EPOS SP – Grant Agreement n. 871121

D4.1 Plan for service testing, harmonization and use of e-Infrastructures

Document Information Summary

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0.0	18/09/2020	
1.0	21/09/2020	Improve ICS-D Conceptual Architecture Minors typography errors
1.0	15/10/2020	V1.0 formally approved by the EB

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THE EPOS SP PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N° 871121

1. Executive Summary

This document gives the framework to enhance the robustness of EPOS ICS in the intention to broaden and deepen the user engagement. Its focal point of attention is the ICS, and therefore it is aiming at the following audience: EPOS governance bodies, EPOS SP project partners, European Commission, IT people, other RIs and International Initiative.

2. Introduction

The first objective is to develop technical sustainability and foster innovation in data science by delivering robust services in an environment suitable for increasing end-user trust and encouraging for new communities to join EPOS as both, data providers and data users. This has three strands (corresponding to the three aspects of T4.1):

a. testing in order to ensure enhanced user experience (presumably functionality, reliability and additional features) and trust;

b. harmonizing to provide better (interoperable) services;

c. interfacing with e-infrastructures to provide better end-user experience of services;

The second objective is that as new communities join EPOS, we need first to provide them with a clear process to facilitate their integration, and secondly provide a list ICS-D and linked e-Infrastructures to match their requirements. The plan will provide the roadmap for the work to be done and the plan for evaluation in D4.2.

The overarching goal of EPOS SP WP4 is to engage with wider scientist user communities. This is an important task of the EPOS-SP project, which is being coordinated through task 4.2 of the WP4 and the three tasks of WP7. In this regards, there are a number of ongoing activities that involve the following:

- Documentation and tutorials
- Training activities
    - Training courses
    - Training workshops
- Outreach activities
- Dissemination activities

These activities are crucial, as they are also the moment to grab feedback from the user communities. In that sense we aim to increase the momentum resulting in two intertwined virtuous loops.

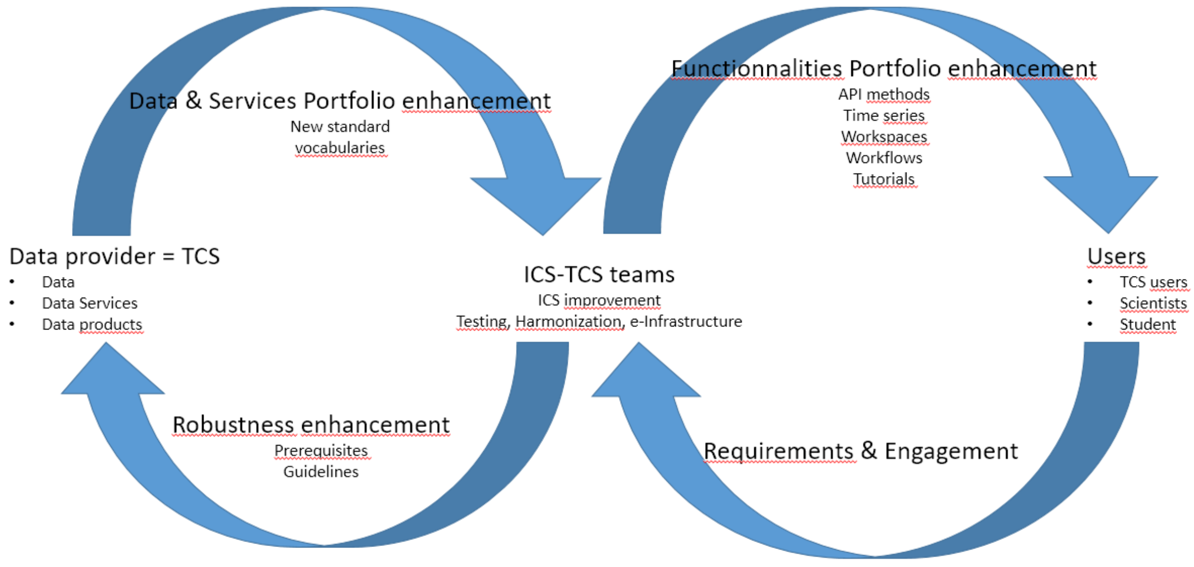

Figure 1: EPOS SP WP4 virtuous loops from richer TCS support and robust ICS for wider user engagements

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3. Testing

3.1. Current testing regime

Short history of testing and validation:

The ICS-C system has been primarily developed through the EPOS-IP project (2016-2019) and further implemented in a hosting environment where UKRI-BGS (UK), BRGM (France) and GEUS (Denmark) have the joint responsibility of hosting and operating the ICS-C system. Throughout the Implementation Phase of EPOS (EPOS-IP), an extensive testing and validation process was adopted in order to make sure that the various EPOS services have passed the required validation criteria seen from technical, governance, legal and financial perspectives. The technical criteria at the time included a comprehensive "Technical Readiness Assessment (TRA)" process with the involvement of testing the TCS services in their own premises as well as their readiness for implementation to the ICS-C system. Extensive reporting explaining the details of this process can be found in the TRA-Report as part of the EPOS-IP Project documentation (see EPOS-IP Project archives in EPOS ownCloud). In the present document, the goal is to present a detailed procedure for the testing of the ICS-C system and the underlying TCS assets and services, as well as a plan for the execution of this testing, before the system starts operating under the Pilot Operational Phase (POP) of EPOS.

The current testing regime aims to ensure only tested software and metadata enter the ICS-C system. This is secured by two separate pipelines covering the metadata ingestion procedures and development and operations (DevOps) processes. These two pipelines are explained in more detail in separate sections below.

Current pipeline for metadata:

Current metadata ingestion pipeline includes several steps (Figure 2). All requests concerning metadata entry for a new service or for an update of an existing service, are first discussed and agreed upon during the ICS-TCS Interaction Workshops regularly executed 3-4 times a year. ICS-TCS Interactions Coordinator institution is responsible for arranging these workshops according to the discussions and approval by the IT-Board of EPOS-ERIC. The metadata details are formally prepared in a file following the RDF/ttl format. These files are then committed by the TCS IT-contacts to a GitLab repository for EPOS ICS-C to the relevant TCS-folder "update-branch".

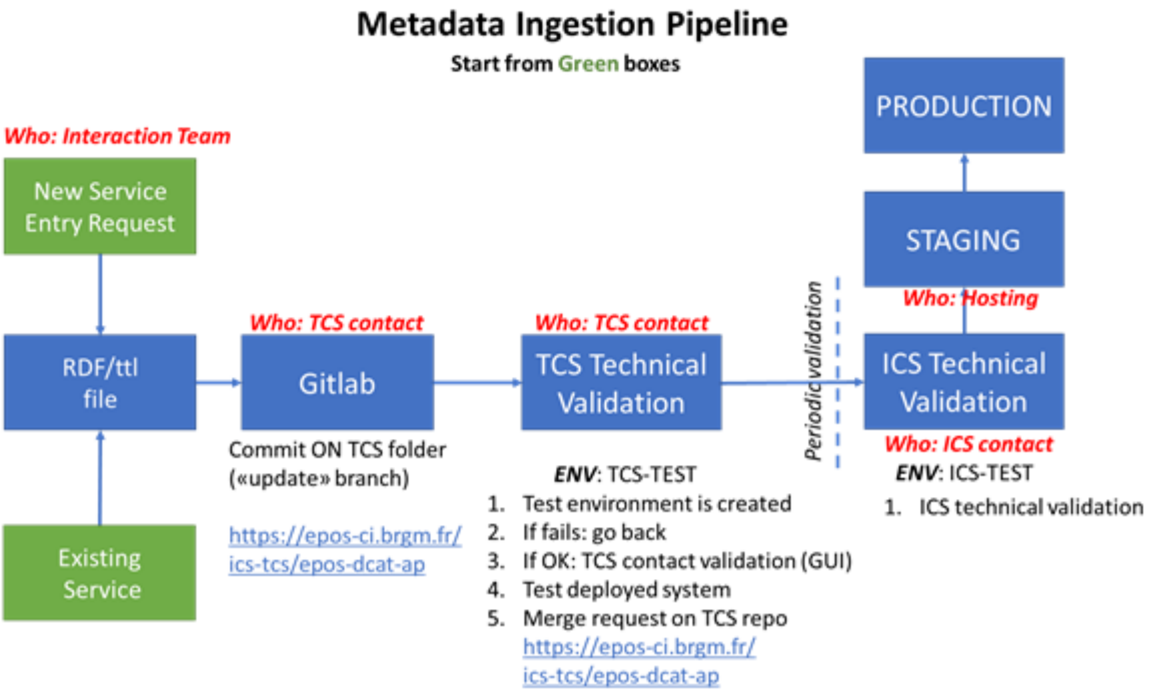
Metadata Ingestion Pipeline
Start from Green boxes
Who: Interaction Team
New Service Entry Request
RDF/ttl file
Existing Service
Who: TCS contact
Gitlab
Commit ON TCS folder («update» branch)
https://epos-ci.brgm.fr/ics-tcs/epos-dcat-ap
Who: TCS contact
TCS Technical Validation
ENV: TCS-TEST
1. Test environment is created
2. If fails: go back
3. If OK: TCS contact validation (GUI)
4. Test deployed system
5. Merge request on TCS repo https://epos-ci.brgm.fr/ics-tcs/epos-dcat-ap
Periodic validation
PRODUCTION
STAGING
Who: Hosting
ICS Technical Validation
Who: ICS contact
ENV: ICS-TEST
1. ICS technical validation

Figure 2: Metadata Ingestion Pipeline for new services or for updating existing services.

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The next step is the technical validation in the sense that the metadata entry goes through a five-step procedure as explained in Figure 2 above. After this process, there is a formal ICS technical validation which is conducted in periodic intervals throughout the year, which consists of ICS technical validation conducted by ICS IT-contacts, followed by putting into staging and then production environments by the hosting institutions.

Current DevOps pipeline for services:

In this section the current development and operational procedures are presented. The development and operational procedures are mainly coordinated by three main bodies, the TCS-ICS Interactions Team, the Development Team, and the ICS-C Operational Team (Figure 3). The IT-Board on the other hand, which consists of representatives from these three bodies, is responsible to coordinate the agreed procedures for development and make sure that developed services are properly handed into operations. The IT-Board is chaired by the IT-Officer of EPOS ERIC.

Procedures associated with the preparation of requests from the TCS communities, their further handling through the ICS-TCS Interactions and development before they are handed over to operation, are described generically in Figure 4. Procedures shown in orange and green pipelines in Figure 4, are handled through the ICS-TCS Interaction workshops arranged 3-4 times a year by the TCS-ICS Interactions Coordinating institution, with participation from all TCSs and ICS developers and ICS-C operators. Various requests from the TCS communities are discussed during these workshops and formulated into a specific development task, the so-called "pitches", as they are used in the "Shape-Up" methodology (Singer, 2019). These development tasks (pitches) are then prioritized and followed up by the IT-Board in development cycles that follow each ICS-TCS Interaction Workshop.

Once the developments are finalized, deployment from development to staging and to operation is done following specific procedures (Figure 5), which also involve testing and validation by the users as well as the product owners (i.e. owners of the completed development tasks).

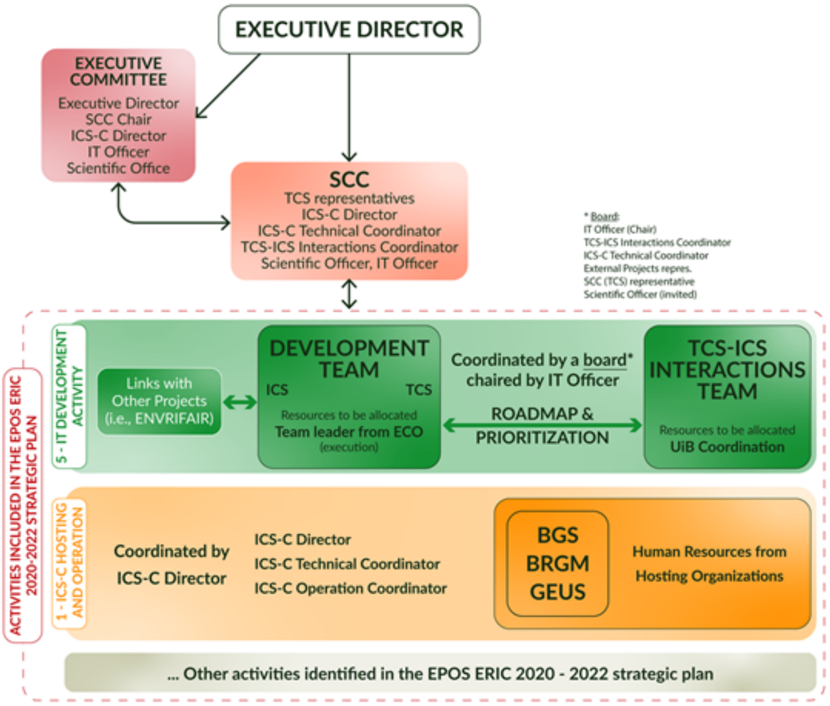
EXECUTIVE DIRECTOR
EXECUTIVE COMMITTEE
Executive Director
SCC Chair
ICS-C Director
IT Officer
Scientific Office
SCC
TCS representatives
ICS-C Director
ICS-C Technical Coordinator
TCS-ICS Interactions Coordinator
Scientific Officer, IT Officer
* Board:
IT Officer (Chair)
TCS-ICS Interactions Coordinator
ICS-C Technical Coordinator
External Projects repres.
SCC (TCS) representative
Scientific Officer (invited)
ACTIVITIES INCLUDED IN THE EPOS ERIC 2020-2022 STRATEGIC PLAN
5 - IT DEVELOPMENT ACTIVITY
Links with Other Projects (i.e., ENVRIFAIR)
DEVELOPMENT TEAM
ICS
TCS
Resources to be allocated
Team leader from ECO
(execution)
Coordinated by a board* chaired by IT Officer
ROADMAP & PRIORITIZATION
TCS-ICS INTERACTIONS TEAM
Resources to be allocated
UiB Coordination
1 - ICS-C HOSTING AND OPERATION
Coordinated by ICS-C Director
ICS-C Director
ICS-C Technical Coordinator
ICS-C Operation Coordinator
BGS
BRGM
GEUS
Human Resources from Hosting Organizations
... Other activities identified in the EPOS ERIC 2020 - 2022 strategic plan

*Figure 3: Interactions between the TCS-ICS Interactions, Development and Operational activities related to the EPOS ICS System as well as their relevant links to coordination and governance bodies. Please note that the IT-Board is referred as " * Board "*

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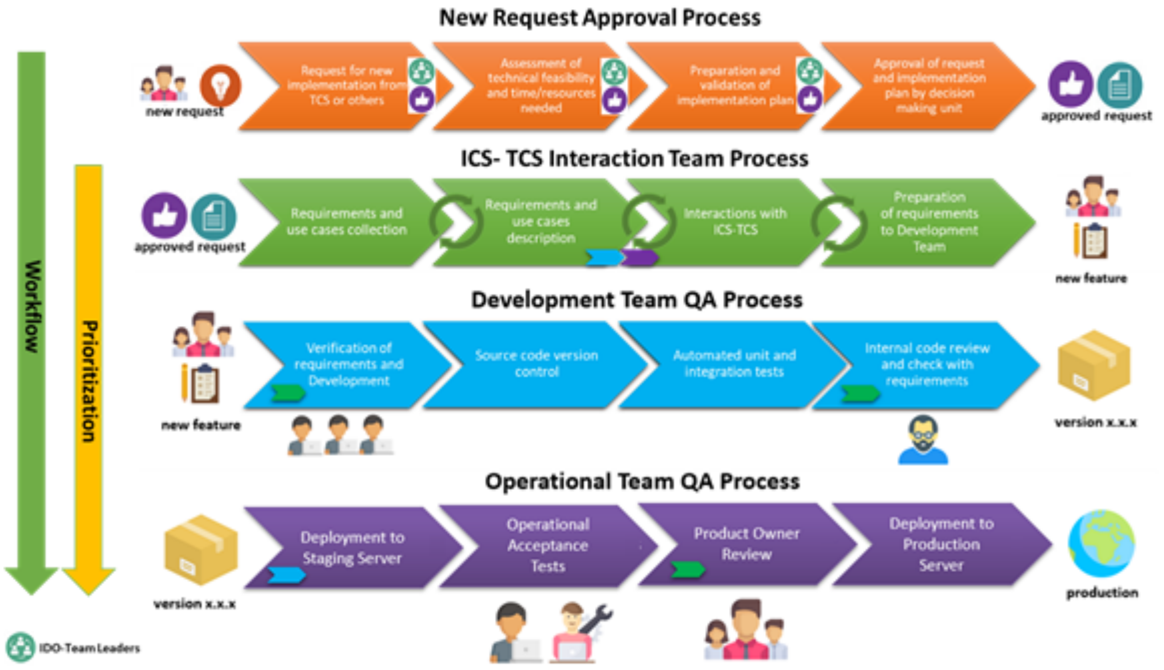
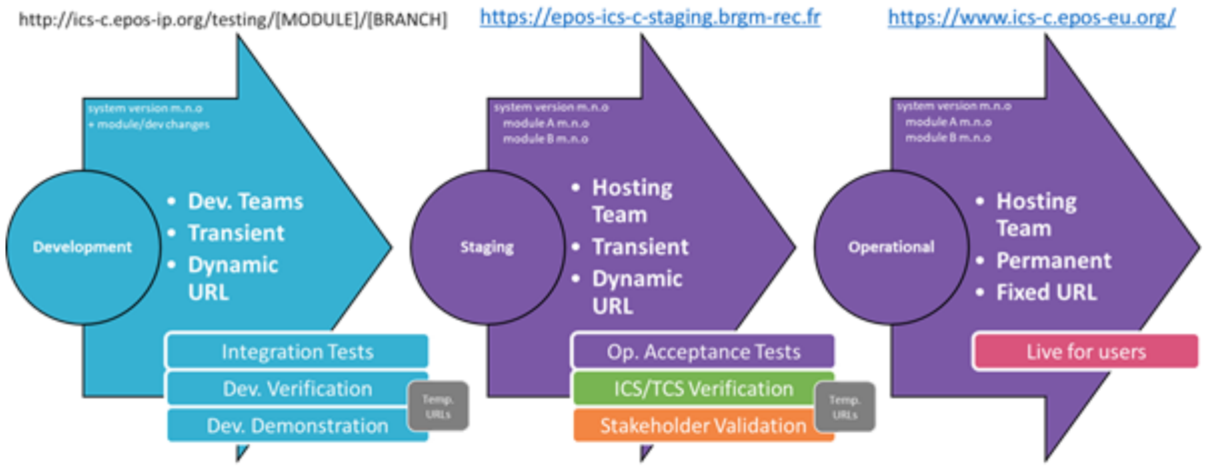

New Request Approval Process
new request
Request for new implementation from TCS or others
Assessment of technical feasibility and time/resources needed
Preparation and validation of implementation plan
Approval of request and implementation plan by decision making unit
approved request
ICS- TCS Interaction Team Process
approved request
Requirements and use cases collection
Requirements and use cases description
Interactions with ICS-TCS
Preparation of requirements to Development Team
new feature
Development Team QA Process
new feature
Verification of requirements and Development
Source code version control
Automated unit and integration tests
Internal code review and check with requirements
version x.x.x
Operational Team QA Process
version x.x.x
Deployment to Staging Server
Operational Acceptance Tests
Product Owner Review
Deployment to Production Server
production
Workflow
Prioritization
IDO-Team Leaders

Figure 4: ICS-TCS Interactions, Development and Operation pipelines and their interconnection.



Validation: The assurance that a product, service, or system meets the needs of the customer and other identified stakeholders. It often involves acceptance and suitability with external customers.

Verification: The evaluation of whether or not a product, service, or system complies with a regulation, requirement, specification, or imposed condition. It is often an internal process.

Figure 5: ICS-C deployment procedures from development to staging and operation.

3.2. Testing DDSS for acceptance (validation tests)

In this section technical validation tests associated with accepting DDSS and their relation to TCS Cost-Book entries for EPOS services are explained. Technical validation tests involve testing the metadata for the DDSS in concern and its technical validation through the ICS-C system. This is done by checking the response of the queries made by the system to TCS DDSS elements and checking of the corresponding service functionalities in the ICS-C system, which includes also configuring the necessary parameters for refining the query. These integration tests, verifying and demonstrating the developed element (i.e. implementation of a DDSS) are done in the development environment. Once the expected outcome is verified, each DDSS element is technically validated in the staging environment after operational acceptance tests and further testing by users (stakeholder validation) and DDSS owners (ICS/TCS verification). It is only after these tests are completed successfully, the version moves into the operational environment (see Figure 5).

Once the DDSS element is operational, it is then possible to include/update the corresponding service provider list of the relevant TCS in the Cost-Book.

It should be noted that DDSS validation is NOT part of the testing plan but is included here for a complete overview of the quality/testing environment.

3.3. Internal testing of TCS services

In addition to the testing procedures explained above (and detailed in Chapter 4) which is related to testing of the TCS services (DDSS elements), ICS services and their interoperability through the ICS-C system and its functionalities, there is also a need to perform internal tests of TCS services in the full scope of their implementation within the TCS premises. This is found necessary as the “EPOS Delivery Framework” includes also the individual TCS services that are available directly by the relevant TCS and may not be implemented to the ICS-C. These tests should be performed by TCSs individually by TCS User Feedback Groups. However, the full description of such tests is out of the scope of the current document and should be elaborated by each TCS independently. A similar approach was already used in the Technical Readiness Assessment done in the Implementation Phase of EPOS (EPOS-IP project).

3.4. Pilot Operational Testing (POT) Planning

Pilot Operational Testing (POT) is designed with three main components. These are: (i) Testing TCS-services, (ii) Testing ICS-C services and (ii) Testing ICS-TCS integration. Details of the POT components are explained in Figure 6.

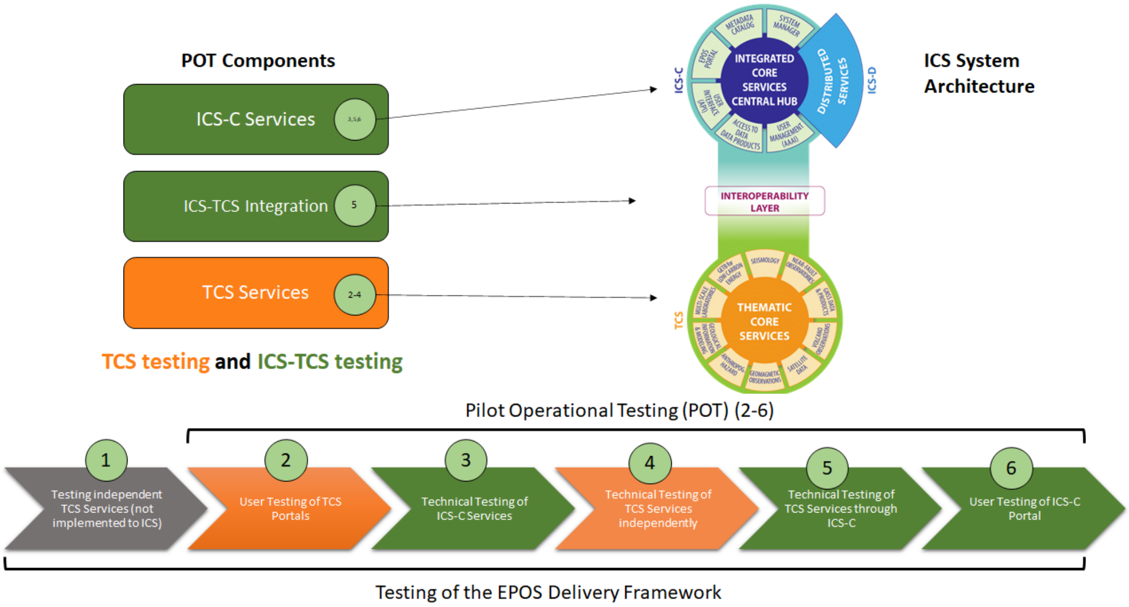

POT Components
ICS-C Services
3,5,6
ICS-TCS Integration
5
TCS Services
2-4
TCS testing and ICS-TCS testing
ICS System Architecture
ICS-C
INTEGRATED CORE SERVICES CENTRAL HUB
METADATA CATALOG
SYSTEM MANAGER
EPOS PORTAL
USER INTERFACE (API)
ACCESS TO DATA DATA PRODUCTS
USER MANAGEMENT (AAAI)
DISTRIBUTED SERVICES
ICS-D
INTEROPERABILITY LAYER
TCS
THEMATIC CORE SERVICES
SEISMOLOGY
NEAR-FAULT OBSERVATORIES
GNSS DATA & PRODUCTS
VOLCANO OBSERVATIONS
SATELLITE DATA
GEOMAGNETIC OBSERVATIONS
ANTHROPOG. HAZARD
GEOLOGICAL INFORMATION & MODELING
MULTI-SCALE LABORATORIES
GETB for LOW CARBON ENERGY
Pilot Operational Testing (POT) (2-6)
1
Testing independent TCS Services (not implemented to ICS)
2
User Testing of TCS Portals
3
Technical Testing of ICS-C Services
4
Technical Testing of TCS Services independently
5
Technical Testing of TCS Services through ICS-C
6
User Testing of ICS-C Portal
Testing of the EPOS Delivery Framework

Figure 6: Pilot Operational Testing components and their relation to the EPOS architecture.

Testing activities will be conducted in two different modes, one group of activities will involve technical testing activities and the other will involve user testing of the services as shown in Figure 7 which also shows the timeline for the execution of the planned POT components.

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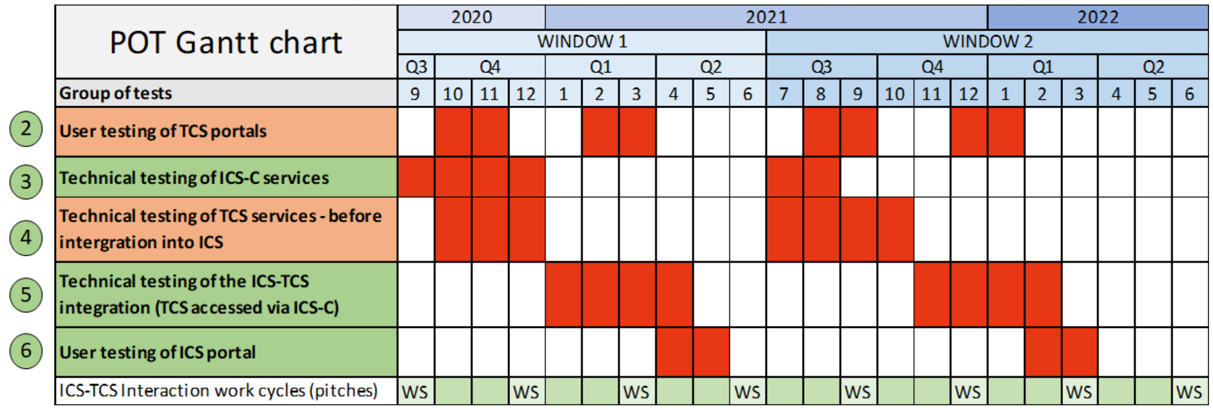


	POT Gantt chart	2020				2021												2022					
		WINDOW 1										WINDOW 2											
		Q3	Q4			Q1			Q2			Q3			Q4			Q1			Q2		
	Group of tests	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
2	User testing of TCS portals		🟥	🟥			🟥	🟥					🟥	🟥			🟥	🟥					
3	Technical testing of ICS-C services	🟥	🟥	🟥	🟥							🟥	🟥										
4	Technical testing of TCS services - before intergration into ICS		🟥	🟥	🟥							🟥	🟥	🟥	🟥								
5	Technical testing of the ICS-TCS integration (TCS accessed via ICS-C)					🟥	🟥	🟥	🟥							🟥	🟥	🟥	🟥				
6	User testing of ICS portal								🟥	🟥									🟥	🟥			
	ICS-TCS Interaction work cycles (pitches)	WS			WS			WS			WS			WS			WS			WS			WS

WS = ICS-TCS workshop

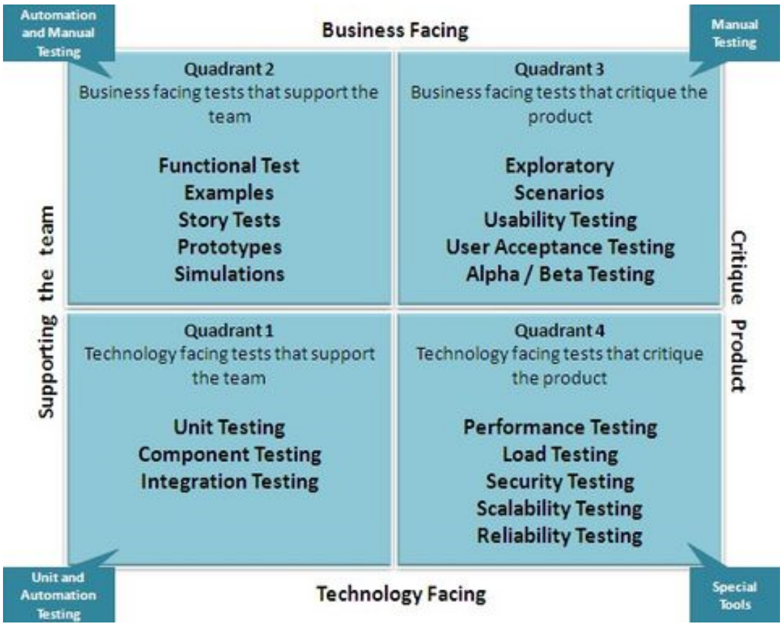
Figure 7: Pilot Operational Testing Gantt Chart

Testing activities are planned in two time windows as presented in Figure 7 and in line with the EPOS ERIC Service Delivery Plan document. Activities start already in September 2020 during the first window and will allow the operational level of the tested services. Based on the outcomes of the first window, improvements that may be required for robustness and increased value for users, will be identified. The corresponding development activities for improvements of the services are planned to be conducted during the regular ICS-TCS interaction workshops and the following development cycles throughout the entire POT period.

Details of the POT plans are given separately in the Annex 1.

3.5. Activities

We started from one of the most common testing in software development (Figure 8).



Quadrant 2
Business facing tests that support the team

Functional Test
Examples
Story Tests
Prototypes
Simulations

Quadrant 3
Business facing tests that critique the product

Exploratory
Scenarios
Usability Testing
User Acceptance Testing
Alpha / Beta Testing

Quadrant 1
Technology facing tests that support the team

Unit Testing
Component Testing
Integration Testing

Quadrant 4
Technology facing tests that critique the product

Performance Testing
Load Testing
Security Testing
Scalability Testing
Reliability Testing

Figure 8: matric example of most common software testing

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From that Matrix, and based on our involvement in other European initiatives, GeoERA, ENVRI-FAIR, ESFRI, EOSC, etc. we came up with this EPOS testing matrix (Figure 9):

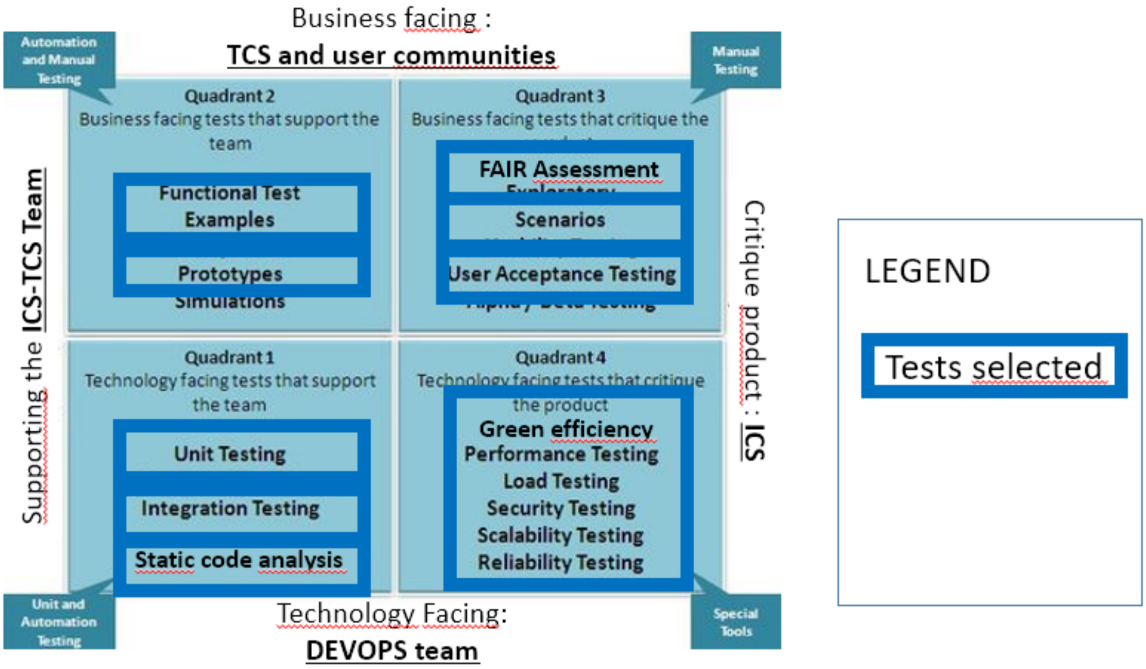

Figure 9: Tests to be performed during the EPOS POT

As EPOS is designed to enhance cross-science, FAIR principles are at the core of the architecture design. As such the EPOS ICS-C provides an API which leverages open standards DCAT-AP and CERIF as the core of the ICS-C catalogue. Nonetheless, the FAIR principles are evolving and technologies associated are following the same trend. As such, FAIRness needs to be assessed on a regular basis.

As the climate change crisis is a reality, sustainability means developing services that are ecologically responsible. We anticipate that the tests for green efficiency will be part of any software development testing framework in the coming years. It is also foreseen that it might also become a mandatory aspect of the EC project calls.

EPOS, while enhancing its testing framework to nowadays best practices of software testing, will, not only, improve the global robustness of software, but also, and more importantly, strengthen its delivery process to reach a higher user experience and satisfaction.

EPOS testing framework also paves the way for the next expected integration in the EC plan with embedded FAIRness and green efficiency, thus ensuring EPOS readiness for the next challenges of science and humanity.

All these tests need also solid knowledge; we intend to share best practices amongst the different teams by putting in place regular webinars and web conferences.

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4. Harmonization

4.1. Introduction

The objective of harmonisation in the context of EPOS-SP is to provide end-users with an improved set of services for geoscience supporting their work. The improvements concern (a) increased standardised metadata descriptions for services and other assets as recorded in the catalog; (b) standardisation of service APIs for use by developers; (c) standardisation of nomenclature for input parameters (that also occur in the APIs); (d) standardisation of output types to allow integration of outputs from different services or other assets into a homogeneous form.

While the harmonisation is dominantly for the purposes of EPOS-SP (improving EPOS sustainability by improved services) it has to be achieved within a broader context involving also the ENVRI cluster - so permitting harmonisation and interoperation across multiple environmental research infrastructures - and European Open Science Cloud (EOSC) - so permitting harmonisation and interoperation across the full range of publicly available services and assets.

A key aspect of harmonisation is to ensure that EPOS assets are FAIR (Findable, Accessible, Interoperable and Re-usable). The main method of achievement is rich metadata, assisted by appropriate API structures and an appropriate interface for users. A recent survey of EPOS within the ENVRIFAIR project indicated that EPOS was FAIR although there is always room for improvement.

The ongoing work on harmonisation is described below.

4.2. Metadata

EPOS uses CERIF (Common European Research Information Format, a EU recommendation to Member States) for the catalog. CERIF has a rich and expressive format based on base entities and linking entities with a semantic layer for ontologies all within a coherent structure. CERIF is a superset of commonly-used metadata schemes and is a data model designed to make it easy to interoperate (through convertor software) with other metadata standards thus providing maximum flexibility. CERIF is extensible, and has indeed been extended by EPOS to cover entities not in the original model.

However, with the richness comes complexity. To facilitate collection of metadata from the TCS - with their (currently 17) different metadata standards an intermediate metadata scheme is used. It is a much-extended version of DCAT namely EPOS-DCAT-AP. Thus, metadata in the standard appropriate to each TCS is converted to EPOS-DCAT-AP and then to CERIF.

Improving the metadata ingestion, conversion and editing facilities the inclusion of further services and other assets into the EPOS catalog thus providing end-users with more assets to use. Furthermore, the provision of a wider range of assets encourages new groups of users to utilise EPOS.

4.3. APIs

Standardisation of APIs ensures that additional services can be developed quickly and easily and that developers creating more complex services (e.g. for ICS-D) can do so more easily. The standardisation of the parameter names in APIs, corresponding with metadata attributes in CERIF, ensures that ICS-C is consistent. Changes in the metadata - for example additional entities or attributes to encompass new requirements from end-users - require changes to the APIs through a controlled process. It is planned that this could be semi-automated thus assisting in rapid deployment of an increased range of services to encourage greater use of EPOS by existing users and use of EPOS by new user groups.

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4.4. Input Parameters

Although defined in the metadata and the APIs, input parameter values may be input by an end-user to configure the execution of a particular service. Name standardisation - according with the metadata and API - reduces the chance of error and thus provides the end-user with a more robust and reliable service leading to greater satisfaction and increased usage with confidence.

4.5. Output Types

In many ways this is the most difficult part of harmonisation. Historically, individual TCS have chosen output types to suit their particular requirements without considering the requirements of other domains of geoscience (or wider). Thus, we have a plethora of output types for download (or transmission to another service on the same or different computer system) or display.

Efforts are being made to understand the requirements of the TCS communities and to work towards a reduced list of approved output types. This will reduce the number of convertors needed between output types communicated between services (e.g. data file formats) and also reduce the number of services needed for displaying output results of the execution of one or more services. At present most services manage their own output but once services are composed into a workflow, and the end-user wishes to display the results together (e.g. overlays of a map) the display services become more complex. In an ideal world, the service would be structured with separate microservices for input collection and validation, for the actual processing, and for output communication or display - then the interoperation of services would be improved. However, EPOS is not yet at that stage of development.

4.6. Vocabularies

Once the previous parameters have been well established, we will have precise API, INPUT format and OUPUT format. However, those are IT languages, protocols, file format, this is still not covering the scientist language. How can we be sure that the "Fe" element in the TNA, is equivalent to the "iron" found while drilling a borehole? Is it described the same way? Is it named the same "iron" vs "Fe"? Should it be written the same way? In summary, how can we have a common scientific language amongst different communities, vast debate?

EPOS IP project has started that work, but lacked the tool to support it.

As a matter of fact, during the EPOS IP project a Vocabulary Task Force was set up, but the results were mitigated. On one hand the communities have been convinced that harmonization has to be made, but on the other hand the huge amount of communities made it a difficult process. There were actually 2 acknowledgements: a) lack of guidance, b) no tools to support the guidance.

While ENVRI-FAIR is supporting the enhancement of the tools and procedures, EPOS SP should work on filling the tools with harmonized vocabularies.

4.7. Activities

The ICS-TCS team has now built a solid experience on integrating TCS. This experience result in certain level of robustness. To sustain that robustness in time, the ICS needs to be careful of not spreading to thin, lessening its maintainability. Therefore, we identified the following key activities:

- Reach the TCS with the list of supported entities: metadata, APIs, input, output, vocabularies
- Enhance this list when needed: for example, there is ongoing work on Equipment and Facilities
- Identify and accompany the Vocabulary Task Force in the effort of evangelisation of the TCS
- Work on harmonized vocabularies based on specific use cases, enabling end-to-end cross science

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5. Use of e-infrastructure

5.1. Context

In the EPOS context, the use of e-infrastructure has been a strategic element identified by the ICS-D. Some TCS communities are already making heavy usage of e-infrastructure. We intend to draw on these 2 aspects to build our plan, and have already captured feedback from the TCS-SATD community.

5.2. EPOS IP ICS-D

ICS-D are the tools that make use of the ICS-C search engine GUI and API to use data of the TCS on e-Infrastructure such as EOSC. The search engine is based on CERIF modelled database that contains the metadata describing the DDSS of the TCS. They are shown in the following schema:

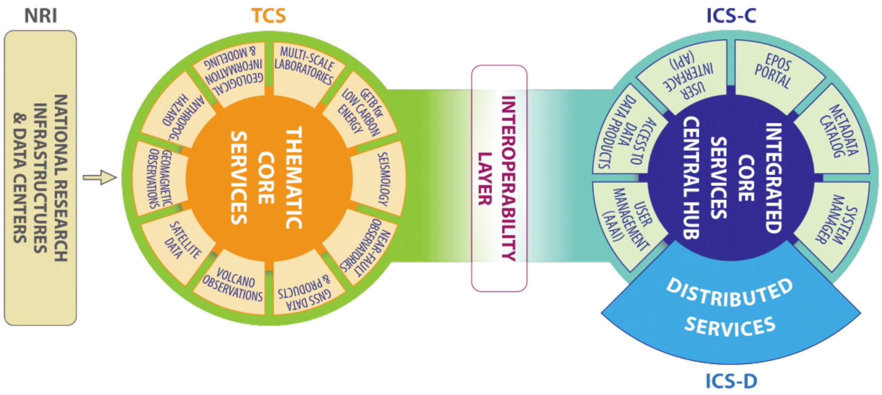

Figure 10: EPOS functional architecture

As of now, there is one ICS-D prototype (Figure 11) based on best of breed technologies: Jupyter Notebook, Docker, Kubernetes, etc.

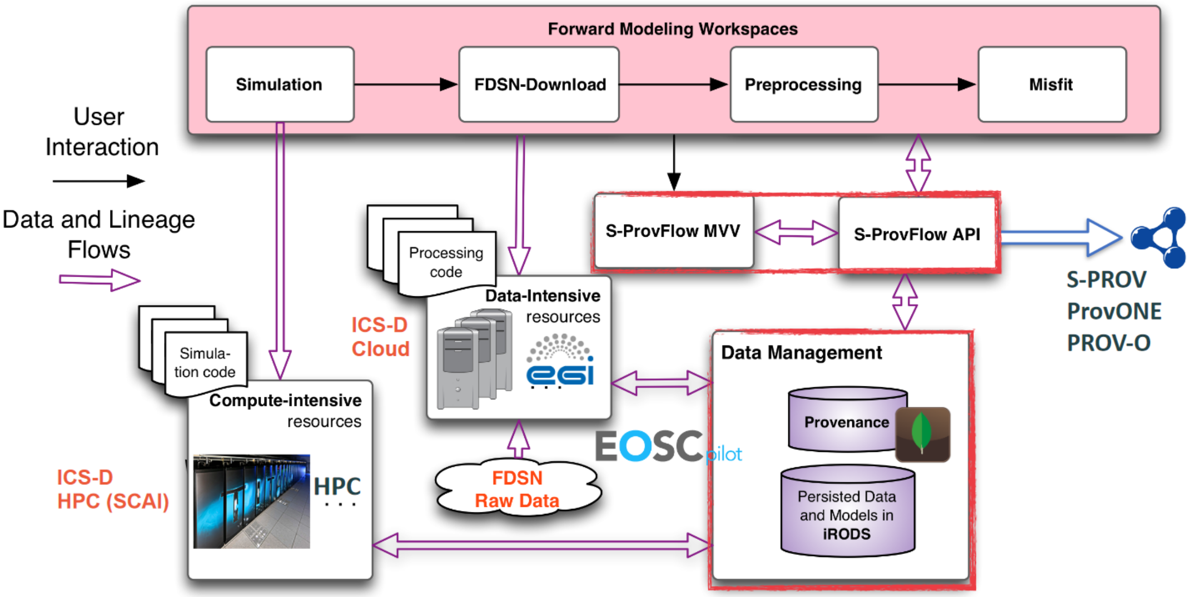

Figure 11: Prototype ICS-D Use Case

This prototype embeds the workflow mechanism, the dedicated software for research (Jupyter Notebook) and also authentication and data provenance.

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5.3. ICS-D conceptual architecture

Let us remind ourselves of the goal of EPOS: providing the capability to researchers to have access to Earth Science DDSS hence enabling cross data science to foster innovation.

This simple goal is in reality complex, because multi-dimensional: a) governance, b) finance, c) cross science, d) computer science.

Out of this 4 dimensions, EPOS SP WP4 focuses on c) cross sciences and d) computer science.

For the sake of clarification, we propose the following simplified use case from searching data to use of computing facility:

1. search data (manual)
2. visualise data (manual)
3. refine search/visualise data (manual)
4. provide credentials (manual)
5. Prerequisites for computation
   5.1. select dataset (manual)
   5.2. select the software (manual)
   5.3. select the e-infrastructure matching the requirement of the dataset and tooling (manual)
6. start e-infrastructure environment
   6.1. provide user credentials
   6.2. fetching the data and the tools (automatic)
   6.3. optional : scientist refine computation/code (manual)
7. close the environment (manual)
8. optional: charge the user for the usage of the environment(automatic)

From this simplified scenario, arise several questions:

- Is the ICS-C the central point for accounting: so that TCS communities don't have to implement it?
  - Should the ICS-C be a data broker?
  - Or should the ICS-C embed an agent in the computation to watch over the use of data?
- Which component is in charge of the workflow: ICS-C, ICS-D, the tool/software used?
- Should the workflow be divided into layer : operations layer, computation layer

The answers to these questions are that the ICS-C lives up to its name, and as such is the central point of orchestration. This is shown below:

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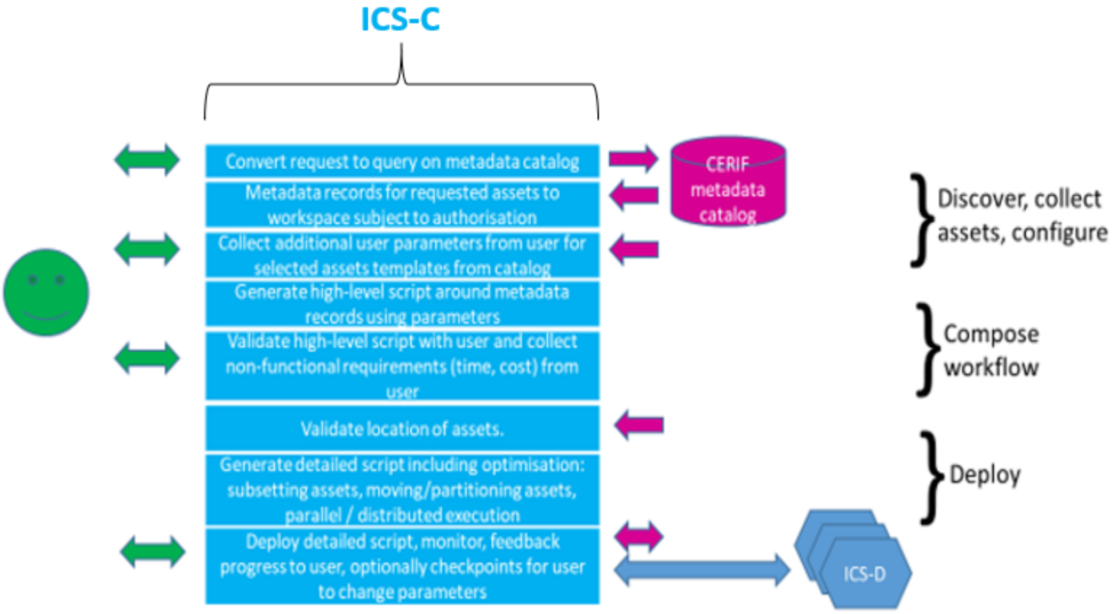


ICS-C

Convert request to query on metadata catalog

Metadata records for requested assets to workspace subject to authorisation

Collect additional user parameters from user for selected assets templates from catalog

Generate high-level script around metadata records using parameters

Validate high-level script with user and collect non-functional requirements (time, cost) from user

Validate location of assets.

Generate detailed script including optimisation: subsetting assets, moving/partitioning assets, parallel / distributed execution

Deploy detailed script, monitor, feedback progress to user, optionally checkpoints for user to change parameters

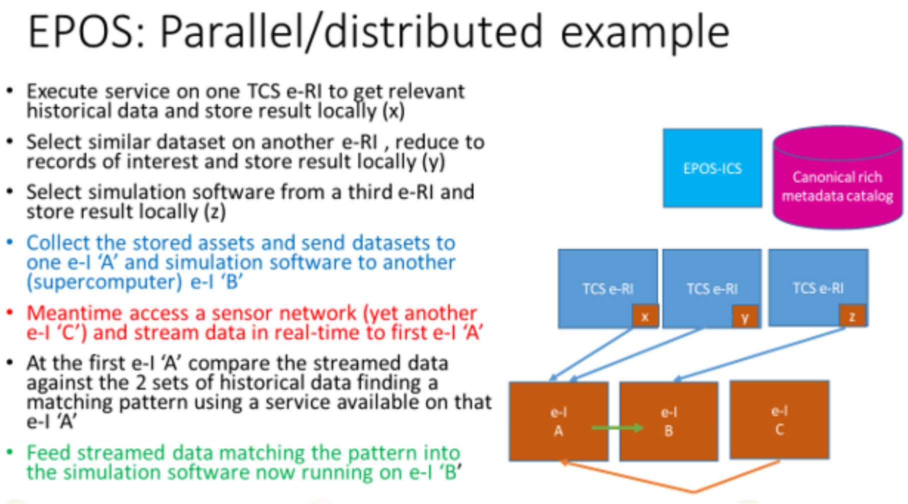
Figure 12: ICS-C activities enable the ICS-D orchestration

The architecture has been envisioned to be generic enough to adapt to the ever-changing technologies landscape (ie: Docker engine was the trend 3 years ago and is now being replaced by other engines: podman, cri-o, rkt, etc.).

5.4. Activities

We are aiming at interoperability testing between EPOS ICS and the e-infrastructure (Figure 13), by:

- Defining/re using a scenario that needs computation with the help of WP4 communities based on the following approach
- Reusing EPOS development process through pitches and ICS-TCS interaction meetings
    - Reuse the actual ICS-D prototype and identify how it can should be extended
    - Refine the conceptual architecture
- Defining the prerequisites for the e-infrastructure.



EPOS: Parallel/distributed example

- Execute service on one TCS e-RI to get relevant historical data and store result locally (x)
- Select similar dataset on another e-RI , reduce to records of interest and store result locally (y)
- Select simulation software from a third e-RI and store result locally (z)
- Collect the stored assets and send datasets to one e-I 'A' and simulation software to another (supercomputer) e-I 'B'
- Meantime access a sensor network (yet another e-I 'C') and stream data in real-time to first e-I 'A'
- At the first e-I 'A' compare the streamed data against the 2 sets of historical data finding a matching pattern using a service available on that e-I 'A'
- Feed streamed data matching the pattern into the simulation software now running on e-I 'B'

Figure 13: Generic use case scenario for the use of e-Infrastructure

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ANNEX 1 - Pilot Operational Testing - testing design

The following text is part of a bigger plan that is constantly evolving, the Pilot Operational Testing. This document the last version can be found, as of the writing of this deliverable in the EPOS intranet: https://repository.epos-eu.org/index.php/s/RAbH3GpQWiXjc3t

The design of the testing takes into account two main testing modalities:

- Technical testing, dedicated to testing machines supporting the services along the full scope of their features (performances, correctness of the output etc.)
- User testing, dedicated to test the usability by humans of the ICS and TCS systems, and the availability of datasets

Technical testing is carried out on the full stack of technologies used to deliver data within the ICS-C portal, that is to say:

- ICS-C (Web APIs + services by hosting countries)
- TCS services
- ICS-TCS Integration and Interoperability

User testing is carried out where the end users can have access to datasets and functionalities delivered, that is to say at the level of ICS-C portal and TCS portals.

Testing will be carried out according to the details described in the following subsections.

Technical testing of ICS-C services

The following ICS C services to be tested have been identified:

- DEVOPS tools (GitLab etc)
- ICS-C URL endpoints (GUI and web-api)
- Procedures to be carried out in the operation of the ICS C (backup, incident management etc)
- cross cluster replication across BRGM and BGS
- development code quality and efficiency
- GEUS monitoring tools.

The following test categories to be run against these services have been identified:

- Availability : e.g. that a web serviceURL responds with an answering code 200
- Accessibility : that the service is accessible either openly or via authorization /authentication
- Security of web applications
- Performance: ensuring performance meets agreed KPIs
- FAIRness
- Green computing credentials
- Code Quality check
- Validity

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Not all test categories are relevant to all services. The matrix below demonstrates which tests need to be carried out against each service.

	availability	accessibility	code quality check	performance	green efficiency	FAIRness	web application security	validity
DevOps tools (GitLab)	X	X		X				
ICS-C endpoint webAPI	X	X		X	X	X	X	
ICS-C endpoint metadata ingestion	X	X		X	X	X	X	
Hosting infrastructure procedure testing	X							X
cross site replication DNS	X							
cross site replication workspace	X							
ICS-C modules code quality								X
Monitoring tools	X	X						

Each test is described below.

Service: DevOps Tools

Test 1: availability

Purpose: Verify that GitLab, Teams, monitoring and logging (Graylog)are available
Scope: devops tools
Acceptance Criteria: Successful ping to URL, HTTP status code 2xx, OK status at https://data.geus.dk/eposmonitoring/
Method: Ping the service URL. Request default service query.
Who should carry out the test : ICS hosting
How results should be reported: ICS services are being monitored by default queries in regular intervals (every hour). Status is published online at https://data.geus.dk/eposmonitoring/

Test 2: accessibility

Purpose: Verify that user can log in and that GitLab, Teams, monitoring and logging (Graylog) are accessible.
Scope: devops tools
Acceptance Criteria: Users can access service in line with their credentials
Method:

- Select a panel of user per tool and validate access.
- For Epos-ci.brgm.fr., monitoring.brgm.fr, graylog.brgm.fr - create X dummy user
- User access the URL
- User log in the system
- User access the EPOS group/view data in the system/search for logs
- User log out of the system,

Who should carry out the test : ICS hosting
How results should be reported: survey per tool where user have access.

Test 3: Performance

Purpose: DevOps tools is providing response and requested payload in adequate time interval.
Acceptance Criteria: meet the KPI

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- Max number of users**:** Target 20 simultaneous users on all environments (development, staging and production) at all sites (BRGM and BGS)
- Response time to requests for user creation on Gitlab by ECO**:** 2 working days
- Response time for a Dev/Op manager to support developers**:** 2 working days
- Avg Session length: 10 min

Scope: devops tool
Method:

- Define the scenarios
- Launch a performance test via opensource tool (apache jmeter of gattling)

Who should carry out the test : ICS hosting

- How results should be reported : report status per scenarios
- Number of Concurrent user supported
- Global Response time
- Notes on the potential bottleneck identified

Service: ICS-C endpoint webAPI

Test 4: availability
Purpose: Verify that the ICS component availability
Scope: ICS-C endpoint
Acceptance Criteria:

- Successful ping to URL
- HTTP status code 2xx
- OK status at https://data.geus.dk/eposmonitoring/

Method: Ping the ICS service URL. Request default service query (ingested in CERIF).
Who should carry out the test : ICS hosting
How results should be reported: ICS services are being monitored by default queries in regular intervals (every hour). Status is published online at https://data.geus.dk/eposmonitoring/

Test 5: accessibility
Purpose: Verify that user can log in with credentials
Scope: ICS-C endpoint
Acceptance Criteria: Users can access service log in with their credentials
Method: Select a panel of user per tool and validate access.
Who should carry out the test: ICS-TCS interaction Team
How results should be reported: Survey per tool where user have access

Test 6: Performance
Purpose: ICS service is providing response and requested payload in adequate time interval.
Acceptance Criteria: meet the KPI defined in the technical annex
Scope: ICS-C URL endpoints
Method:

- Define the 2 scenarios : search for data and get the results
- Launch a performance test via open source tools

Who should carry out the test : ICS hosting How results should be reported : report status per scenarios

- Number of Concurrent user supported
- Global Response time
- Notes on the potential bottleneck identified

Test 7: Infrastructure resource use
Purpose: Measure CPU used for each component/container
Scope: ICS-C endpoint
Acceptance Criteria: All components have required resources assigned
Method: Define a scenario that calls on each component in the web API architecture and measure the resources utilised under different load scenarios

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Who should carry out the test: ICS hosting
How results should be reported: written report in line with agreed template.

Test 8: Green efficiency

Purpose: There is no doubt that we have all the responsibility to make effort in regards to the climate change. There is also a high probability that the EC will make some recommendation on that topic. We would better anticipate that.
Scope: ICS-C endpoint
Method: launch test from http://ecometer.org,
Who should carry out the test: devops
How results should be reported: written report in line with agreed template.

Test 9: FAIRness assessment

Purpose: FAIRness assessment provides a roadmap for improving EPOS FAIRness
Acceptance Criteria: 100 %
Scope: ICS-C endpoints
Method: FAIRness assessment from ENVRI-FAIR
Who should carry out the test : ontologist from ICS and TCS communities
How results should be reported: written report in line with agreed template.

Test 10: Web application security

Purpose: Limit the service security breach
Scope: Only apply to ICS-C endpoint (GUI and Webapi)
Acceptance criteria: on the following scale - critical, major, medium, low

- No critical nor major issue
- Major issues can be accepted if well argumented

Method: use open source tool
Who should carry out the test: ICS hosting
How results should be reported: written report in line with agreed template.

Service: ICS-C endpoint metadata ingestion

Test 11: availability

Purpose: Verify that the ICS component availability
Scope: ICS-C endpoint
Acceptance Criteria:

- Successful ping to URL
- HTTP status code 2xx
- OK status at https://data.geus.dk/eposmonitoring/

Method: Ping the ICS service URL. Request default service query (ingested in CERIF).
Who should carry out the test : ICS hosting
How results should be reported: ICS services are being monitored by default queries in regular intervals (every hour). Status is published online at https://data.geus.dk/eposmonitoring/

Test 12: accessibility

Purpose: Verify that user can access in line with credentials
Scope: ICS-C endpoint
Acceptance Criteria: Users can access service in line with their credentials
Method: Select a panel of user per tool and validate access.
Who should carry out the test: DEV
How results should be reported: survey per tool where user have access.

Test 13: Performance

Purpose: ICS service is providing response and requested payload in adequate time interval.
Acceptance Criteria: meet the KPI defined in the technical annex
Scope: ICS-C url endpoints
Method:

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- Define the scenario : ingestion of TCS .ttl file
- Launch a performance test via open source tools

Who should carry out the test: ICS hosting
How results should be reported: report status per scenarios

- Number of Concurrent user supported
- Global Response time
- Notes on the potential bottleneck identified

Test 14: Infrastructure resource use
Purpose: Measure CPU used for each component/container
Scope: ICS-C endpoint
Acceptance Criteria: All components have required resources assigned
Method: Define a scenario that calls on each component in the web API architecture and measure the resources utilised under different load scenarios
Who should carry out the test: ICS hosting
How results should be reported: written report in line with agreed template.
Test 15: Green efficiency
No suitable test available yet (ICS API endpoint)
Test 16: FAIRness
Purpose: FAIRness assessment provides a roadmap for improving EPOS FAIRness
Acceptance Criteria: 100 %
Scope: ICS-C endpoints
Method: FAIRness assessment from ENVRI-FAIR
Who should carry out the test : ontologist from ICS and TCS communities
How results should be reported: written report in line with agreed template.
Test 17: Web application security
Purpose: Limit the surface security breach
Scope: ICS-C endpoint
Acceptance criteria: on the following scale : critical, major, medium, low

- No critical nor major issue
- Major issues can be accepted if well argumented

Method: use open source tools
Who should carry out the test: ICS Hosting
How results should be reported : written report in line with agreed template.

Service: Hosting Infrastructure Procedures

Test 18: availability
Purpose: Verify that user can find all procedures they need to refer to
Scope: Operational procedures
Acceptance Criteria: 100% procedures are accessible to those who need them
Method: Users locate procedures at their advertised locations
Who should carry out the test: depends on the procedure
How results should be reported: survey per tool where user have access.
Test 19: validity
Purpose: Verify the written procedure are documented and implemented
Scope: Operational procedures
Acceptance Criteria: All procedures work as documented and agreed
Method: Read the documentation and apply the procedure
Who should carry out the test: depends on the procedure
How results should be reported: issue if documentation missing or procedure not implemented

Service: cross site replication DNS

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Test 20: availability
Purpose: Simulate the loss of a datacentre.
Scope: DNS
Acceptance Criteria : 100%
Method: put a Kubernetes cluster down, see if the user has still access to the service and data. Loop on the query the DNS entry : www.ics-c.epos-eu.org on BRGM DNS server. On the F5 device disable the Kubernetes endpoint. After less than 1 minutes the DNS answer should be BGS Public ip for www.ics-c.epos-eu.org. Do the same for BGS DNS server
Who should carry out the test: ICS Hosting
How results should be reported: could be a video of the test showing the stopping of the service and user still accessing the service on the other datacenter.

Service: cross site replication workspace

Test 21: availability
Purpose: Simulate the loss of a datacentre.
Scope: workspace
Acceptance Criteria: 100%
Method: put a Kubernetes cluster down, see if the user has still access to the service and data. While a user is using the workspace, disable the kubernetes endpoint. The user should be able to recover his/her workspace (if saved)
Who should carry out the test: OPS
How results should be reported: could be a video of the test showing the stopping of the service and user still accessing the service on the other datacenter.

Service: ICS-C modules

Test 22: code quality
Purpose: Improve the code quality base on static code analysis
Scope: ICS modules
Acceptance Criteria: 75 % of critical issues and 50 % of the major issues solved
Method: using code quality check open source tools
Who should carry out the test: devops
How results should be reported: report status of the number of issues

Service: Monitoring tools

Test 23: Access log testing
Purpose: Ensure access logging is functioning correctly
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 1: User access the ICS-C portal (GUI) and performs some operations.
Test: Is a record of the actions found in the Matomo access log system?
Who should carry out the test: devops
How results should be reported: report status of the number of issues
Test 24: Resource log testing
Purpose: Ensure resource logging is functioning correctly
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 1: Load test on the system is performed.
Test: Is a record of the increased usage found in the Prometheus resource log system?
Who should carry out the test: devops
How results should be reported: report status of the number of issues
Test 25: Site reliability testing ICS-C GUI container

Purpose: Ensure site reliability issues are picked up.
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 1: ICS-C GUI container is terminated
Does the exernal/remote monitoring detect the failure? Does the internal/local monitoring detect the failure? Is a meaningful error message reported to the end user?
Who should carry out the test: devops
How results should be reported: report status of the number of issues

Test 26: Site reliability testing ICS-C WebAPI container
Purpose: Ensure site reliability issues are picked up.
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 2: ICS-C webAPI container is terminated
Test: Does the exernal/remote monitoring detect the failure? Does the internal/local monitoring detect the failure? Is a meaningful error message reported to the end user?
Who should carry out the test: devops
How results should be reported: report status of the number of issues

Test 27: Site reliability testing ICS-C Rabbit MQ container
Purpose: Ensure site reliability issues are picked up.
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 2: ICS-C Rabbit MQ container is terminated
Test: Does the exernal/remote monitoring detect the failure? Does the internal/local monitoring detect the failure? Is a meaningful error message reported to the end user?
Who should carry out the test: devops
How results should be reported: report status of the number of issues

Test 28: Site reliability testing ICS-C TCS container
Purpose: Ensure site reliability issues are picked up.
Scope: Monitoring tools
Acceptance Criteria: All actions successfully recorded.
Method: Scenario 2: ICS-C TCS container is terminated
Test: Does the exernal/remote monitoring detect the failure? Does the internal/local monitoring detect the failure? Is a meaningful error message reported to the end user?
Who should carry out the test: devops
How results should be reported: report status of the number of issues

Technical testing of TCS services - before integration into ICS

All TCS services which are about to be implemented into ICS should be tested beforehand. This section describes which tests should be performed before the integration. These tests should assure that the TCS services are operational before metadata ingestion and trying to access them from ICS. Testing of TCS services not implemented into ICS is not described in this document.

Prerequisites for this test are metadata files ready for ingestion.

Test 1: Service exists and is reachable – URL check
Purpose: Test that TCS service URL is reachable.
Acceptance Criteria: Successful ping to URL, HTTP status code 2xx
Method: 1. Ping the TCS service URL. 2. Request example service query with mandatory/default parameters.
Who should carry out the test: ICS-TCS interaction team
How results should be reported: Feedback is given directly to metadata providers, via TCS specific GitLab issue tracker.

Test 2: Availability and performance (not quality of data)
Purpose: Test availability and performance of the service in longer period (e.g. 1 month)

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Acceptance Criteria: 99% availability as target
Method: Service query with default parameters is inserted into monitoring system at hosting institution and will be monitored for specific period. Availability (percentage of successful queries) and performance (response time) will be monitored and evaluated.
Who should carry out the test: ICS hosting
How results should be reported: Status is published online at https://data.geus.dk/eposmonitoring/

Test 3: Online documentation
Purpose: Each TCS service should have dedicated page/document (available online) with description of the service including list of available/mandatory parameters, list of HTTP responses, etc. May come from existing metadata or require additional documentation.
Acceptance Criteria: Documentation is directly reachable online with sufficient information provided; target of standard template filled.
Method: Direct access and content check.
Who should carry out the test: ICS-TCS interaction team
How results should be reported: Feedback to TCS via GitLab issue tracker

Technical testing of the ICS-TCS integration (TCS accessed via ICS-C) (Jan)

All TCS services which are implemented into ICS should be tested by the following tests.
Test 1: Service exists and is reachable – URL check
Purpose: Test that TCS service URL ingested in ICS CERIF catalogue exists and is reachable.
Acceptance Criteria: Successful ping to URL, HTTP status code 2xx, OK status at https://data.geus.dk/eposmonitoring/
Method: Ping the TCS service URL. Request default service query (ingested in CERIF).
Who should carry out the test: ICS hosting
How results should be reported: TCS services are being monitored by default queries in regular intervals (every hour). Status is published online at https://data.geus.dk/eposmonitoring/

Test 2: Metadata sufficient - FAIR
Purpose: Check that all mandatory metadata in EPOS-DCAT-AP are provided.
Acceptance Criteria: Metadata are filled in in correct format and with valid content.
Method: Check metadata format during metadata ingestion into CERIF (validating against schema). Check that metadata content in TTL file is valid and correct. TCS internal procedures needs to be put in place.
Who should carry out the test:
ICS developers – metadata ingestion (schema validation, mandatory attributes).
TCS consortium? – metadata content (contact persons, institutions, etc.)
How results should be reported:
Metadata in wrong format (not validated against schema) are not ingested into ICS catalogue. Issues are resolved before ingestion.
Incorrect metadata content should be reported via ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/

Test 3: Security
Purpose: Communication between ICS and TCS servers needs to be secure (e.g. not allowing middle-man attack).
Acceptance Criteria: TLS (HTTPS)
Method: Check that data encryption method is used by TCS services.
Who should carry out the test: ICS-TCS interaction team (check URLs in metadata)
How results should be reported: ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/

Test 4: Privacy
Purpose: Sensitive/private data cannot be exposed at ICS server or via ICS API publicly.
Acceptance Criteria: Sensitive data (GDPR rules?) are not exposed at ICS server or via ICS API.
Method: Check that no personal information is exposed via ICS API and GUI.
Who should carry out the test: ICS developers of EPOS API

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How results should be reported: ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/

Test 5: Performance

Purpose: TCS service is providing response and requested payload in adequate time interval.

Acceptance Criteria: TCS service has average response time (request to first receipt) below 500ms and providing connectivity (download speed) 100 Kbps.

Method: Check parameters from monitoring system https://data.geus.dk/eposmonitoring/

Who should carry out the test: ICS hosting

How results should be reported: problems in ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/ and statistics in annual reports

Test 6: Reliability and robustness

Purpose: Any query should provide adequate response with HTTP status code. Valid query should always provide data. Data content is guaranteed by TCS. TCS webservice is accessible at any time.

Acceptance Criteria: 99% availability per year as target

Method: Regular queries to TCS, i.e. monitoring.

Who should carry out the test: ICS hosting

How results should be reported: problems in ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/ and statistics in annual reports

Test 7: Sufficient online documentation

Purpose: Make sure the description of the TCS webservice is clear and contains all important information (what the service is about). Detailed documentation of the webservice is available at dedicated TCS page (link accessible via ICS Data Portal, field Documentation).

Acceptance Criteria: Description is present and clear and link with detailed documentation provides full description of the webservice (mandatory parameters, available parameters and their meaning)

Method: Manual check of Description and Documentation fields in ICS Data Portal.

Who should carry out the test: ICS-TCS Interaction team (+TCS interview?)

How results should be reported: Dedicated report with list of all webservices.

User testing of ICS-C portal

The ICS Data Portal needs to be tested by various target groups:

- Domain scientists
- Students

Each group will be following predefined interdisciplinary Use Cases (see User testing of TCS services accessed via ICS-C (Jan)) which are covering data from all implemented scientific domains. In addition, users will be asked to combine predefined use cases with data from their own domain (if not covered already).

Purpose of the test: Test usability of the ICS Data Portal by targeted group(s) of users

Acceptance Criteria: (marks from 1 to 10) (LESS THAN 5 FAILS, 5 AND 6 SUFFICIENT, 7 OR MORE GOOD OR BETTER). Areas to be evaluated:

- GUI LOOK and FEEL
- SEARCH
- CONFIGURATION
- FETCHING OF DATA
- PRE-VISUALISATION (map, tabular data, time-series)
- AUTHENTICATION
- WORK-SPACES

Method: NAVIGATING THE GUI, FORMS, WITH SEVERAL QUESTIONS WITH A MARK (1-10)

Who should carry out the test: User Feedback Group (defined above)

How results should be reported: Report to IT Board thence Executive Committee and GA.

User testing of TCS portals

All TCS portals which are accessible from ICS Portal should be tested within each TCS individually by group of domain experts.

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Test 1: Accessibility

Purpose: Check whether the TCS portal is accessible to users.

Acceptance Criteria: Yes/No

Method: Manual check

Who should carry out the test: end users

How results should be reported: internally to TCS representatives, ICS issue tracker https://epos-ci.brgm.fr/epos-public/issuetracker/

Test 2: Usability

Purpose: Test usefulness of the TCS portal for users.

Acceptance Criteria: Mark 1-10

Method: Manual check, forms

Who should carry out the test: end users

How results should be reported: Report

Test 3: Data and tools integration

Purpose: Test availability of data and usefulness of the tools in TCS portal by users.

Acceptance Criteria: Mark 1-10

Method: Manual check, forms

Who should carry out the test: end users

How results should be reported: Report

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ANNEX 2 TCS-SATD (CNR) feedback on usage of e-infrastructure

EOSC-hub project

Abstract

The EOSC-hub project creates the integration and management system of the future European Open Science Cloud that delivers a catalogue of services, software and data from the EGI Federation, EUDAT CDI, INDIGO-DataCloud and major research e-infrastructures. This integration and management system (the Hub) builds on mature processes, policies and tools from the leading European federated e-Infrastructures to cover the whole life-cycle of services, from planning to delivery. The Hub aggregates services from local, regional and national e-Infrastructures in Europe, Africa, Asia, Canada and South America.

The Hub acts as a single contact point for researchers and innovators to discover, access, use and reuse a broad spectrum of resources for advanced data-driven research. Through the virtual access mechanism, more scientific communities and users have access to services supporting their scientific discovery and collaboration across disciplinary and geographical boundaries.

The project also improves skills and knowledge among researchers and service operators by delivering specialised trainings and by establishing competence centres to co-create solutions with the users. In the area of engagement with the private sector, the project creates a Joint Digital Innovation Hub that stimulates an ecosystem of industry/SMEs, service providers and researchers to support business pilots, market take-up and commercial boost strategies. EOSC-hub builds on existing technology already at TRL 8 and addresses the need for interoperability by promoting the adoption of open standards and protocols. By mobilizing e-Infrastructures comprising more than 300 data centres worldwide and 18 pan-European infrastructures, this project is a ground-breaking milestone for the implementation of the European Open Science Cloud.

EPOS contribution (CNR)

EPOS is involved in the development of thematic services by contributing with activities in the Earth Observation (EO) pillar that encompass the EPOSAR service (one of services of the EPOS TCS Satellite Data). The overarching goal of CNR is the integration of the EPOSAR service with the EOSC-hub infrastructure. In particular, the EPOSAR service may benefit from data access and computing services made available by cloud computing providers, which is a key requirement for users dealing directly with EO data. Moreover, the EO pillar of the EOSC-hub project involves also the Geohazards Exploitation Platform (GEP), the cloud-based platform used by the TCS SATD as access point and interoperability layer. This latter activity is not directly related to EPOS, but it has a direct impact on the enhancement of TCS SATD.

OpenAIRE-Advance project

Abstract

OpenAIRE-Advance continues the mission of OpenAIRE to support the Open Access/Open Data mandates in Europe. By sustaining the current successful infrastructure, comprised of a human network and robust technical services, it consolidates its achievements while working to shift the momentum among its communities to Open Science, aiming to be a trusted e-Infrastructure within the realms of the European Open Science Cloud. In this next phase, OpenAIRE-Advance strives to empower its National Open Access Desks (NOADs) so they become a pivotal part within their own national data infrastructures, positioning Open Access and Open Science onto national agendas. The capacity building activities bring together experts on topical task groups in thematic areas (open policies, RDM, legal issues, TDM), promoting a train the trainer approach, strengthening and expanding the pan-European Helpdesk with support and training toolkits, training resources and workshops. It examines key elements of scholarly communication, i.e., co-operative OA publishing and next generation repositories, to develop essential building blocks of the scholarly commons.

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On the technical level OpenAIRE-Advance focuses on the operation and maintenance of the OpenAIRE technical TRL8/9 services, and radically improves the OpenAIRE services on offer by: a) optimizing their performance and scalability, b) refining their functionality based on end-user feedback, c) repackaging them into products, taking a professional marketing approach with well- defined KPIs, d) consolidating the range of services/products into a common e-Infra catalogue to enable a wider uptake. OpenAIRE-Advance steps up its outreach activities with concrete pilots with three major RIs, citizen science initiatives, and innovators via a rigorous Open Innovation programme. Finally, via its partnership with COAR, OpenAIRE-Advance consolidates OpenAIRE's global role extending its collaborations with Latin America, US, Japan, Canada, and Africa.

EPOS Contribution (CNR)

EPOS has a small pilot within the project. The goal is to enhance the GEP functionalities to allow users to publish the results of their EPOSAR experiments on platforms committed to sharing, curating and publishing data and products, such as Zenodo. This activity needs to design and create the "experiment product" (Research Object) in Zenodo, that includes all the information to reproduce the experiment and exploits its results (e.g., input and output data, metadata, main publications, licenses, etc).

The CNR activity is preparatory for others processing tools of the TCS SATD, and in the future could be extended to other TCSs.

TCS-SATD considerations

Copernicus Programme is one of the largest open data initiatives in the world. However, until now a small integration with EOSC has been reached. The two worlds seem to walk on parallel tracks and to have independent development plans (Copernicus is outside of H2020 and HO and has its own financial channel). The main links between them have been established by stakeholders (mainly scientific) that contribute to both programmes.

DG-GROW and ESA supported the creation of a network of (commercial) cloud providers to facilitate and standardise access to Copernicus data. To this aim, the European Commission has funded the deployment of five cloud-based platforms providing centralised access to Copernicus data and information, as well as to processing tools. These platforms are known as the DIAS, or Data and Information Access Services. The five DIAS online platforms allow users to discover, manipulate, process and download Copernicus data and information. All DIAS platforms provide access to Copernicus Sentinel data, as well as to the information products from Copernicus' six operational services, together with cloud-based tools (open source and/or on a pay-per-use basis). Each of the five competitive platforms also provides access to additional commercial satellite or non-space data sets as well as premium offers in terms of support or priority. Thanks to a single access point for the entire Copernicus data and information, DIAS allows the users to develop and host their own applications in the cloud, while removing the need to download bulky files from several access points and process them locally.

Until now, as far as I know, no formal link between DIAS and EOSC has been established. One of the cloud providers of DIAS is involved in EOSC-hub project to integrate its infrastructure in EOSC, but this activity is not fostered by EC and it has been a bottom-up initiative.

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