Implementing the European Open Science Cloud

Ignacio Blanquer
Board of Directors EOSC-A

International Symposium on Grids & Clouds (ISGC)
2022 Virtual Conference

Outline and Presentation

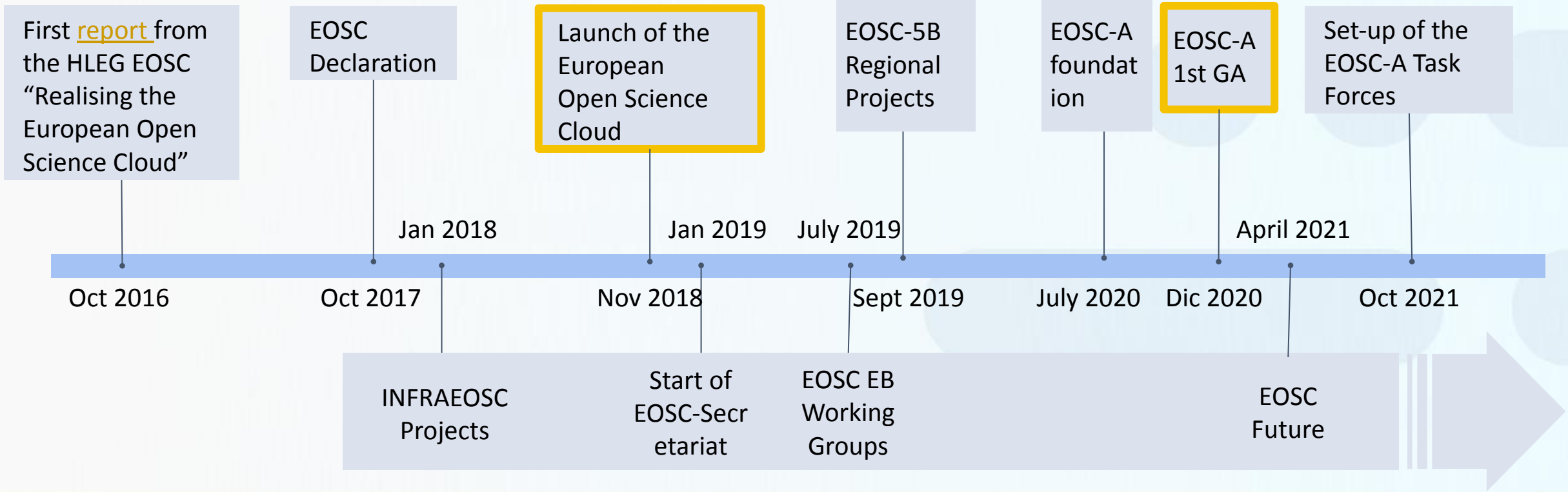
- The EOSC Initiative
- Building the EOSC
- The EOSC Association

Ignacio Blanquer is professor of the UPV, member of the board of directors of EOSC-A, WP leader in EOSC-SYNERGY, third party in EGI-ACE and advisor of the Spanish Ministry of Science and Innovation in the area or EOSC.

DISCLAIMER: The opinions expressed in this presentation are solely those of the presenter and may not be necessarily endorsed by institutions appearing.

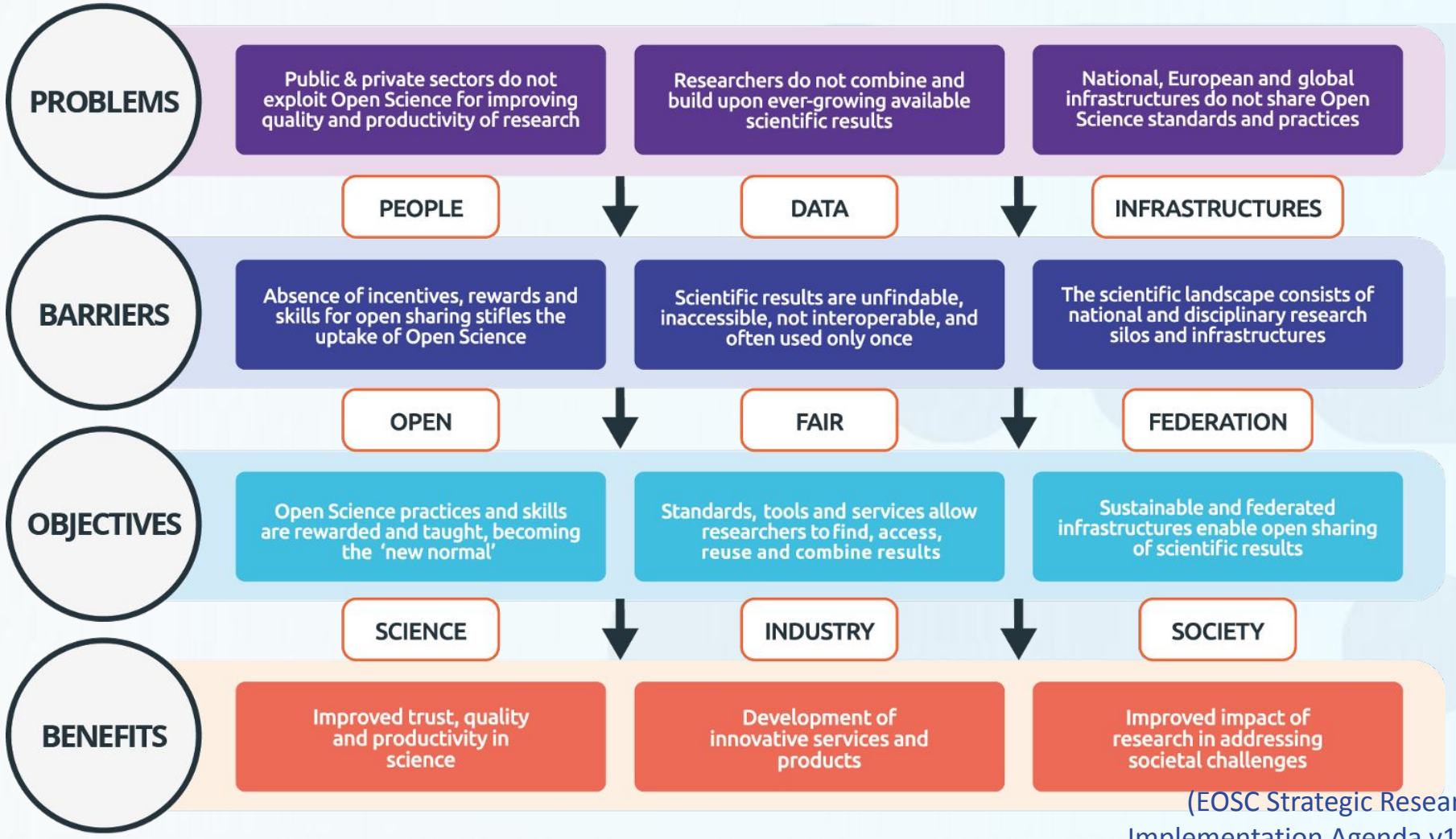
The European Open Science Cloud (EOSC) initiative

- EOSC aims to offer a virtual environment for open access to services to store, share, process and reuse research data and other research digital objects, such as software
  - The EOSC initiative was proposed in 2016 by the EC as part of the European Cloud initiative, funded through the so-called H2020-INFRAEOSC-2018-2020 (€ 157M).
  - Main objective of HEU destination 2 with 89M€ in the HORIZON-INFRA-2021/22-EOSC-01 calls.



EOSC Objectives Tree

- It structures the aims of EOSC in terms of people, data and infrastructures.
- Three General Objectives identified.



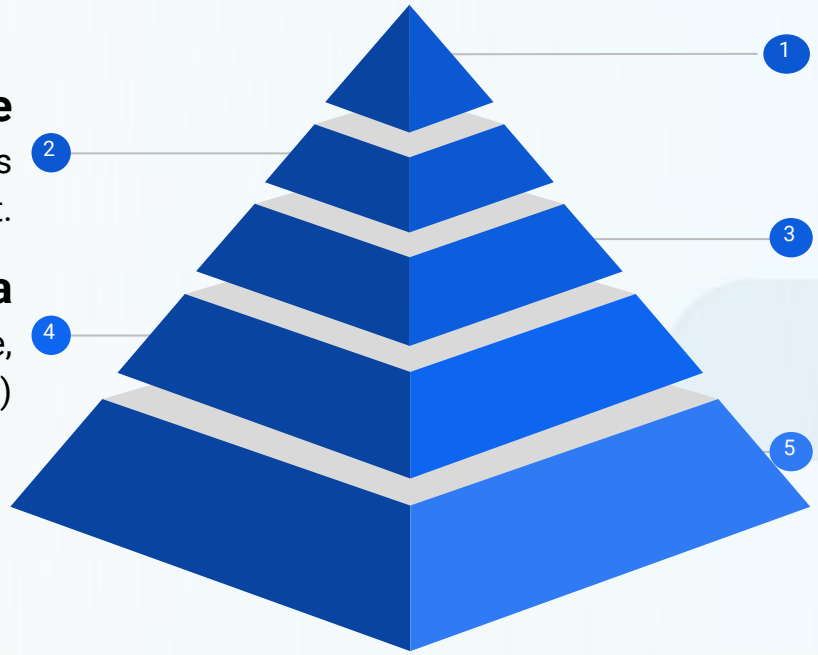
(EOSC Strategic Research Implementation Agenda v1.0)

The Strategic Research and Innovation Agenda (SRIA)

- A key document for the implementation of EOSC is the "Strategic Research and Innovation Agenda" (SRIA) .
- It states three General Objectives
  - GO1. Ensure that Open Science practices and skills are rewarded and taught, becoming the 'new normal'.
  - GO2. Enable the definition of standards, and the development of tools and services, to allow researchers to find, access, reuse and combine results.
  - GO3. Establish a sustainable and federated infrastructure enabling open sharing of scientific results.

Guiding principles for EOSC

- The overarching principle for developing EOSC is that research has to be at the centre of the EOSC initiative
  - Multi-stakeholderism, Openness, Data Following FAIR principles, Federation of infrastructures, Machine-actionable Services.
- Holistic Approach.



Governance and Rules of Participation
Guarantee of quality and trust at a technical and legal level.

Access and Interface
Through a centralized portal and the tools integrated into it.

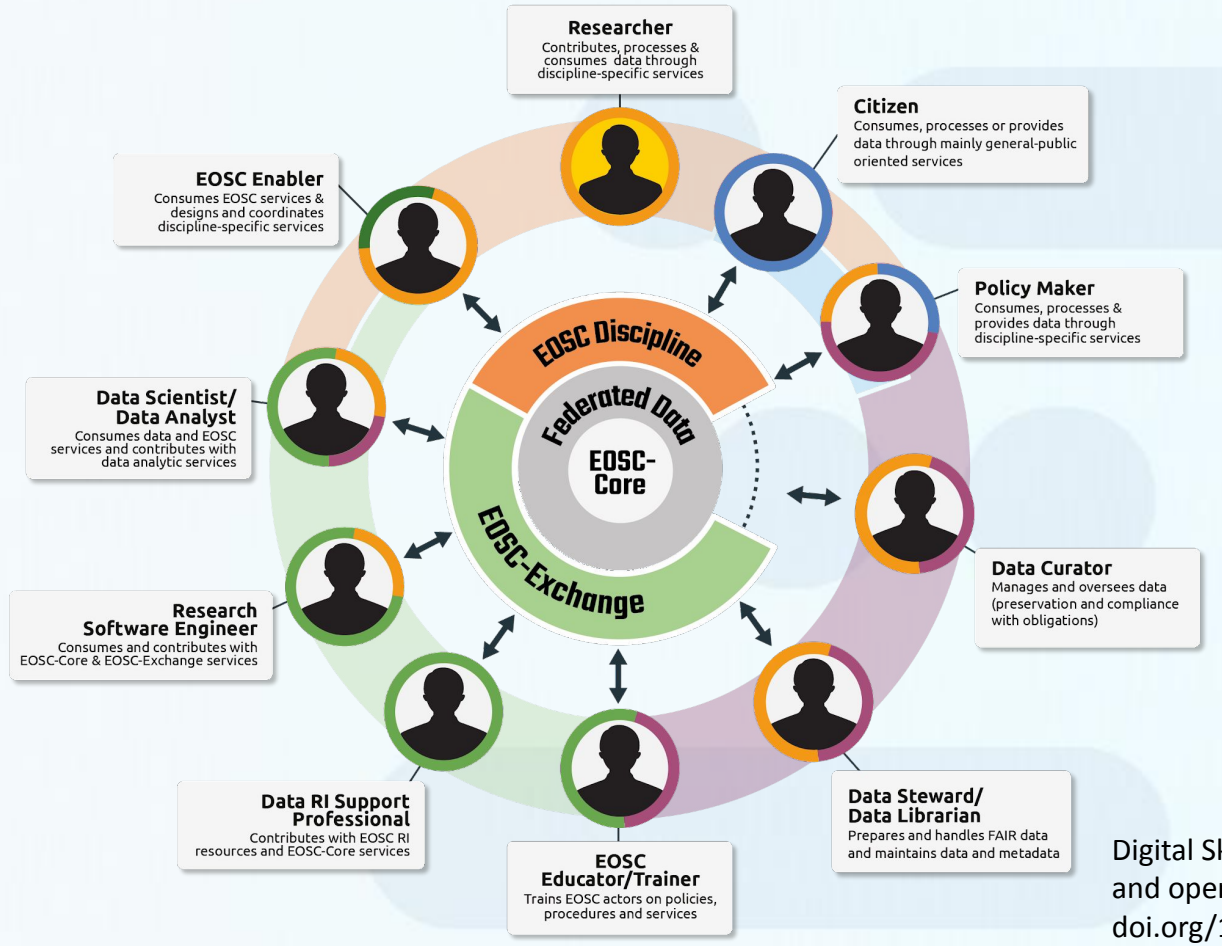
Services
For data discovery, access, storage and processing, potentially with co-funding.

Data
Following the FAIR principles (Findable, Accessible, Interoperable and Reusable)

Federated Resources Architecture
Pan-European, interoperable and scalable, integrating different data infrastructures.

EOSC Addresses a wide range of Actors

- With the Researcher on the top, but also addressing ICT-Specific, Library and Information Science and General Public actors.
- Described in the “Digital skills for FAIR and open science” Report from the EOSC Executive Board Skills and Training Working Group.



Digital Skills for FAIR and open science
doi.org/10.2777/59065

Strategic documents in the context of EOSC

https://www.eoscsecretariat.eu/eosc-governance/eosc-executive-board-outputs

EOSC Architecture Executive Board Working Group

- EOSC Architecture WG view on the Minimum Viable EOSC (https://doi.org/10.2777/492370)
- EOSC Authentication and Authorization Infrastructure (AAI) (https://doi.org/10.2777/8702)
- EOSC Interoperability Framework (https://doi.org/10.2777/620649)
- Scholarly Infrastructures for Research Software (https://doi.org/10.2777/28598)
- PID Architecture for the EOSC (https://doi.org/10.2777/525581)

EOSC FAIR Executive Board Working Group

- Six Recommendations for Implementation of FAIR Practice (https://doi.org/10.2777/986252)

EOSC Sustainability Executive Board Working Group

- Solutions for a Sustainable EOSC (https://doi.org/10.2777/870770)

Strategic Research and Innovation Agenda

https://u.i3m.upv.es/dhv32

EOSC Skills&Training Executive Board Working Group

EOSC RoP Executive Board Working Group

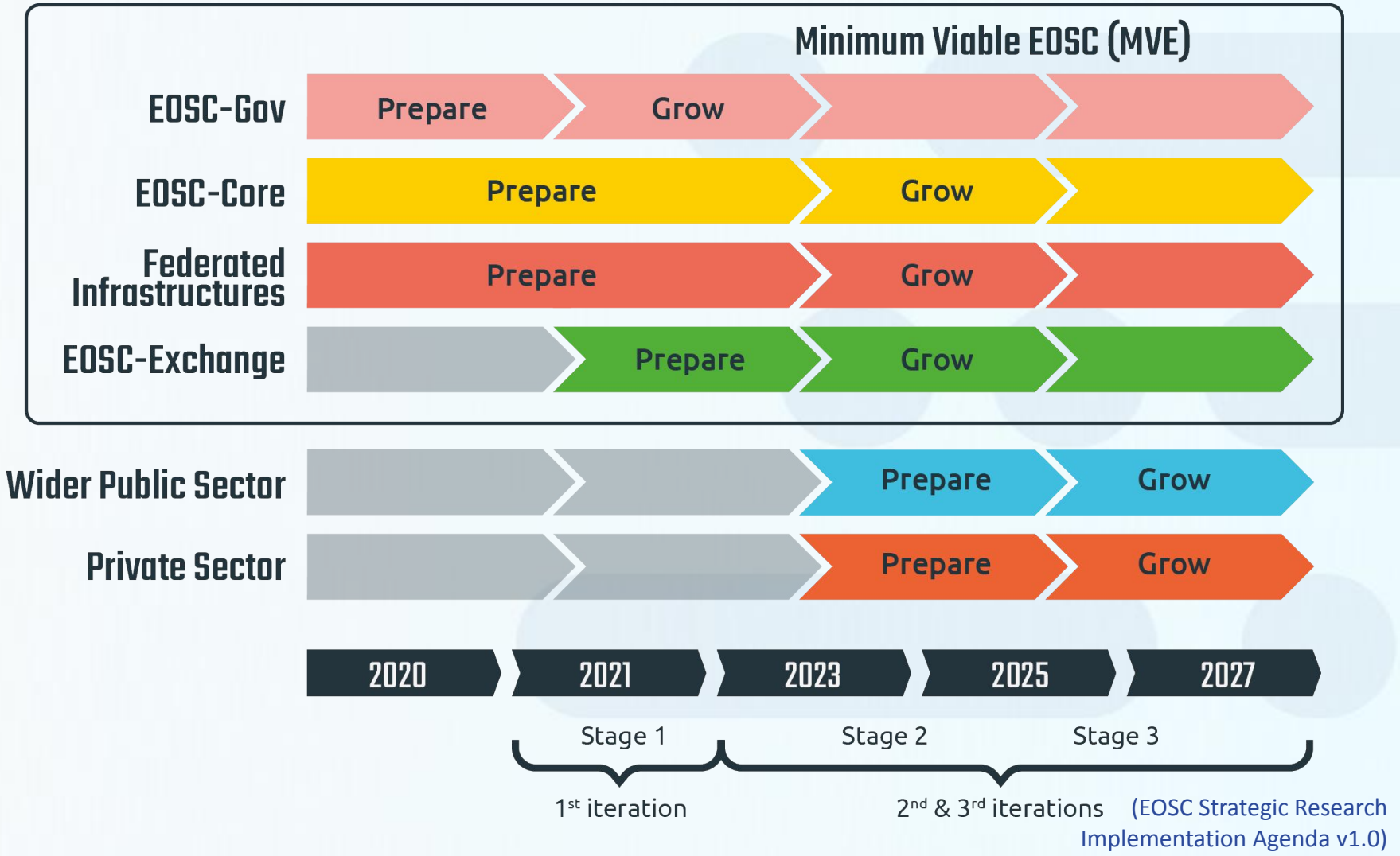
EOSC Landscape Executive Board Working Group

EOSC Implementation timeline

Stage 1 (2021–2022): Development towards added value from a functional federation of infrastructures Enabling the EOSC operations (the EOSC-Core) to provide necessary core functions of the Minimum Viable EOSC (MVE) that allow federation of existing and future infrastructures.

Stage 2 (2023–2024): Expansion to production that generates added value, During this period, activities will build on pilots/demonstrators and work towards linking EOSC beyond the research communities.

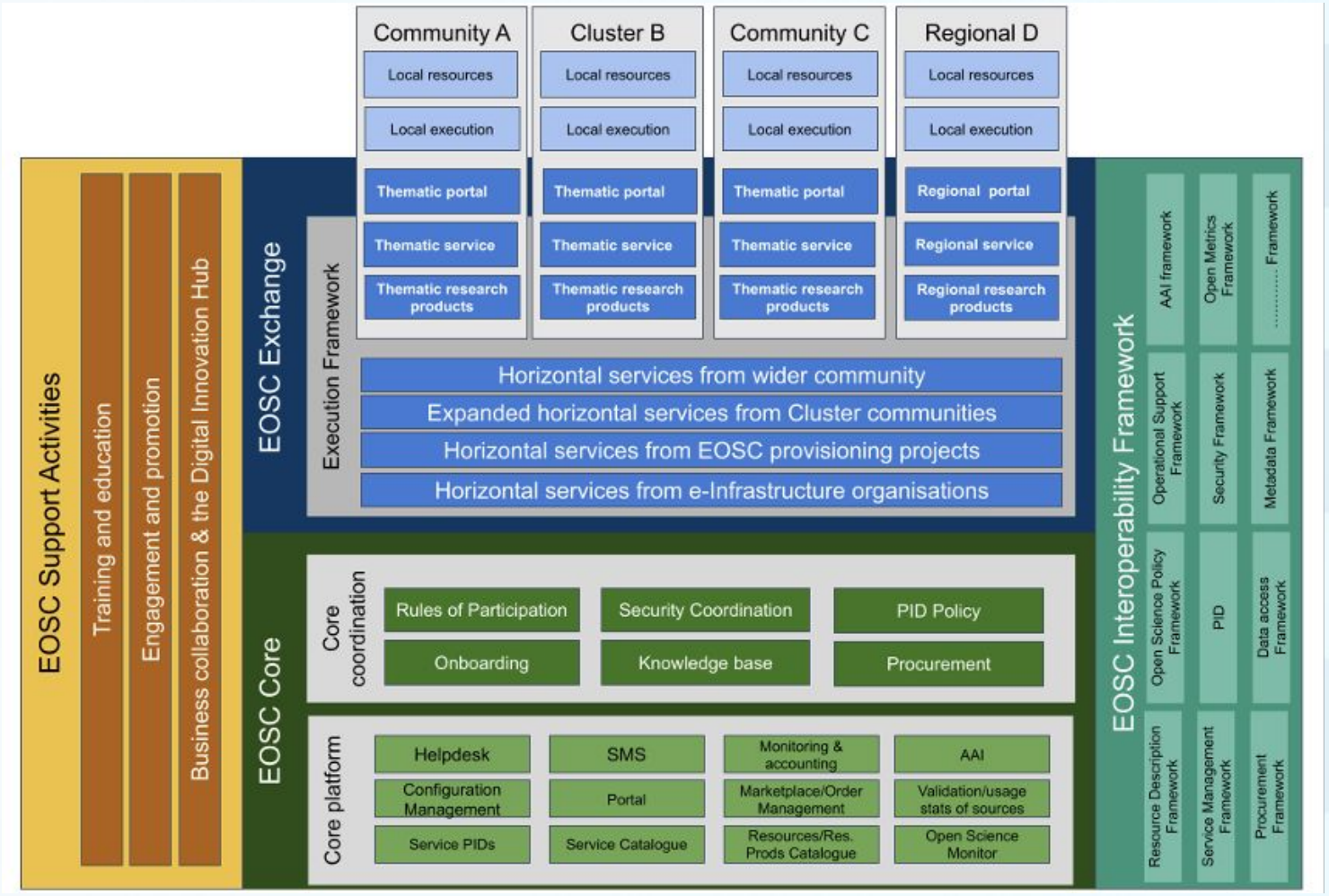
Stage 3 (2025–2027 and beyond): Expansion to develop impact from Open Science Deployment of federated research infrastructures for European researchers with functionality that provisions actors from multiple communities to deliver impactful Open Science.



(EOSC Strategic Research Implementation Agenda v1.0)

EOSC Architecture

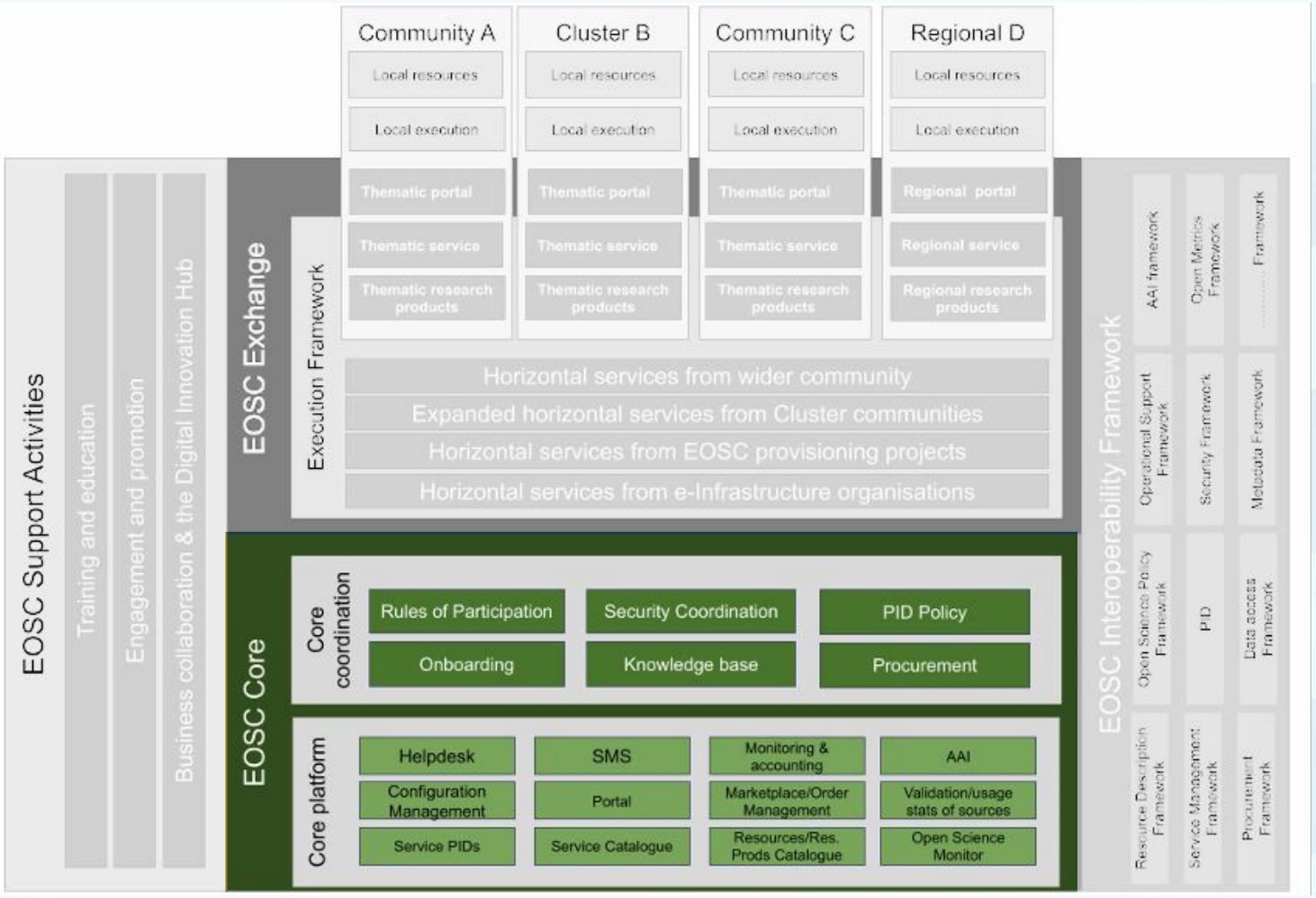
- The EOSC MVE Concept:
  - **EOSC-Core**: Enabling services required to operate the EOSC.
  - **EOSC-Exchange**: Federation services registered to the EOSC by RIs and clusters to serve the needs of users.
  - **EOSC Interoperability Framework**: Scientific services provided by RIs and Clusters to the respective communities.



Picture credits: EOSC Future Consortium

EOSC Core

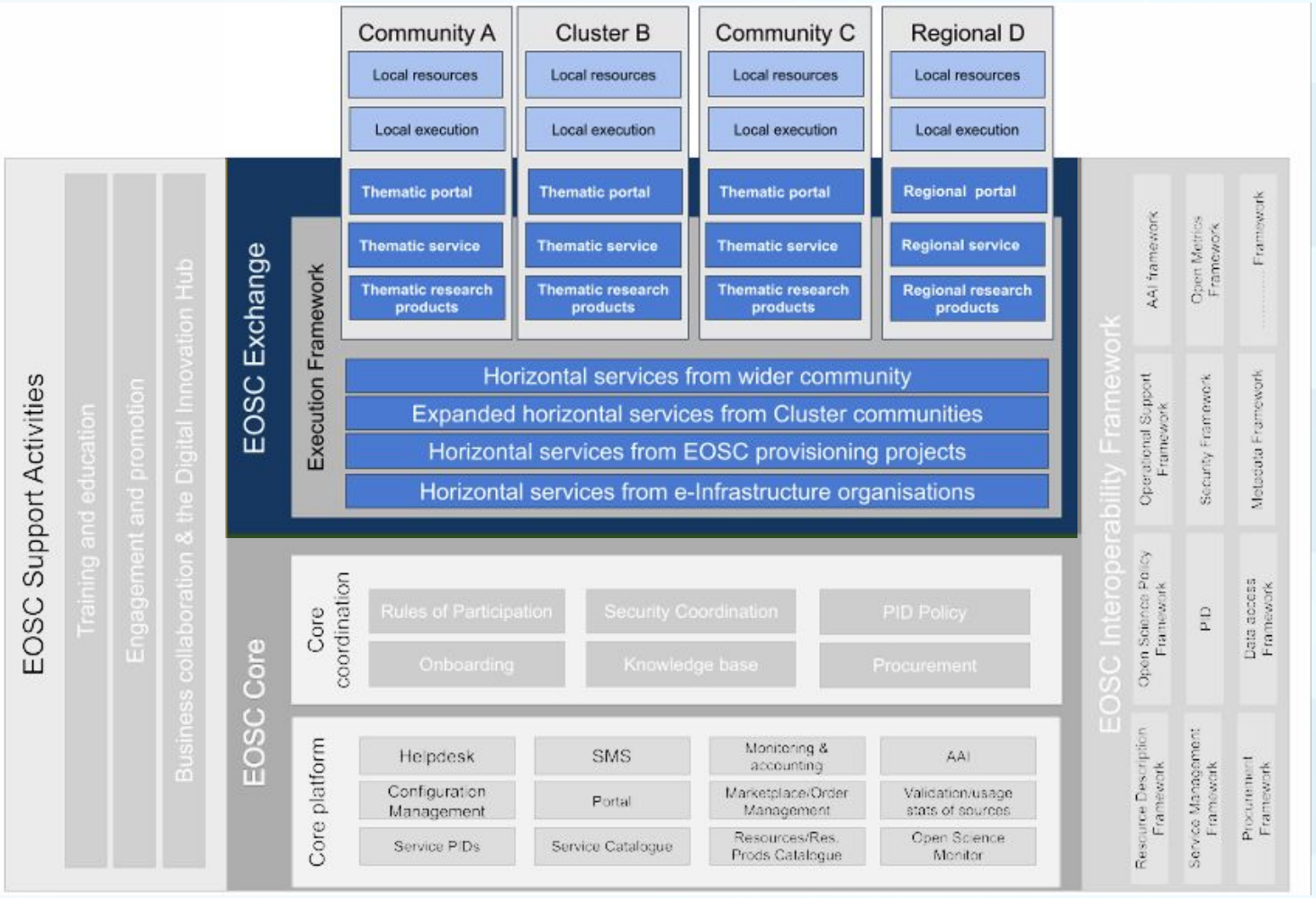
- EOSC Portal.
- EOSC Resource Catalogue, including a provider portal.
- EOSC Federated AAI.
- Monitoring and Accounting.
- Helpdesk and Security Coordination.



Picture credits: EOSC Future Consortium

EOSC Exchange

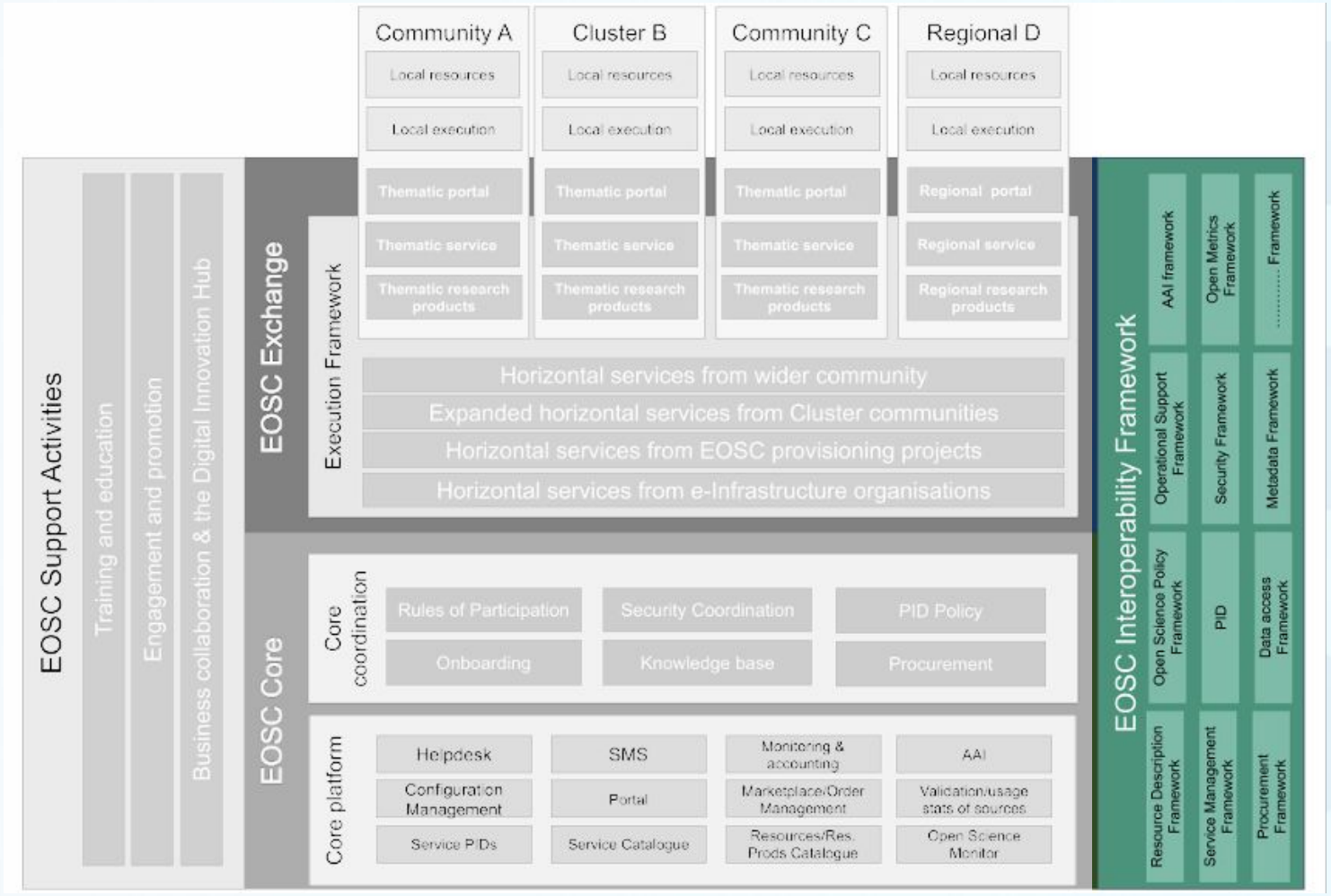
- Horizontal Services provided by e-Infrastructures and Science Cluster Communities.
- Cluster, Community and Regional specific resources such as Thematic/Regional Resources and Portals.
- Execution Framework allowing composability for EOSC resources complying to the EOSC Interoperability Framework.



Picture credits: EOSC Future Consortium

EOSC-Interoperability Framework

- The EIF will enable connecting different kinds of resources across thematic domains and infrastructure boundaries.
- The EIF will provide guidelines for providers to connect resources to EOSC-Exchange and EOSC-Core, supporting the composability of resources.



Picture credits: EOSC Future Consortium

INFRAEOSC-H2020 Calls and Projects

Building infrastructure services

EINFRA-12-2017

- Integrating and managing services for the European Open Science Cloud (**EOSC-hub**)
- OpenAIRE Advancing Open Scholarship (**OpenAIRE-Advance**)

INFRAEOSC-01-2018

- Open Clouds for Research Environments (**OCRE**)

H2020-EU.1.4.1.3.

- Delivering Agile Research Excellence on European e-Infrastructures (**DARE**)
- eXtreme DataCloud (**XDC**)
- Designing and Enabling E-infrastructures for intensive Processing in a Hybrid DataCloud (**DEEP-HybridDataCloud**)
- European e-Infrastructure for Extreme Data Analytics in Sustainable Development (**EUXDAT**)
- Connected Open Identifiers for Discovery, Access and Use of Research Resources (**FREYA**)

User Communities

INFRAEOSC-04-2018

- ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research (**ENVRI-FAIR**)
- Providing an open collaborative space for digital biology in Europe (**EOSC-Life**)
- European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures (**ESCAPE**)
- Photon and Neutron Open Science Cloud (**PaNOSC**)
- Social Sciences & Humanities Open Cloud (**SSHOC**)

INFRAEOSC-02-2019

- Co-designed Citizen Observatories Services for the EOS-Cloud (**COS4CLOUD**)
- Interactive & agile/responsive sharing mesh of storage, data & applications for EOSC (**CS3MESH4EOSC**)
- INODE - Intelligent Open Data Exploration (**INODE**)
- Novel EOSC services for Emerging Atmosphere, Underwater and Space Challenges (**NEANIAS**)
- Transforming Research through Innovative Practices for Linked interdisciplinary Exploration (**TRIPLE**)

Building EOSC

INFRAEOSC-05-2018-2019 a/c

- EOSCsecretariat.eu (**EOSCsecretariat.eu**)
- Fostering FAIR Data Practices in Europe (**FAIRsFAIR**).

INFRAEOSC-06-2019

- Enhancing the EOSC portal and connecting thematic clouds (**EOSC Enhance**)

INFRAEOSC-05-2018-2019 b

- EOSC-Nordic (**EOSC-Nordic**)
- Coordination and Harmonisation of National Initiatives, Infrastructures and Data services in Central and Western Europe (**EOSC-Pillar**)
- European Open Science Cloud - Expanding Capacities by building Capabilities (**EOSC-synergy**)
- EOSC Photon and Neutron Data Services (**ExPaNDS**)
- National Initiatives for Open Science in Europe (**NI4OS-Europe**).

EOSC Services

INFRAEOSC-03-2020

- Integrating and managing services for the European Open Science Cloud **(EOSC-Future)**

INFRAEOSC-07-2020

- Copernicus - eoSC AnaLytics Engine (**C-SCALE**)
- Data Infrastructure Capacity for EOSC (**DICE**)
- EGI Advanced Computing for EOSC (**EGI-ACE**)
- OpenAIRE-Nexus Scholarly Communication Services for EOSC users (**OpenAIRE Nexus**)
- REsearch LIfecycle mAnagemeNt for Earth Science Communities and CopErnicus users in EOSC (**RELIANCE**)

INFRAEOSC-5B Regional Projects

EOSC-NORDIC

Covering Finland, Sweden, Norway, Denmark, Iceland, Estonia, Latvia and Lithuania, the project aims to foster and coordinate all EOSC-relevant initiatives within the Nordic & Baltic countries and exploit synergies to achieve greater harmonisation at policy and service-provisioning level, in compliance with EOSC agreed standards and practices.

- **Website:** www.eosc-nordic.eu/
- **Services:** neic.no/services/

EOSC-Pillar

Gathering representatives of national initiatives for data infrastructures and services in Austria, Belgium, France, Germany, and Italy, to establish an agile and efficient federation model for open science services covering the full spectrum of European research communities.

- **Website:** www.eosc-pillar.eu/
- **Catalogue:** eosc-pillar.d4science.org/catalogue-eoscpillar

EOSC-SYNERGY

Covering Spain, Portugal, UK, Czech Republic, Slovakia, Poland, the Netherlands, and Germany, it focuses on expanding the capacity and capabilities of the EOSC by leveraging the experience, effort and resources of national publicly funded digital infrastructures in a coherent way.

- **Website:** www.eosc-synergy.eu/
- **Services:** www.eosc-synergy.eu/home/developing-capability/

NI4OS-Europe

Covering Greece, Cyprus, Bulgaria, Croatia, Hungary, Romania, Serbia, Slovenia, Albania, North Macedonia, Montenegro, Bosnia-Herzegovina, Moldova, Armenia and Georgia , it supports the development and inclusion of the national Open Science initiatives in the EOSC governance. It will instil the EOSC philosophy and FAIR principles and provide technical and policy support for the on-boarding of service providers.

- **Website:** ni4os.eu/
- **Catalogue:** catalogue.ni4os.eu/

ExPaNDS

ExPaNDS is the EOSC Photon and Neutron (PaN) Data Service. Through ExPaNDS for national PaN RIs and PaNOSC for PaN ESFRIs, coherent FAIR data services will be enabled to the scientific users of all European PaN facilities, universities and even industry.

- **Website:** expands.eu/
- **Services:** www.panosc.eu/services/

EOSC-SYNERGY in a nutshell

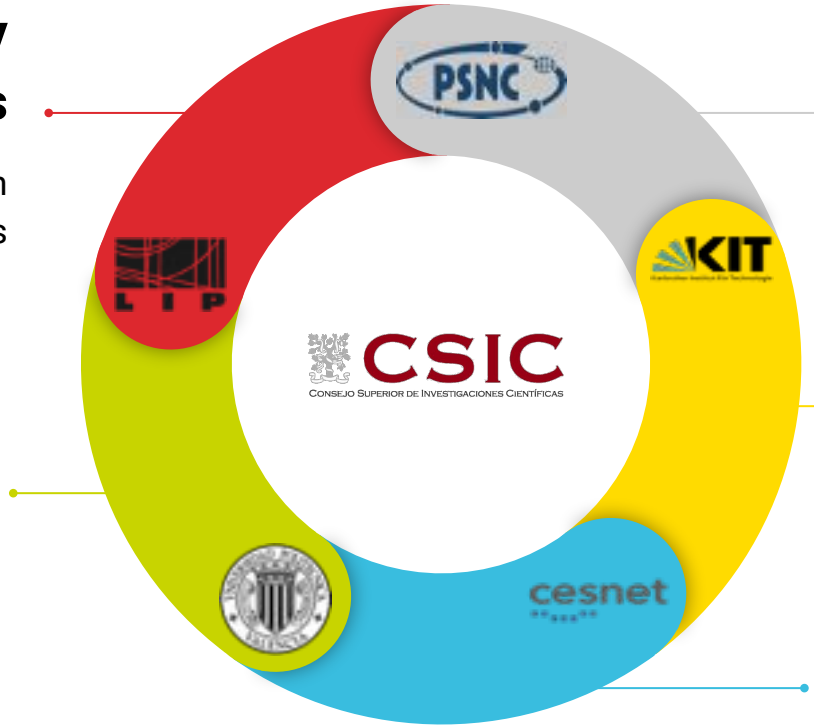
Promote EOSC High Quality Services

Software quality as a service, FAIRness evaluation and quality certification badges

Thematic Services Integration

10 thematic services addressing 4 scientific areas (Earth Observation, Environment, Biomedicine and Astrophysics)

22 partners in 10 countries
(ES, PT, FR, UK, DE, NL, CZ, SK, PL and BR)



Skills development

Environment for tutorials with a dedicated MOOC platform, courses methodology and a Hackaton as a service platform

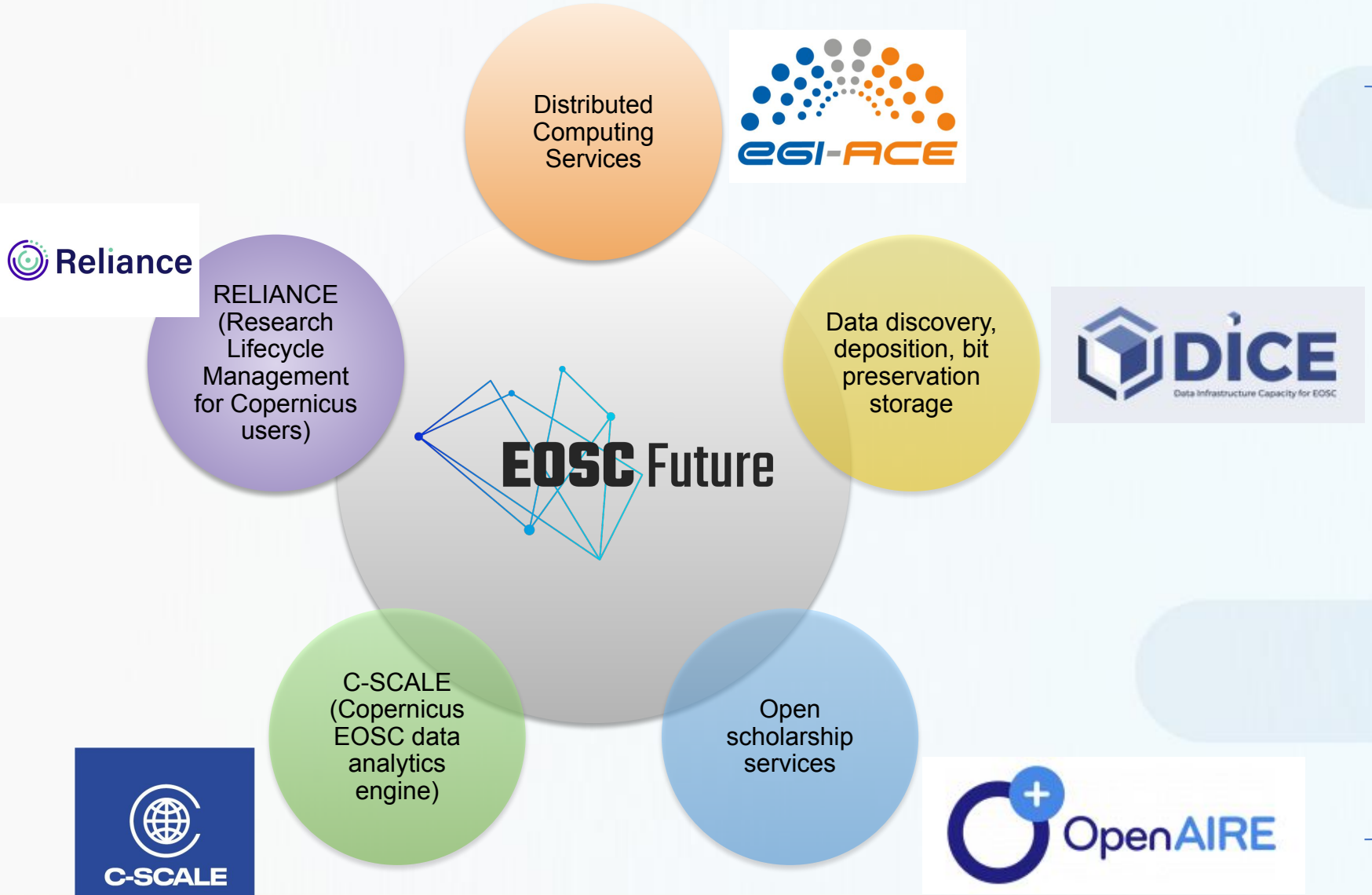
Capacity Expansion at the Infrastructure level

Integration of services and resources from the RIs of the consortium partners

Alignment at the Policy Level

Collaboration with regional projects on landscaping activities, gap analysis and contribution to EOSC policies

INFRAEOSC-3/7 Projects



Collaboration agreement signed on 15/Oct/21:

- Technical Activities
  - Architecture & Technical Interoperability
  - Service Provisioning
  - Resource Provisioning and Technical Support
- Uptake
  - Joint promotional activities
  - Joint events
- Training
  - Joint EOSC training
  - Co-development of new EOSC training materials

Slide credits: EGI-ACE

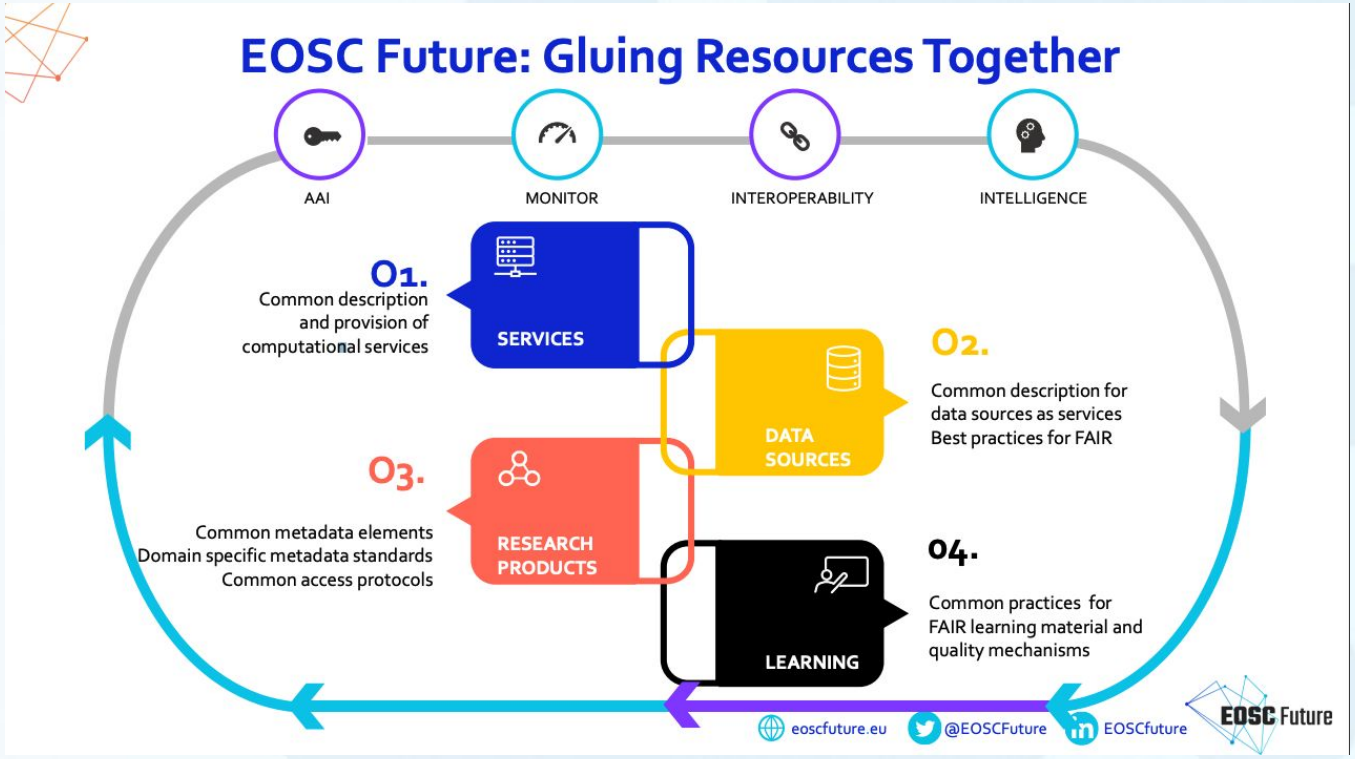
EOSC Future

Vision

- Operational EOSC Platform
  - Consisting of data, services, open research products
  - Accessed and used by European researchers
    - Engaged, facilitated, trained, supported

Mission

- To bring the e-Infrastructures and Science Cluster communities together to implement an operational EOSC Platform focusing on technology and interoperability, resources, user engagement and user experience.



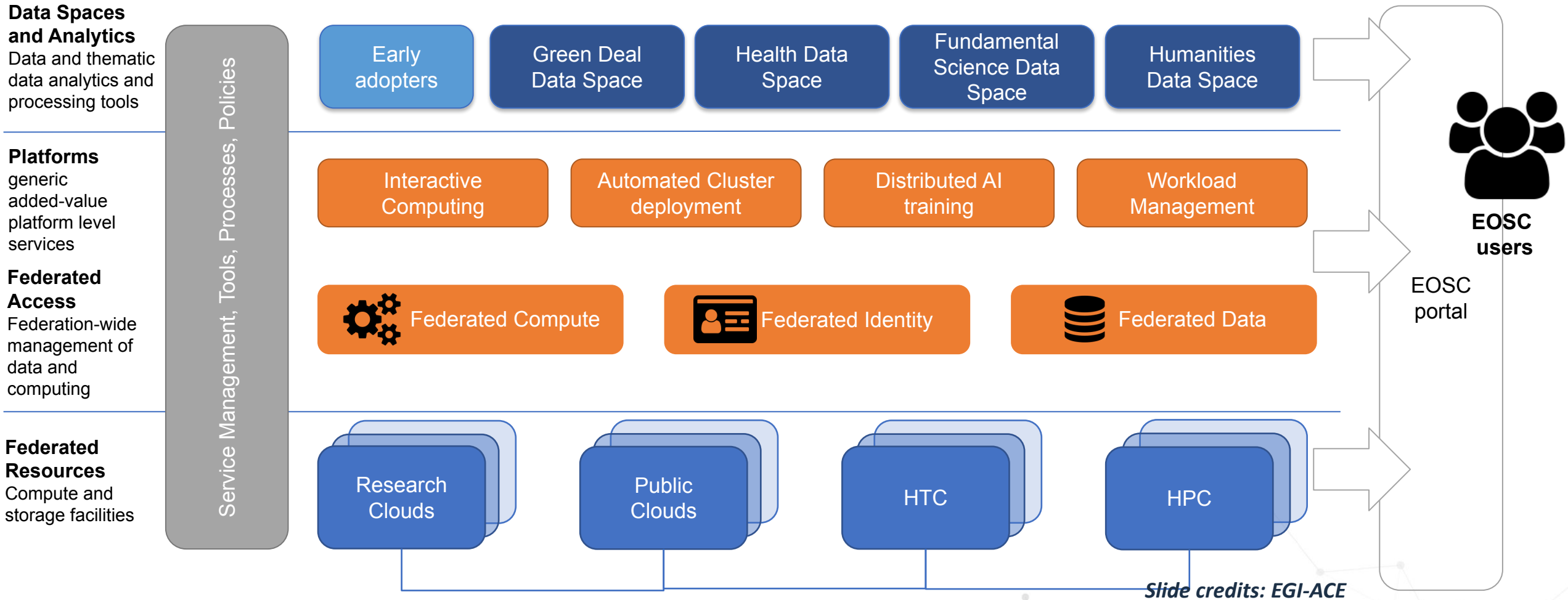
Credits: EOSC-Future, Mission and Outcomes, EOSC Symposium 2021

EOSC Future Vision for the Users

- Users have a personalised dashboard integrating ALL services and data necessary for their work
  - Thematic (vertical) - European, regional, national
  - Generic (horizontal) - European, regional, national
- Users log in with their credential (AAI-Authentication and Authorization Infrastructure) and see the personalised environment.
- Users look for new services/datasets and the system is intelligent to recommend relevant services/datasets available (Artificial Intelligence).
- The system includes various metrics, #downloads, ratings and comments, as in modern marketplaces.
- Not a single portal for everybody.

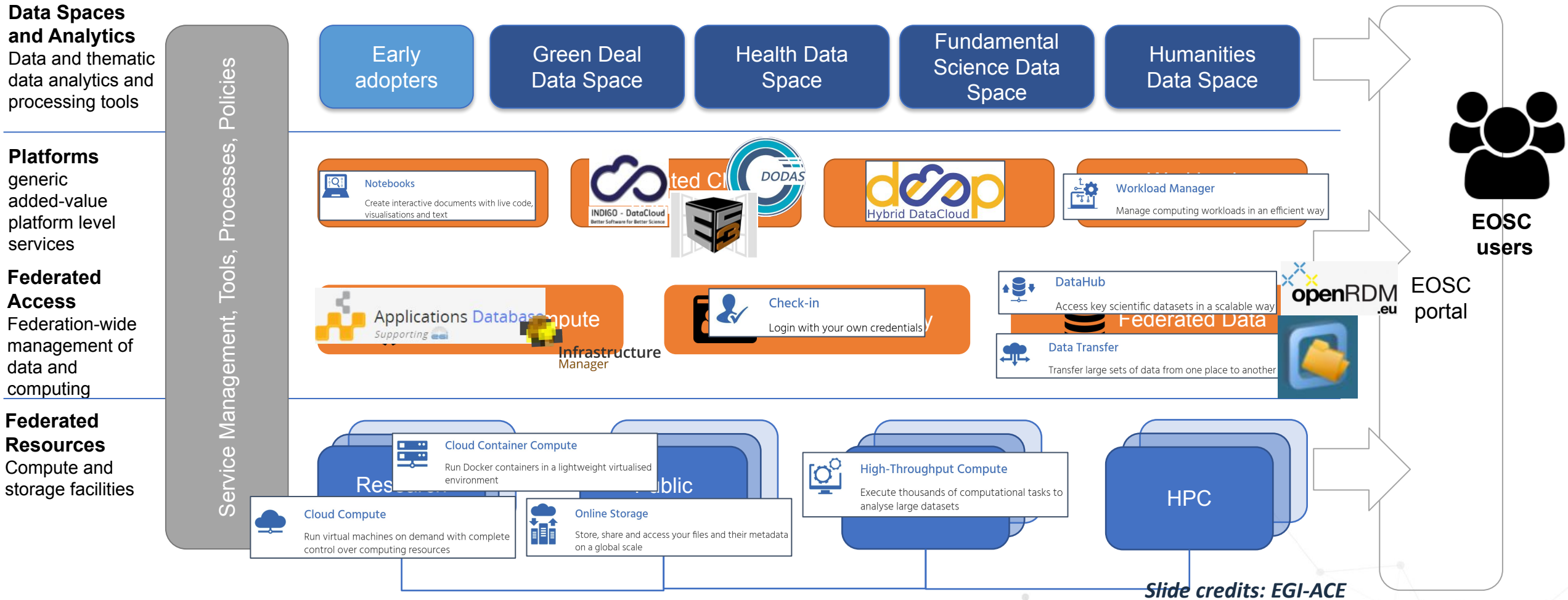
Source: EOSC Future, EOSC Services for the Users, 3rd ESFRI RIs -EOSC Workshop: What does EOSC bring to RI users?

Integrated tiered service architecture



Slide credits: EGI-ACE

EGI-ACE concept and methodology: Tier service architecture



Slide credits: EGI-ACE

EUROPEAN OPEN SCIENCE CLOUD

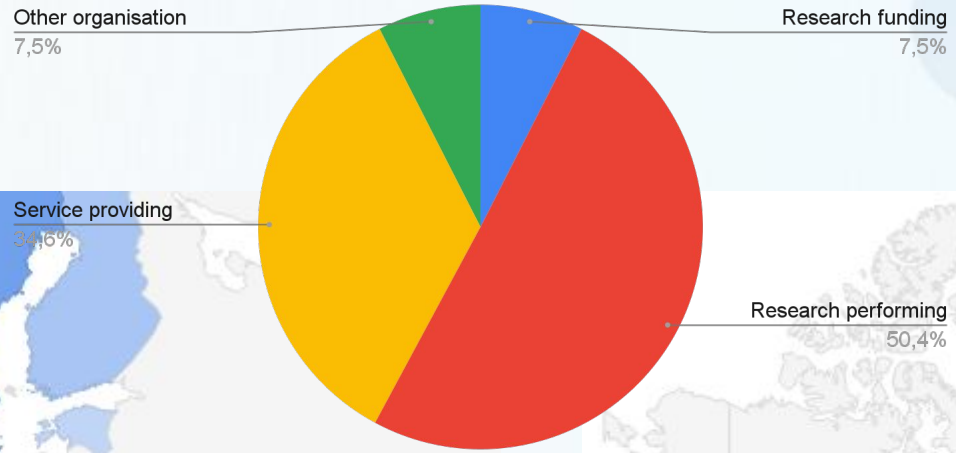
The EOSC-A Association

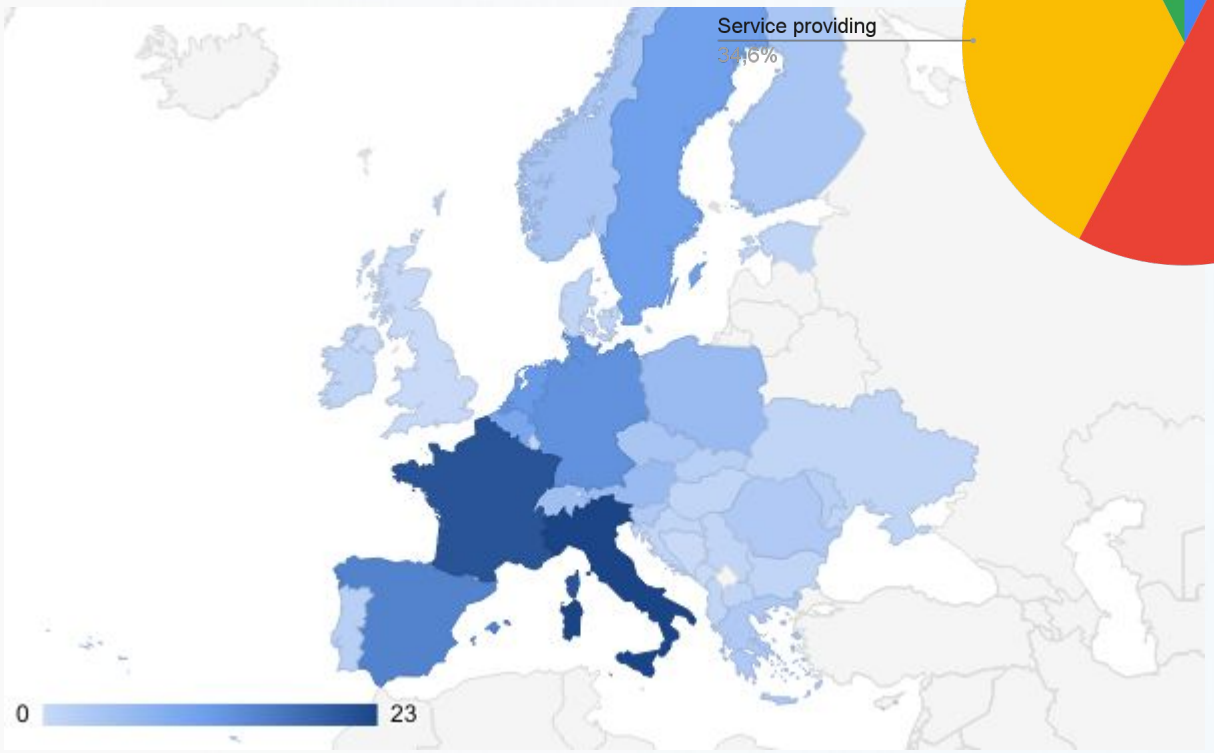
The EOSC Association

- The new governance model agreed with EU countries for the EOSC implementation phase is tripartite including:
  - The EU represented by the Commission.
  - The European research community represented by the EOSC Association.
  - EU countries and countries associated with Horizon Europe represented through a Steering Board.
- The EOSC-A was constituted on 7/29/2020 by four founding members (CESAER, GARR, CSIC and GEANT)
  - In total, more than 250 entities have applied for admission as a member or as an observer.
  - Members have voice and vote and observers only voice
    - Annual fees are € 10K for members and € 2K for observers.
  - In addition, mandated members act as entrusted entities on behalf of the countries and are appointed by the relevant ministries in each country.
  - The association signs a partnership agreement co-programmed with the EC.
  - Belonging to the EOSC association implies being part of this partnership.

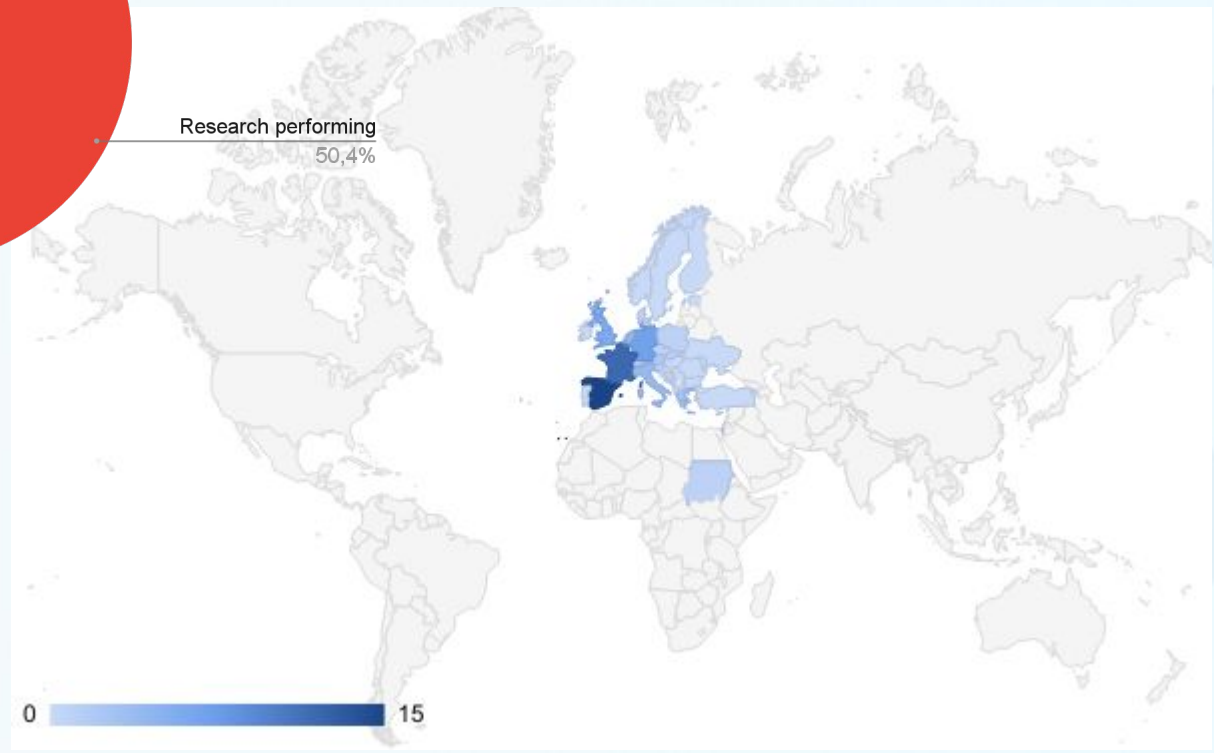
EOSC membership by geographical spread

184 Members





73 Observers



Board of Directors

- Partially re-elected in December 2021

President

22

Karel Luyben (CESAER)

Staff

Ute Gunsenheimer (Secretary General)

René Buch (CTO)

+ 4 additional staff members (dissemination, policy officers, administration).

Year of expiration of the mandate

Directors

23

Marialuisa Lavitrano (UNIMIB)

Vice-President

23

Suzanne Dumouchel (CNRS)

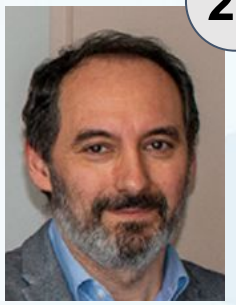
23

Klaus Tochtermann (ZBW)

Treasurer

22

Sarah Jones (GEANT)



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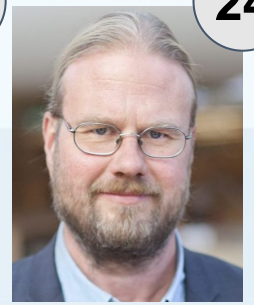
Ignacio Blanquer (UPV)



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Wilhelm Widmark (SU)

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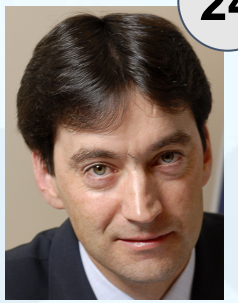
Sara Garavelli (CSC)



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Bob Jones (CERN)

EUROPEAN OPEN SCIENCE CLOUD

Task Forces

Suzanne Dumouchel

Implementation of EOSC

- Rules of Participation compliance monitoring
- PID policy and implementation
- Researcher engagement and adoption

Ignacio Blanquer

Technical challenges on EOSC

- Technical interoperability of data and services
- Infrastructure for quality research software
- AAI Architecture

Sarah Jones

Metadata and data quality

- Semantic interoperability
- FAIR metrics and data quality

Wilhelm Widmark

Research careers and curricula

- Data stewardship curricula and career paths
- Research careers, recognition & credit
- Upskilling countries to engage in EOSC

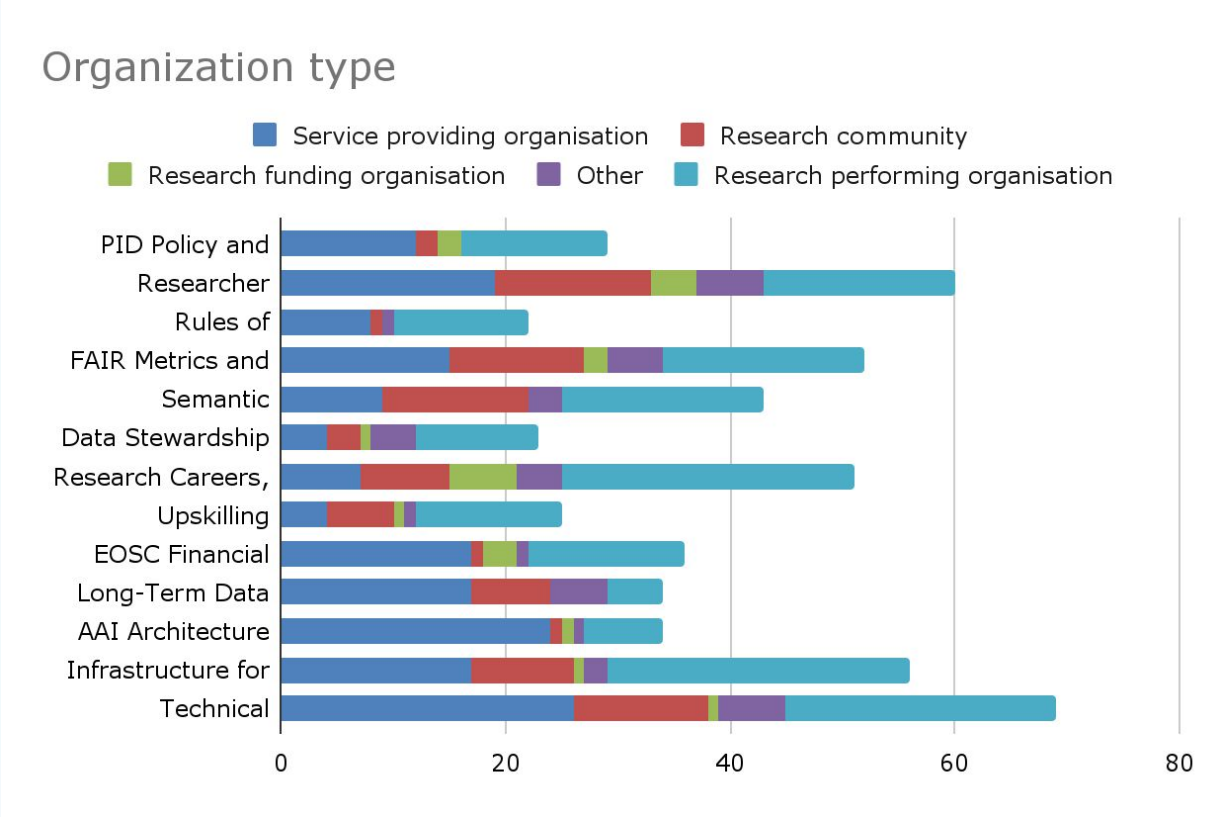
Bob Jones

Sustaining EOSC

- Financial sustainability
- Long-term data preservation

Task Forces activities

- EOSC Association members & observers are the primary members of AGs.
- Around 450 applicants have been selected.
- Representatives of the key implementation projects should be members of relevant AGs to present work in progress and receive advice and steers from the community.
- The ideas and priorities of the EOSC Association Advisory Groups should feed into the Descriptions of Work of the upcoming Horizon Europe projects.
- Draft remits can be found in the web site.



The EOSC-Association Task Force on Technical Interoperability

- Coordinated by Álvaro López (CSIC-ES) and Eva Sciacca (INAF-IT).
- Draft Charter available in the EOSC-A website.
- Objective of the TF
  - The Task Force will take the EOSC Interoperability Framework (EIF) recommendations around technical architecture as their starting point to help develop the EOSC Core and Exchange.
  - The EOSC Core and Exchange will create interoperability whilst preserving a diversity of components, both on the semantic and the technical level.
  - This Task Force will enable the EOSC-Future project, other EOSC projects and the EOSC resource providers to harmonize their approaches to achieve interoperability.

- 4 subgroups defined, addressing:
  - Landscape, Overview and Scouting.
  - Data technical interoperability.
  - Services technical interoperability.
  - Technical Architecture recommendations.

- Five deliverables expected:
  - A first principles document. (May 2022)
  - A landscape overview (capabilities and gaps) of the EIF. (July 22-July 23)
  - A draft technical architecture description of the EIF. (Nov 2022)
  - A technical architecture description of the EIF, including examples of adaptation hints for major existing solutions. (Nov 2023)

The EOSC-Association Task Force on Infrastructures for Quality Research Software

- Coordinated by Roberto di Cosmo (INRIA-FR) and Isabel Campos (CSIC-ES).
- Draft Charter available in the EOSC-A website.
- Objective of the TF
  - Foster the development and deployment of tools and services that allow researchers to properly archive, reference, describe with proper metadata, share and reuse research software.
  - Improve the quality of research software, both from the technical and organizational point of view for research software in general and in particular the software used in the services offered through EOSC.
  - Increase recognition to software developers and maintainers of research software as a valuable research result, on a par with publications and data, in the Open Science landscape.
- A specific subgroup on sustainability, addressing:
  - Build a landscape of the approaches to sustain the development of research software beyond initial seed funding.
  - Identify the blockers and limitations as well as the best practices for a sustainable research software lifecycle management.
  - Formulate actionable recommendations based on the findings.
- A specific subgroup on Quality software services for the EOSC aiming at defining unbiased quality criteria for research software and improving their use in the services offered through EOSC.

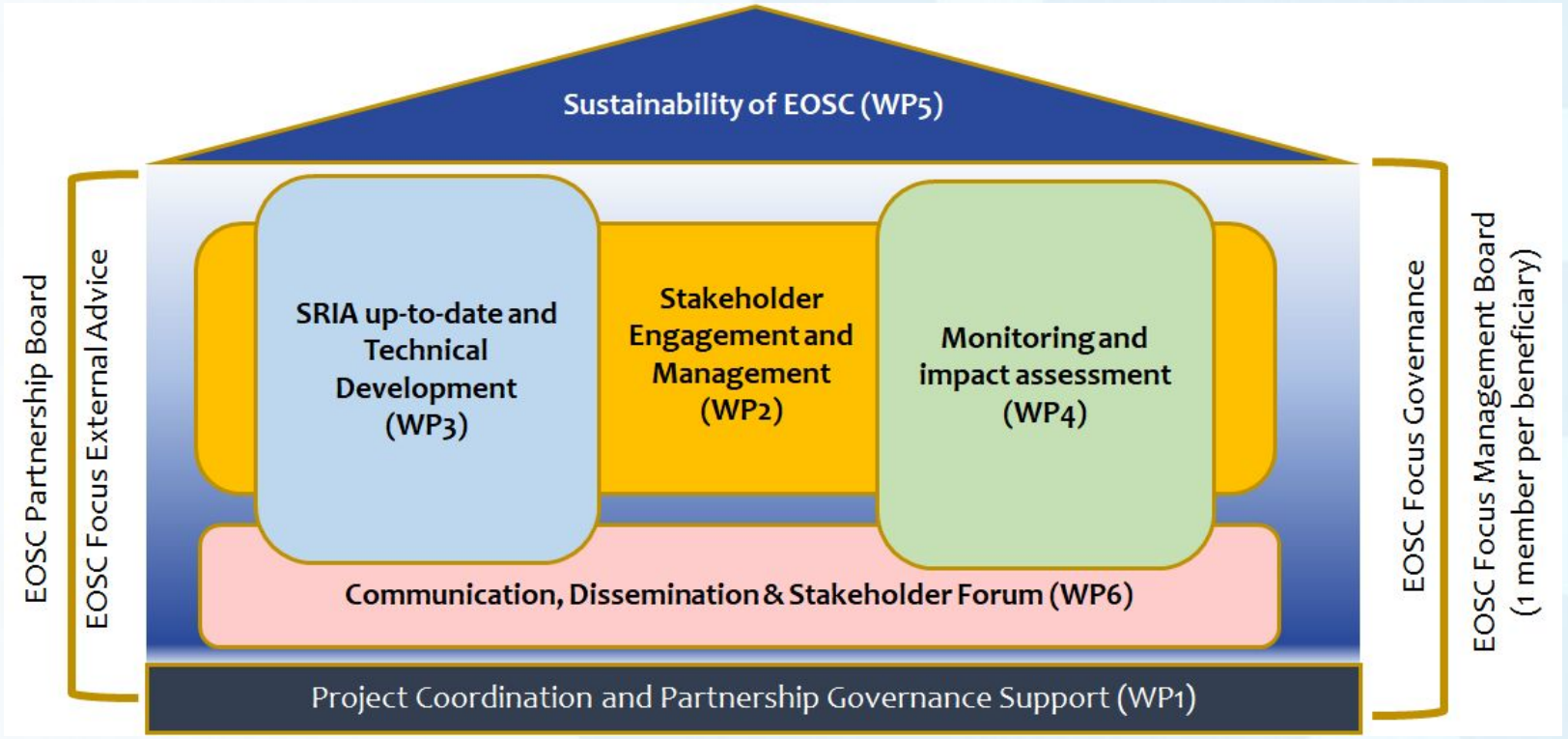
The EOSC-Association Task Force on AAI

- Coordinated by Christos Kanellopoulos (GEANT) and Jana Broncova (Masaryk University).
- Draft Charter available in the EOSC-A website.
- Objective of the TF
  - Develop the next version of the EOSC AAI Architecture
  - Engage with stakeholders to identify new use cases and requirements
  - Analyse governance models for the EOSC AAI
- Five deliverables expected:
  - EOSC AAI Architecture v2022 (due mid 2022)
    - Community attributes and authorization, multi-infrastructure workflows, scalability, consistent user experience and interfaces for service providers, growth of EOSC beyond the research and education community
  - Requirements for the EOSC AAI v2022 (Report)
  - Analysis of possible governance models for the EOSC AAI (due end of 2022)
    - EOSC AAI Federation policies and support services, EOSC Core Infrastructure Proxy components
  - EOSC AAI Architecture v2023 (due mid 2023)
  - Requirements for the EOSC AAI v2023 (due end 2023)

EOSC Focus (101058432)

INFRA-2021-EOSC-01-02
Supporting the development and coordination of activities of the EOSC Partnership (23.09.2021)

Consortium formed after open call for expression of interest of EOSC-A Members



Multi-Annual Roadmap (MAR)

- The EOSC Multi-Annual Roadmap 2023-2024 forms part of the Strategic Research and Innovation Agenda (SRIA).
- The EOSC Association is currently updating the MAR to devise a set of priority actions and outcomes for the 2023/24 period.
  - It also draws from the European Commission's forthcoming Work Programme to identify new areas of interest such as data quality, digital preservation and infrastructure for sharing sensitive data from public authorities.
- These priorities are assigned to three levels for implementation: european, National and Institutional.

Conclusions

- The vision of EOSC is not limited to linking datasets, federating infrastructures, or aligning policies
  - It links stakeholders throughout the data lifecycle and across the European research ecosystem
- It must be inclusive and supplement the activities of research communities.
- Contributions from the wide landscape will be complementary but also will enter into competition
  - An iterative approach is needed to progressively build trust and resolve conflicts between the stakeholders.
  - There must be an objective assessment of what has been achieved with each iteration.
- The creation of the EOSC Association was an important achievement and provides a forum where the stakeholders meet and align
  - Task Forces are a key instrument to promote, discuss and align developments.

THANK YOU

@eoscassociation

info@eosc.eu