EOSC-hub MAGAZINE

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EOSC-hub Magazine

The EOSC-hub Magazine is a publication of the EOSC-hub project, edited to showcase major results and achievements of the project, collaborations ongoing with other initiatives and updates from the communities. The magazine also provides an overview of the latest highlights from the European Open Science Cloud (EOSC) landscape.

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About EOSC-hub

The EOSC-hub project brings together multiple service providers to create the Hub: a single contact point for European researchers and innovators to discover, access, use and reuse a broad spectrum of resources for advanced data-driven research.

For researchers, this will mean a broader access to services supporting their scientific discovery and collaboration across disciplinary and geographical boundaries.

The project mobilises providers from the EGI Federation, EUDAT CDI, INDIGO-DataCloud and other major European research infrastructures to deliver a common catalogue of research data, services and software for research.

EOSC-hub is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement 777536.

Start: January 2018

End: December 2020

Total budget: €33 million

100 Partners

EOSC-hub achievements and contribution to EOSC vision

Tiziana Ferrari and Per Öster give an overview of the project's main outcomes and impact on EOSC

The EOSC-hub project is a first implementation step of the European Open Science Cloud (EOSC) vision and since its beginning in 2018 has brought together multiple service providers to create a *hub* of diverse services available to all European researchers for their scientific work.

Tiziana Ferrari

Per Öster

EOSC-hub is providing the expertise and resources to enable an active usage of the EOSC and foster a culture of co-operation between researchers and EOSC service providers.

Now in 2020, the project is successful in establishing the integration and operation layer to join services and tools for scientific collaboration and make knowledge more accessible across Europe.

What would you say are the main achievements of the project so far and how do they contribute to the development of EOSC?

The project's main focus is to contribute to a single vision: **EOSC as the shared space for research and innovation in Europe.**

EOSC-hub's main results so far (or key exploitable results - KERs - as we call them) have been supporting the building of the EOSC services, ensuring the quality of service components and providing best practices and tools for linking services to the Hub.

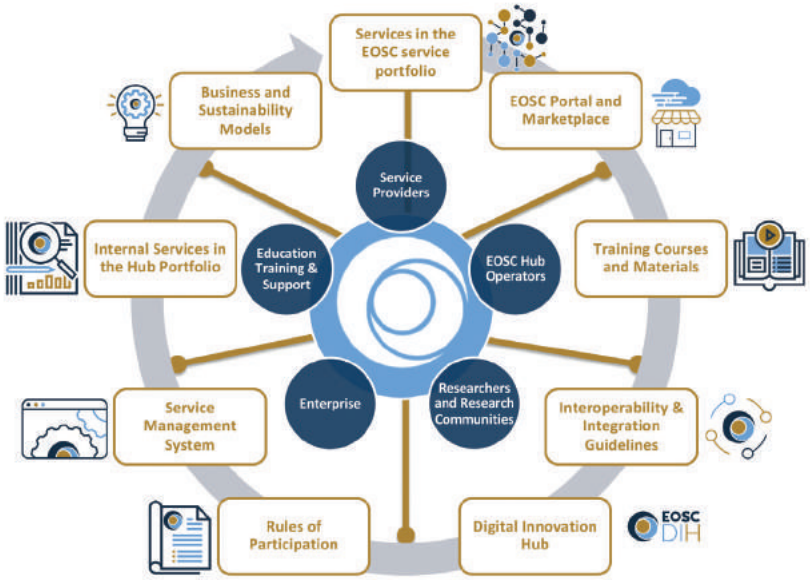
The picture aside provides an overview of the EOSC-hub KERs:

EOSC-hub Key Exploitable Results (KERs)

Specifically: the design, implementation and operations of the **EOSC Portal and Marketplace**, the definition and development of the **EOSC Federating Core**, **the EOSC Service Management System** (SMS), the **Rules of Participation** (RoP), the **technical specifications and interoperability guidelines**, the creation of the **EOSC Digital Innovation Hub** (DIH) for the involvement of the private sectors, the design of **EOSC business models** and the creation of a **network of trainers** and of a knowledge base.

For example, the EOSC Marketplace is now active with more than **260 services published**. The onboarded service providers come from over 130 providers. The catalogue offers integrated additional features such as the ordering, enabling users to request access to EOSC services, and the user space, providing scientists with a personal space where they can combine EOSC services.

Another great example is the setup of the EOSC Digital Innovation Hub - a platform established to support industrial R&D and academic research in their



accessing and sharing of EOSC tools and services.

How does EOSC-hub contribute to innovating and advancing science, specifically?

To give a more comprehensive overview, we can mention the following aspects:

An optimised access to IT equipment and services

EOSC-hub has adopted a *service integration and management approach* to manage suppliers and integrate them to provide a single business-facing hub.

As mentioned before, there are a growing number of services available now via the EOSC Marketplace**,** offered by both project partners and external providers such as research organisations and commercial providers.

No lock-in to particular hardware or software platforms

EOSC-hub has been working on a series of activities to make EOSC an open and community-driven platform fostering open science in Europe. Notably the effort to define and promote the EOSC technical interoperability guidelines that allow data and software portability across multiple facilities and foster EOSC uptake. The project also designed an EOSC Technical Reference Architecture that includes functions, interfaces, APIs and standards as technical concepts.

More scientific communities are using storage and computing infrastructures

Several scientific communities are benefitting of the EOSC-hub effort on fostering the adoption of advanced IT services. This has been achieved with different actions, particularly the publication of the e-infrastructure services in the EOSC Portal and Marketplace.

EOSC-hub is now running 8 Competence Centers (CCs) to co-design and co-develop services for several scientific communities: ELIXIR, Fusion (ITER), Argo, SeaDataNet, EISCAT_3D, EPOS-ORFEUS, LOFAR and SKA, ICOS, eLTER and Disaster Mitigation communities.

Another action is the project's **Early Adopter Programme**, an initiative launched in 2019 to select scientific communities interested in adopting and integrating multiple EOSC-hub services. The program has now 13 use cases on-board.

A growing number of people trained in research and academic sectors

EOSC-hub has established a network of training experts that deliver trainings in different areas: access enabling and federation services, common services, data management planning, federated services management. So far, we have organised over 100 training events attended by more than 2000 people.

An increased incentives for scientific discovery and collaboration across geographical boundaries and further development of the European economic innovation capacity

The EOSC-hub project has supported an access program enabling a number of the partners to provide EOSC services outside their usual user base resulting in new users from more than 100 countries. The initial engagement phase with EOSC stakeholders has been followed by provisioning of support and dedicated webinars on EOSC-hub solutions.

You mentioned the EOSC Digital Innovation Hub. Can be it considered as an important project impact on the private sector?

A: Definitely. The EOSC Digital Innovation Hub (DIH) was successfully established at the end of 2018 and is now officially part of the EU Digital Innovation Hub catalogue. As mentioned previously, the DIH is a mechanism for SMEs to collaborate with universities and other public sector institutions in order to access latest technologies, technical services, research data, and human capital. A total of 11 business pilots have joined the EOSC hub DIH programme since its beginning. We are very proud of this result.

Tiziana Ferrari is Managing Director at the EGI Foundation and Coordinator of EOSC-hub.

Per Öster is Director of the Research Infrastructures unit at CSC and of EOSC-hub.

EOSC-hub Week Series Ends with a Bang

More than **800 decision makers, enthusiasts and stakeholders of the European Open Science Cloud (EOSC)** *all met at the last installation of the EOSC-hub Week between 18-20 May 2020.*

The event was a **vibrant online forum** where the **latest developments on EOSC activity areas** such as architecture, core services, landscaping, FAIR data, rules of participation, sustainability, business models, community use cases and training were discussed with a particular focus on how EOSC-hub in collaboration with the other relevant EOSC-related projects is contributing to the achievements of the EOSC 2020 implementation milestones defined in the Implementation Roadmap for the European Open Science Cloud Commission staff working document.

> Grand societal challenges have also been discussed showcasing how the research communities are better supporting policy makers thanks to the EOSC resources.

The EOSC-hub Week 2020 officially opened on May 18 as it virtually played host to the co-located **EOSC Consultation Day** organised by the EOSCSecretariat project with the EOSC Executive Board.

The EOSC Consultation day: towards a new EOSC Governance

The EOSC Executive Board (EB) form an important part of the EOSC interim governance which with the EOSC Governance Board have worked tirelessly over the last 17 months to address a series of strategic challenges on how to implement the EOSC. The EOSC interim governance will come to an end at the end of 2020 and the recommendations provided by that time will be put into place with the **establishment of an**

EOSC legal entity. This landmark moment coincides with the beginning of the Horizon Europe programme which will be key in the next implementation phase of the EOSC.

The Consultation Day was an opportunity for community engagement on the work of the EOSC EB and its Working Groups.

A large focus of their work to date has been on the **EOSC partnership proposal** which brings the EOSC governance towards a **co-programme partnership under Horizon Europe**. With 49 partnerships being developed for Horizon Europe, **the EOSC is the only cross-pillar partnership being proposed so far** as it addresses the 3 main goals of Horizon Europe: Better science, societal challenges and innovation. **The partnership proposal defines the vision of EOSC as an enabler of interdisciplinary research to address societal challenges**. It will offer researchers anywhere in the EU the resources they need to boost scientific discoveries. It will stimulate the emergence in Europe of a competitive European cloud sector and it will give Europe a global lead in research data management. Finally, it will develop an internet of FAIR digital objects including publications and software and it will reduce fragmentation of existing research infrastructures.

Work has also gone into the establishment of an **EOSC legal entity** that should be in place by December 2020. The legal entity will be in the form of a Belgian not-for-profit association (AISBL) and will be responsible for developing and governing the federating core; managing the compliance framework, trusted certification, the AAI and PID policies; developing outreach, monitoring services and transactions, managing EOSC trademarks, and contributing to Horizon Europe policies. (Read the latest blog of the EOSC EB).

Much discussion at the event was also focused on defining what the **Minimal Valuable EOSC (MVE)** will be. The Tinman document published by the Sustainability WG states that the EOSC MVE will "enable the federation of research data infrastructures for the benefit of publicly funded researchers accessing openly available data". The EOSC-core provides the means to discover, share, access and re-use data and services.

Consultation is open!

- EOSC Interoperability Framework announcement and document
- PID policy v.2 announcement and document
- Metrics and certification papers announcement
- FAIR Metrics for EOSC
- EOSC service certification

For all the latest news from the EOSC Governance please check www.eoscsecretariat.eu/eosc-liaison-platform

From EOSC 1.0 to 2.0

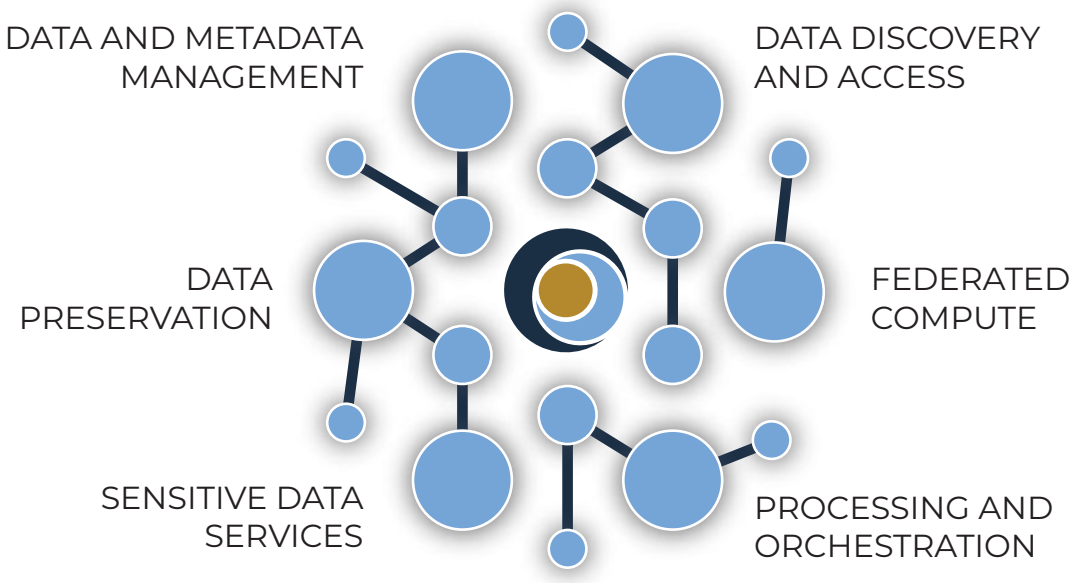
Liina Munari

Fresh from the EOSC Consultation Day on 19 May 2020, EOSC-hub Project Coordinator and EGI Foundation Managing Director Tiziana Ferrari opened the first EOSC-hub day with a plenary session featuring an overview of the main EOSC-hub results and describing the status of EOSC. EOSC-hub Project Director and CSC - IT Center for Science Research Infrastructures Director Per Öster highlighted how EOSC-hub is contributing to the various EOSC implementation areas: **the progress made with the EOSC Portal and its service portfolio**, the **over 30 thematic services** onboarded and **eight competence centres** with the examples of the success stories of the different communities, **the EOSC Early Adopter Programme** as a way to engage new communities and make them closer to EOSC, the **EOSC Digital Innovation Hub** and its business pilots as first experiences of exploitation of EOSC resources from the industry sector and all the contributions to the EOSC Working Groups, in particular to the Architecture and the Rules of Participation ones.

European Commission DG Connect eInfrastructure and European Open Science Cloud Deputy Head of Unit Liina Munari then presented the current and future role of e-Infrastructures in EOSC also outlining a timeline of the key EOSC milestones at the strategic level in the coming months and a possible timeline for the EOSC initiative under the Horizon Europe programme. Liina remarked that **we are at a crucial point for EOSC as we are transitioning from the EOSC 1.0** characterised by the work done by the current EOSC projects, the Executive Board and its Working Groups to establish the foundation with the "EOSC Core" **to an EOSC 2.0 where EOSC infrastructure will need to support both the web of FAIR data and the services** and **the EOSC will need to show the added value and provide rewards and incentives.**

EOSC Services

As a core area of activity for EOSC-hub, a number of sessions were dedicated to EOSC services. In the EOSC-hub contribution to the EOSC Architecture session, **the need for integration with**



existing infrastructure and adopting a pragmatic approach of public, open APIs was emphasised along with **the need for a bottom-up development of the EOSC architecture**. The session Service Onboarding & Catalogue of services gave an overview of the current state of service onboarding in EOSC especially with the new role of EOSC Enhance in the process, the new resource description template as well as future changes to onboarding after EOSC-hub. "A researcher has various paths to choose from using EOSC services depending on their needs as there will be regional portals as well as regular thematic portals available. **The EOSC Platform can be considered as the 'bus' that supports core services**, powering among others the portal website that shows the value of EOSC and all profiles on EOSC" remarked Owen Appleton, EGI Foundation. Service Providers were also at the focus of the Service Providers Forum session that described the EOSC-hub service providers interaction possibilities and collected further feedback on how to improve the service provider participation in EOSC. The EOSC-hub Technical Workshop also tackled common service specifications and the EOSC-hub roadmap and next steps together with the EOSC Portal - focus on requirements collection session.

Landscape and policies

The Issues in Cross-Border Consumption of Resources in EOSC session addressed issues of relevance to the EOSC Shared Resources, an important element of the Federating Core proposed by EOSC-hub. The discussion on the challenges involved in cross-border service provision recognised that **whilst financial incentives to share public services across borders may be limited or lacking**, a case can be made for providing services across borders based on user demand for trustworthy (including sustained) services, access to which would enhance European research excellence. A **shared commitment to the European "greater good"** could potentially result in services being provided across borders if sufficient trust were built amongst member states.

The geographical aspect was also further analysed in the Innovation from the EOSC regional projects session where the EOSC regional projects (EOSC Nordic, EOSC Synergy, EOSC Pillar and NI4OS) discussed the need of EOSC on regional level.

Discussions went beyond the geographical aspects of a federation with the session on Security coordination & policy that addressed the other challenging aspects of a federation such as confidentiality, integrity and availability. The session addresses the entire spectrum of these challenges, from reactive security incident response, to proactive risk planning, handling vulnerabilities, and establishing and maintaining trust across many administrative domains. One of the recommendations was aside from maintaining baseline policies that ensure security in EOSC, a Computer Security Incident Response Team would need to be set up to handle security incidents.

Supporting the research communities

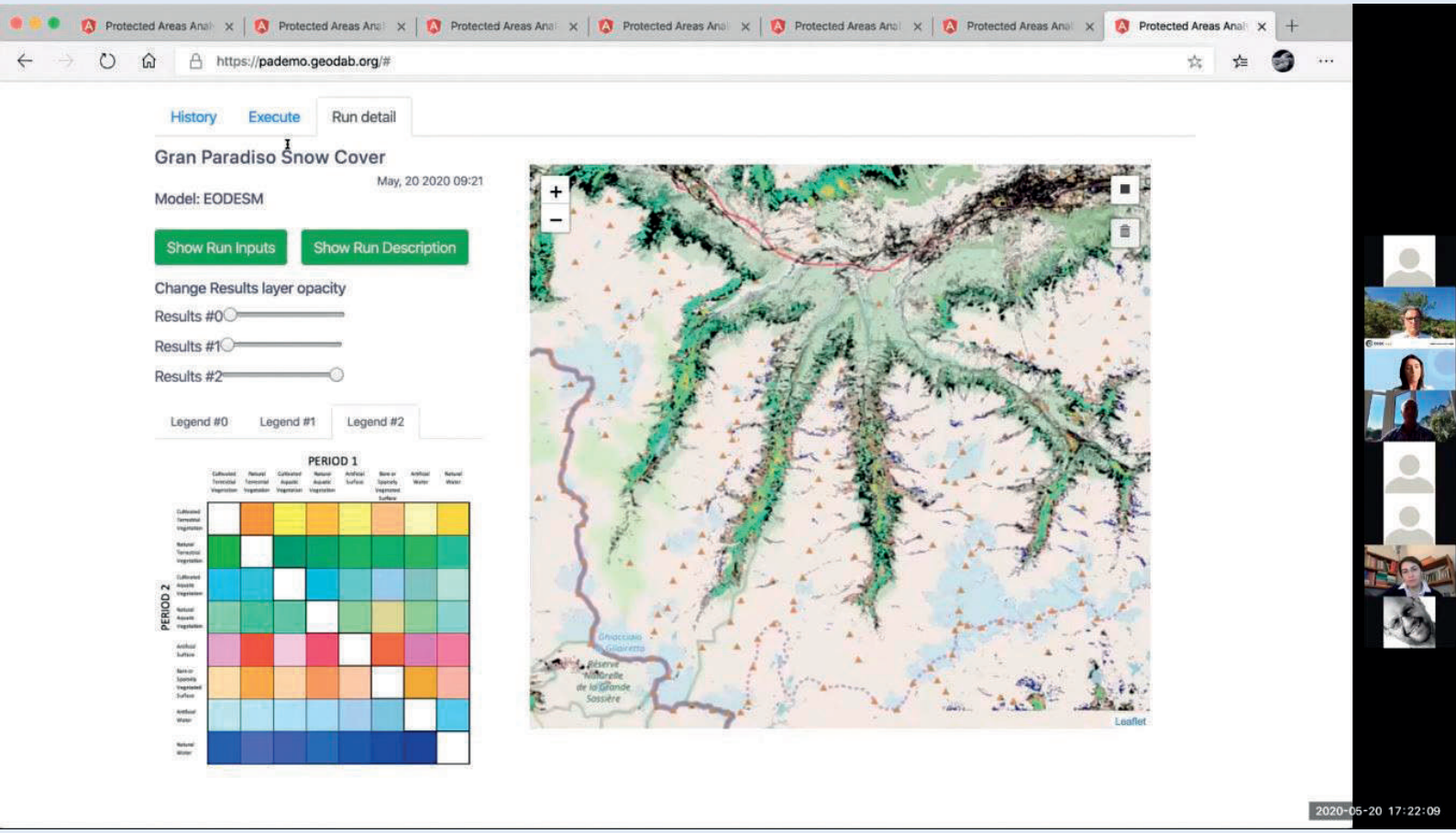
A number of sessions highlighted use cases that saw the practical application of EOSC across various disciplines and types of services. The Impact of EOSC-hub on science communities session featured various thematic services covering structural biology, humanities and social sciences, climate change, and others. The general remark was that the usage of EOSC resources can be boosted only when the issue of the sustainability model of EOSC can be solved. Linked to that discussion, the session on Business Models & Procurement aimed at collecting input for the report on business model analysis for procuring services in the EOSC that EOSC-hub is preparing (October 2020). The report investigates potential mechanisms

Addressing issues relating to climatic variability and sustainable use of forests with EODESM

The Earth Observation Data for Ecosystem Monitoring (EODESM) is a complex and expandable system that generates land cover and change maps based primarily on the Food and Agriculture Organisation (FAO) of the United Nations Land Cover Classification System (LCCS). Previously, EODESM was used within the computing infrastructures of participating institutions where access was limited (including to the satellite data used as input) and processing speeds were relatively low. The EOSC-hub project has allowed EODESM to open up it to the wider community and demonstrate potential for generating land cover and change maps for any site globally and for multiple points in time.

In the demo presented during the EOSC-hub week, Professor Richard Lucas from the Aberystwyth University, Wales, has shown the potential of EODESM to address issues relating to climatic variability and sustainable use of forests, with examples of the impacts of bushfires on Australia's forests and Hurricane Dorian on the Bahamas. The demo also described how commercial harvesting of forests can be monitored to support sustainable use via a series of examples from the Matang Mangrove Forest Reserve Peninsular Malaysia.

View the demo now!



for researchers to access the results of procured services free at the point of use, illustrated by real-life case studies to inform the Sustainability WG on key learning points as the legal entity develops the future operating model of EOSC. During the session the usage of vouchers as a way to start using cloud resources was discussed and considered an efficient instrument provided that the cross-border value added tax issues are addressed. Opportunities were also explored in aggregating demand for procurement.

To give communities an idea of the wide range of services currently available via the EOSC marketplace, the EOSC-Hub Common services - opportunities for usage and integration session gave an overview of the distributed computation and orchestration services, of the foundational FAIR data services and of the long-term preservation and sensitive data services currently orderable via the EOSC Marketplace.

The closing plenary also focused on the users, showcasing two demonstrations on how the services integrated and provided by EOSC-hub are impacting society at large. Prof. Richard Lucas from Aberystwyth University described how EOSC-hub is supporting the EuroGEOSS initiative while Prof. Alexandre Bonvin of Utrecht University highlighted how the EOSC-hub resources have empowered the WeNMR services supporting structural biologists work during the COVID-19 emergency.

Engaging the Private Sector

The EOSC & Industry session highlighted the achievements of the EOSC Digital Innovation Hub (DIH) which has become a catalyst for initiating industrial partnerships within the EOSC. Several DIH pilots presented how they have been able to use EOSC resources to innovate.

Trainings

Various training sessions were also organised such as ARGO Monitoring Service training session for Service Providers, EOSC-hub AAI training for communities, EOSC portal service onboarding - Training for EOSC projects

The Colocated Workshops

The EOSC-hub Week also attracted a number of co-located events bringing in audiences from outside the EOSC-hub project.

FAIRsFAIR organised a session on FAIR certification of repositories and other data services that tackled topics such as the FAIR certification of repositories and other data services, FAIR assessment for data services and FAIR-enabling repository data services.

The EOSC regional projects also provided a geographic flavour to the EOSC-hub Week with their workshop, National Policy Developments Supporting EOSC Implementation that discussed proposals for EOSC readiness indicators measuring on a national level.

The Extreme Data Cloud Workshop presented the XDC software released by the project.

EOSC-hub week facts

- Over 800 participants from all over the world
- 31 sessions for a total of around 40 hours of virtual interaction
- 127 questions with a total of 186 likes and 1214 votes in 69 polls
- 24 submitted posters. The Best Poster award went to bi Enterprise Content Management by Grzegorz Niemiec, Magdalena Makowska, Małgorzata Filipek, Mateusz Romaniuk, Piotr Piórkowski, Dorota Kot, EOSC DIH.
- 4 submitted demos. The Best Demonstration Award was given to DEEP HybridDataCloud by Developing and deploying your Deep Learning application by Valentin Kozlov (KIT), Lara Lloret Iglesias (IFCA-CSIC).

The EOSC Early Adopter Programme: bridging research with the European Open Science Cloud

We talk with Diego Scardaci about the EOSC Early Adopter Programme - an EOSC-hub initiative aiming at bringing together researchers and providers to accelerate science

What is the EOSC Early Adopter Programme?

The EOSC Early Adopter Programme was launched by the EOSC-hub project to support research communities interested in exploring the latest state-of-art technologies and services offered by the European Open Science Cloud (EOSC).

The Early Adopter Programme (EAP) has a main goal to facilitate research communities to scale up the in-house infrastructure and to access a richer set of resources.

Projects from the first EAP call started in December 2019. The second call recently selected more projects in April 2020, reaching a total of 13 use cases in the programme.

What are the main benefits for researchers? Can you give some specific examples?

The programme guarantees to the researchers:

- the support from infrastructure expert staff that will assist them on integrating activities with the EOSC resources and services.
- the technical infrastructure needed for piloting technical solutions. This includes accessing resources such as data, applications, software, and other services from EOSC-hub providers and partners depending on the research community needs.

A nice example is the project "Towards an e-infrastructure for plant phenotyping" from INRAE (France). The principal investigator, Vincent Nègre, has already deployed a first pilot to process a large amount of agriculture data with the EGI Cloud Compute service. To do this, he is also exploiting some other advanced analytic services like the EGI Notebooks. He is also planning to integrate his application with the EGI Check-in service to enable the secure access to the services with institutional identities.

You have coordinated the EAP programme from the beginning. How did you find the process? What are some challenges?

It has been a very nice experience! The EOSC Early Adopter Programme gave us the opportunity to show researchers how EOSC can help them in a concrete way. It has been very interesting matching the needs of the scientists with the large portfolio of services offered by EOSC-hub and EOSC Portal in general. Making scientists really able to order, via the EOSC Portal and Marketplace, access and use these services and see how this can help them in their daily work has been for us a demonstration of the validity of the EOSC concept and of the results we achieved in EOSC-hub.

The biggest challenges we had to deal with have been about making able

scientists and IT experts to work together although they are coming from two different worlds with different backgrounds.

How did you make the selection?

To select the awarded projects from the many proposals we have received, we have defined a thorough review processes that included 3 different phases and involved around 15 experts:

1) a technical review: to assess the maturity of the scientific tools proposed for integration into EOSC and the complexity of the proposed integration scenarios;

2) an impact assessment: to identify the projects dealing with relevant scientific challenges and representative of a broader scenario that when established in EOSC would have impact across Europe and beyond.

3) consensus meeting: involving all the reviewers that participated to the technical and impact assessments to define the final list of awarded projects.

What are the main advantages of being part of the EOSC?

EOSC offers a broad spectrum of services and technologies for the research data management lifecycle and scientific outputs like data, publications and software of pan-European relevance. By joining the EOSC, scientists can benefit from this service offering to integrate their tools with the most advanced ICT services able to deal with huge amounts of data in an effective way. Furthermore, researchers can also use EOSC to advertise their scientific tools, making them available to communities outside their usual areas, and so creating new collaborations.

Have a look at the brochure "The EOSC Early Adopter Programme" to learn more about the use cases.

Diego Scardaci is Senior User Community Support and Outreach Officer at the EGI Foundation and part of the EOSC-hub Technical Coordination Team.

The HADDOCK initiative supports COVID-19 research with EGI High-Throughput Compute resources

Talking about impact in the context of the novel COVID-19 research is, unfortunately, still inconceivable in terms of finding a vaccine or any other solution to eliminate the virus as such. That is not to say that there isn't any progress being made, by tons of researchers, many of them benefiting from Open Science initiatives.

One example of these initiatives is HADDOCK (High Ambiguity Driven protein-protein DOCKing), developed at Utrecht University and operated as a thematic service under the EOSC-hub project and a core software of the BioExcel Center of Excellence. This structural biology simulation tool supports complex simulations to generate 3D models revealing how virus proteins interact with human ones, or to dock small molecules to targets such as the SARS-CoV-2 protease.

This potential drug target plays an essential role in processing the polyproteins that are translated from the viral RNA during replication. Targeting it and other viral proteins such as the RNA polymerase with small molecules could make for effective anti-coronaviral drug cocktails (as is done for example for HIV). Due to the urgency, researchers made use of a strategy that repurposes existing and already approved drugs toward new diseases. The HADDOCK WeNMR platform supported this drug repurposing effort by screening **over 2000 chemical compounds against the protease structure in about only 3.5 days using EGI High-Throughput Compute resources** made available via the European Open Science Cloud. The initial results have revealed interesting compounds, some of which are already under clinical trials, supporting the validity of the screening methodology.

In order to monitor better COVID-19 related runs, the portal allows tagging of submission as COVID-19. Since this monitoring started over 3000 runs (not counting the drug repurposing screen) were processed in a month period. This tagging also allows to target the HTC jobs to sites specifically supporting this research. Another great result or impact, if you will, is to see the international mobilisation of additional resources to support HADDOCK jobs from both European, often high energy physics sites like CPPM (France), KIT (Germany) and USC-LCG2 (Spain), and worldwide sites such as the Open Science Grid (USA).

For more results visit the dedicated webpage of Bonvin Lab's website.

EUDAT cloud and data preservation solutions support the ICOS mission

The Integrated Carbon Observation System (ICOS) ERIC is an organisation of twelve member countries and over 130 greenhouse gas measuring stations aimed at quantifying and understanding the greenhouse gas balance of the European and neighbouring regions. The overall aim of ICOS is to support high-quality climate change research and provide access to research data.

The Carbon Portal is the data portal of ICOS ERIC and ICOS Research Infrastructure where all users can find and download the ICOS data and ancillary products. The Carbon Portal also provides virtual research environments where users can apply models, combined with ICOS and other data and visualize and/or publish the results again through the data portal.

Carbon Portal is now in the process to apply for the CoreTrustSeal certificate, supported by the FAIRSFAIR Horizon2020 project. The Carbon Portal requires trusted long term storage and distributed computing facilities to enable the portal functionality and to provide the virtual research environments with enough resources for the potential growing needs from its users.

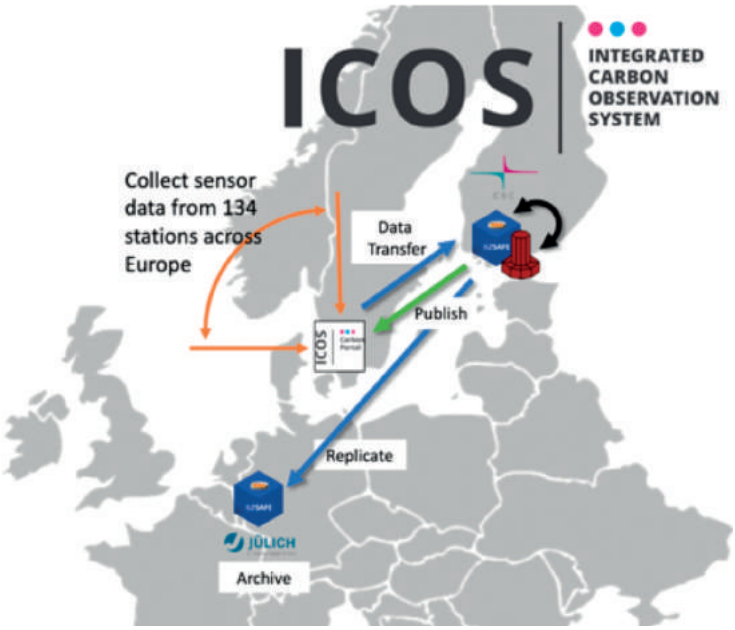
To address this challenge ICOS decided to leverage on the cloud and data analysis and preservation solutions offered by the EUDAT CDI.

The partners started to work on a proof of concept that should include transfering ICOS data to EUDAT B2SAFE in order to maintain a secure copy of the data, and to make the data available for data analysis on a cloud platform.

As a result, the raw and processed measurement data of all ICOS RI stations is now copied and stored in the EUDAT distributed and secure policy based storage, B2SAFE, to maintain a secure copy of the data. This data is then made available for processing and data analysis on the data portal and on the CSC Pouta cloud platform: in this way, researchers can easily and seamlessly access the ICOS data.

To enable the above, EUDAT has developed interfaces (APIs) that allow transfer of data from ICOS RI to B2SAFE. The APIs also support streaming of data in near real-time to enable the data management at ICOS Carbon Portal.

Photos by Konsta Punkka together with ICOS ERIC



The implementation of the streaming solution is an outstanding result achieved by the EUDAT and ICOS teams that over the past months have worked closely together to improve the performance of the streaming solution to enhance its reliability and performance.

Currently, the ICOS data is managed in the B2SAFE installation located at CSC, the Finnish IT Center for Science where also the development work has mainly been done. A replica of the data to a second EUDAT center (FZJ Julich, Germany) is planned. The data from B2SAFE is then successfully made available for researchers via the CSC's Pouta open cloud platform.

The proof of concept of the above system has been developed within the EOSC-hub ICOS competence center of which still some aspects have to be finalised to enhance the developed solution.

> *"ICOS strives to provide reliable data to inform science and society on the greatest environmental challenge of our time: global warming through greenhouse gases. Trust in our data also depends on robust and reliable data storage in real-time. Our checksums connected to persistent identifiers and recorded provenance metadata guarantees at any time that the data provided is the same as generated at measurement and/or processing time and provides full transparency on our data, leaving no room for skepticism."* highlights Alex Vermeulen, Director of the ICOS ERIC Carbon Portal.

As the early results of the implementation were very promising, ICOS and EUDAT have decided to continue the development and deployment of services in mutual collaboration and after an open tender procedure for procuring storage and computing services for the ICOS ERIC Carbon Portal, the EUDAT CDI is now supporting ICOS also beyond the EOSC-hub project.

The workflow implemented for ICOS sets the basis for a solution linking data portals with large scale computing facilities for data analysis and for distributing data to second location for trusted long-term preservation that can support communities from other thematic sectors in the future.

Open Science in action with EGI Notebooks and Zenodo

Giuseppe La Rocca describes a practical example of service integration in support of open science

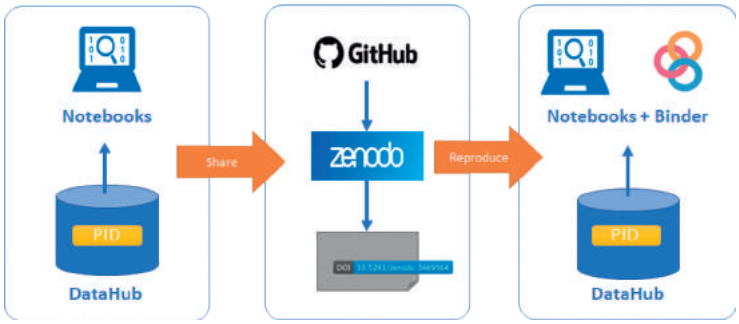
Would you be able to name three important pillars of Open Science? Data, code and papers are the keywords you're looking for. To support the implementation of the Open Science principles with open-source solutions and open services, the EGI Foundation is promoting the integration of the following services: Jupyter, Binder, GitHub and Zenodo.

In particular when speaking about services that support data analysis and visualisation, such as the EGI Notebooks service.

The service provides a user-friendly and highly flexible Jupyter-based web environment for the development and execution of data analysis and visualisation, and can contain programming codes in various languages. Users are enabled to easily share concepts, ideas and working applications, and - combined with Binder - the Jupyter notebooks are allowed to be reproducible and reusable by anyone, anywhere.

In combination with Zenodo, the open access repository for research publications, scientific data and other 'research objects', users are supported to easily engage with the concept of Open Science. Since the end of 2019, the EGI Notebooks service has been in production. Key to the stability of the service is a Binder integration, which is being developed. Currently runned in Alpha, the service is already being used in the PaNOSC cluster project and in some of the EOSC-Hub Early Adopter Programme (EAP) applications, and under evaluation by some EOSC-hub CCs.

To share more know-how on the EGI Notebooks service, it is included in the EGI Community Webinar Programme which was recently launched. The objectives of the past webinar, that took place on the 7th of May, were to show what the service offers to researchers and communities, how it supports compute- or data-intensive tasks and how to use the EGI



Notebooks service with Binder and other open-source solutions. For those who've missed it, the webinar has been recorded and to be found on the EGI YouTube channel under the dedicated webinar playlist. Training material and examples of the Notebooks can be found on the EOSC-hub website.

Giuseppe La Rocca is Community Team Lead at the EGI Foundation and leads the training programme of the EOSC-hub project.

Ensuring long-term access to EOSC resources: PIDs as a service

The European Open Science Cloud is on its way to becoming the reference point for researchers and innovators to discover, access, use and reuse a broad spectrum of research-related services. This will mean broader access to resources supporting scientific discovery and collaboration across disciplinary and geographical boundaries.

To ensure the EOSC resources are easily accessible and their usage continuously tracked, appropriate mechanisms must be put in place. **Persistent Identifiers (PIDs)** represent a good solution to this problem.

Currently there are several PID providers such as DataCite, EUDAT, CrossRef and ORCID, which are among the most popular. With their various persistent identifier systems, they address different use cases.

ORCID provides PIDs to identify researchers in an unambiguous way. DataCite and CrossRef PIDs are more for publications and at the level of datasets, and they require a minimum level of metadata before receiving a Digital Object Identifier (DOI). DataCite also provides connections via metadata to other resources, including other datasets, software, publications, people, funding, etc. These connected resources ideally use persistent identifiers as well, including DOIs from DataCite, other DOI registration agencies and/or handles, ORCID IDs, etc. These connections can be navigated in advanced ways using the PID Graph, a service developed in the EC-funded FREYA project.

EUDAT provides a flexible PID service infrastructure which is based on the Handle System (the so-called EUDAT B2HANDLE service). PIDs provided by EUDAT provide persistent references for all kinds of scientific artefacts and during all stages of the scientific process and across the data life cycle. Communities use flexible EUDAT PIDs within their workflow when digital objects (DOs) are firstly stored within the Research Infrastructure (RI). As RIs work in a distributed environment where data is located and maintained by different institutions, PIDs enable persistent access to DOs independent from the location where the data is stored.

Handles provided by EUDAT are mostly used for large, early stage data outputs, whereas DataCite DOIs – which use handles for persistent identification and resolution – are assigned to more permanent datasets.

Nowadays, there are several examples of organisations using DataCite and EUDAT systems, but to date, the workflows to make the most optimal use of both have not been explicitly identified. This is why DataCite and EUDAT are working together to provide PID services to support the whole researcher data lifecycle within the future EOSC landscape.

Through this collaboration, it would be possible to deliver PIDs for datasets

and digital objects in a more optimal way and identify a workflow that would enable European organizations to use handles for raw data and have a seamless transition to DOIs for more permanent datasets.

At the moment, in the context of the EOSC-hub and FREYA projects, the following activities are under development:

1. **The creation of a PID Service Provider Catalogue.** Merging the information about PID services and their providers into a single resource, helping researchers, data managers, and other EOSC users to discover and use PID services for their data management. A first version of the catalogue will be available by the end of 2020.
2. **The onboarding of the PID services in the EOSC Catalogue**.
3. **Joint training and communication activities**. Best practices for using PIDs, PID decision trees, and how to connect PIDs for data with other resources such as publications or funding to support data managers and researchers. See also the FREYA PID Forum Knowledge Hub.

The result of this collaboration feeds the work of the PID Task force of the EOSC FAIR and Architecture Working Groups to which the two projects are actively contributing. As an early result, the **Second draft Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)** has recently been released**.**

The final achievements of the collaboration will be presented at the **joint EOSC-hub/FREYA/SSHOC event taking place in Amsterdam in November 2020**.

EOSC-hub and OpenAIRE join forces with EOSC Enhance to collaborate on boosting the EOSC Portal

EOSC Providers, users and other interested stakeholders can expect to see some changes to the EOSC Portal with the combined efforts of EOSC-hub, OpenAIRE Advance and the newly-launched EOSC Enhance project.

Active as of 1 December 2019, EOSC Enhance has been tasked with improving and enhancing the discoverability of the EOSC services and resources, further developing and augmenting the EOSC catalogue, and enriching the EOSC data offering by connecting the thematic clusters and clouds currently in development.

These activities complement the foundational work on the EOSC Portal done by EOSC-hub, OpenAIRE-Advance, eInfraCentral and EOSCpilot in 2017-2019.

The recent signature of a dedicated collaboration agreement among these projects will allow them to establish joint coherent work plans to boost the functionalities and usability of the EOSC portal in preparation for the upcoming INFRAEOSC-03 call resulting project.

Streamlining service onboarding and delivery

Much of the tasks that these projects will collaborate on relate to the onboarding and management of services in the Portal. EOSC Enhance will build upon EOSC-hub, OpenAIRE, eInfraCentral and CatRIS initial contributions in these areas, as well as on technical discussions held within the EOSC Working Group on Architecture and on Rules of Participation

In detail, among the specific areas of collaboration include data models and processes for EOSC resources, technical development of the portal's demand-side components as well as the supply-side and operator-side components while jointly operating the EOSC Portal's provider onboarding process.

Building a community

In parallel to improving the technical and procedural infrastructure of the EOSC Portal's user and provider-facing components, the projects will collaborate on building a community around the EOSC Portal by continuously enriching the content side of the EOSC Portal through their involvement in the EOSC Portal Editorial Board and by openly consulting the EOSC stakeholders to enhance and consolidate the Portal's functionalities.

EOSC ENHANCE
CONNECTING THEMATIC COMMUNITIES TO ADVANCE OPEN SCIENCE

For For more information on EOSC Enhance, visit their page.

EOSC-hub releases an integration handbook for service providers

The EOSC-hub project operates many of the core elements of the European Open Science Cloud, and acts as the main facilitator of onboarding new providers in EOSC.

To support this, a handbook is now available to provide guidance for service providers who want to share services via EOSC with the use of EOSC-hub services. The handbook is meant to be used as a booklet to understand the big picture of the EOSC onboarding process and how to choose the best approach for integrating services.

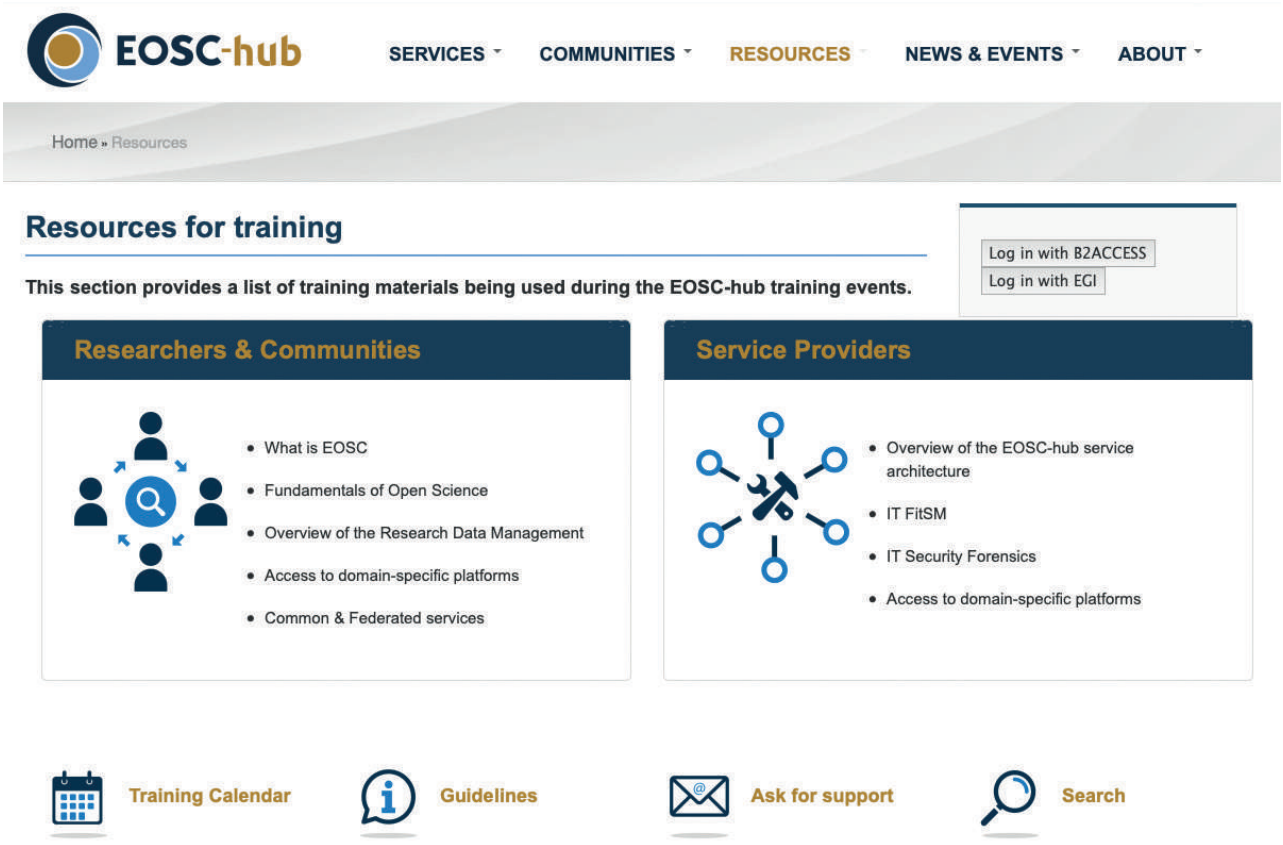
The document is available online.

The new EOSC-hub training catalogue has just been released!

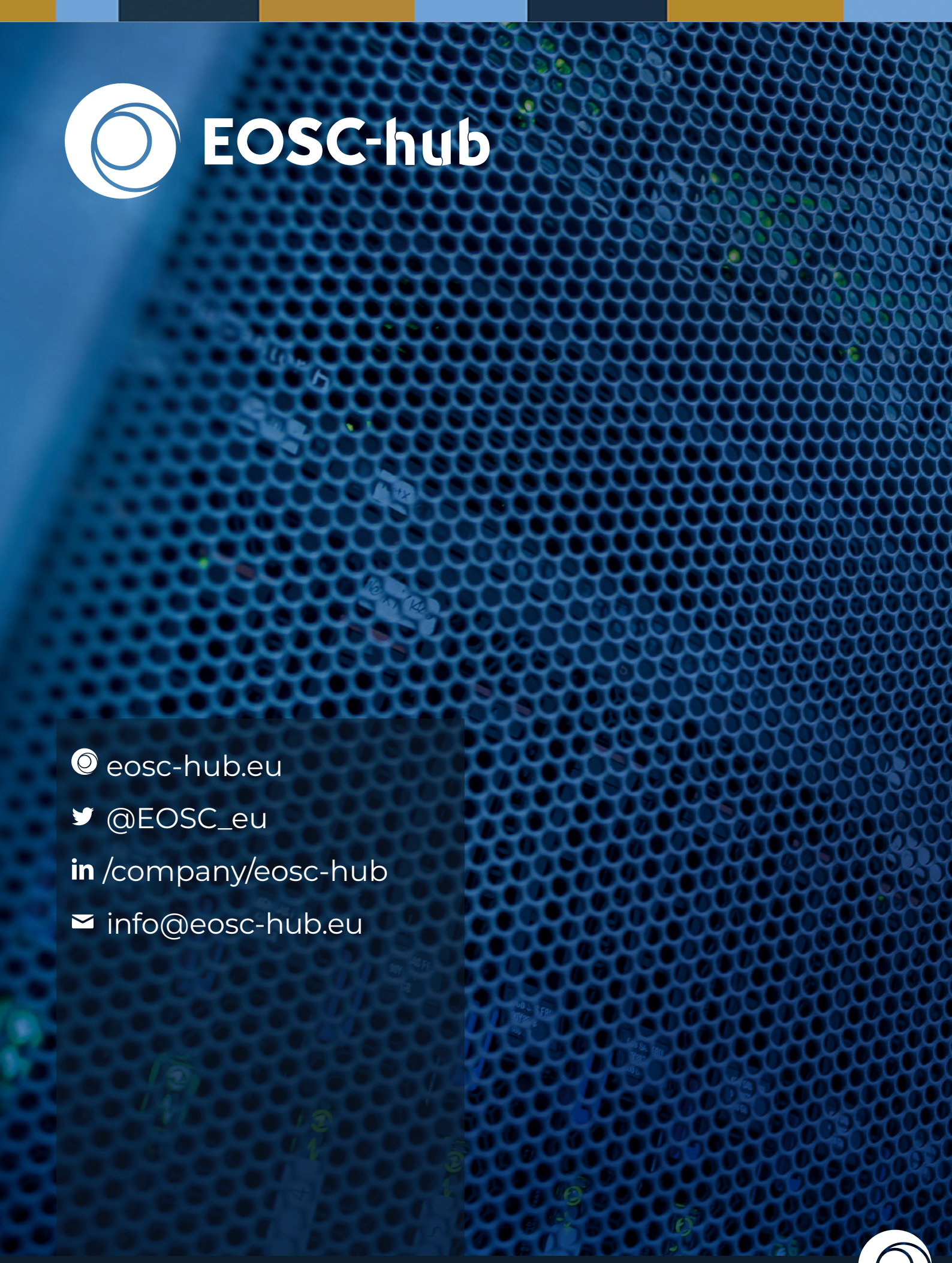
Check out the dedicated training modules for service providers, researchers and communities - all in a more user friendly and easily navigable interface.

Also, don't miss out on the next training event. Check out our training calendar!

See the EOSC-hub Training Catalogue now.




SAVE THE DATE
EOSC-hub
FREYA
SSHOC
social sciences & humanities open cloud
Joint
EOSC-hub / FREYA / SSHOC
Event
Amsterdam, 16-18 November 2020



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