EOSC Portal Concept 2.0

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Delivery slip

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Terminology

Note:
"Glossary 1.0" denotes terms delivered from EOSCpilot Glossary v.1.0[1].
"FitSM" denotes terms derived from the FitSM standard[2].

EOSC Portal (in short, "the Portal"): the EOSC Service implementing a web portal facilitating the access to and use of the EOSC Resources. [Glossary 1.0]

EOSC Portal Operator: an organization responsible for supplying one or more components of the EOSC Portal.

EOSC Portal User (in short, "the User"): Individual that primarily benefits from and uses the Portal. [FitSM]

EOSC Resource (in short, "the Resource"): Any asset made available (by means of the EOSC system and according to the EOSC Rules of Participation) to EOSC System Users to perform a process useful to deliver value in the context of the EOSC. EOSC Resources include assets like services, datasets, software, support, training, and consultancy. [Glossary 1.0]

EOSC Service: An EOSC Resource providing ready-to-use capabilities. EOSC Services are supplied by an EOSC Service Provider in accordance with the EOSC Rules of Participation for EOSC Service Providers. [Glossary 1.0]

EOSC Resource Catalogue (in short, the "Resource Catalogue"): The list of all live EOSC Resources that can be requested by EOSC System Users. It is a subset of the EOSC Resource Portfolio and it populates the EOSC Resource Registry. [Glossary 1.0]

EOSC Service Catalogue: The list of all live EOSC Services that can be requested by EOSC System Users. It is a subset of the EOSC Service Portfolio and it populates the EOSC Service Registry. [Glossary 1.0]

EOSC Resource Registry: An EOSC Service providing EOSC System Users with descriptions of live / ready-to-use EOSC Resources offered by the EOSC System. [Glossary 1.0]

EOSC Resource Provider (in short, "EOSC Provider") an organisation or federation (or part of an organisation or federation) that manages and delivers a service or services to customers. A

EOSC Service Provider: A specialization of a EOSC Resource Provider. [FitSM]

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[1] https://eoscpilot.eu/eosc-glossary#overlay-context=eosc-glossary
[2] https://fitsm.itemo.org/wp-content/uploads/sites/3/2018/05/FitSM-0_Overview_and_vocabulary.pdf

EOSC Resource Customer (in short, "EOSC Customer"): an organisation or part of an organisation that commissions a EOSC Resource Provider in order to receive one or more Resources. A EOSC Service Customer is a specialization of a EOSC Resource Customer. [FitSM]

EOSC Service Management System (in short, "SMS"): Entirety of interconnected policies, processes, procedures, roles, agreements, plans, related Resources and other elements needed and used by a Service Provider to effectively manage the delivery of services to EOSC Customers.

Introduction

In 2016 the European Commission launched the European Open Science Cloud (EOSC) Initiative to capitalise on the data revolution and provide European researchers with seamless access to a wide range of open science services across disciplines by mitigating technical and policy fragmentation in service access and provisioning. By enhancing digital capabilities and *capacities at all stages of the research data lifecycle, the initiative seeks to support knowledge creation.*

In this context, the EOSC vision is *"to provide all researchers, innovators, companies and citizens with seamless access to an open-by-default, efficient and cross-disciplinary environment for producing, storing, accessing, publishing, and reusing data, tools, publications and any EOSC Resource for research, innovation and educational purposes."*

Ground work on tackling the design, implementation and integration has been taking place with projects funded from 2017 onwards, notably through the EOSCpilot (2017-2018), eInfraCentral (2017-2019), EOSC-hub (2018-2020), OpenAIRE-Advance (2018-2020) projects. In addition, FREYA and RDA Europe 4.0 were launched in 2018. The CatRIS project (2019-2021) will extend the service catalogue to a broad range of RIs. From 2019, a suite of additional projects have been launched or have been recently selected including: OCRE, EOSC-Life, PaNOSC, ESCAPE, ENVRI-FAIR, SSHOC, BE OPEN, and EOSC-Nordic, NI4OS-Europe, EOSC-Pillar, ExPaNDS, EOSC-synergy and the EOSCSecretariat.eu. All this work is expected to be consolidated with the INFRAEOSC-06-2019-2020 and INFRAEOSC-03-2019-2020 calls.

The implementation and provisioning of the EOSC Portal addresses action line "*Access and interfaces*" defined in the Commission Staff Working Document "Implementation Roadmap for the European Open Science Cloud"[3]. in the context of this action, the EOSC Portal addresses the need of providing an integrated and easy to use access point to the services and scientific outputs needed to support the digital needs of the EOSC Users.

This document provides an overview of the Portal role in EOSC, how it can support different business models for EOSC Providers, its functional capabilities and interoperability framework, and the operational activities needed to ensure its daily running. It leverages the technical and operational experience of the eInfraCentral, EOSC-hub, and OpenAIRE-Advance projects who are contributing to its development and operations since QR1 2018.

The first version of the EOSC Portal (delivered on November 2018) was built on the experience and technology of major pan-European e-infrastructures, universities and research infrastructures with an already large number of EOSC Resource Providers, i.e., Aggregators, Repositories and Marketplaces of thematic and national/regional initiatives and clusters (ARMs), Research Infrastructures (RIs) and Service and Resource Providers (SRPs).

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[3] https://ec.europa.eu/research/openscience/pdf/swd_2018_83_f1_staff_working_paper_en.pdf

	2017	2018	2019	2020	2021	2022	2023
EOSCpilot	■	■					
eInfraCentral	■	■					
EOSC-hub OpenAIRE-Advance		■	■	■	■		
FREYA, RDA EUROPE		■	■	■			
CatRIS			■	■			
PaNOSC, EOSC-Life, ESCAPE ENVRI-FAIR, SSHOC			■	■	■	■	
OCRE			■	■	■	■	
Blue cloud, Food cloud, Transport cloud			■	■	■	■	
EOSCSecretariat.eu			■	■			
EOSC-Nordic, NI4OS-Europe, EOSC-Pillar, ExPaNDS, EOSC-synergy				■	■	■	
INFRAEOSC-06				■	■		
INFRAEOSC-03						■	■

Figure 1. Overview of projects contributing to the development, operation and enrichment of the EOSC Portal.

Overview

The EOSC Portal is expected to:

- Provide a European-level delivery channel connecting the demand-side (the EOSC Customers) and the supply-side (the EOSC Providers) to allow researchers to conduct their work in a collaborative, open and cost-efficient way for the benefit of society and the public at large.
- Enable different kinds of Users, with different skills and interests, to discover, access, use and reuse of a broad spectrum of EOSC Resources (services, datasets, software, support, training, consultancy, etc.) for advanced data-driven research.
- Support interdisciplinary research and facilitate Resource discovery and access at the institutional and inter-institutional level.
- Allow researchers and institutions to focus on value creation through sharing and reuse as opposed to duplicating Resources and increase excellence of research and European competitiveness.

- Improve the provisioning of access to integrated and composable products and services from the EOSC Catalogue.
- Facilitate the composition of services and products to support multi-disciplinary science for example with high-level community-specific interfaces for running workflows involving EOSC services.
- Help Providers gain additional insight into potential Users outside their traditional constituencies.
- Give Providers the possibility to offer Resources under homogeneous terms of use, acceptable use policies, and in different configuration options, so that Users are guided in the choice.

The Portal will provide capabilities for different stakeholders.

- **EOSC Providers** will register Resources and deliver them to EOSC according to the EOSC business model of choice. It is anticipated that these capabilities will evolve with the definition of the EOSC business model(s), and that different levels of participation will be supported. A prerequisite for participation in EOSC is conformance to its Rules of Participation: the EOSC Resources will follow an EOSC Onboarding Process (OP) defined in the Service Portfolio Management (SPM) of the EOSC Service Management System (SMS). Resources will be described following a common description template. Depending on the business model of choice, the Portal will offer EOSC Providers tools that allow integrated provisioning to the EOSC, for example, for monitoring the usage of their Resources offerings and a rich collection of APIs and interfaces to plug local services (catalogues, accounting, helpdesk) into EOSC.
- **End-Users** will be offered the possibility to discover EOSC Resources and other functionalities, e.g. single sign on, the placement of orders, the request of quotes, the management of accounting and billing information, SLAs and performance reports.
- **The Public, policy makers, funders and other stakeholders** will receive information on mission and vision, governance, policies, news and events, and will get mechanisms to promote their use cases and participate to the EOSC community. The informative part of the Portal is populated and maintained by the EOSC Portal Editorial Board.

The concept will be continually evolved to support the EOSC business model(s), Rules of Participation and the EOSC SMS with the input from al EOSC, projects, Users and Providers.

Architecture

The Portal comprises a number of internal components and will depend on external services.
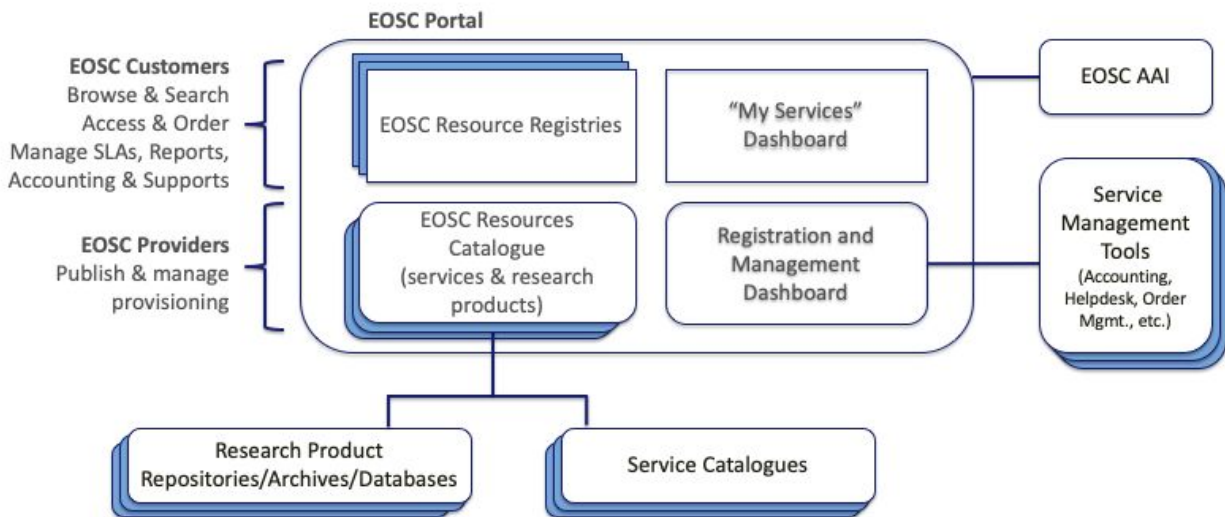

Figure 2. Internal components of the EOSC Portal and dependencies on external services.

Internal components

- From a EOSC Customer point of view, browsing, searching, access and ordering will be possible through the EOSC Resource Registry. According to the EOSCpilot Glossary 1.0, the EOSC Resource Registry provides the descriptions of live / ready-to-use EOSC Resources offered by the EOSC System. Resources will include services and scientific products that are produced by scientists, like data, software, publications, tools and experiments. These are published for discovery and reuse with metadata and links to other products via dedicated sources, e.g. repositories, archives, databases. To facilitate their discovery, cross-discipline or thematic metadata aggregators are today available and widely used by scientists. The EOSC Portal will integrate with scientific product catalogues capable of serving the needs of researchers from different disciplines. Dedicated Registries will be possible in order to present the EOSC offer to specific Users groups.
- From a EOSC Provider point of view, the Catalogue comprises "the list of all live EOSC Resources that can be requested by EOSC System Users". Resources are described by metadata that is either directly inputed after successful validation by the Provider, or through APIs. The Registration & Management Dashboard will provide capabilities supporting the Provider in the on-boarding and validation procedure, and additional functions for integrated service management of the contributed Resources within EOSC. The Additional capabilities for the Providers willing to in that choose a high-level partnership.

External dependencies

The EOSC Portal will interact with external services, namely:

- The EOSC AAI service, conforming to the AARC blueprint architecture and operational guidelines, supporting: (1) uniform representation of unique Users identifiers, (2) a standardised way of expressing group membership/role/information and Resource capabilities, (3) non-web browser based access, (4) delegation, (5) release of mandatory Users attributes according to the REFEDS research and scholarship entity category, (6) operational security, incident response and treacebility - REFEDS Sirtfi, (7) privacy requirements for processing personal information following the GEANT Data Protection Code of Conduct, (8) rules and conditions that govern access to and use of Resources following the WISE Baseline Acceptable Use Policy, and (9) assurance information following the REFEDS assurance framework and IGTF/AARC assurance profiles.
- External catalogues, repositories, databases and archies, providing metadata on services and other products (e.g. datasets, software, applications). Interoperability will be enforced with the adoption of the EOSC Catalogue Framework (see the "Interoperability Framework" section).
- External tools for service management (accounting repositories, helpdesk, order management tools etc.), which will exchange ticket information, usage information and order information that are managed externally. Interoperability will be ensured through a Service Integration and Access Management interoperability framework, that will be developed by the EOSC-hub project.

Capabilities for EOSC Customers

The EOSC Portal will support two types of relationships:

Business-to-User (B2U) for consumer-oriented Resources appealing to a large potential User pool. B2U transaction will address the digital needs of individual researchers and short and medium-term research projects. Because of the large User base, B2U transactions will be possible for those Resources supporting automated or semi-automated provisioning, a short acquisition process, require a low-level of specialization, can be easily compared and chosen without requiring expert support.

Business-to-Business (B2B): for the acquisition of bespoke solutions and/or of large quantities of EOSC Resources involving potentially multiple Providers. B2B suits the needs of research performing organizations and research infrastructures that need to cater for the long-term needs of a large pool of end-Users. A B2B transaction will typically involve a decision maker from the Customer organization, and the long-term consistent supply of Resources. B2B caters for the needs of research communities with advanced needs that require customization and technical enabling expertise. The Portal will support the negotiation of service quotes, and the possibility for multiple suppliers to respond in a coordinated manner. From a Provider's point of view, B2B transactions will require the availability of a technical team with a clear understanding of the service components necessary to meet the User needs, and a higher level of service management integration in EOSC, e.g. for coordinated accounting, monitoring, support, SLA and service report management and IT security management.

In both B2U and B2B scenaria the EOSC Portal allows Users to:

- Discover multiple Resources and services such as software, applications, research data, and services for the data lifecycle management.
- Compare Resources thanks to the use of a single description template that ensures semantic interoperability across different Providers.
- Get registered, authenticated and authorized using the academic/social account of choice, with the possibility to choose various federated identity Providers and Research Infrastructure Identity Providers (compliant with AARC blueprint).
- Get service quotes.
- Request access to bundles of already integrated and composable Resources from the EOSC Service Catalogue[4], and the required enabling expertise. In case of service bundles, the Users is provided with a single helpdesk contact point, and a single integrated view of accounting information from multiple Providers.
- Communicate with Providers through a personal dashboard.

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[4] https://wiki.eosc-hub.eu/display/EOSC/Glossary#Glossary-EOSCServiceCatalogue

The initial set of capabilities will include :

- Discover via search or browse functionality, filter out and compare Resources such as scientific outputs, applications, research data discovery platforms, data management, computing and thematic services. Discovery is facilitated by browsing Resources and services grouped in categories, or via faceted filtering of services according to its Provider, its classification, its TRL or maturity level, etc.
- For each service, the Users can view information based on a harmonized service description that includes generic service information, information about its usage aim, such as types of targeted Users, information about the Provider, access policies, the maturity level, and other related interoperable and programmatically composable services.
  - o Third-party Resource metadata catalogues, research infrastructure and e-Infrastructure service/tool/data registries;
  - o Data, software, applications, workflows, publications and other research outputs.
- Allow Users to select Resources, service configuration options and attributes and submit orders, which can bundled together from multiple Resources from different Providers.
- Allow registration, authentication and authorization using the academic/social account of choice, with the possibility to choose various federated identity Providers and Research Infrastructure Identity Providers (compliant with AARC)
  - o EOSC AAI, and federated identity Providers.
- Discover and support the reuse of Resources like scientific products that conforms to community-defined FAIR best practices:
  - o FAIR-conformant certified data repositories and metadata catalogues, community-verified repositories and metadata catalogues.
- Interact with Providers by submitting requirements, requests for more information and quotes to request for bespoke solutions or a large scale provision of a service.
- Offer customized views and set of Resources that target different types of stakeholders, like researchers, funders, research administrators and Providers.
- Offer a personalized experience in the Portal, by offering Users the ability to rate Resources, add to their favorites list or get suggestions about relevant Resources that match their profile.
- Get information about the requested Resources through a single access point - a personalized "My services" dashboard that allows to: check the status of submitted orders, get instructions on how to access Resources, SLAs and performance reports, and access to a helpdesk to get support.

The capabilities will be evolved with feedback from Users, EOSC projects and stakeholders, and the EOSC governance.

Capabilities for EOSC Providers

One of the Portal functions is to offer a delivery channel to the EOSC offer. Because of this, the Portal capabilities will evolve with the business functions to be delivered. The following Section provides an example of different business models for EOSC Providers, and how the Portal can support them. We expect these capabilities will evolve as the EOSC business model(s) mature.

Support to EOSC Business Models

In order to keep the entry barriers low, different participation schemes can be offered to EOSC Providers, where each scheme presents a different set of entry requirements matching different levels of benefits that EOSC can provide. The support of different partnership levels has been presented for the first time in EOSCpilot Deliverable D5.1 "Initial EOSC Service Architecture"[5]. D5.1 highlighted three possible models, inspired by the FedSM federation business models:

- **Invisible coordinator:** The Portal publishes Resources from multiple Providers, however their Resources are natively delivered to the EOSC Customers through the Provider's specific delivery channel. The added-value perceived by the EOSC Customer with respect to the original functionality is mainly the transparency with respect to the Provider.
- **Matchmaker:** The Portal receives from the EOSC Customer the request for a specific Resource or a specific functionality offered by a Resource. It matches the request with respect to the multiple Providers that can offer it, and dispatches it to the "best option" with respect to established criteria. Matchmaking and dispatching criteria do not only take into account the requested functionality but also other non-functional criteria, like access policies, load balancing, proximity, costs, etc.
- **One-stop-shop**: The Portal acts as single entry-point for a functionality that it delivered through the participation of multiple EOSC Providers. The distribution is transparent to the EOSC Customers as all the details related to the heterogeneity that may exist behind it (e.g. protocols, data types, SLAs, support channels) are hidden to the Customer. In this scenario, EOSC plays the role of "resource integrator" for the adhering Providers, and complex bespoke solutions can be offered as turn-key solution for the Customer.

In this tiered partnership scenario, via the Portal, Providers will be offered the possibility to choose among different partnership levels. By doing so, the Portal will allow EOSC to support different business models. For each Resource published in the Portal, the EOSC Customers will

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[5] https://eoscpilot.eu/sites/default/files/eoscpilot-d5.1.pdf

get different capabilities depending on the partnership level of choice of the Provider, as illustrated in the following example.

Table 1: EOSC benefits scheme in a tiered partnership scenario.

	Entry	**Standard**	**High**
Type of federation	Invisible Coordinator	Matchmaking	One stop shop offering
EOSC Provider benefits	> EOSC plays the role of demand aggregator > EOSC is a platform to advertise Resources to a wide range of European-level target groups. > The EOSC Resource delivery channel is directly managed by the Provider	> EOSC plays the role of demand and offer aggregator > EOSC brings Customers and Providers together through a coordinated delivery channel	> EOSC plays the role of demand and offer aggregator, and of integrator > Providers offload service integration and access management overhead to EOSC for one or more target groups
EOSC User benefits	> Discover from many Providers. They receive the service directly from the Provider. > EOSC does not guarantee the actual service performance delivered, however service level targets are described in a SLA	Get support in obtaining the Resources they need from trusted Providers > Quality of the received service varies within a certain range depending on the Provider of choice	> One entry point for placing their demands > High level of trust > Turn-key solutions and expert advice

Capabilities in a tiered partnership scheme

In the tiered partnership scheme, all Providers contributing Resources to the EOSC Catalogue will meet a minimum set of requirements defined in the Rules of Participation. The Portal offers different participation options, and the Portal will deliver the highest level of functionality to the top tier. Examples of different partnership levels and related capabilities EOSC Portal capabilities are illustrated in Table 2.

Table 2. EOSC Portal functionality for Providers depending on the EOSC partnership level of choice and related Users capabilities.

Entry	Standard	High
> Publish Resources in the Portal either through manual registration or through automated harvesting of Resource metadata > Advertise Resources through the Portal to a wider Users base > Get Users rating Providers choosing "Entry" are free to provide the Resource with the quality of service of choice.	Includes all of Entry, plus: > Get support about EOSC FAIR and technical interoperability guidelines > Get the "EOSC conformant" label - declaring that the Resource conforms to the EOSC Rules of Participation > Get federated AAI, helpdesk and order management as a service > Get information about visits, access requests, Users feedback[6] Providers choosing "Standard" comply to a basic-level of EOSC quality of service	Includes all of Standard, plus: > Get "EOSC integrated" label > Get your local helpdesk integrated with EOSC > Get Incident Response Support > Get your local accounting system integrated to publish usage information centrally > Get SLA and report management tools > Respond to service quote requests and support Users in a B2B fashion > Get access to a community of Providers, collaborate to deliver Resources as integrated solutions Providers choosing "High" comply to a high level of quality of service, for example they guarantee minimum response time to incidents and service orders, support the same acceptable usage policy

The EOSC Portal provides Resource registration capabilities and service integration capabilities that depend on the partnership level of choice of the Provider. Functionality towards Providers aims at offering the following capabilities.

As discussed in EOSC Hub, Work Package 12 Deliverable 12.1[7], it will be necessary to provide for the following models:
- 'Cloud Coin' or Voucher Access Model: where individual researchers or small research groups in need of limited-scale access to commercial services on an ad hoc basis,

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[6] https://wiki.eosc-hub.eu/display/EOSC/Glossary#Glossary-EOSCSystemUser
[7] https://documents.egi.eu/document/3466

expecting free-at-the-point of use services, pre-paid, ring-fenced or discounted resources could be allocated using vouchers. Such a mechanism has been successfully trialled in the context of incentivisation or introductory schemes, but it will be investigated as to whether this can be used as a legitimate mechanism to providing a long-term solution to ensuring commercial services are 'free at the point of use'.

- Sponsored Use: where services can be 'called off' free at the point of use, but where the entity that the user is associated with 'contracts with' the service provider directly on a 1-2-1 basis, and where contract terms between the parties are unique to that relationship (therefore, differing to the 'cloud coin' model).
- Provision of a dedicated area of the Portal to enabling and promoting aggregated procurement opportunities, in which Central Purchasing Bodies (as defined by the EC Procurement Directives) can gather requirements and stimulate demand for planned aggregated procurement opportunities, and publish relevant contractual and/or guidance documentation alongside the results.

On-boarding

This capability is for supporting the onboarding process of new Providers. It will support the end-to-end processes for the registration of a new Provider in the EOSC Portal, the registration of its Resources in the catalogue and their classification according to the EOSC catalogue taxonomy (see Section on interoperability). Validation aims to check the level of conformance of registered Resources metadata to the agreed guidelines.

On-boarding within the EOSC Portal is the process whereby a Provider contributes Resources to the EOSC Resource Catalogue. The process defines various procedures that are triggered at different stages of the process. The overall process is illustrated in Figure 2.
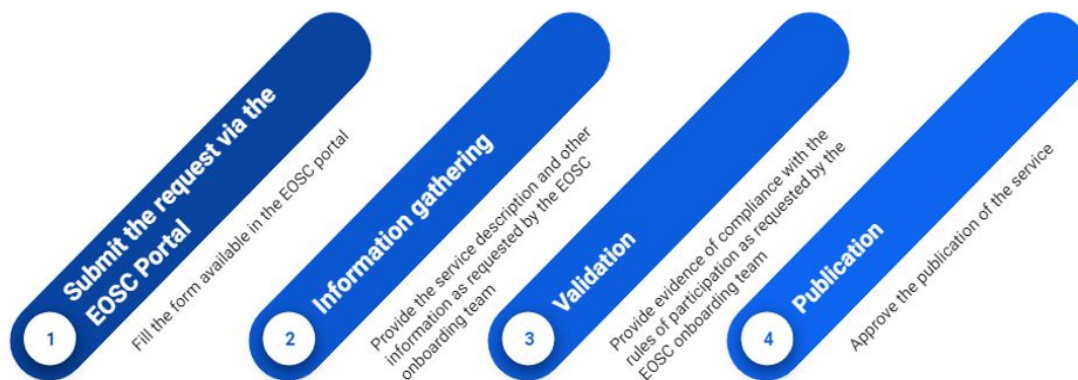

Figure 3: A high level view of the onboarding process, from the Provider's perspective. The Validation procedure takes as input the Rules for Participation, and depends on the level of membership of choice (Entry/Standard/High).

The following diagram illustrates the details of the onboarding process from EOSC portfolio management view. As the diagram shows, the on-boarding process results in new entries published only after a number successfully completed checks.
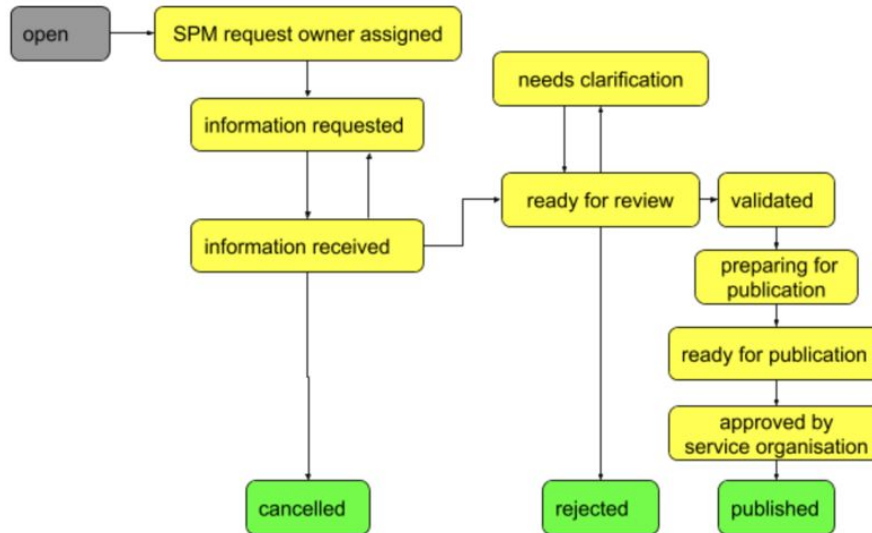

Figure 4. A high level view of the onboarding process, from a EOSC portfolio management perspective.

Provider's subscription
Providers interested in participating to the EOSC will need to receive support on the best partnership level that applies to them. This initial step triggers an internal process to further support the Provider and collect additional information. The initial service requirement information gathering is taken on by operational staff (see Annex 1 for details).

Resource registration and validation against Rules of Participation
After the establishment of a partnership level, Providers are requested to source information (either manually or programmatically) about the contributed Resources. The EOSC Portal requires the adoption of guidelines on Resource metadata description (see section below about the EOSC Catalogue Framework). Staff will conduct a Resource validation process through a checklist to evaluate the level of conformance to the EOSC rules of participation for Providers. Initially, the checks will focus on the operational maturity (i.e. TRL level 8 or higher). The validation procedure may be done as an online meeting. The process will then pass to a validator, who will validate availability of service via the website of the service or via the service endpoint provided, the service maturity level. Based on the partnership level of choice, different validation procedures are triggered. The choice of different levels of partnership allow the EOSC Portal to be a hosting online platform for a variety of different Resources. The validation process also includes information checks such as validation of all contact addresses (e.g. owner, support, security, helpdesk and order management contacts), and validation of references to

standards and certifications (e.g. GDPR, security and for example data, computing and/or api standards), and service webpage, use cases, manuals, training material, helpdesk, monitoring, maintenance announcement page, Privacy and Access policies. The validation process is completed against a practical checklist, which is the implementation of the Rules of Participation. Once the Resource is validated, the metadata is added to the EOSC Resource catalogue.

Validation of Resource metadata
The metadata validation stage includes a procedure that aims at ensuring the quality of the metadata gathered from external sources like data and software repositories, and service catalogues of research infrastructures and e-Infrastructures at national and European level. The procedure checks the conformance of the received metadata against the EOSC Catalogue Framework criteria. This is an essential step to provide basic quality control of the offered/represented catalogue services and ensure that the EOSC Catalogue will gain traction and credibility among the research Users communities.

Ordering

EOSC Customers are provided with the possibility to order online (where supported by the Provider), and to bundle Resources together in one or more "projects". The Portal offers an online platform for managing orders centrally, for example Providers can directly respond to orders[8] and communicate with the Customer.

Registration and Management

A dashboard enables Providers to manage their Resources (e.g., the update of Resource metadata) as well as to monitor and analyse usage statistics about their offerings in the Portal. Monitoring, accounting data, usage statistics and other indicators are automatically collected and aggregated either from within the Portal or by external services and tools delivered by EOSC-hub, or other thematic catalogues participating in EOSC.

Other integration capabilities include:
- **Customer relationship management**: the Portal retains information about the Users accessing services through the Portal, in compliance to GDPR.
- **Service level management and service report management**: in a personalized dashboard, Users are informed about the committed and delivered availability of the required Resources, and have access to the applicable Service Level Agreements and can review service performance metrics.
- **Accounting and billing**: Providers publish accounting information following EOSC accounting interoperability guidelines. Accounting information is aggregated and displayed in a single view to the Users.

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[8] This feature is based on tools and EOSC SMS processes being delivered by EOSC-hub.

- **Incident and problem management**: Providers are offered the opportunity to use a central incident management system to answer support requests from Users. The EOSC helpdesk system can be integrated with the in-house helpdesk system in case the Provider already has a custom platform available. Users are offered a single entry point to submit support requests, instead of requesting support to the multiple suppliers participating in the EOSC offer.

Interoperability Framework

The EOSC Interoperability Framework includes the EOSC Catalogue Framework (ECF), the Open Application Programming Interfaces (APIs) and related Quality Assurance measures.

The Interoperability Framework will continually improve to: (1) extend the guidelines to a wider range of Resources (facilities, material storage, datasets, software, applications, workflows, pipelines, data analytics, etc.), and (2) adapt to the needs of the EOSC business models.

The following Sections provide more information about its components.

EOSC Catalogue Framework

The ECF[9] defines a set of common guidelines among participating Providers on how Resources are described. The ECF is necessary to establish semantic interoperability and quality of the Resources metadata, which is at the core of the EOSC Portal capabilities. The ECF currently provides guidelines on how Resource descriptions are structured (the Service Description Template - SDT) and how Resources are being classified.

Classification relies on various attributes among which: the lifecycle status, Technology Readiness Level (TRL), place offered, scientific domain, and the type of functionality delivered.

The currently defined service and Resource Categories are: Facility, Networking, Compute, Data Storage, Material Storage, Datasets, Scholarly Communication, Software, Applications, Development Resources, Samples, Workflows, Data Management, Data Analytics, Material Analysis and Processing, Security & Identity, Operations & Infrastructure Management Services, Training, Advisory Services.

Each Category has a number of subcategories defined, e.g. for category Networking the subcategories are: Direct Connect, Virtual Network, Load Balancer, VPN Gateway, Exchange, Content Delivery Network, Traffic Manager, Other).

Categories are grouped in parent categories. Various groupings are possible, e.g., Infrastructure Services, Sharing & Discovery, Processing & Analysis, Security & Operations, Training & Support, Other.

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[9] This is work in progress receiving further input from the onboarding processes from EOSC-hub, eInfraCentral and CatRIS to be refined in the EOSC SDT.

The high-level structure of the current SDT, based on the work of the eInfraCentral[10] and EOSC-hub[11] projects, is illustrated in the diagram below.
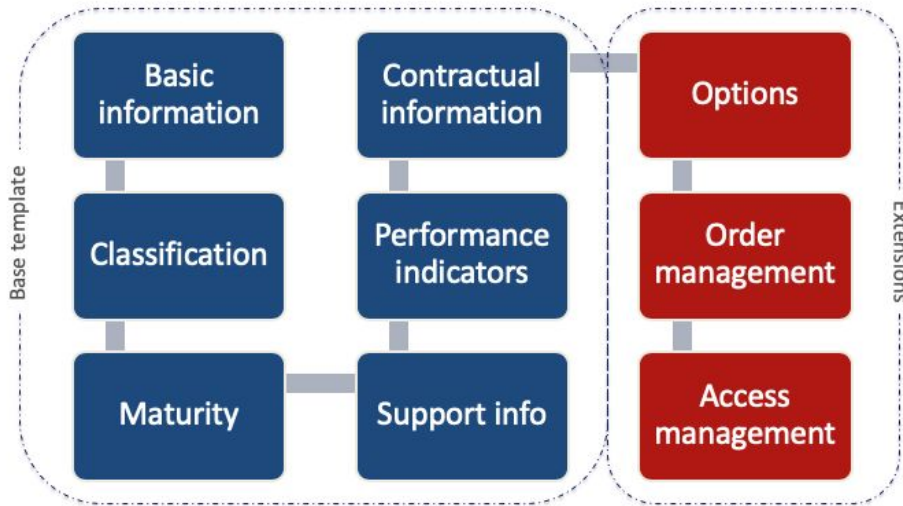

Figure 5: High-level view of the components of the EOSC Portal service description template, which includes base information and extensions aiming at supporting the Standard and High partnership levels.

Open APIs

Application Programming Interfaces (APIs) provide the necessary technology stack for Providers to exchange (provide or consume) Resources and accountable indicators for their usage in an automated way. APIs enable the EOSC Portal to become a fully interoperable ecosystem of federated Providers and consumers, and further facilitate the composition of Resources on the grounds of commonly agreed service representations and exchange protocols. The open APIs include methods and mechanisms for data acquisition (Resource metadata, indicators, and usage, etc.) from federated catalogues, such that synchronization of content will be seamlessly esource Catalogue within the EOSC Catalogue and integrate it in their third-party applications.

An overview of the APIs functionality is shown in the next Figure.

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[10] https://jnp.gitbooks.io/service-description-template-v1-12/content/

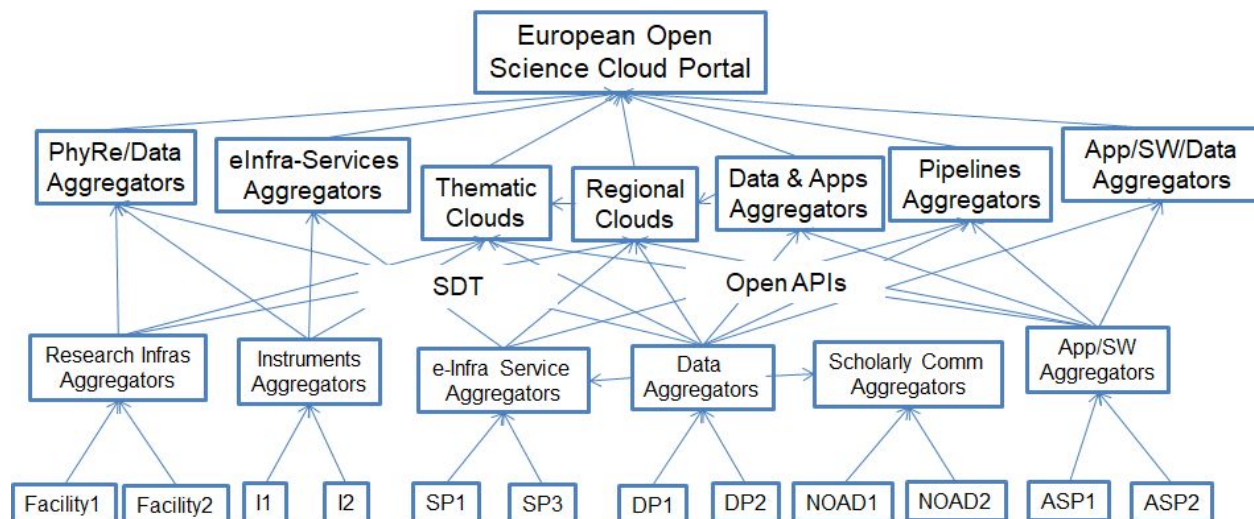[11] https://wiki.eosc-hub.eu/display/EOSC/Comparison+EOSC-hub+with+eInfraCentral+Service+Description+Template

Figure 6. Use of the EOSC Catalogue Framework guidelines allows for harvesting and exporting of metadata across different catalogues, archives, repositories and databases.

Service Integration and Management Framework

For providers opting for a Standard or High partnership level, service management in a federated multi-supplier environment is required. Accounting, billing, incident and problem management, order management etc., will rely on an interoperability framework defining the reference standards, protocols and APIs necessary to "connect" local SMS tools with the EOSC Portal. The Service Integration and Access Management (SIAM) interoperability framework will define such guidelines[12].

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The EOSC Portal will be managed following the requirements, procedures and policies of the EOSC-hub Service Management System (SMS). The SMS follows the FitSM standard in order to ensure a professional service delivery.

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[12] The SIAM interoperability framework will leverage the efforts of the EOSC-hub project. See D4.2 "Operational Infrastructure Roadmap" (https://www.eosc-hub.eu/sites/default/files/EOSC-hub%20D4.2%20Final.pdf).

[13] The SIAM interoperability framework will leverage the efforts of the EOSC-hub project. See D4.2 "Operational Infrastructure Roadmap" (https://www.eosc-hub.eu/sites/default/files/EOSC-hub%20D4.2%20Final.pdf).

Appendix 1. Change Log

Date	Version	Action
04-04-2019	2.0	Document released and presented to the EC
29-05-2019	2.1	Minor editorial improvements to address team comments
11-07-2019	2.2	Added text on B2U and B2C models and related funding model from M. Williams/GEANT

Appendix 2. Areas of improvement

- Terminology and glossary - revision of term "registry" and other terms used in the paper e.g. B2C as opposed to B2U
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