



# SLICES-RI: Building the first European infrastructure for large-scale digital experimentation

From diverse operational testbeds to a pan-European experimental digital infrastructure





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The development of the Next Generation Internet raises many challenges across various research communities to manage combinations of legacy and emerging technologies, including, but not limited to, 5G/6G wireless, Internet of Things (IoT), Edge, Cloud, HPC, AI infrastructure, and programmable elements across the digital continuum, in order to produce trustworthy, repeatable, and accessible results.



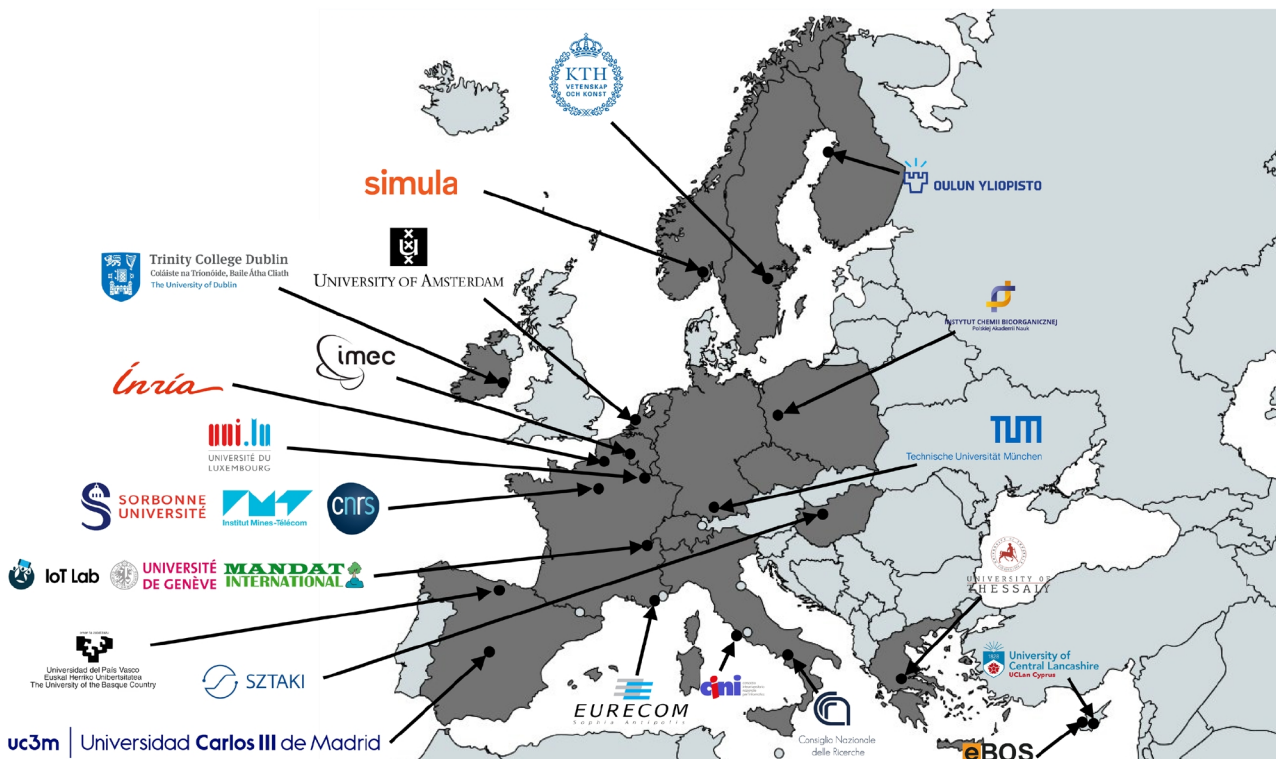
# Partners

As part of the development of the new **SLICES-RI** research infrastructure, included in the **ESFRI roadmap**, 16 European countries have been collaborating over the past three years through the Horizon Europe SLICES Preparatory Phase project (**SLICES-PP**). Building on many years of prior work, this project allowed partners to jointly define, among other things, the governance, legal and financial frameworks, scientific strategy, and service portfolio of this innovative infrastructure.

Meanwhile, each national node is being established by leveraging existing scientific communities and pursuing ambitious goals aligned with the future digital continuum. Throughout this article, we focus on a subset of 14 national nodes

nodes currently under construction, highlighting their progress and ambitions for the future, and underlying the great potential of SLICES-RI, which interconnects all these services and devices to bring them to an upper level. Two other nodes are also currently under construction as part of this research infrastructure in Sweden, and Luxembourg.

The coordinated collaboration across countries and disciplines ensures that SLICES-RI is both technically robust and strategically aligned with Europe's evolving digital research needs. Although uniting such a diverse set of partners is a significant challenge, it is crucial for building the future large-scale experimental infrastructure.



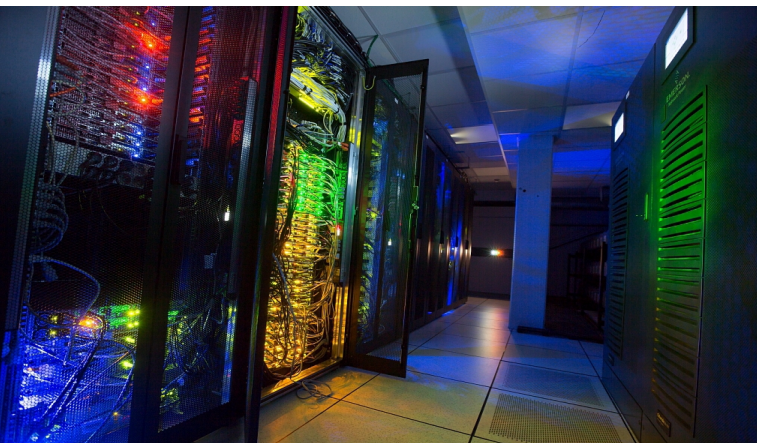
Geographically distributed SLICES nodes interconnected across Europe - Credit: Inria.

# FRENCH NODE

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## **SLICES-FR: Unifying the IoT–Networks–Cloud–HPC continuum research across 16 French institutes!**

The **SLICES-FR** node makes it possible to experiment with any new software and/or hardware approach across the entire IoT–Networks–Cloud–HPC continuum, allowing a holistic vision across the entire data chain, from its capture to its processing, including its transport and storage at a French scale. SLICES-FR is included in the national French infrastructure roadmap. Collectively built by 16 French research institutes, universities and national schools, the initiative is supported through a combination of national and regional public funds, as well as contributions from the partner institutions themselves. To formalise their collaboration, the partners have established a legal entity in the form of a “Scientific Interest Group” (GIS), which was officially launched in January 2026.



**Server room at the French Node - Credit: Inria Photo C. Morel.**

SLICES-FR brings together 17 operational sites across France, all of which have been actively used for years through precursor testbeds. These facilities provide large-scale reconfiguration, reprogramming, control, and measurement services on a wide range of heterogeneous equipment, including server-class and small form factor machines with accelerators and high-speed networks and storage, embedded devices, IoT appliances, and advanced network devices such as SDR devices and 5G antennas. Unified access is currently being implemented to streamline user experience, making SLICES-FR a robust and proven framework for research and innovation.

This collaborative framework aims to serve the entire research community, accelerating innovation, supporting reproducible and responsible research, and fostering collaboration across disciplines. It represents a major innovation in France, combining operational equipment of different types and scales while providing a holistic, end-to-end view of the digital continuum, bringing two communities closer together, as well as to bridging to AI through AI Factory France.



**IoT sensors at the French Node - Credit: Inria Photo G. Scagnelli.**

# BELGIAN NODE

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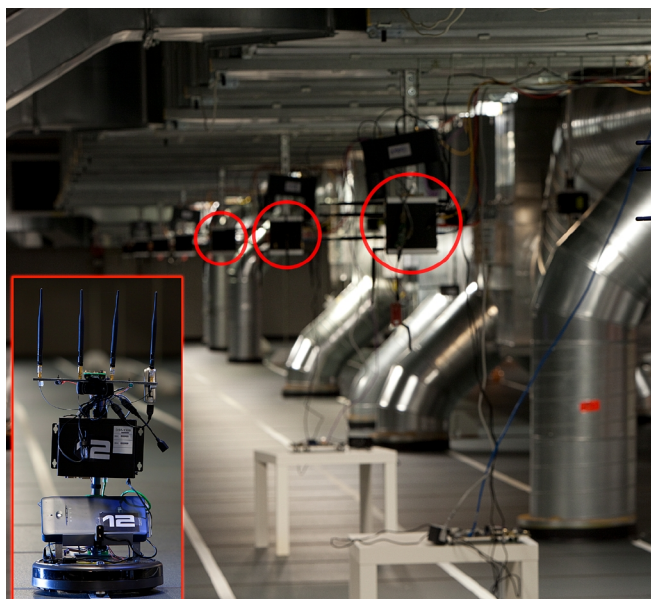
## **SLICES-BE: Connecting AI research to experimentation across networks, radio technologies, and cloud-edge**

The **SLICES-BE** node is currently building the Belgian part of SLICES-RI, covering both hardware and software components. This effort builds on more than 20 years of experience in building and operating (federated) research testbeds. At present, five institutes are involved: three in Flanders (imec, Ghent University, and the University of Antwerp) and two in Wallonia (the University of Louvain-la-Neuve and the University of Liège).



**Belgian node distributed cloud infrastructure - Credit: IMEC/ Ghent University Photo: B. Vermeulen.**

SLICES-BE provides the full spectrum of infrastructure, supporting research that ranges from basic wired and wireless networking to application-driven experimentation on distributed cloud-edge infrastructures and (federated) AI. The platform is designed to offer maximum flexibility for experimentation, where the integration—the “continuum”—of these building blocks represents a key direction for future research. Investigations into next-generation cross-layer networking stacks, AI architectures, and distributed cloud technologies are central to the SLICES-BE node’s mission. In addition to significant hardware investments, SLICES-BE is also investing heavily in the software and architectural frameworks needed to interconnect all SLICES-RI nodes and services. This will enable the creation of a unique, large-scale research infrastructure that provides seamless access for experimenters.



Belgian node wireless and edge infrastructure - Credit: IMEC/ Ghent University Photo: B. Vermeulen.

## CYPRIOI NODE

### SLICES-CY: Unifying next generation networks research in Cyprus

The [SLICES-CY](#) node aims to implement the Cyprus node of the SLICES-RI, providing high-quality experimentation services for Intelligent Systems, AI, IoT, and HPC. The platform facilitates seamless data ingestion through ETL/EL APIs, enriching datasets with versioned metadata to

ensure FAIR compliance and interoperability. Researcher-configurable pipelines automate data cleaning and normalisation while upholding strict regulatory standards like GDPR and OpenScience principles.

The infrastructure supports network programmability and virtualisation via configurable nodes orchestrated through Jupyter notebooks. Specialised services enable complex network emulation, simulation, and data-driven 3D modelling for Digital Twins. By integrating AI-powered analytics and visualisation libraries, SLICES-CY empowers researchers to perform automated data interpretation across heterogeneous environments. This comprehensive ecosystem bridges physical equipment with digital simulations, fostering high-impact innovation within the national and international research landscape.

## DUTCH NODE

### SLICES-NL: Enabling experimental research on the distributed digital continuum

The [SLICES-NL](#) node, currently in its build-up phase, brings together Dutch institutions specialising in future computer systems and networking, including universities, partners, and strategic stakeholders across science, engineering, business, and governance. It leverages national, long-term community strengths and networks to provide a unique, national-scale Research Infrastructure (RI) for exploratory and experimental systems-oriented research, with a focus on the distributed digital continuum (DDC).

This initiative aims to establish and utilise this RI through instruments, data, and services deployed across multiple sites in the Netherlands, building on multi-decade experience in analysing, developing, and advancing next-generation ICT technologies. Its experimental focus includes state-of-the-art analysis and new solutions for optimising the DDC in sustainable and responsible ways, federating data and AI/ML pipelines, leveraging DevOps practices, improving ICT maintainability and usability for research, autonomously managing system complexity, and operationalising AI-assisted ICT and Digital Twinning.

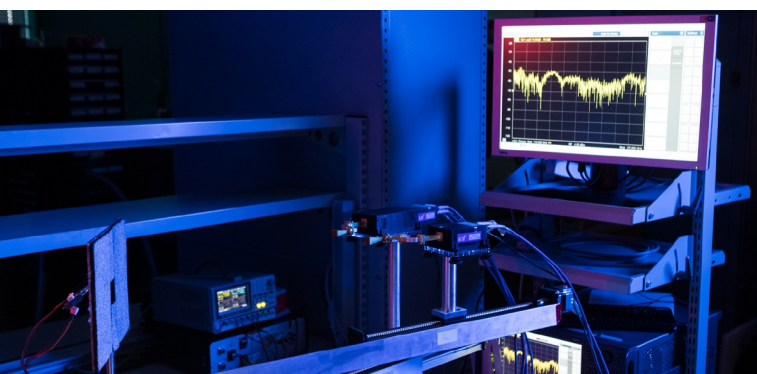
## FINNISH NODE

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The basis of the [SLICES-FI](#) node, the 5G Test Network (5GTN), has been developed since 2015. The 5GTN is deployed at the Univ. campus (outdoor/indoor) and local univ. hospital TestLab (indoor). The constantly evolving 5GTN includes commercial and experimental components. Development of RI towards 6G supports the SLICES-RI evolution path. The University of Oulu serves as Finland's national SLICES-FI node, coordinating SLICES activities in Finland (6GTNF) and aligning operations with other infrastructures within SLICES-RI.

5GTN is present in the National RI roadmap. The Finnish National Roadmap is the basis for a long-term plan and a foundation for excellent research, and for internationally positioning Finland in a coordinated manner in 5G, beyond 5G, and 6G research.

Part of the 5GTN assets are available through the federation portal for remote use; FR1 O-RAN, Allbesmart OAIBOX + Benetel FR1 RU, FR2 RIS, 50TB legal data storage. Datasets can be loaded to Slices Data Repository.



Finland node 5GTN - Credit: University of Oulu.

## GERMAN NODE

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### **SLICES-DE: Shaping Germany and Europe's digital future and sovereignty**

The [SLICES-DE](#) node, included in the national German infrastructure roadmap, is a nationwide research infrastructure comprising 14 interconnected nodes, led by the Technical University of Munich (TUM) and supported by 12

partner institutions across Germany. Together, the partners bring expertise from a wide range of fields in computing and communications, such as the Internet of Things (IoT), artificial intelligence (AI) for High-Performance Computing (HPC), wireless and cellular networks, network (performance) measurements, AI research, Quantum Computing, and Post-Quantum Cryptography. In July 2025, SLICES-DE was officially included in the German roadmap for large-scale research infrastructures, highlighting its strategic importance for Germany's and Europe's sovereign digital future. The infrastructure will be developed over 12 years and continuously updated. The total planned investment in SLICES-DE is €97 million.

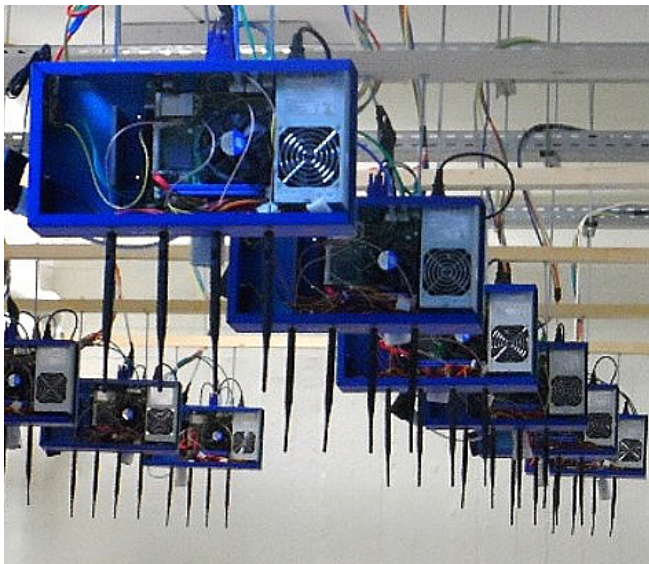
## GREEK NODE

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### **SLICES-GR: Experimental infrastructure for network, edge, and cloud systems**

The [SLICES-GR](#) node enables experimentation across the full networking, edge, cloud, and compute continuum, providing a unified environment for end-to-end, reproducible research at national scale. SLICES-GR is included in the national Greek infrastructure roadmap. It supports the design, deployment, and evaluation of advanced networking systems, ranging from programmable data planes and fully programmable radio access networks to edge services and distributed applications. The ecosystem within the Greek node allows a holistic view of the data lifecycle, from generation and transport to processing, storage and publishing.

SLICES-GR is developed and operated by the University of Thessaly, providing several deployments under different settings that cover several experimental needs. The deployment is the evolution of the [NITOS testbed](#), provided under different setups. The node is developed with the aim of serving the broader research and academic communities in telecommunications, networking, cloud and edge computing, and post-5G/6G systems. It offers unified access to heterogeneous resources, combined with configuration, orchestration, and measurement services, enabling controlled experimentation under realistic conditions.



**Nodes for wireless network experimentation at the Greek node - Credit: NITLAB, University of Thessaly.**

## HUNGARIAN NODE

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### **SLICES-HU: Supporting research and innovation in the field of cutting-edge digital technologies**

The [SLICES-HU](#) node was established under the leadership of the HUN-REN SZTAKI research institute. As one of the most successful and longest-standing members of the Hungarian research network, it has been conducting internationally recognised, high-quality scientific research in the fields of automation and computer science for 60 years. In recent years, there has been an increasing focus on research on autonomous systems, advanced manufacturing technology, artificial intelligence, HPC, cloud computing, and quantum computing.

SLICES-HU node integrates the advanced [HUN-REN Cloud](#) computing infrastructure, created and operated by the institute, which is equipped with GPU accelerators and can be used easily, quickly, and in a user-friendly manner in a wide variety of application areas with the help of numerous ready-to-use reference architectures.

The node's further development plans include connecting the [ZalaZONE](#) experimental test track, which supports the development of autonomous vehicles. This infrastructure is one of the three most advanced autonomous vehicle test tracks in Europe.

## IRISH NODE

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### **SLICES-IE: AI-driven optical, wireless and sensing network testbed**

The [SLICES-IE](#) node, based on OpenIreland, provides a nation-wide testbed for exploring the convergence of wireless and optical technologies in next-generation networks. Based at Trinity College Dublin and affiliated with the ADAPT research centre on AI, the infrastructure features indoor and outdoor 5G deployments integrated with extensive optical transport capabilities across the Dublin region. The testbed combines ceiling-mounted USRP software-defined radio units, outdoor and indoor commercial ORAN small cells, connected to an optical network with over 1,700 km of reconfigurable optical fibre, ROADMs, amplifiers, and coherent transponders, all orchestrated through an open networking control plane.

SLICES-IE node distinguishes itself by integrating optical fibre sensing with classical communications, exploring their coexistence and convergence within the same infrastructure. The testbed's flexibility enables researchers to incorporate sensing and other emerging technologies into the network, allowing integration testing across both laboratory and outdoor field environments. Built entirely on open source software and open interfaces, the testbed enables researchers to dynamically reconfigure network topologies and conduct reproducible experiments across the complete protocol stack and over field-deployed fibre.

## ITALIAN NODE

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### **SLICES-IT: Supporting wide-scale B5G, edge-cloud, and IoT experimentation for the whole Italian community**

The [SLICES-IT](#) node enables research-oriented experimentation and industry-oriented test-before-invest activities over a nation-wide testbed covering the full spectrum of state-of-the-art related technologies, from B5G disaggregated infrastructures to cloud, from edge cloud nodes to quantum networking, from mobile rovers to

industrial IoT sensors and actuators. SLICES-IT is included in the national Italian infrastructure roadmap. Its nation-wide test-bed is provided by the collaboration of CNR, CNIT, and CINI, thus promoting its exploitation by the whole research community in Italy and, at the same time, facilitating access to the research skills of the entire network of CNR sites and CNIT/CINI-affiliated universities.

In addition to providing full support to wide-scale B5G/6G experimentation as other national nodes do, SLICES-IT specifically focuses on some specific verticalisations for the research infrastructure, including industrial IoT, manufacturing (including robotics, automation control, 3D printing, and XR applications), and logistics via mobile robots and AGVs. Also, because of these vertical domains, the national node has invested significant efforts in the ESFRI SLICES cloud continuum support.

## NORWEGIAN NODE

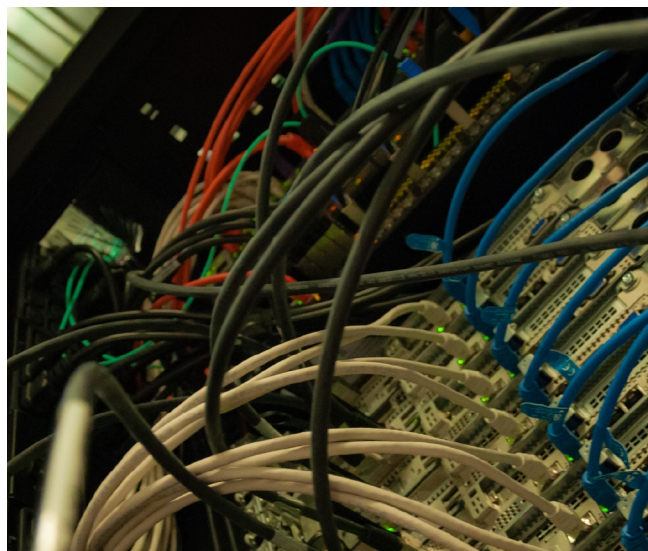
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### **SLICES-NO: Providing hands-on experimentation with state-of-the-art HPC and QC technologies**

The [SLICES-NO](#) node, based partially on [eX3](#), which has since 2018 offered HPC and AI researchers access to an extremely heterogeneous collection of CPU and GPU processors from vendors like Intel, AMD, ARM and NVIDIA, as well as vastly different interconnect technologies. This has allowed hands-on experimentation with hardware configurations and software optimisations that are not possible in a production environment, thereby providing a complement to the more standard HPC systems available to Norwegian researchers. The Norwegian node is included in the national Norwegian infrastructure roadmap.

Moreover, the infrastructure provides access to beyond-GPU computing in terms of FPGAs, neuromorphic processors and massively parallel processors originally designed for AI workloads, such as Intel Habana and Graphcore chips. In 2025, it was extended to become a national gateway for accessing the VLQ quantum computer in Czechia, built by the LUMI-Q consortium and co-funded by EuroHPC.

Pending the outcome of a current proposal for funding, the plan is to renew the central resources in the current platform and extend the infrastructures to include five national nodes via wide area networking and further to the extreme edge. This updated RI would then be a natural basis for the Norwegian node in SLICES.



Norway Node Simula eX3 networking - Credit: Simula research Laboratory.



Norway Node Simula eX3 servers - Credit: Simula research Laboratory.

## POLISH NODE

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### **SLICES-PL: Poland at the heart of Europe's digital research infrastructure**

The [SLICES-PL](#) node is created by five Polish research centres and universities, with the

geographical dispersion and distributed nature of research services being of great importance to the recipients of the project results.



Polish node 5G laboratory - Credit: Maksymilian Furmann, PCSS.



Polish node data centre - Credit: mapadotacji.gov.pl, Mapa Dotacji.

The SLICES-PL node is equipped with modern network, sensor and computing components, including edge devices, as well as software for managing experiments in a distributed infrastructure. SLICES-PL works closely with the national PL5G consortium, which enables optimal use of existing facilities and provides Polish researchers and entrepreneurs access to resources for research into future technologies, such as beyond 5G, artificial intelligence, federated learning, edge-cloud processing and data security. SLICES-PL enables the implementation of European-wide research scenarios and offers unique tools supporting the development of innovation on an international scale.

## SPANISH NODE

### SLICES-ES: Pushing Spanish competitiveness through networking research

The **SLICES-ES** node serves as the premier Spanish gateway to the European SLICES RI, synergising the expertise of the SLICES-ES/Madrid and SLICES-ES/Euskadi sites. This powerhouse consortium is fuelled by five of Spain's leading research institutions—IMDEA Networks, UC3M, EHU, UC, UM, and UNIZAR – and bolstered by SCITEL (the Scientific Society on Telematics). As a high-performance catalyst for digital transformation, SLICES-ES spearheads experimental research in frontier domains: AI-native networking, Quantum communications, Integrated Sensing and Communications (ISAC), and satellite-driven IoT. By providing the scientific community with an elite suite of top-notch, large-scale experimental tools, the node enables researchers to push the boundaries of what's possible in 6G and beyond. SLICES-ES is not just an infrastructure; it is an innovation engine designed to accelerate the next generation of resilient, intelligent, and hyper-connected global networks.



Spanish node panorama CFAA - Credit: Eduardo Jacob, EHU.



Testbed for software defined radio and channel emulation - Credit: Pablo Picazo, UC3M.

# SWISS NODE

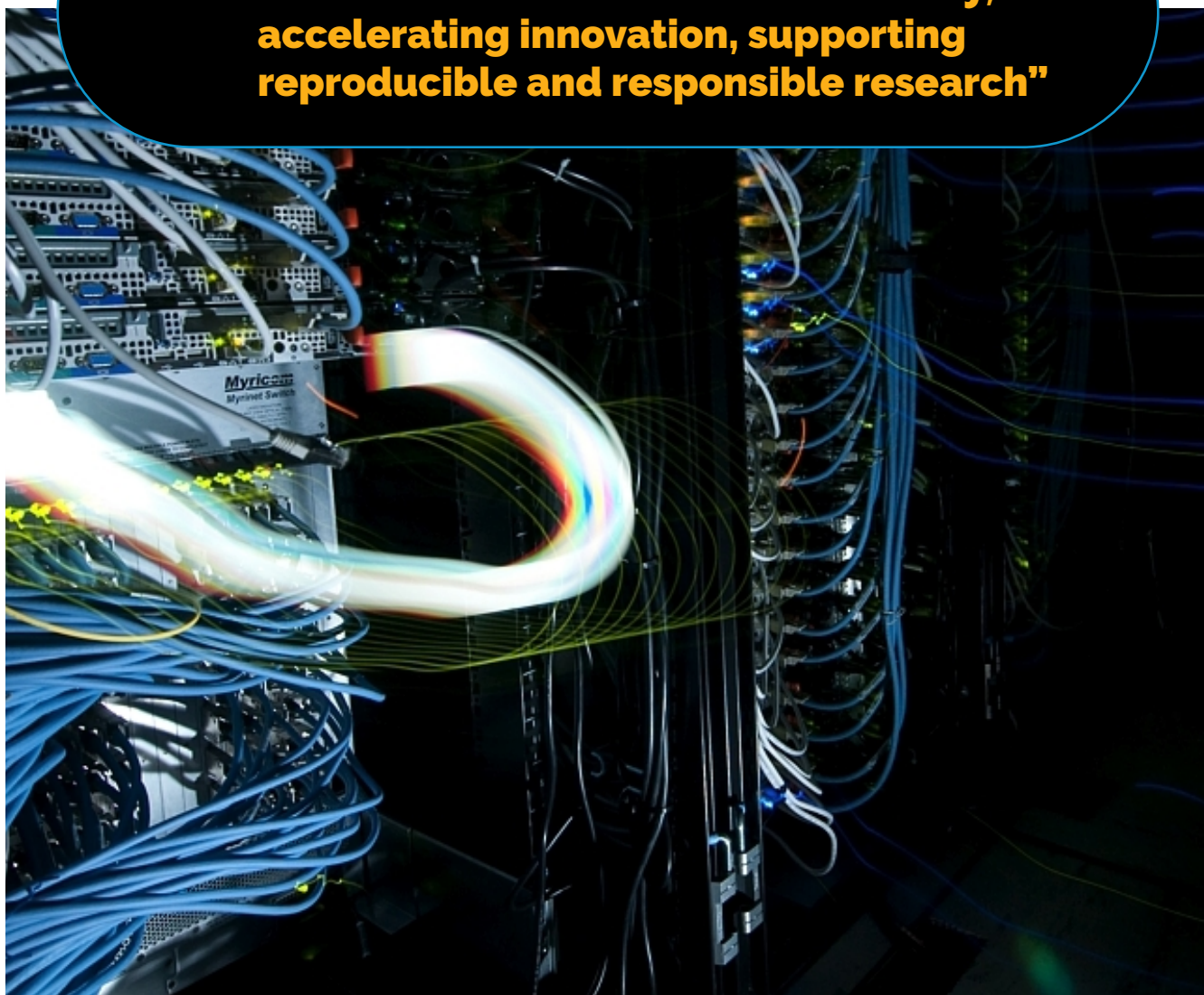
## SLICES-CH: ICT research in the heart of the Alps

The [SLICES-CH](#) node, included in the national Swiss infrastructure roadmap, gathers around ten organisations very active in ICT Research and Development in Switzerland, and is currently in phase of construction. One of the objectives of the Swiss node is to increase the cooperation and the mutualisation of the Research Infrastructure resources at the Swiss national level and to expose

them to the other European nodes of the SLICES Research Infrastructure.

The SLICES-CH Research Infrastructure supports international cooperation, in particular standardisation with the Standards Development Organisations (SDOs) based in Geneva. An important aspect addressed by the Swiss node is data management and protection. The SLICES-CH Research Infrastructure specialises in Internet of Things (IoT) across different domains such as smart cities, smart energy and eHealth, and will allow the creation of experiments dedicated to the interoperability and the integration of IoT devices and other connected systems.

**“ This collaborative framework aims to serve the entire research community, accelerating innovation, supporting reproducible and responsible research”**



Server room at the French Node - Credit: Inria, Kaksonen.

“**By equipping the scientific community with a state-of-the-art suite of large-scale experiment oriented services, SLICES-RI enables researchers to break new ground in digital infrastructures”**

## CONCLUSION

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With the construction of its national and European nodes underway, SLICES-RI is set to become a landmark infrastructure for large-scale digital experimentation. By bringing together diverse platforms, expertise, and scientific communities, it offers researchers a unique environment to explore the full IoT–Networks–Cloud–HPC continuum.

The different nodes presented here illustrate the project's breadth and ambition, built on experience gained on operational platforms of varying types and scales while supporting reproducible, data-driven, and responsible research. The European project SLICES-IP, which will begin in the first half of 2026, will guide the next phase of SLICES-RI implementation, building on the outcomes and results achieved during the Horizon Europe SLICES-PP project.

The official establishment of SLICES-RI is planned for 2027, providing a more structured framework for its future development. Beyond the technical capabilities, SLICES-RI fosters collaboration across countries and disciplines, enabling innovation that addresses Europe's evolving digital research challenges.



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