Solutions for a Sustainable EOSC

A tinman report from the EOSC Sustainability Working Group

Draft 2 December 2019

Abstract

This document explores possible means for sustaining the European Open Science Cloud beyond its initial phase which terminates at the end of 2020. This independent document builds on an earlier strawman version and the feedback that it received, partly by improving the observations and corollaries collected by that earlier draft and partly by better taking into account the rate of progress towards the EOSC goals. It considers the financing model, legal vehicle, governance structure as well as the regulatory and policy environment of the EOSC with a first iteration to establish a Minimum Viable EOSC (MVE) addressing the needs of publicly funded researchers exploiting openly available data. Subsequent iterations expand the EOSC to address more sophisticated use cases and a wider user base including the public sector and industry. The possible options are listed for subjects where there is not yet consensus and it is expected that feedback will be gathered before presenting a final proposal. Such a proposal can then serve as the basis for the introduction and iterative expansion of EOSC.

Editors: Bob Jones, Claire Devereux, Henriikka Mustajoki

Table of Contents

Members of the Sustainability Working Group

Rupert Lück, Executive Board, EMBL (Co-Chair)
Lidia Borrell-Damián, Executive Board, Science Europe (Co-Chair)
Lajos Bálint, KIFÜ, Hungary
Emanuele Barbarossa, DG RTD, European Commission
Jean-Yves Berthou, INRIA, France
Paolo Budroni, Vienna University Library and Archive Services, Austria
Mirjam van Daalen, PSI, Switzerland
Claire Devereux, UKRI, UK
Franciska de Jong, CLARIN ERIC, Netherlands
Maria Häll, Swedish Research Council, Sweden
John Howard, University College Dublin, Ireland
Bob Jones, EOSC Secretariat, CERN (Rapporteur)
Norbert Meyer, Poznan Supercomputing & Networking Center, Poland
Patricia Mergen, Royal Museum for Central Africa, Meise Botanic Garden, Belgium
Panayotis Moschopoulos, DG RTD, European Commission
Liina Munari, DG CNECT, European Commission
Henriikka Mustajoki, Federation of Finnish Learned Societies, Finland
Alberto Pérez, Red.es, Spain
Federico Ruggieri, GARR, Italy
Afrodite Sevasti, GRNET, Greece
Roar Skålin, The Norwegian Meteorological Institute, Norway
Gintare Tautkeviciene, Kaunas University of Technology, Lithuania
Klaus Tochtermann, ZBW - Leibniz Information Centre for Economics, Germany

Foreword

The Sustainability Working Group held its first meeting in July 2019 and a strawman version of this document was distributed in early September in order to gather initial feedback from the Governing Board, Executive Board and projects contributing to the EOSC. During September and October, approximately 30 projects, organisations, board members and individuals provided written feedback on the strawman version. We would like to thank all those that took the time to provide detailed feedback.
This feedback was analysed by a dedicated task force and then reviewed by the Sustainability Working Group at its meeting on 23rd October.
This version of the document takes into account the analysis of the feedback and on-going developments by the EOSC-related projects and other Working Groups. The Strawman document presented early ideas to address the same questions and this document has been developed in the light of the consultation and feedback the Strawman document received. We consider this a living document which will continue to evolve over the coming months and we look forward to receiving feedback from the governing bodies, contributing projects and working groups so that all the stakeholders can converge on a common way forward.

Rupert Lück, Executive Board, EMBL (Co-Chair),
Lidia Borrell-Damián, Science Europe (Co-Chair)

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Introduction

The goal of EOSC is to give the European Union a global lead in research data management and ensure that European scientists reap the full benefits of data-driven science. EOSC could potentially serve 1.7 million researchers in Europe and progressively expand its user base to include the wider public sector and the private sector (business organisations).

A key objective of the Sustainability Working Group is to identify the most feasible alternatives for the Financing Models and Legal Vehicle of the EOSC beyond 2020.

An EOSC that offers added value to researchers was taken as a starting point with its scope as described in the Strategic Implementation Plan:

"*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.*"

Building on existing research data infrastructures, EOSC will grow through a series of iterations. Each iteration will add more functionality and services for a wider user base and satisfying a broader range of use-cases.

The primary stakeholders of the EOSC are researchers as end-users (research communities, long tail of science[1], business organisations), service providers (including data and compute services), as well as research funders and the EC.

A key goal of EOSC is to shift the research enterprise in Europe towards an open science model[2] as many European countries are implementing national programmes that are aligned with the European Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information[3].

Similarly, the EOSC provides a means by which European countries can implement the Open Data and Public Sector Information Directive[4], which Member States have to transpose by 16 July 2021, for research products.

There needs to be political will not just towards the notion of open research, but also to fund the infrastructure for open research in practice. Governments and research funders have to be in a position to supply such funding, in accordance with a jointly agreed cost sharing

[1] when Citizen Scientists are acting as agents of an organisation or Institution, they fit the EOSC End-User definition; when not affiliated with an Institution, Citizen Scientists are defined as 'Consumers'
[2] https://ec.europa.eu/digital-single-market/en/open-science
[3] https://www.eosc-portal.eu/sites/default/files/CELEX_32018H0790_EN_TXT.pdf
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=uriserv:OJ.L_.2019.172.01.0056.01.ENG

model, and to coordinate their approach, policies and legislation. The funding models need to take into account the existing investments by member states to open science and data infrastructures.
The funding models described in this document address only those elements in each iteration and assume that funding for contributing data infrastructures and making data FAIR which will be an important driver for EOSC Sustainability, as well as the underlying high-capacity network that interconnects research, education and innovation communities, continues to be funded by other means.

For EOSC to be a success, it must be widely adopted by researchers which implies EOSC must provide access to services that allow them to pursue their research activities more effectively. While the services to be provided *via* EOSC to researchers are expected to be *free at the point of use*[5], they are not without significant cost to build, maintain and operate. Researchers are practically minded and will only adopt EOSC if it makes their research practices simpler and more cost-effective by providing easy to use services that interoperate to support all phases of the research lifecycle. Readily available training and documentation employing the latest e-learning techniques will be needed to reduce the barriers to adoption. Adherence to a service framework that ensures such characteristics while minimising the support effort will need to be verified for all the services proposed *via* EOSC.
The approach taken in this document is to place the researcher as an end-user at the centre and determine what added-value the EOSC will bring to them.

Therefore the basic condition of EOSC sustainability is performance: how EOSC as an ecosystem operates and how the resources are used and acknowledged by the users. The sustainability of EOSC depends not only on sound business models encompassing the financial, legal and governance aspects to create added-value for the stakeholders but, in accordance with preliminary feasibility investigations, also on the incentives and rewards for researchers that encourage them to participate in a culture of sharing the results of their research. Without such incentives and rewards it is possible that the uptake of the EOSC could be stymied by lack of engagement from researchers.

Finally, it is very important for the EOSC initiative to be considered inclusive and supplement the activities of mature and well-structured research communities rather than competing with them, while at the same time respecting national strategies, business models, and relations between different stakeholders (researchers, universities, research funders, NRENs etc.).

[5] *Free at the point of use* does not imply *Free of charge*. *Free at the point of use* means the end-user does not pay directly for the service when it is delivered but their consumption will be paid for by other means. For example, an end-user would not need to use a credit card to pay for a service but their employer may receive an annual bill from the service provider.

First Iteration - A Minimum Viable EOSC (MVE)

The objective of the first iteration is to establish a Minimum Viable EOSC (MVE) such that it will enable the federation of existing and planned research data infrastructures for the benefit of publicly funded researchers accessing openly available data.
The main focus and value of EOSC is to connect such disciplinary infrastructures and research data to enable cross-disciplinary research, leading to new scientific discoveries and new insights for society. Hence, the federation of research data infrastructures into EOSC *via* the cluster and regional projects[6] is seen as a critical first step to promote early successes for EOSC, and as an enabler to help address society's current and future global challenges.

The MVE includes EOSC-Core and EOSC-Exchange, described below, that work with the FAIR datasets to be federated via EOSC.

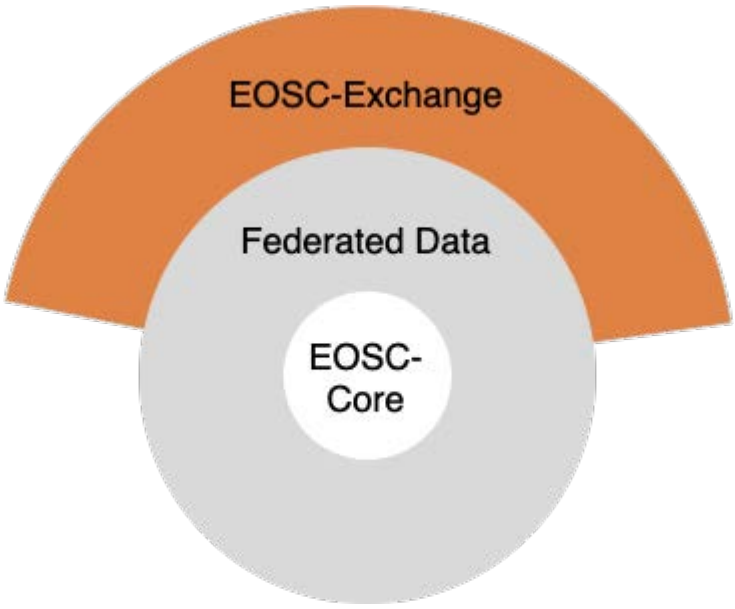

Figure 1: Schematic representation of key elements of the Minimum Viable EOSC

EOSC-Core

The *EOSC-Core* provides the means to discover, share, access and re-use data and services. These elements address key technical, cultural and policy decisions of EOSC and they must be maintained over the long term. Specifically:

[6] EOSC-related cluster and regional projects 5a: ENVRI-FAIR, EOSC-Life, ESCAPE, PaNOSC, SSHOC and 5b: EOSC-Pillar, EOSC-Nordic, EOSC-synergy, ExPaNDS, NI4OS-Europe

- A standard mechanism for naming and locating data and services
- A mechanism for discovery of and access to data and services across the federated EOSC ecosystem.
- A common framework for managing user identity and access

The *EOSC-Core* does not, itself, provide the means to transfer, store, process or preserve research data.

The *EOSC-Core services* will be assembled from amongst the widely used production quality services already deployed by the EOSC-related projects and communities to provide the following functionality:

- **A shared open science policy framework,** which effectively embeds a data compliance framework for open / FAIR data. It dictates and applies the rules of how the data elements are published, shared and re-used.
- **Authentication and Authorization Interoperability (AAI) framework,** a trust and identity service for researchers to seamlessly access all EOSC resources.
- **Data access framework**, whose primary role is to offer data as a service. It enables open interfaces where data consumers are able to discover and use data.
- **Service management and access framework,** whose role it to provide a consistent and agreed upon understanding of e-science services: what they offer, which science problem they address, what is their operational capacity, how they are accessed, who pays for them.
- **A minimum legal metadata framework,** for ensuring openness and interoperability, privacy and security (copyright status, disclosure limitations, patents pending, other IPR on the datasets or workflows, the existence of personal data, designation of data as PSI, etc.)
- **An open metrics framework,** which sets the rules (usage, performance, value for money) for the assessment of EOSC elements, i.e., policies, access framework, services, data, business, funding and usage models. This should include elements to facilitate the incentives and awards mechanism for researchers, as recommended by the EC HLEG on Next Generation Metrics and the EOSC Pilot policy group.
- **PID**: Services to generate, resolve and validate persistent identifiers (PID)
- **Help-desk**: framework for linking national/thematic/institutional service desks that can provide training/consultancy on EOSC-Core services
- **Portal**: an EOSC Service implementing a web portal providing one form of accessing and using the EOSC Resources.

The MVE will be considered operational when key datasets and services provided by the cluster projects are accessible by end-users who are external to these projects.

Access policy

A political goal of EOSC is to promote open research across Europe and consequently the *EOSC-Core* should be as widely used as possible hence it will accessible to any authenticated[7] user.

EOSC-Exchange

EOSC-Exchange builds on the *EOSC-Core* to ensure a rich set of services exploiting FAIR data and encouraging its reuse are available to publicly funded researchers. It is expected that rivalrous services, such as those that store, preserve or transport research data as well as those than compute against it, will be made available via *EOSC-Exchange*. Participation in *EOSC-Exchange* as a service provider is voluntary and without registration fee. Service providers that participate in *EOSC-Exchange* will be required to conform to predefined Rules of Participation. While the technical requirements for participation in *EOSC-Exchange* will be the same for all services, there may be differences in the legal and policy requirements for freely available and payment-based services.

Access policy

EOSC-Exchange will be accessible *via* the EOSC portal, as well as programmatically, by users who have been authenticated and authorized[8].

Funding model

The funding model for the *MVE* takes into account the differences in access policies for the *EOSC-Core* compared to *EOSC-Exchange*. The cost of operating *EOSC-Exchange* (but not the cost of operating the services it contains) will be included in the *EOSC-Core* funding model.

Funding for *EOSC-Core* should be addressed by the participants engaging in EOSC as a means of supporting open research for their communities. There are a number of formulae that have been proposed for the sharing of the costs of operating *EOSC-Core*, including:

- Research population size as reported by Eurostat;
- Research population size, weighted with GDP;
- GDP based, subscription based, consumption based and various combinations there of;
- Some form of GDP based contribution which takes into account EU policies regarding digital divide and inclusion.

[7] Authentication verifies you are who you say you are
[8] Authentication verifies you are who you say you are while Authorization decides if you have permission to access a resource

For a new undertaking, such as the EOSC, significant financial engagement will be a challenge because participants are being asked to invest in a resource under development where the business case has yet to be demonstrated. To overcome this challenge, it is proposed that the financial risk for participants is shared with the EC through a funding mechanism that sees a gradual shift of responsibility from the EC to the participants. As the Science|Business Network concluded[9], a progressive, long-term approach to funding the EOSC is needed:

> *"Although it will ultimately need to break even, the initial priorities for the EOSC have to be driving participation and usage. Like most private businesses, the EOSC will probably need to operate at a loss (be subsidised) in its early years to ensure its proposition is appealing to both the data providers and the data users."*

Specifically, the EC should fund the *EOSC-Core* during the transition period. During this period the EOSC participants should commit to reaching an agreement on a formula for participant financial contributions taking into account information gathered about EOSC costs and usage. Starting from the end of the transition period, the participants' financial contributions will be progressively increased over a number of years so that, by the end of Horizon Europe, the shift of financial responsibility is complete.

Funding for the services included in *EOSC-Exchange* is the responsibility of the organisations that operate them. Services made available *via EOSC-Exchange* may be available free of charge or against payment. *EOSC-Exchange* will establish trust between service providers and users by making use of the authentication and authorization services of *EOSC-Core* and providing service vetting features including reviews, profiles and certification schemes. Where a service is available against payment, charges will be transparent and visible *via* the portal. A transaction for the use of a service will be an agreement between the service provider and user or their sponsor (i.e. the operator of *EOSC-Exchange* will not be involved in the transaction*)*. To encourage the uptake of FAIR services, the agencies and organisation funding research in countries participating in EOSC should make a policy decision to accept the use of any service in *EOSC-Exchange* as an eligible cost in data management plans and grant requests submitted by public funded researchers.

Incentives for service providers and researchers

It is recognised that the services provided by publicly funded organisations frequently have a mandate and budget to serve a well-defined set of users that may be delimited by research discipline or geographical boundaries and that broadening access may generate additional costs. As an incentive to encourage service providers to participate in *EOSC-Exchange* and open up their services to all publicly funded researchers, it is proposed to offer an EC funded means to compensate publicly funded service providers for the additional operational costs they incur. Should a publicly funded organisation request compensation for providing a

[9] https://sciencebusiness.net/report/why-open-science-future-and-how-make-it-happen

service *via EOSC-Exchange*, then it would be classed as a service available against payment.

As an incentive for commercial service providers to participate in *EOSC-Exchange* and offer FAIR services it is proposed that a centrally organised and aggregated procurement activity is undertaken by EOSC and funded by the EC.

Participation by service providers in the *EOSC-Exchange* incentive schemes will be subject to their commitment to participate in reporting schemes intended to gauge usage and uptake of the services.

Access to the services included in the *EOSC-Exchange* incentive schemes will be made available to public funded researchers via two distinct open call channels:

- Small-scale rapid access to resources for any publicly funded researcher (including long tail of science and citizen scientists) on request and subject to a basic eligibility check. Access will be controlled and monitored using a system of vouchers distributed to the individual researchers.
- Peer reviewed for larger-scale project access (similar to PRACE project access calls [10])

It is conceivable that an interconnection between EOSC and EuroHPC could be established so that EuroHPC services would be included in the open calls for large-scale project access.

The services in EOSC-Exchange made available to researchers *via* the incentive schemes will be accessible for an announced and time-limited duration. It is recognised that the availability of long-term data preservation services represents an important added-value for EOSC and the funding models for such services are currently under investigation.

Allocation of EC funds to individual researchers or projects is subject to adherence to Rules of Participation by the recipient that encourage open science behaviour. For example, the recipients must commit to provide feedback on the services they consumed, publish data and results, acknowledge funding from the EC etc. Science|Business suggested in a recent report[11] that one approach to encourage open science behaviour

'*is for "closed science" to subsidise "open science": users that make every step of their research public could access EOSC data for free, while a user that wishes to keep anything private or secret would need to pay*.'

Such an approach could contribute to the long-term sustainability of EOSC and deserves further investigation.

[10] http://www.prace-ri.eu/call-announcements/

[11] Building a Self-Sustaining Science Cloud, A report of the Science|Business Network's Cloud Consultation Group, 05 Nov 2019
https://sciencebusiness.net/report/building-self-sustaining-science-cloud

Incentives for innovation

To encourage the development of innovative services supporting FAIR principles as well data stewardship and preservation across different phases of the research lifecycle, dedicated incentives schemes funded by the EC are foreseen that would use *EOSC-Exchange* as a distribution channel:

- Research and Innovation Action grants to develop services to be made available *via EOSC-Exchange*
- PCP/PPI instrument for innovative services to be commercialised *via EOSC-Exchange*

All such innovation incentives would require developments to adhere to Rules of Participation resulting in production quality (Technology Readiness Levels 7-9) services to be included in *EOSC-Exchange* with associated training material.

The EOSC will be European and open to the world, reaching out over time to relevant global research partners. Coordination fora including COARD, CODATA, RDA and WDS provide an environment where the different layers of interoperability (legal, organisational, semantic and technical[12]) can be discussed with partners from around the world. There is a clear willingness to collaborate and it is expected that the first agreements will be put in place during the first iteration of EOSC.

[12] Layers of the interoperability model defined in the European Interoperability Framework, European Union, 2017, doi:10.2799/78681

Second iteration – serving the public sector

The *MVE* can be expanded with additional functionality and services dedicated to the requirements of end-users from the public sector[13] who are not involved in research activities but want to exploit open access data.
The initial focus will be to expand the EOSC to include support for education use-cases (*EOSC-Edu*) that could potentially exploit the data and services made available *via* EOSC as Open Educational Resources (OER). Taking into account the work of projects such as but not limited to FOSTER[14] and UP2U[15], a more detailed study is required to elaborate the needs and opportunities that exist in this domain.

Third iteration - serving industry

The *MVE* can be expanded with additional functionality and services dedicated to the requirements of end-users from the private sector so that they can exploit the open data and associated services for commercial gain without distorting market competition.
The European Investment Bank published a report[16] which included a section on the EOSC and found that
"*The unique selling point (USP) of the EOSC is the magnitude of data in the context of the convergence of HPC, Big Data and machine learning*."

Enabling the private sector to make use of EOSC resources in such a manner greatly increases the potential for innovation and economic impact of EOSC. It is proposed that further studies are undertaken to determine if alignment with the plans for European common data spaces envisioned by the Digital Europe programme[17] for 2021-27 are feasible. It is suggested to target Earth Observation (*EOSC-EarthOb*) as a candidate initial business sector for such a study building on the data and services of the Copernicus programme[18].

EOSC-Edu and EOSC-EarthOb are identified as candidate first examples for engaging with the wider public and business sectors. It is expected that additional engagement opportunities will be considered in further iterations of EOSC (see Figure 3).

[13] In this document the term 'public sector' refers to all bodies governed by public law as defined in Public procurement of services: Council Directive 92/50/EEC
[14] https://www.fosteropenscience.eu/
[15] https://up2university.eu/
[16] Financing the future of supercomputing How to increase investments in high performance computing in Europe, European Investment Bank, 2018, doi:10.2867/31460
[17] https://ec.europa.eu/digital-single-market/en/policies/building-european-data-economy
[18] https://www.copernicus.eu/en

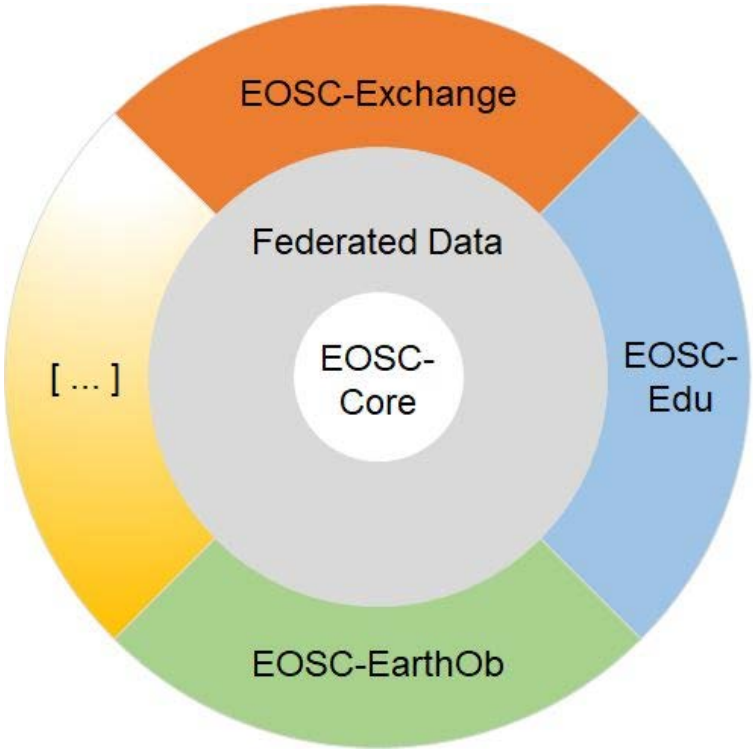

Figure 3: Pictorial representation of the relationships between the elements of the EOSC.

Governance Structure

The EC has demonstrated its support for EOSC during Horizon 2020 and its future role and engagement are dependent on the implementation of the next framework programme, Horizon Europe, as well as the legal structure for EOSC being considered by the Member States and Associated Countries (MS/AC). To this end, the Governance Board and Executive Board are currently studying the suitability of European Strategic Partnerships as funding mechanisms for EOSC. The EC has proposed three vehicles for Partnerships in Horizon Europe: Co-programmed Partnerships, Co-funded Partnerships and Institutionalised Partnerships. Of these, the Co-programmed is feasible to implement for the start of Horizon Europe in January 2021. It would also be possible to implement other partnership models, such as an Institutionalised Partnership, during the course of Horizon Europe, but not at its start.

A dedicated task force within the Sustainability Working Group has concluded that a Co-programme Partnership approach to funding through the EC would allow the greatest flexibility and be the preferred model if the Partnership is required from January 2021 and the start of Horizon Europe.

Irrespective of the EU funding mechanism, the Task Force has also concluded that a new legal entity is required that would represent the Association of participants engaged in EOSC with a broad, open and transparent approach towards different sectors and geographical areas including international partners. Several of the requirements for a legal entity exclude the possibility of using an existing organisation as a legal vehicle. In particular, the requirements to be open to any stakeholder organizations and to have an Executive Board elected by the General Assembly of Members.

The internal organisation of the Association should allow for views of all the stakeholders to be appropriately taken into account and ensure there is a separation between oversight and operation with objective and impartial means of assessing the progress, uptake and effectiveness of its activities. It should be a not-for-profit organization, as small as possible.

From a governance perspective, it is proposed that the legal entity will be governed by three bodies:

- The General Assembly/Governing Board, composed of one representative per member,
- The Executive Board, elected by the General Assembly,
- The Advisory Board, composed of one representative per Member State and Associated Country and representatives from the European Commission.

The Legal Entity Team will be managed by a Director chosen by the Executive Board. The Association should be open to any interested stakeholders and therefore consist of a diversity of members; Member States, Associated Countries, research funders, existing

organisations, foundations and other legal entities (ERICs, intergovernmental organisations etc) and private companies. It should continue to be open to new members after its foundation.

A Belgian AISBL or a Dutch Vereniging appear to be appropriate candidates for the EOSC legal entity. They can be combined with non-legally binding constructs such as contractual arrangements to obtain commitment from countries or to involve other stakeholders. They are appropriate forms for all Partnership models and thus wouldn't preclude the evolution of funding flow from a non-Partnership to a Partnership, or from one Partnership form to another if this was technically and legally feasible. Furthermore, other private body legal entities with a public mission, such as Dutch Stichting, a European Economic Interest Grouping, or a public service mission private entity from another member state, may also be candidates and should not be ruled out at this stage.

A number of further considerations around governance are explored in a separate Sustainability Working Group document[19]. However, the establishment of a legal entity from one of the above options is fully compatible with any of the EU funding Partnership models, and with any of the governance models, irrespective of any decisions made on those considerations.

[19] EOSC Legal Model Options, EOSC Sustainability Working Group, Dec 2019

Timelines

Implementing the set of iterations described in this document will take the EOSC schedule beyond the end of 2020 as depicted in the graph in Figure 2.

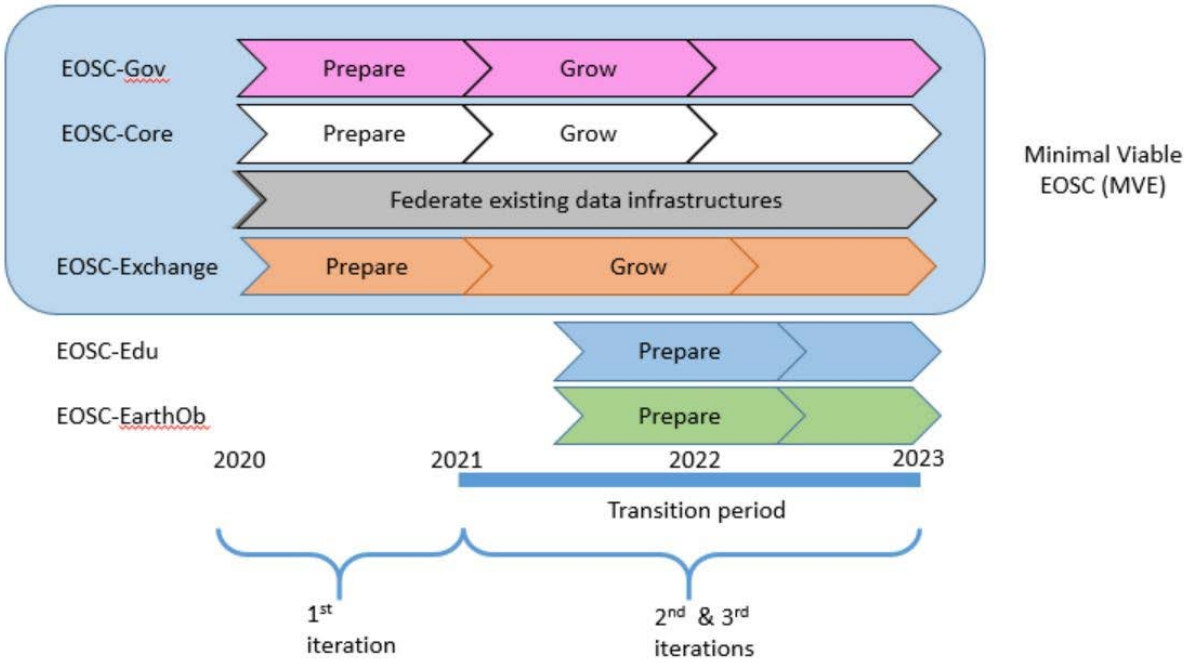

Figure 2: Schematic representation of timelines of EOSC iterations

Consequently it is recommended to foresee a transition period of 2 years (2021-2022) to establish *MVE* and the governance structure.

This transition period can be accelerated by making use of currently running H2020 projects to prepare *MVE*. The EOSCsecretariat.eu project should be charged with establishing the new EOSC legal entity by the end of 2020.
Subsequently, the focus of the proposals selected *via* the upcoming 2019-2020 INFRAEOSC calls should be on pursuing the establishment of the *MVE* with the engagement of existing infrastructures and communities to ensure the successful launch of the first iteration of EOSC.

Further considerations

- The set of EOSC resources from the existing infrastructures to be included in the *Minimum Viable EOSC (MVE)* needs to be more clearly identified and scheduled taking into account the outputs of the Landscaping[20] Working Group.

- The set of services included in the *EOSC-Core* needs to be reviewed taking into account the output of the FAIR[21] and Architecture[22] Working Groups. A more detailed costing of these services also needs to be performed and should be included in the next version of this document.

- A study to identify suitable mechanisms for remunerating public sector service providers participating in *EOSC-Exchange* is required and should take into account the experiences gathered with the H2020 Virtual Access[23] scheme.

- The conditions for service providers to participate in *EOSC-Exchange* needs to be elaborated in collaboration with the Rules of Participation[24] Working Group. The perceived need for a separation between publicly-funded and commercially operated services needs to be examined from a legal point of view.

- A means for ensuring business continuity for data management services that are no longer available via EOSC would bring an added-value by increasing end-user trust in the whole ecosystem.

- The scale and complexity of bringing together all contributors (not just the EC funded projects) to produce annual work plans and reporting represents a full-time activity. In order to support the work of the Executive Board, we recommend that a recognised project management method[25] to produce all the necessary deliverables for the planning phase of EOSC.

- In order to gradually achieve interoperability of the services and compatibility of the data federated via the EOSC framework, standards and interfaces are urgently

[20] https://www.eoscsecretariat.eu/working-groups/landscape-working-group
[21] https://www.eoscsecretariat.eu/working-groups/fair-working-group
[22] https://www.eoscsecretariat.eu/working-groups/architecture-working-group
[23] The Virtual Access (VA) instrument is provided by the European Commission to increase the sharing of research infrastructures and services that otherwise would not be available to international user groups. In VA, the services – also called "installations" – have to be made available 'free of charge at the point of use' for European or International researchers. VA access is open and free access to services through communication networks to resources needed for research, without selecting the researchers to whom access is provided.
[24] https://www.eoscsecretariat.eu/working-groups/rules-participation-working-group
[25] Such as OpenPM^2 https://publications.europa.eu/en/publication-detail/-/publication/ac3e118a-cb6e-11e8-9424-01aa75ed71a1/language-en/format-PDF/source-83307127

needed and are being addressed by the Architecture WG. The activities and plans should put elevated emphasis on step by step developing those standards and interfaces. This may involve revisiting and adjusting of the datasets and e-infrastructures involved in the on-going EOSC related projects.

- The suite of functions encompassed by the EOSC Legal Entity needs further consideration and clarity and inform how the governance is set up.

- A policy needs to be formed to clarify who can be members of the EOSC legal entity, for example the types and sizes of organisations. This would then inform the fee and voting structure, that also need to be developed.

- Further consideration should be given to IP developed EOSC projects. For projects funded through a grant mechanism with EU funding the IP resides with the beneficiary who has generated the results (e.g. a University). Procurement would be the mechanism usually employed when retention of results by a contracting authority is important.

- The Legal Entity Task Force are not legal experts and request that specific legal advice from lawyers versed in appropriate (e.g. Dutch and Belgium) law should be sought to verify that the suggested legal forms could be set up to cover the requirements of the MVE.