



SLICES

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



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3rd ESFRI Open Session
RIs and Big Data

June 30, 2022

Digital transformation, scientific challenges



A scalable, robust and safe **digital infrastructure**



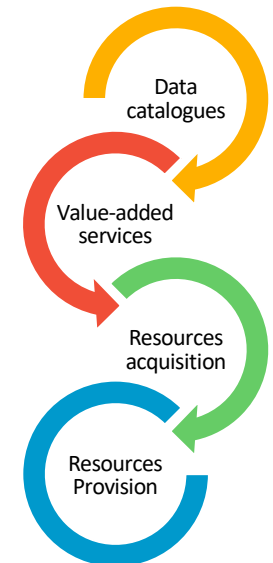
SLICES in a nutshell

- **Digital transformation** is at the heart of our society!
- There is **no** digital transformation **without digital infrastructures**.
- 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.

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what we offer



Fully Controllable, programmable Virtualized Digital Infrastructure Test Platforms



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

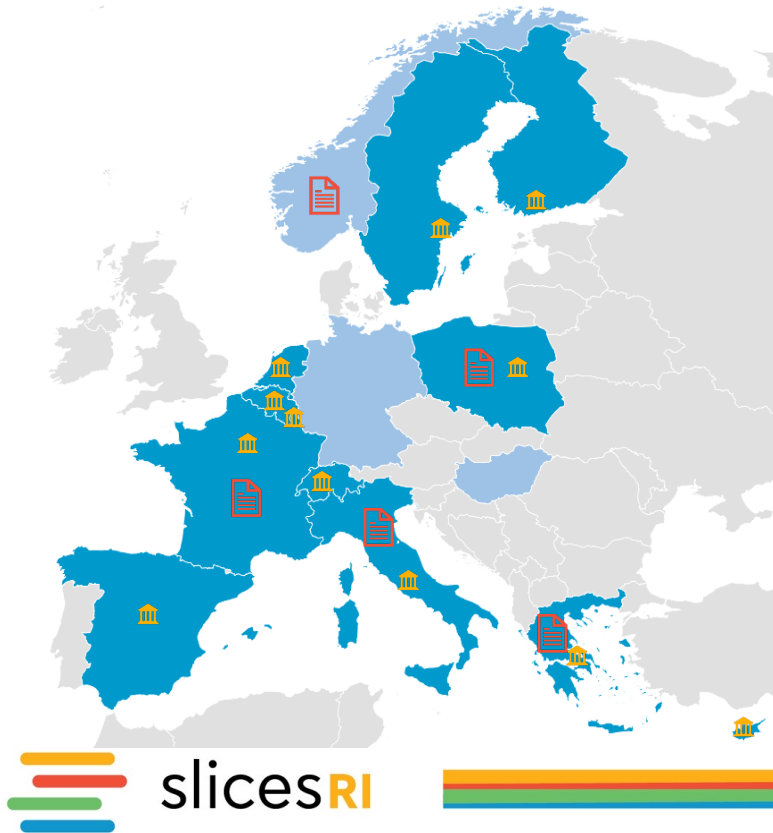
NSF Fabric: NSF, 20 M€, 2019-2023

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

China CENI
Chinese Experimental National Infrastructure
2018-20224
190 M€



SLICES for research on DIs



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

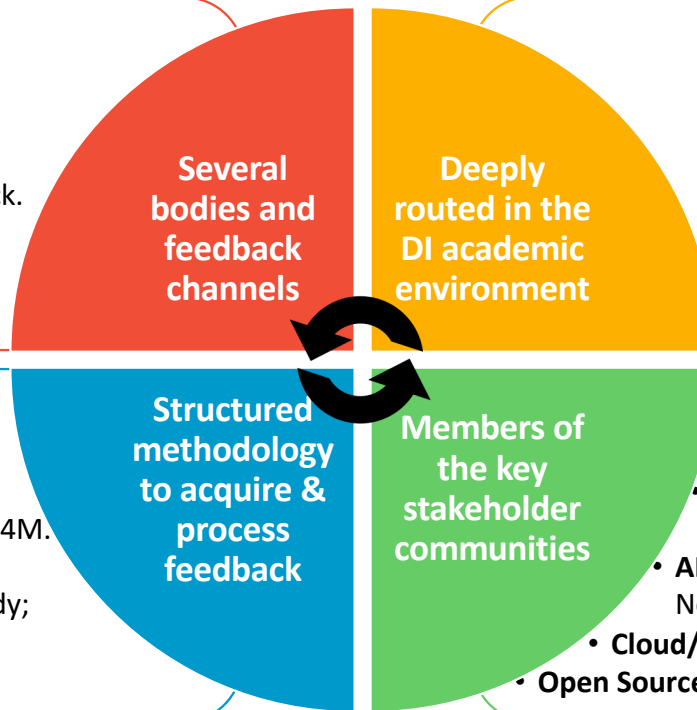
Countries	Government	Research and Academia		Industry	Clusters, networks and others	NRENs	Worldwide support
	National support	Partners	Support				
	Local support confirmed			 			

Core partners

Identifying the most strategic scientific questions

We continuously monitor the relevant research environment

- Coarse-grained/strategic: **ISAB**.
- Middle-grained: **UC**.
- Fine-grained: **Structured** Experimenters feedback.



Quickly "sense" new directions from cutting-edge research.

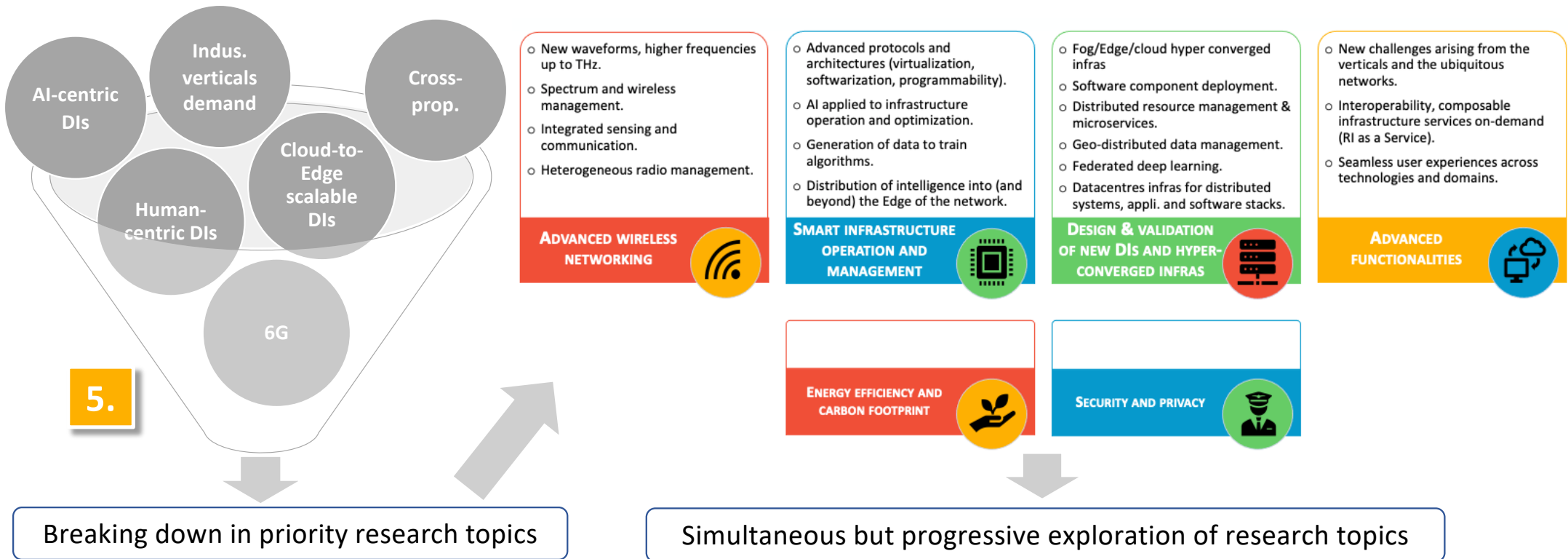
- Stakeholder continuous engagement:
 - ✓ Communities identified & segmented;
 - ✓ **Technology monitor**: evaluation/assessment of meeting user needs/objective, updated every 4M.
- First examples:
 - ✓ **Technology roadmap** included in the Design Study;
 - ✓ **Stakeholder workshop**, March 4th-5th, 2021;
 - ✓ **Community survey** (220+ respondents).

- **5G/6G** in EU, strong links: US, South America, Asia: 5GPPP, Networld EU, PAWR, CENI, etc.
- **Next Generation Internet**: NGI in EU, POWER & FABRIC in US – ex.: EMPOWER.
- **AI/BigData**: BDVA, H2020 ICT-48 Flagships (Humane AI-Net, TAILOR), CLAIRE, ELLIS, AI4EU.
- **Cloud/HPC**: EOSC, PRACE, GAIA-X.
- **Open Source** communities: OpenStack, OpenAirInterface, K8s, etc.



Prioritisation of research topics

What's the methodology behind it?



- New waveforms, higher frequencies up to THz.
- Spectrum and wireless management.
- Integrated sensing and communication.
- Heterogeneous radio management.

ADVANCED WIRELESS NETWORKING



- Advanced protocols and architectures (virtualization, softwarization, programmability).
- AI applied to infrastructure operation and optimization.
- Generation of data to train algorithms.
- Distribution of intelligence into (and beyond) the Edge of the network.

SMART INFRASTRUCTURE OPERATION AND MANAGEMENT



- Fog/Edge/cloud hyper converged infras
- Software component deployment.
- Distributed resource management & microservices.
- Geo-distributed data management.
- Federated deep learning.
- Datacentres infras for distributed systems, appli. and software stacks.

DESIGN & VALIDATION OF NEW DIs AND HYPER-CONVERGED INFRAS



- New challenges arising from the verticals and the ubiquitous networks.
- Interoperability, composable infrastructure services on-demand (RI as a Service).
- Seamless user experiences across technologies and domains.

ADVANCED FUNCTIONALITIES



ENERGY EFFICIENCY AND CARBON FOOTPRINT



SECURITY AND PRIVACY

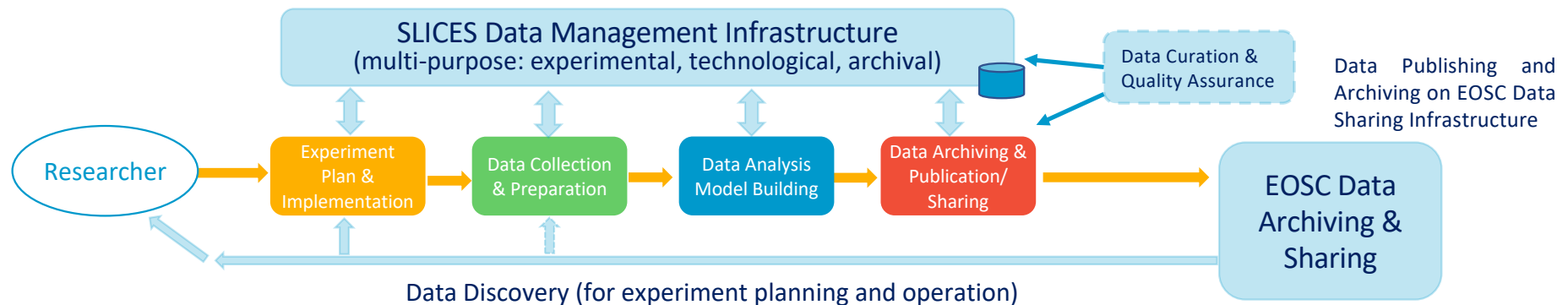


SLICES & BigData: Networks & Data Synergies

- Networks **needs** BigData (and ML/AI)
 - Future networks more and more complex & automated
 - Data will be the basis for any automated decision on virtualisation/dynamic operations of networks
 - Fast data management/analytics pipelines integrated in the network fabric are a must
- BigData (and ML/AI) **needs** Networks
 - Data analytics more and ore decentralised, from cloud to edge
 - Significant user-centric personalisation of data analytics (and management)
 - Ultra-fast, pervasive networks are badly required to support the next wave of Data Analytics
- SLICES & SoBigData **partnership**
 - 2 new RIs in the ESFRI DIGITAL 2021 roadmap
 - Combined effort going on already
 - E.g., joint activities in the Italian nodes of both RIs



SLICES Data Lifecycle Model and Dataflow



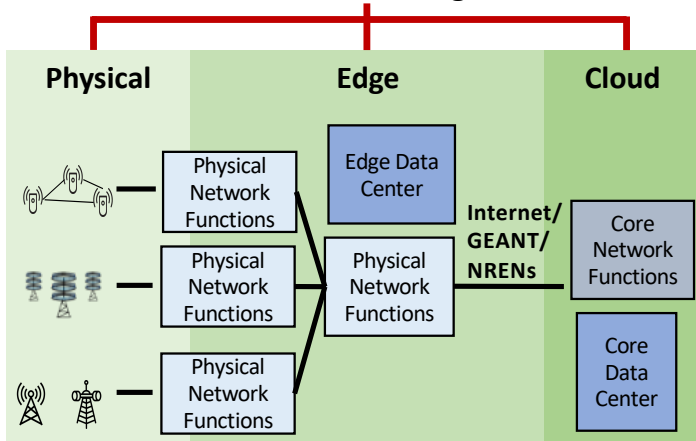
- SLICES maintains fast accessible **Data Management Infrastructure**:
 - Expected capacity: 14 Petabytes of cache data.
 - Expected lifetime: short-term/mid-term preservation of data.
- SLICES leverages on **external Data Infrastructures, especially EOSC**:
 - Expected level of contribution to EOSC: 5-10 Petabytes of data per year for the first 5 years of operation (forecasted, based on previous experiences);
 - Expected lifetime: long-term preservation of data / archiving.

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



Thank you

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On behalf of SLICES consortium



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3rd ESFR Open Research RI and Big Data, 30 June 2022