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SLICES-DE: Digital Research Infrastructure for Computing and Communication

– Platform for Experiments and Collaboration –

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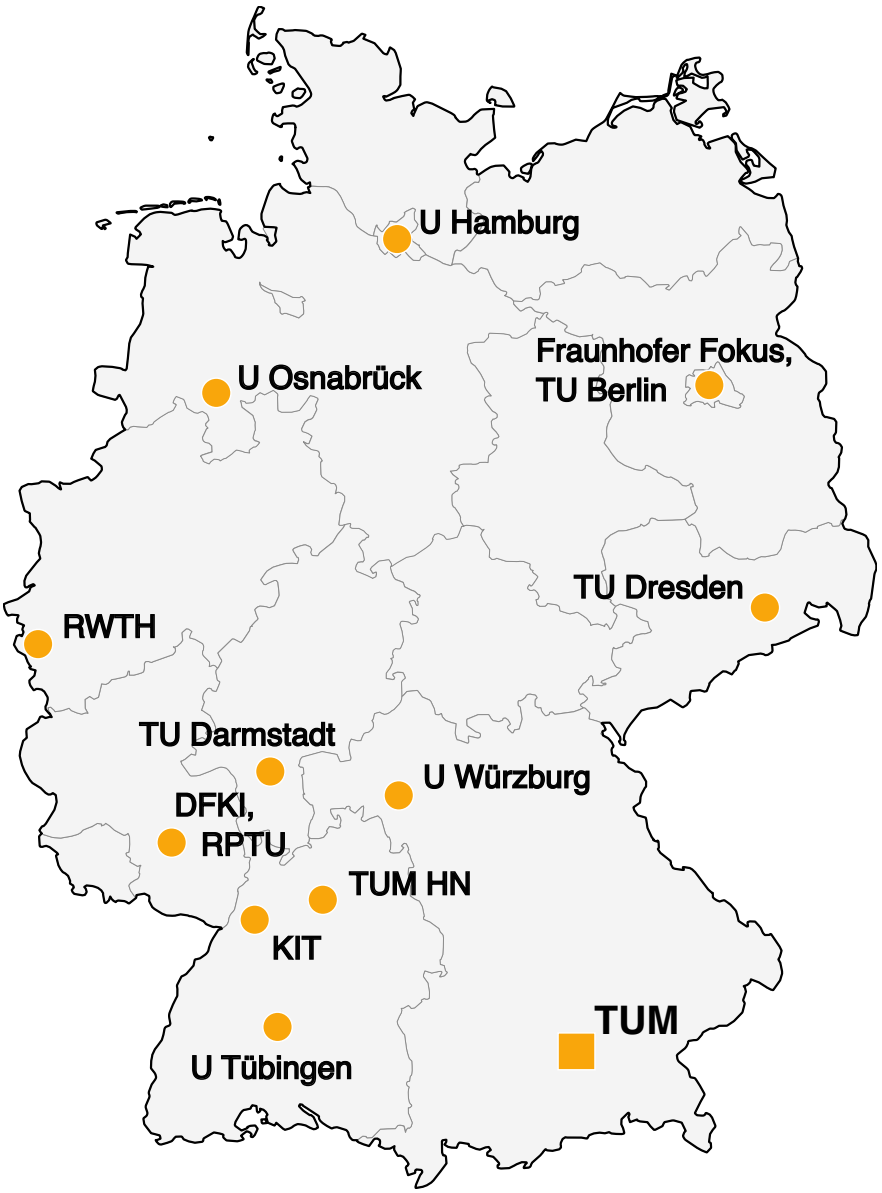
Abstract: SLICES (Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies) is a distributed, flexible digital infrastructure for experimental research in information and communication technology (ICT), in particular on network protocols in combination with cloud- and edge-based architectures, and their security mechanisms including post-quantum security, in relation to innovations in the fields of computers, the Internet, 6G mobile networks, IoT, artificial intelligence (AI), HPC and quantum computing (QC). Thanks to its modular design, the research infrastructure can be flexibly adapted to different research needs.

SLICES-DE represents Germany's contribution to the European initiative "SLICES-RI," which aims to create a Europe-wide research infrastructure with participation from 16 countries. In 2021, SLICES was included in the ESFRI Roadmap by the European Strategy Forum on Research Infrastructures, and since then it has been the only research infrastructure project on the roadmap dedicated to research in the field of information and communication technology. On July 8, 2025, Research Minister Dorothee Bär announced the results of the prioritization of proposals for research infrastructures to be established in Germany, which includes the SLICES-DE project. As part of SLICES-DE, led by TUM as leading responsible institution and in cooperation with 12 partner institutions, an extensive research infrastructure with 14 sites in Germany is planned to be built and connected to the European SLICES infrastructure. The partner institutions, with their specific expertise and infrastructure, represent the areas of German ICT research relevant to SLICES-DE.

The modular infrastructure of SLICES-DE consists of basic and special equipment. The core equipment is available at all sites, providing services and computing resources for experiments. Special equipment extends the infrastructure with unique functionalities for specific research questions. SLICES uses the concept of blueprints as structured templates for scientific experiments. Such a template covers the various phases of the experimental workflow, including experiment design, execution (with generation of data and metadata), storage, evaluation, and publication of research data. Research data management supports the FAIR principles: Findable, Accessible, Interoperable, and Reusable. This approach, with its focus on reproducibility, structured experiment templates, and data management, is unique worldwide and makes SLICES a tool for exceptional research opportunities and, together with its long-term operation, a platform with numerous unique selling points for collaboration and skills development.

Platform for Collaboration with Open and Protected Infrastructure Components, Software Artifacts, Data, Analysis Services, and Training Materials

SLICES-DE aims to create a platform that supports research in a globally unique way through open and freely available hardware, software, data, and training materials. Building on this, additional protected usage and collaboration models will enable the development of an ecosystem for innovation and transfer, featuring access-protected hardware components, confidential software components, and access-protected data. This makes it possible to appropriately address the needs of intellectual property protection, including in connection with publicly funded cooperation projects, as well as confidentiality requirements in collaborative projects with industry and in the platform's use by industry. The platform can also be used to offer commercial analysis services, consulting, and training. Revenue from protected and commercial use will be used to improve the platform's infrastructure and staffing.



SLICES-DE Sites of Leading Responsible Institution TUM and Partner Institutions

Offerings for Universities, Research Institutions, and Industry Partners

SLICES-DE is an infrastructure aimed at German universities and research institutions in the ICT sector and offers various cooperation models for industry partners. As part of membership in the SLICES-DE Community, universities, research institutions, and industry partners can use the research infrastructure for experiments, collaboration, and skills development. In addition, the SLICES-DE platform can be expanded by contributing hardware, software, data, evaluation components, and materials and execution environments for training purposes.

Members of the SLICES-DE Community will have access to resources for theses, practical courses, and other academic projects. SLICES-DE will provide certain course materials and execution environments for programming tasks accessible via remote login. In the medium term, the aim is to collect extensive training materials and associated execution environments within the SLICES-DE Community.

SLICES-DE plans to grant academic members of the SLICES-DE Community a quota-based free-of-charge access to designated resources of the research infrastructure, in accordance with usage rules. Access to resources beyond this quota may incur costs, unless compensation is provided through in-kind contributions by supplying components or services to the SLICES-DE platform.

Concepts for Collaboration Between SLICES-DE and Industry

The flexible and distributed architecture of SLICES-DE enables innovative cooperation models with industry partners that cannot be implemented in more traditional infrastructures. The following cooperation models are offered for industry partners who wish to use SLICES-DE:

Cooperation Model A: The industry partner directly uses resources provided by SLICES-DE. Industry partners may have stricter requirements for the accessibility of experiment code and results. The SLICES data management model will offer solutions that can prevent the publication of data according to the partner's requirements. This cooperation model can be set up quickly, and remote access to the infrastructure can be provided within one working day. If larger experiments with higher resource requirements are needed, additional applications may be required and must be approved by a supervisory board.

Cooperation Model B: This model enables research partners to integrate new hardware into the existing testbeds temporarily or permanently. Depending on the cooperation model, the resources may be shared with selected partners or provided exclusively for a specific partner, depending on the requirements of the hosting testbed and the device provider. Building such infrastructure will take longer because the technical integration of new components may require additional implementation effort. Depending on the complexity of the provided devices and integration requirements, it may take days or weeks before new resources can be used.

Cooperation Model C: This model requires the creation of new testbed sites. Companies with strict regulatory requirements or valuable intellectual property may be unable or unwilling to use a public infrastructure for their research. These companies can instead create their own on-site testbed that uses the same SLICES software stack as other SLICES-RI or SLICES-DE testbeds. This offers the highest degree of isolation; however, a company can still benefit from the network effect of SLICES by using the same experimental workflow, which enables the reuse of existing experiment code. Implementing this model will take longer because a new testbed must be commissioned before experiments can be conducted — a process that may take several months. The

company can purchase support from SLICES-DE to implement necessary software components, integrate new devices, or provide general assistance for the initial setup of the testbed.

Cooperation Model D: This model uses the resources of SLICES-DE for joint projects between industry and universities. In this case, SLICES-DE acts as the infrastructure provider for the project. This cooperation model offers significant advantages for the project partners, as a joint experimental platform is available without having to create and maintain the infrastructure themselves. Exclusive SLICES-DE services can be provided to allow temporary exclusive access to hardware resources and permanently prevent the release of experimental data.

The use of SLICES-DE in the context of industry collaborations will incur costs unless certain conditions for free use are met, such as joint use within the framework of a funded project, jointly supervised student theses or dissertations, or the provision of software artifacts and research data obtained.

Expression of Interest – Letter of Intent

Organisations interested in becoming a member of the SLICES-DE Community are invited to send a Letter of Intent with the following information:

- Description of your field of work and expertise
- What type of use of the SLICES-DE infrastructure is of interest?
- Is there interest in contributing software, data, or hardware to the SLICES-DE research infrastructure?
- Do you agree that the name and logo of your organization may be listed on the “SLICES-DE Community” subpage of the SLICES-DE website?

Send us your letter of intent via https://slices-de.org/community/

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