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D5.1. Report on Technology Transfer Activities v1

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Reviewers	All partners



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Executive Summary

The objective of this document is to report the activities of the consortium partners towards the technology transfer of SLICES-SC and the liaison with industrial stakeholders. The document includes the description of the methods and tools used to improve the awareness of the industrial users on the capabilities and the opportunities available at the different Research Infrastructures (RI). It also describes the brokerage activities of the partners to establish and grow an industrial network in order to raise the awareness of RI services to the industrial community and stimulate the engagement of industrial R&D staff.



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1. Introduction

1.1. Intended audience

This document is aimed at SLICES-SC consortium members, the external communities related to SLICES-SC, and the industrial R&D staff targeting to use the SLICES research infrastructures. The document reports the activities of the consortium partners towards the technology transfer of SLICES-SC and the liaison with industrial stakeholders.

1.2. Document structure

The document is structured into the following sections:

- Chapter 1 – INTRODUCTION: it introduces the intended audience of the document and its structure.
- Chapter 2 – OBJECTIVES OF SLICES-SC AND WP5: It describes the objectives of SLICES-SC and WP5, which is the work package that this document refers.
- Chapter 3 – PROMOTING AND FOSTERING TECHNOLOGY TRANSFER: It describes the methods and tools used to improve the awareness of the industrial users on the capabilities and the opportunities of RIs.
- Chapter 4 – ENGAGING INDUSTRIAL USERS TO THE USE OF RIs: It describes the activities to establish and grow an industrial network in order to raise the awareness of RI services to the industrial community.
- Chapter 5 – ORGANISING AN INDUSTRIAL ADVISORY BOARD: It describes the activities towards organising an Industrial Advisory Board aiming at the engagement of a larger number of external stakeholders.
- Chapter 6 – CONCLUSION.

2. SLICES-SC and WP5 Objectives

2.1. Objectives of SLICES-SC

SLICES-SC aims to develop and provide services related to experimentation in the context of digital sciences such as 5th and 6th generation cellular networks (5G, 6G), Network Function Virtualisation (NFV), Internet of Things (IoT) and cloud computing. The project is currently building a community of researchers, which will offer the necessary solutions to create and manage efficiently experiments performed using the RIs of the project partners. SLICES-SC will also investigate a facilitated access for the experiments, the reproducibility of the research experiments, the validation of the experiment results, and the publication of the results in open data access.

SLICES-SC will provide access to the following research infrastructures depicted in the figure below:

- SILECS-FIT / OneLab, France
- NITOS – UTH, Greece
- Open5GLa - EURECOM, France
- PIONIER-LAB, Poland
- 5TONIC, Spain
- LeonR&Do - COSMOTE, Greece
- 5G Test Network (5GTN), Finland
- FIT-R2lab - INRIA, France



- MTA Cloud - SZTAKI
- TUM, Germany
- CNR lab, Italy



Figure 1: SLICES-SC Facilities

2.2. Objectives of WP5 and its relevant tasks

The aim of WP5 is to liaise with the relevant industry including Operators, Telecom providers, small and medium-sized enterprises (SMEs) and start-ups and to create strong links between them. The RI partners organize and attend a number of events, to build, maintain and pamper industrial networks, by fostering the interaction with industry and, in particular, with SMEs. Specifically, the objectives are:

- to promote technology transfer from academic research to innovation in industry;
- to support small start-ups and SMEs by offering access to state-of-the-art experimental research infrastructures;
- to create links to established relevant industries including telecom providers;
- to maintain and grow industrial networks, raise awareness of RI services to the industrial community, engage industrial R&D staff.

Specifically, Task 5.1 aims at promoting and fostering technology transfer. The focus of the task is to improve the awareness on the capabilities and opportunities available at the RIs sites, especially for SMEs; to create dedicated room with some “must-have” technology platforms for industrial pre-competitive research in the RIs ecosystem; to provide access to specifically tailored smart services; to make, in general, scientific results more suitable for technological innovation.

Task 5.2 aims to engage the industrial researchers to the use of the RI. The focus is to maintain and grow industrial networks, raise awareness of RI services to the industrial community, and engage industrial R&D staff. This will be accomplished by organizing workshops with industrial partners and stakeholders that will serve as brokerage activities with the purpose to create links between



academic and industrial partners and by participating to industry events such as Mobile World Congress, CES, etc.

Finally, Task 5.3 will organize an Industrial Advisory Board aiming at the engagement of a large number of external stakeholders by considering and evaluating the changing needs of the industry and by proposing action plans to meet the new challenges and support the achievement of the SLICES-SC objectives.

3. Promoting and Fostering Technology Transfer

The research infrastructures developed and maintained by the SLICES participants originate from the academic domain. These testbeds enable researchers to create experiments utilizing bleeding-edge technologies. In WP5, we try to raise the awareness for these research infrastructures among other stakeholders, in particular to industrial partners. The availability of these technologies can be crucial for the development of innovative products. However, SMEs often lack the resources to create their own testbeds slowing down or preventing technical progress. To remedy this issue, RIs created in SLICES will be made available to industrial partners.

However, SMEs need to be aware that these kinds of RIs exist to profit from them. In addition, SMEs need to know which features the RIs offer, how the RIs can be used, and finally, how to approach the research community with relevant research problems. In WP 5, we introduce tools that help promote the RIs of SLICES and initiate a transfer of technologies and knowledge from the academic to the industrial domain.

Therefore, we need to promote the availability of RIs among industrial partners. We are in the process of creating a website that acts as a starting point for interested SMEs. The website lists the RIs of participating partners and the features that the individual RIs provide. Through the available feature matrix, users can select their features of interest, to select testbeds with the relevant features. The website is easily extensible, so new testbeds or new features can be added easily. The website also logs the performed search requests. These search requests can be evaluated to identify the most relevant features for the users that performed the searches. This helps us to further develop the research infrastructures to become more attractive to its users. It also can help identify upcoming trends to proactively extend the resources of future testbeds.

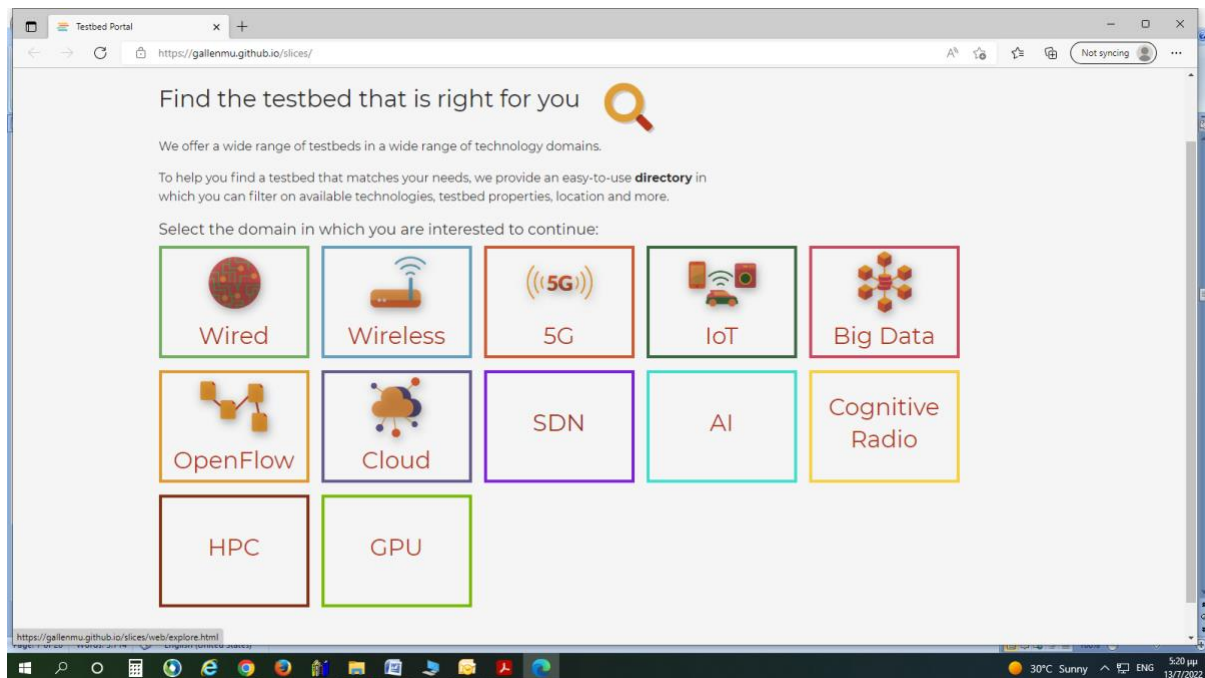


Figure 2: SLICES testbed portal home page

Another building block to foster the technology transfer is the removal of potential barriers that prevent industrial partners from approaching academia. Therefore, we created the concept of a virtual clone of our own testbed that will be publicly available to anyone who wants to try out the testbed. This virtual clone is hosted on a server by the provider of the testbed and accessible through a web browser. We call this service Testbed-as-a-Service (TaaS). An interested user can therefore try out the testbed without the need to provide hardware resources or install any additional software. The testbed can be used immediately after logging in, creating a frictionless way to access and use the virtual testbed clone. By lowering the entry barriers by offering TaaS, we make the testbed more attractive to interested parties that may be deterred by investing time to evaluate the suitability of testbeds for their specific use case. The challenges and the technical concept are described in a publication released at the SLICES Workshop '22¹.

We plan to further develop the described prototypes to create a more robust and usable platform during the remaining time of SLICES-SC. We will implement feedback from users that use our current prototypes and improve the described platforms over the remaining months of the project.

4. Engaging Industrial Users to the Use of RIs

The interaction with industry will contribute towards ensuring the long-term success of SLICES-SC. To achieve this goal, SLICES-SC partners have been engaged in a number of activities with the purpose of creating links with industrial partners and raising awareness of RI services to the industrial community. Such activities include the organization of workshops with industrial partners and the

¹ Sebastian Gallenmüller, Eric Hauser, Georg Carle, "Prototyping Prototyping Facilities: Developing and Bootstrapping Testbeds," in 2022 IFIP Networking WKSHPs: SLICES Scientific Instruments to support digital infrastructure science (IFIP Networking 2022 WKSHPs SLICES), Catania, Italy, Jun. 2022. https://www.net.in.tum.de/fileadmin/bibtex/publications/papers/gallenmueller_slicesworkshop2022.pdf [Last accessed 26 August 2022].



participation to industry events such as Mobile World Congress, CES, etc. Such activities are listed below for each partner.

4.1. Activities to create links with the industry – COSMOTE

COSMOTE, being the leader of WP5, manages activities regarding the Project liaison with industry and other stakeholders. Of particular interest to SLICES is the engagement of industrial researchers to the use of research infrastructures, as it is done for academic researchers. In order to achieve this goal COSMOTE organized the 1st SLICES-SC Industry Day on May 27, 2022, which was an online free of charge event. The purpose of this event was to promote and advertise SLICES research infrastructure to industry users and consisted of partner presentations (around 15’ each) that described the capabilities of their testbeds and what they can offer in particular to industrial users.

The event was very broadly advertised through our industrial and academic connections, together with 6G-IA and 5GPPP. A special site for the event was also created by UTH (<https://slices-sc.eu/events/slices-sc-1st-industry-day/>) There were in total 15 presentations with 12 presentations having to do with the description of SLICES testbeds and their benefits to the industrial users, as shown in Table 1.

Table 1: Agenda of the SLICES 1st Industry Day (May 27, 2022)

Timeslot	Presentation	Presenter’s Name (Partner)
10:00 - 10:10	Welcome	Konstantinos Filis COSMOTE Mobile Communications
10:10 - 10:30	SLICES Vision	Serge Fdida Sorbonne University
10:30 - 10:50	Transnational access Open Call and evaluation process for experimenting on SLICES infrastructures	Peter Kacsuk SZTAKI
10:50 - 11:10	"The pos Framework: A Methodology and Toolchain for Reproducible Network Experiments"	Sebastian Gallenmuller Technical University of Munich
11:10 – 11:30	IoT Lab	Anna Brékine, Cédric Crettaz IoT Lab, Mandat International
11:30– 11:50	OneLab: Cloud Infrastructure for Researchers	Albert (Yiu Quan) Su, LIP6, Sorbonne University
11:50 – 12:10	The Stack4Things framework for Cloud-IoT integration in an industrial environment	Antonio Puliafito, University of Messina
12:10 – 12:30	The LeonR&Do Lab: Experimental facilities fostering research, innovation and collaborations	Konstantinos Filis COSMOTE Mobile Communications
12:30 – 12:50	The offer of the Polish Node for industry and SMEs	Bartosz Belter Poznan Supercomputing

		and Networking Center
12:50 – 13:10	The NITOS testbed: an integrated facility for beyond 5G research	Nikos Makris University of Thessaly
13:10 – 13:30	5TONIC Lab	Carmen Guerrero University Carlos III of Madrid
13:30 – 13:50	The imec testbed portfolio for networking, cloud, AI and IoT research	Brecht Vermeulen imec/Ghent University
13:50 – 14:10	Applying 5G and beyond to smart manufacturing with SN4I	Eduardo Jacob University of the Basque Country
14:10 – 14:30	SOPHIA-NODE: Testing beyond-5G cloud-native network functions and services	Raymond Knopp , EURECOM Walid Dabbous , INRIA
14:30 – 14:40	Closing comments	Konstantinos Filis COSMOTE Mobile Communications

The event was quite successful with more than 50 participants attending it.

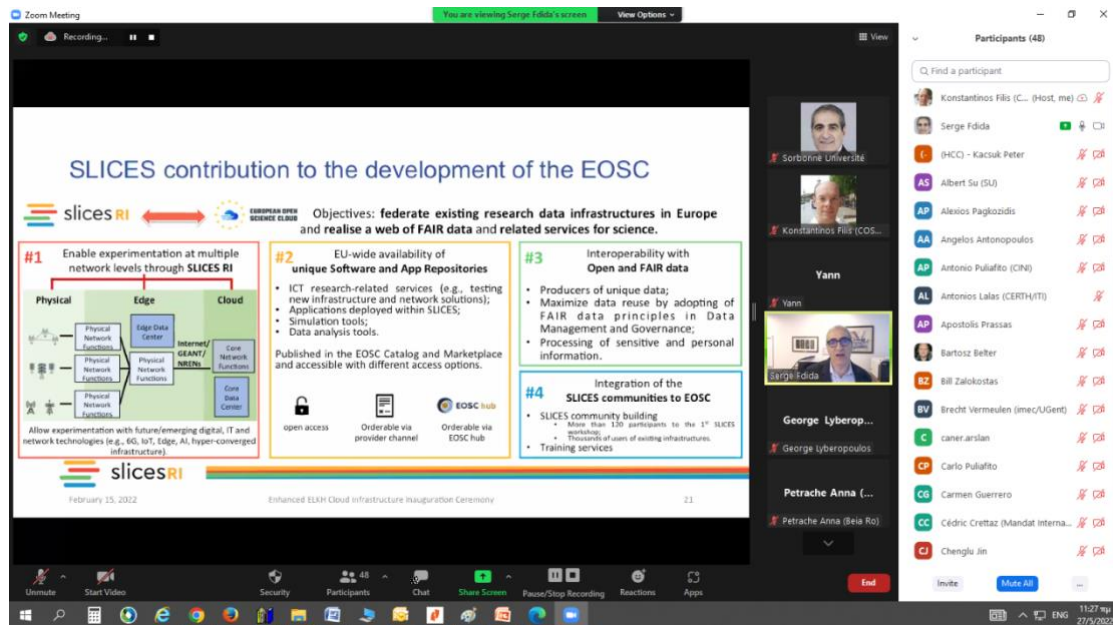


Figure 3: Snapshot of the SLICES 1st Industry Day

COSMOTE attended also several industry events to spot specific industrial needs and requirements that could be met by the SLICES research infrastructure. These events included the following ones:

- 5G World Virtual Event (20-24 September 2021);
- 5G: Connected Mobility in the Digital Age (28 September 2021);



- Smart Networks and Services for Verticals’ (30 September 2021);
- AI in 5G and forthcoming 6G: Standardization and Regulatory Perspectives (16 December 2021);
- ECO6G - European Ecosystem Event on 6G (10 February 2021);
- Sustainable, Intelligent Next G Systems (15 March 2022);
- Open Educational resources for teaching and learning networking (16 March 2022);
- Telecoms Europe Telco to Techno 2022 (29 March 2022);
- Telecoms Europe: Technology and Strategy 2022 (28-30 June 2022).

Finally, COSMOTE participated in the IoT Week 2022 conference in Dublin (23 June 2022) where we presented our IoT platform and how it can be accessed and utilized by industrial users.

Research Infrastructure for Cloud, Edge, IoT

Themes: [Research Infrastructure: IoT new perspectives & breakthroughs for Europe](#) [1. Next-Generation IoT, Research and Cross-Atlantic Cooperation](#)

What: Panel

When: 11:00 AM, Thursday 23 Jun 2022 (1 hour 30 minutes)

Breaks: ☕ Lunch Break at Mezzanine Foyer and Hogan Foyer (Lever 4 and 5) ⌚ 12:30 PM to 01:45 PM (1 hour 15 minutes)

Where: Croke Park Conference Centre - Hogan Mezzanine 2

How: You must be logged in to see the requirements for this session.

[Log In](#)

Discussion: 0

👍 0 👎 0

<p>Andrea Passarella Moderator CNRS</p>	<p>Bartoz Belter Speaker PSNC</p>	<p>Thanasis Korakis Speaker University of Thessaly Professor, Dept. of Electrical and Computer Engineering</p>	<p>Cédric Crettaz Speaker Mandat International Lead Researcher in ICT</p>
<p>Raymond Knopp Speaker EURECOM</p>	<p>Konstantinos Filis Speaker COSMOTE Mobile Communications S.A. Senior Researcher</p>	<p>Enrioo Buraochini Speaker TIM Senior 5G PROJECT MANAGER</p>	

Figure 4: SLICES workshop within the IoT Week (23 June 2022)

4.2. Activities to create links with the industry – SU

Sorbonne University has always promoted the engagement and the use by industrial users of its own platform, OneLab, and is continuing on the same path with SLICES-RI. On the one hand, SU has been very active in order to collect letters of support from industries during the ESFRI application, in 2021, and in inviting the key industrial players of the International Scientific Advisory Board and User Committee of SLICES (e.g., Orange, Nokia, Televic Rail, etc.). The involvement of industrials and the alignment of the industrial users’ needs with the objectives and services provided by SLICES are essential for the sustainability of the platform. On the other hand, now that SLICES is officially in the ESFRI roadmap, SU continues to promote SLICES and the use of RIs, in general, towards the industry



community: for instance, in the framework of projects in which SU is involved together with industrial (e.g., EMPOWER, IoT-NGIN, etc.) or in international associations, such as 6G-IA and the SNS program.

Last but not least, SU participated in the 1st Industry, on May 27, 2022, and presented its Cloud Infrastructure, OneLab.

4.3. Activities to create links with the industry – UTH

UTH has been very active in terms of outreach of the project to external industrial stakeholders. The team has participated actively in the 1st SLICES-SC Industry day. UTH team has been engaged in the wide outreach of the project to external industrial communities, including cloud and data management (with Centro Ricerche FIAT, NORIS, Intrasoft NetCompany, UniSystems, T-Systems, Hellenic Train -Trainose, Fujitsu). Moreover, the team has been promoting the project in cross-sector technologies, including the Agrifood cluster (precision agriculture and food traceability and food waste management), and several industrial stakeholders within this field (Groupe Carrefour, Barilla Group, Olympos S.A., Masoutis S.A.). The UTH team has participated in different workshops (such as EuCNC, IoTWeek, etc.) presenting the overall SLICES vision and contributions taking place within the Greek SLICES node NITOS specifically for industrial stakeholders, working closely with 5G and beyond technologies, cloud and IoT. UTH is part of the 6G-IA association which includes the most relevant industrial stakeholders and continuously disseminates the results of SLICES to all relevant channels.

4.4. Activities to create links with the industry – TUM

TUM took part in several activities creating links with the Industry, such as:

- Presentation of TUM's testbed and experimental workflow for reproducible network experiments at the 1st SLICES Industry Day on May 27, 2022;
- Presentation of our testbed at a German Event to connect with local industrial partners. The event is called WueWoWas'22 and will take place in Würzburg, Germany from July 11 to 13, 2022.

4.5. Activities to create links with the industry – PSNC

In recent years, PSNC has maintained strong connections with industrial partners. PSNC is the operator of the National Research and Education Network (NREN) and the operator of the recognized Data Centre. These responsibilities require continuous monitoring of roadmaps and trends on the networking and computing market.

Recently, PSNC started implementation of several infrastructure projects, which indirectly contribute to the overall SLICES infrastructure. Design, development and validation of research infrastructures require strong involvement of industry – without industrial support delivering these operational infrastructures would not be possible.

Several companies agreed to provide in-kind contribution to infrastructure projects, extending the scope and coverage of technologies in Polish testbeds. For example, three companies donated their state-of-the-art equipment and software to PIONIER-LAB, the biggest Research Infrastructure project in Poland: Adva Optical Networking, Juniper Networks and Arista Networks. Adva Optical Networking is a manufacturer of equipment designed for optical transmission networks - primarily equipment enabling transmission of very large amounts of data over long distances using fiber



optic transmission. Juniper Networks and Arista Networks, in turn, specialize in the production of packet-switching equipment for transmission and computer networks, with the companies concentrating on different areas of packet networks. Juniper Networks primarily offers equipment for telecommunications operators to provide telecommunications services, while Arista Networks focuses more on data centre equipment. Together, these partners have the expertise to cover all areas of today's ICT networks - from optical transmission over long distances to packet transmission in operator networks, to pooling resources in data centres and cloud computing.

In turn, in the next project, PL-5G, Spirent Communications contributes to the RI with measurement tools and software/hardware simulators. Spirent Communications is one of the leading telecommunications and IT entities as well as a provider of solutions in the field of testing, control, analysis and security of network protocols.

In general, in PIONIER-LAB and PL-5G and other infrastructure projects not mentioned in this deliverable, entrepreneurs bring to projects hardware (devices), software and unique knowledge in the field of planning, construction and operation of teletransmission and computer networks (their know-how). Resources contributed by entrepreneurs will be used in different laboratories of these projects.

4.6. Activities to create links with the industry – IMDEA

IMDEA Networks (IMDEA) and the University Carlos III of Madrid (UC3M), as LTP of IMDEA, have been working together to create links between SLICES and the Industry at national and international levels. The main activities carried out within SLICES-SC are the following:

- 6G Smart Networks and Services Industry Association (6G-IA). Both IMDEA and UC3M are full members of the voice of European Industry and Research for next generation networks and services. The main objective is to contribute to Europe's leadership on SNS/6G research. We are involved in the following working groups: VISION-WG, Software Networks WG, the Pre-Standardization WG and the Security WG;
- IMDEA Networks participates for the first time in the Madrid Technology Transfer Zone (MTTZ) at Digital Enterprise Show (DES) from June 14 to 16 2022 in Malaga. This is the largest European professional event on business digital transformation, and ideal environment in which to share knowledge, strategies and success stories. IMDEA shared the MTTZ space with 11 R&D entities that exhibited their disruptive projects, highlighting the innovative capacity of Madrid, which has also been named by the DES organization as their year's Innovative European Region. The event has been a great opportunity for IMDEA Networks and 5TONIC research infrastructure as part of SLICES to explore some possible connections with technology companies and start-ups. More information: www.des-show.com;
- IMDEA Networks joins in June 2022 the four technology clusters of the Community of Madrid. The Madrid Regional Government culminates the opening of the last four digitalization clusters in the region dedicated to Blockchain, AI, Digital Transformation and IoT. Professionals from 57 leading national and international companies, organizations and entities, including the IMDEA Networks Institute, comprise the clusters team with the aim of consolidating the region as a digital hub in Southern Europe, generating new business opportunities, more employment and facilitating the interaction of citizens with the public administration;



- 5TONIC facility, in collaboration with Ericsson, Intel, Telefonica, DeepSight and Capgemini Engineering took a further step towards Network as a Service by integrating the 5G SA network in a multiaccess edge computing platform in May 2022. The use case has been developed with the 5G SA core and the Network Exposure Function of Ericsson and the Multiaccess Edge Computing platform of Capgemini Engineering. A computer vision application developed by DeepSight AI Labs has been deployed on this platform to demonstrate its capabilities. Services such as computer vision, vehicular communications, augmented, virtual or mixed reality applications, immersive communications as well as critical communications and emergency services are likely to require a certain quality of service and specific network capabilities from the network. Future evolution of digital services such as Industry 4.0 and Metaverse will require that the quality and capabilities offered by the network be adapted to their needs. This is what the Network as a Service concept is all about, a concept that will accelerate new business opportunities;
- The Secretary General for Innovation of the Ministry of Science and Innovation and the Director General for Research of the Regional Government of Madrid visit IMDEA Networks and 5TONIC research facility to learn about the cutting-edge projects that the Institute is currently developing to improve the future of communications networks. SLICES was presented to the audience as the first ESFRI infrastructure in Europe for ICT research and experimentation that will play a relevant role in bringing Europe to the forefront of digitalization. The Industry was represented in that meeting with Telefonica, ASTI and Ericsson;
- IMDEA Networks and UC3M has received 24 million in funding from the Ministry of Economic Affairs and Digital Transformation and the European Union-NextGenerationEU/PRTR as part of the UNICO-5G R&D Programme, for the development of 12 innovative projects in the deployment of advanced 5G and 6G technologies. The aim of this programme is to consolidate Spain as one of the leading countries in the implementation of these technologies. The consortium of these awarded projects is also integrated, apart from the research and academic institutions, from Industry, included SMEs.

4.7. Activities to create links with the industry – CNR

To increase the visibility of SLICES among both Italian and European industrial stakeholders, CNR has started expanding his participation into relevant industry-led associations that promote the development of digital innovations and next generation networks and services. In particular, since April 2022, CNR is an associate member of the 6G Smart Networks and Services Industry Association (6G-IA), which is an association of network operators and manufacturers, research institutes, universities, verticals, SMEs and ICT associations, with the primary mission of promoting Europe's leadership on 5G, 5G evolution and SNS/6G research. 6G-IA is structured into multiple working groups, and highly relevant to SLICES initiative are the WGs:

- “Open Smart Networks and Services”, which promotes and supports the evaluation, adoption, deployment, and evolution of open, disaggregated, intelligent and fully interoperable networks;
- “Portfolio Structuring and Analysis”, which monitors existing projects and initiatives in the area of next generation networks and services to foster cooperation and to facilitate the involvement of verticals in the trials.



CNR monitors the activities of these WGs, and it plans to present the SLICES facilities of the Italian node in the upcoming months.

CNR is also a member of two European Digital Innovation Hubs (EDIHs) recently approved by the EU. EDIHs are one-stop shops that foster technology transfer and help industries and SME to get access to the technical expertise and state-of-the-art experimentation facilities to test the business value of new solutions before investment and implementation. CNR is member of the upcoming ARTES 5.0 – Restart Italy EDIH and the Tuscany X.0 EDIH. ARTES 5.0 is a national EDIH led by the Italian Competence Center on Advanced Robotics and Digital Technologies & Systems for Industry 4.0 and Public Administration. The main goal is to extend the activities already undertaken under the national competence center ARTES 4.0 (www.artes4.it) supporting industries (in particular, SMEs) in adopting technologies related to advanced manufacturing, including 5G and IoT. Within this framework, CNR covers aspects related to novel 5G and beyond-5G solutions, decentralized AI, edge computing. Tuscany X.0 is another EDIH led by the Tuscan “Technology District” GATE 4.0 (<https://distrettogate40.it/>). Tuscany X.0 has a regional scope and will support regional industries (particularly SMEs) in the take-up of digital manufacturing solutions. Also in this case, CNR provides services in the areas of advanced networking and decentralized AI. More in general, CNR will promote SLICES in the portfolio of testing facilities that will be made available to the members of the EDIHs.

4.8. Activities to create links with the industry – EURECOM

EURECOM participated in several events informing industry partners of advances in the SLICES-RI, in particular the 1st SLICES-SC Industry Day (May 27, 2022), the IoT Week conference in Dublin (June 23, 2022) and the EMPOWER workshop at EUCNC 2022 in Grenoble (June 7, 2022). In the latter, EURECOM presented the evolution of software tools for experimental wireless platforms for beyond-5G systems.

EURECOM is a full member of the 6G Smart Networks and Services Industry Association (6G-IA) and monitors its activities closely. In this context, it aims to fully integrate its SLICES-RI site in Sophia Antipolis with activities carried out in the context of the first phase of the Smart Networks Services Joint Undertaking (SNS JU) project framework which will begin in 2023. EURECOM is a member and also has regular interactions with the O-RAN Alliance. It has recently proposed its site for use in the European O-RAN OTIC in the fall of 2022.

At a national level, EURECOM participates in several platform-oriented projects funded by the French ministry of Industry and links its SLICES-RI site with the Engage5G infrastructure led by B-COM and with Orange, Nokia and EDF. It regularly presents the evolution of SLICES-RI to these partners to seek synergy in technology building blocks. This extended network provides access to vertical industry partners and SMEs. EURECOM’s site is physically interconnected with the main hub at Orange Innovations in the Paris region.

EURECOM is the founding member and technical lead of the OpenAirInterface (OAI) Software Alliance which maintains software tools for 5G radio-access and core networks. The Alliance has industry members using the software and EURECOM’s SLICES-RI site along with similar US sites for testing and continuous integration. It organizes a bi-annual workshop bringing together all members of the Alliance to exchange on the use of OAI and its integration in experimental wireless platforms. The last workshop took place in Paris at Orange Gardens (June 12-13, 2022) and attracted 150 attendees over two days, most from global industry partners. The next workshop will take place in November 2022 at Qualcomm in San Diego.



Finally, EURECOM participates at major industry events such as the Mobile World Congress (MWC) and the NGMN Forum and Exhibition. For example, in March 2022, it took part in a MWC panel covering beyond-5G experimental platform technologies alongside US academic partners. As an advisor to NGMN, EURECOM also proposed a demonstration on OpenRAN technologies for the upcoming NGMN exhibition in Paris in September 2022. It will have a stand outlining OpenRAN innovations used in its SLICES-RI site.

4.9. Activities to create links with the industry – IoT LAB, MI

The IoT Lab infrastructure provides a Testbed as a Service for the researchers. It combines into a common platform crowdsourcing tools together with several testbeds on the Internet of Things. It provides a unique tool to ease all kinds of multidisciplinary research and experiments. It also facilitates reporting and sharing the most relevant results of the different research activities with the participants. The crowdsourcing tools are composed by the IoT Lab smartphone application enabling participants to join the IoT Lab community with the possibility to suggest, initiate and participate in research projects. It enables participants to accept privacy-friendly interactions with researchers, including crowdsensing on a voluntary basis and with a very strong personal data protection. This enables end-users to be at the core of the research cycle in order to better align the research with the real end-users needs and requirements. A LimeSurvey server is also a part of the crowdsourcing tools allowing the creation of surveys for the participants.

To expand the links with the industry, Mandat International has presented the IoT Lab testbed during the first SLICES Industry Day held the 27th May 2022 and also, during the edition 2022 of the IoT Week physically organised in Dublin in June 2022, at the session on ‘Research Infrastructure for Cloud, Edge, IoT’. Furthermore, IoT Lab has supported the organisation of the trans-Atlantic cooperation sessions of the IoT Week 2022, by bringing together SLICES partners, European Commission representatives and members of the academia and industry in the USA.

IoT Lab is currently planning an online conference of October 6th ‘Conference on SLICES Pan-European Research Infrastructure for Digital Innovation & Transformation – Swiss Cluster Event’ to also create links with the academia and industry at the Swiss national level.

4.10. Activities to create links with the industry – OULU

Environment Background: OULU has a 5G Test Network (5GTN), that has been developed since 2015, with campus wide small cell, macro-cell and distributed antenna based cellular network to be complemented by NFV based EPC and 5G backhauling solution (<http://5gtn.fi/>). Full-scale 5G test network supports using 5G devices, higher frequency bands, cognitive management functionalities, system testing tools for new solutions. The 5G Test Network feature evolution follows 5G research and standardisation progress, acting as verification platform for theoretical 5G research. The cellular devices part of the network is composed of 30 LTE small cells (700 MHz, 2.1, 2.3, 2.6, 3.5 GHz) and 2 macro cells (2.3 GHz). The network has two 5G NR base stations (3.5 GHz) complemented with User Equipment from MediaTek (10) that are easily integrated to any device, and 5G enabled mobile phones from several vendors. The network is currently being complemented by mmW (24-28 GHz) 5G NR base stations as well as with 36 remote radio head (RRH) based cloud RAN 5G NR devices. For research purposes, we have also pre-standard 5G capable NOKIA proof-of-concept (PoC) devices at 26-28 GHz. The network is controlled by operator grade EPC (Evolved Packet Core), thus making OULU in practice a network operator with own SIM production for mobile devices. The current operational EPC version is 5G NSA compliant, but for research purposes 5G stand alone (SA) core is



also available. The network within the campus is complemented by wireless sensor network (IoT, internet of things) extension with estimated 2000 different kinds of sensors with wireless connectivity through NB-IoT, LTE-M and LoRa. Furthermore, the network has big data computing servers for network data analytics purposes. Some of these servers are distributed within the network thus allowing multi-access edge computing (MEC) as well as caching services. The NOKIA EPC has open application programming interfaces (virtualized EPC) that makes it possible to integrate new services to e.g., network management. Therefore, constant upgrades to the environment are essential to keep the status as an up-to-date sought for further research, development and test environment.

Project work: The 5GTN environment has been extensively used in collaborative project work since its' inception. The open 5GTest Network (5GTN), upgraded with 5G new radio and sensors, has attracted over 200 companies to test 5G prototype devices and to explore higher frequency bands, cognitive management functionalities, and system testing tools for new solutions. 5GTN has so far boosted trials in H2020 and HE projects, Business Finland funded projects, Academy of Finland projects and commissioned research projects supporting the R&D&I activities of Nokia, Ericsson, Keysight and over 200 other companies with a total project value of 145M€ and UO share of 17 M€. The European Regional Development Fund and Academy of Finland have also supported the 5GTN investments with 3.7 M€. Collaborators have donated equipment, software, and expertise to 6G Flagship with an estimated value of 24 M€. Most of the projects have been on finalizing the 5G standard. Companies have transferred many new 5G technology components from the collaboration to 5G mobile (3GPP Rel. 16, Rel. 17 and Rel. 18) standards, including ultra-reliable low latency communications, aerial communication, and time sensitive networking on the Industrial Internet. In addition, major international conferences and workshops organized by the 6G Flagship have speeded up 5G-enabled digitalization in the industry through shared research and validation results. 6G Flagship's experimental environment 5G Test Network (5GTN) has been chosen for the Finnish Research Infrastructure Roadmap (FIRI) and, together with partners, received a 6.2 M€ award for future investment into the environment. Public infrastructure funding and collaboration with leading industries have ensured that the development of 5GTN towards 6GTN has progressed per the 2018 roadmap. The roadmap consists of several critical steps, starting with introducing 6G flavored terahertz proof of concept devices into the network. In addition, full use of virtualization and cloud technology are included in the near future targets of the upcoming 6GTN. With the new capabilities, 5GTN will become an even more powerful nexus for 6G Flagship co-creation and trials.

Academy of Finland's profiling PROF16 program's 6G Enabling Sustainable Society (6GESS), a subprogram worth 12,6 M€, is targeting in conjunction with 6G Flagship two strategic vertical areas of 6G Flagship, namely eHealth and Energy.

Media Visibility: The 5GTN environment is used as the experimental facility of national Finnish 6G Flagship program. 6G Flagship has embraced its global leadership role in launching large-scale 6G research, built a vibrant 6G ecosystem and constructed novel discussion forums to critically analyze the limitations of 5G evolution and to explore the most promising enablers for 6G with its global network of 1200 collaborators. At UOULU, 6G Flagship has defined an ambitious 6G Research Architecture to organize the research efforts of its over 400 experts within the four strategic research areas and four strategic vertical areas. Through the extensive marketing activities, the novel communication platforms have further boosted the 6G Flagship's and 5GTN's visibility and image as a future builder. The "6G Research Visions" publication series was launched to ensure accessibility and a unified appearance for 6G white papers with more than one million downloads. The "6G Waves Magazine", a biannual publication for the expert audience, introduces research



highlights and achievements along with innovators' profiles. The magazine has been downloaded close to 310 000 times since its publication.

Furthermore, the 6G Flagship twitter has had 1.2 million tweet views and the experts have been visible in 5800 articles in independent media. LinkedIn and Facebook are also the channels used for reaching industry.

5GTN web site www.5gtn.fi and www.6gflagship.com offers lots of information how to use available services and get involved to the projects or research. On 5GTN web site customers can see the coverage map of all available frequencies and direction of beams. There is also the channel to request services and possibility to become a member of the 5GTN Community and get more insight what is happening in the 5GTN community. Once the new beyond 5G technology comes available, 5GTN will turn, step by step, to the 6G Test Network.

Dissemination in conferences/expos: Through the visibility of the 6G Flagship program, more than 30 keynotes or invited presentations have been given in top conferences and expos in last two years. The 5GTN together with 6G Flagship has been presented e.g., in Mobile World Congress in Barcelona wherein TV stations such as CNN, CNBC, TVE, Deutsche Welle, RAI 1 and national YLE covered the story of 6G Flagship and 5GTN. Additionally, 6G Flagship has been co-organised EuCNC+6G Summit conferences now for two years and will continue at least two more. 5GTN has been presented in those events mainly via technology demos.

Competitions and hackathons: In 2019, the 5GTN was used as a platform for a security hackathon. It invited more than 40 teams globally to compete in four categories sponsored by central ICT stakeholders in Finland. Such hackathons are planned also for the future. In an 5G innovation competition organized by national regulatory authority in Finland - TRAFICOM, a wireless medical demonstration combining vital sign IoT data, 360-degree video and AR/VR-perception in remote patient care was successful and received the second price in this competition.

4.11. Activities to create links with the industry – IMEC

As an independent research institute which is working closely with industry, there are two important routes towards exploitation of the results for imec. The knowledge and IPR gained through running the existing facilities and through SLICES-RI in the future will be exploited in future projects with industry. In such projects, industry directly benefits from imec's knowledge and may use consulting services or support in experimental work from imec. However, industry may also take over some of the IPR for further commercialization. A second path is the exploitation by imec of its knowledge by establishing spin-off companies.

In SLICES, the research group IDLab (Internet Technology and Data Science Lab) is involved. IDLab is a core research group of imec and its research activities are embedded in Ghent University and University of Antwerp.

The embedding in 2 Flemish universities, allows a very efficient exploitation of knowledge by embedding this in the more advanced master courses in engineering and related high-quality PhD programs.

Links with industry and involvement of industry in the SLICES facilities provided by IMEC are in line with activities in the H2020-project "Fed4FIRE+ - Federation for FIRE" (in which FIRE stands for "Future Internet Research and Experimentation") which has been running from 01/01/2017 till 30/06/2022. The project, led by imec provides crucial input in setting up the SLICES RI and has developed a common federation framework that is widely adopted by different experimentation



facilities and used by different experimentation communities within academia and industry all over the world.

The facilities at imec in SLICES (Virtual Wall, w-iLab.t, OfficeLab, CityLab, GPU Lab, etc.) have proven to be key components in the federation. The H2020-project ran Open Calls soliciting experiments from academia, industry and SMEs to make use of the facilities. From the participation in these Open Calls Experiments (over 150 in total) it is clear that the imec facilities to become part of SLICES RI are crucial in the whole operation and are vital components in the proposed ESFRI RI.

The impact on the community (research & industry) can be expected on different levels and within different groups of stakeholders. First of all, a direct impact on the experimenters, the users of the RIs as they are the most obvious stakeholders for the project. Out of a survey run with the users of the SLICES Flanders RIs within the Fed4FIRE project, show the added value for the users (both academic as well as industrial): “Testing a theoretical solution to verify performances”; “reproducibility”; “Shorter development cycle”; “Reliable software/equipment”; “Diversity of available resources”; “High valuable components”; “Easy and remote uninterrupted access”; “Tutorials and documentation”; “Increased scientific impact”; “Conduct a large-scale experiment under realistic conditions”; “provider neutral”.

4.12. Activities to create links with the industry – INRIA

INRIA is operating [R2lab](#) is an open testbed located in an anechoic chamber of about 90m² for reproducible research in wireless WiFi and 4G/5G networks, R2lab proposes customizable commercial off-the-shelf wireless devices, together with USRP nodes and commercial LTE phones, in order to create rich experimental setups. The testbed also features advanced software like [OpenAirinterface](#), as well as efficient software tools such as nepi-ng (<https://nepi-ng.inria.fr/>), to support easy experimentation. These tools allow to book the whole testbed, to remotely control the wireless devices, to easily deploy various scenarios and to collect the results through an ergonomic user interface. R2lab also proposes several tutorials for newcomers to rapidly run their own experiments. In the last two years the R2lab testbed had 75% occupation rate with 50% industrial users.

In order to strengthen the links with the industry, we conducted two parallel activities. On the one hand INRIA has integrated R2lab in the Fed4Fire+ federation as an interim step in the context of SLICES-SC. And on the other hand, INRIA is deploying together with EURECOM an advanced Cloud-Native Mobile Network testbed with a focus on 5G radio access and core networks. This testbed called SophiaNode is built from scratch and is destined to become part of the SLICES-RI.

INRIA participated to the following events to the [1st SLICES-SC Industry Day](#) (May 27, 2022). The presentation focused on testing beyond-5G cloud-native network functions and services.

INRIA participated to the IEEE 5G World Forum – [SLICES session](#), (October 13, 2021) on Unified Research Digital Infrastructure enabling advanced functionalities for experimental based research. The presentation focused on the interconnexion infrastructure between INRIA and EURECOM to deploy the SophiaNode testbed.

Platforms working group at the [French Research Group on Networking and Distributed Systems](#) (21/10/2021). The [presentation](#) focused on O-RAN disaggregated Network architecture and discussed the hardware and software components of the SophiaNode.



5. Organizing an Industrial Advisory Board

SLICES-SC partners are currently working on setting up the Industrial Advisory Board. The Industrial Advisory Board (IAB) will provide a forum to establish dialogue with business and industry in relation to the vision and mission of SLICES.

The primary function of the Industrial Advisory Board in SLICES-RI is to assist and advise the project in the following areas:

- Industry trends and technology roadmaps;
- Industrial needs and requirements for digital research infrastructures;
- Strategic guidance to improve short- and long-term collaboration between science and industry;
- Evaluation of services offered by the research infrastructure.

Members of the IAB will represent the world-wide leading manufacturers, service and solution providers and telecom operators from the broadly understood ICT sector. Members of the IAB are expected to respect the confidential character of the work conducted for the project. Members of the IAB will sign a Non-Disclosure Agreement to be provided to the Project Office at Sorbonne University.

In September 2022 an internal call for proposals for IAB members took place within the consortium. The collected names included representatives from industry, SMEs, telecoms and Open-Source sectors. Each proposed member was contacted in order to be informed about SLICES and their role as an IAB member and asked for their confirmation. The list of proposed names and their confirmation status (as of 5/10/2022) is shown in the following table.

Table 2: IAB Member Names and their Confirmation Status (as of 5/10/2022)

NAME	AFFILIATION	CONFIRMATION	GENDER
Rita Cristovao	CEO, PLUX Biosignals	Confirmed	F
Nicola Ciulli	Nextworks	Confirmed	M
Mauro Boldi	TIM	Confirmed	M
Eleni Trouva	Senior Cloud Ops Engineer, Citrix	Confirmed	F
Pejman Panahi	ID Quantique	Tbc	M
Valerio Frascolla	INTEL Germany	Tbc	M
Azimeh Sefidcon	ERICSON	Tbc	M
Hagen Woesner	BISDN	Tbc	M
Ana Gonzalez	Director of Strategic Partnerships, iPronics	Tbc	F
Annachiara Pagano	Lab Director, Telecom Italia	Tbc	F
Laura Bernasconi	Program Coordinator European Research Projects Office, Keysight Technologies Belgium	Tbc	F

The final documentation of the IAB (including Terms of Reference and list of members of the board) will be approved by the whole SLICES-RI community.



Conclusions

This deliverable reported the activities of the consortium partners towards the technology transfer of SLICES-SC and the liaison with industrial stakeholders until month 18 of the project. Firstly, it described the objectives of SLICES-SC and WP5. Then, it presented the methods and tools used to improve the awareness of the industrial users on the capabilities and the opportunities of RIs. The activities to establish and grow an industrial network in order to raise the awareness of RI services to the industrial community were next presented by each individual partner. Finally, the activities towards organizing an Industrial Advisory Board aiming at the engagement of a larger number of external stakeholders were explained.

