



**EUROPEAN OPEN
SCIENCE CLOUD**



Position Papers on EOSC

Insights from Regional Projects & Infrastructures

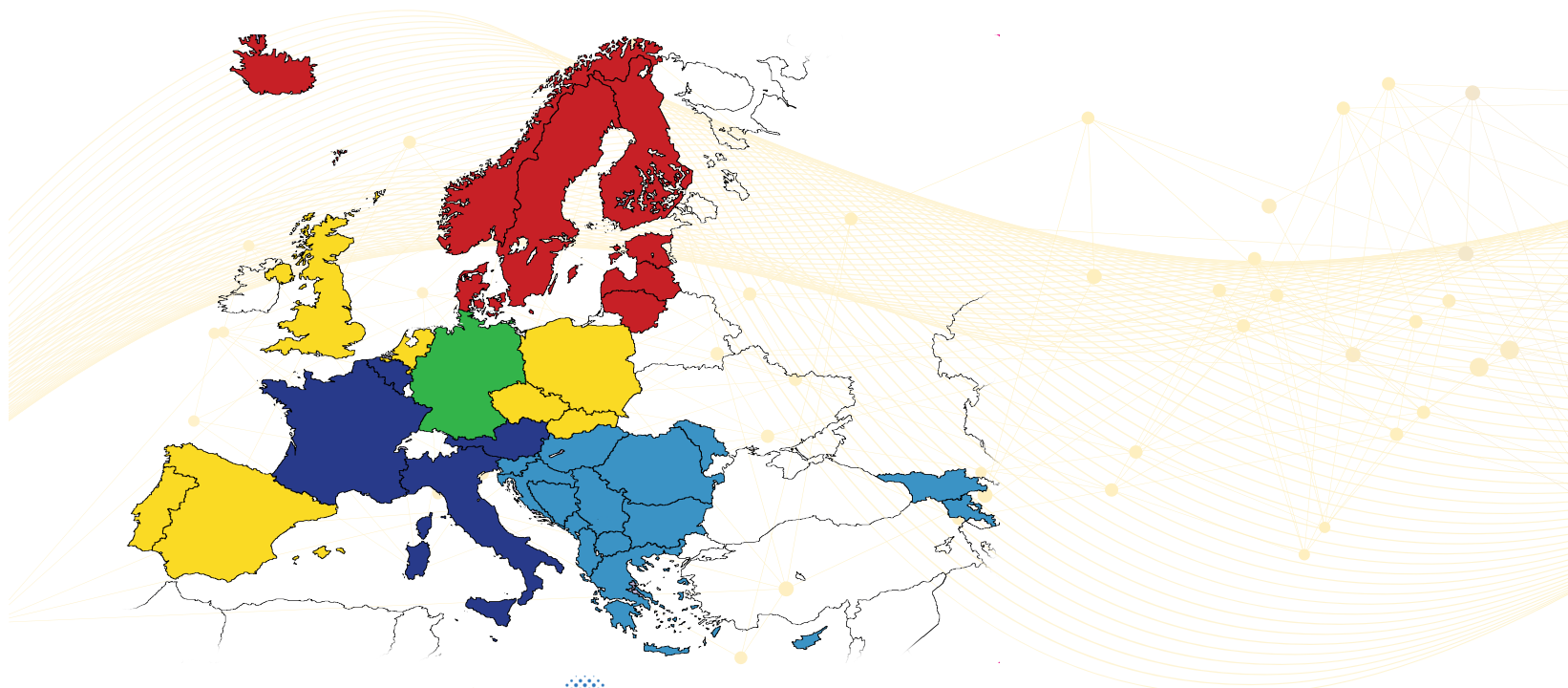


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Executive Summary

This interesting and forward-thinking collection of position papers provide the expectations, contributions and recommendations concerning the European Open Science Cloud (EOSC), from projects funded under the INFRAEOSC 5b call: a subgroup of four regional projects and the thematic project ExPaNDS.

- **EOSC-Nordic:** Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway and Sweden.
- **EOSC-Pillar:** Austria, Belgium, France, Germany and Italy.
- **EOSC-Synergy:** Czech Republic, Germany, the Netherlands, Portugal, Poland, Slovakia, Spain, and the United Kingdom.
- **NI4OS-Europe:** Albania, Armenia, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Moldova, Montenegro, North Macedonia, Romania, Serbia and Slovenia.
- **ExPaNDS:** the EU Open Science cloud photon and neutron data service, a collaboration between 10 national Photon and Neutron Research Infrastructures and EGI.

★ Expectations from the future EOSC

The EOSC vision wants to model Europe as a place where science is both stronger and easier, an environment that benefits society at large. As with many other European undertakings, this also starts with the willingness to collaborate and with the policy support by Member States and Associated Countries. EOSC is considered as an open, inclusive structure, where countries can play a leading role, while the voices of the scientific communities and society that can bring value to this vision, from Industry to citizens, can also be heard.

EOSC will boost the **transparency** on its governance structures and procedures, as part of its clear added value for the research community. A **support mechanism** and best practices that **facilitates convergence and alignment** between European, national and regional structures and initiatives are also being defined.

Technically speaking, several aspects are highlighted, such as a common way of **identifying, authenticating, and authorising users (AAI)** across Europe, or the need for **long-term archiving** of large quantities of open data coupled to high-performance storage and computing resources. In terms of facilitating the future uptake of EOSC across communities, **incentives and prerequisites** of all primary stakeholder groups should be taken into account, and the **onboarding procedure** for services has to be made user-friendly.

★ Contributions to EOSC

The main contributions of all regional projects will be focused on supporting coordination, harmonisation and alignment of national open science policies and practices related to research data services with EOSC. The promotion of **FAIR data principles** is one of the key aspects of this process, and is at the centre of all InfraEOSC-5b initiatives.

Surveys on the state of national initiatives across Europe have been carried out, in order to have a clearer overview of **the current landscape** on issues related to open science and FAIR principles. Going forward, the projects will play an important role in the **training process** and in the **direct engagement** of regional open science circles, working as a special link with the broader EOSC community with the goal of expanding their usage throughout Europe.

In terms of infrastructures, an important contribution will be given to the definition of the **EOSC standard interfaces**, evaluating their adoption locally in order to maximise **interoperability** between EOSC services and those offered by national RIs. Standardisation and certification are therefore also essential priority areas for collaboration and the projects will also cooperate on the **federation of existing data catalogues and services**.

★ Recommendations and key messages to the governance

The InfraEOSC-5b projects believe that national initiatives are among the key elements for the creation of an inclusive and sustainable EOSC. A truly European endeavour such as EOSC ensures the involvement and long-term commitment of Member States and Associated Countries.

It is fundamental that the EOSC Governance addresses several critical issues, such as national open science policies, and the delivery of horizontal services and access to resources in a transnational environment. Attention must be paid to the legal challenges associated with the cross-border sharing of resources, and to guarantee the long-term sustainability of the coordination, in terms of budget and governance.

Considering the different levels of readiness across Europe in terms of open science, the EOSC Governance is also encouraged to stimulate awareness and incentivise in less mature or smaller environments, through widespread communications and training activities as well. EOSC needs clear Rules of Participation, as well as common standards for FAIR data and services and the EOSC community look to actively contribute to the reports delivered within the EOSC WGs in 2020.

EOSC can only succeed if all the national initiatives, with their specificities and strengths, are taken into account and can play a leading role in making this vision a reality. This should be reflected in the design of the EOSC legal entity and its governance, but also in the mechanisms that ensure the functioning of EOSC as a federation and we hope these position papers may support, in a pragmatic way the support to a truly EOSC European partnership.

EOSC

 **NORDIC**



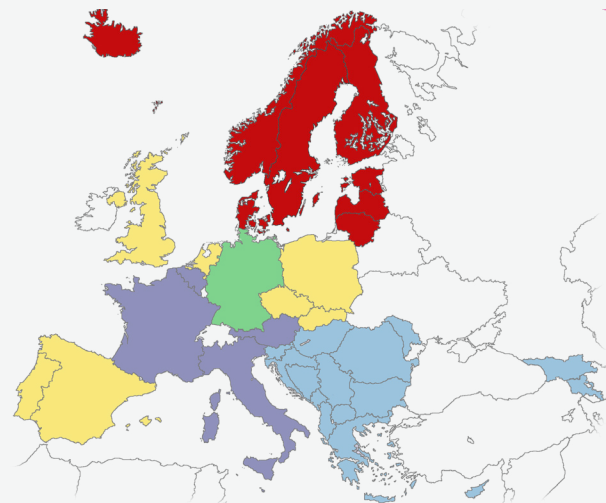
Introduction

EOSC-Nordic project's overall objective is to foster & advance the take-up of the European Open Science Cloud at Nordic level by coordinating the EOSC relevant initiatives taking place in Finland, Sweden, Norway, Denmark, Iceland, Estonia, Latvia and Lithuania; bringing them to bear in the context of the EOSC.

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 not only across the Nordic and Baltic region, but also between the Nordics, the Baltics and other countries, in compliance with EOSC agreed standards and practices. By doing so, the project seeks to establish the Nordic & Baltic region as frontrunners in the take-up of the EOSC concept, principles and approach. By working together to realise EOSC at the regional level, the countries can provide "Nordic Added Value" (Nordisk Nytte), a key concept for the Nordic Council of Ministers and Nordic cooperation at large, and a way to achieve more together than separately.

Expectations from the future EOSC

EOSC-Nordic expects the future EOSC to provide a seamless access to resources, and enable cross-border research collaboration which requires promoting the uptake of FAIR data principles. Therefore, in the future development of EOSC, incentives and prerequisites of all



EOSC-Nordic

A new path to European research and innovation in Nordic and Baltic countries

Project website	www.eosc-nordic.eu
Start date	01-09-2019
End date	31-08-2022
Countries	Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden
Coordinator	Nordic e-Infrastructure Collaboration/Nordforsk (Norway)
Contact e-mail	po@eosc-nordic.eu
Size	24 Partners
Social Media	Twitter: @EOSC_Nordic Instagram: @eosc.nordic YouTube: EOSC Nordic

primary stakeholder groups, end-users, service providers and funders, should be taken into account.

End-users

- Enable researchers to share the results of their research and engaging researchers to use EOSC is of high importance

for the future of EOSC. Researchers are interested in whether EOSC will be able to provide 1) access to data of their interest, 2) applications of their interest, 3) more visibility for their data, and 4) easy sharing of data with researcher colleagues.

- Higher Education Institutions and public research organisations should be placed as the key stakeholder of the EOSC. Focus should be on serving researchers well before defining the needs and added-value of EOSC to user groups from the public sector and industry.
- EOSC-Nordic is committed to a common culture of data stewardship and FAIR principles and to develop user driven data infrastructure commons. The core of the success of EOSC is having FAIR research data available and researchers using EOSC.

Service providers

- EOSC-Nordic pilots innovative solutions that are designed to support cross-border research collaboration of research communities and provide access to a wide range of publicly funded services supplied at national, regional, and institutional level. In the future development of EOSC, what should be emphasised is the viewpoint of public service operators and how cross-border services could be realized.
- It should be taken into account that public service providers have limitations to operate and serve outside the mandate set by their owners and to compete in the same market than commercial service provides due to the EU legislation on competition and procurement.
- EOSC needs to make sure it is easy for a service or a repository to join.

Funders

- EOSC-Nordic expects a sustainable model with funders' engagement from the future EOSC. Therefore, prerequisites of funders' engagement and incentives to make investments need to be assessed properly. Funders' overall engagement require their engagement in the governance structure. Sufficient financial commitment will likely only be possible through a resource federation (including both national and institutional resources).

Contributions to EOSC

A successful EOSC-Nordic will reinforce Nordic research area capability and competitiveness; create a profile of a leading knowledge based region; increase the ability of the region to attract talent and investments; enhance its appeal as a partner in cooperation; and strengthen the Nordic region and its efforts in the overall EOSC, through the creation of a cross-border cooperation model for Europe. The main objectives of the project are outlined below.

Support coordination, harmonisation and alignment of Nordic and Baltic national policies and practices related to the provision of horizontal research data services with EOSC. EOSC-Nordic aims to facilitate the alignment of the delivery of horizontal services by improving interoperability practices across the national initiatives. This is to establish a truly coherent environment where services can work and be combined together to enable seamless access to resources. This project addresses interoperability issues at the four levels identified by the European Interoperability Framework (EIF) (organisational, semantic, legal and technical) in order to facilitate the integration of the services with EOSC.

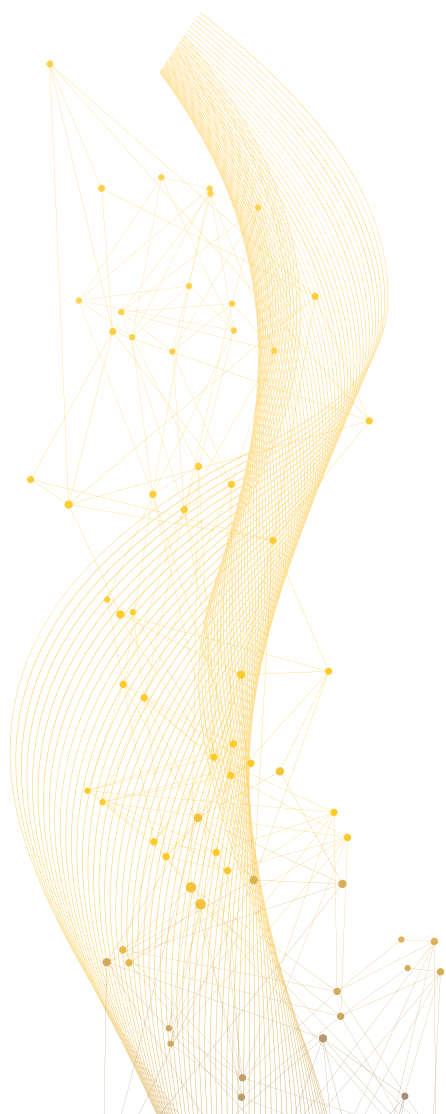
Increase the discoverability of Nordic and Baltic services. Extend and expand their use by making them accessible through the EOSC portal. This will include identifying and engaging with prospective service providers and supporting their integration with the EOSC catalogue, service management framework and operational environment. Particular attention will be paid to services, which can be "opened up" to users beyond their initial, local customer base. By integrating services with EOSC core components, such as EOSC portal, federated AAI, marketplace, and helpdesk, our goal is also to simplify access to these services across the Nordics and beyond.

Promote and support the uptake of FAIR data practices and certification schemas across the Nordics and Baltic countries. EOSC-Nordic will work in close collaboration with FAIRsFAIR and other relevant initiatives (such as GoFAIR) on data management to promote best practices and support the adoption of relevant certification schemas. We will also address the question of incentives and develop a set of recommendations for the uptake of FAIR practices across EOSC.

Accelerate the progress and attractiveness of EOSC by piloting & delivering innovative solutions developed and tested in a useful and functional cross-border

environment. The project will demonstrate the potential of EOSC by piloting innovative solutions, designed to support cross border research collaboration, using the Nordic and Baltic countries as a testbed environment. We will focus on a series of demonstrators addressing different parts of the research and data life cycle: discovery and re-use, analysis and post-processing, data management (including sensitive data management), sharing and archiving. The solutions which will be tested and validated by research communities leverage existing services (from national e-infrastructures and/or research communities as well as core EOSC services and components provided by pan-European initiatives involved in EOSC) and are suitable by-design to spin-off on a cross-border environment such as EOSC.

Provide a Knowledge Hub. EOSC-Nordic will consolidate and expand a distributed network of experts and service operators at local and national levels. A distributed team will be created involving experts within and from outside the consortium to deliver training and technical support to new service providers and communities willing to engage with EOSC, during and after the project lifetime.



Recommendations and key messages to the governance

The overall objective on Governance & Legal issues is to foster the coordination of and connection between the national initiatives at policy level, in the context of EOSC. The tasks address open science policies and the delivery of horizontal services and access to related resources in a cross-border environment, the legal aspects associated with the sharing of resources, and the sustainability of the coordination.

- **Policies and principles.** Identify and map the open science policies & resource provisioning principles applied in the Nordic and Baltic countries.
- **Services and resources.** Investigate models, roles and responsibilities for the coordinated provisioning and delivery of EOSC services and resources at national level.
- **Legal challenges.** Identify current and potential legal hurdles associated with the sharing of data and resources across national borders. Suggest solutions.
- **Coordinate and align.** Discuss and coordinate policy activities, and advise on directions the national initiatives should take to align with relevant EOSC policies.

WP2 of EOSC-Nordic is fundamentally policy-oriented and its main external stakeholders are national policy-makers and funders. A majority of stakeholders do not know about EOSC or are unclear about how to engage with it and what benefits it can bring to them. By interacting and engaging with policymakers, funding agencies and governance bodies we aim to make them informed about the project's strategy plans, roadmaps and demonstrate added values and successes. We provide the following:

- Updates about how to achieve the best possible usage of digital data to benefit the economy and society, and support the EOSC and regional efforts to harmonise policies on research data.
- Advice in removing legal restrictions from creating EOSC in the Nordic and Baltic context.
- Help in the facilitation of the discussion around EOSC future in the Nordic and Baltic context.
- New guidelines to provide sustainable funding levels for Open Science implementation by including FAIR and Open Science requirements on future funding programmes.



EOOSC-Pillar

Coordination and Harmonisation of National & Thematic Initiatives to support EOOSC

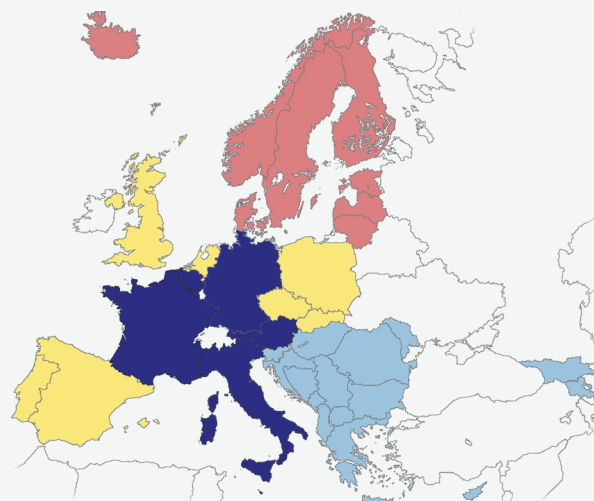
Introduction

EOSC-Pillar gathers representatives of the fast-growing national initiatives for coordinating 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.

Our proposal aims to implement some of the main pieces of the EOSC jigsaw within a science-driven approach which is efficient, scalable and sustainable and that can be rolled out in other countries.

Expectations from the future EOSC

Science does not stop at national borders. This is our belief in EOSC-Pillar, which we believe is shared with many researchers worldwide. Of all human endeavours, science is the most collaborative and global, not by accident, but by design. The drive to learn and answer more and more difficult questions about the world we live in has always led



EOSC-Pillar

Coordination and Harmonisation of National Initiatives, Infrastructures and Data Services in Central and Western Europe

Project website	www.eosc-pillar.eu
Start date	01-07-2019
End date	30-06-2022
Countries	Austria, Belgium, France, Germany, Italy
Coordinator	Consortium GARR (Italy)
Contact e-mail	info@eosc-pillar.eu
Size	18 Partners
Social Media	Twitter: @EoscPillar LinkedIn: EOSC-Pillar YouTube: EOSC Pillar

scientists to cooperate and tackle problems that would be impossible to solve for a single mind. But while cooperation is far stronger than competition among researchers, many barriers still make it difficult, and this is especially true in the new wave of data-driven science that has characterised the beginning of this millennium.

Knowledge seems to be there for us, right among the data, if we only could find the right ones and extract it. But what if the right answers are out there and you cannot find, access, read, and reuse them in an open environment because of licenses, formats, policies (or the lack of them)? That's what the European Open Science Cloud is about to us in EOSC-Pillar, and what is great about this vision. We fully believe in this vision and we want to be part of it, playing a role in removing the barriers that still make European (and wider) data-driven collaborations impractical if not impossible. Interoperability and ubiquitous availability of services, data FAIRness and machine actionability are key to this path. Of course, there are specific communities and domains where this is happening already, but that's all the more reason to upscale this paradigm and make it the new way to make science.

We expect the EOSC vision to make Europe a place where science is stronger and easier and that society at large can benefit from it. In our view, this starts where things have always started in the EU: with the willingness to collaborate and with policy support by the Member States (MS). For this reason, our wish is that the EOSC is an open, inclusive structure. A place where the MSs can play this leading role. A place where the voices of scientific communities and other parts of society such as industry and citizens can be heard. We are now pioneering a road that, in a few years from now, will lead to a large federation of data and services.

This will make it possible for us to achieve new scientific results, and address the many challenges that face us today, from climate change, to an ageing population, to sustainable energy and agri-food, to novel - or old, but still untamed - diseases.

Contributions to EOSC

EOSC-Pillar brings together the user communities of national initiatives, to co-build the EOSC as a world-leading user-oriented resource for tomorrow's data enhanced science. To this end, we intend to bring our creative contribution to several both technical and non-technical aspects. Landscaping, policies, community engagement, and also interoperability and scalability are at the centre of our action plan.

When planning where you want to go, it is important to know where you should start from. With this idea in mind, we have worked on a large Survey involving approximately 2,200 organisations in Austria, Belgium, France, Germany, and Italy in order to provide a picture of the state of the art of National

Initiatives and their perspectives in terms of funding, policies, business models, services, usage and more. We wanted it to be quantitative and we plan to evolve it further by defining, in collaboration with the other regional projects, a set of indicators that can help us to identify the strengths and areas of improvement for each country, monitor their progresses and guide our supporting action.

Science does not stop at national borders. Therefore, from a **policy perspective**, we plan to help harmonise and improve the national policies and strategies related to FAIR data and Open Science, not only in our five countries, but also with the other European regions, and international partners worldwide.

EOSC-Pillar directly involves representatives of the fast-growing initiatives for national coordination of data infrastructures and services in Italy, France, Germany, Austria and Belgium in order to define and implement a lean and efficient federation model to facilitate the offer of transnational open science services to and from scientific communities. We directly engage with national governments on a ministerial level and have first-hand knowledge of research e-Infrastructure requirements from a capacity building, storage, resources, compute and data point of view. We believe we can act as a model for other emerging initiatives to follow.

But while shared policies are a key ingredient, and a prerequisite to succeed in bringing an ambitious vision such as EOSC's, they are not the only one. **(co)funding strategies and business and usage models** are a key to ensure long-term sustainability, and a part of our work is focusing exactly on these aspects, in order to identify barriers and opportunities and design model(s) that can viably ensure cost and responsibility sharing among the different countries that implement, host, maintain and use trans-national services.

On the **community engagement** side, we plan to aggregate and achieve wide adoption of processes and practices for optimal use of resources, tapping into a diverse set of scientific communities to consolidate and interconnect research support services in different research domains. This we are doing by building on real-science use cases, and working together with the researchers who should not just use the infrastructure, but be at the centre of it.

We plan to contribute to the **uptake of FAIR and Open Science**, and meet the challenges of the exponentially growing need of European RIs for data-driven research. Our

use cases are live labs where we try out strategies to support data curation, preservation and exploitation through our use cases initiatives, from transnational communities, and progressively remove technical and organisational barriers to ensure findability, accessibility, interoperability and re-use of research data.

From a more technical point of view, we are working on **interoperability and standardisation**, and on workable federation models that can ensure scalability and extensibility of the infrastructure while maximising the ease of use for both service providers, data depositors and data consumers.

Our innovative communications strategy is directly aimed at **promoting national and European achievements on a global level**. This will be coordinated and enhanced through close liaison with the EOSC Executive board, Secretariat, working groups, and Stakeholder Forums. Our ambition is to have the expected outcomes of EOSC-Pillar reviewed and adopted globally.

Recommendations and key messages to the governance

In EOSC-Pillar we believe that National Initiatives are one of the key elements for the creation of an inclusive and sustainable EOSC. Indeed, they are in our vision, the pillars that will support EOSC as a truly European endeavour and ensure the involvement and long-term commitment of Member States. On both a policy and funding level, the need for the MSs to be included in the process and have a say in the steering of this ambitious vision is clear and probably does not need commenting on. Ultimately, the political will of making EOSC into reality rests on them. But National Initiatives should not be seen just as a tool in the hands of the relevant ministry or government. Of course, they will be the organisations that are mandated to represent the country in the EOSC Governance, and will implement their bit of the infrastructure. But they are far more than that: already now, National Initiatives, even if they're not yet fully structured, are the place where the competences are and where the stakeholders meet and discuss the standards, share their experience and best practices, and work together to achieve more. They are the place where the communities from different domains get together and the actor for newcomers to contact when they want to learn more on EOSC and Open Science in general, or

when they need expert advice and support.

In the countries represented by EOSC-Pillar, we see that the initiatives are often bottom-up and aim at defining the way the national scientific community will be part of EOSC, and shape it with their experience, requirements and vision. At the national level, expert working groups are now doing their part to design the future EOSC and to turn Open Science into a reality for the benefit of everyone. The National Initiatives have something that a central hub, however excellent, can never have: the capacity to reach out to the wider scientific and cultural community, involve national and even local stakeholders and initiatives and create that critical mass need to make the paradigm shift happen that is required for EOSC, and ultimate Open Science, to become a reality.

Critical mass is crucial, but scalability is also important. Tackling this challenge at the national level is, in our view, the key to ensure scalability and performance for all researchers across Europe - and beyond.

Our key message is that EOSC is a truly European endeavour and can only succeed if all the national initiatives, with their specificities and strengths, are taken into due account and can play a leading role in making this vision a reality. This should, in our opinion, be reflected in the design of the EOSC legal entity and its governance, but also in the mechanisms that ensure the functioning of EOSC as a federation, which should allow a suitable level of devolution.





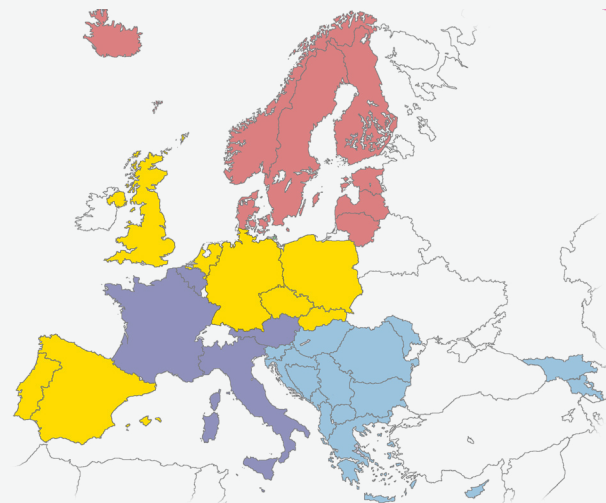
EOSC
SYNERGY



Introduction

EOSC-Synergy will expand the capacity and capabilities of the European Open Science Cloud (EOSC) by leveraging the experience, effort and resources of national publicly funded digital infrastructures in a coherent way, therefore acting also as an incentive for national resource providers. EOSC-Synergy extends the EOSC coordination to participating countries by harmonising policies and federating relevant national research e-Infrastructures, scientific data and thematic services, bridging the gap between national initiatives and EOSC.

The participating countries are: Spain, Portugal, UK, Czech Republic, Slovakia, Poland, the Netherlands, and Germany (except in the landscape analysis).



EOSC-Synergy

Expanding Capacities
by building Capabilities

Project website	www.eosc-synergy.eu
Start date	01-09-2019
End date	28-02-2022
Countries	Spain, Portugal, Germany, Poland, Czech Republic, Slovakia, Netherlands, United Kingdom
Coordinator	The Spanish National Research Council – CSIC (Spain)
Contact e-mail	coordinator@eosc-synergy.eu
Size	16 Partners
Social Media	Twitter: @eosc_synergy

Expectations from the future EOSC

- **Easy access to scientific services, research infrastructures and data.** EOSC should offer interoperable computing services, scientific tools, applications and research data to help communities in their scientific research. The access to these services should be easy and

light for scientists, avoiding bureaucracy and inefficiencies. At the same time, the services should guarantee security and reliability.

- **Clear exposure of conditions for accessing the EOSC resources.** In addition to ease and security, the information

about access conditions to these resources and services should be guaranteed. Researchers need to know the economic terms for their use, the legal restrictions or responsibilities that the use implies or the authorship/ownership of the services, amongst others.

- **A space to share and re-use scientific data.** Following the FAIR principles, we expect EOSC to provide Findable, Accessible, Interoperable and Reusable data to foster data-driven research in Europe.
- **Transparency in the governance procedures. EOSC should boost the transparency on its governance structures and procedures.** Researchers already face their respective national policies, structures and procedures. EOSC should consider the simplicity and transparency as part of the clear added value of EOSC for the research community.
- **Clear position of European scientific interests and strategies, at national and international level.** A clear understanding of the strategies of Europe and its member states should be highlighted in order to bridge the gap between decision makers and the scientific communities.
- **A networking and innovation space to open new opportunities of collaboration.** Europe is watching a fast-changing and very competitive digital environment where science and innovation should work together to face the global challenges. We expect EOSC to become an innovative space to support scientific collaborations within industry and society.

Contributions to EOSC

EOSC-Synergy contributes to EOSC in the following perspectives:

Building capacities. EOSC-Synergy contributes to enlarge EOSC with a critical mass of computing and storage resources in such a way that resources can be seamlessly exploited via federation services. EOSC-synergy builds on, and complements the EOSC-hub project activities by fostering the uptake of the EOSC core functions and horizontal services at national level. AAI integration is a particularly interesting concept as it allows federating access to centralized storage facilities, which already exists at the national level. EOSC Synergy leverages knowledge on AAI and infrastructures federation to facilitate the desired harmonization.

Developing capabilities to expand EOSC adoption. EOSC Synergy promotes EOSC adoption by research communities by expanding and building knowledge on common interfaces, standards and best practices. EOSC-synergy builds on the

expertise of leading research organizations, infrastructure providers, NRENs and user communities. EOSC-Synergy expands EOSC global reach by integrating research infrastructures and data providers beyond Europe, fostering international collaboration and open new resources to European researchers in the fields of environment, climate change, earth observation and life sciences.

Supporting skills development. EOSC-Synergy implements a skills development framework that promotes EOSC adoption by the research communities including training and adoption of common interfaces, standards and best practices. EOSC-Synergy incorporates online training as a new full-fledged component of the EOSC Portal, facilitating access to high quality technical information and tailored training materials.

Facilitating the on-boarding of providers. Quality is a key aspect for a successful uptake of EOSC services and data repositories by the European research communities. EOSC-Synergy pushes the state-of-the-art in software and service life-cycles through a quality-driven approach to services integration. The project works to improve service quality and reward adherence to EOSC standards through an EOSC SQA qualification/stamp to enable the automatized assessment of service quality, conformance and compliance. EOSC-Synergy published a white paper on the state-of-the-art of Digital Badge issuing technologies as part of its software quality assurance architecture. The document is available in open access at the Digital CSIC repository¹.

Promoting the FAIR adoption. EOSC-Synergy fosters EOSC adoption by promoting the uptake of quality standards and best practices applied to services, reducing issues and improving maintainability. We work together with FAIRsFAIR towards the implementation of a FAIR data baseline, including self-assessment capabilities.

Harmonising policies. EOSC-Synergy works on federating relevant national research e-Infrastructures, scientific data and thematic services, bridging the gap between national initiatives and EOSC. Our policy activity provides the means to identify potential issues in the harmonisation of dialogue with national infrastructures and communities, and to push for the alignment of national policies and practices including access to services, data protection and privacy, infrastructure security, leveraging public investments, alignment of practices and service management.

¹ <http://dx.doi.org/10.20350/digitalCSIC/12505>

Recommendations and key messages to the governance

Given the wide variety of EOSC Stakeholders an appropriate governance model needs to be devised in a way as to capture the common denominator of funding agencies, research performing organisations, but also including a clear role for the various types of pan-European organisations (research clusters such as ESFRIs, service providers and infrastructure integrators, etc.) to help provide the European-wide insight required for this endeavour.

Transparency in the decision-making processes is of paramount importance for EOSC to grow its constituency at a sustained pace, in line with the expectations of national and European policy makers.

Awareness and implementation

The different countries and their research strategies show different levels of awareness and implementation of EOSC. In order to obtain a harmonised and wider implementation of EOSC, three different perspectives at governance level should be considered:

- **Create awareness.** A better understanding of how aware scientific communities are of EOSC is needed in order to define specific means and ways to raise this level of awareness.
- **Raise readiness.** In order to implement EOSC, it's imperative to identify how many scientific communities are ready for it. Using/offering services, sharing/reusing data or how many services are available to be included in the EOSC marketplace should be clarified as well as the procedures to increase this readiness.
- **Foster willingness.** The willingness to use EOSC can be defined as how keen a community is to use/adopt the EOSC. Under what conditions (in terms of economics, service relevance or amount of data shared) will depend on each national (local or research centre) interest more than on EOSC efforts. The low added value perceived by some of the countries and research communities could be behind this lack of willingness.

There are several initiatives and practices that could be carried out to improve these three aspects. One of the potential challenges facing these initiatives and practices identified in the analysis of national policy landscapes is the separation of the different e-Infrastructure service components into silos.

The current EOSC-related solutions (for example EOSC portal and marketplace) are reducing the impact of these divisions on the technical level (e.g. by facilitating access to HPC-related services or advanced NREN networking solutions). However, synergies in the overall awareness, readiness and willingness would benefit from a matching approach in the outreach activities.

We thus recommend that all stakeholders could commit to the principle that all the outreach efforts by operational e-Infrastructure services providers should systematically cross-promote each other. The contribution to visibility and acknowledge should be done on the national and European levels, and could be shown with just a simple statement on communication material (e.g. acknowledge at the title and final slides and websites).



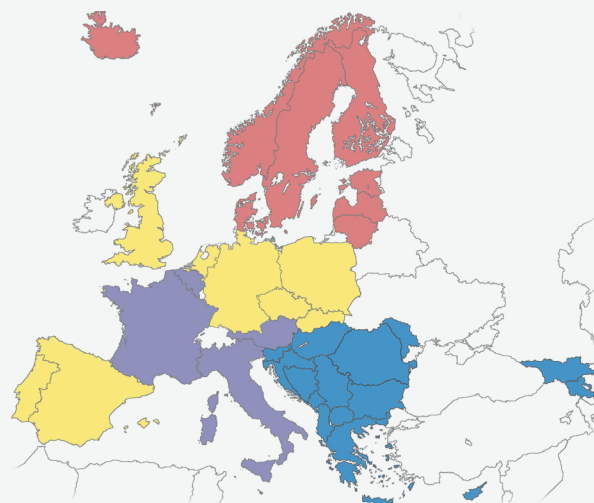


NILOS
Europe



Introduction

National Initiatives for Open Science in Europe – NI4OS-Europe aims to be a core contributor to the EOSC service portfolio, commit to EOSC governance and ensure inclusiveness at the European level for enabling global open science. The project supports the development and inclusion of the national Open Science Cloud initiatives in 15 Member States and Associated Countries in the EOSC governance. NI4OS-Europe aspires to instil within the community the EOSC philosophy and FAIR principles. It also provides technical and policy support for the on-boarding of service providers into EOSC.



NI4OS-Europe

National Initiatives for Open Science in Europe

Project website	https://ni4os.eu
Start date	01-09-2019
End date	31-08-2022
Countries	Albania, Armenia, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Greece, Hungary, Moldova, Montenegro, North Macedonia, Romania, Serbia, Slovenia
Coordinator	GRNET S.A. – National Infrastructures for Research and Technology S.A. (Greece)
Contact e-mail	ni4os-europe-po@ni4os-europe.eu
Size	22 Partners
Social Media	Twitter: @ni4os_eu Facebook: @NI4OS Instagram: @ni4os.eu

Expectations from the future EOSC

From NI4OS-Europe perspective, EOSC will bring together the existing generic and thematic services, datasets and repositories from the target region, for pan-European researchers to benefit from their exploitation and use. NI4OS-Europe aims at removing the barriers regarding cross-

border and cross-sectoral collaboration within the wider scope of EOSC. NI4OS-Europe relies on the **strong core/central/federation services to be provided by EOSC portal and federation mechanisms**, in order to be able to support linking of services provided from 15 countries: this is a

crucial requirement for future EOSC. Also, **clear onboarding procedures** should be in place, and services should be **compatible and easily accessible** across to board, **with established service levels**.

NI4OS-Europe partners, being active contributors in the Open Science developments in the region are aware of the existing obstacles to the implementation of EOSC vision. First and foremost, the Open Science landscape is fragmented, in terms of open access standards, models and publications practices. NI4OS-Europe partners would expect EOSC to define a **support mechanisms and best practices that will facilitate convergence and alignment between European, national and regional structures and initiatives**.

Regarding governance, NI4OS-Europe calls for harmonisation of governance structures on national level and their involvement in pan-European governance, ensuring **equal participation of relevant institutions, of profiles which can be comparable and compatible between countries**.

NI4OS-Europe defines rewarding and incentive mechanisms for ORDM and FAIR that can be used by different stakeholders, while in parallel it identifies and classifies available technical guidelines and technical, organisational and legal tools supporting the onboarding of data repositories and compliance with ORDM and FAIR requirements.

This work is concluded with the development of data management and certification tools, that put the above into practice. We, thus, consider future EOSC as the “place” that, among others, also allows for **a broad and harmonized access to any services and tools that support ORDM and FAIR**.

Contributions to EOSC

NI4OS-Europe facilitates access to **infrastructures, data, resources and services for users** to benefit from know-how sharing and exploitation. The primary goal is to build the local, national and regional capacities by supporting the development and inclusion of Open Science initiatives in the 15 partner countries. The project is getting ready for the smooth transition of the existing services and resources into the EOSC service portfolio.

An extensive survey to capture the EOSC awareness and readiness status in South East Europe (SEE) has been performed, maybe the first one for the region. The **survey provides insights on the existing Open Science initiatives, infrastructures, services, policies, stakeholders and topics in NI4OS-Europe partner countries**. A wide range of

stakeholders has been identified and clustered on the basis of important Open Science functions. The **dataset capturing stakeholder information from SEE** has been made available as open access dataset, following the FAIR principles and captured in an **online map**².

Parallel to the technical effort, policy making, and organisational activities are taking place to define a set of operational best practices, rules and principles for managing services and research data across the EOSC ecosystem.

NI4OS-Europe will also facilitate the **FAIRification of the repositories and data sets** and their inclusion in the EOSC service catalogue and in the OpenAIRE ecosystem. Best practices for onboarding and related policies are collected and made available for partners as a guidebook. Connected to the onboarding processes, the widest community will be supported in the uptake of research data sharing and practices, in alignment with FAIR principles.

The NI4OS-Europe **specific on-boarding procedure is created to help the service providers integrate their services in EOSC**. The procedure is supported by necessary templates and documents as well as the preproduction framework to validate these services and their integration. This method is also helpful for the services providers to identify the readiness levels for their services, to recognize the importance of good service management practices, as well as to identify and apply the required integration steps, making the services more accessible and reliable.

The project **delivers knowledge to all interested parties** of its network via training activities, providing the necessary technical, organisational and legal guidelines, tools, mechanisms and certification schemes, to support Open Research Data Management (ORDM). The training facilitates the adoption of the EOSC services at national and institutional level and ensures the introduction and maintenance of **high-quality ORDM practices**. NI4OS-Europe has set up and gradually expanding its training platform, providing access to online courses and training materials, while it has established and runs the ‘Train-the-Trainer’ series of events that provide NI4OS-Europe partners with the necessary training skills and means to diffuse in their countries information and knowledge related to various aspects of EOSC and Open Science.

NI4OS-Europe’s collaboration with other EOSC-related projects will leverage developments in the European Open Science landscape, **contributing** in a decisive manner **to the EOSC vision of open and inclusive science and innovation**. In this respect, a Collaboration Agreement is signed with complimentary projects EOSC-Pillar, EOSC-synergy, EXPANDS, EOSC-Nordic, EOSCSecretariat.eu, and FAIRsFAIR. The document will be evolving to meet the needs of EOSC.

² <https://ni4os.eu/os-stakeholders-map/>

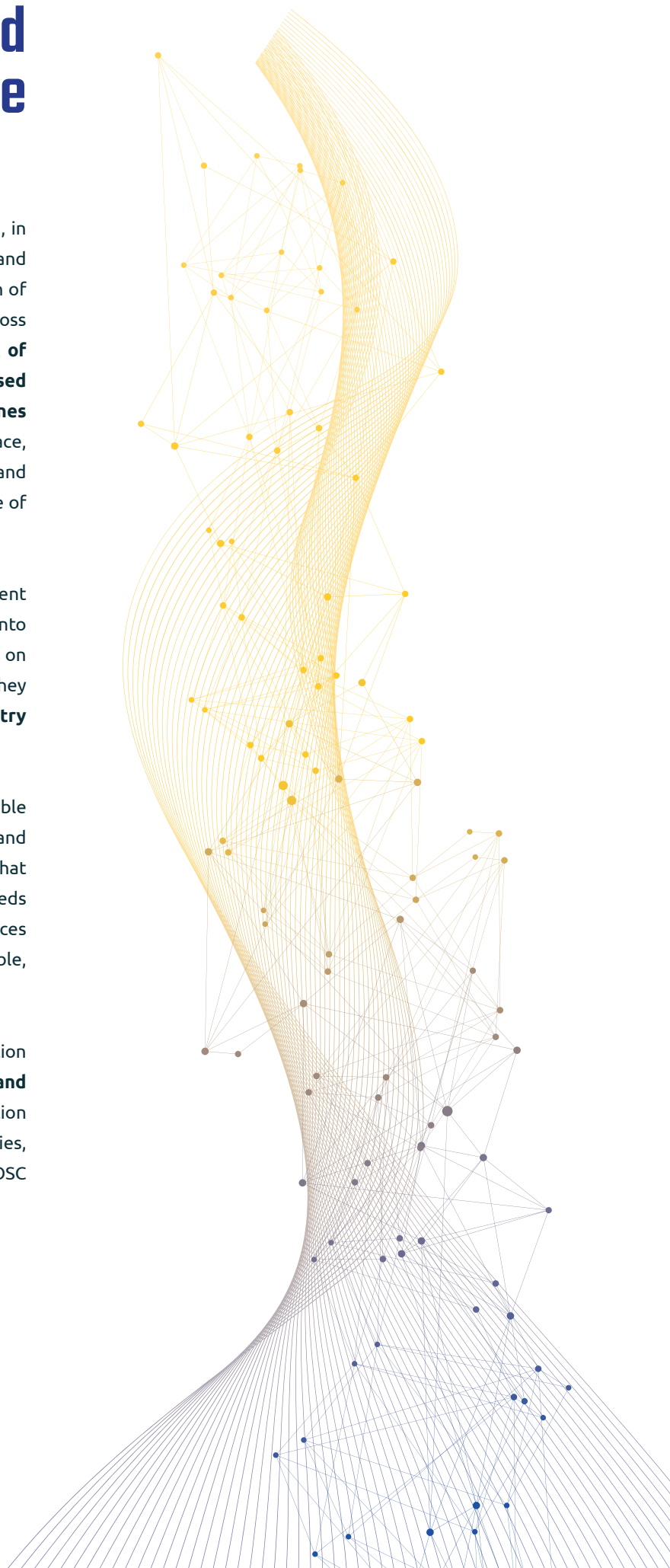
Recommendations and key messages to the governance

Technological challenges should be effectively addressed, in order to ensure that EOSC will be an efficient, reliable and trustworthy platform that ensures quality in the provision of infrastructures, services and data for all researchers, across all disciplines. As such EOSC needs to have a **strong set of central and federating services to ensure harmonised service management and delivery**. Further, **guidelines for Open Research Data Management** should be in place, ensuring FAIRness of repositories in a standardised and interoperable fashion, as well as the development and use of **easy-to-use technical tools for ORDM**.

At policy level, actions that support the creation, development and inclusion of national Open Science Cloud initiatives into EOSC governance holds a key role. Governance structures on national level are crucial, they should be **inclusive**, and they should be **comparable and provide coherent per-country involvement** in pan-European governance.

Considering the role of EOSC, as the open, interoperable digital environment for all scientific disciplines to create and share knowledge and data, the Governance has to ensure that technological offerings and solutions meet the user needs in terms of provision of interoperable, easy to use services and infrastructures, as well as to enabling access to findable, interoperable and reusable data and services.

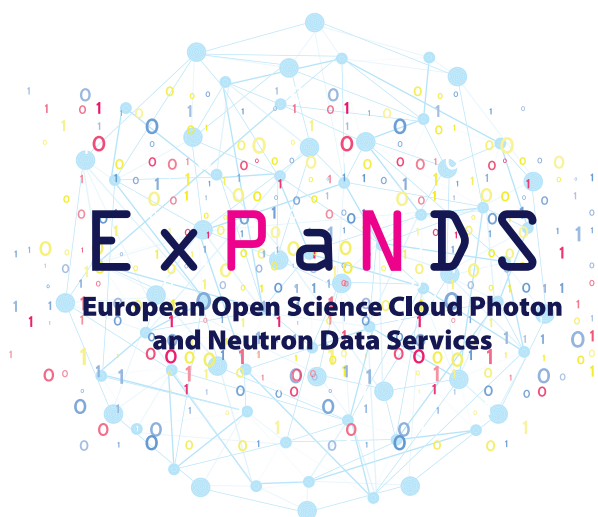
Another essential aspect of the EOSC vision materialisation and **sustainability is maximising community outreach and engagement**, across all geographical regions. Communication activities for raising awareness and attracting communities, as well as systematic training for the take-up of the EOSC services will ensure the use of the **EOSC digital space**.





ExPaNDs

European Open Science Cloud Photon
and Neutron Data Services



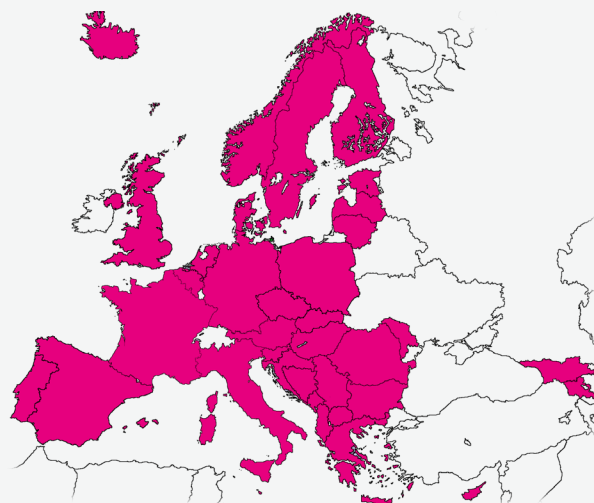
Introduction

Photon and Neutron Research Infrastructures (PaN RIs), as facilities with user-focused services and a user community of more than 30000, are service providers with a high relevance for the success of EOSC. Through ExPaNDS for national PaN RIs and PaNOSC³ for PaN ESFRIs, coherent FAIR data services will be enabled to the scientific users of all European PaN facilities, universities and even industry.

As ExPaNDS and PaNOSC are representing the same scientific community, it is inherent that we share a common view on EOSC. PaNOSC issued a position paper in Dec. 2020⁴ which is consequently largely re-used here, to reinforce and confirm the position of the Photon and Neutron community with respect to the EOSC.

Expectations from the future EOSC

The PaN community regards EOSC as the perfect tool to generalise the adoption of FAIR data practices at our research facilities. Adopting FAIR data will enable data sharing and reuse across a wider community, and the provisioning of services for remote data analysis. In order for these objectives to be realised the EOSC must provide



ExPaNDS

ExPaNDS is the European Open Science Cloud Photon and Neutron Data Service

Project website	https://expands.eu
Start date	01-09-2019
End date	31-08-2022
Countries	PaN research infrastructures in Germany, United Kingdom, Spain, Sweden, Switzerland, Italy and France
Coordinator	German Electron Synchrotron – DESY (Germany)
Contact e-mail	info@expands.eu
Size	11 Partners
Social Media	Twitter: @ExPaNDs_EU

the following services:

- A common way of **identifying, authenticating, and authorising users (AAI) across Europe**. The EOSC AAI should be operated and sustained by the team(s) implementing the EOSC infrastructure. The final EOSC AAI ecosystem should enable the entire European community

to share data and compute facilities. This can be achieved by being compliant with the AARC Blueprint Architecture and its guidelines.

- A service for **transferring data between distributed facilities** using high bandwidth data links, as well as allowing users to **seamlessly download their data shares**;
- A solution for the **long-term archiving of large quantities of open data (exabytes)** coupled to **high-performance storage and compute resources** for the (re)analysis of this open data, accessible through cloud technologies like containers or FaaS technologies⁵. One possible implementation could be the data lake developed and prototyped by the ESCAPE cluster project⁶, allowing large scale rule-based data management.
- Common services like service registration, helpdesk, monitoring and accounting are essential to provide a **consistent picture of the EOSC offerings** and allow users to get an instant view of the availability and health of EOSC services in a customisable dashboard;
- A **federated search capability** for searching and finding scientific data in a wide variety of domains. It is particularly important to consolidate a common vocabulary for cross-community database searches;
- A set of **services for data simulation and analysis** ranging from generic services like Jupyter notebooks to domain specific applications per scientific application, including cloud and HPC resources. These data services could be remote from the data source if the data are easy to move but should be available close to the data if the data are difficult to move.

Contributions to EOSC

The ExPaNDS and PaNOSC RIs will be an essential part of the EOSC as sources of data and providers of data services. Our partners aim to provide:

- **Exabytes of raw and processed data in a wide variety of scientific domains**
- **Meta-data** that will create **FAIR** raw and processed scientific data
- Software for generic and specific **data simulation and data analysis**
- Workflows and expertise for **reducing and analysing data**
- Reference **training material and training platform** for understanding photon and neutron science and associated handling of data
- **Liaison with large user communities** of photon and neutron sources and their expectations for services

On a practical level, ExPaNDS will contribute to the definition of the **EOSC standard interfaces**, with the expertise of its consortium and evaluate the adoptions of such interfaces in its architecture to maximise the **interoperability** with other EOSC services and harmonise the services offered by the national RIs. At the governance level, ExPaNDS is taking an active role in the EOSC stakeholder forum and other bodies such as the different technical Working Groups of the EOSC Executive Board on Architecture, FAIR, Sustainability, Rules of Participation, Landscaping, Skills and Training.

Concretely, producing **Data Management Plan templates for PaN instruments, pushing for a common data policy at our facilities, federating our existing data catalogues and services** will enable ExPaNDS to enrich the EOSC with specific, high profile PaN offerings.

³ <https://www.panosc.eu/>

⁴ <https://doi.org/10.5281/zenodo.3675080>

⁵ https://en.wikipedia.org/wiki/Function_as_a_service

⁶ <https://projectescape.eu/>

Recommendations and key messages to the governance

Most importantly, the EOSC governance bodies must provide a clear concise answer to the question “what is the EOSC?”.

ExPaNDS, like PaNOSC, is a bottom-up approach to make data FAIR and FAIR data sustainable for the PaN community, helping users provide better science, be more efficient thanks to better data management, and make science more reproducible. The EOSC can play an important role in this by bringing in a top-down approach in the areas below:

Architecture

The EOSC should:

- Provide **scalable cloud resources** for running data analysis workflows and simulations, ideally unlimited but at least enough to make a significant difference for users needing access to computing resources, improving the current offerings lacking a common distributed architecture;
- Define and maintain **EOSC APIs and standards** into computing, storage and higher level services, like artificial intelligence and machine learning, to facilitate the integration of components into services;
- Provide common services like **service registration, helpdesk, monitoring and accounting** essential to provide a **consistent picture of the EOSC offering**;
- Provide scientists with a **personal space** where they can create content (data analysis recipes, workflows, publications), store analysed data and share their work with collaborators via a versioning system like Git;
- Make an **aggregated publication database** available; ideally in collaboration with neutronssources.org and lightsources.org.

FAIR

- EOSC should define **common standards for FAIR data and services** so that the different scientific fields are following a common approach and understanding. That could be achieved by using FAIRsFAIR guidelines and examples on how to implement FAIR in different communities.
- In the long term, EOSC should provide **“FAIRness” certification** for the data of PaN centres, beamlines and proposals, based on the output of FAIRsFAIR and the

RDA FAIR data maturity model WG. It should also support scientific communities in implementing DMPs.

- The EOSC should encourage the adoption of FAIR principles with their registered providers, including **FAIR requirements in the Rules of Participation**.
- The 5B-projects task force on FAIR is working on these activities and will provide recommendations and proposals to the EOSC WG, especially on the certification process.

Sustainability

The EOSC must provide **long-term plans on how it will be maintained and financed**. We regard the establishment of the EOSC legal entity at the beginning of 2021 as a promising first step in that direction. The governance entity must continuously monitor **the cost-benefit** of the various EOSC activities, in order to justify its budget.

Rules of Participation

Well-defined Rules of Participation in EOSC, securing the integration of only **high quality services** are key to the success of the planned federated infrastructure. The RoP should be kept **updated and the compliance of the onboarded services** should be continuously monitored.

Training

We would expect the governance to provide a **cross-community e-learning platform**. The EOSC governance must make sure to encourage the various scientific communities to provide **up-to-date domain-specific knowledge** through videos and other MOOC-style content, to foster cross-scientific activities and to simplify the assimilation of methods and methodologies to newcomers.

Landscaping

We would expect the governance to keep an **up-to-date landscape analysis**, on both EOSC service candidates and scientific communities potentially benefiting from EOSC.





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