



e-IRG White Paper 2021

29 November 2021

Good practices of coordination within and across e-Infrastructures and thematic Research Infrastructures

Annex 2.2 - Full descriptions of institutional, national and regional approaches

Table of Contents

	1
Annex 2.2 - Full descriptions of institutional, national and regional approaches	3
A2.2.1 INSTITUTIONAL APPROACHES	3
A2.2.1.1 The Chalmers e-Commons	3
A2.2.2 NATIONAL APPROACHES	3
A2.2.2.1 Austria	3
A2.2.2.2 Croatia	12
A2.2.2.3 Denmark	14
A2.2.2.4 France	16
A2.2.2.5 Germany	18
A2.2.2.6 Greece	21
A2.2.2.7 Hungary	26
A2.2.2.7 Italy	29
A2.2.2.8 Netherlands	32
A2.2.2.9 Portugal	35
A2.2.2.10 Spain	40
A2.2.3 REGIONAL APPROACHES	44
A2.2.3.1 The Nordic case	44
<i>Introduction</i>	44
<i>NordForsk</i>	44
Nordic e-infrastructure Collaboration (NeIC)	45
NORDUnet	48
Conclusion	50
A2.2.3.2 The Iber case	50
Annex I – Editorial board	55
Annex II – Email template and Guiding Questions	56
Annex III – Terms of Reference	59

Annex 2.2 - Full descriptions of institutional, national and regional approaches

A2.2.1 INSTITUTIONAL APPROACHES

A2.2.1.1 The Chalmers e-Commons

Introduction

Chalmers e-Commons is a recently initiated university-wide initiative to further empower researchers and innovators at Chalmers University (Sweden) by providing support and collaborative projects for the full range of digital aspects of research. Building on several earlier efforts and a top-level strategic decision, e-Commons will provide an expert hub and integrated entry point for researchers and innovators.

The activities of Chalmers e-Commons are based on a data-centric perspective, covering all phases of the research data life-cycle, from planning, management and large-scale computing/analysis in active projects, to long-term preservation, data sharing and data publishing. e-Commons also provides and facilitates access to a span of local, national and international e-Infrastructure resources for large-scale computing and data storage/management. Here, e-Commons coordinates Chalmers participation in national e-Infrastructures such as SNIC and SND as well as in European initiatives like EOSC and access to computing resources in EuroHPC.

A main goal of e-Commons is to host a vibrant community of Digital Research Engineers and Data Champions, collaborating with researchers, research initiatives and research infrastructures to advance research and innovation in all areas at Chalmers. Complementing the Digital Research Engineers, e-Commons also hosts a group of computer system experts, developing, building and managing the local e-infrastructure resources for large-scale computing and data storage and providing user support.

A2.2.2 NATIONAL APPROACHES

A2.2.2.1 Austria

The Austrian EOSC Mandated Organisation/The EOSC Support Office Austria

The European Open Science Cloud (EOSC) envisions establishing a European data infrastructure, integrating high-capacity cloud solutions, eventually widening the scope of these services to include the public sector and industry. In November 2018 the European Commission launched the European Open Science Cloud (EOSC) at the University of Vienna. Two years later the EOSC Association was established as a legal entity on 29th July 2020 with four founding members. In January 2021 TU Wien created a new organizational unit, the EOSC and International Liaison Office, based at TU Wien Bibliothek – and in February 2021 the ACONET Association applied for membership in the EOSC Association as Austrian Mandated Organisation. In the meantime, four Austrian RIs applied to become a Member of the EOSC Association AIBL: the Natural History Museum Vienna, TU Graz, TU Wien and University of Vienna. Observers

Status was requested for the Climate Change Centre Austria (CCCA) and the University of Linz (JKU). The Academy of Fine Arts Vienna followed.

These are the direct Austrian players. The main questions related to the development of EOSC in Austria are: what does it mean to implement the EOSC at a domestic level, and how does it fit with the newly launched EOSC Association? How can Austrian communities engage with EOSC? How can Austrian EOSC Stakeholders contribute to the structuring of these co-creation processes? How can the communities addressed help to prepare the transition to a new "Stakeholder-based governance" at a domestic level?

This report offers some reflections for a better understanding of the realization of EOSC at a local level at the present stage, including the newly established Austrian EOSC Mandated Organisation and the EOSC Support Office Austria.

1. Preliminaries

In Austria the operative EOSC-related activities are led by the Austrian Federal Ministry of Education, Science and Research (BMBWF) that has assigned an EOSC Steering Board member. As the operation and further development of the Austrian NREN "ACOnet" is strategically supported and controlled by an association ("ACONET Verein"), the BMBWF has asked this association to act as a neutral bridging body, to assume a mandated role, and to apply as a representative of Austria in the EOSC Association AISBL. In order to be able to fulfill this task, the ACONET association needs an executive body with an appropriate staff capacity, and TU Wien offered default liability through a contract. TU Wien offered this role, due to its extensive involvement in the EOSC building process, and through its activities in the EOSC Secretariat Project (Leader of Sub Task "Researcher Engagement"). TU Wien also offered a physical infrastructure for the Austrian initiative, which is now acting as a contact point for the EOSC Association AISBL and has been named the EOSC Support Office Austria/EOSC Mandated Organisation¹. It is important to emphasize the neutral status of the EOSC Support Office Austria, which is meant to represent the convergence of interest of all involved Austrian Stakeholders. The development of the EOSC Support Office Austria is further supported by the regional H2020 project EOSC-Pillar with the University of Vienna (UNIVIE) as main partner. Within the project EOSC-Pillar, UNIVIE has the lead in activities such as the monitoring of the RI landscape and stakeholder engagement - activities that will be aligned with the Austrian EOSC initiative and will benefit the establishment and operation of the EOSC Support Office Austria.

2. Kick-off meeting - 26. March 2021

On 26th March 2021, after some preliminary talks and with the participation of BMBWF, the ACONET association, the Austrian EOSC Members and Observers, further national initiatives, such as the RDA-Austrian National Node and the FAIR Office Austria, organized a kick-off meeting. The meeting was useful in learning about stakeholder sentiments and in defining the objectives until June 2021. The main decision taken during the meeting was to organize meetings on a regular basis ("weekly meetings") until July 2021, aiming at obtaining these outcomes:

- to define the spirit of the initiative,
- to define the minimum requirements needed to run the joint office,

¹ The address of the office is: EOSC Support Office Austria, TU Wien, Favoritenstraße 16 / 5. Stock, 1040 Wien

- to create a virtual environment for the EOSC Support Office Austria,
- to create a setting for the coordination of activities,
- to create a trusted virtual space at domestic level (National Wiki), with Terms of Use,
- to create Austrian EOSC Points of Reference based at each participating institution or related initiative,
- to define a good governance model compliant with EOSC and the EOSC Association,
- to define the related rules of participation,
- to create a rotation model in the Management of the EOSC Mandated Organisation/EOSC Support Office Austria,
- to define Working Groups mirroring the activities of the Task Forces of the EOSC Association, and finally,
- to translate the governance model into a written consensual agreement (MoU) and
- to organize a Validation Workshop in July 2021 - with the aim of codifying the then obtained common results
- to prepare the General Assembly of partners of the Austrian EOSC initiative, to be held in October 2021.

The development of the Consensual agreement (MoU) of the “Austrian EOSC Mandated Organisation/EOSC Support Office Austria” included defining the following:

- the relationship of the partners to each other,
- the regulation of operations,
- the institutions and the management including the rights, duties and responsibilities with respect to the initiative, and
- the results including free access to the joint work carried out within the initiative and relevant information with respect to the assignment of intellectual property rights.

3. The Austrian EOSC Initiative: Moment of truth as per October 2021 - Organisation and structure

Following the decisions taken at its first General Assembly² (13th October 2021), the internal management structure of the partner community consists of the following bodies:

- The **General Assembly** acts as the representative body and as the final body responsible for decision-making.
- The **Management** ensures the optimization of processes and acts as an intermediary and coordinator between the institutions of the Community and the partners.
- The **Steering Committee** sets the basic orientation of the project.
- The **Synergy Team** bears the responsibility for expertise in each discipline. Several **Working Groups** act in the frame regulated by the Synergy Team.
- The **Reflection Group** (“Austrian EOSC Café - Open Forum”) provides external influence and stimulus.

A trusted virtual space at domestic level was installed as a platform for communication. A centralised web-based **Wiki**, available to all partners, provides the organisational framework for the pooling of resources, the centralization and brokerage of current information about the project

² The records and the takeaways of the first General Assembly (GA) have been published in ZENODO and are available at <https://zenodo.org/record/5588259#.YXEmBJ5ByUk>. The composition of the bodies of the GA is illustrated in Annex 1.

status, meetings, documentation as well as stimulating the exchange of experiences and knowledge. This Wiki is regulated by clearly defined terms and conditions of use, **with a binding commitment to Open Access**.

All above mentioned bodies are inherent to the daily operations of the EOSC Mandated Organisation/EOSC Support Office Austria, with one exception, the Reflection Group:

The **Reflection Group** is a team of experts of multidisciplinary organisations (such as industry, public administration, the Austrian national funding body, science and research) that provides insight and expertise to the different organisational units of the initiative Austrian Mandated Organisation. The Reflection Group actively participates in the definition of long-term development strategies and provides motivation for their implementation. The Reflection Group promotes networking and exchange with similar Austrian and European institutions working in similar projects, and ensures that Austria is connected to the rest of the world in research matters. Moreover, it promotes access to decision-makers in Austria and in the European Union, and facilitates access to qualified and structured data and information.

The Coordinator of the Reflection Group is the Austrian Representative at the EOSC Steering Board.

The Management of the initiative is responsible for the operational activities and ensures the quality of the initiative's actions. The management consists of a Management Board and a Secretariat. Four representatives for the Management Board have been elected among the partners, with only one representative per partner to ensure the balance of power and interests as well as to strengthen the neutral status of the EOSC Support Office Austria, which represents the convergence of interests of all Austrian Stakeholders involved.

The operations of the Management will be supported by the future team of the **EOSC Support Office**, whose main activities are: Providing support to the Management Board concerning coordination of the initiative, coordination of back-office functions, establishing and maintaining a contact network with opinion leaders within the partner institutions participating in the initiative, supporting the experts in the individual Work Packages, monitoring and analysis of developments in each Work Package of the project, actively participating in meetings and events, organising of partner events, and supporting marketing activities in cooperation with the Management and partners.

4. Focus of Activities

The following eight fields of action were identified, and they are interlinked: Stakeholder Engagement, Enlargement of Membership, Landscaping Activities, Key Performance Indicators (measurement of success, adoption of EOSC KPIs), Engagement of Providers, Engagement of Users, Increase of Awareness (e.g through training activities), Reflection on Sustainable Business Models.

5. The Working Groups

Following the identification of the fields of action, it has been decided to propose some Working Groups (WGs), mirroring, where possible, the supranational level (EOSC Association AISBL). At this stage, the WGs may be divided into two clusters: A) WGs that have started operations, B) WGs that are on the way to be settled/that are on the way to be designed.

A) Working Groups, that have started activities:

i) Austria Country Report

The task of this WG is to regularly monitor EOSC building processes in Austria, i.e. open science and FAIR related policies, projects, activities as well as RDM infrastructures. Its report will be updated on a quarterly basis. First deadline was 23 June 2021. The second report was published at the end of Quarter II³.

Coordination WG Austria Country Report: Barbara Sánchez Solís (TU Wien)ii) Key Performance Indicators (KPIs).

ii) Key Performance Indicators (KPIs)

The WG on Key Performance Indicators (KPIs) develops measurable indicators to make the success of EOSC visible at international/European level along the overarching goals for Austria (“readiness indicators”), at the level of the EOSC Support Office AT, as well as at institutional level the implementation of EOSC. In addition, KPIs are a steering instrument for targeted impact-oriented further development and EOSC-compliant implementation and stakeholder readiness.

The WG also develops and adapts suitable methods; they may be percentages of FAIR data, surveys, or social network analyses.

iii) Researcher Engagement in Austria

The EOSC should meet the requirements and needs of daily research in Austria. At the same time, EOSC services should be widely accepted within the Austrian research landscape. Activities of this WG – of which all are to be well documented and/or published in the form of e.g. reports, papers, or recommendations – support achieving this objective.

Since the WG Researcher Engagement in Austria has been established in 2019 in the context of the EOSC Secretariat initiative as supporting activity of the EOSC building process, the WG can build on already existing networks, extensive experiences and numerous publications. At the next meeting of this WG – scheduled for late November/early December 2021 – activities and the distribution of work will be defined.

Coordination WG Researcher Engagement in Austria: Katharina Flicker (TU Wien)

iv) Data Stewardship

Data stewards are experts in the field of research data management and bring their expertise to the organization. Their role is being newly established at Austrian research institutions. In addition, the development and definition of a data steward profile as well as training offers and career paths for data stewards are an essential part of the EOSC Association Advisory Group - “Research careers and curricula”. The aim of this working group is to coordinate developments at national level, especially in connection with the FAIR Data Austria project, and to contribute to the “TF Data stewardship curricula and career paths”. Activities include workshops with national research institutions, reports, position papers, recommendations and exchanges with international communities.

Coordination WG Data Stewardship: Ilire Hasani-Mavriqi (TU Graz)

v) Technical Infrastructure

The activities of this working group are based on preliminary work and results of related projects (e.g. FAIR Data Austria, Austrian DataLAB and Services, EuroCC, EuroCC Austria, IDE@S). Activities include working with the community to coordinate the implementation and rollout of FAIR tools and services, as well as to provide interactive access to HPC clusters and accessible data

³ The WG Austria Country Report has published the “Austrian Country Profile” in Zenodo in October 2021. Link: <https://zenodo.org/record/5571922#.YXug8RxCRPY>

science tools and resources. The results of the EOSC Association Task Forces such as “Technical Interoperability of Data and Services”, “AAI”, “Infrastructure for quality research software” and “Long-term preservation” will be considered to create an overarching and integrating outlook.

Coordination WG Technical Infrastructure: Claire Jean-Quartier (TU Graz)

vi) Training

The working group aims to make existing training materials more accessible and visible as Open Educational Resources, but also to develop new training materials where needed and to fill gaps in the range of training courses currently offered. The training materials should be in line with the FAIR principles. They should be easy to find, accessible, both adapted to specific circumstances, but also generic and thus interchangeable, and available long term. We are therefore committed to reviewing existing materials, adding appropriate metadata and making them more widely available. As there is already a wide range of training resources in English, the working group will focus particularly on materials in German, either by developing new training or by translating high-quality content from other languages. Since many Austrian research institutions already offer training on data management, the goal is to collect and document these materials and make them available on one platform. The WG will work together with other initiatives to select an established RDM training platform that will raise the international visibility of the materials from Austrian research institutions.

Existing training materials should not only be made available as a permanent link but also provided with contextual information. The content of the training, the target group and the possibilities of use will thus become more transparent. The description should include information such as language, accessibility, keywords, target group and as such simplify the search and (re)use for training materials.

Coordination training activities: Susanne Blumesberger (University of Vienna)

B) Working Groups that are on the way to be settled/that are on the way to be designed

vii) Stakeholder Engagement

EOSC activities in Austria need to address as many stakeholders as possible. For example, information on and knowledge exchange with European initiatives such as EuroHPC, EuroCC⁴, and GAIA-X, or digitalization projects on the Austrian level (e.g. FAIR Data Austria, Austrian Data Lab and Serves and RIS Synergy) are crucial for the EOSC Support Office Austria to work efficiently. This WG thus focuses on facilitating such a flow of information without creating extra demands for resources (e.g. by making use of communication channels that already are in place). The approach is twofold: First, relevant stakeholders will be identified and mapped as a baseline for further engagement activities. Second, actual engagement activities are to be derived from this baseline. The objective is to identify best practices of engagement and sustain the knowledge exchange between networks.

⁴ The European High Performance Computing Joint Undertaking (EuroHPC JU) is a joint initiative between the EU, European countries and private partners to develop a World Class Supercomputing Ecosystem in Europe. EuroCC (European Competence Centre) is an international project to support research and innovation in High-Performance Computing (HPC) in Europe

Coordination WG Raman Ganguly (University of Vienna)

viii) Collections

Collections represent a special research infrastructure whose digital assets (inventories, 2D and 3D figures, voices) are the basis for research, development, creativity and communication. Moreover, collections are located in the area of the third mission of the universities. The diverse collections, ranging from natural and geoscientific collections to works of art and born digital collections, thrive on the linkage with other data, be it geographical, biographical, historical or climatic. Their use requires comprehensive availability and interoperability. Therefore, on the one hand, this WG will work very closely with the FAIR Office Austria as well as with the other working groups, especially the WG Training, and address the national collection landscape of museums and universities. On the other hand, it will be inherently active internationally in order to introduce developments at the global level into the Austrian research infrastructure initiatives. This includes all aspects necessary for cross-domain interoperability: Adoption and active co-design of standards, workflows, and data pipelines.

Coordination WG Collections: Heimo Rainer (NHM)

6. Major challenges and how to deal with them

Such a complex initiative, developed within a tight timeframe, encompassing a wide range of entities operating in scientific fields, requires management that is attentive and skillful in responding to stakeholder requirements.

In addition, and for better implementation of the initiative, it was determined that from the outset, the initiative would adopt guidelines, reflecting the orientation indicated by EOSC and principles set by the Open Science movement.

The Guiding Principles of the Austrian EOSC Initiative

The major challenges are derived from the ambitious Guiding Principles, which are enumerated in the Memorandum of Understanding (MoU), and they summarize the spirit of the Austrian EOSC Initiative. They are defined as follows:

a) Openness: open communication between all partners in the partner network.

b) Culture of Dialogue: Encouraging a "culture of dialogue" to promote institutional networking and exchange of ideas.

c) Access: The partners are committed to free access to the results of the joint operation in the project.

d) Ownership of rights: The project partners ensure the sustainability of the results by a defined ownership of rights within and outside the network.

e) Recognizable roles: regulated relationship between all project partners by means of defined organizational units and processes. Roles and responsibilities are clearly visible from the inside and outside.

f) Structured approach: The operation of the working groups/work packages is defined by controlled sessions, responsibilities, well defined voting, and communication.

g) Clear information infrastructure: The project partners have at their disposal a common, nation-wide information infrastructure established in the form of a Wiki.

Corporate behaviour

Another challenge arises from an area that can be defined as “EOSC Austria corporate behavior”. Heterogeneity characterizes the Austrian research landscape. The different stakeholders active in the Austrian EOSC Initiative are also members and observers of the EOSC Association AISBL and experience to a certain extent forms of competition among them. To this already fragmented landscape entities are added which are not members of the EOSC Association, but which are important for the European Open Science Cloud or for the Open Science movement. The identification of this challenge means that from the outset the measures taken must pay more attention to what can be described as *team spirit building*, while at the same time attention must be paid to a careful *balance of power*.

Community building is closely linked to corporate behaviour, and the management of the initiative devoted particular interest and effort to achieving a high level of satisfaction in the different working groups, observing the different wishes expressed in the course of the work, and above all involving all parties in managing a memorandum of understanding that reflects the priorities defined by the partners. Good governance models and balance of power.

Good governance models and balance of power

A major challenge in the setup of the initiatives’ structure and the definition of the good governance of the initiative is the balance of power among the participating partners, especially in light of the above-mentioned different roles in the Austrian research and RIs landscape, in the EOSC Association and in the wider EOSC community. The Austrian Initiative addressed this challenge through a detailed structure of committees with clear competencies, voting and election processes as well as a rotation principle in leadership and in representation of the initiative.

Open Science, a challenge and an opportunity. The relationship to the Austrian Open Science Policy.

According to Directive (EU) 2019/1024 of June 20, 2019 on open data and the re-use of public sector information (“Open Data and Public Sector Information Directive”)⁵, the EU member states have to adopt national strategies and to support relevant measures with the aim of making publicly funded research data openly accessible according to the principle of “open data by default” and in accordance with the FAIR principles. Together with the objectives of the EU in the field of research and data policy, a recommendation by OANA (Open Science Network Austria, a joint initiative of the national funder FWF and the Austrian Rectors’ Conference UNIKO), for an open science strategy formed the basis for the development of an Austrian policy (in the sense of a common orientation) on open science and the European Open Science Cloud (EOSC).

Austria actively supports the development of an open, transparent and inclusive science and promotes the FAIR handling of research processes and their results. With a clear commitment to “Horizon Europe” and Austria’s active participation in the European Research Area (ERA), Open Science was included in the federal government’s strategy for research, technology and innovation (FTI Strategie 2030).

As a result, intensive work was carried out on the development of an Austrian policy on Open Science and the European Open Science Cloud. Three Austrian Ministries were involved in this

⁵ A first workshop on Open Data and the Public Sector Information Directive was held on 20 October 2021: Shaping EOSC -Open Data and the European Data Strategy. Ein Workshop zur Etablierung der PSI Richtlinie (Public Sector Information Directive) und der Bildung der European Open Science Cloud in Österreich, Martin Semberger, Federal Ministry Republic of Austria, Digital and Economic Affairs; Paolo Budroni, EOSC and International Liaison Office at TU Wien Bibliothek

development process at the working level, under the direction of the Austrian Federal Ministry for Education, Science and Research (BMBWF). In the course of this, the relevance of participation in the process of implementing the European Open Science Cloud (EOSC), as World Wide Web of FAIR data and services, was expressly pointed out. The Open Science Policy Austria will be announced and adopted in the Austrian Parliament within the year 2021.

The Austrian EOSC initiative: Open Science by default. The partners in the Austrian initiative decided from the outset and by mutual agreement that the initiative would be developed in an 'open science by default' mode. This spirit is evident in the text of the Memorandum of Understanding (Consensual Agreement), which has been validated on 12th July 2021 and prepared for signature not only by the Austrian Members and Observers, but also by any other entity or EOSC-related initiative that wishes to make a concrete contribution to the development of the Austrian initiative⁶.

7. Implementation of the Austrian Mandated Organisation

a) Mirroring the EOSC Association AISBL

The "Austrian EOSC Mandated Organisation" and the "EOSC Support Office Austria" are created within the framework of the formation of the European Open Science Cloud (EOSC) and the EOSC Association AISBL. The partners are united by their common interest in the coordinated development of requirements and implementations in accordance with the Austrian Open Science and EOSC goals.

The aim of the "EOSC Support Office Austria" is to establish a real "Austrian EOSC Mandated Organisation", the function of which is currently legally performed by the ACONET Association.

b) The Weekly Meetings

After the kick-off meeting it was decided that all partners involved should meet once a week. These meetings were coordinated by the TU Wien and took place until the "Validation Workshop" (July 12, 2021). Also, the modality of rotating the coordination was practiced: this was then taken over by the partners TU Graz, University of Vienna, The Natural History Museum Vienna - NHM and then again handed over to TU Wien.

c) The Validation Workshop

A Validation Workshop was held in July 12, 2021. The following topics were jointly decided, validated and defined as the basis for further joint action by all partners involved after prior discussion: The Guiding Principles of the initiative, The contents of the Consensual Agreement (MoU), The acting bodies of the joint initiative, especially the Management, the Working Groups, the common wiki, the work plan (at the time of the validation workshop), the definition of the resources needed for operations, the date of the official kick-off of the joint initiative (official establishment of the bodies of the initiative)⁷.

d) Embedding existing EOSC related initiatives and their current results into the Austrian Mandated Organisation

In the development of the preparatory activities, as many existing initiatives and projects as possible were considered from the beginning, and the representatives of these activities were

⁶ The terms of the Consensual Agreement laid the basis for the implementation of the first General Assembly (13th October 2021). The Consensual Agreement will be signed in November 2021 by all Partners

⁷ As mentioned, the first General Assembly was then held on October 13th

invited to the meetings. Among them are: the Horizon 2020 projects EOSC Secretariat (TU Vienna) and EOSC-Pillar (University of Vienna), Research Data Alliance Austria National Node, the Austrian national delegates of the e-Infrastructures Reflection Group and the recently founded FAIR Office Austria.

e) Liaison with EOSC Nodes in Europe

Another activity that was consistently carried out was to establish contacts with similar initiatives in Europe (EOSC Nodes) and the holding of virtual meetings with colleagues from the Italian Initiative and the Swedish Initiative. Inquiries were also made to colleagues in Croatia, Switzerland, and Hungary. In June, the Austrian initiative was presented together with others at the EOSC Symposium.

f) The “Austrian EOSC - Strategic Innovation Agenda”

Perhaps the most important activity planned for this fall, besides the kick-off meeting, would be the editing of the Austrian EOSC Innovation Agenda. This should become a living document, which will be subject to constant updates. The preparation of the work will take place after the General Assembly.

8. Unique selling propositions of the Austrian Mandated Organisation

The Austrian initiative has a few outstanding features that have characterized it from the outset and which have already been mentioned and presented above. These are:

- ❖ The initiative is developed in an 'open science by default' mode
- ❖ The initiative has been continuously managed from the beginning by a dedicated reflection group that includes as many players as possible and whose cooperation started in 2017 - in the time before the EOSC launch.
- ❖ Communication will take place via a trusted virtual platform (Austrian National EOSC Wiki), with terms of use that underline the open science character of the initiative.
- ❖ The management of the initiative is based on a rotation principle, which is intended to guarantee the balance of power in the partner network and compliance with the guiding principles.
- ❖ Existing EOSC related initiatives and their current results are embedded from the beginning into the Austrian Mandated Organisation.

Follow the activities of the Austrian EOSC Initiative on ZENODO.

On ZENODO, the community "EOSC Austria" was created to serve all Austrian stakeholders as a common platform for published documents: <https://zenodo.org/communities/eosc-austria/?page=1&size=20>

A2.2.2.2 Croatia

Introduction

In Croatia, an initiative has started for the establishment of a National Open Science Cloud (NOSC), gathering national institutions that have a prominent role and interest in the field of open science. The Ministry of Science and Education of the Republic of Croatia is the initiator of the

initiative, but the role of coordination of all national initiatives for open science and building the National Open Science Cloud has been assigned to the University of Zagreb Computing Centre – SRCE, as a leading institution for building the national e-Infrastructures and services for the Croatian scientific and academic community.

Purpose/Governance/Structure/Ownership

The initiative aims at creating and developing a NOSC as national infrastructure providing open science-oriented services and support to the research and academic community. Currently, the initiative has finalized a Memorandum of Understanding (MoU) that has formalized the relationships, defined the main goals, and specified how those goals will be achieved. By signing the MoU, all involved parties agreed to build a modern, high quality, internationally relevant and competitive science system based on the principles of open science, interoperable with the European Research Area and connected to the European Open Science Cloud and other relevant European initiatives. The Croatian NOSC is named Croatian Open Science Cloud (HR-OOZ).

The main purpose of the Croatian NOSC is to serve the research and academic community in Croatia. Existing national infrastructure components and related services are free of charge for academic and research institutions, which will remain within NOSC as well.

The main goals of HR-OOZ initiative are:

- Setting up and defining organizational and governance structures of HR-OOZ.
- Drafting a proposal for a National Action Plan for Open Science.
- Coordinating and harmonizing all activities related to Open Science in Croatia.
- Providing consultations and support to the Ministry of Science and Education of the Republic of Croatia in defining a national position about the activities of the European Union related to open science and EOSC in particular.
- Coordinating and harmonizing the activities related to participation of Croatia in European and international initiatives for open science.
- Promoting Open Science and applying the FAIR principles in the Croatian academic and science community related to research data management.
- Encouraging Croatian academic and research community to participate in European and international initiatives related to open science, especially in EOSC and RDA.
- Supporting the Croatian institutions in applying for Horizon Europe calls and other EU funding programme calls related to open science.

The initial members of HR-OOZ initiative and signatories of MoU are key institutions for relevant stakeholder groups: the main policy-making institution (Ministry of Science and Education), the main research funding institution (Croatian Science Foundation), the main e-infrastructure building institution (SRCE, also an RDA node), and all public universities in Croatia, of which many are also hosting national representatives of European research infrastructures consortiums (ERICs), i.e. CERIC, CESSDA, CLARIN, DARIAH, the OpenAIRE NOAD, and the main library in Croatia (National and University Library in Zagreb).

The signatories of the MoU agreed to form the national coordination body, HR-OOZ Council, composed of their representatives. The HR-OOZ Council will create and adopt policies, regulations, or other acts, which will regulate the work of HR-OOZ. SRCE, as the coordinator of the initiative, will provide organizational and administrative support to the HR-OOZ Initiative and to the work of the HR-OOZ Council. The MoU will allow other institutions in Croatia to join the initiative and participate in the creation and usage of the Croatian Open Science Cloud.

Connection with European initiatives

The HR-OOZ Initiative will be connected with various ongoing European initiatives, since signatories are internationally recognized members that actively participate in relevant international projects in the area of information technology and open science. For example, SRCE is currently the coordinator of the Croatian Scientific and Educational Cloud (HR-ZOO) project, the coordinator of the National Competence Centre for HPC, and the Croatian RDA node. SRCE is also an active participant and partner in several EOSC-related projects and a mandated organization of the Republic of Croatia in the EOSC Association.

A2.2.2.3 Denmark

Introduction

DeiC is an entity under the Ministry of Higher Education and Science by Act 70 of April 19, 2012. It is a unit under the Danish Agency for Science and Education, and is not yet an independent legal entity. It currently acts as a virtual organisation, which means that all staff are employed in other organisations. Work is being done to establish DeiC as a self-owned legal entity by law, expected during 2022.

Purpose/Governance/Structure/Ownership

The purpose of Danish eInfrastructure Collaboration (DeiC) is to provide network connectivity, computing and storage resources and services to the Danish universities, research institutions and higher education. DeiC is organised as a virtual organisation where the actual delivery of services is contracted to universities.

DeiC is formally a legal part of the Ministry of Higher Education and Science, but both the Ministry and the universities are considered owners, and the funding is shared 50:50 between the owners. DeiC is governed by a board composed of members at management level from the Danish universities. Thereby the main stakeholders have directed influence on the activities in DeiC, and at the same time can guarantee the necessary commitment and involvement from the universities/users. The daily management of DeiC is handled by a Chief Executive Officer (CEO) employed by the board. This can be considered as an efficient combination of both bottom-up and top-down coordination.

The universities are committed to the collaboration and the use of the research network through a paragraph in the State Budget. The collaboration on HPC and Data Management are more informal through a decision in the Danish Rectors College depending on the financial development of the funding for the area in the State Budget. All areas have advisory groups

composed of expert users from each university. The expert groups advise the DeiC board and its Chief Executive Officer. In this way there is further engagement of user communities in the overall scheme.

Funding/Cost sharing/Business models

DeiC is partly funded from the state budget, partly from membership contributions, which provides diversity and flexibility. The ministry and universities co-fund some activities, and the ministerial contribution is directly linked to that of the universities (and vice versa) in order to ensure the diversity and maximise the impact.

Costs are shared among the DeiC members. Together with the governance model this ensures that DeiC activities are those that the universities request or prioritize.

Sustainability is directly linked both with the connection of the DeiC members being part of the governance and also responsible for providing funding for the DeiC activities.

Following the release of the HEU Work Programme 2021-2022, EOSC Core and some parts of EOSC-Exchange are planned to migrate from the current EU grants to public procurement (tender) organised by the EC. As DeiC is an organisation created to supply services to researchers at Danish research institutions, the focus is currently and primarily national.

Resource sharing and access policies

In DeiC there are resource sharing policies, primarily for access to HPC resources. 50% of the resources are divided between the universities according to their financial contribution/funding. The other 50% are allocated through applications and are based on research quality/peer review.

Peer review makes the access effective, based on scientific excellence. The access is mainly for the academic and research community but industry and SMEs have the option of paying for access. For the end users the access is free. Access to resources from other countries currently requires a Danish Principal Investigator (PI).

Coordination between vertical/thematic and horizontal/generic providers

Thematic providers in Denmark are always embedded in a university and therefore are handled through the same governance model. This inherent organisation makes the coordination efficient.

Thematic infrastructures are not actually paying for the services they are getting from horizontal providers, rather only indirectly from their hosting organisations (i.e. being their universities).

Connection with European initiatives

DeiC coordinates Danish participation in Nordic and European e-infrastructure organisations and projects. Interfacing with the EU initiatives/bodies is always handled via DeiC, thus being the national representative in all international e-Infrastructure related activities which makes coordination simple.

A2.2.2.4 France

Introduction

France is in the progress of aligning its policies regarding open science, research infrastructures, e-infrastructure landscape, and the participation in EOSC and GAIA-X.

As main initiators one can identify the “La loi pour une République numérique⁸” (Law for a digital Republic, 2016), which is a law putting in place policies to adopt a progressive digital approach, based on individuals, to strengthen their power to act and their rights in the digital world. A next major step in this direction was the National Plan for Open Science⁹, adopted in 2018 by the French Ministry of Higher Education, Research and Innovation (MESRI) to ensure a transition to a research system that is committed to making scientific research results open to all – researchers, companies, citizens.

In addition, the Artificial Intelligence Strategy “AI for Humanity”¹⁰ was launched in March 2018 by the French president. This includes a roadmap to support the development of AI technologies in France, combined with a significant investment of 300 M€ in a number of dedicated *Interdisciplinary Institutes for Artificial Intelligence* (3IA) plus 350 researcher chair positions along with 300 PhD grants.

Funding

With these overarching themes and starting policies, a number of initiatives have been launched in recent years and are in progress. The national funding opportunities are in parallel to the significant investment of public budget for e-infrastructure, as it is provided through the research performing organisations, e.g. CNRS, INRAE, INRIA, CEA, INSERM and the universities.

1) Recurrent national investment in network services and HPC infrastructures

Direct national funding is provided on an annual basis to the national research and education network (RENATER). RENATER is a public interest group with an annual budget of about 30 M€. Its members are major research organisations: CNRS, CPU, CEA, INRIA, CNES, INRA, INSERM, ONERA, CIRAD, IRSTEA, IRD, BRGM, as well as the Ministry of Higher Education, Research and Innovation (MESRI). RENATER also manages the SFINX traffic exchange point and has research project links with CERN. It provides a network connecting more than 1,300 sites via links with 10 Gbps. Higher bandwidth is available e.g. between centers in Paris and Lyon (150 Gbps), between Lyon and Marseille (80 Gbps), and towards CERN (120 Gbps via Lyon and Grenoble). RENATER is connected to the pan-European GÉANT network.

GENCI (*Grand équipement national de calcul intensif*) is a civil society that implements and ensures the coordination of the major equipments of the 3 French high-performance computing centres IDRIS (CNRS / INS2I), CINES (Universities), and TGCC (CEA). GENCI is 49% owned by the French State, 20% by CEA, 20% by CNRS, 10% by the Universities and 1% by Inria. Its annual budget is about 40 M€. GENCI is the French representative at PRACE and participates in the EuroHPC councils.

⁸ Law for a digital Republic, 2016, France

https://en.wikipedia.org/wiki/Loi_pour_une_R%C3%A9publique_num%C3%A9rique

⁹ National Plan for Open Science - France [SO_A4_2018_EN_01_leger_982501.pdf \(enseignementsup-recherche.gouv.fr\)](#)

¹⁰ AI for humanity -France, <https://www.aiforhumanity.fr>

2) National long-term investment into e-infrastructures

France has a recurrent Future Investment Program (Programme d'investissements d'avenir, PIA), which has provided a budget since 2010 of 57 billion € for the higher education and research sector. In the latest investment round (PIA3), 422 M€ are invested in structuring equipment for research, also to support the digital transition of research and innovation in France, and a significant part of this budget is foreseen to be invested in e-infrastructures.

The PIA4 program has been announced in November 2020 and is prepared right now for investment foreseen for 2022 – 2026.

In parallel to the PIA investments, France provides budget to the research domain also through the *Contrat de plan État-région* (CPER), which is a co-financing program between the state and the regions.

3) Recovery plan: *Plan de Relance*

In parallel to the European “Next Generation EU” investment initiative to overcome the crisis caused by Covid-19, France invests 100 B€ in a national recovery plan (plan de relance) in 2021 and 2022. Out of this budget, about 1 B€ is foreseen for investment in higher education, research and innovation.

Governance

To better coordinate activities and investment in the domain of digital services and e-infrastructures, MESRI is putting in place a national committee for the coordination of Digital Services and Infrastructures (*Coordination des Services et Infrastructures Numériques*, CoSIN). This shall be established in summer 2021 and will then work in parallel and in collaboration with the national committee on Open Science (CoSO). The CoSIN will combine the main actors of the French research and higher-education domain. It will assess and propose strategic decisions (also in the form of a roadmap or national plan) and act as a coordinator of the different relevant fields. The creation of sub-committees is foreseen to coordinate areas such as the French participation of the EOSC. This so-called *Collège EOSC* will for example propose the French entity acting as the mandated organization in the EOSC Association in the future.

Structure

In addition to the creation of the CoSIN and its subcommittees, which are also part of the structuring efforts that impact the French e-infrastructure landscape, a number of initiatives are in progress to further improve the service offer in terms of e-infrastructure provision to the domain of higher education, research and innovation. These are to be seen in parallel with European programs that aim at similar goals on the transnational level, such as the EOSC, EuroHPC, GAIA-X, and others.

1) Labeling of regional and national e-infrastructures

France hosts a large number of data and computing centres of different sizes, with different aims, serving a diverse number of scientific domains. In order to focus investment and to mutualise the usage of the services, of both the e-infrastructures themselves and the expertise of colleagues at the different e-infrastructures, MESRI labeled centers at the national and at the regional level.

This process is nearly finalised, with some clarifications in specific regions still ongoing. The label as a national or regional data center will also be a necessary, although not always sufficient, criterion to obtain national and institutional funding in the future.

2) National roadmap for research infrastructures

About every five years, MESRI evaluates the national landscape of research infrastructures, and determines which of these are of national strategic importance. The last roadmap, published in 2018, included 99 research infrastructures, among which 6 were in the domain “Scientific and Technical Information”, and 4 were e-infrastructures (GENCI, RENATER, CC-IN2P3 and France Grilles), plus several thematic infrastructures, which provide data services to their community as their main mission or as part of their mission. For the next research infrastructure roadmap, that is foreseen to be published towards the end of 2021, the e-infrastructures and numerical services label will have 3 sub-categories: numerical services (including computing and network), data infrastructures (which includes many of the thematic and community specific e-infrastructures), and Scientific and Technical Information. As for the label as regional or national e-infrastructure, the inclusion of an infrastructure in the national roadmap is a necessary but not always sufficient criterion to obtain certain types of national and/or institutional funding.

Proposed approach

Evolution of the national landscape taking into account the different relevant levels, institutional, local, regional, national, European and international. Polling material means and expertise as far as possible, inclusiveness and consideration of community practices but coordination and definition and implementation of strategic development directions by the MESRI.

A2.2.2.5 Germany

Introduction

In Germany, the responsibilities for universities and research institutions are distributed between the federal government and the federal states (*Länder*). Big research organisations like Fraunhofer, Max-Planck, Helmholtz and Leibniz Association are funded by the federal government and the *Länder* as well as other sources, whereas the universities and smaller research institutions are primarily funded by the Land in which the institution is situated.

Questions of research funding, science and research policy strategies and the science system that jointly affect the Federal Government and the *Länder* are decided in the Joint Science Conference (Gemeinsame Wissenschaftskonferenz, GWK), which was established by the German Federal Government and the Heads of Government of the *Länder* in 2007.

To address questions of supply of digital information, the GWK installed a specific Council for Scientific Information Infrastructures (Rat für Informationsinfrastrukturen, RfII) in 2013. Its task is to increase the level of transparency of developments and processes in the area of information infrastructures in the scientific system and beyond and support the development and communication of German positions in European and international debates.

Based on a recommendation of the Rfll, and with a view to reconciling the partially fragmented research data landscape in Germany, the federal government and the ministries in the federal states agreed to establish a **National Research Data Infrastructure** ([link to the agreement](#)).

The NFDI is developed by users and providers of research data and is implemented in three successive rounds of application with an expected amount of overall 30 consortia.

Furthermore, Germany has set itself the goal of interlinking existing and developing European and German initiatives in order to enable and promote better data access and exchange. In particular, the federal government will support the cooperation between the NFDI and the federated data infrastructure GAIA-X.

Funding

The German National Research Data Infrastructure is jointly funded by the federal government (Federal Ministry for Research and Education) and the *Länder*, with an annual sum of up to 90M Euro p.a. when all consortia are included. The federal government funds 90% of the activities and the *Länder* contribute the remaining 10%.

Not included in the funding for the NFDI are infrastructure costs. Joint major infrastructures are covered by separate funding actions:

The Gauss Centre for Supercomputing is a joint action between the federal government and three states. It funds continuous investments and operations of the three tier-1 supercomputers in Germany. These supercomputers in Jülich, Munich, and Stuttgart are open to all researchers in Germany and participate also in the European PRACE research infrastructure.

The National High Performance Computing at Universities (“NHR”) is expected to become operational by the end of 2021. NHR comprises eight major tier two HPC centers until now, which currently establish an association. NHR will provide joint user access to tier two computing for all researchers at German universities, joint activities for capacity building and HPC development plus a joint investment planning for all centers. The funding of investment and operational costs is shared equally by the federal government and the *Länder*.

Establishing interfaces between the infrastructures for high performance computing and the NFDI and bringing data and computing resources together are part of the national program on high performance computing.

Objectives of the NFDI

As described in the agreement between the federal government and the *Länder*, the “aim of the NFDI to provide the scientific community in Germany with systematic access to research data”.

As data is still frequently stored in a decentralized, project-based and temporary form the mission of the NFDI is to “set new data management standards and serve as a digital, regionally distributed and networked knowledge platform to secure research data and its usability in the long term”. The expectation is that “the NFDI will create added value for the entire science system as existing data collections and services will be integrated and contribute to the establishment of the NFDI”.

Key objectives of the NFDI include

- a) Building a coordinated and networked information infrastructure to support the development of a sustainable and interoperable research data management system;
- b) Establishing processes and methods for the standardized handling of research data that are accepted in the scientific disciplines;
- c) Providing reliable services on a long-term basis which cover general and specific research data management needs in Germany;
- d) Developing cross-disciplinary metadata standards to ensure the universal re-usability of research data;
- e) Linking German research data infrastructures to European and international platforms;
- f) Optimizing the re-usability of existing research data and of the infrastructures in which they are embedded, thus generating additional knowledge without costly repeated data collection;
- g) Creating a common basis for data protection and data sovereignty, integrity, security and quality.

Furthermore it was intended from the start that “the NFDI will closely cooperate with European and international research data infrastructures wherever this is possible to the benefit of all sides”. In particular, this is a mandate to interconnect with the European Open Science Cloud.

Governance and structure

The NFDI is organised as “eingetragener Verein”, with currently (May 2021) more than 150 members from academia, research performing organisations, data infrastructures etc which are organised in the consortia or have a thematic link to the NFDI. Structural elements of the NFDI comprise an Assembly of Consortia, a directorate as executive body, and a Scientific Senate as advisory board. The Joint Science Conference (GWK) takes all fundamental decisions on financial matters concerning the NFDI consortia (e.g. admission of consortia to NFDI funding and withdrawal of funding based on evaluation results) and the directorate.

Lesson learnt

The establishment of the NFDI is an ongoing process, which has attracted much attention in the scientific community of Germany and beyond. The NFDI is structured as a network of consortia that act on their own initiative in a science-driven process. The subject-oriented profile and content focus of a consortium are the results of an intensive discussion process between those responsible for the consortium and the disciplinary communities being addressed. It is of particular importance for the success of the NFDI as a whole that there is adequate subject-specific coverage of the scientific fields after three selection rounds, and that there is active cooperation between the individual consortia.

When the consortia network with each other in cooperation with the Directorate and work on cross-cutting topics in a coordinated, collaborative way, they play an active role in ensuring that the NFDI is more than the sum of its parts; in other words, more than the individual consortia.

An in-depth evaluation of the German research data infrastructure NFDI is planned for 2025.

A2.2.2.6 Greece

Introduction

After 2016 some major developments have taken place in Greece, with regards the support to digital transformation and Open Science.

The National Digital Strategy 2016 – 2021[1] that was launched in 2016, clearly included among its priorities open data, open source and open access to services and information.

In parallel, in 2017, considering the EOSC realization, the General Secretariat for Research and Innovation (GSRI) in Greece established an experts' group of key stakeholders from the research sector and academia to consult in developing a national strategy on Open Science. Complementary, and feeding to this group, Athena Research Center (ATHENA RC) [2], with its leadership roles in OpenAIRE[3] and the Research Data Alliance (RDA) [4] and in the development of the Hellenic Data Service –HELIX[5], set up and led a bottom-up Open Science Task Force (OSTF) consisted of representatives of 25 national academic and research institutions, research infrastructures, national nodes and Open Science initiatives.

The OSTF delivered a proposal for a National Open Science Plan[6] in 2021 to serve as a reference point towards the establishment of a national strategy for Open Science, assist national organizations in embracing Open Science principles, and ensure national alignment with the European Open Science Cloud (EOSC). In doing so, the plan includes provisions for open access to scientific outputs produced from publicly funded streams and for better access to and FAIR-aligned infrastructures and services also according to EOSC standards and rules of participation (in their early form). It also proposes a roadmap for implementation.

Background and policy framework

The Greek R&I ecosystem is to a large extent cluttered, as the R&I responsibilities are delegated among three Ministries: Ministry of Development and Investments, Ministry of Digital Governance, Ministry of Education and Religious Affairs.

Today, Law 4310/14 is the regulatory tool for Public Policy for Research, Technological Development and Innovation (RTDI) in Greece, driving scientific and research code of conduct and allocating research and innovation (R&I) resources for actions of public interest. However, it only partially supports open access to publicly funded research and needs to be updated according to the Recommendation on access to and preservation of scientific information[7] as well as be aligned with the EOSC Declaration[8].

Those needs have been addressed in the Open Science Plan proposal and have been positively received by the new Ministry of Digital Governance that included parts of the policy and

implementation suggestions made by the bottom-up OSTF in the Digital Transformation Bible 2020-2025[9]. This is the latest policy document in Greece, outlining a holistic digital strategy that includes the guiding principles, and the horizontal and vertical interventions that will lead to the digital transformation of the Greek society and economy. Through collaborations with stakeholders from the public and private sector as well as with the research & academic community and the civil society, the policy document describes the aims but also the implementation measures of the digital transformation strategy in Greece

The Digital Transformation Bible takes into account all the elements to advance the national Open Science Cloud ecosystem, from strengthening the national electronic infrastructures and digital research services, to interconnecting them with the European Open Science Cloud infrastructures, to the Open Access for scientific publications, research data and software, and to empower the Greek R&D community with the necessary qualifications, digital skills, incentives and reward mechanisms for the adoption of Open Science at national level.

National Infrastructure

The National Research Infrastructures Roadmap[10] provides a full picture of R&D capacity employed by European (including ESFRIs) and national infrastructures for research, both horizontal and vertical in nature, to support R&I in all and across domains and borders.

Below two major building blocks of Open Science Infrastructures, namely the ones covering network & computing facilities and data management services, are presented.

Network and computing, storage

The e-Infrastructure services to the academic, research and educational community of Greece and their link to the global e-Infrastructures is provided by the National Infrastructures for Research and Technology (GRNET S.A), an integrated electronic Infrastructure service provider. GRNET offers an integrated environment of cutting-edge technologies and provides infrastructural and technology support to academic and research institutions, to educational bodies at all levels, and to agencies of the public sector. GRNET is responsible for promoting and disseminating network and computing technologies and applications, as well as for promoting and implementing Greece's Digital Transformation goals and consults the Ministry of Digital Governance on issues relating to the design of advanced information systems and infrastructures. GRNET is the main infrastructure/service enabler for Open Science in Greece and leader in a coordinated effort for development of electronic infrastructures and services in Southeast Europe (SEEREN, SEE-GRID series, HP-SEE, VI-SEEM, NI4OS-Europe projects) and the wider region. GRNET has also been involved in the pan-European and global integration efforts in the full spectrum of electronic Infrastructure technologies over the past 20 years: this covers the underlying networking technologies within GEANT, Grid/Cloud/High-Throughput Computing via EGI, data infrastructures via EUDAT, and High-Performances Computing via PRACE and EuroHPC. GRNET is also the National Research and Education Network (NREN) and operates a backbone network covering the whole national territory: more than 9000 km of dark fibers, operated by GRNET-owned equipment, with several 10Gbps connections to 50 Institutions.

GRNET is interconnected with pan-European network GÉANT with 4x10Gbps uplinks, where it has an active role in pan-European network operations. GRNET is the leading cloud computing and data infrastructure provider for R&E community in Greece and beyond. Regarding data storage, GRNET has over 11 Petabytes of raw disk storage and 7 Petabytes of tape archive. GRNET supports a number of communities in Greece and Europe. GRNET is one of the core data centers of the EUDAT Collaborative Data Infrastructure, involved in infrastructure and service operations and management. Also, GRNET operates nationally and contributes to pan-European PID service provisioning. Regarding cloud computing, GRNET operates Infrastructure as a Service via large data centers (135 racks, 1800+ servers, 7000 Virtual Machines active, 5 Petabytes of storage), which is currently under migration to OpenStack and integrated into EOSC. GRNET is currently in the process of multifold expansion of its electronic infrastructures aiming to radically expand its Network, Cloud and HPC Services so that its capable to cater for the needs of the users' communities GRNET supports.

Data Management Services

Hellenic Data Service “HELIX”[11] is a data catalogue and repository supporting knowledge management and scholarly communication in Greece. It is comprised of a diverse set of services, features and functionalities that facilitates responsible research conduct while easing compliance with Open and FAIR practices in the Greek research area. Moreover, HELIX succeeds in linking digital assets of publications, data and processes together thus contributing to information contextualisation and ultimately to building a European data economy of added value services and return on investments through improved research exploitation. HELIX assumes the role of a national mechanism for research, also included in the National Roadmap for Research Infrastructures, and consists of:

- A publications harvester, collecting metadata records from national and institutional literature repositories, including OpenAIRE compatible repositories
- A data catalogue and repository, with a dual role in storing and preserving data that are self-deposited by researchers as well as in harvesting data records from other national data sources and catalogues
- A pool of tools for (big) data analysis, allowing for data intensive research to be performed by utilising national cloud computing and High Performance Computing infrastructures.

Particularly for the data repository, it is worth mentioning that its model and specifications are adopted and followed by Greek Universities data repositories infrastructure “HARDMIN”[12]. Complementary, every academic library has an institutional repository aiming at streamlining availability and access to scientific publications. Furthermore, services and repositories provided by thematic research infrastructures of the National Research Infrastructures Roadmap, offer data management, analysis and software development tools tailored to discipline specific demands and needs.

Aims

Organizations that have constituted the OSTF, along with policy-makers, funders, and NGOs, are pursuing the formation of the Hellenic Open Science Initiative (HOSI, or ΕΠΑΕ in Greek), a bottom-up approach, seeking governmental approval. HOSI aims to (a) foster Open Science activities in Greece identified in the 'National Plan for Open Science', (b) work with government funders, all research performing organizations, and law makers towards a sustainable open science policy and infrastructure, and (c) officially represent Greece in EOSC as a Mandated Organization. HOSI is expected to be formalized via an MoU by the end of 2021, collectively representing the interdisciplinary Greek Research and Development Community, and positioning itself as a National Open Science Cloud Initiative (NOSCI). This activity is also directly supported by the regional INFRAEOSC-5b project NI4OS-Europe [13], in which two organisations (ATHENA RC and GRNET) that have been active in the OSTF and HOSI also participate. The initiative strives to maximize EOSC benefits, brings together all relevant stakeholders, promotes synergies and cooperation among the consortium, as well as scientific excellence and the sustainable development for the country in the rapidly evolving European Research Area.

Governance

An MoU has been drafted and is currently in the process of being officially signed by all parties of HOSI. This foresees a lightweight governance structure for the National Initiative, composed by the General Assembly (GA) which is the highest decision-making body. The GA consists of official representative members and alternate members of HOSI members who have the right to vote in elections (Organizing Committee, National Representatives) and on the occasions of urgent requests and general meetings. The GA meets regularly to discuss important issues relevant both to HOSI organization and EOSC contributions. Moreover, the organizing committee consists of the President/Chairman, the Vice-President/Vice-Chairman and the Secretary who support voting procedures and meetings of the GA. The Organizing Committee is elected by the GA and its term is annual. HOSI foresees the setting up of working groups to more effectively address key areas of Open Science implementation.

GSRI currently endorses this initiative as an observer, but the possibility to upgrade to become a formal member remains on the table.

Funding

Main public funding streams for RTDI come from GSRI that manages public expenses and budget received from the European Central Bank for all framework and operational programs (ESPA, EPAnEK, etc). GSRI funds research and infrastructures. In addition, the Ministry of Digital Governance secures resources for academic networks, such as services maintained by GRNET.

Links to EOSC

There are two Greek organizations that directly contribute to EOSC Architecture through their pillar infrastructures: ATHENA RC being the coordinator of the OpenAIRE pan-European infrastructure for Open Science Scholarly Communication, and GRNET via national

representation in GEANT, PRACE, EUDAT and EGI infrastructures and partnership in EuroHPC. ATHENA RC and GRNET, individually or in cooperation, participate in EOSC-related projects at European level, such as NI4OS-Europe, DICE, EGI-ACE, C-Scale, NEANIAS, EOSC-Enhance and EOSC FUTURE. They also collaborate at national level by undertaking projects, such as the Hellenic Data Service – HELIX, to support the digital economy and Open Science in Greece. Their aim is to support population of EOSC with services following standardized FAIR-enabling and EOSC-compatible processes, increase digital up-skilling and re-skilling and build competences for Open Science and EOSC uptake, as well as guide EOSC strategic plans and policies implementation.

Finally, one of the major objectives of the MoU already mentioned, is to drive EOSC activities at national level and provide a coordinated framework for the participation in the EOSC Association. The aim is to progressively move to a fully-fledged legal entity following the National Open Science Initiatives blueprint, developed by the INFRAEOSC-5b project NI4OS-Europe[14].

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[11] <https://hellenicdataservice.gr/main/>

[12] <https://hardmin.heal-link.gr/>

[13] <https://ni4os.eu/>

[14] "A NOSCI is envisaged as a coalition of national organizations that have a prominent role and interest in the Europe Open Science Cloud (EOSC). The main aim of NOSCI will be the promotion of synergies at national level, and the optimization/articulation of their participation to European and global challenges in this field of OSC, including the EOSC. National initiatives are envisaged to play a prominent role in Member States and Associated Countries and facilitate EOSC governance." <https://zenodo.org/record/4061801#.YN4ZcegzY2w>

A2.2.2.7 Hungary

Introduction

Governmental Agency for IT Development (Kormányzati Informatikai Fejlesztési Ügynökség - KIFÜ) is an independent no-profit public budgetary organisation operated under supervision of the Ministry of Innovation and Technology. KIFÜ is one of the major central service providers and development organisations for the research and educational sector, however there are some other players also. Each university and research organisation is operating their own infrastructure to serve their users. Universities and research institutes started to support data management, especially those who are participating in H2020 or some local research funds starting in 2021.

After the reorganisation of Hungarian Academy of Science (MTA) in 2019, a new organisation was established called Eötvös Loránd Research Network (ELKH). ELKH Secretariat is an independent public budgetary institution operated under supervision of the Ministry of Innovation and Technology with the aim to manage and operate the publicly funded independent research network in Hungary. ELKH research network funded via ELKH secretariat currently comprises 11 research centers, 7 research institutes, and around 150 additional supported research teams operating at universities and other public institutions, conducting basic and applied research, exploring the most varied disciplines of mathematics and natural sciences, life sciences, social sciences and the humanities.

The Ministry of Innovation and Development provided HUF 14 billion for the creation and setup environmental exploitation of research results (Autonomous Systems National Laboratory, Biotechnology National Laboratory, Security Technologies National Laboratory, Digital Heritage National Laboratory, ELI National Laboratory, Climate Change Multidisciplinary Laboratory, HCEMM Teaming National Laboratory, Human Reproduction National Laboratory, ICT and IT National Laboratory, Quantum Information Science National Laboratory, Artificial Intelligence National Laboratory, Centre for Molecular Fingerprinting National Laboratory, Nanoplasmonic Laser Fusion Research Laboratory, Agricultural Technology National Laboratory, Laser Transmutation National Laboratory, Social Innovation National Laboratory, Virology National Laboratory).

These laboratories are expected to gradually support research data management as one of the initial elements of open science, however they must also support industrial exploitation and innovations. This may cause some potential controversy.

Hungary maintains a long tradition to support openness in science, since one of the first open access initiatives the Budapest Open Access Initiative happened in February 2002 (<https://www.budapestopenaccessinitiative.org/read>) Since that time the case of open science was gradually progressing. In 2017, 30% of the articles published in Hungary were published under the Open Access policy. This rate is similar to the World average. OA policies are slowly adopted in Higher Educational Institutes (HEI). The official policy in most HEI encourages researchers to deposit all research outputs at the institutional repository and to provide open access upon publication or as soon as possible (respecting publishers' policies). The deposit of PhD and master theses is mandatory. The Open Access policy has been mandatory for all National Research, Development and Innovation Office (NKFIH/NRDIO) NRDIO funded research since 2014. Institutional Open Access policies are prevailing, both in the non-university research institutes and HEIs, although without a high-level policy. To support the open access publication a central open access bibliographic database was established in 2009 (<https://mtmt.hu/>) under successful operation of the Library and Information Centre of Hungarian Academy of Science.

Currently, there is neither open science nor FAIR data policy in Hungary. In 2017 a working group at NRDIO was established to formulate the policy regarding open-science. The working group developed some knowledge base and documents about the open access part of open-science (<https://nkfi.gov.hu/english-2017/boards-and-committees/open-science-expert>). In autumn 2020 as a stimulus of the NI4OS-Europe project KIFÜ and University of Debrecen started to organise a forum to discuss open science among research organisations. In May 2021 an Advisory Board for National Open Science established by NRDIO to help formulate white paper discussing different aspects of open science including open access, data management, research integrity, open science skills development, reward system in open science, etc. Both KIFÜ and University of Debrecen are willingly participating in the work of this advisory board. In 2019 the Hungarian node of Research Data Alliance (HRDA) was set up for supporting and developing the research data management in Hungary. As part of its work, HRDA ran a series of meetups during 2020 to discuss research data management and University of Debrecen developed training material on Research Data Management.

The present Hungarian e-infrastructure landscape

The main players e-infrastructure at national levels are:

- KIFÜ is the National Research and Network (NREN) providing service from networking, HTC and HPC. It connects all the Hungarian Research Organisations, Research Infrastructures. Hungary became a member of EuroHPC JU in 2019 and joined the Leonardo EuroHPC collaboration and is equally participating in the EURO CC project to strengthen HPC competence centers. HTC or cloud computing is also provided for both education and research. KIFÜ is funded as an e-infrastructure mostly from government funds (94%) and partially from served organisations (4%) and partially from projects (2%).

Members pay a contribution fee (that contributes to the cost to cover collaboration, innovation and most of the KIFÜ services, e.g. network, eduroam), as well as a tariff per additional KIFÜ service that they subscribe to (e.g. extra storage or cloud capacity). Access to the HPC capacity is based on the scientific project proposals submitted by the applicants from research institutions. The usage cost of the Hungarian supercomputer is free to positively-evaluated scientific proposals. KIFÜ is actively working together with its members on services and development of new services and services. Some new service requests came from the supervising ministry, some providing opportunities for the members to experiment and develop jointly with KIFÜ. Several infrastructure and service development elements (network, computing, development, procurement, project management) are in one hand at KIFÜ, which started to be less unique in the e-Infrastructure landscape in Europe by 2021. A development strategy for services for universities, research institutions, libraries, and museums KIFÜ jointly developed with its members in 2019 for 2020-2025, but the COVID-19 generated the same changes and also a new source of funding appeared via RRF funds. Using this fund, a latest generation of HPC infrastructure is planned to be built by the end 2021 based on the user requirements, with robust support of GPGPU, tensor or other AI calculations. However, this new system HPC will have several partitions able to fulfil different user requirements. KIFÜ is a member of several international organisations (GÉANT, PRACE, EuroHPC, EOSC - also the mandated organisation) which allow researchers to collaborate internationally acting as a gateway to the international e-infrastructures. KIFÜ via these memberships can channelise international culture and standards to support Hungarian Research infrastructure better.

- ELKH after establishment of the new research network started strengthening some strategically critical research and infrastructure elements of Hungarian Research. Based on the successful MTA cloud pilot, ELKH started to fund the next generation of it. ELKH cloud was designed to support artificial intelligence research in Hungary. The ELKH cloud is operated and developed by SZTAKI and WIGNER Physics Center. SZTAKI is closely collaborating with EGI.
- Hungary has 2 members in the most active data infrastructure called OpenAIRE. HUNOR (HUNGarian Open Repositories) is a consortium of Hungarian higher education libraries and the Library of Hungarian Academy of Science. Its primary purpose is to establish a network of institutional repositories in Hungary in order to provide coordination for research institutions to make all their research publications openly accessible. University of Debrecen is in addition member and acting also as a representative of HUNOR and National Open Access Desk (NOAD) of Hungary. OpenAIRE NOADs have been long involved in national efforts for Open Access, and recently for open science. Their goal is to develop capacity at a local level, in order to put in place, the relevant support structures for open science practice and to be able to provide expert advice on infrastructures that support the workflows for open science.
- NRDIO is the primary funding body of research. As mentioned earlier they established an Advisory Board for National Open Science. In 2020, NRDIO started to require research data management plans in the domestic research funds similarly to the Horizon 2020 project proposals.

- ELKH is the operational and funding body of members of Eötvös Lóránd Research Network.

EOSC Policy in Hungary

KIFÜ is of the opinion that EOSC should build a federation of robust national infrastructures. The central part of EOSC should provide the federation operation and the coordination. Without federation the scalability and variety is impossible. Every country has its own peculiarities, strong points and weak points which should be developed. Each country should empower their national infrastructures including networking, computation, data infrastructures. This also implies development of skills, attitude and policies at national levels and further down to research performing organisations, the research teams and even to individual researchers. This should be performed via education, development of internationally harmonised standards, legal frameworks, and collaborations.

Proposed approach (not in priority order)

- Establish a forum to discuss open-science related issues and contribute to the EOSC Task Forces.
- Start with a bottom-up approach with the research teams enthusiastic to some aspects of open science.
- Complement with a lightweight top-down approach.
- Find and use the synergies between the Hungarian research infrastructures and e-infrastructures.
- Help Hungarian open science players to contribute to EOSC.
- Contribute to the national open science discussion.
- Develop skills, standards, legal framework as needed.
- Advocate open science.
- Fund the open science infrastructure elements where they serve their users.
- Sustainability should be provided by combination of sharing agreements and national and international funds

A2.2.2.7 Italy

The Italian e-Infrastructures landscape in view of Horizon Europe

Objectives

In the long term, our vision aims to create a national coordination body that is representative of Italian infrastructures, mandated by the Government. Key objectives are:

- to promote synergies between Italian Research Infrastructures and e-Infrastructures, and coordinate the Italian participation in national and international initiatives and programmes;
- to contribute to the creation and discussion of national strategies for the participation in the construction of an European Open Science Cloud and streamline/optimize the usage of available funding.

- to foster the development of a national and European data network, basing on data producers and on the various service levels offered by Research Infrastructures, R&E networks and advanced computing centres;
- to collaborate on a common definition of federated services, in order to optimise their usage for the benefits of already involved scientific communities, while extending to new ones the access to the federated services.
- to advocate open science and research infrastructure, disseminate the relevant competences in the Italian Research communities and contribute to the creation of a solid data culture in the country.

The present Italian e-Infrastructures landscape

The Italian landscape counts a large number of Research Infrastructures of different scientific domains from Astrophysics to Biomedicine, Earth and marine sciences and a few e-Infrastructures Organizations.

Each domain is administered and funded by public Research Organizations like CNR, INFN, ENEA, INGV, INAF and by Universities. In their turn all these legal entities are mainly funded by the Government.

The situation on e-Infrastructures at national level sees essentially:

- GARR as the National Research and Education Network (NREN) interconnecting all the Italian Research Organizations sites and Research Infrastructures. GARR is funded by its users, i.e. Research Organizations and Universities. It is not funded directly by the Italian Government. GARR also includes a “generalist” Cloud service, currently used by biomedicine, CNR and Universities. GARR has started a new Project GARR-T that is deploying a new Multi-Terabit capable network in line with the current GN4-3N project coordinated by GEANT at European level.
- CINECA as the main HPC player. It is a consortium of Ministry of University and Research (MUR), Universities and Research Institutes which also provide the funding. CINECA, in agreement with INFN, MUR and Emilia Romagna Region, is building a new Data Centre in Bologna that will host one of the 3 pre-exascale supercomputers co-funded by the European Commission under the umbrella of the EuroHPC JU (Joint Undertaking). The new site is part of the Tecnopolo that already hosts the new data centre of ECMWF (European Centre for Medium Term Weather Forecast) and will also host the new INFN data centre. The connectivity is ensured by GARR that already provides 2x100 Gb links to ECMWF.
- ICDI (Italian Computing and Data Infrastructure) is a forum created by representatives of major Italian Research Infrastructures and e-Infrastructures, with the aim of promoting the creation of a nationally federated Computing and Data Infrastructure in the spirit of EOSC. ICDI activity is regulated by a Memorandum of Understanding among the major research organizations and all the members/organisations participate on their own resources.

In view of the participation as a founding member in the EOSC Association, upon MUR's (Ministry of University and Research) mandate, ICDI is considering to acquire a legal personality, the key requirements being for this new body to be non-for-profit, lightweight, inclusive and open to the accession of new members, and collecting economic and in kind contributions from members and funding agencies.

In the meantime GARR has been designated to officially represent ICDI in the EOSC Association.

EOSC related activities

To fulfil its mandate at the national level, i.e. foster coordination among the Research community in relation to Open Science - and cloud-related topics, ICDI has launched in 2020 several task forces dedicated to topics of interest to the Italian community:

- The *Italian Federated Cloud Platform Task Force* (FCP-IT), launched in June 2020, aims to develop a strategy and identify adequate technical solutions to achieve the creation of a federated cloud dedicated to research on a national scale, and to propose itself as a model also at the European level. The FCP-IT TF, proposed by GARR has received a strong interest by the major Research Organisations such as CNR and INFN which currently have the two co-chairs.
- The *Italian Competence Center for EOSC Task Force* (CC-IT), approved in July 2020, aims to create a national Competence Center that can act as a reference for the Italian community and a platform to federate, coordinate and further disseminate the existing competences within Research bodies, Infrastructures and Universities that are part of the Italian Open Science community. The CC-IT TF initially is based on the activities of CNR and the Italian component of OpenAire.
- The *Clinical Data Management Task Force*, also launched in July 2020, intends to build a support platform for the management of clinical data within the institutions where they are first created. The work of the TF, coordinated by the Italian component of Elixir, initially has been focused on data related to COVID-19, with the twofold objective of facilitating data sharing on this urgent line of research by contributing to the European COVID-19 platform, and creating a Proof of Concept that can be used for sharing biomedical data relating to other pathologies.

Proposed approach

Governance/Structure/Ownership

As already mentioned ICDI is in the process of acquiring legal personality, but this will require some time. The research organisations, universities and other entities, which are part of the described landscape, are however solid and stable and currently provide all the services. They will continue serving research/academic activities in the broad sense and in all the scientific domains.

Funding/Cost Sharing/Business Models

All the organisations are not-for-profit and are not intending to expose their services in a commercial market and are generally not structured to apply a pay-per-use business model that will be severely impacted by the different VAT regimes in the other EU Countries.

Sustainability of the national structure should instead be based on community services and specific agreements for using shared resources. Governmental funding is also a relevant part of the sustainability model.

Coordination at national level and connections at EU level

Coordination at national level is a difficult task when there are so many research organisations and universities in the country and the risk is to either become a dispersive huge assembly or remain a niche and very focused covenant. A good balance must be sought, with no predominance of specific fields or stringent selection criteria. Inclusiveness of different research fields, backgrounds, competences and thematic infrastructures is a key factor to achieve such balance, but this implies a strong coordination effort.

The coordinated approach we had in the last years during the collection of information (landscape analysis), participation to EU EOSC program and contribution to EOSC WGs demonstrated the evident benefits of coordination and synergy between Research Infrastructures (RI), eInfrastructures (eI), Clusters, Research Organisations, Universities and Ministries.

A2.2.2.8 Netherlands

SURF case for e-IRG

Introduction

SURF is a cooperative association of Dutch educational and research (performing) institutions in which the members combine their strengths. Within SURF, people and institutions work together to acquire or develop the best possible digital services, and to encourage knowledge sharing through continuous innovation. The members are the owners of SURF.

SURF currently serves mainly education and research. SURF does not serve primary and secondary education as the requirements vary, but a close contact is kept with this sector and work together where appropriate, mostly in procurement. SURF also serves a small number of government research institutes, mainly because of the very close relationship with the main body of members. Keeping the focus on research and education for (future) professionals is thus a main priority and this is not expected to change.

In 2020 SURF Cooperative has merged its three companies (SURFmarket, SURFnet and SURFsara) into one (SURF BV), leading to a bundling of procurement, network services and computing and data services. All staff that used to be employed at Cooperative level were also placed in the BV. There is a board with three members: a Chief Executive Officer, Chief Operations Officer and Chief Innovation Officer and 3 main branches accordingly (staff, services, innovation). We have ~350 FTEs.

Funding

Since 2014 SURF is no longer funded directly by the Dutch Ministry of Education, Culture & Sciences, but receives a subsidy from the research funding organization: NWO. The remainder (and bulk) of our income comes from member institutions who are active in education (vocational education through to research universities) and research (incl. several government research bodies). Members pay a fee (that covers collaboration, innovation and the core SURF services, e.g. network, eduroam), as well as a tariff per additional SURF service that they subscribe to (e.g. supercomputing). Procured services are paid for depending on who participated in the tender and those that actually use the service; rates are applied according to the contract.

Cooperative as legal status

We chose a legal form called 'cooperative' which is basically an association (with membership) with a company (for execution). We are regulated by statutes (passed by a notary) and regulations (decided by members). Members have the final say over everything we do. We find this beneficial for the sense of ownership. Also, this gives us a legal advantage for procurement: we can negotiate with provider companies (software, hardware, services) and procure 1 contract; all members can then use the products offered according to the conditions SURF has negotiated. For big tech, we serve as a channel (and have a certain market power).

Services and innovation

Historically SURF already worked together with its members quite intensely on services and development of new experiments and services. This is the foundation of the strong infrastructure we have. This continues to be so. Now that all companies are merged we can collaborate better among ourselves to deliver better service, by combining the strength of our network and compute engineers, as well as procurement expertise. More and more often an integral technical approach is necessary to develop the right solutions. Finally, in the new structure a department for Innovation has been established to ensure that we devote enough of our time and attention to new developments (with members and the larger network, including international partners).

SURF aims to not only develop its own services, but provide a space where members can experiment and develop together. Sometimes with an aim to develop services all members will use, more often to develop services a smaller group will have need of. There is a free flow of knowledge between SURF and its members; SURF enables members to learn from each other.

Decision making

The members council (representatives of the boards of institutions) decides on strategy, priorities in development and the budget. Advice is offered by IT Director or CIO level officers, before they finalize decisions. This is all prepared by the board of SURF and our staff. For development of services, our points of contact are the specialists who work at the institutions (ranging from researchers and professors and teachers/lecturers, to IT engineers, procurement officers, privacy officers, security experts, and more recently data stewards). It is a complex process to get the whole community to agree; this is also time-consuming. But once complete, the commitment is real.

European perspective

SURF has an extensive network internationally. For example, SURF is a member of GEANT, EGI, EUDAT, PRACE, EuroHPC and have recently entered the EOSC Association, as well as GAIA-X foundation. SURF participates in numerous EC funded projects (e.g. in support of EOSC and other infrastructures). International participation is necessary to coordinate across borders and get things done. Establishing eduroam is perhaps the most well-known accomplishment, but there are many more.

When it comes to EOSC, SURF is of the opinion that EOSC should build on strong national infrastructures – a federation of national OSCs (NOSCs)– instead of imposing a centralized European infrastructure. The latter is not even possible, given the enormous variety of how we have organized ourselves within Europe. But it does require strengthening the national infrastructures, including how to deal with data. Like the NRENs can only be connected into GEANT or the NGLs into the EGI Federation, because we work together and safeguard the architecture, standards and everything around it. FAIR data can only really come to life if we make similar agreements and act upon them. And now the challenges are even bigger: for networking this involves just making agreements among NRENs. For data, work is needed across the whole community, down to the very last researcher. And it requires enormous investments of all concerned (e.g. storage, archiving, data stewardship, data processing services, collaboration services, machine learning, etc). EOSC can however provide the international requirements from the point of view of research and help define the standards as well as the legal framework that is necessary to protect European values.

At national level, SURF provides a gateway to the international ICT infrastructure. And vice versa, SURF needs to strengthen the national infrastructure and the way it collaborates with its members at local and regional level. There needs to be a strong infrastructure locally that adheres to the same standards and where support can be given close to the researcher. More importantly, universities have an enormous challenge in getting all members of their community to adopt new ways of working to really achieve the goals of FAIR. This extends to compute power as well: 2nd tier supercomputers are installed with members, the 1st tier is with SURF at national level and exascale computing can only be done internationally. SURF is what connects the dots, so a researcher can have access to what (s)he needs for the work.

Members more or less expect SURF to make sure their international collaboration is ‘taken care of’ by our connections to other similar national organizations (because SURF’s technical solutions make it possible). International research (and education) should experience no boundaries in the view of SURF’s community (although security questions are being raised more and more often: academic freedom needs to be protected strongly from those who wish to abuse it). When FAIR becomes the norm, this will be doubly true and international standards (incl. protective mechanisms) will be even more important. At the same time, all of this should be made available at local level: an individual working for our members usually doesn’t even notice they are using SURF services.

Challenges ahead

With regards to the upcoming public procurement of EOSC Core and some parts of EOSC Exchange, SURF would prefer grants/subsidies instead of tendering, because public bodies may not participate in tenders in the same way that private bodies can. It would be beneficial however, if grants/subsidies would fund larger programmes (instead of a project with a shorter/smaller scope) with a view to delivering lasting infrastructure and collaboration between national infrastructures and at European level. This would require sustained investments over a period of years. SURF however cannot become a European network as its focus is national and this is where its funding comes from. Collaborating at European level is good, helping to shape the European IT landscape, but public bodies cannot become executive deliverers of services at European level.

Assuming that the model underpinning EOSC is a network of functioning (federated) national infrastructure with a European layer on top, this requires careful design, planning and executing. In addition, infrastructure is not the main topic within EOSC itself compared within GEANT, EGI and EUDAT. The proposed approach would be that national governments will be required to invest in building the national infrastructures (necessary to ensure FAIR data research practice), in accordance with the European vision, taking into account the national situation; while the EC will invest in facilities that are necessary to exchange FAIR data on an international scale, as well as taking care of the necessary legislation to enforce European values. The actual building of the infrastructure seems not to be in scope in EOSC, so this needs to be addressed.

SURF has an important role to play in order to make sure that universities (and all other SURF members) will be provided with the IT support (in terms of infrastructure, additional services, innovation, collaboration and learning) they need to deliver good (or even top) quality research and education. Public values are an important point of attention in this: commercial providers do not always share the SURF and research community values. SURF tries to enforce these values by negotiating better contracts (procurement) as well as building critical infrastructure ourselves or with members. We want to ensure researchers, teachers and students keep sovereignty over their own data, since this is not automatically so.

Sustainability becomes more and more important, as the increased use of ICT makes for a sizable footprint in electricity use. The data revolution will require us to step up: universities demand this of us, and rightly so.

One thing is for sure, this will not fly without international collaboration: this needs to be built on international standards, while they rest on strong implementation within the national setting.

A2.2.2.9 Portugal

Introduction

In Portugal the most prominent aspect of a vision for an inclusive and holistic e-Infrastructure ecosystem for the European Research Area stems from the Portuguese Roadmap of Research Infrastructures [¹¹] that was first published in 2013 and had the last review in 2020.

This document is coordinated by FCT IP that is the Portuguese main national funding agency for science, research and technology, whose financing includes access to the national budget, assigned to the Science, Technology and Higher Education sector.

In parallel and connected with the e-Infrastructures roadmap, the political initiative INCoDe 2030, establishes strategic relevant orientations regarding digital competences complementary to e-Infrastructures, such as the topics of Advanced Computing, Artificial Intelligence and, more broadly, the development of digital competences [¹²]. This program has double guardianship, initially from Science and lately also from the Economic sector.

The Roadmap is a centrally funded program for CAPEX expenses of the beneficiaries.

Purpose/Governance/Structure/Ownership

The main purpose of having an organized e-Infrastructure ecosystem, although manifold, can be specified as a means to do better research, science and innovation, through the optimization of scarce resources, meaning the optimization of the e-Infrastructures and its associated processes such as training, education and awareness creation.

Regarding governance and structure of e-Infrastructures in Portugal, traditionally, special relevance is instead given to more direct support to scholarships, science/innovation projects and research institutions. The e-Infrastructure model is a somewhat new European mandatory instrument introduced by the Roadmap of Research Infrastructures.

A notable exception of a true standing e-Infrastructure was the National Research and Education Network (NREN), that ran and operated by a private institution until 2013, then integrated in FCT, losing its agility and flexibility but gaining financial stability with regards to OPEX expenses. Regarding CAPEX expenses, the integration of the NREN in the national main science financing body, brought difficulties not present before, since it is an administrative challenge to be both in the role of financier and also to be a technical executor of e-Infrastructures projects, that are CAPEX-based.

e-Infrastructures of the Portuguese Roadmap of Research Infrastructures are mostly based on consortium agreements, hosted on large institutions, such as universities.

A relevant exception was the National Distributed Computing Infrastructure (INCD) that was created as a private association supported by FCT and other partners, notably LIP - Laboratory of Instrumentation and Experimental Particle Physics, the main operational driving force of INCD.

¹¹ <https://www.fct.pt/apoios/equipamento/roteiro/index.phtml.en>

¹² <https://www.incode2030.gov.pt/en/documents-publications>

A relatively new legal figure that is emerging is the collaborative laboratories that try to tie together financing sources from the economy (innovation) and science sectors, whenever there are synergies to be explored. This approach is now a letter of law in the so-called “law of science”, reviewed lastly in 2019.

Advanced computing has gained much global and national interest, especially, since the Rome declaration in 2017 on High Performance Computing. A Portuguese Network for Advanced Computing (RNCA) is being established within FCT’s coordination as a cooperation network of operational centers and competence centers. In 2019 it published its general regulation. RNCA was included in the Portuguese Roadmap of Research Infrastructures with a strong reference to Minho Advanced Computing Center and the Iberian Advanced Computing Network.

Funding/Cost sharing/Business models

With regards to funding it is most convenient in this report to separate well between CAPEX and OPEX expenses. In the first case, CAPEX, the most important strategy for building e-Infrastructures is to resort to structural European funds, combined with other sources, such as national budget, regional funds or others. In the second case, OPEX, it is not usually possible to resort to structural funds, and so, being FCT the main funding body for science institutions with access to the national budget, naturally these needs flow to FCT’s desk for appreciation. For Portuguese research e-Infrastructures it is not often observed, until now, business models with cost sharing principles applied to its users, although it is usual that such provisions are mentioned on the statutory documents of the e-Infrastructure consortium. An important barrier to applying cost sharing models to its users is the lack of legal personality of the e-Infrastructure, that makes it difficult to issue invoices, although there are also other factors such as the idea of making the access process the simplest as possible to the research community. This argument does make sense since in a public research institution, an administrative process that encompasses some sort of payment can take from a few weeks to months to be fully approved. Instead of a simple pay per use model, sometimes a special cooperation protocol can be signed between a legally represented user base and a host institution of an e-Infrastructure, and then the consumption of e-Infrastructures services is taken from that signed contract, with regular, yearly for instance, account settlements. The counterpart of such cooperation protocols is the science or innovation produced by the consumption of e-Infrastructures services. Sometimes this is something that is not easy to define clearly. Common metrics are scientific publications produced or patents registered.

Resource sharing and access policies

An e-Infrastructure ecosystem is diverse and can therefore have different forms of resource sharing and access policies. Common methodologies are dedicated time sharing or simultaneous use with some sort of quota usage enforcing control. It does not fit in this report to lay out a complete analysis of all Infrastructures, but some representative cases should be mentioned:

The NREN is centrally supported and free of charge to public higher educational institutions. Other use cases may be subjected to end user payment. This categorization also greatly automatically defines the access policies.

The National Network of Advanced Computing (RNCA) is also centrally supported and free of charge to the research sector. Its general regulation allows for charged services, but this hasn't been exercised yet for the part of resources included in RNCA. The operational centers are free to sell capacity by their own arrangements with interested parts. RNCA's access policy is through regular calls for usage, the first one in 2020 and the second planned to occur in 2021. The regulation also allows for ad-hoc, strategic accesses, but this hasn't been exercised yet. Starting from 2021, proposals are to be ranked by scientific scoring among other factors, being awarded the limited existing resources to the proposals best ranked.

Other e-Infrastructures:

GÉANT OCRE (Cloud computing)	N/A	Framework agreement call off. Payment by the final user to the commercial cloud operator
Video conferencing software and Infrastructure	N/A	Included in the NREN service
Video and Audio Physical Studio	Timesharing, one user at any given time	Free for users of the Science, Technology and Higher Education sector
Videocast and Educast – video editing, storage and remote access	N/A	Included in the NREN bundle
Filesender local implementation – high volume file transfer	N/A	Included in the NREN bundle
Authentication and Authorization Infrastructure	N/A	Included in the NREN bundle
Massive Open Online Courses	N/A	Included in the NREN bundle, also available to the Science, Technology and Higher Education sector

Scientific open repositories (mandatory usage)	N/A	Included in the NREN bundle, also available to the Science, Technology and Higher Education sector
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Also, an embryonic effort is being made to provide a long-term data e-Infrastructure. This a pilot project with an Eudat local installation, that is being operationally led by LIP - Laboratory of Instrumentation and Experimental Particle Physics.

Connection with European initiatives

There is a clear effort of alignment of local developments with European initiatives, which give not only a positive global framework for digital projects and services, but also provide substantial support for CAPEX expenses. It is with concern that in the recent financial cycle, European financing reduced from 80% to 50%. This can, in time, produce a gap of prevalence of digital services that may be present in some parts of Europe but not in other parts in any significant way.

Portugal participates in a diverse set of European initiatives, related to the e-Infrastructure ecosystem, being in most cases a quota member of initiatives such as: GÉANT, PRACE, EuroHPC, IBERGRID, Eudat, e-IRG, ESFRI, and others.

In addition to the participation in the initiatives mentioned above, under the Funding Program Connected Europe Facility- Telecom (2014-2020) several digital service infrastructures (assuring transnational connection through the EU Member States) were [implemented in Portugal](#), namely eID and eSignature (for electronic recognition), eDelivery (safe transfer of documents), eTranslation (automatic translation of documents and websites) that later gave origin to the [EU Student Card](#) (not yet implemented in Portugal), Europeana (a repository of cultural heritage items), Public Open Data, among others.

Lesson learnt

The European e-Infrastructure ecosystem for the European Research Area has had very important, useful, and currently vibrant success stories such as the interconnection of the European academic networks, through the GÉANT network. Other success stories exist that are more difficult to implement.

The perceived ambition is to have an e-Infrastructure ecosystem readily available to all European organizations of the Research Area that need those resources, in order to leverage science and innovation of excellence that compete in a globalized world.

For this to happen, at European level, the e-Infrastructure ecosystem cannot be treated only at the initial investment phase, but also throughout the complete service lifecycle, and this means a more complete financial support provided to the service operators, but also to increase a central European effort in providing service functions and supporting processes, such as service

catalogues, clear access rules to the services, rigorous usage accounting, quality control and reporting. Full service models can be found on references such as ITIL or Cobit. There are great challenges ahead for this evolution to take place, beginning by choosing the e-Infrastructure operators and defining frontiers of what is to be centrally supported, that is, the European usage quota of a national resource, and what is national responsibility, i.e., the local quota. For supporting the European usage quota, since there may be an absence of a central budget for years to come due to policies in place, a rigorous accounting can be set up that makes it possible to create a financial compensation chamber among state members. This is somewhat of what happens at the PRACE level, with annual quotas that enable, to each state member, a certain amount of service consumption to occur in the European supercomputing network. This rigorous accounting and comprehensive set of service functions and processes is also necessary if e-Infrastructures are to be shared among research and other sectors, such as industry on its innovations processes.

A2.2.2.10 Spain

Introduction

This document focuses on the analysis of two Spanish e-Infrastructures in the context of the analysis of the e-IRG White Paper on Good practices of coordination within and across e-Infrastructures and thematic Research Infrastructures.

The landscape of e-Infrastructures in Spain has been recently addressed in several individual and joint documents [1][2]. In those documents four types of initiatives related to e-Infrastructures are identified:

- The Spanish Network for Supercomputing [3], a network of 13 supercomputing centres in Spain.
- IBERGRID [4], a federation of distributed computing facilities from Spain and Portugal.
- Singular Scientific Technological Infrastructures (ICTS in Spanish) initiative [5]. An initiative to build up unique research facilities openly available to Spanish and international researchers on different scientific fields, some of them, including e-Infrastructures.
- The Spanish Network for e-Science [6], a coordination network across ICT infrastructures, policy agencies and researcher communities.

The first two are analysed more deeply in the document.

Spanish Network of Supercomputing (RES)

Structure, Governance and Ownership

The RES infrastructure is organized as a federation of 14 national HPC facilities (so-called RES nodes) that provide joint access to their computing resources; this is complemented with user support services, technical training, dissemination and outreach. Each RES node is legally independent and has its own management structure. RES nodes are funded in different ways, gathering contributions from regional, national, european and private sources

RES is coordinated by BSC-CNS (Barcelona Supercomputing Center – Centro Nacional de Supercomputación), following a bottom-up approach (from the e-infrastructure) to provide a country-wide competitive access based on scientific excellence criteria. This model has proven successful to foster collaboration among Spanish researchers, to share best practices between system administrators and to promote organization of joint events, while serving the requirements of the different nodes, which could offer a share of the resources under different conditions to researchers coming from regions and/or institutions who fund and operate the nodes.

RES does not have a legal form. Instead, RES is based on well-established procedures and agreements between the node managers. The RES Council is the main governing body of the Spanish Supercomputing Network and is composed of one representative from each node. The RES Council has a president, nominated by the Spanish General Secretary of Scientific Policy Coordination, and the BSC-CNS Council representative as Vice-President.

The RES Council is responsible for the appointment of the RES manager, the elaboration of the annual work plan and its associated budget, the approval of the multi-annual RES strategic plan, the incorporation or exclusion of nodes into the infrastructure, the definition of the minimal technical requirements for the supercomputers contributing to the RES, the approval of the annual report and the approval of the working rules for the Access Committee.

RES users are engaged through the CURES (Spanish Supercomputing Network Users Committee), which has the purpose to provide advice and feedback to the RES management about the current state and future delivery of RES resources and services. CURES aims at promoting an optimal use of the HPC infrastructure by sharing information about user experience, by suggesting new research and technology directions in scientific computing, and by voicing user concerns. CURES is composed of scientists from each RES scientific area. All CURES members are lead users of RES resources (Principal Investigators).

Funding, Cost Sharing and Business Models

Resource sharing has been one of the main principles in the foundation of the Spanish Supercomputing Network. Each node contributes a fraction of their available resources to RES periodic calls for proposals. This single-entry point to a wide federation of resources is an effective manner to preserve an independent governance of the nodes and their resources. Moreover, the joint pooling of resources enables the homogenisation of access policies and evaluation criteria. It also allows balancing individual demand peaks and valleys through compensation with the demand in the rest of the nodes. Finally, this facilitates the applications of researchers to RES resources, which indirectly increases the number of potential users.

The access to RES resources is requested through periodic competitive calls that follow the RES Access Protocol. Proposals to RES resources must include their detailed objectives, necessary resources and estimated timeline. These can be applications for single calls or long-term projects that will require resources in successive calls. Proposals are evaluated and awarded every four months. The Spanish State Research Agency (Agencia Estatal de Investigación, AEI) performs an evaluation of the general research programme and the Access Committee carries out the

evaluation of the proposals received based on the general research programme and the Access Protocol. The Access Committee is assisted by a Technical Experts Panel, a Scientific Experts Panel and a Data Management Experts Panel. Resources are awarded based on their scientific excellence, as ranked by the Access Committee. The user committee CURES evaluates the results of RES calls periodically.

Access to RES resources is free of charge at the point of usage. Both academic and non-academic researchers are eligible to apply. Only proposals for open research are accepted, i.e.: research projects enabled by RES must publish their results. This is further enforced by the requirement that project proposals must be supported or part of larger research projects publicly funded, which both ensures the availability of the human resources necessary to use RES resources and the open research nature of the projects awarded.

Resource sharing and access policies

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Coordination between vertical/thematic (domain specific) and horizontal (generic)

The user committee CURES provides a mechanism to link RES infrastructure with user communities. It includes representatives from RES scientific areas, namely Physics, Engineering, Mathematics, Chemistry, Biomedicine, Life Sciences, Astronomy, Space and Earth Sciences. CURES periodically analyses the results of RES calls, while it is also a communication channel between RES users and RES management. This committee also veils for a vertical, thematic balancing.

The RES infrastructure is included in the map of Spanish ICTS (Singular Scientific-Technological Infrastructures) along with other thematic infrastructures from multiple domains. The Spanish State Research Agency evaluates their general research programmes. Further engagement with user communities and user-oriented initiatives is achieved at the node level.

There are three strategic projects recognized by BSC-CNS stakeholders. This includes Gaia, EGA and LHC. Strategic projects can use up to 7% of the MareNostrum resources. These projects must submit yearly their expected resources requirements and should also submit the applications to the Access Committee for evaluation. Resources are granted unless the scientific quality of the project is not clearly demonstrated in every call.

Connection with European initiatives

The RES infrastructure has a strong connection with the pan-European HPC Infrastructure PRACE through the contributions of the coordinating node (BSC-CNS) to the flagship access programme of PRACE (Tier-0, Project Access). Indeed, Spain is a founding member and has been strongly involved in the developments of PRACE since its inception in 2007. This includes the access procedures to the infrastructure, sustainability, and impact assessment. BSC-CNS has been deeply involved in the 6 Implementation Phases funded by the EC (by 2021), with other RES centres joining in the recent phases. BSC-CNS also has a seat in PRACE Board of Directors, being responsible for managing the Peer Review process for the access to PRACE Tier-0 resources.

Complementing the European HPC ecosystem, RES nodes are coordinating or strongly involved in most of the European Centres of Excellence in Supercomputing Applications, and Spain is a founding member of the European Technology Platform for HPC (ETP4HPC).

More recently, BSC-CNS is also a key member of the EuroHPC Joint Undertaking, aiming at coordinating the efforts and resources to deploy a European world-class supercomputing infrastructure and an innovation ecosystem in supercomputing technologies, applications and skills. Moreover, Spain has been selected to host a EuroHPC-JU pre-exascale HPC system that will have an anticipated performance above 150 PFlop/s.

On the Data Services dimension, RES is also represented through its nodes in the European Data Infrastructure EUDAT, and has been participating in the definition of the European Open Science Cloud through the EOSCpilot and EOSC-hub.

Finally, the RES infrastructure is directly connected to other EU research initiatives, who are important users of RES resources either through the periodic competitive calls or through the

strategic priorities set by the Access Committee. RES is also indirectly involved in additional EU or worldwide initiatives such as SKA, ESRF, CERN, or projects like Fortissimo series, through the participation of the individual nodes.

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A2.2.3 REGIONAL APPROACHES

A2.2.3.1 The Nordic case

Best practices from Nordic e-infrastructure collaborations: Nordforsk, NeiC, NorduNet

Introduction

The Nordic countries, including Denmark, Finland, Iceland, Norway and Sweden, as well as the three autonomous areas, the Faroe Islands, Greenland and the Åland Islands, have a long-standing history of collaboration in science and research. There exist today many strong and extensive collaborations among Nordic researchers, institutions, and research infrastructures that are based on common values and goals for research, as well as long-term established trust. As a result of these, there have over the years been established structures and frameworks among the Nordic countries that foster easy collaboration among them, also regarding a more aligned participation in international initiatives. In this short case study, we look at a few of the most relevant frameworks for Nordic collaboration in e-infrastructures and aim to point out a few of the most important and common best practices and some of the factors that have proven important to adjust over time in order to improve the frameworks.

NordForsk

NordForsk was established in 2005 as a formal organization under the Nordic Council of Ministers to provide funding for and facilitate Nordic cooperation on research and research infrastructures

within common Nordic priority topics across the borders of the Nordic countries. One of the strategic priorities for NordForsk is the Nordic research infrastructure cooperation which aims to enable an increased joint Nordic use and access to research infrastructures at the national, Nordic and international level. NordForsk supports several activities relevant for research infrastructure cooperation. Examples of activities under this priority area include the Nordic e-Infrastructure Collaboration (NeIC), the Joint Nordic Neutron Research Initiative, the Joint Committee of the Nordic Research Councils for Natural Sciences and the Joint Committee of the Nordic Medical Research Councils, as well as Nordic research infrastructure networks.

Governance and funding

The NordForsk board is appointed by the Nordic Council of Ministers and has the overall responsibility for the operations of NordForsk. The board is responsible for the organization's strategy, economy and personnel policy - within the framework set by the Nordic Council of Ministers. The NordForsk Board includes representatives of the largest national research funding agencies in Denmark, Finland, Iceland, Norway and Sweden, a representative for the Nordic University Cooperation, as well as observers from the Faroe Islands, Greenland, Åland and the Nordic Council of Ministers. The chairmanship of the NordForsk Board circulates among the board members.

The NordForsk funding partners include the Nordic national research funding agencies. NordForsk also facilitates the high-level meetings of the directors of the Nordic funding agencies with the aim to further develop Nordic research and research policy through cooperation and knowledge exchange.

The Nordic eScience Action Plan

In 2006, the Nordic Council of Ministers formed an ad hoc eScience group assigned to propose a joint Nordic eScience strategy, also including e-infrastructures. The group delivered its initial report in summer 2007 and the Nordic eScience action plan was presented in November 2008, comprising ten concrete actions for implementing an integrated Nordic strategy covering higher education in eScience, eScience research and e-infrastructure. Following the successful implementation of many actions in the first version of the action plan, a new ad hoc expert group was appointed in 2012 to produce an updated version of the Nordic eScience Action Plan, the Nordic eScience Action Plan 2.0, which was published in 2015. The updated plan also has a set of ten concrete actions in e-science and e-infrastructure that were intended to respond to the rapid changes in tools and techniques in the research landscape and to spur "action to maintain and further strengthen the competitiveness of Nordic eScience and education." It was recognized that collaborations across the region are essential to "lead the way in strategic areas of research in implementing new modes of science also in the digital age." This emphasis on the value of Nordic e-infrastructure cooperation has retained its prominence and has been highlighted by the Nordic Council of Ministers "Our Vision 2030" in August 2019 and the subsequent action plan to establish the Nordic region as the most sustainable and integrated region of the world.

Nordic e-infrastructure Collaboration (NeIC)

NeIC is hosted by NordForsk since it was established in 2012 and it is NordForsk's main tool to implement the Nordic eScience Action Plan. When NeIC was established it had two major roles:

1. The first role is to assume operational responsibility for the Nordic distributed Tier-1 facility that is part of the Worldwide LHC Computing Grid (WLCG) and provides computing and storage for CERN.
2. The second role is to jointly or collaboratively explore, evaluate, develop and deploy innovative e-infrastructure services in response to the Nordic strategic priorities and the needs of the national e-infrastructure providers, their users and selected ESFRI projects of joint Nordic interest.

In 2019 NeIC stepped into a new role, to support coordination of projects on e-infrastructure in the Nordic region funded by the European Commission.

With all roles, NeIC is becoming an intersection point between national, Nordic and international research infrastructure strategies that heavily depend on collaborations among Nordic e-infrastructures. NeIC is by and large a virtual organization with a core staff of only two persons.

Governance and funding

Funding for NeIC activities is provided through the Nordic countries' national funding agencies, NordForsk and participating project partners.

NordForsk appoints the NeIC Board based on nominations by the national e-infrastructure provider organizations. The strategic partner organizations are CSC (Finland), SNIC (Sweden), UNINETT Sigma2 (Norway), DeiC (Denmark), RHnet (Iceland) and ETAIS (Estonia). The NeIC Board consists of one representative from each of these.

The NordForsk Board has delegated to the NeIC Board the authority to make strategic decisions regarding computing and data-storage infrastructure and react to upcoming opportunities. This includes allocating a budget, implementing the organization structure, as well as prioritizing and coordinating Nordic collaboration projects. The NeIC Board develops and maintains a strategy for NeIC. The NeIC Board recommends the NeIC Director to be appointed by NordForsk. NeIC is managed by an Executive Team chaired by the NeIC Director. The Executive team coordinates the activities and participates in project steering groups. NeIC engages national e-infrastructure providers, developers, and researchers to participate in projects and operational activities. Projects are developed in accordance with the strategy set out by the NeIC Board. The project reference groups and use cases involve users of the upcoming tools and services, ensuring that the project results meet the needs of the research community. NeIC engages with its stakeholders in several ways, e.g. through the bi-annual NeIC conference, and the NeIC dialogue meetings with the national e-infrastructure providers. Needs for collaborative digital infrastructure development are gathered through the proposals submitted to the annual NeIC open calls and discussed by the NeIC Board.

Coordination between generic and thematic research e-infrastructures

Initially, NeIC assumed operational responsibility for the Nordic distributed Tier-1 facility in 2012 and coordinates since then the Nordic computing and storage for CERN. This Nordic solution is unique in being distributed across existing national e-infrastructures of four countries: Denmark,

Finland, Norway and Sweden. The Nordic LHC Computing Grid (NLCG) Committee is a NeIC body that oversees CERN-related activities, such as Nordic Tier1 implementation and interactions with ATLAS and ALICE experiments at CERN.

Since 2012, NeIC has expanded its portfolio to a wider spectrum of scientific application areas. This came about through the implementation of the Nordic eScience Action Plans and from responses to the open calls for letters of interest by national e-infrastructure providers and Nordic research groups with clear e-infrastructure needs. Since 2019, NeIC also invites consortia consisting of e-infrastructure providers, developers, researchers, and related communities around the Nordic region to propose collaboration projects of joint Nordic interest through annual open calls. The proposed collaborations may include development of e-infrastructure solutions supporting open science or exploring new technologies, sharing knowledge, or offering training to improve the use of current and future e-infrastructure capabilities in research areas of joint Nordic interest. Projects are developed bottom-up through collaborations among researchers and national institutions from participating countries and financed on a cost-sharing basis. Participation from at least three countries, of which one can be other than a Nordic country or Estonia, is required. The proposed collaboration projects may also include partners from beyond the Nordic region. The NeIC board has the mandate to select the projects based on the NeIC strategic prioritizations. Through submitting pre-studies and publishing of application abstracts the potential for enhanced collaboration is further fostered.

Coordination with European initiatives

NeIC has over the years worked to increase collaborations that include the national e-infrastructure providers in the Nordic countries, partners in ESFRI projects, and other institutions in the Nordics and Europe. Operating at the interface between national, Nordic and European strategic development of e-infrastructures, NeIC has served as a platform to extrapolate regional collaborations into wider European collaboration projects to share and further develop existing e-infrastructure related resources. A prime example for this is the EOSC-Nordic project, which is coordinated by NeIC and funded by the European Commission H2020 program. EOSC-Nordic aims to facilitate the coordination of EOSC-relevant initiatives within the Nordic and Baltic countries and exploits synergies to achieve greater harmonization at policy- and service provisioning-level across these countries, in compliance with EOSC-agreed standards and practices. By doing so, the project seeks to establish the Nordic and Baltic countries as frontrunners in the take-up of the EOSC concept, principles, and approach. Another example is the NeIC-funded Tryggve project which developed state-of-the-art scalable e-infrastructure solutions for sharing of sensitive personal data for biomedical research between the Nordic countries, and, ultimately enabling a possibility for expanding some of these efforts also to European collaborations.

Good practices and lessons learned

A recent survey among collaborators in NeIC-funded projects showed that the NeIC collaboration benefits the Nordic e-infrastructure community first and foremost through a more effective sharing of e-infrastructure related knowledge and competences across the Nordic region. This is made possible due to the joint development work where the cross-border teams work together to build

concrete solutions or e-infrastructure services. One of the key factors to achieve good and useful results appears to be enhanced interaction and dialogue between the national e-infrastructure providers and user communities. It is at this level where a good integration of new e-infrastructure services developed through NeIC can be achieved to jointly benefit the Nordic research community. The uptake of the collaboration framework that NeIC offers appears to have improved a lot over the years, something that also is apparent in the growing amount of proposals submitted to the NeIC calls and the fact that these proposals now engulf users from a broader research community. One of the factors for the successful development of NeIC hence appears to be a positive long-term experience for the Nordic e-infrastructure community and a growing trust in the structure and functioning of the organization.

While a part of the funding for NeIC has come through NordForsk, there are challenges related to the national membership fees and the mechanisms through which these are allocated. The processes and timelines for applying for national funding for NeIC are different in each NeIC member country, something which makes the long-term funding perspective of NeIC less stable. With the growing portfolio of NeIC projects and the stable funding this requires it becomes apparent that aligning national strategies for common e-infrastructure collaborations among the Nordic countries with the national funding streams is another important factor for developing successful joint Nordic e-infrastructure services.

The growing trust in the established structure and functioning of the NeIC seems to also enable NeIC to act as an efficient platform for extrapolating regional Nordic e-infrastructure collaborations to wider European collaboration projects where resources can be shared and new services be developed. The experiences with recent NeIC projects such as the EOSC-Nordic show that knowledge and experiences from integrating existing national e-infrastructures with larger Nordic systems and structures can be transferred to facilitate the widening of e-infrastructure collaborations from the national to the regional and onto the European level.

NORDUnet

NORDUnet is a collaboration between the National Research and Education Networks (NRENs) of the five Nordic countries Denmark (DeiC), Iceland (RHnet), Norway (Uninett), Sweden (SUNET), and Finland (Funet). The organization provides a common Nordic world-class network infrastructure and a collaboration platform for developing and facilitating other common e-infrastructure services as requested by the Nordic national e-infrastructure stakeholders as represented by the NRENs.

Governance and funding

The NORDUnet collaboration started with the first NORDUnet Conference in 1980, and from there on evolved into a dedicated Nordic network during the NordForsk funded NORDUNET program (1986 to 1992). Since 1993 NORDUnet is organized as a limited liability company with the ministries of the five Nordic member countries as equal shareholders. The NORDUnet board consists of members who are appointed by the shareholders. Sticking with tradition since 1993, the board members of NORDUnet are the national network directors who are formally (re-)appointed every four years by the general assembly. The chairmanship of the board circulates

among the five directors. NORDUnet operates by co-financing and co-operating, where operations and developments of services are mainly done in a collaboration between NORDUnet and the Nordic NREN, as well as a few dedicated personnel resources that are directly employed by NORDUnet.

The shared NORDUnet services are funded through fixed annual membership contributions that are proportionally distributed among the member countries according to the same cost sharing ratio as set by the NordForsk funding partners. The stable long-term funding of shared services and the stable board member composition have over the years proven to be an important factor for the provisioning of a large and costly Nordic network for research and education. With the joint framework and funding model NORDUnet had a much more powerful position from the start to negotiate with commercial vendors and to participate in larger international network projects than any of the Nordic countries would have been able to achieve on their own. The aggregation of Nordic demands through NORDUnet gave way for a stronger market position and ultimately enabled an economy of scale for the organization and its member countries.

Over the years, the NORDUnet model was further evolved to include a forum for the NRENS technical directors to exchange experience and best practices at the strategic level, for sharing information about key challenges and initiatives, and to coordinate and align strategic efforts across the Nordic countries. This forum also brings in much of the information about the national end-users needs in the sense that it is the national providers who know about the user needs in their respective countries. The funding model was further developed over the years to also accommodate the development of new joint Nordic services. In NORDUnet, new services are only developed if there are a minimum of two member countries who are interested and willing to finance the development of a new NORDUnet service through additional and dedicated national funding.

Coordination between NORDUnet and generic research e-infrastructures.

In addition to providing the Nordic network for research and education, NORDUnet is also directly involved in the development and integration of network solutions on a Nordic level for a few larger international thematic research infrastructures, such as the WLCG Large Hadron Collider Optical Private Network (LHCOPN) and the Large Hadron Collider Open Network Environment (LHCONE), the European Spallation Source network (ESSnet) and the European Incoherent Scatter (EISCAT) 3D network.

Coordination with European and wider international initiatives

NORDUnet is an active participant in the European NREN collaboration GÉANT, as well as the Global Research and Education Network (GREN) through its membership in the intercontinental NREN collaborations Advanced North Atlantic (ANA) and the AsiaPacific Europe Ring (AER).

Good practices and lessons learned

Provisioning and operating a large Nordic e-infrastructure, such as the network for research and education between the Nordic countries and abroad, requires a dedicated and long-term committed funding- and organizational structure. The build-up of a solid and fundamental Nordic organization like NORDUnet over the years has also laid a foundation for trust and willingness by the NORDUnet participating countries to expand the collaboration beyond the initial core-services.

Today, NORDUnet has established a governance and funding structure that enables the development of new services on a more flexible and need-basis and with options for some countries to join or also refraining from joining developments of new services.

However, the member countries in NORDUnet can still find themselves in situations where different national strategies and funding streams are not always easily aligned. Such conflicting positions can nevertheless usually become solved through the well-established structures and routines of NORDUnet, as well as the long-term established (personal) trust. These have proven to be important factors for efficiently finding common positions in both Nordic and wider international collaboration projects.

The NORDUnet collaboration benefits its member countries also in the context of wider international project participation. In cases where NORDUnet is formally a part of a larger European or global collaboration, such as GÉANT, the Nordic Countries interests are emphasized and given an even heavier weight in larger international initiatives with, for example, the European commission or with other foreign governments. Even in cases where no formal representation through NORDUnet takes place and international membership is directly by the individual countries, the structures of NORDUnet still allow for an informal discussion of national and Nordic plans and strategies. This then still enables a regional Nordic alignment of common Nordic interests towards these European initiatives and thus a better leverage than what would be the case without the underlying NORDUnet structure.

Conclusion

Nordic e-infrastructure collaborations have over the years established successful frameworks, organizational structures and joint funding models that have facilitated the development and provisioning of joint Nordic e-infrastructure services. In many cases, these Nordic collaborations have been expanded to function beyond their initial core tasks and have become platforms for an aligned Nordic participation into wider international e-infrastructure collaborations. Common factors for these developments appear to be the establishment of long-term organizational trust, common values in developing e-infrastructure services and a willingness to fund and achieve results that contribute to a dynamic development and increase Nordic competencies and competitiveness on the international level.

A2.2.3.2 The Iber case

IBERGRID (Spain and Portugal)

Distributed Computing Infrastructure (IBERGRID)

Structure, Governance and Ownership

The Iberian Distributed Computing Infrastructure IBERGRID [4] is a joint Spanish-Portuguese initiative created under the agreement of Scientific and Technological cooperation signed by both countries in 2003, and the collaboration agreements signed in 2005 in terms of Grid Technologies and Communication Networks for R&D. In 2019 the agreements were reinforced giving IBERGRID a coordination role regarding EOSC, and support to the involvement in CERN experiments. The IBERGRID infrastructure federates the Spanish Distributed Computing

Infrastructure (NGI-ES) with the Portuguese National Distributed Computing Infrastructure (INCD), supporting compute and data intensive research projects of common Iberian interest. Both national infrastructures comprise High Throughput Computing, Cloud Computing, High Performance Computing, and data resources that are deeply integrated at the operational and technical coordination levels.

The Spanish side of IBERGRID comprises 10 resource centres (7 of them for Grid and 5 for Cloud, 2 of them in both). The Portuguese side of IBERGRID comprises 2 resources centres and is being enlarged to new centres in the north and central regions, it supports Cloud, High Performance and High Throughput Computing. The coordination among the centres is bottom-up and lightweight, mainly happening at the technical side. Each centre owns the resources and adhere to the infrastructure by means of Service Level Agreements which commit the fulfilment of a set of minimum quality criteria. The general coordination is ensured by representatives of both countries.

Funding, Cost Sharing and Business Models

IBERGRID is funded through regional, national and European competitive calls in which the members of the collaboration participate. Funding for infrastructure and operation typically come from different calls. There is no explicit membership fee from IBERGRID and any resource provider can join if they fulfil the procedures, based on recommendations for best practices adopted in integrated European infrastructures.

The funding model is not efficient especially for the operational costs, which are typically funded through European calls and are based on the specific support to new communities. A more stable funding model based on the operation costs would be more adequate. The sharing of the operation cost is performed on a voluntary basis, distributing the operation of key services along the collaboration.

As usual in distributed computing infrastructures, they have been built by a bottom-up approach, that is, the research communities created the seed of the infrastructure by providing their resources. In time these resources have been complemented with additional infrastructure of generic use for all user communities.

Resource sharing and access policies

Access to the resources is performed through Virtual Organizations and service calls. IBERGRID relies on EGI which implements the access request calls and in the future through the EOSC marketplace. Depending on the funding stream for the infrastructure, access can be restricted to researchers and technologists explicitly involved in the Spanish or Portuguese scientific system and projects.

Users are engaged through their participation in thematic Virtual Organizations that are supported by the different centres. Through a process of engagement users place a request that is evaluated and forwarded to the providers, who offer a quota of their resources. Centres can individually support specific Virtual Organizations that may not come through the engagement process. There

is no upfront quota committed by the resource providers, which is defined in the assignment of the calls. Users access normally the resources freely, although a process of pay-per-use is being piloted.

Coordination between vertical/thematic (domain specific) and horizontal (generic)

The coordination in this case is higher as the resources are allocated to Virtual Organizations, which are defined at thematic level. The support of IBERGRID includes generic thematic VOs (e.g. compchem, biomed), ESFRI/ERICs (such as vo.lifewatch.eu, vo.emso-eric.eu) or international project (e.g. eossc-synergy.eu).

Several of the centres contributing to IBERGRID also develop research on one or several disciplines, which also facilitates the interaction of the communities and the resource providers. In many cases support at the level of a resource center, implies also a scientific-technical cooperation between the final users and the user support teams, being use case engineering one of the areas in which IBERGRID has shown a stronger potential to foster adoption of distributed infrastructures.

Moreover, IBERGRID organizes a conference series in which users and infrastructure providers meet together and align on their activities and needs, and serves as a discussion forum for the Iberian centers to be kept updated via experiences sharing and monographic discussions.

Connection with European initiatives

Spain has a strong participation in European Organizations related to Research Infrastructures. In particular, Spain participates in EGI through the Spanish Research Council. Spain has a Joint Research Unit in the area of Distributed Computing RIs that was created to set up the National Grid Initiative in 2007, with 14 signatory institutions. This JRU has been used to organize the participation in some RI projects, such as the EGI-InSPIRE or EGI-ENGAGE.

The coordination of IBERGRID at European level, beyond Spain and Portugal, is strong through EGI, following the policies and best practices defined in such collaboration.

1. Annex of Austrian case:

Annex 1: General Assembly, elected members

First Chair of the General Assembly	Paolo Budroni, TU Wien
Second Chair of the General Assembly	Maria Seissl, UNIVIE
Members of the Steering Committee	Josef Eberhardsteiner, TU Wien; Claudia von der Linden, TU Graz; Christopher Lindinger, JKU UNI Linz; Roland Maier UNIVIE; Chris Schubert (<i>ad interim</i>), CCCA; Katrin Vohland, NHM
Coordinator of Steering Committee Deputy Coordinator of Steering Committee	Katrin Vohland, NHM Claudia von der Linden, TU Graz
Members of Management Board	Ilire Hasani-Mavriqi, TU Graz; Heimo Rainer, NHM; Tereza Kalová, NHM; Gerhard Wotawa, CCCA
First Chair of Management Board (Coordinator)	TU Graz, represented by Ilire Hasani-Mavriqi
Second Chair of Management Board	NHM, represented by Heimo Rainer
Third Chair of Management Board	UNIVIE, represented by Tereza Kalová
Fourth Chair of Management Board	CCCA, represented by ZAMG, Gerhard Wotawa
Coordinator of EOSC Café	Stefan Hanslik, BMBWF
Spokespersons of Synergy Team	Barbara Sánchez Solís, TU Wien Susanne Blumesberger, UNIVIE Claire Jean-Quartier, TU Graz

Annex 2: The Entities involved in the Austrian EOSC Initiative (Status October 2021)

ACONET Association [legal entity of the Austrian Mandated Organisation]
Academy of Fine Arts Vienna [official Candidate Observer at EOSC Association AISBL]
Climate Change Centre Austria [Observer of EOSC Association AISBL]
Johannes Kepler University Linz [official candidate Observer at EOSC Association AISBL]
Natural History Museum Vienna [Member of EOSC Association AISBL]

Graz University of Technology [Member of EOSC Association AISBL]
Vienna University of Technology [Member of EOSC Association AISBL]
University of Vienna [Member of EOSC Association AISBL]

Extraordinary Partners of the EOSC Austrian Initiative

Federal Ministry of Education, Science and Research (BMBWF)
ACOnet (NREN)
FAIR Office Austria

Annex I – Editorial boards

Austria: Blumesberger Susanne, Brandt Florian, Budroni Paolo, De Mello Castro Giroletti Juliana, Eberhardsteiner Josef, Flicker Katharina, Fröhlich Johannes, Ganguly Raman, Gergely Eva, Gruber Alexander, Guba Beate, Hanslik Stefan, Hasani-Mavriqi Ilire, Hönegger Lisa, Jean-Quartier Claire, Kalová Tereza, Knopper Sabrina, Kranewitter Michael, Logar Bernd, Von der Linden Claudia, Lindinger Christopher, Maier Ronald, Panigl Christian, Rainer Heimo, Rauber Andreas, Sánchez Solís Barbara, Saurugger Bernd, Schubert Chris, Vohland Katrin, Zimmermann Kerstin

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Croatia: Ivan Marić (e-IRG), Draženko Celjak, Sandra Razbornik, Slaven Mihaljević, Kristina Posavec (experts)

Denmark: Gitte Julin Kudsk (DeiC-expert), Josva Kleist (e-IRG)

France: Volker Beckmann (e-IRG)

Hungary: János Mohácsi, Imre Szeberenyi (e-IRG)

Germany: Jan Wiebelitz (e-IRGSP6), Andrea Hedegen (e-IRG)

Greece: Eleni Toli, Elli Papadopoulou, Elias Papastamatiou, Ognjen Prnjat (experts)

Italy: Federico Ruggieri, Enzo Valente (e-IRG)

Netherlands: Jet de Ranitz, Arjen van Rijn (e-IRG)

Nordic region: Ulrike Jaekel (e-IRG Delegate for Norway)

Spain/Iberia: Ignacio Blanquer (e-IRG), Isabel Campos, Sergi Girona (experts)

Annex II – Email template and Guiding Questions

Dear delegate,

in the last communication about the White Paper, the agreed ToR and decisions/actions from the last meeting were circulated, along with the updated draft White Paper concept. In this draft, following a review of the country reports from the last delegates meeting, a series of potential good practices has been identified, for the following countries:

Austria, Croatia, Denmark, Hungary, Spain, Sweden and Latvia.

In addition, the countries/regions already identified in the National Nodes document (France, Germany, Italy, Nordic countries) are also being considered to dive deeper and provide updates and further practices that can act as good paradigms at EU level.

CASE 1: Existing National Nodes case

With this e-mail, we would thus like to ask whether you would be interested to update your contribution and provide nuances, further practices as well as lessons learnt and experiences gained.

CASE 2: New country (identified above)

With this e-mail, we would thus like to ask you whether you would be interested to explore your country-case, and work towards identification of good practices.

FOR BOTH

Please let us know of your interest in participating in the White Paper development, so that we can plan for the next meeting in the coming weeks. Note that you can also assign an expert from your country to support you in this effort.

You can also find the current on-line version of the White Paper that includes the first section on “Good practices of coordination within and across e-Infrastructures and thematic Research Infrastructures” in the [Google doc](#). In this Google document, an updated version for Germany Research Data Infrastructure NFDI has been included as an example of how a country case could be developed.

For CASE1. This update is meant to provide some insights into recent developments in terms of coordination within the countries.

For BOTH: Such country reports can be included as annexes and then a short summary can be prepared for the main section of the White Paper.

Looking forward hearing from you,
Best wishes

Guiding questions

1. Governance/Structure/Ownership:
 - a. Purpose of the organization (serving only research/academic organisations or also other public sector bodies, e.g. schools, some ministries, hospitals, ...)
 - b. Is the coordination top-down (from the funder or ministry) or bottom-up (from the e-Infrastructures themselves and/or the thematic providers/communities)?
How/why is it efficient?
 - c. Is there a legal form of the coordination (contractual or even a lightweight MoU) and/or it is just a “forum” of coordination via an assembly or another committee?
How/why is it efficient?
 - d. Are users engaged in the scheme? How/why is their engagement efficient?
 - e. Other points that you may want to highlight that work effectively or you may want to highlight how you overcame challenges to become effective.
2. Funding/Cost sharing/Business models
 - a. How is the flow of funding to the initiative/infrastructure and is it shared among multiple stakeholders? Are there membership fees, etc? Why/how is this effective?
 - b. Are the costs shared among the partners of the initiative or a single organization covers the costs? Why/how is this effective?
 - c. What are the business model that make the initiative a good practice (in the research world regarding business models we refer to how the infrastructure creates, delivers and captures value for its users and remain financially sustainable). Why/how are they effective?
 - d. Other points that you may want to highlight that work effectively or you may want to highlight how you overcame challenges to become effective.
 - e. In the draft HEU Work Programme 2021-2022 EOSC Core and some parts of EOSC-Exchange are planned to migrate from the current grants to public procurement (tender) by the EC. Would the main e-Infrastructure providers in the country be in a position to submit bids (possibly together with other EU organisations as part of a consortium) to such a tender, or there are restrictions that will face challenges (in offering resources/people across borders, issuing invoices, and having limitations with percentages with such bids across borders). Are these limitations showstoppers or can be worked around?
3. Resource sharing and access policies
 - a. Are there resource sharing policies (depending on the resource)? Why/how are they effective?
 - b. What are the access policies that make the initiative/infrastructure effective? Are they peer-reviewed/evaluated or not, for public institutions only or industries entities/SME can also access the resources. Why/how are they effective?
 - c. Are the access free at the point of use for users? I.e. free vs organization or user fees? Are there quotas? Are resources only for national or is there also a percentage open for other countries.

- d. Other points that you may want to highlight that work effectively or you may want to highlight how you overcame challenges to become effective.
- 4. Coordination between vertical/thematic (domain specific) and horizontal (generic) providers
 - a. Why/how is the coordination effective? What is the coordination forum, informal or formal? If formal, what is the structure (committee, assembly, interface, etc.). If not, how does the ad-hoc approach work effectively?
 - b. Are thematic infrastructures paying for the services they are getting from horizontal providers?
 - c. Other points that you may want to highlight that work effectively or you may want to highlight how you overcame challenges to become effective
- 5. Connection with European initiatives
 - a. How is the interfacing with the EU initiatives/bodies successful?
 - b. In case of multi-party initiatives/infrastructures, how is the representation/participation in EU bodies handled? How is it effective?
 - c. Other points that you may want to highlight that work effectively or you may want to highlight how you overcame challenges to become effective

Annex III – Terms of Reference

Title: Vision for an inclusive and holistic e-Infrastructure ecosystem for the European Research Area - Resilient and flexible e-infrastructures that serve data interoperability and federation.

Scope: "Partnerships" among e-Infrastructures and the cooperation and linking ("interconnectability") between EOSC and EDI (networking/HPC), in particular EuroHPC towards their "convergence".

Topics:

- Good practices of coordination and collaboration within and across e-Infrastructures and thematic research infrastructures.
- Realisation and enhancement of partnerships in the e-Infrastructure landscape covering the full spectrum, including EDI and ECI.
- Resilience and value of e-Infrastructures in transient situations, e.g., COVID-19 pandemic.
- Advanced technologies and e-Infrastructures (Artificial Intelligence, Quantum technologies, etc.) - Highlighting the crucial role of e-Infrastructures, discussing the issues of financing and access.

Prioritisation: *The first two topics will be worked out in 2021.*

General point: Avoid writing something already appearing elsewhere, including the EOSC documents or the draft Horizon Europe Research Infrastructures Work Programme.

Focus: The next e-IRG policy document will aim at holistic high-level views, focusing on horizontal/transversal aspects. Inputs from the e-IRG workshop presentations and discussions, can also feed into the policy document. If appropriate, critical views can also be provided. A combination of multiple topics should be pursued, possibly via a story or stories, keeping a main focus.

e-Infrastructures are of high impact and there is no body with a holistic view in this area, while in other individual areas there may be such bodies. So, e-IRG should focus on e-Infrastructures, be independent and provide views, including critical views.

The idea for horizontal topics, building on the experience of e-IRG, should be exploited, highlighting good practices of cooperation of e-Infrastructures. If there is something concrete at the policy level from e-Infrastructures that can be highlighted with regards to Covid-19, this may also be valuable. The possibility of creating a story via a selection of some of the topics should be considered.

The importance of ethics and ethical aspects, in particular in AI and innovation, was highlighted and the ethical aspects related to EOSC were not mentioned in the SRIA document.

Linking some of the selected topics with the e-IRG workshop in December has clear benefits, as concrete inputs can be received via the workshop presentations and discussions, and incorporated into the e-IRG policy document(s).

e-IRG addresses mainly policy makers at the MS/AC and the EC. A summary of the main points raised for this policy document include:

- the holistic high-level approach;
- the horizontal/transversal point of view, talking about syncing of activities, not excluding though some examples in vertical/domain areas;
- the critical views that need to be provided;
- the possibility of a combination of topics, via possible stories.