astrophysical transients (SNe, GRBs, FRBs, TDEs) - so that they can be easily gathered, analysed and modelled holistically, and not remain fragmented as present.

*Linked to two corresponding JENAA Eols
(with already about 1000 subscribed scientists)*



JENAS Eol: Initiative for Dark Matter in Europe and beyond: Towards facilitating communication and result sharing in the Dark Matter community (iDMEu)

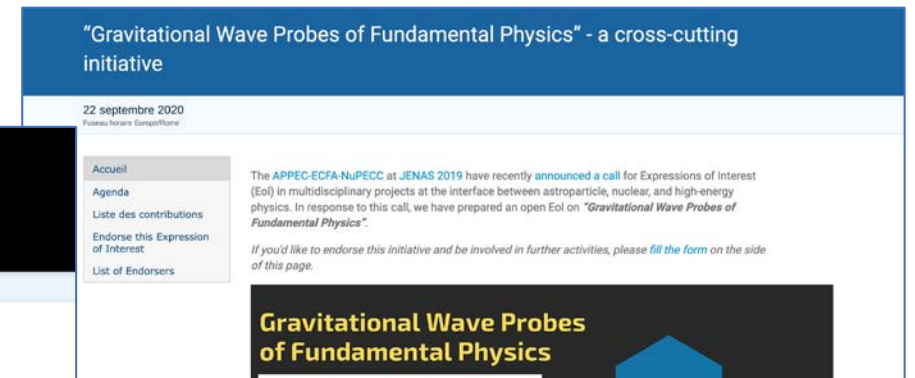
5 décembre 2019 à 30 décembre 2020
Fuséau horaire Europe/Zurich

Rechercher...

If you would like to endorse this Expression of Interest, please use the menu on the left

- Accueil
- Endorse this Expression of Interest
- Endorsers List

Following the call for Expressions of Interest by APPEC-ECFA-NuPECC at JENAS 2019 (attached below) for possible projects with interest spanning the high energy physics, astroparticle physics and nuclear physics community, we have drafted an open Eol on dark matter. The text is just below. If you'd like to endorse this initiative and be involved in further activities, please fill the form on the side of this page.



"Gravitational Wave Probes of Fundamental Physics" - a cross-cutting initiative

22 septembre 2020
Fuséau horaire Europe/Horine

Accueil

Agenda

Liste des contributions

Endorse this Expression of Interest

List of Endorsers

The APPEC-ECFA-NuPECC at JENAS 2019 have recently announced a call for Expressions of Interest (Eol) in multidisciplinary projects at the interface between astroparticle, nuclear, and high-energy physics. In response to this call, we have prepared an open Eol on "Gravitational Wave Probes of Fundamental Physics".

If you'd like to endorse this initiative and be involved in further activities, please fill the form on the side of this page.

Gravitational Wave Probes of Fundamental Physics



- Part of ESCAPE work programme is to work with PRACE and GÉANT
- Recent agreement is aligned with ESCAPE goals
- ESCAPE will collaborate on demonstrators and common aspects
 - e.g. AAI, data delivery to PRACE

SKAO Signs HPC Agreement With CERN, GÉANT, PRACE



Eckhard Elsen (top left), Director for Research and Computing at CERN; Philip Diamond (top right), SKA Director-General; Erik Huizer (bottom left), Chief Executive Officer of GÉANT; and Philippe Lavocat (bottom right), PRACE Council Vice-Chair, signed the agreement for the new collaboration.

SKA Global HQ, Wednesday 22 July – SKAO has signed a Cooperation Agreement with CERN, the European Organization for Nuclear Research; GÉANT, the pan-European network and services provider for research and education; and PRACE, the Partnership for Advanced Computing in Europe; to overcome challenges related to the use of high-performance computing (HPC) to support large, data-intensive science projects.



ESCAPE synergies

Explore, plan and support potential ESCAPE industrial engagement

- Co-developments with digital SMEs, e.g.
 - **Wavefier**: real-time Classifier for transient signals in Gravitational Waves
 - **Gamma-Learn**: real-time machine learning pipeline for Gamma-ray astronomy

- **IDEFICS** project (*Computing, Data and Businesses for Training and Innovation in Scientific Computing and for Society*)

Under the European Regional Development Fund programme, and French Regional Funds CNRS-LAPP has developed cooperation with networks of regional industrial companies, e.g. CIMES, USMBFond et al. (on data and digital uptake, deep learning training, co-developments, etc.)

- Many industrial ICT cooperation schemes (within ESCAPE ESFRI RIs)

- Outlook into the future (e.g. Horizon Europe) :

ESCAPE community proposals for EOSC connections with the Common European Data Spaces.

 - **Industrial (manufacturing), health and skills data space**
 - **Green deal and Energy data space**




Broader synergies with other research clusters



Social Sciences & Humanities Open Cloud (SSHOC)



<https://zenodo.org/record/3675081#.X2R2PJNLhTY>

ESFRI cluster projects

Position papers on expectations and
planned contributions to the EOSC



<https://zenodo.org/record/4044010#.X2oaYtaxVcs>

EOSC - a tool for enabling Open Science in Europe

The European Open Science Cloud (EOSC) will “enable a trusted, virtual, federated environment in Europe to store, share and reuse digital outputs from research (including publications, data, metadata and software) across borders and scientific disciplines”¹. Today, at the end of 2020, many building blocks are in place and on-going EOSC projects endeavour to enrich the EOSC ecosystem. To ensure strong engagement by research communities, we believe that this is the time to re-orient the EOSC activities towards higher relevance for these communities.

With the creation of the EOSC Association and the new Horizon Europe framework programme taking shape, the H2020 Science Cluster projects and the European e-infrastructures believe that efforts of the EOSC construction have now to focus on the uptake by researchers. This uptake will be the main KPI against which the success of the EOSC will be measured.

The Strategic Research and Innovation Agenda (SRIA) defines important action items to ensure rapid progress on the construction of EOSC. However, more emphasis should be placed on making EOSC user centric. User requirements should be at the heart of the next phase of the EOSC implementation.

To this aim we believe that the following points need careful consideration and reflection on how to integrate them in the EOSC roadmap:

- 1. Research-oriented services:** Our vision is an EOSC which is an inclusive and federated ecosystem based on FAIR data and other open science outputs, integrating many services such as data visualisation, analysis and physical resources to store and re-use data for open science. We expect EOSC to take up the mandate of providing the resources required for the re-use of data.
- 2. Trust based open access:** Using EOSC services must be easy, with low barriers and transparent access mechanisms. Similarly, contributions to EOSC should not be subjected to overly complex regulation. A careful balance between a top-down and bottom-up approach in the design and governance needs to be built on trust to allow for a user friendly EOSC.
- 3. Collaboration support:** The EOSC user communities, service providers and governance must closely work together to ensure that EOSC is capable of adapting to innovative emerging needs. This implies a stronger coordination of on-going and future EU funded projects and a strong participation of the user communities in the EOSC governance.
- 4. Sustainability:** The EOSC must have sustainable funding from the relevant authorities, particularly the Member States, allowing for long-term service provisioning, data preservation, and concrete support. Simple funding mechanisms which avoid complex

¹ https://www.eoscsecretariat.eu/sites/default/files/open_consultation_booklet_sria-eosc_20-july-2020.pdf



- ❑ ESCAPE brings together Astronomy, Astrophysics, Astro-Particle, High Energy and Nuclear Physics communities
 - Common interests in Exabyte-scale FAIR data management and open science
 - Objectives are science-driven (multi-messenger/multi-probe key approach) as well as commonality and synergies across infrastructure, services and tools.

- ❑ Broader synergies within a large scientific community and for innovation/society
 - Test Science Projects (TSP) to enhance researchers commitment in Open Science and building EOSC by focusing on transdisciplinary scientific objectives
 - Committing in and leveraging ESCAPE for industrial engagement in the future

- ❑ Broader synergies with the other ESFRI science cluster projects
 - All acting in concert towards the EOSC – aligned goals and common interests across a broad range of European Research actors

