EGI Annual Report 2021

2021, a year of collaboration, openness and innovation

egi.eu

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Foreword

Tiziana Ferrari
Director of the
EGI Foundation

It is with great pleasure that we publish the annual report 2021, which allows me to celebrate another set of stellar results with you.

2021 was a year of growing international collaborations. We are strengthening our partnerships with e-Infrastructures in Africa, America and Asia. Together, we will jointly deliver better and more integrated solutions for a truly global federated infrastructure that meets the advanced computing needs of next-generation experiments.

Collaboration is in the DNA of the EGI Community and fuels excellence in research. The impact delivered in 2021 was only possible thanks to the many research collaborations that joined forces with the EGI Federation. Together, we integrated national computing facilities, research data, scientific applications, training and expertise to make open science a daily practice in research. The trust within the collaborations resulted in more than 20 innovation projects that are currently boosting our ability to innovate and align new requirements.

I am happy to see the EGI Federation and its user base growing at an increasing pace. In 2021, we welcomed six new EGI Council participants, of which two were incoming in 2022. 72 new scientific collaborations successfully completed the EGI service adoption phase between 2019-2021, 30 of which happened in 2021. We extended our governance through the Digital Innovation Hub (DIH) to increase our collaboration with private companies. I expect this new initiative to open up to a growing number of innovation opportunities in the coming years.

Collaboration is our foundation, and it is the highest expression of our values, including openness, passion and trust. Every day I am inspired by this community, which has been working on crossing national and institutional boundaries for more than 20 years. The technical bridges built are our greatest testimony and an enduring and tangible sign of peaceful collaboration. Thanks to all of you for this legacy!

Foreword

Arjen van Rijn
Chairperson EGI Council
and Executive Board

With pride, I present the 2021 Annual Report of the EGI Federation.

The report shows what a community can achieve when united by one vision: ‘All researchers should have seamless access to services, resources and expertise to collaborate and conduct world-class research and innovation’. We are a community working together for more than two decades. We are a federation of organisations providing resources for the common good: scientific research. We come from a legacy of federating computing infrastructure and are moving into federating infrastructure and research by integrating computing software, data and applications.

Federation is our core competence! We see the various flavours of computing brought together, High Throughput Computing, High Performance Computing, Cloud Computing, and accelerators, simply because research needs it. We see a federation of data and applications to support data-intensive research communities, all to enable Open Science, the goal of the European Open Science Cloud (EOSC).

The EGI Federation rests on strong pillars, the NGIs. As I have stated many times before, it is essential that each of these national building blocks of the EGI federation is well embedded in its national e-infrastructure context, where the various aspects of facilitating research with ICT come together, with the need to work this out on the European level for cross border collaboration. To this end, EGI has been actively engaging in discussions with our fellow European e-infrastructures.

In 2021 we have actively contributed to the success of the EOSC initiative with the closure of the EOSC-hub project, which has been praised by the reviewers ‘for the impressive work carried out over the project duration’. We also launched the EOSC Compute Platform with the start of EGI-ACE, our new flagship project that opens national and thematic infrastructures of the EGI federation to EOSC users.

EGI has also started to update its 2020 – 2024 strategy with the first workshop on its service portfolio. Much effort has also been devoted to preparing EC proposals. Thanks to the EGI team, the effort was again met with great success! To achieve the project commitments, EGI Foundation will grow to almost 40 FTEs in 2022.

A final word to mention Davide Salomoni and Sigve Haug, who left the Executive Board after completing their term. I thank them both very much for serving EGI in this capacity. We have welcomed Tommaso Boccali and Marius Sterzl as their successors.

In 2021 we saw each other mainly as 2D human beings. I hope that in 2022 our EGI community will be able to meet face to face again!

Key Highlights

2021

January

Four new members joining the EGI council

EGI becomes the operator of the EOSC Compute Platform

March

New engagement programme (EGI-ACE Open Calls) opened to user communities

April

EOSC-Future project kicks off with EGI being a key partner

August

Integration of China's CSTCloud with the EGI Federation

October

EGI2021 Conference is succesfully organised

November

EGI council formally approves EGI-DIH and two new Council memberships

December

EGI reaches 1,000 FitSM certificates

EGI Federation 2021 in numbers

+72%
50.8M
Cloud CPU hours consumed

27
EU funded projects

450.3M
Computational jobs

+78,100
Users

+15%
6.5B
HTC CPU hours consumed

1230[1]
Enabled articles

27
EGI Council participants

Enabled articles:

43 HTC and **82** Cloud active scientific communities supported and **23** new Cloud scientific communities engaged

+800 service endpoints from over **150** data centres

[1] Based on OpenAIRE portal statistics for open access publications and community repositories.

annual increase in 2021

About EGI

EGI – Advanced computing for research

We believe research is fundamental to propel humanity forward. EGI's mission is to support data-intensive research with a wide range of advanced computing services. Our services include high-throughput and cloud computing, storage and data management, analytics, consultancy and support, training and co-development.

We continuously innovate our services and technology, foster international collaborations and knowledge sharing, and create opportunities for professional development and acquiring know-how.

Our Vision & Mission

Our Vision

All researchers should have seamless access to services, resources and expertise to collaborate and conduct world-class research and innovation.

Federation Mission

Deliver open solutions for advanced computing and data analytics in research and innovation

Foundation Mission

Enable the EGI Federation to serve international research and innovation together.

Our Structure

EGI Federation

EGI is a federation of computing and storage resource providers united by a mission of delivering advanced computing and data analytics services for research and innovation.

EGI Foundation

EGI Foundation is a not-for-profit organisation created to coordinate and develop the EGI infrastructure and engage diverse users of our broad service portfolio.

EGI Community

The EGI community is a community of researchers, developers, funders, technologists, dreamers and do-ers: anyone with a stake in advanced computing for research.

Our Members

Participant

Associated Participant

Headquarter of international research organisation or institutional representative

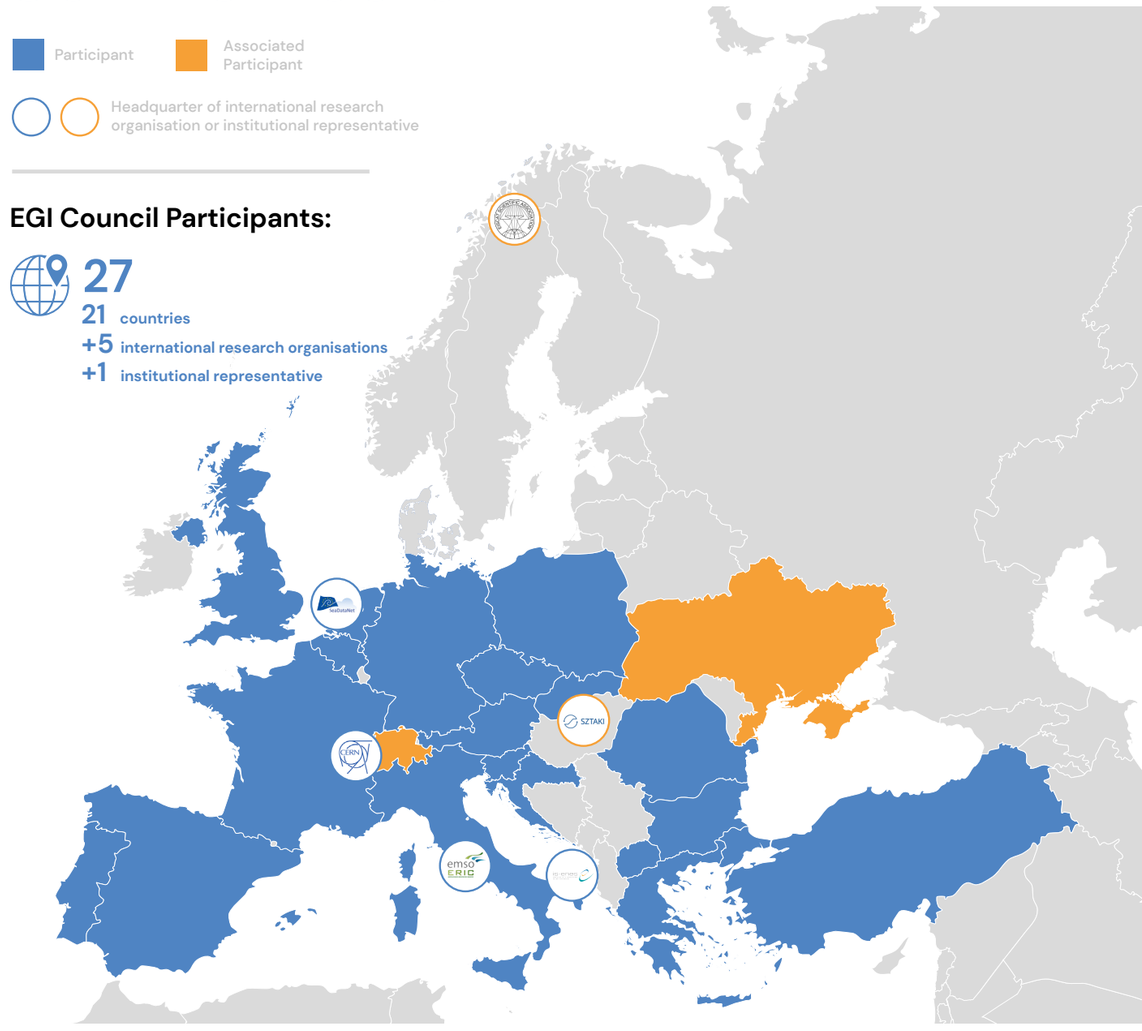
EGI Council Participants:

27

21 countries

+5 international research organisations

+1 institutional representative



Our Services

Services for research

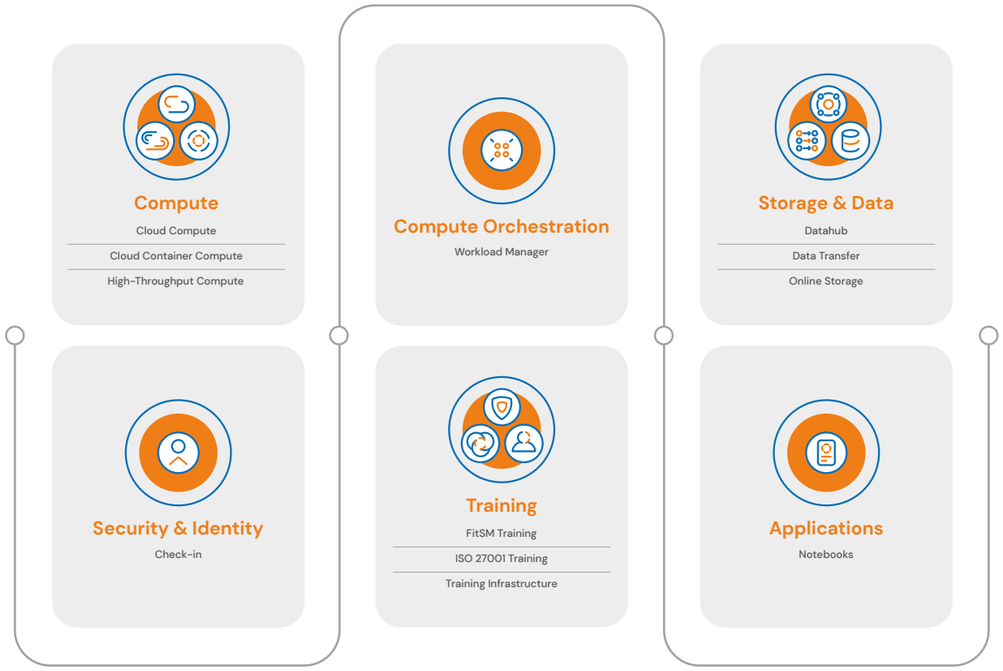
Our large-scale computing and data analytics services are helping scientists to accelerate the process leading to research outputs.

Services for federation

Our internal services are primarily serving the EGI Council members and affiliated organisations. They improve how we, as a federation, work together.

Services for business

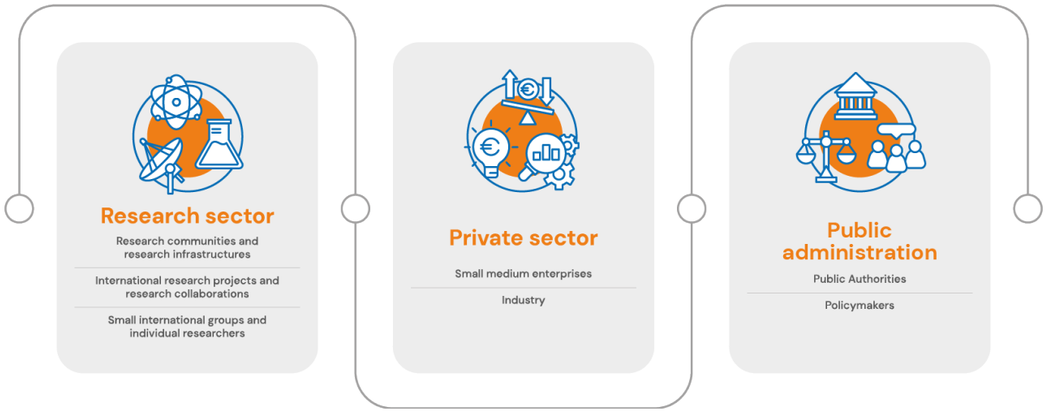
Our business engagement programme is organised within EGI DIH, a virtual space where companies and technical service providers meet to test solutions before investing.



Services for Research

You can read in detail about all the services on our website.

Our Users



Key Numbers

78,100
Total number of users

5,000
New users in 2021

Largest user community

By number of users

Structural Biology (WeNMR) with

27,000 +19.5%

registered users

By volume

LHC consuming

6.3 billion CPUh

annual increase in 2021

Essential partners and the largest adopters

Research infrastructures and research communities

23
New scientific communities engaged in 2021

14
Research infrastructures included in the ESFRI Roadmap supported by EGI

48
Research infrastructures using our services

3
New research infrastructures engaged in 2021

Environment

Landmarks
EISCAT_3D
EMSO ERIC
LifeWatch ERIC

Health & Food

Landmarks
ELIXIR
INSTRUCT ERIC
BBMRI NEW

Projects
EMPHASIS
METROFOOD-RI NEW

Social & Cultural innovation

Landmarks
CLARIN ERIC
DARIAH

Projects
E-RIHS NEW
OPERAS

Physical sciences & Engineering

Landmarks
CTA
ELI ERIC
HL-LHC
SKAO

Projects
KM3NeT 2.0

ESFRI research infrastructures supported by EGI

EGI Cloud federation user groups

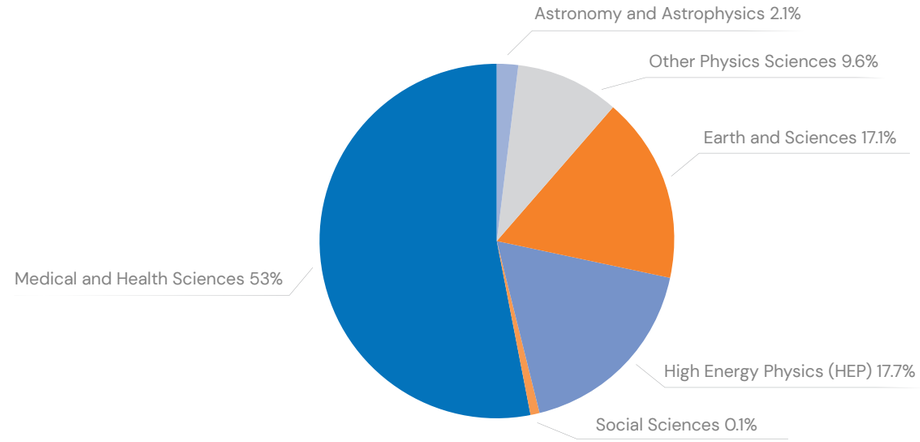
82 +45%
Active user groups using capacities from 25 federated research clouds

72%
CPUh consumption increase in 2021

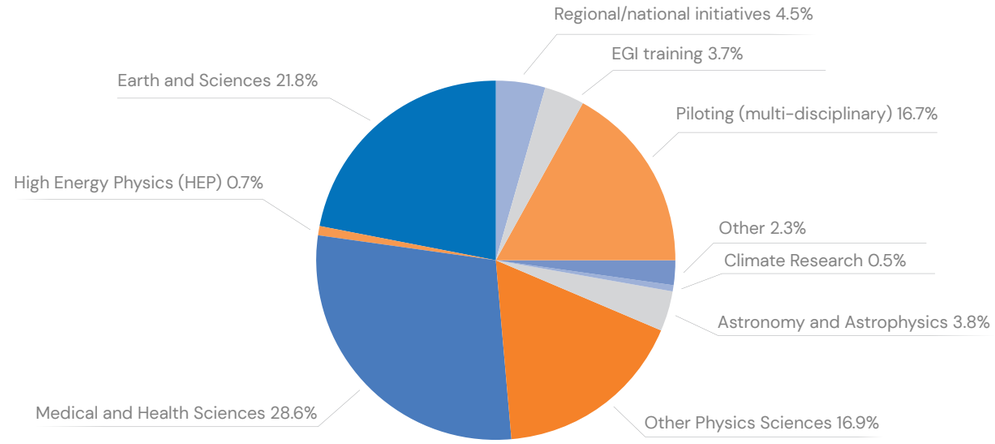
Top consumer communities in the Cloud:

Life Sciences, Environmental Sciences and Fusion physics

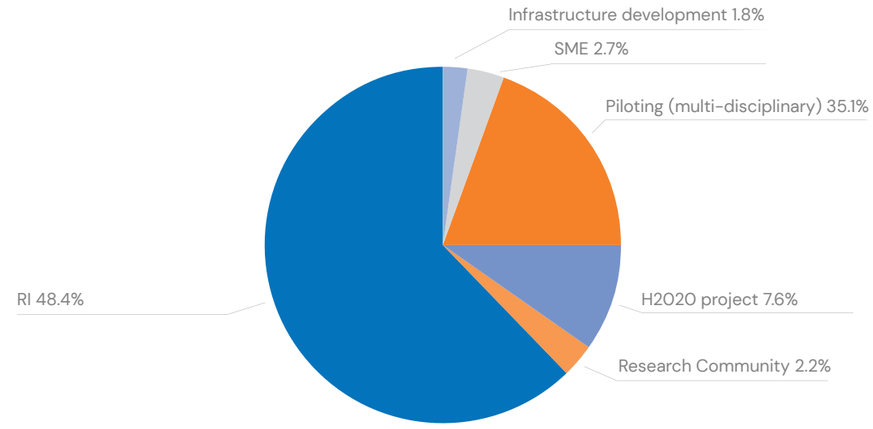
annual increase in 2021



Spread of EGI users across disciplinary areas



Spread of EGI Cloud CPU-hour use across disciplinary areas



Spread of cloud CPU/h across type of activity

Our projects

To achieve our strategic goals and provide services to our existing and new users, EGI coordinates or supports its collaborators in several EU funded projects.

In 2021, EGI kick-started its flagship project EGI-ACE.

26
Projects running in 2021

12
New projects initiated in 2021

Flagship project: EGI-ACE

EGI-ACE's main objective is to implement the Compute Platform of the European Open Science Cloud and contribute to the EOSC Data Commons by delivering integrated computing, platforms, data spaces and tools as an integrated solution that is aligned with major European cloud federation projects and HPC initiatives.

Timeline
1 Jan 2021 - 30 Jun 2023

Total Budget
12,380,165

EGI Budget
2,585,988€

Website
egi.eu/projects/egi-ace/

Project Description

EGI-ACE is a 30-month project with a mission to empower researchers from all disciplines to collaborate in data- and compute-intensive research through free-at-point-of-use services.

EGI's Role

EGI Foundation, as the project coordinator plays a central role in the project while relying on several EGI federation partners that contribute to project implementation.

In the framework of EGI-ACE we have set up and supported:

13 Data Spaces
to integrate domain-specific solutions. These Data Spaces enable interdisciplinary research by hosting research datasets on our infrastructure, allowing scalable data exploitation.

7 Early Adopters
to assess and integrate the solutions developed by the EGI-ACE project for potential new Data Spaces and contributions to the EOSC ecosystem.

30 Use case applications
from different scientific areas, helping to increase the user base of the EOSC Compute Platform.

Our Projects

Research sector

	SAOSC	01 Sep 2021	31 Aug 2022	
LABPLAS	LABPLAS	01 Jun 2021	31 May 2025	https://labplas.eu
EOSC Future	EOSC Future	01 Apr 2021	30 Sep 2023	https://www.eoscfuture.eu
	PITHIA-NRF	01 Apr 2021	31 Mar 2025	https://pithia-nrf.eu
C-SCALE	C-SCALE	01 Jan 2021	30 Jun 2023	https://c-scale.eu
lethe	LETHE	01 Jan 2021	31 Dec 2024	https://www.lethe-project.eu
	ESA ITT Open Earth Engine	01 Sep 2020	01 Sep 2022	
SoBigData	SoBigData++	01 Jan 2020	31 Dec 2024	https://project.sobigdata.eu
Triple	TRIPLE	01 Oct 2019	31 Mar 2023	https://www.gotriple.eu
	EOSC Synergy	01 Sep 2019	31 Oct 2022	https://www.eosc-synergy.eu
ExPaNDS	ExPaNDS	01 Sep 2019	31 Oct 2022	https://expands.eu
EOSC-Life	EOSC-life	01 Mar 2019	28 Feb 2023	https://www.eosc-life.eu
panosc	PaNoSC	01 Dec 2018	30 Nov 2022	https://www.panosc.eu
EOSC ENHANCE	EOSC Enhance	01 Dec 2019	30 Nov 2021	Ended
OPERAS	OPERAS-P	1 Jul 2019	30 Jun 2021	Ended
EOSC-hub	EOSC-hub	1 Jan 2018	31 Mar 2021	Ended

Private sector

BD4NRG	BD4NRG	01 Jan 2021	31 Dec 2023	http://www.bd4nrg.eu
STAIRWAI	StairwAI	01 Jan 2021	31 Dec 2023	https://stairwai.nws.cs.unibo.it
EUH4D	EUHubs4Data	01 Sep 2020	31 Dec 2023	https://euhubs4data.eu
DIGITBRAIN	DIGITbrain	01 Jul 2020	31 Dec 2023	https://digitbrain.eu

Public administration

HEALTHYCLOUD	HealthyCloud	01 Mar 2021	31 Aug 2023	https://healthycloud.eu
Decido	DECIDO	01 Mar 2021	29 Feb 2024	https://www.decido-project.eu
AI4PublicPolicy	AI4PublicPolicy	01 Mar 2021	29 Feb 2024	https://ai4publicpolicy.eu
Policy Cloud	PolicyCLOUD	01 Jan 2020	31 Dec 2022	https://policycloud.eu

Research sector and public administration

H-CLOUD	H-CLOUD	01 Jan 2020	31 Dec 2021	Ended

See all projects

egi.eu/projects/

Progress towards strategic goals

01
Be a trusted service & technology partner for research and innovation

02
Evolve the service offering to meet the needs of researchers

03
Improve skills of users/operators and maturity in service providers

04
Align business models to better support cross-border service provisioning

05
Strengthen the governance and broaden European coverage

06
Be a recognised foundation of the EOSC

Goal 1

Be a trusted service & technology partner for research and innovation

In 2021, we promoted our services and engaged our target user groups to grow further the EGI Federation's role as a trusted technology partner. We newly engaged 23 scientific communities and over 48 research infrastructures currently use our services. Our involvement in several strategic H2020 projects and buy-in from new partners, rooted in new and previously unfamiliar research areas, are tangible indications of increasing trust in our services across different stakeholders.

Expanding & deepening our strategic partnerships

Research sector

In 2021, EGI established strategic partnerships with new research infrastructures, including EMSO-ERIC, IS-ENES, EISCAT Association and SeaDataNet, which joined the EGI council.

Marine Science
EMSO-ERIC

The EGI-hosted EMSO-ERIC services, including the EMSO data portal, reached pre-production phase in 2021. The system was validated through multiple use cases and was already used by over 800 users, serving over 19,000 user requests from 90 countries.

Supported by:

CESGA (ES), INFN-BARI (IT) and GRNET (GR)

Marine Science
SeaDataNet

Under the support of EGI, SeaDataNet completed the integration with several components of the EOSC Compute Platform, including: AAI, EGI Data Cloud, PaaS Orchestrator. The first release of the Data Space was on-boarded in the the EOSC Portal: Link.

Supported by:

INFN (IT)

Climate Modelling

IS-ENES

The ENES climate modelling community rolled out their new, EGI-supported ENES Data Space service into production in 2021. The system provides discovery and interactive analytics on top of 150TB of data using the cloud, and HPC resources.

Supported by:

TÜBITAK (TR) and UPV (ES)

Atmospheric Science

EISCAT and the China Science and Technology Cloud

With the support of EGI, the EISCAT scatter radar community expanded its e-infrastructure set up in 2021 to China. Together with the China Science and Technology Cloud (by CNIC), a data and compute federation was reached, making data processing scalable and possible for experiments of global relevance.

Supported by:

TÜBITAK (TR), CNRS (FR), and GRNET (GR), CESNET(CZ)

Social Sciences and Humanities

SoBigData and OPERAS

SoBigData and OPERAS are two social sciences research infrastructures that were added to the ESFRI Roadmap in 2021. EGI has supported these two communities since 2019 with Notebooks, Workload Manager and Check-in services. The e-infrastructure services support interactive data analytics and increase our recognition as trusted IT partner within the broader social sciences and humanities landscape.

Supported by:

CNRS (FR), CESNET (CZ), and GRNET (GR)

Physics

IceCube

The IceCube Neutrino Observatory observes the cosmos from deep within the South Pole ice. In 2021 IceCube tapped into GPU resources provided by the EGI Federation.

Supported by:

IFCA (ES), CESNET (CZ), and GRNET (GR).

Goal 1

Be a trusted service & technology partner for research and innovation

Growing our user community

Research sector

Our flagship project EGI-ACE, which extends our technology and service offerings to new computing use cases, powerfully drove EGI's user engagement activity. EGI members collaborating in the project have been offering 17 different services through the EOSC Portal, and 16 of our user communities already do the same with their thematic applications hosted by the EGI Federation.

In 2021, EGI-ACE promoted a new open call programme to engage new user communities and increase the user base of the EOSC Compute platform. Close to 30 successful applications allowed us to expand our user base further and improve the promotion and the level of engagement with a broad portfolio of projects conducting data- and computation-intensive research.

Private sector

The collaboration with industry and SMEs continued with the formal approval of EGI Digital Innovation Hub (DIH) and within several H2020 projects, such as EUHUBS4Data, BD4NRG, DIGITbrain, EOSC-Future, SoBigData++ and StairwAI. Within these projects, EGI played an active role in formulating technical requirements, supporting the business pilots, integrating, designing and setting up the new services. The goal is to bring research and industry together to increase the innovation potential of EGI, EOSC and partners from the private sector.

Highlight

EGI DIH: Supporting SMEs in their digital transformation

The formal approval by the EGI Council in November 2021 will make 2022 the year of the official launching of the EGI DIH (Digital Innovation Hub). EGI DIH acts as a one-stop shop to provide technical assets, knowledge, expertise and support in the business, market, and finance, leading to sustainable innovation.

Test before you invest

EGI DIH helps and supports companies in adopting, testing, and validating advanced computing technologies to help the digital transformation and enhance productivity and competitiveness.

Find Funding & Investment

EGI DIH facilitates access to funding opportunities and investment mechanisms to sustainably support innovation.

Build a Network & Community

EGI DIH brings SMEs and companies in contact with the EGI community to facilitate interaction and open new market opportunities.

Get Consultancy & Training

EGI DIH provides knowledge on the technical offer through webinars and consultancy services.

Find out more about EGI DIH

egi.eu/egi-dih/

Goal 1

Be a trusted service & technology partner for research and innovation

Public administration

EGI intensified the collaboration with public authorities and contributed to several projects, including PolicyCLOUD, DECIDO, and AI4Public. Being a trusted partner, EGI defined interoperability standards in these projects, and offered consultancy and resources to run the different piloting activities and validate the project infrastructures.

EGI Federation

In the summer of 2021, EGI established the Community Managers Group (CMG) network. The Group serves as an information-sharing network about user engagement, training, technical support and partner liaison activities in the EGI context.

Success stories

Structural Biology:

The COVID-19 pandemic underlined the critical role of computational approaches in Structural Biology, a field seeing a surge in computations required to tackle the virus. HADDOCK, a web portal that offers computational tools for structural biologists to model the structure of proteins and other biomolecules, has been used worldwide in research and training (>28000 users from >135 countries) with plenty of dissemination, training, and support. Numerous workshops have been given in and around Europe, but also in Asia (China, Taiwan, India, Malaysia), South America (Brazil, Chile) and North America (USA, Canada). Lectures and training tutorials are available online and on the WeNMR and BioExcel YouTube channels. The capabilities of WeNMR services and, in particular, HADDOCK in addressing scientific challenges have been promoted in presentations at scientific conferences worldwide.

Biodiversity:

OpenBioMaps is a collaborative framework for biodiversity research and conservation. The technical support and consultancy provided by EGI contributed to the scale-up of resources of the OpenBioMaps framework, increasing its user base (up to around 1,000 users from 60 active projects) and creating a service for biologists' research groups and citizen science initiatives under the EOSC umbrella. The OpenBioMap collaborative framework for biodiversity research and conservation is now fully onboarded in the EOSC Portal.

Citizen Science:

Cos4Cloud (Co-designed citizen observatories for the EOS-Cloud) is a European Horizon 2020 project to boost citizen science technologies. As part of the collaboration with EGI, the Mobile OBservation Integration Service (MOBIS) service used to report all environmental and biodiversity observations in one mobile phone app was integrated into the EOSC Compute Platform and on-boarded in the EOSC Portal. The service offers a nice, user-friendly interface to collect all kinds of biodiversity and an attractive environmental data using smartphones and low-cost sensors. All the data collected by the sensors is processed, stored, and made FAIR on the EOSC Compute Platform delivered by EGI.

Long-tail of Science:

At the Animal and Food Genomics group of the Department of Agricultural and Food Sciences of the University of Bologna, a group of researchers led by Prof. Luca Fontanesi has analysed thousands of honey samples produced over the last years all over Italy. In 2021, the group processed 500GB of raw data (eDNA datasets) in the computing resources provided by EGI. An additional 1.3TB of raw data collected from public repositories was added to the analysis pipeline, generating 4TB of data.

Fighting against the global pandemic, EGI supported several simulations of the COVID-19 epidemic. One of these activities, conducted by Jean-Francoise Mathiot at CNRS over the France Grilles clouds, resulted in a Nature paper.

Goal 2

Evolve the service offering to meet the needs of researchers

New service offering

We constantly enhance the EGI Federation with new co-designed solutions and improved services, accessible with federated identities through EGI Check-in[2].

We extended compute capabilities with new solutions for cloud access orchestration: Infrastructure Manager, Elastic Cloud Compute Cluster, INDIGO PaaS-Orchestrator and DODAS, covering different ways of managing Virtual Machine- and container-based workloads of user communities in the EGI federated cloud.

We advanced our capabilities for extreme-scale data management with two new services: Rucio, enabling scalable data management and orchestration, and OpenRDM, an integrated environment for advanced data organisation during ongoing research projects, as an integrated environment with data management and digital lab notebooks.

EGI is also offering new specialised services:

- DynamicDNS[3] for registering domain names;
- The DEEP training facility[4] for supporting machine learning and artificial intelligence applications on the EGI Infrastructure;
- Binder[5], allowing to (re-)create custom computing environments to reproduce notebook executions.

EGI-ACE also aims to broaden the federated infrastructure with HPC resources to support hybrid computing workflows. 4 pilots explored various technical approaches for running research workloads combining Cloud, HTC and HPC resources. Pilots have already demonstrated federated access with Check-in, portable code execution with containers over different types of computing resources and integration with accounting.

[2] Support for federated identities for Rucio is expected to be available in 2022.

[3] https://docs.egi.eu/users/compute/cloud-compute/dynamic-dns/

[4] https://train.deep-hybrid-data-cloud.eu/

[5] https://docs.egi.eu/users/dev-env/binder/


Research sector


Public administration


Private sector

Enhancing the existing services

EGI is constantly working on improving its existing services to offer an advanced and integrated service portfolio.

Check-in

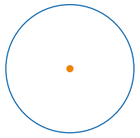
- We developed Federation Registry, a new service component that provides a secure web interface through which Service Owners can rimprovingnd manage their services in the Check-in. Through this component, providers can submit requests to register/deregister and configure their services in Check-in that, once approved, they are automatically served.
- Users can now authorise access permissions related to their personal information or enable offline access through a new consent page for OIDC services connected to Check-in.
- The statistics viewer component is enriched with information about the total number of logins per country and the number of active accounts in a reference period.

Cloud Compute

- EGI welcomed three new providers who joined the EGI Cloud Federation in 2021: GSI (DE), INFN-CNAF (IT), CSTCloud (CN).
- We now offer GPUs at 6 providers CESNET (CZ), IFCA-LCG2 (ES), IISAS (SK), IN2P3-IRES (FR), INFN-BARI and INFN-CNAF (IT).
- We facilitate the interactions with the providers through a new command-line client.
- We facilitated the management of resources through web-based providers dashboards.

Cloud Container Compute

- Automated Kubernetes deployment with EC3 service is now available in all the cloud providers of the EGI Federation.
- EGI made a Container registry available in beta in the AppDB to share container images among research communities.



Data Transfer

- Since the start of 2021, UKRI-STFC has been operating a new instance of the FTS service in addition to the one already available at CERN.
- CVMFS (Content Distribution) work is ongoing to enable access via federated identities through EGI Check-in, and we will complete the work in 2022.

Online Storage

- EGI completed the technical integration of the EOS storage (developed by CERN) with the EGI infrastructure. In 2022, EOS storage will replace DPM as a solution for HTC storage, together with the already available dCache and StoRM. In 2021, we designed Accounting probes for both Block and Object storage, and we will complete their implementation in 2022.

DataHub

- We upgraded the EGI DataHub to the latest major version.
- EGI installed new providers at IN2P3, CESNET and TUBITAK together with a PLAYGROUND space accessible to anyone for testing.
- We completed integration with EGI Notebooks and Binder.
- New communities tested and adopted the service during 2021 (Fusion, LETHE, LABPLAS and Reliance).

Workload Manager

- We migrated the service to IN2P3 and it now supports federated identities through Check-in and Python 3.

Notebooks

- We introduced support for MATLAB, and improved the python, julia, R and octave environments with new libraries and upgrades (TensorFlow, PyTorch and etc.).
- Users can find and access their DataHub spaces directly from the Notebooks interface thanks to seamless integration with DataHub.
- We now provide support for federated identities through EGI Check-in.
- EGI provides support of the D4Science AAI to manage D4Science Notebooks instances.
- We increased the quotas for members of the 'long tail of science' (4GB RAM / 2 CPUs per user). Community specific notebooks continue with custom capacity allocations.

Without the continuous support of EGI over the years we could not have grown the WeNMR user community and our services to the size, success and worldwide impact they have today. We are surely looking forward to many more years of symbiosis between WeNMR and EGI.

Alexandre M.J.J. Bonvin

Professor of Computational Structural Biology,
Faculty of Science - Chemistry, Utrecht University, the Netherlands

Goal 2

Evolve the service offering to meet the needs of researchers

Keeping our users satisfied

Highlight

The number of users registered in EGI Check-in increased by 170% in 2021

Sessions organised during the EGI 2021 conference and the efforts of the EGI community support team allowed us to understand our users' needs better. In 2021, we reorganised and enriched our user documentation available at docs.egi.eu/users/ with many tutorials and quick start sections to easily navigate the EGI service offering. We improved the interface of our federated Trust and Identity Management solution Check-in to simplify and improve identity linking. We offered dedicated and targeted training, set up pilots to integrate services from different providers (B2DROP and OpenAIRE, EISCAT_3D and Check-in), and implemented the new requirements for the EGI DataHub expressed by the PaN user community. Last but not least, we adequately trained the Virtual Organisation (VO) Managers to increase their skills in the operational management of their user groups and supported the user community in registering with the VO.

We also worked with Research Infrastructures from the atmospheric research domain (EISCAT_3D) to adopt federated Trust and Identity management via Check-in and the Photon and Neutron domain in the PaNOSC Cluster projects to enable remote distributed data analysis in the EGI Infrastructure via the Notebooks services.

Technical highlights from our projects

LETHE

We designed a new set-up and architecture for sensitive research data processing and management. The solution contains functionalities to share, store, compute and develop AI/ML applications.

StairwAI

We have contributed to the requirements gathering and design architecture of the new service layers enriching the functionalities of the AI-on-Demand platform[6]. This new service layer will contain a multi-lingual interaction layer and horizontal and vertical matchmaking services that will dimension and provision hardware resources through a proper hardware provider.

AI4PublicPolicy

We contributed to developing a dynamic provisioning of Cloud and HPC and an EOSC-based Virtualized Policy Management Environment.

BD4NRG

We have contributed to the first version of the HTAP and Data pipelines optimiser components design. Part of the Data governance layer is being developed in the project.

ESA ITT Open Earth Engine

We provide federated access to the openEO platform, user identity and group/roles management to ESA ITT Open Earth Engine, a procurement action funded by ESA. It aims to establish a European cloud analytical capability as a versatile and scalable tool for allowing users to simultaneously exploit large EO data repositories with other data sources, enabling and advancing a range of application scenarios.

EUhubs4data

We designed and prototyped a federated data catalogue for the DIHs involved in the project. We also enabled access to datasets stored in EGI DataHub via IDS connector[7], thus implementing data sharing mechanisms compatible with the GAIA-X ecosystem and future EU Data Spaces.

SoBigData++

We provided an interactive coding environment for users of D4Science Virtual Research Environments and extended the service with specific big-data and social science libraries and tools. This service instance allows access to the data available in the D4Science user workspace.

EOSC-Life

We are responsible for providing components of the Life Science AAI service (EGI Perun and Hostel IdP) and its daily operations. Furthermore, we have actively participated in the development of various procedures related to service management, Relying Parties registration, the escalation and the activities for the release of the policies of the LS AAI service, in particular the ones about security and GDPR.

[6] https://www.ai4europe.eu/

[7] https://internationaldataspaces.org/use/ids-components/

Goal 3

Improve skills of users/ operators and maturity in service providers

In 2021, we continued to deliver dedicated training and consultancy to increase the knowledge and quality of work of both our users and our operators. Sharing best practices and standards, and improving the skills of our operators enables us to align service management and seamless service delivery across the federation.

Improving user experience through training

In 2021, all the EGI training activities organised were online due to travel restrictions related to the pandemic.

EGI Federation

We arranged two training events for service operators of the EGI Federation. We also organised 11 FitSM training courses (9 on the Foundation level and 2 Advanced courses) to help service providers to improve the professional services offered to the customers. During the FitSM training, +150 trainees received a formal certification backed by the APMG certification authority. In 2021, EGI hit 1,000 total certificates.

Research sector

We organised online webinars to ensure continuous engagement with the scientific communities and help with the uptake of the services published in the EGI Service Catalogue. The Webinar Programme, hosted by EGI-ACE, saw broader audience participation and community engagement throughout the year, with participation of scientific communities, Research Infrastructures and representatives of H2020 projects with an international footprint.

600
Participants

20
Different countries

14
Webinars

11
FitSM training courses

+150
Trainees

1,000
EGI hits 1000 certificates in total

10
Training events

300
Participants

> **As a system administrator, part of my work is the integration of technologies to solve problems for the users. The webinar offered a nice use case to consider in my workday, and the technical part was very interesting to me.**
>
> ENES Data Space webinar attendee, 9th March, 2022

Goal 3

Improve skills of users/operators and maturity in service providers

Accelerating research through consultancy

In 2021, we set up a dedicated network of experts to deliver the proper level of support to the use case applications selected via the EGI-ACE open call. The network comprises of service and resource providers, representatives from the EGI partners, members of the Community Support and the Technical Support Teams of EGI. Over 2021, this network of experts received 29 requests of support from scientific communities in various scientific domains.

We organise support through dedicated experts (the 'shepherds') who follow the community during the initial testing phase, helping them connect to the right community experts and service providers of the federation. An introductory tailored technical training programme and documentation complements this.

Aligning the quality of service delivery across the Federation

We started to plan advanced FitSM training for suppliers who have not got that level yet, supporting the implementation of the supplier's Service Management System (SMS). The aim is to create an interface between our SMS and theirs, raising the maturity of the collaboration and the quality of the services delivered.

Goal 4

Align business models to better support cross-border service provisioning

Many resources of the EGI Federation are funded nationally following a range of different policy and governance models. An essential goal of the EGI Federation is to harmonise and simplify access across borders by providing a European-level access channel that grants entry to the largest network of research data centres in Europe and beyond.

In 2021, we set up a new coordinated resource allocation model. This model integrates access to facilities supported by national and European investments via a single access channel. With this approach, we can match the use cases and communities to providers with the same interest and national/institutional commitments, minimising the use of EC funds for service delivery. Such an approach has greatly simplified the process and enabled greater efficiency in using funding sources for the research communities.

EGI also offers market-driven access against payment. Three different projects with dedicated resources to enable purchases were supported with this policy: PITHIA-NRF, AI4PublicPolicy and DECIDO. The allocation planned for 2022 will consider the national/institutional interest and long-term commitment of providers for Plasmasphere Ionosphere Thermosphere research (PITHIA-NRF) and public administration (AI4PublicPolicy, DECIDO).

Finally, we expanded the EGI Business Model Innovation Program with three new internal projects that are exploring business model ideas with Globus, MathWorks, and the EGI Check-in service delivery.

The new resource allocation mechanism allows matching user needs to resources funded via a combination of both national and European funding streams, creating efficiencies and cross-border use.

Goal 5

Strengthen the governance and broaden European coverage

In 2021, we consolidated our ability to serve an expanding group of scientific collaborations. This was possible thanks to four new members of the EGI Council and establishing a new set of partnerships involving research communities and national e-Infrastructures.

New members, stronger federation

Research sector

EISCAT Scientific Association (Associated), MARIS B.V. representing SeaDataNet AISBL (Participant) and EMSO ERIC (Participant) are active in the domains of Atmospheric and Marine research. Being members of several international frameworks supporting environmental research, they bring the voice of the international research collaborations to our council. They will drive the evolution of EGI technical solutions via co-design and co-development, keeping them strategically aligned with the digital needs of research collaborations.

SZTAKI - the Institute for Computer Science and Control of the Eötvös Loránd Research Network (associated) brings its expertise to improve the delivery of advanced cloud solutions. SZTAKI will integrate ELKH Cloud, the general-purpose research cloud computing system of the Hungarian Academy of Sciences. The Council also approved the participation of ACOnet (Austria) and Vilnius University (Lithuania) starting from 2022.

2021 starting membership

- EISCAT Scientific Association (Jan 2021)
- EMSO ERIC (Jan 2021)
- SeaDataNet / MARIS B.V. (Jan 2021)
- SZTAKI (Jan 2021)

2021 approved membership

- aconet (Jan 2022)
- Vilnius University (2022)

Highlights

4
new participants joining the EGI Council

2
new approved memberships

4
new collaboration agreements

EGI joined **Global Open Science Cloud (GOSC)**, a new global initiative launched in 2021

EGI Federated Cloud has integrated clouds in **China and South Africa.**

Further expansion and innovation of SeaDataNet as a major stakeholder and player in the European marine and ocean data space and towards the planned Digital Twin of the Ocean requires further development and adoption of e-services. Cooperation and synergy with leading European e-infrastructures such as EGI is a no-brainer. SeaDataNet has become a member of EGI to become better informed about technical and organisational developments at the e-infrastructure level, which might be relevant for the ocean and marine data space, and to become partners in several ventures, especially in the context of EOSC.

Dick Schaap

Managing director MARIS (Netherlands) and technical coordinator of SeaDataNet

A new EGI Governance framework for SMEs and Industry

The EGI Digital Innovation Hub Partnership established by the Council in 2021 is our new framework governing the EGI engagement with the private sector. The DIH offers three different levels of participation to meet different interests and needs:

- The Community level is the entry point to the EGI Community and brings partners in touch with our extensive network of research collaborations and innovation projects.
- The Content level partnership allows the private sector to receive support and innovate faster thanks to our services, solutions and know-how.
- The Federated level partnership allows technology and service providers to establish Collaboration Agreements with the EGI infrastructure for co-development and joint activities. With this type of partnership, allowing for expanded capacity and technical capabilities, EGI can better respond to the demand of its user communities.

The power of collaboration

In 2022, EGI signed the following collaboration agreements:

CNR-IIA, Institute of Atmospheric Pollution of CNR, Italy

We will contribute to a coordinated delivery, and scaling up for the GEO community in the context of GEOSS/EuroGEOSS.

WLCG, Worldwide LHC Computing Grid

We will consolidate the existing long-term framework of collaboration activities in preparation for the HL-LHC research infrastructure (Link)

BSUN, Black Sea University Network

EGI will facilitate the adoption of federated authentication, and authorisation, security and policies to facilitate the sharing of resources for education and research.

EOSC Compute Platform

We signed collaboration agreements with the national research clouds from Hungary, Georgia, Moldova, Latvia and Armenia to broaden the cloud compute network of the EOSC Compute Platform. They are enabling the exchange of virtualised applications and scientific datasets between the national clouds and the EGI-ACE infrastructure.

EGI is an active member of the Global Open Science Cloud (GOSC), an initiative launched in 2021 with the support of CODATA (Committee on Data of the International Science Council), encouraging international cooperation and interoperability between existing and emerging Open Science Clouds, (Link). In GOSC, EGI co-leads the Technical Infrastructure working group aiming at federating global e-Infrastructures to offer advanced computing, data and communications services. Thanks to GOSC, the EGI Federated Cloud grew its geographical reach with the integration of CSTCloud in China and IDIA in South Africa. Our shared aim in GOSC, which was in-depth discussed during the EGI 2021 conference, is to better support international collaborations of common interest and exchange federation best practices and policies.

Goal 6

Be a recognised foundation of the EOSC

EOSC (European Open Science Cloud) is the initiative where research communities and infrastructures at the national and European levels are all coming together, united by their efforts to accelerate science. Modern science requires long-term access to data, scientific applications, publications and other research outputs. EGI expects EOSC to improve and expand its current ability to engage researchers thanks to better and more coordinated processes uniting the efforts of all the European research infrastructures. Through our service provision, knowledge, skills, and involvement in the projects building EOSC, such as EGI-ACE, EOSC-Synergy and EOSC-Future, EGI can be truly considered one of the key pillars helping to realise EOSC.

The EOSC Compute Platform and EuroHPC

Research sector

Supporting project:

EGI-ACE

Within EOSC, the role of EGI is to deliver the EOSC Compute Platform as a dedicated decentralised and federated infrastructure where, with dedicated training and support, EOSC users can access, process and analyse open data.

The platform is built on top of the EGI infrastructure thanks to the facilities provided by the NGIs, and thematic data and applications delivered by research communities, in a joint partnership with EGI. Funded through the EGI-ACE project, the EOSC Compute Platform can host federated data space leveraging research and national investments and ensuring the sovereignty of data and digital infrastructures.

The Platform is built on hybrid facilities composed of cloud computing resources, High-throughput computing (HTC) sites, and High-Performance Computing (HPC) centres. Such facilities cover the full spectrum of compute-intensive open science, from data injection, cataloguing, processing and analysis to data sharing. We expect the integration of this platform with national HPC centres from our NGIs to further expand the ability to process data at different scales of parallelism.

It empowers users with higher-level services by easing the setup and operation of complex workflows, applications, containers, virtual research environments and data spaces on top of the hybrid infrastructure. E-infrastructure providers joining the EOSC Compute Platform can benefit from simplified integration with EOSC, streamlined user access handling and scalable resource allocation mechanisms, and various financial incentives.

EOSC Compute Platform: helping to realise EOSC in practice

EGI services received 75 access requests via the EOSC Marketplace in 2021, representing 30% of the total orders received in the whole EOSC Market place, and two of them are among the top 10 most demanded services in EOSC. The 'EGI Cloud Compute service' is the most ordered service in EOSC since January 2021 (with 34 orders). The popularity of EGI Cloud Compute service demonstrates the demand for compute capacity in the context of the EOSC.

EGI-ACE: Impact

Since the beginning of the project, EGI-ACE has received more than 30 user applications and is currently supporting 67 different user communities. The scientific collaborations from EGI-ACE consortium deliver 18 data spaces and processing platforms to EOSC. 30 additional thematic services, from EGI partners are also supported. Approximately 30% of those 67 communities are 'communities of practice', 30% are H2020 projects, 20% research infrastructures, 10% from projects involving the long tail of science, and 6% SMEs.

EGI-ACE services have been used by 77,000 users since the start, with approximately half of those coming from Europe. The majority of these users (65,000) are researchers, who interact with the thematic services delivered by the project consortium. An additional number of 11,000 researchers are the users of those services delivered by external partners and initiatives while another 1000 expert users interact with the Compute Platform services to set up new tools.

Finally, the project has delivered over 42 million CPUhours of computing (35 million cloud; 7 million HTC). Among those, 20 million were delivered with VA, 20 million with policy-based access, 2 million with pay-for-use, i.e. the user community brought funding for the resources).

Be a recognised foundation of the EOSC

The EOSC Core Platform

Research sector

Supporting projects:

The EOSC-Core provides a set of internal services which allow EOSC to operate and enable the different scientific communities to find resources for research and make their content available to other communities at a central location.

Via EOSC-hub and EOSC Future, EGI applies its expertise in federation governance, best practices in service management and business models and contributes to the development and the day-by-day provisioning of the EOSC Core services and central processes. Such processes include the EOSC Marketplace, AAI Federation with the EOSC Core Infrastructure AAI proxy, Accounting, Collaboration Systems, Configuration Management, the EOSC Core helpdesk, order management and service management.

The EGI members contributed to the definition of the Minimum Viable EOSC to:

- advance the specifications of the EOSC architecture, the design, implementation and operations of the EOSC Portal,
- provide recommendations for the business models which could be adopted to realise the EOSC, and
- define the high-level EOSC Rules of Participation.

Research sector

Private sector

Supporting project:

EOSC DIH

EGI coordinates the EOSC Digital Innovation Hub (DIH), the collaboration framework for innovation with industry by leveraging EOSC services and data. Bringing together industry and the scientific community, the EOSC DIH community will act both as a supplier and a user of EOSC to further stimulate cross-fertilisation across sectors, promoting innovation and digitisation of SMEs, and showcasing the innovation potential of the EOSC for the private sector.

During 2021, the EOSC DIH worked on the definition of its strategy with the new partners under the EOSC Future project. A collaboration with INFRAEOSC 07 projects (DICE, OpenAireNexus, C-Scale and EGI-ACE) to onboard their business-oriented services into the EOSC DIH service offer was established. The EOSC DIH launched a new onboarding campaign and continued the management of the lifecycle of four business pilots.

The EOSC Interoperability Framework

Supporting projects:

EGI contributes to the definition of guidelines that promote standards and community best practices within EOSC with a focus on Trust and Identity, federated computing and storage and federating service. Because EOSC is a federated infrastructure, interoperability is essential to deliver services to users and enable sharing and composability of resources.

Since September 2021, EGI has been co-chairing the Technical Alignment with Science Projects Task Force (TF) in the EOSC Future project. As part of this TF, EGI coordinates the integration of the Science Projects with the EOSC core services. Finally, EGI and GEANT have been co-leading the project Technical Coordination Board.

EOSC Policy Framework

Research sector

Public administration

National policies and strategies relevant to the EOSC need to be aligned and, if possible, coordinated to provide services and support researchers across borders and disciplines effectively. The EOSC Synergy project and other national EOSC projects participated by various EGI members contributed to this goal by carrying out a gap analysis and formulating policy recommendations, both at the national and the European level, in areas including open science strategies, PIDs, funding policies, and access provisioning policies.

The South African Department of Science and Innovation (DSI) has convened a dialogue to follow up on the recommendations of the South African Open Science Framework report, at a time when international Open Science Cloud initiatives are developing to empower global and equitable research collaboration. The EGI Foundation committed expertise to the DSI on the establishment of a South African Open Science Cloud (SAOSC).

Supporting project:

Our Plans

As a coordinating body of the EGI initiative, the foundation's mission is to enable the EGI Federation to serve international research and innovation together. Our plan has been shaped into five main areas for the coming year to uphold this mission. We identified priorities for change while continuing the delivery of our day-to-day activities.

Employees

In a very short period, the number of employees almost doubled in a context where we were all forced to work remotely due to the pandemic situation. The teams quickly adapted to this new challenge. We now operate as a distributed organisation with part of the staff based at the Amsterdam office, and the other part working remotely from different European countries. The priority will be to improve the way of working as a distributed organisation, develop a talent management program, and grow the skills and competencies needed for the upcoming challenges.

Organisation

The focus will be on improving agile planning and operations to ensure that the organisation is faster in reacting and adapting to opportunities. Also, there will be further development of internal capabilities to support the EGI Federation in tapping into procurement with opportunities.

User communities

To better support user training, the foundation will launch an EGI Training Management System where we collect the diverse training material from the EGI community and enable easier access and consumption; the number of engaged user communities will expand thanks to the currently funded projects; also there will be consolidation of the user support network; finally, the EGI Digital Innovation Hub will be officially launched.

Products and services

Following the new service strategy for 2022-2024 (Link), the foundation will support the development of service and technical roadmaps; also, the project portfolio management will seek opportunities for fast-tracking the implementation via dedicated funding; finally, there will be the integration and validation of HPC systems in the EGI Federation as well as further work on data spaces innovation.

Federation

As the number of organisations joining the EGI Federation is growing, we aim to create a knowledge base for current and new participants providing the information on what to organise in their domain to make their membership more efficient; also, there will be a focus on seeking new members; finally, we will further consolidate our key partnerships including the continued contribution to the Global Open Science Cloud initiative.

Finances

Items	Actual 2021 (€)
Projects Income	3.243.866
Other Income 1	(Interest) 7.194
EGI.eu Participants	1.160.000
TOTAL INCOME	4.411.060

Expenditure

Items	Actual 2021 (€)
Personnel	3.643.453
Staff Development	35.913
Operating costs Core activities grant to Council Strategic Innovation Funds	 568.466 4.940
ICT (inc depreciation costs)	102.782
Facilities [1]	158.171
Non Project Travels	8.997
Project Travels	3.593
General expenses	108.652
Project central budget	101.792
VAT	66.776
TOTAL	4.803.535

Expenses 2021

€ 4.803.535

Income 2021

€ 4.411.060

Reserve 2021

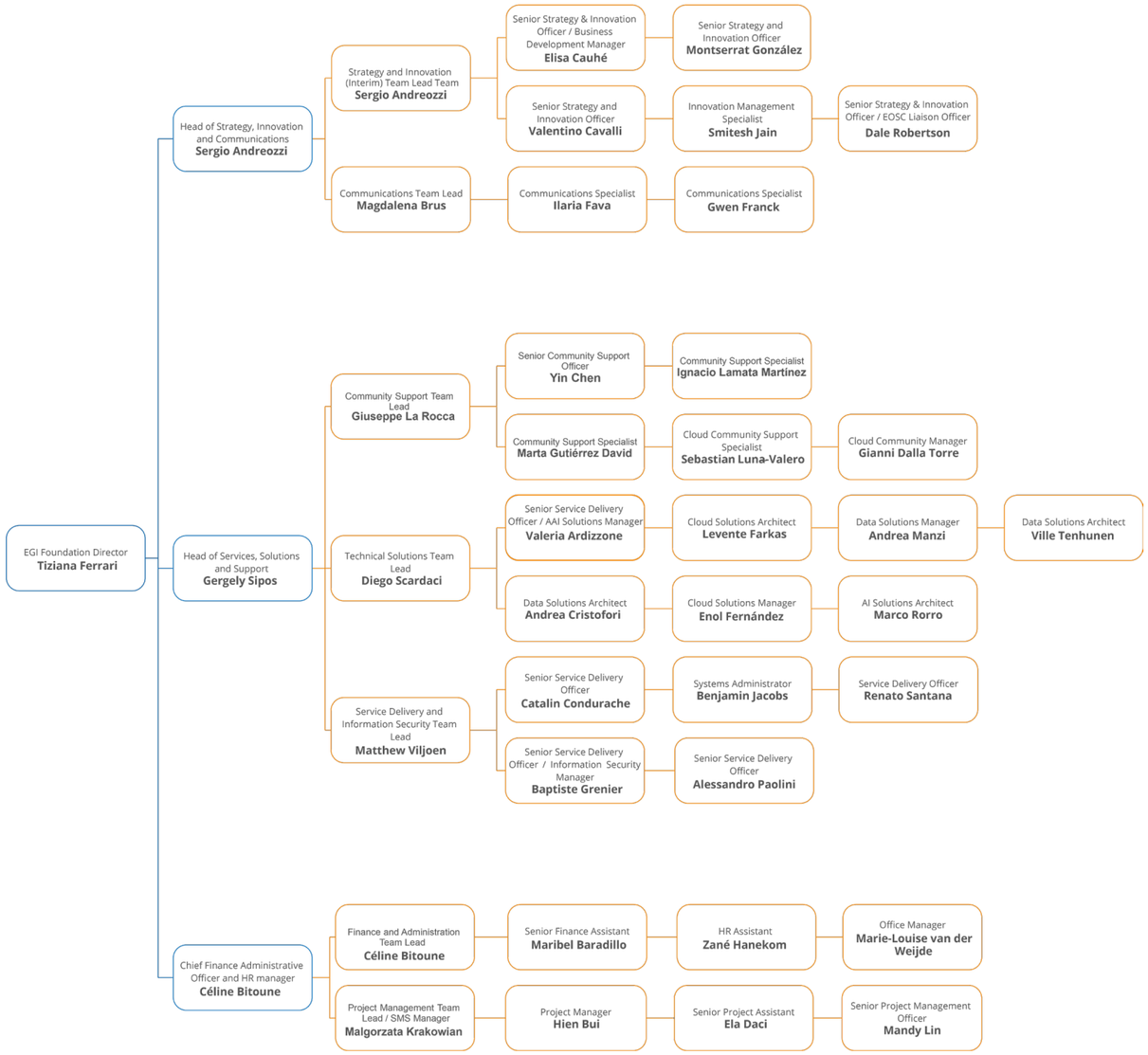
€ 1.998.065

Our Team

The EGI Foundation is the coordinating body of the EGI Federation. It was established in 2010 with a headquarters in Amsterdam, Netherlands.

The foundation staff is distributed across many countries and it ensures that the internal capabilities sustaining the federation are delivered professionally.

Our team is distributed in the following countries



Glossary

The entire glossary can be found at go.egi.eu/glossary

- **EGI:** Abbreviation of EGI Federation. Note: if EGI is mentioned, this only refers to the EGI Federation.
- **EGI Federation:** EGI Foundation, EGI Foundation Participants and Associated Participants, their linked organisations (e.g. service and resource providers) represented within EGI Foundation that contribute to the objectives of the foundation.
- **EGI Foundation:** The legal entity whose objective is to coordinate and develop, in collaboration with its Participants, the EGI infrastructure that provides long-term distributed compute and storage resources for performing research and innovation activities.
- **EGI community:**The EGI Federation plus the served research communities, the technology providers or any other organisation linked via an agreement with the EGI Foundation and contributing to the mission of the EGI Federation.
- **EOSC:** Initiative to offer researchers a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines.
- **HPC:** Abbreviation of High-Performance Computing. A computing paradigm that focuses on the efficient execution of compute-intensive, tightly-coupled tasks.
- **HTC:** Abbreviation of High-Throughput Compute. A computing paradigm that focuses on the efficient execution of a large number of loosely-coupled tasks.
- **NGI:** The national federation of shared computing, storage and data resources that delivers sustainable, integrated and secure distributed computing services to the national research communities and their international collaborators. The federation is coordinated by a National Coordinating Body providing a single point of contact at the national level and has official membership in the EGI Council through an NGI legal representative. Note: the name comes from "National Grid Infrastructure", which is now deprecated.
- **Virtual Organisations (VO):** A group of people (e.g. scientists, researchers) with shared interests and requirements, who need to work collaboratively and/or share resources (e.g. data, software, expertise, CPU, storage space) regardless of geographical location.

Key Publications

Strategy 2020-2024

An overview of the EGI Federation strategy for 2020-2024.

Link

Service Strategy 2022-2024

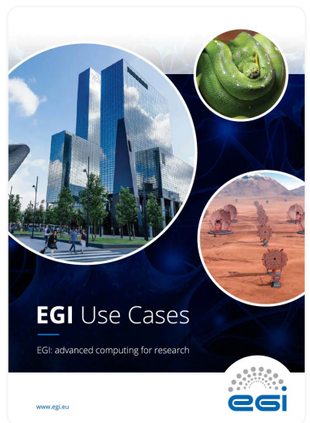
This report describes the service strategy of the EGI Federation for the period 2022-2024.

Link

EGI support for Research Infrastructures

This report provides a selection of collaborations through which EGI support the setup and operation of European Research Infrastructures.

Link



EGI Use Cases

This report provides a collection of the most significant use cases from EGI.

Link

Joining the EGI Federation - brochure

Link

EGI Federation Annual Report 2020

The annual report 2020 provides an extensive overview of the results that have been achieved through the collaborative efforts in 2020.

Link

Acknowledgements

We are grateful to all individuals who contributed to this Annual report, but most importantly, the advancements of EGI federation. With a special thanks to EGI Foundation and our federation members.

We would also like to thank the European Commission for the trust and funding received to support our work.

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