EOSC Future

D4.2a

Back-Office Requirements Analysis

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D4.2a / 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 changes are 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 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 for all components comprising the Back-Office.

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

2 Introduction

This deliverable contains a detailed report of the technical requirements and their analysis for the EOSC Portal Back-Office. 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. 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. 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, the method of delivery of the EOSC Portal, new services or possibly a revised approach to how EOSC meets the needs of its users.

Requirements gathering and analysis for the components that form the *EOSC-Core* have not been done solely within EOSC Future project-the majority of the *EOSC-Core* components have been developed in previous projects. Section 3.1 presents a brief description of past projects work on setting the context for the work performed under EOSC Future.

The EOSC Future HLR covers the requirements addressing the needs of the resource providers, which are then analysed from a functional point of view and presented in Section 3.2. Another important aspect of the requirements gathering process originates from the point of view of the user, the different types of users and their needs. This process is covered in Section 3.3.

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 and Monitoring) it is not possible to easily map requirements to the HLR. In these cases, requirements are listed as a list of functional and non-functional requirements.

3 Requirements Gathering

3.1 Requirements from Past Projects

3.1.1 EOSC-hub[1]

The EOSC-hub project is one of the projects that preceded EOSC Future. At the beginning of the EOSC-hub project, the term 'Core Services' which now underpin the Back-Office had not been conceived. However, this project incorporated a number of federating and collaboration services; some of which would later – towards the end of the project – be regarded as components of the 'EOSC Federating Core': AAI, Marketplace and Order Management, Integrated Business and Operations Support, Monitoring, Accounting, Messaging and Security Tools and finally the Helpdesk. These services were delivered and enhanced as part of EOSC-hub due to integration and maintenance functional requirements within the project. There was not a focus on requirements gathering *per se* within the project. However, the project was able to register, validate and process new requirements by making use of a Jira-based ticket management system. In this way, the requirement to incorporate an introduction of an EOSC Portal (not initially planned for within the project) was accommodated and implemented within EOSC-hub.

Within EOSC-hub, all activities relating to requirements gathering and the integration of new functionality via the development of the different services, were documented in three project deliverables:

- D5.1 Initial maintenance and integration plan for federation and collaboration services[1];
- D5.3 1st Report on maintenance and integration of federation and collaboration services[2];
- D5.5 2nd Report on maintenance and integration of federation and collaboration services[3].

To summarise, as a result of work done in EOSC-hub, many of the EOSC Back-Office services benefitted from early alignment with the first incarnation of EOSC within the EOSC-hub project.

3.1.2 EOSC Enhance[2]

The EOSC Enhance project started before EOSC Future and partially overlapped with EOSC Future. The project focused on enhancing the value of the EOSC Portal, harmonising the human and machine interfaces, getting consensus on the data model and merging the databases of services onboarded by previous projects (EOSC-hub and eInfraCentral), as well as establishing the deployment environment that will support the sustainable growth of the EOSC Portal. EOSC Enhance divided the architecture into three functional components: the **Content Component**, **User Component** and **Provider Component**. The three functional components of the EOSC Portal were incorporated in the extended architecture of the *EOSC-Core* platform, fully described by the EOSC Future. EOSC Enhance besides the Portal evolution also served the reinforcement of the EOSC Portal value by building up the wider users' community. Several user workshops that were carried out during the project course brought a set of requirements that helped to shape the course of the EOSC Enhance project and created the baseline for the EOSC Future requirements gathering process for the segment of the functionality relevant to the EOSC Portal. The requirements gathered during EOSC Enhance have been documented in the relevant project deliverables, as well as handed over to EOSC Future with the use of a Wiki platform (Confluence):

- D5.2 - EOSC Portal requirement[4];
- D5.3 - EOSC Portal requirements (update)[5];
- D2.3 - EOSC Processes Development and Consensus (update)[6];
- EOSC Portal New Requirements-Backlog to EOSC Future project[7];

3.2 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 proposal preparation taking into account the requirements collected from all the major

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

past EOSC projects and initiatives (EOSC-hub, EOSC Enhance, 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 in different categories that include requirements of 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 M18 – the requirements for M30 will be covered in the subsequent updates of this deliverable.

All the categories are listed in the table below together with a short description and the main technical requirements from 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 M18
A. User Experience - Resource Sharing and Discovery	Enabling easy discovery, access and sharing of a wide set of resources in EOSC	• Extending the EOSC Resource Catalogue to include datasets and other research artefacts (e.g. publications, software, etc.). • Enable the onboarding of third parties service/resource catalogues in the EOSC Resource Catalogue. • Community catalogues connected to the EOSC Resource Catalogue can import resources from it. • The datasets that are available in the EOSC Resource Catalogue are enriched with usage statistics indicators visible to end-users. • Resources onboarded in EOSC can be integrated with *EOSC-Core* services (AAI, helpdesk, Monitoring and Accounting, etc) following the interoperability guidelines of the *EOSC Interoperability Framework*. • The EOSC Resource Catalogue allows easy identification of special categories of services like the horizontal ones.
B. User Experience - Resource Allocation	Enabling the discovery and access to the EOSC IT resources	• The EOSC Resource catalogue offers mechanisms to easily identify EC-funded resources and retrieve information about their access policies through the EOSC Portal or community portals. • The EOSC Order Management supports Virtual Access and other EC funding models.

[3] https://www.openaire.eu/advance/

C. User Experience - Resource Composability	Enabling easy resource composability	• Researchers can identify and access computing resources provided by e-Infrastructure resource providers navigating on the EOSC Resource profile through the EOSC Portal or a community portal. • Researchers can select the resources that best fit with the requirements of her/his workflow and access them thanks to the extension of the EOSC Resource profile to describe compute resources (information about interfaces, access models, etc). • An extension of the EOSC Resource profile to describe storage systems will allow researchers to easily identify protocols to transfer back the output of an analysis to her/his storage system. • Researchers can identify compute resources and data management tools that can interoperate thanks to resource bundle concept.
D. *EOSC-Exchange*	Enrich the *EOSC-Exchange* with a wide set of different types of resources and expand its capabilities	• Extending the EOSC Resource Catalogue to include datasets and other research artefacts (e.g. publications, software, etc.). • Provide interfaces (e.g. S/W interfaces, APIs, etc) to integrate *EOSC-Exchange* resources with tools of the EOSC Portal Back-Office.
E. *EOSC-Core*	List of new features to be supported by *EOSC-Core* elements derived from requirements in categories A, B, C and D.	• Detailed technical roadmaps for EOSC Portal Back-Office tools: EOSC Resource Catalogue, Order Management, Monitoring, Accounting, Helpdesk.
F. Clusters and Science Projects	Roadmap to deploy the EOSC Future Science Projects in EOSC	• Requirements for EOSC Portal Back-Office tools collected from the Science Projects.
G. *EOSC Interoperability Framework*	Delivery interoperability frameworks for *EOSC-Core* and *EOSC-Exchange* resources	• The *EOSC-Core* services support the interoperability frameworks for *EOSC-Core*. • The EOSC Resource Catalogue store information about the compliance of a resource against a given interoperability framework. • An EOSC IF database/directory is developed as a part of the EOSC Portal Back-Office.

		• The Order Management and the execution framework support composability.

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 to shape the roadmap for each tool of the EOSC Portal Back-Office.

However, although the HLR has been the main input to define the WP4 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 project course into the overall EOSC Portal technical roadmap. WP4 is a key actor in this process responsible to assess the requirements related to the Back-Office tools and properly update its technical plans when a requirement is accepted. This process is detailed in the next section.

3.3 Requirements Engineering Process for *EOSC-Core* platform

Requirements Engineering Process (REP) describes the way the requirement flow is modelled from the first insight to the reporting. REP is subsidiary to the High-Level Roadmap (HLR) planning process and assumes that the implementation schedule and direction is linked with the timeline of the HLR by performing appropriate analysis and design. It allows to glue the high-level planning with the collection of insights needed to correctly address solutions for bridging identified technical or functional gaps. The process definition doesn't start from scratch and is based on the experiences gained through the implementation of the EOSC Enhance project. The process documented in the EOSC Enhance deliverable *D2.3 EOSC Processes Development and Consensus (update)*[8] has been revised and adapted to the scope of the EOSC Future environment. The elaborated consensus on the process makes it usable for all other EOSC- Core platform components and allows to align the requirement gathering activities of the project WP4 and WP5 regardless the different nature of requirements, different target groups and vastly different approaches to requirement gathering and analysis.

The primary goal of this process is to structure the requirements engineering from insights elicitation to the reporting.

The process covers the following objectives:

- Gathering and structuring requirements for the *EOSC-Core* platform;
- Analysis of requirements and identification of technical gaps;
- Design of the solutions bridging identified technical gaps and responding to elicited requirements;
- Linking the process of collected user requirements with the High-Level Roadmap planning.

The process does not cover:

- Related stakeholder consultation activity based on the Stakeholder Engagement Plan;
- Related UX Process;
- Related HLR Planning Process.

The process is described in the two diagrams presented below; one (Figure 3.1) focusing on the various process phases and the second (Figure 3.2) focusing on the activities required to be implemented at the various phases.

Figure 3.1 below focuses on the states of the requirements and briefly describes the actions linked with the state transitions. It is helpful when trying to understand the scope of each action, as well as the accompanying implementation with the use of an issue tracking system of choice.

The states documented in Figure 3.1 have been divided into activity groups and associated teams. Relevant information is passed between the teams via the issue tracking system – specifically comments made against an issue (i.e. requirement) as it transitions between the states. The roles of the groups are representing by the following semantics:

Requirement gathering and structuring

- **New** – insight collected;
- **Invalid** – insight definition is incomplete or misleading, even after clarification attempts are made with the requestor;
- **Needs clarification** – requirement previously structured needs clarification from the author or other relevant stakeholder.

Analysis and design

- **Structured** – structuring completed with all the mandatory insight attributes provided. The insight becomes a requirement;
- **Relevant** – relevant for an ongoing analysis and design or awaiting planned analysis;
- **Rejected** – rejected in analysis and design process;
- **Pending** – analysis and design completed. Requirement is awaiting planning.

Planning

- **Planned** – requirement scheduled for implementation.

Delivery

- **Implemented** – solution has been provided and deployed in production.

The second diagram describing the process focuses on the actions needed to execute the process and presents the needed decisions, action causes and their consequences (Figure 3.2). Phases of the process and the corresponding roles have been indicated in both Figures. The colour codes for the respective phases are matched in both Figures for the reader's convenience.

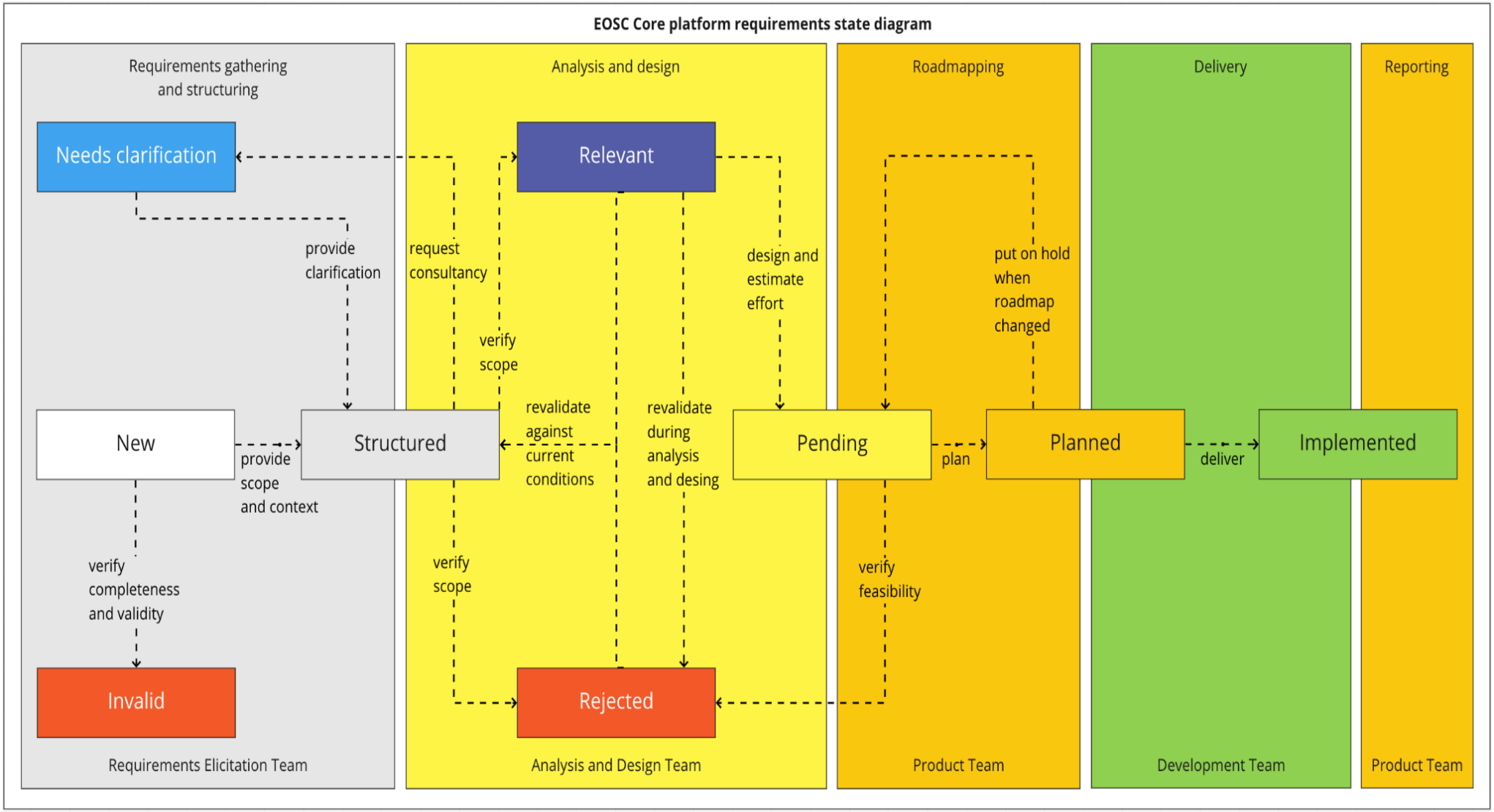

Figure 3.1: EOSC-Core platform requirements state diagram

Figure 3.2: Requirements Engineering Process for EOSC-Core platform

3.3.1 Requirements Template

A Requirement Template represents a set of insights or requirement's attributes that correspond to the respective roles in the process and cover respective phases of the REP. For each phase the requirement template offers a set of attributes allowing to gather the relevant information introduced in this phase. The following specification supplemented by the definition of the system functional and technical components has been mapped to an issue tracking system ticket structure.

Table 3-2: Requirement's template

Phase	Requirement template field	Example field values
Requirements gathering	ID	System-generated identifier which is automatically generated
	Channel	E-mail, online survey, interview, HLR etc.
	Title	Short description of the proposed requirement
	Problem to be solved / user need	What problem is the user trying to solve? What does the user need and want? What will the user achieve when the requirement is met?

	Related use cases, real life scenarios	Example: I'm a climate scientist. I'm looking for a specific set of data from Africa about the temperature distribution in Kenya. But I have no idea where to find such data.
	Where did the user find the problem / expect solutions to be found?	Link, picture, place in the Portal etc.
	User importance factor	Prioritization assigned by user: Not important, Important, Crucial
	Known constraints and considerations (provided by user)	Rules and limitations (e.g., time, resource, funding) that may dictate how the requirement is carried out.
	User group(s) benefitted	Who will benefit from the result of the implementation? • Researchers • Service Providers • Content Providers • Research communities • Research projects • Private companies • Founders
	Author(s) affiliation	Who proposed the requirement? Organization name
	Contact point	Who should be contacted to provide the details/ verify results? e-mail, other preferable contact channel.
Requirements structuring	Affected functional components	Part of the functionality affected by the desired requirement (i.e. one or more EOSC services)
	Affected processes	Affected processes by the potential solution e.g. Resource Onboarding Process, Order Management Process.
	Prioritization	Assigned prioritization (MoSCoW): must have, should have, could have, won't have.
	Other known constraints and considerations	Rules and limitations (e.g., time, resource, funding) that may dictate how the requirement is carried out.
	Identified target group(s)	• Researchers • Service Providers • Content Providers • Research communities • Research projects • Private companies • Founders
	Other parties potentially involved	Who will also be affected / take part in the process defined by the desired functionality/ requirement? (stakeholders/ infrastructures).
Analysis and design	Analysis and estimated effort	Link to the specification of the design and estimated effort analysis. Specification defines estimated effort to implement the overarching design concept with a feature set including the requirement.

Planning	Estimated delivery	Estimated delivery date for the overarching functionality planned.

3.3.2 Roles in Requirements Engineering Process

The following roles are relevant in the context of this process and need to be assigned to persons or teams/ groups involved in the process.

Table 3-3: Roles in Requirements Engineering Process

Role	Tasks
Requirements Elicitation Team member **RET**	• Elicit insights / requirements • Provide scope and context for the new insights • Verify completeness and validity of the new insights • Consult authors / stakeholder to provide clarification for insights/ requirements when needed
Analysis and Design Team member **ADT**	• Verify scope of the structured requirements • Revalidate relevant requirements against current conditions • Perform needed analysis and design for the overarching functionality for which requirements are relevant
Product Team member **PT**	• Based on a design concept specifications and estimated effort analysis prepare the tasks planning for the High-Level Technical Roadmap (HLR) • Verify HLR tasks feasibility • Periodically verify the status of the HLR tasks implementation • Report the HLR implementation progress based on the statuses of the roadmap tasks • Report deviations from the estimated delivery
Development Team member **DT**	• Based on the HLR schedule deliver functionalities needed to complete design concepts implementation • Report requirements implementation status • Report reasons for deviations from the estimated delivery date

3.3.1 Artefacts of Requirements Engineering Process

Process artefacts are 'things' that are required, produced or processed by the process or one of its activities. The following objects are relevant:

Table 3-4: Artefacts of Requirements Engineering Process

Process artefact	Description
Insight	A set of user needs identified during requirements elicitation. Structure of an insight is defined, be the Requirement Template.
Requirement	An insight structured by the Requirement Elicitation Team by refining problem descriptions, assigning known *functional* and *technical components*, *processes potentially affected by implementation*, *identifying constraints for the solution*, *target groups* and *parties potentially involved, and applying initial priority*. Structure of a requirement is an extension of an insight structure. Both follow the specification of the Requirement Template.

High-Level (Technical) Roadmap (HLR)	A master High-Level Roadmap defining high level areas of implementation, milestones, and technical tasks (HLR tasks).
HLR task	High level technical task describing a solution / design concept related to an identified technical gap and a set of requirements. Relevant requirements are referenced in the HLR task through the design of the specification.
Design concept	A specification for product improvement bridging the identified functional or technical gap and responding to a set of relevant requirements.
Functionality	A named solution for an identified problem elaborated in the design concept specification. e.g. Provider Portal Resource Dashboard.
Functional component	A named functional part of the system e.g. EOSC Monitoring for Exchange Services.

3.3.2 Activities of in Requirements Engineering Process

Requirement Engineering Process is defined based on four interrelated activities: **Requirements gathering and structuring, Analysis and design**, **Roadmapping and reporting,** and **Delivery**. These activities are performed one by one by the teams identified as groups of people with a corresponding role described in the Roles and artefacts paragraph. This paragraph documents the tasks needed to perform each of these activities as well as the influence on the requirement state they might have.

3.3.2.1 Requirements gathering and structuring

To be able to identify the needs of EOSC users, the EOSC Enhance project-initiated requirements gathering activities, which continue in the EOSC Future project. The purpose of these activities is to identify, collect, refine, analyse, and prioritize functional and non-functional requirements coming from all stakeholders, e.g., users, providers, and European Open Science Cloud implementation projects, to improve the *EOSC-Core* functionalities and the value proposition continuously, reveal insights on the needs of future EOSC users and increase the EOSC user base by guiding user-focused implementations.

The first EOSC Portal document regarding functional and non-functional requirements was released [4] and included a set of requirements to be further analysed. Since then, EOSC Enhance continued the work on the EOSC Portal development which together with the complete analysis of the remaining user requirements have been handed over to EOSC Future at the end of November 2021. EOSC Future work on enhancements has been ongoing and the updated set of requirements following the REP with the accompanying requirement structure and workflow will be documented in the successive deliverables.

From the REP point of view, the requirements gathering activity may be defined as either documenting insights gathered with stakeholders/user consultations or by conducting the consultations to revisit requirements that have been classified as requiring clarification:

- **New** – collected insight.
- **Needs clarification** – requirement previously structured needs a clarification from the author or other relevant stakeholder.

Requirement structuring in turn should be considered as a process that leads either to reducing the noise coming from incomplete or misleading insights or providing additional information described by the Requirement template:

- **Invalid** – insight definition is incomplete or misleading.
- **Structured** – structuring completed with all the mandatory insight attributes provided. The insight becomes a requirement.

The Requirements gathering and structuring (Figure 3.3) diagram documents the channels through which the requirements flow, the required steps needed to gather insights and the actions that are needed to structure gathered insights.

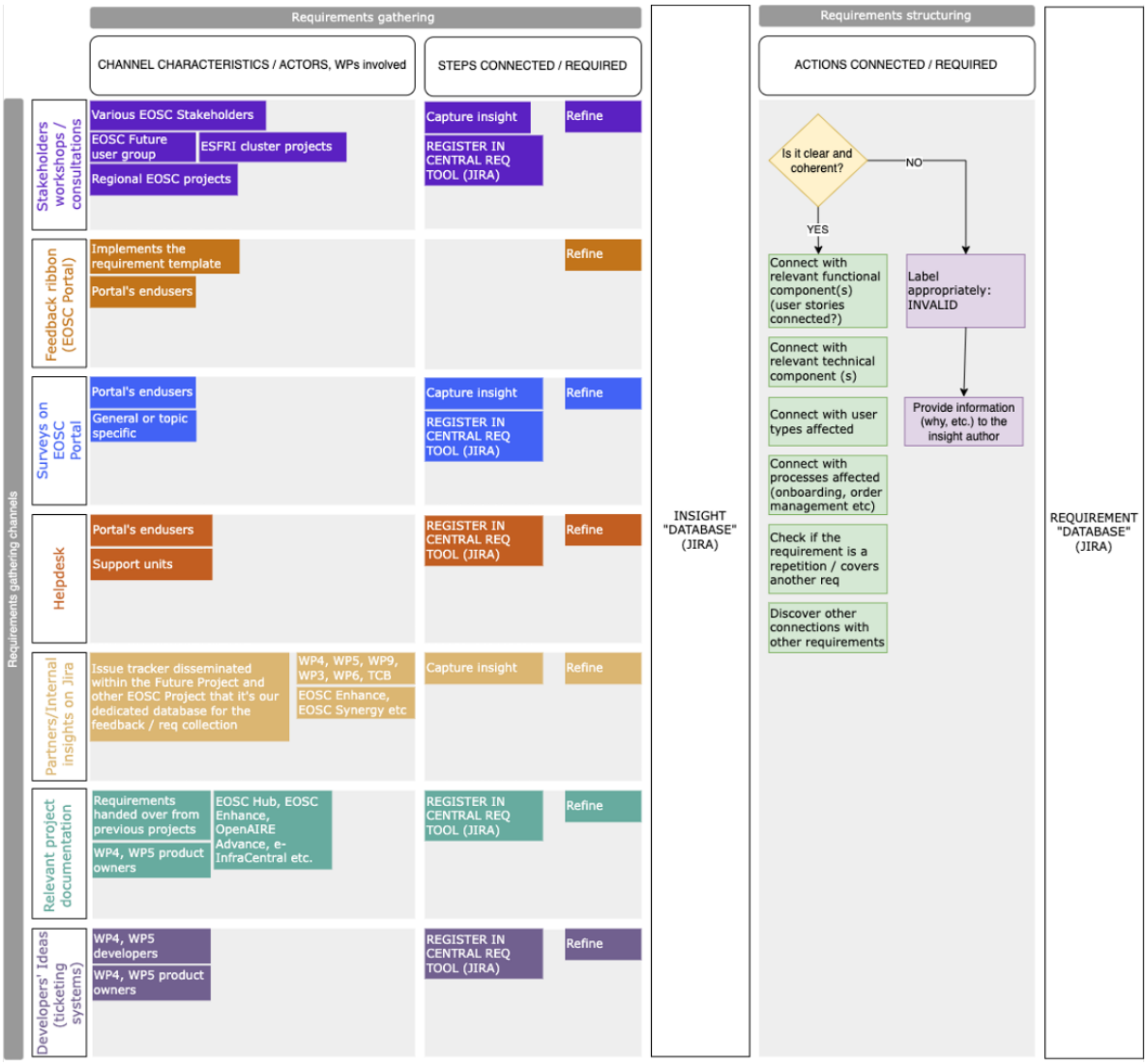

Figure 3.3: Requirements gathering and structuring

Table 3-5 presents the full list of actions in the scope of the Requirement gathering and structuring activity

Table 3-5: Requirement gathering and structuring

Inputs, required information	• Requirements needing clarification
Roles involved	• RET
Outputs	• Structured requirements • Invalid insights
Actions	• Elicit New insights based on the activities following Stakeholder Engagement Plan. • Verify completeness and validity of the new insights • Provide the scope and the context for the new insights • Based on the consultation with authors or relevant stakeholders restructure requirements that Need clarification.

3.3.2.2 Analysis and design

Analysis and design are the activities starting from reviewing the structured requirements and verifying their scope. The scope of the Back-Office platform constitutes the set of functional and technical components together with the set of the topics undergoing analysis and design conducted in the scope of the EOSC Back-Office User Experience Process. From the REP point of view the status of the analysis and design is represented by the four states in the requirement state diagram:

- **Structured** – structuring completed with all the mandatory insight attributes provided. The insight becomes a requirement.
- **Relevant** – relevant for an ongoing analysis and design or awaiting planned analysis.
- **Rejected** – rejected in analysis and design process.
- **Pending** – analysis and design completed. Requirement awaits implementation planning.

Table 3-6 documents the inputs, REP roles involved, outputs and actions that need to be performed in order to link the REP with the respective analysis and design activities:

Table 3-6: Inputs, REP roles involved, outputs and actions

Inputs, required information	• Structured requirements • Rejected requirements
Roles involved	• ADT
Outputs	• Design concept specifications • Pending requirements • Rejected requirements • Requirements needing clarification • Structured requirements
Actions	• Periodically verify scope of the Structured requirements • Based on a relevant process (e.g. Back-Office UX process) perform needed analysis and design for the overarching functionality with Relevant requirements. • Mark analysed requirements Pending or Rejected. • Periodically revalidate Rejected requirements against current conditions.

3.3.2.3 Road mapping and reporting

To frame the requirements engineering in the project that needs to ensure delivery of the main project goals there is a need to properly identify interfaces between the process of the High-Level Roadmap Planning and the Requirement Engineering Process.

From the REP point of view, it may be seen as the work focused on planning the implementation of the requirements for which the analysis and design has been completed. The implementation planning is performed based on the estimated effort analysis underpinned in the design concept that has been prepared. Based on the HLR changes, requirements already planned may return to the pending state. The requirement states relevant in this activity:

- **Pending** – Requirement analysed and awaiting planning.
- **Planned** – Requirement scheduled for implementation.

The Road mapping and reporting activity respond to this need with the following set of actions:

Table 3-7: The Road mapping and reporting activity.

Inputs, required information	• HLR • Design concept specifications • Pending requirements • Implemented requirements
Roles involved	• PT
Outputs	• HLR tasks • Planned requirements • Pending requirements • Rejected requirements • Implementation reports
Actions	• Periodically check for the HLR updates and reflect changes / requirement status updates during the design and analysis activity • Periodically check for the need to update the HLR tasks definitions with the changes in the Planned requirements / analysis and design findings. Propose the HLR changes • Periodically verify the status of Planned requirements connected to HLR tasks against estimated delivery date. • Report the HLR task progress based on the Implemented requirements.

3.3.2.4 Delivery

Delivery is the activity that maps the status of the development to the status of the source requirement. Considering that all the developed software solutions are mature and work with the use of their own issue tracking systems this part of the process is simplified to the bare minimum of states and transitions. The requirements already planned need to be implemented, which finalises the delivery. The following states are considered relevant for this activity:

- **Planned** – requirement scheduled for implementation
- **Implemented** – solution has been provided and deployed in production.

Table 3-8: The Delivery activity.

Inputs, required information	• Planned requirements
Roles involved	• DT
Outputs	• Implemented requirements
Actions	• Deliver functionalities needed to complete a design concept implementation.

4 Requirements Analysis

This section goes into detail about the gathering and analysis of requirements at the level of the different Back-Office components.

4.1 EOSC Service Catalogue and Provider Dashboard

EOSC Service Catalogue and Provider Portal are the back and front-end components that consist of the providers and services repository for the EOSC Resource Catalogue. The need for onboarding and management of Providers and Resources is fulfilled through these components. The EOSC Service Catalogue maintains an up-to-date map of the EOSC Resources, as offered by EOSC Providers, which are organisations approved or authorised to publish their respective EOSC Resources in the Catalogue. The types of EOSC Resources will eventually include providers, services, data sources, research products, and aggregates of all these in the form of third party catalogues.

Figure 4.14 gives a diagrammatic overview of the Resource Catalogue, its main components, and the ways they interact with each other and with external components and users.

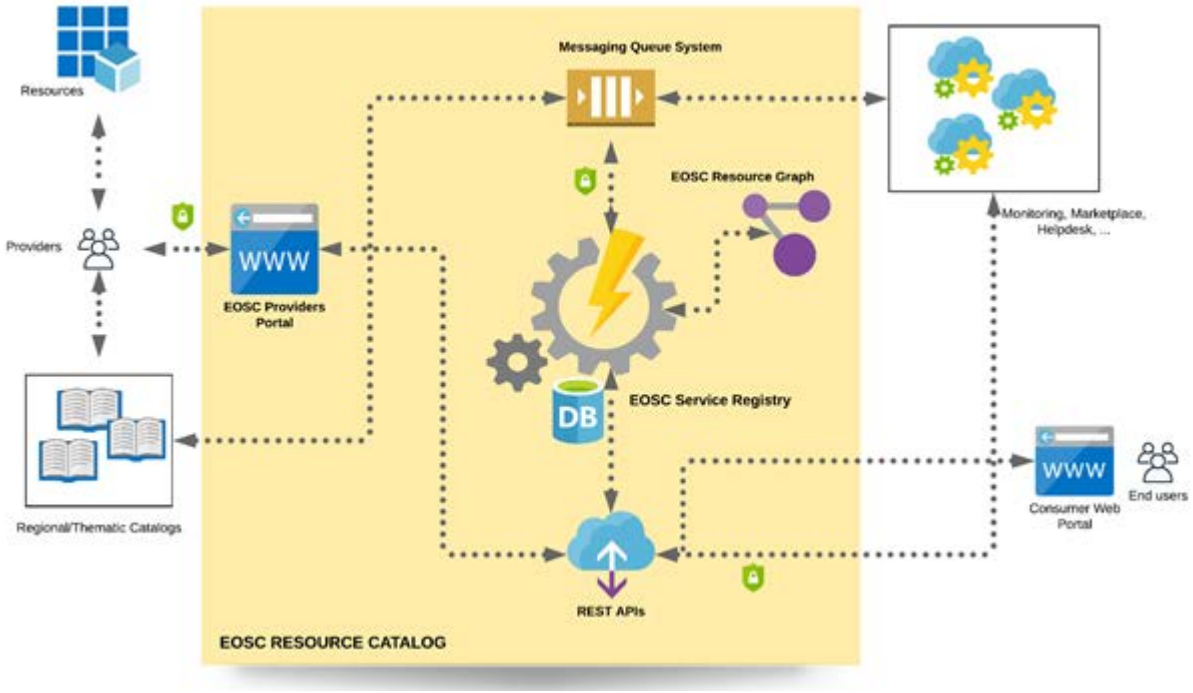

Figure 4.1: High level architecture

Already offered functionality includes:

- **Onboarding a resource,** which implements the EOSC Portal onboarding process, i.e., the registration of a new Provider and the registration of Resources managed by a Provider. Onboarding targets authenticated users who will be able to onboard either via a Web-based step wise process or programmatically by using the EOSC Registry's APIs to facilitate the onboarding.
- **Resource Management service**: It allows users to view the list of Resources assigned to their organisation and manage all characteristics of their offerings. Resource management also enables users to 'activate'/'deactivate' a Resource in the EOSC Portal, to assign it to categories or other classification schemes (e.g., scientific domain, TRL, etc), manage the different versions of a Resource and add new users who will be responsible for managing the offerings of a Provider.
- **Providers Dashboard** offers an overview to the users for the list of Providers, it represents the list of Resources and their properties including a history of changes applied to a Resource.
- Researchers using a thematic portal can access Resources (services, data) from the EOSC Service Catalogue.

- **Statistics** over the content of the registry, organised by Resources and Providers, such as number of Resources per scientific discipline, Providers per country, etc.

4.1.1 User requirements

Users of Service Catalogue and Provider Dashboard are:

- The EOSC Portal Onboarding Team (EPOT) team, which reviews onboarded Resources;
- The *EOSC-Core* components;
- Third party Regional and Thematic Catalogues and their Providers.

In the context of the EOSC Future, Service Catalogue and Provider Dashboard general user requirements are (respective to each user category):

- To provide better and easier reviewing/feedback functionality of onboarded Resources, on a more extended collection of Resources, stemming from the updated EOSC Profiles.
- To disseminate information to other *EOSC-Core* components using APIs/frameworks adapted to the updated EOSC Profiles, in a seamless/loosely coupled perspective.
- To be able to extend the circle of available Resources and data to include Resources from third party catalogues and the community and/or to make already onboarded Resources available to them.
- For the Service Catalogue, to facilitate functionality to allow interoperability and composability of offered Resources.

4.1.2 Functional requirements

In the context of EOSC Future project, 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:
  - third party regional and thematic catalogues and their Providers;
  - data sources
- Regional/Thematic Catalogue Resources should be directly onboarded in the EOSC Resource Catalogue through the current onboarding procedure or connecting community catalogues to the EOSC Resource Catalogue through AAI infrastructure.
- The community that owns the catalogue can seamlessly publish a set of its Resources in the EOSC Resource Catalogue.
- Resources that are available in the EOSC Resource Catalogue will be accompanied by usage statistics indicators visible to Providers.
- 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 evolution of EOSC Profiles.
- Portal UI supports updated EOSC Profiles, for catalogues and data sources.
- Statistics related to combined/integrated usage of EOSC Resources, as collected from Monitoring and Accounting services are displayed.
- The Portal Onboarding team will use automatic validation indicators to better review and give feedback to onboarded resources.

4.1.3 Non-functional requirements

Non-functional requirements briefly include:

- Use of PIDs for all resources in EOSC Catalogue, to allow deduplication of onboarded resources.
- Implementation of Catalogue-Resource/Provider relationships to the internal Service Catalogue data model.
- Existing API/Messaging updates/support and backwards compatibility for new types of Resources: data sources, catalogues.
- Transition to AMS messaging, support in parallel for the existing JMS messaging functionality, for *EOSC-Core* components communication.
- Portal integration of monitoring statistics using Monitoring API.

4.2 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 4.2 is defined by the EOSC Resource Description Interoperability Framework (WP3) and today 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].

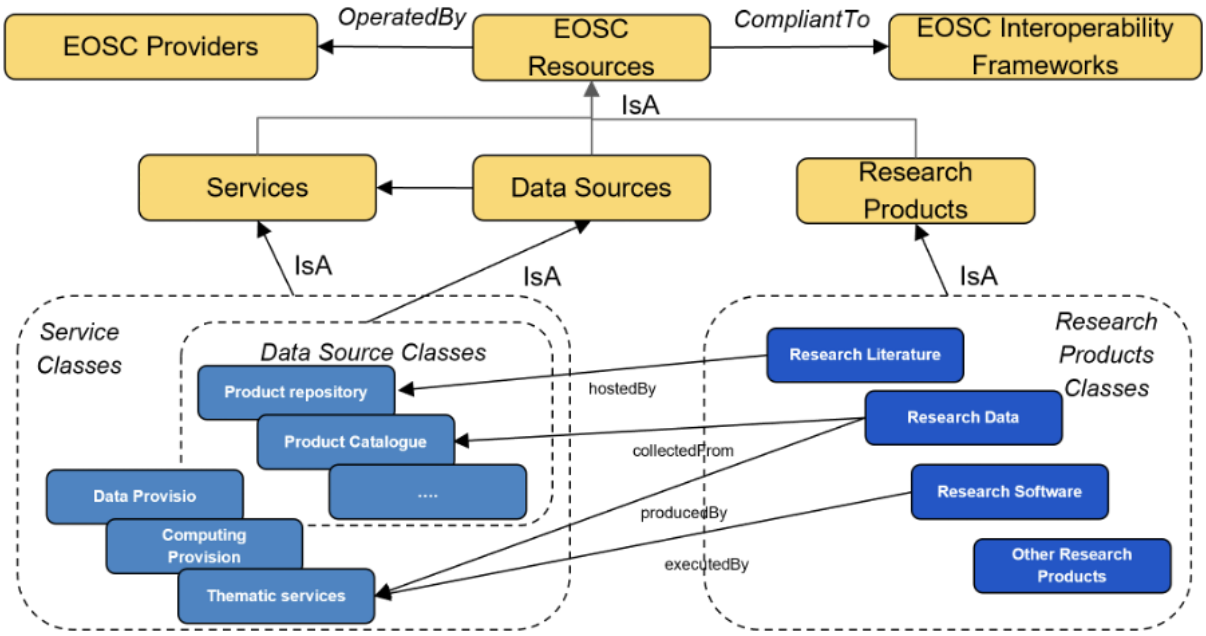

Figure 4.2: EOSC Resource Catalogue Data Model.

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) of 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.
- **An EOSC Service Catalogue:** the component offers the underlying storage functionality and the interoperability tools for the programmatic access, registration, manage (CRUD) of providers, services, and catalogues. It also offers the necessary API functionality for the interoperability of service

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

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

- **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 represent the semantic associations between them (see Data Model in Figure 4.2), 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 a preferential behaviour and properties of the EOSC Resource Catalogue.

4.2.1 Users

Users of the dashboard are:

- **EOSC service/data source providers**: persons responsible for the operation of a service or data source;
- **Service developers**: programmers in the need of interacting with EOSC Research Catalogue APIs to build added value services, e.g. managers of RI catalogues willing to integrate in 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.

4.2.2 Functional and non-functional requirements

This section lists all functional and non-functional requirements derived from the High-Level Roadmap at M18, which are considered as High-Priority to the EOSC Research Catalogue.

Table 4-1: EOSC Research Product Catalogues and Provider Dashboard functional and non-functional requirements derived from the High-Level Roadmap at M18

Channel	Title	Users & Problem to be solved	Affected components
HLR milestone	**A1-M18.** A researcher searching on EOSC Portal sees a comprehensive set of resources from multiple communities and clusters.	**Researcher and EOSC Resource Providers** The EOSC Portal makes accessible a comprehensive set of resources from multiple communities and clusters. These resources may be directly onboarded in the EOSC Resource Catalogue through the current onboarding procedure or by connecting community catalogues to the EOSC Resource Catalogue. Once a community catalogue is	EOSC Marketplace EOSC Service Catalogue EOSC Research Catalogue EOSC Provider Portal EOSC Portal Platform

		connected, the community that owns the catalogue can publish a set of its resources in the EOSC Resource Catalogue. Researchers can discover and access EOSC Resources, understand how/if they are linked with other resources (e.g. articles linked to data, in turn linked to service), and access statistics about them (e.g. number of services related with data in given domains).	
HLR milestone	**A2-M18.** Usage statistics for datasets (views, downloads) will be collected and made available.	**Researchers, EOSC Resource Providers, Service developers** The datasets that are available in the EOSC Resource Catalogue will be enriched with usage statistics indicators visible to end-users.	EOSC Research Graph EOSC Accounting for Research Products
HLR milestone	**A5-M18.** Researchers using a thematic portal can see resources (services, data) pulled in from the central EOSC Registry.	**Researchers, Service developers** Community catalogues connected to the EOSC Resource Catalogue can import resources from it.	EOSC Resource Catalogue Cluster catalogues
HLR milestone	**A6-M18.** A richer set of horizontal services to support science is offered to researchers.	**Researchers, EOSC Resource Providers, Service developers** Several horizontal services offering functionalities useful for multiple research communities and scientific disciplines are onboarded in the EOSC Resource Catalogue. The EOSC Resource Profile is enriched with additional attributes to identify horizontal services that are reflected in the EOSC Resource Registry and used by the EOSC Front-End to present horizontal services to end users with dedicated views.	EOSC Service Catalogue EOSC Provider Dashboard
HLR milestone	**D3-M18.** All main INFRAEOSC07 horizontal services are integrated with *EOSC-Core* functionalities.	**Researchers, EOSC Resource Providers, Service developers** Several INFRAEOSC07 horizontal services onboarded in EOSC are integrated with *EOSC-Core* services (AAI, helpdesk, Monitoring and Accounting, etc). EOSC Dashboards providing information about availability/reliability and usage of EOSC Resources are covering several INFRAEOSC07 horizontal services too.	EOSC Service Catalogue EOSC Provider Dashboards
HLR milestone	**D6-M18.** *EOSC-Exchange* highlights which services can be easily integrated or composed.	**Researchers, EOSC Resource Providers, Service developers**	EOSC Research Graph EOSC Service Catalogue

		An *EOSC Interoperability Framework* (IF) DB needs to be established. The EOSC Resource Catalogue enriches the description of the *EOSC-Exchange* services with information about supported standards and interfaces retrieved by the EOSC IF DB. The EOSC Front-End platform shows this information in the service entries and allows combining compliant services in form of bundles. The Order Management is extended to support the ordering of service bundles. A third-party service (e.g. an orchestrator) can query the EOSC platform to retrieve information about service compatibility.	EOSC Marketplace EOSC Order Management
HLR milestone	**D7-M18.** The onboarding process is extended to include validation of data sources to align to community (FAIR) metadata guidelines.	**EOSC Resource Providers, EOSC Resource Onboarding curators** In the case of onboarding of data sources, the onboarding process needs to be extended with an extra step to validate the data sources against community (FAIR) metadata guidelines.	EOSC Provider Dashboard for Research Products
HLR milestone	**D8-M18.** The onboarding process for EOSC Resources is extended to not only register them into the EOSC registry but also to include optional *EOSC-Core* integration steps in the same workflow, such as AAI, Monitoring, Accounting, Helpdesk, Order Management., Onboarding of research products (for data sources), etc.	**EOSC Resource Providers, EOSC Resource Onboarding curators** The onboarding process needs to be revised to enable the optional steps related to the integration with *EOSC-Core* services. When a provider starts the onboarding process, it should receive information about the optional integration with the *EOSC-Core* services (AAI, Monitoring, Accounting etc). Whether the provider decides to perform integration with the *EOSC-Core* needs to be properly supported by the technical teams.	EOSC Provider Dashboard for Services EOSC Service Catalogue EOSC Monitoring EOSC Accounting EOSC Helpdesk
Derived from HLR milestone	**E2-M18** EOSC Resource Catalogue Registry - Service Provider portal & Service catalogue - *Service Catalogue* Integration of a) EOSC Profiles 4.00 and b) implementation of	**EOSC Resource Providers, Service developers, EOSC Resource Onboarding curators** Service providers can onboard their services and data sources. EOSC Resources can specify the *EOSC Interoperability Frameworks* they comply with, to enable discovery by IF compliance and therefore forms of	EOSC Service Catalogue EOSC Provider Dashboard for Services

	APIs/processes for b1) catalogue and b2) data source service onboarding to align with research product onboarding, c) support for PIDs for providers and services.	composability. RIs can onboard their resources by making their catalogue interoperable with the EOSC Resource Catalogue. Vice versa, RIs can integrate EOSC Resources from the EOSC Resource Catalogues APIs/dumps in their local catalogues, to expand their local discovery services beyond the RI boundaries.	
Derived from HLR milestone	**E2-M18** EOSC Resource Catalogue Registry - Service Provider portal & Service catalogue - Portal Onboarding team Increased automatic validation tools and automatic flagging of resources which are likely to require review.	**EOSC Resource Onboarding curators** Onboarding team curators for the EOSC Service Catalogue are offered tools that highlight resources that require further review.	EOSC Service Catalogue EOSC Provider Dashboard for Services
Derived from HLR milestone	**E2-M18** EOSC Resource Catalogue Registry - Research Product catalogue & Research Product - Data Source onboarding Integration of research product data sources following *EOSC Interoperability Framework* Core guidelines	**EOSC Providers, EOSC Resource Onboarding curators** EOSC Service Catalogue to include data sources as special kinds of services. The onboarding of services and research products are merged into a common onboarding workflow. EOSC Research Product catalogue to include EOSC Data Sources as Graph entities related with Research Products.	EOSC Service Catalogue EOSC Provider Dashboard for Services EOSC Research Product Catalogue
Derived from HLR milestone	**E2-M18** EOSC Resource Catalogue Registry - Research Product catalogue & Research Product - Provider Dashboard enhancements	**EOSC Providers, EOSC Resource Onboarding curators** Provider Dashboard is enriched with additional information on EOSC Resource providers and resources and on activities of researchers in EOSC, UI supports updated EOSC profiles.	EOSC Service Catalogue EOSC Provider Dashboard for Services
Derived from HLR milestone	**E2-M18** EOSC Resource Catalogue Registry - EOSC Research Graph Integration of service catalogue and research product catalogue to offer a complete map of interlinked EOSC Resources	**EOSC Providers, EOSC Resource Onboarding curators, researchers** EOSC Service Catalogue is integrated in the EOSC Research Product Catalogue to deliver the EOSC Research Graph. The Graph includes EOSC IF references.	EOSC Research Product Catalogue EOSC Provider Dashboard for Research Products EOSC Research Product Catalogue EOSC Service

			Catalogue

4.3 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 4.6) 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, meaning a coherent experience from their side.

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 offering use cases. 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 to integrate existing Order Management Systems (OMSes) while providing an out-of-the-box support for JIRA-based solutions as a reference implementation of the integration.

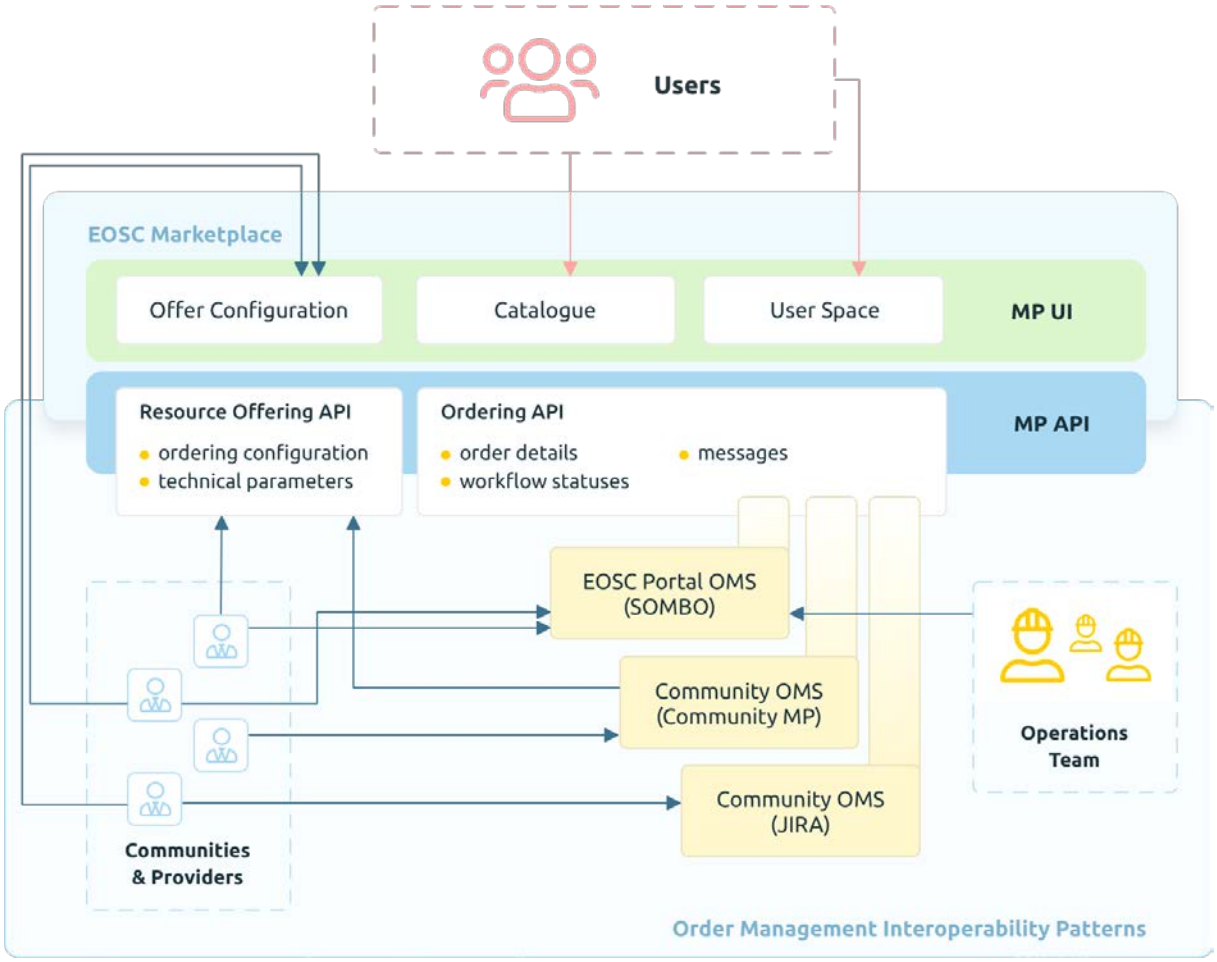

Figure 4.3: Order Management Interoperability Patterns

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 towards their own users. An example of such a component is EOSC Portal OMS, i.e. SOMBO. On one hand, it has its own UI catering to its users (mostly providers and operations team), and on the other it bridges over to the EOSC MP through the Ordering API.

The Service Order Management Back-Office (SOMBO) is the orchestration tool between EOSC Marketplace, service providers, service requesters and shifters/operators in EOSC Portal Operations Team (Figure 4.4). It is designed to track all the orders received by the EOSC Marketplace and to propose different actions on these orders.

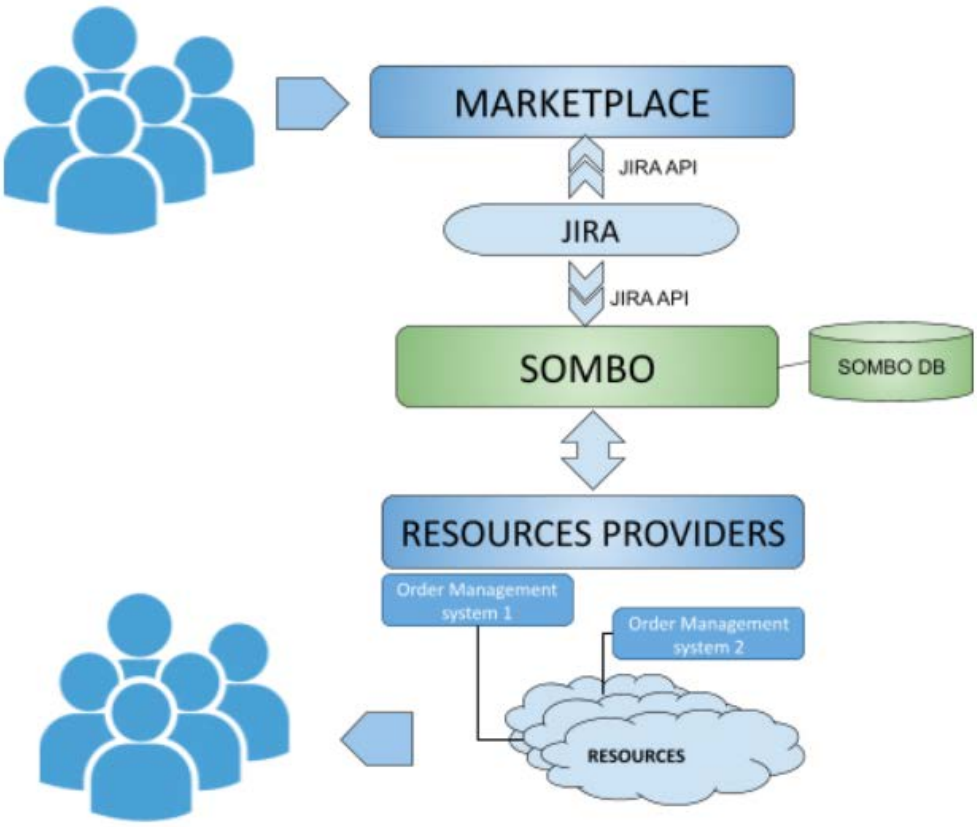

Figure 4.4: The role of SOMBO in managing the service orders.

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 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.

4.3.1 Users

Users of the OMS are:

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

4.3.2 Functional requirements

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

Channel	Title	Description	Affected components
Derived from HLR milestone	**A3-M18.** Researchers using resources through EOSC will have common elements such as AAI, support, Monitoring, and Accounting.	Several resources onboarded in EOSC are integrated with *EOSC-Core* services (AAI, helpdesk, Monitoring and Accounting, etc). Dashboards providing information about availability/reliability and usage of EOSC Resources are available for both *EOSC-Core* and *EOSC-Exchange*.	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers, EOSC SOMBO
Derived from HLR milestone	**B1-M18.** A researcher requesting resources through the EOSC Marketplace portal can request access to EC-funded resources.	The EOSC Resource catalogue offers mechanisms to easily identify EC-funded resources and retrieve information about their access policies through the EOSC Portal or community portals. The EOSC front-end platform uses these mechanisms to offer end-users search, filtering, and comparison tools. The EOSC Order Management supports Virtual Access and other EC funding models.	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers
Derived from HLR milestone	**C1-M18.** Researchers can orchestrate data analysis on computing resources provided by multiple e-Infrastructure resource providers and transfer back the output to his/her storage system.	Researchers can identify and access computing resources provided by e-Infrastructure resource providers navigating on the EOSC Resource profile through the EOSC Portal or a community portal. S/he can select the resources that best fit with the requirements of her/his workflow and access them thanks to the extension of the EOSC Resource profile to describe compute resources (information about interfaces, access models, etc). S/he can	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers, EOSC SOMBO

		transfer back the output to her/his storage system thanks to the extension of the EOSC Resource profile to describe storage systems. S/he can identify compute resources and data management tools that can interoperate thanks to resource bundle concept.	
Derived from HLR milestone	**D3-M18.** All main INFRAEOSC07 horizontal services are integrated with EOSC-Core functionalities.	INFRAEOSC07 horizontal services onboarded in EOSC are integrated with *EOSC-Core* services (AAI, helpdesk, Monitoring and Accounting, etc). EOSC Dashboards providing information about availability/reliability and usage of EOSC Resources are covering several INFRAEOSC07 horizontal services too.	EOSC Catalogue and Marketplace, EOSC SOMBO
Derived from HLR milestone	**D4-M18.** Numerous other horizontal services (publishing workflows, data transfer, data packaging, VM/container deployment, and orchestration) are integrated with EOSC-Core functionalities.	Several horizontal services from other providers (not in EOSC Future and INFRAEOSC07 projects) onboarded in EOSC are integrated with *EOSC-Core* services (AAI, helpdesk, Monitoring and Accounting, etc). EOSC Dashboards providing information about availability/reliability and usage of EOSC Resources are covering several INFRAEOSC07 horizontal services too.	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers, EOSC SOMBO

Derived from HLR milestone	**D6-M18**. EOSC-Exchange highlights which services can be easily integrated or composed.	An *EOSC Interoperability Framework* (IF) DB needs to be established. The EOSC Resource Catalogue enriches the description of the EOSC-Exchange services with information about supported standards and interfaces retrieved by the EOSC IF DB. The EOSC Front-end platform shows this information in the service entries and allows combining compliant services in form of bundles. The Order management is extended to support the ordering of service bundles. A third-party service (e.g. an orchestrator) can query the EOSC platform to retrieve information about service compatibility.	EOSC Marketplace for Providers
Derived from HLR milestone	**D8-M18.** The onboarding process for EOSC service resources is extended to not only register them into the EOSC registry but also to include optional *EOSC-Core* integration steps in the same workflow. such as AAI, monitoring, accounting, helpdesk, Order Management., onboarding of research products (for data sources), etc.	The onboarding process needs to be revised to enable the optional steps related to the integration with *EOSC-Core* services. When a provider starts the onboarding process, it should receive information about the optional integration with the *EOSC-Core* services (AAI, monitoring, accounting…). Whether the provider decides to perform integration with the *EOSC-Core* needs to be properly supported by our technical teams.	EOSC Marketplace for Providers
Derived from HLR milestone	**D9-M18**. Resource requests can lead to automatic provisioning of resources.	A resource request (e.g. storage, compute, data, etc.) from a researcher can be automatically approved under certain conditions. This would require the addition of information about	EOSC Marketplace for Providers

		access policy in the EOSC Resource profile. The Order Management system should be able to automatically recognise such requests according to certain criteria.	
EOSC-WP05 Requirements gathering workshop	Users can view the live order status	Each user should have the capability to view live the status of their order.	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers, EOSC SOMBO
EOSC-WP05 Requirements gathering workshop	User can see the expected order fulfilment time	Each user should clearly see the estimated time it takes for each order to be fulfilled or acknowledged. This should be displayed on the resource page.	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers, EOSC SOMBO
EOSC-WP05 Requirements gathering workshop	Post-order feedback survey	Portal could run post-order feedback survey to extract best practices that can be a way to help service providers improve their internal processes as well.	EOSC Marketplace for Providers
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
EOSC Enhance internal request	Add in the Provider's resource web forms and EOSC APIs the blocks of information for the different options of a resource.	Add in the Provider's resource web forms and EOSC APIs the blocks of information for the different ordering options of a resource. Providers should be able in the dashboard to View list of configurations\offerings per resource, Edit\Add\Activate\Deactivate configurations (similar to what it is offered currently for the resource), View stats about orders per resource.	EOSC Marketplace for Providers, EOSC Service Provider Dashboard
EOSC Enhance internal request	Add to the resource detail page a section with resource configuration details + order placement functionality	View list of configurations in the resource Page: Users should be able to view the list of configurations of a resource, access the details and select (order) one of them.	EOSC Marketplace for Providers

		Place an order. They should be able to place an order in the EOSC Portal Marketplace, where all further validations regarding the availability of the offer are performed (or in case there is a link to an external order placement system to be redirected to the Provider's Order Management system and proceed with the ordering). Users should be able in the Marketplace to • review an order, see details • cancel, revert an order • see the status of an order (in case it is long running) • view the list of orders\resources in their project\portfolio	
EOSC-WP05 Requirements gathering workshop	Providers can access a dashboard that shows top services ordered across the portal and filterable also by category, country, domain.	The dashboard must show top services ordered across the portal and be filterable also by category	EOSC Marketplace for Providers, EOSC Service Provider Dashboard, EOSC SOMBO
EOSC-WP05 Requirements gathering workshop	Accounting system to manage transactions	Accounting system to manage transactions	EOSC Marketplace for Providers
EOSC-WP05 Requirements gathering workshop	Automated order fulfilment or at least minimise manual processes.	Develop a broker system for resources and the possibility to interact directly to the service providers.	EOSC Marketplace for Providers
EOSC-WP05 Requirements gathering workshop	Enriched service descriptions with more technical information.	- Service description has to be harmonised, expanded and improved to cover more technical aspects. - A Service Ontology should be developed in agreement with the service providers.	EOSC Marketplace for Providers

EOSC-WP05 Requirements gathering workshop	Users can see the complete requirements, policies and user documentation in Service/Resource pages to access or order them.	Clear access & usage policies for the Service/Resources must be clarified and described.	EOSC Catalogue and Marketplace
EOSC-WP05 Requirements gathering workshop	Integrated CRM (helpdesk, orders, supplier-customer communications) for a single view of customer history.	An integrated way of communicating/handling customers in the portal where helpdesk info and orders info is centralised and visible. EOSC Portal operators Harmonization of the CRM being developed as part of the SMS would definitely be beneficial for the end user. User Component plays this role of the main contact point for the end user, but there are several contact methods, and they are detached to some extent. Integrating different entities like order history and helpdesk on a single customer history will be appropriate once the plans for the maintenance of these channels will be concretized by the future Portal operators	EOSC Catalogue and Marketplace
EOSC-WP05 Requirements gathering workshop	Increase the range of services and integrate better some existing services.	The portal carries the necessary functionalities, however not all services are fully integrated	EOSC Marketplace for Providers
from adopted requirements not (fully) implemented under EOSC Enhance project	View number of scientific domain specific orders.	The User can view the number of total orders made for orderable EOSC Resources on the EOSC Portal, according to the scientific domain that he/she is searching for.	EOSC Catalogue and Marketplace
from adopted requirements not (fully) implemented under EOSC Enhance project	Register one or more offerings for an EOSC Resource.	The Provider Administrator can register one or more resource offerings for a certain EOSC Resource. Each resource offering includes a set (package) composed of support	EOSC Catalogue and Marketplace, EOSC Marketplace for Providers,

		terms, KPIs and pricing of the EOSC Resource.	
from adopted requirements not (fully) implemented under EOSC Enhance project	Publish/update EOSC Resource availability calendars.	The Provider Administrator can publish and update, for bookable EOSC Resources, a calendar for the EOSC Resource availability for booking on the EOSC Portal.	EOSC Marketplace for Providers
from adopted requirements not (fully) implemented under EOSC Enhance project	New event for coexistence of resources in user projects.	Extend the current event (or generate a second one) with the list of resources already present in the project, in which the resource is added. In this case we need to know that: • Resource A was added to a project which already contains Resource B, C, etc. • Alternatively, redundant events for Resource B, C, can be generated (technical details can be discussed)	EOSC Marketplace for Providers

4.4 Monitoring

The EOSC service availability and reliability monitoring (EOSC Monitoring) is a key service needed to gain insights into an infrastructure, the applications, services, and even into processes/behaviours. The EOSC Monitoring has been implemented in EOSC-hub through 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. ARGO Monitoring Service offers near real-time status updates which allow both end-users and site admins to have an overview of the service offered 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 is shown in Figure 4.5. The service 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 individual test results that contributed to the computed figure.

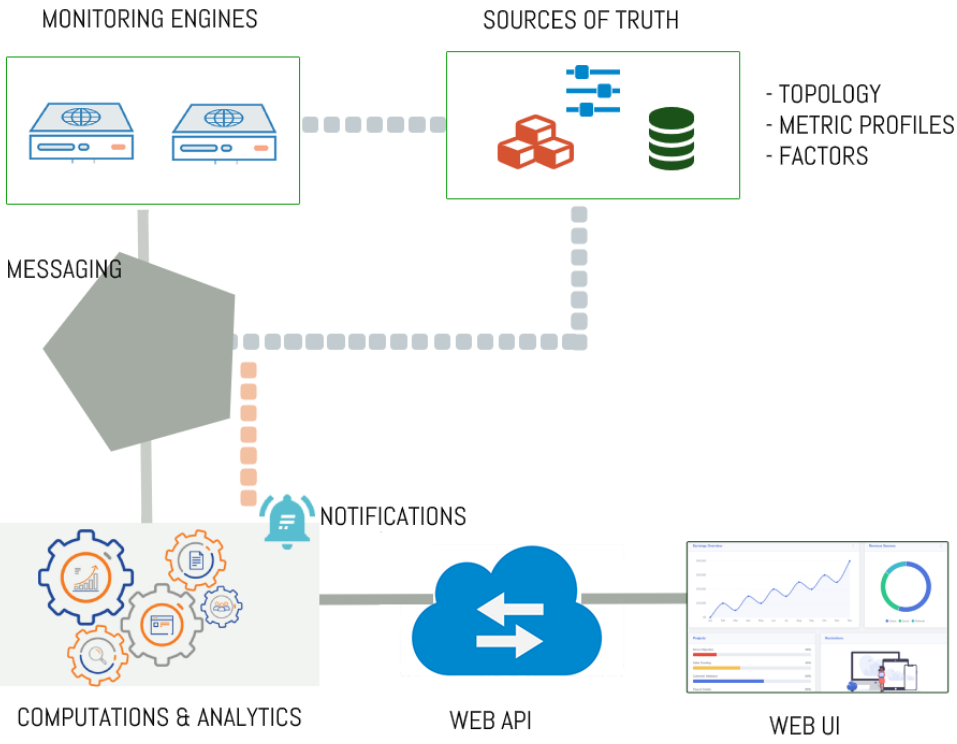

Figure 4.5: High-level architecture of a monitoring service.

4.4.1 User requirements

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 – services;
- End users that may observe the service Availability, Reliability and Status at the marketplace.

4.4.2 Functional requirements

The functional requirements of EOSC monitoring are as follows:

- Provide monitoring dashboards for *EOSC-Core* services and integrate it with Service Level Monitoring within the SMS;
- Provide monitoring dashboard for *EOSC-Exchange* services and integrate it with Service Level Monitoring within the SMS;
- Monitor the availability and reliability of the URLs and endpoints provided by the Onboarded Services Allows checking of services based on availability of their web pages/endpoints. Can support better integration via specific metrics;
- Provide an Automated/self-service integration point/API for monitoring probes and metrics offered to providers;
- Automated monitoring in the Service Management System includes:
  - automated thresholds,
  - raising issues, or

- alarms based on results.

4.4.3 Non-functional requirements

The non-functional requirements of EOSC Monitoring are as follows:

- Provide interoperability guidelines for EOSC Monitoring;
- The onboarding process is enriched with optional steps for integrating EOSC Monitoring. Monitoring requires topology information that can be used for service monitoring;
- Integration with Service Registry to enrich the services data;
- Use of ARGO Messaging Service as a transport layer for *EOSC-Core* components communication defined in the users' requirements.

4.5 Service Accounting

Resource usage accounting is a core tool in managing widely distributed e-Infrastructures, and this is the essential role that EOSC Service Accounting performs. It enables funding bodies and global collaborations to ensure resource providers are delivering the resources they committed to and that user communities are accessing the resources they were granted. Service Accounting collects, aggregates, stores, and displays usage information of HTC compute, storage space, and cloud VMs. This usage data is collected from the Resource Centres of the EOSC infrastructure.

Accounting information is gathered from distributed sensors into a central Accounting Repository where it is processed to generate summaries that are made available through an Accounting Portal (Figure 4.6). Depending on the use case the data may go via intermediate repositories that collate accounting data for particular regions, infrastructures or communities.

The Accounting Repository has a database backend and needs to ensure the exchange of accounting information with peer e-Infrastructures. The Accounting Portal receives and stores the resource centre, user, and user group level aggregated summaries generated by the Accounting Repository and provides views via a web portal. For example, by grouping resource centres in a country on specific time intervals a customized view can be generated and displayed. The Portal databases are organized into resource record databases (e.g. CPU, storage, dataset, etc), a user record database, and a topology database.

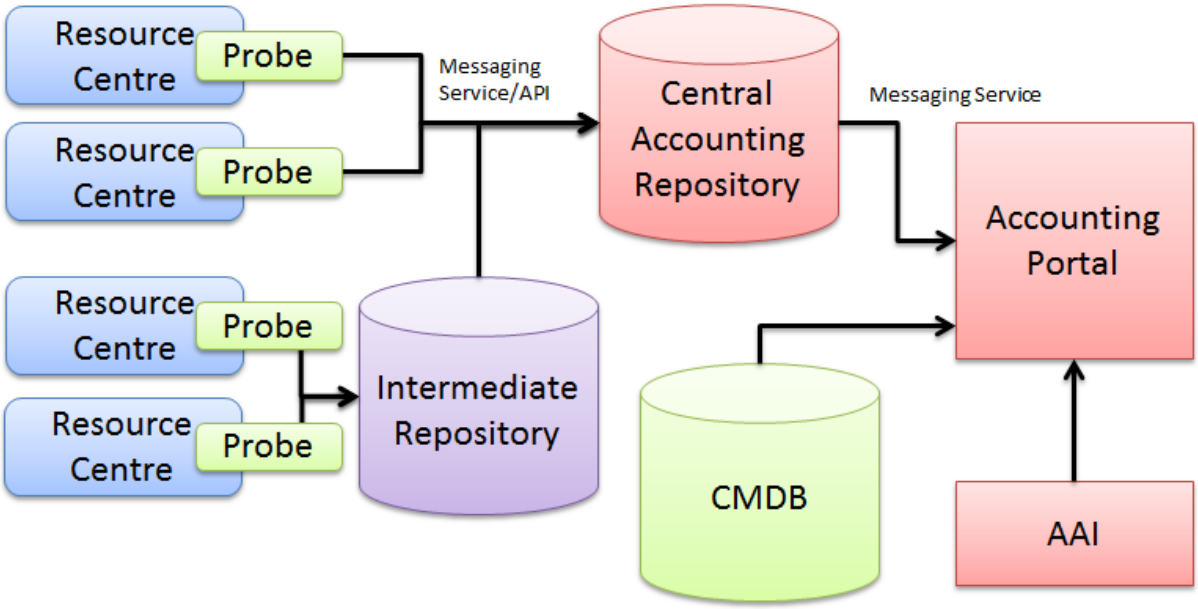

Figure 4.6: Diagram of the Accounting service.

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 M18, regarded as high priority to EOSC Service Accounting.

Table 4-3: Service Accounting functional and non-functional requirements derived from the High-Level Roadmap at M18.

Channel	Requirement	Users & Problems to be solved	Affected components
Derived from HLR milestone	Dashboards for Service Accounting are available	**A3-M18.** Researchers using resources through EOSC will have common elements such as AAI, support, monitoring, and accounting • Setting up the *EOSC Interoperability Frameworks* supporting the operation of *EOSC-Core* services for accounting **D3-M18.** All main 07 horizontal services are integrated with EOSC-Core functionalities. • Setting up the *EOSC Interoperability Frameworks* supporting the operation of *EOSC-Core* services for accounting • The onboarding process for EOSC service resources is extended to not only register them into the EOSC registry but also to include optional *EOSC-Core* integration steps	EOSC Service Accounting

		in the same workflow (AAI, monitoring, accounting, helpdesk, Order Management, etc)	
Derived from HLR milestone	Usage tracking to support virtual access reimbursement by the EC	**B1-M18.** A researcher requesting resources through the EOSC Marketplace portal can request access to EC-funded resources. **E5-M18.** Service Accounting allows for accounting of usage based on parameters in provider and resource profiles (location, sector, organisation type).	EOSC Service Accounting
Derived from HLR milestone	Service Accounting allows for Virtual Access reports to be presented	**B1-M18**. A researcher requesting resources through the EOSC Marketplace portal can request access to EC-funded resources.	EOSC Service Accounting
Non-functional requirement from current provision	Process all new records from every resource provider at least once a day	Users of this type of accounting service have come to expect this level of performance so it should not be less than this.	EOSC Service Accounting

4.6 Research Product Accounting

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

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 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's service architecture is depicted in Figure 4.7.

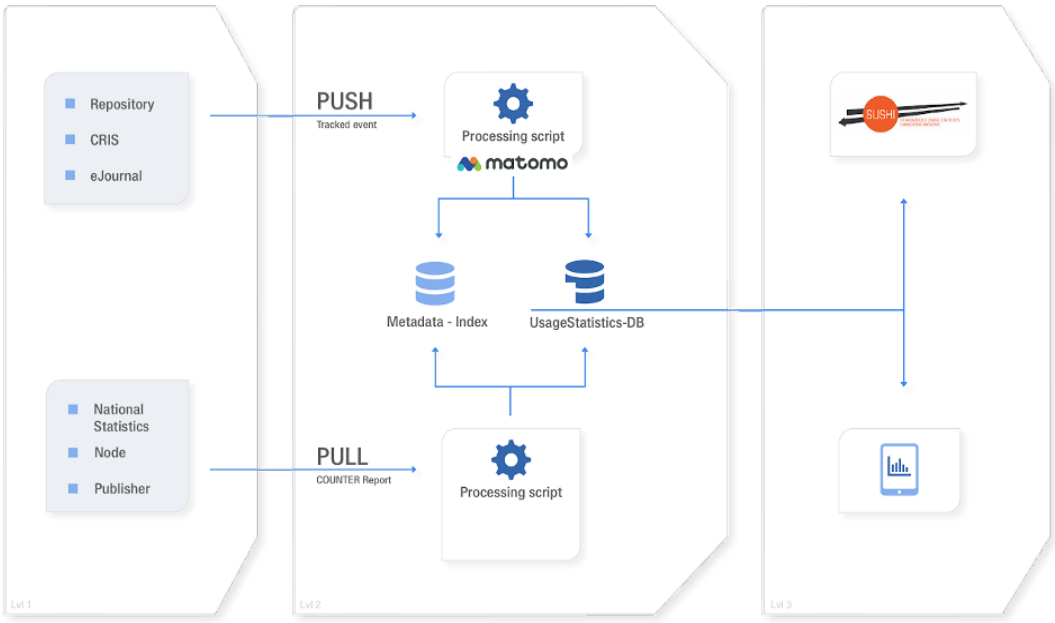

Figure 4.7: UsageCounts service architecture

User requirements of Research Production Accounting are:

- Provides standards for usage data exchange (OpenAIRE Usage Statistics Guidelines);
- Complies to COUNTER Code of Practice[6] and COUNTER CoP for research Data;[7]
- 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.
- 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[8] 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 M18, regarded as high priority to EOSC Service Accounting.

[6] https://www.projectcounter.org/code-of-practice-five-zero-two/
[7] https://www.projectcounter.org/code-of-practice-rd-sections/foreword/
[8] https://app.swaggerhub.com/apis/COUNTER/counter-sushi_5_0_api/5.0.2

Table 4-4: Research Product Accounting requirements derived from the High-Level Roadmap at M18.

Channel	Requirement	Users & Problems to be solved	Affected components
Derived from HLR milestone	Usage tracking of EOSC Graph Research products (publications, datasets, etc)	**A2-M18.** The research products that are available in the EOSC Resource Catalogue will be enriched with usage statistics indicators visible to end-users.	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-M18.** 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. 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 for Messaging are as follows:

- 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;
- Support of different authentication methods.

4.7.3 Non-functional requirements

Non-functional requirements for Messaging are as follows:

- 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 an effective user support, such as a form to submit a ticket, a ticket search, email notifications on change of the ticket status. The EOSC Helpdesk has been integrated with EGI and EUDAT Helpdesk to deliver a unified support system for EOSC users. The helpdesk's support unit structure is organized in three levels and comprises multiple Support Units (SU) for effective resolution of the incidents and user requests. The workflows and tickets triage are organized according to the established procedures of the Incident Service Request Management (ISRM) process within the EOSC *Service Management System* (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 the service incidents. Based on the consultations with several EOSC communities and related projects, results of the surveys have identified a set of requirements for the helpdesk in the federated EOSC environment. The requirements are strongly coupled to the target groups and roles in the EOSC. For simplicity we consider two main groups: users and service providers. The users typically create incident 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 user or requester perspective we have collected, 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 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 identified major requirements from service providers, EOSC communities and supporters in case they would like to use 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 portal via AAI;
- Possibility to define auto-response and templates for answers per support unit;
- 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 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 4-5: EOSC Helpdesk functional and non-functional requirements.

Channel	Title	Description	Affected components
Derived from HLR milestone	**E7-M18 Helpdesk** Customisation based on new/updated technology and connected to the Service Management System	• The EOSC Helpdesk system is customised based on new technology. All Support Units for *EOSC-Core* Services are defined, established and functional. • The users could create tickets for any *EOSC-Core* component and post a general request for major EOSC procedures e.g., onboarding using webform on EOSC Portal or via email. • The Helpdesk integrated with AAI. • Each support unit has its own mail address and can be contacted directly via email. • Automatic routing of the tickets submitted to the central EOSC Helpdesk to a dedicated support unit depending on defined rules and workflows is implemented. • Multiple dashboards are available to perform statistical analysis and KPI assessment • Integration plan of the helpdesk with a dedicated helpdesk configuration management database is defined and ready for implementation.	EOSC Helpdesk, EOSC Portal

Derived from HLR milestone	**A3-M18.** Researchers using resources through EOSC will have common elements such as AAI, support, monitoring, and accounting.	• Generation of tickets by e-mail or dedicated web-form, available on community or service portals which are onboarded and integrated with *EOSC - Core*.	EOSC Helpdesk
Derived from HLR milestone	**D3-M18.** All main 07 horizontal services are integrated with EOSC-Core functionalities.	• Integration with already existing helpdesks of EOSC infrastructures like EGI and EUDAT is accomplished, the integration with other EOSC communities is defined. • Support of REST API (currently only SOAP API is supported).	EOSC Helpdesk EGI Helpdesk, EUDAT Helpdesk, Community Helpdesks
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. • Integration of the helpdesk with JIRA upon EOSC SMS requirements and procedures. • Helpdesk is integrated with dedicated configuration management database • according to the defined plan. • Integration of the helpdesk with EOSC Portal Provider Dashboard	EOSC Helpdesk, Portal Provider Dashboard

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 aimed to provide an initial overview of the requirements gathering and analysis of the EOSC Back-Office during the first year of the project. The requirements as part of the High-Level Technical Roadmap have been provided for components where this can be done, along with a description of the Requirements Engineering Process as developed within the project along with the EOSC Front-Office. EOSC Future is the latest of a series of EOSC projects and since many of the components of the Back-Office existed before the project, it has been necessary to provide a background of requirements gathering in the EOSC landscape before EOSC Future in order to provide the complete overview and put this work into context. There will be an update to this deliverable in Month 20.

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