



Conference

ESCAPE to the Future | 25-26 October 2022

Royal Belgian Institute of Natural Sciences | Brussels, Belgium

25 October 2022, 09:30 - 10:20

Welcome Plenary



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LAPP - CNRS-IN2P3



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ESCAPE to the Future

25-26 October 2022
Brussels, Belgium

ESCAPE, a wager and an adventure

Giovanni Lamanna

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ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 824064.



ESCAPE (ESFRI and other world-class) RIs



ESCAPE H2020 consortium



- 31 partners including 2 SMEs
- 10 ESFRI projects & landmarks: CTA, EST, FAIR, HL-LHC, KM3NeT, SKA, LSST, VIRGO, ESO, JIVE
- 2 pan-European International Organizations: CERN, ESO with their world-class established infrastructures, experiments and observatories
- 2 European Research Infrastructures: EGO and JIV-ERIC
- 1 involved initiative/infrastructure: EURO-VO
- 4 supporting European consortia: APPEC, ASTRONET, ECFA and NuPECC

- Budget: 15.98 M€
- Started: 1/2/2019
- Duration: 48 months (end date 31/1/2023)
- Coordinator: CNRS-LAPP

Connecting ESFRI infrastructures through Cluster projects

The H2020 cluster concept was aimed at supporting:

- “**Open data intensive driven science**” in order to “**rise productivity of researchers and to lead to new insights and innovation**”

The approach:

- Foster the establishment of **cross-border open innovation environment**.
- Develop **synergies and complementarity** between involved (ESFRI) research infrastructures.
- Adopt global standards and common solutions to the **data management for economies of scale**.

The scope:

- Commit in **Open Science** that means implement the **FAIRness** of scientific data
- Link the ESFRI and other world-class RIs to **EOSC**



European Open Science Cloud - EOSC

EOSC in 2018:

A concept and a political decision of the EU member states in support of “Open Science”. According to the *EOSC Declaration* :

EOSC as data infrastructure commons serving the needs of scientists and federating resources.



ESCAPE, a wager...

Common needs of ESCAPE ESFRIs:

- Astronomical observatories Nuclear/Particle physics facilities operations require global, open access to data, long term curation, and sustainability.
- Exascale data generators imply to support further the tradition of ESCAPE community as early adopters of ICT and data management innovations, pushing the state-of-the-art.

ESCAPE communities' complementary excellences in data stewardship:

- Astronomy Virtual Observatory infrastructure
- HEP expertise in large scale data management and distributed computing

Main challenges:

- Economy of scale required by common national agencies
- Bridging sociological barriers and supporting new generation researchers' aims for cross-fertilisation and interests for multi-probe fundamental research
- Building an inter-RIs virtual research environment on top of dominant RI-wise Big Science international consortia
- Combining the continuous support to the implementation of ESFRIs with a strategy to uptake the EOSC concept as well as interpreting and fostering a domain-based concept of "Open Science"



ESCAPE work programme...

... aimed at building a domain-based «EOSC-cell»

Data Lake:
Build a scalable, federated, data infrastructure as the basis of open science for the ESFRI projects within ESCAPE.



Software Repository:
Repository of "scientific software" as a major component of the "data" to be curated in EOSC.

Science Platforms:
Flexible science platforms to enable the open data analysis tailored by and for each facility as well as a global one for transversal workflows.

Citizen Science:
Open gateway for citizen science on ESCAPE data archives and ESFRI community

Virtual Observatory:
Extend the VO FAIR standards, methods and to a broader scientific context; prepare the VO to interface the large data volumes of next facilities.





EOSC



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EOSC in 2022:

« EOSC Association » legal entity established with more than 200 members, steering investments via its Task Forces and other governance structures.

Advancing Open Science to accelerate the creation of new knowledge, inspire education, spur innovation and promote accessibility and transparency.

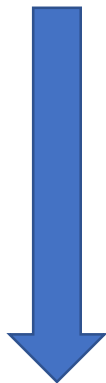
With the ambition to develop « EOSC » as a « Web of FAIR Data and services » for science in Europe.



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Initially, a step forward and an acceleration of the pan-European e-infrastructures to have a role in the “CLOUD”

In parallel, a contribution of the Science Clusters, in cooperation with the ESFRI-EC-EOSC task force, to focus on the scientific content and usefulness of EOSC for researchers and RIs.

EOSC ecosystem still dominated by computing despite the dominant participation of Universities and Research Institutes in the EOSC Association
-> Still a fundamental role of the Science Clusters such as ESCAPE in EOSC

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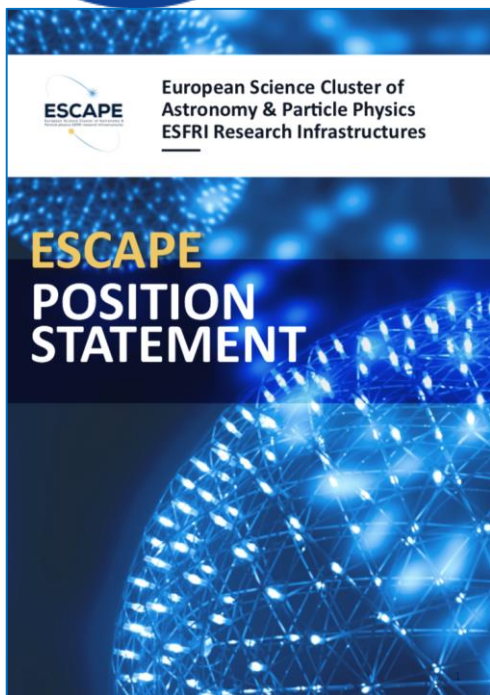
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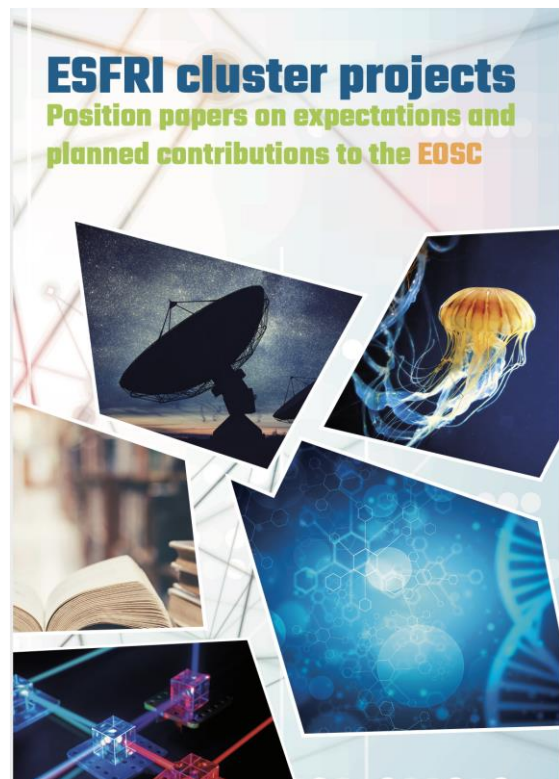


ESCAPE, an adventure...

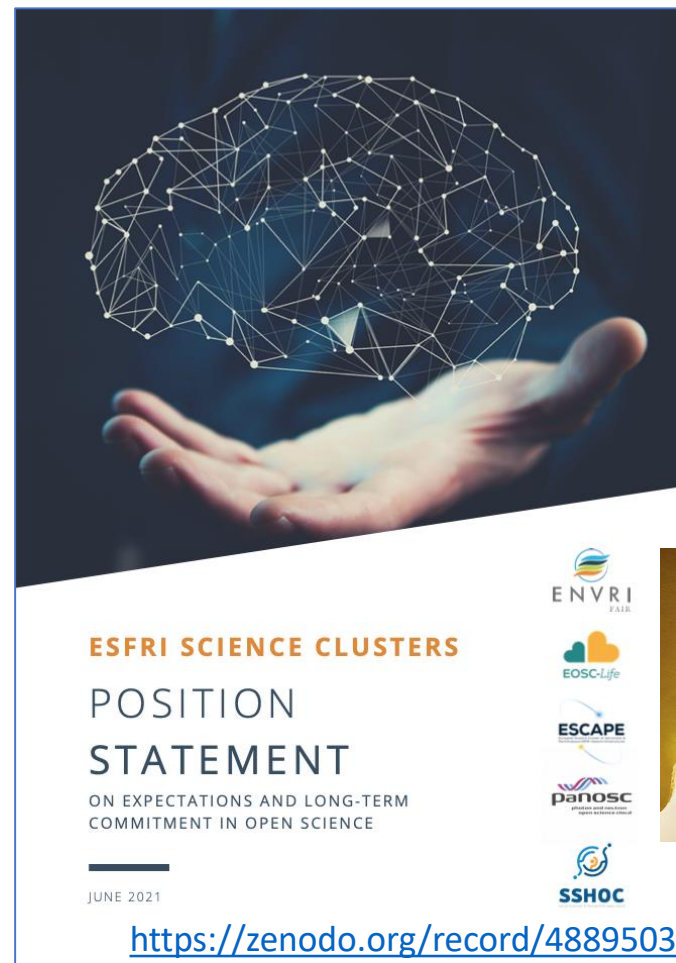
An exceptional human adventure such as the fruitful collaboration between the 5 SCLs



https://www.projectescape.eu/sites/default/files/Escape_position_statement_web.pdf



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



<https://zenodo.org/record/4889503>



<https://indico.in2p3.fr/event/24327/>





ESCAPE, an adventure...

An exceptional human adventure such as the one experienced by our successful training event online during the COVID-19 pandemic as well as during many more training actions and collaborative works



ESCAPE Summer School 2021

 **1000**

Participants from all over the world

Videos with

 **2.8k**

views

 **302**

Certificates provided

 **375**

Registrations on Exam Platform



ESCAPE, an adventure...

Acknowledged as an example of a real synergistic cooperation scheme in the 2020 European Strategy for Particle Physics

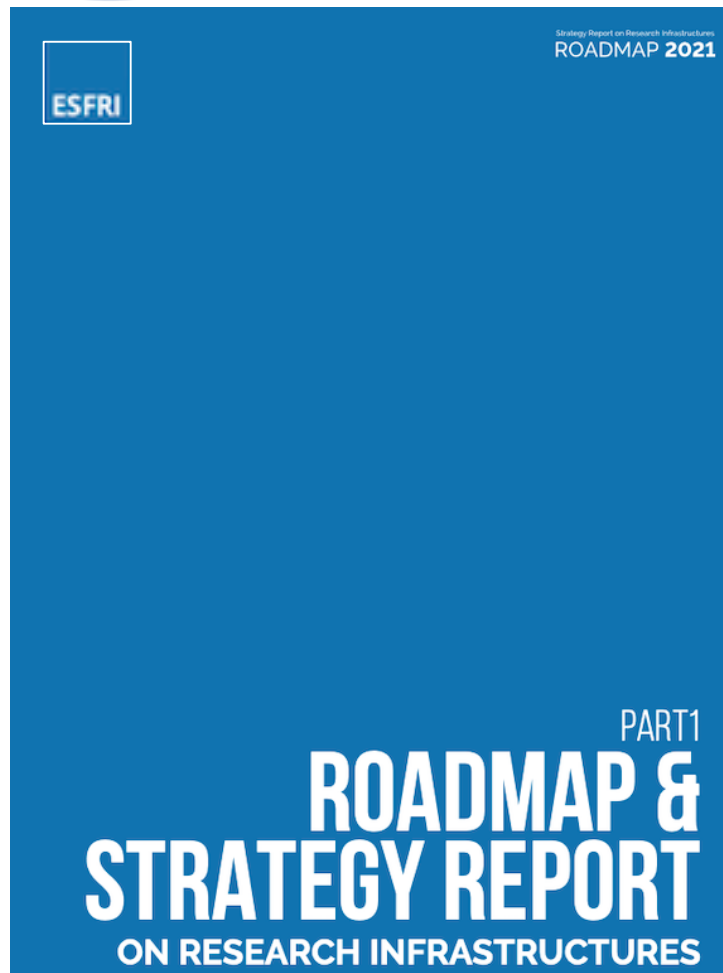
Deliberation Document on the 2020 update of the European Strategy for Particle Physics



The scientific outcomes of particle physics experiments are made possible by the development of an efficient computing and software infrastructure. Computing and software are profound R&D topics in their own right and are essential to sustain and enhance particle physics research capabilities. There is a need for strong community-wide coordination for computing and software R&D activities, and for the development of common coordinating structures that will promote coherence in these activities, long-term planning and effective means of exploiting synergies with other disciplines and industry. Some recently initiated examples are the HEP Software Foundation addressing the common computing and software challenges related to particle physics, and ESCAPE (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) exploring the synergies in the areas of astronomy, astroparticle and accelerator-based particle physics.



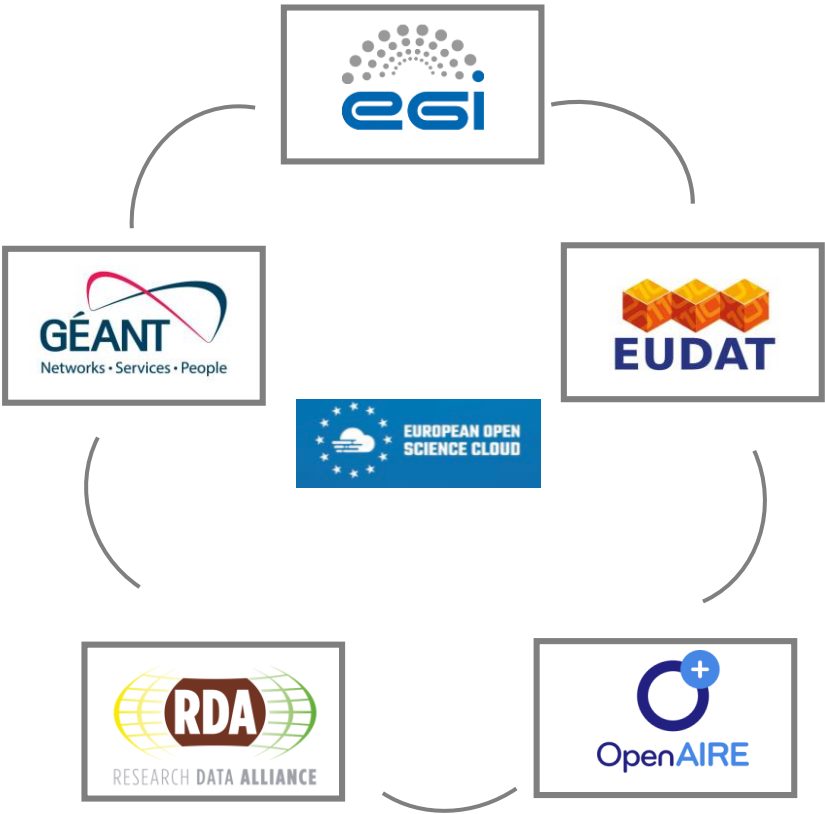
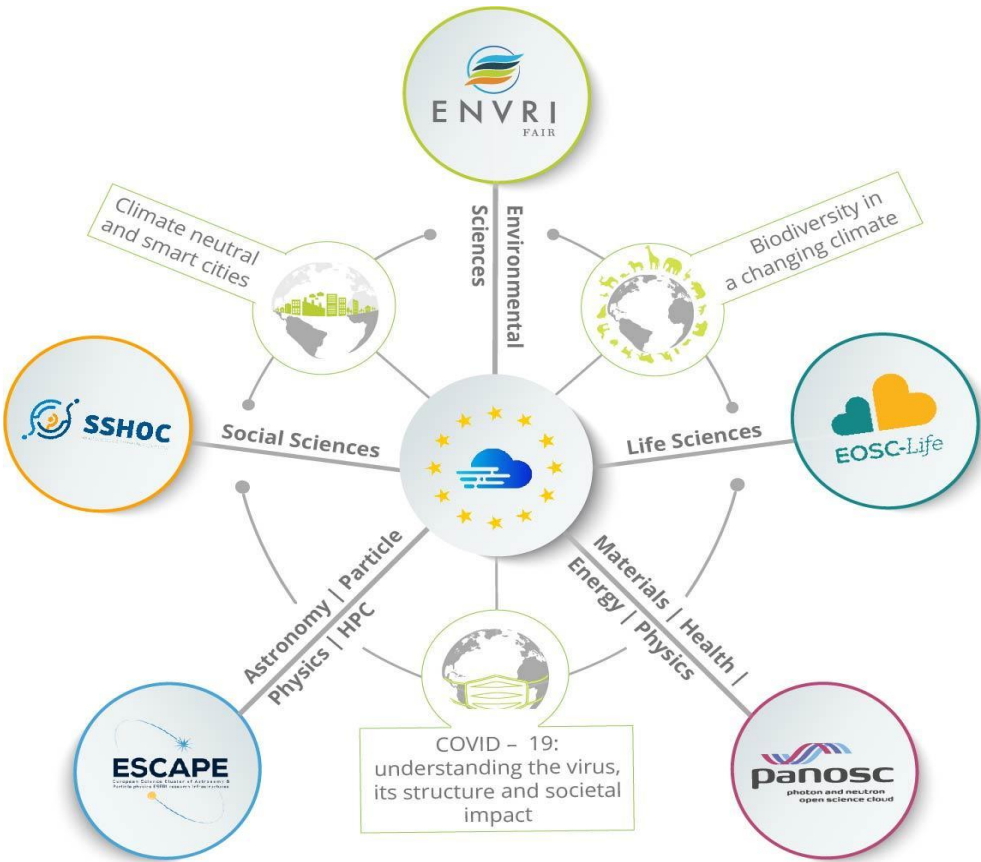
ESCAPE, an adventure...



Acknowledged as a successful approach in “Making Science Happen”, “Consolidation of The European RI Landscape” as well as an example of scheme for new coordinated focus by ESFRI.



Fostering synergies in EOSC Future
between Science Clusters & e-infrastructures



Strengthening multidisciplinary collaborations
among young researchers on open-science projects

First set of Open Science Pilot Projects proposed to demonstrate multi-domain science integration across ESCAPE

- demonstrate new cutting edge open science capabilities, making use of the services implemented within 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)

1. Dark Matter Science Project
2. Extreme Universe (& Gravitational waves) Science Project



ESCAPE part:
about 2 M€
250 PMs
10 institutes





ESCAPE workshop programme

Day 1st

● *Session about ESCAPE results*

● *Panel Discussion*

The valuable return of investment of the H2020 ESCAPE project and the rationale for a long-term engagement of the astrophysics and particle physics community in the ERA

Day 2nd

● *Session about Open Science Projects: Current and future*

● *Panel Discussion:*

Science clusters and the EOSC Association: cooperation and new challenges



Thank you



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Open Science Technical Challenges

Ian Bird; CNRS-LAPP

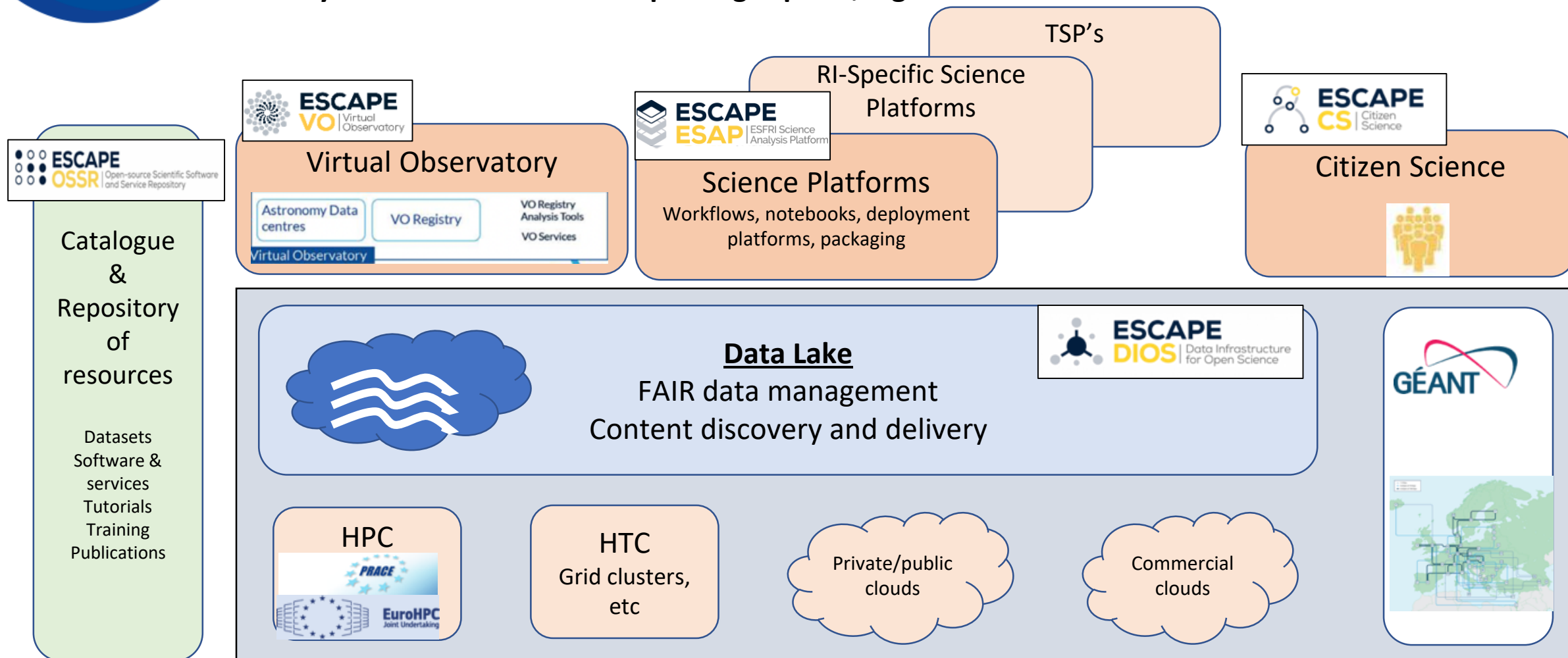


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ESCAPE: "EOSC cell"

- Envisage ESCAPE services moving into the EOSC-Exchange layer
- Rely on EOSC-Core for underpinning aspects, e.g. AAI



High Level Key project results

- Prototyped a full Exabyte-scale Data Management (Storage, Transfer and Access) Service with common AAI framework for distributed scientific computing;
 - validated by ESFRIs through Data Challenges
- Developed a catalogue to publish digital scientific products of ESCAPE communities;
 - onboarded into EOSC portal
- Developed interoperability standards for astronomical data services; Enables a *Virtual Research Environment* of interoperable tools and services based on IVOA standards
 - VO services prepared to be integrated with EOSC
- Produced a reusable analysis toolkit for integrating diverse service offerings, and a Virtual Research Environment prototype that integrates ESCAPE services
 - A number of RI's using tools in their analysis frameworks
- Developed and produced training materials/schemes, and ran a number of highly successful schools and workshops
- Several Citizen Science projects built upon ESCAPE developments, and attracted significant interest/involvement
- Dark Matter and Extreme Universe Science Projects as demonstrations of Open Science in ESCAPE
 - and integration with EOSC platform through EOSC-Future

How does ESCAPE contribute to EOSC?

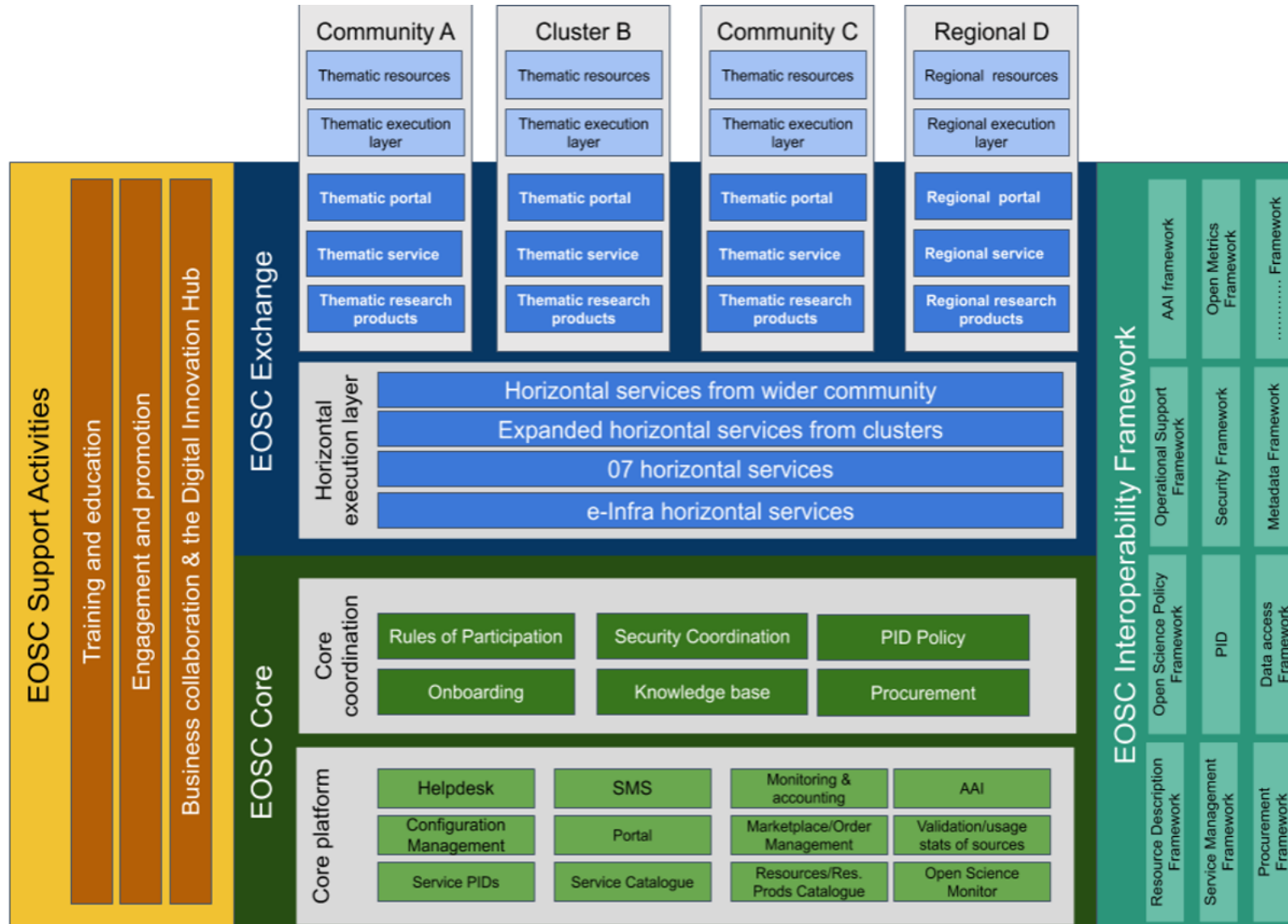
Within EOSC-Future: (until end 2023)

- Share ESCAPE products through EOSC, enable re-use, broader exploitation, encourage Open Science and FAIR data
- Science projects (TSPs on Dark Matter and Extreme Universe) as demonstrators of cross-domain science, and validators of EOSC
- Integrate EOSC services (core and Exchange) with ESCAPE services to add value
- Contribute to technical architecture of EOSC; ensure appropriateness

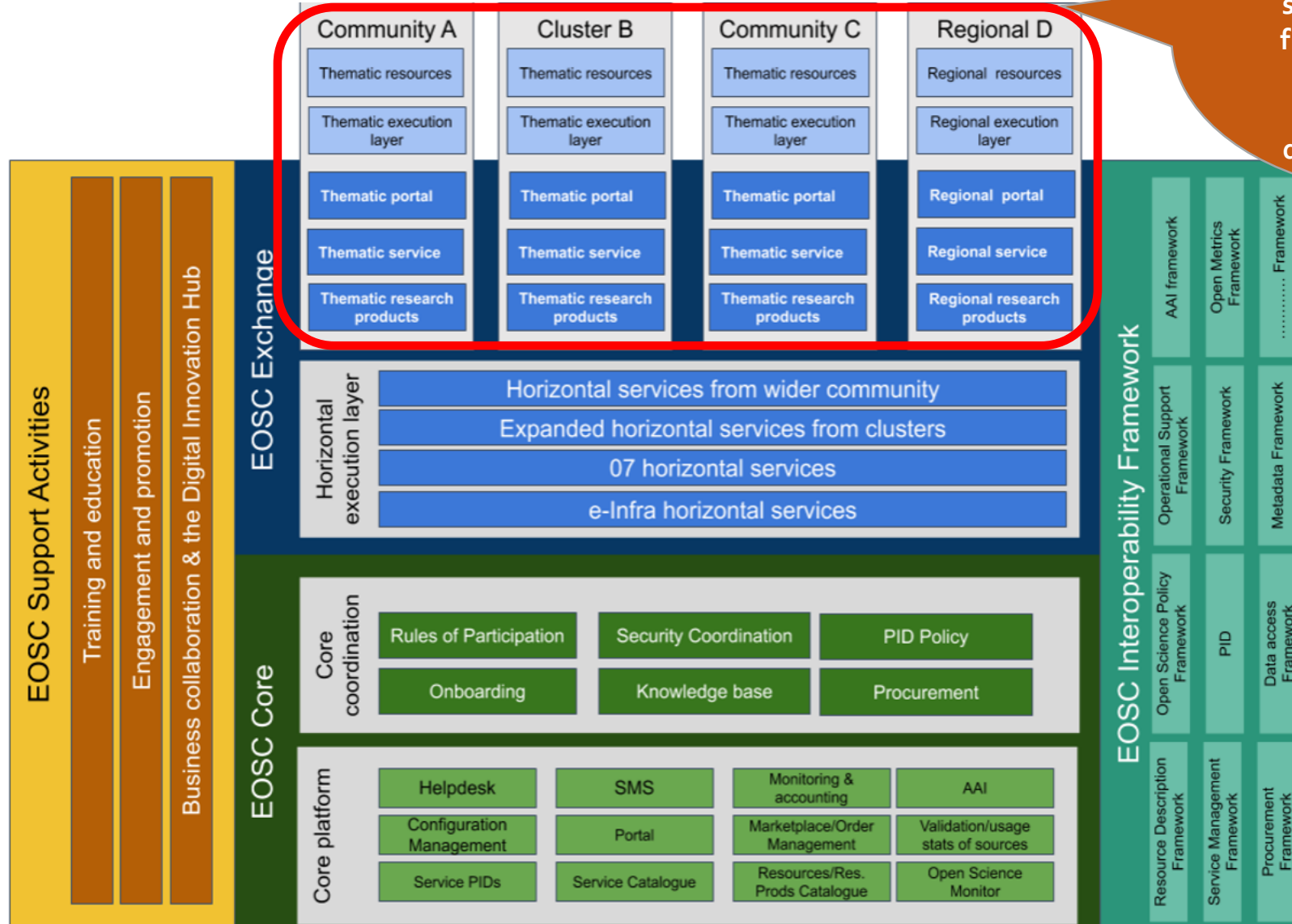
With clusters: (2023 - 2025?)

- Prepare next generation of projects for:
 - Cluster consolidation and specific Open Science projects
 - Software quality, training, career development, etc.

EOSC Architecture – Federation model



EOSC Architecture – Federation model

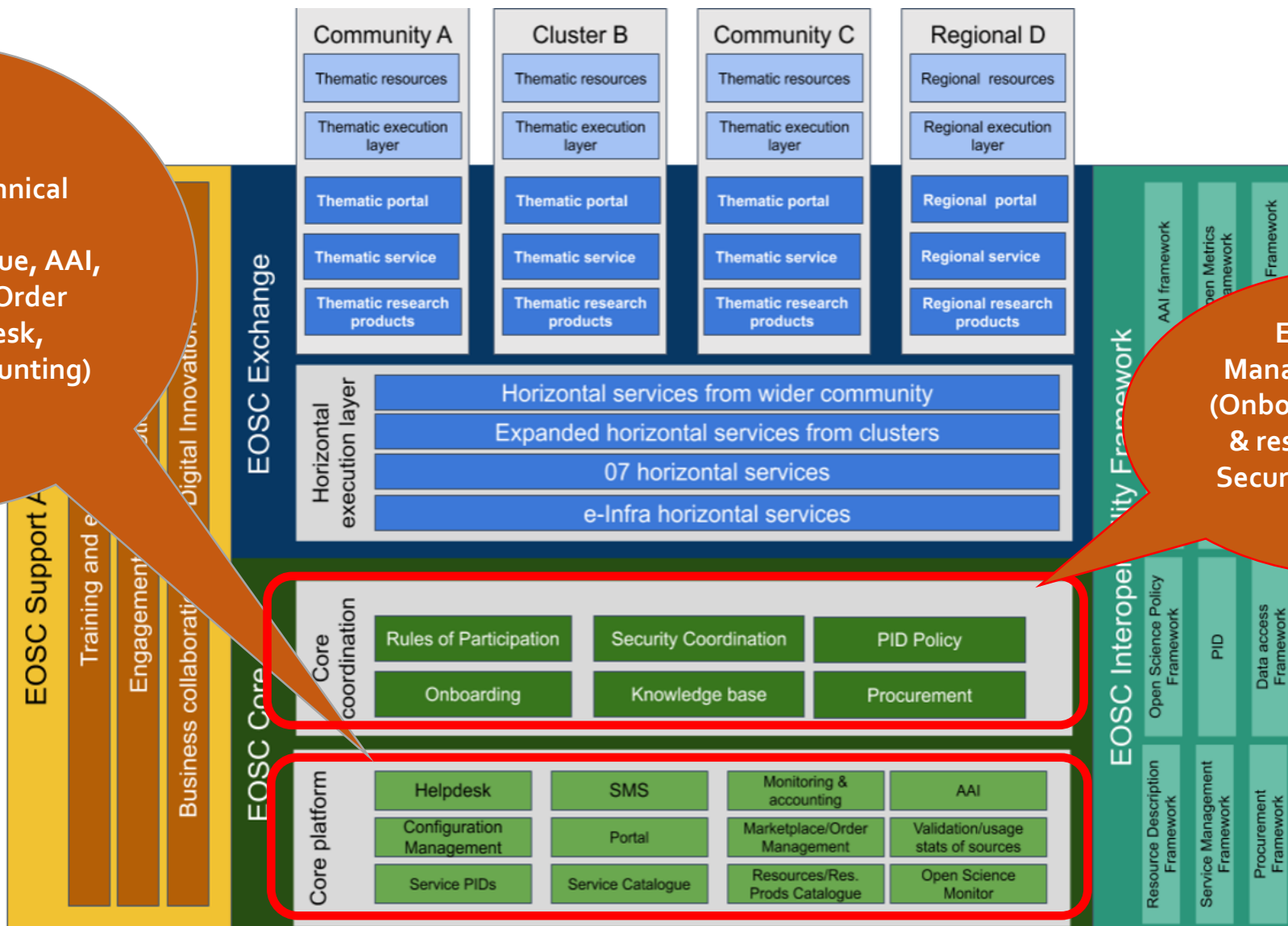


Science communities & researchers, use services & resources from EOSC, but also have higher level specific services & dedicated resources

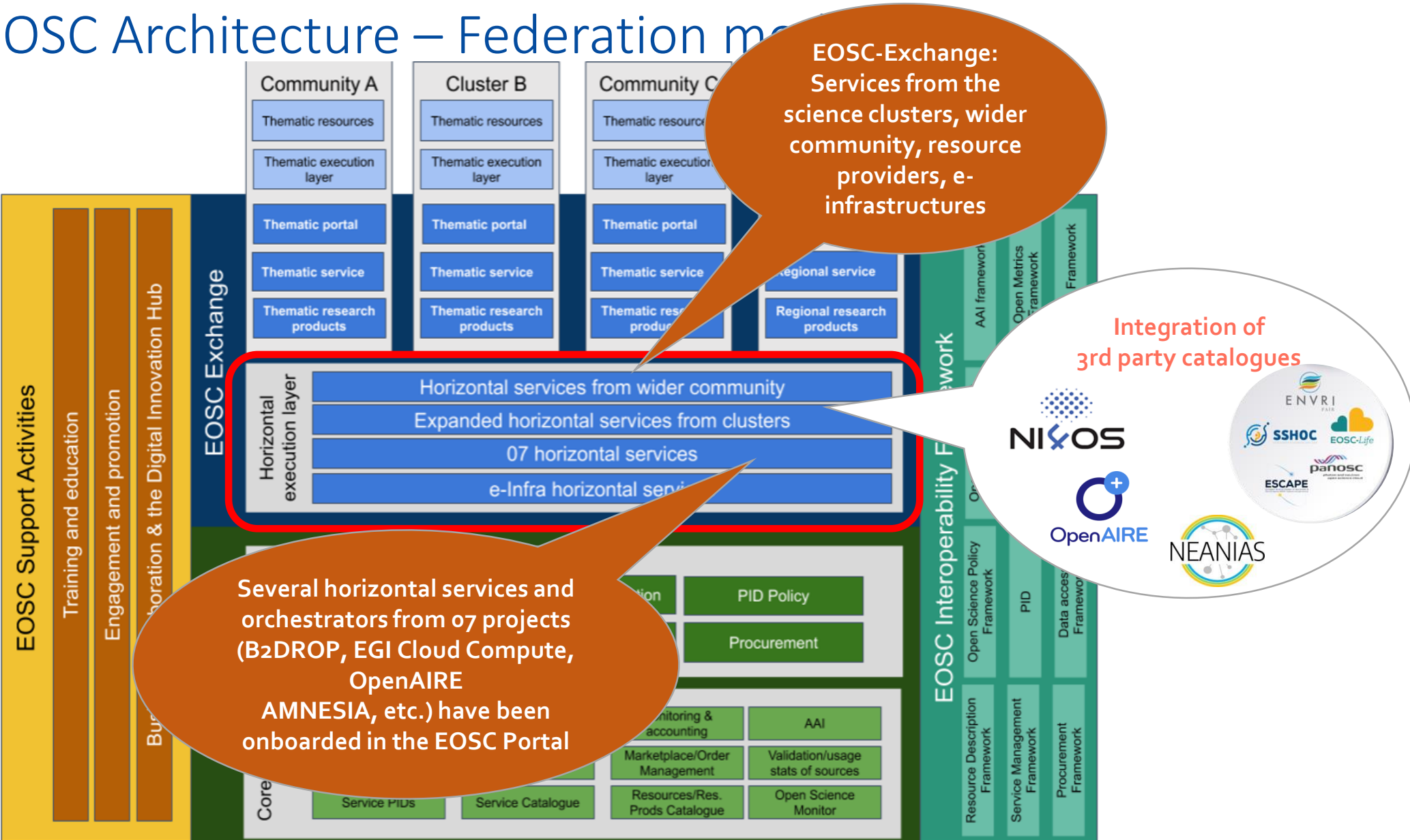
EOSC Architecture – Federation model

EOSC-Core Technical Platform
(Resource Catalogue, AAI, Marketplace & Order mgmt, Helpdesk, Monitoring, Accounting)

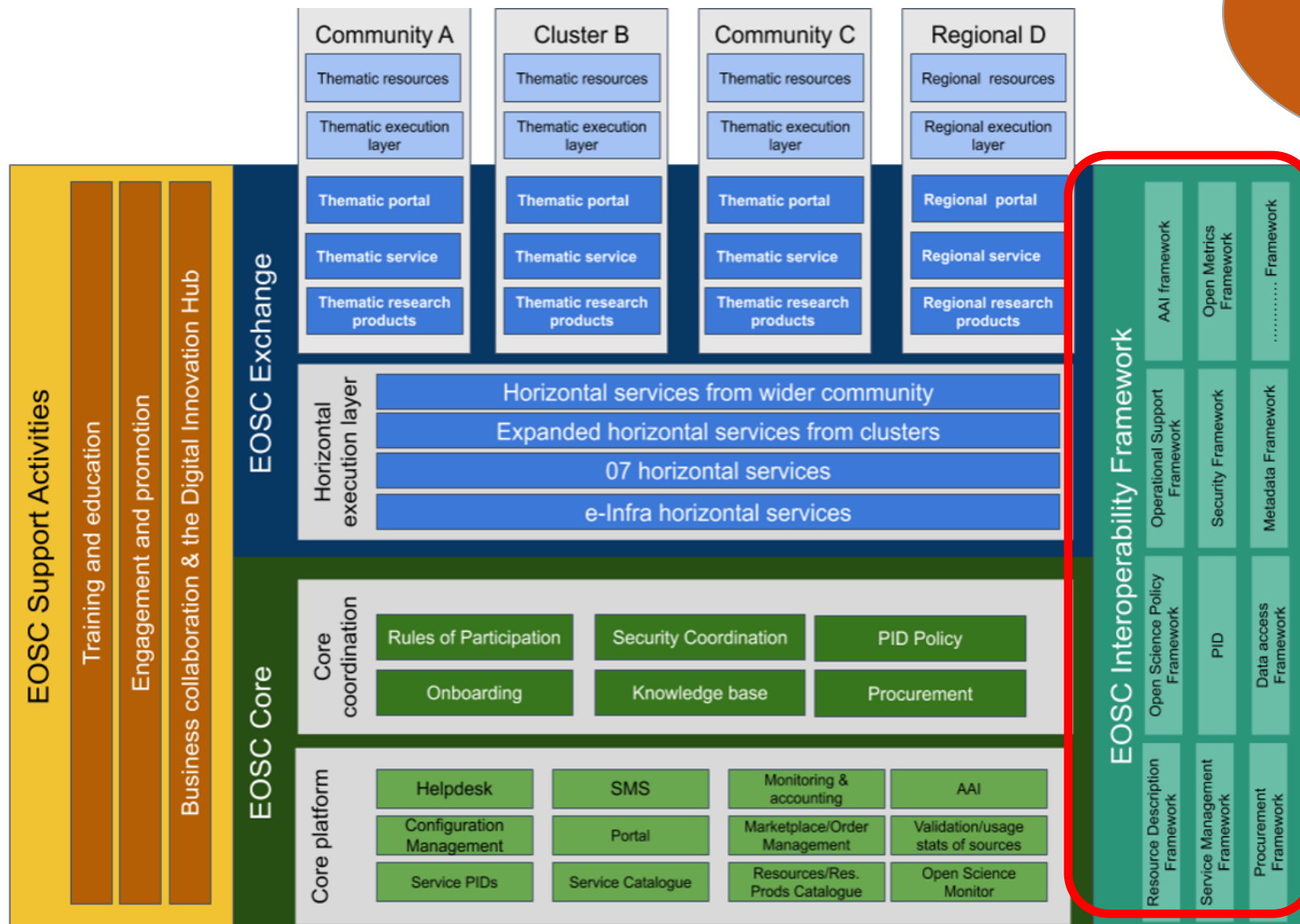
EOSC Service Management System
(Onboarding of services & research products, Security Coordination, etc.)



EOSC Architecture – Federation model



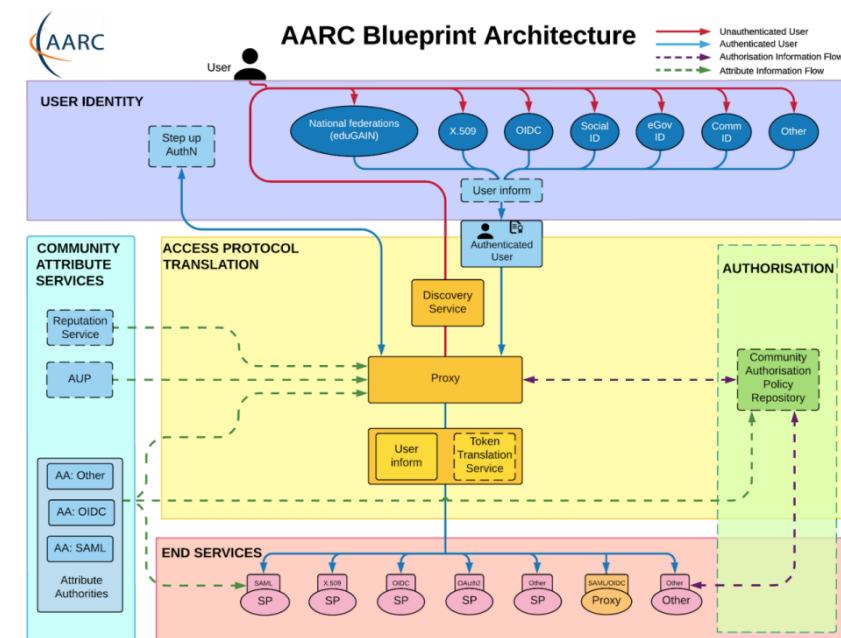
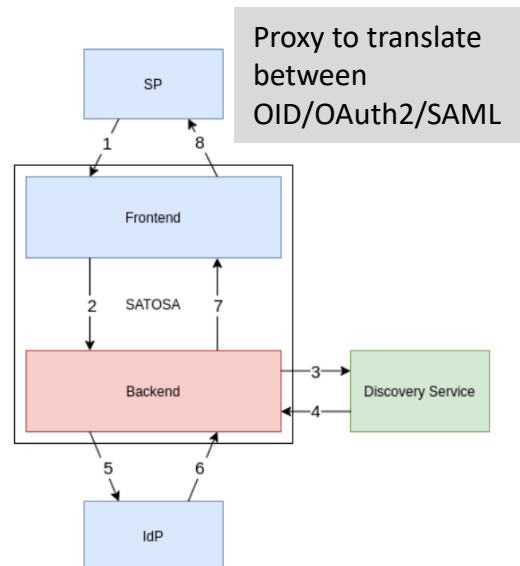
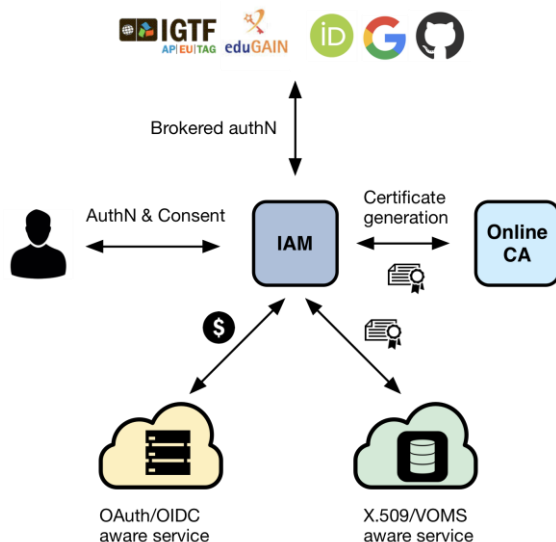
EOSC Architecture – Federation model



EOSC-Core Interoperability Guidelines available (Resource Catalogue, AAI, Monitoring, etc.)

Exploitation of ESCAPE through EOSC (-Future) - 1

- ESCAPE AAI (IAM) is now part of the EOSC AAI federation
- An additional proxy was required, now in place and tested
- Today we can do 1-1 interactions, e.g. ESCAPE users can use EGI resources;
- 1-many requires further development (**each cluster AAI must implement**); pending agreement on specifications



Exploitation of ESCAPE through EOSC (-Future) - 2

Self contained Open Science objects:

1. OSSR → has been onboarded into [EOSC Explorer](#)
 - Need the new Provider Dashboard to complete the integration into the Marketplace (M18 release of EOSC-Future @ Oct 20)
 - This is scalable for ESCAPE – if we put ESCAPE products into OSSR will automatically be visible in EOSC Marketplace
 - **ESCAPE Action: publish ESCAPE tools into OSSR**
2. Virtual Observatory – data and tools
3. HEP Open Data portal
- Both of these are complete services, providing data, tools, software, tutorials, etc.
 - **ESCAPE Action: they need to be onboarded** from the [Provider area of the EOSC portal](#) & following the process



Integration of ESCAPE with EOSC Core services

- Core services:
 - AAI (see above), Helpdesk, Accounting, Monitoring
- Helpdesk: ESCAPE strategy
 - Create support units for TSPs
 - Integrate RI helpdesks with EOSC helpdesk (same model as WLCG GGUS, etc.)
 - New RI's: set up independent helpdesk and integrate OR use EOSC to create support units
- Monitoring & Accounting
 - Some RIs have full Monitoring/Accounting services
 - Need to connect to exchange info about what is used (e.g. EOSC-funded resources)
 - New RIs can use EOSC core service (or implement their own)
 - Also for services we onboard (e.g. OSSR etc), monitor/account accesses via EOSC etc.

Use of Exchange Services

- Resources – compute & storage: integration being tested
 - ❑ Made available via EGI-ACE, but use ESCAPE/EOSC AAI to access
 - ❑ Resources for ESCAPE provisioned at INFN
 - ❑ need to combine use of ESCAPE/RI resources and “EOSC” resources
 - ❑ Want to e.g. use cloud storage as part of DL too
 - ❑ ESCAPE storage provisioned at CESNET
- We would welcome a common notebook service,
 - that integrates backend compute and storage

Deployment of SPs in EOSC (-Future)

● Start to deploy some parts of sub-TSP projects on EOSC resources

❑ Example:

- ❑ data in the ESCAPE data lake (DL),
- ❑ run compute on EGI-ACE cloud resources;
- ❑ move data between DL and compute, transparently, with single credential
- ❑ Integrate use of HPC (with FENIX) to relevant workflows
- ❑ Demonstrate full workflows combining ESCAPE and EOSC services and resources, including use of appropriate core services
- ❑ Publish scientific outputs (software, algorithms, data, publications) into EOSC (via ESCAPE services like OSSR, data portals, Zenodo, etc.)

➤ A clear goal is to have these pieces ready to demo at EOSC-Future M18 Review

What can ESCAPE bring to EOSC?

- ESCAPE represents a broad set of communities, with significant technical requirements and expertise:
- Exabyte-scale data management: expertise accumulated over 20 years and evolved/validated in ESCAPE to be ready for next generation of Exabyte data generating experiments
 - HL-LHC & SKA >> Exabyte/year; others few PB – 100 PB/year
- Globally federated compute infrastructures
- Long term expertise in reliable operation & support of federated infrastructures
- Expertise & experience in all aspects of collaborative software & computing;
 - focus on performance, efficiency etc. Relevant for energy efficiency
 - Initiatives on career development, training, etc for software and computing *scientists*

ESCAPE Partners contributed to many EOSC Task Forces

- Researcher Engagement and Adoption
 - Mark Allen (CNRS)
- Semantic Interoperability
 - Marco Molinaro (INAF)
- Rules of Participation Compliance Monitoring
 - Jose Fernando (CERN), Luciano Gaido (INFN)
- Upskilling Countries to Engage in EOSC
 - Daniele Bonacorsi (INFN)
- Infrastructures for Quality Research Software
 - Kay Graf (ECAP), Jose Gonzales Lopez (CERN)
- Technical Interoperability of Data & Services
 - Tommaso Boccali (INFN), Gonzalo Merino (CIEMAT), Jakub Moscicki (CERN)
- Financial Stability
 - Silvana Muscella (Trust-IT), Bob Jones (CERN)
- Long Term Data Preservation
 - Sabine Crepe-Renaudin (IN2P3), Gerardo Ganis (CERN)

- ESCAPE has successfully delivered on its technical objectives
- Synergy between our communities will continue in the new Collaboration
- Integration into EOSC is proceeding, with specific objectives
- The DM and EU science projects will validate ESCAPE capability for Open & cross-RI science in an EOSC environment
- Together with other Science Clusters we must ensure the technical direction of EOSC helps deliver Open Science



Thank you