



D5.1 Collaboration with the implementing entities of the EOOSC EU Node and Technical Roadmap

01/08/2024

Abstract

The EOOSC Beyond main mission is to innovate EOOSC Core services and related assets. This deliverable positions the project in the overall EOOSC landscape and describes its collaborations with EOOSC stakeholders with a focus on the EOOSC EU Node contractors. The document also presents the initial project technical roadmap as a basis to establish the collaboration with the EU Node Contractors.



EOOSC Beyond receives funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101131875

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Document Description

Document title			
Work Package number 5			
Due date	31/07/2024	Actual delivery date:	02/08/2024
Nature of document	Report	Dissemination level	Public
Document Status	Under EC Review	Version	1
Lead Partner	EGI Foundation		
Authors	Diego Scardaci (EGI)		
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Approved by	Technical Coordination Board (TCB)		
Document link	https://documents.egi.eu/document/4113		
DOI	https://doi.org/10.5281/zenodo.13165339		
Keyword	EOSC Node, EOSC Platform, EOSC Core Innovation Sandbox, EOSC Federation, EOSC EU Node		

Revision History

Issue	Date	Description	Author/Reviewer
V 0.1	29/05/2024	Initial ToC	Diego Scardaci (EGI)
V 0.2	10/06/2024	First draft	Diego Scardaci (EGI)
V 0.3	10/07/2024	Full draft	Diego Scardaci (EGI), and the product teams
V 0.4	24/07/2024	External Review	Roksana Wilks (CYFRONET), Mark Dietrich (EGI)
V 0.5	30/07/2024	Final version modified according to reviewers' and TCB comments	Diego Scardaci (EGI)
V 0.6	01/08/2024	Approval by Board	TCB
V 1.0	01/08/2024	Final	

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Executive Summary

The EOSC Beyond main mission is to innovate EOSC Core services and related assets (EOSC Platform Architecture, interoperability guidelines, EOSC Profiles, etc.) in order to support the establishment of the EOSC Federation and the growth of EOSC in terms of integrated providers and active users.

EOSC Beyond has been conceived taking into account the most recent evolution of the EOSC and the introduction of the concept of EOSC Nodes. EOSC Beyond will define an enhanced version of the EOSC Platform Architecture that will become a fundamental asset for other initiatives willing to establish an EOSC Node. It will support a number of pilots to set up a network of EOSC Pilot nodes that will act as the first prototype implementation of the EOSC Federation.

When the project started, there were no operational EOSC Nodes available yet. The EOSC EU Node will be the first operational node of the EOSC Federation and is expected to be delivered during the summer of 2024. As such, it will initially be the primary target of the EOSC Beyond innovation activities. Community feedback on the EOSC EU Node will be important to drive the EOSC Beyond innovation activities and deliver new core services that better satisfy community requirements.

The outcome of the EOSC Beyond innovation activities is expected to be an essential input to define the technical specification of the next version of the EOSC EU Node (2027 onwards). However, this does not preclude that new EOSC Beyond capabilities that reach a high level of maturity and guarantees adequate stability, reliability and performance can be incrementally added to the current version of the EU Node upon agreement between the European Commission (EC), EU Node contractors and the project.

A collaboration with the EOSC EU Node contractors will be established to identify the EOSC Beyond features that might be deployed in the EOSC EU Node during the current contracts. The large correspondence between EOSC EU Node contractors and EOSC Beyond project members will facilitate the set up of such a dialogue.

It is worth noting that the project results target not only the EOSC EU Node but, in general, any community willing to set up their own EOSC Node. Indeed, the project will deliver fundamental assets to facilitate the set up of every EOSC Node and adequate technical support to design, implement and operate EOSC Nodes. Related to this, EOSC Beyond will deliver and operate the EOSC Core Innovation Sandbox, a pre-production environment of the enhanced EOSC Platform that will be used as a testing and staging environment by the communities to create their Nodes and integrate them with EOSC.

Finally, the document presents the initial project technical roadmap with the aim to share it with the EOSC Community, to gather feedback and suggestions for improvements, and with the EU Node contractors as the basis to establish a productive partnership. This roadmap is expected to evolve during the project execution reflecting the requirement gathering and gap analysis that the project will conduct.

1. Introduction

This deliverable focuses on the collaboration between EOSC Beyond and the implementing entities of the EOSC EU Node and presents the project's initial technical roadmap.

1.1. Scope and Purpose of the document

EOSC Beyond specifically targets the EOSC Core innovation programme, working to enhance Core Services currently operated by the EOSC EU Node and to create new services that will empower EOSC. The project intrinsically supports the EOSC Node concept and is also establishing a network of EOSC Pilot nodes.

EOSC Beyond tasks can be successfully completed only with collaboration with relevant EOSC stakeholders, including the EC, the EOSC Association, the EOSC Nodes (including the EU Node), and research communities. This document describes how the project is interacting with these entities with a focus on the EOSC EU Node contractors.

Furthermore, the deliverable also presents the initial project technical roadmap with the aim to share it with the EOSC Community, to gather feedback and suggestions for improvements, and with the EU Node contractors as the basis to establish a productive partnership.

Summarising, the main objectives of this document are thus:

- position EOSC Beyond in the overall EOSC landscape and define how the project is expected to collaborate with the EOSC EU Node contractors;
- present the initial project technical roadmap.

1.2. Structure of the document

The document is structured as follows:

- **Section 2** introduces EOSC Beyond main objectives and positions the project in the overall EOSC landscape. Relationships with EOSC stakeholders are described with a focus on the EOSC EU Node.
- **Section 3** depicts the initial EOSC Beyond technical roadmap. The roadmap is presented in two main areas: (1) Evolution of the services in the current EOSC Platform, (2) New Core services for EOSC Nodes, including the EOSC EU Node.
- **Section 4** draws conclusions and outlines future work.

2. EOSC Beyond in the overall EOSC Landscape

The EOSC Beyond main mission is to innovate EOSC Core services and related assets (EOSC Platform Architecture, interoperability guidelines, EOSC Profiles, etc.) in order to support the establishment of the EOSC Federation and the growth of EOSC in terms of integrated providers and active users. The project is working to achieve this objective both by enhancing the current set of Core services (federated resource catalogue, AAI, monitoring, accounting, etc.) and by creating new services that allow developers of scientific application environments to easily combine and compose a diverse portfolio of EOSC Resources offering them as integrated capabilities to researchers.

EOSC Beyond has been conceived taking into account the most recent evolution of the EOSC and the introduction of the concept of EOSC Nodes. In this new scenario, EOSC is made up of a network of European/Regional/National/Thematic Nodes that collaborate to offer federated services to end-users. These services are enabled by EOSC Core services, which can be operated by multiple Nodes.

Through the EOSC Procurement, the EC has funded the first node of this network, the EOSC EU Node, which is expected to become operational during summer 2024. The EU Node will work at European level and operate the current Core services, offering them to other EOSC nodes and providers for integration. As such, it will be the primary initial target of the EOSC Beyond innovation activities.

Indeed, the project aims to deliver an improved and extended set of EOSC Core services that will be the base to evolve the EU Node in the next procurement cycle (2027 onwards) and to create other Nodes of the network. EOSC Beyond Core services will be created considering the users' feedback on the EU Node, the outcome of the node piloting activities the project has planned and other research communities requirements, being ready to support the network of nodes scenario. It is expected that the EOSC Beyond pre-production Core services will be a relevant input for the EC, future EOSC governance and other relevant stakeholders in order to define the technical specifications of the EU Node in the next EOSC procurement phase.

Furthermore, EOSC Beyond will assemble a new EOSC Platform, taking into account the new features offered by the enhanced core services delivered by the project, that will become a fundamental asset for other initiatives willing to establish an EOSC Node. The project will operate this enhanced EOSC Platform as part of the EOSC Core Innovation Sandbox, a pre-production environment that will be used by the communities to create their EOSC Nodes.

It is important to note that the innovation activities within the EOSC Beyond project are not expected to be released as part of the current EU Node but will be ready for exploitation in its future development. The EU Node could, however, adopt minor improvements in agreement with the EC and its implementing entities as long as they are compatible with the execution of current procurement contracts.

This document presents the technical roadmap to deliver the new Core capabilities for the next phase of the EOSC EU Node. Some of these Core services improvements could be considered for earlier adoption by the current EU Node.

2.1. EOSC EU Node

One of the main objectives of the EOSC Beyond project is to extend the EOSC Platform Architecture and deliver enhanced versions of its components, the EOSC Core services.

As the first implementation of the EOSC Platform Architecture, the EOSC EU Node will be directly affected by the results of EOSC Beyond because its evolution will be planned taking into account the new architecture delivered by the project. With its extended EOSC Platform Architecture, EOSC Beyond is expected to provide a key input for the definition of the technical specifications of the next version of the EOSC EU Node.

2.1.1. Current EOSC EU Node

The EOSC EU Node is expected to become available to the public in Summer 2024 and will be operated by a series of contractors selected by the EC. These contractors are expected to deliver the services satisfying strict operational requirements.

As an operational production service, the EOSC EU Node is not an environment where tests and validation of new technologies can be performed. This means that new capabilities developed by EOSC Beyond can be incrementally added to the EU Node only when they reach a high level of maturity that guarantees adequate stability and reliability, performance, etc.

This narrows the set of potential new capabilities that can transition from EOSC Beyond to the EOSC EU Node during the project lifetime to only those well-bounded features that are incremental to the existing, already procured, core functions. These can be, for example, simple updates or basic extensions that do not add too much extra burden to the baseline operations of the contractors.

A collaboration with the EOSC EU Node contractors will be established to identify the EOSC Beyond features that might be deployed in the EOSC EU Node during the current contracts taking into account the limitations described above. The large correspondence between EOSC EU Node contractors and EOSC Beyond project members will facilitate the set up of such a dialogue.

2.1.2. Next phase of the EOSC EU Node

As mentioned above, the next versions of the EOSC EU Node will be the main target for EOSC Beyond innovation activities.

The extended EOSC Platform Architecture will highlight new connections between Core services and will integrate the newly developed Core services in the overall platform architecture.

The project will define a **technical roadmap to extend the EOSC EU Node with the new EOSC Beyond capabilities**. This roadmap will be a primary input to define the technical specifications of the EOSC EU Node v2.

2.2. Other EOSC Nodes

EOSC Beyond is expected to deliver fundamental assets to facilitate the set up of EOSC Nodes for national/regional/european/thematic collaborations and to effectively support those collaborations in the design and implementation of their Nodes.

For this aim, firstly, the project will produce an EOSC Platform Architecture that inherently supports the concept of EOSC Node. This architecture will act as a reference architecture that can be implemented and customised by each collaboration willing to set up its EOSC Node.

Reference implementations for the different Core services of the platform will be made available for adoption via different models (e.g. SaaS, open-source software).

Furthermore, the project will offer a testbed, the EOSC Core Innovation Sandbox, a pre-production environment of the enhanced EOSC Platform used as a testing and staging environment, that could be used by the communities to create their Nodes and integrate them with EOSC.

All these assets will be complemented by dedicated technical support that the project will deliver to help initiatives to establish their nodes.

In addition, the project is tasked to prototype a network of EOSC Nodes with a series of pilots. This activity will allow EOSC Beyond to fine tune its results taking into consideration the feedback of the communities running the pilots. The establishment of the network of EOSC Pilot Nodes will also give to the project the opportunity to test interactions among Nodes (with or without the involvement of the EOSC EU Node) and identify federating capabilities of interest to multiple communities. Several use cases will be identified and developed with the aim to validate the model of EOSC Federation as a network of peer-to-peer EOSC Nodes.

2.3. EOSC Association and EOSC Governance

EOSC Beyond is actively collaborating with the EOSC Association (EOSC-A) and the EOSC Governance (the EOSC Tripartite Group). The project created channels to regularly share its technical plan and achievements with them and align its activities according to the policy directions defined by the Tripartite Group and the requirements from the research communities represented by the EOSC Association.

This work has already begun, with a presentation of project activities to the Tripartite Group, sharing of documents for feedback, and direct contribution to EOSC-A activities, such as the EOSC Federation Handbook writing and EOSC-A task forces.

D5.1 Collaboration with the implementing entities of the EOSC EU Node and Technical Roadmap

Particularly interesting for EOSC Beyond is the initiative of the Tripartite Group to gather expressions of interest to setup an EOSC Node via a questionnaire¹. Information gathered by the Tripartite through this initiative is relevant for the network of EOSC Pilot Nodes that EOSC Beyond will establish. The results of the EOSC Beyond's own piloting activities can enrich the information gathered by the Tripartite via the questionnaire. Coordination with the EOSC Tripartite and the EOSC-A is expected to be extremely important in the coming months.

1

<https://eosc.eu/eosc-about/building-the-eosc-federation/questionnaire-for-parties-interested-in-contributing-to-the-build-up-phase-of-the-eosc-federation/>

3. Technical Roadmap for EOSC Nodes evolution including the EU Node

This section presents the EOSC Beyond Technical Roadmap expected to drive the evolution of the emerging EOSC Nodes, including the EOSC EU Node. As explained in [section 2](#), the roadmap targets the next version of the EOSC EU Node (after 2027) as well as new, but more limited, capabilities that might be deployed during the current procurement.

This roadmap is a live document that will change during the project execution according to the output of the requirement gathering and gap analysis. The roadmap reported in this deliverable represents the current state of the art. It will be enriched with more tasks and further detailed at the end of the analysis.

The roadmap for the second period of the project (M19-M36) should be considered provisional and is still under development for some activities. The planning of technical activities for this period strongly depends on the requirement gathering and gap analysis that is currently ongoing. It will be further defined and detailed in the coming months and is expected to become stable by M18.

3.1. Evolution of the services in the current EOSC Platform

Table 1 details new capabilities contemplated for existing Core Services that the project could deliver during its lifetime. Together they will define an extended EOSC Platform Architecture and its reference implementation, which are the main outputs of the project and fundamental assets to set up EOSC Nodes, including the EU Node.

The subset of new capabilities that can transition from EOSC Beyond to the current EOSC EU Node is not defined here, but these will be identified later in collaboration with the EOSC EU Node contractors, taking into account the evolution of the EOSC EU Node and the EOSC Federation as whole.

There is a risk that beneficial evolution of the Core services and of the whole Core ecosystem could break compatibility with the previous version and prevent or limit the deployment of incremental capabilities in the EOSC EU Node during the project lifetime. This is a risk the project is taking into consideration and will actively mitigate.

Core service	Capabilities	Timeline (MM/YY)
Resource Catalogue (includes Service Catalogue, Service Providers Dashboard, Knowledge Graph, Research Product Provider Dashboard)	Extending Integration Capabilities of the Service Catalogue: use of EOSC Messaging Service to integrate with EOSC Core components, support PIDs via EOSC PID service. Integration with other EOSC Core Components (Monitoring, Accounting, Helpdesk, etc.).	04/25 (M13)

Core service	Capabilities	Timeline (MM/YY)
	<p>EOSC Knowledge Graph: The Graph will be adapted to include the EOSC Node concept, linking onboarded resources to specific Research Infrastructures, clusters, etc. It will comply with the evolving Infrastructure Framework for Scientific Knowledge Graphs (RDA IG: Open Science Graphs for FAIR Data) to join the SKG federation supported by SciLake and EOSC-2023-01-03. The model will encompass metrics and indicators, trust and provenance (including EOSC Nodes), and publishing workflow quality.</p>	04/25 (M13)
	<p>The Research Product Provider Dashboard as-a-Service (aaS) will be fully integrated with the EOSC Service Provider Dashboard, including AAI user-context synchronisation, a unified look and feel, and alignment with EOSC Knowledge Graph identifiers (PIC registry, ROR.org, orgreg RISIS registry). A version will be deployed for the EOSC Core.</p>	04/25 (M13)
	<p>Service Catalogue - Better User Experience: Redesigned UI/UX for uniform and user friendly resource onboarding procedure across all different types of resources. UI ability to adapt to resource profile changes. Associate resources with IF Guidelines</p>	09/25 (M18)
	<p>Service Catalogue - Support for Profile evolution: Specialisation of service types to include more specific properties (datasource, computing services, deployable services). Ability to adapt to resource profile changes</p>	09/25 (M18)
	<p>Deployable Service Catalogue: Finalisation of the Service Catalogue for EOSC Nodes (aaS, deployable service), ensuring local instances feature an off-the-shelf integration with EOSC AAI, EOSC PID service, and EOSC Messaging Service. Listing and linking to Resources in other EOSC Node instances highlighting the Resource Profile version used</p>	09/25 (M18)
	<p>Service Catalogue - TOSCA Deployable Services support: Include the ability for Providers to onboard a TOSCA-based deployable release of their services,</p>	12/26 (M33)

Core service	Capabilities	Timeline (MM/YY)
	compatible with the EOSC Deployment Service	
	Service Catalogue - Assistance tools: Tools for Providers onboarding and advanced insights and analytics for their service portfolio across EOSC Nodes	12/26 (M33)
	Service Catalogue - Audit operations support: Introduce a new audit module for the EPOT team to proactively identify service profiles that need quality improvement, and a messaging dashboard and integration with Helpdesk for Providers-EPOT communication	2/27 (M35)
Marketplace/Tool Market & Order Management	First release of the Marketplace including: <ul style="list-style-type: none"> • functionality in the EOSC Marketplace for service discovery by IF Guideline, programming language, or platform of available integration libraries. • visual representation of the relationships between EOSC services, IF Guidelines, and integration libraries. 	06/25 (M15)
	Second release of the Marketplace including <ul style="list-style-type: none"> • The EOSC Marketplace extended to enable the discovery of onboarded libraries for IF Guidelines • availability of applications like Data Transfer Service, Scholarly Metadata Aggregator Service, and Data Analysis Environment in the EOSC Marketplace • Marketplace extensions to support embedding EOSC Execution Framework capabilities 	12/25 (M21)
	Extended Order Management UIs and Back-ends: Order Management interfaces and back-end systems will be enhanced to introduce consumable resources.	12/25 (M21)
	First release for the IF Guidelines Marketplace Extension, enhancing the Marketplace to:	2/26 (M23)

Core service	Capabilities	Timeline (MM/YY)
	<ul style="list-style-type: none"> • Support visualisation of libraries for IF Guidelines. • Enable service discovery by IF Guidelines and library features. • Visualise relationships between IF Guidelines, libraries, and services. 	
	<p>Integration with EOSC IF Registry and Service Catalogue: The Marketplace will integrate elements that support resource composability.</p> <p>Marketplace Projects Update: Projects within the Marketplace will be updated to notify users of composability opportunities.</p>	6/26 (M27)
	<p>Filtering Capabilities: Users will be able to filter resources based on their interoperability capabilities.</p>	8/26 (M29)
	<p>Second release for the IF Guidelines Marketplace Extension, enhancing the Marketplace to:</p> <ul style="list-style-type: none"> • Support visualisation of libraries for IF Guidelines. • Enable service discovery by IF Guidelines and library features. • Visualize relationships between IF Guidelines, libraries, and services. 	12/26 (M33)
AAI	<p>Explore advanced authentication options (e.g. Multi-Factor Authentication - MFA, Passwordless Authentication) for enhanced security, focusing on interoperability and support for these methods across members of the EOSC AAI Federation.</p>	06/25 (M15)
	<p>Add support for OpenID Federations to enable connecting to the EOSC AAI Federation without the need for a SAML to OpenID Connect/OAuth 2.0 proxy layer.</p>	08/25 (M17)
	<p>Add support for advanced authorisation mechanisms to enable more efficient and effective sharing of federated resources across different infrastructures.</p>	02/27 (M35)

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Core service	Capabilities	Timeline (MM/YY)
	Study the SIMPL framework and identify potential integration points with the EOSC federated AAI. Analyse decentralised identity management requirements for achieving interoperability with SIMPL-based data spaces.	02/27 (M35)
	Pilot / proof of concept showcasing user and access provisioning and deprovisioning across different infrastructures and services within the EOSC AAI Federation. Investigate mechanisms based on standards such as SCIM.	02/27 (M35)
PID	PID Service: assign and resolve PIDs for providers/resources onboarded into Resource Catalogue.	08/25 (M17)
	Accounting for PIDs: create the necessary metrics for the Accounting service and the process to provide the data.	08/25 (M17)
	PIDs for instruments based on standards agreed by the research community.	08/25 (M17)
	Creation of machine readable type descriptions for supported resources.	08/25 (M17)
	Development of a EOSC Core adapter for the PID Service.	08/25 (M17)
	Check the Quality of Prefixes and PIDs used.	09/26 (M30)
	Align PIDs with the FDO concept and model.	09/26 (M30)
	Add support for custom PID namespaces.	09/26 (M30)
Monitoring	Monitoring: Improved integration with the Resource Registry so that monitoring data are available in the Providers Portal. Automated procedure for the definition of new metrics for providers.	08/25 (M17)
	Extend the Monitoring Integration Profiles with service properties that enable richer monitoring reports	08/25 (M17)
	Support integration of monitoring data as part of service profiles in the Service	08/25 (M17)

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Core service	Capabilities	Timeline (MM/YY)
	Catalogue, for reuse across Core components	
	Enable the definition of new monitoring metrics by the providers.	08/25 (M17)
	Add support for EOSC Nodes to create their Status Pages	08/25 (M17)
	Extend the Monitoring Integration Profiles (Monitoring Extensions), with additional fields like extra service description that will add extra Business Value based on the functionalities of the service. This will bring trends and better Insights of the service.	08/25 (M17)
	Automate procedure for the definition of new metrics to be included by the providers	08/25 (M17)
	Verify compliance auditing on various areas (e.g. Security, Profiles, AAI)	02/27 (M35)
	Automate the creation of monitoring instances/tenants to be offered as a service	02/27 (M35)
	Automate the generation of Status reports based on filters;	02/27 (M35)
	Add support for the validation of compliance of members of the AAI federation	02/27 (M35)
	Add “badges” for services based on monitoring status reports	02/27 (M35)
	Monitoring of service performance	02/27 (M35)
	Investigate the possibility to Automate the validation and auditing of EOSC Profiles: Monitoring will be the service to validate and audit the profiles according to prerequisites for the onboarding process and after the process to check the status of onboarding service.	02/27 (M35)
Messaging	The EOSC Messaging Service (EMS) will fill the gap to the end to end integration between services, by providing a library of commonly used message data.	08/25 (M17)

Core service	Capabilities	Timeline (MM/YY)
	Messaging acts as a data transport layer between the EOSC Core and EOSC exchange services and the EOSC Core and National or Thematic EOSC Nodes.	08/25 (M17)
	Providing UIs to customise a messaging framework (users, topics, subscriptions, message structure, schemas) to define a specific service-to-service message transport layer;	02/27 (M35)
	Adding support for users to define contracts about messages expected to arrive (schemas validation), expected activity (frequency and size of messages etc). Definition of a contract for exchanging Real Time data between Core components and EOSC Exchange services.	02/27 (M35)
Accounting for services	Integrate with the Service Catalogue to allow Accounting data for services to be introduced in the EOSC Profiles	08/25 (M17)
	Support grouping of services by KPIs and by EOSC Nodes	08/25 (M17)
	Support the creation of reports per Provider, Service, EOSC Node	08/25 (M17)
	Add support for National or Thematic nodes.	02/27 (M35)
	Add Support for reports based on different filters and criteria	02/27 (M35)
	Add Support for Capacity management	02/27 (M35)
	Add Support for Order management	02/27 (M35)
	Add Support for the creation of reports per Project, Provider, Resource, National or Thematic Node	02/27 (M35)
Accounting for Research Product	Collect from the OpenAIRE Graph provenance information about the organisations behind the authors of given research product.	02/27 (M35)
	Offer APIs to access aggregated usage statistics at organisational level, as well as	02/27 (M35)

Core service	Capabilities	Timeline (MM/YY)
	for sets of PIDs.	
Helpdesk	Delivery of Enhanced Helpdesk-as-a-Service <ul style="list-style-type: none"> • Introduce more custom features • Improve management of community users • Enhance isolation of the helpdesk community space from other spaces within the helpdesk 	05/25 (M14)
	Implement Ticket Dashboard <ul style="list-style-type: none"> • Develop a matrix of ticket states for better ticket tracking and management 	05/25 (M14)
	Prototype of Smart Integration with Zammad Helpdesks <ul style="list-style-type: none"> • Create a prototype adopters for seamless integration with other Zammad helpdesks and systems 	09/25 (M18)
	Pilot integration with OpenAIRE based on the new prototype <ul style="list-style-type: none"> • The integration will be performed with OpenAIRE instance 	01/26 (M22)
	Pilot integration with NFDI HIFIS Zammad instance based on the new prototype <ul style="list-style-type: none"> • The integration will be performed with HIFIS instance 	01/26 (M22)
	Subscription and assignment by multiple support groups <ul style="list-style-type: none"> • Subscription and assignment to the ticket by multiple support groups to facilitate collaboration 	09/26 (M30)
	Improve Integration with EOSC Core components (Provider Dashboard, Marketplace) <ul style="list-style-type: none"> • Improve integration with EOSC Core components (Service Provider Dashboard for providers-EPOT team interaction, Marketplace for users-EOSC support group 	09/26 (M30)

Core service	Capabilities	Timeline (MM/YY)
	interactions).	
	Helpdesk for Exchange services <ul style="list-style-type: none"> Helpdesk integrated in EOSC platform to off-the-shelf support EOSC Exchange services; 	09/26 (M30)
	Improvements of front-end and backend for Helpdesk as a Service delivery <ul style="list-style-type: none"> Finalisation of front-end and back-end improvements to support Helpdesk aaS. 	09/26 (M30)

Table 1 - New capabilities for the EOSC EU Node in the next procurement cycle.

3.2. New Core services for EOSC Nodes, including the EOSC EU Node

EOSC Beyond will add and integrate into the extended EOSC Platform Architecture three new core services:

- EOSC Integration suite,
- EOSC Execution Framework,
- EOSC Core Innovation Sandbox.

The planned technical roadmap for these new services is presented below.

3.2.1. EOSC Integration Suite

The EOSC Integration Suite provides a set of tools designed to share and reuse software libraries (adapters) among research communities and technology providers, addressing common patterns in scientific applications. These adapters complement the Interoperability Guidelines (IG) of the EOSC IF, implementing the interfaces and the best practices they define.

The EOSC Integration Suite is designed to improve service interoperability within the EOSC ecosystem, fostering a collaborative and efficient environment for scientific research and technological innovation.

Core service	Capabilities	Timeline (MM/YY)
Integration Suite	Extension of the EOSC Interoperability Framework Registry (IF Registry): Support for adapter libraries and link to Interoperability Guidelines.	09/25 (M18)

Core service	Capabilities	Timeline (MM/YY)
	Extension of the EOSC Marketplace: <ul style="list-style-type: none"> • Support adapters when onboarding services • Service discoverability by available adapters • Visualisation of service-guidelines-adapters relationships 	09/25 (M18)
	First set of core adapters for Helpdesk, PID Service, Service catalogue, Research product catalogue, Service monitoring, Service accounting, Research product accounting.	09/25 (M18)
	First version of adapters for the EOSC Data Transfer Service	03/25 (M12)
	Integration of the CERN File Transfer Service with the EOSC AAI service	03/25 (M12)
	Data transfer orchestration by the CERN File Transfer Service between FTP storage endpoints	09/25 (M18)
	Extend FedCloud client with capabilities to provision storage and stage datasets into it.	06/25 (M15)
	First version of JupyterLab or Jupyter Notebooks compatible libraries to provision computational infrastructure, storage, and stage datasets into storage.	09/25 (M18)
	First set of libraries that research communities use extensively to access and consume services or research products from the EOSC Marketplace are identified.	03/25 (M12)

Table 2 - New Core Service: EOSC Integration Suite.

3.2.2. EOSC Execution Framework

The EOSC Execution Framework will provide an extendable suite of composability-based applications designed to enhance the deployment and accessibility of services within the EOSC ecosystem.

The EOSC Execution Framework consists of two main components:

- Enriched EOSC IF Registry:

D5.1 Collaboration with the implementing entities of the EOSC EU Node and Technical Roadmap

- The EOSC IF (Interoperability Framework) Registry, part of the EOSC Platform, provides essential tools for describing and managing the interoperability capabilities of various resources. This registry facilitates the annotation of EOSC resources across different research and e-infrastructure domains, enhancing the discovery and usability of these resources based on their interoperability features.
- Interoperability Guidelines: associates resources with the EOSC IF Guidelines they comply with and specific configurations (access parameters) for users. These guidelines typically combine technical elements such as protocols, APIs, and formats, providing detailed instructions on their use and assembly.
- **Deployment Service:**
 - On-Demand Deployment: facilitates the deployment of services on hybrid Cloud infrastructures, offering flexibility and scalability.
 - Integration with Resource Catalogue: works seamlessly with the Resource Catalogue to provide users with comprehensive descriptions of service access and deployment procedures.

Together, the EOSC IF Registry and the Deployment Service form a cohesive framework that supports the dynamic and efficient provisioning of services, enhancing the overall functionality and user experience of the EOSC platform.

Core service	Capabilities	Timeline (MM/YY)
Execution Framework	Delivery of an EOSC Deployment Service: Enable dynamic deployment of EOSC Exchange services based on the TOSCA standard.	09/25 (M18)
	Foundation for Development of EOSC Horizontal Applications: Exploit the capabilities of the EOSC Execution Framework.	09/25 (M18)
	Drafting of a State-of-the-Art EOSC Digital Rights Vocabulary: Identify and define the terminology and standards for digital rights within the EOSC framework.	09/25 (M18)
	Delivery of an EOSC Deployment Service: Enable dynamic deployment of EOSC Exchange services based on the TOSCA standard integrated with the Dynamic DNS Service. Manage data movement, bringing data closer to dynamically-provisioned	03/27 (M36)

Core service	Capabilities	Timeline (MM/YY)
	computation.	
	Foundation for Development of EOSC Horizontal Applications: Exploit the capabilities of the EOSC Execution Framework. Complete and deliver EOSC composability-based applications.	03/27 (M36)
	Drafting of a State-of-the-Art EOSC Digital Rights Vocabulary: Identify and define the terminology and standards for digital rights within the EOSC framework. Finalise the Digital Rights Vocabulary for the EOSC.	03/27 (M36)
	Extension and Support for EOSC Integration Suite: Extend the EOSC IF Registry to support the developments of the EOSC Integration Suite.	03/27 (M36)

Table 3 - New Core Service: EOSC Execution Framework.

3.2.3. EOSC Core Innovation Sandbox

The EOSC Core Innovation Sandbox (CIS) is a comprehensive testbed equipped with advanced automation tools designed for testing and validating EOSC Core services. It serves two primary purposes: prototyping enhanced and new EOSC Core services and allowing providers to validate the integration of their own services and data with EOSC Core Services before deploying their resources into production. It will also be used to showcase the enhanced EOSC capabilities delivered by EOSC Beyond.

The CIS features will be rolled out gradually to providers and nodes in multiple stages.

The setting up of the CIS is going to use the following dynamics. In the initial phase, a pre-production instance of the CIS catalogue will be made available to the providers. This will be followed by a complete set of guidelines aimed to enable third parties to test the integration of their services, as well as external catalogues integration in the Sandbox catalogue. When the EOSC EU Node moves to production, work will be performed to make the CIS as much compatible as possible with the EOSC EU The newly developed features by the EOSC Beyond project will be made available through the pre- production environment in the next phase. In addition, automation tools for testing and validation of services will be added to the CIS. Two of the newly developed key core services by the EOSC Beyond, the EOSC Integration suite, and the EOSC Execution Framework will become integral parts of the

CIS. New sets of Core services, as well as updated automation tools will extend the CIS. Before adding the final set of EOSC Core services, the EOSC Sandbox will be made available as a software package for external installation. The exact timeline for these activities is presented in Table 4.

Core service	Capabilities	Timeline (MM/YY)
Core Innovation Sandbox (CIS)	The sandbox is operational enabling the providers to start their integration testing with the core elements from the CIS catalogue.	07/24 (M4)
	Third party nodes can test the integration with EOSC in the sandbox, including their catalogue integration.	10/24 (M7)
	Compatibility with the EOSC EU Node	03/25 (M12)
	The first set of new EOSC Beyond developed features will be made available in the sandbox	09/25
	Initial set of automation tools for testing and validation of services available in the sandbox	09/25
	Integration suite and execution framework becoming available in the sandbox	12/25
	The second set of new EOSC Core features available in the sandbox	04/26
	Update of the automation tools, as well as new tools made available in the sandbox	09/26
	External deployment of EOSC sandbox services as a software package	12/26
	The final set of new EOSC Core features available in the sandbox	03/27

Table 4 - New Core Service: EOSC Core Innovation Sandbox.

3.3. Assets to establish the EOSC Federation

In addition to the technical development, EOSC Beyond will release a series of assets fundamental to the establishment of the EOSC Federation. These assets can be documents, architecture diagrams, technical specifications, etc.

A non exhaustive list that highlights the most important follows:

- **EOSC Platform Architecture:** set of architecture diagrams and related description documents that defines a reference architecture for a EOSC Node
- **EOSC Profiles:** metadata schemas for the description of services, research products or other research artefacts that their providers choose to share with the EOSC user community through the EOSC Exchange, as well as for describing the organisations offering to provide these resources to EOSC.
- **Interoperability Guidelines:** version-controlled documents that describe standards to enable interoperability and explain how Providers can make their resources compatible with them. They outline the high-level protocols (such as REST) and low-level protocols (such as OAI-PMH), data models (e.g. DCAT model), and schemas (e.g. DCAT JSON schema) that need to be implemented or customised to ensure compatibility with each guideline. Guidelines specify the essential technical requirements and configurations that providers should follow in order to make their services compatible with the interoperability guidelines.
- **Federating Capabilities:** functionalities that are offered by the EOSC Federation such as a common search engine, a single sign-on (AAI), common interfaces to share, access and analyse data, etc. These functionalities are collaboratively delivered by multiple EOSC Nodes. EOSC Beyond will identify a set of Federating Capabilities of interest for research communities and define their technical architecture (core services to enable the capabilities, interfaces, metadata structures, etc).

These assets will be delivered in two releases as EOSC Platform Architecture together with *D5.3 EOSC Platform Architecture and Network of EOSC Nodes (M15)* and *D6.2 EOSC Platform Architecture and Network of EOSC Nodes update (M30)*.

4. Conclusions and next steps

The EOSC Beyond innovation activities are important instruments to move EOSC to the next stage. New features delivered by the project can foster and accelerate the creation of the EOSC Federation as a network of Nodes and allow EOSC to be more tailored to research communities and researchers.

However, the results of EOSC Beyond will become effective if they are accepted and adopted by the EOSC stakeholders. So, collaborations with relevant stakeholders such as the Tripartite Group, EC, EOSC-A and its task forces, EOSC EU Node contractors are fundamental. This document has described the established connections with these entities with a focus on the EOSC EU Node contractors.

Specifically on the latter, the technical roadmap presented in this deliverable will serve as a basis to establish the collaboration with the EOSC EU Node contractors. In the coming months, EOSC Beyond will propose to the contractors the establishment of a working group that will take care of connecting these two initiatives with the aim to: (1) identify new Beyond features that can be adopted by the EOSC EU Node during the project lifetime, (2) gather user feedback that can help the project to adjust and better detail its technical roadmap, and (3) working on the initial definition of the technical specifications of the next version of the EOSC EU node.

5. Acronyms

Term	Definition
AAI	Authentication and Authorization Infrastructure
aaS	as a Service
API	Application Programming Interface
CIS	Core Innovation Sandbox
DCAT	Data Catalog Vocabulary
DNS	Domain Name System
DOI	Digital Object Identifier
EC	European Commission
EMS	EOSC Messaging Service
EOSC	European Open Science Cloud
EOSC-A	European Open Science Cloud Association
FAIR	Findable, Accessible, Interoperable, Reusable
FDO	FAIR Digital Object
FTP	File Transfer Protocol
IF	Interoperability Framework
IG	Interoperability Guidelines
JSON	JavaScript Object Notation
MFA	Multi Factor Authentication
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
OpenID	Open standard and decentralized authentication protocol
PID	Persistent Identifier
SaaS	Service as a Service
SAML	Security Assertion Markup Language
SCIM	System for Cross-domain Identity Management
SIMPL	An open source, smart and secure middleware platform that supports data access and interoperability among European data spaces.
SSO	Single Sign On
TOSCA	Topology and Orchestration Specification for Cloud Applications