EOSC Future

D4.2b

Back-Office Requirements Analysis

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D4.2b / Back-Office Requirements Analysis

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Abstract

This deliverable contains a detailed report of the technical requirements and their analysis for the EOSC Portal Back-Office. These requirements originate primarily from the High-Level Technical Roadmap covering the needs of the resource providers, which are then analysed.

Version History

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Glossary

EOSC Future project Glossary is incorporated by reference: https://wiki.eoscfuture.eu/x/JQCKA. Additional terminology used in this document is included below.

List of Abbreviations

Acronym	Definition
ADT	Analysis and Design Team
AMS	Argo Messaging Service
API	Application Program Interface
A/R	Availability and Reliability
CMDB	Configuration Management Database
CRIS	Current Research Information System
CRUD	Create Read Update Delete
DT	Development Team
EC	European Commission
HDFS	Hadoop Distributed File System
HLR	EOSC Future High-Level Technical Roadmap
HPC	High Processing Compute
ISNI	International Standard Name Identifier
JMS	Java Messaging System
OMS	Order Management System
PT	Product Team
REP	Requirements Engineering Process
RET	Requirements Elicitation Team
REST API	Representational State Transfer Application Program Interface
SOMBO	Service Order Management Back-Office
UI	User Interface
UX	User Experience

1 Executive Summary

This deliverable is an updated version of **D4.2a-Back-Office Requirements Analysis** and contains a detailed report of the evolution of the technical requirements and their analysis for the EOSC Portal Back-Office up to M30, as developed since the release of D4.2a in M18. These requirements originate primarily from the High-Level Technical Roadmap (HLR) covering the needs of the resource providers, which are then analysed for all components comprising the Back-Office.

This document should be viewed in conjunction with **D5.2a** and **D5.2b** covering the requirements analysis for the EOSC Portal Front-Office. These deliverables cover the requirements analysis of the entire EOSC Portal at this stage of the project.

2 Introduction

The primary direction of development for the EOSC Portal derives from the EOSC Future High-Level Technical Roadmap (HLR). However, in order to ensure that the needs of EOSC users are met, a framework is necessary to ensure that the process of requirements gathering is performed effectively throughout the project (see section 3 of D4.2a). Such a framework will serve as a means for High-Level Roadmap validation but also will provide the processes for augmenting it or even changing it for a reason (i.e., to satisfy end-users' requirements/expectations which are changing). Thus, a means whereby feedback may be gathered, analysed, and acted upon is needed which is sufficiently agile given the complexity of EOSC and the extremely diverse nature of the different communities that EOSC is there to serve. Feedback in the form of analysed requirements may result in new functionality for the EOSC Portal, in a different method of delivery of the EOSC Portal, new services or possibly a revised approach to how EOSC meets the needs of its users.

The EOSC Future HLR covers the requirements addressing the needs of resource providers and users, which are then analysed from a functional point of view and presented in Section 3.

Finally, Section 4 covers the requirements analysis for all the EOSC Back-Office components, presented for each of the components. Where possible, and specifically for the higher-level components with which users interact, a mapping to the HLR is presented. However, for the lower-level components (e.g., Messaging) it is not possible to map requirements to the HLR. In these cases, requirements are listed as a set of functional and non-functional requirements.

3 Requirements from the High-Level Technical Roadmap

The EOSC Future High-Level Roadmap (HLR) is the main driver for the development activities in WP4. The HLR was defined during the EOSC Future proposal preparation taking into account the requirements collected from all the major past EOSC projects and initiatives (EOSC-hub[1], EOSC Enhance[2], OpenAIRE-Advance[3], etc.) and the wide experience on digital infrastructures and federated systems of the four (4) e-Infrastructures (EGI, EUDAT, GEANT, OpenAIRE) and five (5) science clusters (ENVRI-Fair, EOSC-Life, ESCAPE, PANOSC, SSHOC) that are the core partners of the EOSC Future project.

The HLR was organised into categories that encompass the requirements of the different levels of abstraction spanning from high-level user experience to specific technical activities on components of the *EOSC-Core*. The user experience category was further split into sub-categories specifying the area of interest. Each category contains multiple entries with milestones at M6, M18 and M30. This document is focusing on the requirements for M30 – the requirements for M18 were described in the previous version of this deliverable.

All the categories are listed in the table below together with a short description and the main technical requirements for the EOSC Portal Back Office tools derived from them.

Table 3-1: The categories of the EOSC Future High-Level Roadmap.

Category	Description	Main requirements for M30
A. User Experience - Resource Sharing and Discovery	Enabling easy discovery, access and sharing of a wide set of resources in EOSC	• A researcher can do the full lifecycle of data processing, storage, analysis, and publishing supported by resources available and transparently integrated through EOSC. • EOSC allows research communities to build cross-disciplinary portals.

[1] https://www.eosc-hub.eu/
[2] https://eosc-portal.eu/enhance
[3] https://www.openaire.eu/advance/

		• Researchers can gauge the quality and suitability of resources based on usage statistics and feedback from other services.
B. User Experience - Resource Allocation	Enabling the discovery and access to the EOSC IT resources	• Requesting resources through EOSC includes the possibility to access commercial or centrally funded resources. • Researchers can request HPC resources (e.g., from EuroHPC) directly through the EOSC Marketplace.
C. User Experience - Resource Composability	Enabling easy resource composability	• Researchers can compare and select resources based on how easy they are to compose and connect to. • Communities can offer their users fully integrated (end-to-end) workflows and a number of these are available for various research topics.
D. *EOSC-Exchange*	Enrich the *EOSC-Exchange* with a wide set of different types of resources and expand its capabilities	• Production release of EOSC File Transfer Service. • First releases of other horizontal services arising from clusters and communities. • Ability to create thematic execution environments/VREs based on integration of compliant thematic, horizontal, and core resources. • The onboarding process allows for automated/self-service integration with some EOSC-Core functionalities. • The onboarding process for resources is extended to include more optional integration steps in the same workflow. • Resource requests integrated with procurement as well as provisioning functions. • EOSC-Exchange includes numerous services from communities other than those represented by the clusters.
E. *EOSC-Core*	List of new features to be supported by *EOSC-Core* elements derived from	• Detailed technical roadmaps for EOSC Portal Back-Office tools: EOSC Resource Catalogue, Order

	requirements in categories A, B, C and D.	Management, Monitoring, Accounting, Helpdesk.
F. Clusters and Science Projects	Roadmap to deploy the EOSC Future Science Projects in EOSC	• **Science Project (SP) Deployment** Full scale operation of SPs to the point where many have full scientific analyses ready or close to publication as full demonstrations of open cross-disciplinary science. Demonstrations of the full lifecycle of data processing, storage, analysis, and publishing supported by resources available and transparently integrated through EOSC. Workflows deployed across cluster/Research Infrastructure resources and where appropriate on commercial cloud and/or European HPC resources. • **Clusters' Input to EOSC Horizontal Services** General availability of Research Infrastructure-originated horizontal services (as appropriate) visible through EOSC Portal and catalogues.
G. EOSC Interoperability Framework	Delivery interoperability frameworks for EOSC-Core and EOSC-Exchange resources	• **Resource Description Framework** Provider and resource description stable release v4.0 incorporating new features requested by the user and provider communities. • **Identifiers** Draft interoperability framework for a PID meta-resolver and guidelines for PID service providers for minimum Kernel Type Information. • **AAI** Technical interoperability guidelines for supporting cross-sector access to the EOSC Federated AAI. • **Metadata and Ontologies** Guidelines for minimum metadata to support the discovery, metadata exchange, and cross-walks of research products across communities. • **Accounting** Extended interoperability framework for service providers for automated

		reporting of accounting and usage metrics. • **Monitoring** Extended interoperability framework for service providers for monitoring service availability of services registered in the EOSC Catalogue. • **Order Management** Extended interoperability framework for service providers for automatic dispatching of orders for services registered in the EOSC Catalogue. • **Helpdesk** Extended interoperability framework for service providers for automatic dispatching and handling of user requests for services registered in the EOSC Catalogue. • **Data Platforms for Processing** EOSC-endorsed guidelines for data ingesting and movement for processing in hybrid cloud environment adopted by one or more horizontal services. • **Data Publishing and Open Data** EOSC-endorsed guidelines for data repository adopted by one or more horizontal services. • **Cloud Compute Containerisation and Orchestration** EOSC-endorsed guidelines for VM/container management and orchestration adopted by one or more horizontal services. • **HTC-HPC Compute** EOSC-endorsed guidelines for HPC/HTC clusters on demand and multi-tenant containerised job submission adopted by one or more horizontal services. • **Machine Learning** EOSC-endorsed interoperability guidelines for Machine Learning.

Section 4 of this deliverable describes in detail the requirements derived from the HLR, maps them to the relevant components described in dedicated subsections allowing the roadmap to be shaped for each tool of the EOSC Portal Back-Office.

However, although the HLR has been the main input to define WP4's technical plans and tools roadmap, WP4 is ready to promptly react when new requirements emerge, assess them and pro-actively refine its roadmaps when needed. This is possible through the collaboration with the T3.4 'EOSC Portal Technical Roadmap' that established a process to translate the requirements to be collected during the lifetime of the project into the overall EOSC Portal technical roadmap. WP4 is a key actor in this process, responsible for assessing the requirements related to the Back-Office tools and properly updating its technical plans when a requirement is accepted. This process is detailed in the next section.

4 Requirements Analysis

This section presents the details about the gathering and analysis of requirements for each of the different Back-Office components.

4.1 EOSC Research Product Catalogues and Provider Dashboard

The EOSC Resource Catalogue maintains an up-to-date map of the EOSC Resources, i.e., the EOSC Research Graph, as offered by EOSC Providers, which are organisations eligible (thus authorised) to publish EOSC Resources in the Catalogue. The EOSC Resource data model, depicted in Figure 4-1 is defined by the EOSC Resource Description Interoperability Framework (WP3) and currently includes: providers, services (with data sources as an explicit subtype), as per the guidelines defined by the provider & resource description template (developed by the EOSC Enhance project[4]), and research products, as per the guidelines defined by the OpenAIRE-Advance project[5].

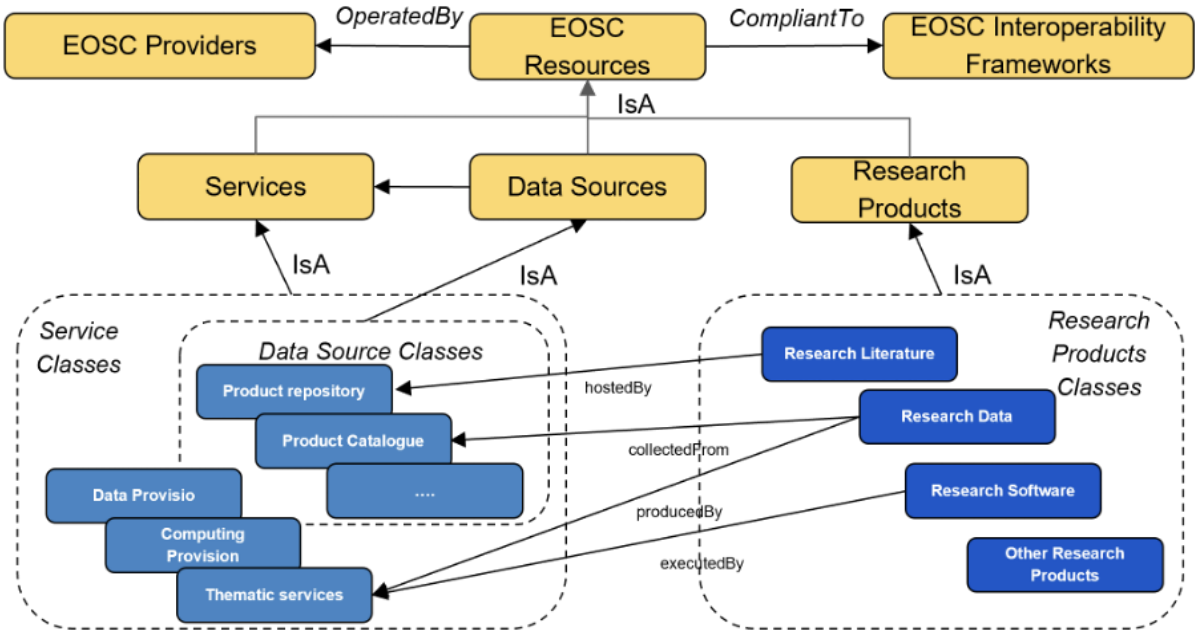

Figure 4-1: EOSC Resource Catalogue Data Model.

Specifically, The EOSC Resource Catalogue consists of the following components:

- **The EOSC Provider Portal:** the portal enables the front-end functionality for the registration of EOSC Providers, organisations that publish their Resources via the EOSC Catalogue. It offers capabilities to onboard and manage EOSC Resources - both services and research products. It also offers the Provider Dashboard, where representatives from Providers' organisations have a detailed view of their offerings in the EOSC Portal as well as various usage statistics on their resources, obtained from EOSC Monitoring and EOSC Accounting. Finally, it offers members of the EOSC Portal Onboarding Team (EPOT) the functionality to manage EOSC Portal Catalogue entries (i.e., manage the onboarding process of providers that apply to list their resources in the Portal), audit the onboarded resources, etc.
- **EOSC Service Catalogue:** the component offers the underlying storage functionality and the interoperability tools for the programmatic access, registration, management (CRUD) of providers, services, and catalogues. It also offers the necessary API functionality for the interoperability of service catalogues from individual providers or aggregators (e.g., thematic or regional catalogues) with the EOSC Portal. Modifications to the entities maintained in the Service Catalogue are synchronised with the EOSC Research Graph, which aggregates the entire set of entities and their relationships in the EOSC Portal

[4] https://eosc-portal.eu/providers-documentation/eosc-provider-portal-provider-profile
[5] http://guidelines.openaire.eu

- **EOSC Research Graph (EOSC-RG):** the component offers capabilities to populate and access a knowledge graph, where (i) the nodes represent instances of the different EOSC Resource types (e.g., services and products) and (ii) the relationships representing the semantic associations between them (see Data Model in Figure 4-1 which shows the EOSC-RG high-level data model). Nodes of the graph contain information describing the Resources, the EOSC Provider behind the Resources and with which *EOSC Interoperability Framework*s the Resources are compliant.

The EOSC Resource Catalogue is delivered by combining the efforts of EOSC Enhance and OpenAIRE-Advance in providing:

- **EOSC Enhance Provider Dashboard** and **OpenAIRE PROVIDE Dashboard** for respectively enabling the onboarding of services and research products into the EOSC
- **EOSC Enhance Service Registry and OpenAIRE Research Graph** for respectively operating a catalogue of service profiles and research product profiles, populated via integration with community, institutional, RI catalogues and data sources.

The requirements below are the ones obtained via the HLR milestones, which indicate the preferential behaviour and properties of the EOSC Resource Catalogue.

4.1.1 Users

Users of the EOSC Resource Catalogue are:

- **EOSC service/data source providers**: persons responsible for the operation of a service or data source.
- **Service developers**: programmers that interact with EOSC Research Catalogue APIs to build added value services, e.g., managers of RI catalogues willing to integrate their catalogue resources in the EOSC Catalogue.
- **Researchers:** researchers willing to access data in the EOSC Research Graph to perform data analysis experiments.
- **EOSC Resource Onboarding Team - Curators**: the users in charge of managing and supporting EOSC Providers during the onboarding process.
- **External Catalogues**: Third party Regional and Thematic Catalogues and their Providers.
- **EOSC Core Components.**

4.1.2 Functional and non-functional requirements

This section lists all functional and non-functional requirements derived from the High-Level Roadmap at M30, which are considered as High-Priority for the EOSC Resource Catalogue

In the period running up to M30, the Service Catalogue will offer the following functionality:

- Service Catalogue data model and offered APIs/frameworks should adapt/extend to include changes/extensions to EOSC Profiles regarding:
  - training resources.
  - Guidelines used for interoperability between resources.
- Service Catalogue data model and offered APIs/infrastructure will allow onboarding of Interoperability Framework Guidelines through the Providers portal and facilitate a process to validate Guidelines applying for onboarding.
- Resources that are available in the EOSC Resource Catalogue will be accompanied by usage statistics and metrics indicators visible to Providers through APIs.
- Service Catalogue will provide increased automatic validation tools and automatic flagging of Resources which are likely to require review.
- Service Catalogue will implement parts of the Interoperability Framework, and more specifically offer functionality for Providers to specify the metadata of Resources that enable their connection and composition with other offered data, Resources and Services into bundles of offerings for end users.

Providers' portal will offer the following functionality:

- Portal provides additional information on EOSC Resource Providers and Resources and on activities of researchers in EOSC, following the further evolution of EOSC Profiles.
- Providers Portal supports onboarding and validation of Interoperability Framework Guidelines.
- Providers Portal offers recommendations for Providers during the onboarding process to enable them to place their offered resources better in terms of categorization, scientific domain, etc.
- Portal UI supports updated EOSC Profiles, for Training resources.
- Statistics and monitoring metrics related to combined/integrated usage of EOSC Resources, as collected from Monitoring and Accounting services are displayed on the Providers Portal.
- The Portal Onboarding team will use automatic validation indicators to better review and give feedback to onboarded resources.

Non-functional requirements briefly include:

- Existing API/Messaging updates/support and backwards compatibility for new types of Resources: (Training Resources).
- API updates and support for linking onboarded resources to Interoperability Guidelines.
- Portal UI form updates and support for new resources and IF Guideline support.
- Use of PIDs for all resources in the EOSC Catalogue, to allow deduplication of onboarded resources.
- Implementation of Catalogue-Resource/Provider relationships and Profiles evolution to the internal Service Catalogue data model.
- Integration with the Recommender System functionality API.
- Completion of transition to AMS messaging, support in parallel for the existing JMS messaging functionality, for *EOSC-Core* component communication.
- Extend/Finalise Portal integration of monitoring statistics using Monitoring API.

Table 4-1: EOSC Research Product Catalogues and Provider Dashboard functional and non-functional requirements derived from the High-Level Roadmap at M30.

Channel	Title	Users & Problem to be solved	Affected components
Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue Integration of service catalogues through the EOSC Provider Dashboard (push & pull)	Service providers	Service Catalogue
Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue Support to data sources and related research product onboarding	Service providers	Service Catalogue, Research Product Catalogue
Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue EOSC Resource Catalogue APIs and dumps	Service providers	Research Graph Catalogue
Derived from HLR milestone	**C1-M30**. Researchers can compare and select resources based on how easy they are to compose and connect to. Information on resource compatibility with IF guidelines is linked to resource catalogue entries	Users	Service Catalogue, Research Product Catalogue, Research Graph

Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue Mining algorithms to infer links between scientific articles and EOSC services in the Marketplace	Users	Service Catalogue, Research Product Catalogue, Research Graph
Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue FAIRification of data sources	Service (data source) providers	Research Product Provider Dashboard
Derived from HLR milestone	**E2-M30** EOSC Resource Catalogue Support of Training Resources onboarding	Service providers	Research Product Catalogue, Research Graph

4.2 EOSC Service Order Management & Composition

Among other functionalities supporting resource accessibility, EOSC Marketplace provides end-user features to order resources, monitor user requests and communicate with resource providers. For the providers in turn, it offers various interoperability patterns (Figure 4-2) to integrate the Order Management process in alignment with a vision of a federated system of systems, creating a baseline for the EOSC Service Order Management & Composition. The implemented interoperability patterns are aimed at individual providers and provider communities adopting the guidelines to integrate their own resource provisioning mechanisms. EOSC Service Order Management & Composition engages also the EOSC Portal Operations Team who play a key role in the platform CRM (Customer Relationship Management), end-users support and guidance through the composability of resources in the EOSC ecosystem.

EOSC Marketplace facilitates the ordering process, being a connection point between resources and Order Management systems (OMSes) for resource providers. It is also an entry point for the users looking to advance their research projects by using EOSC Resources. They can follow the entire path from resource discovery to order fulfilment in a single portal, which provides them with a coherent experience.

On the other hand, providers and communities are met with several flexible options to integrate their ordering process. Firstly, they can specify offerings for their resources. Providers can configure their offerings using an interoperable Offering API or ergonomic UI. Both are flexible enough to support various use cases for offerings. Secondly, they can handle orders placed in the system in several interoperable ways, either utilising the existing SOMBO system (Service Order Management Back-Office) dedicated to all EOSC Service Providers or using the EOSC Marketplace Ordering API. The latter allows the integration of existing OMSes, while providing out-of-the-box support for JIRA-based solutions as a reference implementation of the integration.

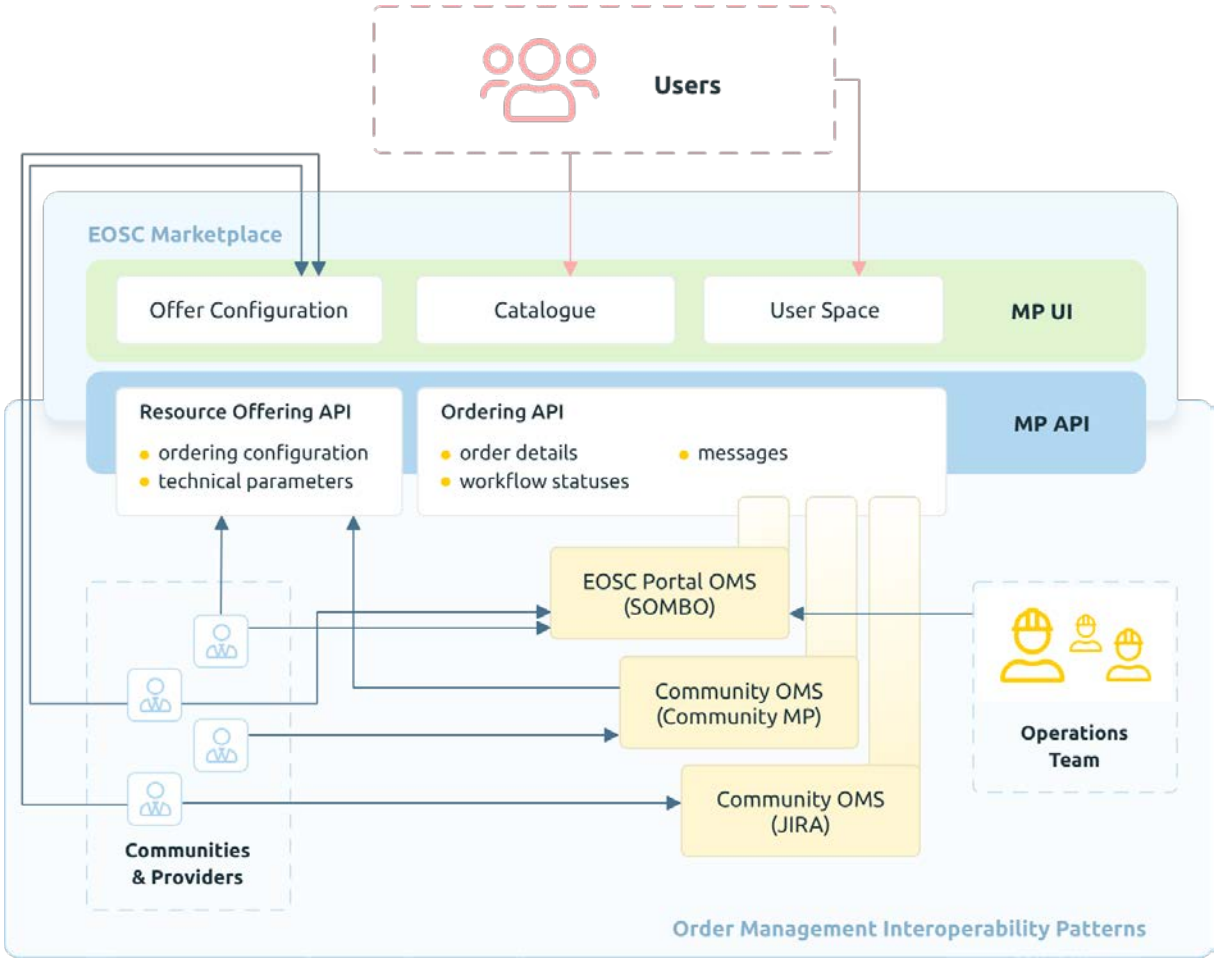

Figure 4-2: Order Management Interoperability Patterns.

The EOSC Marketplace is the central part of the EOSC Service Order Management & Composition architecture that facilitates the order processing and provides various ways to interface with it. The EOSC Marketplace exposes Offering API and Ordering API, for use of providers, communities and the EOSC Portal Operations Team, and with the use of different interoperability patterns provides several methods of order handling. OMSes are a separate group of components that integrate closely with the EOSC Marketplace Ordering API but are free to have additional functionalities for their own users. An example of such a component is EOSC Portal OMS, i.e., SOMBO. On the one hand, it has its own UI catering to its users (mostly providers and the operations team), and on the other it bridges over to the EOSC Marketplace through the Ordering API.

The Service Order Management Back-Office (SOMBO) is the orchestration tool between the EOSC Marketplace, service providers, service requesters and shifters/operators in EOSC Portal Operations Team (Figure 4-3). It is designed to track all the orders received by the EOSC Marketplace and to propose different actions on these orders.

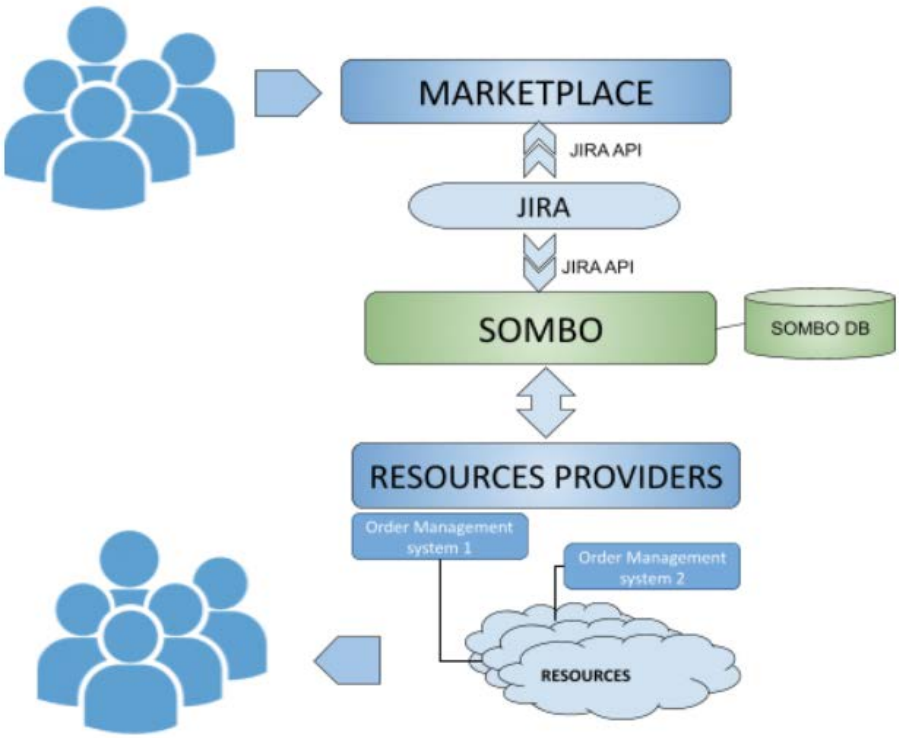

Figure 4-3: The role of SOMBO in managing the service orders.

The aim is to facilitate the daily operations made by shifters, ease the communication between all parties, facilitate the negotiation between service requesters and service providers, and provide facilities to sign an SLA/OLA. The SOMBO application provides a complete dashboard to shifters to list all service orders per status (on-going, accepted, rejected) and to operate them.

4.2.1 Users

Users of the OMS are:

- EOSC Service Providers.
- EOSC Service Catalogue Providers.
- EOSC Service Provider Communities.
- EOSC Portal Operations Team.
- EOSC Consumers.

4.2.2 Functional requirements

Table 4-2: EOSC Service Order Management functional requirements.

Channel	Title	Description	Affected components
EOSC-WP05 Requirements gathering workshop	User is automatically sent/directed to training/tutorial/quick start guide after order is fulfilled	Training on specific services should be linked to the services and ordering.	EOSC Catalogue and Marketplace, Training Catalogue
EOSC-WP05 Requirements gathering workshop	Enriched service descriptions with more technical information.	• Service description has to be harmonized, expanded and improved to cover more technical aspects. • A Service Ontology should be developed in agreement with the service providers.	EOSC Marketplace for Providers
Discussion with EGI Operations	Integrate new template for SLA	Modify existing SLA templates and a template for pay-for-use case	SOMBO
Derived from HLR milestones	Solutions/Bundles can be ordered/accessed in one shot	Order management process supports resource solutions/bundles and allows to order or access them as a package. It's consistent with EOSC solutions/bundles definition.	EOSC Marketplace for Providers, EOSC Marketplace
Derived from HLR milestones	Enhanced order management process to support new emerging use cases	Order management capabilities are extended to capture new information collected via the requirement analysis process and support new use cases.	EOSC Marketplace for Providers, EOSC Marketplace
Derived from HLR milestones	Basic support for workflow management	Order management is extended to include features supporting workflow management.	EOSC Marketplace for Providers, EOSC Marketplace
Derived from HLR milestones	Enhanced service offer definition for providers	Graphical interface allowing to define parameters connected with the offer (and ordering if applicable). Any type of parameter is available to the providers and a business	EOSC Marketplace for Providers

		logic behind it allows to better express technical capabilities of the service.	
Derived from HLR milestones	Enhancements in Integration on demand in the EOSC Provider Portal & Marketplace	Possibility to connect provider's OMS with EOSC OMS. Possibility to forward provider's offers to EOSC OMS.	EOSC Marketplace for Providers

4.3 Interoperability Framework Registry

The EOSC Interoperability Framework (EOSC-IF) provides common models and practices to describe the interoperability capabilities of EOSC resources across research/e-infrastructures' borders. The resulting environment provides an interoperability-driven overlay of EOSC resources across different disciplines, thereby enabling the discovery of resources based on interoperability features. Consequently, an overlay of resource orchestration is made possible, referred to as the EOSC Execution Framework, whose complexity and level of enabled automation depend on the level of description of the resources - the Execution Framework includes the set of orchestration services that, thanks to the exploitation of the EOSC IF, make resources dynamically composable via the EOSC platform.

Given the current types of resources supported by EOSC, namely services and products, two composability patterns are possible:

Composability of products with services:

- Compatibility ("potential composability", recommendation): Detection of services that may be of interest to a researcher to process a given product, e.g., a researcher discovers interesting Twitter Data and can find EOSC Services capable of processing Twitter Data; e.g., researchers interested in text processing in Cultural Heritage can find services that are able to process products compatible with EOSC Textual Files guidelines related with the discipline in the EOSC resource catalogue;
- Machine composability: Detection of a service that can be (discovered/found and) invoked by another service (sort of orchestrator) ; e.g. an orchestrator service allows researchers, via an UI, to (i) discover repository services that can be used to deposit a dataset of interest (ii) act as a proxy between the researchers and the selected repository to carry out the deposition (no need to access the repository web site); to this aim, target repository services are characterised by their adherence to common IF guidelines for deposition as defined by related EOSC WG on Repository Publishing APIs;

Composability of services (with services)

- Compatibility ("potential composability", recommendation): Detection of services that may be of interest or combined in the experimental settings of a researcher; e.g., a researcher that has developed a Galaxy service wants to discover other Galaxy compatible services available via the EOSC capable of performing a given functionality;
- Machine composability: Detection and execution of services that can be automatically pipelined and executed as steps of a workflow executed by a workflow engine (e.g., CWL, Galaxy, Taverna, etc.)

The EOSC-IF registry adds a thin semantic layer on top of the EOSC resource catalogue that allows viewing (and discovery, browsing, etc.) EOSC resources in the EOSC Catalogue in terms of their compliance with IF guidelines. As described afterwards, the Registry is designed in such a way that it can support different degrees of composability.

To this aim, an EOSC-IF Registry assigns unique IDs and profile descriptions to IF guidelines for both the EOSC Core and the EOSC Exchange. EOSC-IF guidelines also include the semantics of compatibility and IF guidelines configurations (see Figure 4-4):

- *Semantics of compatibility*: a vocabulary must be drafted to highlight the different forms of compatibility resources may feature; for example, a service could accept data compatible with

guidelines XYZ as input or instead produce it as output; or a service could be compatible with a given set of APIs.

- *Configuration*: "being compatible with a set of guidelines" is a relevant piece of information, allowing for example resource discovery by compatibility (e.g., all services compatible with the OAI-PMH protocol); however, knowing the specific configuration of guidelines for a given service (e.g., the URL of the OAI-PMH end point) is critical to enable orchestration at the service level. The EOSC-IF registry should make it possible to provide a dedicated configuration template (set of properties required for compliance) for each EOSC IF guideline. Services onboarded in the EOSC Service Catalogue and declaring their conformance to EOSC-IF guidelines should provide the necessary info (configuration instance) as requested by the respective configuration template.

To complete the scenario, the EOSC Resource Catalogue data model will be extended to express the compliance of a resource (service, product, or other types in the future) to an EOSC-IF guideline in the EOSC-IF registry. For example, EOSC service profiles will express a semantic relationship with the EOSC-IF guidelines for Service onboarding (Core guidelines), which come with a given option (versions); e.g., service catalogues integrated with the EOSC Catalogue will (i) specify their compliance with the "EOSC-IF guidelines for service Catalogues" and (ii) provide a configuration instance that describes the "pull"/harvest APIs for the given service catalogue.

In EOSC Future the registry will be delivered incrementally, to ensure a production-ready system will be delivered despite the DoA expectations being limited to a prototype. The roadmap is organised in three stages:

- **First stage** (TRL7, prototype ready): delivery of a tag-based registry to deliver composability by compatibility
- **Second stage** (TRL8, production-ready): delivery of a registry database v1.0 and UIs to deliver composability by compatibility and enable EOSC IF guidelines profile management, with referrable unique identifiers, discovery and access of guidelines and related material
- **Third stage** (TRL7, prototype ready): building on top of Registry Database 1.0, delivery of a registry database v2.0 and UIs to deliver machine composability

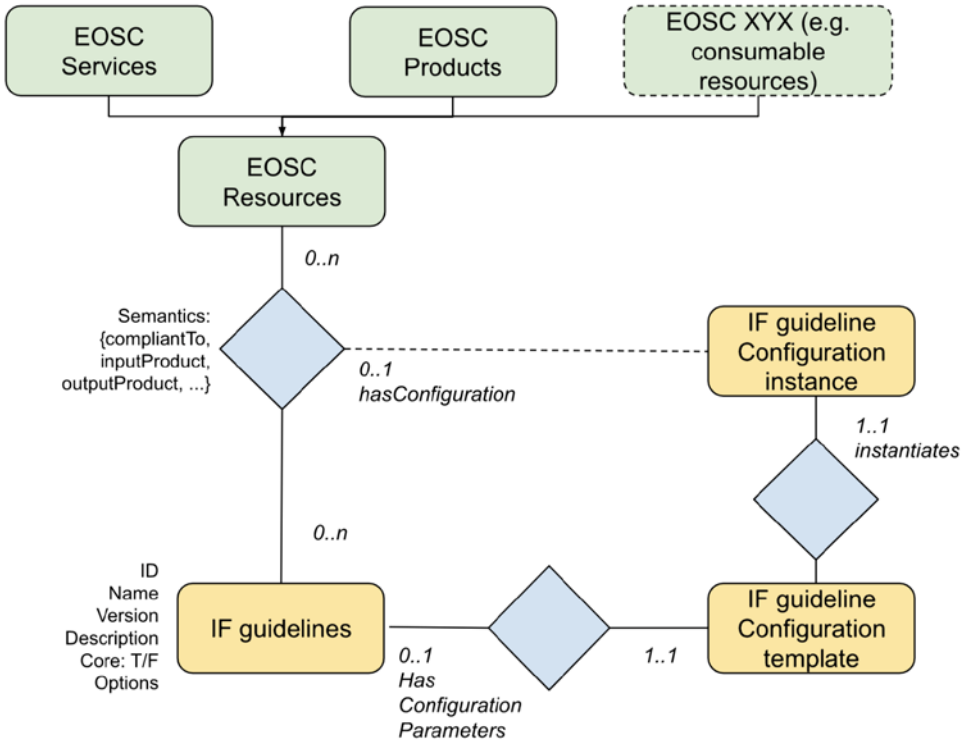

Figure 4-4: EOSC-IF data model: a draft.

4.3.1 Functional requirements

Table 4-3: EOSC Interoperability Framework Registry functional requirements.

Channel	Title	Description	Affected components
Derived from HLR milestone	**C1-M30.** Researchers can compare and select resources based on how easy they are to compose and connect to **D6-M18.** EOSC-Exchange highlights which services can be easily integrated or composed **G1-M18.** EOSC Interoperability Framework's framework	Onboarding capabilities are extended to allow linking (new or existing) resources to Interoperability Framework guideline entries and to identify compatibility relationship types between resources and guidelines. Information on guidelines supported by a resource can be retrieved via the resource catalogue API.	EOSC IF Registry, EOSC Resource Catalogue
Derived from HLR milestone	**C1-M30.** Researchers can compare and select resources based on how easy they are to compose and connect to Research communities can start to register horizontal or thematic Interoperability Guidelines in the EOSC IF. To facilitate process to publish Interoperability guidelines for EOSC-Exchange.	Procedures are ready to be used to onboard interoperability guidelines from the research communities. Dedicated area of the eosc-portal.eu to be available for the purposes of publishing procedure and associated documentation.	EOSC IF Registry
Derived from HLR milestone	**D6-M21.** EOSC-Exchange highlights which resources can be easily integrated or composed	EOSC IF registry: guidelines IDs and profiles.	EOSC IF Registry
Derived from HLR milestone	**G5-M24.** Extending the EOSC IF to onboard community-specific metadata profiles G1-M21 EOSC Interoperability Framework's framework **C1-M30.** Researchers can compare and select resources based on how easy they are to compose and connect to **D3-M30.** Ability to create thematic execution	Providers can indicate which guidelines each of their services is compliant with and this will be presented in the EOSC Marketplace and available as a possible filter for search and selection. E.g. a service in the marketplace/explore is marked as compliant with the EOSC AAI if it can be accessed through the AAI federation.	EOSC IF Registry EOSC Service Providers Dashboard

	environments/VREs based on integration of compliant thematic, horizontal, and core resources IF registry integrated with the Resource Catalogue, Marketplace, and Explore		
Derived from HLR milestone	EOSC IF registry prototype. Piloting the ability of providing specific configurations for the specific guidelines (e.g. actual API URLs), to enable automated reuse	EOSC IF registry: IF guideline configuration profiles.	EOSC IF Registry

4.4 Monitoring

The EOSC service availability and reliability monitoring (EOSC Monitoring) is a key service that provides insights into an infrastructure, the applications, services, and even into processes/behaviours. The EOSC Monitoring service has been implemented in EOSC Future through the ARGO Monitoring Service. It monitors services by emulating typical user scenarios, which allows them to infer the quality of service the actual user gets. It mimics the actual end-user behaviour without requiring special privileges or special configurations from the service provider side. The ARGO Monitoring Service offers near real-time status updates which allow both end-users and site administrators to have an overview of the status of a service offering at any given point in time. The major objective of the monitoring system is to quickly identify and correlate problems before they affect end-users and ultimately the productivity of the services, the infrastructure and, finally, the organisation.

The high-level architecture of the EOSC Monitoring service is shown Figure 4-5. It collects status (metrics) results from one or more monitoring engine(s) and delivers daily and/or monthly availability (A) and reliability (R) results of distributed services. Both status results and A/R metrics are presented through a Web UI, with the ability for a user to drill down from the availability of a site to the individual test results that contributed to the computed figure.

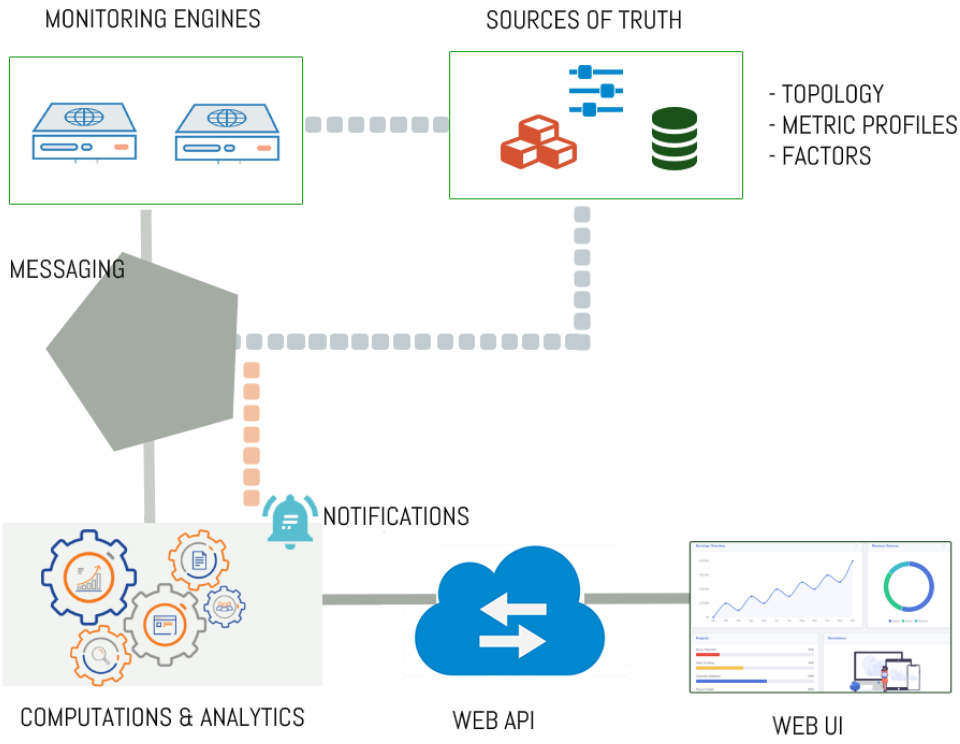

Figure 4-5: High-level architecture of a monitoring service.

4.4.1 Users

Users of EOSC monitoring are the following:

- ***EOSC-Core* providers** to monitor their service Availability, Reliability and Status.
- ***EOSC-Exchange* providers** to monitor their service Availability, Reliability and Status.
- **EOSC Service Registry** to enrich the Providers Portal dashboard with Availability, Reliability and Status information.
- **EOSC Marketplace** to enrich the service offerings with Availability, Reliability and Status information.
- **EOSC Recommender System**: The recommender can fetch the A/R and status results of the resources.
- **End users** may observe service Availability, Reliability and Status in the marketplace.

4.4.2 Functional requirements

Table 4-4: EOSC Monitoring functional requirements.

Channel	Title	Description	Affected components
Derived from HLR milestone	**D4-M30.** The onboarding process allows for automated/self-service integration with some EOSC-Core functionalities **D5-M30.** The onboarding process for resources is extended to include more optional integration steps in the same workflow **E4-M30** EOSC Monitoring	Enhanced integration of the EOSC Provider Portal with the Monitoring Service. The integration of EOSC Exchange services with the EOSC Monitoring via the Provider Portal is simplified and automated as much as possible.	EOSC Provider Portal

Derived from HLR milestone	**A3-M30**. Researchers can gauge the quality and suitability of resources based on usage statistics and feedback from other services **E4-M30.** EOSC Monitoring	Integration of the EOSC Resource Catalogue and Marketplace with the Monitoring Service. The Marketplace and the Provider Portal will include Monitoring Data (status, A/R) in the resource entries.	EOSC Marketplace, EOSC Provider Portal
Derived from HLR milestone	**E4-M30** EOSC Monitoring	Status Pages about Core Services. A service to display the latest status about the EOSC Core services.	EOSC Monitoring
Derived from HLR milestone	**D4-M30.** The onboarding process allows for automated/self-service integration with some EOSC-Core functionalities **D5-M30.** The onboarding process for resources is extended to include more optional integration steps in the same workflow **E4-M30** EOSC Monitoring	Automated/self-service integration of monitoring probes and metrics offered to EOSC-Exchange providers. The EOSC Exchange dashboard will offer to the providers the possibility to integrate new monitoring probes and metrics. In that way, providers will be able to customise the monitoring of their services according to their features.	EOSC Exchange Dashboard

4.5 Service Accounting

The Accounting System is a platform that is responsible for collecting, aggregating, and exchanging the metrics between different infrastructures, providers, and projects.

Essentially, the main functions of the platform are expressed by a REST API. Therefore, the primary duties of the API are the following:

- Accepting input from several different resources.
- Storing the input into a database.
- Aggregating the incoming input.
- Offering the aggregated input to several different clients.
- Request accounting data for a specific time period.
- In addition, API resources must only be obtainable by authenticated clients. For this reason, every client who wants access to API resources must be authenticated.

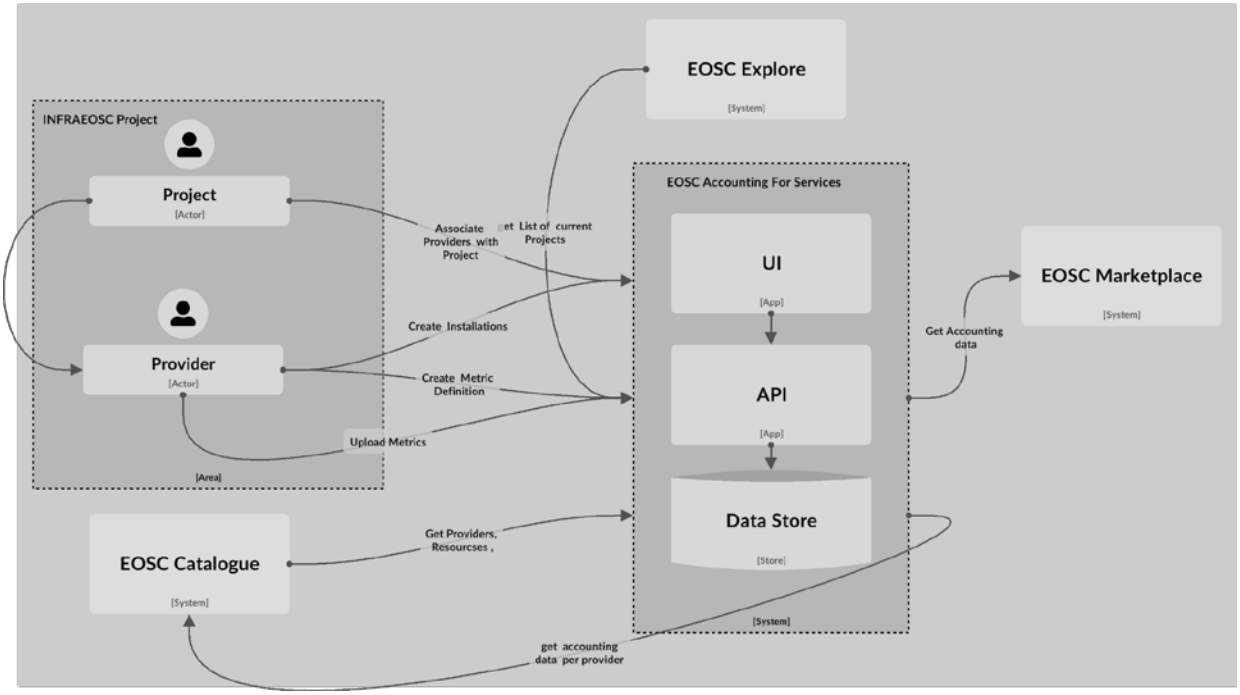

Figure 4-6: Diagram of the Accounting service.

4.5.1 User requirements

For resource consumers, user requirements are:

- Aggregated views of their usage wherever that usage occurred.
- Views that allow usage to be checked against allocation.

For resource providers, user requirements are:

- Provider-centric views of resource usage by user.
- Views that allow comparisons to be made between resource providers within and between regions and communities.

4.5.2 Functional and non-functional requirements

This section lists functional and non-functional requirements derived from the High-Level Roadmap at M30, regarded as high priority to EOSC Service Accounting.

Table 4-5: Service Accounting functional and non-functional requirements derived from the High-Level Roadmap at M30.

Channel	Requirement	Description	Affected components
Derived from HLR milestone	**D4-M30.** The onboarding process allows for automated/self-service integration with some EOSC-Core functionalities **D5-M30.** The onboarding process for resources is extended to include more optional	Integration of accounting in the EOSC Provider Portal. EOSC Exchange providers can request integration with the EOSC Accounting for services via the Provider Portal	EOSC Service Accounting

	integration steps in the same workflow		
Derived from HLR milestone	**A3-M30.** Researchers can gauge the quality and suitability of resources based on usage statistics and feedback from other services	Integration of accounting for services in the EOSC Marketplace. The Marketplace will include Accounting Data in the service entries.	EOSC Service Accounting
Derived from HLR milestone	**A3-M30.** Researchers can gauge the quality and suitability of resources based on usage statistics and feedback from other services	Usage statistics of the research products are available into the EOSC Marketplace. Usage statistics are embedded into the EOSC Resource Catalogue and exposed in the Marketplace. Usage statistics can be also retrieved via API.	EOSC Service Accounting

4.6 Research Product Accounting

The Research Product Accounting service is able to aggregate, from data sources (via push and pull protocols), usage indicators for different types of EOSC research products at the level of PIDs. Usage indicators are manifested by full research products download and counts of metadata views. The service exploits open standards and protocols for both collecting and exporting data and integrates the aggregated usage statistics with the EOSC Research Products. It is powered by the OpenAIRE UsageCounts service[6].

The OpenAIRE UsageCounts service collects usage activity from events related to research products of the EOSC Research Graph and creates and deploys aggregated statistics for these products.

Registration to the service is via the EOSC Service Provider Dashboard when an EOSC Research product onboarding is requested. The process is depicted in Figure 4-7.

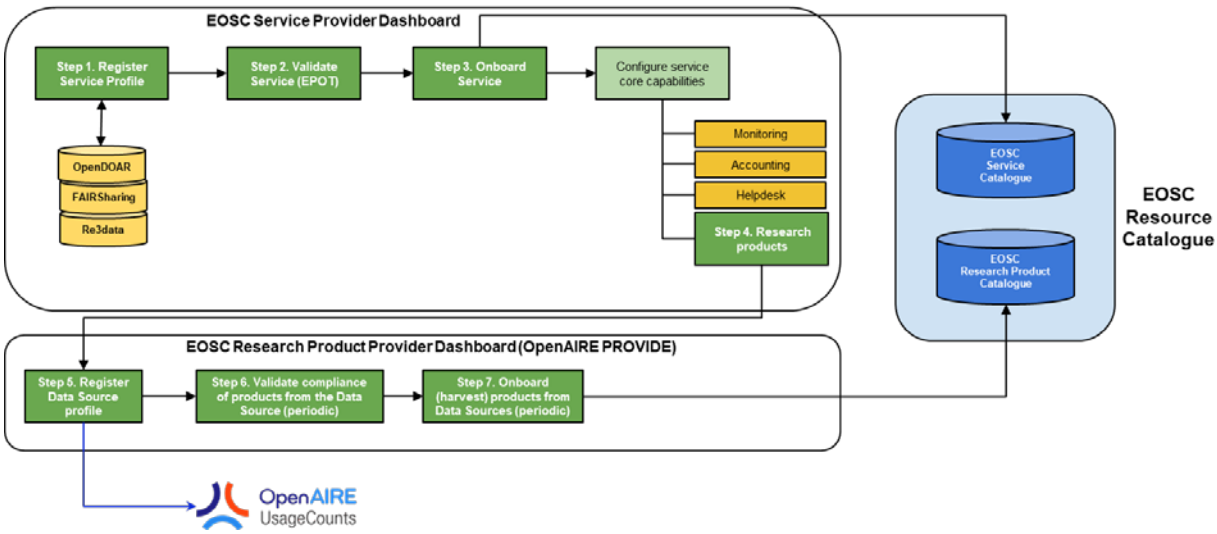

Figure 4-7: EOSC Research Product Accounting Registration.

[6] https://usagecounts.openaire.eu/

The UsageCounts service architecture comprises two approaches or workflows:

PUSH Workflow:

- Server-side real-time tracking using Matomo's Analytics Platform API.
- Generic Log file parser: A Python script that parses log files and sends the usage events to a Matomo Analytics platform (not in real time).
- IP Anonymization is supported.

PULL Workflow

- Collecting consolidated statistics reports from aggregation services using protocols such as SUSHI-Lite.

A pictorial view of the UsageCounts service architecture is depicted in Figure 4-8.

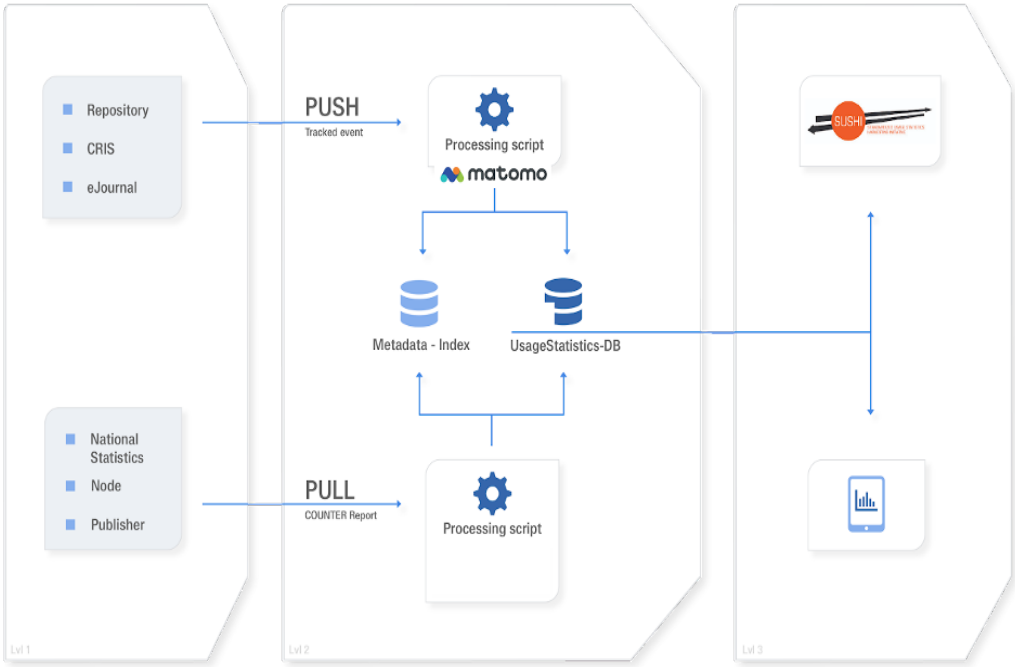

Figure 4-8: UsageCounts service architecture.

User requirements of Research Production Accounting are:

- Provides standards for usage data exchange (OpenAIRE Usage Statistics Guidelines);
- Complies to COUNTER Code of Practice[7] and COUNTER CoP for research Data;[8]
- Follows GDPR guidelines.

4.6.1 Functional requirements

The functional requirements of Research Product Accounting are as follows:

- Exports different types of reliable and comparable reports following standards and in particular the COUNTER CoP.
- Offers accurate and objective performance measures monitoring of EOSC research products and services.
- Supports evidence based analytical metrics of views and downloads, aggregated from all over the world.

[7] https://www.projectcounter.org/code-of-practice-five-zero-two/
[8] https://www.projectcounter.org/code-of-practice-rd-sections/foreword/

- On the individual item level, the statistics provided can demonstrate popularity and are considered an important indicator to analyse trends.

4.6.2 Non-functional requirements

The non-functional requirements of Research Product Accounting are as follows:

- Use of PIDs for Research Products.
- SUSHILite API[9] support for exchanging accounting information.
- Integration with EOSC Portal.

In addition to the above functional and non-functional requirements, the following requirements are derived from the High-Level Roadmap at M30, regarded as high priority to EOSC Research Product Accounting.

[9] https://app.swaggerhub.com/apis/COUNTER/counter-sushi_5_0_api/5.0.2

Table 4-6: Research Product Accounting requirements derived from the High-Level Roadmap at M30.

Channel	Requirement	Description	Affected components
Derived from HLR milestone	Usage tracking of EOSC Graph Research products (publications, datasets, etc)	EOSC research product onboarding via EOSC Service Provider Dashboard **A2-M30**. The research products will be available in the prod EOSC Resource Catalogue with usage statistics indicators.	EOSC Service Provider Dashboard EOSC Research Product Accounting
Derived from HLR milestone	Users will be able to share and view Research Product usage statistics via the EOSC Portal or APIs	**A-M30.** Exports different types of reliable and comparable reports following standards like COUNTER CoP	EOSC Research Product Accounting

4.7 Messaging

The ARGO Messaging Service (AMS) is a Publish/Subscribe Service, which implements the Google PubSub protocol[10]. Instead of focusing on a single Messaging API specification for handling the logic of publishing/subscribing to the broker network the API focuses on creating nodes of Publishers and Subscribers as a Service. It provides an HTTP API that enables Users/Systems to implement message-oriented service using the Publish/Subscribe Model over plain HTTP.

The features of this service include:

- Ease of use: It supports an HTTP API and a Python library to easily integrate with the AMS.
- Push Delivery: AMS instantly pushes asynchronous event notifications when messages are published to the message topic. Subscribers are notified when a message is available.
- Replay messages: replay messages that have been acknowledged by seeking to a timestamp.
- Schema Support: on demand mechanism that enables a) the definition of the expected payload schema, b) the definition of the expected set of attributes and values and c) the validation for each message if the requirements are met and immediately notify client.
- Replicate messages on multiple topics: Republished script that consumes and publishes messages for specific topics

4.7.1 User requirements

EOSC-Core components are the main users of the EOSC Messaging Service.

- Component will use the Schema Support to validate messages exchanged with other components.

4.7.2 Functional requirements

Functional requirements at M30 for Messaging are the same than the ones at M18 and there were no updates since the previous version of this deliverable:

- Offer publish functionality to clients.
- Offer push delivery functionality to automatically push messages to verified remote endpoints.
- Offer pull functionality to clients for consumption of messages.
- Offer replay mechanism of messages.
- Offer Configurable retention policy per topic/project.

[10] https://cloud.google.com/pubsub/docs/overview

- Support of different authentication methods.

4.7.3 Non-functional requirements

Non-functional requirements at M30 for Messaging are the same than the ones at M18 and there were no updates since the previous version of this deliverable:

- Define the schema(s) for the messages to be exchanged.
- Be able to scale out as required by the usage.
- Verification process for remote endpoints as destinations to push delivery.

4.8 Helpdesk

The EOSC Helpdesk developed and deployed in the EOSC-hub project contains all basic features of a helpdesk system needed to provide effective user support, such as a form to submit a ticket, ticket search, email notifications on change of the ticket status. The EOSC Helpdesk has been integrated with the EGI and EUDAT Helpdesks and some of the onboarded CESSDA services to deliver a unified support system for EOSC users. The helpdesk's support unit structure is organised in three levels and comprises multiple Support Units (SU) for effective resolution of the incidents and user requests. The workflows and tickets triage is organised according to the established procedures of the Incident Service Request Management (ISRM) process within the EOSC *Service Management System*[11] (SMS).

Although the deployed EOSC Helpdesk has delivered basic functionality, it has to be mentioned that in the modern IT infrastructures the helpdesk service provides a much richer set of functions which are not limited only to the tracking of the issues submitted by the users and resolution of service incidents. Consultations with several EOSC communities and related projects have identified a set of requirements for the helpdesk in the federated EOSC environment. The requirements are strongly coupled to the target groups and their roles in EOSC. For simplicity two main groups are considered: users and service providers. The users typically create incidents or service requests, and service providers or supporters act as helpdesk agents and resolve addressed tickets assigned to them.

4.8.1 User requirements

The major requirements from the user or requester perspective can be summarised as follows:

- Creation of a ticket for any EOSC Resource, service, process or procedure.
- Ability to use a helpdesk portal to access and manage all created tickets.
- Modern and responsive interface.
- Access to the helpdesk via EOSC Portal AAI.
- Multiple possibilities to submit tickets: e-mail submission, web portal, webform on the portal of dedicated service.
- Ability to perform search related to the information before creation of the ticket (access and search in the knowledge base).

The major requirements from service providers, EOSC communities and supporters (in the case where they would like to use the EOSC Helpdesk as a service for their users) are:

- Generation of tickets by e-mail or dedicated web-form, available on community or service portal.
- Multiple support units with possibility to move tickets between them.
- Possibility to build units' hierarchy and implement subgroups for different support divisions.
- Role management and access rights management.
- General email address e.g., support@communityX.eu, additional emails addresses for support units with powerful spam filters. (This requirement is not to be implemented for any support unit by default. The direct email addresses will be added only in some special cases upon the community); request.)
- Access to the helpdesk via EOSC Portal AAI.
- Possibility to define auto-response and templates for answers per support unit.

[11] https://wiki.eoscfuture.eu/display/EOSCSMS/EOSC+SMS+Home

- Automatic routing of the tickets submitted to the central EOSC Helpdesk to a dedicated community support unit depending on defined rules and workflows.
- Dedicated community Helpdesk Portal with self-support functions.
- Flexible notification management: notifications can be configured by the community or supporters per support unit.
- Statistics and KPI assessment for tickets, e.g., first contact resolution rate, average time to first response, average resolution time, user satisfaction etc. should be possible.

4.8.2 Functional and non-functional requirements

The EOSC Helpdesk will be evolved and enhanced in the scope of the EOSC Future Project. The following functional and non-functional requirements towards M30 for the successful delivery of the Helpdesk to EOSC and as-a-service to EOSC communities, which are mapped to the HLR milestones are summarised below in the table:

Table 4-7: EOSC Helpdesk functional and non-functional requirements.

Channel	Title	Description	Affected components
Derived from HLR milestone	**E7-M30 Helpdesk** • *Core services* • *Exchange services* Helpdesk-as-a-service available as optional add-on during onboarding. Integrated with central helpdesk functions.	• Possibility to implement dedicated community Helpdesk Portal with self-support functions. • Helpdesk knowledge base to enhance self-support functions on the dedicated portals of EOSC communities is available. • Flexible notification management: notifications can be configured by the community or supporters per support unit.	EOSC Helpdesk, Portal Provider Dashboard
Derived from EOSC Future Technical Roadmap D3.3.	Enhanced integration of the EOSC Provider Portal & Marketplace with the Helpdesk Service	• Helpdesk provides its webforms for submission of feedback/incident reporting on the multiple marketplace and provider portal pages	EOSC Marketplace, EOSC Providers Portal
Derived from the feedback provided at EOSC Symposium	Group management granted to Agents	• Implementation of group leader role in the helpdesk which allows to manage the access of the agents in the dedicated support team.	EOSC Helpdesk

Derived from the requirements of the EOSC Portal Onboarding Team (EPOT)	Notification of multiple groups on the ticket	• Implementation of functionality which permits adding more groups as observers for a ticket.	EOSC Helpdesk
Derived from the requirements of EOSC Future WP5	Delivery of the Helpdesk for training catalogue and learning platform	• Definition and delivery of the helpdesk structure, workflows and procedures for Training catalogue and learning platform	EOSC Helpdesk
Derived from the requirements of EOSC Future WP5	Integration of the EOSC Helpdesk with multiple providers in the scope of delivery of the Helpdesk for training catalogue and learning platform	• Full integration of the EOSC Helpdesk with: ▪ OpenAIRE Helpdesk ▪ LifeWatch Helpdesk ▪ other providers of learning resources	EOSC Helpdesk OpenAIRE Helpdesk LifeWatch Helpdesk

The other set of non-functional requirements is focused on stable delivery of the service which is guaranteed by operation of the service in a dedicated data centre at KIT with defined backup and recovery procedures.

5 Conclusions

This deliverable provides an updated overview of the requirements analysis of the EOSC Back-Office during the second phase of the project: the requirements derived from the High-Level Technical Roadmap covering the needs of the resource providers, which have been then analysed for all components comprising the Back-Office.