

European Open Science Cloud (EOSC)

Involvement and implications for IN2P3

Ian Bird; LAPP
23/06/2022



The European Open Science Cloud (EOSC) is an environment for hosting and processing research data to support EU science.

The ambition of the European Open Science Cloud (EOSC) is to provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and re-use data, tools and services for research, innovation and educational purposes.

This environment will operate under well-defined conditions to ensure trust and safeguard the public interest.

The EOSC enables a step change across scientific communities and research infrastructures towards

- seamless access
- FAIR (Findability, Accessibility, Interoperability and Reusability) management
- reliable reuse of research data and all other digital objects produced along the research life cycle (e.g. methods, software and publications)

EOSC ultimately aims to develop a **Web of FAIR Data and services** for science in Europe upon which a wide range of value-added services can be built. These range from visualisation and analytics to long-term information preservation or the monitoring of the uptake of open science practices.

The EOSC is recognised by the Council of the European Union as [the pilot action to deepen the new European Research Area](#) (ERA). It is also recognised as the science, research and innovation data space which will be fully articulated with the other sectoral data spaces defined in the [European strategy for data](#).

Full deployment of the EOSC will lead to higher research productivity, new insights and innovations, as well as improved reproducibility and trust in science.

Free at the
point of use



INITIAL DEVELOPMENT OF EOSC

- Since 2015 several precursor projects were funded in Horizon 2020 to explore different aspects of EOSC and Open Science
- These have covered different scopes:
 - Thematic: science clusters, in particular ESCAPE for IN2P3
 - Regional: initiatives to federate various national open science efforts; EOSC-Pillar includes France/IN2P3
 - Topical: addressing specific aspects of EOSC; EOSC-Enhance, EOSC-hub, EOSC-Pilot

- EOSC-Pilot supported first EOSC development phase
 - Objectives were:
 - Propose and test governance frameworks for EOSC, contribute to development of European open science policy and best practice;
 - Develop pilots that integrated services and infrastructures to show interoperability and benefits in a number of scientific domains; and
 - Engage with stakeholders, across borders and communities.
 - Outputs: included a recommendation on EOSC architecture, and a roadmap for a service portfolio, used as input to EOSC Executive Board working groups.
 - Had 15 science pilots on specific Open Science topics in 8 domains
 - IN2P3 involved, WP lead



Social Sciences and Humanities



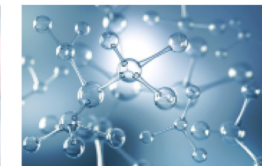
Generic Technology



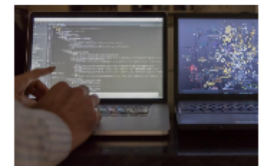
Physical Sciences / Astronomy



Physics / Materials Science



High Energy Physics



Energy Research



Life Sciences and Health Research



Environmental & Earth Sciences

- EOSC-Hub ran from 2018 until December 2020, to
 - build a service catalogue to simplify access to a range of products, resources, and services coming from the pan-European and international organisations,
 - encourage adoption of standards for interoperability of compute, storage, data and software.
 - consolidate existing e-infrastructures, expanding capacity and improving services, as well as broadening the access to researchers, educators, business
 - It also built on work of previous projects (EGI, EUDAT, INDIGO-DataCloud, etc.) & RIs
- The project developed
 - the initial EOSC portal and marketplace, and a
 - platform for industrial collaborations with EOSC - the Digital Innovation Hub
- It also developed a number of aspects that are picked up in the EOSC-Future project as enablers of the EOSC structure, including:

IN2P3 partner in EOSC-hub



EOSC Portal and Marketplace



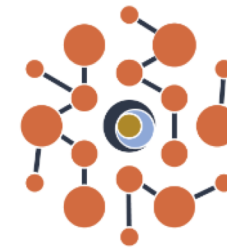
Services Management System



Rules of Participation



Internal services in the Hub portfolio




Services in the EOSC Services Portfolio




EOSC Portal Training materials

Updated video tutorials and training materials on the different Features of the EOSC Portal for end-users and resource providers.



EOSC Portal APIs

The EOSC Portal Application Programming Interface (API) enables Providers to update their profiles with all the resources they offer, allowing them to retrieve content from EOSC Portal.




EOSC Portal Onboarding Process

Integration and improvement of the existing procedures to onboard Providers and Services into the EOSC Portal, in collaboration with EOSC-hub and EOSC Future.




EOSC Portal Providers platform

Making life easier for the growing number of EOSC service providers willing to become an active part of the EOSC community, thanks to a better interface and a more consistent integration with existing platforms.




EOSC Portal Profiles

Specifications that define common data models for EOSC entities and related taxonomies.



EOSC Portal Marketplace

A user-friendly marketplace interface showcasing the resources included in the Catalogue, which are searchable and filterable by scientific domain, provider, dedicated user group, related infrastructure, and rating.



EOSC Portal Catalogue of resources

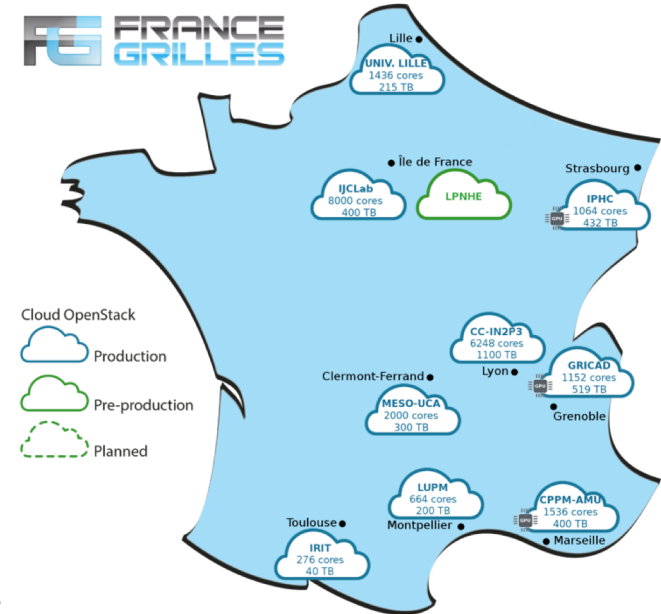
A single Catalogue initially resulting from the migration and merging of previously existing EOSC Resources. The Catalogue is constantly expanding and currently welcoming new resources.

- EOSC-Enhance ran from Dec 2019 to Nov 2021;

IN2P3 partner in EOSC-Enhance, development of portal and catalogue

- Goals were:
 - improve and enhance the discoverability of scientific services and data resources, by
 - developing and widening the EOSC catalogue,
 - through the integration of additional services and data resources & technical enhancement of the functionalities for service providers and users

- EOSC-Pillar is a regional initiative (France, Germany, Italy, Austria, Belgium), funded as part of INFRAEOSC-5b call
 - To support coordination and harmonization of national initiatives relevant to EOSC
 - Help integrate initiatives & providers through common policies and tools
 - Help user communities to use services and develop new
 - Stakeholders are research infrastructures, universities, e-infrastructures, SMEs
 - IN2P3 leads the delivery of infrastructure layer (storage & compute), and transnational access; CINES leads overall technical management
- Part of a collaboration and joint activity plan with the other regional projects:
 - EOSC-Nordic, NI4OS-Europe, EOSC-Synergy, and ExPaNDS together with FAIRsFAIR and EOSCsecretariat



Work in e-infrastructures, at international and National level also built up the basis of the technical and policy foundation for the EOSC

IN2P3 in EGI Council & executive Board,
France-Grilles is EGI federated partner

Scientific Communities within EOSC

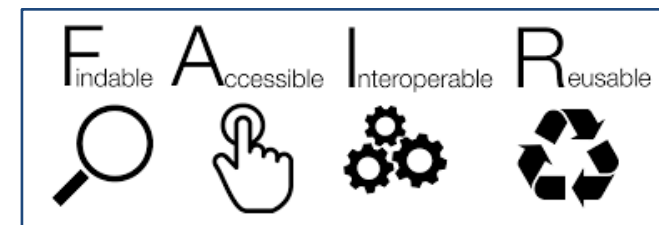
SCIENCE CLUSTERS

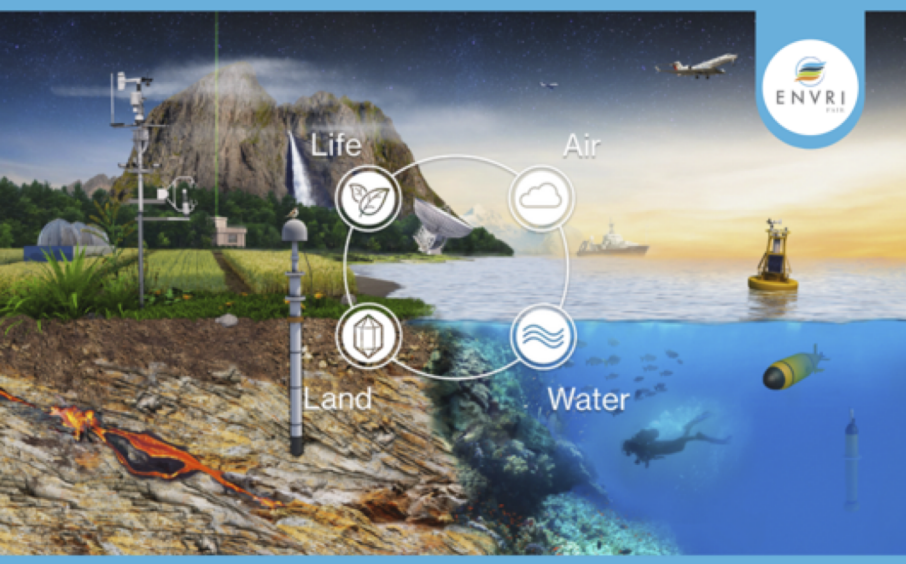
Science Clusters of Research Infrastructures (RIs) proposed in 2018 in response to a dedicated H2020 call.
Five Science Clusters to ensure the connection of the ESFRI RIs with European Open Science Cloud (EOSC).

Expected impact:

- *Improve access to data and tools leading to new insights and innovation*
- *Facilitate access of researchers to data and resources for data driven science.*
- *Create a cross-border open innovation environment.*
- *Rise the efficiency and productivity of researchers through open data services and infrastructures for discovering, accessing, and reusing data.*
- *Foster the establishment of global standards.*
- *Develop synergies and complementarity between involved research infrastructures.*
- *Adopt common approaches to the data management for economies of scale.*

Working together to make data FAIR ...





Five thematic Science Clusters



More than 80% of ESFRI RIs, plus other world-class RIs and new emerging ones.

CNRS involvement in ENVRI-FAIR, SSHOC, PANOSC, EOSC-Life (via Elixir), IN2P3 leads ESCAPE



Next generation data infrastructure

Being prototyped in the ESCAPE project



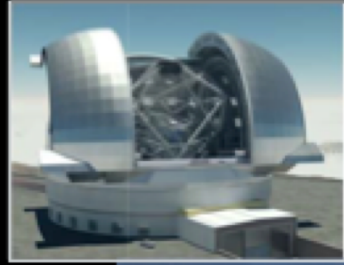
Radio



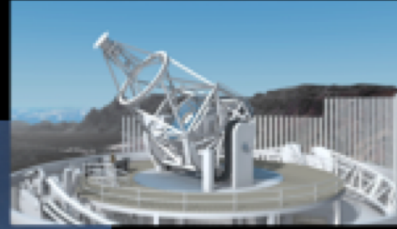
SKA

JIVE-VLBI

Visible light



ELT

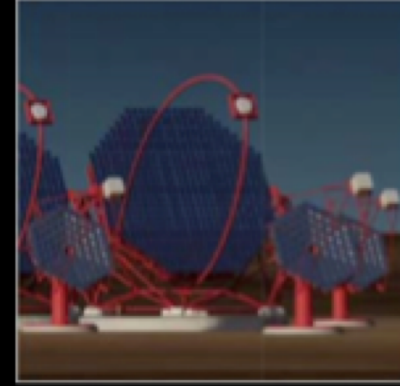


EST



ESO

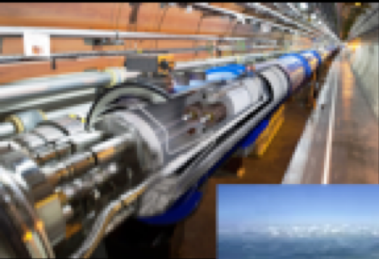
Gamma rays



CTA

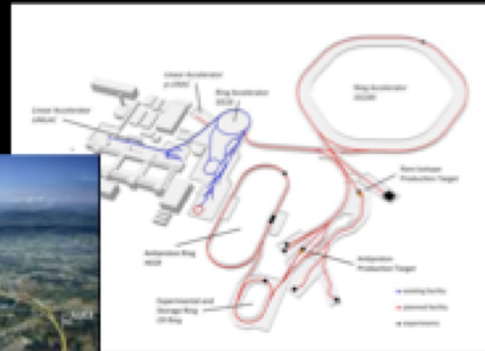


Accelerator-based Particle Physics



HL-LHC

Accelerator-based Nuclear Physics



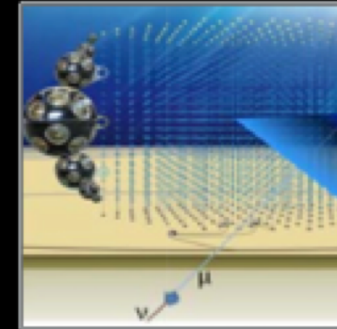
FAIR

Gravitational Waves



EGO-VIRGO

Cosmic-rays Neutrinos



KM3NeT



CERN

The ESCAPE cluster comprises world-class research facilities in astronomy and particle physics. ELT, CTA, SKA, KM3NeT, EST, HL-LHC, FAIR, JIVE-ERIC, LSST, EGO-Virgo.

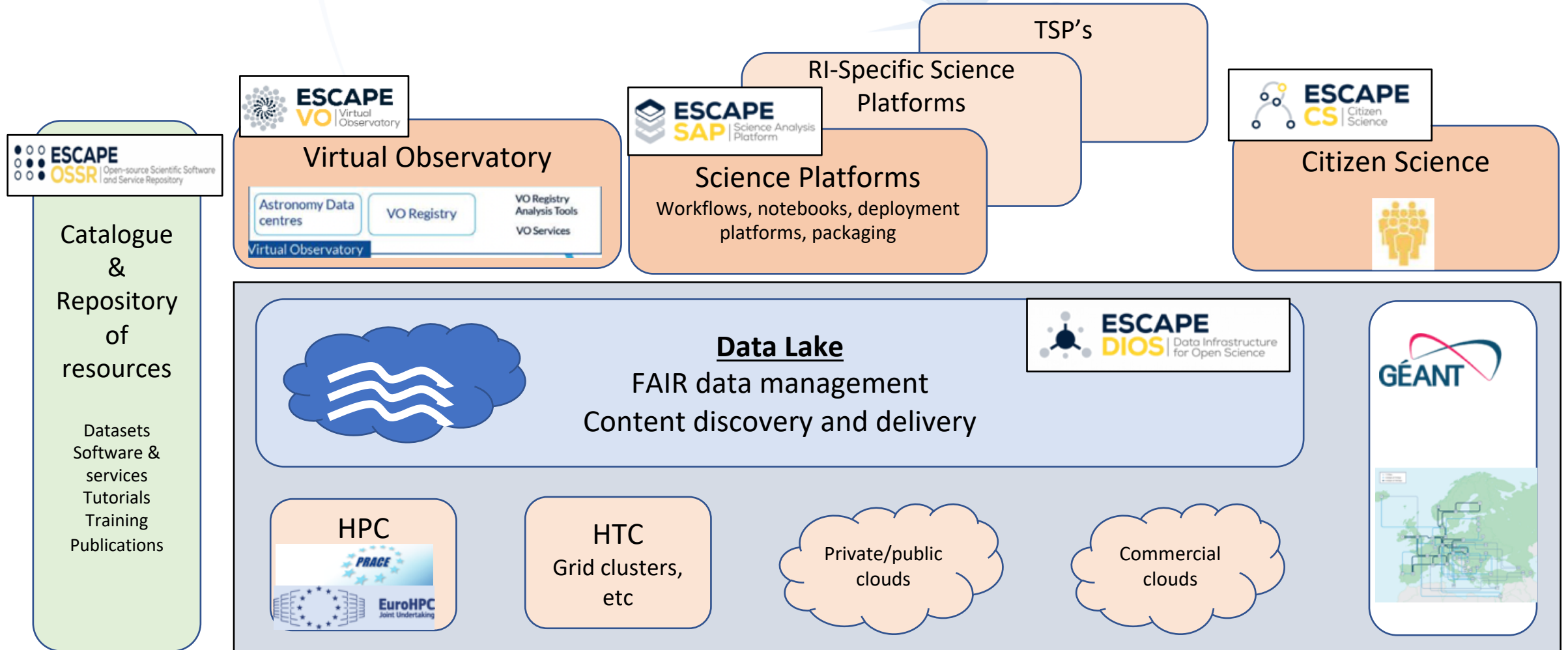
ESFRI and other large RIs in ESCAPE

IN2P3 is Project Lead, & technical coordination; CNRS leads VO WP; IN2P3 contributes to all WP, and through most RIs

Promoting, implementing and committing to *Open Science*

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

ESCAPE EOSC cell



Integrators: Cross-cutting Science Projects

☐ Dark Matter:

- 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 ESCAPE Open Science services needed to answer it

☐ Extreme Universe:

- 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

IN2P3 involvement:

Through all science sub-projects in both DM and EU

Also coordination & deployment of SPs in EOSC-Future

*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/Rome

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".

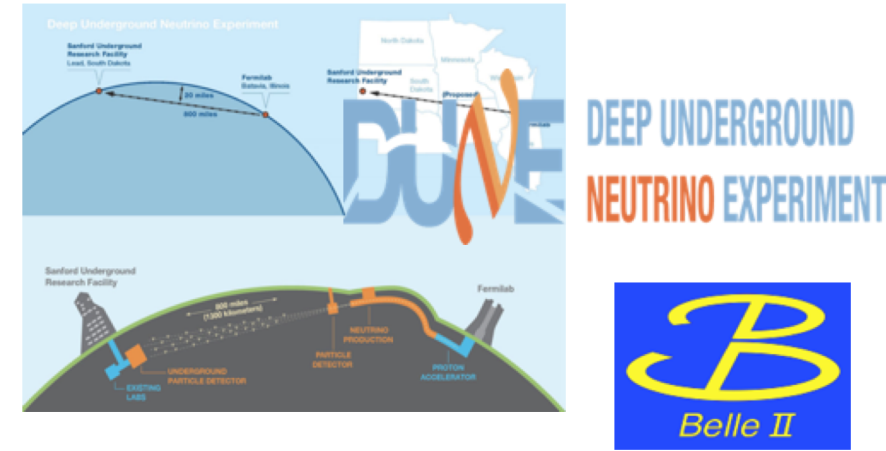
If you'd like to endorse this initiative and be involved in further activities, please fill the form on the side of this page.

Gravitational Wave Probes of Fundamental Physics



The 2020 European Strategy

D. Large-scale data-intensive software and computing infrastructures are an essential ingredient to particle physics research programmes. The community faces major challenges in this area, notably with a view to the HL-LHC. As a result, the software and computing models used in particle physics research must evolve to meet the future needs of the field. **The community must vigorously pursue common, coordinated R&D efforts in collaboration with other fields of science and industry, to develop software and computing infrastructures that exploit recent advances in information technology and data science. Further development of internal policies on open data and data preservation should be encouraged, and an adequate level of resources invested in their implementation.**



Astroparticle Physics European Consortium (APPEC)

APPEC Contribution to the European Particle Physics Strategy

December 17, 2018

Editorial Board:
S. Katsanevas, A. Masiero, T. Montaruli, J. de Kleuver, A. Haungs

Contact Person:
T. Montaruli (APPEC Chair from Jan. 1, 2019)
Email: teresa.montaruli@unige.ch
Website: <http://www.appec.org>



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.

B. The particle physics community and the European Commission have a strong record of collaboration. The relationship between the particle physics community and the European Commission should be further strengthened, exploring funding-mechanism opportunities for the realisation of infrastructure projects and R&D programmes in cooperation with other fields of science and industry.

C. European science policy is quickly moving towards Open Science, which promotes and accelerates the sharing of scientific knowledge with the community at large. Particle physics has been a pioneer in several aspects of Open Science. The particle physics community should work with the relevant authorities to help shape the emerging consensus on Open Science to be adopted for publicly-funded research, and should then implement a policy of Open Science for the field.



Funded Horizon



APS Division of Particles and Fields Response to European Strategy Group Call for White Papers:
Tools for Particle Physics

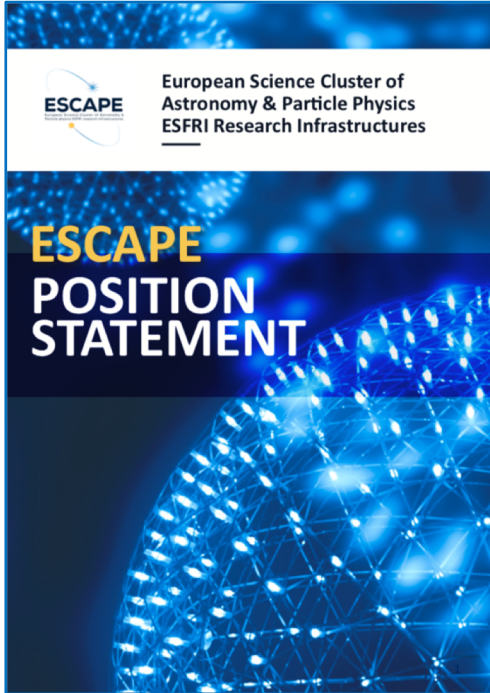
DPF Executive Committee and Strategy Whitepaper Editing Group
dpmatstrategy@fnal.gov

December 18, 2018

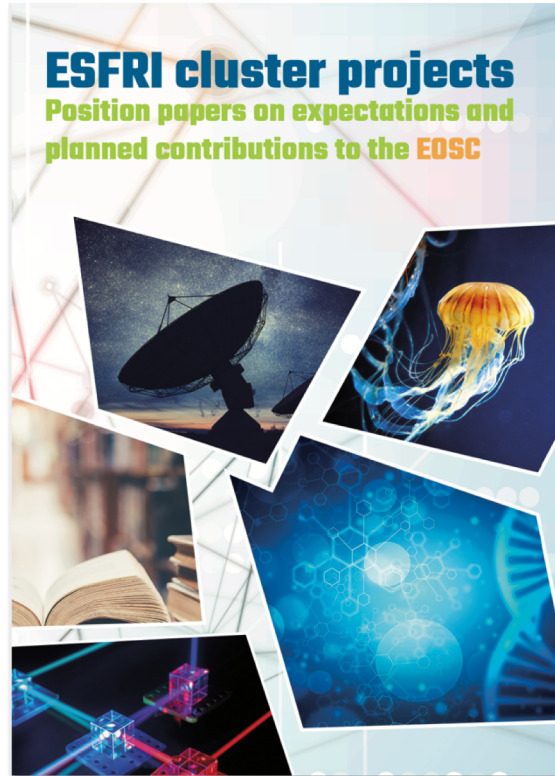
Abstract

The U.S. particle physics strategy process is summarized in a companion white paper that also describes U.S. activities related to the five P5 science drivers. Additional activities within the U.S. particle physics program that are critical to progress in our field are described here.

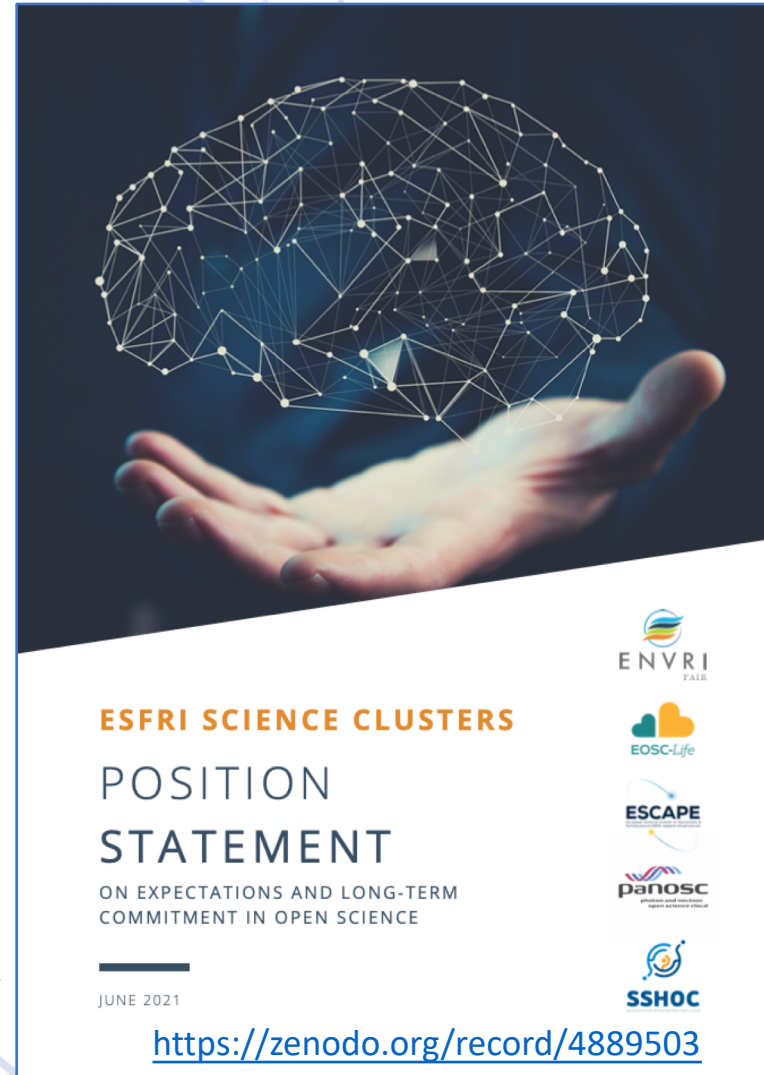
Broader synergies with other research clusters



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



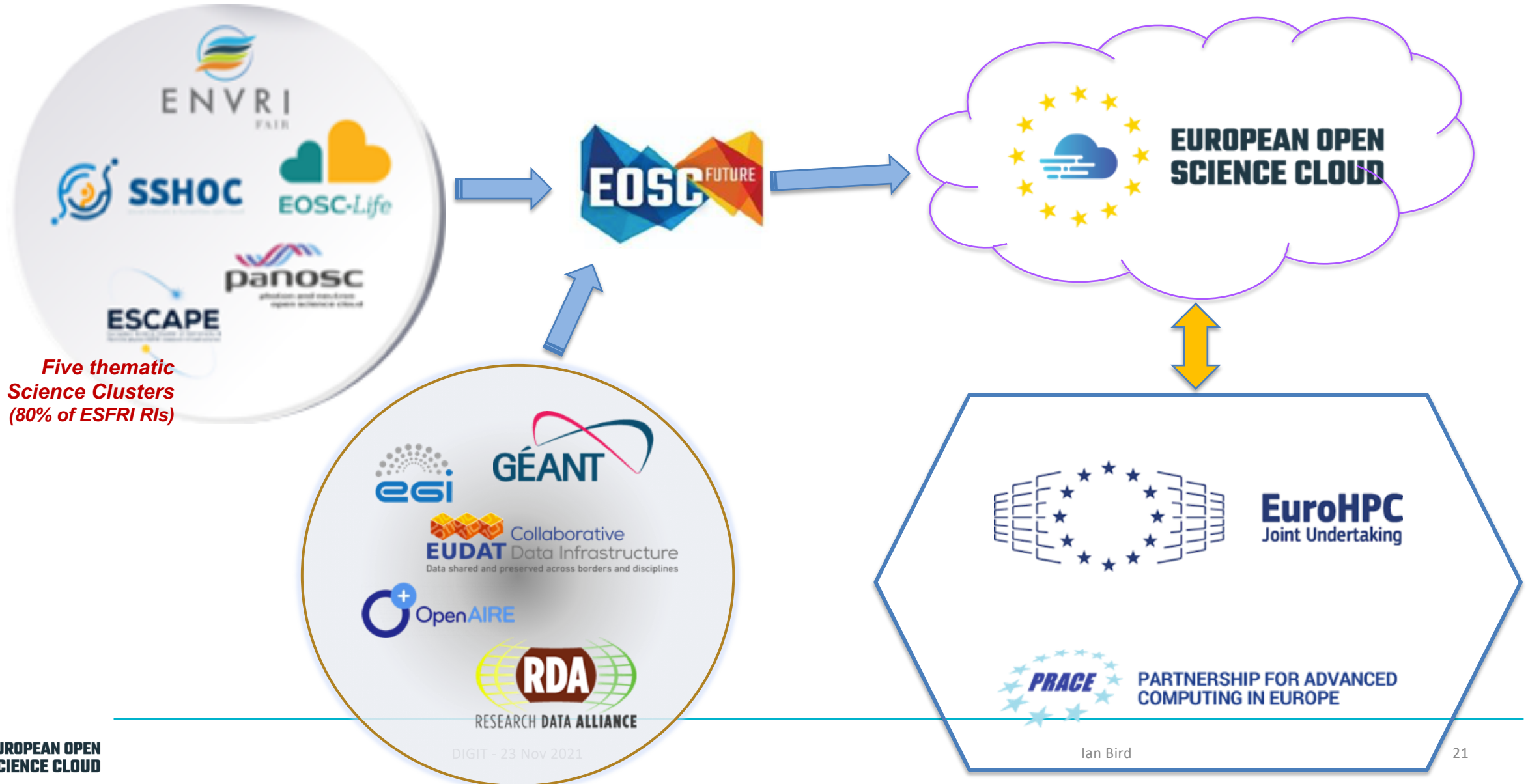
<https://zenodo.org/record/3675081-.X2R2PJNLhTY>



EOSC-Future

Implementing the EOSC





Five thematic Science Clusters (80% of ESFRI RIs)

DIGIT - 23 Nov 2021

Ian Bird

☐ Started 1st April 2021

☐ Responding to EU H2020 funding call, (INFRAEOSC-03-2020):
30 months, 40 M euros

➤ *EOSC-Future is a prototype of an integrated EOSC*

INFRAEOSC-04 - ESFRI science clusters

- 5 thematic clusters of 52 world-class RIs to implement FAIR data and connect to EOSC
- Develop standards, approaches, requirements, tools
- Create thematic catalogues of resources
- Provide data, services and innovation to the EOSC
- Provide a coordinated requirements and feedback

INFRAEOSC-05b - Regional projects

- 5 regional nodes to implement FAIR data and connect to EOSC
- Provide a link to national resources, programmes, priorities
- Develop standards, approaches, requirements, tools
- Create thematic catalogues of resources
- Provide data and services to the EOSC

EOSC Governance

- Inclusive participation from academia, industry, and member states
- Deliver the EOSC partnership
- Maintain the SRIA
- Work on specific EOSC policies
- Oversee the EOSC landscape



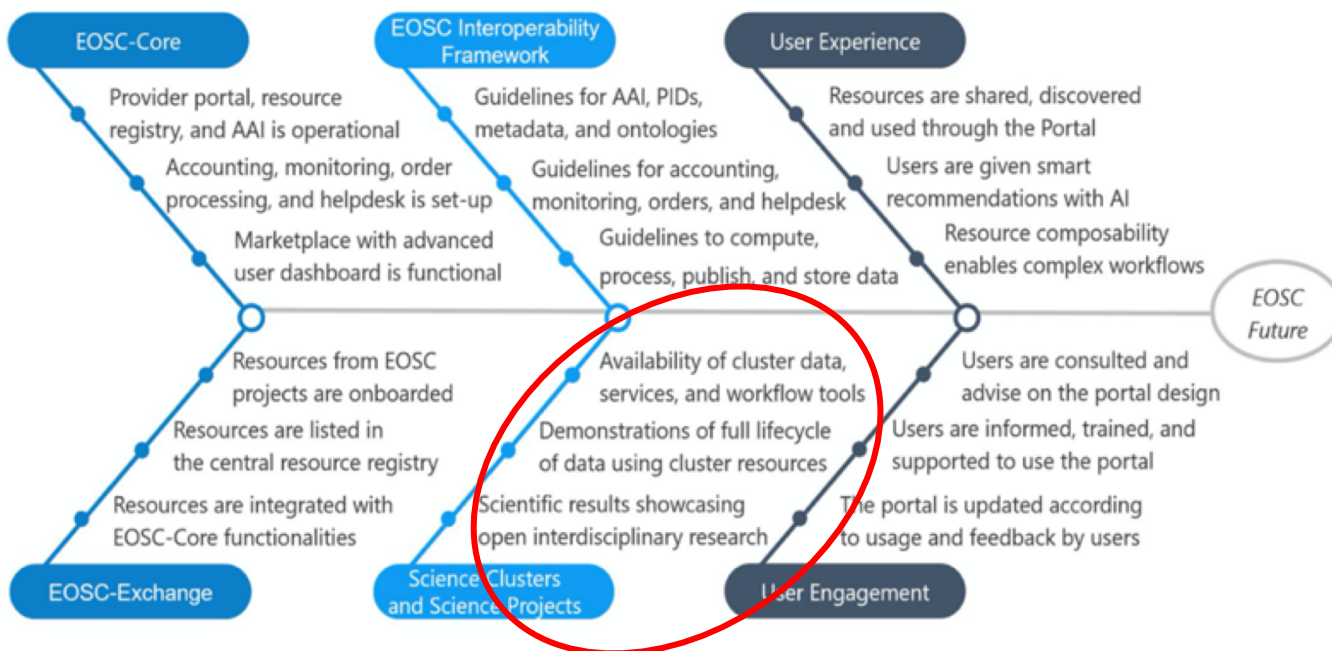
- Provide **EOSC Core** to enable basic EOSC operation, including capacity, service evolution, deployment and operation
- Create and maintain **EOSC Exchange**, including onboarding services from communities, offering them via the Portal and offering integration
- Deliver **EOSC Interoperability Frameworks** to allow integration, harmonisation and composability of resources across the EOSC landscape through the **EOSC Execution Framework**
- Deliver **support activities** including training, engagement and commercial liaison.

Other RIs, thematic, regional and national research communities

- Access and provide resources via the Exchange
- Integrate and benefit from EOSC Core services
- Strengthen and extend new communities

INFRAEOSC-07 - EOSC provisioning projects

- Provide horizontal resources and capacity through EOSC Exchange for data processing, storage, management
- Provide services for Open Science and Copernicus data
- Provide a basis for building PaaS and SaaS services on top of services and capacity from EOSC Exchange



CNRS Involvement:

LAPP, CPPM & CDS (Strasbourg)

Areas of activity:

- Post-docs funded to integrate science & Virtual Observatory projects, & ESCAPE outputs into EOSC
- Coordination of DM science project
- Contribution to overall technical coordination
- Citizen science and engagement
- Member of Strategy & Oversight Board



Key Exploitable Results – KERs 1-4

KER 1 – EOSC Core and Support

KER champions: Klaas Wierenga,
Diego Scardaci

This encompasses both development and delivery EOSC Core including the specification of functionality, interactions and resulting architecture of both front-end and back-end of EOSC Core.

KER 2 – EOSC Exchange

KER champions: Matthew Viljoen,
Ian Bird

Set of resources registered to the EOSC by research infrastructures, e-infrastructures to serve the needs of research communities and the widening to the general public and private sector.

KER 3 – EOSC Science Projects

KER champions: Andreas Petzold,
Christos Arvanitidis

This covers the integration of the ten large cross-domain research science projects into EOSC.

KER 4 – EOSC Observatory

KER champions: Gareth O'Neill, Natalia Manola

A policy intelligence tool for monitoring policies, investments, resources, and infrastructures related to EOSC. The observatory consists of an interactive dashboard for the collection and presentation of data on the implementation and uptake of EOSC.



Key Exploitable Results – KERs 5-8

KER 5 – EOSC Interoperability Framework (IF)

KER champions: Licia Florio, Paolo Manghi

The EOSC Interoperability framework allows the EOSC to work seamlessly. The EOSC IF will act as the glue layer connecting and interoperating the products and services available on the platform making them available across scientific communities.

KER 7 – Commercial Services and Support

KER champions: Veronika di Luna, Giovanni Lamanna

This KER includes the procurement framework and the EOSC Digital Innovation Hub.

KER 6 – EOSC Knowledge Hub

KER champions: Shanmugasundaram Venkataraman, John Shepherdson

EOSC Knowledge Hub covers the development, integration, and adaptation of a technical platform for training and skills activities, materials and webinars developed in the project.

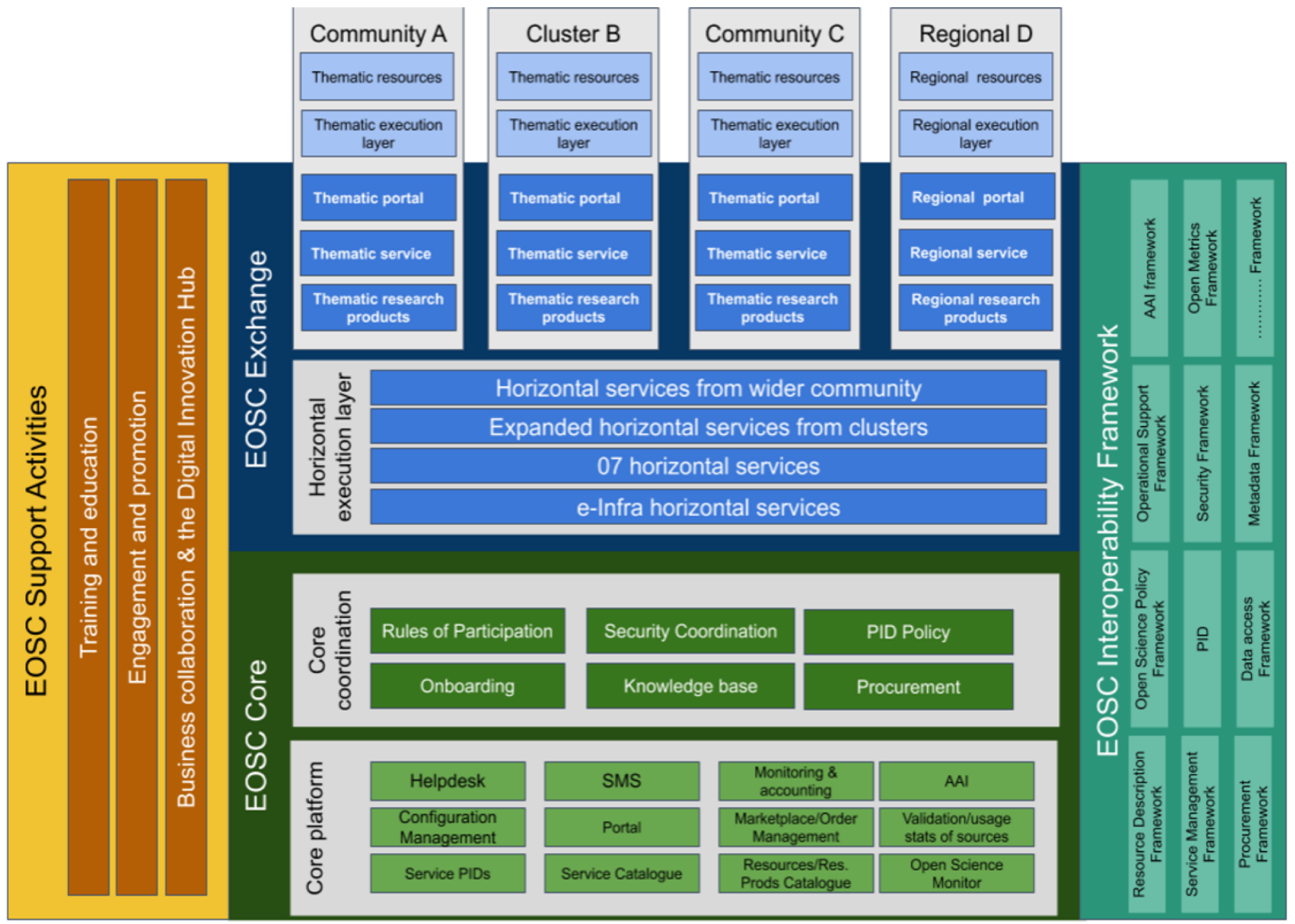
KER 8 – EOSC Future Community

KER champions: Sara Garavelli, Ron Dekker

This result covers the community of users, service providers and other initiatives (INFRAEOSC Projects, EUROHPC, GAIA-X) engaged by the project.



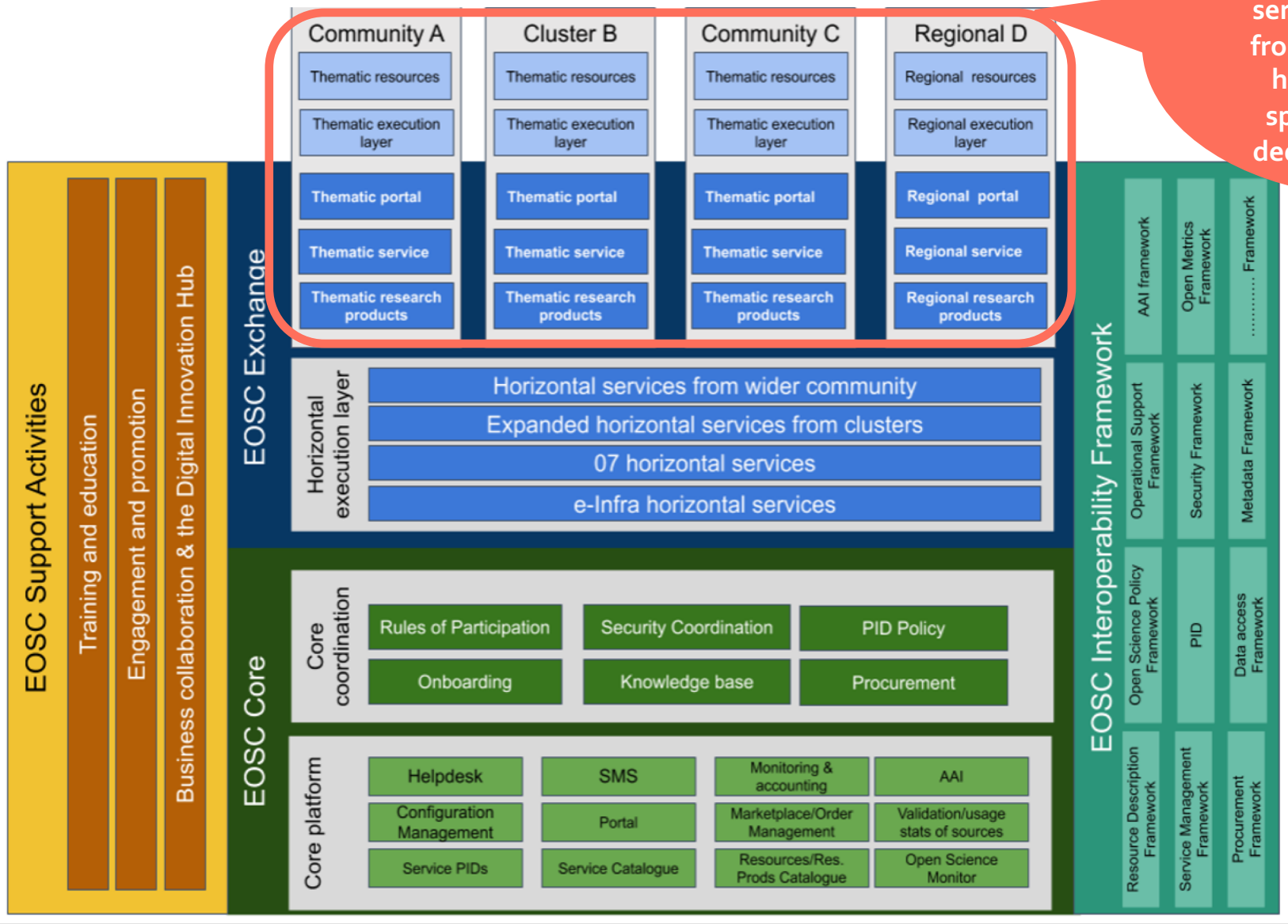
EOSC Architecture – Federation model





EOSC Architecture – Federation model

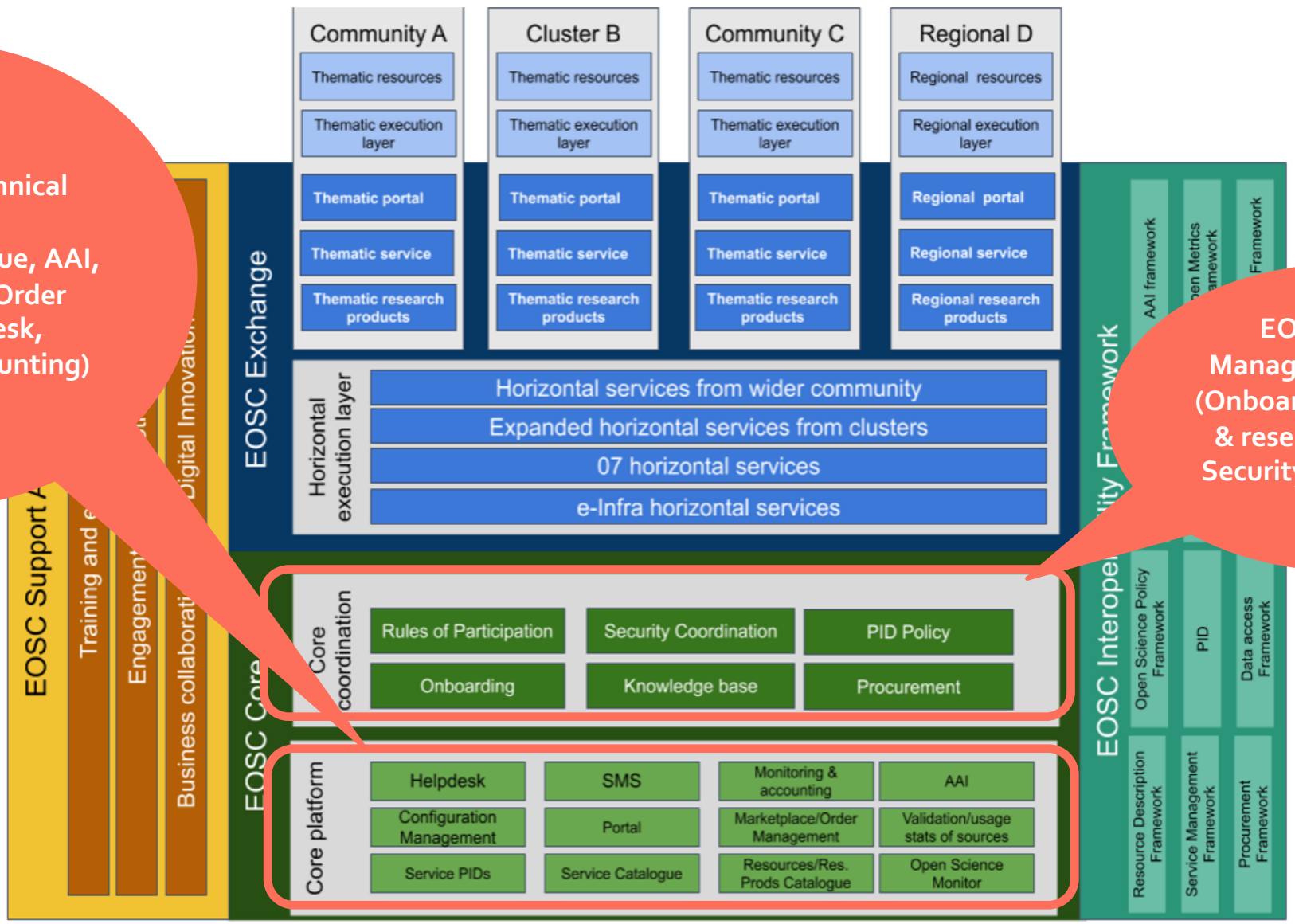
Science communities & researchers, use services & resources from EOSC, but also have higher level specific services & dedicated resources





EOSC Architecture – Federation model

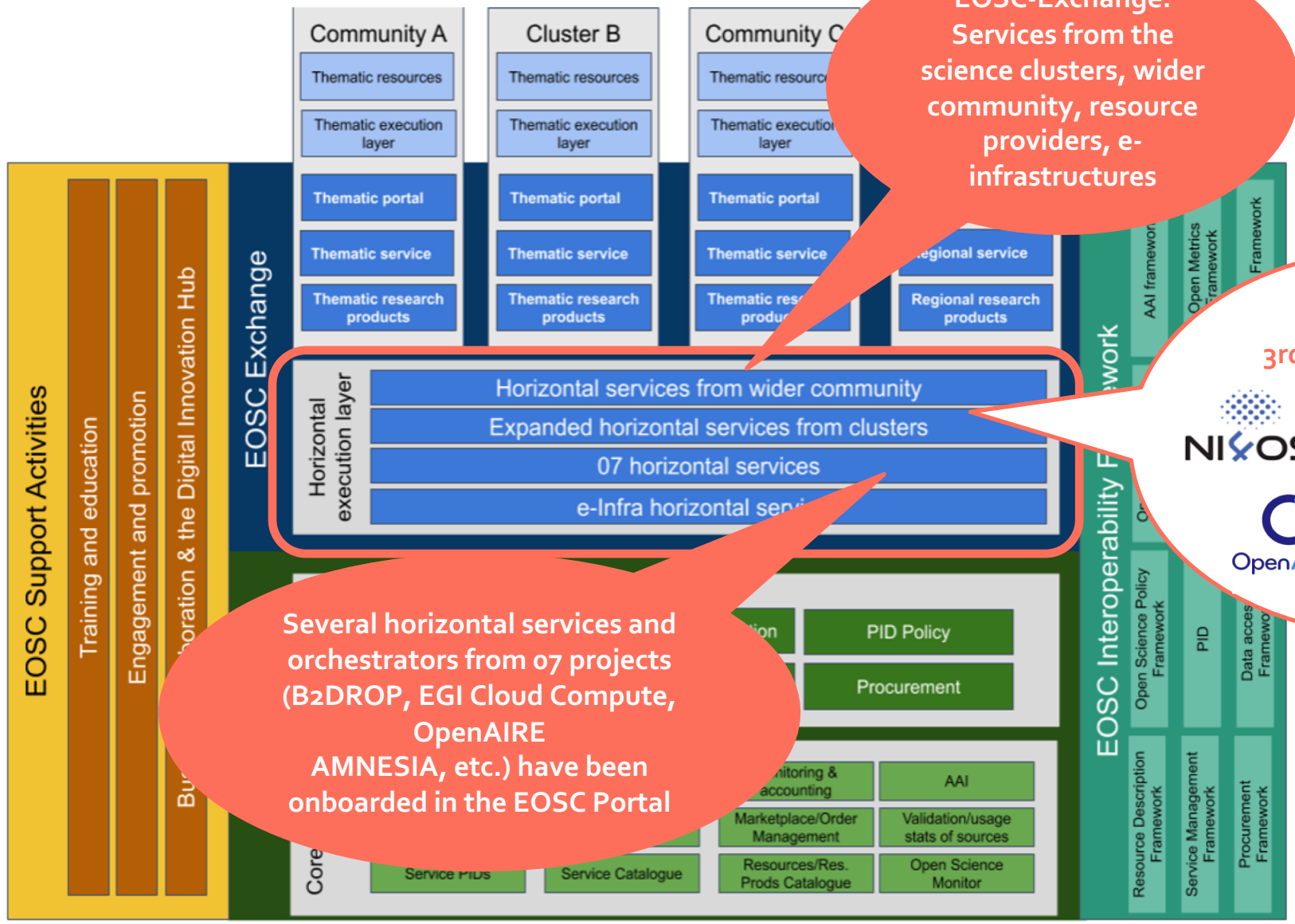
EOSC-Core Technical Platform
 (Resource Catalogue, AAI, Marketplace & Order mgmt, Helpdesk, Monitoring, Accounting)



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



EOSC Architecture – Federation model



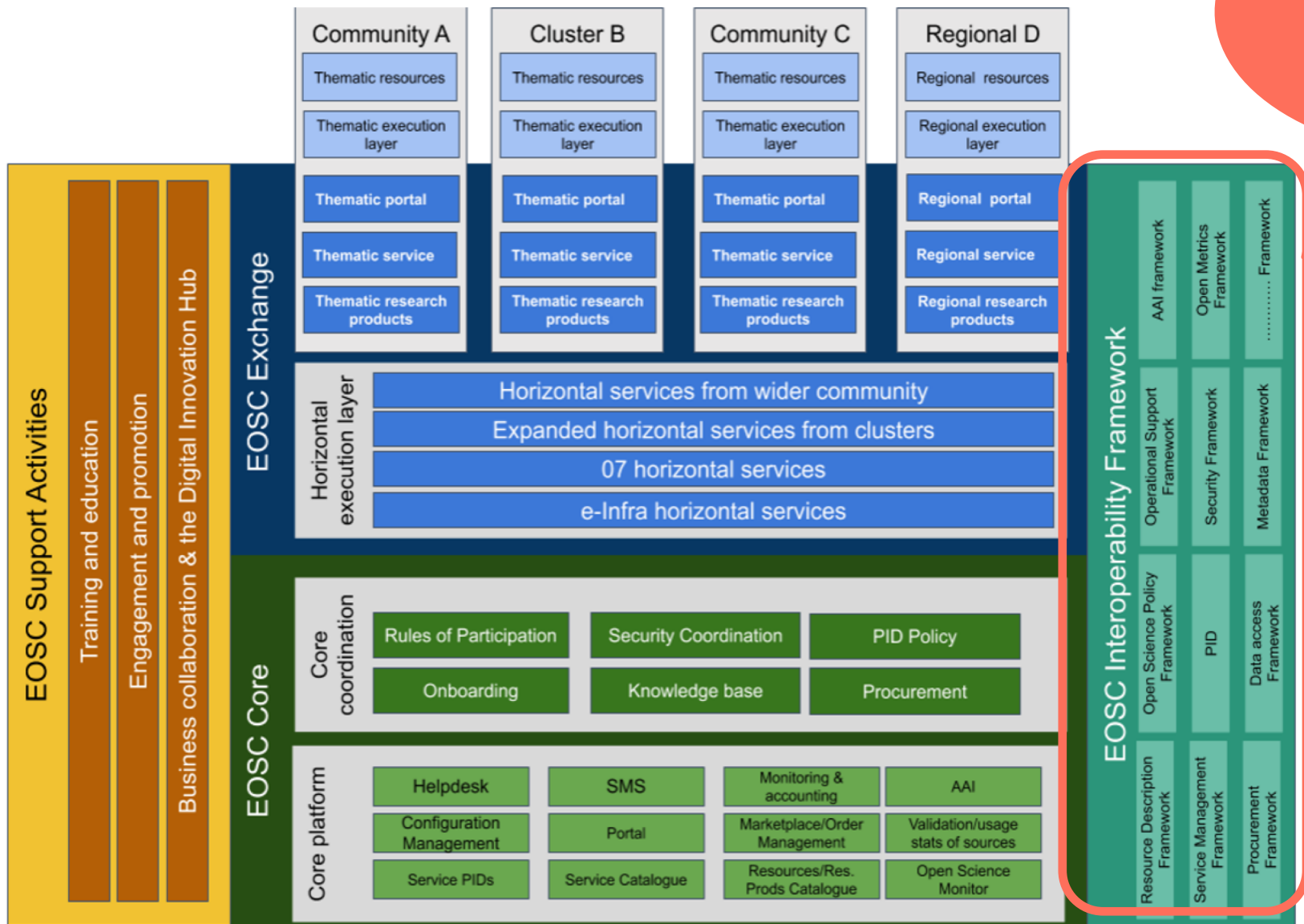
EOSC-Exchange:
Services from the science clusters, wider community, resource providers, e-infrastructures

Several horizontal services and orchestrators from 07 projects (B2DROP, EGI Cloud Compute, OpenAIRE AMNESIA, etc.) have been onboarded in the EOSC Portal

Integration of 3rd party catalogues



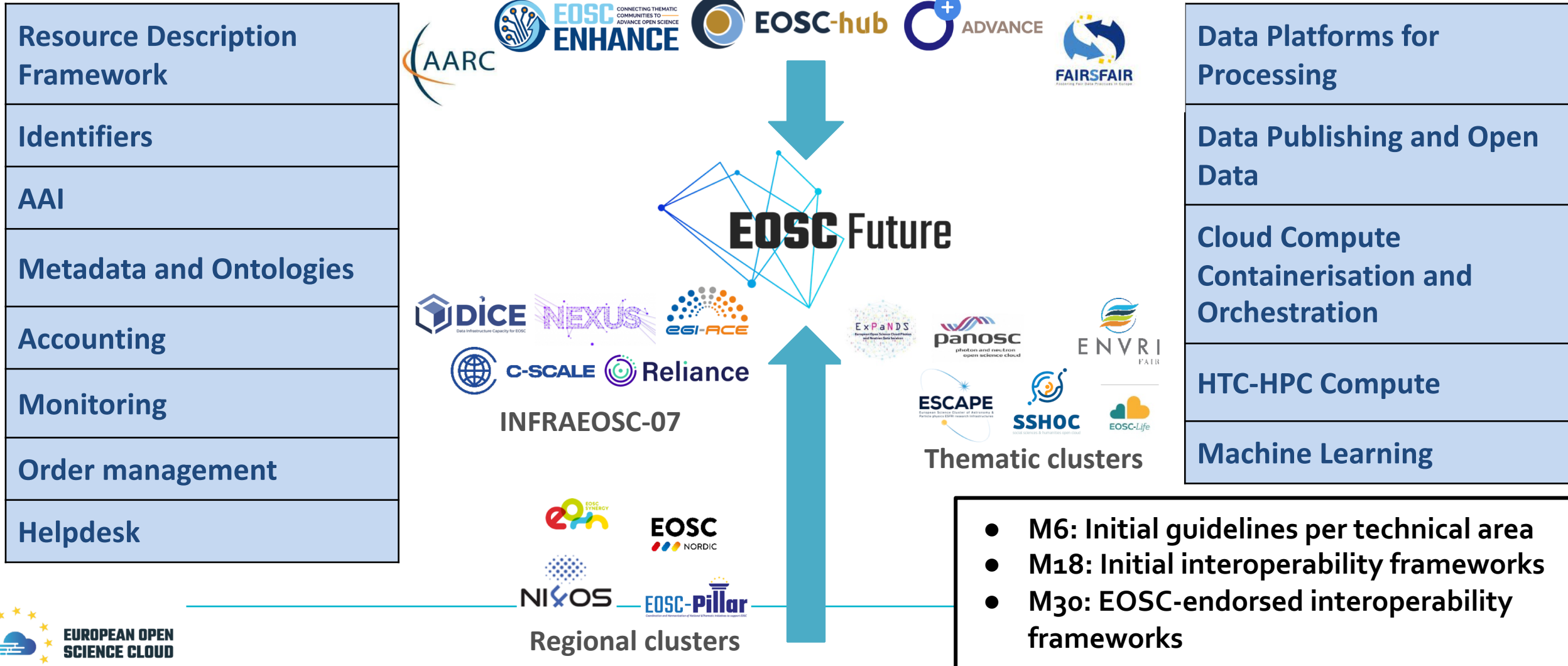
EOSC Architecture – Federation model



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

EOSC Interoperability Framework

Interoperability frameworks to enable the integration/composability of EOSC resources



Data Lake
Software Repository

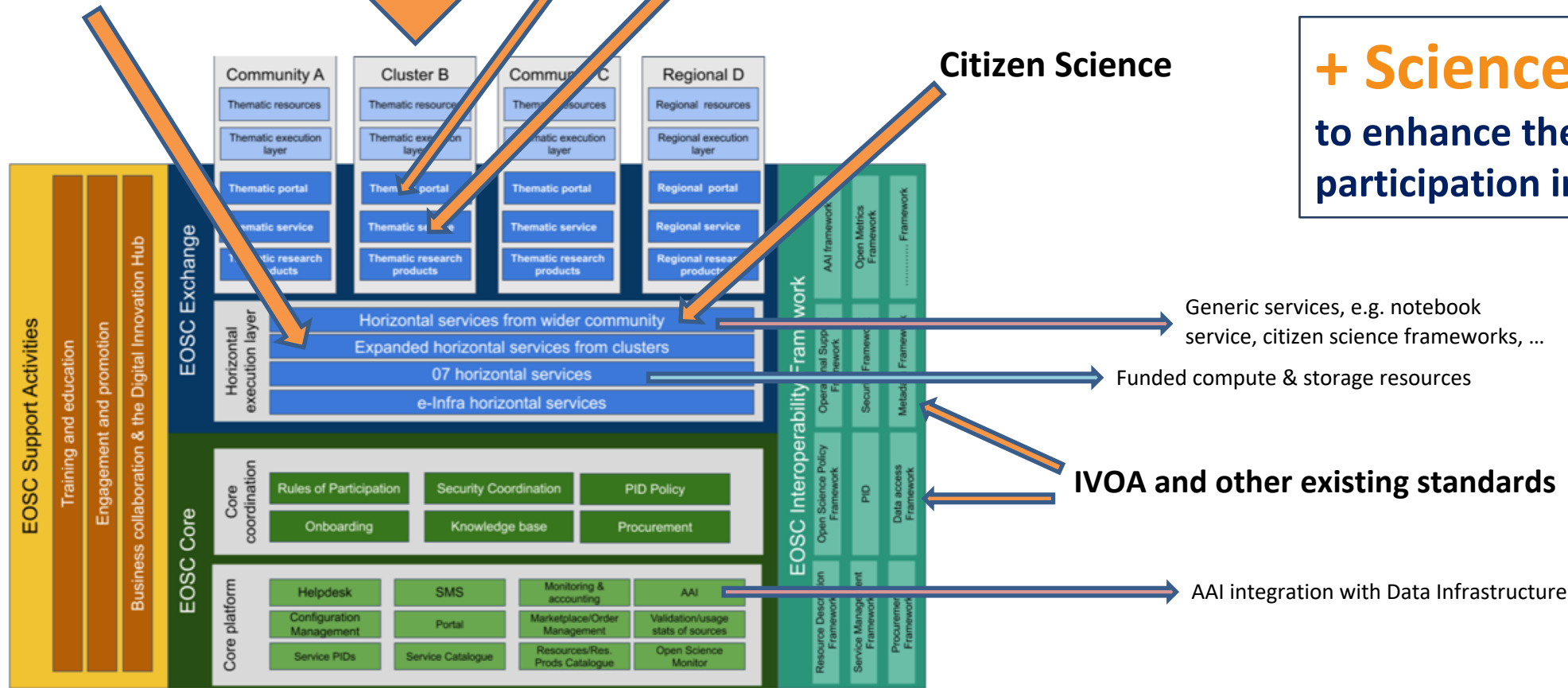
ESCAPE

Science Analysis Platform

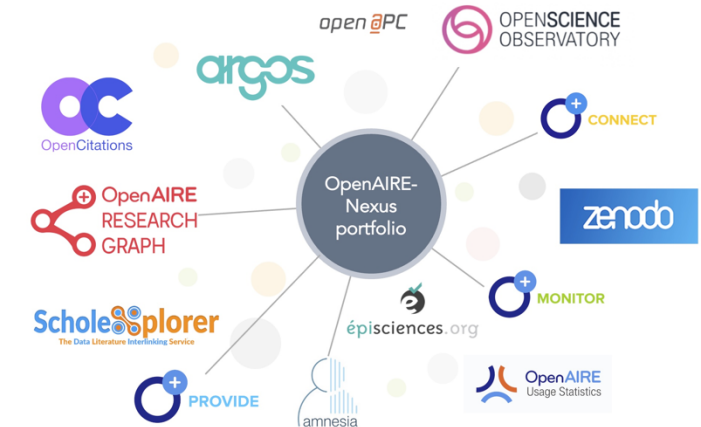
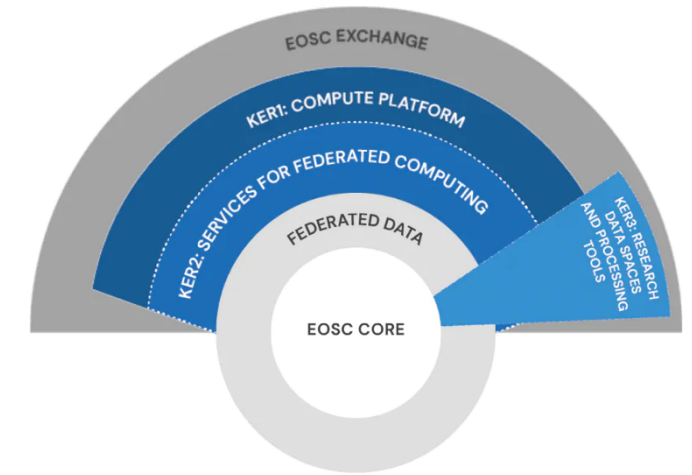
Virtual Observatory services, ESFRI workflows

Citizen Science

+ Science Projects
to enhance the researcher
participation in EOSC



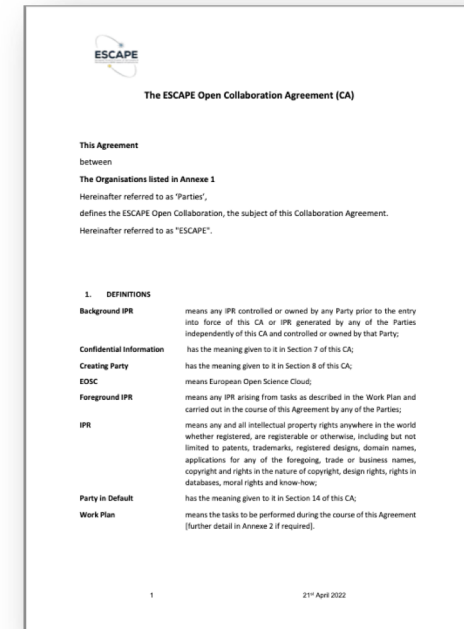
- Projects funded (INFRAEOSC-07) in parallel with EOSC-Future to provide specific resources or functions
- EGI-ACE (Advanced Computing for EOSC)
 - IN2P3 involved here
 - Building a compute platform, and federated services; hybrid (HTC, HPC) & free-at-the-point-of-use
- OpenAire Nexus
 - Portfolio of tools for Open Science
 - FAIR data, publishing, access, exploitation, ...



- Science benefits from a common underlying e-infrastructure
 - Single AAI, common robust services, common policy and interoperability frameworks
 - Building a robust open science, open (FAIR) data ecosystem; enabling data sharing, open access
 - Federated, collaborative environment and infrastructure
 - Sharing expertise, software, research outputs, training; with common standards and policies
 - Encouraging cost-effectiveness and re-use
 - Recognising and building up new commonly used services (e.g. a Notebook service, integrated with scalable, heterogeneous compute)

- Science use cases:
 - IN2P3 is present in most of the ESCAPE RIs, encourage future involvement of new RIs (not only ESFRI)
 - Science cases must be *the* driver of the evolution of EOSC
 - Participation of Research Organisations and Funders in the EOSC-Association
- Developments in ESCAPE and previous EOSC projects, will be integrated into EOSC-Exchange, including
 - Data management infrastructure and expertise
 - Integration of ESCAPE AAI
 - Virtual Observatory
 - VRE and Data analysis tools (AI techniques),
 - workflow tools such as DIRAC, etc.
- National resources:
 - CC-IN2P3 as centre of expertise and resources for moving towards Exascale
 - France-Grilles as partner of EGI-ACE and expertise in federated infrastructures
 - DIRAC as software system supporting generic workflows used by many sciences over >15 years
 - Expertise in ESCAPE and other EOSC-related projects

- The 5 Science Cluster projects are close to ending
- However, synergies between them have been significant, and collaborative activity is increasing
- Recently, all of the 5 have put in place long-term structures – through MoU or Collaboration Agreement
 - E.g. ESCAPE has Collaboration Agreement signed by Directors of all the partner RIs. The agreement will come into effect at the end of ESCAPE project → ESCAPE Open Collaboration
- The Clusters agree: they want to have effective mechanisms to enable cross-cluster/cross-domain collaborations
 - but not an additional layer of governance



- Anticipated funding calls in Horizon Europe; highly relevant and potentially important to us
 - Building on the science cluster approach to ensure uptake by RIs and research communities
 - Consolidation and new Science projects;
 - Clusters expected to work together; bring in new world-class RI, and others via open calls and cascading grants
 - Development of community-based approaches for ensuring and improving quality of scientific software and code
 - Framework for community curation across disciplines
 - Limited scope for innovation or development
 - But highly relevant to all clusters: examples of previous work HSF, SIDIS, software carpentries, training materials and schools, career development of young scientists specialising in software and computing
- Also anticipated tender from EC for procurement of EOSC services
 - Operation of core and exchange services, provision of resources, etc.
 - PIN was issued, calls for tender in September/October?

- EOSC deployment is progressing in parallel with policy and governance development
 - Science Clusters together with EOSC-Future and associated infrastructure projects are main mechanisms
- Essential that science RIs and organisations engage and ensure the direction is appropriate and useful
 - Experience shows that science must be the driver and infrastructure must be able to respond to changing needs
 - We must also help define the long term funding model that is appropriate for our funding mechanisms and communities
- EOSC is a complex landscape, but the benefits can be significant