



**CS³
MESH⁴
EOSC**

Connecting European Data



ScienceMesh – Federated Collaboration Platform for Researchers

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TNC 21



CS3MESH4EOSC has received funding from the European Union's Horizon 2020 Research and Innovation programme under **Grant Agreement No. 863353**.

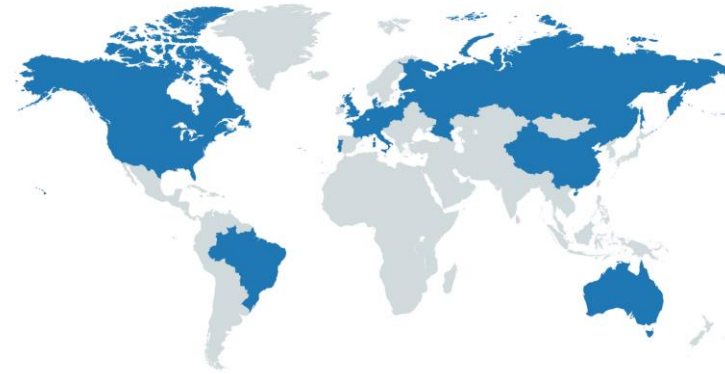


08/07/2021

Status quo

- # Many EFSS nodes, prominently NRENs, providing valuable **services** to the community
- # **Mostly Sync and Share**, but not limited to that
- # User environments, higher level **applications** (e.g. editors, data analysis...)
- # Basic **file sharing** possible

<http://www.cs3community.org>

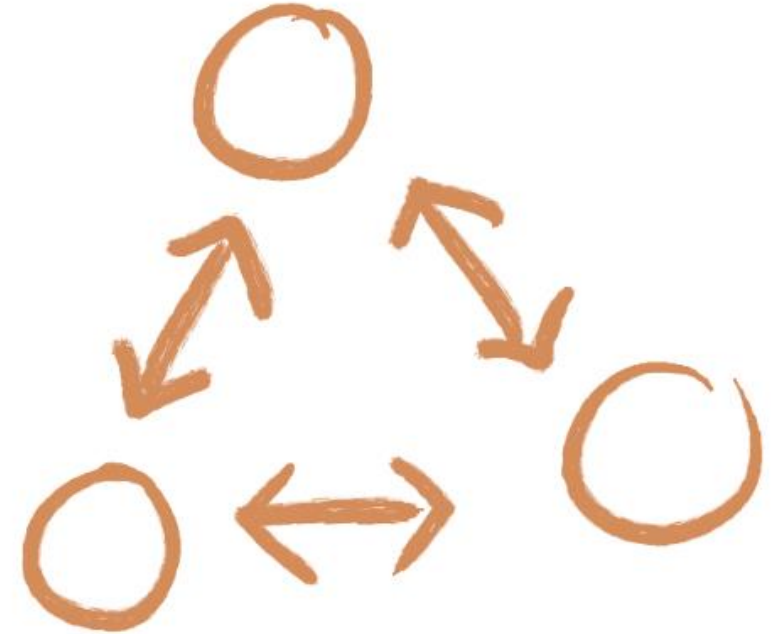


- # **CS3 Site Reports:**
- # **~16 PB** of data
- # **> 20 nodes**
- # **> 400.000 users**
- # **> 3.5 billion files/directories**



But...

- # Researchers remain **isolated on data islands** because these services aren't interconnected
- # **no common, ratified API among NRENs**
 - # Hard to share add-ons between NRENs
 - # Hard to get traction with eScience community
- # **Suboptimal knowledge transfer** back to commercial and business environments. We can't make a joined-up front this way



3-year Project

- # Started **January 2020** (kick-off meeting in Copenhagen)

Objectives

- # Delivering a **Global Collaboration Service** for researchers, educators, data curators, analysts...
- # Providing an **interoperable platform** to easily share and deploy applications and software components
- # Leveraging the potential of the **CS3 Community** and expanding it

Split in 5 Work Packages

Led by CERN

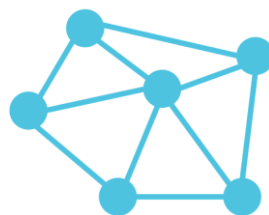


<https://cs3mesh4eosc.eu>





CS3MESH4EOSC



- Sync and Share services
- # Collaborative services
- # Higher-level environments
- # Compute + storage combined

- # Federation of nodes
- # Seamless exchange of data
- # Groups of (remote) users
- # Cross-site and cross-discipline collaboration

"[...] trusted, virtual, federated environment in Europe to store, share and re-use research data across borders and scientific disciplines."

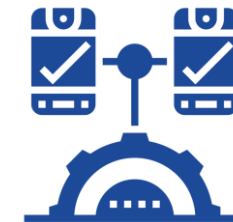
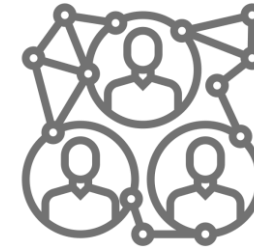
FAIR Data

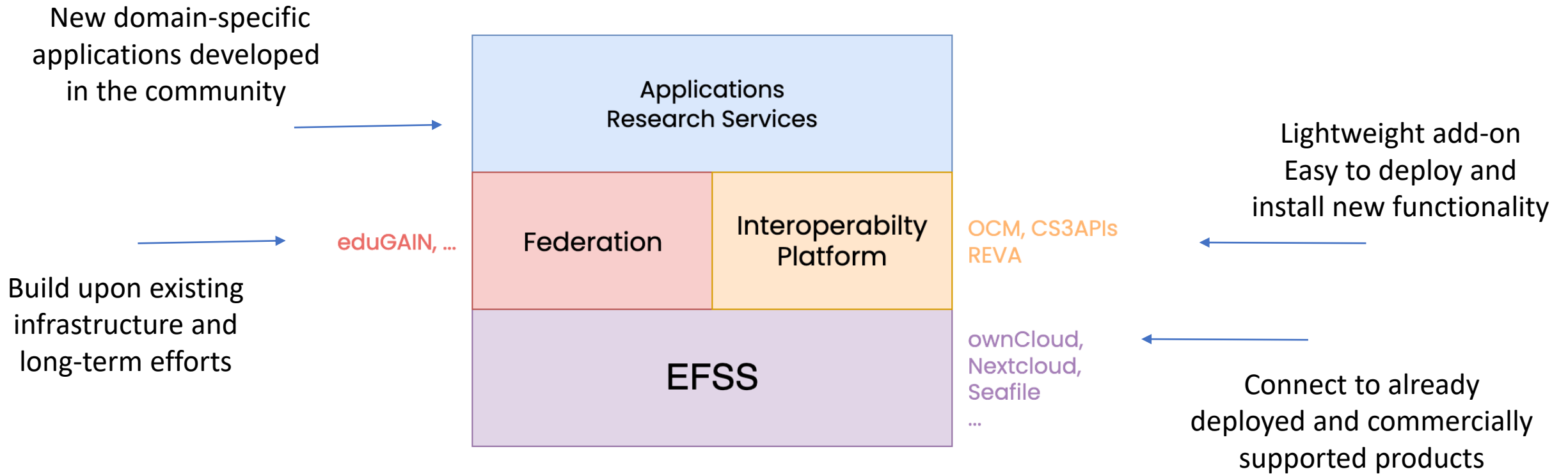


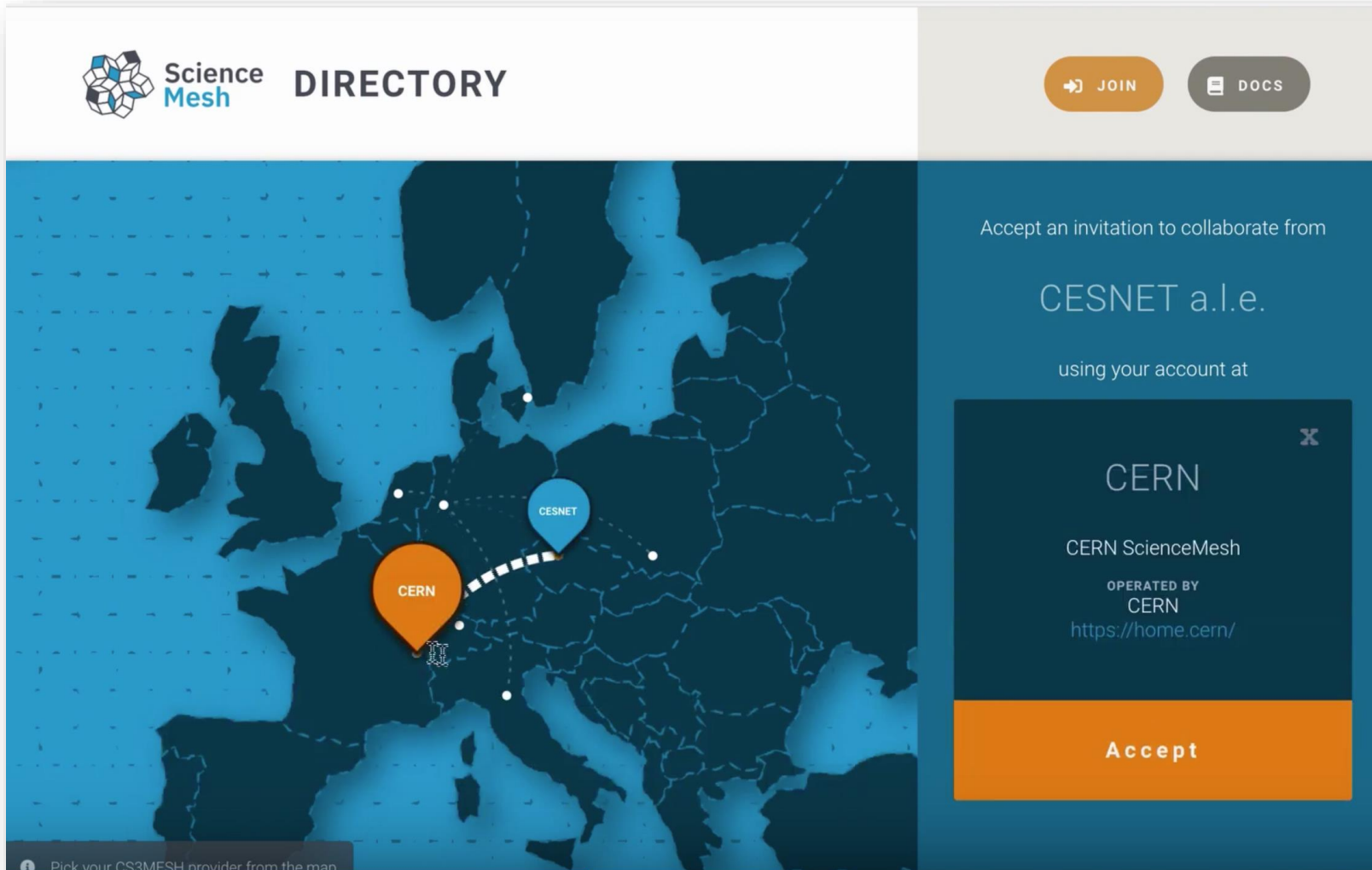


Science Mesh

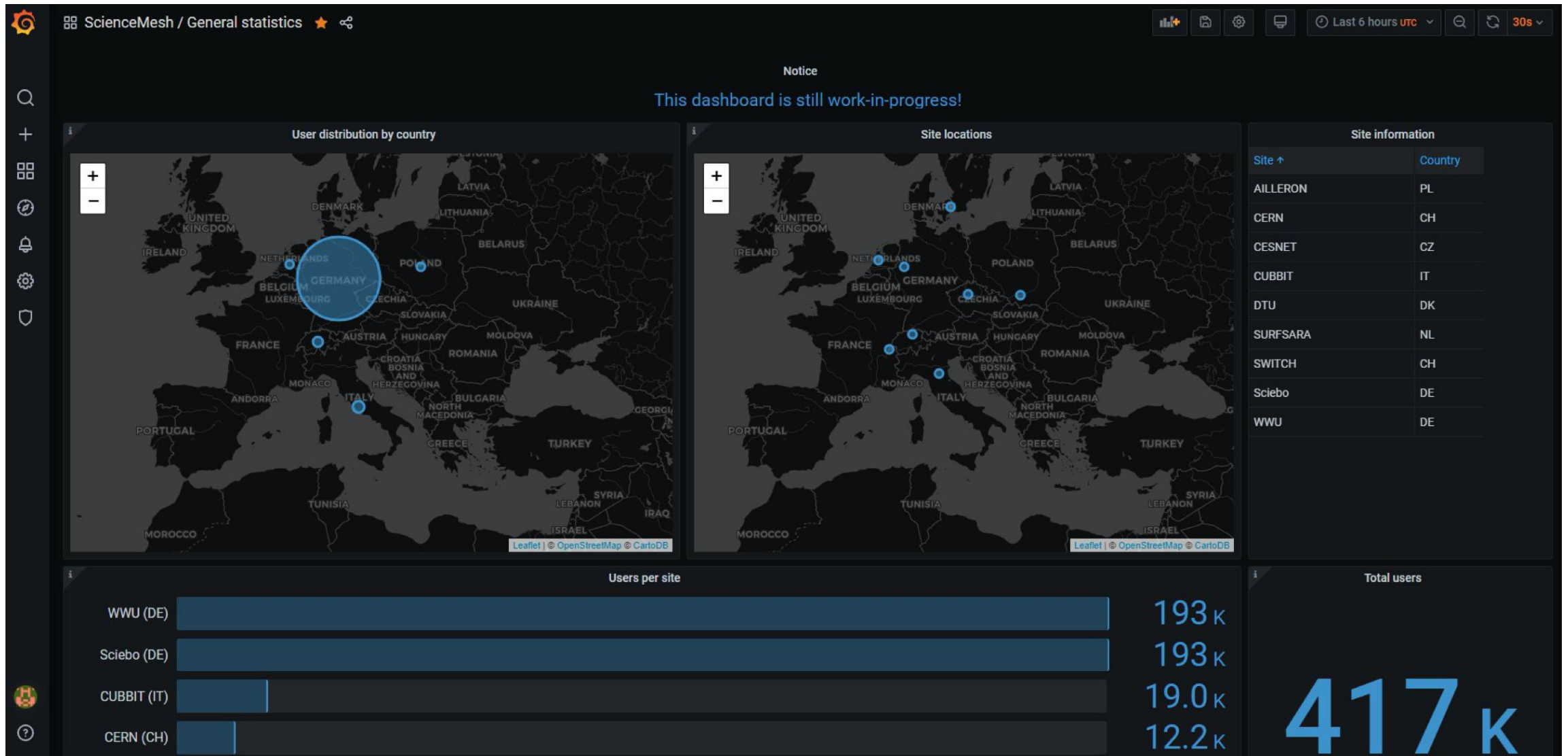
- # Decentralized **Mesh of EFSS nodes**
- # Based on **Open Standards** and **Open Source Software**
- # **Federated** environment where researchers can collaborate
- # **Application Platform** for distributed collaborative tools

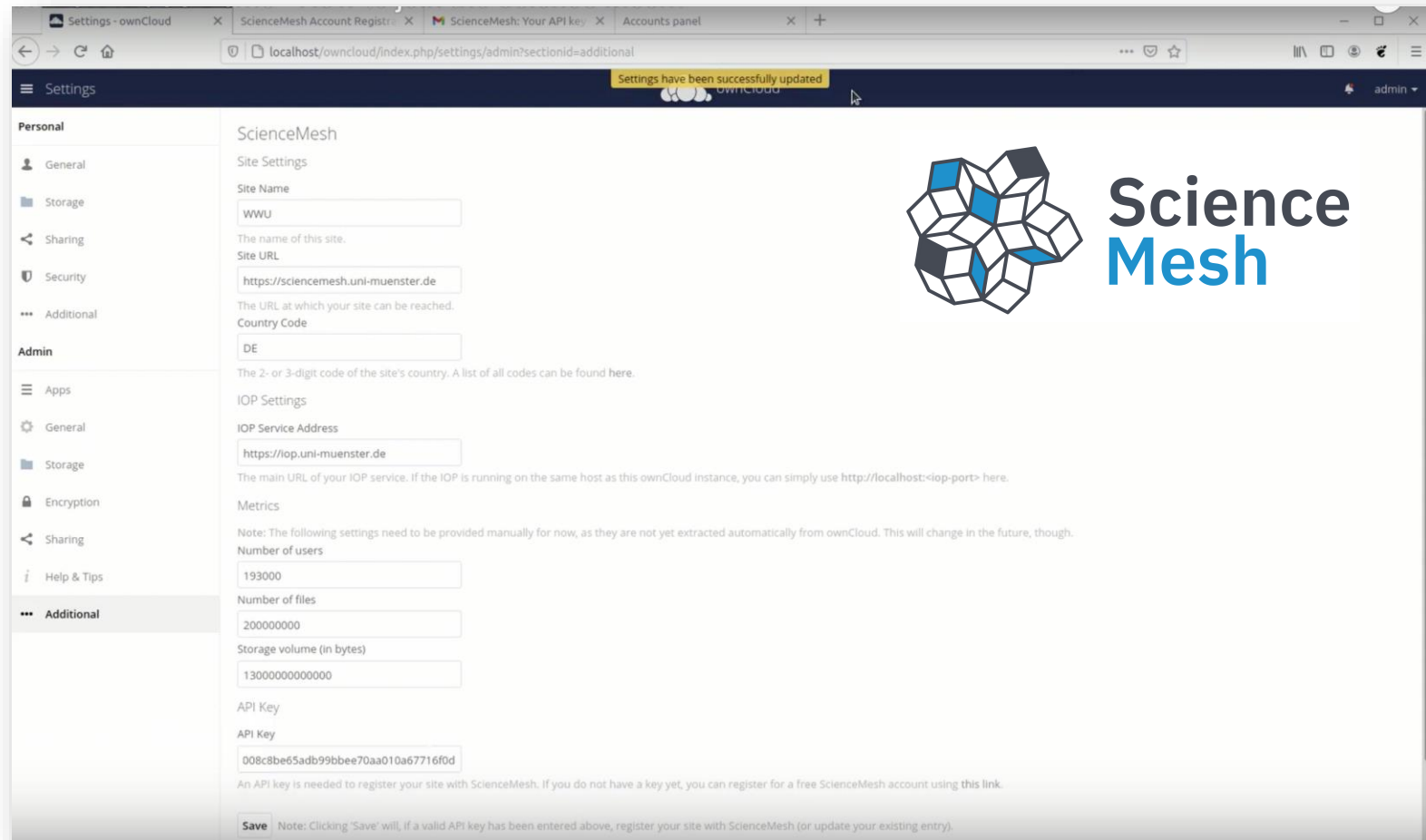






The screenshot shows the Science Mesh DIRECTORY interface. On the left, a map of Europe displays two location markers: an orange one for CERN and a blue one for CESNET, connected by a dashed line. On the right, a dark blue panel contains the following text: "Accept an invitation to collaborate from CESNET a.l.e. using your account at CERN ScienceMesh OPERATED BY CERN https://home.cern/". At the bottom of this panel is a large orange "Accept" button. In the top right corner of the interface, there are "JOIN" and "DOCS" buttons. A small tip at the bottom left of the map area reads: "Pick your CS3MESH provider from the map".





Connectors developed by the community for **Owncloud**, **Nextcloud** and **Seafile**



**Data Science
Environments**



Open Data Systems



**Collaborative
Documents**

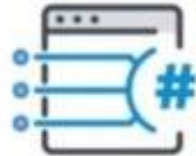


**On demand large
dataset transfer**



**Cross-domain data
sharing**

- # Web-based, interactive platform that combines code, text and outputs
- # Ideal for Collaboration, Sciences, Education, Interactive Dashboards...
- # Many languages supported (Python, C++, R, Octave...)
- # De facto standard for data science



Data Science
Environments



Text

Code

Graphics

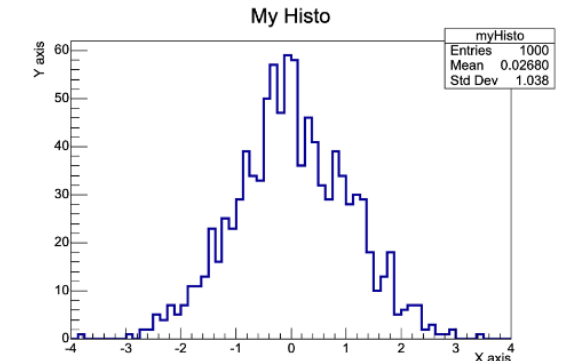
If you are wondering what this output represents, it is what we call a "printed value". The ROOT interpreter is instructed to "print" according to certain rules instances of a particular class.

Time to create a random generator and fill our histogram:

2 Displaying Graphics

We can now draw the histogram. We will at first create a [canvas](#), the entity which in ROOT holds graphics primitives.

```
In [4]: TCanvas c;  
        h.Draw();  
        c.Draw();
```



We'll try now to beautify the plot a bit, for example filling the histogram with a colour and setting a grid on the canvas.

```
In [5]: h.SetFillColor(kBlue-10);  
        c.SetGrid();  
        h.Draw();  
        c.Draw();
```



Big Data Platform at JRC

- Copernicus Earth Observation
- Geo Visualization and Data Exploration
- Interactive Dashboards

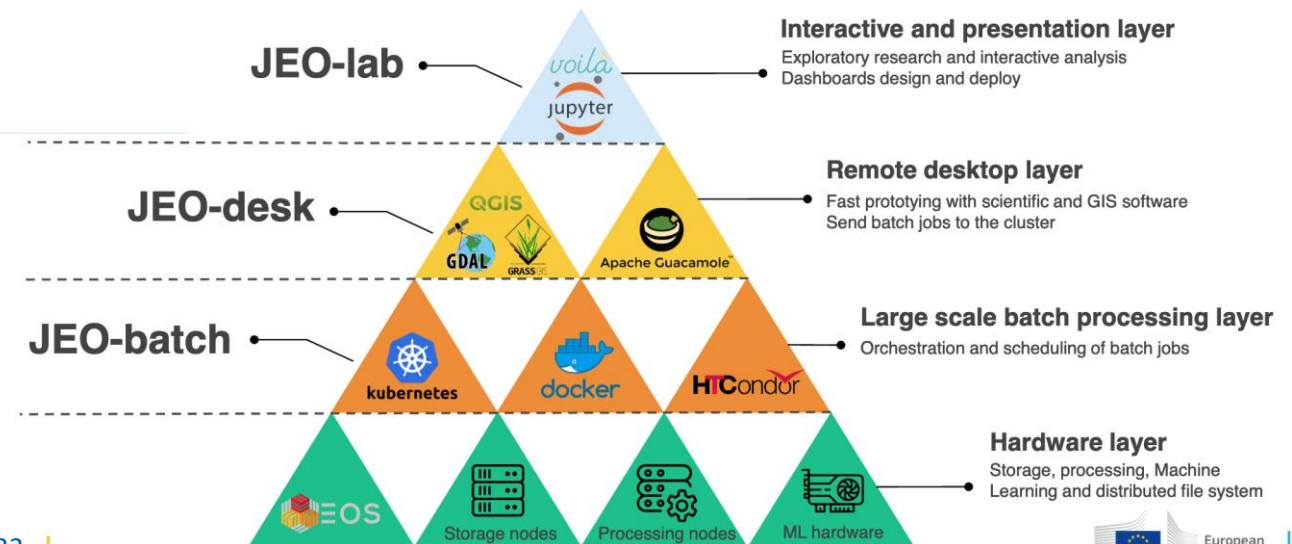
[D. De Marchi, CS3 2021](#)

<https://indico.cern.ch/event/970232/contributions/4158372>

SWAN Service at CERN

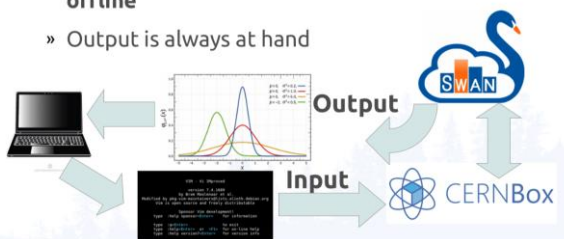
- High Energy Physics
- Interactive Data Analysis
- LHC Machine Learning
- Accelerator Logging

• ... [D.Castro, CS3 2020](#)
<https://indico.cern.ch/event/854707/contributions/3680522>



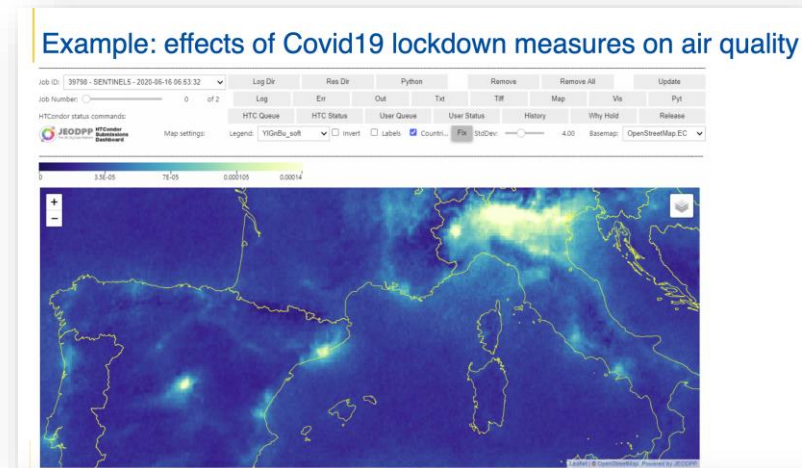
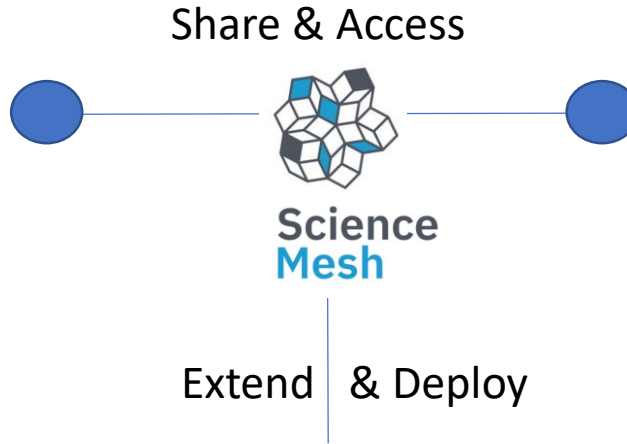
How SWAN works for me

- Usage with **cernbox** and **EOS** is great
 - » Develop locally, run your code **both on-line and offline**
 - » Output is always at hand

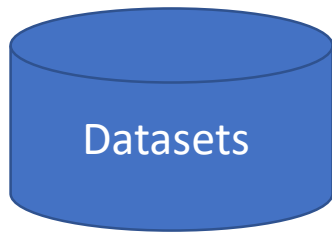


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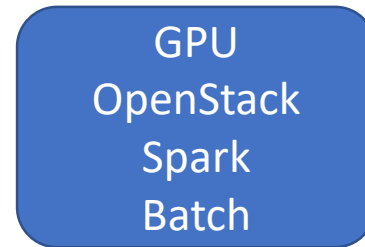
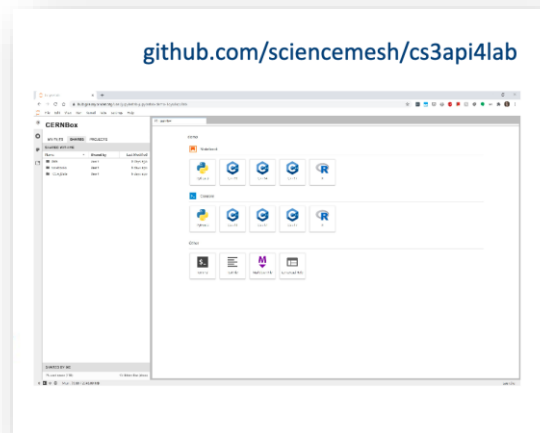
Live Analysis Workspaces



Visualization Dashboards



Storage



Compute

- # Open, practical, bottom-up approach
 - # working closely with users communities we take existing best practices, services and technologies, improve them and open up for other scientific communities
- # Leverage open-source community effort
 - # Build and extend existing services and infrastructures

Expected outcome of Science Mesh

- # **Enable frictionless collaboration on research objects for users**
- # **Increase the value of each individual service node for providers**



<https://sciencemesh.io>

<https://gitter.im/sciencemesh/community>

<https://github.com/sciencemesh>



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Thank you!
Discover more on...

 cs3mesh4eosc.eu

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 [@cs3mesh4eosc](https://twitter.com/cs3mesh4eosc)



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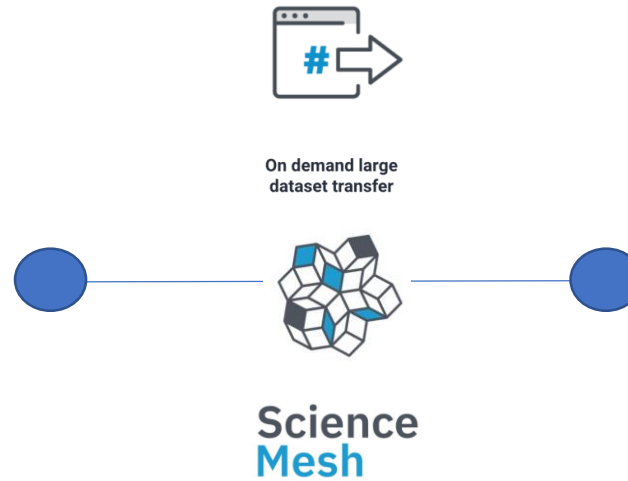
- # **Federation** – consistent quality of service, availability, ...
 - # Clear rules for onboarding
 - # Minimizing maintenance effort
- # **Technology** – interoperability across vendors/platforms
 - # Focus on existing Open Standards
 - # Keep close contact with vendors, invite them to participate
- # **Sustainability** – support services, development
 - # Create a lean infrastructure with as few “central components” as possible
 - # Build on existing CS3 Community
- # **Privacy** – bringing users and data together while respecting it
 - # “Privacy by design” from the beginning
 - # Core functionality should not require concessions



Icons:

- # [“Connection”](#) by **Eucalyp** from the Noun Project
- # [“Connection”](#) by **Doub.co** from the Noun Project
- # [“Platform”](#) by **Eucalyp** from the Noun Project
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Dataset transfer between research groups



LOFAR