

SLICES

European Scientific Large-Scale Infrastructure
for Computing/Communication Experimental
Studies

Presenter: Panayiotis Andreou, UCLan Cyprus, Larnaka, Cyprus

Coordinator: Serge Fdida, Sorbonne Université, France

GRP 2023

Lemesos, October 09, 2023

SLICES is a digital infrastructure

Supports experimental driven research

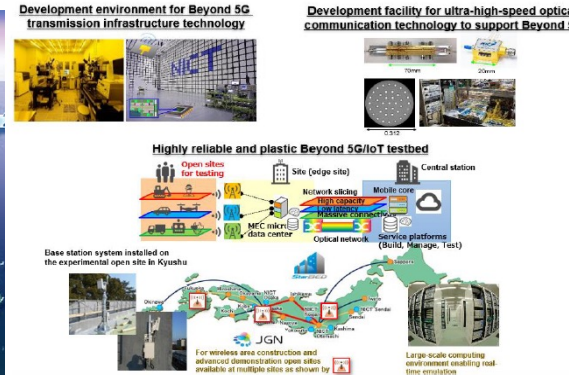
Fields (Digital Sciences):

- Networking, Data Science, IoT, Cloud/Edge
- flexible to support current and future research (e.g., 6G)

We are building upon past experience: e.g., PlanetLab, Orbit



Third generation Mid-Scale Test Platforms



USA NSF PAWR (Platforms for Advanced Wireless Research): NSF + Industry, 100M€, 2017-2022

NSF Fabric: NSF, 20 M€, 2019-2023

Colosseum: NSF-DARPA, 20+7,5M\$, 2017-2025.

BRIDGES: NSF, 2.5M€, 2020-2023

EU Horizon Europe
ICT 17-19-52, 2018-2022,
205 M€
SNS Stream C, first call,
2022-2025, 25M€

Japan NICT R&D
Shared Open Platform
200 M\$

China CENI
Chinese Experimental National
Infrastructure
2018-2022
190 M€

Better understanding of the need
More structured efforts



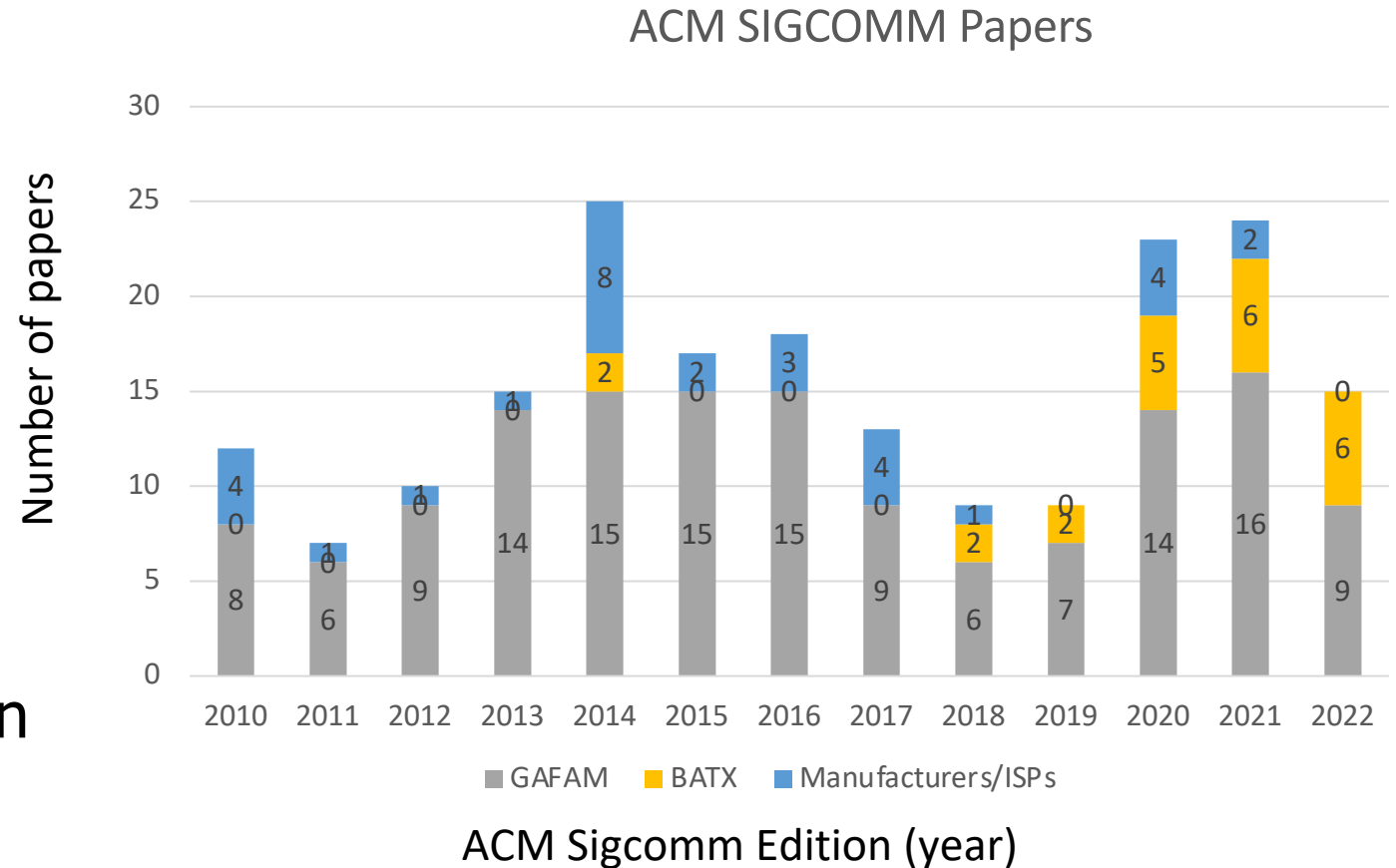
Important “competition” from the Tech Giants



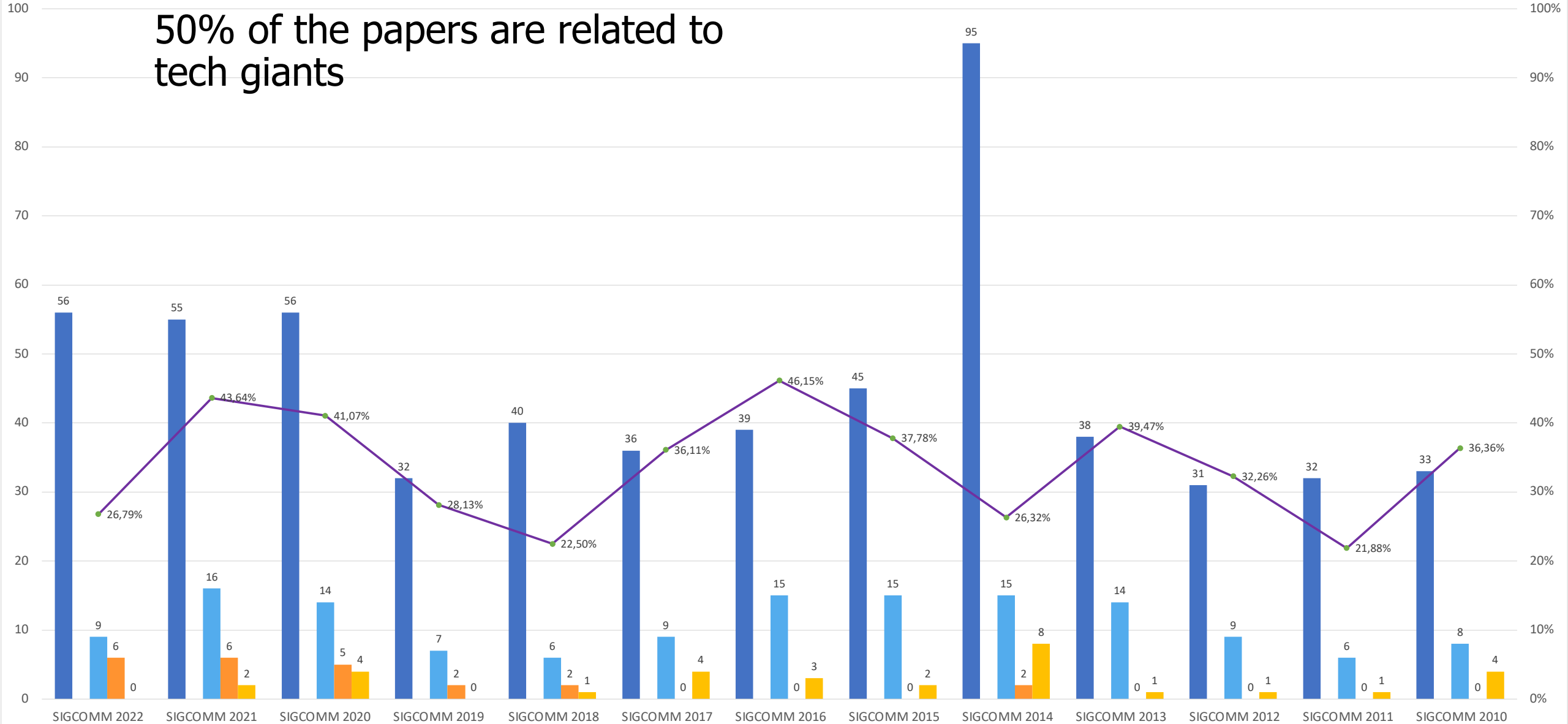
Large Scale Infrastructures to support the design and validation of systems



Analysis of ACM SigComm scientific publications from 2010



50% of the papers are related to tech giants



Why?

The need

Access to a very competitive instrument is an essential

Instruments allow for end-to-end experimentation

- Design, Develop, Deploy (scale), Test, Collect information
- Easier to convince reviewers

Europe needs to have access as a community to an instrument, interconnecting facilities, appropriate equipment, software, tools and data to **maintain competitiveness**



Lessons learned from past and present platforms

Previous and current generations are successful, strongly used but however,

- Mid-scale 100-300M
- Federation is not transformative (functionality focusing to support federation)
- Not sustainable (typically associated with project funding 2-3y)

Change the narrative

- Science driven (The full research life-cycle)
- Targetting much more ambition and sustainability



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



The European ESFRI framework

European Strategy Forum on Research Infrastructures

Supporting a scientific methodology

MAKING SCIENCE HAPPEN

A new ambition for Research Infrastructures in the European Research Area

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



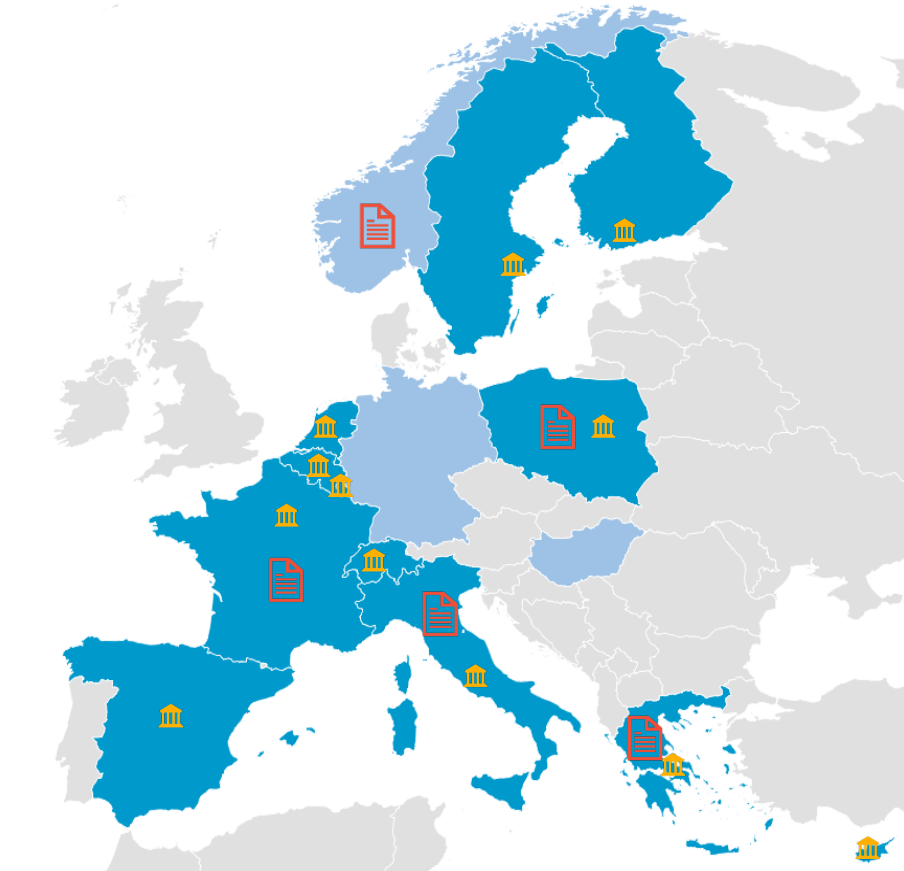
SLICES for research on Digital Infrastructures



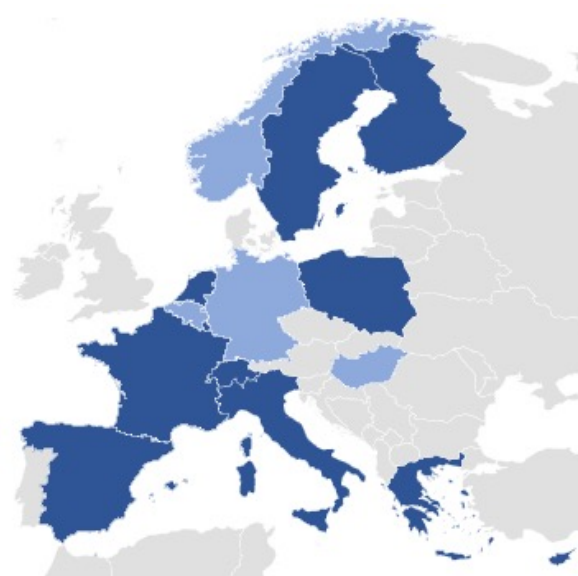
Initiated in 2017, **25 partners** from 15 countries:

- **12 political support** from National Ministries 🏛️
- included in **5 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.



Current status of the partnership



SLICES
ESFRI successful application – 2020



Countries	Government	Research and Academia		Industry	Clusters, networks and others	NRENs	Worldwide support
	National support	Partners	Support				
	<i>Local support confirmed</i>						

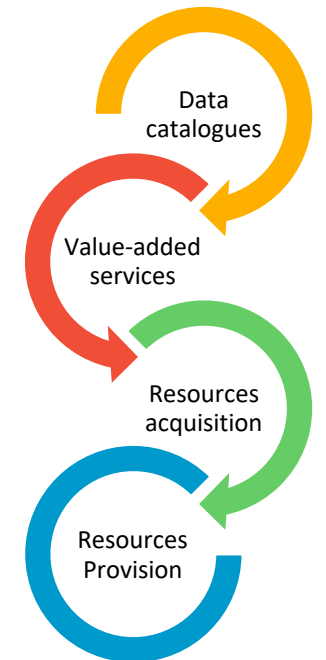
Core partners

SLICES, first in digital sciences to enter the ESFRI 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.
- **Main Challenges**: Fragmented platforms (specialized on specific network aspects), different language, different backgrounds, different methodology



www.slices-ri.eu



Fully Controllable, programmable Virtualized Digital Infrastructure Test Platform

Openness



SLICES is a distributed RI

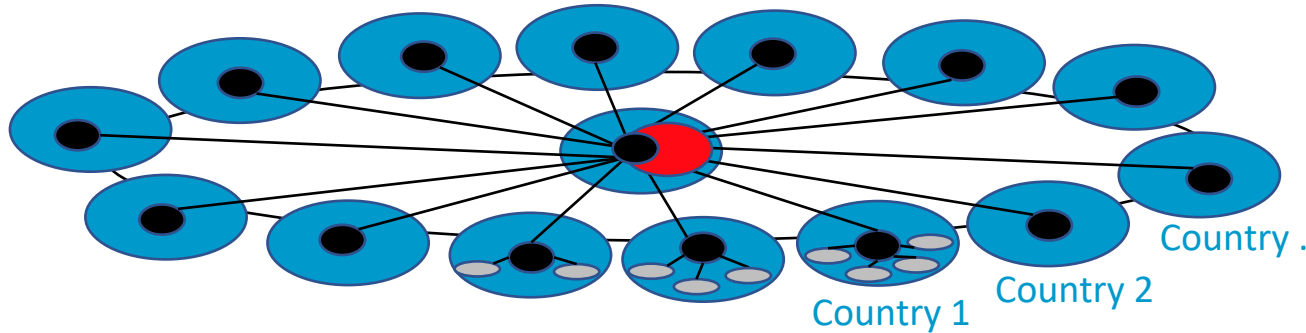
Centralised governance

Supervisory Board

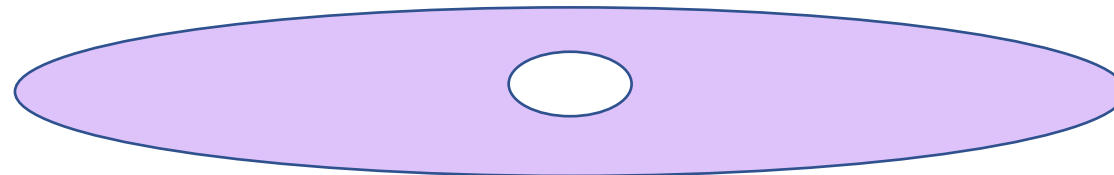
CMO

Management Committee

Distributed Infrastructure



Single entry point, single access policy



Users

Own Governance (ERIC legal structure)

Decisions on new nodes

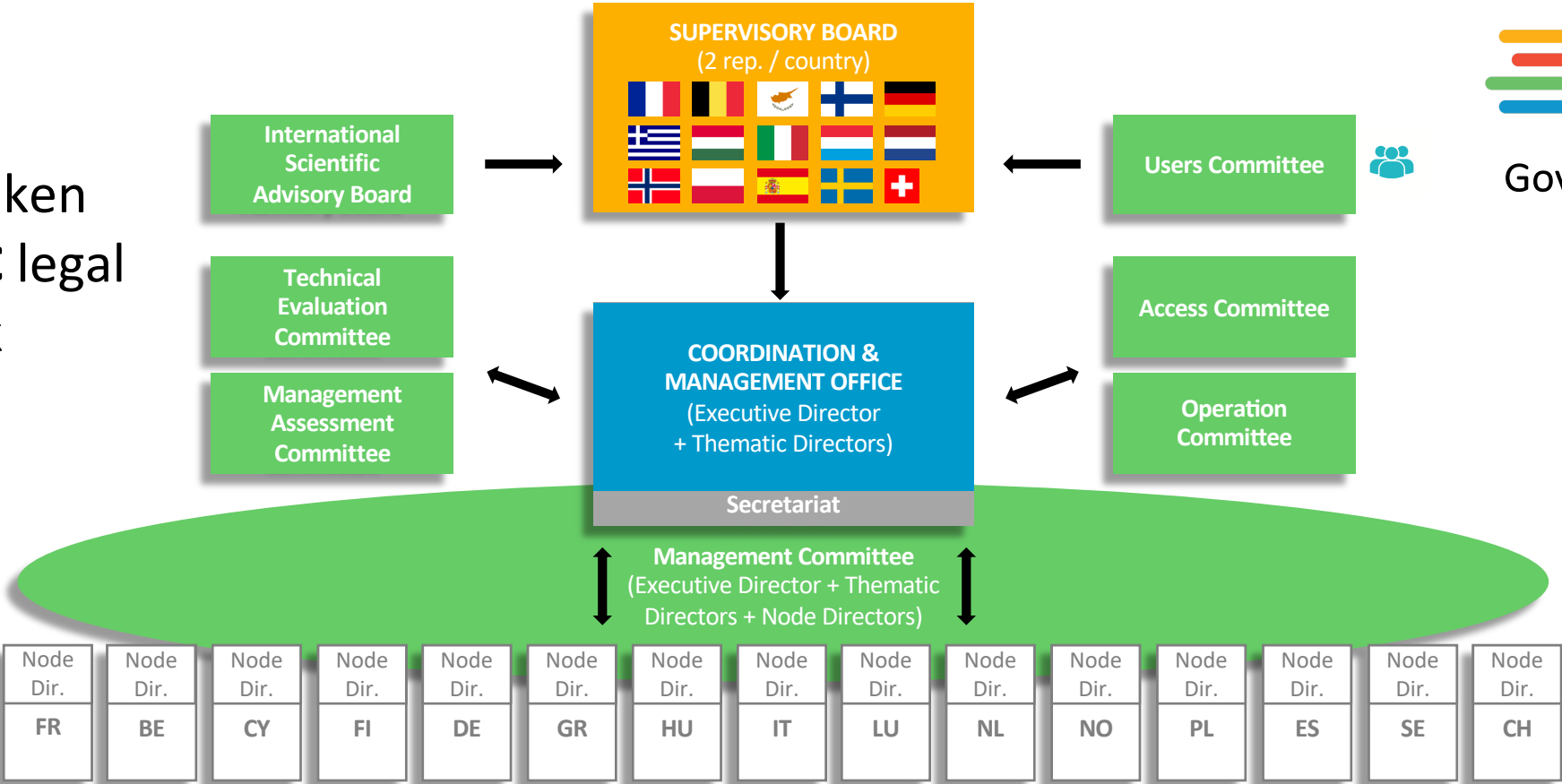
Decisions on core functions and data centre

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



End Design & Preparation - Q1 2022

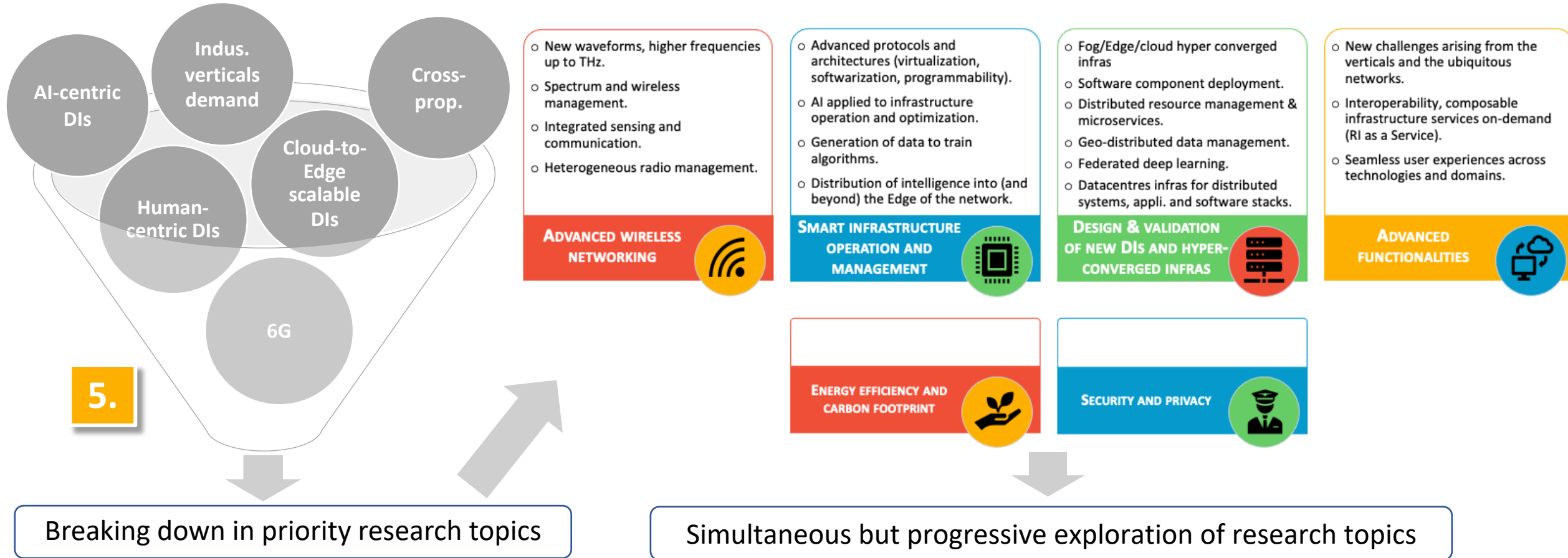
12/2022:
Decision taken for an **ERIC** legal framework



 **slices RI**
Governance structure

Prioritisation of research topics

What's the methodology behind it?



Open-source software for telecommunication

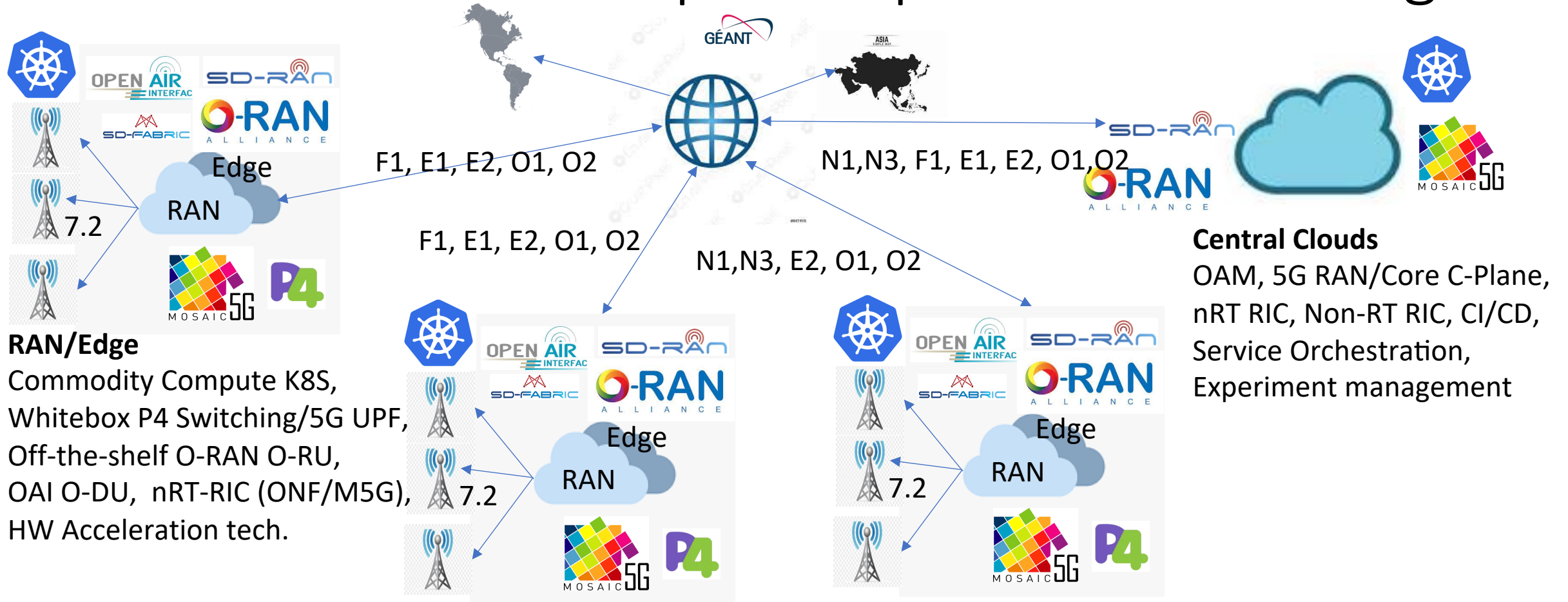
- Network disaggregation
- Vertical service integration and testing
- Software defined networks
- Low-level access to radio resources



Post5G Experimentation in SLICES-RI

- Short/Medium term
- Evolve around 5G using *open* 5G technologies on large-scale **end-to-end** platform
 - Multi cell-site and multi-region, common infrastructure “blueprints” across sites
 - Reproducible experiments and reusable/collaborative tools (HW/SW)
 - Align with SNS Streams C/D in EU and related national initiatives
 - Align with international academic initiatives (US, Japan, Brazil)
- Focus on technologies targeting integration of *disaggregated* post5G RAN and Core with cloud-native deployment framework
 - Reuse and contribute to open-source initiatives (OAI, ONF, LF)
 - Experiment with *fine-grain automatic control* of network functions
 - Contribute to O-RAN architecture evolution : EU/USA collaboration on blueprints
 - Integration of new applications on experimental post5G infrastructure (SNS C/D)

SLICES-RI PoC Blueprint – post5G Cloud-Edge



Roadmap

- **July 2023 - Initial PoC**
 - IEEE HPSR Tutorial (USA)
 - EUCNC demo
 - SLICES-SC Summer School tutorial
- **June 2023 - December 23 lessons / Deployment . Consolidation . Lessons learned**
 - Buildup of initial SLICES-RI post-5G sites (Targeting 6 countries – 10 physical sites)
 - Blueprint will provide input for planning new sites
 - Alignment with O-RAN NGRG platform activities and SNS Streams C/D
 - Alignment with other International activities (OpenRANGym, Japan, Brazil, 6G hubs in Germany)
- **January+ 2024 – SLICES-RI Pre-operation**
 - Development of required interfaces for SLICES-RI (portal, central cloud services, contribution to API development)
 - CD activities



Lessons learned

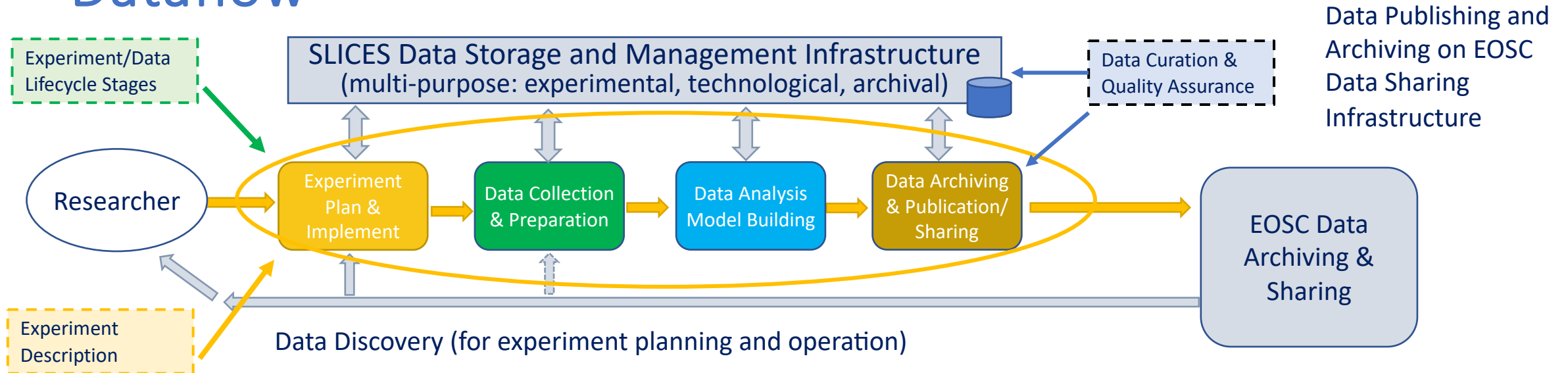
What is your scientific question?

No Reproducibility – No Science!

SLICES Full research lifecycle Open data & Reproducibility



SLICES Experimental Data Lifecycle Model and Dataflow



- **Each Data Lifecycle stage** – experiment, data collection, data analysis, and finally data archiving, works with own **data set**, which must be **linked**.
 - All data sets need to be stored and possibly re-used in later processes.
- Many experiments and research require already existing datasets that will be available in SLICES data repositories or can be obtained/discovered in EOSC data repositories

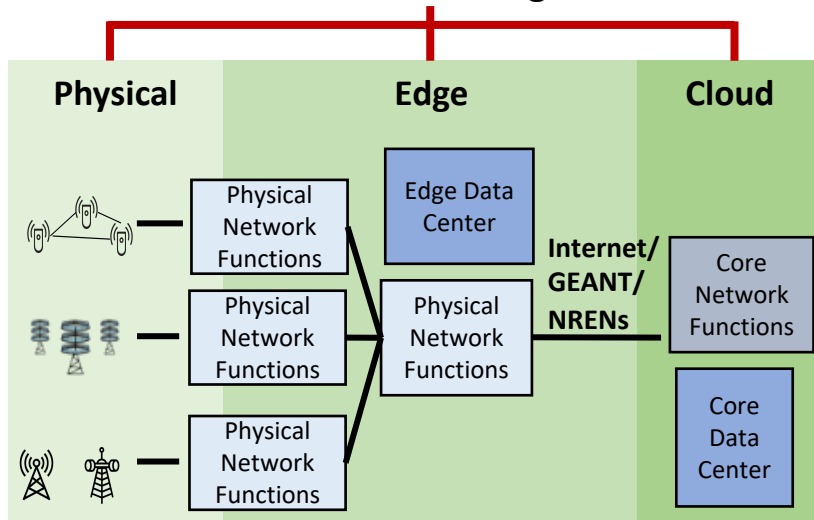
SLICES contribution to the development of the EOSC



EUROPEAN OPEN
SCIENCE CLOUD

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.



open access



Orderable via
provider channel



Orderable via
EOSC hub

#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 1st SLICES workshop;
 - Thousands of users of existing infrastructures.
- Training services



Thanks for your attention

Questions?

For more information, please contact:

Serge Fdida

serge.fdida@sorbonne-universite.fr



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