Spanish Network for E-Science

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Spanish
Network for
e-Science

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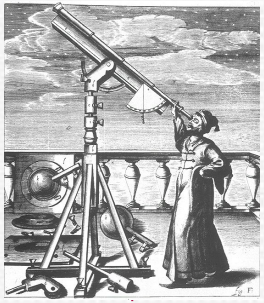
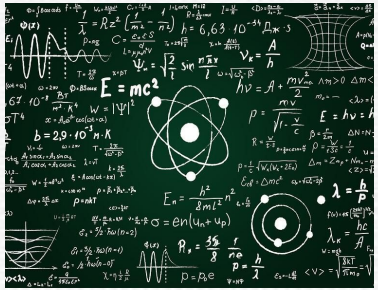
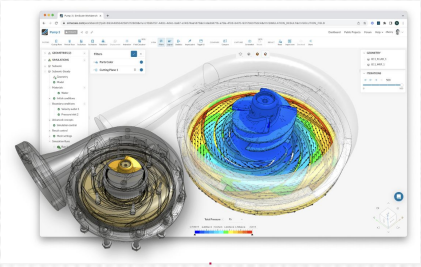






Empirical Science

Experience and observation of facts; Description of natural phenomena.

Theoretical Science

Use of Models, formulas, and generalizations

Computational Science

Simulation of complex phenomena.

e-Science

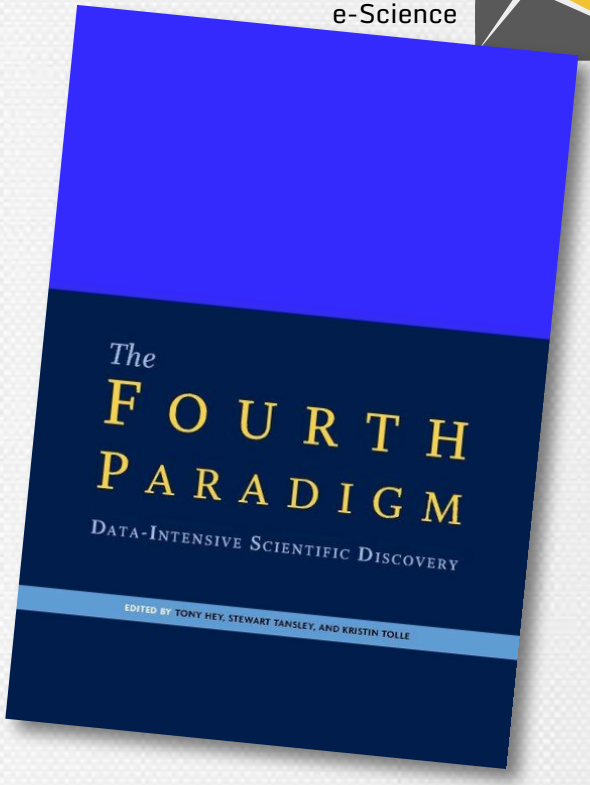
Unification of theory, experimentation, and simulation.

Massive data capture using instruments or generated through simulation and computer processing.

Contents

- Many scientific fields produce large amounts of data that are common and relevant to other disciplines.
- E-Science (*) refers to scientific activities conducted using distributed resources accessible via the internet. It encompasses computationally-intensive and data-intensive research methods, often carried out collaboratively using distributed infrastructures.
- The goal is to accelerate scientific production and improve its quality.

Spanish Network for e-Science



(*) White Paper on e-Science FECYT 2007

https://www.microsoft.com/en-us/research/publication/fourth-paradigm-data-intensive-scientific-discovery/

E-Science - Three pillars

Spanish Network for e-Science

e-Science Skills and recognition

Improved curricula in Data Science, Open Science rewarding and assessment, Training

FAIR Data

Technical specs. for FAIR assessment, interoperability, federation of SW repositories; PID infrastructure

e-Science Infrastructure

Broad-band network connecting data and computing facilities: Federation services (AAI, monitoring, helpdesk, etc.)

Spanish Network for e-Science

Structure of the Network

Spanish Network for e-Science

- Approved in the Ministerial order CIN/658/2020, of 13/7/2020 (link)
  - Colegiated body[1], formally under the Secretary General of Research (SGI) of the Ministry of Science, Innovation and Universities, with the objective of supporting the SGI on the impulse and coordination in the development of e-Science in Spain.
- Objectives
  - Promote and coordinate the development of e-Science in Spain.
  - Promote the cooperation of the Spanish ecosystem of R+D+i among them and other international programmes and initiatives.
- Normative context
  - [1]Articles 15 to 22 of the law 40/2015, October the 1st, Legal regime of the collegiated bodies in the public sector.
  - Law 14/2011, of June the 1st on Science Technology and Innovation and further modification in the law 17/2022, of September the 5th, with special reference to Open Science and references to the digitalization and innovation, related to e-Science.

Pillars of the Spanish e-Science Network

Spanish Network for e-Science

Supercomputing

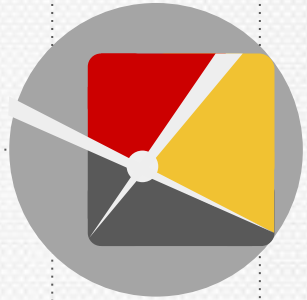
Spanish Supercomputing Network

Research Network

Spanish NREN

Distributed Computing

IBERGRID Federated HTC and Cloud computing facilities



RI User Communities

Researchers from Spanish Nodes of major ESFRI and ERIC infrastructures

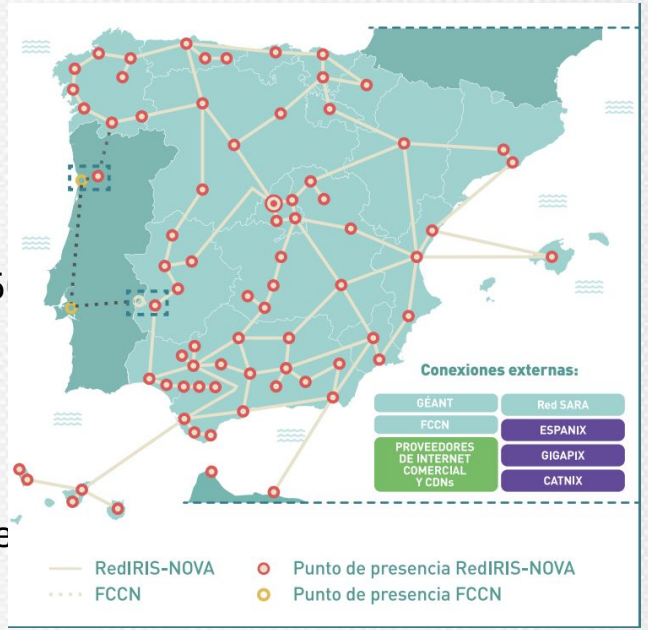
Open Science Policy

Spanish National Strategy on Open Science and European Open Science Cloud

Spanish Research Network (RedIRIS)

Spanish Network for e-Science

- Structure and Governance:
  - Academic and research network funded by the Ministry of Science and Innovation.
  - Managed by Red.es (Ministry of Economic Affairs and Digital Transformation).
  - It is part of the map of Unique Scientific and Technical Facilities (ICTS).
- Resources and Scope:
  - 70 points of presence with 100 Gbps links.
  - RedIRIS-NOVA backbone with 14,000 km of dark fiber.
- Access Model:
  - Free membership of more than 5 (universities & public research centers).
- International Connection:
  - Collaboration with networks such as GÉANT.
  - Advanced services for e-science identity (EDUGAIN), security, etc.



Spanish Network of Supercomputing
Red Española de Supercomputación (RES)

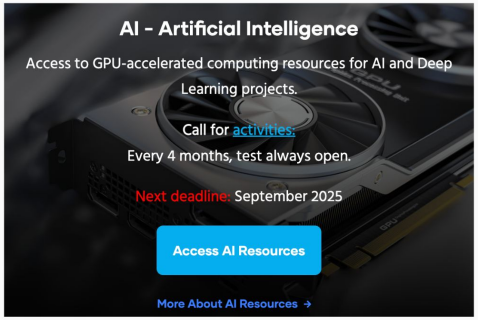
Spanish Network for e-Science

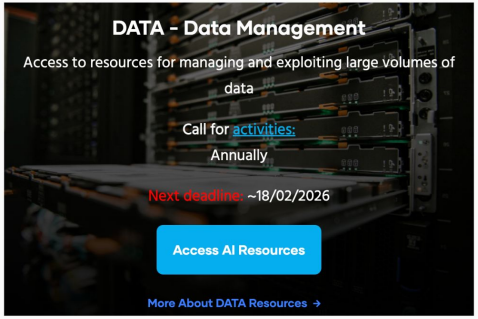
- Structure and Governance:
  - Federation of 14 independent nodes with HPC resources.
  - Coordinated by the BSC-CNS and Governed by the RES Council.
  - Regional, national, European, and private funding.
  - Resource sharing among nodes, with centralized calls for proposals.
- International Connection:
  - Strong ties with PRACE and EuroHPC-JU.

Spanish Network of Supercomputing
Red Española de Supercomputación (RES)

Spanish Network for e-Science

- Resources and Scope:
  - 13 PFlops of total computing capacity + 450 PFlops of MareNostrum 5.
- Access Model:
  - Access through (https://www.res.es/en/home), evaluated by technical committee.
  - Free access accepting only by public funding.
  - Up to 7% of for strategic EGA, LHC).

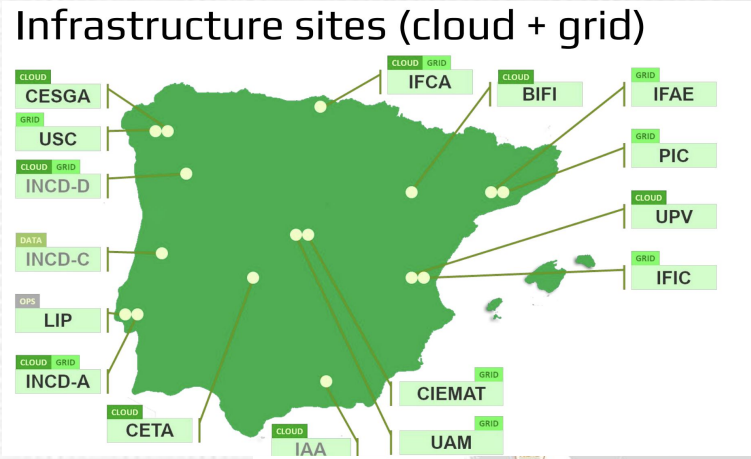




Spanish Distributed Computing Federation (IBERGRID)

Spanish Network for e-Science

- Structure and Governance:
  - Spanish-Portuguese initiative since (strengthened in 2019).
  - Federation between NGI-ES (ES) & RIDC (PT).
  - Bottom-up technical coordination Service Level Agreements.
  - Regional, national, and European No membership fees.

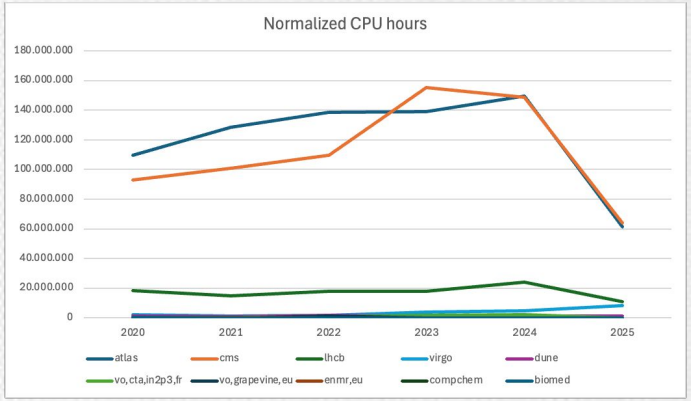


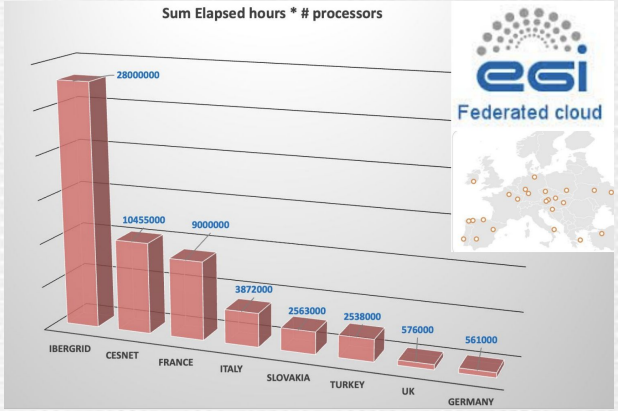
- International Connection:
  - Active participation in EGI through the CSIC (Spanish National Research Council).
  - Coordination with European policies through the Spanish Joint Research Unit (JRU).

Spanish Distributed Computing Federation (IBERGRID)

Spanish Network for e-Science

- Access Model:
  - Based on thematic Virtual Organizations (VOs).
  - Requests evaluated and assigned by providers.
  - Support for scientific volunteers, ESFRI/ERIC projects, and international projects.
- Resources and Scope:
  - High Productivity Resources (batch jobs) and Federated Cloud.
  - Spain (2020–2025):
    - 13.5 billion CPU hours (HEPSPEC06).
    - More than 600,000 cloud instances.
  - Managed access via EGI portals:
    - [High-Throughput Computing]
    - [Federated Cloud]



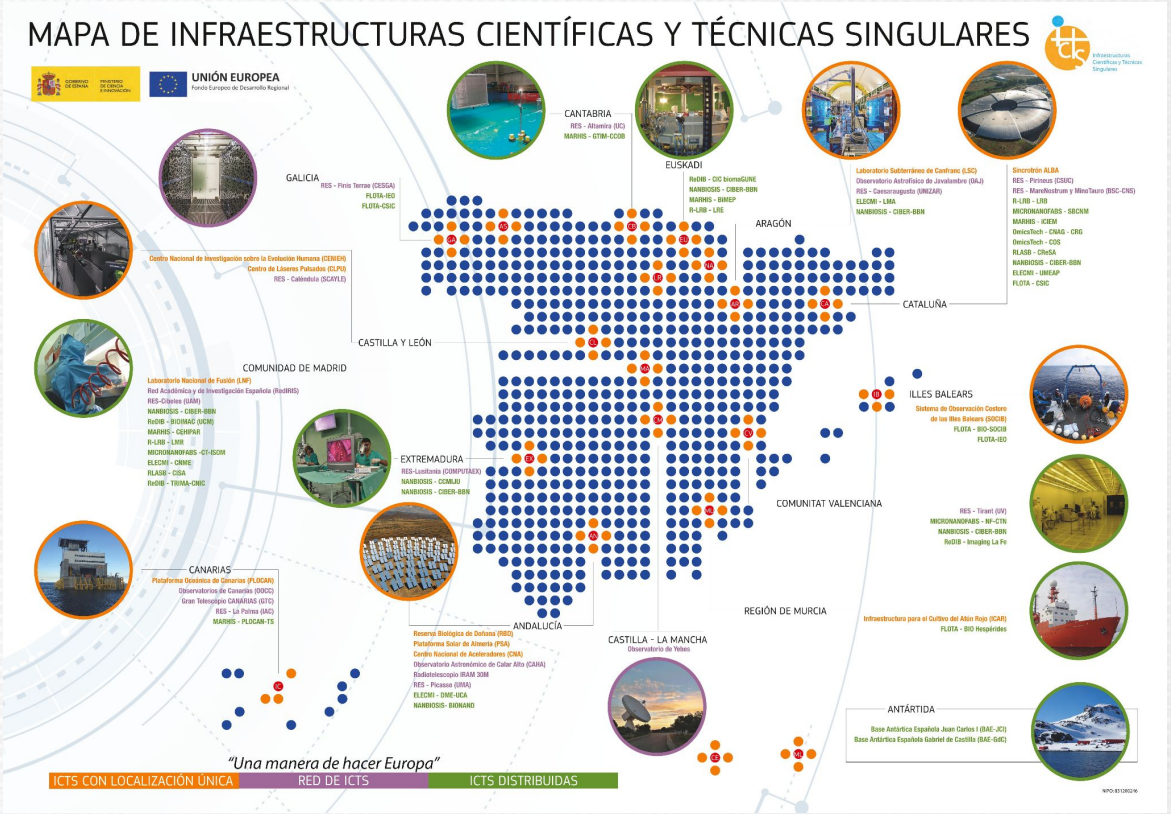


Thematic Research Infrastructure

ICTS – Infraestructuras Científico-Técnicas Singulares

Spanish Network for e-Science

- ICTS are unique, high-performance public research infrastructures in Spain that provide in an open, competitive access, cutting-edge resources and services to scientific and technological communities.



Thematic Research Infrastructure

ICTS – Infraestructuras Científico-Técnicas Singulares

Spanish Network for e-Science

- There are 29 ICTs, managed by public entities, gathering 62 infrastructure sites.
  - Supports cutting-edge research, knowledge transfer, innovation.
  - Aligned with ESFRI, EU thematic platforms, and integrated into EOSC initiatives
- ICTs are of unique scale, addressing different disciplines:
  - Particle physics & materials; Fusion; Astronomy & astroparticle; Health & biotech; Marine & environmental; Energy & engineering; and ICT & e-science.
- Funding & Investment
  - Heavy public/EU investment: €37–38 M/year.

Thematic Research Infrastructure

International Relations

Spanish Network for e-Science

- e-Infrastructures ESFRI
  - ESFRI is a strategic EU body that identifies, promotes, and supports the development of pan-European research infrastructures of long-term interest, across all scientific domains.
  - Spain actively participates in 21 ESFRI-listed research infrastructures.
    - Leading Lifewatch-ERIC and IFMIF-DONES.
    - Deep involvement in environmental science, fusion, gravitational waves, and digital biocollections.

- CERN (European Laboratory for Particle Physics)
- ESRF (European Synchrotron Radiation Facility)
- ILL (Institut Laue-Langevin)
- European XFEL (X-ray Free-Electron Laser)
- ESO / ELT (European Southern Observatory / Extremely Large Telescope)
- ITER (International Thermonuclear Experimental Reactor)
- ESS (European Spallation Source)
- SKAO (Square Kilometre Array Observatory)
- EFI (European Forest Institute)
- EMBL-EMBO-EMBC (Molecular Biology associations)
- INL (International Iberian Nanotechnology Laboratory)
- GBIF (Global Biodiversity Information Facility)
- PRACE (Partnership for Advanced Computing in Europe)
- e-Ciencia / EGI / IberGrid (Pan-European Grid Infrastructure & Spanish-Portuguese grid)
- Euro-HPC (European High Performance Computing Joint Undertaking)
- CECAM (Centre Européen de Calcul Atomique et Moléculaire)
- ACTRIS (Aerosols, Clouds, Trace Gases)
- DiSSCo (Distributed System of Scientific Collections)
- eLTER (Long-Term Ecosystem Research)
- Einstein Telescope (3rd-gen gravitational wave observatory)
- IFMIF-DONES (International Fusion Materials Irradiation Facility)

Thematic Research Infrastructure

International Relations

Spanish Network for e-Science

- European Research Infrastructure Consortium (ERIC)
  - ERIC is a legal framework created by the European Commission to facilitate the establishment and operation of European research infrastructures with cross-border impact.
    - It offers legal personality and privileges recognized by EU and member states.
    - ERICS are composed of member countries and observers, with a host country.
  - Comprehensive Spanish presence across diverse ERICs: biobanking (BBMRI), social science (ESS), geosciences (EPOS), language (CLARIN), structural biology (Instruct), biomedicine (EATRIS and EuroBioImaging) and biodiversity (LifeWatch).

ERIC Name	Spain's Role
Euro-BioImaging	Member state
BBMRI-ERIC	Observer
ESS ERIC	Full member
EPOS ERIC	Member
ACTRIS ERIC	Founding
CLARIN ERIC	Full member
DARIAH ERIC	Full member
EMSO ERIC	Member
JIVE ERIC	Member
CTAO ERIC	Founding
ESS ERIC	Founding
ELIXIR	National Node
LifeWatch ERIC	National Node

Spanish National Open Science Strategy
Estrategia Nacional de Ciencia Abierta (2023-2027)

Spanish Network for e-Science

- Governance & Scope:
  - Approved by the Spanish Cabinet on May 3, 2023, led by the Ministry of Science & Innovation and Ministry of Universities, coordinated with FECYT.
  - Builds on the 2022 Science, Technology & Innovation Act (Law 17/2022) and the 2021–2023 National Scientific Plan.
- Main Objectives:
  - Ensure robust, interoperable digital infrastructures, aligned with EOSC.
  - Promote FAIR data management (Findable, Accessible, Interoperable, Reusable).
  - Make open access to publicly funded publications and results the default.
  - Develop new research evaluation systems and incentives, plus training for all R&D personnel.
  - Invest in open digital infrastructure and open-source platforms
- Budget & Context:
  - Initial public investment of €23.8 million in 2023, with similar annual allocations projected through 2027
  - Harmonized with EU open science policies and EOSC integration roadmap.

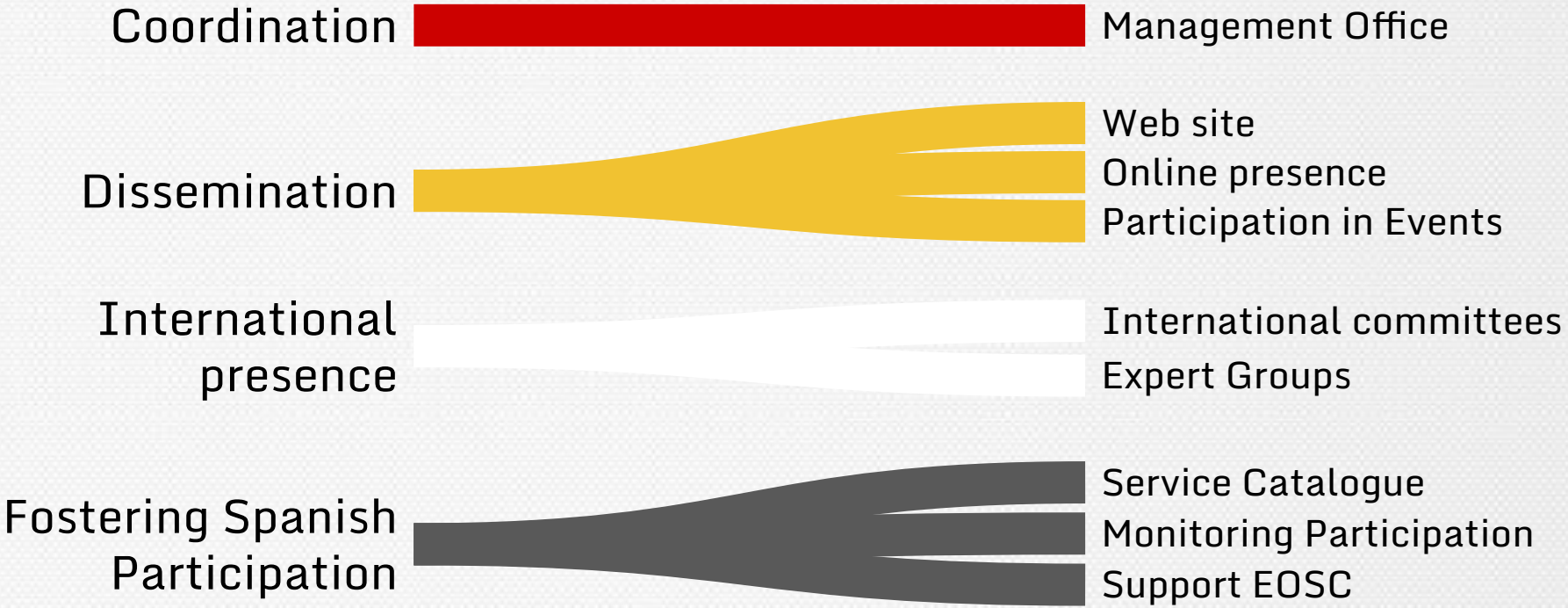
Activities of the Spanish Network for e-Science

Spanish Network for e-Science

- **Analyze** the various aspects of **e-Science**, national and international initiatives in this area, and their impact on the Spanish and international R&D&I system, and advise on possible actions to improve or enhance the development of e-Science in Spain.
- **Collaborate** in the **design and implementation of strategies** and action plans in their field, as well as coordination actions and protocols in specific areas.
- **Perform** other **advisory tasks** in the field of e-Science as requested by the General Secretariat for Research.
- **Carry out** any other **activities** necessary to fulfill its purposes and objectives.
- **Establish working groups** for analysis and study, or for the coordination of initiatives, for the development of e-Science.

Activities

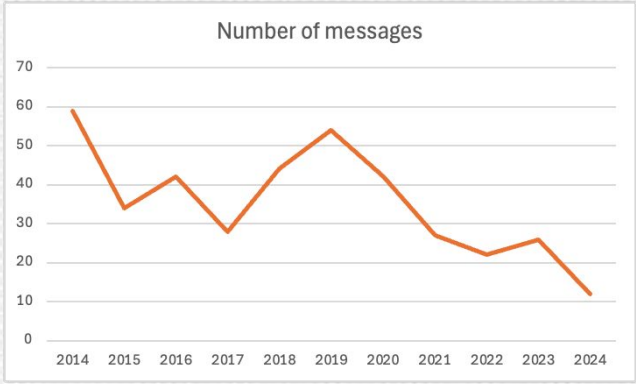
Spanish
Network for
e-Science



Functions of the Network: Dissemination

Spanish Network for e-Science

- Web presence www.e-ciencia.es
- Mailing list: e-ciencia@upv.es
  - 173 subscriptors
- Participation in Conference Booths.



International Presence (Currently)

Red Española de
e-Ciencia Abierta

- International Committees
  - European e-Infrastructures Reflection Group (e-IRG).
  - Board of Directors of the EOSC-A.
  - EOSC Steering Board.
  - ESFRI DIGIT Working Group
  - Governing body of EUROHPC JU
  - Board of directors and Industrial Advisory Committee (IAC) of PRACE
  - General Assembly of GEANT
- Working Groups
  - EOSC-SB Policy subgroup.
  - EOSC-A Task Forces.

Red Española
de e-Ciencia

European Open Science Cloud

What is EOSC

EOSC is the extra support we can offer for research in Europe based on a federated structure (EOSC Federation) of contributions (EOSC Nodes) that are part of the Web of FAIR Data and Services.

DOI 10.5281/zenodo.15083486

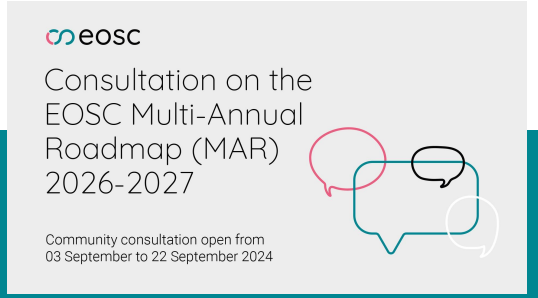
Why EOSC is pivotal to European competitiveness

The Co-Programmed Partnership for EOSC

EOSC Association has been asked by the EC for input and advice in **defining the call topics related to EOSC,** to be included in the Horizon Europe Work Programme 2026-2027.
The Document was written based on the input of 35 volunteers from the EOSC-A.

https://eosc.eu/sria-2-0-community-consultation/#SurveyInsights

Partnership Board adopted the **Strategic Research and Innovation Agenda** of the European Open Science Cloud (SRIA 1.3) in December 2024



The **Multi-Annual Roadmap 2026-2027 (MAR),** which is a part of SRIA and serves as the EOSC Partnership's input to the Horizon Europe Work Programme for 2026-2027, proposed **four Strategic Pillars** around which EOSC's priorities for the Work Programme are grouped:

Strategic Pillar 1

Sustaining and enhancing the EOSC Federation

Strategic Pillar 2

Contributing to the web of FAIR data and the uptake of AI

Strategic Pillar 3

Ensuring research security and sovereignty

Strategic Pillar 4

Linking with other Common European Data Spaces and beyond

Expertise available to subgroups

The **EOSC Association Task Forces**, together with the **EOSC Opportunity Area Expert Groups**, represent the EOSC brain pool. Together, these groups include hundreds of expert volunteers collectively working to develop key areas in the implementation of EOSC

EOSC Association Task Forces

- Technical and Semantic Interoperability Task Force
- FAIR Metrics and Digital Objects Task Force
- Health Data Task Force
- Long-Term Data Retention Task Force

EOSC Opportunity Area (OA) Expert Groups are voluntary collaborations across Horizon Europe (HE) EOSC-related projects

- OA Expert Group: Persistent Identifiers
- OA Expert Group: Metadata, Ontologies and Interoperability
- OA Expert Group: FAIR Assessment and Alignment
- OA Expert Group: User and Resource Environments
- OA Expert Group: Skills, Training, Rewards, Recognition and Upscaling
- OA Expert Group: Open Scholarly Communication
- OA Expert Group: Research Software

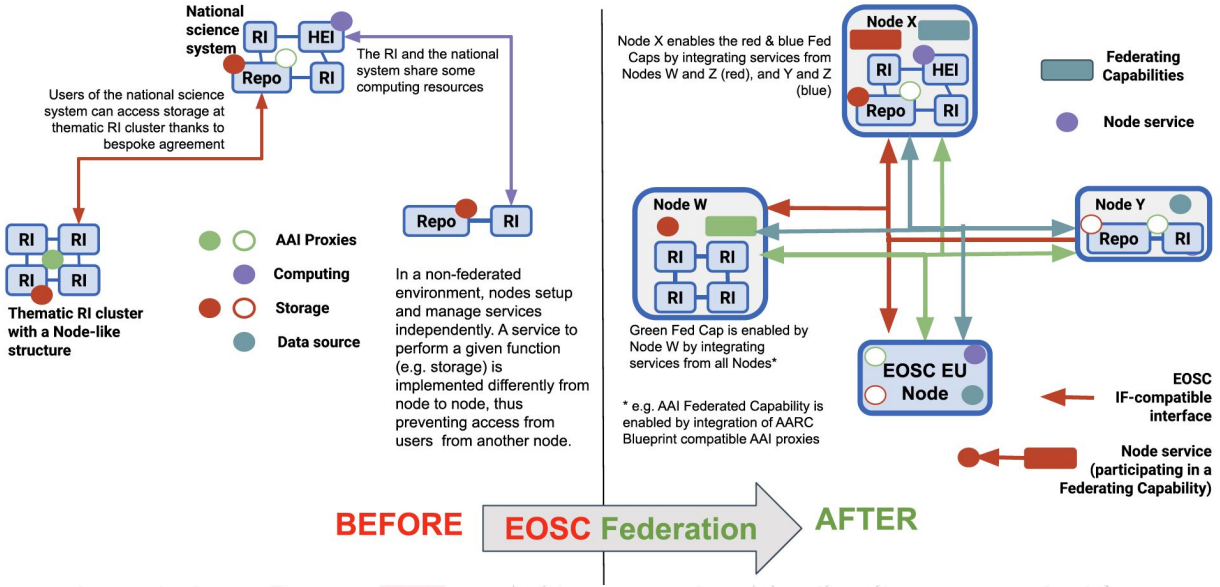
Establish links between build-up phase subgroups chairs and EOSC-A Task Force and Opportunity Area expert groups

Defining the EOSC Federation

The EOSC Federation is to function as a network of interconnected and interoperable systems, called Nodes.

These Nodes can represent scientific disciplines / domains, (national) (e)-infrastructures, research infrastructures, etc.

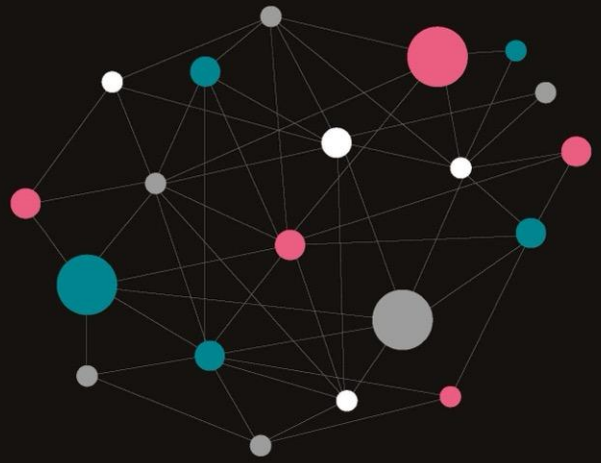
The EOSC Federation will offer a unified platform for European researchers to discover, access, and reuse FAIR scientific data.



https://zenodo.org/records/14999577

eosc | Tripartite

EOSC Federation Handbook



DOI 10.5281/zenodo.14999577

Contents

The EOSC Federation Handbook has been written by a group of **volunteers,** who have been working together since March 2024 with the support of the EOSC Focus project.

The Handbook provides an overview of the organisational and operational structure, and technical characteristics, of the EOSC Federation

DOI 10.5281/zenodo.14999577

EOSC Federation Handbook

March 27, 2025

Conceptual architecture

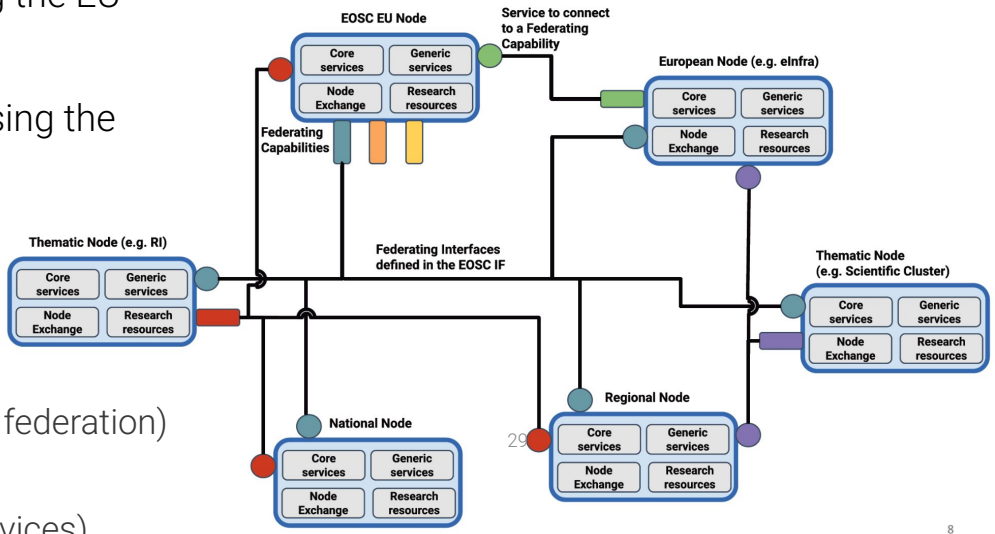
EOSC nodes covering national, regional, thematic, as well as nodes of European scope (including the EU Node).

Not a central architecture, potentially exposing the nodes their own federating capabilities.

Nodes connect to the federated capabilities.

Services In a node

- **Core services** (required to implement the federation)
- **Generic services** (horizontal services)
- **Research resources** (domain-specific services)
- **Node Exchange** (Services exposed across the federation)



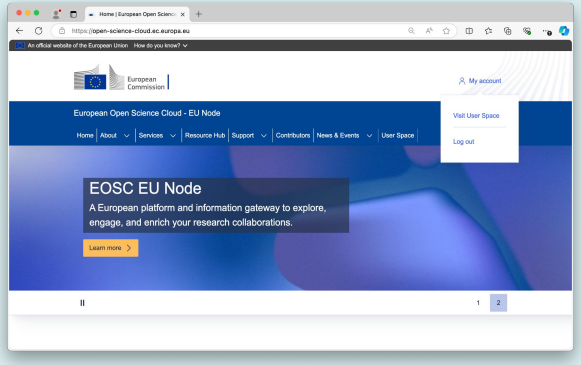
Node Core Capabilities

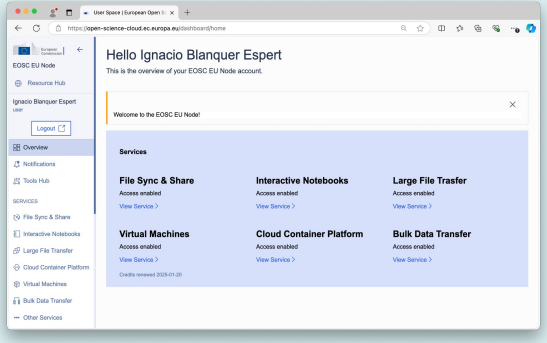
The Node Core Capabilities enable the basic operation of an EOSC Node.

The EOSC-EU node is a reference implementation of this node core capabilities (Annex 1 in the handbook).

Node Core Capabilities	Description
Resource Catalogue and Registry services	Catalogue of resources that can be accessed through the EOSC Node with a search engine to discover, access and order them
AAI	AAI (AARC Blueprint- compliant) enabling access to Node resources (Core and Exchange) via federated credentials (i.e. community AAI and Infrastructure Proxy)
Helpdesk	Support incident response and service requests for services and other integrated resources
Service Monitoring	Monitor the availability and quality of the Node services
Service and Research Product Accounting	Track and record usage of resources
Order Management	A framework for providers to define offers and a unique interface for end-users to request access to resources
Configuration Management System	Shared space to store information on Node capabilities and on how services are provided through the node to ensure consistent service delivery (only for internal use)
User space	Dynamic customisable dashboard, where the node user logs-in, offering easy access to the Node resources.
Application Workflow Management	Orchestrate services, datasets and other research objects on the underlying Node provisioned infrastructure
Resource provisioning	Support users on identifying all available resources for a project and then assigning them to the project

Principles for Building the EOSC Federation





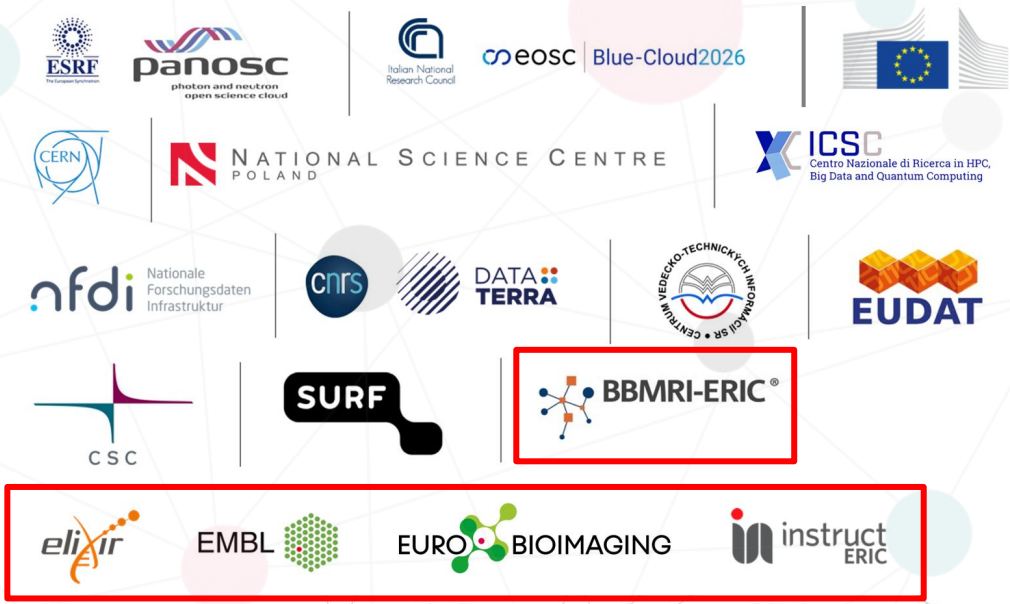
https://open-science-cloud.ec.europa.eu/

- **Inclusivity and accessibility**: Ensure low barriers to entry, ease of use, and broad participation.
- **Community-driven and participatory**: Engage the research community in co-creating and shaping the Federation.
- **Flexibility and adaptability**: Allow for an evolutionary approach, adapting based on findings and lessons learned.
- **Autonomy and control**: Respect institutional autonomy while ensuring that data and service owners retain full control over shared resources and openness levels.
- By the **fourth quarter of 2025**, the **EOSC Federation** should comprise several EOSC Nodes that will have established an initial operational governance and organizational structure.

13 Candidate Nodes + EOSC EU Node

121 Applications from 25 countries, with 5 types of nodes (national thematic, institutional, regional and others)

29 Applications from 25 countries, with 5 types of nodes (national thematic, institutional, regional and others)



~13 To join the first wave starting March 2025 **+** Subsequent waves of enrolment from Q4 2025 onwards

Spanish
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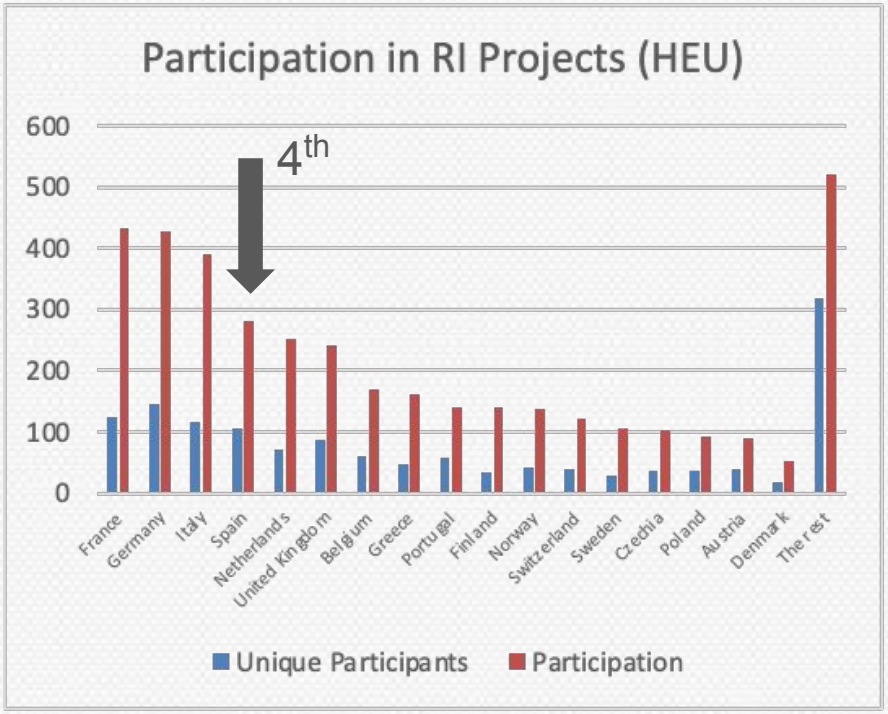
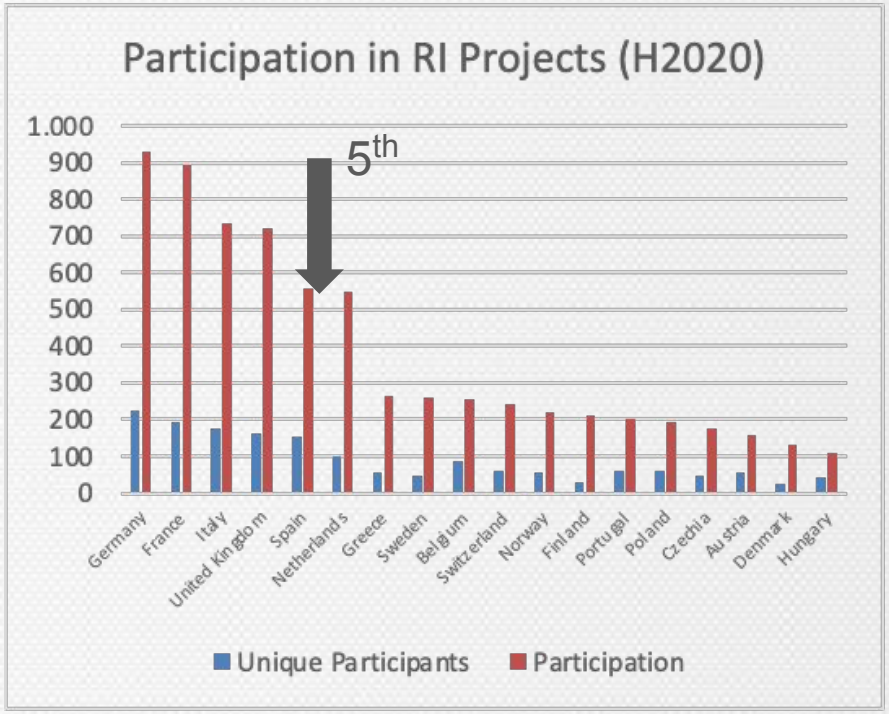
Impact on RI Projects and Conclusions

International Presence (HEU)

Red Española de
e-Ciencia Abierta





International Presence (HEU)

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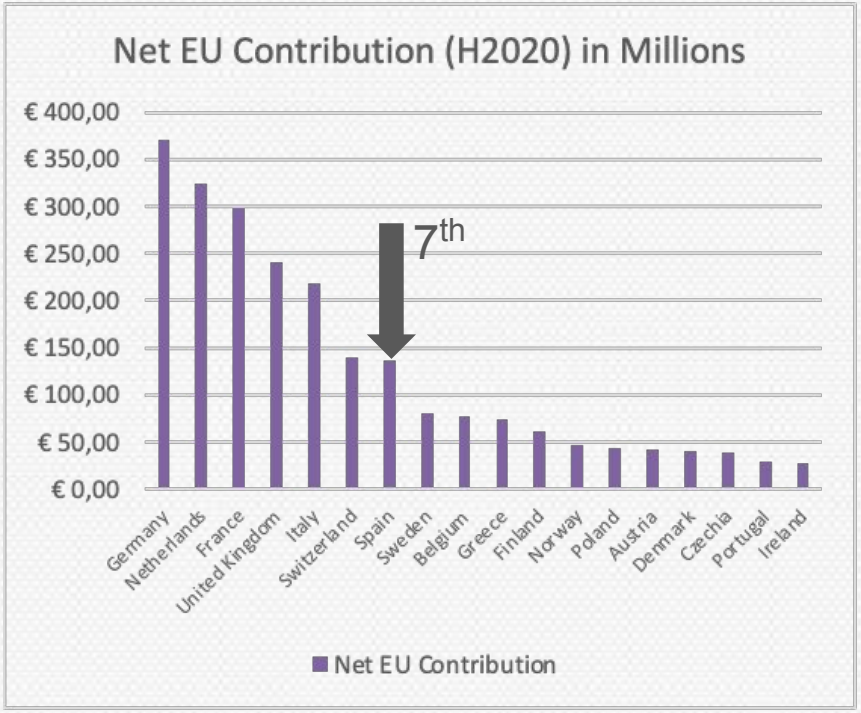

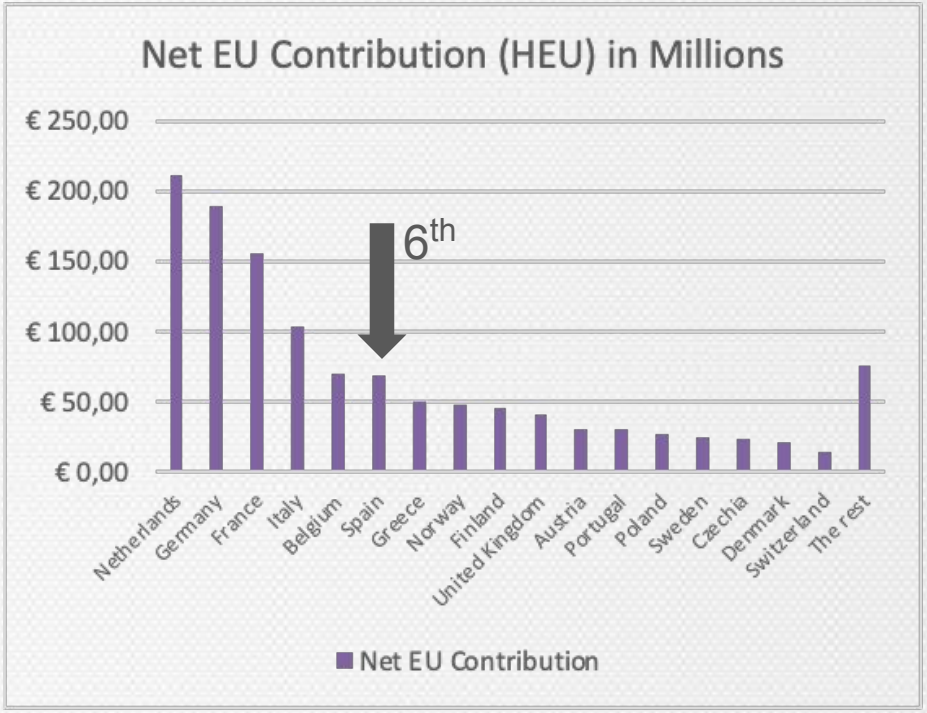

Spanish Participation in EOSC projects

73% of the project consortium included an Spanish institution

e-Science

EOSC cancer | AI4 EOSC | EOSC SIESTA | EOSC TITAN

Coordinated by Spanish Institutions

EOSC Focus Skills 4 EOSC | EOSC Blue-Cloud2026 A federated European FAIR and Open Research Ecosystem for oceans, seas, coastal and inland waters | EOSC RAISE | EOSC FAIR-IMPACT | Scilake

EOSC EuroScienceGateway | EOSC EVERSE | EOSC BEYOND | EOSC DATA COMMONS

EOSC FAIR2Adapt | BY-COVID | EOSC RAISE Suite | EOSC United | EOSC FIDELIS

ostrails | EOSC DataGEMS | EOSC | OSCARS Open Science Clusters' Action for Research & Society | EOSC AquaINFRA | EOSC ENTRUST European Network of Trusted Research Environments

Participated by Spanish institutions

EOSC GRAVITY | CRAFT-OA | RDA TIGER | graspos open research metrics dataspace | EOSC EDEN Enhancing Digital preservation strategies at European and National level | EOSC FAIR-EASE

Lumen | EOSC | EOSC | EOSC | ClimateAdapt | EOSC | EOSC FAIRCORE4EOSC

Conclusions

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- The Spanish Network for e-Science is a Strategic body to gather input from multiple stakeholders in e-Science in Spain
    - Infrastructure, Data, Scientific communities, Policies.
- Given the complexity of its stakeholders, the network cannot be a prescriptive body and participants must remain independent on their actions.
    - However coordination and integration of services is important and it should pursue a higher degree of coordination among the providers.
    - e-Infrastructures are facing an increasing demand of users, data and computing needs.
- It must be deeply linked to Open Science and Open Data.

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