



EGi Annual Report 2022

Embracing Support, Collaboration, and
Innovation with the Research communities

egi.eu

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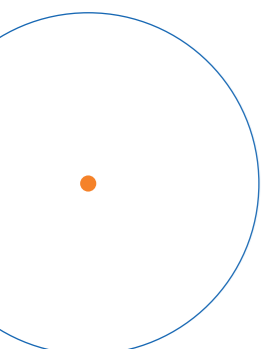
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Foreword



Tiziana Ferrari
Director of the
EGI Foundation

2022 proved to be a special year for the EGI community, marking major milestones achieved by our members, EGI user communities, and partners. The research data centres of our federation assisted over 84,000 researchers (+5,900 new users in 2022) across 138 countries in their daily data processing and analytics tasks, resulting in the publication of over 1,790 research papers specifically during this year.

40 new research collaborations responded to our Open Call programme in the EU funded EGI-ACE project in 2022, and the

project is currently supporting 144 different user communities. These collaborations were able to thrive and flourish thanks to the invaluable assistance provided by our technical support network, a fundamental component of our infrastructure. As we move forward, our strategic vision involves solidifying and expanding this network in the years to come. The success of our efforts hinges upon the trust placed in us by research communities that actively engaged in 36 projects throughout 2022, and on the digital capabilities of our National Grid Initiatives (NGIs). Their dedication to technological innovation enabled them to enhance their services and deliver state-of-the-art solutions to meet the evolving needs of the research community.

I am also particularly proud of how collaboration and support towards European research infrastructures has been growing thanks to research projects and European Open Science Cloud integration actions. 6 new research infrastructures on the

ESFRI roadmap were engaged this year, and 48 pan-European research collaborations have integrated research data and thematic applications with the EGI infrastructure.

2022 was also a year tinged with sadness as we witnessed the military aggression in Ukraine, leading to the interruption of operations for our partner, the Ukrainian National Grid. In light of these circumstances, we called upon all scientists to stand up for peace and collaboration.

I am delighted to share that my term as EGI Foundation Director has been extended until 2027. It is my heartfelt dream that in the years to come, Europe will evolve into a stronger and safer place for everyone, largely due to the remarkable contributions of our dedicated researchers and the unwavering support provided by the EGI Federation.

Foreword



Arjen van Rijn
EGI Council Chair
2019 - 2022

As I reflect upon my tenure as the EGI Council Chair, which concluded at the end of 2022, I am filled with a deep sense of gratitude and pride for the remarkable journey we embarked upon together. It has been an incredible honor to serve in this role and witness our community's tremendous growth and achievements.

During my two terms from 2019 to 2022, we worked tirelessly to reinforce the position of the EGI Federation in the realm of advanced computing and data analytics and to strengthen

our collaborations with e-Infrastructures and research infrastructures jointly supporting the implementation of the European Open Science Cloud within projects such as EOSC-hub, EOSC Enhance, EGI-ACE and EOSC Future. Collectively, we have made significant strides, leaving an enduring impact on research and scientific progress worldwide.

Looking back at 2022 in particular, it was a year marked by major milestones and exceptional collaborations. One highlight that stands out is the extraordinary achievement of delivering over 7 billion CPU hours through the High-Throughput Computing platform. This remarkable accomplishment demonstrates the power and scalability of our infrastructure, providing researchers with the computational resources they need to accelerate their work and make groundbreaking discoveries. I am also delighted to announce the expansion of our community with the inclusion of Austria (ACONET Verein), Lithuania (University of Vilnius) and National Bioinformatics Infrastructure of

Sweden (NBIS) as our newest members. The addition of these countries further strengthens the EGI and reinforces our commitment to fostering collaborative efforts. I extend a warm welcome to our new members and eagerly anticipate the valuable contributions they will bring to our collective pursuits.

As I pass the torch to the incoming Council Chair Volker Guelzow, I offer my warmest wishes and heartfelt congratulations. Your chairmanship and vision will undoubtedly steer the EGI community to new horizons of success and innovation. May you find fulfilment in this role, as I have, and may you inspire and unite the EGI community on the path to even greater achievements. Through our collaborative efforts, we have built a legacy of excellence, fostering strong research connections and contributing to the advancement of science.

Key Highlights

January

The EGI Digital Innovation Hub (EGI DIH) partnership is launched

Austria (ACONET Verein) and Lithuania (University of Vilnius) join the EGI Foundation

March

The Ukrainian National Grid stops operations as a consequence of the military aggression of Ukraine. EGI calls for all scientists to stand up for peace

April

Back in April 2004, CERN published the first usage accounting records, and a new era for data-intensive computing starts

June

The Green Deal Data Space coordination action has commenced

August

The data centres collectively deliver 650M CPU hours/month, a record in the history of our federated infrastructure

September

EGI2022 conference in Prague

The innovation programme on digital twins, AI and federated data management for marine science starts with the interTwin and iMagine projects

November

National Bioinformatics Infrastructure of Sweden (NBIS) joins EGI and SZTAKI (Hungary) becomes a full member

The success of the EGI Community webinars continues with 164 participants from 62 countries learning about data analysis of marine data from SeaDataNet and Argo

December

New record: EGI has delivered more than 7B CPU Hours through the HTC platform

40 scientific use case applications were received through the EGI-ACE open call

2022

EGI Federation 2022 in numbers

1790¹
Enabled articles

7.1B
HTC CPU hours consumed

29
EGI Council participants

84.000
Users

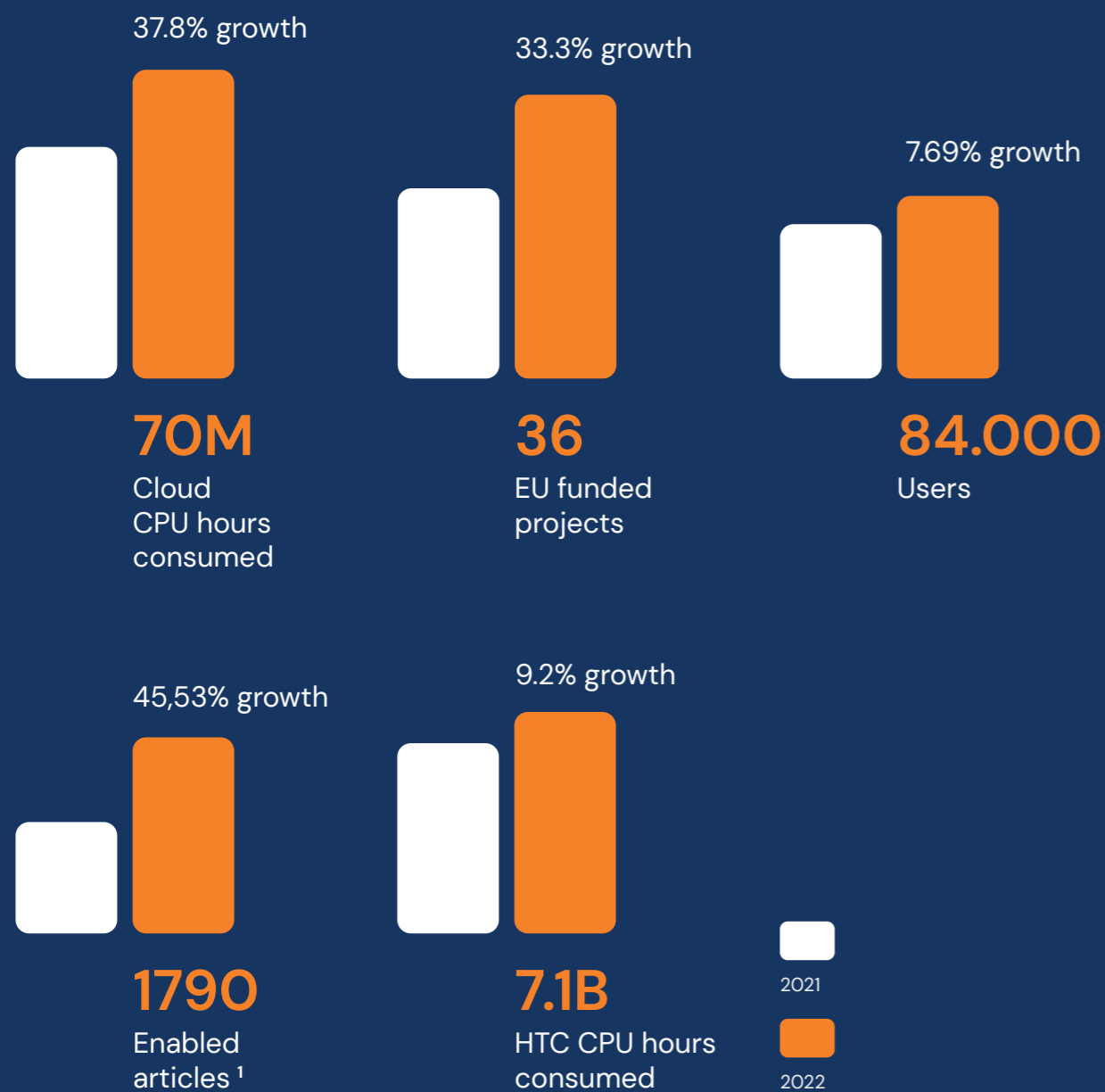
70M
Cloud CPU hours consumed

407M
Computational jobs

36
EU funded projects

¹The number of publications is based on data provided by OpenAIRE Explore.

Our growth in numbers



¹The number of publications is based on data provided by OpenAIRE Explore.

About EGI

EGI – Advanced computing for research

At EGI, we firmly believe that research is the driving force behind human progress. We aim to empower data-intensive research by providing a comprehensive suite of advanced computing services. Our offerings encompass high-throughput and cloud computing, storage and data management, analytics, consultancy and

support, as well as training and co-development opportunities. Through continuous innovation, we enhance our services and technology, fostering international collaborations, sharing knowledge, and creating avenues for professional growth and acquiring expertise.

Our Guiding Principles

Vision

EGI

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

Mission

EGI Federation

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

EGI Foundation

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 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

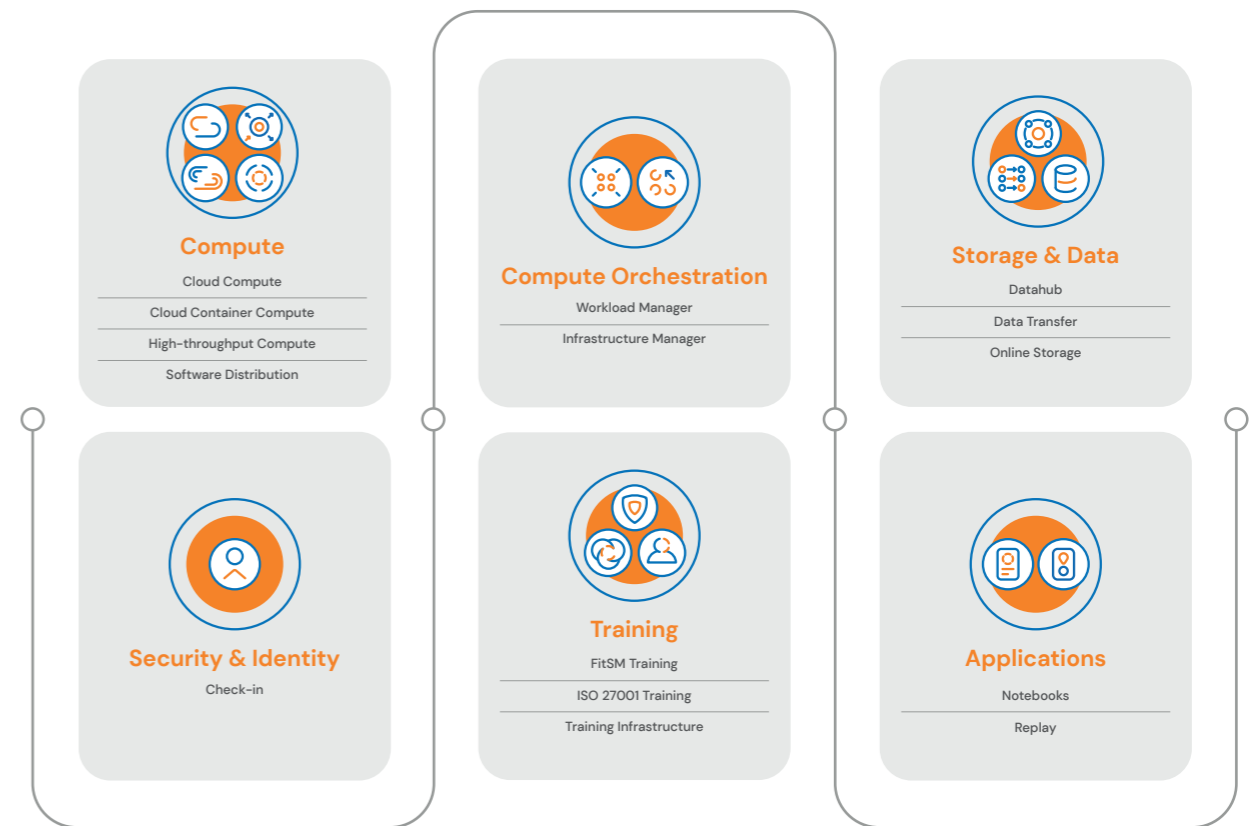
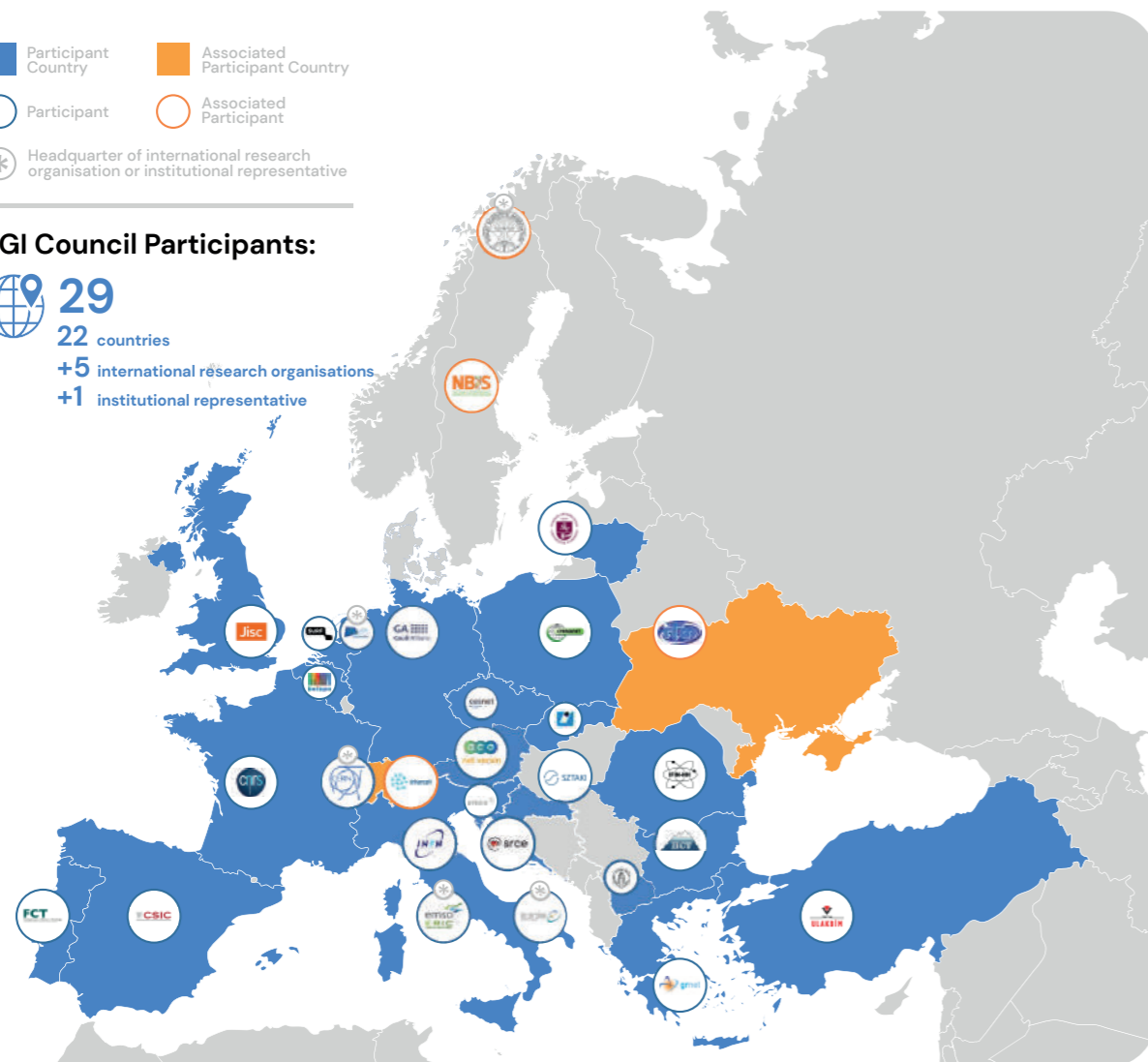
Our business engagement programme is organised within EGI DIH, a virtual space where companies and technical service providers meet to test solutions before investing.

Our Members

- Participant Country
- Associated Participant Country
- Participant
- Associated Participant
- * Headquarter of international research organisation or institutional representative

EGI Council Participants:

- 29 countries
- +5 international research organisations
- +1 institutional representative

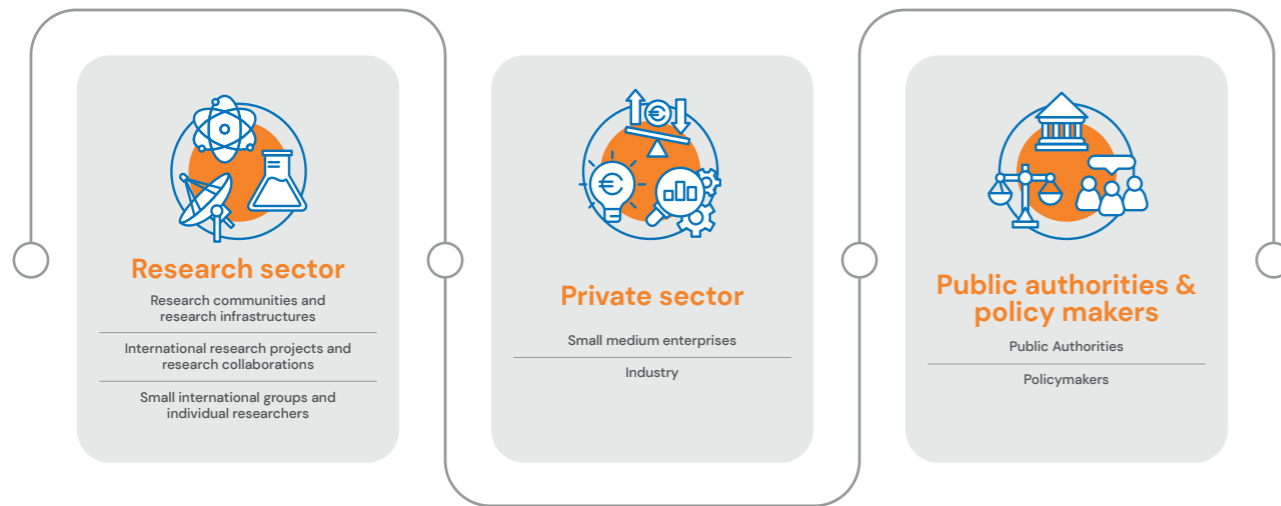


Services for Research

You can read in detail about all the services on our [website](https://www.egi.eu/services/research/)².

² <https://www.egi.eu/services/research/>

Our Users



Key Numbers

84.000

Total number of users

5.900

New users in 2022

Top 5 cloud communities

WeNMR	NBIS	Terradue	BioMed	EMSO-ERIC
+31K	+21K	+2.8K	+1.4K	+1.2K

By number of registered users

Top HTC community

WLCG
+11.3K

Essential partners and the largest adopters

Research infrastructures (RI) and research communities

23
new scientific communities

48
RIs using our services

22
RIs on ESFRI roadmap

6
new RIs engaged in 2022



Physical sciences & Engineering


Landmarks
CTA, ELI ERIC, HL-LHC, SKAO, European XFEL

Projects
KM3NeT 2.0



Data Computing & Digital RIs

Projects
SoBigData++, EBRAINS, SLICES



Social & Cultural Innovation


Landmarks
CLARIN ERIC, DARIAH

Projects
E-RIHS, OPERAS



Environment

Landmarks
EISCAT_3D, EMSO ERIC, LifeWatch ERIC



Health & Food

Landmarks
ELIXIR, INSTRUCT ERIC, BBMRI, EU-OPENSOURCE ERIC

Projects
EMPHASIS, METROFOOD-RI

ESFRI research infrastructures supported by EGI

New RIs engaged in 2022

EGI Federation member

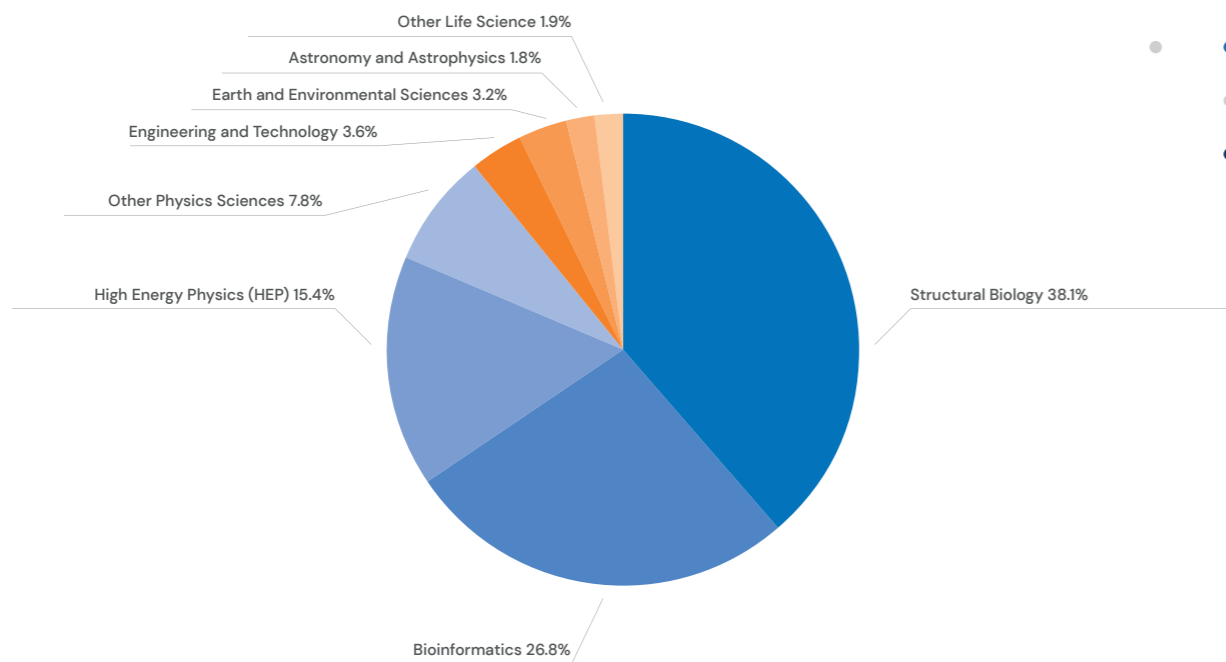
EGI Cloud federation user groups

45
Active Service Level Agreements using capacities from 14 federated research clouds

+42.4%
increase in Cloud CPU/h consumption in 2022

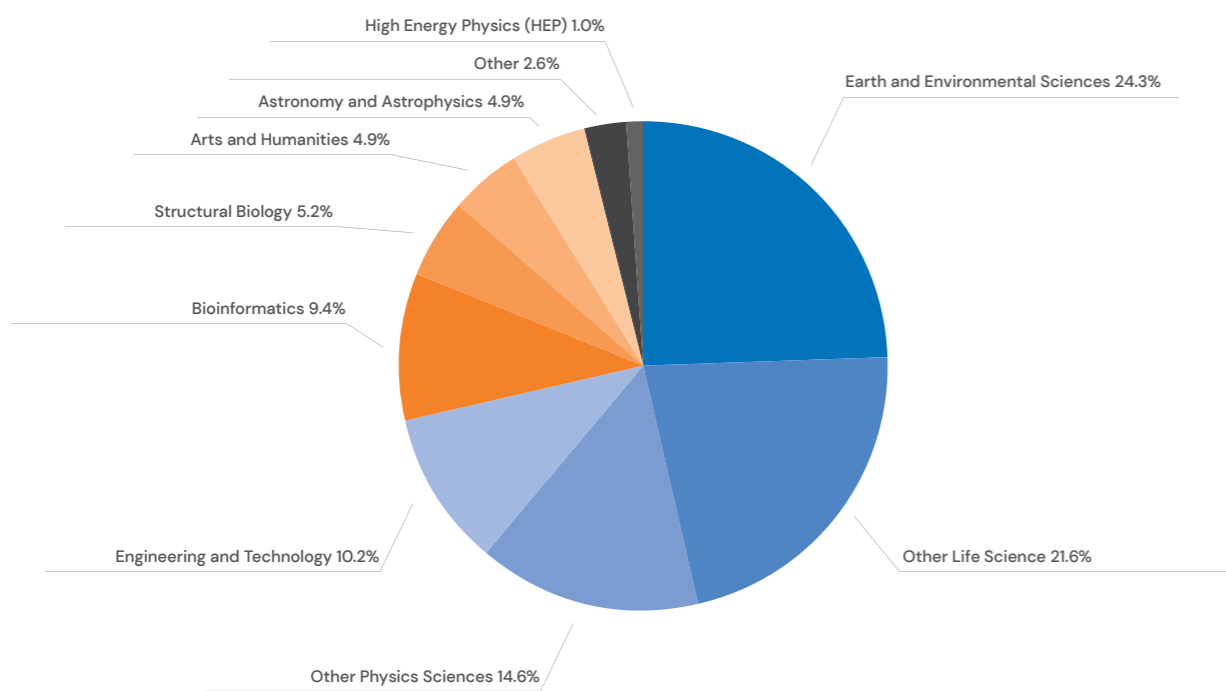
Top 5 Cloud compute user communities based on CPUh consumption:

- | | |
|--|--|
| <p>perla-pv.ro 3.2M^{CPU/h}</p> <p>Molecular dynamics simulations to develop efficient, stable, reproducible perovskite solar cells.</p> | <p>vo.panosc.eu 3.1M^{CPU/h}</p> <p>Piloting data transfer activities in the framework of the PaNOSC EC-funded project.</p> |
| <p>emso-eric 3.0M^{CPU/h}</p> <p>Provide access to curated data and offer high-quality services to a large and diverse group of users, from scientists and industries to institutions and policy makers, for defining environmental policies based on scientific data.</p> | <p>fusion 2.8M^{CPU/h}</p> <p>Uses computing resources to better understand the plasma instability, design and development of materials which can withstand the hostile environment within a fusion reactor.</p> |
| <p>eli-np.eu 2.1M^{CPU/h}</p> <p>Running simulation to better describe the structure and dynamics of biomolecules.</p> | |



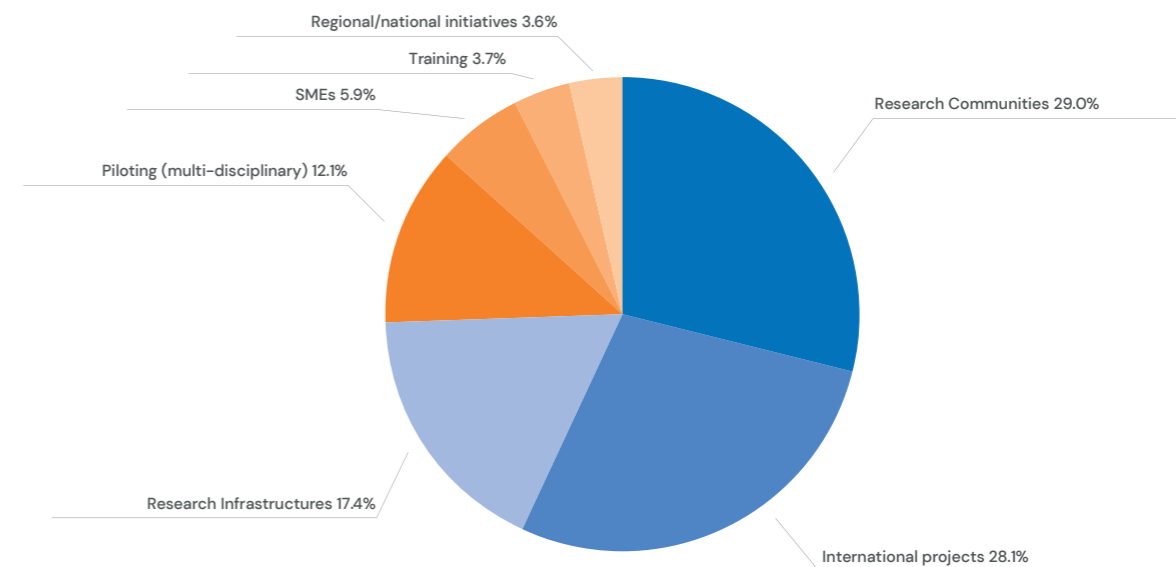
Spread of EGI users across disciplinary areas

In 2022, the Medical and Health Sciences domain experienced a significant increase in users, including a notable contribution from the WeNMR community. This growth was driven by the additional resources allocated by EGI to support NBIS, resulting in a boost in the number of users supported by the community. Furthermore, BioISI also saw a substantial rise in users in 2022, thanks to the computational resources provided by EGI in response to user requests.



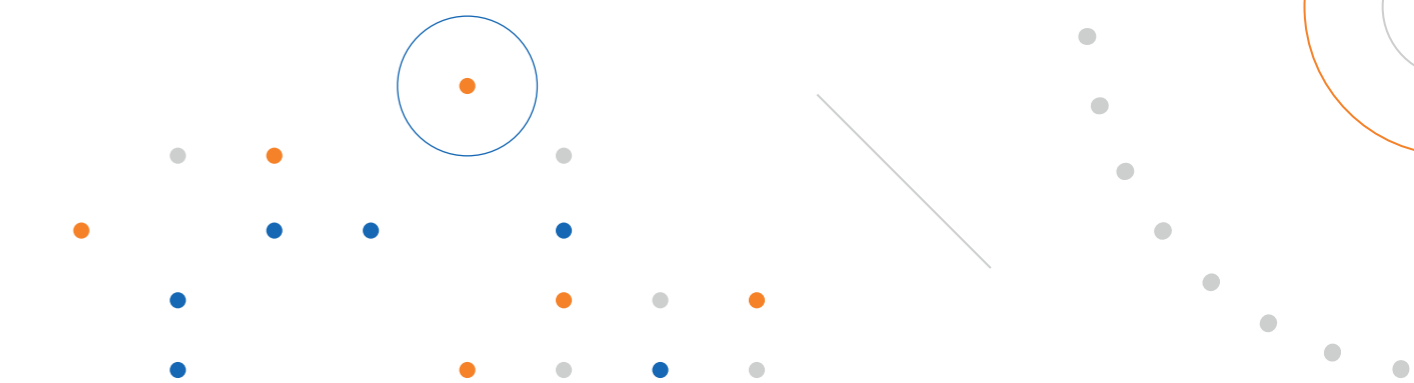
Spread of EGI Cloud CPU-hour use across disciplinary areas

The growth in CPU hours within the Medical and Health Sciences discipline area directly correlates with the increase in the number of users, as mentioned earlier.



Spread of cloud CPU/h across type of activity

In 2022, the EGI Federation launched a successful campaign to promote its open call for scientific use cases. The campaign effectively targeted H2020 projects in need of AI/ML solutions, research infrastructures, scientific communities with big data analytics needs, and even reached out to the business sector through the partnership with EOSC DIH. As a result, the campaign broadened the reach of the EGI open call, generating interest from diverse stakeholders.



Our projects

To accomplish our strategic objectives and meet the needs of our expanding user base, EGI actively collaborates with or provides support to a range of EU-funded projects.

In 2022, EGI kick-started two new flagship projects interTwin & iMagine.

36

Projects running in 2022

9

New projects initiated in 2022



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 Thematic services

to integrate domain-specific solutions, enabling 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 Thematic services and contributions to the EOSC ecosystem.

144 Use case applications

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



Flagship project: InterTwin

interTwin will co-design and implement the prototype of an interdisciplinary Digital Twin Engine (DTE) – an open source platform based on open standards that offers the capability to integrate with application-specific Digital Twins (DTs).

Its functional specifications and implementation are based on a co-designed interoperability framework and conceptual model of a DT for research – the DTE blueprint architecture.

Timeline
1 Sep 2022 – 31 Aug 2025

Total Budget
€ 12,379,251

EGI Budget
€ 1,817,118

Website
<https://www.intertwin.eu/>

EGI's Role

The EGI Foundation coordinates the project while participants contribute to use cases, the technical architecture definition, development and validation focusing on the requirements of scientific Digital Twins from High Energy Physics, Radio Astronomy, Gravitational Wave Astrophysics and Environmental sciences.

Key numbers

10 Resource Providers

are delivering cloud, HTC, and HPC resources and access to Quantum systems.

11 Technology providers

are delivering the Digital Twin Engine infrastructure and core capabilities.

14 Community representatives

from 5 scientific areas are bringing requirements and developing DT applications and thematic modules.



Flagship project: iImagine

iImagine provides a portfolio of image datasets, high-performance image analysis tools empowered with Artificial Intelligence, and Best Practice documents for scientific image analysis. By building on the compute platform of the European Open Science Cloud (EOSC) the project delivers a generic framework for AI model development, training, and deployment.

The project supports eight use cases in platform adoption, addressing various challenges in marine and freshwater research: water pollution mitigation, biodiversity and ecosystem studies, climate change analysis and beach monitoring. 5 of the 8 cases will set up AI-powered image analysis services in EOSC and AI-On-Demand.

Timeline
1 Sep 2022 – 31 Aug 2025

Total Budget
€ 4,500,000

EGI Budget
€ 829,586,25

Website
<https://www.imagine-ai.eu/>

EGI's Role

The EGI Foundation coordinates the project and EGI Federation members deliver compute-storage and AI platform services for scientists.

Key numbers

8 Use cases

addressing marine and freshwater research, and its technical implementation.








6 Research Infrastructures

and relevant EU initiatives in the marine and inland waters domains involved in the project





1 iImagine AI Platform

connected to EOSC and AI-On-Demand, providing access to a diverse portfolio of AI-based image analysis services and image repositories from multiple RIs.

Our Projects

 Research sector					
	SAOSC	01 Sep 2022	31 Aug 2022	Ended	
	ESA ITT Open Earth Engine	01 Sep 2020	01 Sep 2022	Ended	
	EOSC Synergy	01 Sep 2019	31 Oct 2022	Ended	
	ExPaNDS	01 Sep 2019	31 Oct 2022	Ended	
	PaNoSC	01 Dec 2018	30 Nov 2022	Ended	
	EOSC Enhance	01 Dec 2019	30 Nov 2022	Ended	
	OPERAS-P	01 Jul 2019	30 Jun 2022	Ended	
	LABPLAS	01 Jun 2022	31 May 2025	https://labplas.eu	
	EOSC Future	01 Apr 2022	30 Sep 2023	https://www.eoscfuture.eu	
	PITHIA-NRF	01 Apr 2022	31 Mar 2025	https://pithia-nrf.eu	
	C-SCALE	01 Jan 2022	30 Jun 2023	https://c-scale.eu	
	LETHE	01 Jan 2022	31 Dec 2024	https://www.lethe-project.eu	
	SoBigData++	01 Jan 2020	31 Dec 2024	http://project.sobigdata.eu	
	TRIPLE	01 Oct 2019	31 Mar 2023	project.gotriple.eu	
	EOSC-life	01 Mar 2019	28 Feb 2023	https://www.eosc-life.eu	
	TANGO	01 Sep 2022	31 Aug 2025	https://tango-project.eu/	
	AI4Europe	01 July 2022	31 Dec 2025	https://www.ai4europe.eu/ai-community/projects/ai4europe	

 Private sector					
	BD4NRG	01 Jan 2022	31 Dec 2023	http://www.bd4nrg.eu	
	StairwAI	01 Jan 2022	31 Dec 2023	https://stairwai.nws.cs.unibo.it	
	EUHubs4Data	01 Sep 2020	31 Dec 2023	https://euhubs4data.eu/	
	DIGITbrain	01 Jul 2020	31 Dec 2023	https://digitbrain.eu	
	UNLOCK CEI	01 June 2022	30 Nov 2024	https://eucloudedgeiot.eu/	

 Public administration					
	PolicyCLOUD	01 Jan 2020	31 Dec 2022	Ended	
	DECIDO	01 Mar 2022	29 Feb 2024	https://www.decido-project.eu	
	AI4PublicPolicy	01 Mar 2022	29 Feb 2024	https://ai4publicpolicy.eu	

 Crosscutting					
	H-CLOUD	01 Jan 2020	31 Mar 2022	Ended	
	EOSC-Focus	01 Apr 2021	30 Sep 2023	https://www.egi.eu/project/eosc-focus/	
	PrePAI	01 Nov 2022	31 July 2023	https://www.egi.eu/project/pre-pai/	
	GREAT	01 Sep 2022	29 Feb 2024	https://www.greatproject.eu/	
	DSSC	01 Oct 2022	31 May 2025	https://dssc.eu/	
	HealthyCloud	01 Mar 2022	31 Aug 2023	https://healthycloud.eu	

See all projects

egi.eu/projects/

Progress towards strategic goals

01

Be a trusted service & technology partner for research and innovation

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02

Evoluce the service offering to meet the needs of researchers

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03

Improve skills of users & operators and maturity in service providers

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04

Align business models to support cross-border service provisioning

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Strengthen the governance and broaden the international presence

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Be a recognised foundation of EOSC

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GOAL

01

Be a trusted service & technology partner for research and innovation

Goal 1

Be a trusted service & technology partner for research and innovation

In 2022, the EGI engagement programme proved to be highly successful in bringing new opportunities to our community and helping us expand our partner and user networks. We actively collaborated with 198 scientific communities, including 21 new leads, which has helped us to achieve significant growth.

Highlights

198

Scientific communities engaged

21

New community leads

6

New partnerships with RIs listed on the ESFRI Roadmap

Expanding & deepening our strategic partnerships



Research sector

EGI primarily partners with research infrastructures (RIs) and large-scale European scientific networks. In 2022, we established partnerships with 6 RIs from the ESFRI roadmap, raising the total number of ESFRI partners of EGI to 22.

New Partnerships with ESFRI research infrastructures

METROFOOD-RI

Food and Nutrition Sciences

Aims to establish an RI for promoting Data Space for the Food domain and connect it with EOSC. METROFOOD is seeking EGI's assistance to identify the main components and services for the setup and sustainable operation of the technical METROFOOD infrastructure.

e-RIHS

Heritage Science

The European Infrastructure for Heritage Science aims to offer a scalable web portal with applications and datasets to help scientists implement standardised analytical techniques used in characterising cultural heritage objectives. The prototype release of this portal was deployed on the EGI Cloud Infrastructure in 2022, offering access to 15,000+ datasets with their metadata.

Instruct-ERIC

Structural Biology

Started collaborating with EGI to host the ARIA in the EGI cloud and reach new scales of delivery. ARIA is a collection of cloud services Instruct-ERIC provides to several research infrastructures from different disciplines for research access proposal and access management.

EU-OPENSREEN-ERIC

Chemical Biology

Aims to establish centralised storage within the EGI infrastructure to facilitate collecting and sharing cell painting data with scientific partners. EGI set up a dedicated space within the EGI DataHub service, allowing multiple institutes to share and access data in a controlled manner through EGI Check-in.

EBRAINS

Health

Works on developing Virtual Research Environments for EU researchers from the EOSC-related 'Virtual Brain Cloud' and 'eBRAIN-Health' projects. EGI contributes to the pool of cloud resources to deploy and operate the VREs.

SLICES

Digital Technologies

Aims to establish an infrastructure for computing and communication experimental studies. At the end of 2022, EGI, SLICES, SoBigData and EBRAINS started collaborating on green computing, with the ambition to identify and implement coherent approaches to reduce the environmental impact of ICT services in pan-European federated infrastructures.

Elevating Science to the next level

In addition to partnerships with new ESFRIs, the year 2022 marked a significant advancement in providing support for research communities that were already engaged. The year witnessed several remarkable achievements in this regard, some of which are highlighted below as success stories.

Agriculture

EMPHASIS

ESFRI research infrastructure

With the EGI's support, the RI is implementing an e-infrastructure for plant phenotyping. The services used by EMPHASIS spawn from the AAI, to Cloud Compute and DataHub.

With the support of EGI, instances of the open-source Phenotyping Hybrid Information System (PHIS) were deployed in the EGI Infrastructure. More than 200K data and more than 10K images are declared with their associated metadata in EGI for sharing and reusing data in the plant phenomics community.

In 2022, the plant phenotyping community consumed a total of **921K Cloud CPU hours**.

Supported by:
CESNET (CZ), and IN2P3-IRES (FR)

Energy Saving

I-ENERGY: AI for Next Generation Energy

Horizon 2020 project

The objective of the I-ENERGY project is to develop and demonstrate innovative AI-as-a-Service Energy Analytics Applications and Digital Twins services through 9 pilots. With EGI's support, the I-ENERGY project successfully developed 16 AI services, which have the potential to change the energy industry by improving efficiency and reducing costs.

In 2022, a total of **653K Cloud CPU/h** were consumed. A total of **7 scientific publications** were submitted in 2022.

Supported by:
INFN-CLOUD-CNAF (IT)

Agriculture

Grapevine

Horizon 2020 project

Grapevine is set to develop a predictive model for grape disease prevention and control in the wine industry, using Machine Learning techniques. EGI's support enabled the adaptation of phenological, disease, and meteorological models to viticulture, resulting in a more effective response to pest treatment and reduced fungicide use. The decision support tool developed by the project can be potentially adapted to other crops, regions, and pests.

More than one year of meteorological predictions required the consumption of a total of **1M HTC CPU/h**. As a result of these efforts, **three research papers were produced**.

Supported by:
CESGA (ES)

Molecular Physics

Perovskite material studies

International research collaboration

Halide Perovskite (HPs) have been identified as one of the most promising materials in photovoltaic and light-emitting devices.

With the technical support of EGI, the collaboration was able to carry out multiple instances of molecular dynamics calculations in order to characterise the HP materials, interfaces and defects.

In 2022, a total of **3,2M Cloud CPU/h** were consumed by the study and **one publication showcasing** the results has been submitted.

Supported by:
CLOUDIFIN (RO)

Hydrology

DELTARES

Not-for-profit research institute

Thanks to the support of EGI, DELTARES could set up a Kubernetes cluster on the cloud resources to run simulation models of numerous water reservoirs worldwide and compare the results against satellite and other observations. The results have the potential to contribute to the UN State of the Water Report for 2022, demonstrating the significance of this research activity on a global scale.

In 2022, a total of **1,4M Cloud CPU/h** were consumed.

Supported by:
CESGA (ES)

Astronomy

LOFAR Science Processing

International research collaboration

Supported by EGI, the Astronomy community completed the integration of the LOFAR Science Processing Data Space with several components of the EOSC Compute Platform, including AAI, and HTC. The first release of the Data Space was onboarded in the EOSC Portal.

A total of **1.6 M CPU hours** and **150 TB of storage** were consumed by LOFAR from the SURF site in 2022.

Supported by:
SURF (NL)

Medical and Health Sciences

Biomed

International research collaboration

Biomed is an international Virtual Organisation that supports the Life Sciences community, particularly in medical image analysis, bioinformatics, and drug discovery. Its flagship science gateway, the Virtual Imaging Platform (VIP), offers researchers access to multiple applications and vast storage and computing resources. These are provided by the Biomed EGI VO with no required technical skills beyond the use of a web browser.

In 2022, a total of **3M HTC CPU/h** were consumed by the biomed community (**+843% growth compared to 2021**)

Supported by:
BEIJING-LCG2 (CN), CESNET-MCC (CZ), CLOUDIFIN (RO), CREATIS-INRA-LYON (FR), IN2P3-IRES (FR), INFN (BA, CT, FE, PI, RM), NCG-INGRID-PT (PT), GRIF (FR), IN2P3-CPPM (FR)

Geoscience

Pangeo

International research collaboration

EGI has provided computational resources and technical support to deploy a Jupyterhub/Binder service Infrastructure for Big Data Geoscience in Europe. The newly deployed infrastructure has been successfully used for onboarding users during focused training events in 2022.

A total of **3 training events** were supported in 2022 and **four scientific publications** were produced.

Supported by:
CESNET (CZ)

Growing our user community



Research sector

In 2022, the EGI-ACE flagship project kept playing a crucial role in enabling novel scientific use cases to leverage the solutions provided by the EGI Cloud Compute Platform, thereby accelerating the pace of scientific discovery. The project received 15 new use cases through six open calls. Additionally, our services received 71 access requests through the EOSC Marketplace in the same year.

The top 5 requested services from EGI-ACE in 2022 are the following: (1) EGI Cloud Compute, (2) Notebooks, (3) Check-in, (4) Online Storage, and (5) EGI Cloud Container Compute. The total capacity delivered to these 15 new use cases amounts to 6,8 million Cloud CPUh and +130,000 HTC (Wall Clock Time) CPU/h with Virtual Access. In addition, 65 million CPUh was delivered through Virtual Access and 50 million with local support.



Private sector

EGI has maintained its partnership with industry and small and medium enterprises (SMEs) through the EGI Digital Innovation Hub (EGI DIH). This collaboration has aimed at providing support to the private sector within the scope of H2020 projects, including EUHUBS4Data, BD4NRG, DIGITbrain, EOSC-Future, EGI-ACE, Tango, and StairwAI.

EGI actively contributed to these projects by participating in the formulation of technical requirements, providing support for business pilots, and facilitating the integration, design, and establishment of new services. The overarching objective was to foster collaboration between the research and industry sectors, thereby enhancing the innovation potential of EGI, EOSC, and private sector partners.

Empowering Private Sector Innovation: Binare's Success Story

Binare Oy, a cybersecurity startup from Finland, partnered with EGI and obtained support from EGI DIH within the scope of EGI-ACE and EUHUBS4Data projects. Binare's goal with these projects was on addressing cybersecurity challenges in the Internet of Things (IoT) domain encompassing billions of devices and a significant market value.

From 2021 to 2023, EGI provided extensive support to Binare, managing projects and offering computing & storage resources. With EGI's technical expertise and network of computing centers across Europe,

Binare could concentrate on their project's core challenges rather than on troubleshooting and resource management. As a result, Binare highly recommends EGI as a reliable partner for anyone involved in computing-based innovation.

Binare would like to express their gratitude to EGI for their exceptional support and looks forward to future collaborations with EGI and its partners to address current and future cybersecurity and IoT challenges.

EGI DIH is further described in the section describing our activities towards the alignment of business models to better support cross-border service provisioning ([Page 44](#)).



Public administration

In 2022, PolicyCLOUD organised five co-creation workshops using the EGI Federated Cloud services to present project results to relevant stakeholders and gather feedback to enhance its service portfolio.

AI4PublicPolicy successfully finalised the reference architecture for the project using results from previous co-creation activities, serving as input to refine the current architecture, especially the Virtualised Policy Management Environment (VPME). The VPME is deployed on the EGI Federated Cloud and uses services provided by EGI.

During EGI2022 "Computing for the public sector" workshop, PolicyCLOUD, DECIDO, AI4PublicPolicy, DUET, and Intelcomp (pan-European projects and initiatives dedicated to using the cloud for data-driven policy), joined forces in the Data Driven Policy Cluster. Together they demonstrated technologies developed to advance decision-making in the public sector.



EGI Federation

EGI established the Community Managers Group (CMG) network as a platform for information-sharing about user engagement, training, technical support, and partner liaison activities in the context of the EGI Federation. The network gathered during several monthly meetings throughout 2022. A dedicated session at EGI2022 encouraged interaction and knowledge-sharing among community managers. Individual interviews were conducted with each community manager to obtain direct feedback and identify necessary improvements to ensure the group's continued benefits. The interviews will be organised annually to evaluate progress and adapt to evolving expectations.

GOAL

02

Evolve the service offering to meet the needs of researchers

Goal 2

Evolve the service offering to meet the needs of researchers

New service offering

EGI strives to meet the evolving needs of researchers by continually enhancing its services and solutions through collaboration and innovation. Our services are accessible through federated identities via EGI Check-in, ensuring a seamless and

secure user experience. In response to the growing demand for application reproducibility and software distribution, we have extended our application-hosting frameworks and compute capabilities, offering new services to support these needs.

New services

Replay



Reproduce and share research on a notebooks-based platform

Replay allows reproduction and sharing of custom computing environments for replicating the execution of analysis in a notebooks-based platform. Replay is based on the Binder technology, and builds environments on the fly from a code repository, which contains the code (e.g. notebook) to run, and a set of configuration files that determine the exact computing environment to deploy. The service generates shareable links for others to interact with the created content easily from any browser, reproduce the analysis and access data available in EGI's infrastructure.

- Simplicity: users don't need to operate or manage the service. They can simply access it via their browser and enjoy the benefits.
- Significantly larger resource limits than other alternatives.
- Better integration with the European Open Science Cloud ecosystem, providing a seamless experience that enables users to share and reproduce research with the EOSC community.
- Customisable for communities to integrate specific features such as GPUs, specific data stores, and more.

Software Distribution



Publish and access software efficiently across multiple sites

Based on the well-known CernVM-File System (CVMFS), Software Distribution provides a scalable, reliable and low-maintenance content distribution service that supports the deployment of software on EGI's distributed computing infrastructure. EGI Software Distribution service provides a POSIX read-only file system optimised for the software use case with aggressive caching and low latency.

- Efficiency: easy access to software uniformly on the infrastructure.
- Transparent upgrade of software.
- Bandwidth optimisation and caching.

Upcoming services

We also achieved progress in other technical areas, to deliver three new solutions in 2023 (currently in the Alpha phase, ready for early adopters):

Infrastructure Manager:

a service for deploying complex and customised virtual infrastructures on multiple clouds. IM automates the deployment, configuration, software installation, monitoring and update of virtual infrastructures with a DevOps approach. It supports a wide variety of public and on-premises Cloud back-ends, thus making user applications Cloud agnostic.

Secrets Store:

a federation-wide solution for users to store secrets such as service credentials, certificates, keys, and generally any sensitive information. This service not only allows users to programmatically access their secrets, removing the need to put these sensitive pieces of information in source files of configuration files, but it also makes managing, rotating, tracking, and auditing secrets possible.

Data Orchestrator:

a software framework based on Rucio that provides functionality to organise, manage, and access large volumes of scientific data using customisable policies. The data can be spread across globally distributed locations and across heterogeneous data centres, uniting different storage and network technologies as a single federated entity. The Data Orchestrator offers advanced features such as distributed data recovery or adaptive replication, and is highly scalable, modular, and extensible.

Enhancing the existing services

EGI is committed to providing researchers with an integrated service portfolio that meets their evolving needs. We continuously strive to enhance our existing services through ongoing improvements and innovation to achieve this goal. By staying at the

forefront of technology and best practices, we can offer a comprehensive suite of services that enables researchers to achieve their goals more efficiently and effectively.



Research sector



Public administration



Private sector

Security & Identity

EGI changed the Check-in service technology by adopting the Keycloak framework (powerful RedHat solution). The EGI community benefits from this change with more flexibility and better sustainability of its use cases.

We have made ongoing improvements to the Federation

Registry of the Check-in service. This web service allows service providers of the EGI Federation or EGI Community to record and manage their SAML/OIDC entities in three Authentication and Authorisation Infrastructure environments: production, demo and development. The Federation Registry simplifies the onboarding process in

the production environment, monitors service adherence to policies and offers support for GDPR compliance. Additionally, it includes the OIDC/SAML configuration of the clients, manages broadcast flows and finally, directs notifications with different types of contact for each service (administrative, technical, security and support).

Data

EGI enhanced the Data services portfolio with new capabilities and improved maturity. The DataHub service reached production status. New open datasets have been made available from LOFAR and EUHubs4Data project.

In the area of Sensitive Data handling, we explored existing solutions for data storing, sharing and processing sensitive data. We continued to operate the first project solution (LETHE) for sensitive data based on EGI FedCloud services.

Applications

With the EGI Notebook, users can now seamlessly access files available in B2DROP, expanding the data sources for analytics in the Notebooks environment. We have also enabled user-level software environments to install custom libraries and languages in a completely self-managed way.

We expanded the analytics capabilities of the Notebooks with libraries for Quantum Computing, support for Rstudio, and Tensorboard, a tool for measuring and visualising machine learning workflow. Finally, we added support for running Notebooks on GPUs, allowing the execution of AI/ML workflows.

Compute

EGI improved its Cloud Compute service, with a common entry point to the OpenStack dashboards of the providers in the EGI Federation. In addition, we also provide support for accounting for GPUs at the EGI Cloud Compute and HPC providers.

Service integrations

EGI Workload Manager

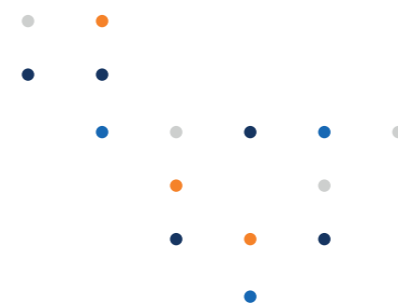
Workload Manager was integrated with EGI Notebook to allow users to manage and distribute computing tasks generated by notebooks in an efficient way in the EGI infrastructure.

Software Distribution

The Software Distribution service was integrated with EGI Notebook for access to existing software from collaborations. Getting additional software was simplified with the nbgitpuller extension to synchronise Git repositories.

DataHub

We improved the integration of DataHub with EGI Notebook and Replay services.



Highlight

The number of users registered in EGI Check-in increased by **90% in 2022**

Meeting User Needs: Our Service Improvements in Action

In 2022, we improved the EGI services to facilitate their adoption and usage and, organised tutorials and hands-on sessions to show how to exploit our service offer. Various requirements were gathered and analysed, leading us towards new developments shortly described below.



EGI's prompt support and high-quality services were instrumental in the success of our RELIANCE project. Their check-in service enabled researchers to access different EOSC services in a uniform way, while EGI DataHub, Notebooks, and Replay tools enabled our researchers to easily share and analyse the data in interactive and reproducible computing environments.



Raul Palma

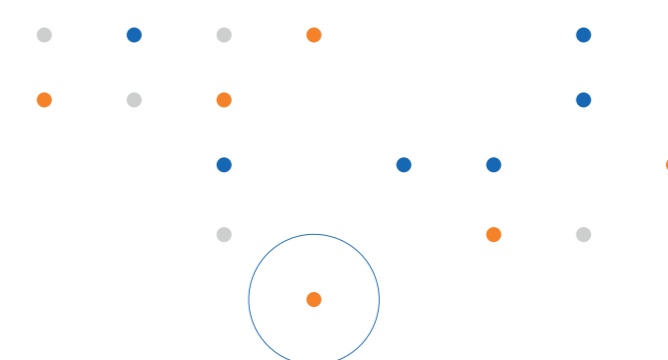
Head of Data Analytics and Semantics Department
Poznan Supercomputing and Networking Center (PSNC)

Security & Identity

In the context of the EGI-ACE project, we have accelerated the adoption of identity federated services supporting 33 new communities and around 30 new Community services have been integrated with Check-in. Enhancements have been delivered to meet the needs of Virtual organisation (VO) Community Managers, through the release of a set of Check-in REST APIs to manage the

process of memberships and roles directly from the community services (i.e. science portal). We gathered user requirements to improve the information in the Operation Portal VO ID Cards and enhanced the synchronisation between Check-in and the Portal. Also, we modified and improved the flow of notification of the expiration of user membership in a VO has been.

A video was created to show service providers the process of registering a client through the Federation Registry in both the demo and production environments. And finally, two training events were organised during EGI2022 with new users, VO Managers and service providers as target groups.



Compute and Orchestration

Several initiatives, as demonstrated during dedicated sessions at EGI2022, used Notebooks and Replay for training and webinars. We increased the computing capacity available to execute users' Notebooks to allow for running larger analytics in our services. To further facilitate new use cases, we expanded the list of programming environments available for Notebooks and allowed users to install their custom environments.

We simplified the deployment of large applications requiring multiple containers as one or more container clusters by improving the Cloud Container Compute service. Specifically, working with self-managed containers, where users deploy and manage the virtual machines

where their containers run, is now easier thanks to the Infrastructure Manager (IM) service, which can automate the provisioning of Kubernetes clusters and/or virtual machines with Docker on any federated resource provider. Additionally, a fully-managed service based on Rancher was added as a service option to the Cloud Container Compute service. It allows users to just interact with the Kubernetes APIs to run their applications. This service option offers centralised management of multiple clusters in the underlying infrastructure and delivers enterprise support for container-based applications.

As part of the EGI-ACE project, we simplified the use of HPC in the federation by allowing users to access HPC providers

using EGI Check-in with their community credentials. We implemented accounting for the usage of resources in HPC centres and monitoring of the providers. Execution of the containerised workloads in HPC is now possible with uDocker. Access to DataHub is now also possible from HPC workloads, making data transfers easier.

We piloted the use of Federated authentication and authorisation technology based on OpenID Connect in the High Throughput Compute and Workload Manager services. This pilot will remove the need to rely on user certificates in the infrastructure and provide a user-friendly and modern standard-based way to interact with these services.

Data and storage

Tutorials and presentations have been delivered for Data services at EGI2022 and as part of the EGI Webinar series. In the context of the EGI-ACE project, increasing the adoption of the DataHub service was facilitated by a new image of JupyterLab integrated with DataHub that was made available in AppDB. The integration of the EGI Data Transfer service with EGI Check-

in has been completed to ease user interaction with the service.

In the LETHE project, we continued to develop sensitive data storing and processing solutions based on EGI FedCloud services and EGI Check-in. The solution serves researchers and AI developers to build a personalised prediction and intervention

model for early detection and reduction of risk factors causing dementia, based on AI and distributed Machine Learning. During EGI2022, we organised a session about integrating health initiatives with tools and services under the European Open Science Cloud (LETHE, FEMaLe and HealthyCloud).

Highlight

The number of users registered in EGI Check-in increased by **90%** in 2022

¹ <https://rancher.com>

Technical highlights from our projects



EOSC Future/EGI-ACE

We developed a new horizontal EOSC Data Transfer service which enables seamless and efficient transfer of datasets to cloud storage. This service will allow plugging existing services for transferring large data sets, such as EGI Data Transfer, into EOSC. With this new functionality now in production, users can access the service through the EOSC Portal starting from Q1 2023.

The EOSC Core Infrastructure Proxy OpenID Provider framework can be upgraded to improve compliance with the OpenID Connect specification and OAuth 2.0 Best Current Practices, as well as to add support for the OAuth 2.0 Proxied Token Introspection.



ESA ITT Open Earth Engine

The EGI Check-in service has been used both for the management of the identities of the openEO Community and for the management of their federation through the Infrastructure Proxy and the Federation Registry components.



EuroScienceGateway

We have established a new Virtual Organisation (VO) to support Galaxy activities within the EGI Federation. As part of this effort, we have deployed a virtual Galaxy cluster to facilitate the development of new features and test the integration of Galaxy with the EGI infrastructure. We have also collaborated with the biomedical research community to conduct a pilot program for submitting Galaxy jobs using the EGI Workload Manager (DIRAC).



TRIPLE

The GOTriple service platform has been integrated with the Check-in service allowing its users to select one of the many possible identities offered (eduGAIN, ORCID, Social IdP, etc.) to login into the service.



AI4PublicPolicy

We deployed MLflow, a platform for managing the end-to-end machine learning lifecycle, on a K8s cluster. It allows tracking and comparing machine learning experiments, and storing, annotating, and managing models in a central repository.



PITHIA-NRF

We have been supporting the project by contributing to the architecture of the e-Science Centre, the central European portal for Earth's ionosphere, thermosphere, and plasmasphere datasets and models. CNRS is also providing Cloud Compute resources and services to run the e-Science Centre during and even after the project's end, complementing the EGI core services of Check-In, Container Cloud Compute, and Dynamic DNS.



SoBigData++

We contributed to the operations of an EGI Notebooks-based environment for interactive analytics for SoBigData++ users and developed new integration features with D4Science's VREs to allow users to access their workspace data and select custom computing environments based on their identity managed by Check-in.



EUhubs4data

EGI further enhanced the component developed to connect EGI DataHub to the IDS DataSpace connector. Our solution has been included in the 5th IDS Data Connector report. EGI continued to lead the Federated Data Catalogue activity successfully and provided a CKAN instance for the project.



AI4Europe

We played a key role in designing an architecture that evolves the AI-on-Demand platform into a distributed ecosystem. This new architecture makes it easier for users to access, add and discover resources through common data and metadata standards.



Pre-PAI

Our contributions to a recent pre-PAI survey included providing insights on HPC, cloud technology, and technical questions. We also assisted in distributing the survey to SMEs, public bodies, and DIHs in various European countries to gather their requirements. Additionally, we conducted a thorough gap analysis to help drive the further development of the AI-on-Demand platform.



BD4NRG

EGI has made a significant contribution by providing Cloud Compute resources to host the complete suite of services that comprise the project's Data Governance Layer. The layer is built on top of open-source solutions such as Apache Druid, Minio, MongoDB, Kafka, Apache DataHub, Apache NiFi, and Fiware Keyrock. Additionally, EGI developed a Java Spring component that optimises the Apache Druid pipeline.



EOSC-Life

EGI, in collaboration with GEANT, has been actively involved in the operational activities of the Life Science AAI service in a production environment, the management of new users, as well as the migration of users and services of the ELIXIR community. Moreover, EGI has prepared for the migration of BBMRI services after conducting a comprehensive review of the latest community requirements.



DECIDO

We supported the DECIDO portal project by offering Cloud Compute resources, Check-In capabilities, DataHub tools, and Notebooks. We initiated the establishment of a Competence Centre for Policymakers in the EOSC Context to serve as a one-stop-shop to onboard and use services and data from/ for policymaking.

GOAL

03

Improve skills of users & operators and maturity in service providers

¹³ <https://www.ai4europe.eu/>

¹⁴ <https://internationaldataspaces.org/use/ids-components/>

Goal 3

Improve skills of users & operators and maturity in service providers

Throughout 2022, we continued to provide top-notch training programs to enhance the knowledge and skill sets of our users and service providers. As the global pandemic gradually

subsided, we organised face-to-face training events alongside online ones, though the latter still dominated. Notably, most in-person training events were held during EGI2022 in Prague, leading

to a significant increase (+8.43%) in the number of attendees from the EGI Federation community who benefited from the EGI training program.

Improving user experience through training



Research sector

In 2022, we made efforts to keep the scientific communities engaged and assist them with utilising the services published in the EGI Service Catalogue through our online webinars. Our Webinar Programme attracted a larger audience and community participation throughout the year, including scientific communities, research infrastructures, and representatives from international EU funded projects.

The EGI Webinar Programme also promoted the uptake of advanced computing by the research community. We organised a total of eight webinars, with one of the highlights being the webinar on the “EGI-ACE webODV – Online extraction, analysis, and visualisation of SeaDataNet and Argo data,” in collaboration with SeaDataNet. This webinar had an impressive turnout demonstrating the growing confidence in EGI’s advanced solutions and their ability to meet the needs of various stakeholders.

Moreover, we organised nine additional co-located training events during EGI2022 in Prague, attended by 120 participants.

In 2022, EGI also organised a Summer School for students from the Black Sea Universities Network (BSUN) members and service providers interested in Federating services and resources with EGI and EOSC. During the school, EGI introduced security best practices when using e-Infrastructures and provided technical support to run proof-of-concept and pilots on the EGI Federated infrastructure.

In December 2022, EGI organised a dedicated training workshop to enable researchers in Ukraine to leverage the advanced computing resources provided by EGI, despite the difficult situation in the country.

Highlights

EGI-ACE webODV
online webinar

164

participants

62

countries

Key numbers

8

Webinars

6

FitSM training courses

9

Training events at EGI2022

30

Participants of Summer school

387

Participants

44

Certified Trainees

120

Participants

20

Participants for the training WS Ukrainian research community

62

Countries



I rely heavily on ODV for data visualisation, selection, QC, and TEOS-10 analysis. So, when I discovered the Web-based version of ODV, I was delighted. It’s a great feature that enables easy data sharing, making collaboration a breeze. The Web-based ODV has truly enhanced my workflow and opened up new possibilities.

WebODV Data Space webinar Attendee

2 Nov. 2022

Accelerating research through support and consultancy



Research sector

In 2022, we continued providing technical support to various use case applications selected through the EGI-ACE open call. We carried out the consultancy and support through a scalable and distributed team of experts (shepherds) composed of service and resource providers, community experts, and federation members. We received 15 requests for support from various scientific communities and EU funded projects in different scientific domains.

Additionally, we received six requests to support business use cases chosen through the EOSC DIH. To help technical support experts involved with the integration plans of the use cases, and the onboarding of the resulting solutions in EOSC, we ran a training programme, organised a workshop in April 2022, and published a handbook providing insights and guidelines for the experts.

Aligning the quality of service delivery across the Federation



EGI Federation

Throughout 2022, we delivered six training courses tailored to service operators within the EGI Federation. In total, 44 trainees completed the training and earned a formal certification accredited by the APMG certification authority. This accomplishment underscores our commitment to empowering service operators with the knowledge and skills needed to deliver exceptional performance and services to our users.

GOAL

04

Align business models to support cross-border service provisioning

Goal 4

Align business models to support cross-border service provisioning

The EGI Federation harnesses the power of diverse policy and governance models to create a cohesive network of resource centres throughout Europe and beyond. Our primary objective is to harmonise and simplify cross-border access by offering a European-level access channel connecting users to the largest federation of data centres for research.

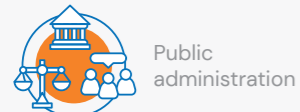


EGI Federation

In 2022, we explored opportunities and constraints to deliver service commercially to be able to respond to more opportunities for serving research.



Research sector



Public administration

EGI also offers market-driven access against payment. Five different projects with dedicated resources to enable purchases were supported with this policy: PITHIA-NRF, AI4PublicPolicy, DECIDO, EUHubs4Data and DigitBrain. The allocation during 2022 considered the national/institutional interest and long-term commitment of providers for the respective project areas. In 2023, three new projects (ANERIS, Blue-Cloud-2026 and DATAMITE) will also allocate resources through this mechanism.



Private sector

We also introduced the EGI DIH (Digital Innovation Hub), evolving from our previous business engagement program. The EGI DIH is a new type of partnership where companies and technical service providers can collaborate, test solutions, and access advanced computing services to drive digitalisation and enhance productivity. Our primary focus is on coordinating and developing human and technical support for business-oriented pilots and collaborations, empowering innovation and growth.

Highlights

In 2022, the EGI Federation made significant strides in empowering collaboration and innovation across borders, conducting a comprehensive analysis to enhance joint service delivery, supporting market-driven access for research and public administration, and launching the EGI DIH to foster partnerships between companies and technical service providers in the pursuit of digitalisation and improved productivity.

GOAL

05

Strengthen the governance and broaden the international presence

Goal 5

Strengthen the governance and broaden the international presence

In 2022, we strengthened our capacity to support a growing range of scientific collaborations by welcoming three new members to the EGI Council and forming new partnerships with national e-infrastructures and research communities. In addition, one of our associated members stepped up to become a full member of the Council.



Research sector

New members, stronger federation

In 2022, EGI welcomed three new members. The EGI Council has approved the participation of ACONET Verein (Austria) and Vilnius University (Lithuania) as full members and NBIS (Sweden) as an associated member.

ACONET Verein, the Association for the Promotion of an Austrian National Research and Education Network, joined the EGI Council on 1 January 2022. The ACONet science network is a national backbone network for Austria's non-profit research, education, and cultural institutions. It started operations in 1990 and currently has around 200 participating organisations across Austria, including universities, technical colleges, regional school networks, research institutions, libraries, and more.

In July 2022, **Vilnius University** was appointed by the Ministry

of Education, Science, and Sport to represent Lithuania in the EGI Federation. Vilnius University is the reference provider for the Lithuanian academic community, and it provides HPC services distributed across three different institutes of the University. By joining the Federation, Vilnius University will benefit from a broader and diversified user base, establish stronger liaisons and collaboration with the national scientific communities, and work to scale up scientific output.

We also welcomed **NBIS** as an associated participant in November 2022. NBIS is distributed national RI supporting life science research in Sweden. It will help provide reliable services to the life sciences community with the cloud resources provided by the EGI, and, moreover, to promote collaboration

with other European RIs, especially for knowledge sharing and development of the e-infrastructure technology for research data and computing-intensive science. We are pleased to have NBIS on board.

Finally, **SZTAKI** – the Institute for Computer Science and Control of the Eötvös Loránd Research Network has stepped up from the Associated partnership to a full EGI Federation membership. SZTAKI 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.

We look forward to working with all our new members and partners to continue strengthen and expanding the EGI Federation's service offering to the research communities.

Highlights

3

new participants joining the EGI Council

ACONET Verein (Jan 2022), Vilnius University (July 2022), NBIS (Nov 2022)

1

Change from Associated to Full membership

SZTAKI (Nov 202)

2

New collaboration agreements

OPERAS, CNR-IAA



In 2016, several research institutions in Austria built up and federated joint processing infrastructures to meet the growing need for data storage and processing in Environmental Sciences and Earth Observation. Discussions began on how to connect national infrastructures to international platform providers, and in 2022, Austria's NGI became an EGI member. By joining the EGI, Austrian NGI, represented by ACONET, can take part in international joint ventures, increase its visibility, enhance its opportunities to apply for international research calls and extend the Austrian EGI community in various scientific fields.



Matthias Schramm

ACONET Verein

The power of collaboration

In 2022, EGI signed the following collaboration agreements:

MoU with OPERAS

EGI and OPERAS joined forces in May 2022 through the signing of a Memorandum of Understanding (MoU), solidifying their commitment to long-term collaboration. OPERAS, the European research infrastructure for advancing open scholarly communication in the Social Sciences and Humanities (SSH), has been an important partner to EGI. Over the past few years, OPERAS and EGI collaborated on multiple projects: OPERAS-P, Triple and EGI-ACE. Building upon the achievements of our past endeavours, the MoU establishes a shared vision for future collaboration between the organisations. In addition to exploring membership and cross-membership options within each other's governance structures, both parties will seek opportunities for bilateral involvement in other projects.

MoU with CNR-IAA

CNR-IAA undertakes research and innovation activities in several thematic areas dealing with Earth System Science and Earth Observation, including developing systems and technologies for Earth and Space data sharing and interoperability. The MoU defines a framework of the long-term collaboration between the EGI and CNR-IAA to enable the vision of jointly providing sustainable e-Infrastructure services for delivering Earth Observation data-centric advanced services in support of multidisciplinary communities.

New and reinforced international collaborations

Pacific region

In 2022, EGI allocated a dedicated pool of resources to allow the iCOMCOT Tsunami Wave Propagation Simulation Portal to serve a wider range of user requests and perform Tsunami simulations. Some EGI services, including EGI Cloud Compute, EGI Notebooks and EGI Replay, were also configured to promote the reproducibility of Open Science in the Asian Pacific region. In addition, EGI and Academia Sinica started to work on the invitation letter to join the EGI Council.

South America

The collaboration between EGI and CLAF, the Latin American Centre for Physics, has been further strengthened. Our shared commitment lies in expanding the scope of our existing collaboration to provide enhanced support to scientific communities in the Latin-American region. This involves integrating Cloud Computing and HPC facilities, leveraging the valuable experience gained from our cloud federation with European providers.

EGI and RedClara started a collaboration to identify areas of shared interest and topics for a joint set of action plans that can advance Open Science in Latin America and Europe. Federated cloud-HPC computing was identified as a topic of joint interest.

EGI's role in European Data Space movement

The concept of data spaces has gained significant momentum in Europe, and for a good reason. Common European data spaces will ensure that more data becomes available for use in the economy and society while keeping companies and individuals who generate the data in control!

By establishing partnerships in new projects such as in DSSC, GREAT, EUCAIM, and EUreka3D,

EGI is strengthening its position as a trusted and reliable infrastructure provider in the evolving data-driven landscape. A notable collaboration worth mentioning is the involvement of EGI in the DSSC (Data Spaces Support Centre) project as an Associated and collaboration partner. EGI actively participates in the Strategic Stakeholder Group, which acts as a dynamic think-and-do-tank, supporting the project in delivering on its

policy objectives. Furthermore, through the development of Thematic Data spaces for EOSC within the framework of EGI-ACE, EGI is directly showcasing practical examples of Data space implementation. Throughout 2022, we successfully demonstrated we can strongly contribute to the future success of Data spaces through our technology, tools, and expertise.

EGI's support for Data Spaces

• Technological Solutions:

Through EGI services such as Check-in, Cloud Compute, Notebooks, DataHub and Online Storage, EGI facilitates easy and controlled data access and sharing, data management, tools for processing and storing large amounts of data, and data-intensive applications, to name a few.

• Policy Development Support:

EGI's policy development support activities help ensure that Data spaces are established and managed in a way that promotes transparency, trust, and accountability.

• Landscape Harmonisation:

EGI helps create synergies between different projects and initiatives, identifying common

goals, aligning activities and standards, avoiding duplication of effort and maximising the impact of funding and resources.

• **Contributions to Projects:** EGI aims at developing thematic data spaces or contributing to the development of overarching, multidisciplinary data spaces.

¹ <http://dataspaces.info/common-european-data-spaces/#page-content>

GOAL

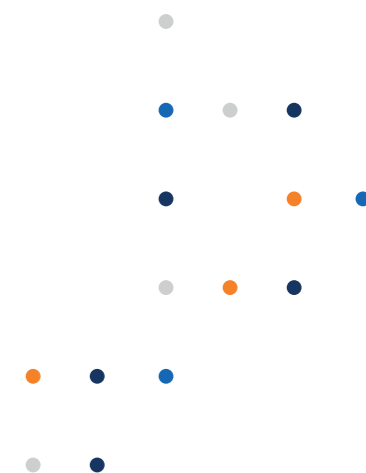
06

Be a recognised foundation of EOSC

Goal 6

Be a recognised foundation of EOSC

The European Open Science Cloud (EOSC) aims to federate existing infrastructures and services to develop a multidisciplinary environment where researchers can publish, find and re-use data, tools and services. EGI plays a leading role in the development of EOSC due to its potential to realise the EGI vision that all researchers should have seamless access to services, resources and expertise to collaborate and conduct world-class research and innovation. EGI continues to contribute strongly to the ongoing building of EOSC, whether it is through its flagship EGI-ACE project delivering the EOSC Compute Platform and experimenting with the use of funding to deliver services to multi-country collaborations, or through major roles in the EOSC Future project, through involvement in the EOSC Synergy and EOSC Focus projects, and active engagement and contribution in the EOSC Association.



The EOSC Compute Platform



EGI draws on its successful experience of federated service delivery to provide 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 Compute Platform is a key component of EOSC.

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

Supporting project:



It is built on hybrid facilities comprising cloud computing resources, High-Throughput computing sites, and High-Performance Computing 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 expand further the ability to process data at different scales of parallelism.

The platform 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.

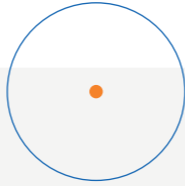
Highlight

EGI-ACE: Impact

Since the beginning of the project, EGI-ACE has received more than 44 use case applications and is currently supporting 144 different user communities. The scientific collaborations from the EGI-ACE consortium deliver 5 Data Spaces and 7 processing platforms to EOSC and support 30 Thematic services from EGI partners. EGI-ACE has also been instrumental in supporting 3 EOSC Future Science Projects (cross-disciplinary usage and service integration proofs of concept), and 8 SMEs from the EOSC Future project. These activities help to

diversify the range of services available through EOSC and deliver the benefits of EOSC to a larger user base.

EGI-ACE services have been used by 72,000 users since the start, with approximately half of those coming from Europe. Most of these users are researchers who interact with the thematic services the project consortium delivers. An additional 12,000 researchers use those services provided by external partners and initiatives.



The EOSC Core Platform and Integration



Research sector

Supporting projects:



The EOSC Future project is the major ongoing EOSC technical implementation project. During 2022, EGI Foundation continued to co-lead coordination of the project's technical work to develop the EOSC Core. 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 Future, EGI applies its expertise in federation governance and best practices in service management and business models. It also contributes to the development and day-by-day provisioning of the EOSC Core services and central processes, including EOSC Marketplace, AAI Federation with the EOSC Core Infrastructure AAI proxy, Accounting, Collaboration Systems, Configuration Management, Helpdesk, Order management and Service management.

EGI also contributes its expertise in operating federated infrastructure to jointly lead the coordination of the integration of the EOSC Future Science Projects with the Core services. This activity ensures the interoperability of services, meaning users can share and compose them as required for their work.



Research sector

Private sector

Supporting project:



EOSC DIH

EGI coordinates the EOSC Digital Innovation Hub (EOSC DIH), the collaboration framework for innovation with industry, by leveraging EOSC services and data. Bringing together industry and the scientific community, the EOSC DIH facilitates engagement of the private sector as a supplier to and a user of EOSC. This stimulates cross-fertilisation across sectors, promotes innovation and digitisation of SMEs, and showcases the innovation potential of EOSC for SMEs, startups and spin-offs.

During 2022, the EOSC DIH ran multiple pilot campaigns onboarding more than 20 pilots that have received technical support from the projects such as EGI-ACE, C-SCALE, DICE, OpenAireNexus and Reliance. The initiative explored research communities' needs for the co-development of solutions in collaboration with the private sector and set up the basis for the tender process to be launched in early 2023. The tender process aims to procure the commercial solution to be co-developed with the research community and the EOSC DIH as an open innovation process where the private sector contributes to enriching EOSC.

Supporting Development of EOSC

Of equal importance to the major technical effort required to deliver EOSC infrastructure is the alignment of European, national and institutional policies, and the development and coordination of the community of EOSC stakeholders. EGI Foundation and its participants are an active member of the EOSC Association, the legal entity established to govern EOSC.

EGI experts are co-chairs of its Financial Sustainability and Semantic Interoperability Task Forces (TFs) and actively participate in several others. The TFs address key areas of the implementation of EOSC. They liaise with EOSC projects to offer feedback on developments, as well as identify strategic gaps and areas for investment to input to the SRIA, the EOSC Partnership's Strategic Research and Innovation Agenda.

Via the EOSC Focus project, EGI also contributes to the EOSC Association's technical coordination of EOSC-related Horizon Europe projects, the definition of the EOSC Rules of Participation, and business modelling. EGI members have also contributed to policy recommendations formulated in the EOSC Synergy project across open science strategies, PIDs, funding, and access provisioning policies.



Research sector

Supporting projects:



Our Plans

The EGI Foundation, as the central coordinating entity of the EGI Federation, is dedicated to empowering the Federation and its research and innovation activities. Our strategic blueprint for 2023 outlines four key priorities that are instrumental in nurturing the continuous growth and advancement of the EGI Federation and the broader EGI community.

Firstly, our focus lies in successfully completing crucial EOSC projects, including EGI-ACE, EOSC Future, and C-SCALE. By integrating the outcomes of these projects into the EGI ecosystem, our goal is to facilitate knowledge sharing and ensure that the wider community reaps the benefits of the invaluable insights derived from these initiatives.

Secondly, together with the EGI Federation members, we are committed to renewing the funding arrangement for the EGI core services and mandated activities through to 2026. By guaranteeing long-term financial support, the EGI Foundation ensures the uninterrupted provision of vital services, thereby bolstering the stability of

the EGI Community and enabling it to persist in its trailblazing work in advanced computing and data analytics.

Thirdly, we remain firmly committed to the successful implementation of the European Open Science Cloud. These strategic actions are instrumental in ensuring the EGI community remains at the forefront of open science and research infrastructure support.

Lastly, the EGI Foundation is devoted to investigating and validating a novel business model for community provider engagement within the federation. We recognise the community providers' invaluable role in broaden advanced computing and data

analytics service offerings. By validating innovative business models, the EGI Foundation seeks to establish a sustainable long-term relationship with community service providers and enrich the services offered at the application level for the research communities.

In essence, the EGI Foundation's 2023 plan is a strategic trajectory aimed at reinforcing its role in the advanced computing and data analytics domain. Through a focus on business model validation, steadfast commitment to the EOSC, long-term funding of core services, and successful project closure, the Foundation is primed for a year of sustainable growth and advancement.

Finances

Items	Actual 2022 (€)
Projects Income	4.277.484
Other Income	(paid service delivery) 7.656
EGI.eu Participants fee	1.192.500
TOTAL INCOME	5.477.640

Expenditure

Items	Actual 2022 (€)
Employee expenses	4.079.430
Staff Development	43.726
Other operating expenses Core activities grant to Council	485.294
ICT (incl depreciation)	104.312
Facilities	163.796
Non Project Travels	49.416
Project Travels	271.891
General expenses	114.748
Project central budget	79.372
VAT	70.031
TOTAL	5.462.016

Expenses 2022

€ 5.462.016

Income 2022

€ 5.477.640

Equity 2022

€ 1.904.064

Our Team

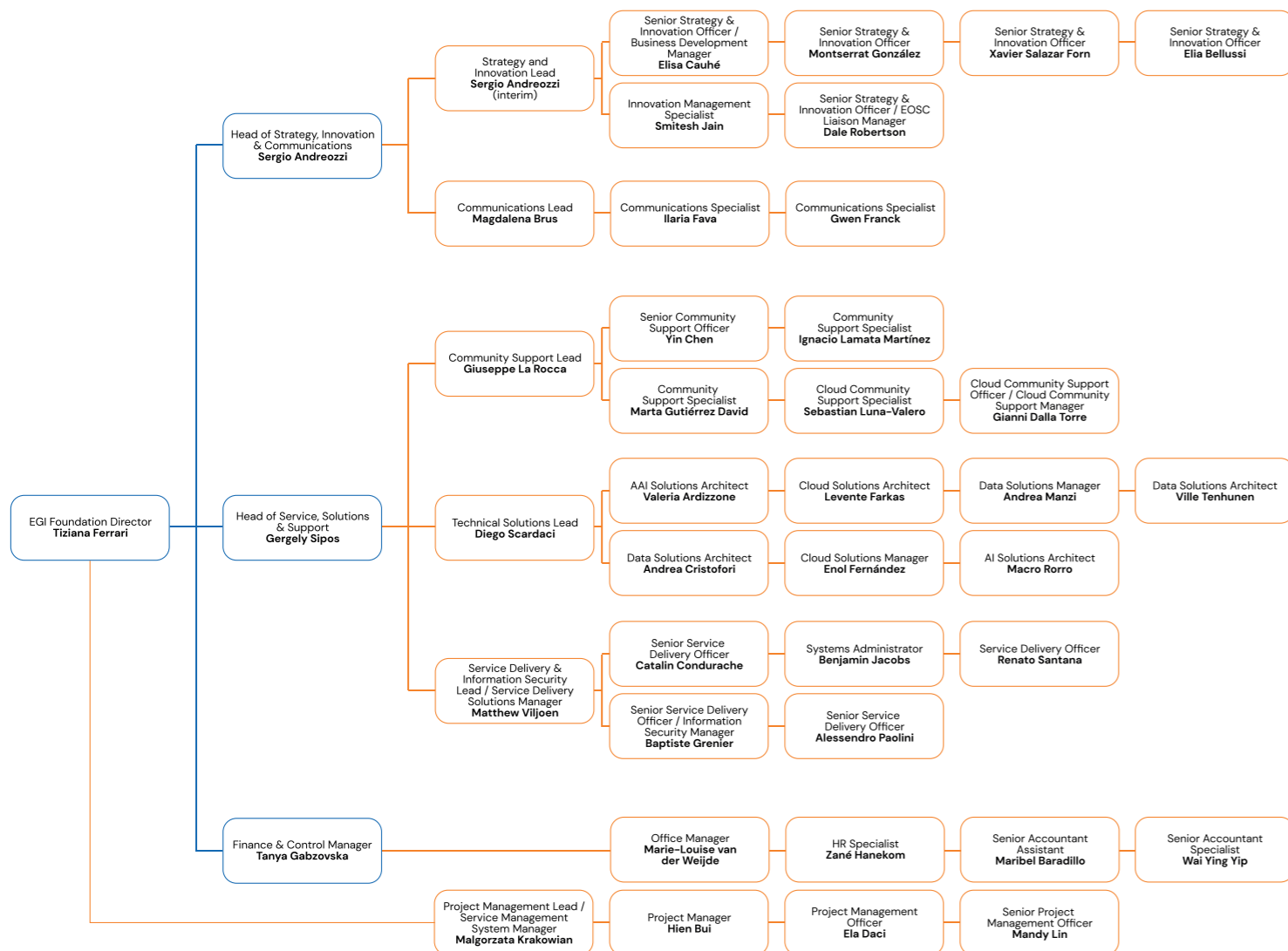
The EGI Foundation is the coordinating body of the EGI Federation. It was established in 2010 with a headquarters in Amsterdam, Netherlands.

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:



It comprises individuals from **20 different nationalities**, fostering a rich tapestry of diverse perspectives and cultural backgrounds.



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:** 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



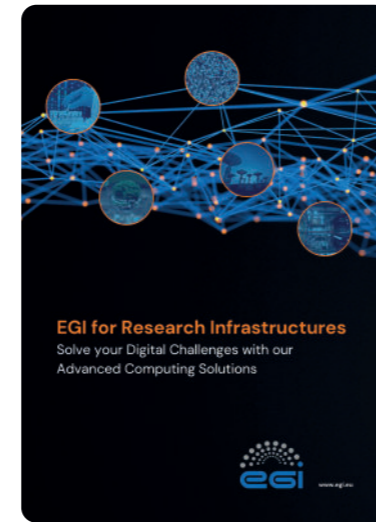
Strategy 2020-2024

An overview of the EGI Federation strategy for 2020-2024.
<https://www.egi.eu/publication/egi-federation-strategy-2020-2024-2/>



Service Strategy 2022-2024

This report describes the service strategy of the EGI Federation for the period 2022-2024.
<https://www.egi.eu/publication/egi-federation-service-strategy-2022-2024/>



EGI for Research Infrastructures

Solve your Digital Challenges with our Advanced Computing Solutions (2022)
<https://www.egi.eu/publication/egi-for-research-infrastructures/>



EGI-ACE Impact report

Discover the profound impact of the project through our comprehensive EGI-ACE Impact Report, showcasing the Key Exploitable Results, Success stories and Impacts on different areas
<https://www.egi.eu/publication/EGI-ACE-Impact-Report/>



Joining the EGI Federation - brochure

<https://www.egi.eu/publication/joining-the-egi-federation/>



EGI Federation Annual Report 2021

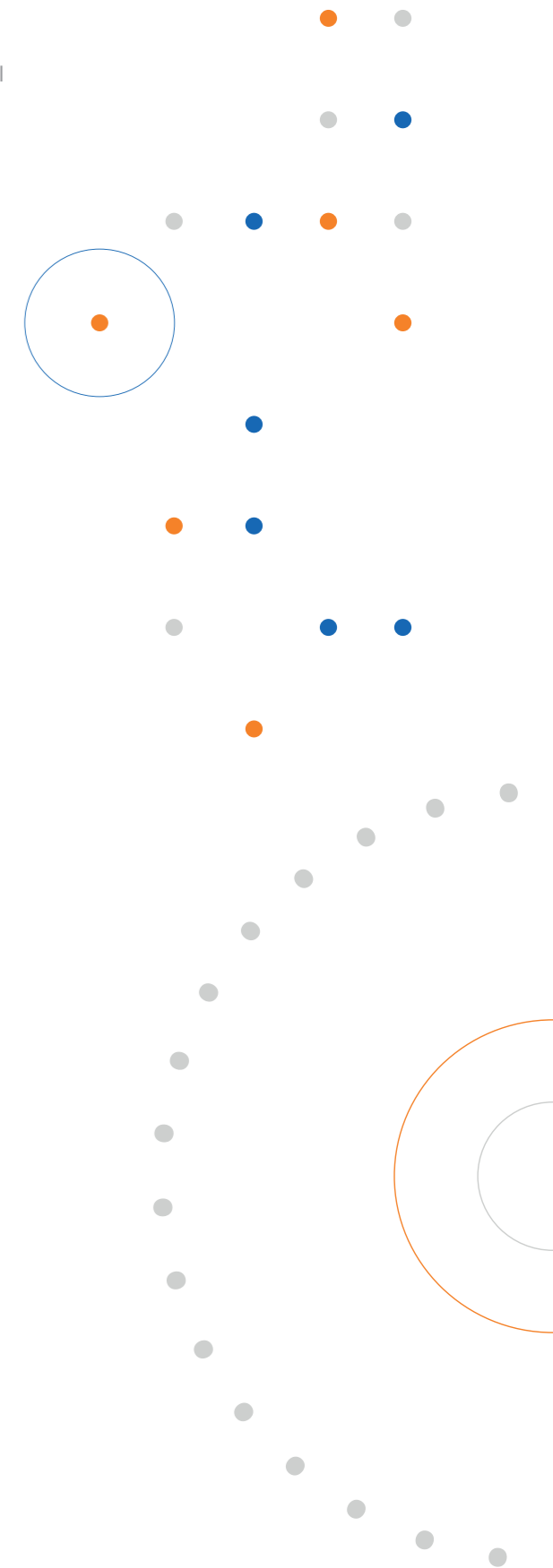
The annual report 2021 provides an extensive overview of the results that have been achieved through the collaborative efforts in 2021.
<https://www.egi.eu/publication/annual-report-2021/>

You can find all our publications at: <https://www.egi.eu/publications>

Acknowledgements

We are grateful to all individuals who contributed to this Annual report, but most importantly, the advancements of EGI federation. With 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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