slices DE

A Digital Research Infrastructure for Computing and Communication in Germany and Europe

Georg Carle, Sebastian Gallenmüller

Chair of Network Architectures and Services
School of Computation, Information and Technology
Technical University of Munich

Communication and Computation Experimental Research

Current situation: highly heterogeneous research infrastructures

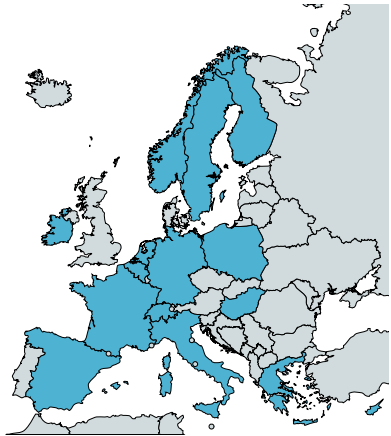
- Purpose-built setups
- Difficulty to modify or extend experiments of other researchers

Demo session @ 6G Platform Conference in Berlin

SLICES-RI (Research Infrastructure)

SLICES-RI

- Scientific Large Scale Infrastructure for Computing/Communication Experimental Studies (SLICES)
- Goal: Create a European research infrastructure for computing and communication by the community for the community
- Funding framework: European Strategy Forum on Research Infrastructures (ESFRI)
  - Long-term funding framework (**>10 years**) for large-scale infrastructures (e.g., telescopes or particle accelerators)
  - SLICES became part of the European ESFRI roadmap in **2021**
  - SLICES is the first **digital** RI not as a provider for others but for the digital community itself
  - Shared funding between EU (focus on coordination projects) and national funding agencies (focus on infrastructure resources)



Partner countries of SLICES-RI

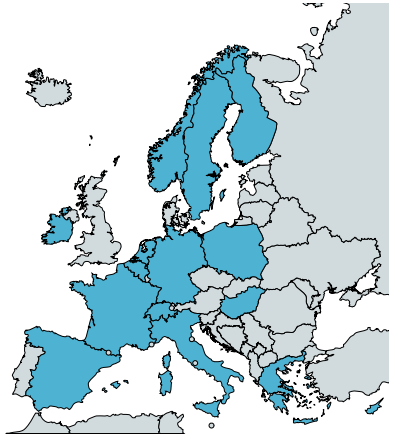
SLICES-RI (Research Infrastructure)

SLICES-RI milestones

- 2020–2022 SLICES-DS (design study) H2020 project
- 2021–2024 SLICES-SC (starting communities) H2020 project
- 2024 Start of the pre-operation of SLICES-RI
- 2023–2025 SLICES-PP (preparatory phase) Horizon Europe project

Planned steps

- Starting in 2026: SLICES-IP (implementation phase) Horizon Europe project
- Founding of the SLICES-ERIC (European Research Infrastructure Consortium), the legal entity for SLICES-RI
  - Only countries can become member of ERICs
  - National nodes organize the national activities



Partner countries of SLICES-RI

German Roadmap Process

Priorization process for large-scale research infrastuctures

- Goal: Identify important research infrastructure to shape the German research landscape for the next decades
- Application submission in October 2024
- Evaluation lead by the German Science and Humanities Council (Wissenschaftsrat) with three evaluation strands:
  - Science-led assessment
  - Assessment of innovation and transfer potential
  - Assessment of costs and risks
- Results announced on July 8, 2025 by the Federal Minister of Research Dorothee Bär:
  - *"With bold investments in research infrastructure, we are laying the foundation for remaining internationally competitive in the future."*

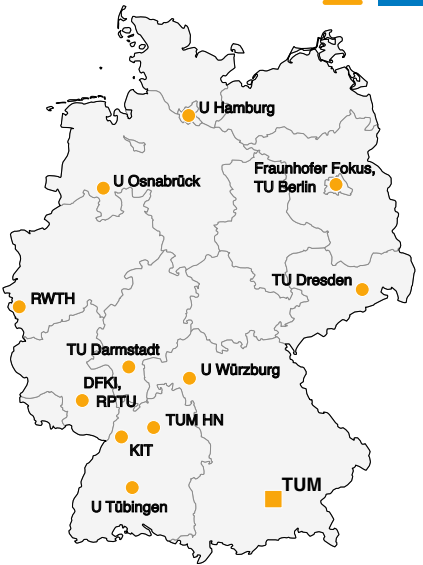
German Roadmap Process

Result: Shortlist of reserach infrastructures

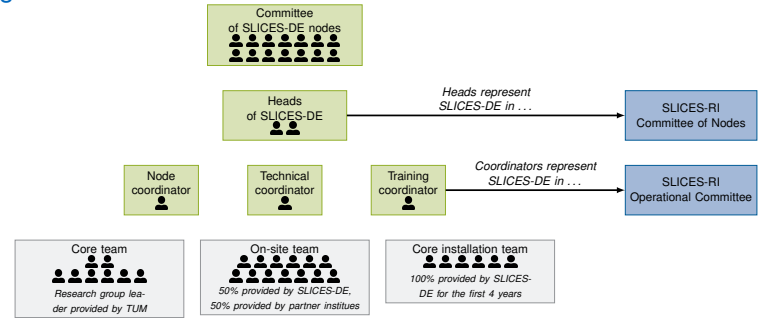
	Infrastructure	Research Field	Installation	Operation
C	CREATION	Cell therapy	84 M€	100 M€
D	DALI	Matter research	292 M€	355 M€
E	Einstein Telescope	Gravitational waves	200 M€	–
H	HBS-I	Neutron research	118 M€	125 M€
I	IceCube-Gen2	Neutrino research	71 M€	46 M€
L	LEGEND-1000	Neutrino research	66 M€	29 M€
P	PETRA IV	X-ray microscope	1740 M€	3150 M€
R	RIDLOP	Social science	50 M€	122 M€
S	**SLICES-DE**	**ICT research**	**60 M€**	**37 M€**

SLICES-DE

- TUM is the designated national node for Germany
- Goal: Create the German national research infrastructure aligned with the other infrastructures in SLICES-RI
- Coordination of activities in Germany with SLICES-RI
- Technically: Connecting German testbeds to SLICES services, with authentication (OpenID) and reproducibility (with pos)



SLICES-DE: Organization



Staff of SLICES-DE

- Committee of SLICES-DE nodes: Research group leaders of SLICES-DE partners
- Heads of SLICES-DE are elected from the committee of SLICES-DE nodes
- Three teams to create, develop, and organize SLICES-DE RI:
  - Core team @ TUM (1 × scientific lead, 1 × project management, 6 × researchers/engineers)
  - On-site @ SLICES-DE partners (13 × 1/2 researchers/engineers)
  - Installation team @ TUM (6 × researchers/engineers, temporary)

SLICES-DE: Technical Background

Infrastructure

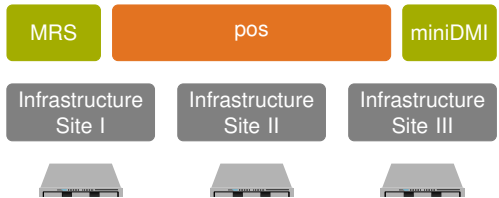
- Shared testbed resources (Europe & Germany)
- Basic services for access and reservation
- Connectivity between different testbeds

[0] [1] S. Gallenmüller*, D. Scholz*, H. Stubbe, and G. Carle, „The pos Framework: A Methodology and Toolchain for Reproducible Network Experiments“, in CoNEXT '21: The 17th International Conference on emerging Networking EXperiments and Technologies, Virtual Event, Munich, Germany, December 7 - 10, ACM, 2021. DOI: 10.1145/3485983.3494841

SLICES-DE: Technical Background

Reproducibility and Data Management

- Reproducibility and data management are an integral part of SLICES-RI
- Plain orchestrating service (pos)[1]
  - Framework to ensure reproducible experiments through a well-structured experiment workflow
  - Developed at our research group at TUM
  - Already part of SLICES-RI pre-operation (Nov. 2024)
- Data management
  - Automated collection of data and metadata for experiments
  - Compliance with FAIR principles:
    Findable, **A**ccessible, **I**nteroperable, **R**eusable
  - Alignment with European and German initiatives:
    - European Open Science Cloud (EOSC)
    - Nationale Forschungsdateninfrastruktur (NFDIxCS)
  - SLICES services for data management
    - MRS (metadata registry service)
    - miniDMI (mini data management infrastructure)



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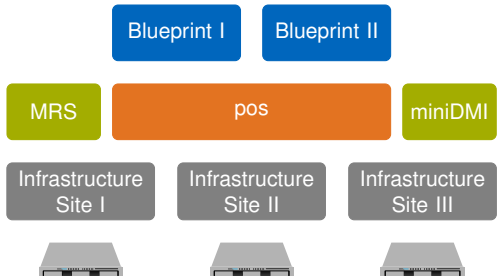
SLICES-DE: Technical Background

Blueprints

- Fundamental building principle of SLICES
- Blueprints represent a reference experiment for a specific community (e .g., 6G, Cloud-edge continuum)
- Scientific communities create and extend blueprints
- Blueprints allow to focus on the actual experiment rather than infrastructure maintenance

Differences to other testbeds

- Testbeds typically focus on providing resources
- SLICES offers a platform for experiments offering additional services
  - Reproducibility through pos
  - Services for data management
  - Reference experiments (blueprints)



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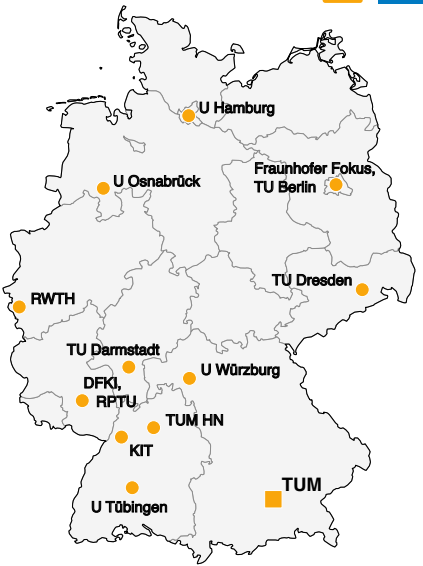
Planned usage scenarios

- Research
  - On-demand experiments, e.g., benchmarks
  - Long-running experiments and observations, e.g., longitudinal measurements, monitoring
- Training & Teaching
  - SLICES-DE platform can be used to host a virtual infrastructure for lab courses or lectures
  - Each participants gets their own resources (VM or container)
- Collaboration with industry
  - Different collaboration models possible:
    - Direct collaboration: Industry directly uses testbed resources
    - Shared components: Integration of new resources into testbed
    - Replicated testbed: Industry partner creates separate testbed (using SLICES/pos toolchain and API)
    - Joint projects: Academia and industry share common testbed for joint projects

SLICES-DE Partners

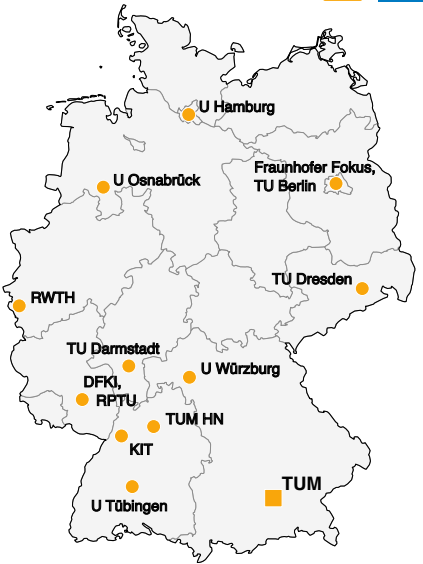
Organization	Participants	Selected Reserach Areas
TUM	G. Carle, S. Gallenmüller, J. Ott, W. Kellerer, I. Weber and others	NFV, Performance-Measurement, 6G, Edge, PQ-Crypto, AI for HPC
Fraunhofer FOKUS	Thomas Magedanz	6G RIC, AI for 6G
TU Berlin	Falko Dressler	Wireless Networks
dfki RPTU	Hans Schotten Frank Fitzek, Giang Nguyen, Matthias Wählisch	6G RAN, Digital Twinning and AI 6G Core and RAN, IoT, Quantum Networks, Resilient Internet
RWTH Aachen University	Klaus Wehrle Björn Scheuermann, Matthias Hollick	Networked Cyber-Physical Systems Secure Communication, Mobility
TU Darmstadt	Thorsten Strufe, Martina Zitterbart	High-Performance Networks, AI for Networks, Security
KIT	Tobias Hoßfeld Mathias Fischer, Hannes Federrath, Janick Edinger	Network Performance Secure Networks, Privacy, Edge AI, Security and Privacy for AI
U Würzburg	Stephan Günther a. o.	Coded Networks
U Osnabrück	Nils Aschenbruck	Hybrid NTNs
U Tübingen	Michael Menth	Network Softwarization



SLICES-DE Community

Benefits of SLICES-DE

- SLICES-DE is planned to be available for the whole community
- . . . for academia:
  - **Research:** Access to state-of-the-art hardware & software for experiments
  - **Teaching & education:** Individual resources for each student
- and industry:
  - **Collaboration Models:** Flexible cooperation opportunities with academia and research institutions.
  - **Reuse of results:** Simplified transfer of results from academia to industry through joint infrastructure.

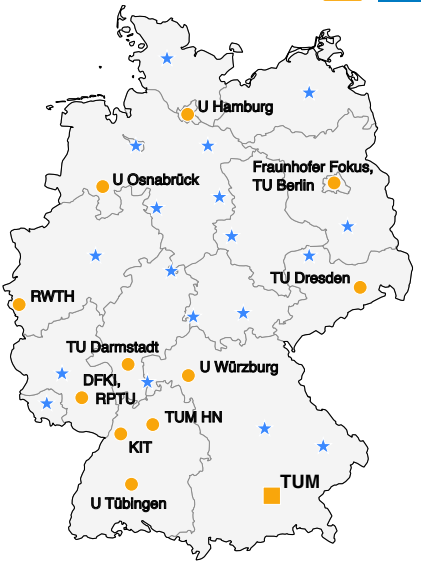


SLICES-DE Community

How to participate?

- SLICES-DE concept will be evaluated before creation starts
- A strong community participation (universities (of applied sciences), organizations, companies) will help to secure the success of SLICES-DE
- Send us an LoI stating:
  - Field & expertise,
  - Planned use of SLICES-DE, and
  - Contribution interest.

https://slices-de.org/community/



Website & Contacts

Contacts: Georg Carle (carle@tum.de)
Sebastian Gallenmüller (sebastian.gallenmueller@tum.de)

Website https://slices-de.eu
LinkedIn Profile https://linkedin.com/company/slices-de
Zenodo Community https://zenodo.org/communities/slices-de

Address: Chair of Network Architectures and Services
Technical University of Munich
Boltzmannstr. 3
85748 Garching near Munich

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