European Commission

European Open Science Cloud (EOSC) Strategic Implementation Plan

This plan, produced by the EOSC Executive Board, presents the activities that will contribute to the implementation of the EOSC for 2019-2020

Research and Innovation

EOSC Executive Board
June 2019

Executive Board of the European Open Science Cloud (EOSC) - Strategic Implementation Plan

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Manuscript completed in June 2019

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Luxembourg: Publications Office of the European Union, 2019

PDF ISBN 978-92-76-09175-2 doi: 10.2777/202370 KI-03-19-507-EN-N

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EUROPEAN COMMISSION

European Open Science Cloud (EOSC)

Strategic Implementation Plan

This plan, produced by the EOSC Executive Board, presents the activities that will contribute to the implementation of the EOSC for 2019-2020

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EOSC
Executive Board

2019 Directorate-General for Research and Innovation

Table of Contents

1 VISION FOR A EUROPEAN OPEN SCIENCE CLOUD 4

1.1 WHY CREATE A EUROPEAN OPEN SCIENCE CLOUD? 4
1.2 WHAT IS THE EUROPEAN OPEN SCIENCE CLOUD? 4

2 INTRODUCING THE EOSC STRATEGIC IMPLEMENTATION PLAN 6

3 FROM VISION TO LAUNCH (2016-2018) 7

3.1 FIRST ROUND OF PROJECTS 11
3.2 HLEG & FAIR REPORTS 11
3.3 LAUNCH EVENT 12

4 FROM LAUNCH TO SUSTAINABILITY (2019-2020) 12

4.1 THE FEDERATED APPROACH 12
4.2 GOVERNANCE 13
4.3 FIVE STRATEGIC PRIORITIES 14

5 DRIVING PRINCIPLES FOR IMPLEMENTATION 26

5.1 COOPERATION 26
5.2 DECISION PROCESS 26
5.3 COMMON INTEREST 26
5.4 AVAILABILITY 27
5.5 VOLUNTARY ADOPTION 27
5.6 ROLE OF SOFTWARE 27
5.7 ROLE OF WORKING GROUPS 27

6 IMPLEMENTATION MECHANISMS 27

6.1 H2020 PROJECTS 28
6.2 WORKING GROUPS 28

7 COMMUNICATION 29

8 NEXT STEPS 30

9 REFERENCES: LIST OF EOSC OFFICIAL DOCUMENTS 32

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1 VISION FOR A EUROPEAN OPEN SCIENCE CLOUD

1.1 Why create a European Open Science Cloud?

In the initial stages of this earth, when only microorganisms were inhabiting the planet, the transfer of data was through the transfer of DNA from generation to generation. The information contained in the DNA of particular species changed with roughly one bit per year.

Over time the number of species grew; other forms of communication between species evolved; ultimately language appeared; writing as a form of preserving information was developed; printing was invented and different forms of storage were created. Today the increase in data per year is measured in Zettabytes (10^{21} bytes).

This development has nowadays led to an exponential increase in data and information in all branches of society. In the domain of the sciences, this inherently has led to a huge differentiation in subdisciplines, that have often their own 'language' and standards. For most of the scientists, it is not possible anymore to read all the relevant material that is being published in their discipline. In some of the domains more relevant publications are being written in one year than a person can read in his or her whole life. Thus, with the help of search engines, publications are selected for reading.

How about data? Most of the underlying data of scientific work are not published. Most of the data does not have the necessary metadata with it. And the data resulting from the majority of scientific studies cannot be found. In some sub-disciplines, the situation is relatively good, but even in those cases the interoperability with other disciplines is usually not taken care of.

Wouldn't it be good if many more of the data resulting from scientific work would be well curated? Wouldn't it be great if we would be able to combine any dataset with any other dataset we would want to? Of course, many combinations will not be relevant. However, most of the problems in this world will need the help of several if not many disciplines to come closer to solutions. In other words, if relevant data would be findable, accessible and interoperable for scientists, these combinations would lead to (unforeseen) reuse and to a faster development of science.

This is the aim of what we call the **European Open Science Cloud**. The ultimate aim is, of course, that this will lead to a global structure where, as a result of the right standardization, data repositories with relevant data can be used by scientists and others to the benefit of mankind.

1.2 What is the European Open Science Cloud?

There is a parable of the blind men and the elephant, which originated in ancient India. It is the story of a group of blind men who have never come across an elephant before and who are to describe the elephant by respectively touching one - only one - different part of the elephant. Each blind man feels a different part of the elephant's body, such as the tail, the trunk, one leg. They describe the elephant based on their different experiences and of course, the descriptions are entirely different from one another.

If you ask a room full of people what EOSC is, you'll get a room full of different answers. It's such a large-scale initiative and ambitious mission that it's like an elephant – everyone sees a different part and few see the big picture…

In building EOSC, we are designing a virtual commons where science producers and science consumers come together for more insights, new ideas and more innovation. EOSC is greater than the sum of its parts: by federating data and services we add value. EOSC uses information technologies to revolutionize the way we do research, the way collective scientific knowledge is created in all disciplines, in all geographies.

We could liken EOSC to an open festival of science, inclusive to people of all backgrounds and cultures, with an open-ended range of content and services. There will be headlining acts such as the leading research groups with long-awaited data releases, the ground-breaking algorithms and models, or the killer apps. The diverse range of content available at everybody's finger tips will open people's eyes to new interests and collaborations. By offering a space that people want to come to and engage in, creativity will follow; a range of stalls offering a wide variety of publications, data, software and services, catering for diverse user needs will spring up.

Naturally there needs to be common rules that we all play by and business models to ensure that the platform remains viable. The stakeholders all play different roles but share a common set of values. The underlying infrastructure and foundation of EOSC needs to be developed, owned and operated publicly. That platform will be extended and scaled. It will engage with private initiatives, but all will adhere to rules of participation and uphold the common values. These could be articulated as being:

- Focused on research needs
- Community-driven
- Inclusive and respectful of diversity
- Accessible to all from large equipment, large computers & 'big data' to 'small data' & long-tail research
- Open by default – closed where necessary
- Hands-on and participatory
- Transparent and trustworthy

In order to make EOSC work, we need a close coordination between scientific communities and continual engagement to co-create a platform and set of services which meet diverse user needs. EOSC will be a living system that is flexible by design and can adapt to the changing landscape and technological advances. This necessitates an incremental and iterative approach, where we remain pragmatic and start small. We cannot afford to wait for the perfect solution or control of our scholarly commons will be lost to more agile and innovative initiatives. We should release early and often (beginning with 'low hanging fruits'), continually testing and improving the best practices, tools and services until open science is no longer spoken about but becomes standard scientific practice.

In this process, overall interoperability is the ultimate goal, therefore we have to foster technical competences and train people, such that data, software, methods and publications can be shared as part of an Open Science community of practice.

This EOSC vision will take time to fully realise, but the initial steps have already been made. A minimal viable platform with an official status consisting of rules of participation, a governance structure, FAIR data and interoperable services will be available to early adopters by the end of 2020, in short 'Data made in Europe'.

2 INTRODUCING THE EOSC STRATEGIC IMPLEMENTATION PLAN

The European Open Science Cloud (EOSC) Executive Board has been set up by the Commission Decision C(2018) 5552 of 27.8.2018 :

"The Executive Board's tasks shall be to establish a cooperation between the Commission and Research & Innovation stakeholders on questions relating to the Implementation Roadmap for the European Open Science Cloud ('EOSC') in coordination with the Member States. The group shall assist the Commission in the first phase of development of the EOSC until 2020 and in the preparation of the transition to the second phase of development of the EOSC after 2020.

The Executive Board shall carry out the following tasks:

(a) provide advice and support on the strategy, implementation, monitoring and reporting on the progress of the implementation of the EOSC as set out in the Staff Working Document on the Implementation Roadmap for the EOSC, notably in the form of:

(a) a ***strategic implementation plan*** and annual work plans, and of a proposed mechanism for overseeing and steering the implementation of the strategic and annual work plans, and for monitoring and reporting on progress;

(b) rules for participation to guide service provision and an action plan for scientific data interoperability to operationalise the FAIR principles,

(b) provide recommendations on the appropriate mechanisms and possible forms for the EOSC governance after 2020 including business models and modes of financing, and on how the user base of the EOSC could be extended to the public sector and the industry."

The EOSC Strategic Implementation Plan presents the activities that will contribute to the implementation of the EOSC for the period 2019-2020. While the document will be made public after final approval, it is primarily intended for use by stakeholders engaged into building EOSC. Other documents will be developed and made public for use by research communities which will be the primary users of EOSC capabilities.

This document draws from the EOSC Implementation Roadmap

- adopted by the Commission on 14 March 2018,
- built upon the outcome of an extensive and conclusive consultation with scientific and institutional stakeholders in 2016 and 2017 and
- designed concretely on the Horizon 2020 Work Programme 2018-2020.[1]

This document presents a comprehensive overview of the implementation of the EOSC, with action lines and timelines for the period 2019-2020. The list of activities includes the most recently approved Horizon 2020 projects.

This document has been reviewed and amended by the EOSC Executive Board during its 17 April 2019 meeting. It was presented to the EOSC Governing Board during its 22 May 2019 meeting.

[1] European Commission Decision C(2017)7124 of 27 October 2017.

3 FROM VISION TO LAUNCH (2016-2018)

The Commission presented its vision for the European Open Science Cloud (EOSC) in its April 2016 Communication on the 'European Cloud Initiative',[2] as a part of the Digital Single Market Strategy. The objective of the EOSC is to give the Union a global lead in research data management and ensure that European scientists reap the full benefits of data-driven science, by offering *'1.7 million European researchers and 70 million professionals in science and technology a virtual environment with free at the point of use, open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines'.*

The European Cloud Initiative also foresees setting up a European Data Infrastructure, underpinning high-capacity cloud solutions with super-computing capacity,[3] as well as widening the EOSC by gradually opening up its user base to the public sector and industry.

Key documents collectively lay out the vision and framework for EOSC, including Council Conclusions, Expert Group reports, the EOSC Declaration and Commission communications:

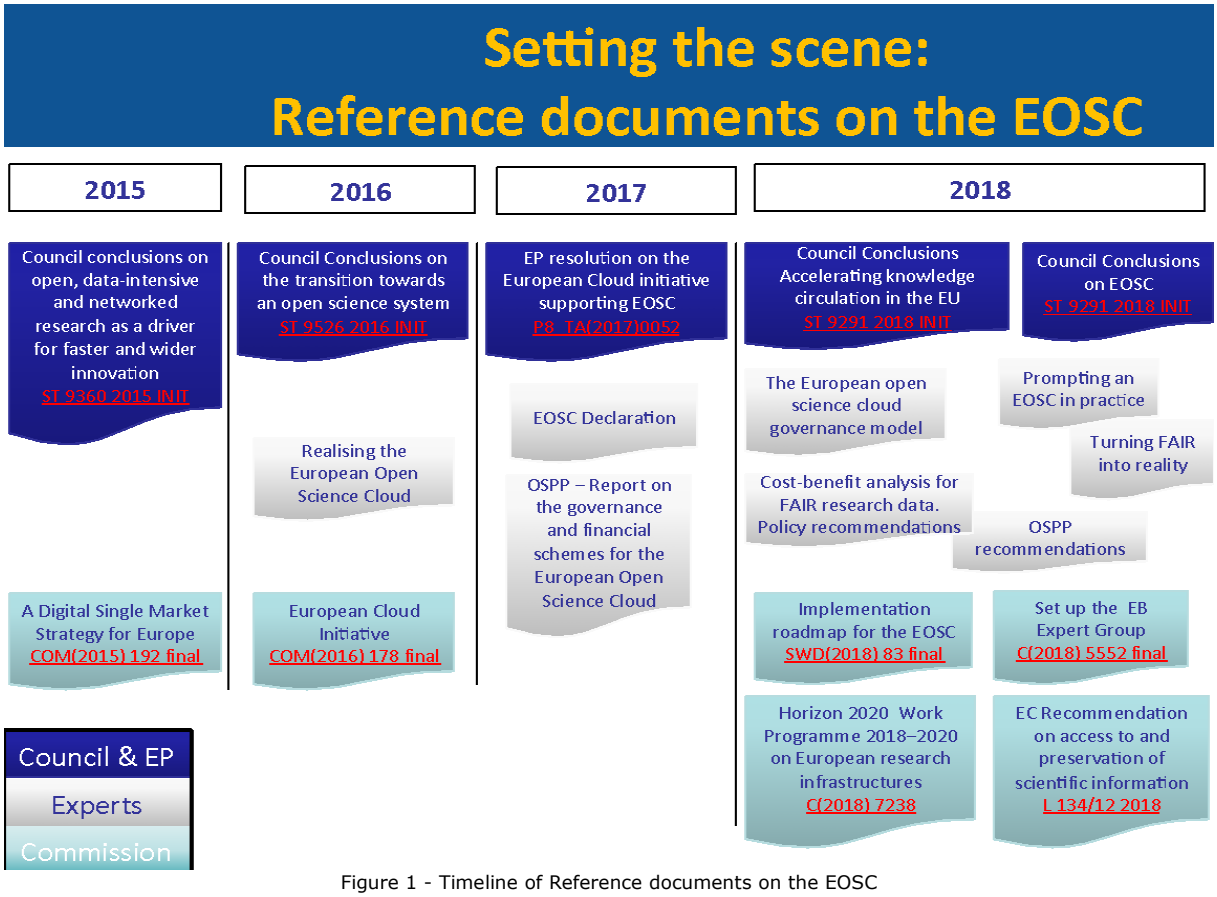

Figure 1 - Timeline of Reference documents on the EOSC

The EOSC has emerged as a clear policy priority for European research and innovation. It has been strongly supported by the European scientific community in the *EOSC Summit*

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[2] COM(2016)178 final

[3] This document does not report in detail on the implementation of other pillars of the Communication, namely *European Data Infrastructure (EDI)* and *Widening access and building trust.*

and *Declaration,* by the Council in Council Conclusions (May 2015, May 2016, May 2018)[4] and by the European Parliament in a Resolution (January 2017).[5] It also received favourable opinions from the Economic and Social Committee[6] (September 2016) and from the Committee of the Regions (October 2016).[7]

The Commission is providing and planning the necessary financial support to implement the EOSC along the policy orientations of the Communication by means of projects under the EU Framework Programme for Research and Innovation (Horizon 2020)[8] for an aggregate budget of about €600m. The launch in 2018 of the INFRAEOSC dedicated Call, will support notably

- the integration of services and the federation mechanism;
- the setting/operationalization of the principles of FAIR data (findable, accessible, interoperable and reusable);
- the development of a FAIR-compliant certification scheme for data infrastructure and the connectivity of the pan-European Research Infrastructures such as the ESFRI projects and landmarks.

Moreover, the Commission launched the EuroHPC Joint Undertaking, which will provide a world-class High-Performance Computing infrastructure to underpin data computation for the EOSC.[9]

In the Mid-Term Review of the implementation of the Digital Single Market Strategy,[10] the Commission confirmed its intention to come forward with an implementation Roadmap for the EOSC.

Research stakeholders provided key inputs at the *EOSC Summit* (June 2017). Later they demonstrated their concrete support to the initiative via wide endorsement of the *EOSC Declaration* (October 2017),[11] which sets out the guiding principles for implementation of the EOSC. The Declaration is composed of 33 high level statements that capture stakeholders' shared understanding of the actions needed on Data culture and FAIR data, on research data services and architecture, on governance and funding, to make the EOSC a reality by 2020. About 70 major scientific stakeholders undersigned the EOSC Declaration

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[4] http://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf

[5] http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P8-TA-2017-0052+0+DOC+XML+V0//EN

[6] TEN/592-EESC-2016
http://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/
european-cloud-initiative-building-competitive-data-and-knowledge-economy-europe

[7] CDR 2880/2016
http://cor.europa.eu/en/activities/opinions/pages/opinion-
factsheet.aspx?OpinionNumber=CDR%202880/2016

[8] https://ec.europa.eu/programmes/horizon2020/

[9] Proposal for Council Regulation establishing the European High-Performance Computing Joint Undertaking ('EuroHPC'), COM(2018)8 final, http://europa.eu/rapid/press-release_IP-18-64_en.htm

[10] COM(2017)228 final,
https://ec.europa.eu/transparency/regdoc/rep/1/2017/EN/COM-2017-228-F1-EN-MAIN-PART-1.PDF

[11] https://ec.europa.eu/research/openscience/pdf/eosc_declaration.pdf

following the Summit, out of which 60 committed to undertake specific actions to make the EOSC happen. Furthermore, several key European e-Infrastructures signed position papers[12] and a joint e- Infrastructures statement on the EOSC[13] that expressed strong support for the principles of EOSC implementation expressed in the Declaration.

The European Union institutions responded favourably to the vision proposed by the Commission. The European Parliament *Resolution on the European Cloud Initiative* (16 February 2017), Council conclusions on *The transition towards an Open Science system* (27 May 2016), the Opinion of the Committee of the Regions (CoR) and the Opinion of the Economic and Social Committee (EESC), all welcome and support the initiative and ask the Commission to act quickly and resolutely with an integral, coherent implementation plan.

A first Commission High Level Expert Group on the EOSC was created[14] [15] [16] [17] to provide advice to the Commission on a possible strategy for the implementation of the EOSC initiative. It recommended framing the EOSC as the EU contribution to a future global *Internet of FAIR Data and Services* underpinned by open protocols. It exhorted the Commission and Member States to set a wide framework for the implementation of the EOSC initiative that extends beyond individual projects well into the global scientific community, to address fundamental issues for the future of EU science.

The Commission services examined the relation between the initiative and long-standing reference European Research Infrastructures, such as the European Strategy Forum for Research Infrastructures (ESFRI) infrastructures.[18] Indeed, the Communication included *Connecting Research Infrastructures to the EOSC* as one of the main actions required, and the legislators mentioned Research Infrastructures explicitly as assets to be federated into the EOSC.

The *Consultation on the Long Term Sustainability of the ESFRI Infrastructures* (May 2016)[19] identified the better exploitation of data generated by the Research Infrastructures as one

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[12] https://www.geant.org/News_and_Events/CONNECT/Pages/european_open_science_cloud.aspx

https://documents.egi.eu/public/RetrieveFile?docid=2417&filename=EGI-Strategy-2015-2020.pdf

https://www.eudat.eu/news/the-european-open-science-cloud-for-research

[13] https://zenodo.org/record/32915#.Wiz38_6ouUk

[14] http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3353

[15] http://ec.europa.eu/research/openscience/pdf/realising_the_european_open_science_cloud_2016.pdf
The Report was downloaded more than 2000 times shortly after publication and it was featured in a number of scientific publications.

[16] http://ec.europa.eu/research/index.cfm?eventcode=44D86060-FBA1-1BD1-9355822B162BB0EE&pg=events

[17] http://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud

[18] Research Infrastructures are key actors in open access as they generate, collect and handle significant volumes of data that is used by thousands of researchers and innovators across scientific disciplines.
https://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri

[19] The consultation collected about 200 answers from stakeholders on the pre-conditions of long-term sustainability of Research Infrastructures and on the potential actions/measures to tackle the challenges posed by their implementation. The communities targeted were European Research Area stakeholders, ESFRI projects, European Research Infrastructure Consortia, ESFRI delegations, members of the Programme Committee for the Research Infrastructures part of Horizon 2020, e-Infrastructure Reflection Group delegations, EIROforum members, International Organisations, Research Infrastructure associations, National Contact Points and science attachés from strategic third country partners.

of the pre-conditions for long-term sustainability.[20] Respondents identified interoperability, common services, policies and open data obligations as top requirements to improve data management, better exploiting data and facilitating reuse of research data. As a result, the Commission services identified *exploiting the data produced by European Research Infrastructures in a more strategic way* as a key challenge and potential action of a future European action plan on long term sustainability of European Research Infrastructures (SWD(2017) 323 final).[21] Specifically, this paper encourages Research Infrastructures to promote the re-use of their research data for innovation and education purposes by supporting the connectivity of Research Infrastructures to the EOSC.

To complement the inputs from EU institutions and from the scientific community, the Commission services gathered specific independent advice and analysed relevant documents on the appropriate shape of a future governance structure for the initiative.[22] This included an analysis of current governance practices of major functioning, large-scale scientific networks including ICANN, IETF, AIOTI, GÉANT and ELIXIR. The synthesis of the results in this section is based on:

- A study on the appropriate governance of the EOSC;[23]
- A report on EOSC governance by Science Business;[24]
- A report on the governance aspects of the EOSC by the Open Science Policy Platform;[25]
- Two OECD reports on coordination and financing of international research data infrastructures;[26]
- A deliverable of the EOSCpilot on a Draft Governance Framework for the EOSC;[27]

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[20] https://ec.europa.eu/research/infrastructures/pdf/lts_report_062016_final.pdf

[21] https://ec.europa.eu/research/infrastructures/pdf/swd-infrastructures_323-2017.pdf

[22] Member States and national research funders also produced reports on the governance and funding of national research data infrastructures, including Germany (http://www.rfii.de/en/category/documents/) and the Netherlands. (https://www.nwo.nl/en/news-and-events/news/2017/ew/nwo-advocates-permanent-funding-for-national-digital-infrastructure.html) Reports from France and from the UK are forthcoming in 2018. While these reports were considered as academic inputs for the implementation Roadmap, this editorial process is not reported here.

[23] https://ec.europa.eu/research/openscience/index.cfm?pg=publications

[24] https://sciencebusiness.net/report/governing-european-open-science-cloud; Science|Business is an independent consultation group representing research, industry and policy.

[25] https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-policy-platform

[26] Under the aegis of the Global Science Forum, the Commission services participated to two OECD working groups on Open Science. The Commission hosted the final validation workshops on 28-31 March 2017. The groups provided recommendations to OECD member institutions regarding the challenges and enablers for the effective functioning of international research data networks, and the income streams, costs, value propositions, and business models for research data repositories. https://www.innovationpolicyplatform.org/open-data-science-oecd-project and http://www.codata.org/working-groups/oecd-gsf-sustainable-business-models

[27] https://eoscpilot.eu/content/d22-draft-governance-framework-european-open-science-cloud

- Review of the governance model proposed for the GO-FAIR initiative.[28]

All these sources converge that EOSC requires:

- **Strong policy guidance** including a **clear governance framework** for the initiative that makes it predictable; a multi-level and multi-stakeholder governance with clear institutional, executive and advisory roles that empowers the scientific community and evolves with time; the need for long-term public funding for the services needed to enable the integration of and access to the data resources to be federated in the EOSC;

- **Clear business model** for research data repositories and networks that mixes sources of revenue for long-term sustainability;

- **Initial services** to gather and organise FAIR research data and data-related research products, to be available via a service platform with easy **access and re-use**;

- Cost optimisation.

It emerged clearly from the consultation of scientific stakeholders and Member States and Associated Countries that the EOSC would need to be both scalable and flexible, adaptable to the emerging needs of the scientific community and able to support the whole research data lifecycle. The implementation roadmap should be iterative and take account the impacts on innovation;[29] so that the EOSC could respond to changing needs of scientists regarding research data and to strategic EU and national decisions on research data.

3.1 First round of projects

The first developments contributing to the EOSC were launched in the 2016-2017 period. These include EOSCPilot, EOSC-Hub, OpenAIRE-Advance, FREYA, eInfraCentral, RDA Europe 4.0, GEANT and the Helix Nebula Science Cloud. Project descriptions are available in Annex 1.

The first round of H2020 projects have been developing outputs which act as the initial base layer of the EOSC. For example, eInfraCentral & EOSC-Hub collaborated on a prototype portal which was unveiled at the EOSC launch event, EOSCPilot has drafted initial Rules of Participation and EOSC-Hub is working towards the federation of core eInfrastructures. All the projects are feeding into the core delivery: Helix Nebula is providing a Science Cloud, GEANT is providing networking, FREYA is working on persistent identifiers, OpenAIRE supports the uptake of open science and RDA is coordinating community data practices and standards.

3.2 HLEG & FAIR reports

In the perspective of the launch of the European Open Science Cloud (EOSC) implementation phase 2018-2020, two important reports have been published by the Commission that constitute major sources of strategic orientations and concrete actions for the new EOSC governance structure:

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[28] GO-FAIR was first presented at the COMPET Council of 30 May 2017. See https://www.go-fair.org/news/

[29] As mentioned in the European Parliament Report and in the *EOSC Declaration.*

- Prompting an EOSC in practice
  Report of the Commission 2nd High Level Expert Group on EOSC (EOSC 2nd HLEG)

- Turning FAIR into reality
  Report of the Commission FAIR Data Expert Group (FAIR Data EG)

The report **"Prompting an EOSC in Practice"** covers on a number of elements of the EOSC, from defining the Minimum Viable Research Data Ecosystem, to establishing the main Rules of Participation; also paying attention to issues such as Governance and possible Business Models. The report analyses various aspects of how the EOSC can interlink People, Data, Services and Training, Publications, Projects and Organisations and presents a set of recommendations – for implementation, engagement and steering – which can serve as an input for the EOSC governance.

The report **"Turning FAIR into reality"** describes the broad range of changes required for the implementation of the FAIR data principles. It offers a survey and analysis of what is needed to implement FAIR and it provides a set of concrete recommendations and actions for stakeholders in Europe and beyond. By following a holistic approach, the FAIR Data EG provides a template for key changes in the practice and culture of research and the implementation and normalisation of certain technologies and practices.

Both reports have been produced following a wide and open consultation of the scientific communities in 2018.

3.3 Launch event

The Austrian Presidency and the European Commission gathered stakeholders from all Member States to celebrate the launch of the European Open Science Cloud (EOSC). The launch event on 23 November 2018 marked the conclusion of a long process of consultation and reflection with stakeholders and is a symbolic start for the EOSC.

The Vienna Declaration on the European Open Science Cloud Governance Structure summarizes the consultation process by highlighting most important steps and by reminding the commitments, agreed upon by the Member States in the format of various policy documents. It also emphasizes the need to actively support this joint effort to ensure smooth and successful implementation. The Declaration was approved by acclamation at the event.

The first release of the EOSC Portal, a possible entry point of the Cloud, was demonstrated and its functionalities explained.

The newly appointed representatives of both Governance Board and Executive Board presented the Governance Structure of the EOSC.

4 FROM LAUNCH TO SUSTAINABILITY (2019-2020)

4.1 The Federated Approach

The EOSC implementation plan provided that Horizon 2020 would be used to integrate and consolidate e-Infrastructure platforms, to federate existing research infrastructures and scientific clouds and to support the development of cloud-based services for Open Science.

On this basis, the implementation of the EOSC as a federated model combines effectiveness and flexibility, primarily through the Research Infrastructures (including e-Infrastructures) part of Horizon 2020 Work Programme. Horizon 2020 funding constitutes the core of the

actions around which the EOSC implementation Roadmap unfolds. Beyond the initial projects mentioned earlier, as part of Work Programme 2018-2020, the Call INFRAEOSC added another €60m investment to support implementation and governance of the EOSC and a second set of projects.

Once this EOSC strategic implementation plan is approved, H2020 projects will be encouraged to liaise to ensure the proposed plans align with funded Descriptions of Work. For example, the FAIRsFAIR project has begun mapping its activity and will define a liaison point to synchronise project deliverables with the priorities of the EOSC as defined by the EOSC Governance. Other key implementation projects are encouraged to do the same.

4.2 Governance

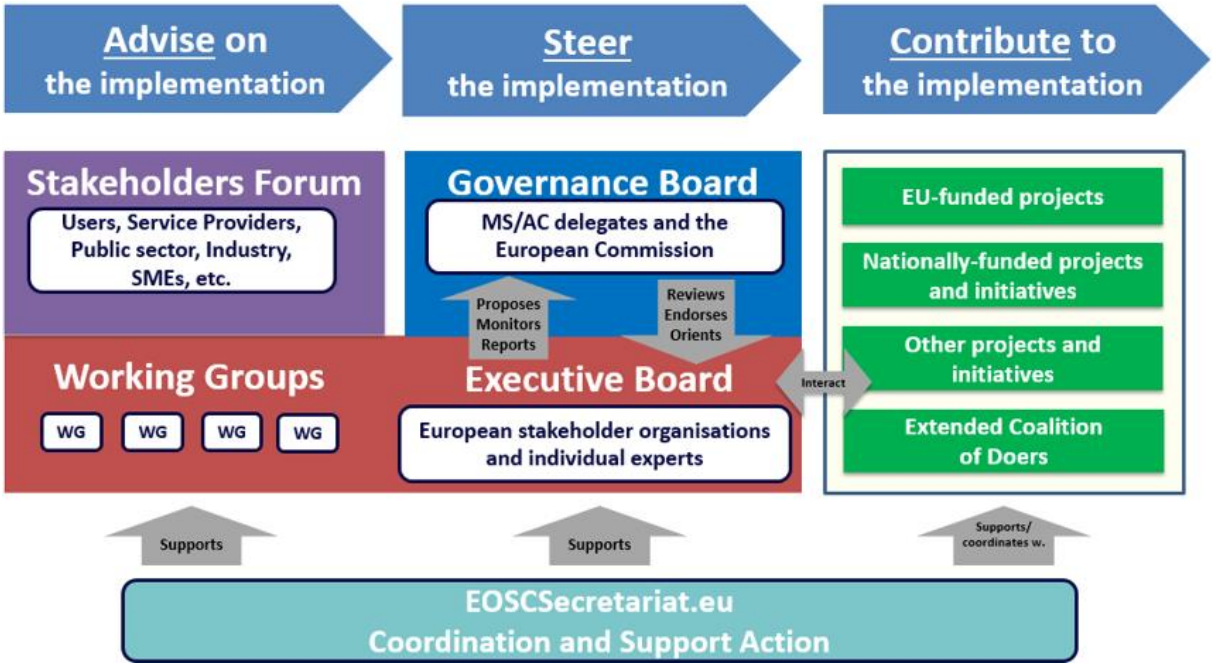

Figure 2 - EOSC Governance Structure

For the period 2019-2020, the EOSC governance is organized with a Governance Board, an Executive Board, and a Stakeholders Forum.

- The Governance Board is composed of representatives from Member and Associate States. It is chaired by representatives from the European Commission.
- The Executive Board is composed of 11 members which have been chosen following a call for applications the results of which have been published on 23 November 2019 .
- The Stakeholders Forum will comprise users, EU-level and national projects, service providers, public sector, SMEs, Industry, etc
- Five Working Groups will be created during the second quarter of 2019 in order to coordinate progress on the priorities chosen by the Governance Board after proposal from the Executive Board. They will be composed of representatives from the EOSC stakeholders. More Working Groups will be created as new priorities emerge.

The EOSC governance is responsible for the implementation of the EOSC roadmap. Therefore, one of the initial decisions by the Governance Board was to choose five priorities to allow stakeholders to focus their efforts towards common goals.

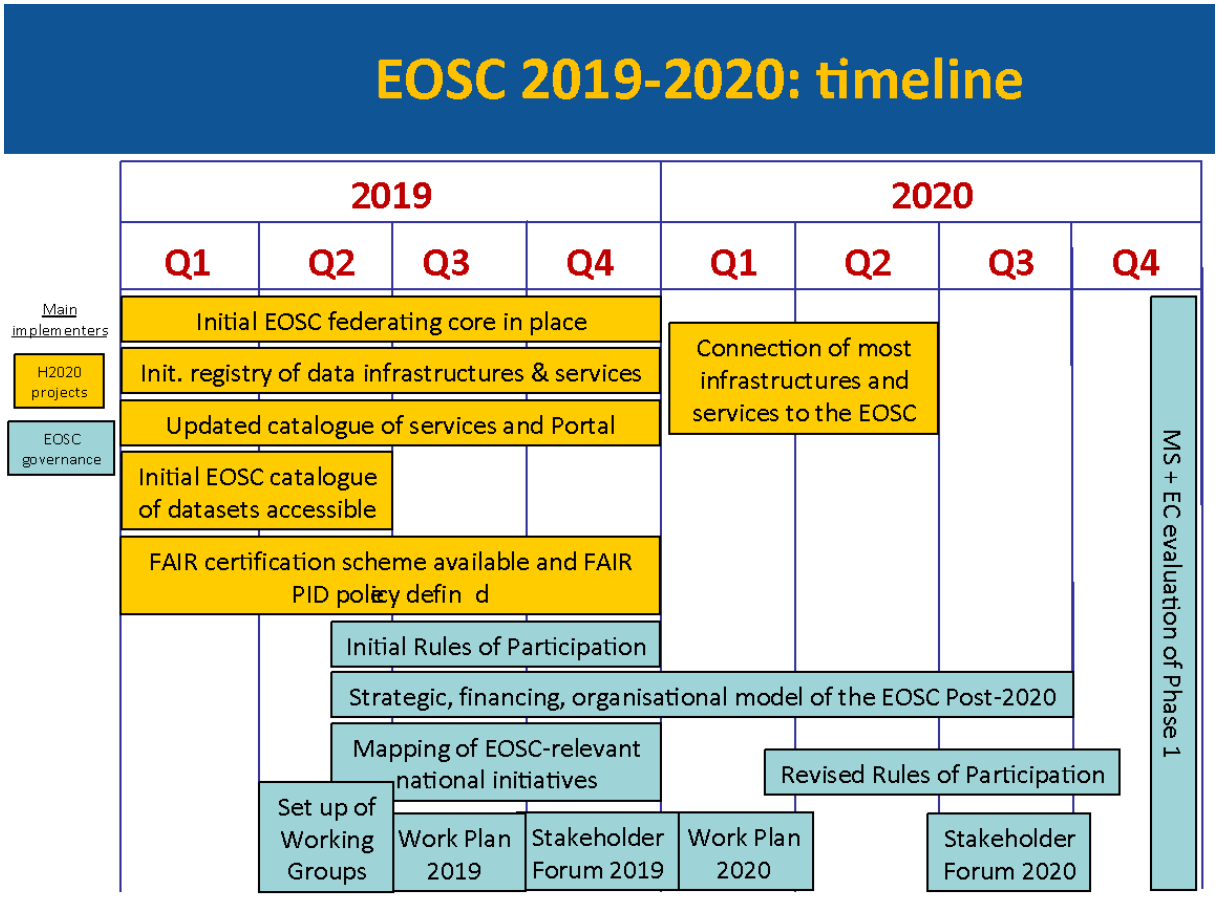

Figure 3 - EOSC 2019-2020: timeline

4.3 Five Strategic Priorities

Stakeholder consultation suggested that the process for developing EOSC shared resources should be staged, iterative and flexible. It should start by taking stock of the tools and practices in place in different scientific disciplines, before agreeing, cataloguing, certifying and finally implementing them according to agreed Rules of Participation. Research stakeholders would increasingly rely on standards and recommendations developed by their respective communities under well-established initiatives such as W3C and RDA to ensure service interoperability.

The EOSC model envisions a pan-European federation of data infrastructures built around a shared core, as well as providing access to a wide range of publicly funded services supplied at national, regional and institutional levels, and to complementary commercial services. This process of federation of resources would be implemented gradually, based on simple guidelines consistent with existing good practices:

- data infrastructures would enter the federation on a voluntary basis based on the commitment of resources and on the capacity to comply with its rules;
- data infrastructures would define the extent of their own involvement in the federation, in terms of the data sets and services they would contribute to the EOSC; their commitment and rule compliance would be limited to these data sets and services;

- data infrastructures would continue to follow their own rules outside of their specific commitments to the EOSC;

- data infrastructures would operate in the EOSC according to FAIR data principles and seek to become FAIR-accredited/certified entities, meaning that their data services would meet over time infrastructural and quality standards under a quality-assurance scheme;

- the structuring of the EOSC federation would occur flexibly, in response to actual needs and requests. For example, data infrastructures that already have the capacity, commitment and added value to facilitate/coordinate EOSC operations at a geographical or thematic level could seek to become EOSC federated centres;

- the federation would entail as few constraints as needed to deliver the expected EOSC services;

- the federating process would aim to achieve economies of scale and scope.

In order to build this federation, the Governing Board together with the Executive Board has established EOSC priorities.

- **Landscape**: Mapping of the existing research infrastructures which are candidates to be part of the EOSC federation;

- **FAIR**: Implementing the FAIR data principles by defining the corresponding requirements for the development of EOSC services, in order to foster cross-disciplinary interoperability;

- **Architecture**: Defining the technical framework required to enable and sustain an evolving EOSC federation of systems;

- **Rules of Participation**: Designing the Rules of Participation that shall define the rights, obligations governing EOSC transactions between EOSC users, providers and operators;

- **Sustainability**: Providing a set of recommendations concerning the implementation of an operational, scalable and sustainable EOSC federation after 2020.

4.3.1 Landscape: Mapping the existing European research infrastructures

The Landscape activity will be assigned with the task of providing options allowing a progressive EOSC convergence and alignment of structures and initiatives in Europe including national research infrastructures and e-infrastructures, national open science policies, ESFRI RIs and cluster projects, thematic initiatives and clouds, EOSC-relevant H2020 projects and international working groups (such as RDA, etc.).

The Landscape activity will build on the outcomes of the EOSC-related Horizon 2020 projects and on the inputs provided by the Member states.

The Landscape activity is expected to:

1. Deliver the mapping of EOSC-relevant national infrastructures and the current level of spending on research data infrastructures as follows:

- an **initial mapping by Q3 2019**, based on what's existing in EOSC-Hub and other related projects, as well as any contribution by Governing Board members;

- a revised and **final mapping by Q4 2019** with the input by the new INFRAEOEC-5b cluster of projects (to build on top of the initial mapping when they kick-off their activities in September 2019).

- The mapping should take into consideration the Conclusion no 10 of the Draft Council conclusions on the European Open Science Cloud (EOSC).[30]

  2. Take stock of federation constraints and opportunities at the various architectural levels, arising from national and regional structures and initiatives
  3. Propose mechanisms and best practices that will facilitate convergence and alignment between European, national and regional structures and initiatives.
  4. Conduct an analysis of the Member State's level of preparedness to provide financial resources and support for political stability and infrastructural planning to EOSC

Starting from	Committed resources (non-exhaustive)	Action	Milestones
2019, Q2	**WG Landscape, EC, GB, INFRAEOSC 5b projects, dedicated workshop**	**Targeted collecting of data on national initiatives and data RI, supplementing the info gathered by MS and projects**	**Q4 2019 - draft of the analysis presented to the EB**
2020, Q1	**WG Landscape, WG Sustainability, EC, GB, dedicated workshop**	**"EOSC readiness" of the MS and the RIs**	**Q3 2020 - report presented to the EB**

Table 1 – Landscape WG Timeline

4.3.2 FAIR: Implementing the FAIR data principles

The EOSC FAIR working group will provide recommendations on the implementation of Open and FAIR practices within the EOSC. It will address cross-disciplinary interoperability, gather requirements relevant to the EOSC services, and advise the EOSC Executive and Governance Boards on FAIR-related matters.

[30] "INVITES the Commission and the Member States therefore, to jointly explore the creation of a map of national research data infrastructures and initiatives in the Member States which could be federated, in order to ensure that current structures, competences, functions, and initiatives regarding research data management are duly taken into account;" Draft Council conclusions on the European Open Science Cloud (EOSC), 9029/18. https://data.consilium.europa.eu/doc/document/ST-9029-2018-INIT/en/pdf

The FAIR & Architecture WGs will operate in close alignment. The former addresses cultural aspects such as semantic and legal interoperability, certification and community data standards, while the latter will focus on the related technical specifications that address FAIR requirements.

The implementation of FAIR and Open Science policy requires a culture change supported by appropriate incentives and coherent, easy-to-use data services. This WG will build on existing FAIR practices in all disciplines and address interoperability across them. It will propose measures for increasing FAIR maturity to maximise data sharing and re-use.

The EOSC-FAIR working group will define and implement a FAIR work plan. These will be based on the Action Plan proposed by the EC Expert Group on "Turning FAIR into reality", as well as ongoing community initiatives and outputs from key projects like FAIRsFAIR, RDA and FREYA.

The WG will provide recommendations on:

1. The development and adoption of data standards and sharing agreements
2. Best practices that are already applied in specific scientific domains or countries and can be adopted at the multi-disciplinary and European levels
3. An EOSC Interoperability Framework that overarches disciplinary approaches and encourages research infrastructures to be interoperable-by-design
4. Service requirements for FAIR implementation, relevant to the Architecture WG
5. A Persistent Identifier (PID) policy for the EOSC
6. Frameworks to assess FAIR data and certify services that enable FAIR, including the collation of results e.g. catalogues of certified repositories
7. The international dimension of FAIR principles, converging towards globally-accepted frameworks

Starting from	Committed resources (non-exhaustive)	Action	Milestones
2018, Q1	**• FAIR data Expert Group (E03464)** **• EOSC FAIR Working Group**	**Prepare a FAIR data Action Plan**	**Q3 2018: FAIR data Action Plan published** **Q2 2019: Release an annual FAIR work plan** **Q1 2020: Release as annual FAIR work plan**
2019, Q1	**• FREYA project** **• RDA Europe 4.0**	**Release a draft Persistent Identifier policy for FAIR data to be tested in 2020**	**Q4 2019: FAIR persistent identifier policy defined** **Q4 2020: Results from testing and an updated PID policy**

2019, Q1	**• FAIRsFAIR**	**Release a draft outline approach for accrediting FAIR data and a certification scheme for repositories**	**Q4 2019: Outline approach for accrediting FAIR data and certifying repositories.** **Q4 2020: Results from testing and an updated scheme for accrediting FAIR data and certifying repositories**
2018, Q3	**• DG RTD** **• RDA Europe 4.0** **• FAIRsFAIR** **• Disciplinary data services** **• INFRAEOSC & H2020 projects**	**Define an EOSC interoperability framework for FAIR research data**	**Q3 2020: EOSC interoperability framework released**

Table 2 – FAIR WG Timeline

The FAIR data Action Plan is meant to set out the actions needed to develop EOSC shared resources and define the operational guidance and methodologies for applying the FAIR principles with these shared resources, including through FAIR maturity models and FAIR accreditation/certification schemes. Good relations with the projects delivering outputs is key. The outcome of the action plan would eventually constitute a new operational framework for FAIR research data.[31]

The policy-related work to support the demand for FAIR data has also started. This includes the introduction of the obligation of FAIR data management in Horizon 2020 grant agreements and funding provided to cover the costs of access to data in various research areas of Horizon 2020. Funding for data mandates and incentives to make data open are being addressed at Member State level via recommendations on access to and preservation of scientific information[32]. The activities of the GO FAIR initiative support mainstreaming of FAIR data management, as do many of the activities, outputs and recommendations emerging via the global Research Data Alliance (RDA) forum. Finally, mainstreaming would build on the *EOSC Declaration,* specifically on the several concrete commitments made by major scientific stakeholders to change their institutional practices (e.g. careers, rewards and incentives) towards open, FAIR data.

[31] Similar in nature to the existing European framework for the interoperability of public services. As foreseen by the Communication, this work should aim at maximising re-use of existing practices and standards in the science and ICT field.

[32] https://ec.europa.eu/digital-single-market/en/news/commission-recommendation-access-and-preservation-scientific-information

4.3.3 Architecture: Defining the technical framework to enable the EOSC federation of systems

The Architecture activity will propose the technical framework required to enable and sustain an evolving EOSC federation of systems. Such a technical framework may include standards, APIs and protocols that will facilitate interoperable services delivered by diverse providers.

In order to fulfil the EOSC vision, an interoperability layer that allows to build the EOSC federation of systems

1. has to be defined
2. has to be agreed upon by relevant stakeholders
3. has to be developed through an open and transparent process.

It will be built on the results delivered by the EOSC-related Horizon 2020 projects.

The EOSC Architecture activity will provide an in-depth independent review of the current offering and the required evolution of the EOSC technical architecture, its standards and best practices. It will propose a way forward by describing and/or defining:

1. the EOSC core services and their interfaces
2. the EOSC open source APIs for reuse by thematic services
3. the EOSC portal components and federated catalogues of service offerings
4. the EOSC data description standards
5. any other standards and best practices necessary to ensure the evolution of EOSC and the widening of its user base to the industry and the public sectors.

Based on the consultation of stakeholders, the EOSC should be a federation of existing and planned research data infrastructures, adding a *soft* overlay to connect them and making them operate as one seamless European research data infrastructure. In terms of architecture, the EOSC would essentially comprise a federating core and a variety of federated research data infrastructures committed to providing services as part of the EOSC. The groundwork for such a federated EOSC architecture was laid by several projects funded under Horizon Work Programme 2016-2017, which aim at federating data infrastructures at the European level and offering shared services (e.g. EGI, EUDAT, ELIXIR, EPOS etc.).[33] In addition, resources were committed to examine the EOSC architecture through the EOSCPilot project.

The EOSC federating core is understood to be constituted by EOSC shared resources and by a compliance framework including notably the Rules of Participation. The Work

[33]The Commission funded the integration, interoperability and federation of data infrastructures in various fields and the development of horizontal data services. These actions delivered generic and thematic data services, workflows, interoperable standards and ontologies, which pave the way toward the establishment of a European integrated environment for research data. In particular, Horizon 2020 supported the development and interoperability of pan- European thematic data infrastructures, through targeted support to the implementation and operation of the ESFRI roadmap projects identified through the ESFRI prioritisation exercise. Among these, two priority ESFRI projects, EPOS (European Plate Observing System) and ELIXIR (The European Life-Science Infrastructure for Biological Information), received significant funding in the 2014-2015 WP.

Programme foresees developing the initial shared resources around the EOSC-hub project, the EOSC Portal and a catalogue of data infrastructures and services.

Therefore, the process of federation entails two inter-related activities:

1. To develop shared resources as part of the *federating core.* In the initial phase, Horizon 2020 projects, notably EOSC-hub, will provide an access channel complementing the access mechanisms in use by different data infrastructures. A portfolio of projects (see Annex 1) will provide horizontal services such as a portal, authentication and authorisation and security services, allowing users to access the computing, data and services of pan-European and disciplinary research data infrastructures, which already federate data infrastructures at the European level. A catalogue of EOSC services, including both thematic and generic services - for data storage, management and analytics, simulation and visualisation, distributed computing, etc. will help researchers discover, select and use the services they need.

2. To connect to the core *a large number of research data infrastructures* (henceforth *data infrastructures).*[44] The *hub* would relay the resources and the services of data infrastructures funded at European, national and regional levels. Service and resources might be both generic and thematic-specific. *The progressive federation* over time of existing service providers in the EOSC would provide a single, coherent access channel to EOSC services at European level that meets researchers' needs for data sharing, management and computing.

The timeline below shows how resources of Horizon 2020 would serve this particular effort.

Starting from	Committed resources (non-exhaustive)	Action	Milestones
2018, Q1	**• EOSC-hub project • OpenAIRE-Advance • FREYA project**	**Develop initial EOSC federating core including the EOSC shared resources**	**Q4 2019: Initial EOSC federating core in place**
2019, Q1	**• EOSCpilot project • INFRASUPP-01 (b3)**	**Develop catalogue of interested and eligible (per Rules of Participation) data infrastructures to be federated into the EOSC and identify EOSC federate centres**	**Q4 2019: Registry of data infrastructures of the EOSC (initial)**
2018, Q4	**• INFRAEOSC-04-2018**	**Connection the research infrastructures identified in the ESFRI Roadmap to the EOSC. Support to this activity will be provided through cluster projects.**	**Q2 2020: Preliminary connection of most infrastructures and services to the EOSC**

Table 3 – Architecture WG Timeline – Horizon 2020 resources

In addition to directly supporting the federation of ESFRI projects in the EOSC (INFRAEOSC- 04-2018), WP 2018-2020 of Horizon 2020 funds specific actions in scientific areas with a tradition of research data sharing and services like transport, food, marine, health and earth- observation; this ensures that the EOSC is fully inclusive.

The WP 2018-2020 on food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy includes two topics, one each for developing and building cloud services on food data and ocean data, in such as a way that they can be eventually federated into the EOSC.[34] In health, a significant development included in WP 2018-2020 is the Health Research and Innovation Cloud (HRIC), which aims to structure first and later establish a thematic cloud for health-related research, in strict relation with the EOSC.

The Commission also invests heavily in data regarding the planet and the environment in the Copernicus programme, the flagship space programme. Copernicus's *Data and Information Access Services* (DIAS) provide access, tools and processing capabilities for scientists and innovators to exploit this data. DIAS are operated by the industry and will offer additional services in the EOSC under commercial conditions. Federating Copernicus data and DIAS added-value services into the EOSC will leverage the existing Commission investments for the benefit of multiple science and innovation communities. In line with the intervention logic of the Communication, this will reduce the burden for scientific institutes to engage in complex procurement processes, support cross-analysis of data from heterogeneous sources, create market opportunities for research data services and represent a demand-side stimulus for the commercial DIAS.

Generic services

The consultation and the available evidence show that EOSC might offer five main types of services for European researchers. While such services are currently being provided to specific scientific communities, they are limited by the contexts of disciplines, by national boundaries or by both. The EOSC would make them all available irrespective of discipline or national boundaries.

These services are:

1. A unique identification and authentication service and an access point and routing system towards the resources of the EOSC.

2. A protected and personalised work environment/space (e.g. logbook, settings, compliance record and pending issues).

3. Access to relevant service information (status of the EOSC, list of federated data infrastructures, policy-related information, description of the compliance framework) and to specific guidelines (how to make data FAIR, to certify a repository or service, to procure joint services).

4. Services to find, access, re-use and analyse research data generated by others, accessible through appropriate catalogues of datasets and data services (e.g. analytics, fusion, mining, processing).

5. Services to make their own data FAIR, to store them and ensure long-term preservation.

[34] The two calls are: DT-SFS-26-2019: Food Cloud demonstrators and BG-07-2019-2020: The Future of Seas and Oceans Flagship Initiative, http://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water

The consultation process recommended providing free of charge the services under 1, 2 and 3, as well as under 4 except when the re-use and analysis of data involves big data or large computation power, in particular via a commercial service provider. This would entail co-financing from other sources (e.g. a national or European grant). The cost model of the services described under 5 would be determined when deciding on the long-term business model for EOSC.

Services as proposed above, that could effectively be provided under the EOSC reflect existing offers by service providers across Europe such as EGI, EUDAT and GEANT, and by existing research data repositories. Work to integrate and federate such services has already began in Horizon 2020 Work Programme 2016-2017, with the EOSC-hub project and other related projects expected to deliver services under the EOSC. The projects will deliver the initial catalogue of services and data to be provided by EOSC and will define the delivery model(s) for the services. Those catalogues would be enriched periodically based on the process of federation.

Starting from	Committed resources (non-exhaustive)	Action	Milestones
2018, Q2	**• EOSC-hub project • eInfraCentral project • OpenAIRE-Advance • INFRAEOSC-01-2018 • INFRAEOSC-02-2019 • INFRAEOSC-03-2020 • INFRAEOSC-04-2018 • INFRAEOSC-05b • INFRAEOSC-06a • INFRAEOSC-06b**	**Develop initial catalogue of services to be provided via the EOSC (to be enriched periodically) and define delivery model(s)**	**Q4 2018: Initial EOSC Catalogue of services accessible & prototype EOSC Portal accessible Q4 2019: Updated EOSC Catalogue of services & EOSC Portal**
2018, Q2	**• EOSCpilot project • EOSC-hub project • INFRAEOSC-04-2018 • INFRAEOSC-05b**	**Develop initial catalogue of datasets accessible via the EOSC (to be enriched periodically)**	**Q2 2019: Initial EOSC Catalogue of datasets accessible.**

Table 4 – Architecture WG Timeline – Services

Access & Interface

The consultation and evidence gathered indicate the benefits of giving users a choice between different entry points for accessing EOSC services for practical reasons and to ensure a smooth transition from legacy research data systems in contrast to implement a single access point. Work on the EOSC access and interface has already begun under Horizon 2020 Work Programme 2016-2017.

The entry points to the EOSC would be similar but not equivalent, and typically would consist of a web-based user interface, or front-end, which can be tailored to the specific needs and context of particular user communities. In addition, it would comprise a common platform building on the EOSC-hub project and further developed in the INFRAEOSC-06-2020 call a) and b), that would be accessible to users via machine-to-machine interfaces and which offers access to shared EOSC resources and to the full range of EOSC services.

Services provided under the EOSC would be made accessible via a EOSC portal, based on the work developed by the EOSC-hub and eInfra Central projects and further support

planned in Horizon 2020. Acting as an *entry point for all potential users,* the portal would have a full-fledged user interface supported by the common platform. Such an entry point usually guarantees that all users have access to the full range of services, irrespective of geographical location or scientific affiliation.

4.3.4 Rules of Participation: Defining the rights and obligations governing EOSC transactions

The Rules of Participation activity will focus on recommending a minimal set of clear Rules of Participation that shall define the rights, obligations and accountability governing all EOSC transactions by the various EOSC users, providers and operators. Emphasis will be put on finding the common requirements across the very heterogeneous European landscape of Research Infrastructures and service providers.

The Rules of Participation shall embrace the principles of openness, transparency and inclusiveness. They shall guarantee an open, secure and cost-effective federated EOSC with services of documented quality. There will be room and need for differentiating the rules applicable to different EOSC users taking into account:

1. The different roles and different services available in EOSC (eg data producers, service providers, data/service users);

2. The specificities of different scientific disciplines;

3. The diversity and level of readiness of infrastructures and services at disciplines, Member States and Associated Countries, and European levels and the differences in their established rules and processes;

4. The variety of service providers and users that will be involved in the EOSC (e.g. public versus private, horizontal versus specialized);

5. Changing needs and practices regarding the implementation of the rules, in particular concerning compliance with existing legal frameworks in Europe (GDPR, etc.) and emerging ones (e.g. free flow of data);

6. The widening of EOSC user base to the industry and the public sector taking into account both the supply side and demand side.

The Rules of Participation activity outputs will include:

1. The objectives for the Rules of Participation (Q3 2019)

2. A proposal of an initial set of RoP for immediate implementation (Q4 2019);

3. The collection of user feedback on the initial set of RoP (Q2 2020)

4. A revised proposal of the RoP for application after 2020 (Q4 2020).

Due to the nature of the research that the Rules of Participation activity will conduct, it is advised that all other activities should also contribute to the progress by providing findings that directly contribute towards the completion of the tasks planned.

The groundwork for the design of such rules is being laid primarily by the EOSCPilot project funded by the Work Programme 2016 and the work of the High Level Expert Group on the EOSC, while the EOSC Declaration set the general principles.

The consultation and available evidence suggest that the rules ought to address:

- the use of the tools, specifications, catalogues and standards (EOSC shared resources) and applicable methodologies (framework for FAIR research data);
- the principles for regulating transactions (e.g. financial mechanisms and procedures, agreements/bylaws established by the EOSC governance framework); and
- the applicable legal frameworks (e.g. GDPR, copyright, Data Security and Cybercrime, dispute resolution and redress mechanisms, e-commerce directive).

Moreover, the rules would apply differently to different EOSC participants, depending on their maturity and role (providers vs. users, scientists or innovators), location (European vs. global research partners), and would need to respect the specificities of different scientific disciplines. Therefore, compliance with the rules could differ based on:

- the current situation and readiness of data infrastructures and services at the level of Member States (research infrastructures, e-Infrastructures) and disciplines (level of standardisation and integration) and the differences in their established rules and processes;
- the actual existence and variety of service providers and the actual needs of users of the EOSC (e.g. public vs private; horizontal vs specialised); or
- evidence of changing needs and practices in relation with the implementation of the rules, in particular as concerns compliance with existing legal frameworks (e.g. GDPR) and emerging ones (e.g. free flow of data).

Starting from	Committed resources (non-exhaustive)	Action	Milestones
2018, Q2	• **DG RTD** • **EOSCpilot project** • **EOSC-hub project** • **OpenAIRE Advance** • **HLEG EOSC** • **EOSC secretariat**	**Develop Rules of Participation in consultation with stakeholders**	**Q3 2019: Initial EOSC Rules of Participation** **Q3 2020: Final EOSC Rules of Participation**

Table 5 – Rules of Participation (RoP) WG Timeline

4.3.5 Sustainability: Delivering recommendations for a scalable and sustainable EOSC

The EOSC Sustainability activity will provide a set of recommendations concerning the implementation of an operational, scalable and sustainable EOSC federation after 2020, will gradually open up its user base to the public sector and industry.

The activity will examine suitable business models of EOSC, governance structures and legal entity. The analysis will result in a set of strategic and financing orientations for EOSC in its second phase of implementation (post 2020). The activity will also examine the impact of each legal and financial option to different stakeholders at national and European level.

The Sustainability activity foresees discussing the alternative scenarios and options with the Governing Board and Executive Board at an early stage of work. Regular updates of the Governance Board on work progress are seen as a way to favour real-time harmonisation of the national positions and enable a timely set up of the EOSC future model.

The Sustainability activity will build on the legacy of the EOSC Roadmap, Council Conclusions 2018, Horizon 2020-funded projects, stakeholder reports and experience of similar initiatives. Taking on board input of ongoing international and national initiatives will support analysing the gaps towards identifying a future sustainable model for EOSC.

The Sustainability activity will take stock, assess and recommend strategic, legal and financing orientations that EOSC could follow during its second phase of implementation (post 2020).

More specifically, the activity will aim to:

1. Conduct an in-depth analysis of business models and their different implications in the choice of legal-entity, cost analysis, regulations, financial strategy and sustainability. The analysis would include an estimation of initial and longer-term cost projections. The proposed options accompanied with a sound risk analysis should be able to sustain, upgrade and scale the EOSC federation, as a whole and in its components. It should allow for alignment and convergence with national data infrastructures.

The final model will emerge as a transparent, concerted result of discussions with the Executive Board and the Governance Board and will be based on reliable mechanisms to ensure appropriate ongoing financial commitment by stakeholders and identify where funding responsibility lies for different components and services. It will identify income streams as well as opportunities for consolidation and economies of scale.

At the same time, it will conduct either in subgroups or as an outsourced activity:

1. A mapping of potential legal entities taking into account the existing national and European legislation.

2. At the same time, and in line with the selected suitable legal entities, it will analyse options for a governance framework to steer and oversee initial EOSC operations and further development beyond the initial phase. It is foreseen that the design of a suitable governance will follow the choice of the legal entity. The proposed framework will aim at balancing the requests of stakeholders, Member States and European Commission.

3. An analysis of the current regulatory/policy environments at the MS/AC levels for data and services with options and recommendations on how to regulate the EOSC ecosystem. The analysis should include an assessment of the impact that the proposed structures and funding streams will have on different stakeholders at national and European level.

It will be important for the Sustainability activity to work in collaboration with Rules of Participation activity in order to ensure that the EOSC Governance and legal entity post-2020 will be compatible with the EOSC Rules of Participation.

Starting from	Committed resources (non-exhaustive)	Action	Milestones

2018, Q1	**EC, with support of EOSCpilot project, High Level Expert Group EOSC, OSPP and other sources**	**Set up the EOSC governance framework in consultation with MS**	**Q4 2018: EOSC Governance established**
2019, Q1	**EOSCsecretariat**	**Prepare legacy for 2nd implementation phase (post 2020)**	**Q3 2020: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020**

Table 6 –Sustainability (RoP) WG Timeline

5 DRIVING PRINCIPLES FOR IMPLEMENTATION

In order for EOSC to build the trust necessary for wide *deployment* among a large variety of research communities, it is essential that the *development* of EOSC follows principles that will drive its implementation. Key decisions regarding EOSC will have to be based upon as large a consultation as possible, as complete a debate as possible. Those consultations and debates will have to follow basic rules.

5.1 Cooperation

Respectful cooperation between stakeholders, whereby each respects the autonomy, integrity, processes, and intellectual property rules of the others.

5.2 Decision Process

- **Openness.** Processes will be open to all interested and informed parties.
- **Broad consensus.** Processes will allow for all views to be considered and addressed, such that agreement can be found across a range of interests.
- **Transparency.** Stakeholders will provide public notice of proposed development activities, the scope of work to be undertaken, and conditions for participation. Easily accessible records of decisions and the materials used in reaching those decisions will be provided.
- **Balance.** Activities will not be exclusively dominated by any particular person, organization or interest group.
- **Due process.** Decisions will be made with equity and fairness among contributors. No one party will dominate or guide decisions. Processes will be transparent. Periodic reviews and updating will be well defined.

5.3 Common interest

Criteria for decision-making will be such that decisions:

- will be made and defined based on common interest;
- will provide global interoperability, scalability, stability, and resiliency;

- will enable global cooperation;
- will serve as building blocks for further innovation.

5.4 Availability

Decisions will be made accessible to all for implementation and deployment. Stakeholders will have defined procedures to develop contributions that can be implemented under open terms.

5.5 Voluntary adoption

Decisions will be voluntarily adopted and success will be determined by the effective use by research communities.

5.6 Role of Software

While all data will be considered 'first class' citizens and treated on a common basis, software will play a specific role as enabler of services and interoperability.

In order to be EOSC compliant, software developments will be open source by default. Exceptions will have to be justified and approved after appropriate debate.

Software development will be conducted on open development platforms to allow for participation and contribution by all stakeholders interested.

5.7 Role of Working Groups

While addressing key priorities, Working Groups will be the standard way to proceed. Working Groups will be open by default to any interested participant and will be conducted following the driving principles for implementation.

As of Q2 2019, Working Groups are the only way to address key priorities. Other cooperation approaches will be developed in due time if needed.

6 IMPLEMENTATION MECHANISMS

EOSC will be the result of the federation of existing infrastructures augmented by new services dedicated to sharing publications, data and software for the benefit of research communities. The evolution of existing infrastructures and the creation of new ones will remain under the sole responsibility of their own governance. The federating efforts are therefore the way that EOSC will make a difference by offering services that would not have existed otherwise.

6.1 H2020 projects

Horizon 2020 funding constitutes the core of the actions around which the EOSC implementation Roadmap unfolds. Since 2016, a series of projects have been supported by the Horizon 2020 programme. Those projects are listed in Annex 1.

The role of EOSC governance is therefore to orchestrate those efforts in order for them to be as much as possible complementary of each other.

Moreover, EOSC will need to engage with stakeholders that are not engaged in Horizon 2020 projects. The role of the Working Groups is to ensure that the five priorities that have been put forward by the Governing Board and the Executive Board receives attention by as large a panel as possible.

6.2 Working Groups

In order to orchestrate the projects and to bring consistency between them, the new EOSC Governance started its activities in 2019. The Governance Board first met on 28 January 2019. Based upon the suggestions of the Executive Board, it decided on the prioritization of five topics and the creation of five working groups. It tasked the Executive Board to put them in place. In its meeting of 1 March 2019, the Executive Board discussed in more details the description of each working group together with the nomination of a coordinator for each group:

- Landscape: Jan Hrušák
- FAIR: Sarah Jones
- Architecture: Jean-François Abramatic
- Rules of Participation: Juan Bicarregui
- Sustainability: Rupert Lück & Stephan Kuster

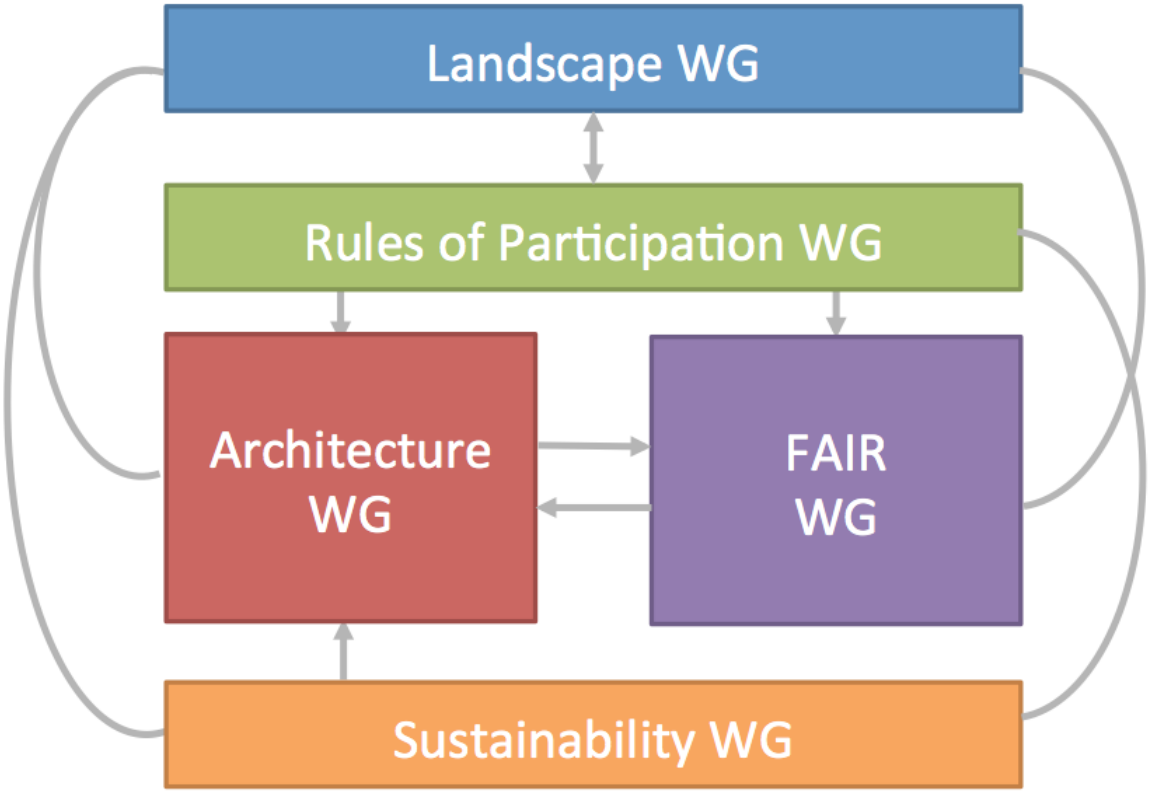

Fig.4 EOSC Working Groups

It is envisaged to create other working groups in the future on topics such as

- Going global
- Widening user base
- Skills & training

The Strategic Implementation Plan will be updated if and when new groups are launched.

7 COMMUNICATION

To successfully develop a federation of widely distributed systems, such as the EOSC, requires a strong and consistent communication strategy. It is necessary to perform an in-depth analysis to understand the EOSC stakeholder communities and their diverse communication needs and values. Coordinated messaging in different 'languages' that speak to all stakeholders is also critical, as is the use of the existing communications channels available across the stakeholder community to reach scale.

Both Communications and Stakeholder Engagement are fundamental activities to be delivered in the EOSCsecretariat project. The Executive Board will make it a priority to engage with the EOSCsecretariat into the stakeholder analysis, definition of audiences, channels and content. Attention will be given to ensure that both functional (technical features and information) as well as impactful (benefits and user stories) will be made available in the correct channels. The Executive Board will subsequently support the EOSCsecretariat in its communication function to ensure that the complex communication with EOSC stakeholders is carried out in a professional, consistent and integrated way.

The Executive Board, supported by the EOSCsecretariat, will ensure regular communication and collaboration with existing projects and activities to ensure a gradual harmonisation of messaging around the EOSC activities, but specifically around the activities of the Executive Board. The input of existing H2020 projects and data initiatives within Member States is critical to the effective functioning of the EOSC Working Groups and ultimately the building of the EOSC.

The Executive Board itself represents not only a stakeholder, but also one communication channel and will work with the EOSCsecretariat to become a valuable communicator on EOSC across the stakeholder community and beyond the various EOSC projects currently in place.

Particular attention will be paid to establishing concrete communication channels to the Governance Board and other Member State fora. This direct communication channel between the Executive Board and the Governance Board is of vital importance and will be managed among the two Executive Board chairs, the Member State appointed Governance Board Chair and his Alternate, as well as the EC.

8 NEXT STEPS

On May 22 2019, the EOSC Executive Board presented the Strategic Implementation Plan to the EOSC Governing Board for comments and received approval to make the document public.

Annual workplans will be derived from the Strategic Implementation Plan.

The Strategic Implementation Plan will be updated as needed following EOSC progress.

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Annex 1 EOSC projects funded by Horizon 2020

GÉANT

GÉANT (€64m in WP 2016-2017 - €128m in WP 2018 – 2020 for an action until 2022) serves as the network access provider for the EOSC, contributing, together with the National Research and Education Networks (NRENs), secure seamless high-speed multi-domain networking and wide peering together with federated identity services delivering appropriate access to cloud services, data, research infrastructures and the many other components and resources of the EOSC. In addition, GÉANT has a role in a coordinated data management framework where the network, compute and storage are all working together to serve the needs of researchers. Furthermore, GÉANT contributes to end-to-end performance optimisation and user support services including data planning consultancy, troubleshooting, training, service marketing and public procurement.

Helix Nebula Science Cloud, HNSciCloud

HNSciCloud is a European pre-commercial procurement (PCP) initiative co-funded by Horizon 2020. Scientific research in many different domains generates massive amounts of data, creating enormous challenges for data capturing, management and processing. Today commercial cloud services do not play a significant role in the production computing environments for the publicly funded research sector in Europe. Using the approach of Pre-Commercial Procurement (PCP) leading research organisations from 7 countries have joint to pull together commercial cloud service providers, publicly funded e-Infrastructures and in-house resources to build a hybrid cloud platform on top of which a competitive marketplace of European cloud players can develop their own services for a wide range of users. The project brings together Europe's technical development, policy and procurement activities to remove fragmentation and maximise exploitation. HNSciCloud develops requirements for cloud services addressing the needs of research institutes from across Europe for multiple dataintensive research communities.

EOSCpilot [Jan 2017 – April 2019]

The EOSCpilot project supports the first phase in the development of the European Open Science Cloud (EOSC). It proposes and trials the governance framework for the EOSC and contribute to the development of European open science policy and best practice; develops a number of demonstrators functioning as high-profile pilots that integrate services and infrastructures to show interoperability and its benefits in a number of scientific domains; and engages with a broad range of stakeholders, crossing borders and communities, to build the trust and skills required for adoption of an open approach to scientific research.

These actions will build on and leverage already available resources and capabilities from research infrastructure and e-infrastructure organisations to maximise their use across the research community.

eInfraCentral [Jan 2017 – June 2019]

eInfraCentral (€1.5m) builds and provides access to the catalogue of e-Infrastructure services which will feed the EOSC-Hub. The overall aim of the project is to ensure that a broader and more varied set of users (including industry) benefits from European infrastructures. The catalogue is the single point of reference for researchers and the broad community to discover and compare services and resources, as well as to monitor the

performance and quality across multiple service providers. The eInfraCentral catalogue resulted from an open dialogue between e-Infrastructures to consensually define, monitor, improve and increase the uptake of their services. A beta version of the portal is already accessible.

Freya [Dec 2017 – Nov 2020]

FREYA (€5m) will provide a robust environment for a range of Persistent Identifiers (PIDs), an essential component of the EOSC. A universal and persistent mechanism will be developed for discovering elements in the EOSC interoperable research environment, through richer linking of research entities, metadata enrichment and improved machine actionability. The project will integrate and connect existing PID systems into a federated Graph, and provide a PID Services Registry. FREYA and RDA will collaborate on PID requirements, standards and protocols to support interoperability. An open, sustainable framework for collaborative self-governance of PIDs and innovative services built on them will be established.

EOSC-Hub [Jan 2018 – Dec 2020]

EOSC-HUB started in 2018 to directly contribute to the EOSC implementation. The project (€30m) will integrate and consolidate services, software and data from the key existing e-Infrastructures EGI Federation, EUDAT CDI, INDIGO-DataCloud and major research e-Infrastructures through a pan-European access mechanism, providing an integrated entry point to both generic and thematic services for the scientific community. EOSC-Hub builds on mature processes, policies and tools from the leading European federated e-Infrastructures to cover the whole life-cycle of services, from planning to delivery. It aggregates services from local, regional and national e-Infrastructures in Europe and worldwide and builds a comprehensive Catalogue of Services based on the results of the eInfraCentral project (see above). Through the project's virtual access mechanism, more scientific communities and users will have access to services supporting scientific discovery and collaboration across disciplinary and geographical boundaries. The project will improve skills and knowledge among researchers and service operators by delivering specialised trainings and by establishing competence centres to co-create solutions.

OpenAIRE-Advance [Jan 2018 – Dec 2020]

OpenAIRE-Advance (€10m) addresses key aspects and challenges of the currently transforming scholarly communication landscape in terms of quality assurance, communication of scientific outputs with a focus on EOSC developments. It is based on the OpenAIRE network that supports, accelerates and monitors the implementation of Open Science policies, including Open Access to publications and research data. The project lays the groundwork for OpenAIRE to play a central role in the European Open Science Cloud (EOSC), enabling greater integration with Research Infrastructures and developing a catalogue of services that are inherently interoperable with and complementary to other EOSC services. It will work in close collaboration with the EOSC-Hub project.

RDA Europe 4.0 [March 2018 – May 2020]

RDA Europe 4.0 (€3.5m) addresses the need for open and interoperable sharing of research data and the need to build social, technical and cross-disciplinary links to enable such sharing on a global scale. To do so, it builds on its community-driven and bottom-up approach, which has been operational since 2012. The project takes forward the current

RDA Europe effort, and brings in and structures the organisations that implemented RDA Europe since 2012. The scope of RDA Europe 4.0 is to become the centrepiece for an EU Open Science Strategy through a consolidated European network of National Nodes, bringing forward an RDA legacy in Europe, providing skilled, voluntary resources from the EU investment to address DSM issues, by means also of an open cascading grant process.

PaNOSC [Dec-2018 – Nov 2022]

PaNOSC will build on top of the existing local meta-data catalogues and data repositories to provide federated services for making data easily Findable, Accessible, Interoperable, and Re-usable (FAIR). Extracting the scientific value of the experimental data produced in our RIs is not always an easy task. The raw data tends to be larger and larger and quite often required special skills for being correctly exploited. PaNOSC will develop and provide data analysis services to overcome these difficulties. The services will include notebook (Jupyter based), remote desktop applications and containers or VMs. These services will be provided locally by the RIs for their users (especially when they are on site or when the volume of data is too huge to be exported), the same services should also be available on the EOSC for general use. The data analysis services will offer in a single user experience the data, the software, the IT capacity and the necessary scientific support. All these services should be fully integrated into the EOSC catalogue, in terms of discovery, accessibility, and user authentication/authorisation, SLA, accounting etc. The PaNOSC cluster will also help introduce a new data culture to the user community – via training at each site and workshops on scientific data management and publishing practices. Best practices in data stewardship will be shared with other laboratories within the PaN community and other clusters. Experiences, trials and results will be shared openly via publications and meetings. The positive experience of implementing an Open Data policy and connecting data and services to the EOSC will help convince other PaN institutes still struggling with adopting the FAIR principles.

EOSCsecretariat.eu [Jan 2019 – June 2021]

EOSCsecretariat.eu addresses the call Support to the EOSC Governance subtopic (a), Setup of an EOSC coordination structure. It will deliver an EOSC Secretariat that is a proactive, dynamic and flexible organisational structure with all the necessary competences, resources and vision to match the ambition of the call. The 30-month project will maintain a practical approach addressing all the specific needs of the coordination structure required for the EOSC. The project will adopt a co-creation approach working with the community to deliver many of the activities and has reserved a substantial portion of the budget for organisations not in the consortium. This approach will enable a high degree of flexibility in order to address any foreseen or unforeseen challenges that may arise during the project. EOSCsecretariat.eu is characterised by being neutral towards the community it is serving and by having a pragmatic approach that is fully dedicated to realising the outcomes of the EOSC design as stated in the Implementation Roadmap Staff Working Document and adopted Council Conclusions to deliver an operational open science cloud for all European stakeholders. The outputs of EOSCsecretariat.eu include: Secretariat organisational structure, processes & procedures, rules & legal framework; business models; press & media office; pan-European awareness increase; open consultation; knowledge base; coordination services to WGs; coordination with EOSC-related projects; organisation & support to Boards & events; two Stakeholders Forums; liaison with non-EU countries; engaged community with all stakeholder groups represented.

OCRE [Jan 2019 – Dec 2021]

The Open Cloud for Research Environments consortium combines the expertise of four partners to enable access and drive the adoption and use of commercial digital services by the European research community. After gathering user requirements, the OCRE will manage the adoption funds and buy resources from the selected suppliers (OCRE will act as customer) and make cloud resources available to institutions. Such a delivery vehicle is effective and efficient for the supply as well as the demand side. Service adoption is the key focus of this work. A legal and technical mechanism (The OCRE Business Management Platform) will be created to integrate a range of these commercial services into the EOSC hub in order to make them more easily available to researchers.

ARCHIVER [Jan 2019 – Dec 2021]

Using the PCP instrument and building on results of recent projects, ARCHIVER's goal is to fulfil these data management promises in a multi-disciplinary environment, allowing each research group to retain ownership of their data whilst leveraging best practices, standards and economies of scale. ARCHIVER will combine multiple ICT technologies, including extreme data-scaling, network connectivity, service inter-operability and business models, in a hybrid cloud environment to deliver end-to-end archival and preservation services that cover the full research lifecycle. The potential uptake for the services resulting from this proposal are many-fold, including supporting the needs of ESFRI and related research infrastructures as well as the results of short-term research projects funded at the regional, national and European-level. The European Open Science Cloud is a major European undertaking that will provide this project with a privileged engagement channel with Europe's research communities who seek reliable and scalable solutions that satisfy the obligations of data management plans required by funding agencies.

SSHOC [Jan 2019 – April 2022]

The project aims to provide a full-fledged Social Sciences and Humanities Open Cloud (SSHOC) where data, tools, and training are available and accessible for users of SSH data. The focus of the project is determined by the goal to further the innovation of infrastructural support for digital scholarship, to stimulate multidisciplinary collaboration across the various subfields of SSH and beyond, and to increase the potential for societal impact. The intention is to create a European open cloud ecosystem for social sciences and humanities, consisting of an infrastructural and human component. Development, realisation and maintenance of user-friendly tools & services, covering all aspects of the full research data cycle will be built, taking into account human-centric approach and creating links between people, data, services and training. SSHOC will encourage secure environments for sharing and using sensitive and confidential data. Where relevant, the results of EOSC-hub H2020 project will be adopted. The SSHOC will contribute to the Open Science agenda and realising the EOSC. This project aligns with prescribed cluster activities in order to realise a SSH cloud that can fully encompass infrastructural support for the study of social and cultural phenomena. Moreover, the planned SSH Cloud is instrumental to Europe's multilingualism; data in Europe is often available in multiple languages thus making a strong incentive for comparative research of the societal and cultural phenomena that are reflected in language use. The SSH Cloud shall contribute to innovations stemming from the coupling of these heterogeneous data types - and work on the Interoperability principle of FAIR.

ENVRI-FAIR [Jan 2019 - Dec 2022]

ENVRI-FAIR is the connection of the ESFRI Cluster of Environmental Research Infrastructures (ENVRI) to the European Open Science Cloud (EOSC). Participating research infrastructures (RI) of the environmental domain cover the subdomains Atmosphere, Marine, Solid Earth and Biodiversity / Ecosystems and thus the Earth system in its full complexity. The overarching goal is that at the end of the proposed project, all participating RIs have built a set of FAIR data services which enhances the efficiency and productivity of researchers, supports innovation, enables data- and knowledge-based decisions and connects the ENVRI Cluster to the EOSC. This goal is reached by: (1) well defined community policies and standards on all steps of the data life cycle, aligned with the wider European policies, as well as with international developments; (2) each participating RI will have sustainable, transparent and auditable data services, for each step of data life cycle, compliant to the FAIR principles. (3) the focus of the proposed work is put on the implementation of prototypes for testing pre-production services at each RI; the catalogue of prepared services is defined for each RI independently, depending on the maturity of the involved RIs; (4) the complete set of thematic data services and tools provided by the ENVRI cluster is exposed under the EOSC catalogue of services.

FAIRsFAIR [Feb 2019 – Jan 2022]

Emphasis of the project is on fostering FAIR data culture and the uptake of good practices in making data FAIR. Keeping in mind that there is no 'one size fits all', the consortium will focus on all scientific communities for supporting, creating, further developing and implementing a common scheme to ensure data development, wide uptake of and compliance with FAIR data principles and practices by data producers as well as national and European research data providers and repositories contributing to the EOSC. Furthermore, the consortium will closely collaborate with other relevant (global) projects and initiatives already on the way e.g. GO-FAIR, Research Data Alliance (RDA), World Data System (WDS), CODATA. We will provide a platform for using and implementing the FAIR principles in the day to day work of national and European research data providers and repositories. The consortium cooperates with other projects that will be funded under the INFRAEOSC-05-2018 topic (e.g. the EOSC governance (5a) and where appropriate 5b, the projects funded in the INFRAEOSC-04-2018 topic (e.g. the ESFRI clusters SSHOC, PANOSC, ENVRI FAIR, ESCAPE and EOSCLife) and with the EOSC coordination structure developed in the existing EOSC-pilot and EOSC-hub projects.

ESCAPE [Feb 2019 – July 2022]

ESCAPE (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) aims to address the Open Science challenges shared by ESFRI facilities (SKA, CTA, KM3Net, EST, ELT, HL-LHC, FAIR) as well as other pan-European research infrastructures (CERN, ESO, JIVE) in astronomy and particle physics. ESCAPE actions will be focused on developing solutions for the large data sets handled by the ESFRI facilities. These solutions shall: i) connect ESFRI projects to EOSC ensuring integration of data and tools; ii) foster common approaches to implement open-data stewardship; iii) establish interoperability within EOSC as an integrated multi-messenger facility for fundamental science. To accomplish these objectives ESCAPE will unite astrophysics and particle physics communities with proven expertise in computing and data management by setting up a data infrastructure beyond the current state-of-the-art in support of the FAIR principles. These joint efforts are expected result into a data-lake infrastructure as cloud open-science analysis facility linked with the EOSC. ESCAPE supports already existing infrastructure such as astronomy Virtual Observatory to connect with the EOSC. With the commitment from various ESFRI projects in the cluster, ESCAPE will develop and integrate the EOSC catalogue with a dedicated catalogue of open source analysis software. This catalogue will provide researchers across the disciplines with new software tools and services developed

by astronomy and particle physics community. Through this catalogue ESCAPE will strive to cater researchers with consistent access to an integrated open-science platform for data-analysis workflows. As a result, a large community "foundation" approach for cross-fertilisation and continuous development will be strengthened. ESCAPE has the ambition to be a flagship for scientific and societal impact that the EOSC can deliver.

EOSC-Life [March 2019 – Feb 2023]

EOSC-Life brings together the 13 Biological and Medical ESFRI research infrastructures (BMS RIs) to create an open collaborative space for digital biology. It is our joint response to the challenge of analysing and reusing the prodigious amounts of data produced by life-science. Managing and integrating this data is beyond the capabilities of most individual end-users and institutes. By publishing data and tools in a Europe-wide cloud EOSC-Life aims to bring the capabilities of big science projects to the wider research community. Federated user access (AAI) will allow transnational resource access and authorisation. EOSC-Life establishes a novel access model for the BMS RI: through EOSC scientists would gain direct access to FAIR data and tools in a cloud environment available throughout the European Research Area. EOSC-Life will make BMS RIs data resources FAIR and publish them in the EOSC following guidelines and standards (e.g. EDMI). Overall this will drive the evolution of the RI repository infrastructure for EOSC and integration of the BMS RI repositories. EOSC-Life will implement workflows that cross disciplines and RI boundaries and address the needs of interdisciplinary science. Through open hackathons and bring-your-own-data events we will co-create EOSC-Life with our user communities, providing a blueprint for how the EOSC supports wide-spread and excellent data-driven life science research. EOSC-Life will address the data policies needed for human research data under GDPR. Interoperable provenance information describe history of sample and data to ensure reproducibility and adherence to regulatory requirements. The goal of the EOSC-Life project is to make sure that life-scientists can find, access and integrate life-science data for analysis and reuse in academic and industrial research. EOSC-Life will transform European life-science by providing an open, continent-scale, collaborative and interdisciplinary environment for data science.

EOSC-Nordic [Sept 2019 – Aug 2022]

EOSC-Nordic aims to facilitate the coordination of EOSC relevant initiatives within the Nordic and Baltic countries and exploit synergies to achieve greater harmonisation at policy and service provisioning across these countries, in compliance with EOSC agreed standards and practices. By doing so, the project seeks to establish the Nordic and Baltic countries as frontrunners in the take-up of the EOSC concept, principles and approach. EOSC-Nordic brings together a strong consortium of 24 partners including e-Infrastructure providers, research performing organisations and expert networks, with national mandates with regards to the provision of research services and open science policy, and wide experience of engaging with the research community and mobilising national governments, funding agencies, international bodies and global initiatives and high-level experts on EOSC strategic matters.

EOSC-Pillar [July 2019 – June 2022]

EOSC-Pillar gathers representatives of the fast-growing national initiatives for coordinating data infrastructures and services in Italy, France, Germany, Austria and Belgium 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. National initiatives are the

key of our strategy, for their capacity to attract and coordinate many elements of the complex EOSC ecosystem and for their sustainability, which will add resilience to the whole structure. We will combine these initiatives, who represent research communities in each country, with use cases of transnational networks working to implement FAIR data practices. Through the coordination of national initiatives, EOSC-Pillar will be able to support the gradual alignment of policy and practice among countries and compliance to EOSC standards. We are convinced that by federating national initiatives through common policies, FAIR services, shared standards, and technical choices, EOSC-Pillar will be a catalyst for science-driven transnational open data and open science services offered through the EOSC portal. These initiatives will emanate the promotion of FAIR data practices and services across scientific communities, sharing best practice, and igniting opportunities for interdisciplinary approaches in the EOSC. Above all, our vision is that national initiatives are key to involve user communities and research infrastructures both as test-beds for solutions, but also in their very design and sustainable evolution. For this reason, EOSC-Pillar's workplan is built around selected user-driven pilots from 7 scientific domains, that will show EOSC in action and provide valuable input to guide the roll out of services for other communities.

EOSC-Synergy [Sept 2019 – Feb 2022]

EOSC-synergy extends the EOSC coordination to nine participating countries by harmonizing policies and federating relevant national research e-Infrastructures, scientific data and thematic services, bridging the gap between national initiatives and EOSC. The project introduces new capabilities by opening national thematic services to European access, thus expanding the EOSC offer in the Environment, Climate Change, Earth Observation and Life Sciences. This will be supported by an expansion of the capacity through the federation of compute, storage and data resources aligned with the EOSC and FAIR policies and practices. EOSC-synergy builds on the expertise of leading research organizations, infrastructure providers, NRENs and user communities from Spain, Portugal, Germany, Poland, Czech Republic, Slovakia, Netherlands, United Kingdom and France, all already committed to the EOSC vision and already involved in related activities at national and international level. Furthermore, we will expand EOSC's global reach by integrating infrastructure and data providers beyond Europe, fostering international collaboration and open new resources to European researchers. The project will push the EOSC state-of-the-art in software and services life-cycle through a quality driven approach to services integration that will promote the convergence and alignment towards EOSC standards and best practices. This will be complemented by the expansion of the EOSC training and education capabilities through the introduction of an on-line platform aimed at boosting the development of EOSC skills and competences. EOSC-synergy complements on-going activities in EOSC-hub and other related projects liaising national bodies and infrastructures with other upcoming governance, data and national coordination projects

ExPaNDS [Sept 2019 – Aug 2022]

The ambition of EOSC Photon and Neutron Data Services (ExPaNDS) is to enrich the EOSC with data management services and to coordinate activities to enable national Photon and Neutron (PaN) RIs to make the majority of their data 'open' following FAIR principles and to harmonise their efforts to make their data catalogues and data analysis services accessible through the EOSC, thereby enabling them to be shared in a uniform way. EOSC currently provides a range of services that needs to be adapted to the ever-increasing requirements of scientific experiments held at various PaN RIs. It is essential that these services become standardised, interoperable and integrated to fully exploit the scientific opportunities at PaN RIs. ExPaNDS therefore seeks to: Enable EOSC services and to provide coherent FAIR data services to the scientific users of PaN RIs; connect PaN RIs through a platform of data catalogues and analysis services through the EOSC for users from RIs, universities, industry etc.; gather feedback and cooperate with the EOSC governance

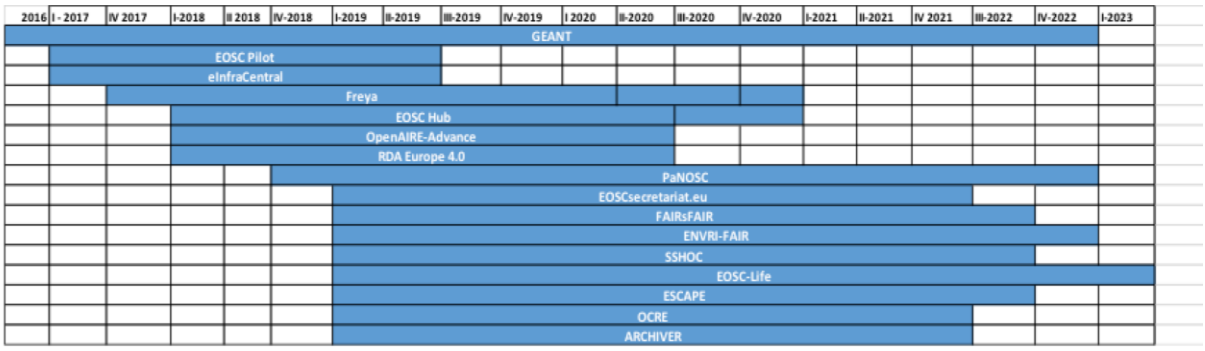
bodies to improve the EOSC and develop standard relationships and interconnections between scientific publications, PaN scientific datasets, experimental reports, instruments and authors (via ORCID). Concretely ExPaNDS proposes to standardise and link all the relevant PaN RI catalogues to ensure that the user community has access to both the raw data they collect, which is linked to their research session at the various national RIs, and relevant peer review articles produced as a direct result of their usage. It is paramount that we develop a common ontology to fully integrate all the elements of the catalogues as well as a roadmap for the back-end architecture and functionalities. We also propose to develop a powerful taxonomy strategy in line with the requirement of the EOSC user community. The proposed activity will feed into the OpenAIRE infrastructure integrating and linking entities from a wide range of scholarly resources.

NI4OS-Europe [Sept 2019 – Aug 2022]

Mission and vision of the project are to be a core contributor to European Open Science Cloud service portfolio, commit to EOSC governance and ensure inclusiveness on the European level. The objective of the project is to support the development and inclusion of the national Open Science Cloud initiatives in 15 Member States and Associated Countries in the overall scheme of EOSC governance; spread the EOSC and FAIR principles in the community and train it; and provide technical and policy support in on-boarding of the existing and future service providers into EOSC, including generic services (compute, data storage, data management), thematic services, repositories and data sets - thus covering the whole spectrum of services related to Open Science, data and publications. The overall approach is that national Open Science landscape in all countries will be mapped, analysed and systematized so as to facilitate both the creation of national OSC initiatives to support the overall EOSC governance, and to engage all stakeholders. A set of providers (generic e-Infrastructure providers, thematic providers, repositories) will be on-boarded into EOSC - following the best practices, policies, guidelines and tools formulated by the project, in alignment with the existing EOSC initiatives and standards. The project solutions provided will be interoperable with EOSC services and will be tested and fine-tuned by real users, and the widest community will be supported in the uptake of research data sharing and practices, in alignment with FAIR principles. Following the work programme requirements, the project will support the operational framework for governance by focusing on coordination between relevant national initiatives, as well as data infrastructures, e-Infrastructures and thematic services, and their federation into the EOSC. The effort is mandated by national governments of 15 countries through explicit Letters of Support.

Annex 2 Timeline of EOSC projects funded by Horizon 2020

Timeline



Annex 3 Projects supported via 2018-2019 INFRAEOSC calls (as of May 2019)

Name of the call	Resulting project(s)	Link
INFRAEOSC-4 (disciplinary clusters)	ENVRI-FAIR EOSC-Life ESCAPE PANOSC SSHOC	http://envri.eu/envri-fair to come https://www.projectescape.eu https://github.com/panosc-eu/panosc/wiki https://sshopencloud.eu
INFRAEOSC-5a	EOSCsecretariat	https://www.eoscsecretariat.eu
INFRAEOSC-5b (national initiatives)	EOSC-Nordic EOSC-Pillar EOSC-synergy ExPaNDS NI4OS-Europe	Projects to begin in Autumn 2019. Overview slidesets for each available at: https://www.eosc-hub.eu/events/eosc-hub-week-2019/programme/eosc-offering-regional-views
INFRAEOSC-5c	FAIRsFAIR	https://www.fairsfair.eu

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The EOSC Strategic Implementation Plan presents the activities that will contribute to the implementation of the EOSC for the period 2019-2020. While the document will be made public after final approval, it is primarily intended for use by stakeholders engaged into building EOSC. Other documents will be developed and made public for use by research communities which will be the primary users of EOSC capabilities.

This document draws from the EOSC Implementation Roadmap adopted by the Commission on 14 March 2018 and presents a comprehensive overview of the implementation of the EOSC, with action lines and timelines for the period 2019-2020. The list of activities includes the most recently approved Horizon 2020 projects.

This document has been reviewed and amended by the EOSC Executive Board during its 17 April 2019 meeting. It was presented to the EOSC Governing Board during its 22 May 2019 meeting.

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