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D5.4. Strategy for the future communication and exploitation of SLICES-RI

Acronym	SLICES-DS
Project Title	Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies – Design Study
Grand Agreement	951850
Project Duration	24 Months (1/9/2020 – 31/8/2022)
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Reviewers	All partners

Scientific Large-scale Infrastructure for Computing Communication Experimental Studies **Design Study**

www.slices-ds.eu

Executive Summary

The objective of SLICES-DS dissemination activities was to maximise the influence/impact of SLICES-DS and to promote exploitation routes of the project results in order to pave the way for SLICES-RI. SLICES-DS managed to increase its impact and outreach by:

- Raising awareness and openly demonstrate clear benefits for the SLICES community;
- Reaching out and building a sustainable community for SLICES-RI;
- Disseminating its outcomes to the widest possible community of potential beneficiaries.

SLICES-DS's outputs and results will be continued towards the long-term strategy of SLICES-RI. Activities that will facilitate the long-term sustainability and created during SLICES-DS are listed below:

- The continuation and enrichment of the dissemination activities and communication tools through the SLICES family projects (SLICES-SC, SLICES-PP);
- SLICES community building and awareness through the uptake of the support of the operation of theNetworkingChannel (https://networkingchannel.eu);
- Design, development and organisation of the SLICES Academy;
- The support and the operation of the different Boards created through SLICES-DS will be enhanced and continued;
- Continuous dissemination and engagement of the national communities towards the implementation and operation phases of SLICES-RI.

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1. Introduction

The objective of this document is to present the communication and exploitation strategy for the future SLICES-RI, which is based on the results of the Design Study. The deliverable presents the communication and exploitation strategies for the next phases of the SLICES-RI and analyses the technical, operational, economic and business impact of the outcomes. The main exploitation direction is focused on the preparation of the consortium for the SLICES-RI. The sustainability of the SLICES-DS communication and exploitation strategy, developed during the project, is planned through the SLICES-SC, SLICES-PP, and future projects to come, and the participation in ESFRI roadmap 2021.

2. The SLICES family and the steps ahead towards the sustainability of SLICES-RI

The digital infrastructures research community continues to face numerous new challenges towards the design of the Next Generation Internet. This is an extremely complex ecosystem encompassing communication, networking, data-management and data-intelligence issues, supported by established and emerging technologies such as IoT, 5/6G, cloud-to-edge computing. Coupled with the enormous amount of data generated and exchanged over the network, this calls for incremental as well as radically new design paradigms. Experimentally-driven research is becoming worldwide a de facto standard, which has to be supported by large-scale research infrastructures to make results trusted, repeatable and accessible to the research communities.

SLICES-Research Infrastructure (RI), included in the **ESFRI 2021 roadmap[1]**, aims to answer the above needs by building a large infrastructure for experimental research on various aspects of distributed computing and networking technologies, including IoT and 5/6G, where all resources (compute, storage, network) are brought together so as to continuously design, operate and automate the full life cycle management of digital infrastructures, data, applications and services.

Figure 1: The SLICES Family

Experimentally driven research in digital infrastructures has been developed in order to equip the relevant communities with instruments that can assist them with testing various design assumptions and deployment scenarios for the-future of the Internet. It is worth remembering that the Internet started out as an experimental infrastructure. Testbed as a Service (TaaS) was developed for several years in order to propose instruments to explore various Internet design paradigms. OneLab/FIT[2], Grid'5000[3], GENI[4] and Fed4Fire+[5], are examples of such solutions that have been hosting hundreds of thousands of experiments from thousands of users. However, the limitations and bottlenecks of the current Internet have called for a new design supported by recent worldwide initiatives, of which SLICES-RI will be the first of its kind in Europe. From a European perspective, **it is definitely needed to research new digital services and technologies**. SLICES-RI can clearly help with this goal as it differs significantly from target focused facilities, giving opportunities to researchers who are interested in the complex Internet systems, for which the lack of an RI with sufficient size and diversity is obvious. The intent is also to ensure return on investment at European and national levels and sustain the work already started in previous national and European initiatives, but at the same time entering a new dimension. From the perspective of current DG-Connect investments, it is well understood that infrastructures such as GEANT, PRACE and EGI are not appropriate for infrastructure-level

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[1] ESFRI Roadmap 2021: Strategy report on research infrastructures, https://roadmap2021.esfri.eu/media/1295/esfri-roadmap-2021.pdf, [Last accessed 31 August 2022]

[2] Onelab and FIT websites, https://onelab.eu/ and https://fit-equipex.fr/, [Last accessed 31 August 2022]

[3] Grid'5000 website, https://www.grid5000.fr/, [Last accessed 31 August 2022]

[4] GENI website, https://www.geni.net/, [Last accessed 31 August 2022]

[5] Fed4FIRE+ website, https://www.fed4fire.eu/, [Last accessed 31 August 2022]

experimentation. Similar approaches such as NSF/PAWR[6] and NSF/Fabric[7] in the US and CENI[8] in China exist, but SLICES-RI will provide a complete platform, much more than a federation of tools or testbeds dedicated for verticals (such as in PAWR). SLICES-RI will provide not only the means to experiment on the network (such as in FABRIC) but will also provide interconnected cloud, edge and HPC services in a completely open fashion. It will complement GEANT[9] and we are also planning to use GEANT services to provide reliable connectivity between local testbeds deployed in the Member States. SLICES-RI's ambition is to provide a sophisticated service infrastructure characterised by its size, diversity and articulation with the various players and become a strong asset for **deploying, testing, prototyping new Internet services and hardware, serving European sovereignty, innovation and industrial competitiveness in digital and data driven technologies**. SLICES-RI will enable large-scale end-to-end experimentation with software and applications at all levels of the Internet software and components layers for an open and reproducible research environment providing easy access to a large set of heterogeneous resources such as advanced computation, storage and network components (IoT devices, edge servers, distributed computing, cloud computing, reprogrammable networks, etc.) interconnected by dedicated high-speed links. The H2020-InfraDEV **SLICES-Design Study (DS)** studied the design of SLICES-RI, in order to strengthen the research excellence and innovation capacity of European researchers and scientists in the design and operation of digital infrastructures. The H2020 **SLICES-Starting Community (SC)** aims to foster the community of researchers around this ecosystem, as well as create and strengthen necessary links with relevant industrial stakeholders for the exploitation of the infrastructure.

The design phase of SLICES-RI delivered its results to meet the list of Minimal Key Requirements to enter the next phase. SLICES-RI now enters in its **Preparation phase** through the Horizon Europe SLICES-PP that starts its implementation on 1st of September 2022 based on the results of SLICES-DS. SLICES-PP tackles all key questions concerning legal, financial and remaining technical issues of the set-up, management and operability of the new research infrastructure. It will lay the basis to guarantee the commitment of all partners and the involved Member States in the implementation and operation phases of the platform in its funding.

More details on the SLICES family can be found at: here.

As clearly presented in SLICES-DS Deliverable D3.5 - Roadmap for the implementation of the governance and sustainability, the timeline for the SLICES activities and its different steps is depicted in Figure 2 below and shows clearly that SLICES's timeline will last for the next 20 years, which will facilitate its sustainability and the deployment of its services to the research community.

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[6] PAWR website, https://advancedwireless.org/, [Last accessed 31 August 2022]
[7] FABRIC website, https://fabric-testbed.net/news/fabric-award, [Last accessed 31 August 2022]
[8] Chinese Experimental Network Initiative
[9] GEANT network website, https://network.geant.org, [Last accessed 31 August 2022]
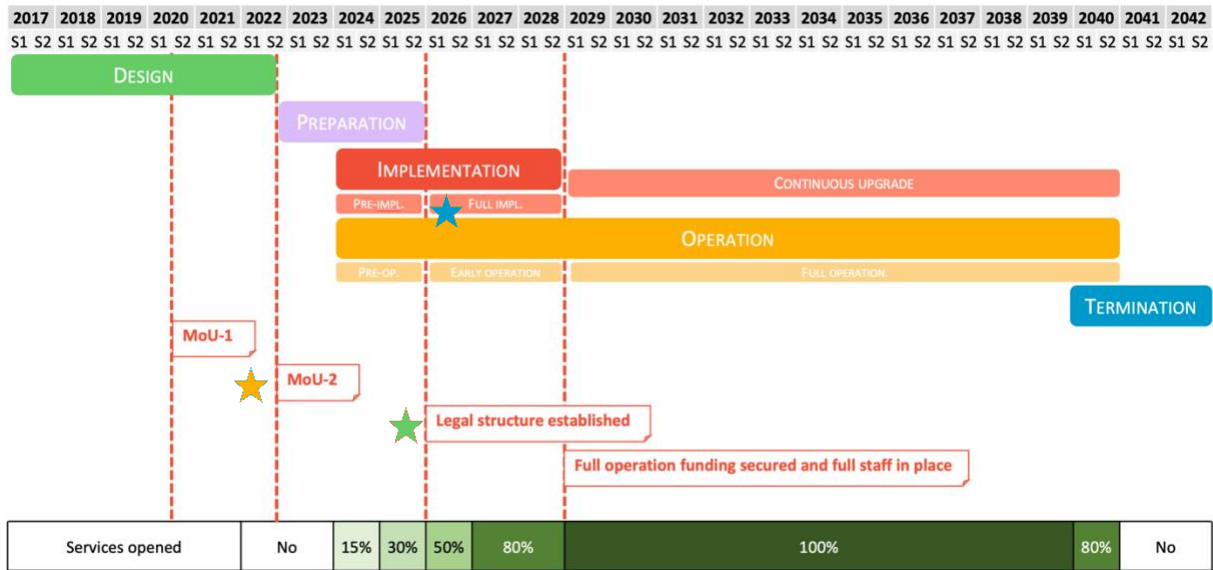
Figure 2: SLICES timeline including the governance steps

The main steps related to SLICES timeline and its sustainability, listed in a retro planning approach, are the following:

→ The **full implementation** is planned to **start beginning of 2026;** ⭐
→ So, the **SLICES legal structure** has to be established by the **end of 2025**, so at the end of SLICES-PP⭐
→ In the meantime, we need to base our decision making on a clear and defined structure and process,
→ so, we are in the signing phase of the **MoU2 to clarify the governance and decision process** of SLICES during the **intermediary phase** from nowadays, until the legal structure is installed. ⭐

3. SLICES Scale of significance

In deliverable D3.5 the first SLICES governance guidelines and sustainability roadmap are described in details and will be set in SLICES-PP. SLICES' plans for expansion are detailed and will be supported from the different phases of the initiative.

In the following table, the scale of significance of the SLICES-PP project for the Preparatory Phase expected outcomes and impacts are depicted and analysed.

#1: 20 EU Member States (MS)/Associated Countries (AC) represented in SLICES-RI governance
Scale: SLICES aims to include 5 more EU MS / AC in SLICES-RI governance in addition to the current 15 partners countries represented.
Significance: Enlarging the partnership and the support to SLICES-RI will benefit to a larger scientific community and widen the impact on economy and society. Moreover, a broader European territory will be involved.

#2: SLICES-RI national nodes included on 10 national roadmaps
Scale: Among the 15 current partners countries of SLICES-PP, 5 are already included on their national roadmaps. By the end of SLICES-PP, we aim to add 5 more.
Significance: Having SLICES-RI included on national roadmaps demonstrates the commitment and support of member states and ensures funding and sustainability of the infrastructure.

#3: 10 standards - Having the experts group supporting the technical Working Group on HPC, Distributed Computing, Data Storage, Telecommunication and Networking, will impact on average 10 documents. To maximise the impact on Europe needs, a focus on harmonised standards needs will be made.
Scale: 20% of new standards analysed. An effect of this type immediately contributes to bringing the European standardisation community at a remarkable level of impact on international standardisation.
Significance: Standardisation bodies will benefit from outcomes of the enabling technologies validation, by the identification of gaps in current technologies, or by innovative uses of the existing technologies specifically in terms of communication layer protocols and hardware properties.

#4: 50 training modules across Europe - to introduce the use of RI in the educational process, which is highly innovative.
Scale: 90% of the identified user community will be scientific community, students and software engineers for which a specific training is required.
Significance: Traditional courses in HPC, distributed computing, telecommunications and networking are based in theoretical analysis and simulations. Access to real equipment is rather limited and, more often than not, this equipment is outdated. The recently established availability of remote experimentation with state-of-the-art equipment offers new educational opportunities at no extra cost. It is known that there is a lack of skilled software engineers in Europe. The design, development of organisation of the SLICES Academy has be decided and is on-going.

#5: 10,000 researchers aware of SLICES-RI
Scale: SLICES-RI recognised as the future European standard in the scientific community in Digital Science
Significance: A better represented community will attract all the relevant local, regional and national interest leveraging an added-value recognised for research and science (as for academics).

#6: SLICES-RI recognised as a global player in Digital Infrastructure
Scale: 5 established liaisons with major similar international initiatives such as PAWR, FABRIC, BRIDGES (US), CENI (China), FIBRE (Brazil).

Significance: By liaising with such international initiatives, SLICES-RI will be recognised as the major European Research Infrastructure in Digital Science. This will promote collaboration on developments and joint experiments.

#7: Up to 2 joint actions with other ESFRI RIs or LANDMARKS such as PRACE or SKAO

Scale: At least 1 joint initiative organised with key peer initiatives at the international level

Significance: Joint initiative will aim to mutualise resources, serve a common scientific community, catalyse new research opportunities and initiate new collaboration between scientific communities. To ensure interoperability with other EU-based and international RIs, SLICES-RI will be designed according to policies, recommendations and best practices published by EC and EOSC community, including Open Science, Open Data and FAIR principles and recommendations. The planned integration with EOSC will maximise the impact and outreach of SLICES-RI by allowing any digital object produced or maintained within SLICES-RI, such as data, publications, services, software and tools, to be shared with the rest of the community, creating an environment open to sharing of knowledge and fostering collaboration and long-term reusability.

4. SLICES sustainability

A first step for the sustainability of SLICES-DS is the inclusion of SLICES in the ESFRI Roadmap 2021 as mentioned above, and the SLICES-DS has defined the coming steps and paths to sustainability (including in deliverable D3.5).

As a consequence, SLICES-PP started and it analyses the various dimensions across which SLICES-RI can contribute to make an impact, and maximise its relevance. It should be noted that the results of WP1, WP2, WP3 are setting the scene and the basis for the implementation of SLICES-PP activities. SLICES-DS deliverables related with governance, legal status, roadmap, architecture is the basis for the SLICES sustainability and will be further extended through the implementation of SLICES-PP.

Activities already defined in SLICES-DS and will continue in SLICES-PP in order to enhance and facilitate SLICES sustainability are depicted below:

- The SLICES National nodes contribute to it by highlighting the features of the local smart specialisation strategies in their territories. Some of the SLICES National nodes already started their organisation by setting up the legal framework and gathering the national relevant partners (i.e. France, etc).
- SLICES-PP will specify the scientific, social, environmental and economic KPIs to assess the impact of SLICES-RI;
- A continuous dialogue with Member States representatives and other relevant stakeholders will be organised. Based on the results of SLICES-DS and specifically the deliverables related to the Governance of the RI, SLICES-PP will set up the *entire legal framework* and the *governance structure* underpinning the implementation and operation of SLICES-RI, allowing to contribute to a *solid ground for the decision-making for MS and funding bodies*. The establishment of the legal SLICES-RI legal entity is ongoing as well as the definition of transparent, fair and sustainable rules and procedures for the selection of the Central Hub, as well as new National Nodes.
- Within SLICES-PP a *business model* and *financial framework* will be set up for the implementation and operation of SLICES-RI, with the purpose to maximise the synergies between different funding opportunities at the regional/national/European levels.
- Creation of a Funder Forum for the engagement of external (industrial & public) funders;
- Definition of rigorous, accountable and stringent rules and procedures for in-kind contributions;
- Definition of both short-term and long-term business models and finalisation of the cost book;
- Establishing SLICES-RI as a prominent initiative also within the national research programmes on Digital Infrastructure, exploiting dedicated funds for the development of national nodes of RIs, as well as a tool to support experimentally-driven research on the next-generation Internet.

5. Standardisation

The standardisation plays an important role as it permits to facilitate the definition of common interfaces to integrate testbeds into the future SLICES Research Infrastructure and make them cooperate. Furthermore, the standardisation eases the technology transfers between the countries involved in SLICES in general and guarantees a kind of sustainability. SLICES-DS has identified some global standardisation bodies where the efforts of the SLICES community should be put. The EU Rolling Plan for ICT Standardisation was also used as input to select the appropriate SDOs related to e-Infrastructures for research data and computing-intensive science. The main SDOs are namely 5G-PPP, ETSI, IEEE, ITU and NIST. On the other hand, some assets linked to SLICES-DS were identified and are eligible to be potentially standardised:

- Architecture of the distributed research infrastructure;
- Interconnection of nodes, respectively of networks;
- Interoperability and integration;
- Monitoring and management of testbeds or infrastructures;
- Setup and monitoring of experiments.

Several partners have already initiated collaborations with different working/study groups in the SDOs. For instance, ITU-T SG11 "Signalling requirements, protocols, test specifications and combating counterfeit products" is a perfect match concerning the standardisation on testbed federations, dedicated Open APIs and interoperability between testbeds. ETSI ISG IPE was also contacted in relation with the IPv6 connectivity between testbeds and nodes.

ITU-T has also put in place a Focus Group on Testbeds Federations for IMT-2020 and beyond (FG-TBFxG). As usual, the Focus Group is open to all and different SDOs are involved such as ITU-T, ETSI TC INT, IEEE and NIST. FG-TBFxG is developing in fact the different topics addressed by the ITU-T Recommendation Q.4068 "Open APIs for interoperable testbed federations". This Recommendation defines a generic reference model on how to integrate or federate testbeds in a large research infrastructure. The Recommendation specifies also the different APIs used to interconnect the testbeds and make them interoperable. The objectives of this Focus Group are to collect and define use cases, requirements and other contributions concerning the topic of testbeds federations. Furthermore, the ITU-T Focus Group is studying the concept of Testbed as a Service (TaaS) which should provide new services related to the experiments. In fact, the same technical subjects are discussed in the ITU-T Focus Group and the SLICES partners. SLICES-DS has already contributed to this Focus Group, notably through the deliverable D2.2 "SLICES as Service, baseline" which provides useful inputs for the services to be accessible through the Testbed as a Service concept.

SLICES-DS actively participates and contributes to such industry best practices associations as Research Data Alliance (RDA) that represents the community of practices in the Research Data Management (RDM), and International Data Spaces Association (IDSA) that coordinates developments of the architectural, infrastructure and governance aspects of the industrial data handling. SLICES-DS contributes to several interest and working groups at RDA on data management, metadata, data spaces and organisational roles definition in RDM. At IDSA, SLICES-DS contributes to IDSA Reference Architecture definition, data sharing security aspects.

The work on standardisation in the context of the SLICES Research Infrastructure continues through the SLICES-SC and SLICES-PP projects. In particular, the deliverables D6.1 and D6.2 of SLICES-SC are reporting the complete strategy and progress of the standardisation undertaken by the SLICES community for the standardisation. In addition, a full WP of SLICES-PP is dedicated to standardisation.

6. SLICES Communication and dissemination

SLICES-DS web site will continue its operation for the next five years. The main tool for dissemination of the SLICES family project is the SLICES-RI web site (www.slices-ri.eu), which is the main entry point for all communication tools of SLICES initiatives. It was decided that the SLICES-RI web site will be the central website linked to the websites of the SLICES projects. At the moment: SLICES-DS, SLICES-SC and SLICES-PP that are similarly designed.
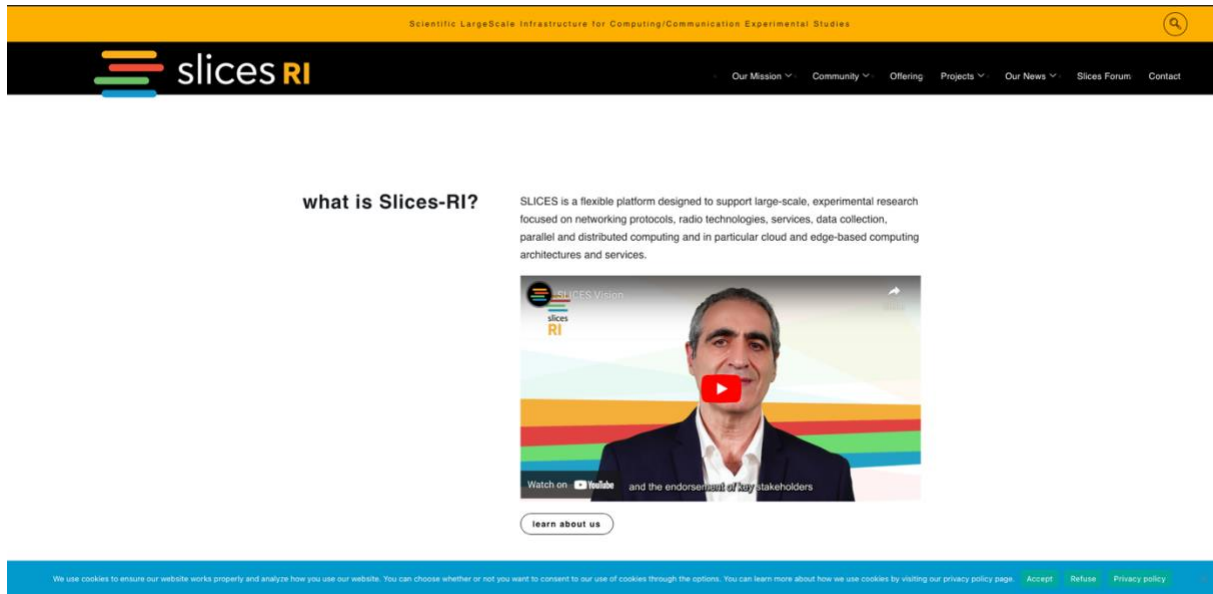

Figure 3: SLICES-RI website

Figure 4: Twitter account

Other communication tools such as social media will continue their operation.

Twitter: project related news and relevant articles from other sources in support Digital Research Infrastructures will be tweeted. The target groups are researchers, general public, scientific and academic personnel, businesses, NGOs technological developers, policy makers, funding authorities, etc.

https://twitter.com/SLICESRI

YouTube: promotional videos and "Success Stories" to be linked to website, Twitter. Frequency: as videos become available. The target groups are researchers, general public, scientific and academic

personnel, businesses, NGOs technological developers, policy makers, funding authorities, etc. The YouTube channel includes the recordings of the workshop, the videos related to SLICES.

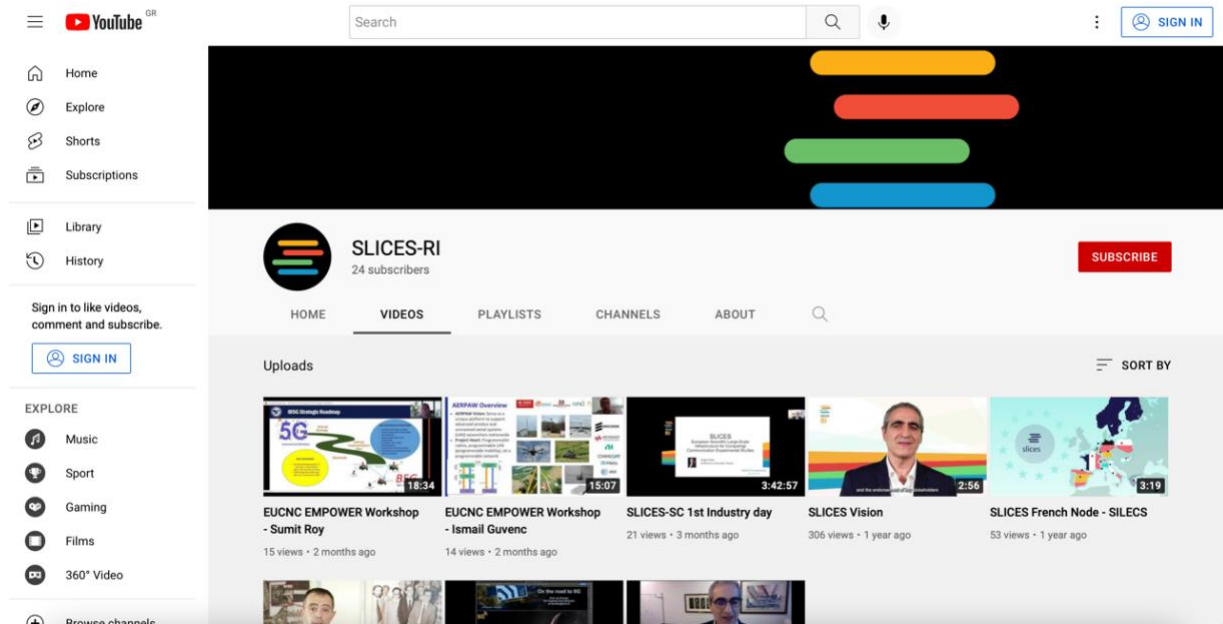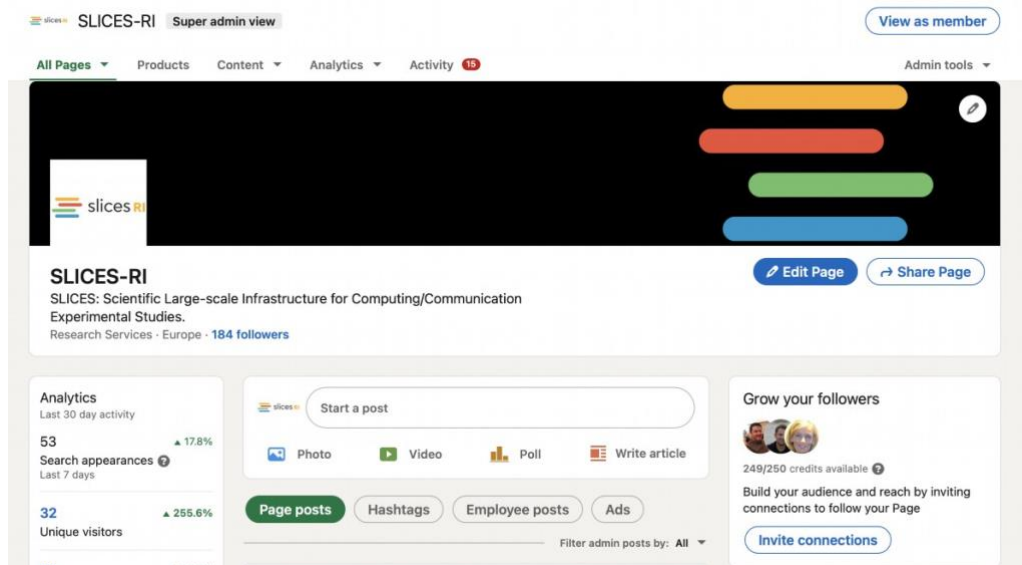https://www.youtube.com/channel/UCKM15y2D8rRYAnUDjpLsHug/featured?view_as=subscriber

Figure 5: YouTube account

LinkedIn: project related news and relevant articles from other sources in support Digital Research Infrastructures tweeted and disseminated. The target groups are researchers, general public, scientific and academic personnel, businesses, NGOs technological developers, policy makers, funding authorities, etc.

https://www.linkedin.com/company/slices-ri

Figure 6: LinkedIn account

7. SLICES exploitation

SLICES-DS has started several actions to pave the way for the future exploitation of the SLICES-RI, which are synthesized in the subsections below, in close relation with the SLICES-SC project, which has an objective to create and strengthen necessary links with relevant industrial stakeholders for the exploitation of the RI.

Regarding the Intellectual Property strategy, it is still too early to detail it, especially since the chosen approach is based on open source solutions.

7.1 Stakeholders engagement

We work both at the global level with Ministries, organisations, and EOSC, and at the level of the nodes with the national infrastructures with the SLICES Roadshow that have started to mobilise the community and stakeholders. These actions are pursued in SLICES-PP.

7.2 Impact assessment

The impact assessment and/or monitoring have been highlighted as an important element of the long-term sustainability of research infrastructures[10] by ESFRI, European Commission, Competitiveness Council as well as OECD. This includes for SLICES the design of the KPIs and the work on the economic model with the Cost book. We need to design it from the conception, for example, to the needs of industries for market-based access and in dialogue with society with topics such as the carbon footprint.

7.3 Governance and legal framework

This includes all the work that will allow the implementation and exploitation of SLICES, such as the legal framework with the MoU2 and Consortium Agreement of SLICES-PP, the set-up of the Central hub, and the design of the steps toward the SLICES legal entity.

7.4 Exploitation plan for SLICES outcomes

SLICES-DC team dealt with the long-term exploitation and continuation issues aiming to secure the sustainability of the project's service and dissemination scheme. In close coordination with SLICES's engagement and dissemination strategy and associated activities, SLICES followed an effective, concrete and dynamic exploitation strategy that regularly reviewed and expanded and of course this is only the beginning since the activity will continued within SLICES-PP. A list of exploitable assets as initially defined within SLICES -DS are listed in the following table.

The exploitation strategy of SLICES follows the following stages of expansion with specific short-term and long-term objectives:

- ***Short-term objectives***: within the timeframe of SLICES aiming to set up the framework for long-term sustainability via demonstration of the SLICES value via engagement with diverse communities and via industrial and real-life demonstrators, community building via engagement, plus determine exploitation plans, partnerships and business plans to take the project's results forward.

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[10] https://www.ceric-eric.eu/events/workshop-on-impact-assessment-evaluation-and-monitoring-of-research-infrastructures/

- *Long-term objectives*: SLICES-RI, establishing partnerships and business plans, release of open source code and maintenance of the community built within SLICES, including the potential commercialization of results and developments of semi commercial products and services where appropriate.

SLICES Services / Exploitable results	Scientific Exploitation	Commercial exploitation	Open Source Exploitation
SLICES Architecture for conducting experiments	Reference architecture for adding nodes to the core SLICES infrastructure		Open source and of general interest for the scientific community
Open Source Experiment Data and Metadata	Data of experiments made available directly relevant to the networking community	New products and ideas can emerge from post-experiment processing of the experiment data	of general interest for several communities
Educational Activities such as SLICES Academy	Educational courses can be conducted over the real-world facilities for observing network behaviour over real infrastructures	New courses can emerge with paid/privileged access	Open source and of general interest for the scientific and educational communities

7.5 Exploitation plan at partners/nodes level

Each node and each partner have started to design a plan for future exploitation, with the following elements per node:

Country	Exploitation plans
France	Develop the community; create the structure to engage the French node, articulation with the EU level, relation with the US, capacity building and education. As SLICES coordinator we are actively involved with the discussion with the main stakeholders both at the national and EU level. This is contributing to the attractiveness of Sorbonne University in the field and its recognition as an operator of large projects in Europe. In addition, we contribute to the discussion with the EU, in particular regarding its SNS program and potential implication of SLICES that serves Sorbonne University role in Europe. Finally, we also develop its international dimension by leading the dialogue with US and Asia.
Belgium	The partners currently involved in SLICES in Belgium identify two important routes towards exploitation of the results. The first is exploitation of the results in future projects with industry. The embedding of the facilities in 2 Flemish universities, allow a very efficient exploitation of knowledge by embedding this in the more advanced master courses in engineering and related high-quality PhD programs, as a second route towards exploitation. The current partners will also set up and work on dissemination activities and roadshows to trigger interest form the local community. They will also actively explore possible new partners in Belgium to become part of the SLICES network.

Cyprus	Develop the community, formalize the operational structure of the Cyprus node, inform political authorities and register SLICES on the Cypriot national roadmap for research infrastructures, engage with funding agencies to enhance the planned testbed deployments and explore SLICES enhancements, facilitate the capacity building and education of the community, liaison with the industry to further exchange knowledge and collaborate, communicate and disseminate SLICES to a national and international level.
Finland	The Finnish node of SLICES-RI is the experimental platform to the national 6G Flagship programme (started in 2018). The 6G Flagship ecosystem globally includes more than 300 companies, more than 600 academic partners and 150 governmental and association members. The ecosystem will be developed further towards several vertical areas where the most opportunity rich verticals are assumed to be energy, health, automotive and industry. The Finnish node will evolve towards 6G test network with three pronged approach wherein 1) 3GPP release based approach will provide e.g. coverage, medium data rate, latency & jitter, zero carbon footprint solutions, RedCap Devices, 2) O-RAN/Open Source approach providing e.g. low capex with moderate performance, high opex , studying security, energy consumption, jitter/latency perf., stability, and 3) disruptive 6G path providing e.g. 1 Tbps, joint communication and sensing, low latency and jitter, sub-cm positioning, reflective surfaces, and sub-THz transceivers. These capabilities will be used in research e.g. in recently awarded 12 HE SNS JU projects (including Hexa-X-II and 6G-XR) and furthermore in undergraduate and graduate education. Together with industrial partners and regulators, the environment will be also used to study methodologies for future spectrum regulations.
Germany	Develop the community, establish a common ground of experimental methodology focused reproducible experiments among related scientific groups, embed the methods and hands-on experience of experimental research in education. Introduce SLICES into the German research community and industrial partners
Greece	Develop the community, engage the MS authorities and funding agencies, facilitate the capacity building and education of the community, liaison with the industry to further exchange knowledge and collaborate, create a legal structure for the Greek node that easily will take actions at national and EU level, follow the evolution of the relevant technologies and integrate them in the Greek node and the SLICES architecture
Hungary	ELKH Cloud became very popular among academic researchers in Hungary. Recognizing its popularity ELKH (Eötvös Lóránd Research Network) signed a 3,5-year maintenance and operation contract with us. This contract covers beside the hardware /software maintenance and operational cost support for building the user community. Our goal is to further increase the number of projects running on ELKH Cloud and attract researchers not only from the ELKH research institutes but also from the various universities.
Italy	Develop the community, involve the research Ministry in the SLICES-RI establishment and funding process, build, connect and integrate the various sites of the national node, integrate common technologies across sites, prepare for interconnecting and inter-operate the national node's sites with those of the other countries involved in SLICES-RI
Luxemburg	Participate to the development of the SLICES community. Advertise SLICES to the major players in Luxembourg. Plan and design the setup of the SLICES-Lux node

	according to the Research and Strategic top priorities at national and European levels. Align with other SLICES partners while integrating new promising hardware based on the evolution of the recent technological advents according to the global site missions
Netherlands	Started activities to launch national program SLICES-NL that includes infrastructure, organisational and legal aspects as well as inclusion into the national roadmap on Large Scale Scientific Infrastructures for future funding. Coordination group comprising of the major Dutch research centers has being working since 2021 with several working groups defined; a special working group on digital technologies research priority for Netherlands has started its work with the goal to prepare the long-term plan for SLICES-NL development. Plan to design and setup the Dutch SLICES node jointly by UvA and SURF that will serve as a gateway to resources at SLICES-NL. Alignment with Computer Science is planned for better SLICES-RI exploitation
Norway	Started the dissemination of information about SLICES-RI to the Norwegian research community, and to influence the research Ministry to support participation in SLICES-RI. The existing eX3 infrastructure, which will constitute the Norwegian node, is in full operation and subject to further extensions within the existing national funding until the end of 2023
Poland	Polish contribution to SLICES is based on ongoing projects from National Roadmap of Research Infrastructures. The main goal for next period is to develop the community around the Polish node of SLICES. To enable smooth transition from the national to the European scale of operation, we need to design physical interfaces between Polish infrastructures and SLICES and implement all required APIs and software interfaces. We plan to continue the discussion with our Ministry to involve them in the process of establishment of the SLICES governing bodies.
Spain	Spain contribution to SLICES is articulated across the following main axes: i) building links, defining and participating in calls for funding with the national government main Ministries on Science and Research and on Economical Affairs and Digital Transition and the regional governments (Madrid and Basque Country); iii) promoting the involvement of the Industry currently very active in both Spanish nodes in SLICES; iv) presenting SLICES to the research community in Spain and promote the participation of new nodes in the infrastructure: v) promoting SLICES in the academia (researchers, faculty and students), via supervision of Master and Thesis in the scientific topics relevant on advanced networking and providing lab infrastructures within SLICES national nodes for lectures, students and researchers experiments.
Sweden	Started the dissemination of information about SLICES-RI to the Swedish research community, and to influence the research Ministry to support participation in SLICES-RI.
Switzerland	Several remote meetings were organised since the beginning of the SLICES-DS to communicate and disseminate about the SLICES Research Infrastructure at the national level. The building of the community around the Swiss node has started with the interested stakeholders and a first dedicated workshop has been scheduled the 6th October 2022. On the other hand, the process to register SLICES in the Swiss national roadmap for research infrastructures was achieved and the Swiss node is currently waiting for the final decision.

8. SLICES exploitation and sustainability through community building, awareness and other tools

SLICES-DS's outputs and results will be continued towards the long-term strategy of SLICES-RI. Activities that will facilitate the long-term sustainability and created during SLICES-DS are listed below.

8.6 Exploitation and sustainability path #1: Dissemination and communication activities

The continuation and enrichment of the dissemination activities and communication tools will be done through the SLICES family projects (SLICES-SC, SLICES-PP) and others to follow. All tools started within SLICES-DS including:

- the websites for SLICES-RI, SLICES-DS, SLICES-SC and SLICES-PP will continue to support the communication of actions and outcomes
- the organization of events within the different projects, including workshops, info-days, summer schools, hackathons, tutorials, roadshow to present SLICES at the national level, national events will continue under the umbrella of SLICES projects
- the social media including Twitter, Linkedin, Slack Channel, YouTube
- participation in different third-party events relevant to the community, where the outcomes will be disseminated
- publications based on the scientific results of the SLICES projects
- promotion materials such as posters, newsletters, etc

The lessons learnt from SLICES-DS dissemination and communication will be used for future actions within the SLICES projects.

8.2 Exploitation and sustainability path #2: Community building and awareness: TheNetworkingChannel

SLICES community building and awareness will also be expanded through the uptake of the support of the operation of theNetworkingChannel (https://networkingchannel.eu). This channel was originally set up by the EU Empower CSA dedicated to the collaboration between EU and US in future advanced wireless platforms, as an answer to the Covid crisis preventing physical meetings. This initiative has been proved a very successful channel that is sustained, with the support of all stakeholders, by having the SLICES community now in charge (as EMPOWER terminated in April 2022). Lessons learnt from its two years of operation, shows that TheNetworkingChannel is working as a fantastic venue for the collaboration between EU and USA. In the last years, characterized by the explosion of virtual events, TheNetworkingChannel has succeed on attracting the networking community thanks to its top-quality talks and speakers. The top watched event has exceeded 1,000 post-event views on the YouTube channel. TheNetworkingChannel continues its operation with new events the SLICES umbrella together with the NSF PAWR Office, and in cooperation with ACMSigcomm, facilitating the community building, sustaining the international community that counts more than 6000 people and disseminating SLICES' results.

Figure 7: TheNetworkingChannel

TheNetworkingChannel is organized as a regular event, taking place **every other Wednesday, at 8am PST (11am EST, 5pm CET, 1am JST)**, where a diversity of events is organized for the community, live and pre-recorded. Topics are broad and open ranging from research to experimentation and education. The channel consists of webinars, panels, tutorials, virtual site visits, keynotes, and any other innovative forms of community interaction. A dedicated YouTube channel used for the recordings of the events (https://www.youtube.com/channel/UCAtFAG5JdQrHac6ArIWJ-hw, see (Figure 8) is available where previous streams can be downloaded and viewed asynchronously. ***There are currently more than 446 subscribers in the YouTube Channel and the recordings of the events have been viewed hundred times. There 7356 replays of the recordings in total; 1000 replays of episode 11; 908 replays of episode 4; 796 replays of episode 1; 575 replays of episode 2.***
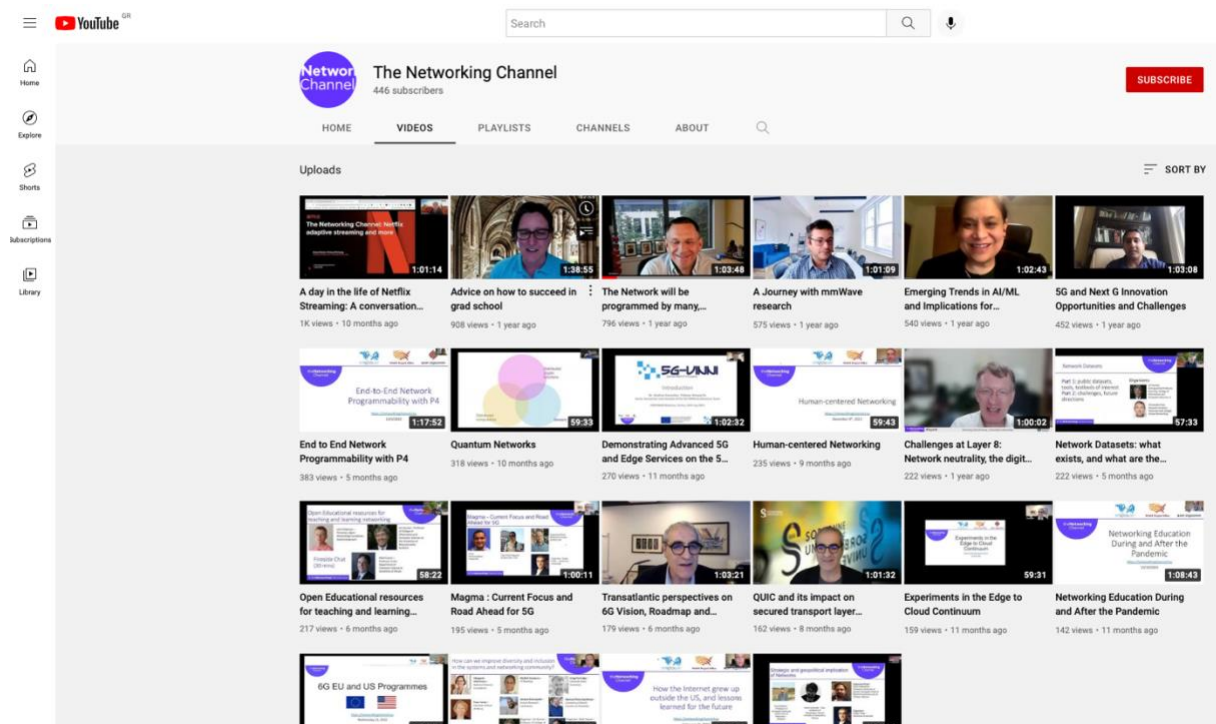

Figure 8: TheNetworkingChannel YouTube Channel
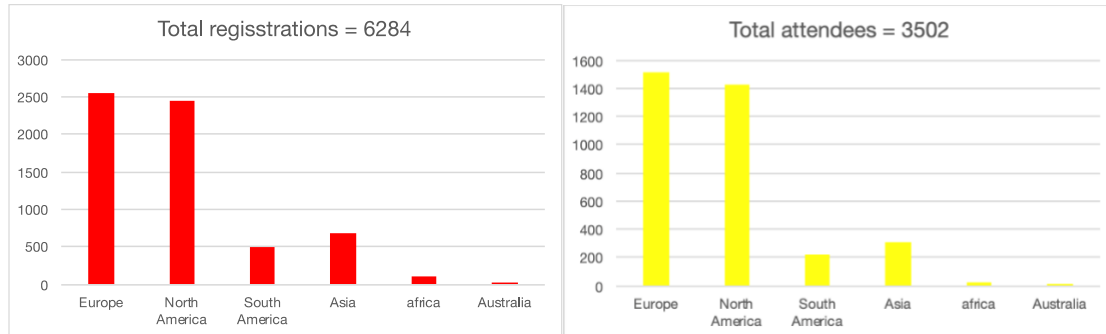
Important numbers are shown below in figure 9:

Figure 9: Statistics of registrations/attendees per regions

The uptake of theNetworkingChannel by SLICES will create a great impact to the community and will facilitate the sustainability and exploitation of SLICES activities and results.

8.3   Exploitation and sustainability path #3: SLICES Academy

The offering of SLICES through the remote access to infrastructure and data created over this infrastructure is in line with online education demands that has slowly transitioned to an online model, allowing access to a massive amount of online courses from virtually anywhere, as data and resources can be used for training future professionals remotely.

There are specific needs for SLICES Academy as: (1) Need for the development of a high-performing digital education ecosystem in advanced networking systems and technologies seeking organise new curricula aiming to enhance researchers' competences and skills; (2) Need to support the delivery of high-quality education; (3) Need for development of new skills and competences in advanced digital technologies; (4) Need for boosting innovation and digital competences in all education institutions; (5) Need for open education systems. The objectives of the SLICES Academy are to develop new educational material that can be organised in order to support the needs of the community. Educational material can be collected from different partners / sources, such as summer school, hackathons, etc. SLICES has the tools and the resources to support the development of the Academy, which is expected to support the sustainability of SLICES towards the development of new skills.

8.4   Exploitation and sustainability path #4: The support and the operation of the different Boards

The support and the operation of the different Boards created through SLICES-DS will be enhanced and continued in order to facilitate the exploitation and innovation, engagement of the different communities and support the international and industrial dimension of SLICES. Specifically:

- The **SLICES User Committee** aiming to interact with SLICES-RI's user community and to provide information about their needs. It is a key part of the future structure of the SLICES-RI and created under SLICES-DS in order to ensure that the users' needs are correctly set up at the core of the design phase and to ensure consistency during the future transition phase to implementation.

- The **SLICES International Scientific Advisory Board** aiming to provide independent and general guidance with regards to the scientific direction to be undertaken. It is a key part of the structure of the SLICES-RI.

- The **SLICES Innovation Management Board created under SLICES-DS,** is led by the Exploitation and Innovation Manager, aiming to understand the possible barriers to the exploitation, to monitor the innovation as well as to identify the potential markets and potential exploitable project results.

- The **SLICES Industrial Advisory Board (IAB) created under SLICES-SC** provides a forum to establish dialogue with business and industry in relation to the vision and mission of SLICES. The primary function of the IAB is to assist and advise the project in the following areas: i) industry trends and technology roadmaps, ii) industrial needs and requirements for digital research infrastructures, iii) strategic guidance to improve short- and long-term collaboration between science and industry, and iv) evaluation of services offered by the research infrastructure.

9. Conclusions

This document provides an overview of the sustainability of the the communication and exploitation strategy, developed under SLICES-DS, through the SLICES initiative and the continuation of community building and awareness raising through the different tools created during its implementation.

The SLICES-DS key outcome of the dissemination and communication activities are described in the following lines:

• SLICES-DS managed to build commitment through user workshops and the engagement activities of the target groups;

• SLICES-DS facilitates SLICES-RI to become part of Digital Research Infrastructures in Europe through the engagement of different communities and stakeholders;

• Share knowledge about SLICES-DS: through online and offline activities with different stakeholders including decision makers and academics;

SLICES-DS's outputs and results will be continued towards the long-term strategy of SLICES-RI. Activities that will facilitate long-term sustainability and created during SLICES-DS are listed below:

• The continuation and enrichment of the dissemination activities and communication tools through the SLICES family projects (SLICES-SC, SLICES-PP, and future projects to come)

• SLICES community building and awareness through the uptake of the support of the operation of theNetworkingChannel (https://networkingchannel.eu).

• Design, development and organisation of the SLICES Academy.

• The support and the operation of the different Boards created through SLICES-DS will be enhanced and continued.

• Continuous engagement of the national communities, and development of the national nodes within the framework of national research programmes on Digital Infrastructures and Research Infrastructures more generally.