

# SLICES National Roadshow

## SLICES Research Infrastructure

[www.slices-ri.eu](http://www.slices-ri.eu)

Serge Fdida, SLICES coordinator

3 October 2023

SLICES Spanish National Roadshow



Strategy Report on Research Infrastructures

# ROADMAP 2021

# 6G Research Infrastructures?





# *Research Infrastructures as a Scientific Instrument*

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**MAKING SCIENCE HAPPEN**  
A new ambition for Research Infrastructures in the European Research Area

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<http://www.esfri.eu/>



# From mid-Scale (~100M€) to Large-Scale (~B€)



ESFRI

## MAKING SCIENCE HAPPEN

A new ambition for Research Infrastructures in the European Research Area



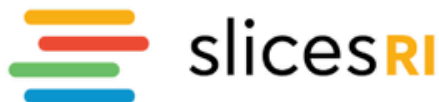
## The European ESFRI framework

European Strategy Forum on Research Infrastructures

Supporting a scientific methodology

Joint investment strategy between EU and Member States

<http://www.esfri.eu/>



# SLICES, first in digital sciences to entered the ESFRI Roadmap 2021



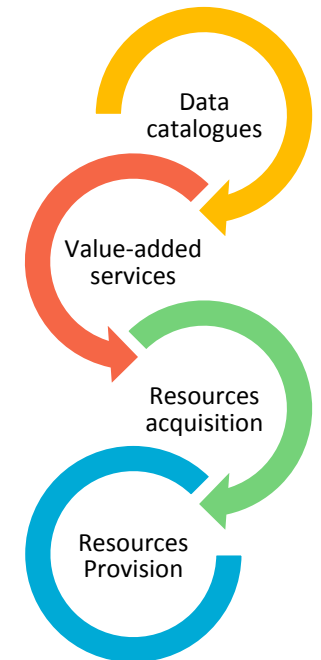
Strategy Report on Research Infrastructures  
**ROADMAP 2021**



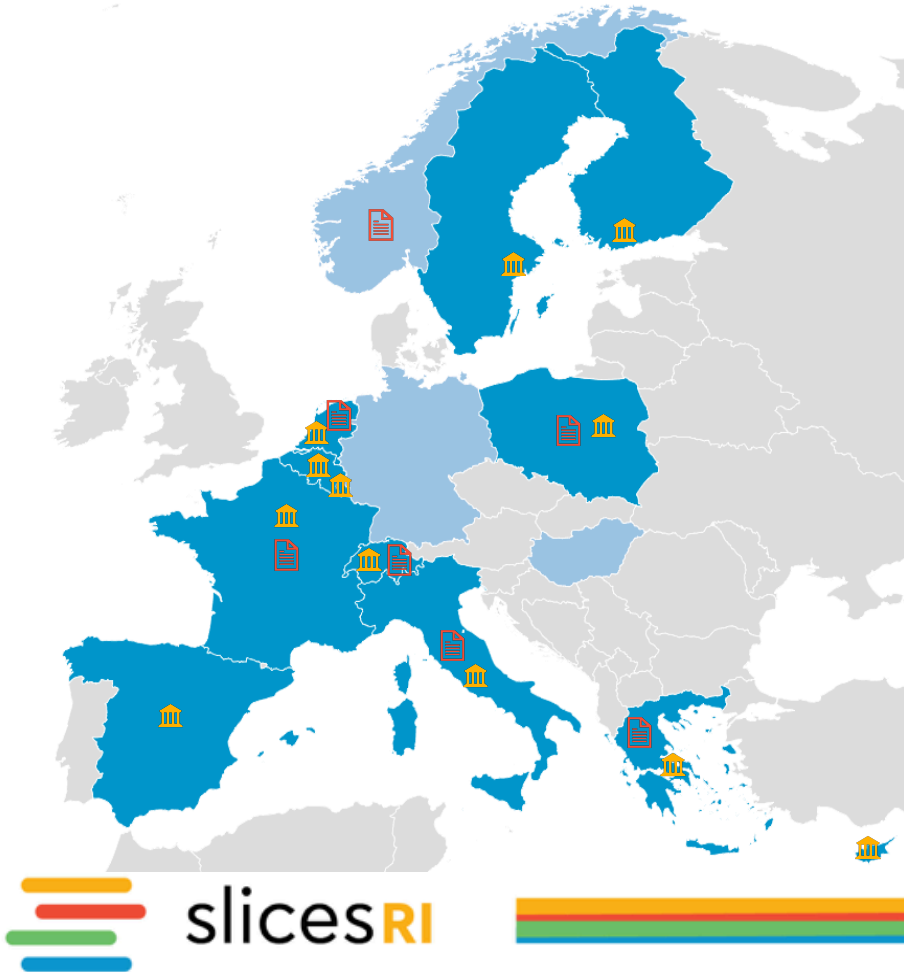
## what we offer

- Launched in 2017, **SLICES** is an **RI** to support the **academic and industrial research community** that will design, develop and deploy the **Next Generation of Digital Infrastructures**:
  - **SLICES-RI** is a **distributed RI** providing several **specialized instruments** on challenging research areas of Digital Infrastructures, by **aggregating** networking, computing and storage **resources** across countries, nodes and sites.
  - **Scientific domains**: networking protocols, radio technologies, services, data collection, parallel and distributed computing and in particular cloud and edge-based computing architectures and services.

[www.slices-ri.eu](http://www.slices-ri.eu)



# SLICES for research on Digital Infrastructures



Initiated in 2017, **25 partners** from 15 countries:

- **12 political support** from National Ministries 🏛️
- included in **7 national roadmaps** 📄

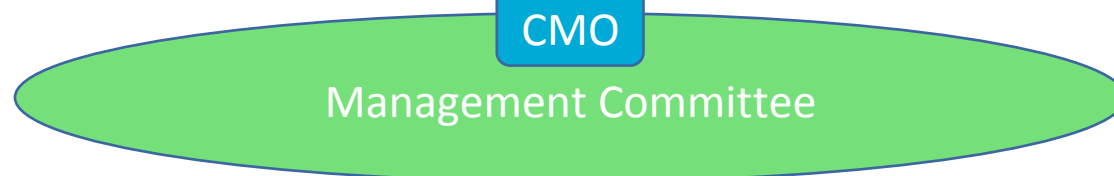
SLICES will enable **scientific excellence and breakthrough** and will **foster innovation in the ICT domain**, strengthening the **impact of European research**, while contributing to European agenda to address **societal challenges**, and in particular, the twin transition to a sustainable and digital economy.

# SLICES is a distributed RI

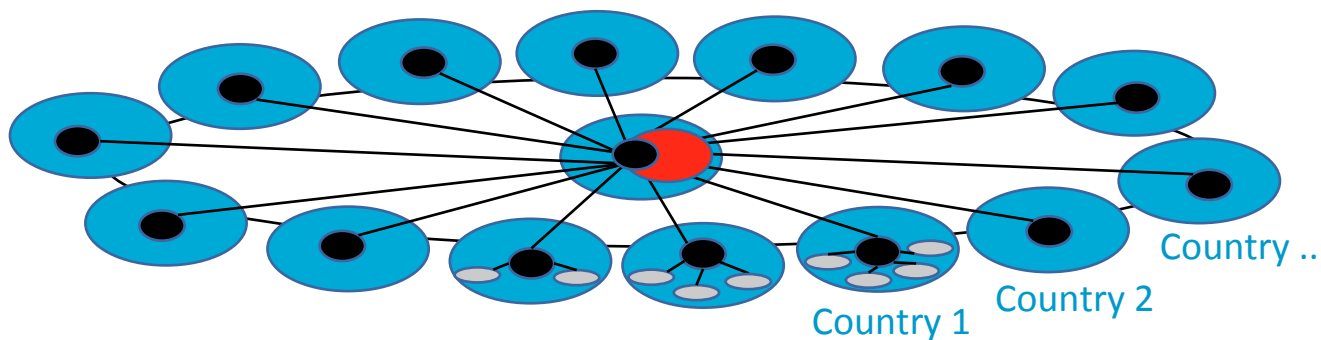
**Centralised  
governance: ERIC**

Supervisory  
Board

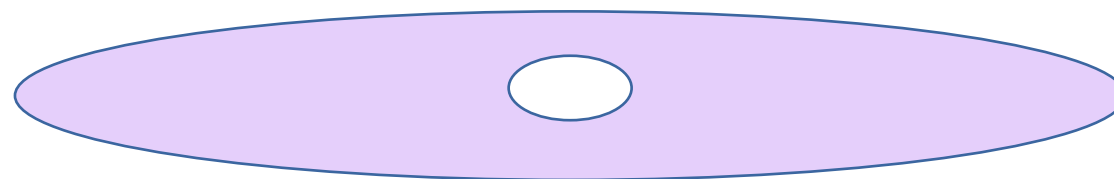
↓  
CMO



**Distributed  
Infrastructure**



**Single entry  
point, single  
access policy**

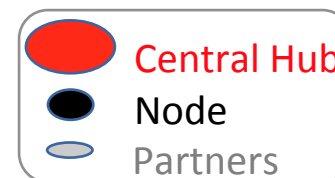


Users

Joint investment strategy

Decisions on new nodes

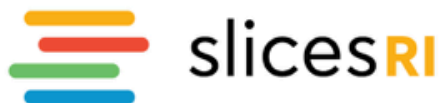
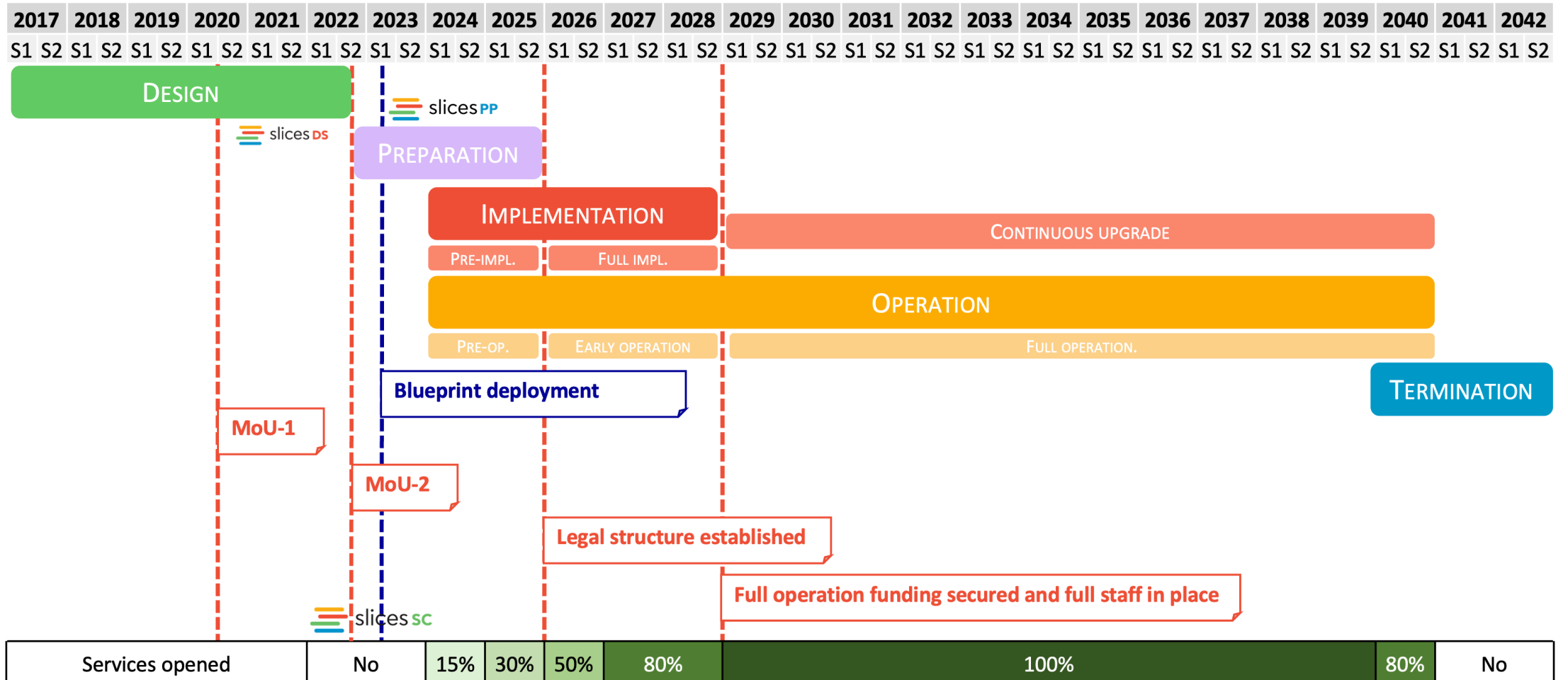
Decisions on core functions  
and data centre



Optimize the distribution  
of resources according to  
needs and competences:  
control plane, edge  
computing and slicing,  
terahertz, MIMO, ...

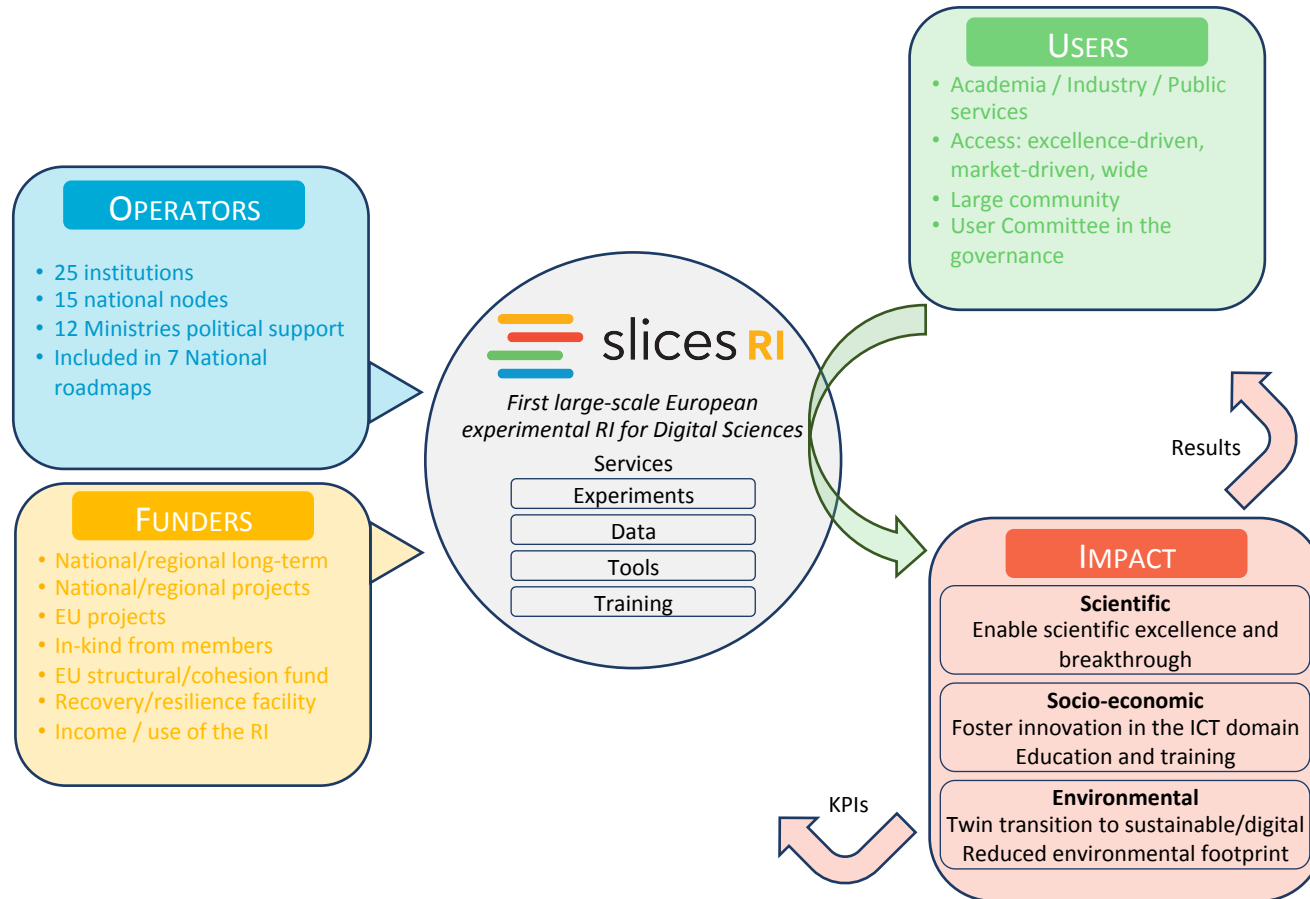


# SLICES timeline





# SLICES Business model



Category	The core sustainability Central Hub	The local sustainability National nodes
Main source of funding	<b>Member's fees</b>	<b>National and regional funding to support their node developments</b>
Other sources of funding	Host Premium, partly in cash and partly in-kind	EU projects and all other sources
Key aspects	ISB discussions will allow to list the countries that wish to commit to funding the SLICES-ERIC for the first 5-year period	Importance to be listed on the National RI Roadmap or other strategies
	Based on commitment to contribute to the Core Budget during renewable 5-year periods or budgetary cycles to provide the SLICES-ERIC with medium-term funding continuity	Centrally coordinated by the ISB (vision, investment plans, etc.) for stronger impact
	Provide all funders at National and EU level, with regular KPIs updates of the impact in order to demonstrate the importance of the SLICES-RI	



# SLICES leverages access to national funding



## ***SLICES on the ESFRI Roadmap 2021*** (indicative)

- ***Belgium (Flanders):*** 1.6M€, 2023-2026
- ***Finland:*** 6.2M€, 2022-2025
- ***France:*** 15M€, 2022-2028, PEPR Cloud – PEPR 5G
- ***Italy:*** 5.6M€, 2022-2025, +
- ***Poland:*** 6M€, 2021-2025 years, +
- ***Spain:*** ...



# SLICES family projects

- **SLICES-DS**

- Title: Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies - Design Study
- Duration: 24 months
- Date: 01/09/2020 - 31/08/2022
- Budget: 2,914,175.00 €



- **SLICES-SC**

- Title: Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies - Starting Community
- Duration: 36 months
- Date: 01/03/2021 - 29/02/2024
- Budget: 4,998,986.25 €



- **SLICES-PP**

- Title: Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies - Preparatory Phase
- Duration: 40 months
- Date: 01/09/2022 - 31/12/2025
- Budget: 2,999,591.25 €

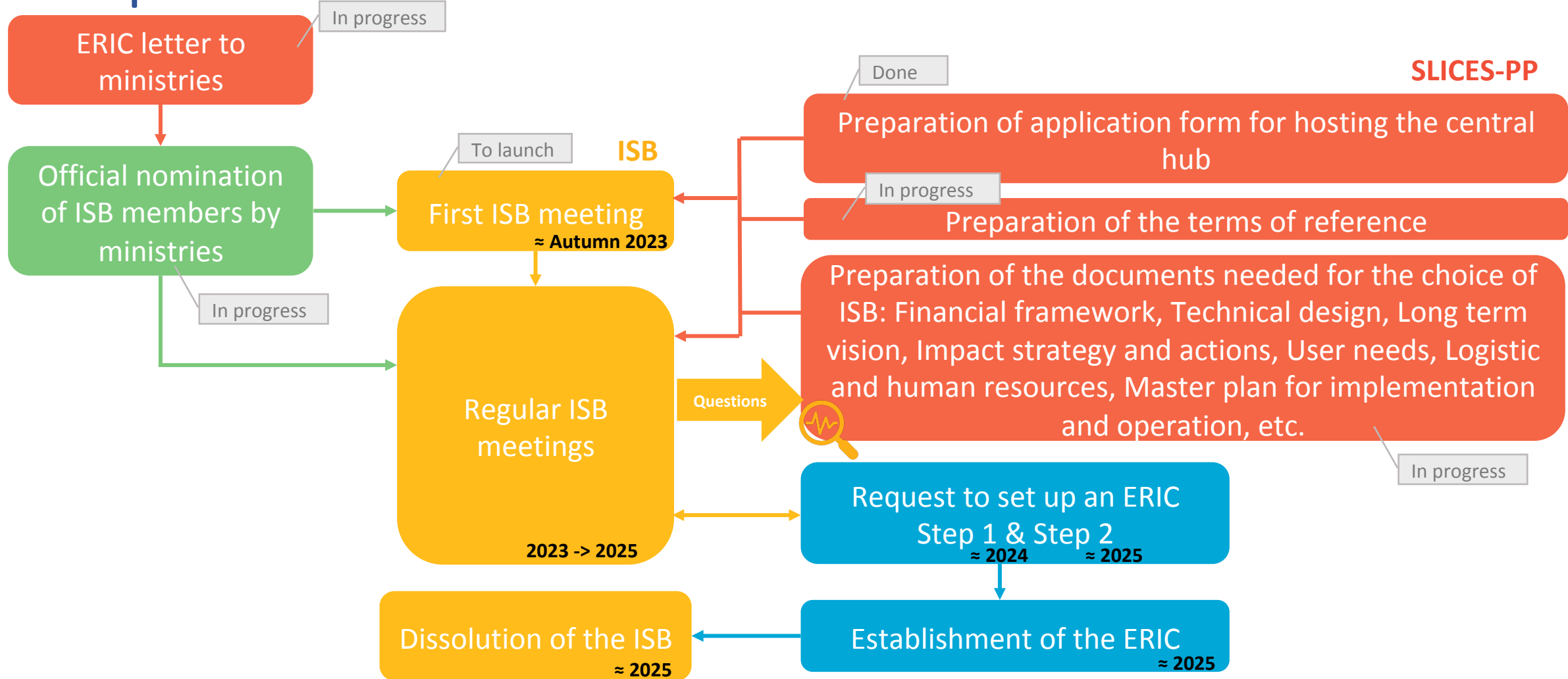


# SLICES – complementary funding

- **CONVERGE - Telecommunications and Computer Vision Convergence Tools for Research Infrastructures** (*Coord.: INESC TEC*)
  - Call: HORIZON-INFRA-2022-TECH-01
  - Date & duration: 01 Feb. 2023 – 31 Jan. 2026 (36 months)
  - EC grant: 8,025,202.75 €
- **SUNRISE-6G - Sustainable federation of Research Infrastructures for Scaling-up Experimentation in 6G** (*Coord.: ISI/ATH*)
  - Call: HORIZON-JU-SNS-2023-STREAM-C-01-01
  - Date & duration: 01 Jan. 2024 – 31 Dec. 2026 (36 months)
  - EC grant: 13,120,676.76 €
- **6G-XCEL - 6G Trans-Continental Edge Learning** (*Coord.: TCD*)
  - Call: HORIZON-JU-SNS-2023-STREAM-B-01-06
  - Date & duration: 01 Jan. 2024 – 31 Dec. 2026 (36 months)
  - EC grant: 2,994,474.25 €
- **GreenDIGIT - Greener Future Digital Research Infrastructures** (*Coord.: UvA*)
  - Call: HORIZON-INFRA-2023-TECH-01-01
  - Date & duration: 01 Mar. 2024 – 28 Feb. 2027 (36 months)
  - EC grant: 4,938,972.50 €

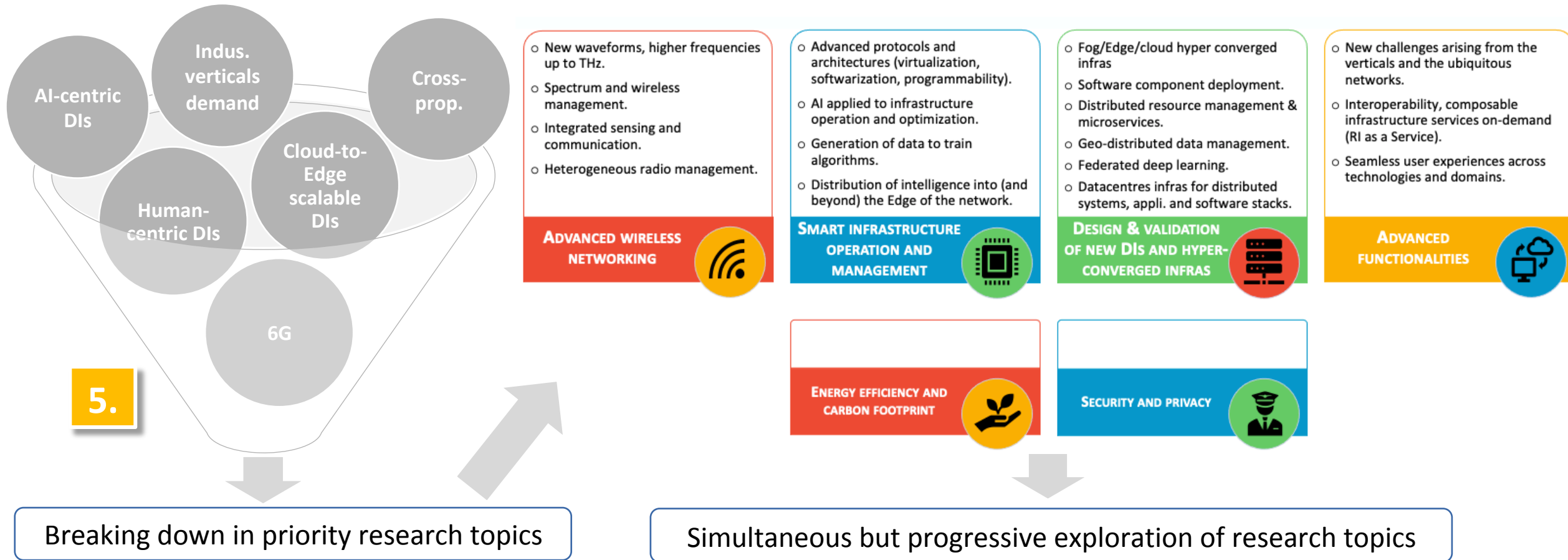


# Steps for ERIC establishment



# Prioritisation of research topics

What's the methodology behind it?



# SLICES and EOSC Interoperability and Integration

EOSC: European Open Science Cloud

<https://eosc-portal.eu/>

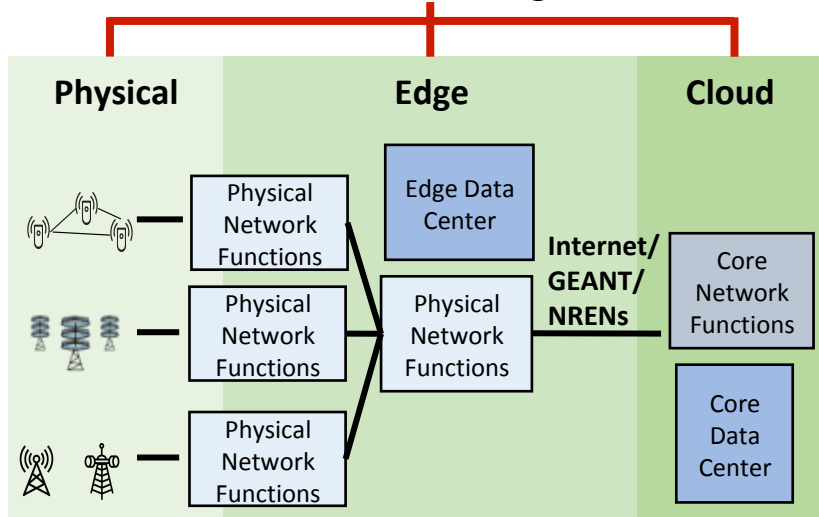


# SLICES contribution to the development of the EOSC



Objectives: **federate existing research data infrastructures in Europe** and **realise a web of FAIR data and related services for science.**

## #1 Enable experimentation at multiple network levels through SLICES RI



Allow experimentation with future/emerging digital, IT and network technologies (e.g., 6G, IoT, Edge, AI, hyper-converged infrastructure).

## #2 EU-wide availability of unique Software and App Repositories

- ICT research-related services (e.g., testing new infrastructure and network solutions);
- Applications deployed within SLICES;
- Simulation tools;
- Data analysis tools.

Published in the EOSC Catalog and Marketplace and accessible with different access options.



## #3 Interoperability with Open and FAIR data

- Producers of unique data;
- Maximize data reuse by adopting of FAIR data principles in Data Management and Governance;
- Processing of sensitive and personal information.

## #4 Integration of the SLICES communities to EOSC

- SLICES community building
  - More than 120 participants to the 1<sup>st</sup> SLICES workshop;
  - Thousands of users of existing infrastructures.
- Training services





# SLICES Reproducible Experiment Workflow

# Reproducibility-as-a-Service

How can we limit the effort spent on reproducibility?

- Reduce amount of work for experimenters to create reproducible experiments
- Reduce amount of work for other researchers to recreate experiments
- Make reproducibility an integral part of experiment design
- Automate entire experiment (setup, execution, evaluation)

How can we create robust, reproducible experiments?

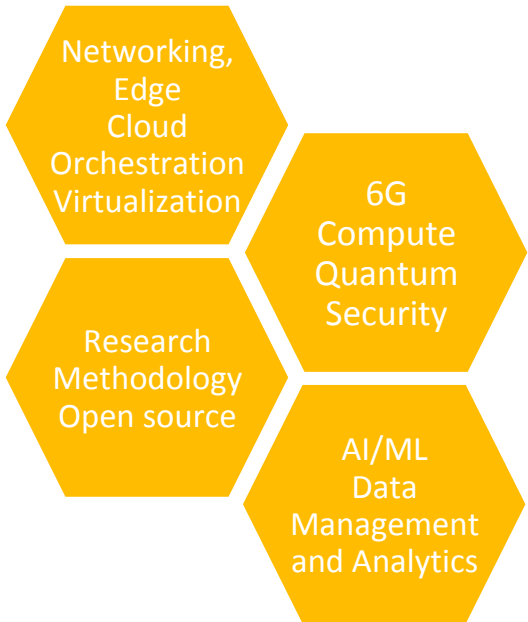
- Document all relevant parameters for experiments
- Automate the documentation of experiments
- Well-structured experiment workflow serving as documentation



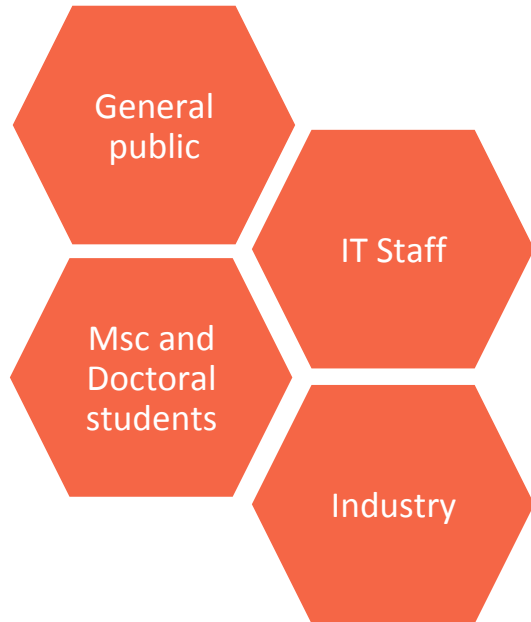
# SLICES Academy

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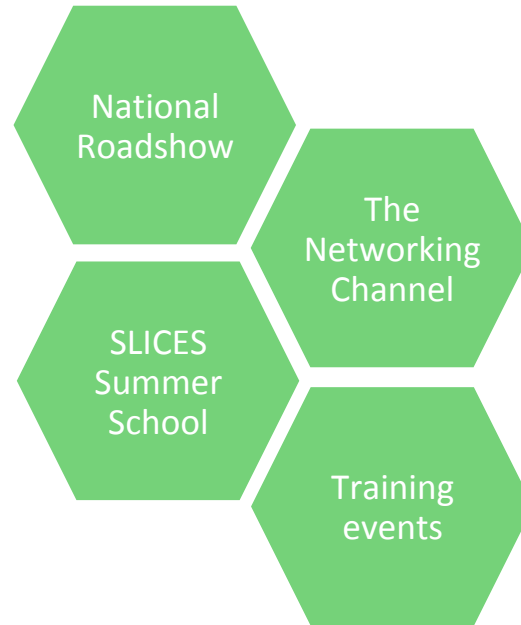
## Skills



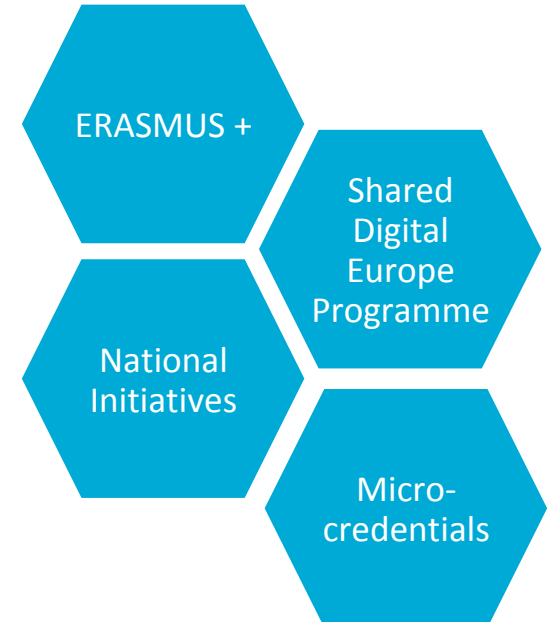
## Audience



## Tools



## Funding



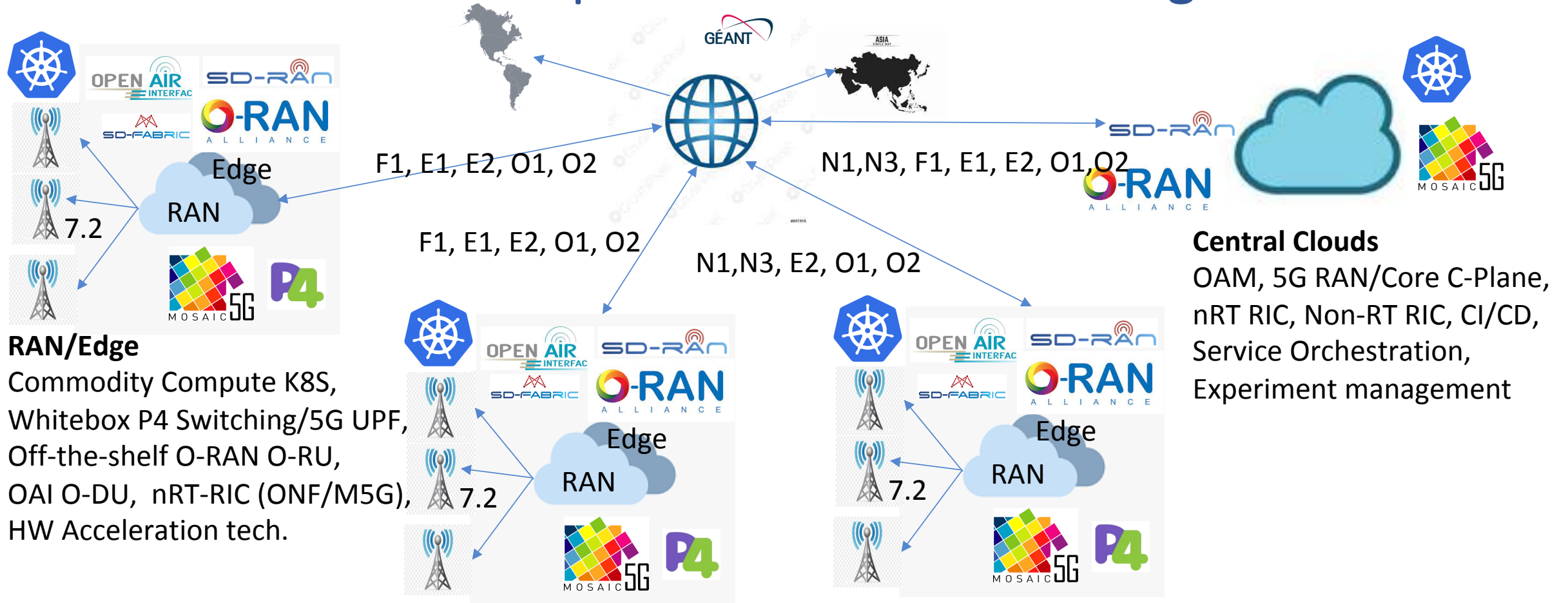


# SLICES BluePrint

# SLICES Blueprint

- Evolve beyond 5G using **open** 5G technologies on large-scale end-to-end platforms,
- **Disaggregated** post5G RAN and Core with **cloud-native** deployment
- **Multi**-site, -tenancy and -management deployment
- Enable many types of **user perspective** experiments
- Documented blueprint, common software/hardware base, **fine-grain automatic control**

# SLICES-RI PoC Blueprint – post5G Cloud-Edge



## RAN/Edge

Commodity Compute K8S,  
Whitebox P4 Switching/5G UPF,  
Off-the-shelf O-RAN O-RU,  
OAI O-DU, nRT-RIC (ONF/M5G),  
HW Acceleration tech.

## Central Clouds

OAM, 5G RAN/Core C-Plane,  
nRT RIC, Non-RT RIC, CI/CD,  
Service Orchestration,  
Experiment management

# SLICES Blueprint

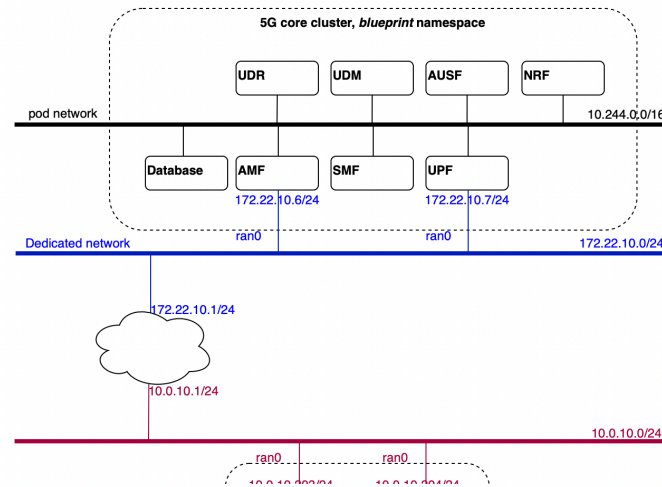
This documentation describes the SLICES blueprint. Historically blueprints were used to produce unlimited numbers of accurate copies of plans. For SLICES, the concept is taken to allow each site to reproduce software and hardware architectures on the SLICES sites and nodes. The SLICES blueprint targets testbed owners and operators, it is not intended to be used by experimenters or testbed users. The blueprint is an way to eventually reach a unified architecture between sites and nodes composing SLICES and easily onboard members to fields of research that may not be their core business and so learn about the needs and best practices to make SLICES a success.

With the blueprint, sites are able to deploy and operate partial or full 5G networks, with simulated and/or hardware components.

The blueprint is designed in a modular way such that one can either deploy it fully or only partially. For example, people only interested in 5G can only deploy the core and use a simulated RAN while people interested only by the RAN can just deploy a RAN, assuming they have access to a core (e.g., via the SLICE central node or another partner). Advanced users may even deploy a core and connect it with multiple RANs.

## Architecture

In this blueprint, the core and RAN are implemented with OpenAirInterface (see <https://gitlab.eurecom.fr/oai/cn5g/oai-cn5g-fed> for details) that are deployed in kubernetes clusters that can be remotely connected as shown in the figure below.



```

---
# 5G config
GCN:
  namespace: blueprint
  core:
    present: true
    custom_files: blueprint/files
    custom_values: blueprint/values
  
```

Assuming this file is called `params.5g.yaml`, then the core is deployed with the following command:

```
ansible-playbook -i inventories/blueprint/ 5g.yaml --extra-vars "@params.5g.yaml"
```

After running this command, the 5G core is deployed in the `blueprint` namespace of the kubernetes cluster.

<> Code Issues 14 Pull requests 1 Actions Projects Wiki Security Insights Settings

### Code

main + 🔍  
Go to file t

- > .devcontainer
- > Automation
- > SONIC
- > docs
- > edge-core
- > intel\_connectivity\_research\_pr...
- > k8s
- > oai5g
- ✓ sopnode
  - > DHCP
  - > aether
  - ▼ ansible
    - > collections
    - > files/chassis\_config
    - > inventories
    - > misc/ssh
    - > roles
    - 5g.yaml
    - 5g\_test.yaml
    - Dockerfile
    - README.md
    - container.yaml
    - dummy.yaml

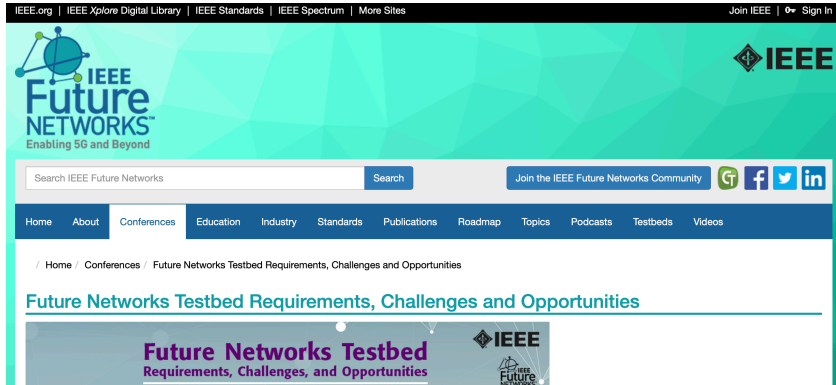
### SLICES / sopnode / ansible /

dsaucez ramdisk optional

Name	Last commit message
..	
collections	ansible-collection
files/chassis_config	sopnode-z1
inventories	Configuration working for UTH for setting up the
misc/ssh	slow environments
roles	ramdisk optional
5g.yaml	support Linux rocky 9
5g_test.yaml	5g UE testing
Dockerfile	shorter
README.md	apiserver_advertise_address
container.yaml	support containers
dummy.yaml	read params
fabric-switch.yaml	distinguish compute and switch resources
fabric.yaml	temporary workaround for #21
k8s-master.yaml	partial support of Linux rocky 9
k8s-node.yaml	partial support of Linux rocky 9
k8s-ready.yaml	cluster must be ready
network.yaml	network aliases from netbox



# Establishing SLICES as a transformative initiative



## General Assembly

CET	13th December	
09:30	Welcome, opening of the meeting	Rui Aguiar
09:40	Elections process - last call for voting + overview of membership	Uwe Herzog
09:50	<u>NetworldEurope</u> Brief overview of 2022	Rui Aguiar
10:05	The SLICES ESFRI infrastructure	Serge Fdida ←
10:25	The German 6G Initiative	Hans Schotten
10:45	Coffee Break (virtual)	
11:05	HE programme and SNS call 1 results	Peter Stuckman
11:35	6G IA - SNS upcoming workprogram	Colin Willcock
12:05	The Hexa-X view on 6G networks	Mikko Uusitalo
12:25	Lunch break (also virtual)	
13:25	Overview of the different WGs	Jacques Magen, Ari Pouttu, Tomaso de Cola, Maziar Nekovee
14:05	The SRIA 2022 presentation	Ari Pouttu
14:25	Steering board election announcements	Uwe Herzog



## Beyond 5G Japan

10:20~ (60min: 15min *4)	Subcommittee e① -R&D session-	Palazzo, Tsuru (West)	Open RAN	Beyond 5G advanced technology
			Mr. Alex Botting, ORPC (Open RAN Policy Coalition)	Mr. Hideyuki IWATA, TTC
			Mr. Nozomu Watanabe, NEC	Ms. Yuko HANADO, NICT
			Mr. Larry Peterson, Open Networking Foundation	Dr. Andreas Müller, Bosch
		→	Prof. Serge Fdida, University of Sorbonne of France	Mr. Kazunori Sakumoto, Fujitsu

SLICES Spanish National Roadshow, October 3, 2023

# SLICES USP and partnerships

***SLICES able to engage a large community***

*SLICES Infrastructure and open data*

*SLICES Academy*

***Stimulate cooperation with important stakeholders***

- *EU:* SNS program (Stream C)
- *USA:* NSF PAWR, ONF/Aether
- *Brazil:* RNP
- *O-RAN* NGRG



Thanks for your attention

Questions?

For more information, please contact:

Serge Fdida

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