D5.1a

EOSC Front-Office Design, Functional and Technical Specification

D5.1a / EOSC Front-Office Design, Functional and Technical Specification

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Abstract

This deliverable is the first step in defining the boundaries for the EOSC Platform Front-Office development within the scope of the EOSC Future project. The summary presented in the following sections describes the main goals of WP5, the typology of the Front-Office users, the state-of-play of the Front-Office architecture and technical specification (including the relevant supporting components), and the initial functional design. In addition, there is an analysis of the gaps that need to be bridged by the Front-Office development teams. The assumptions used in this deliverable will be updated during the EOSC Future project to reflect the feedback from users and additional needs.

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List of Abbreviations

Acronym	Definition
AAI	Authentication and authorisation infrastructure
AI	Artificial intelligence
API	Application programming interface
BoF	Birds of a feather
CMS	Content Management System
CRUD	Create, read, update, delete
DIH	Digital innovation hub
e-IRG	e-Infrastructure Reflection Group
EC	European Commission
EDIH	European Digital Innovation Hub
ENA	European Nucleotide Archive
EOSC	European Open Science Cloud
ESFRI	European Strategy Forum on Research Infrastructures
FAIR	Findable, Accessible, Interoperable and Reusable
GDPR	The European Union's General Data Protection Regulation
GGUS	Global Grid User Support (system). GGUS is one of the EGI core services and part of the EGI Federated Operations service
HTC	High Throughput Computing
HPC	High Performance Computing
ICT	Information and communications technology
KH	(EOSC) Knowledge hub
KPI	Key performance indicator
ML	Machine learning
MP	Marketplace
OAG	OpenAIRE research graph
ORCID	Open Researcher and Contributor ID
PaaS	Platform as a Service
PDB	Protein data bank
PID	Persistent identifier
RePEc	Research Papers in Economics
REST	Representational state transfer
RoP	Rules of participation
RS	(EOSC) Recommender system
RS-MP	EOSC) Recommender system for the marketplace

SME	Small and medium-sized enterprises
UI	User interface
UP	User panel
UX	User experience
WP	Work package

Glossary

Only terms that are not included in the EOSC glossary [1]] appear here.

Term	Definition
arXiv	A free distribution service and an open-access archive.
Crossref	Anot-for-profit membership organization that exists to make scholarly communications better.
DataCite	A DOI registration agency that enables the registration of scholarly content with a persistent identifier (DOI) and metadata.
EOSC training catalogue	The EOSC training catalogue is part of the EOSC learning/training platform, and the learning/training platform might become part of the EOSC knowledge hub. The EOSC training catalogue is a catalogue of catalogues and also a catalogue on its own for training learning/material which would otherwise have no place/space.
EOSC knowledge hub	The EOSC knowledge hub builds on top of the EOSC learning/training platform and is a workspace for training and knowledge sharing.
EuropePMC	An archive of life sciences journal literature.
EOSC Platform	A set of services implemented in scope of the EOSC Future project to support delivery of EOSC Core and EOSC Exchange
FAIR	A set of principles to make data (F)indable, (A)ccessible, (I)nteroperable and (R)eusable
Feature	A tool that helps to accomplish functions. For example, the wheels of an aircraft are features that support functions such as landing or taking off.
Function	A goal that can be accomplished with a product, service, process, practice, system, application, document, component, machine or environment.
Front-Office	A set of components in the EOSC Platform focused on the delivery of user-centric functionalities supporting research activities in Europe.
GRID.ac	A free and openly available global database of research-related organisations, cataloging research-related organisations and providing each with a unique and persistent identifier.
High Level Roadmap	High Level Roadmap of EOSC Future project. A set of milestones, activities and the timeline defining the high-level overview of the EOSC Future project implementation.
OpenDOAR	Aquality-assured, global Directory of Open Access Repositories.
re3data	A global registry of research data repositories that covers research data repositories from different academic disciplines.
Research products	Resources relevant for the scientific research. Eg. Publications, Research Data, Research Software. The definition of the research products is provided by the OpenAIRE Guidelines [4]].
Sitemap	A visual representation of a website structure allowing to express the navigation between successive website pages in a tree like structure.
User Panel (UP)	A component of the Front-Office responsible for managing the interaction with users and providing them with access to EOSC-managed items.

User story	A user story is an informal, general explanation of a software feature written from the perspective of the end user. Its purpose is to articulate how a software feature will provide value to the customer.
User flow	User flows are diagrams that help map out the logical path a user should take when interacting with a system. As a visual tool, the user flow shows the relationship between a website or app's functionality, potential actions a user could take, and the outcome of what the user decides to do.
User Experience	User Experience is the quality of experience a person has when interacting with a specific design.
UX design	User experience design is the process of supporting user behaviour through usability, usefulness, and desirability provided in the interaction with a product.
UX methodology	A methodology supporting specific UX modelling and UX design process. Together with accompanying tools forms the principles of for the UX modelling and UX design.
UX best practices	Established engineering best practices for UX modelling and UX design.
(EOSC) Resource	An asset made available by means of the EOSC system and according to the EOSC Rules of Participation to EOSC End-Users to perform a process useful to deliver value in the context of the EOSC.
(EOSC) Recommender System	Recommends a set of items to the EOSC users in a given context, based on users' preferences, background data and algorithms.
(EOSC) Resource type	The types of EOSC resources are defined by the EOSC Resource Description Framework Interoperability Framework, which today includes: Resource Providers, Service Providers (data sources as an explicit subtype), as per the EOSC-Enhance project Provider profile [2] and Resource profile [3]], and as per the guidelines defined by the OpenAIRE Guidelines [4]].

1   Executive summary

The vision of EOSC Future is to deliver an operational EOSC Platform with an integrated environment consisting of data, professionally provided services, open research products and infrastructure that will be accessed and used by the European research community.

The researchers will be engaged, facilitated, trained and supported to utilise a web of scientific resources that are open and/or Findable, Accessible, Interoperable, and Reusable (FAIR). In addition, the resources will be equipped with suitable services to allow their exploitation.

In order to achieve these goals, EOSC Future builds upon the results of previous projects (EOSC Enhance [5]], EOSC-hub [6]], OpenAIRE-Advance [7]], etc.) to open a new chapter in the implementation of the EOSC Platform software, service infrastructure and supporting processes, laying the foundations for its use in the everyday life of European researchers.

At the heart of the EOSC Platform are the users who both provide and exploit EOSC resources. Users include researchers, resource providers, research and technology enablers, trainers and policy makers. By utilizing the EOSC Platform Front-Office as a gateway to the information and resources in EOSC, its users not only gain another access channel, but also a way to take part in co-creating the development of the EOSC Platform according to their own needs and experiences. Among other EOSC Future Work Packages (WPs) supporting this mission, WP5 plays the role of the main contributor in the user interplay.

WP5 is responsible for the design and implementation of the Front-Office functionalities of the EOSC Platform for EOSC users who want to discover and use EOSC resources and outputs aimed at supporting European science. The primary goal is to facilitate Open Data processing in the research lifecycle. Building on the foundation of requirement gathering and analysis, supported by the various methods and processes for user feedback collection, User experience (UX) modelling and design verification, WP5 will deliver crucial parts of the next generation functionalities for the EOSC Platform Front-Office users.

In order to extend the existing functionality of the Front-Office as per the following, new EOSC Platform Front-Office components will be implemented according to elicited user needs and feedback, using UX best practices:

- Additional types of EOSC resources and better resource composability;
- Smart search and discovery, enhanced catalogue and marketplace functionalities;
- User-profiles, improved user options and feedback capabilities;
- Customisable AI-based recommendations;
- Open Science support;
- Skills and training modules.

This deliverable is the first step in defining the boundaries for the EOSC Platform Front-Office development within the scope of the EOSC Future project. The summary presented in the following sections describe the main goals of WP5, the typology of the Front-Office users, the state-of-play of the Front-Office architecture and technical specification (including the relevant supporting components), and the initial functional design. In addition, there is an analysis of the gaps that need to be bridged by the Front-Office development teams. The assumptions used in this deliverable will be updated during the EOSC Future project to reflect the feedback from users and additional needs.

2 Overview

The EOSC Platform Front-Office (referred to throughout as 'the Front-Office') is a set of components in the EOSC Platform focused on the delivery of user-centric functionalities supporting research activities in Europe. It is also referred to as the platform demand layer.

With such a compass in mind, WP5 responsible for the delivery of the Front-Office in the EOSC Future project takes the results of the previous (or still ongoing) EOSC-related projects and aims at the design and delivery of a complex but consistent environment for EOSC users. The nature and main elements of this environment are set out by the knowledge obtained so far. The results of:

- the EOSC Pilot / EOSC-hub / OpenAIRE Advance / EOSC Enhance projects;
- SRIA analysis;
- EOSC Secretariat's Architecture / Sustainability / Landscape working groups;
- other EOSC analysis documents,

have built EOSC as we know it today and contributed to the mission of further development of EOSC in the EOSC Future project, the delivery of the Front-Office being one of them.

The Front-Office will be built on the current Front-Office's User Component (which is focused on functionalities relating to EOSC service discovery and access). In particular, the components developed in the EOSC-hub and EOSC Enhance projects which currently support some of the identified needs of EOSC users will be used. The Front-Office will extend the capabilities of this user-oriented segment of the EOSC Platform by adding new building blocks and broadening the capabilities of the existing components. To achieve that goal, WP5 will use the guidelines that are known and included in the proposal of the EOSC Future project and, additionally, the use of a UX methodology specific to Front-Office users to discover their needs and design the platform accordingly to fulfil them as much as possible.

The following sections explain today's vision for the Front-Office, both functional and technical, based on EOSC Future principles and recommendations, expanded and detailed by the ongoing analysis conducted in the scope of WP5 Task 5.1 (EOSC Front-Office: Requirement Analysis). It is important to emphasise that WP5 Task 5.1 will conduct iterative analysis and will verify the conclusions with user consultation mechanisms to deliver the most suitable user environment.

Section 3 introduces the concept of user typologies and their application to the Front-Office user community.

Section 4 presents the functional specification of the Front-Office, along with the tools used to maintain it and present the first version of the functional gap analysis which will guide the future development of the Front-Office. It also specifies who the Front-Office is aimed at, the vision of its functional scope and architecture, the current state-of-play, any design assumptions and the first round of the functional gap analysis exercise.

Section 0 focuses on the technical aspects and describes the technical architecture, defines the main technical characteristics of the relevant services and provides an initial understanding of any technical gaps that needs to be bridged. This will form the basis for the development carried out in WP5 and will be the main driver for the introduction of new functional components in the Front-Office.

3 Front-Office user typology

User typologies allow us to understand the target user groups and to properly analyse new requirements for those groups. The currently acknowledged definition in the EOSC Future project is based on:

- EOSC actors [8]];
- EOSC Portal target users [9]];
- Alignment with the definition used in the EOSC Enhance project [10]].

It is however assumed that the typology might change or generally evolve based on any new findings identified in the course of the project and analytical activities performed in the scope of it.

For the Front-Office, the user typology differentiates three main user groups:

- Consumers;
- Providers;
- Facilitators.

The largest and most complex group are the consumers who encompass users from the public and private sectors (such as individual researchers, research communities, citizen scientists, and research support staff). When analysing this user group, one can categorise it in different ways, leading to different perspectives on the requirement analysis and the ensuing UX design process.

- **Research cooperation structure:** Researchers work in groups which are diverse in their complexity. Based on the group structure (including its diversity), the cooperation and coordination of its research activities will differ. It has been recognised that the platform requirements that support research-performing activities will differ too. This realisation led to the introduction of this specific branch in the Front-Office typology. The categories defined (e,g, informal research groups, cross-border projects) within the research cooperation structure branch are often correlated with the types of workflows relevant in the Front-Office's operations (like resource ordering, resource access) and bring different types of policy rules that will shape both the operations and the Front-Office itself.
- **Scientific disciplines:** Requirements for the Front-Office will differ depending on the scientific discipline, as a connection between the scientific discipline and the types of resources used (in particular the workflows) to support the research carried out in that particular discipline exists. Further analysis needs to be conducted to unambiguously correlate the scientific disciplines with the resources most commonly used. Nevertheless, the connection has been recognised and is considered. This analysis might also shed some fresh light on the resource categorisation in EOSC and adjust it to the everyday life of EOSC users.
- **Level of seniority:** It is assumed that the level of seniority of a researcher is another aspect which is relevant when describing the Front-Office user type. Requirements brought by the senior researchers will be different from those of their less experienced colleagues, due to the different goals that come with advancement in a scientific career. This assumption will be verified using the UX techniques that identify the user personas, followed by analysis of whether there is a correlation between scientific career seniority and expectations of the functionality offered by the Front-Office.

The current Front-Office user typology is presented in Figure 3.1, Figure 3.2 and Figure 3.3 below. For clarity, only the basic Consumers categorisation is presented. For the full Consumers typology, please refer to Appendix A: Front-Office user typology.
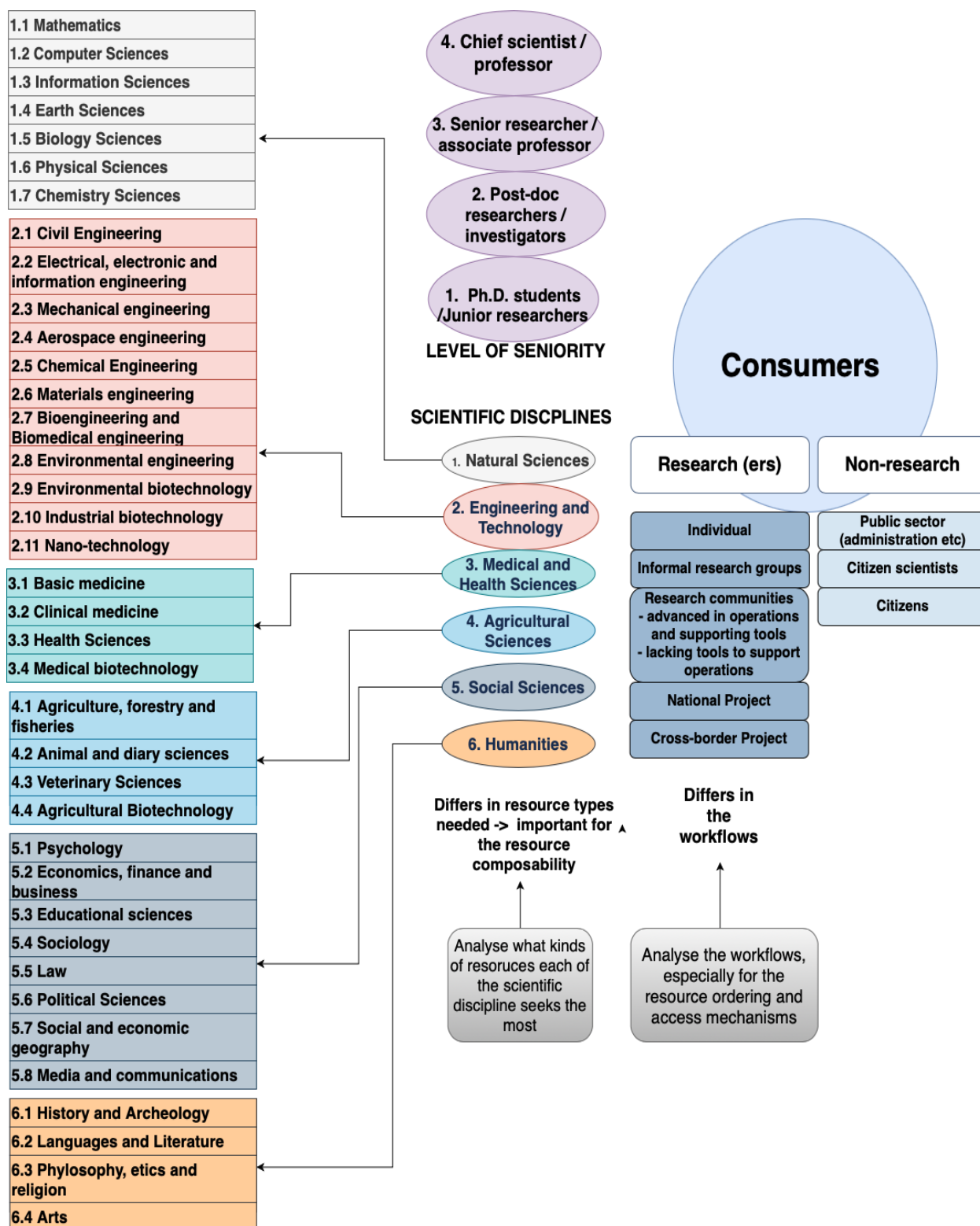
Figure 3.1: Front-Office user typology – Consumers (simplified)

Figure 3.2: Front-Office user typology – Facilitators
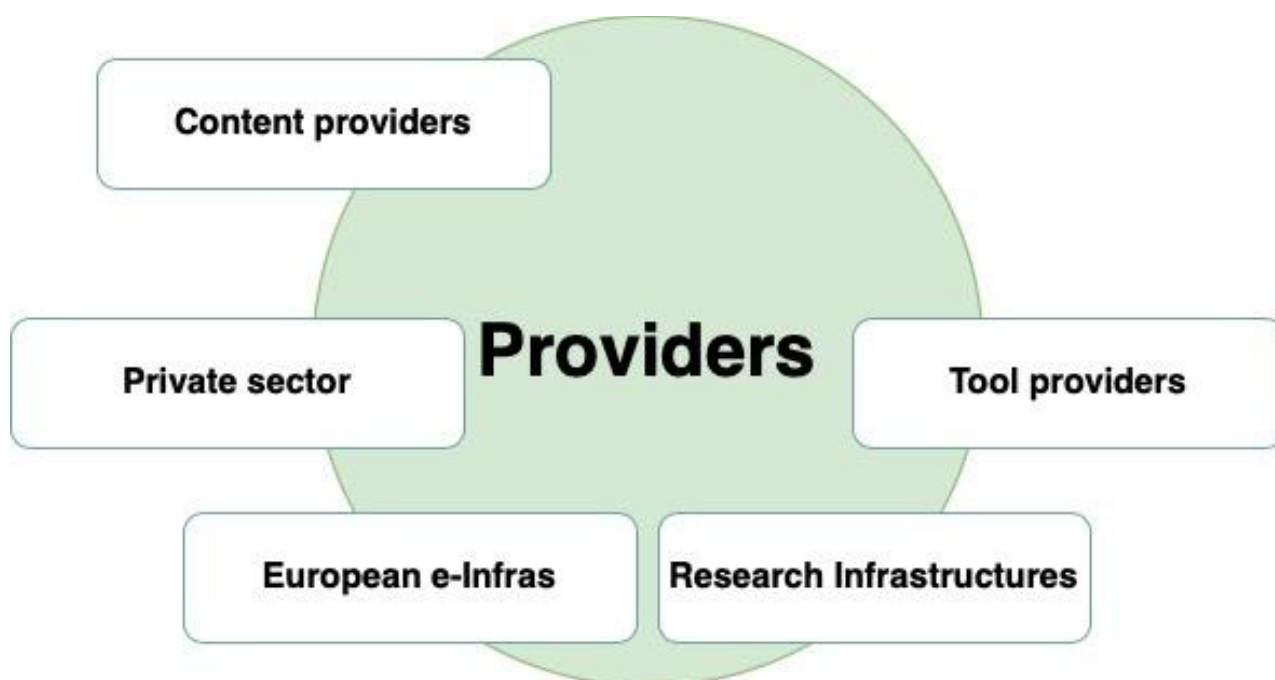
Figure 3.3: Front-Office user typology – Providers

4 Front-Office functional specification

As already mentioned, the EOSC Platform Front-Office is a continuation of the previous development undertaken by various EOSC-related projects. In particular, the UX framework for the User Component (which was delivered by the EOSC Enhance project) has been used for the functional specification of the system.

The following EOSC Enhance artefacts were chosen initially for the Front-Office UX design process:

- User personas,
- User stories,
- User journey maps,
- Card sorting.

When the EOSC Future project started, WP5 Task 5.1 entered a collaboration with the EOSC Enhance work package that curates the UX framework and decided to follow the patterns and guidelines used in that framework and to adjust it for the Front-Office.

The first months work effort focused on defining WP5's requirement gathering and analysis process (to be described in deliverable **D5.2a Front-Office Requirement Analysis**). The EOSC Enhance list was taken as the starting point for the set of artifacts that support the system's functional documentation. The consensus about the final set has been reached (together with EOSC Enhance project members) and the artifacts themselves have been developed in a collaborative manner and are currently maintained in the scope of WP5 Task 5.1 in EOSC Future.

The specification is currently documented in the EOSC Future project's wiki pages [11]] and covers the Front-Office functions and functional architecture.

The following artefacts are maintained to document the functional specification of the Front-Office and the present state-of-play:

- EOSC Portal sitemap (which evolve into the Front-Office sitemap);
- User flows;
- User stories.

4.1 Front-Office functional scope

The EOSC Platform Front-Office features span over several architectural components. The main challenge for functional modelling is to avoid technological bias during the analysis. Instead, a holistic modelling approach is taken to deliver a usable, integrated solution rather than a set of independent services. The functional scope is described based on the mapping of coarse grained user functions to the feature set that supports reaching the user goals.

In what follows, a function is defined as a goal that can be accomplished with a product, service, process, practice, system, application, document, component, machine or environment. As an exemplifying analogy '*an aircraft that can land'*.

In what follows, a feature is defined as a tool that helps to accomplish functions. As an exemplifying analogy '*the wheels of an aircraft are features that support functions such as landing or taking off'*.

Functional components, documented in the functional architecture diagram Figure 4.1, are distinguished to create logical blocks of functionalities. However, several crosscutting functional areas are also identified to indicate where it is possible to design a common and intuitive user interface. Table 4-1 summarises the scope of the Front-Office functionality and provides a mapping between the main functions and the corresponding features.

Table 4-1: Front-Office functions and features

Function	Features
Navigate the Front-Office	• EOSC Platform gateway webpage • Front-Office functions access

	• Back-Office functions access
Discover, access and compose resources	• Smart search user interface • Personalised resource suggestions • Resource comparison • Provider/resource details and access pages • Resource ordering and order management • User space for resource composition
Interact with the Front-Office using a personalised dashboard	• User profile • User settings • Personalised content • User space access • Feedback mechanisms
Access and contribute to EOSC knowledge	• Landing page for knowledge access • Training and learning materials access • Training and learning materials authoring
Access Open Science statistics	• Open Science metrics • Graphical metric analysis tools
Obtain support	• Open Science helpdesk/messaging access • EOSC Core Helpdesk reporting access

Each function will have underpinning goals formulated from the user perspective. Here are some of the goals already identified and used in surveys to understand which of them should have a higher priority over the others.

Examples of user goals based on the initial analysis conducted for the identified functional components:

- I am interested in exploring and following a European initiative whose mission states: 'To provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and re-use data, tools and services for research, innovation and educational purposes.' (Navigate the Front-Office).
- I am interested in exploring research-supporting results, guidelines and use cases supported by such an initiative - EOSC. (Navigate the Front-Office).
- I want to find new tools and resources that might support my research. (Discover, access and compose resources: Catalogue and Marketplace).
- I want to investigate in detail resources, tools or providers that are a part of the initiative supporting European science. (Discover, access and compose resources: EOSC Resource / EOSC Provider information).
- I am interested in training / training materials. (Access and contribute to EOSC knowledge: Training catalogue).
- I want to find potential partners for my scientific research. (Access and contribute to EOSC knowledge: EOSC knowledge hub (KH)).
- I want to investigate use cases like mine. (Access and contribute to EOSC knowledge: EOSC KH),
- I want to be able to use the resources discovered via the mechanisms offered in EOSC. (Discover, access and compose resources: Resource access).
- My use case(s) require(s) a specific technical configuration and I need support in setting up the infrastructure (Discover, access and compose resources: Resource provisioning).
- I am interested in service / resource provisioning on demand (Discover, access and compose resources: on demand access).
- I want to be able to specify my scientific profile, to be offered resources tailored to my needs (Interact with the Front-Office using a personalised dashboard: user profile management).
- I am interested in organising EOSC resources of interest in a dedicated space / project where I can find use-case specific user support (Interact with the Front-Office using a personalised dashboard: Marketplace projects).

- I want to organise EOSC resources of interest in a dedicated space / project for using them together (Interact with the Front-Office using a personalised dashboard: Marketplace projects).
- I am interested in organising EOSC resources of interest in a dedicated space / project so I can compose those resources in a workflow (Interact with the Front-Office using a personalised dashboard: Marketplace projects).
- I want to be able to report problems about the resources I use (Interact with the Front-Office using a personalised dashboard: Marketplace projects).
- I want to be able to give my feedback about the EOSC infrastructure (Interact with the Front-Office using a personalised dashboard: feedback mechanisms).
- I want to have a say about what EOSC should/will become (Interact with the Front-Office using a personalised dashboard: Feedback mechanisms).

To define the Front-Office functions, a dedicated template (see example of a filled in template in Table 8-2: Requirements template**)** has been created and is maintained in the scope of WP5, Task 5.1. Each function is linked with other functions (functional architecture) and has multiple connections to the technical components and requirements gathered.

4.2   Front-Office functional architecture

Based on the identified functions, and an understanding of the connections and interdependencies between them, the Front-Office functional architecture has been defined and analysed.

When creating a functional architecture for the system in question, one of the two main approaches might be incorporated:

- Designing functional components so they implement the features of multiple system's functions,
- Designing functional components so they implement features related to one system's function only.

In the Front-Office functional design, for each identified Front-Office function a dedicated functional component has been identified:

- Portal Website for the **Navigate the Front-Office** function;
- Catalogue and Marketplace for the **Discover, access and compose resources** function;
- User Panel for the **Interact with the Front-Office using a personalised dashboard** function;
- EOSC KH for **the Access and contribute to EOSC knowledge** function;
- Open Science Statistics for the **Access Open Science statistics** function;
- Open Science Helpdesk for the **Obtain support** function.

The complexity, interconnections, similar goals of the users and user workflows created by the functions are expressed by the following cross-cutting components:

- **Content browsing** - gathers the functions aimed at the discovery of EOSC offering in general (resources, guidelines, training etc.);
- **AI/Recommendations** - the features of the system which enable or create the user-specific presentation of EOSC;
- **User space** - all user dashboards with their features aimed at fulfilling dashboard-specific user goals in the system;
- **Engagement and interactions** - features allowing the user to communicate or interact with other EOSC stakeholders and/or representatives in a given operational scope (resource information, resource ordering, rating, EOSC feedback, user support, etc.);
- **Analytics** - features delivering quantitative and qualitative data and analytical tooling on EOSC-related artifacts or EOSC users' behaviour.

The functional architecture of the Front-Office is presented in Figure 4.1.
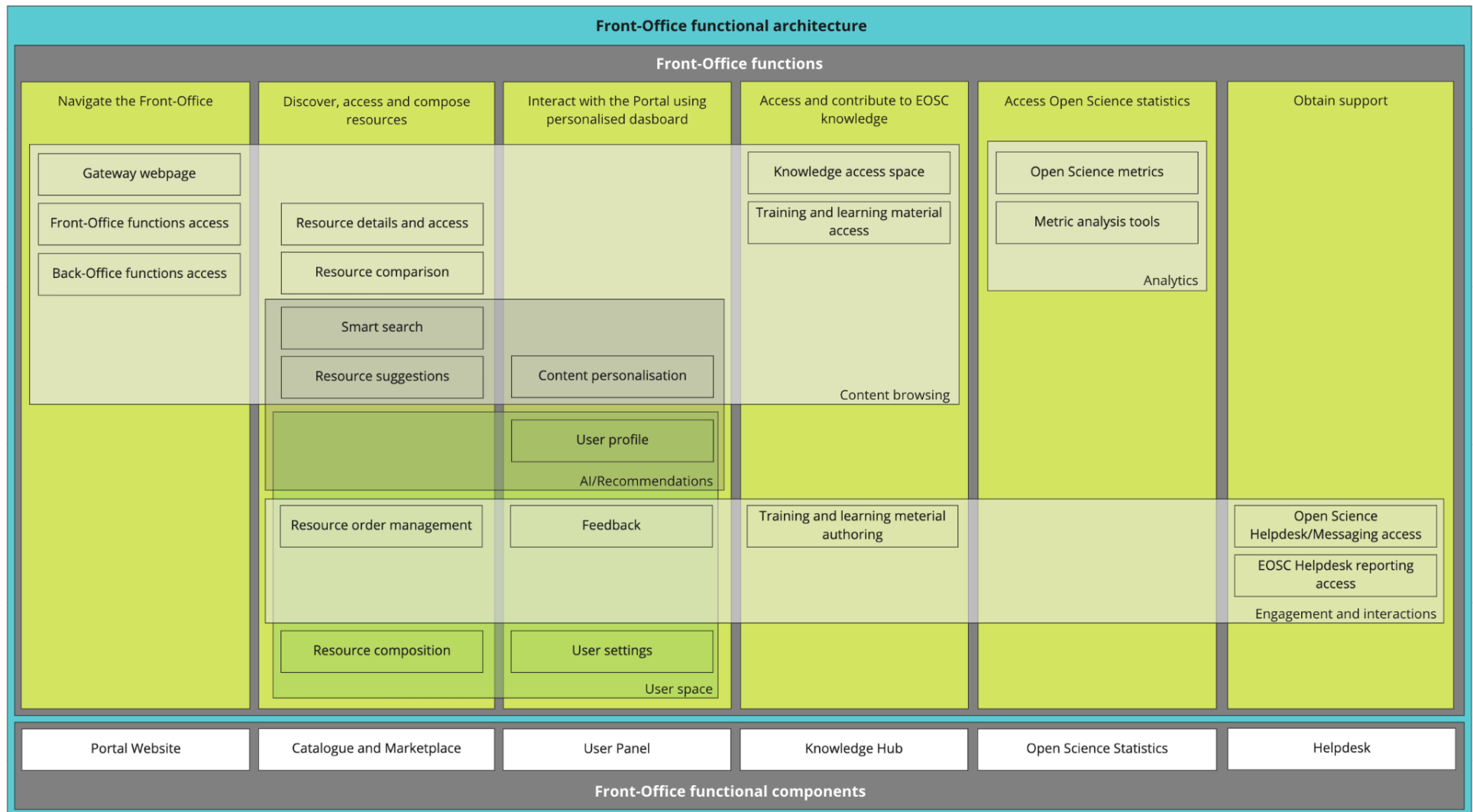
Figure 4.1: Front-Office functional architecture

4.3 Front-Office functional state of play

Of the various functional components identified, three already exist:

- Portal Website [12] .
- Catalogue and Marketplace [13] .
- Open Science Statistics [14] .

The state-of-play documentation refers to them and uses the artefacts introduced at the beginning of this chapter: sitemap, user stories and user flows.

4.3.1 Front-Office sitemap (Portal Website, Catalogue and Marketplace)

The Front-Office sitemap (limited to the Portal Website and the Catalogue and Marketplace functional components) helps developers, users, stakeholders and other parties to understand the Front-Office complexity, its content and the end user goals it serves. Maintaining an up-to-date sitemap supports the correct definition and analysis of the user journeys in the EOSC platform and is a tool used when assessing the platform's usability and user-friendliness. Due to the large sitemap structure, the visualisation provided in Figure 4.2 is simplified and might be insufficient to grasp the full structure. For the full sitemap, please refer to its source [13]]. Additionally, **Appendix C: Front-Office** sitemap presents a decomposed view of the sitemap.
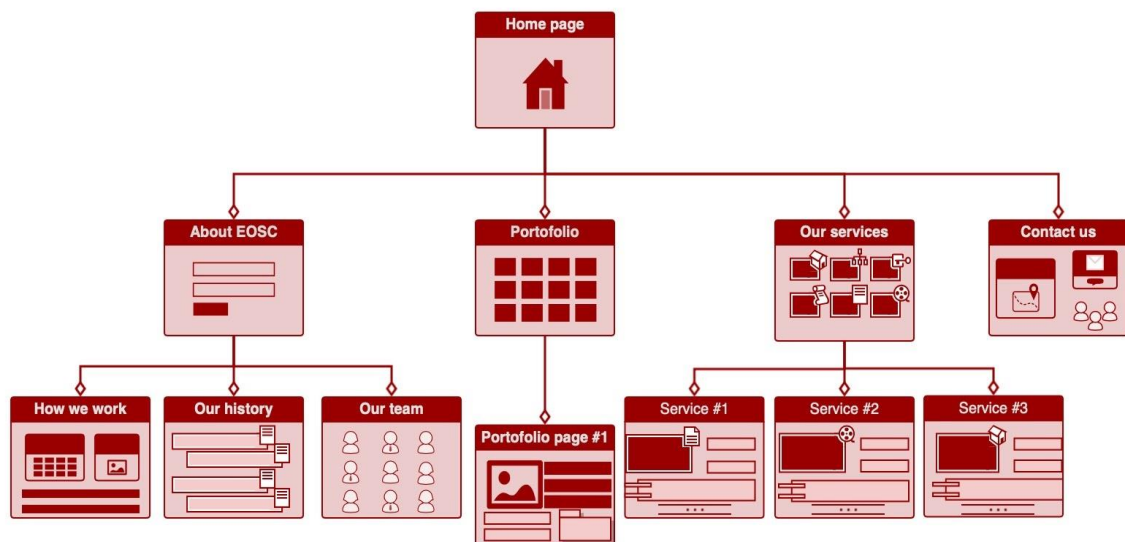
Figure 4.2: Front-Office sitemap visualisation (simplified)

4.3.2 Catalogue and Marketplace user stories

User stories describe the user experience for a defined user type and support product planning and delivery in UX methodologies.

Since the beginning of the development of the Catalogue and Marketplace (the component responsible for the majority of the user-oriented Front-Office features), it has relied on the UX methodology and artifacts to support its design and delivery. User stories were the first artifact used to document the Catalogue and Marketplace features via a set of user-oriented goals. User stories have proven they are fit for purpose and are being used elsewhere in the EOSC Future project to document existing features and plan the scope for the next ones.

The user stories database should properly support the purposes of the user stories. To be able to apply to the whole of the Front-Office, where Catalogue and Marketplace is just one of its functional components, the structure of the database has been updated (including the following changes):

- Added information about the connected user types (aligned with the Front-Office user typology),
- Added information about the connected functional components (aligned with the Front-Office functional components list presented in the previous section),
- Added information about the connected Front-Office services (aligned with the Front-Office technical architecture presented in the next chapter).

Appendix D: EOSC Platform Front-Office user stories contains a copy of the Front-Office user stories database (developed in course of the previous projects as EOSC-Hub, EOSC Enhance) which, currently covers the Catalogue and Marketplace functional component. It will be populated with the user stories for the rest of the Front-Office functional components in due course. The database records are not entirely up to date with respect to recently added fields (an ongoing activity in WP5 Task 5.1) but are up to date in terms of the Catalogue and Marketplace features documented here.

4.3.3   Catalogue and Marketplace user flow diagrams

The flow diagrams document the user workflows implemented in the Catalogue and Marketplace. They are aimed at keeping track of the system's complexity and the processes they implement.

When defining the user flows for the Catalogue and Marketplace as a whole, four main functional areas emerged which were the germ for the Front-Office functional components identification.

- Resource browsing and filtering (Catalogue and Marketplace discovery);
- User profile;
- Resource access mechanisms (initially defined as resource ordering);
- Marketplace user projects (Marketplace projects).

The identified workflows are presented in

Appendix E: Catalogue and Marketplace user flows.

Catalogue and Marketplace features

An integrated, user-facing part of the EOSC Platform that provides access to the onboarded EOSC resources for various research domains. A set of features (seeTable 4-2), implemented in the Catalogue and Marketplace functional component, supports efficient resource discovery and access, order management and facilitates the interactions of users with EOSC Platform and EOSC providers.

Table 4-2 Features implemented in Catalogue and Marketplace functional component

Features	Functional area	Description (how the feature is built and what it provides)	Added value for EOSC users
User profile	User profile	User-defined settings of the user account.	A dedicated space to specify user's scientific profile, to be offered resources tailored to user research needs.
Resource search	Discovery	Advanced full-text search capabilities allowing to find matches in various research metadata properties.	Possibility to find new tools and resources that might support user's research with a use of search phrases relevant to the user's research.
Resource filtering and sorting	Discovery	Ability to reduce the result set of the search with the use of filters and various sorting mechanisms.	Possibility to find new tools and resources that might support user's research with a use of dedicated filters able to reflect users research profile.
Resource Presentation Page	Discovery	User-optimised display of the metadata properties of the resource. The main space for obtaining resource access and support.	For the researcher: Possibility to investigate in detail resources, resource offers, tools or providers that are a part of the initiative supporting European Open Science. For the provider: Possibility to advertise providers, services and resources to a wider user base.
Provider Presentation Page	Discovery	User-optimised display of the metadata properties of the resource provider.	For the researcher: Possibility to investigate in detail resources, tools or providers that are a part of the initiative supporting European Open Science. For the provider: Possibility to advertise providers, services and resources to a wider user base.
Resource comparison	Discovery	A feature allowing for setting up the infrastructure of resources based on the user needs.	Comparing the resources of interest using informational parameters relevant to the user's search/filtering criteria.
Favourite resources	Discovery	Favourite resources selection on the list of search results and the resource presentation page.	Ability to mark resources to express the user interest and have easy access to them on a dedicated dashboard.

Resource Access Button	Access mechanisms	The access wizard intuitively guiding the user via various resource access mechanisms.	Possibility to express the will to use the resources discovered in Catalogue and Marketplace via the mechanisms offered in EOSC (Open Access, Internal Ordering, External Ordering).
Resource Access technical parameters form	Access mechanisms	A configuration panel for the technical parameters specification in the access wizard.	Possibility to express the requirements of specific technical configuration needed by the user to support user's scientific use case .
Marketplace user project's project items list	Marketplace user projects	Project item = access request or resource order	Organising EOSC resources of interest in a dedicated space (Marketplace user project) to show the wish to use them in the scope of one research project.
Marketplace user project definition	Marketplace user projects	User project feature allowing to group resources by use cases.	Describing the Marketplace user project with information possibly relevant to EOSC providers when assessing access requests or resource orders. Helps the providers to assess the relevance and scientific value of the incoming request.
Marketplace user project support	Marketplace user projects	Support tab in the user project functionality.	Possibility to receive use-case specific user support from EOSC Experts and Providers. Possibility to report problems about the resources added to the user project in one, dedicated place.
Feedback ribbon	Feedback and support	User interface element allowing to submit feedback via form.	Possibility to submit feedback regarding the EOSC infrastructure.
'Ask a question' button	Feedback and support	Sending the message to the provider about the resources (button in the resource presentation page) or a provider (button in the provider presentation page).	When discovering an EOSC provider or resource, the users have a dedicated feature allowing them to ask a specific question from the resource presentation page or provider presentation page.
Report an issue	Feedback and support	Creating a ticket in the EOSC Core helpdesk.	Possibility to inform about the problems occurring when using EOSC Corel services.
Feature highlight	Feedback and support	Stepwise visualisation of the newly added feature with the usability instructions.	A dedicated tour of a new Catalogue and Marketplace feature, presenting the feature's capabilities to the user, providing the information potentially relevant for the user's experience in the system.
A/B testing Catalogue and	Feedback and support	Session-based mechanism of presenting variants of the	More intuitive design for the sake of a better user experience in the

Marketplace framework		user interface components to assess usability.	Catalogue and Marketplace functional component.

4.3.5 Open Science Statistics features

With the use of the Open Science Monitor service, the Open Science Statistics functional component presents a collection of indicators and visualizations that help interested stakeholders (policy makers and research administrators among others) better understand the Open Science landscape in Europe across countries and (in the near future) subject areas. The platform assists with monitoring, and consequently the enhancing, of open science policy uptake across different dimensions of interest, revealing weak spots and hidden potential. Based on the EOSC Research Graph, following open science principles and an evidence-based approach, the indicators can be used to provide timely and reliable insights on the evolution of open science in Europe and assist in promoting good practices.

Despite the wealth of information presented through the Open Science Monitor, the functionality of the component can be considered quite straightforward:

- Only one user type is supported, the anonymous user. Users don't need to login, since there is no envisioned additional functionality for registered users.
- The set of indicators and visualisations is predetermined by the design team. The users may only navigate through the offered information and cannot in any way create new indicators or visualisations, or modify the existing ones.

As such, the design of the component consisted of two tasks: the selection of which indicators and visualizations to present in the Front-Office and the arrangement of the data in the various pages. The former is an ongoing process and out of the scope of this document, while the latter concluded with the following arrangement:

- **Home page:** In this page the most basic and essential indicators are included such as the number of open access publications by country and the number of open access journals and repositories in Europe.
- **Europe overview:** In this page more detailed indicators and visualizations about Europe are presented. The list of indicators includes the number of open access publications/datasets/software broken down by country, funder, organization, and data source and also similar indicators about publications with a Persistent Identifier (PID) or license, etc.
- **Country Overview:** This page contains similar detailed indicators as the overview of Europe but this time it is specific to a country.

The features of the Open Science Statistics functional component are elaborated in Table 4-3.

Table 4-3: Features implemented in the Open Science Statistics functional component

Features	Description (how the feature is built and what it provides)	Added value for EOSC users
Overview of Open Science across Europe	This page displays a set of indicators that present the overview of Open Science across Europe, such as the number of open access publications/datasets and the number of repositories and journals.	Indicators and statistics about Open Science across Europe
Detailed view of Open Science across Europe	This page displays the most detailed set of indicators across Europe, such as the number of open access publications by type, country, data source, and organization, or the number of publications with a PID or a license.	Indicators and statistics about Open Science across Europe
Detailed view of Open Science for individual countries	This page is similar to the detailed view of Open Science across Europe with the difference that it displays those indicators for a specific country.	Indicators and statistics about Open Science for a specific country

4.4 Initial functional gap analysis for the Front-Office

The delivered functional architecture compared with the state-of-play of the Front-Office resulted in the first functional gap analysis. Considering what the Front-Office is aspiring to become and the vast range of functionalities it is supposed to offer, the first months of EOSC Future were devoted to the analysis of the functional components and areas which are non-existent at the moment:

- User Panel;
- Knowledge Hub;
- Recommender System.

Due to the recognised importance of training and information sharing capabilities in EOSC, a dedicated analysis was additionally conducted for the EOSC learning platform with the emphasis on one of its subcomponents (EOSC training catalogue).

During the comparative analysis, the missing features of the existing components have also been identified. However, the focus of the whole gap analysis was concentrated on the missing components. The major features that are currently missing from the existing components are:

- Resource composition;
- Smart search;
- Metric analysis tools.

They will be analysed in the scope of WP5 Task 5.1 and, based on the resulting design, implemented in the corresponding development tasks in WP5.

In addition to the missing features, there is also space for extensions or enhancements to the features already delivered by the platform. As a result of an ongoing process of requirement gathering and analysis in WP5 Task 5.1, some potential features were identified for development to better meet user expectations. These features should also fulfil the user goals recognised in the Wp5 Task 5.1 feature verification activities (surveys, requirement gathering, feature-specific consultation). The features identified so far are resource details and access, content browsing.

The underlying analytical process and its results for the identified features will be the focus of deliverable **D5.2a: EOSC Front-Office requirement analysis**, planned to be published at the end of month 9 of the EOSC Future project.

4.4.1 User Panel

4.4.1.1 Introduction

The *User Panel* (UP) is a functional component of the Front-Office for managing the interaction with the user and providing them with user-specific information about the services offered in EOSC. It includes elements relevant or possibly relevant to the user's activity in the Front-Office. Those activities are:

- supporting the research-related activities of the user,
- supporting the EOSC-related activities (projects, task forces, communities etc.) of the user,
- managing user profiles settings.

4.4.1.2 Functional specification

The User Panel is directed primarily to Consumers - Researchers who play the key role as the users who want to access the items offered by the Front-Office to support, foster and facilitate their research activities.

The User Panel provides the user with information that enables them to conduct EOSC-supported research activities. There are five major functional areas in the User Panel:

- **User profile,** which covers the functions responsible for collecting, entering and managing data about the user stored in EOSC. It includes the data about the user, its identifiers (e.g. the Open Researcher and Contributor ID (ORCID)), contact data, affiliations, involvements, history, publications, projects etc. The profile is currently identified with ORCID, but other supporting identifiers can be used as well.

Data stored in the User Profile will be used by the Recommender System module, and the results will be presented in the User Panel.

- **User settings**, which allow for customizing the User Panel to the user's needs.
- **Access to EOSC-managed items**, which helps the user to discover, learn, acquire, manage and compose items (i.e., resources, services, training etc) offered by the Front-Office.
- **Feedback**, which allows the users to rate items (both positively and negatively); the ratings could be used by other users, resource providers or the recommendation system in Front-Office.
- **Collaboration with other EOSC users**, projects or research groups.

The following functions are considered most relevant for the users:

- accessing EOSC resources, news, articles and other items that could be relevant to them, based on their research domain or interests;
- defining technical needs, related with deploying, using and combining EOSC resources to create research environments;
- discovering and creating new groups of interest, to foster collaboration with other researchers;
- providing feedback and rating the EOSC resources that have been used by the user;
- creating a dedicated personal space to collect and visualize the relevant information about the research projects the user is involved in, to facilitate accessing the resources related to them.

Proper implementation of these functional needs requires that some non-functional constraints or requirements are addressed:

- The User Panel manages personal data, which makes it a sensitive module with respect to accessing data, securing them from unauthorized access and managing consents the user needs to grant.
- The User Panel needs to be customizable and intuitive, to help users using it and prevent them from making mistakes.

As user stories are used as one of the main approaches for documenting the functional specification of the Front-Office, the intentions of the users and resulting possible features to be implemented are formulated with the use of this tool. The list of user stories identified for the Front-Office User panel is:

- As a Researcher, I want to define my scientific profile and interests in order to be offered services and scientific products that might support my research activities.
- As a Researcher, I want to define my interests so I am exposed to relevant scientific content that might apply to my research or interests.
- As a Researcher, I want to see news and articles that are related to my interests and activities.
- As a Researcher, I want to define my technical needs in order to be offered resources that might support my research activities.
- As a Consumer, I want to define my EOSC activities (projects, communities, working groups, task forces) so I can reach all relevant websites from one place.
- As a Consumer, I want to provide feedback on the (suggested) resources available.
- As a Consumer, I want to be able to rate services in the EOSC (user satisfaction).
- As a Consumer, I want to be able to remove all data related to my account (General Data Protection Regulation (GDPR) compliance).
- As a Consumer, I want to have a dedicated and intuitive space to reach the services and scientific products of my interest.
- As a Consumer, I want to have a dedicated and intuitive space to reach the services I'm using (workflows I've defined).
- As a Consumer, I want to have a dedicated and intuitive space to reach the Marketplace projects I have defined.
- As a Consumer, I want to have a dedicated and intuitive space to locate funding opportunities.
- As a Consumer, I want to have a dedicated and intuitive space where I can find my EOSC-related messages.
- As a Consumer, I want to be able to form user groups in the Front-Office.
- As a Consumer, I want to relate a user group to a Marketplace research project.

- As a Consumer, I want to be able to join a discussion of my interest (forum feature).

After further analysis and confirmation of the elements included in the list, they will be added to the Front-Office user stories database (see **Appendix D: EOSC Platform Front-Office user** stories**)** and described with the rest of parameters existing in the user story record (connected user type/functional component/technical component).

4.4.2   EOSC knowledge hub

4.4.2.1   Introduction

A brainstorming session held in August 2021 revealed that there are quite different levels of expectations of what the EOSC KH should be. It is therefore considered important that within EOSC Future there is as a first step an initial agreement on the basic functionalities of the EOSC KH, allowing the design of those basic Front-Office functionalities to which additional future functions can be added throughout the project and beyond.

The grant agreement specifies that WP9 will specify the EOSC KH, will hand over the specification to WP5 for implementation, and after validation it will pass to WP7 for operation within the Front-Office. The EOSC KH specification is due in M18 (to be described in deliverabel **D9.2 EOSC EOSC knowledge hub (Training Catalogue and Platform)** to be led by LifeWatch). This is too late considering that the EOSC KH will require an iterative design of the Front-Office. WP5 should therefore strive to create a consensus with WP9 on the basic functionalities to kick-start the iterative development as soon as possible. This would most likely also enhance the content of the deliverable D9.2).

Starting from the definition in the EOSC Future grant agreement, which states that 'The Knowledge Hub has two essential components: a training resource catalogue and a learning platform, both intended to support FAIR sharing and reuse of training resources in EOSC. From an architecture point of view, the KH will build on existing technologies and concepts, including prototypes developed by cluster projects like TeSS (ELIXIR Training Registry) and initiatives like FOSTER', it is possible to imagine that the EOSC KH will be a place to:

- Pool resources for reading, watching, or working;
- Share work with others, network and collaborate with peers (birds-of-a-feather (BoF));
- Enhance skills and expertise and develop and retain specialist knowledge;
- Connect to relevant up-to-date professional development resources.

4.4.2.2   Definition

The EOSC KH builds on top of the EOSC learning platform and is a workspace for training and knowledge sharing.

4.4.2.3   Functional specification of the EOSC knowledge hub

The user interface of the EOSC KH has to provide functions for 1) the user, 2) persons providing content, and 3) system administrators. The EOSC KH will allow multilingual support for inclusiveness and ease of access.

Seen from the perspective of the user, unauthenticated access should allow use of the training catalogue and the training platform, whereas authenticated access should allow the learning experience to be shared with others. For this it should be possible to create or subscribe to groups of interest with dedicated workspaces and tools such as wikis, mailing lists, dashboards, FAQs, etc. For subscribing to a group it should be possible to search EOSC KH groups according to metadata tags. Each user should have the possibility to edit her/his user profile that is exposed in the EOSC KH. The user should have the possibility to subscribe to an activity stream/thread and be able to receive activity notifications for the subscribed streams/threads. An EOSC KH messaging system should allow users to easily communicate between each other.

Each user group should have a set of well-defined metadata allowing others to identify the scope of the group. This would allow others to decide whether to join a user group. A user deciding to create a new group will assume the role of group facilitator and will be able to manage all group attributes including the transfer of the group to new group facilitator.

- For the content-provider, the EOSC KH should identify groups for which the content might be relevant. Content-providers should be able to gather usage statistics for their learning material.
- For the system-administrator, the EOSC KH should monitor the creation and operation of user groups to ensure the requirements for rules of participation (RoP), GDPR, and cybersecurity are respected. System administrators may also be entrusted with the curation for inactive groups and/or content.

4.4.2.4   Other important considerations

Cybersecurity and GDPR compliance have to be core considerations in the implementation and operation of the EOSC KH. Both aspects require detailed technical specifications to deliver a trustworthy platform.

4.4.3   Learning Platform

4.4.3.1   Introduction

The Learning Platform is part of the EOSC KH. It will give EOSC users access to highly interactive training courses and training material. The main features of the learning platform are:

- A repository and a directory of openly available training material;
- A place for depositing and integrating new or updated training material;
- A place where users can interact with each other and store user-related information linked to training;
- A place to collect and store monitoring and accounting information and to manage the platform.

4.4.3.2   Definitions

The EOSC training catalogue is part of the Learning Platform, and the learning platform might become part of the EOSC KH. The training catalogue and the learning platform are tightly integrated and therefore are discussed together in what follows. The training catalogue will be mainly, but not only, the aggregation of existing catalogues.

The EOSC training catalogue is a catalogue of catalogues and also a catalogue on its own for training material which would otherwise have no place/space.

The term 'training material' refers to content of different types and formats, such as text, audio, video, virtual reality.

4.4.3.3   Functional specification of the Learning Platform

The user interface to the Learning Platform must provide functions for 1) the user, 2) persons providing training material, and 3) system administrators. The learning platform will allow multilingual support for inclusiveness and ease of access.

As seen by the user, the Learning Platform should allow access to training materials without authentication or to authenticate with the EOSC AAI; search for training material either by simple keywords or by using Boolean expressions; preview the training material via well designed landing pages and constitute a learning programme similar like adding items to a shopping list. When starting a training session, the user should be able to visualise the training material on different devices such as tablets, smartphones, or computer screens, stop and restart training sessions where stopped, and change from one device to another. The training platform should keep records for each authenticated user about their profile/interests, training history, certifications/badges obtained. Training material may also be licensed material and hence involve ordering and payment by the user. The user should be able to provide feedback on training material. The feedback should either go directly to the trainer or be associated with the training material as a rating. Authenticated users should be able to receive content alerts when new or updated training materials become available. Other, more complex functions, such as gamification, integration with social networks, quality assurance, accreditation etc, will be discussed as part of the EOSC KH.

As seen by the trainer or content provider, the Learning Platform should allow users to deposit new training materials in the EOSC training catalogue (independently of existing training catalogues) and organise a review procedure/workflow for training materials. Since training materials will have to comply with a set of rules and standards (RoP), the Front-Office will help in the verification and completeness of training material metadata.

The Learning Platform should support versioning for training material. The trainer or content provider should have all the necessary tools to interact with the trainees, to react to their feedback, and to provide assistance.

As seen by the system administrator, the Learning Platform should allow gathering usage statistics, manage and create user groups, manage notifications, and overall manage all functions of the training platform such as feedback, dashboard or interaction with the recommender system. It should be possible to create hierarchical access and management rights for systems administrators ranging from overall EOSC learning platform management down to individual training management.

4.4.4   EOSC recommender system for enhanced User Experience

The recommender system developed in the scope of the EOSC Future project builds upon the practices and methods tested in the previous projects and prepares the Front-Office for the delivery of a personalised user experience. The recommendations are based on AI-enabled reasoning, using the metadata of the resources that can be found and used via the Front-Office. The following analysis defines the initial understanding of the functional gap that needs to be bridged during the lifetime of the project.

4.4.4.1   Motivation

Currently, the users who access EOSC gateways (such as the existing Marketplace) are presented with the full spectrum of available resources. They may use and combine services from different service providers representing various domains. The researchers, who are the primary target group of users, are expected to know in detail their specific needs and the constraints of EOSC to find a proper set of resources. Furthermore, the researchers need to be technically skilled to assemble the resources. Typically, this is not the case and results in an information gap and sub-optimal selection of resources. Moreover, the user interactions and experiences can be affected by the sheer volume of resources as well as the diversity of the thematic platforms available through EOSC. Discovery and navigation throughout the Catalogue and Marketplace can be confusing and often overwhelming, which in turn decreases the overall satisfaction in using EOSC.

The demand state for EOSC gateways serving the content to users is to present them a carefully selected subset of available resources, based on intelligent discovery of user preferences, comprising the items which fit the user profile as well as intuitive and effective search capabilities throughout the various types of resources.

4.4.4.2   Expected capabilities

The Front-Office should provide a user with a tailored set of available resources, an intelligent discovery and smart recommendations, based on the user's feedback and explicit or implicit preferences. Users (such as researchers or research-oriented organisations) should be able to find, compose, and reuse resources (e.g., services, research publications, data and software) across disciplines and communities through a resource sharing framework. Moreover, researchers would be able to share their scientific results as openly as possible and get recommendations for EOSC resources (such as services) or research products and other entities (such as authors or projects) that may be of use to them. This feature supports the implementation of FAIR data principles to foster cross-disciplinary interoperability [17]].

In general, there are three main scenarios for providing a personalized view of the EOSC resources and enhanced capabilities to explore EOSC:

- **Interactive workflows.** The interactive workflows function should support the discovery, composition, and execution of workflows obtained as a combination of resources compliant with the same framework. The system can assist the researcher in this process by recommending the resources to be picked-up. Moreover, the system would utilize the user's past engagements (experience, collaborations, organizations and contacts), as well as the user's previous activity (views, searches, orders etc.) to provide meaningful resource recommendations.
- **Smart search.** The smart search function should support personalized search across the data, services and software available in EOSC. The information provided by the user explicitly in a typical search query is usually incomplete or imprecise and may produce confusing results. Similarly to the interactive workflows, smart search would rely on the user's past engagements (experience, collaborations, organizations, publications and contacts), as well as the user's previous activity (searches, orders etc.),

to provide contextualized results. Query autocomplete is a recommendation feature that has been successfully integrated into search engines.

- **Personalized recommendations**. Personalized recommendation function should support EOSC end-users visiting the Front-Office to select services and resources, as well as extracting their needs. In general, such recommendations can be expressed in two ways:

  o based on the preferences of other users with similar characteristics; for example, if a geologist orders a service, the recommender system may present a message such as 'the ABC service is recommended because people like you also use it' or 'the ABC service is recommended for you because geologists often use it'.

  o based on the specific product features, e.g., *'you may be interested in the ABC service because you have also ordered the XYZ service' or 'in connection with the fact that you were interested in the XYZ research dataset, we recommend the ABC research paper to you'.*

The personalisation of usage and recommendation of services should span beyond the scope of a single system. EOSC end-users can be offered various types of advanced infrastructural services, aligned to their interests, and based on the information related with their user profile and activity: historical data, preferences, professional profile, budgetary constraints or similar choices made by other users with similar needs etc. That would make the process of selecting services more declarative, in which the user expresses their needs, while many technical aspects of composition of the services and compatibility issues could be managed (or at least supported) by the Front-Office. On top of that, e-Infrastructure services providers (public and commercial) could be fed with instant, evidence-based data concerning users' activities and their demands for all types of services and resources (e.g., storage, computation, sharing and discovery and others). Based on this information, EOSC operators could adjust their services to the demands and expectations from the community.

4.4.4.3 Solution

The solution to meet the aforementioned needs is the EOSC Recommender System (EOSC RS). The goal of the EOSC RS is to recommend a set of items to users in a given context, based on their preferences, background data and algorithms. Recommended items can be anything that is of interest to the user: EOSC services, EOSC resources, scientific results (i.e., literature, software, datasets). As a result, the EOSC RS will improve the overall UX of the system and increase the visibility of EOSC resources in user communities.

EOSC RS will utilise various types of data, such as events from user activity in the Catalogue and Marketplace, user profiles, resource metadata, and information collected from external data sources e.g. EOSC Research Graph. They will be used for data mining, analysis, profiling and to create recommendations (for example, by content-based and collaborative filtering algorithms).

Researchers will be provided with recommendations based on a variety of data sources, such as:

- history of items browsed, observed or used by the user in the past;
- user interests declared by them or extracted from the data associated with the user;
- items that have been used by former or current collaborators of the user;
- items that are popular in the community, both general or the researchers who are like the user or work in the similar domain;
- data provided explicitly by the user, either directly or in an interaction with the EOSC RS.

The information about researchers, their interaction with the Front-Office, usage of resources and similar will be enabled through standardized ways (Application programming interfaces (APIs)). Thereby, EOSC service providers can personalize and offer services based on the overall usage paths and preferences collected in the wider EOSC ecosystem.

4.4.4.4 Impact

With the introduction of EOSC Recommender System, delivering AI-driven enhancements to the EOSC gateways, WP5 will not only attract more users as a result of innovative services and the enhanced user experience, but will lead to a wider adoption of EOSC resources within European research communities. It will

also improve the user experience by recommending services or resources that are better aligned with the users' needs.

5 Front-Office technical specification

Based on the analysis of the functional gap that needs to be bridged with the implementation phases of the EOSC Future project, the technical architecture needs to be aligned accordingly. The vision of the architecture is presented as the target version expected at the end of the project. Nevertheless, the current vision needs to be treated as a preliminary design as many of the architectural concepts are currently being elaborated by the respective research and implementation activities in WP5 and WP4. In addition, the continual requirement gathering and analysis processes will guide the future evolution of the technical architecture throughout the whole project. The technical specification is based on the architecture diagram and technical specification of the respective architectural components. A clear distinction has been made between the Front-Office components and other components in the project landscape that will be supporting the Front-Office implementation. The provided description addresses the current state of play and the initial assumptions towards reaching the project goals by bridging the technical gap described in the last paragraph.

5.1 Front-Office architecture

Front-Office architecture diagram documents relationship between following architectural components:

Components currently integrated in the Front-Office:
- EOSC Portal website;
- EOSC Marketplace;
- EOSC Marketplace Recommender System.

Supporting components developed by other WPs within the project:

- EOSC AAI;
- EOSC (Core) Helpdesk;
- EOSC Service Registry;
- EOSC Portal Providers dashboard;
- EOSC Research Graph;
- EOSC Digital Innovation Hub.

Front-Office components to be developed and integrated during the project by WP5:

- EOSC Knowledge Hub;
- EOSC Recommender System;
- Open Science Helpdesk/Messaging;
- Open Science Training Catalogue;
- Open Science Monitor.

Based on the implementation of these components, the Front-Office will be built to support the functions that were described in the functional architecture. The Front-Office functions are mapped to the functional components that together form the Front-Office user interface layer. The components of the user interface are supported by the Front-Office services as well as the supporting services (other services of the EOSC Core including monitoring and acconting, AAI, helpdesk) that are being developed out of the scope of the Front-Office (mainly by WP4). The logical links between the parts of the user interface as well as the interrelations between services and front-end components are presented in Figure 5.1 (for visual simplicity the 'EOSC' acronym has been removed from the service names). The details of each of these services are presented below.
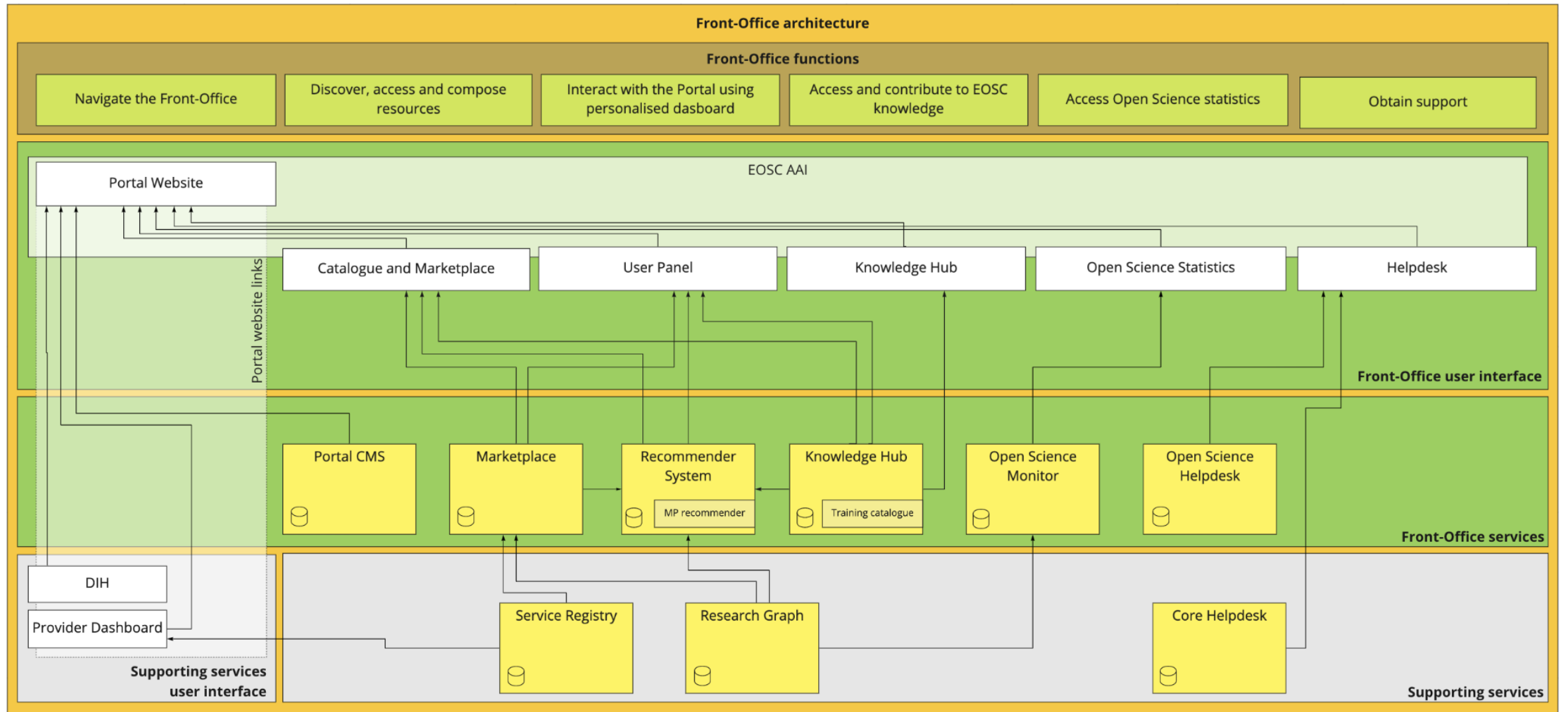
Figure 5.1: Front-Office technical architecture

5.2 Front-Office components technical specification

The technical specification of components complements the architectural diagram and describes the technical characteristics of the Front-Office services. This specification reflects the initial state of the project and will be updated in the successive deliverables to include changes implemented to complete the project goals. Descriptions have been simplified to minimise the content to the necessary essence for the readers.

5.2.1 EOSC Portal Content Management System

The Front-Office is a gateway to information and resources in EOSC, providing updates on its governance and stakeholders, the projects contributing to its realisation, funding opportunities for EOSC stakeholders, relevant European and national policies and recent developments. The technology of the Front-Office Content Management System (CMS) is a Drupal Content Management System which allows groups of editors to curate the various materials that are published via the EOSC Portal website.

Table 5-1: EOSC Portal CMS technical feature summary

Component Name	EOSC Portal CMS
Main features	- Front-Office gateway - EOSC related news and events - EOSC Projects, EOSC Association, EOSC Glossary info - Policy info - Community use cases info - Public documentation space
URLs	- Website: https://eosc-portal.eu/ - About: https://eosc-portal.eu/about-eosc-portal
Documentation	- Drupal documentation: https://www.drupal.org/documentation; - Common navigation/login components: https://github.com/cyfronet-fid/eosc-portal-common
API types and use-cases	No API
EOSC-Future components expected to interact with this component	- Integrated navigation for the front-end layer of Catalogue and Marketplace, User Panel, EOSC KH, Open Science Monitor and the Open Science Helpdesk - Is linked via Portal website to many other Front-Office services (see Figure 5.1 architectural diagram for details)

5.2.2 EOSC Marketplace

The EOSC Marketplace is an integrated platform that allows easy access to resources from top European providers for various research domains along with integrated data analytics tools (see Figure 5.2).

With the use of the Marketplace, it will be possible to operate a scalable and well-managed EOSC resources-oriented ecosystem with a growing service portfolio and with a transparent governance model. From the researcher point of view, the key benefits include the ability to:

- Discover and compare multiple resources and services such as scientific outputs, applications, data management, compute services and thematic services;
- Order EOSC resources;
- Organise resources of interest and resource orders into logical blocks in Marketplace Projects to reflect a common scientific purpose and gain EOSC expert support for the created Marketplace Project;
- Access services and resources using a common authentication/authorisation process;
- Pick up on best practices and practical examples featuring research communities (see the Use Cases in **Front-Office functional scope** above) benefitting the most from EOSC;
- Provide feedback about services and information to contribute to building the EOSC service portfolio.
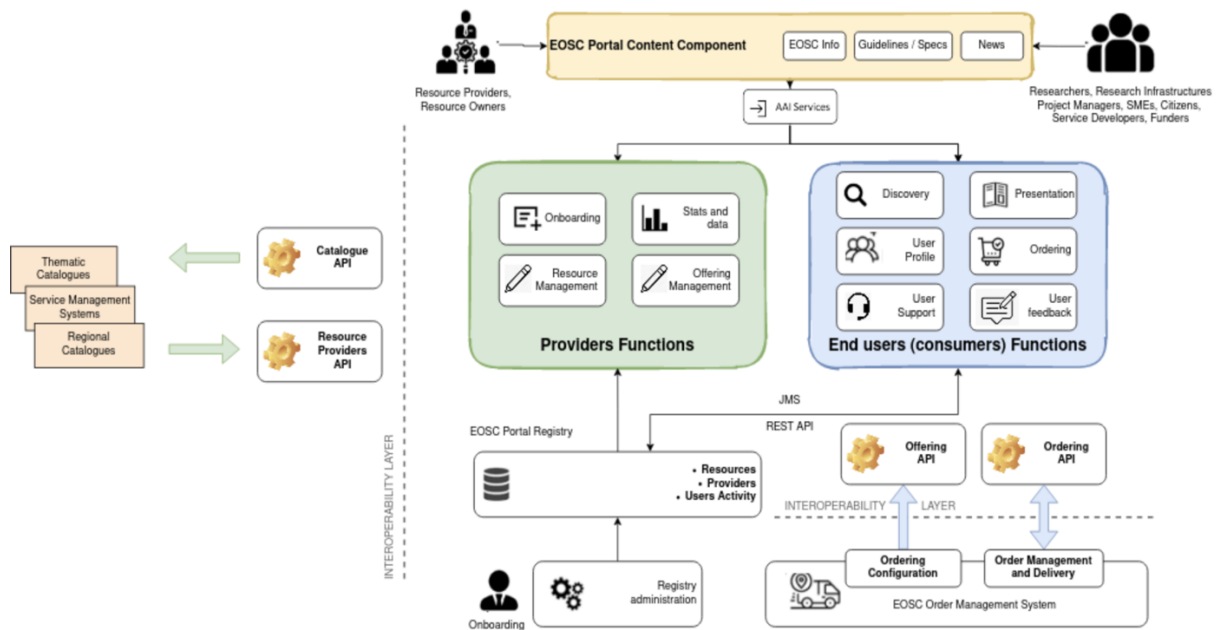
Figure 5.2: EOSC Portal Website (Content Component), EOSC Marketplace (End User Component), EOSC Service Registry and EOSC Provider Dashboard in the current Front-Office architecture

Table 5-2: EOSC Marketplace technical feature summary

Component Name	EOSC Marketplace
Main features	- Important element of the EOSC-supporting infrastructure - Interfaces towards other CORE services to promote user and resource related data and functionalities - Possibility to offer resources through the EOSC channel, increased visibility - Dedicated panels and provider supporting functionalities - Functionalities supporting the connection of existing catalogues or order management systems - Increased (demonstrable) impact of resources delivered (e.g. order statistics) –> additional funding - Access to EOSC resources - Discovery - Information - Access mechanism - EOSC support and expertise - User requests - EOSC experts support - EOSC providers support - Dedicated functions and panels - User profile - Marketplace user projects - Possible access to statistics connected with the interest around EOSC resources - Additional source of information about the exploitation of the EOSC resources - Lower the marketing and transaction costs considerably compared to targeting individual research institutes or researchers. - Exposure to EOSC offerings that might enrich enterprise services
URLs	Service URL: https://marketplace.eosc-portal.eu

	• Source code repository: https://github.com/cyfronet-fid/marketplace
	• API endpoint: https://marketplace.eosc-portal.eu/api
Documentation	• Introduction: https://eosc-portal.eu/using-the-portal
	• Tutorial video: https://www.youtube.com/watch?v=T2G70yZ52Kc
	• API documentation: https://marketplace.eosc-portal.eu/api_docs
API types and use-cases	• Offering API
	- Supporting providers' capabilities to publish information about the services'/resources' offers via a dedicated API. No need to use user interface for the sake of showing the consumers the service/resource offers
	- Allows to create/update/delete the offers
	- Allows to manage the technical parameters of te offers which are essential for the order management process
	• Ordering API
	- API allowing to retrieve information about the customer orders
	- Order status handling
	- Channel for the user support (user/provider/OMS team messages exchange)
	- Passing user details (credentials, SLAs etc)
	- Passing MP project details (information about the scientific use case the customer is bringing)
EOSC-Future components expected to interact with this component	• EOSC Recommender System
	• EOSC Research Graph

5.2.3 Open Science Monitor

The open science observatory presents a collection of indicators and visualiszations that help interested stakeholders (policymakers and research administrators, among others) better understand the open science landscape in Europe across countries and (coming soon) subject areas. The platform assists the monitoring, and consequently the improvement, of open science policy uptake across different dimensions of interest, revealing weak spots and hidden potential. Based on the OpenAIRE research graph, following open science principles and an evidence-based approach, the indicators can be used to provide timely and reliable insights on the evolution of open science in Europe and assist in promoting good practices.

Table 5-3: Open Science Monitor

Component Name	**Open Science Monitor**
Main features	End users: Provide indicators and visualizations of the Open Science landscape in Europe
URLs	• https://osobservatory.openaire.eu
Documentation	https://osobservatory.openaire.eu/methodology
API types and use-cases	• No API
EOSC-Future components expected to interact with this component	As a consumer: EOSC Research Graph (OpenAIRE Research Graph), to get data for all offered indicators

5.2.4   EOSC Recommender System

The EOSC Recommender System (RS) will be immersed within the EOSC applications ecosystem and built upon the existing EOSC components (such as the Recommender System for the Marketplace (RS-MP)). The system architecture is shown in Figure 5.3.

In addition to that, the recommendations created for the user could have the following properties:

- **Be explainable:** The user should be able to understand how a given recommendation was created and which data source has been used for it.
- **Be evaluable:** The user should be able to provide feedback on the quality of recommendations, both on a per-list and per-item basis, positive and negative.
- **Be customisable:** The user should be able to switch on/off recommendations, both in general and for specific types of recommendations.

From the RS point of view, there are three types of users: (1) an authenticated EOSC user, for whom a complete record of publications, interests, involvements and interactions is available; (2) a user authenticated using the federated login, for whom only partial information (mainly concerning the user's interest and affiliation) can be extracted and gathered, (3) an anonymous user, for whom no record of research-relevant data is available, and only their behaviour and interaction with the Front-Office could be tracked.

Recommendations provided by the RS are directed primarily towards a Researcher - a persona representing people conducting research. There are two types of recommendations: (1) immediate - generated by RS in real time and immediately available to the user, and (2) delayed, which require a more time-demanding analysis. The online recommendations would be provided directly in the Front-Office, in response to the user's request; the offline recommendations are more accurate than online ones, but due to the time needed to generate them, they need to be sent to the user through a different channel than the Front-Office, mainly via email.   For example, recognizing researchers' neighbourhoods and potential connections to the other users via common authorship or institutions requires offline processing.

The researcher needs to be able to manage and explicitly restrict specific sources of data, in accordance with GDPR. Any other information about the user, processed by the RS, should also be managed by the user.

5.2.4.1   System Architecture

Figure 5.3: EOSC Recommender System architecture below shows the initial vision of the recommender system architecture with two separate APIs (for the EOSC Marketplace and OpenAire Research Graph respectively). The block in the middle represents the three components that play a key role in computing the recommendations – candidate generator, scoring and re-ranking/aggregator component.
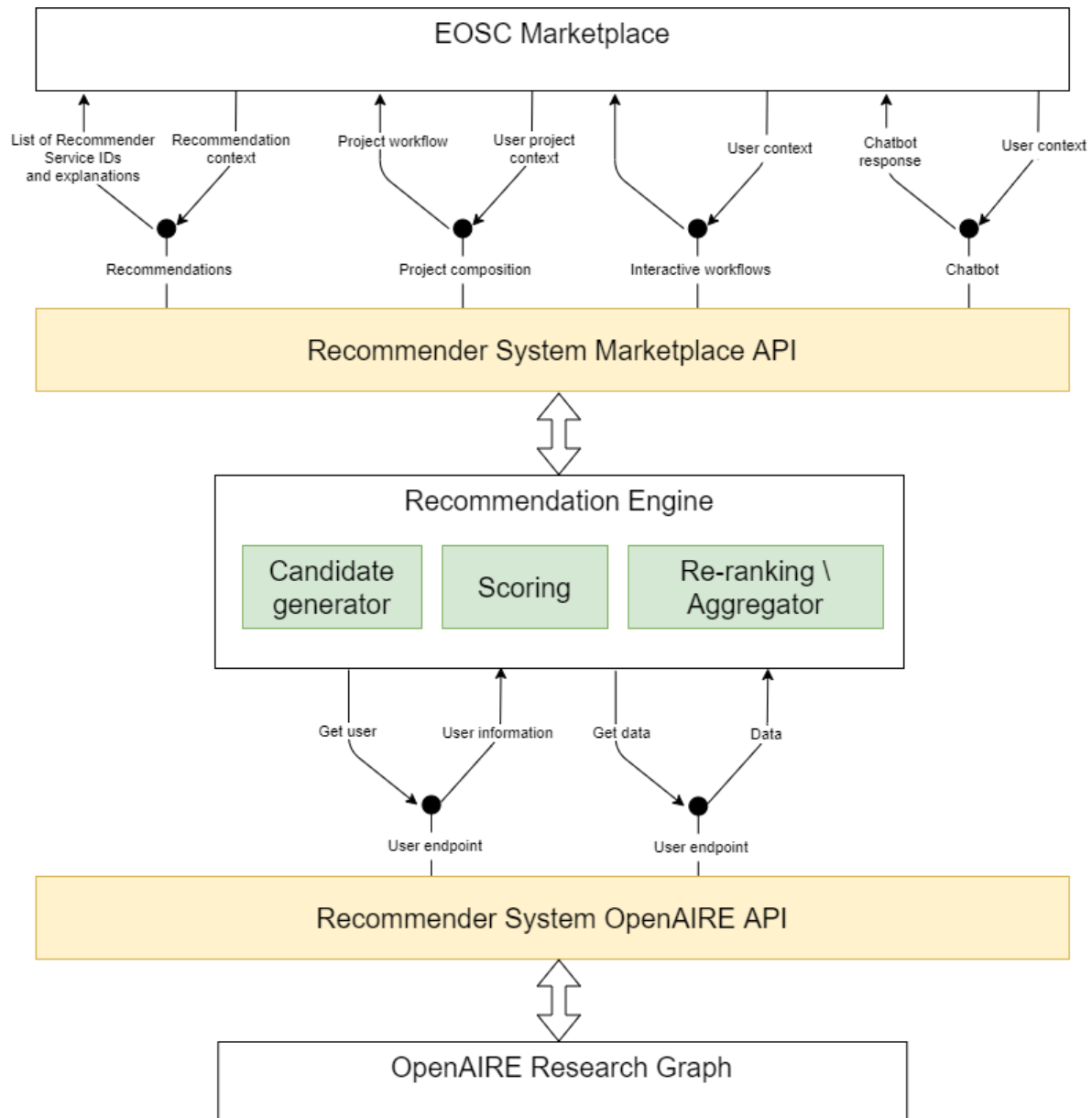
Figure 5.3: EOSC Recommender System architecture

5.2.4.2   Recommendation engine

Artificial Intelligence/Machine Learning (AI/ML) tasks within the proposed recommender engine span over various categories such as personalized recommendations and project composition/interactive workflows. The AI/ML modules operate in online, nearline and offline layers, where they perform different, often complementary tasks.

While designing AI/ML modules responsible for recommending resources in the scope of personalized recommendations or project composition, we comply with the common architecture of recommender systems [1]].

Modules are thus decomposed into the following three components:

- **Candidate generator:** This is the first stage of the recommender system's operation. It takes events from the Front-Office user's past activity as input and retrieves a small subset of resources from the Front-Office catalogue. There are mainly two common candidate generation approaches: content-based filtering, collaborative filtering. A small subset of the most promising resources is selected as a result of this stage.

- **Scoring:** In the second stage another model is applied to further rank and score the resources selected in the previous stage giving them a rating of relevance. For example, a ranking neural network or an ensemble of tree models may be used to assign a score to each resource according to the desired objective function using a rich set of features, also from other sources than Front-Office describing the resource and the user (like OpenAIRE, ORCID, etc). As a result of this stage, the highest-scoring resources are presented to the user, ranked by their score.
- **Reranking\aggregator:** In the third stage, the ranking system considers additional information to ensure diversity, novelty, fairness, and/or other aspects. For example, the system removes resources which have been explicitly disliked by the user earlier and takes into account any resource recently introduced to the Front-Office.

5.2.4.3 RS Marketplace API

The RS-MP API is designed as a representational state transfer (REST) API intended for communication with other EOSC systems in particular with EOSC Marketplace. RS Marketplace API acts as a go-between for the EOSC Marketplace and the Recommender System, through specified endpoints:

- **Recommendations:** Endpoint enabling queries for recommendations for a specific user; response is sent in the form of lists of recommended resources along with explanations.
- **User events:** Endpoint for communicating user events related to their behaviour on the EOSC website.
- **Database dump**: Endpoint for access to all information stored in the Catalogue and Marketplace Database containing information about users and resources.
- **Control:** Endpoint used to configure the RS.

5.2.4.4 OpenAIRE API

The OpenAIRE API is designed as a REST API intended for communication with external data providers (e.g. OpenAIRE). The RS External API is mainly designed to collect additional data about EOSC users with the intention to enrich information stored in the user profile with additional information taken from the OpenAIRE Research Graph (OAG), based on content analysis. Matching between EOSC users and OAG users (i.e. Users who have accounts in OAG) is not planned.

5.2.4.5 Recommender System for EOSC Marketplace

The RS-MP is an existing component of the EOSC Marketplace with capabilities that will be used to provide the EOSC users with recommendations concerning the items (resources, services, trainings, projects and publications) that could be of their interest, based on a multi-focal perspective of the users. The results would be delivered to the users via User Panel or other means (e.g. email). RS-MP is meant to improve user experience (UX) by guiding the users and supporting them in suggesting the items they would likely use.

RS-MP will be supplied with data from the EOSC Marketplace database and EOSC Research Graph, but it will be open for other data sources that could be added and integrated in the future.

5.2.4.6 Technical specification

At the initial project stage the recommender system for EOSC Marketplace has been deployed in the productional architecture. It uses two strategies to compute recommendations – Collaborative Filtering (Pre-Agent) and Reinforcement Learning. The recommendations come from the service catalogue entries and are based on the preferencs coming from a declared interests and/or computed user profiles.

Table 5-4: EOSC Recommender System technical specification

Component Name	Recommender System for EOSC Marketplace
Main features	- Artificial Intelligence (AI) framework that integrates machine learning libraries, AI models, and APIs for the Front-Office - Data-processing services for acquisition of AI-related information from existing EOSC resources - Components for analysing user-related information and definition of a model for user profiles

	• Integration of AI-powered discovery and recommendation mechanisms for users and providers into the Front-Office
	• Evaluation mechanisms to measure the impact of AI-enhanced services and user satisfaction with them
URLs	• Recommender System for EOSC Marketplace source code: https://github.com/cyfronet-fid/recommender-system
Documentation	• (working version) https://wiki.eoscfuture.eu/display/EOSCF/T4.5+Recommender+system+-+Functional+and+Technical+specification
API types and use-cases	• (working version) https://wiki.eoscfuture.eu/display/EOSCF/EOSC+RS+API+-+DRAFT
EOSC-Future components expected to interact with this component	• EOSC Marketplace • EOSC Research Graph (based on the OAG) • Other Front-Office components

5.3 Supporting components technical specification

This specification describes technical details of the architectural components supporting the development and operation of the Front-Office, as well as components regarded as relevant for the end users (and for that reason included in the Front-Office architectural diagram).

5.3.1 EOSC (Core) Helpdesk

The EOSC Helpdesk service is the entry point and ticketing system/request tracker for issues with EOSC core services. It works as a unified ticketing system and for managing all submitted help requests.

The current EOSC (Core) Helpdesk solution is based on the Global Grid User Support (GGUS) system and offers interfaces to e-infrastructures like EUDAT and EGI (see Figure 5.4: EOSC Helpdesk architecture). It provides first level support by dispatching incoming requests to the appropriate expert service teams and other downstream support teams.
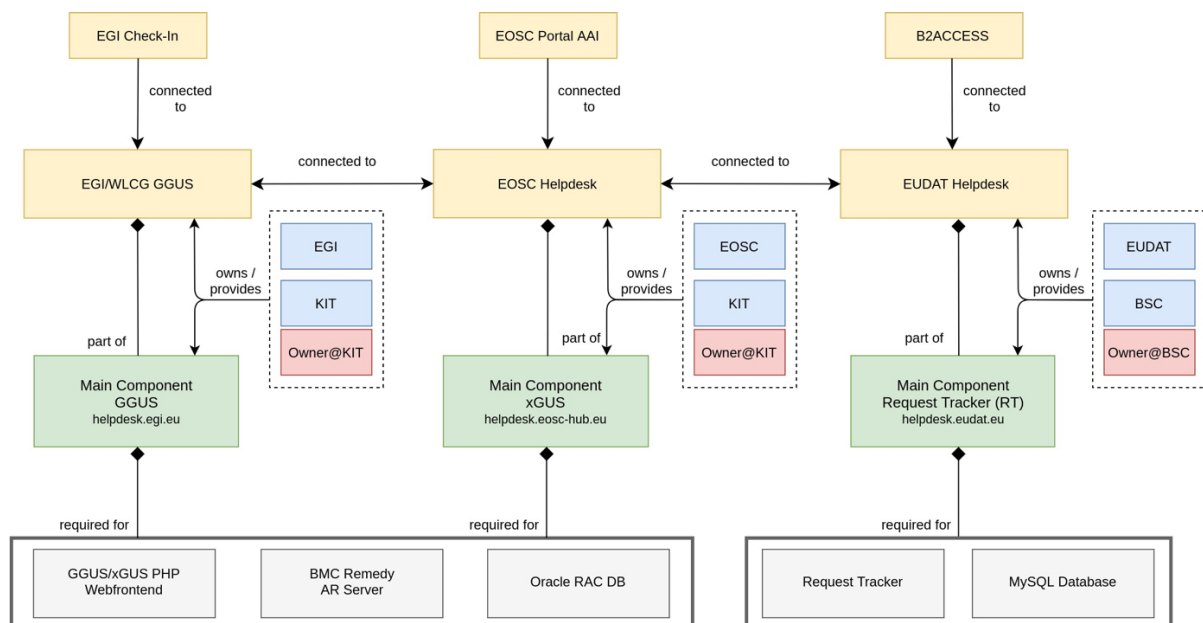

Figure 5.4: EOSC Helpdesk architecture

For the Front-Office users, it represents a tool currently offering the user support function in the scope of the EOSC Core services and some of the horizontal (e-Infra) services. In EOSC Future, the addition of the EOSC Exchange services to the EOSC Helpdesk scope is considered but it's yet unclear whether EOSC Exchange services will be hosted in the same instance as EOSC core services or whether a dedicated instance will be deployed. This consideration and the associated analysis will take place in WP4.

WP4 will also base the EOSC (Core) Helpdesk on a new technology platform to extend its capabilities and ensure its sustainability. There is an ongoing analysis aimed at finding the best possible solution for the EOSC (Core) Helpdesk.

Table 5-5: EOSC Core Helpdesk technical specification

Component Name	EOSC (Core) Helpdesk
Main features	The features of the EOSC Helpdesk can be grouped by two target groups: users and helpdesk internal agents or teams. Main features offered to the user are: • Creation of a ticket for any of the EOSC Services (Hub and EOSC Portfolios) • Display all the tickets created by the owner • Find a previously created ticket • Notify the user of answers and changes to the tickets • Access integrated with the EOSC Portal Authentication and Authorisation Infrastructure (AAI) system Features offered to the helpdesk teams are: • Notification when a new ticket is created • Classification of the tickets • Escalation of the tickets • Creation of a new support unit with assignation of an administrator role to specific users • Management of incident or disruption of Hub services • Interface for communicating with other service providers ticketing systems • First level support for EOSC integrated services as a service
URLs	• https://helpdesk.eosc-portal.eu/
Documentation	• https://ggus.eu/?mode=docu • https://wiki.egi.eu/wiki/GGUS
API types and use-cases	• https://wiki.egi.eu/wiki/GGUS:SOAP_Interface_FAQ
EOSC-Future components expected to interact with this component	• EOSC CMDB • EOSC Monitoring • User Interfaces of EOSC Platform services • Community Helpdesks

5.3.2 EOSC Provider Dashboard

EOSC Provider Dashboard (or EOSC Portal Provider Dashboard) is a dedicated user interface for providers, who wish to onboard resources in the EOSC Portal registry, and who then wish to manage and customize the way resources are presented in the EOSC Portal (especially in the Catalogue and Marketplace). The dashboard will also allow one to gain insights on a multitude of usage statistics and user-generated events.

The Resource management function that the EOSC Portal Provider Dashboard offers allows the Providers to view the list of resources assigned to them and manage all characteristics of their offerings. Resource management also enables Providers to 'activate'/ 'deactivate' a resource in the Catalogue and Marketplace, to assign it to categories or other classification schemes (e.g., scientific domain, technology readiness level, etc) and to manage different versions of a resource. These actions decide on the presentation of the resource, how they will be perceived and how findable they will be from the Front-Office users' perspective.

Table 5-6: EOSC Provider Dashboard technical specification

Component Name	EOSC Provider Dashboard
Main features	For providers: • Onboarding • Management of resources • Live usage statistics from the Front-Office • Email notifications • Interaction with EPOT team For EPOT team members: • Onboarding management • Auditing and Registry management • Email digest and interaction with providers For other users (funders, EOSC profile managers): • Statistics
URLs	• EOSC Provider entry point: https://providers.eosc-portal.eu/ • EOSC Provider Sandbox: https://sandbox.providers.eosc-portal.eu/ • EOSC Provider Beta: https://beta.providers.eosc-portal.eu/ • Front-Office API: https://providers.eosc-portal.eu/openapi • EOSC API base URL: https://api.eosc-portal.eu/
Documentation	• User interface (UI) documentation: https://eosc-portal.eu/providers-documentation/eosc-provider-portal-basic-guide • API: https://providers.eosc-portal.eu/developers • GitHub: https://github.com/madgeek-arc/resource-catalogue

API types and use-cases	EOSC API base URL: https://api.eosc-portal.eu/{method}
	
	API Calls and examples:
	
	• Provider Controller (API):
	  ○ PUT /provider: Updates the Provider assigned the given id with the given Provider, keeping a version of revisions
	  ○ GET /provider/all: Filter a list of Providers based on a set of filters or get a list of all Providers in the Catalogue
	  ○ GET /provider/services/{id}: Get a list of services offered by a Provider
	  ○ GET /provider/{id}: Returns the Provider with the given id
	• Resource API:
	  ○ POST /resource: Creates a new Resource
	  ○ PUT /resource: Updates the Resource assigned the given id with the given Resource, keeping a version of revisions

	o POST /resource/validate: Validates the Resource without actually changing the repository
	o GET /resource/{id}: Get the most current version of a specific Resource, providing the Resource id
	o GET /resource/all: Filter a list of Resources based on a set of filters or get a list of all Resources in the Catalogue
	o GET /resource/by/{field}: Get all Resources in the catalogue organized by an attribute, e.g. get Resources organized in categories
	o GET /resource/byID/{ids}: Get a list of Resources based on a set of ids
	o GET /resource/{id}/{version}: Get the specified version of a Resource, providing the Resource id and version
	• EOSC Profiles Controlled Vocabulary API:
	o GET /vocabulary/byType: Get all vocabulary entries organized per type
	o GET /vocabulary/byType/{type}: Get a list of vocabulary entries for the given type
	o GET /vocabulary/{id}: Get a vocabulary entry by id
	o GET /vocabulary/countries/EU: Returns a list of European (EU) countries
	o GET /vocabulary/countries/WW: Returns a list of Worldwide (WW) countries
EOSC-Future components expected to interact with this component	• EOSC Service Registry APIs: Create, read, update, delete (CRUD) operations to Service registry • EOSC Catalogue: Consumes registry (resource, providers) entries • EOSC Marketplace: Consumes registry (resource, providers) entries + Provides User events • EOSC Order Management: Provides Order events for resources of a provider • EOSC Interoperability Frameworks (IF) database: Provides connections between registry resources • Catalogue and Marketplace: Offering monitoring data via API • EOSC Exchange Systems: CRUD operations via API for updating\syncing the registry

5.3.3   EOSC Service Registry

EOSC Service Registry is the storage component offering the necessary programmatic interfaces for the addition, modification, and access to information regarding providers, resources and user activity collected in the Front-Office. It's a database that stores the records relevant for the Provider Dashboard and the Front-Office: records about the registered EOSC providers and services they offer.

Table 5-7: EOSC Service Registry technical specification

Component Name	**EOSC Service Registry**
Main features	• EOSC profiles management (vocabularies, schema, etc) • Onboarding of Providers and Resources to EOSC via APIs

	• Management of Providers and Resources records to EOSC via APIs • Validation mechanism via the APIs • Front-Office Id assigned to resources and providers. • Versioning of providers\resources • Messaging (JMS) of CRUD events for 3rd party consumers • Authorization of provider users, and EPOT team
URLs	Idem 5.3.2
Documentation	Idem 5.3.2
API types and use-cases	Idem 5.3.2
EOSC-Future components expected to interact with this component	• Catalogue and Marketplace: Consumes registry (resource, providers) entries + Provides User events + Offering monitoring data via APIEOSC Order Management: Provides Order events for resources of a provider • EOSC Interoperability Frameworks database: Provides connections between registry resources • Provider Dashboard: Provider onboarding, Resource management, and EPOT operations over the service registry • EOSC Exchange Systems: CRUD operations via API for updating\syncing the registry

5.3.4   EOSC Research Graph

The EOSC Research Graph (based on OAG) is a public, open access, collection of metadata regarding research-related objects. It is collected from thousands of data sources and there are many millions of semantic links between the entities. The entities are research products, namely articles (millions), datasets (millions), software (thousands), and other research products (millions), organizations (thousands), funders (tens), funding streams, projects (millions), research communities (several), and data sources (thousands). It will act as a main data source for the EOSC Research Products - relevant information which will be used to make the EOSC Research Products discoverable in the Front-Office.
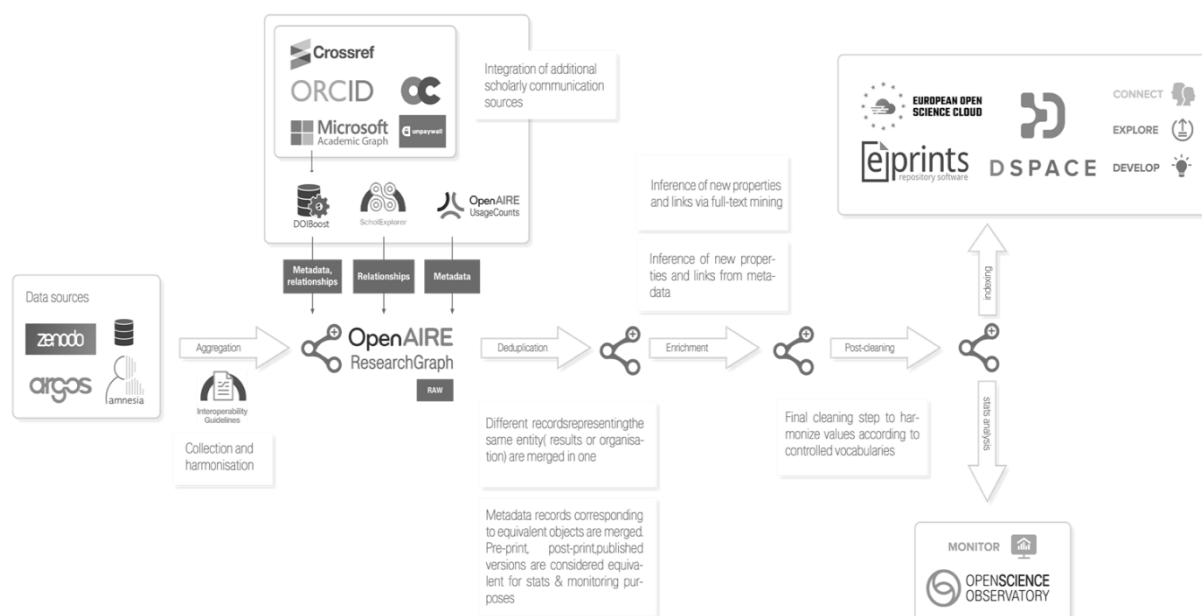
Figure 5.5: EOSC Research Graph architecture

Table 5-8: EOSC Research Graph technical specification

Component Name	EOSC Research Graph
Main features	Content acquisition: • The Graph content is constantly (scheduled jobs) aggregated from the data sources; • Data sources are of different kinds: publishers, data repos, databases (Protein Data Bank, European Nucleotide Archive, etc.), institutional repositories, thematic repositories (arXiv, EuropePMC, RePEc, etc), preprint servers, software repositories, entity registries (ORCID, ROR, Crossref, DataCite, GRID.ac, OpenDOAR, re3data, PDBs, etc); • The Graph index is published bi-weekly, being the result of harmonizing, deduplicating, and enriching the harvested metadata by mining; • Selected data sources, while still being regularly aggregated, can be kept in-sync real-time with the index. Access to content : • The Graph is open and accessible via APIs and data dumps in Zenodo; • The Graph is accessible via discovery portals for communities and generic users.
URLs	• Graph informative site: http://graph.openaire.eu • Graph discovery website: http://explore.openaire.eu (all users), http://connect.openaire.eu (scientific communities) • Graph APIs: https://develop.openaire.eu • Graph dataset dumps: https://develop.openaire.eu/graph-dumps.html
Documentation	• https://develop.openaire.eu
API types and use-cases	• Resolution of records by ID/PID: website widgets (e.g. project websites to collect related publications), European Commission (EC) Participant Portal to recommend project publications to project coordinators • Query on APIs to collect list of records: DSpace and ePrints platforms to collect list of projects from deposition UIs

	• Download of data dumps: Elsevier, Springer, researchers, download the data to integrate with their services or perform data analysis
EOSC-Future components expected to interact with this component	Graph as a consumer (data sources): • EOSC Service registry: services to become entities of the graph (extension of the current 'data source' type); regular harvesting, but also in-sync with Graph index (updates to the registry are sent to the index); • EOSC Interoperability Frameworks database. Regular harvesting of EOSC IFs as research products (identify proper resource product type); • Data Usage Statistics (downloads and views of research products): explore possibility to include stats as part of the information indexed with the data, so as to enable discovery based on stats; • AI components: embedding as part of the graph index the information to ensure AI discovery is supported (this may require the realization of extra indexing structures). Components consuming the Graph: • Catalogue and Marketplace: enabling discovery of EOSC resources via APIs; • Front-Office (consumers/providers): enabling discovery of EOSC resources via APIs; • AI components: support data provision to enable AI-supported discovery.

5.3.5   EOSC Digital Innovation Hub

The EOSC digital innovation hub (DIH) is a platform which also can be of interest to the Front-Office users as it provides a clear interface for commercial innovation that can be supported by EOSC as part of the broader European Digital Innovation Hub landscape (such as free access trials). It is a multi-dimensional mechanism that allows research e-Infrastructures to support business organisations to stimulate innovation, as well as helping start-ups, small and medium-sized enterprises (SMEs), and other innovative actors to tap into the academic world in accessing both knowledge and technical services.

The goal of the EOSC DIH is to create a one-stop-shop that brings IT services, research data, technology and expertise into a single place to support innovation in the industry to become more competitive. EOSC DIH offers several public-private collaboration models around piloting and co-design of new services (proof-of-concept work, performance testing, etc.), technical access to different 'as a Service' resources (HPC/HTC/Cloud computing, storage, data management and higher-level services), training and support (Technical consultancy, service management, commercialisation) and visibility, using the DIH as a networking tool to expand beyond local markets.

In the EOSC Future project, the DIH is foreseen to become a mechanism which centralises the multiple innovation and business collaboration initiatives around the EOSC. In addition, the cross-border nature of the EOSC DIH allowed the generation of external collaborations with other European Digital Innovation Hubs (EDIHs), links that have been defined as 'DIH corridors' by the EC. The EOSC DIH will establish new corridors to cooperate with other EDIHs by complementing their technical offer which will imply a wider impact of the EOSC outside the research context.

DIH requirements for the Front-Office:

* To be able to determine if a given service, resource, or dataset can be provided for SME or Industry.
* Even if a service can be provided in general for industry, its not a given that all providers are willing/can provide such service. Is would be good to establish a methodology to tag providers that can provide the support.
* Conditions, e.g. mandatory data provider agreements, and pricing for available items for use by the EOSC-DIH partners and commercial entities in general.
* To include EOSC DIH in the workflow of approval/validation of new pilots coming from the EOSC DIH, not to duplicate the validation process and delay the potential provider journey.

• To promote EOSC DIH as a mechanism that supports consultancy/customer journey in test before invest kind of activities.

From the previous pilots there were the following requests:

- API to access the Catalogue and Marketplace with search terms;
- Indicator on Front-Office which of the registered partners are interested in working with business.

Table 5-9: EOSC DIH technical specification

Component Name	EOSC DIH
Main features	EOSC DIH is a platform for interaction and partnership with industry partners. It offers four sets of services: • **Piloting and Co-Design,** where services or products can be designed and tested and where pilots or proof of concepts are carried out. Service is complemented with the Platform as a Service (PaaS) and Software as a Service (SaaS) solutions, combined with the appropriate computing and storage resources, where business pilots can be tested and performed. • **Access to the technical assets** includes Data management and analytics, HPC and Cloud resources, and solutions for integration of the above into training facilities for ML/AI models, as well as orchestration. • **Training & Support** aims at providing the broad landscape analysis assess the technological readiness complemented with the necessary consultancy services and training on digital skills, digital business coaching and support for commercialization. • **Visibility of partners** through media exposure, participation in not only EOSC related events but also in Industry and Information and communications technology (ICT) fairs, providing digital and promotional material. EOSC DIH offers the inclusion of the partners' solutions in the Catalogue and Marketplace, which can enhance business networking and opportunities, especially within the R&E domain.
URLs	https://eosc-dih.eu/
Documentation	https://eosc-dih.eu/training-materials/
API types and use-cases	EOSC Marketplace Search API EOSC recommender system API
EOSC-Future components expected to interact with this component	• EOSC Provider Dashboard: onboarding resources from EOSC DIH pilots. • Catalogue and Marketplace: availability of resources/services to the EOSC-DIH partners as well as commercial entities. Interaction with the training platform to promote EOSC-DIH services to the commercial entities.

5.4 Initial technical gap analysis for the Front-Office

The WP5 contribution to the EOSC Future project implementation is to bridge several known technical gaps. Although the project builds on a solid groundwork of the previous EOSC-related efforts and established services, there is significant technical development needed to deliver the expected results for the Front-Office users. To meet the identified high-level requirements covered by the functional gap analysis, new architectural components, new programmatic interfaces between existing components and changes to the inner structure of some existing architectural components are needed. Although a thorough technical analysis has been performed during the proposal preparation phase and the first months of the EOSC Future project, inherent variability of the architectural design still exists at this stage. A stepwise approach and successive improvements

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implemented gradually, by an agile development process, will pave the way towards implementation of the next generation software and services for the Front-Office.

5.4.1 Various resource types available in the Front-Office

One of the key project outcomes identified in the High-Level technical roadmap [18] is allowing the full lifecycle of data processing, storage, analysis, and publishing to be supported by resources that are available and transparently integrated through the EOSC platform. In order to achieve that goal in a coherent manner by the implementation of the Front-Office services, interoperability between EOSC Marketplace, EOSC Recommender System and EOSC Research Graph needs to be established. Resources harvested in the EOSC Research Graph should be used as a basis for the evolution of the functionalities of Front-Office components. Smart search should allow resources suitable for the user's research to be found and recommendations in the personalised user space should provide easier access to other resources that are potentially interesting to them. There are several types of interfaces that can be used for these integrations. The Research Graph exposes a REST API for selective access to scientific products, including publications, research data, software, projects and other research products. It allows the user to request the results based on exact matches to parameters such as title or author. This API is offered to both authenticated users (with OpenAIRE AAI) and non-authenticated users. Both methods are subject to traffic limitations, to manage access control and deliver an adequate quality of service. Examples of such limits are the number of total results returned by one query (which is limited to 10,000) or the number of requests (limited to 60 requests per hour for non-authenticated users, and 3,600 for authenticated users). In order to access the whole graph, developers are encouraged to use the OpenAIRE Research Graph dumps. A new version of this dataset is published every 6 months, which means the content available on the OpenAIRE Explore and Connect portals is almost always more up to date with respect to the data that can be found in the dump. The graph dumps may be parsed offline and processed to create other methods of indexing the data. This integration method is more suitable when full control over the query parameters is required to process the database of research products. There is also a possibility of direct integration with the OpenAIRE processing pipeline (via a custom-built API) to perform processing on the data each time the graph is being computed. This integration gives the highest level of flexibility in data pre-processing for further use and provides access to the most up-to-date dataset. The downside is the higher integration effort needed, but this comes with the aforementioned added value. At the current project stage, the joint forces of the development teams are preparing Proof of Concept implementations to evaluate possible integration solutions and establish the communication between the systems in the most efficient way.

5.4.2 New challenges for search and discovery

The inclusion of a new data source in the EOSC Portal requires a significant update in the current approach to the search and discovery functionalities that the current Front-Office offers. On the technical standpoint, it will require revisiting the internal structure of the EOSC Marketplace search component to make use of a complex nature of the new data and still provide accurate full text search and autocomplete mechanisms. The evolution will also require responding to the requests within acceptable time constraints when the user is waiting for the user interface results to be displayed. In practice, new data pre-processing methods will be used to prepare the necessary indices in the search system database. New types of data records also require changes in the frontend user interfaces. The chosen implementation is dependent on the results of the technical analysis performed during the first stages of the project. The results, implementation details addressing the choice of technological solutions, selected data processing methods, as well as the updates in the corresponding internal interfaces will be provided in the deliverable **D5.1b Front-Office Design, Functional and Technical Specification**, which is due in project month 24.

5.4.3 Customised user space and recommended resources

One of the goals for the EOSC Future WP5 Task 5.2 is to prepare a personalised panel (User Panel) that will support the research-related activities of the user, the EOSC-related activities (projects, task forces, communities etc.) of the user and allow the settings of the user profile to be managed. This frontend component will allow the user to have a customised view of EOSC resources and manage user-related functions of the Front-Office. It will also allow linking of the existing feedback mechanisms to consolidate the user experience in their interaction with the Front-Office. The new component will technically be closely linked to the Recommender

System (developed in WP5 Task 5.4) that will prepare the personalised content for the user, as well as receive feedback about its own performance when trying to match users' interests. The new frontend component will be coherent with the current architecture of the Front-Office and a contributor to the consistent design of the new, revamped look and feel. From the technical standpoint, this will require strong integration with the EOSC Marketplace and also an update in the existing APIs to adopt the new Recommender System architecture. The new APIs are documented in the Recommender System component description. Recommendation lists will be composed based on different resource properties and various user activity measures, then presented as part of the intuitive design which allows users to grasp the reasons for the recommendations that appear in the User Panel.

5.4.4   Recommender system

Among other challenges for the Front-Office development in the scope of the EOSC Future project, one of the most important ones is to significantly increase the added value of the Front-Office with the use of Artificial Intelligence to support the discovery of EOSC resources. This work does not start from scratch as some of the recommendation techniques, as well as the proof-of-concept architecture for the class of recommender system have been already tested in practice during the EOSC Enhance project. Based on the agent-based models of Neural Collaborative Filtering and Reinforcement Learning, the EOSC Marketplace recommender system offers personalised recommendations to ease the discovery of services in the EOSC Service Registry. The implementation allows for data collection, measuring the conversion rate, training and fine tuning the models deployed in the current architecture. Although the basic functionality that is implemented allows the evaluation of the feasibility of implementation and established techniques for delivery for a class of architectural solutions, these results are preliminary and the scope of the EOSC Future project defines a far more ambitious plan for establishing a recommender system. The architecture of the EOSC Recommender System (to be developed by WP5), although somehow resembling the main characteristics of the existing EOSC Marketplace recommender system, addresses different implementation challenges.

As previously mentioned, one of the main tasks consists of implementing a system to support the discoverability of various types of research products originating from the OpenAIRE Research Graph. This goal alone is quite challenging, given that there is a need to map various sets of the users (Front-Office users vs OpenAIRE users), make use of the types and metadata of the research products (such as publications, affiliated projects, authors etc.), properties of the Front-Office user profile, as well as characteristics of the user activity in the Front-Office, to suggest resources that might be particularly valuable for a specific user. Therefore, the architecture of the Recommender System should not be considered as the update to the previously established one, but instead as a new approach that integrates the legacy functionality of the previous efforts.

Using near-real-time reasoning in the complex dataset of the research graph requires a specific approach for data pre-processing to narrow down the scope of exploration and limit computational complexity to deliver the expected quality of service. Although the main assumptions for the agent-based nature of the system remain the same (as well as scoring and re-ranking components), because of the aforementioned reason, the need for another architectural component (that hadn't been identified earlier) became an obvious technical requirement. The candidate generator component allows a small subset of the most promising resources to be created. This will allow further reasoning within the time constraints, with enhanced end results being delivered for user interface rendering.

As it was identified during the initial phase of the project, in order to deliver the expected results, there is a need to identify users based on their ORCID identifiers. This would allow the use of cross-origin data to establish a consistent dataset for reasoning about potential user interests. The newly established APIs will allow for the composition of recommendation lists for different applications in the Front-Office. The technical assumptions for the design of the new APIs have been described above in the chapter of the Recommender System. As mentioned earlier, the main frontend component utilising the recommender functionality will be the User Panel implemented in the Marketplace service. APIs between the two systems will be implemented, and the strict alignment between the methods of creating recommendation lists and the corresponding designs for visualising results will be established. Concrete scenarios for the implementation of the necessary recommendations are supported by the requirement gathering and analysis processes, as well as the user experience design in WP5.

Other applications of the next generation recommender system in the EOSC Marketplace and the Front-Office may be identified during the project and will be described in the deliverable **D5.1b Front-Office Design, Functional and Technical Specification.**

5.4.5   Open Science Statistics availability in the Front-Office

Based on the efforts in previous projects (and particularly OpenAIRE Advance), statistics were generated, based on the data gathered in the OpenAIRE Research Graph and interconnected scholarly communication shared data from open initiatives around the world. The OpenAIRE Monitor is a service dedicated to research communities that allows measurement of the impact of research organisations, and the discovery of trends and connections to improve and optimize further actions in scientific research. The integration in the Front-Office of the existing service will lead to the Open Science Monitor service, which gives Front-Office users access to statistics, metrics tools and advanced visualisation methods. The graphical design of the service will be adapted to allow a consistent user experience when using the EOSC Portal as a gateway to the EOSC Platform.

5.4.6   A new service to access knowledge in EOSC

The EOSC KH is a much-needed Front-Office service that hasn't been developed by the previous EOSC projects. This means that EOSC Future is responsible for collecting requirements and defining the boundaries for the functional design and the technical architecture that will lead to the creation of this new component of the Front-Office. Besides WP5 (which takes care of the requirement analysis, design and the implementation of the software), WP9 plays a significant role in the creation of this service. WP9 brings expertise in maintaining knowledge in the form of training/learning materials, outreach to other knowledge experts, as well as requirements gathering in the scope of the EOSC KH functional component definition. As mentioned earlier, the activities in the two work packages will be carried out in parallel to some extent, as the project timeline requires the Consortium to deliver the first results early enough (due in project month 9) to start the core development activities before the full set of the requirements (due in project month 18) can be defined. As far as the results of the first analysis performed with the joint forces of WP5 and WP9 indicate, the EOSC KH will be a separate component which forms a user gateway to the EOSC knowledge base. Initial technical analysis shows the potential need to establish APIs to the Marketplace and the Recommender System services. An important gap that needs to be bridged by the development of the EOSC KH is the creation of the training catalogue, which will allow the integration and/or federation of the existing training catalogues as well as registration of new entries for the EOSC KH. The inclusion of specialised training records in the broader scope of functionalities supporting resource discovery and access means that some of the processes that are currently operational in the Catalogue and Marketplace functional component may need to be adapted. It is also likely that some of the content available in the EOSC knowledge hub will be relevant from the perspective of the personalised user view offered in the User Panel. Currently, the results of the functional and technical analyses are still immature and will be updated in the deliverable **D5.1b Front-Office Design, Functional and Technical Specification.**

6   Conclusions

This deliverable summarises the aims of the Front-Office development activities. Identification of the potential users has clarified the target user groups that will be addressed in the processes of requirement gathering, analysis and UX design. The analysis provided here indicates the main challenges arising from bridging the current state of the services established in previous EOSC-related projects and the results expected in this project. One of the main objectives for this deliverable is to encourage communication among the EOSC Future project consortium to align the next implementation steps across work packages. This report outlines the need for a significant functional evolution, the necessity to establish new services and the technical challenges in the integration of the existing ones. It also provides the background for the holistic approach that should be undertaken when integrating architectural components to deliver a consistent user journey for each goal of the users. This approach will lead to harmonised design and development, paving the way to the broader adoption of EOSC services and increasing the added value that the Front-Office brings to the European Open Science landscape.
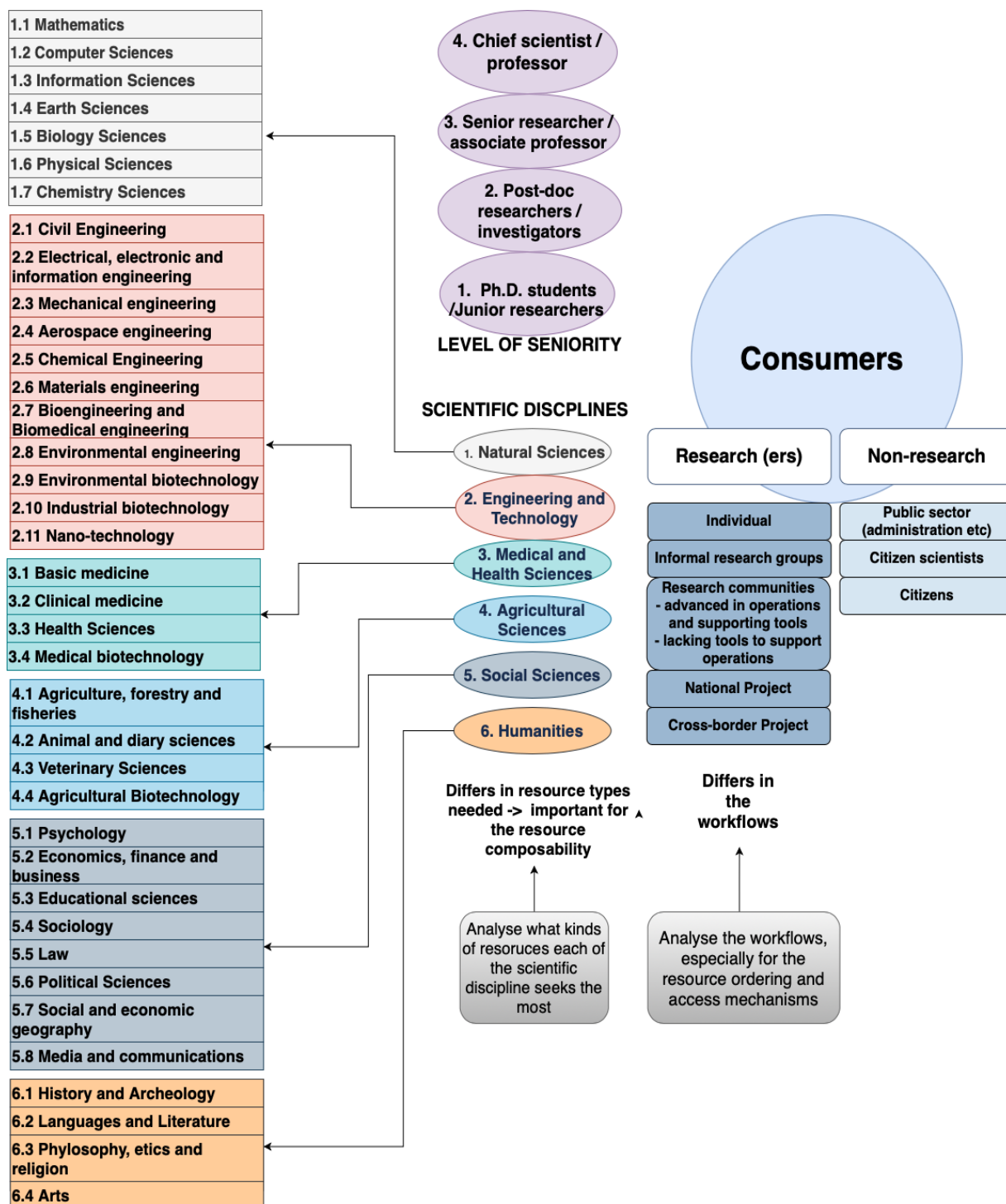
7   Appendix A: Front-Office user typology

1.1 Mathematics
1.2 Computer Sciences
1.3 Information Sciences
1.4 Earth Sciences
1.5 Biology Sciences
1.6 Physical Sciences
1.7 Chemistry Sciences

2.1 Civil Engineering
2.2 Electrical, electronic and information engineering
2.3 Mechanical engineering
2.4 Aerospace engineering
2.5 Chemical Engineering
2.6 Materials engineering
2.7 Bioengineering and Biomedical engineering
2.8 Environmental engineering
2.9 Environmental biotechnology
2.10 Industrial biotechnology
2.11 Nano-technology

3.1 Basic medicine
3.2 Clinical medicine
3.3 Health Sciences
3.4 Medical biotechnology

4.1 Agriculture, forestry and fisheries
4.2 Animal and diary sciences
4.3 Veterinary Sciences
4.4 Agricultural Biotechnology

5.1 Psychology
5.2 Economics, finance and business
5.3 Educational sciences
5.4 Sociology
5.5 Law
5.6 Political Sciences
5.7 Social and economic geography
5.8 Media and communications

6.1 History and Archeology
6.2 Languages and Literature
6.3 Phylosophy, etics and religion
6.4 Arts

4. Chief scientist / professor

3. Senior researcher / associate professor

2. Post-doc researchers / investigators

1. Ph.D. students /Junior researchers

LEVEL OF SENIORITY

SCIENTIFIC DISCPLINES

1. Natural Sciences

2. Engineering and Technology

3. Medical and Health Sciences

4. Agricultural Sciences

5. Social Sciences

6. Humanities

Consumers

Research (ers)	Non-research
Individual	**Public sector (administration etc)**
Informal research groups	**Citizen scientists**
Research communities - advanced in operations and supporting tools - lacking tools to support operations	**Citizens**
National Project	
Cross-border Project	

Differs in resource types needed -> important for the resource composability

Differs in the workflows

Analyse what kinds of resoruces each of the scientific discipline seeks the most

Analyse the workflows, especially for the resource ordering and access mechanisms

Figure 7.1: Front-Office user typology – Consumer

8 Appendix B: Front-Office function definition – User profile

8.1 Presentation of the functional component

8.1.1 Goals

- I want to define my scientific profile in order to be offered services and scientific products that might support my research activities.
- I want to define my interests in order to be offered services and scientific products that might support my research activities.
- I want to define my interests so I am exposed to relevant scientific content that might apply to my research or interests.
- I want to define my technical needs in order to be offered resources that might support my research activities. - proposition to be verified
- I want to define my EOSC activities (projects, communities, working groups, task forces) so I can reach all relevant websites from one place - proposition to be verified

8.1.2 Demonstration materials

Table 8-1: Demonstration materials

Link	Description
https://eosc-portal.eu/using-the-portal/eosc-marketplace-qa-main-functionalities	Video tutorial about collecting feedback on the EOSC Marketplace functionalities
https://eosc-portal.eu/using-the-portal/new-user-functionalities-eosc-resources-discovery	Video tutorial for new EOSC Portal users on how to discover resources.
https://eosc-portal.eu/using-the-portal/new-user-functionalities-eosc-portal-user-space-tutorial	Video tutorial for new EOSC Portal users about the EOSC User Spaces
https://marketplace.eosc-portal.eu/profile	The functional component for a logged in user

8.1.3 Requirement gathering for the function using the template

The template below is used for specification and setting up the JIRA issue tracker. JIRA filers allow to underpin dynamic requirements table in the project wiki (Confluence) pages dedicated to a certain function. The whole requirement gathering and analysis process will be described in a separate deliverable (D5.2). Although, to give an exemple of the contents that can be expected in a function definition, the requirement template is also underpinned in this document.

Table 8-2: Requirements template

Phase	Requirement template field	Example field values
Requirements gathering	ID	No
	Channel	E-mail, online survey, interview, JIRA 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 temp distribution in Kenia. I have no idea where to find such data and I NEED IT BADLY
	Where did 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
	Affected user group(s)	Who will benefit from the result of the implementation? Researchers Service/Resource Providers Research communities Research projects Private company Founder
	Author(s)	Who proposed the requirement? Organization name
	Contact point	Who should be contacted to provide the details/ verify results? Name, e-mail, project, position provided in Hiden sheet (evaluable to some goup)

	Affected system functional components	Part of the functionality affected by the desired requirement (searching, ordering, backoffice, offers, provider view etc.)
	Affected processes	Affected processes by the potential solution a.g. Resource Onboarding Process, Order Management Process
	Affected technical components	Architectural components affected by the desired requirement
	Prioritization	Assigned prioritization: critical, desirable or optional.
Information structuring	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/Resource Providers Research communities Research projects Private company Founder
	Other parties potentially involved	Who will also be affected / take part in the process defined by the desired functionality/ requirement? (stakeholders/ infrastructures)

9   Appendix C: Front-Office sitemap

Due to its nature, the sitemap is a structure which is hardly readable in A4 format so the pictures below present only parts of it. Please refer to the source diagram [16] of the sitemap, or the **Textual Sitemap index** below to see it as a whole.
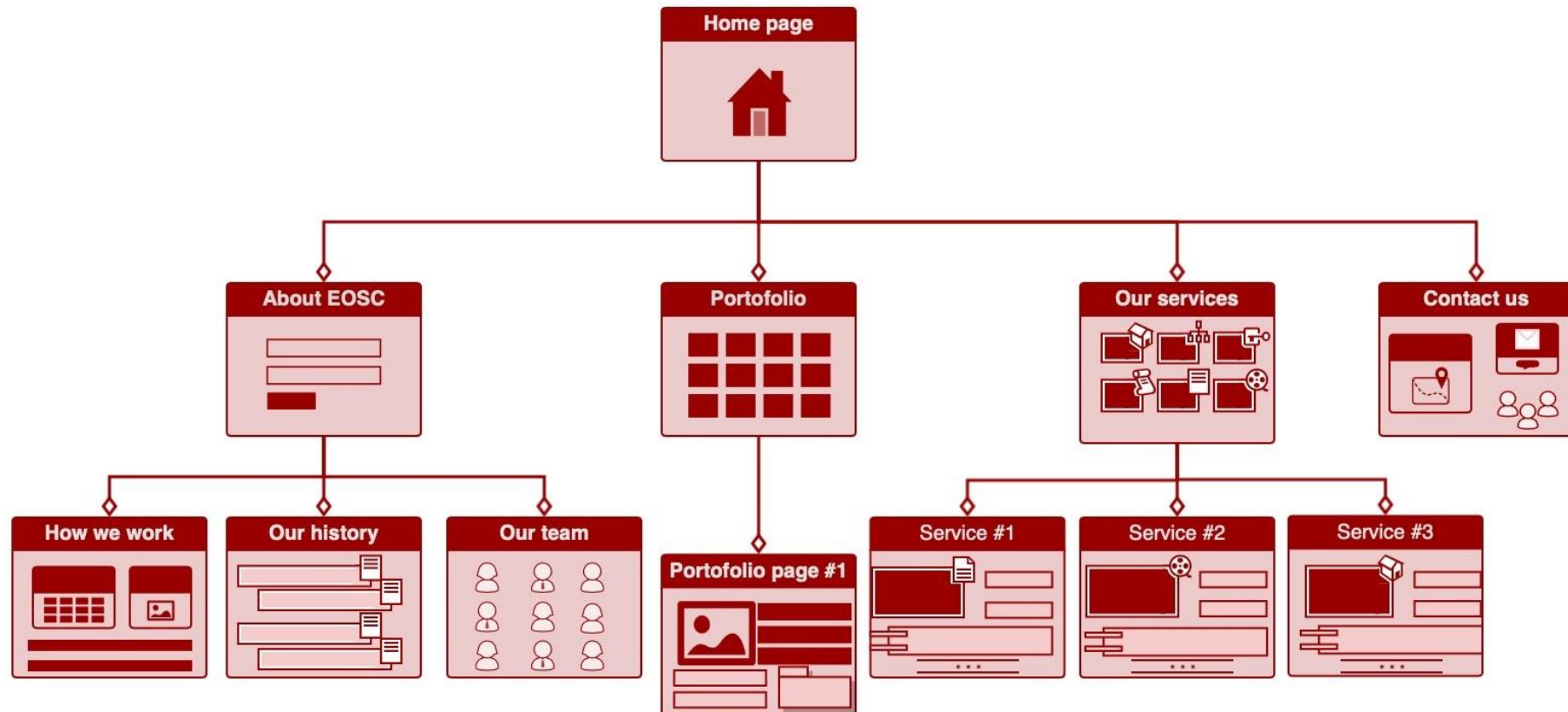
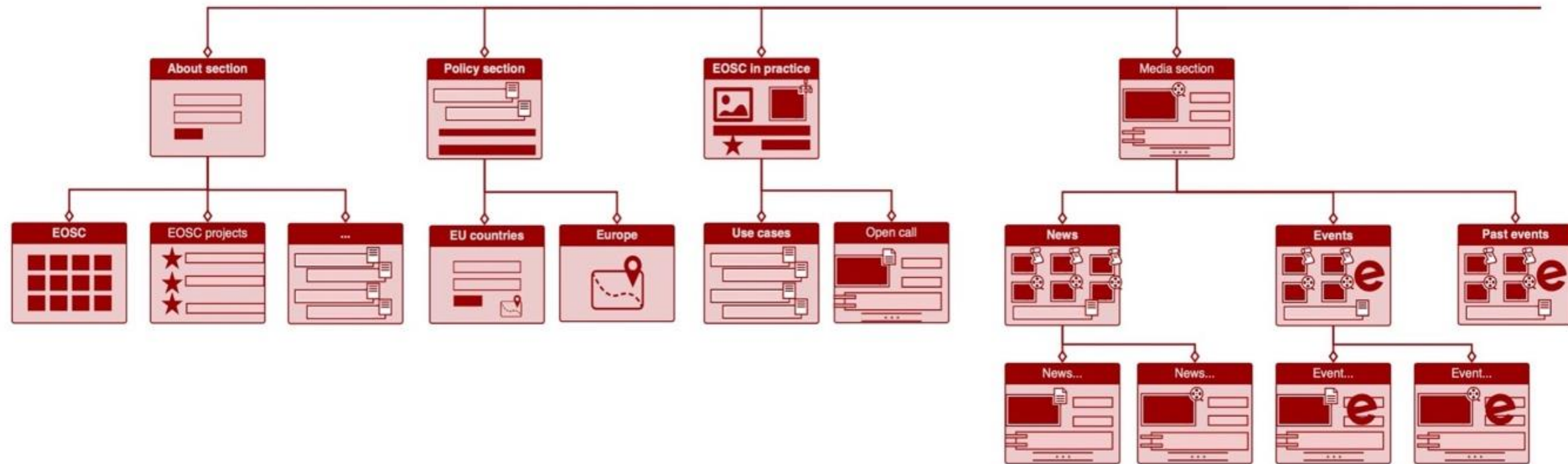*Figure 9.1: Front-Office sitemap – Overview*

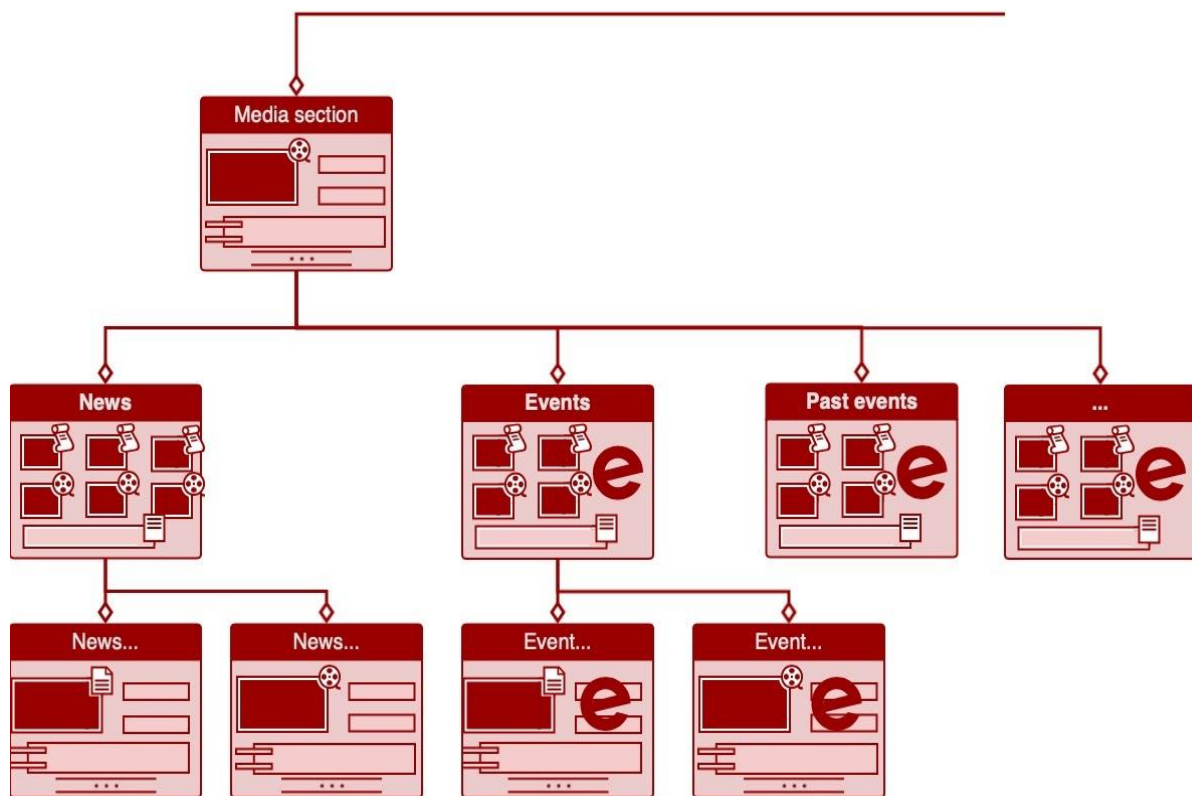*Figure 9.2: Front-Office sitemap – Main sections with their leaves*
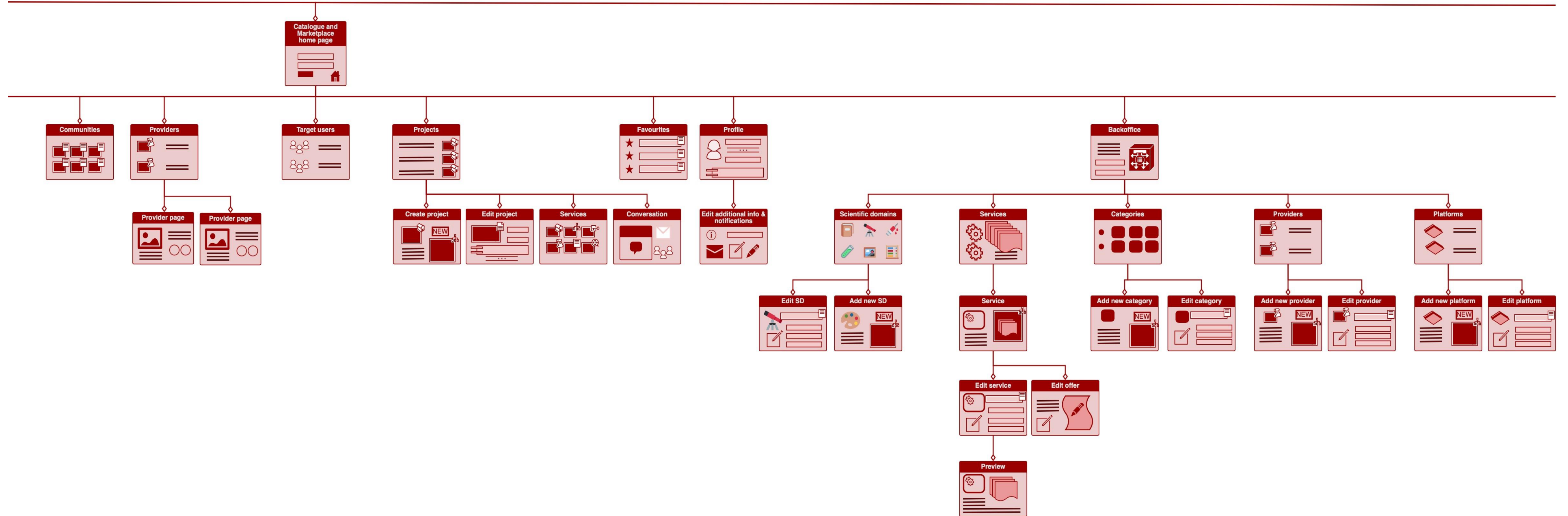
Figure 9.3: Front-Office sitemap – Media section

Figure 9.4: Front-Office sitemap – Catalogue and Marketplace section
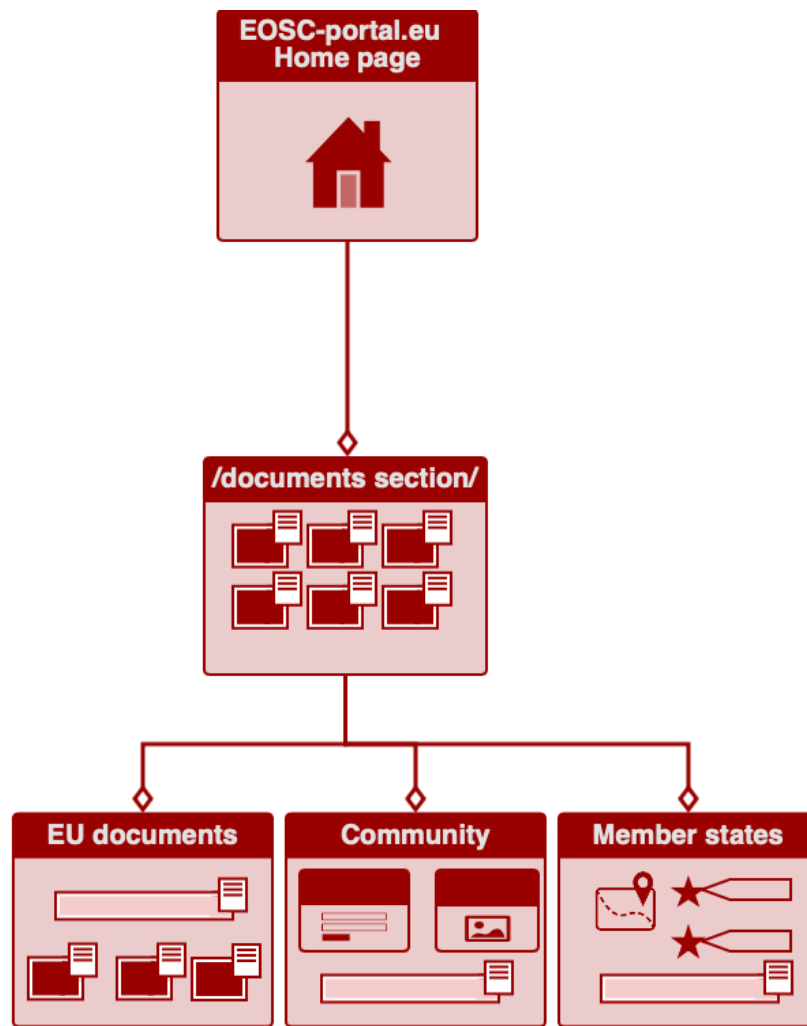
Figure 9.5: Front-Office sitemap – Homepage

9.1   Textual Sitemap index

1. Home page eosc-portal.eu

1.1. /about section/

1.1.1. EOSC

1.1.2. EOSC Projects

1.1.3. …

1.2. /policy section/

1.2.1. EU Countries

1.2.2. Europe

1.3. /eosc in practice section/

1.3.1. Use Cases

1.3.2. Open Call

1.4. /media section/

1.4.1. News

1.4.1.1. News ..

1.4.1.2. News …

1.4.2. Events

1.4.2.1. Event …

1.4.2.2. Event …

1.4.3. Past events

1.4.4. …

1.5. multiple sites

1.6. /documents section/

1.6.1. EU documents

1.6.2. Community

1.6.3. Member states

1.7. /Providers' documentation section/

1.7.1. Site 1

1.7.2. Site …

1.8. /using the portal section/

1.8.1. Using the portal

1.8.1.1. Tutorial …

1.9. /site/default/files/

1.9.1. File …

1.9.2. File …

1.10. Catalogue and Marketplace Home Page

1.10.8.5.1. Add new platform

1.10.8.5.2. Edit platform

1.11. Providers' dashboard (become a provider)

1.11.1. Statistics

10 Appendix D: EOSC Platform Front-Office user stories

The list of the user stories collected with efforts of the previous projects (EOSC-Hub, EOSC Enhance). Please note that the 'Connected functional component' column has been skipped, as all of the listed user stories relate to the Catalogue and Marketplace functional component.

ID	Functional area	User stories group	User stories (who-what-why/for what reason)
1	Browse services through service categories		As a user I'm able to see registered categories tree
			As a user, I can browse specific categories to list all services in this category or subcategories.
2	Service search - basic and advanced	As a user I'm able to find a service	As a user I'm able to filter services using phrase
			As a user I'm able to find a service by its name
			As a user I'm able to filter services by selecting service properties
			As a user I'm able to filter services by short and long description
			As a user I'm able to filter services by by quality tags
3	Service filters and sorting	As a user, I'm able to limit the number of services.	As a user I'm able to limit the number of services by selecting specific filters
			As a user I'm able to sort the results by research area
			As a user I'm able to sort the results by providers
			As a user I'm able to sort the results by target group
			As a user I'm able to sort the results by selecting service properties specific to the category
			As a user I'm able to sort the results by rating

			As a user I'm able to sort the results by provider location
			As a user, I can filter and list services with an order type of each, to find an interesting one.
			As a user, I can filter and list services dedicated to a specific group of users.
			As a user, I can browse resources by category and subcategory.
4	Discovering the services on the service entry page (service view)	As a user, I'm able to see service details	As a user, I'm able to see the service title and description
			As a user I'm able to see useful documents: Service of Terms of use, Access Policies and, Service corporate SLA
			As a user, I'm able to find useful links: Website, Manual, Helpdesk, Tutorial
			As a user, I'm able to see related infrastructures and platform
			As a user, I'm able to see Service restrictions
			As a user, I'm able to see the service is available: Places and languages
			As a user, I'm able to see order technical configuration
			As a user, I'm able to see the Service Maturity
5.	Service comparison	As a user I'm able to compare the existing services	As a user, I'm able to see and compare the existing services
6.	Requesting more detailed service description from provider	As a user I'm able to request further service description/operational details from provider	As a user, I'm able to contact a service provider and ask about service details
7.	User registration	As a user I'm able to sign up for using marketplace	As a user, I'm forced to accept terms of use conditions during my first login

8.	User login	As a user I'm able to login to marketplace using the check-in identity provider	As a user, I'm able to login to marketplace using the check-in identity provider
8.a	Non - registered user	As a user I'm able to see the service catalogue	As a user, I'm able to see the service catalogue
			As a user, I am able to ask a question related to the service
9.	Profile update	As a user, I'm able to update my details	As a user, I'm able to review user profile
			As a user, I'm able to update information in my user profile
			As a user, I can edit my Categories of interests/Scientific domains of interests.
			As a user, I can edit email notifications for categories of interest, scientific domains of interests.
10.	Filling in order-relevant information	As a user, I'm able to fill in a form with service-specific attributes necessary to process my order	As a user, I'm able to fill in a form with service-specific attributes necessary to process my order
11.	Project creations and moderation	As a user, I'm able to use Project functionality	As a user I'm able to create a Project
			As a user I'm able to update information in a Project
			As a user I'm able to copy a Project
			As a user I'm able to archive a Project
			As a user I'm able to delete a Project
			As a user, I can add a review for a service included in the project.
12.	Ordering the services	As a user I'm able to order selected service	As a user I'm able to choose a technical configuration of the service (if possible)
			As a user I'm able to add the selected service to my project

			As a user I'm able to leave a comment about the selected service
12.a	Order a selected service		As a user I'm able to place an order of the selected service
12.b	Ordering a bundle		As a user I'm able to place an order for the bundle
13.	Service Access		As a user I'm able to access selected service
13.a	Open Access	As a user I'm able to access a selected service	As a user I'm able to add the service to your project and access it from there
			As a user I'm able to access open access service from the service entry
13.b	Full Open Access	Service with one offer	As a user, I'm able to access open access service from the service entry
		Service with few offers	As a user, I'm able to access an open access service from the service entry
13.c	Normal ordering	As a user I'm able to access selected service	As a user I'm able to add the service to my Project
			As a user I'm able to access the service when the service order is ready
13.d	Order required	Service with default offer + order via Marketplace	As a user, I'm able to order and add a service to my project.
		Service with default offer + external order	As a user, I'm able to order and add a service to my project.
		Service with few offers, via Marketplace	As a user, I'm able to order and add a service to my project.
13.e	Other access	Service with one offer	As a user, I'm able to order and add a service to my project.
		Service with few offers	As a user, I'm able to order and add a service to my project.
14.	User dashboard with ordering	As a user I'm able to see the status of orders and active services	As a user I'm able to see the status of service orders being processed

			As a user I'm able to see the list of active services
			As a user I'm able to see the history of previously ordered services
15.	Possibility to inquiry about the order status by the user		As a user I am able to ask a question related to order that hasn't been completed
16.	Possibility of inquiry about the order status by the service provider	As a service provider I'm able to notify user about order status/details	As a service provider I'm able to notify a user or am able to ask a user a question related to an order that hasn't been completed
			As a user, I can see the provider's reply/ question in the context of the order status
17.	Roles management	As a marketplace administrator, I'm able to manage marketplace users	As a marketplace administrator, I'm able to add/remove/edit other user roles
			As a marketplace administrator, I'm able to block the user
18.	Service rating		As a user, I'm able to see service rate on a list
			As a user, I'm able to see rates from other users in service detail
			As a user, I'm able to rate the service after gaining access.
19.	Order handling process rating & gathering user feedback	As a service customer, I'm able to rate the ordering process	As a user, I'm able to give my feedback about the order process
			gathering user feedback
20.	Automatic service import (all functionalities)	As an SPMT I'm able to send service	

		details/updaters about services	
21.	Service orders functionality for providers	As a service owner, I'm able to create my order for a service	As a service owner, I'm able to add my order to a service
		As a service provider, I want to easily manage offers and set ordering parameters so the users (researchers) could get clear information about usage policy.	As a service owner, I am able to choose service attributes relevant for order handling
			As a service owner, I am able to manage service attributes relevant for order handling
			As a service owner, I'm able to update my suspended/ deleted order from the service
			As a Resource Provider, I can preview the Resource Presentation Page before publishing, to verify the quality of provided data.
			As a Data Administrator, I can add or edit an offer and its parameters on owned resource/provider.
			As a Resource Provider, I can add resources without a logo, whilst MP will add the default logo.
			As an executive member, I can review Front-Office statistics, to verify OKR/KPI and metrics.
			As a service owner, I can edit service drafts and service offer drafts.
22.	Supplement Service Description (all functionalities)	As a service owner, I'm able to add additional service details (to the data received from SPMT)	
23.	Pricing model		As a service owner, I'm able to pay for my service
23.a	Use of Voucher-based orders		As a service owner, I'm able to use vouchers during orders

	Use of research grants		As a service owner, I'm able to use research grants during orders
24.	Create favourite resources.	As a user I want to create a list of favourite resources, to quickly and easily get access to these.	As a user (logged in), I can create a list of favourite resources, to quickly and easily get access to these.
			As a user (unlogged), I can create a list of favourite resources, but it will not be saved.
			As a user (logged in), I can remove resources/services from the list of favourite resources.
25.	Recommender		As a user, I can see recommended resources connected to my scientific domain (or research) to find interesting solutions.
26.	Navigation for Providers		As a Resource Provider, I can navigate to the Provider Component from the Resource Presentation Page to edit the resource description.
			As a Resource Provider, I can navigate to the ordering parameters management from the Resource Presentation Page to manage offers and set ordering parameters.
27.	Geographical availability of resources		As a user, I can zoom the map in the Resource/Provider Presentation page, to verify geographical availability.
28.	Social media and newsletter		As a user, I can find social media links on EOSC MP, to see the latest happenings and information.
			As a user, I can subscribe to a newsletter about new services (and resources) added to the Marketplace.
			As a user, I can find information about the EOSC Marketplace on the webpage.

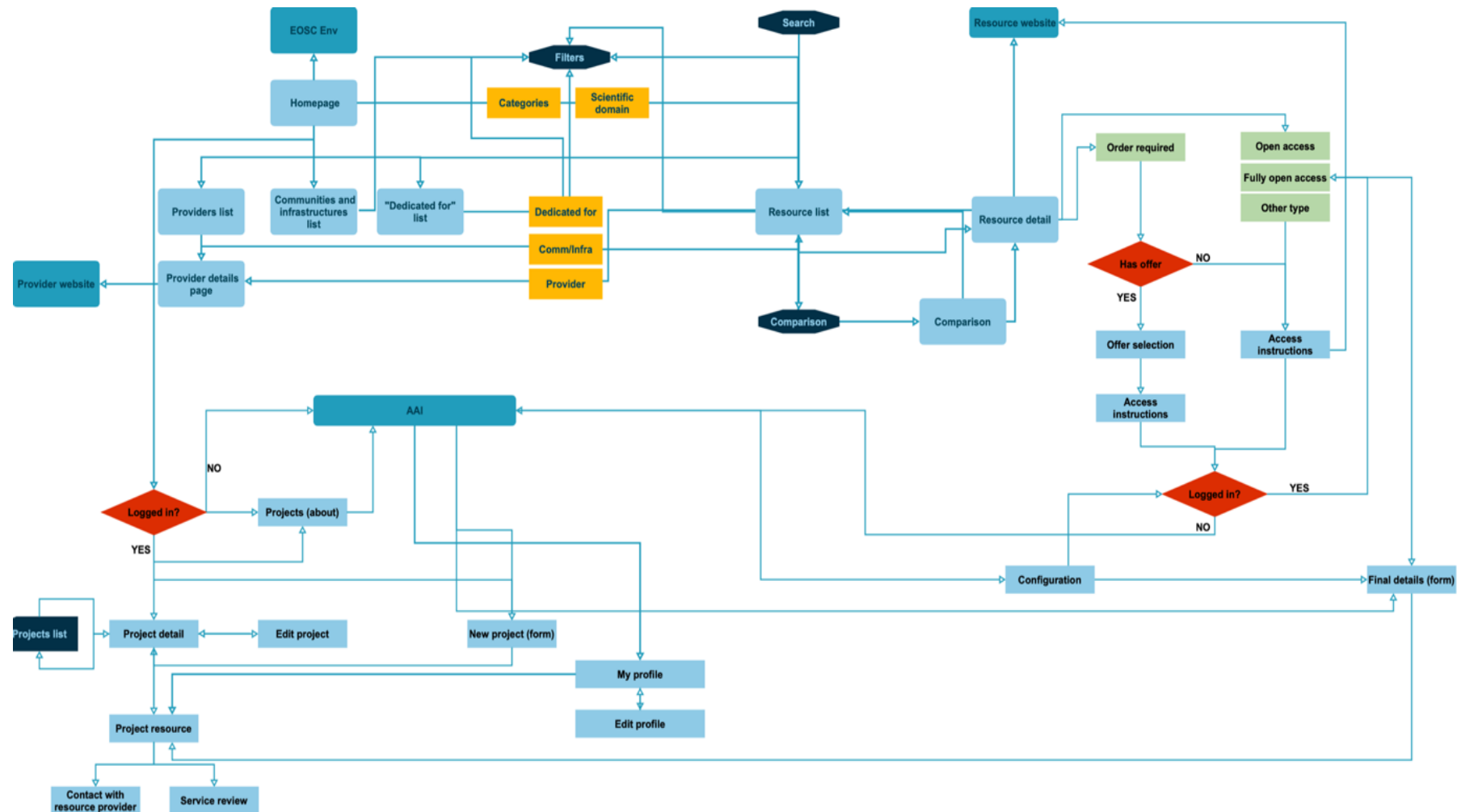# 11 Appendix E: Catalogue and Marketplace user flows

Figure 11.1: Catalogue and Marketplace user flows - complete view
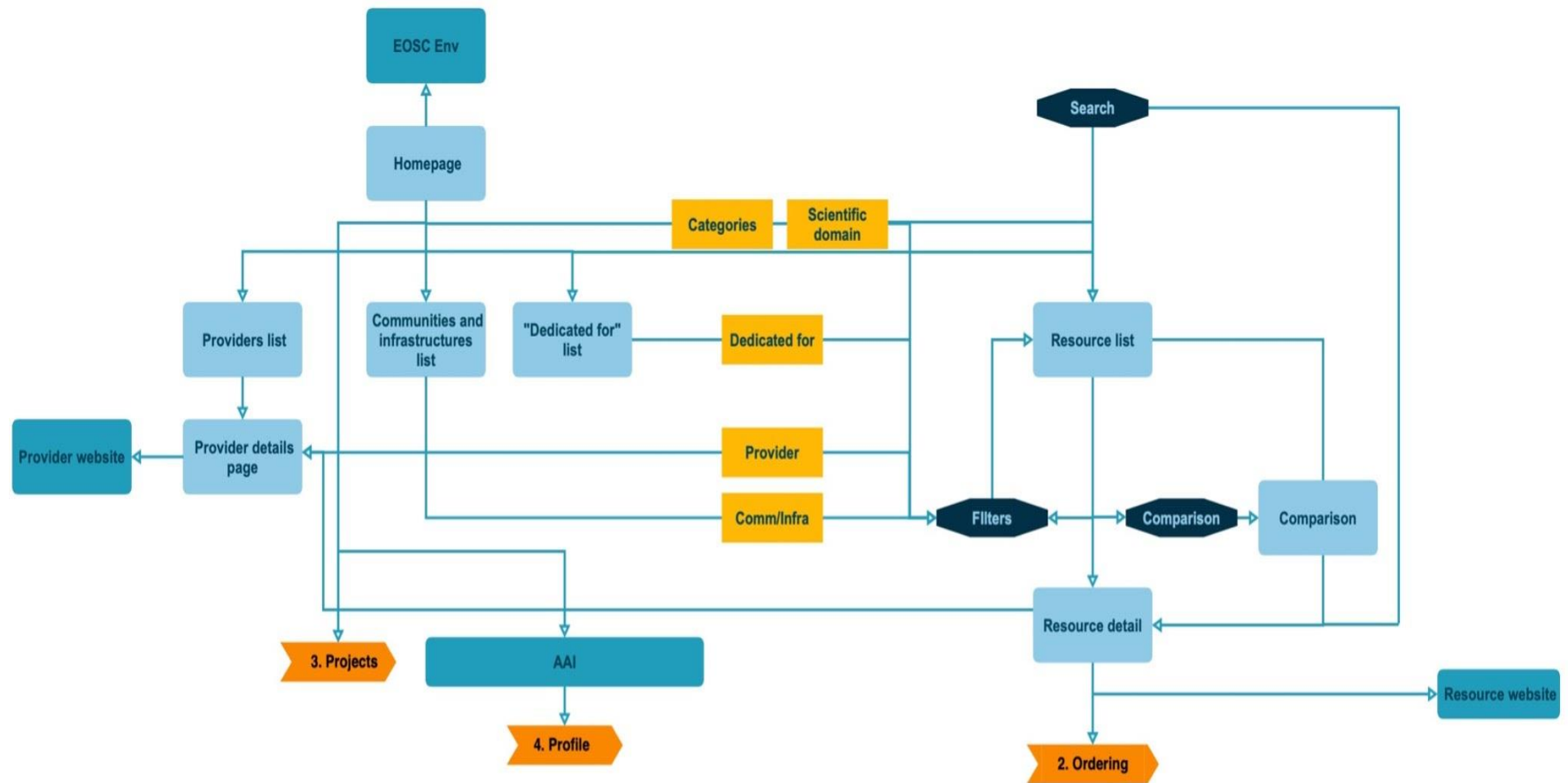
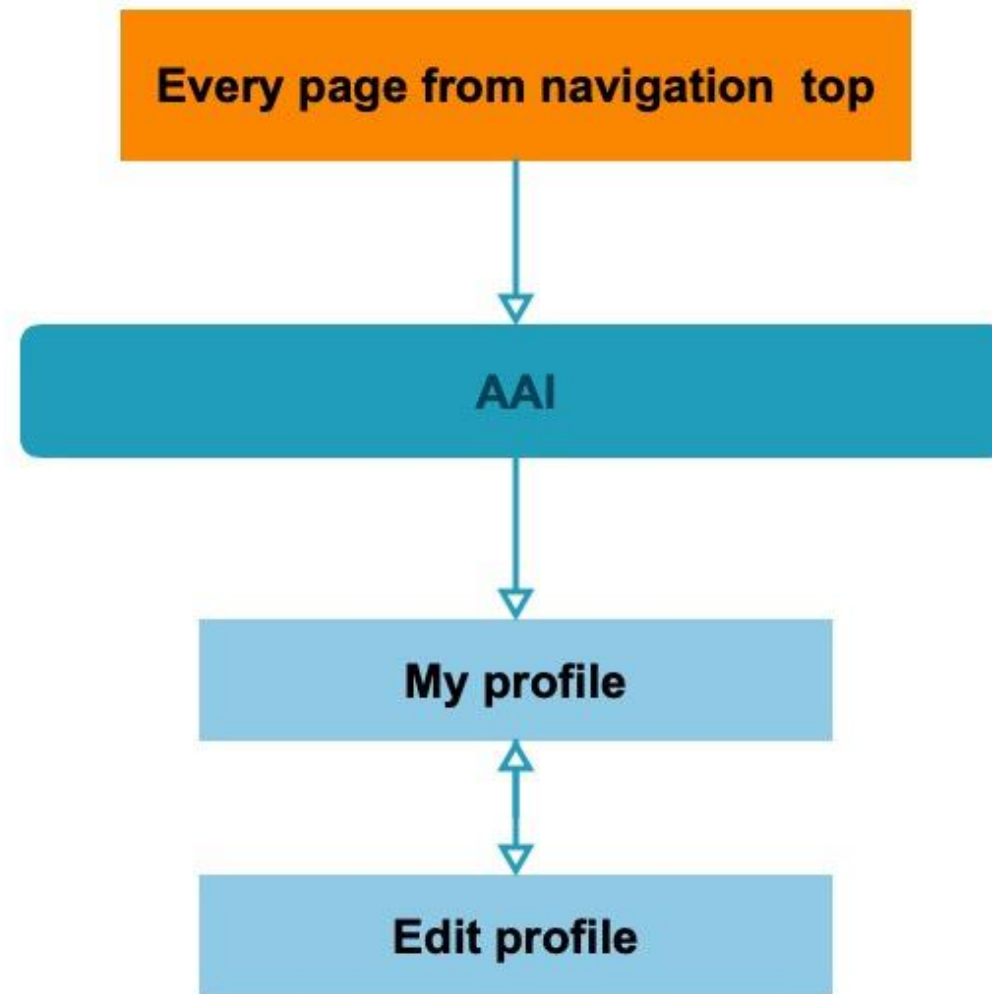*Figure 11.2: Catalogue and Marketplace user flows – Resource discovery*

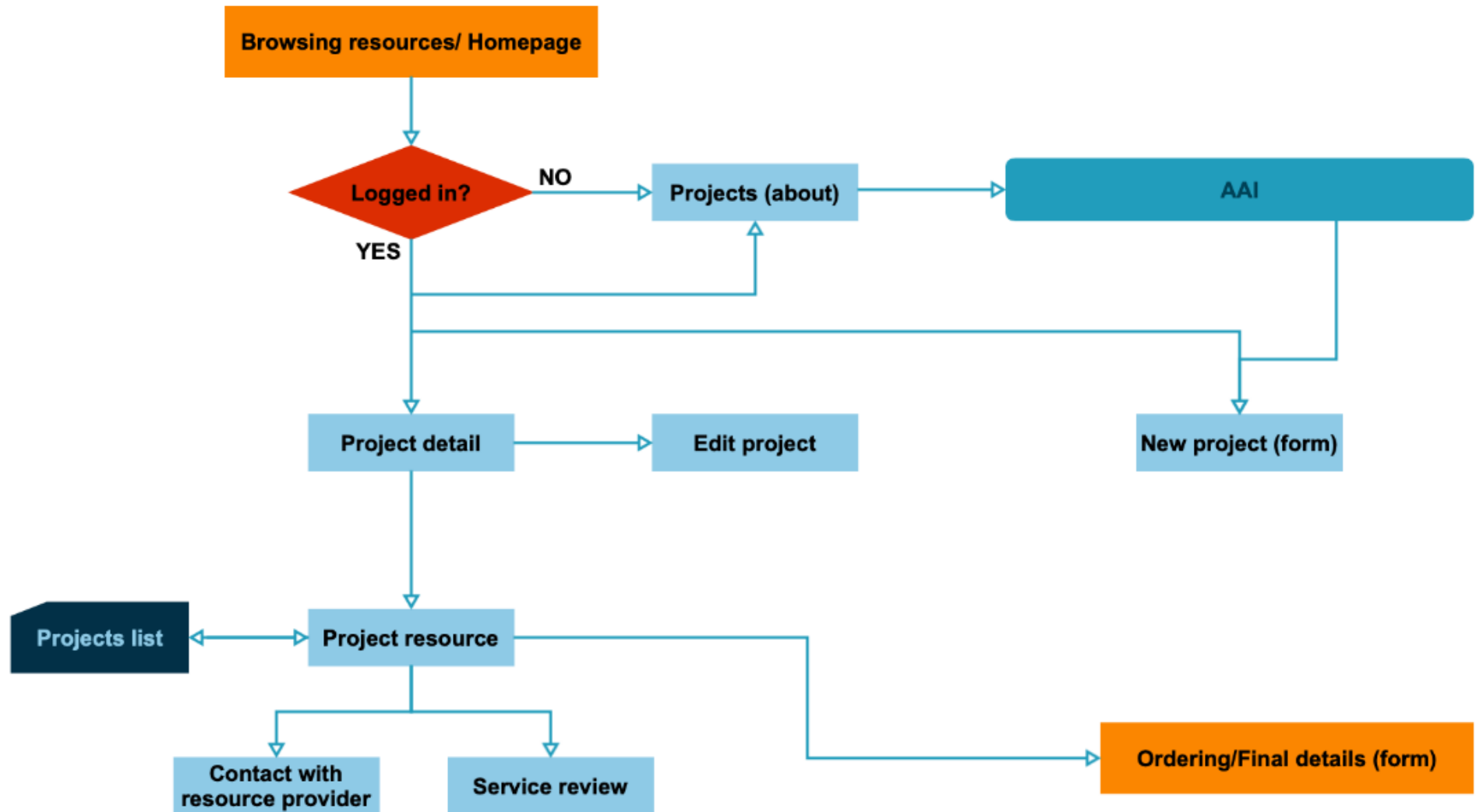*Figure 11.3: Catalogue and Marketplace user flows – User profile*

Figure 11.4: Catalogue and Marketplace user flows – User projects
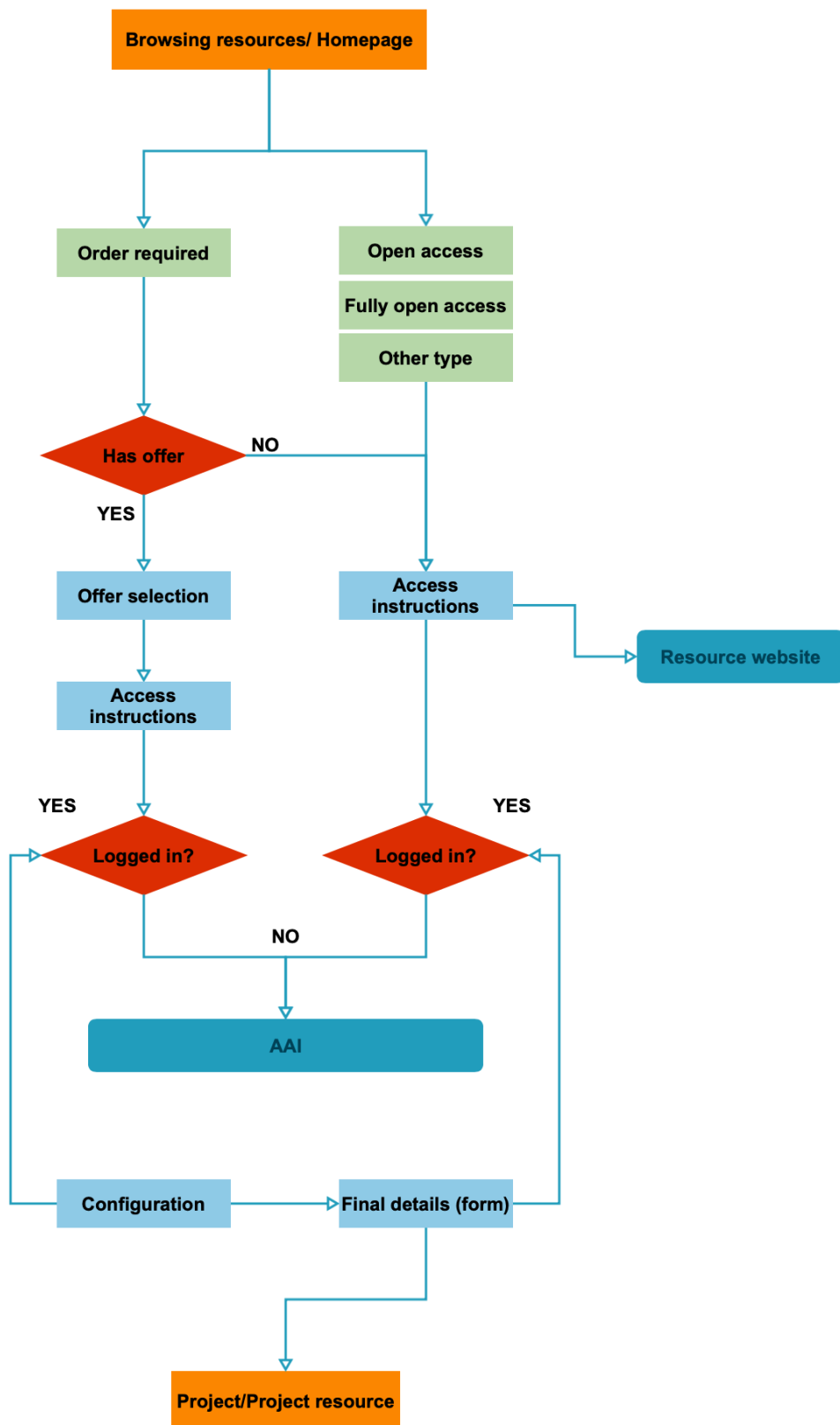
Figure 11.5: Catalogue and Marketplace user flows – Resource access mechanisms

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