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D8.2 Report of first period of Transnational Access

Acronym	SLICES-SC
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Scientific Large-scale Infrastructure for Computing Communication Experimental Studies **Starting Communities**

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1. Executive summary

The deliverable reports on the first reporting period Transnational Access (TA) and the initiatives undertook to achieve such activities. The deliverable reports on the organisation of the 1st Open Call for proposals, including the dissemination campaign, the evaluation of the proposals received, the initial results of the experiments and the assessment of the RI from the experimenters. The 1st Open Call for proposals was organised and provided Remote Transnational Access to SLICES Research Infrastructures nodes.

The deliverable reports on lessons learnt from the 1st Open Call and how these lessons depicted in the organisation of the 2nd Open Call for proposals, which started and will continue till the end of the project. In addition, another parallel open call for Researchers Mobility has been launched in January 2023.

2. Transnational Access definition

SLICES-SC is providing two different types of accesses for the provided Research Infrastructure (RI). These are broken down to either 1) Transnational Access (TA), for selected users conducting experiments over the infrastructure, who validate their novel solutions, algorithms and protocols with an experimentally driven approach, or 2) Virtual Access (VA) for providing experimental results, datasets, experiment definitions and open source code for replicating and reproducing experiments in other premises.

This document delves into the transnational access activities that have taken place during the first period of accesses. Overall, SLICES-SC develops tools regarding both access schemes, in order to provide high-quality services to the end users who access the infrastructure. SLICES-SC complies with the EU guides for accessing RIs[1].

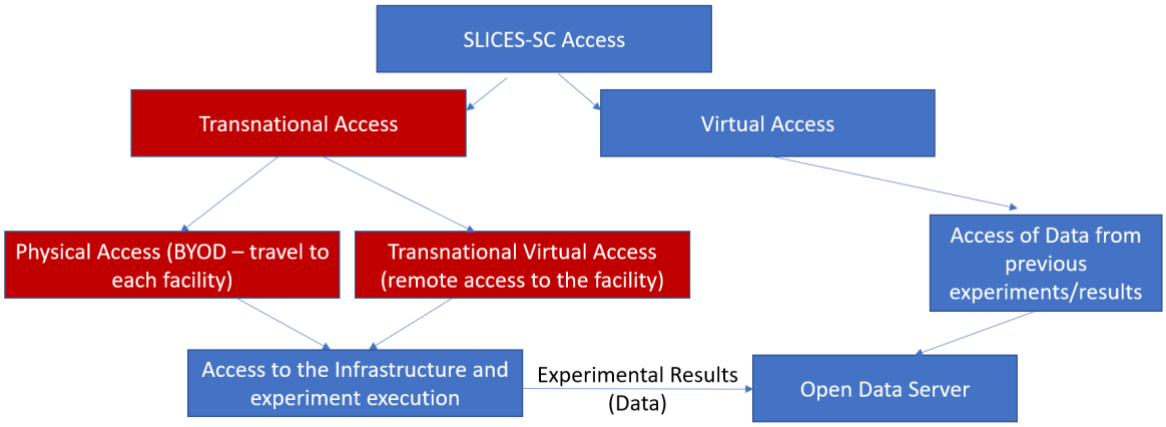


Figure 1: Definition of accesses in SLICES-SC

2.1. Transnational Access in SLICES

The transnational access in SLICES-SC is broken down to:

(1) **physical transnational access**, where the experimenters visit the facilities, and might install their own IP protected equipment, so as to conduct their experiments.

(2) **remote transnational access**, where the experimenters use resources that are already installed at the different testbeds, and conduct their experiments remotely. The case of remote transnational access is further elaborated in the next subsection.

SLICES-SC has developed through the contributions in WP2 the necessary tools for enabling transnational access to the infrastructure. ***The tools are web-based (e.g., the SLICES-SC portal – https://portal.slices-sc.eu), ensuring that remote access of the facilities can take place over the Internet, and all the required tools for making remotely available the infrastructure***. On the other hand, the protocols for on-site visits and enabling the addition of new equipment to the infrastructure have been specified, as part of the different mobilities that are supported by SLICES. Examples on the

[1] European Commission, Directorate-General for Research and Innovation, *European charter of access for research infrastructures : principles and guidelines for access and related services*, Publications Office, 2016, https://data.europa.eu/doi/10.2777/524573 [Last accessed 28 January 2023]

process of researcher mobility, eligibility and scope are further presented in section 4. During the first period of transnational access, only remote transnational access experiments were approved for being executed over the involved RIs.

2.2. Remote Transnational Access

The remote transnational access in SLICES-SC has been the main form of access during the first period of Open Calls. During such accesses, experimenters use the provided tools from the testbeds and get access to the resources and accompanying tools that each testbed provides. The experimenters can access the SLICES-SC portal, and use it to select nodes for their experiment (filtering them based on their type/capabilities), load specific distributions of operating systems to them, and access testbed specific services (e.g. services for changing the wireless channel configuration for wireless network/5G experiments) for conducting their experiments.

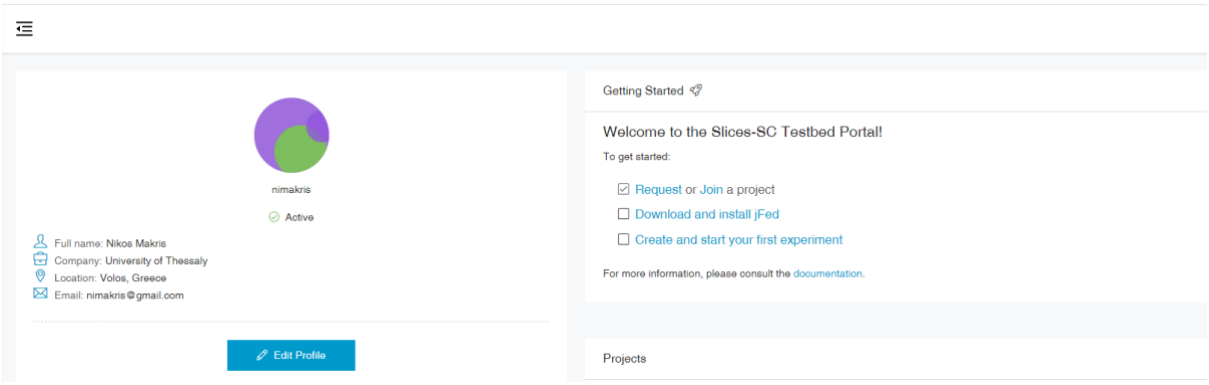


Figure 2: SLICES-SC portal

Several of the facilities within SLICES-SC have been integrated within the SLICES-SC portal for the first period of accesses. The remaining facilities use their own tools for providing remote access, mainly by giving remote terminal access to the experimenters for bare metal access. All the partners in the project have been participating in several other projects with their infrastructure, as a mean for verifying contributions under real-world settings, and have therefore developed their own tools for providing access to their dedicated resources. The set of resources provided by each testbed in the first period of transnational access in the project are detailed in the next section.

3. 1st Open Call for Transnational Access

3.1. SLICES RIs providing TA for projects of the 1st Open Call

3.1.1. UTH

UTH provides in its premises an integrated infrastructure, named the NITOS Facility, which is a union of heterogeneous testbeds focusing on experimentation-based research in the area of wired and wireless networks. The testbed is integrated in the SLICES-SC portal, and can be controlled and accessed remotely through the project's tools. NITOS is remotely accessible and open to the research community 24/7 through the NITOS portal, allowing users from around the globe to take advantage of highly programmable equipment. The testbed is based on open-source software that allows the design and implementation of new algorithms, enabling new functionalities on the existing hardware. Parallel experimentation (slicing) of different users is enabled, through the utilization of the NITOS scheduler software.

Figure 3: NITOS testbed deployment

A brief description of resources made available to experimenters during the first period of transnational access are:

- A **wireless experimentation testbed**, which consists of 100 powerful nodes (some of them mobile) in indoor and outdoor deployments that feature multiple wireless interfaces and allow for experimentation with heterogeneous (Wi-Fi, WiMAX, LTE, Bluetooth) wireless technologies.
- A **wireless sensor network**, consisting of a controllable testbed deployed in an indoor environment, a city-scale sensor network in Volos city and a city-scale mobile sensing infrastructure that relies on bicycles of volunteer users. Most of the sensor platforms are custom-made, developed by UTH, and some others commercial, all supporting open-source and easy to use firmware and exploit several wireless technologies for communication (ZigBee, Wi-Fi, BLE, LoRa and 6LoWPAN).

- A **Software Defined Radio** (SDR) testbed that consists of Universal Software Radio Peripheral (USRP) devices attached to the NITOS wireless nodes. USRPs allow the researcher to program a number of physical layer features (e.g. modulation), thereby enabling dedicated PHY layer or cross-layer research.
- A **mmWave** testbed, consisting of six different nodes supporting multi-Gbps over the air speeds, and beam-steering with 15 degrees step.
- A drone base testbed, consisting of five high-performing drones that are able to carry NITOS nodes and setup wireless mesh setups with different technologies (WiFi, mmWave).
- A **Software Defined Networking** (SDN) testbed that consists of multiple OpenFlow technology enabled switches, connected to the NITOS nodes, thus enabling experimentation with switching and routing networking protocols. Experimentation using the OpenFlow technology can be combined with the wireless networking one, hence enabling the construction of more heterogeneous experimental scenarios.
- A **Cloud infrastructure**, which consists of 7 HP blade servers and 2 rack-mounted ones providing 272 CPU cores, 800 GB of Ram and 22TB of storage capacity, in total. The network connectivity is established via the usage of an HP 5400 series modular OpenFlow switch, which provides 10Gb Ethernet connectivity amongst the cluster's modules and 1Gb amongst the cluster and GEANT.

NITOS has constantly been upgraded with state-of-the-art equipment. During the second phase of transnational access, more resources are foreseen to be made available, including P4 programmable SmartNICs, off-the-shelf 5G-NR UEs, and 802.11ax devices.

3.1.2. COSMOTE

COSMOTE's RI is not yet connected to the SLICES-SC Testbed Portal, but COSMOTE is in close collaboration with UTH (WP2 leader) towards that direction. This RI is used in several European funded projects and its use is free of charge in the context of these projects under certain limitations.

During the first period of the project COSMOTE's activities on transnational access were mainly focused on researching and analyzing relevant documentation and requirements on how this access can be achieved, including SLICES-SC deliverables D2.1 (Requirements Analysis for exposing the RI) and D3.1 (SLICES-SC Data Management Plan). Since D2.1 has been rejected, a new version of the document is anticipated. When it becomes available it will be further studied for any changes and additions.

The activities to connect the LeonR&Do lab with the SLICES-SC platform have been initiated with the collaboration of UTH. COSMOTE can offer two methods of connection for data retrieval:

COSMOTE can offer two methods of connection to its RI

- An Offline Mode for historical data and
- A Real-Time Mode IoT testbed playground

The Offline Mode can offer:

- Historical data (up to two years from residencies)
- Up to 3 different residencies
- Sensors (power meters, smart plugs, environmental)
- Data formats (CSV, JASON)

The Real-Time Mode IoT testbed playground can offer:

- A site with various sensors (energy, environmental, activity, etc.)
- Real-time data acquisition via MQTT

- WebGUI (cloud) for sensor measurement depiction, manipulation, actuation, automations, etc.
- Non-real time and historical data visualization from different sensors.

3.1.3. UOULU Node

The 5G Test Network (5GTN RI) is a national Finnish joint effort of University of Oulu, Technical Research Center of Finland (VTT). It is a complete physical 5G test system and worlds first open 5G test network. 5GTN usage is free of charge for all. It has been used in several EU funded research projects and 3rd parties (companies) in their own development projects already for years.

5GTN targets to serve multiple application, component, and device developers by providing extensive test facility services in a carrier-grade state-of-the-art network. 5GTN has radio coverage in several locations in Finland. 5GTN Oulu includes the University of Oulu campus, VTT and the technology village area together with several distant locations around Oulu, like, Oulu University Hospital Test Lab and Nokia factory in Rusko area in the City of Oulu.

The 5GTN is not yet connected to the SLICES-SC Testbed Portal but virtual access to the 5GTN is made possible via proprietary system. An adaptation layer has been implemented to offer access to 5GTN resources. We are working daily basis to get it connected to the SLICES-SC Testbed Portal.

The 5GTN Oulu coverage map https://5gtn.fi/technology/ can be seen in Figure **4** below. Visitor can see different coverage areas by selecting one or several technologies or bands of interest.

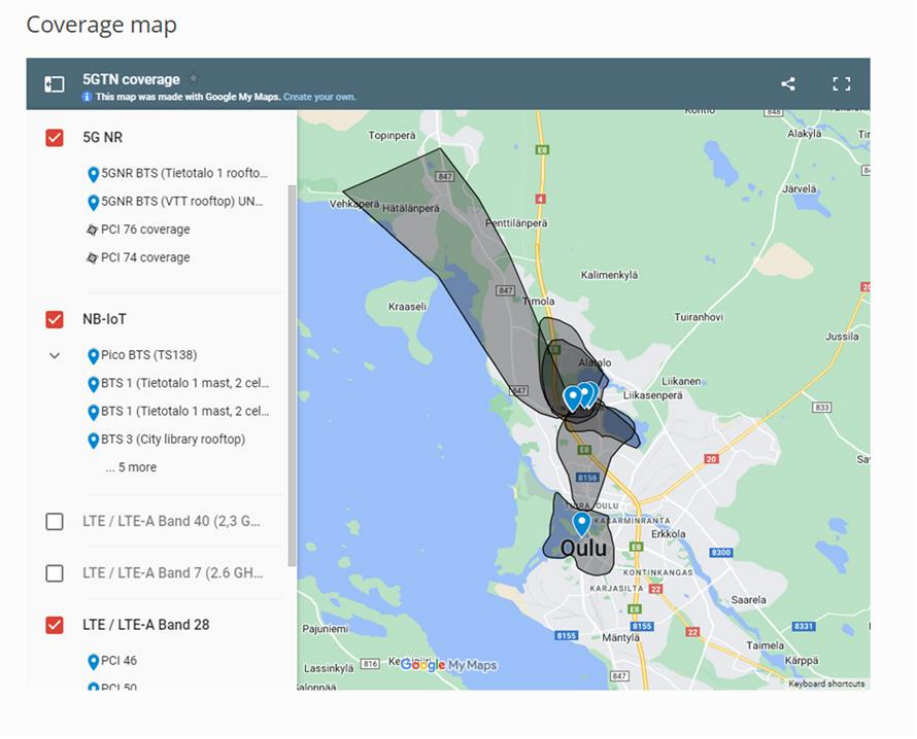


Figure 4: 5GTN coverage map

Architecture of the current infrastructure

5GTN is a real micro-operator with its own SIM-cards. It uses mainly non-standalone (NSA) architecture with both 4G and 5G coverage and its core network is implemented in a cloud environment. Currently also standalone (SA) 5G core and radios have been introduced, tested, and

taken into use in the 5GTN. On top of 4G and 5G radio coverage 5GTN has also Lora, WiFi, cellular IoT (LTE-M, NB-IoT) and Bluetooth coverage. The network architecture is defined in Figure **5** below.

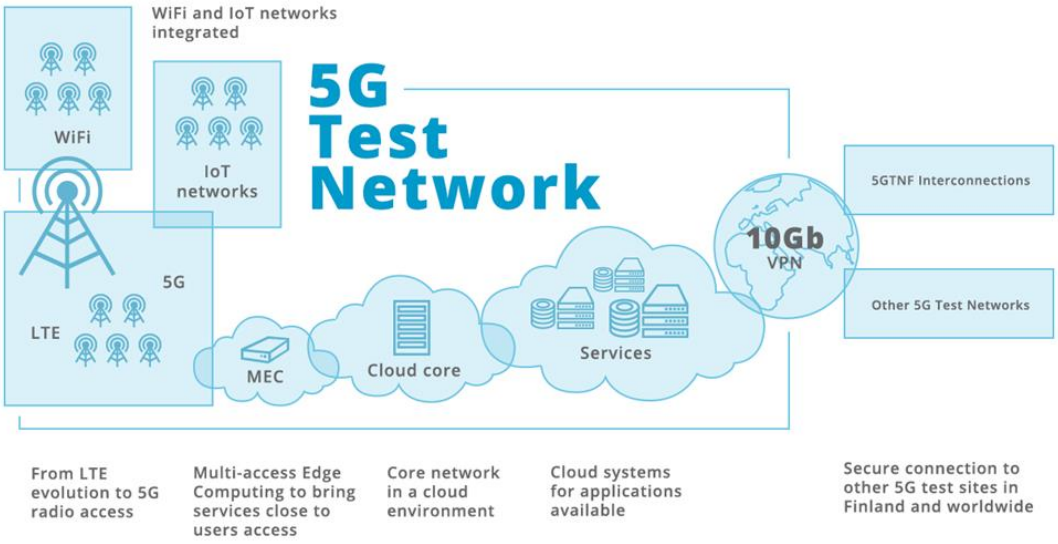


Figure 5: 5GTN architecture

Services currently offered by the UOULU 5GTN research infrastructure:

- **A Wireless 4G and 5G testbed**: 5GTN has both 4G and 5G wireless connectivity with its own SIM cards. 5G operates mainly in NSA mode but also SA can be offered as an alternative solution. 5G NSA is available through several Rel. 15 3.5 GHz outdoor macro–Base Stations. NSA indoor coverage is enhanced by several 5G Base Stations also as a C-RAN deployment. 5G SA is supported through Open 5GS. The near future extensions include mmWave (24-25 GHz, 800 MHz bandwidth) base stations on sharing based frequency band and Rel. 16 URLLC base stations and devices.
- **A Wireless Sensor Network**: University of Oulu campus area and botanical garden are covered by over 400 wireless LoRaWAN and NB-IoT sensor platforms (total 2400 sensors). Current setup with map of installed sensors can be viewed at Smart Campus web pages https://smartcampus.oulu.fi/manage/map. Data collected by the sensor network is freely available as open data. Grafana can be used to view customized dashboards created from the data. REST API to access the network is offered.
- **Edge servers and Mobile Edge Computing (MEC)**: 5GTN offers Edge servers as part of the platform offering. Customer applications can be installed to one or more of 5GTN Edge server virtual environment. Also, a MEC platform that enables low latency and brings the application services close to end user has been installed and is now being upgraded to newest version to enable state-of-the-art MEC functionality to 5GTN users.
- **5GTN External API**: An API has been defined so that 5GTN can be used from remote locations. API supports Network Slice Management and KPI Management Interfaces.
- **5G integrated devices**: The 5GTN team has integrated several small form factor devices to the 5GTN including cameras, lidars, hyperspectral cameras, AR/VR and medical devices.
- **Drones:** Several Drones at different sizes with small to large payloads and WiFi or 4G/5G connectivity are available.

- **Automobiles:** The university of Oulu has two Toyota Rav 4 vehicles which have been instrumented with various sensing devices and also 4G/5G connectivity to the 5G test network to enable testing automotive use cases.
- **Excavator:** An excavator has been integrated with the 5GTN network to offer capabilities of testing remote controlled heavy machinery in professional use cases
- **3D imaging facility:** Cylindrical camera array of 144 separate cameras is used to make full body scan of a person or an object in a single "shot". Images are turned into a 3D model, with full color texture using photogrammetry software located at 5GTN Edge server. Process can be remotely controlled.
- **Test tools**: Automated test capabilities have been developed and can be offered to 5GTN users. Even remote test capability with remote pre-programmed drone flying capabilities is being developed and is currently under testing.

Services are available via https://services.5gtn.fi/ or contacting directly to the representatives of 5G Test Network.

3.1.4.SZTAKI Node – ELKH Cloud

The primary goal of ELKH Cloud is to support the Hungarian scientific community by providing the essential e-infrastructure for their research. As opposed to the lengthy process of procuring and deploying the necessary IT tools, ELKH Cloud gives researchers the opportunity to quickly and easily create their desired research environment in as little as a few hours. In addition, the resulting e-infrastructure can be adjusted dynamically to the current needs of the ongoing project, and when the reserved resources are no longer needed, they become available for other researchers to use. This approach is more time and cost effective and all together results in a significantly more efficient e-infrastructure management for the scientific community and the entire ELKH network than what the traditional method of e-infrastructure procurement and operation offered.

ELKH Cloud is an e-infrastructure framework that allows users to create an e-infrastructure tailored to their specific needs in a cloud environment. ELKH Cloud is based on a project-oriented approach meaning that users don't typically utilize the cloud as individual researchers but as members of a project. The launching of a project can be initiated by the project manager by filling out a request form describing the purpose, duration, and resource requirements of the project. If the project is accepted, it receives the required resource capacity in the form of a quota. Within this quota, the project is then free to create an e-infrastructure that is best suited to its objectives (e.g., Spark cluster, Kubernetes cluster, deep learning supporting environment, etc.). The project manager may allow individual researchers to join at any time. Project members share the e-infrastructure that was created within the project. The different projects are completely isolated from each other and cannot access each other's data.

Creating the desired e-infrastructure in a cloud environment is usually a complex task requiring expertise, so ELKH Cloud provides reference architectures for the most commonly used, typical e infrastructures to help users build their desired infrastructures in a trusted and secure way in minimal time. Reference architectures are pre-made, carefully tested, ready-to-deploy infrastructures that can be used to automatically deploy the desired infrastructure after some customization and adjustment of properties.

ELKH Cloud offers direct assistance to users wanting to build non-typical e-infrastructures and then aims to create reference architectures for all e-infrastructures created this way while also providing a repository for them for easy access and storage. This allows all ELKH Cloud users to utilize these unique reference architectures as well.

ELKH Cloud was built on the infrastructure of MTA Cloud created in 2016 and underwent significant development starting from the third quarter of 2020. The table below shows the updated resource capacity post-development.

Type of resource	ELKH Cloud capacity
number of vCPU	5.904
memory (RAM, TB)	28
HDD (TB)	1,248
SSD (TB)	338
internal bandwidth (Gbit/s)	100
number of GPU cards	68
GPU memory (RAM, GB)	2.400
GPU double (TFLOPS)	584
GPU single (TFLOPS)	1.174
GPU FP 16 tensor (TFLOPS)	13.736

The 3 main types of cloud computing service models are infrastructure-as-a-service (IaaS), platform as a-service (PaaS), and software-as-a-service (SaaS). ELKH Cloud currently offers the IaaS level with the possibility for the additional levels to be added in the future. Most of the available reference architectures already provide cloud services at the platform level.

As an IaaS Cloud ELKH Cloud allows researchers to create different types and sizes of e-infrastructures that are dynamically adjustable according to the current needs of their ongoing projects. With the help of the reference architectures, these infrastructures may range from a simple desktop computer (e.g., MS Windows, Linux) to high performance computing clusters (e.g., SLURM cluster).

ELKH Cloud also provides a large storage capacity for the temporary storage of scientific data while the applications running on the associated e-infrastructure are processing said data. The secure storage of data is ensured by OpenStack cloud middleware.

In accordance with its operational concept, the services that help the use of ELKH Cloud are provided in the form of reference architectures. Projects can create their desired e-infrastructures after selecting the corresponding service below. For the actual list of available reference architectures and their technical descriptions please visit URL: https://science-cloud.hu/en/reference-architectures

Reference architectures are available in the following categories:

- General solutions for architectural, access control, orchestration, continuous integration and delivery.
- Clustering of various services based on industry standard solutions, such as Kubernetes,
- Docker-Swarm, CQueue as well as several tailor-made solutions like our own Occopus cloud orchestrator, gUSE grid user portal or Flowbster data workflow management.
- BigData oriented services, such as Jupiter, Apache Hadoop, Apache Spark, RStudio, DataAvenue.
- Applications for machine learning, like Tensorflow, Keras and Horovod

These reference architectures are made available for other SLICES RIs by uploading them in the SLICES-SC GitLab repository.

3.1.5 Imec Node

imec has made available multiple testbeds for Transnational Access (https://doc.ilabt.imec.be).

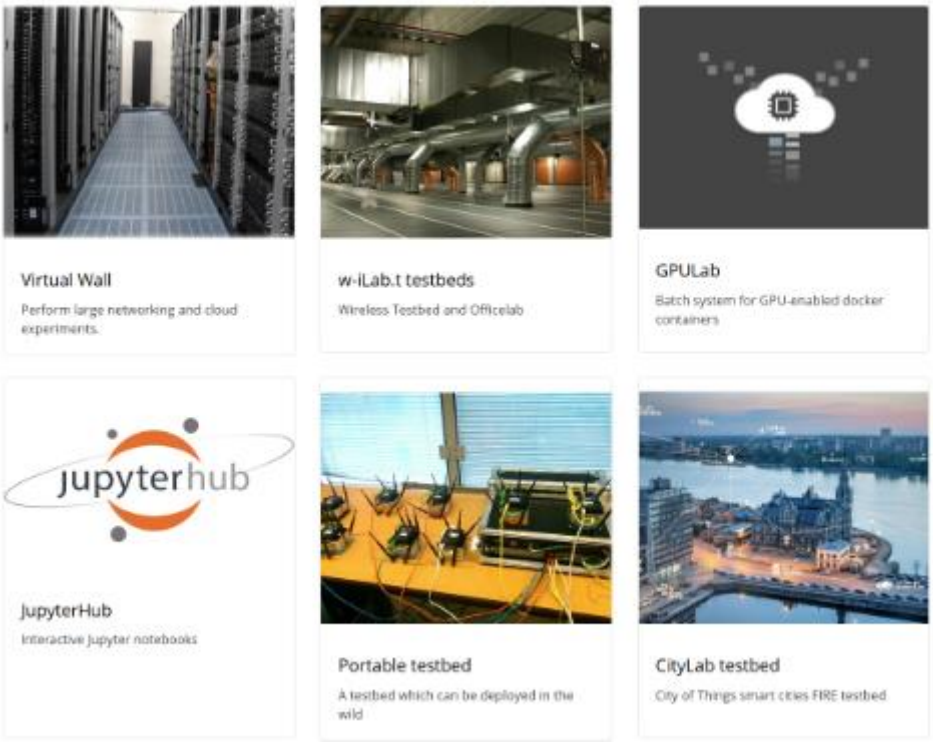


Figure 6: imec testbed portfolio available through Slices-SC

- Virtual wall (Gent): to perform wired networking, cloud, distributed software, service backends and scalability experiments. 550+ installed servers.
- w-iLab.t (Gent): pseudo shielded environment for wireless and IoT research with over 150 wireless nodes (fixed and mobile), including software defined radios
- Officelab (Gent): a real office environment for wireless and IoT research with over 110 embedded PCs spread over the building.
- GPULab (Gent and Antwerpen): testbed with 125+ GPUs with over 570.000+ cuda cores and 1.8TB+ GPU RAM for AI research and everything which needs GPUs. Available through interactive jupyter notebooks and scheduled jobs.
- CityLab (Antwerpen): testbed for wireless networking experimentation in the unlicensed spectrum in the city of Antwerp. 50 nodes are spread over an area of 1 square km.

All testbeds are available through the SLICES portal and tools. The testbeds are open to externals. All testbeds are perfectly accessible through remote access, which is also the main usage of the testbeds. At the moment of writing, we had about 15 external users coming in on our testbeds through SLICES.

4. Evaluation and results of the 1st Open Call

The first Open Call for transnational access was released on 27 April 2022 on SLICES-SC web site with extended submission deadline of 24 June 2022. By the deadline, we have received 4 applications two from Hungary and two from Italy.

The 1st open call advertised through the different SLICES's channels, including the web-site, the social media and direct mails to the SLICES community.

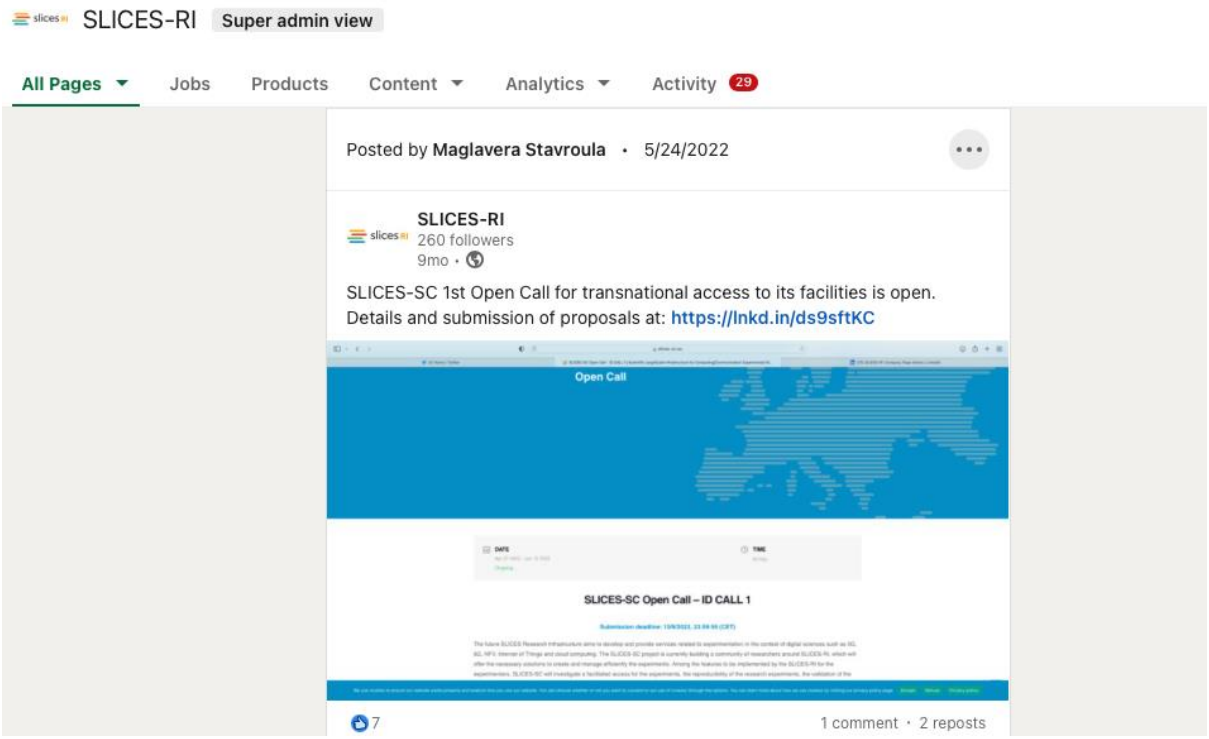


Figure 7: Dissemination of 1st Open Call through LinkedIn

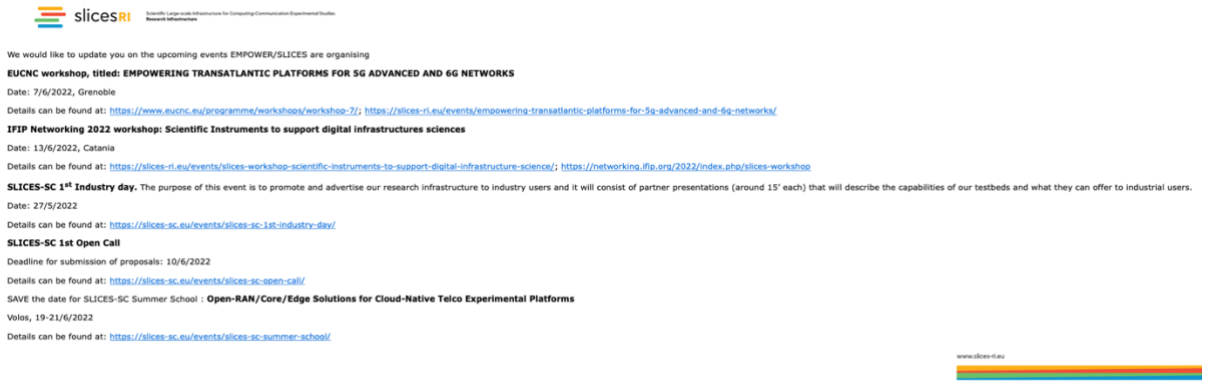


Figure 8: 1st Open Call dissemination through SLICES newsletter

The user selection procedure was a 3-phase process. In the first phase, SZTAKI as the leader of WP8 has checked the eligibility criteria of the applications based on the prepared Eligibility Form. Then those applications that successfully went through the first evaluation phase were forwarded to the technical representatives of those SLICES RIs that were requested to be used by the applications. In the 2nd phase, the technical representatives of the requested SLICES RIs made a technical evaluation

of the submitted applications and filled in the Technical Assessment Form concerning the requested capacity, the type of resources to be used and the technical feasibility of the application. Then, those applications that successfully went through the 2nd evaluation phase were forwarded to the User Committee. In the 3rd phase, the task of the User Committee was to evaluate the scientific merit of the applications by filling in the Scientific Evaluation Form. Here the applications were evaluated on a scale of 1-10 based on the following criteria:

1. Research and scientific innovation & motivation
2. Research and scientific relevance
3. Clarity and methodology
4. Socio-economic impact and sustainability of the results
5. Scale and complexity of experiment
6. Relevance for SLICES-SC
7. Possible future follow-up experiments
8. Technological expertise and quality

Each application was evaluated independently by 2 members of the User Committee. The final decision was made at an online User Committee meeting chaired by Peter Kacsuk (leader of WP8) on 20 July 2022. All the 4 submitted applications were accepted by the User committee and the applicants were notified on the evaluation result on 21 July 2022.

Members of the User Committee (Selection Panel) were:

- Attila Kertesz, Hungary
- Dana Petcu, Romania
- Domenico Talia, Italy
- Mariusz Glabowski, Poland
- Matthias Waehlisch, Germany
- Nicola Blefari Melazzi, Italy
- Olivier Audouin, France
- Vincent Breton, France

Both members of the User Committee and the technical representatives of the SLICES RIs received a document under the title “Instructions for evaluators of SLICES-SC Transnational Access Open Calls” that described the whole evaluation procedure including the three evaluation forms of the three phases (Eligibility Form, Technical Assessment Form, Scientific Evaluation Form).

4.1. Awarded Projects from the 1st Open Call

The following four projects were awarded from the 1st Open Call:

Number	Project title	Submitting organisation	Summary of objectives	Requested SLICES RIs
1	Vibration analysis at pipelines (VAP-EUR)	Euroil Kft. (Hungary)	The aim of the project is to determine the vibration of a gas pipeline system that results from the flow. The gas pipeline, what the open callers would like to examine is still in design phase, so they would like to use various types of finite element analyses to specify the flow and its behaviour in advance with ANSYS.	Imec IDLab.t infrastructure – only GPULab

			Calculation of these types of simulations is very complex and require a lot of computing, therefore high-performance computers are needed to solve the tasks.	
2	Massively Parallel EEG Processing on Multi-GPU Systems (EEGMGPU)	University of Pannonia (Hungary)	Within the framework of SLICES-SC, the applicants plan to implement and test several compute-intensive EEG medical signal processing algorithms on multi-GPU NVIDA systems programmed in CUDA. The defined work plan consists of three consecutive stages. In the first stage (1 month), they will test our single-GPU implementations on a single V100 GPU for potential optimisation opportunities and perform optimisations. The algorithms ported to the V100 will serve as a baseline for evaluating the multi-GPU versions. In the second stage (3 months), they will design and implement several multi-GPU implementation variants of the target algorithms using NCCL and NVSHMEM technologies. Different parallelisation strategies will be compared. This phase will end with extensive numerical validations. The final stage (two months) of the work will focus on performance optimisation. They will extensively profile the implementations first to select the best multi-GPU version and then study the selected implementation for further performance optimisation. The work will finish with a demonstration of the performance of the developed multi-GPU algorithms on real EEG datasets.	Imec IDLab.t infrastructure – only GPULab
3	Tropical Cyclones Detection through Deep Learning (TCDDL)	Euro-Mediterranean Center on Climate Change (CMCC) Foundation (Italy)	The research project aims at performing the detection of Tropical Cyclones using Convolutional Neural Networks.	ELKH Cloud (SZTAKI) Imec IDLab.t infrastructure – only GPULab
4	Deep Learning for Downscaling Approaches in Atmosphere (DL-DAA)	Euro-Mediterranean Center on Climate Change (CMCC) Foundation (Italy)	The project aims at using deep learning for statistical downscaling for atmosphere studies in the context of climate change evaluations. The ultimate target of the project is to be able to setup an operational framework which is able to exploit pre-trained ML models for downscaling climatic maps in different geographical areas with a reasonable accuracy and in a cost-effective way.	ELKH Cloud (SZTAKI) Imec IDLab.t infrastructure – only GPULab

All the four projects started using the requested RIs from September 2022 for a period of 6 months.

4.2. Early results of the experiments

So far only one project out of the 4 granted projects was successfully completed. This was the *project titled "Massively Parallel EEG Processing on Multi-GPU Systems (EEGMGPU)*". The main achievement of EEGMGPU was that they could create multi-GPU versions of their previous single-GPU EEG data processing algorithms and were able to use a state-of-the-art multi-GPU computer for this task. The new multi-GPU implementations are functional, final performance tuning and scalability tests from 1 to 16 GPUs are in progress. According to their statement this work would have not been possible for them without the GPULab infrastructure.

The leader of the project EEGMGPU has filled in the Experiment Feedback Report providing useful feedback both for the RI provider and for the Open Call organizers. The questions and answers in the filled in Experiment Feedback Report of the project EEGMGPU were as follows:

0	1	2	3	4	5	Weight	Sum
1. How easy was to use the SLICES-SC portal at https://portal.slices-sc.eu/? (0 – very difficult … 5 – very easy)							
					5	2	10
2. How easy was to get access to the requested resources?							
				4		2	8
3. How easy was to set up and start your application on the requested RI?							
			3			2	6
4. How informative was the description of the features of the requested RI?							
				4		1	4
5. How usable was the documentation of the requested resources?							
				4		1	4
6. How responsive was the staff of the requested RI?							
				4		2	8
7. How helpful was the staff of the requested RI?							
					5	1	5
8. How easy was the troubleshooting on the requested RI?							
				4		1	4
9. How successful was the experiment on the requested RI?							
					5	1	4
Total score							53

10. Where did you learn about the SLICES-SC transnational open call?

Open Call information was received from colleagues.

11. What were the major results, achievements using the requested RI?

The main achievement is that we could create multi-GPU versions of our single-GPU EEG data processing algorithms and were able to use a state-of-the-art multi-GPU computer for this task. The new multi-GPU implementations are functional, final performance tuning and scalability tests from 1 to 16 GPUs are in progress. This work would have not been possible for us without the GPULab infrastructure.

12. What were the major problems, difficulties using the requested RI?

Initial difficulty occurred with data storage area access but once we learnt the few extra steps required for this, we did not have problems with data transfer. The second problem was the lack of HPC SDK and the NVSHMEM library in the system. We tried to install this in our custom Docker container but the NVSHMEM test programs did not work. Following this, we used a lower-level communication layer (CUDA Peer2Peer access) with which we could achieve the same results). The NVSHMEM version can wait until we port our algorithms for GPU-accelerated supercomputers.

13. What is your recommendation to improve the usability of the requested RI?

A more transparent job scheduling policy description that explains how GPUs are shared and which job has preference over others and when could help users in estimating potential queuing times for jobs.

14. Do you plan to use the requested RI in the future? If not, what the reasons are?

Yes, definitely, if possible.

As it can be seen from the filled in feedback form this experiment was a success.

The *second experiment (Vibration analysis at pipelines (VAP-EUR))* was less successful. The experimenter was not able to complete the planned experiment although he achieved partial success. They also filled in the Experiment Feedback Report:

0	1	2	3	4	5	Weight	Sum
1. How easy was to use the SLICES-SC portal at https://portal.slices-sc.eu/? (0 – very difficult … 5 – very easy)							
					5	2	10
2. How easy was to get access to the requested resources?							
			3			2	6
3. How easy was to set up and start your application on the requested RI?							
		2				2	4
4. How informative was the description of the features of the requested RI?							
				4		1	4

5. How usable was the documentation of the requested resources?							
				4		1	4
6. How responsive was the staff of the requested RI?							
			3			2	6
7. How helpful was the staff of the requested RI?							
			3			1	3
8. How easy was the troubleshooting on the requested RI?							
				4		1	4
9. How successful was the experiment on the requested RI?							
		2				1	2
Total score							43

10. Where did you learn about the SLICES-SC transnational open call?

HUNspace send us an email. (Hungarian space agency)

11. What were the major results, achievements using the requested RI?

- Test blender rendering on GPUlab
- Knowledge of company expanded with usage of container image based HPC environment
- Realization of no existing docker image with ANSYS software environment

12. What were the major problems, difficulties using the requested RI?

- We have never used container image based HPC environment
- Realization of no existing docker image with ANSYS software environment

13. What is your recommendation to improve the usability of the requested RI?

- Stronger personal support

14. Do you plan to use the requested RI in the future? If not, what the reasons are?

Yes, we would like to continue. We would like to build docker image with ANSYS software environment and achieve our original goal. (We would like to build a very complex, bound-together model. For the CFD simulation we will use Ansys Fluent, for the Structural, Modal and Vibration simulations Mechanical Module will be used.)

From the feedback form it turns out that although they had some problems with using container image based HPC environment they would like to continue the experiment in order to achieve their original goal.

The other two experiments were not started yet. We are in contact with the applicants in order to support them starting and implementing the experiment.

4.3. Experiences gained during the 1st Open Call

Experiences can be summarized from the point of view of the open call organizers and from the point of view of experimenters.

As organizers we gained, first of all, better insight how to advertise the open call and the experiences used in order to improve the advertisement campaign of the 2nd Open Call. We understood that the dissemination campaign should be supported by targeted and direct communication and specific focus events to promote the open calls and their purpose. The dissemination campaign of the 2nd Open Call includes:

- An e-mail kit was prepared for all partners to send out. The kit includes:
    - A flyer that summarizes in bullet points why researchers should apply to the call. (It can be further shared online, posted on the partners' websites or social media pages, or even printed if needed)
    - A banner image containing the most important information about the call and a QR code that directs you to our website. (This can also be posted on the partners' websites and social media pages)
    - A template e-mail to use if partners do not wish to write their own message when sending out the promotional materials.

  The e-mail kit was shared with all partners. In Hungary, for example, we sent it out to 100+ contacts and posted the flyer and the banner on multiple websites.

- Several social media posts were prepared (LinkedIn, Twitter) and are being posted continuously. Some posts focus on the benefits of applying by listing them from different perspectives or highlighting a past successful project, while others talk about a specific node or event and connect it to the Open Call. Dedicated posts and an infographic were created to help researchers differentiate between the Call and the Mobility Programme. As we gear up for the first deadline, the posts are much more frequent and always emphasize the upcoming cut-off date.
- An e-mail banner was created that links to our website and highlights the next deadline, which can be included in all partners' signatures when sending out e-mails.
- Bilateral interviews are being conducted with partners with some questions focusing on what SLICES has to offer to researchers and academia. These interviews are posted on You Tube and will also be used in the promotion of the Open Call and the Mobility Programme.

By understanding the requirement of direct and targeted talk to research teams, we plan to organize national roadshows that give detailed explanation of the possibilities of accessing and using the SLICES infrastructures. The first such national roadshow activity organised in Hungary on the 26th of January 2023 with 31 participants. Agenda and details can be found at: https://slices-sc.eu/events/opportunities-for-the-domestic-use-of-cutting-edge-european-it-research-infrastructures-under-the-slices-esfri-programme/. The talks of this roadshow can be accessed publicly both in the SLICES CKAN repository (http://ckan.iotlab.eu/dataset/roadshow-presentations-hungary-2023) and in the web page of ELKH Cloud (https://science-cloud.hu/en/presentations). The contents of this roadshow clearly show that focus was providing information on the transnational access of SLICES resources:

- Péter Kacsuk (SZTAKI): *Introduction to the SLICES ESFRI Program and SLICES IT Research Infrastructures*
- Péter Kacsuk (SZTAKI): *Transnational and Virtual Access of SLICES Infrastructures and Connected Long Mobility*
- Brecht Vermeulen (IMEC, Belgium*): Introduction to the IMEC research infrastructure*

- Zoltán Juhász (Pannon University): *Parallel Multi-GPU Bioelectrical Signal Processing by the Trans-National use of the IMECInfrastructure*
- Sebastian Gallenmüller (Technical University Munich, Germany): *Introduction to the TUM research infrastructure*

Figure 9: SLICES-SC Hungarian Roadshow web page

During the roadshow, two Hungarian research teams immediately indicated that they were intending to submit an application for the 2nd Open Call.

In order to make more attractive the transnational access activities we decided to combine them with the long mobility possibilities if applicants ask for it. Therefore, we extended the text of the 2nd Open Call with more detailed explanation how to apply for transnational access with long mobility possibility. We also agreed with representatives of WP4 who are responsible to organize and manage the long mobility process that they automatically accept the long mobility applications that are coming from transnational access applications asking for long mobility. That was another experience in the 1st Open Call process that researchers who were granted with the transnational access could not easily start their activity on the selected SLICES infrastructure. They have met problems like how to reach the infrastructure, how to use its resources, how to deploy new libraries, etc. Combining the transnational access with long mobility also enables the granted researchers to visit the selected infrastructure and learn the most important knowledge on the usage of the infrastructure.

During the evaluation process, we learnt that some of the evaluation forms should be improved (particularly, the Technical Assessment Form) and also the text of the open call should be extended with some further information concerning the post-experiment duties of the applicants. Therefore, the text of the Open Call was significantly revisited resulting in the text of the 2nd Open Call that is now available in the SLICES web page: https://slices-sc.eu/events/slices-sc-open-call-id-call-2/

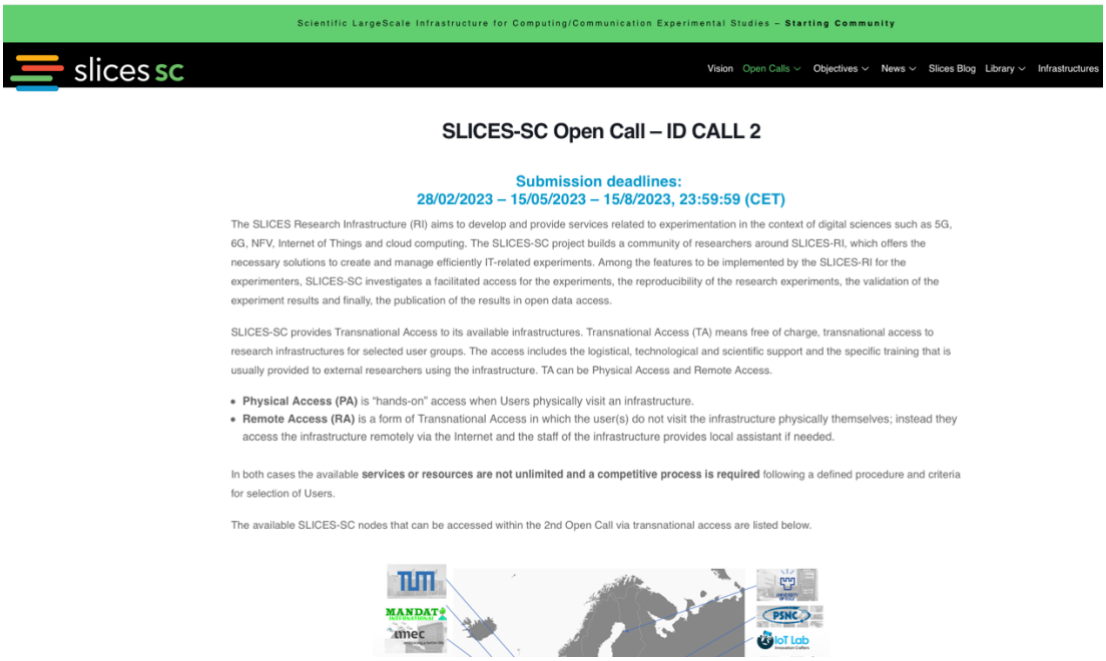


Figure 10: SLICES-SC 2nd Open Call web page

There was another novelty concerning the application submission deadline. We have found that giving one strict deadline could discourage potential applicants and hence we moved from the one fix deadline to the continuous submission possibility with a set of cut-off date. We believe that seeing this continuity of submission possibility will encourage the potential applicants to plan their submission when it is the most appropriate for them.

5. Future steps for Transnational Access activities

5.1. Next Open Call

The 2nd Open Call was prepared according to the experiences we have collected during the evaluation and implementation phase of the 1st Open Call. We have extended the text of the open call with the following paragraphs:

5.1.1. Explanation of transnational access

SLICES-SC provides Transnational Access to its available infrastructures. Transnational Access (TA) covers the usage of the facility from a different country free of charge access for selected user groups. The access includes the logistical, technological and scientific support and the specific training that is usually provided to external researchers using the infrastructure. TA can be Physical Access and Remote Access.

- **Physical Access (PA)** is "hands-on" access when Users physically visit an infrastructure.
- **Remote Access (RA)** is a form of Transnational Access in which the user(s) do not visit the infrastructure physically themselves; instead, they access the infrastructure remotely via the Internet and the staff of the infrastructure provides local assistant if needed.

5.1.2. Extended list of available SLICES RIs

NITOS – UTH, Greece; Open5GLab - EURECOM, France; 5TONIC, Spain; 5G Test Network (5GTN), Finland; ELKH Cloud – SZTAKI, Hungary; Imec, Belgium; PSNC, Poland; SILECS-FIT/OneLab, France; LeonR&Do – Cosmote, Greece; FIT-R2lab, France; TUM Baltikum Testbed, Germany

5.1.3. The Eligibility section was extended

Only user groups that are allowed to disseminate the results and the knowledge they have generated under the action may benefit from the free of charge access. User groups must explicitly declare their willingness and eligibility for dissemination and must also agree to comply with the SLICES-SC data policy.

5.1.4. A new section was introduced on post access requirements

- After completing the experiment the User Group leader should provide an experiment feedback report based on the **Experiment Feedback Report Template**.
- All the data collected during the experiment should be stored in the SLICES-SC experiment repository and should be made open and available for other researchers.

5.1.5. A new section was introduced on application for physical access

- The application must explicitly indicate if physical access is required for the experiment.
- If physical access to the facility is requested, users shall abide by the normal working practices, working hours, and health and safety regulations of the Infrastructure while present on the site.
- Travel grants for physical access to the RI can be requested. The maximum duration of a visit is four weeks, and the maximum amount of a mobility Grant is 6.000 €, covering travel costs and related subsistence. Note that it is possible to split the visit into two separate parts, the first one to perform the activities of the first stage (i.e., training) and the second

one to carry out the activities of second stage (i.e., experimentation). If such grant is needed it must be indicated and justified in the application providing a detailed visit plan and schedule. Reimbursement is eligible if the experiment has successfully completed including the post-access requirements.

5.1.6. Deadlines and cut-off dates for the submission of proposals

The 2nd Open Call was released on 15 Dec 2022. This is a continuous call with 3 evaluation cut-offs in 2023 as follows:

- 28 Feb 2023
- 15 May 2023
- 15 Aug 2023

The 2nd Open Call can be found on the SLICES-SC web page: https://slices-sc.eu/events/slices-sc-open-call-id-call-2/

Besides the Open Call text the related Proposal template was also updated and applicants can download the new, extended template from the 2nd Open Call text:

Proposals must follow the proposal template

Based on the experiences of the evaluation process of the 1st Open Call the evaluation forms (Eligibility Form, Technical Assessment Form, Scientific Evaluation Form) were also updated and extended where it was important.

5.2. Researcher Mobility Scheme

Within the framework of the WP4 activities, SLICES-SC is financially supporting a mobility of researchers programme to enable researchers and professionals from academia and industry to physically visit a SLICES site and to learn how to use the research facility of that site for experimentation purposes. The mobility of researchers' programme entails different types of visits that are managed through dedicated calls, targeting both members of the consortium, as well as researchers not affiliated with any of the consortium partners. Of particular relevance for the Transnational Access activities are the calls for "*micro projects*". Specifically, micro-projects are short research visits from one up to four weeks, aiming not only at offering to the visiting researcher a specific training on the SLICES research facility of the hosting institution, but also at producing a tangible scientific output (e.g., a data set, a software package, a joint collaboration for a publication, an official technical report) to be made available to the research community at large through the SLICES open-data portal. Therefore, the mobility of researchers' programme can also be leveraged to offer travel grants to the users of the Transnational Access, who want to physically access the SLICES facilities to receive on-site training and to perform (part of) their experimentation plan.

The mobility of researchers programme has been officially launched in January 2023 and the call for micro-projects has been opened in February 2023 (see the link for a detailed description of the application procedures). Applications for micro-projects will be evaluated on a first-come, first-served basis until resources are available.

In the Proposal template of the 2nd Open Call applicants can indicate if they need mobility grant to the requested RI. Since the transnational access applications' evaluation process is much more sophisticated than the evaluation process of the "*micro projects*" WP4 and WP8 agreed that those

transnational access applications that were granted by the User Committee and asked for travel grant will automatically get the required mobility grant (up to 6.000 €).

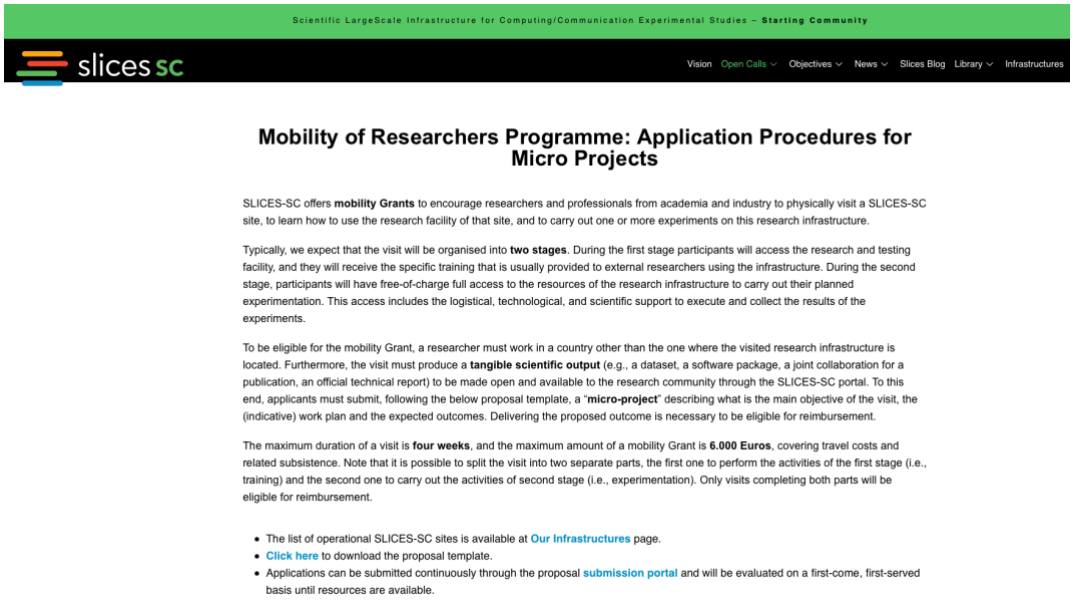


Figure 11: SLICES-SC mobility of researchers

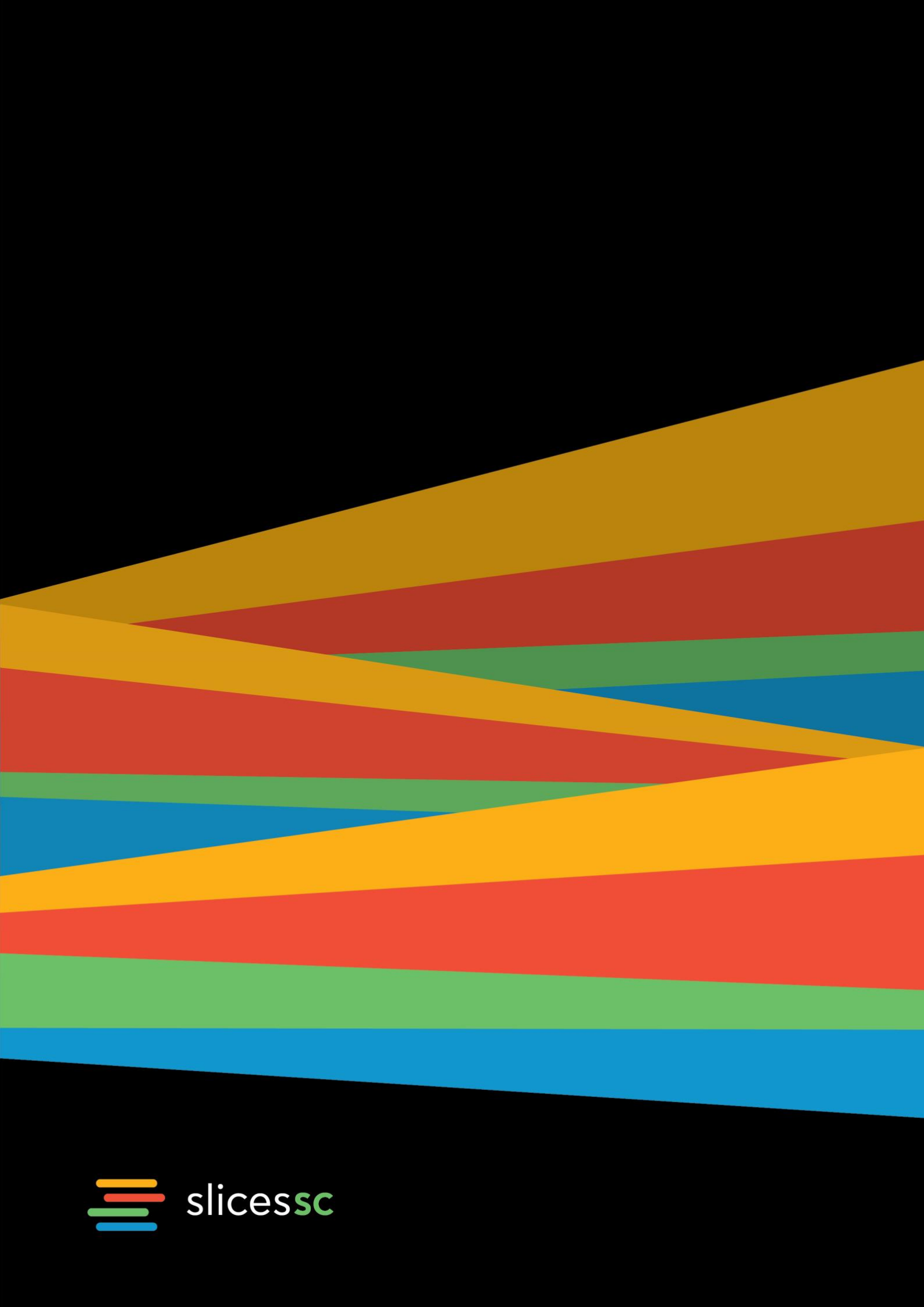
Thus, we expect that the mobility of researchers' programme will be an important tool to further encourage the second open call of Transnational Access throughout the entire 2023.

6. Conclusion

SLICES-SC is providing two different types of accesses for the provided Research Infrastructure (RI). The subject of this deliverable is the transnational access type, where we enable users to conduct experiments over the infrastructure, to validate their novel solutions, algorithms and protocols with an experimentally driven approach. Since the transnational access type requires real access to the infrastructures it can raise capacity issues and hence a fair selection of potential users is required. Therefore, we organized two open calls for potential users. The 1st Open Call was successfully managed and its results are covered in this deliverable.

This document reports on the transnational access activities that have taken place during the first period of accesses. The deliverable covers the whole procedure of organizing the open calls including the evaluation process of applications and documents required to assess the applications.

The experiences gained in the 1st Open Call were carefully analysed in order to improve both the advertisement campaign and the evaluation process of further open calls. The 2nd Open Call was launched based on the experiences, we gained during the 1st Open Call process and an improved advertisement campaign was initiated. Very importantly, the 2nd Open Call was extended with the possibility of mobility and another call for Researchers Mobility is organised.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