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Colophon

## 2 About the organisers

picture of the activities triggered by the EOSC developments in Europe.

### 2.1 About PLAN-E

PLAN-E ([plan-europe.eu](http://plan-europe.eu)) is the Platform of National eScience Centers in Europe. It consists of representatives of the major centers in Europe concerned with eScience, including Data Science and Computational Sciences, and which have -by rule or *de facto*- a national or regional role in their home country.

PLAN-E is based on voluntary co-operation and knowledge sharing, in particular regarding the further development of eScience, the status of people working in the eScience domain, the proliferation of knowledge about the impact of (big) data, the importance of proper data management and the relation to proper academic conduct and so on. But also the more traditional topics, like Computational Science, involving modelling, are covered by most of the PLAN-E member organisations.

PLAN-E Plenary meetings are hosted twice annually in turn by different countries. The meetings involve mostly two or three different topics addressed in workshops.

### 2.2 About the Workshop

Many PLAN-E members, in particular the local host at the Paris PLAN-E Plenary meeting, wanted to share their efforts on harmonising their national ICT infrastructures, towards the future connection into the European Open Science Cloud. Their presentations together with the discussions in different breakout sessions that took place afterwards, are combined into this very report. From this material conclusions on the state of affairs and matters to attend to are presented.

### 2.3 About the report

This report is the direct reflection of the input and discussions during the PLAN-E Plenary meeting in Paris, April 19-20 2018. The observations and conclusions are direct translations of the discussions in different workshop sessions of the participating members and invited speakers. About 12 members states and associated countries provided their input directly to this workshop, so as to provide a broad

### 3 Executive summary

- Investing in national public (academic) ICT-infrastructures at the national level is ongoing business in EU's member states and will continue.
- The EOSC developments are generally supported in member states at the various policy levels.
- Member states are seriously missing direction and directives from the commission as to how to go forward to ensure future connectivity and embedding into an EOSC-type infrastructure.
- The combination EOSC+EDI has hard and soft components. It so seems that the EOSC has more of the soft elements and EDI more hard elements, but it is as yet unclear what member states should focus on.
- An unfairness is generally felt in a perceived bias towards the "Big Sciences" compared to science in general. The EOSC should, according to the PLAN-E members, involve *all* sciences and disciplines from the very start and not just the domains which just happen to require Big Facilities that only can be afforded at the European level.
- The gradual growth model for the EOSC carries a risk that this would reinforce any existing bias towards the Big Sciences.
- User involvement at the policy level should cover all sciences and not be overly dominated by ESFRI-type of representation. This is derived from the fact that policy for data sharing and re-use in general should not be directly drawn from policy related to Big Data or Big Sciences.
- Members are charmed by the EOSC ideas and see room for implementation and proliferation, but the Commission should seek to profit from the present pace of developments and provide guidance at its earliest possible convenience in order to maximize benefit from this momentum.
- This report gives an overview of national activities in a large number of member states with a fair spread over Europe. It

demonstrates a high dynamic in plans and investments and a variety in scopes and focal areas. The purpose of this overview is to show that tapping into this dynamics should allow for a swift implementation of the EOSC ideas once these have been made clear.

- PLAN-E supports the EOSC concepts presented so far and continues to help in proliferating a major pillar that should carry the EOSC: The FAIR Principles.

## 4 Background to the workshop

PLAN-E bundles the potential and interests of the eScience communities (with eScience encompassing Data Science, Computational Science). As party with most aspects of eScience present in its overall membership, the national organisations involved in eScience or providing eScience services, PLAN-E has adopted to proliferate the FAIR principles and the EOSC endeavors at large to the scientists and national policy domains.

While these activities were adopted by PLAN-E at the European Open Science Cloud (EOSC) Summit in Brussels on 12 June 2017, and was PLAN-E mentioned twice in the list of do-ers to help establishing the EOSC, the results of our (PLAN-E) efforts are being monitored during the semi-annual PLAN-E Plenaries. This is done by plenary reporting from the participants and/or through progress and state-of-art discussions in workshops.

From these session topics reports are and will be continued to be compiled and distributed.

## 5 Plenary contributions

### 5.1 Croatia

Croatia has several distinguished institutes/ organisations involved in European activities and/or data sciences:

- The Rudjer Boskovic Institute (RBI) that leads the DARIAH Competence Center project;
- SRCE - University of Zagreb University Computing Centre as the major national infrastructural ICT institution
- DATACROSS, the Center of Excellence for DATA Science and Cooperative Systems, the first national research center in the technical sciences;

RBI, the Centre for Informatics and Computing, is leading the DARIAH Competence Center (DARIAH CC) activities. Its mission is to broaden the usage of the advanced research infrastructures (eScience) and technologies, such as cloud-oriented services,

computational and storage resources in the domain of the Arts and Humanities research, using Data Science.

Associate institutions are:

- The Magyar Tudományok Akadémia Számítástechnikai és Automatizálási Kutatóintézet (SZTAKI), or the Institute for Computer Science and Control of the Hungarian Academy of Science
- The Italian National Institute of Nuclear Physics (INFN)
- The German Gesellschaft für wissenschaftliche Datenverarbeitung mbH (GWDG)
- The Dutch Archiving and Networked Services (DANS)
- The Austrian Academy of Science (AAS).

RBI is partner in the EOSC Hub and OpenAir H2020 projects.

SRCE is providing a modern, sustainable and reliable e-infrastructure for research and higher education community all over Croatia.

In 2015 SRCE built a national digital repositories infrastructure Digital Academic Archives and Repositories (DABAR) in cooperation with the number of institutions from academic and research community in Croatia. DABAR is a key component of the data layer of Croatian e-infrastructure, a system that enables all higher education and/or research institutions to easily establish and maintain reliable and interoperable institutional digital repositories. It also enables the research community to establish thematic repositories and archives.

The implementation, maintenance and development of digital archives and data services are of significant importance for SRCE, together with supporting the open access initiative, as well as open education and open science paradigms.

Several digital archives were implemented by SRCE alone or in partnerships, such as: the Portal of Croatian scientific journals (HRČAK), Croatian repositories and archives aggregator (ARA) and the Croatian web archive (HAW).

SRCE is involved in the EOSC Hub project.

Inspired by development and research in Europe, and by the scope of activities that PLAN-E covers through its members, RBI and FER initiated the DATACROSS Center of Excellence, which was created in 2016.

The center comprises 13 distinguished higher education and research institutions in Croatia. The Center has two research units:

- Research Unit for Data Science
- Research Unit for Cooperative Systems

The project team consists of more than 80 distinguished researchers who are active in the various areas of data science with industrial involvements.

## 5.2 Denmark

In Denmark is the Danish eInfrastructure Cooperation DeiC responsible for most of the interactions with European eInfrastructure (and eInfrastructure projects) and the end users in the research domains. DeiC was

	<i>ABACUS 2.0</i>	<i>COMPUTEROME</i>	<i>KAC</i>
Host/Location	Southern University of Denmark, Odense (SDU)	Technical University of Denmark, Lyngby (DTU)	Royal Danish Library, Aarhus (KB)
Cores Storage	14,000 CPU 1 PB	19,000 CPU 8 PB	<500 CPU 0.1 PB
Access model	Pay-per-use	Pay-per-use Subscription model	Subscription model

established in 2012 and operates as a virtual organization under the umbrella of the Danish Agency for Science, Technology and Innovation. DeiC is a cooperation between 8 Danish universities, to provide for digital research infrastructures, including HPC. The national HPC resources are located and operated by three different Hosts: The Southern University of Denmark, Odense (SDU), The Technical University of Denmark, Lyngby (DTU) and the Royal Danish Library, Aarhus (KB). They operate not only different systems, but also under different access conditions (see table).

The different access modes seem to fit the requirements of the different disciplines. Abacus 2.0 (SDU) being mostly used in physics and Computerome (DTU) in Life Sciences.

In the ideal situation, according to DeiC, scientists should have the cost for storage and compute included in their research budgets. However, sustainability of the access modes model without continuous national funding is yet an issue.

As part of the 2015-2018 strategy, DeiC formulated six goals, with a strongly international focus:

- Ensure a national development of e-infrastructures according to international standards
- Ensure establishment of relations and e-infrastructures for international collaboration and knowledge sharing.
- Increase the use of eScience
- Maintain and further develop a funding platform for research e-infrastructures
- Coordinate solutions around data management and large data amounts
- Ensure that DeiCs activities are known and widely used.

## 5.3 France

The French ICT-infrastructure components to serve the public research community has grown into a rather fragmented set of organizational resources.

Fragmented in terms of communities served, physical resources offered and financial scope. CNRS, the French Research Council/Funding agency holds 10 institutes. And next to that there are CEA, INRIA, INSERM, IRSTEA, IFREMER and the universities. There is no overall strategy for interoperability (Access, Exchange, Communities), they have different business models, policies and standards. CNRS has understood that this situation needs to be addressed and they did.

CNRS installed an advisory body, named MICADO (for Mission Calcul – Données (Mission on Compute and Data) that produced important conclusions and advise:

- Do not dissociate HPC from data analytics (in other words involve HPC in the total ICT-infrastructure)
- Rationalise the complete ICT-infrastructure
  - Put scientific challenges central in policy
  - Coordinate and rationalize investments
  - Harmonise national and site policies

- o Distinguish resources from science
- Perform a landscape analysis on resources, involving PRACE, Tier-1, Tier-2 and their respective needs and usage
- Optimise the deployment of financial means
- Valorise data resources.

Although these advisory lines may concern the whole French ICT-infrastructure, the scope of MICADO formally only concerns the CNRS sites.

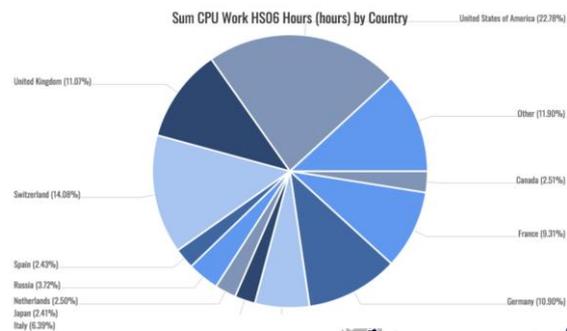
French top-research is rather internationally (European) embedded and IN2P3, operating under the umbrella of the CNRS is an example of the participation in Europe's major research infrastructures.

IN2P3 stands for Institute National de Physique Nucléaire et de Physique des Particules. It holds a research budget of 70 M€, not including salaries and an additional 20 M€ for very large research infrastructures. It encompasses 25 laboratories and 8 interdisciplinary accelerator based platforms across France and participate in 30 major research programs and 50 International research agreements. It's mission is now to coordinate the research in the fields of nuclear, particle and astroparticle physics. It so covers the two extremes in physics: from elementary articles to cosmology. It has set itself the task to coordinate national research programs and the French participation in major international Research Infrastructures. In addition it provides expertise, training and teaching.

The institutes under IN2P3 share a common infrastructure with approximately 0,5 Pflops over 47000 cores, 65 PByte of disk and 40 PByte of tape storage. The national Research network Renater provides the interconnections and connections to the outside world.

Next to resources of IN2P3 there are a grid and a cloud infrastructure in France. France was one of the early adopters of the grid as originally a supporting international infrastructure for CERN, but since long extended from that original scope. France has its National Grid Initiative, the national entity that participates in EGI, the European Grid Initiative, to

which it contributes significantly, as can be seen from the breakdown below.



The French grid involves 13 sites with a total storage capacity of 45 Pbytes, and a CPU-total of 65000 cores. The younger and smaller Cloud infrastructure involves 7 sites, with 1500TB storage and 7500 cores.

Of course the grid did not come in one day. An illustrative development picture is given below:

- **2010: birth of GIS France-Grilles and EGI foundation**
- **2011: EGI Technical Forum in Lyon gathers over 670 participants**
- **2012: discovery of the Higgs boson using LHC Computing Grid**
- **2013: birth of SUCCES national workshop with HPC user group - birth of FG-Cloud**
- **2014: french EGI users harvest 40% of their computing resources outside France**
- **2015: France-Grilles virtual organization enters EGI top 10 VO**
- **2016: France-Grilles enters top5 contributors to EGI cloud federation**
- **2018: french EGI users have harvested 1 billion normalized CPU hours outside France since january 2014**

## 5.4 Germany

Integration and modernization concepts of the German ICT infrastructure are driven by and formed in consultation with the German Council for Scientific Information Infrastructures (RfII). The Council monitors transitions in the German academic system at large and gives practical recommendations to academia and the government. Specifically, the Council

provides foresight on the development of digital science;

promotes coordination of existing activities;

identifies potential synergies between the diverse actors and new fields of action;

intends to stimulate cooperation within the academic system;

monitors international policy developments.

High-performance computing (HPC) is fostered by Gauss Centre for Supercomputing (GCS). The GCS strives for the sustained development of computer-aided scientific research in Germany and Europe by providing the highest level of HPC expertise and services as well as state-of-the art HPC resources. In this endeavour, the GCS relies on its member centres: High Performance Computing Center Stuttgart (HLRS), Jülich Supercomputing Centre (JSC), and Leibniz Supercomputing Centre (LRZ).

The LRZ, a centre at the Bavarian Academy of Sciences and Humanities operates since 1962. LRZ is a member of the GCS, in the field of Research Computing, data and IT services - one of the major national and international players in the field of research computing, data and IT services as well as one of the leading centers in the European HPC-infrastructure (e.g., PRACE, EuroHPC). Furthermore, LRZ one of the first HPC centres which deploys direct-liquid-cooled computing resources. Aiming at supporting outstanding research and education in various scientific domains, LRZ provides the stable, reliable, secure, and energy-efficient IT services (see the graph below) based on the latest IT technologies.



LRZ feels a high responsibility in providing the best of services to scientific communities. As the services must be reliable and secure, the ongoing ISO certification of LRZ in IT Service Management (ISO 2000) and Information Security (ISO 27000 series of standards) is of utmost importance.

The current flagship resource of LRZ is is a high-end supercomputer SuperMUC. With 500 TByte of

memory, 20 Pbyte of storage and 245,512 x86 cores, it reaches and a peak performance of over 6.8 PFlop/s.

The high-capacity, flexible and energy-efficient supercomputer, SuperMUC-NG, is the Next Generation to the SuperMUC. LRZ remains a strong advocate of hot-water cooling and SuperMUC-NG is designed to be a highly energy-efficient machine – a common requirement for German supercomputers. Operating from January 2019, with more than 6.400 Lenovo ThinkSystem SD650 DWC compute nodes and 300,000 cores; and a peak performance of 26.7 PFlop/s, this one of the fastest supercomputers in the world will be used to support scientists from all those fields where high performance computing plays a role.

In addition to the compute, network, and storage components, the energy efficiency of the cooling and air conditioning systems contribute significantly to the overall power consumption in a data center. Energy-efficiency has been an important topic for many years at LR, and, in fact, has evolved into one of main research fields. LRZ has developed a holistic methodology for optimizing the energy efficiency of the entire data center infrastructure and employs a large number of measures (e.g. reuse of waste heat, automatic frequency control as part of the energy/power-aware resource management and scheduling system, etc.) that are in production use of the center for the overall energy consumption reduction.

LRZ as a member of the “Munich Data Science Centre”, provides to the scientific community large-scale data archiving resources, Big Data technologies and Cloud solutions. Furthermore, as a Bavarian Big Data Competence Centre, LRZ collaborates with Bavarian academicians in data analytics, big data, artificial intelligence, etc.

One of the prominent answers to challenges regarding data and e-infrastructures in Germany and Europe, is the project GeRDI (Generic Research Data Infrastructure) Funded by the German Science Foundation (DFG). the project “aims to enable all scientists in Germany, especially those who hold only

small amounts of data, to store, share and re-use research data across disciplines". LRZ plays the essential role in GeRDI.

GeRDI connects existing and future research data centres in order to support the findability, accessibility, interoperability and reusability (FAIR) of research data across all research disciplines. It plans

To build an RDM infrastructure in Germany

First Phase: 2016 – 2019

Based on FAIR Principles

To include of new communities in development;

To model structure und achieve connectability with national and European RD infrastructures.

Awareness grows daily of the importance of proper RDM in Germany. Through GeRDI, Phase 2, the proper RDM, focusing on FAIR principles should be assured. LRZ also actively investigates the circumstances that stand in the way of data reproducibility. Among others, with help of RDM, LRZ assists researchers in designing the solutions, which can prevent or reduce the reproducibility crisis.

Training and education of the user community members is a prerequisite of successful operation of IT service provider! Within the framework of the Partnership initiative Computational Sciences (PiCS) of the centre, introductory workshops are organised for the scientists from Bavarian universities and research institutions as well as other stakeholders like ministries or governmental agencies. In a series of various training events, LRZ experts provide introductory courses for researchers and students who want to utilize LRZ resources for various tasks.

## 5.5 Greece

Greece is actively involved in major European projects that have the goal to make the EOSC come alive, such as the EOSC-Pilot and the EOSC-Hub. But Greece has a long history of participating in European projects that support or encourage open science and the open availability of data, such as OpenAir. The Athena Research Center is the major Greek player in OpenAir

and GRnet, the Greek National Research Network organization, is member in both the EOSC-Hub and EOSC-Pilot projects.

Furthermore a Research Cloud service is operated in Greece, under the name Okeanos. It provides IAAS (Infrastructure As A Service).

All in all is Greece active in the presently leading European projects that help establishing the EOSC.

## 5.6 Hungary

Hungary is in hopeful expectation regarding the impact of the EOSC on Hungary's research infrastructure. Hungary fully supports the ongoing actions towards the EOSC in Europe and supports the underlying promises that make up the EOSC.

The common understanding in Hungary is, that the EOSC will consist of the combination of Coverage, Integration, Efficiency and Impact. More in particular the EOSC should provide:

- Full coverage of European users, scientific disciplines, available e-Infrastructure services
- An as complete as possible integration of the available e-Infrastructure resources in Europe
- The simplest, easiest, friendliest access to, and utilisation of, the e-Infrastructure services by R& I & E
- Arrangement to a one-stop-shopping like reach and use of the integrated European and national services
- An approach to a fully sustainable operation of the integrated e-infrastructure system and its elements
- And offer affordable open access to the services and to all freely available user data for interested researchers
- The widest possible exploitation of the European e-Infrastructure facilities, tools, methods and services
- Support to the ERA (the European Research Area) by providing a ubiquitous EOSC harness.



## 5.8 Netherlands

In The Netherlands policies and services regarding Compute, Data, Connectivity, ICT-facilities and ICT-services are the domain the three tightly connected organisations: SURF, DANS and NLeSC. All three are (co-)funded by NWO, The Netherlands Organisation for Scientific Research (the national science funding organisation). SURF is an association of the Dutch universities and vocational high schools and a few research related organisations, DANS stands for Data Archiving and Data services and NLeSC for Netherlands eScience Center. SURF hosts the compute, storage, networking, cloud and grid services, DANS is a data-added value organization where researchers can deposit their data from short term to long term and create FAIR-compatible data sets and databases, and NLeSC provides academic-research level ICT-related support to major scientific projects in the Netherlands on the basis van peer reviewed competition of support proposals. Together they form the heart of the Dutch national policies on ICT and the international cooperations on organizational (e-IRG, EOSC) and practical (PRACE, EGI, EUDAT) level.

Specific actions regarding FAIR:

- NWO has taken up FAIR in all research proposal templates
- FAIR features clearly in the new strategy of NWO
- Open data is one of the key themes in National Plan Open Science , a policy platform of the universities, academy of sciences, research council, SURF etc, in the discussions of which also the ministry of science, education and culture participates. [www.openscience.nl/en](http://www.openscience.nl/en)
- FAIR is, next to FACT (Fairness, Accurate, Confidential, Transparant i.e. legal, Normative, Ethical), a major theme in the national research agenda on Big Data (large collaborative projects)
- FAIR in the public sector at large being discussed
- SURF, DANS, eScience participate in various H2020 projects (EOSC-Pilot, EOSC-Hub)

Challenges in implementing FAIR are faced by:

- Testing a prototype of FAIRdat within DANS, with 4 other repositories at the Open Science FAIR in

Athens

(<https://www.surveymonkey.com/r/fairdat>)

- Participate in the FAIR metric group: see <http://fairmetrics.org>.
  - 14 metrics on Github: <https://github.com/FAIRMetrics/Metrics>
  - Preprint of paper "A design framework and exemplar metrics for FAIRness" (<https://www.biorxiv.org/content/early/2017/12/01/225490>).
  - Evaluate DANS archive against FAIR metrics.

About the proliferation of AIR in the domains, engaging scientists and scholars: see [www.esciencecenter.nl](http://www.esciencecenter.nl).

On September 14, 2017, ePLAN, the "Dutch national version of PLAN-E" organized a workshop "FAIR: Facts and Implementations", of which the workshop report can be found at <https://doi.org/10.17026/dans-z6h-4dcw>.

NLeSC and DANS together are working on a translation of the FAIR Principles for their application to *software*. The foundations of this implementation were laid during the Sustainable Software Sustainability Workshop at DANS in March 2017 (DOI: 10.17026/dans-xfe-rn2w).

Also in this context NLeSC and DANS published a report Research Software at the Heart of Discovery (16-02-2016)



([https://www.esciencecenter.nl/pdf/Software\\_Sustainability\\_DANS\\_NLeSC\\_2016.pdf](https://www.esciencecenter.nl/pdf/Software_Sustainability_DANS_NLeSC_2016.pdf)) And finally NLeSC also opened a Research Software Directory, encouraging the re-use of software ([www.research-software.nl](http://www.research-software.nl)).

## 5.9 Nordic countries

The "Nordic Countries" Finland, Sweden, Norway, Iceland and Denmark each have their own national services and policies based on their national ICT-infrastructure (see for example section 5.2 Denmark).

In addition they have established an agreement to co-operate in the domain of ICT-infrastructures. The co-operation is named NelC (Nordic e-Infrastructure Collaboration).

NelC is a joint initiative between the Nordic countries, hosted by NordForsk since 1 January 2012. NordForsk appoints the NelC Board based on nominations by the national e-infrastructure provider organisations. These strategic partner organisation are CSC (Finland), SNIC (Sweden), UNINETT Sigma2 (Norway), DelC (Denmark) and RH Net (Iceland). The NelC Board consists of one representative from each of these.

The NordForsk Board has delegated to the NelC Board the authority to make strategic decisions regarding computing and data-storage infrastructure and react on upcoming opportunities. This includes allocating budget, implementing the organisation structure as well as prioritising and coordinating Nordic collaboration projects. The NelC Board develops and maintains a strategy for NelC. The NelC Board recommends the NelC Director to be appointed by NordForsk.

NelC's activities in support of the EOSC involve:

- Large-scale data storage
- Strategic Theme Development Projects
  - Nordic e-Infrastructure for Sensitive Data
  - Nordic Cloud Collaboration
  - Nordic e-Infrastructure for Research Software
  - Nordic Sharing and Exchange of e-Infrastructure Resources
  - Researcher Training and visits
- Possible Nordic Data Management collaboration

A Nordic outlook and planning cycle is taking place, involving:

- a coordination with the potential partners in 2018
  - EOSC Data culture and FAIR data
  - Ideas will or need to include:
    1. common strategies for implementation of FAIR principles
    2. common tools for machine-actionable data management plans,
    3. data stewardship

A Nordic pilot for the EOSC is under consideration. NelC could well set an example for the EOSC, through trust. The NelC consortium has demonstrated that a high-level Nordic-European co-operation on practical matters such as ICT-infrastructures at large, based on mutual trust of the partners, can work.

### 5.10 Poland

Poland serves the science community already for a long time an integrated ICT-service, named PL-Grid. This grid is the main vehicle that should carry the transition to an all-encompassing European Science Cloud. Fortunately Poland does not have to start from scratch. In the early two- thousands a Distributed Computing Environments (DICE) Team was formed by a group of computer scientists and IT experts from the [Department of Computer Science AGH](#) and [ACC Cyfronet AGH](#). This curiosity- and research-driven team, specializes in large-scale distributed computing, HPC, Web and Cloud technologies and develops new methods, tools and environments for e-Science, healthcare and industrial domains.



Collage (2011) was an early development project, to support executable publications. Because Collage was conceived already in 2011, there were significant challenges ahead:

Scientific: A common description schema for primary data (experimental data, algorithms, software, workflows, scripts) as part of publications; deployment mechanisms for on-demand reenactment.

Technological: An integrated architecture for storing, annotating, publishing, referencing and reusing primary data sources.

Organizational: Provisioning of executable paper services to a large community of users representing various branches of computational science; fostering further uptake through involvement of major players in the field of scientific publishing.

In that same timeframe, Poland engaged in the grid developments that started in Europe. It has taken a prominent position therein. The Polish Grid

Infrastructure (NGI) was built within the PL-Grid project (2009 – 2012) to provide the Polish scientific community with an IT platform based on computer clusters, enabling research in various domains of e-Science. The infrastructure supports scientific investigations by integrating experimental data and results of advanced computer simulations carried out by geographically distributed research teams.

The PLGrid infrastructure enables Polish scientists to carry out scientific research based on the simulations and large-scale calculations using the computing clusters as well as provides convenient access to distributed computing resources.

Since March 2010 the Polish Grid Infrastructure has been a part of a pan-European infrastructure built in the framework of the EGI (European Grid Initiative), which aims to integrate the national Grid infrastructures into a single, sustainable, production infrastructure. PLGrid infrastructure is both compatible and interoperable with existing European and worldwide Grid frameworks. Meanwhile PLGrid serves over 6000 users (!), with 5+ PFlops of computational resources from over 130.000 cores and 60+ PBytes of storage. In a follow-up process, PLGrid engages explicitly with Scientific Communities, through the PLGrid Plus and PLGrid NG projects. Goals are to create synergy between domain specific researchers and IT experts. The resulting solutions enter the PLGrid Infrastructure as an added service.

Cyfronet, the Polish National Research and Education Network (NREN), participates in the EOSCPilot and EOSCHub projects. For EOSCPilot it delivered “Onedata” for the hybrid cloud and for EOSCHub it adapted OneData for the EGI-Datahub and Marketplace, to discover order and access services from the EOSCHub service catalogue.

Onedata is a complete high-performance storage solution that unifies data access across globally distributed environments and multiple types of underlying storages, such as NFS, Lustre, GPFS, Amazon S3, CEPH, as well as other POSIX-compliant file systems. It allows users to share, collaborate and perform computations on their data.

Globally Onedata comprises of: Onezones, distributed metadata management and authorisation components that provide entry points for users to access Onedata; and Oneproviders, that expose storage systems to Onedata and provide actual storage to the users. Oneprovider instances can be deployed, as a single node or a HPC cluster, on top of high-performance parallel storage solutions with ability to serve petabytes of data with GB/s throughput.<sup>1]</sup>

More on Marketplace can be found at <https://marketplace.eosc-hub.eu/>.

Special attention was paid to serving the medical research community, with its special requirements regarding privacy and security. Developed are VPH-Share Federated Cloud (VPH for Virtual Physiological Human), see <http://www.cyfronet.krakow.pl/cgw13/abs/vph-tutorial.pdf> and EurValve, a Personalised Decision Support system for Heart Valve Disease (<http://www.eurvalve.eu/>).

### 5.11 Switzerland

In Switzerland different players are involved in the provision of ICT-Infrastructures for science.

Founded in 1991, CSCS, the Swiss National Supercomputing Centre (CSCS)<sup>2</sup>, develops and provides the key supercomputing capabilities required to solve important problems to science and/or society. The centre enables world-class research with a scientific user lab that is available to domestic and international researchers through a transparent, peer-reviewed allocation process. CSCS's resources are open to academia, and are available as well to users from industry and the business sector. The center is operated by ETH Zurich and it's headquarter is located in Lugano. CSCS is a hosting member of the Partnership for Advanced Computing in Europe. Latest efforts go in the deployment of a PID/handle infrastructure (C2CAMP, ePIC).

In 2017 in a joint initiative the Federal Institutes of Technology in Zurich (ETH) and Lausanne (EPFL)

<sup>1</sup> <https://indico.cern.ch/event/663264/contributions/2818153/>

<sup>2</sup> <https://www.cscs.ch/>

founded the Swiss Data Science Center (SDSC)<sup>3</sup>. The center is designed to ensure that Switzerland has the data science competences needed to succeed on the international stage. Researchers from a wide range of disciplines can use the platform to store organised and – if necessary – anonymised data, which are then made available to other scientists. The result is a bridge between researchers who produce data and those who develop new data analysis and data system technologies.

SWITCH<sup>4</sup> is the national academic network, security and identity manager. Based on his core competencies SWITCH offers collaboratively developed ICT solutions that empower users in and beyond the academic world to achieve leading edge results in a globally competitive environment.

The goal of the P-5<sup>5</sup> program of swissuniversities has the goal to combine the currently separate efforts in ICT to provide and process scientific information. The aim is to establish a reorganized system by the year 2020 that will provide researchers, teachers, and students with an extensive range of science-related digital content and the optimum tools for processing it. swissuniversities<sup>6</sup>, the umbrella organization of all Swiss universities, has the goal to strengthen and enhance collaboration among Swiss institutions of higher education and promote a common voice on educational and research issues in Switzerland. In the context of P-5, swissuniversities is aiming in the context of P-5 to create a Coordination Office for Scientific Information (COSI) with the goal to support the universities in the development of scientific information strategies. It is aimed that COSI will be operated by SWITCH.

In 2017 Switzerland signed a letter of support for EuroHPC<sup>7</sup>. The EuroHPC Joint Undertaking (JU) is a legal and funding entity which will enable pooling of the Union's and national resources on High-Performance Computer (HPC). The EuroHPC Joint

<sup>3</sup> <https://datascience.ch/>

<sup>4</sup> <https://www.switch.ch/about/foundation/>

<sup>5</sup> <https://www.swissuniversities.ch/en/organisation/projects-and-programmes/p-5/>

<sup>6</sup> <https://www.swissuniversities.ch/en/>

<sup>7</sup> <https://ec.europa.eu/digital-single-market/en/eurohpc-joint-undertaking>

Undertaking builds on the declaration launched in Rome in March 2017 and signed by several European countries that are committed to upgrading European computing power.

## 5.12 Turkey

Tübitak is the Scientific and Technological Research Council of Turkey. Under the umbrella of Tübitak resides the institute Ulakbim (ULUSAL AKADEMİK AĞ ve BİLGİ MERKEZİ) the national Academic Network and Information Center. It carries out work regarding the education/research network infrastructure and information products and services on a national scale. TRUBA is the eScience infrastructure organization, set up by Ulakbim. The TRUBA eScience Center is supported by the Ministry of Development and by TUBITAK to support individual researchers, research groups and national infrastructures, The goals of TRUBA are:

- To provide the creation of technological, administrative and political frameworks that enable scientific computation, data centers and network infrastructures built with national investment supports to be used efficiently and cost-effectively by researchers.
- To provide advisory services to policy-makers to coordinate coordination among Distributed Computing Infrastructures (High Performance, Grid, Cloud, ...), which enable them to work in computational sciences.
- Consulting services by the scientific computing centers and data warehouse to be included in the e-Science Infrastructure Turkey.
- Following the e-infrastructure, in coordination with national and international institutions and organizations, to support programs and projects related to the integration of Turkey in the international infrastructure.

TRUBA resource usage can be read from the following table:

CPU cores	≥ 17000
High performance storage capacity	3.2 Pbytes
Registered users	≥ 1800
Computing resource usage	≥ 310 Million CPU core hours
EGI resource usage	≥ 5.3 Million CPU core hours
SCI Publications (2012-2017)	454
Theses (2012-2017)	104
Supported research projects (Since 2008)	50
Supported national communities	HEP, Seismology, ELIXIR
Participated EU projects	11
EGI sites	2 Grid, 1 Federated cloud

The EOSC claims to provide 1.7 million EU researchers an environment with free, pen services for data storage, management, analysis and re-use across disciplines. From that number, 120.000 researchers will be from Turkey.

Ulakbim supports Turkish researchers through:

- Open data and data-intensive science with TRUBA,
- Pre-print, open access and open annotation via the services provided by CABIM,
- Diffusion of open source software.

Moreover, by its founding member of EGI.eu, ULAKBIM has a commitment to several EOSC actions.

ULakbim has been serving the "Long Tail of Science" (LToS) data as well as repositories of major research domains since over 15 years. In support of the EOSC, ULAKBIM will also empower national research communities to perform collaborative compute/data-intensive science across Europe and beyond.

Meanwhile, ULAKBIM prepared a platform (Invenio<sup>8</sup> based) in order to fulfill the requirements of open access and open data. The back-end services are ready and the front-end web access is under development.

### 5.13 United Kingdom

The situation in the UK is complex due to the Brexit process. As in most other parts of daily life, Brexit poses problems and opportunities. And also like everywhere else, the consequences and positive/negative balance are still hard to grasp.

<sup>8</sup> <https://invenio-software.org/>

One attempt of an analysis is a published paper by Paul Ayris, "Brexit-and its potential impact for open access in the UK"<sup>9</sup>. The conclusions of this article are that new opportunities will remain, but that the - relatively natural- leadership of the UK in the open and open science matters will no longer be so obvious. A warning against isolation is in place.

The universities of Leeds, Sheffield and York share an office in Brussels, White Rose Brussels (<https://brussels.whiterose.ac.uk/>). They published an article on the future of Open Access research in the UK<sup>10</sup>. They estimate that a real challenge will arise if the UK is not an equal partner in the future EOSC. The UK, presently claimed to be world leader in Open Research Data repositories with an over 7% global share, is as yet unsure about membership of the EOSC or FP9 for that matter. All depends on the final deal, the report ends.

In the UK, STFC, Jisc, Southampton University, the Oxford eResearch Center, and the Edinburgh EPCC are most prominently involved in the EOSC, formally or through project participation. STFC is notably coordinator of the EOSC-pilot project.

Recently, UK Research and Innovation (UKRI), whose members are the seven UK Research Councils, Research England and Innovate UK, was commissioned by the UK government and universities to compile a research and innovation infrastructure roadmap, that should lead to realise the Government's ambition of [2.4% UK GDP investment in R&D by 2027](#). The Roadmap exercise, the first ever of this scope and nature in the UK, is to:

- identify future research and innovation capability priorities
- identify opportunities for increasing inter-connectivity
- support development of UKRI's overall long-term investment plan
- promote the UK as a global leader in research and innovation

<sup>9</sup> <https://insights.uksg.org/articles/10.1629/uksg.336>

<sup>10</sup> <https://brussels.whiterose.ac.uk/the-european-open-science-cloud-the-future-of-open-access-research/>

- set out the major steps needed to reach the long-term vision.

This can be considered a major step in the harmonization of national research infrastructures, not just ICT-infrastructures.

## 6 Workshop results

### 6.1 Pre-amble

If ever good will was shown by such a large audience to support a major European endeavor, it is for the success of the EOSC. The time is right, the kernel parties ready and eager to act and the international discussions positive in nature. But then, what to do?

Most of the PLAN-E members work very close to the heart of the EOSC-activities. Close to the governance, close to the physical infrastructures, members of the EOSC-Pilot and/or EOSC-Hub projects, and so on. Yet much needs to be clarified or decided upon, in order not to lose momentum or pace. This came out of the discussions in groups, following the plenary presentations. Take into account some remarks come "from the belly", but are taken as is, because they are yet a reflection of how things are conceived. This seems important to take into account.

### 6.2 Discussion elements and remarks

- Even for the closely involved, the EOSC-concept is not clear:
  - Member states want to save money
  - The EU wants more control
  - Infrastructure developers want more opportunities.
- How to cope with these different interests?
- Need to define the services the (end-)user can expect and explain the added value of these services
- The EOSC seems defined primarily from a policy point of view. But the benefits for (end-)users need to be articulated and even better: shown to users.
- Pay attention to explain how, according to the onset expectations for the EOSC, the very

existence of the EOSC will change the way research is going to be conducted.

- In order to do this, EC needs to involve end-user researchers in the process so to better understand their point of view of the needs - "give me a faster horse" - and translate into innovation - "1st car".
- Most scientists working in domains that do not belong to the hard core HPC or grid-users group have difficulty to understand what the issue ("the problem") really is, nor can they appreciate actions that involve their traditional workflows.
- Unfairness is perceived from the fact that funding goes to "big (big data or big science)" projects, while much and no less relevant research has no access to such (financial) resources.
- The EOSC is clearly a focal point for new directions in national ICT-infrastructures. This can readily be derived from the plenary presentations.
- This is a good thing, but by lack of directives from the EU, national parties are still creating their own solutions to a yet unknown end goal.
- Fear is expressed that -with reference to the long tail discussions - the support bias towards the Big Sciences will only be reconfirmed or become stronger (unless dedicated action is taken to counter that). A step-by-step route will even strengthen this bias, because one then starts with the inner circle parties that are already involved in ESFRI-projects or other major H2020-related projects.
- There may be hope that scientific and technological results and experiences from Big Science projects may trickle down to the "Small Science" domains. But this remains to be seen. Perhaps some policies can be designed to encourage/facilitate this.

## 7 Formal PLAN-E statement of support for the European Open Science Declaration

This statement is the result of the discussions continued during the 7<sup>th</sup> Plenary meeting of PLAN-E in Oxford, 10-11 October 2017. It is repeated here because it fits the topic of this report.

The plenary of PLAN-E confirmed during its meeting in Oxford, October 10-11 2017, that PLAN-E supports the EOSC Declaration.

In detail PLAN-E can and will:

1. Help proliferate and implement FAIR principles for data in all disciplines and help refining its very definition in different application domains. Furthermore PLAN-E will help:
  - a. extending the working domain of FAIR principles to software,
  - b. promote FAIR principles within our communities, and
  - c. implement FAIR data principles within our own institutes;
2. Upon invitation, act as an active stakeholder in the EOSC governance structure by translating scientific requirements into advice for practical services and physical components in the infrastructure;
3. Provide hubs, via its membership, for collaboration among the eScience community and provide knowledge on the deployment potential of ICT and available e-Infrastructure for domain researchers, largely at National level;
4. PLAN-E, based on understanding both vertical needs and horizontal demands for e-Infrastructure services, will be able to:
  - i. identify gaps in service provision,
  - ii. identify research profiles for domains,
  - iii. oversee future needs;
5. Help harmonizing, within and among disciplines, Research Data Management Planning across institutions, from

faculties/universities to national funding agencies and European funding organizations:

- i. in co-operation with national organizations for scientific research and especially eScience,
  - ii. in communication with Science Europe,
  - iii. by communicating best practice in data stewardship to implement DMPs;
6. Advocate the importance of Software Sustainability next to Research Data Management planning.