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The German 6G Program

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German 6G Program (BMBF)

6G program announced in April 2021

- 6G Platform, October 2021 – 2025
- Four 6G Research Hubs, 2021 – 2025
- Eighteen 6G Industry Projects, 2022 - 2025
- Seven Projects on Resilience, 2023 – 2025
- AI-NET, 2021 – 2024 (CELTIC)
- Four StartUp Incubators, 2023 – 2027
- ...



6G Program

Goals

Cyber-security and resilience by design
Energy efficiency and sustainability
Technology and digital sovereignty

Vision

Human in the centre
of a hyperconnected and sustainable world
based on resilient infrastructure

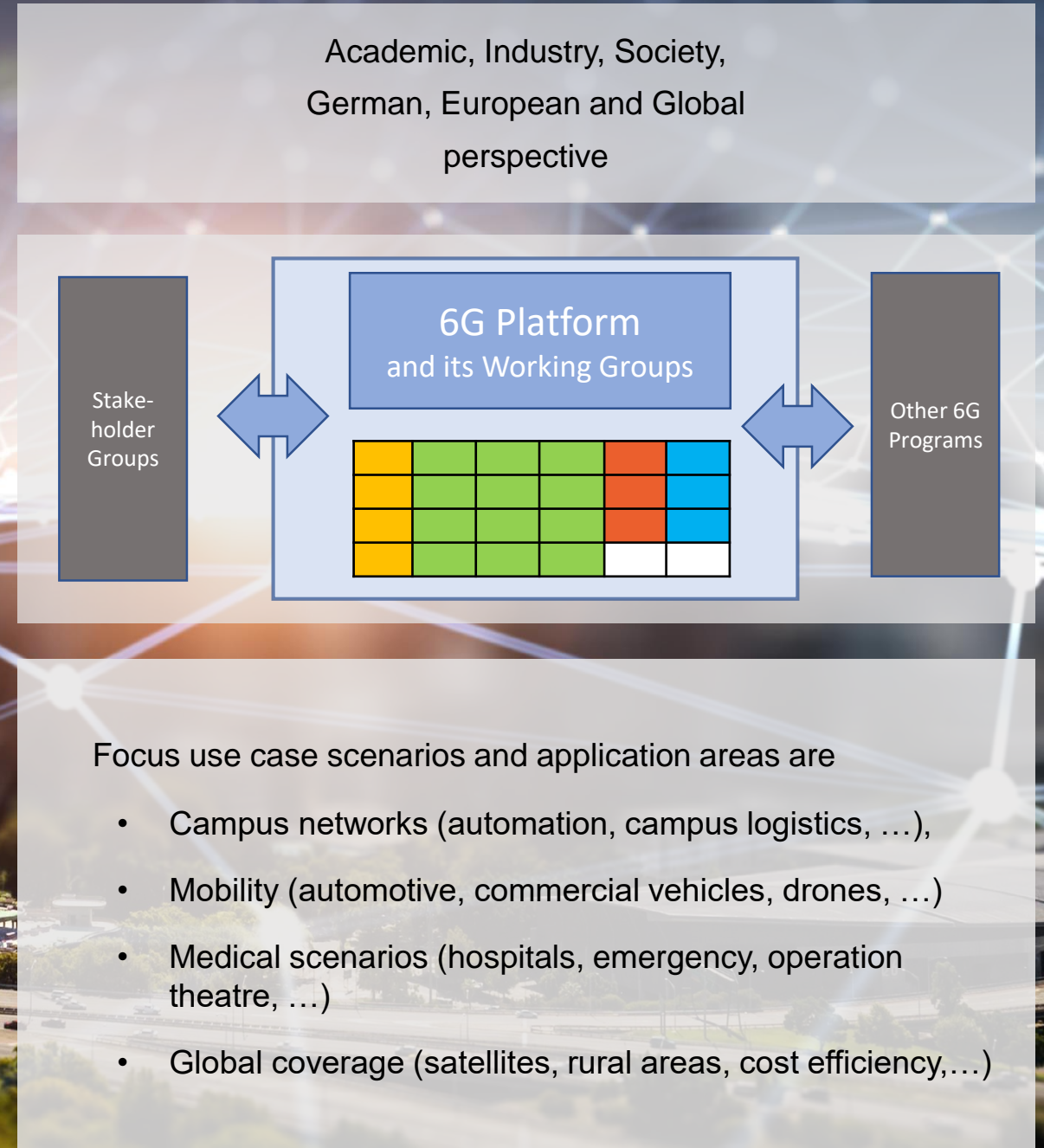
Technology

Communication technology with strong links to AI
and microelectronics/ RF technology
(and SW engineering, quantum technology,
cobots, digital twins, ...)



Our Mission

- Managing liaisons and collaboration with other European and international 6G programs
 - Support representation of European values in future digital infrastructure
 - Contribute specific technical content and avoid duplication of work
 - Initiate match-making process in order to join forces
- Harmonisation of concepts and results for joint dissemination
- Creating an innovation network with SMEs and start-ups
- Ensuring acceptance of 6G concepts in society by a bidirectional science communication process
- Creating a skilled worker force
- Creating harmonized German contributions to UN SDGs



WG1 - Science Communication

WG2 - *Societal perspective*

Sustainability and participation

WG3 - *Maximising impact*

Involving vertical industries, SMEs, StartUps

WG4 - *Building a global 6G vision*

WG5 - Security, Resilience, and Trustworthiness

WG6 - 3D Networking

WG7 - Architecture and System Engineering

WG8 - Large Scale Experimental Facilities

WG9 - Connected Health

WG10 - Task Force Spectrum

WG11 - Women in 6G

WG12 - Task Force EMV, Exposition

WG 1 Science Communication

WHY?

Concerns about electromagnetic exposition, privacy issues, technological sovereignty and participation (in particular in rural areas)

6G?

The use of new frequency bands, the integration of sensing capabilities in networks, the required investments, some new applications might result in similar concerns.

Vertical user groups are today reluctant to support 6G processes.

How?

Early dialogue with public, all stakeholders, press, political decision makers, vertical user groups → white papers, video clips, workshops.

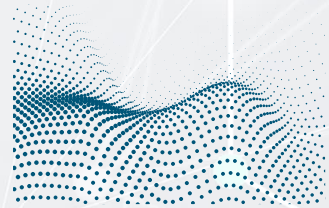
6G Program

Regulatory Questions

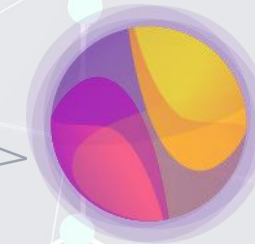
- Energy Efficiency
 - KPIs, direct and indirect effects, life cycle, CAPEX and OPEX, ...
- Privacy and Data Protection
 - Sensing capabilities (JC&S), exposure to third parties, use of AI functions and intelligent network functions, ...
- Technology and Digital Sovereignty
- Security, Resilience, Critical Infrastructure, Zero Trust
- AI usage and AI ACT
- Coverage Requirements and Participation
- Electromagnetic Exposition
- Spectrum ...



6G Research Hubs



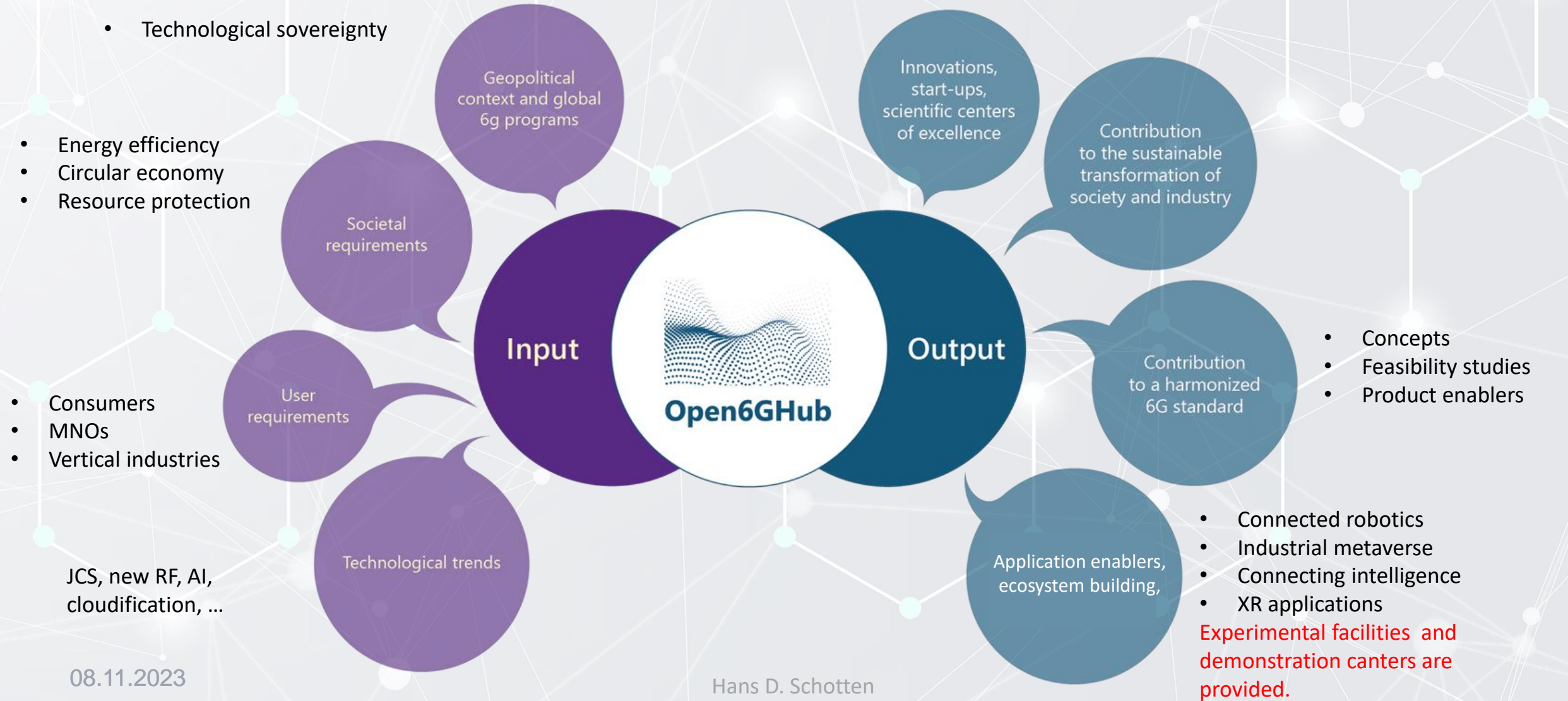
Open6GHub



6G-life

- Four 6G research hubs with an overall budget of approx. 250 M Euro started in 2021
- 160 research groups at overall 21 universities and 15 research institutes
- More than 40 SMEs are already part of the research network

Research Hubs – Research Logic (Example Open6GHub)



6G Industry Projects

18 projects starting in H2, 2022, all lead by industry

Overall around 70 industry partners, 20+ universities, and 9 research institutes are involved.

Industry participation includes

- major infrastructure vendors,
- four major MNOs,
- test- and measurement equipment and service providers,
- major semiconductor manufacturers,
- OEMs in automotive, airplanes, drones, robots, automation equipment, commercial vehicles, medical equipment, ...
- infrastructure operators (factories, airports, ...),
- more than 40 small and medium companies with products completing the 6G ecosystem or benefiting from 6G connectivity.

6G Industry Projects (Coordinator)

6G-ANNA (Nokia)

6G-NetFab (ADVA)

6G-TakeOff (Dt Telekom)

6G-LICRIS (R&S)

6G-ICAS4Mobility (Bosch)

ESSENCE-6GM (Nokia)

6G-Campus (NXP)

6G-TERAKOM (Ericsson)

6G-CampuSens (Infineon)

Nitrides-4-6G (Tosat)

KOMSENS-6G (Nokia)

MassIMO (Infineon)

6G-Health (Vodafone)

USWA (NXP)

6G_NeXt (Deutsche Telekom)

INTERSOUL (SilOriX)

6G-Terafactory (ADVA)

6G-ADLANTIK (R&S)

6G Industry Projects

Focus **use case scenarios and application areas** are

- Campus networks (automation, campus logistics, digital twins, industrial metaverse, new security concepts, tailored solutions for cost and complexity reduction)), ...),
- Medical scenarios (hospitals, emergency, operation theatre, ...)
- Mobility (automotive, commercial vehicles, drones, ...)
- Global coverage (satellites, rural areas, in-X networking, ...)

Almost all **components** and many new **system engineering concepts for 6G systems** will be addressed with a focus on

- Joint Communications and Sensing,
- Realtime and sync'ed networking,
- D2D, infrastructure-less, nomadic and organic networking,
- Device management, authentication, security concepts,
- Disaggregation, Open RAN evolution, OpenXG, open interfaces for third parties, ...,
- Massive usage of AI everywhere,
- RF components (antennas, modulators, microelectronics),
- mmW and THz technology integration,
- Energy-efficient Terabit and other specialized transceiver technologies.



Projects on Resilience

Resilience of communication infrastructure and digital systems:

Architecture, technologies and modules (HW and SW), and management.

Seven projects started in January 2023, addressing the cyber(-physical) resilience, security and protection of connectivity infrastructure, data, and data processing.

Results will be input to 6G Platform WGs.

AKITA (Bundesanstalt für Straßenwesen)

- Road tunnel operation center

ConnRAD (Bosch)

- Connected and automated driving functions

FRONT-RUNNER (ADTRAN (ADVA))

- Optical access networks

HealthNet (AWARE7)

- Health sector infrastructure

Q-TREX (TU Dresden)

- Quantum communication

RePro (Univ. of Braunschweig)

- Industrial and campus networks

RILKOSAN (Univ. of Lübeck)

- Industrial and campus networks

Example Focus Areas

NPN Evolution

- RoI maximisation, Cost and complexity reduction
- Open interfaces for value-added services
- Open X design
- Radio-modem integration
- Simple integration of applications, industrial metaverse ...

Migration story

- Smooth evolution (FR1, FR2, full backwards compatibility, island deployments, ...) ... NGMN
- Avoid overloading 3GPP standards
- 6G for Open-RAN
- Integration of NTN
- Building resilience



Example Focus Areas

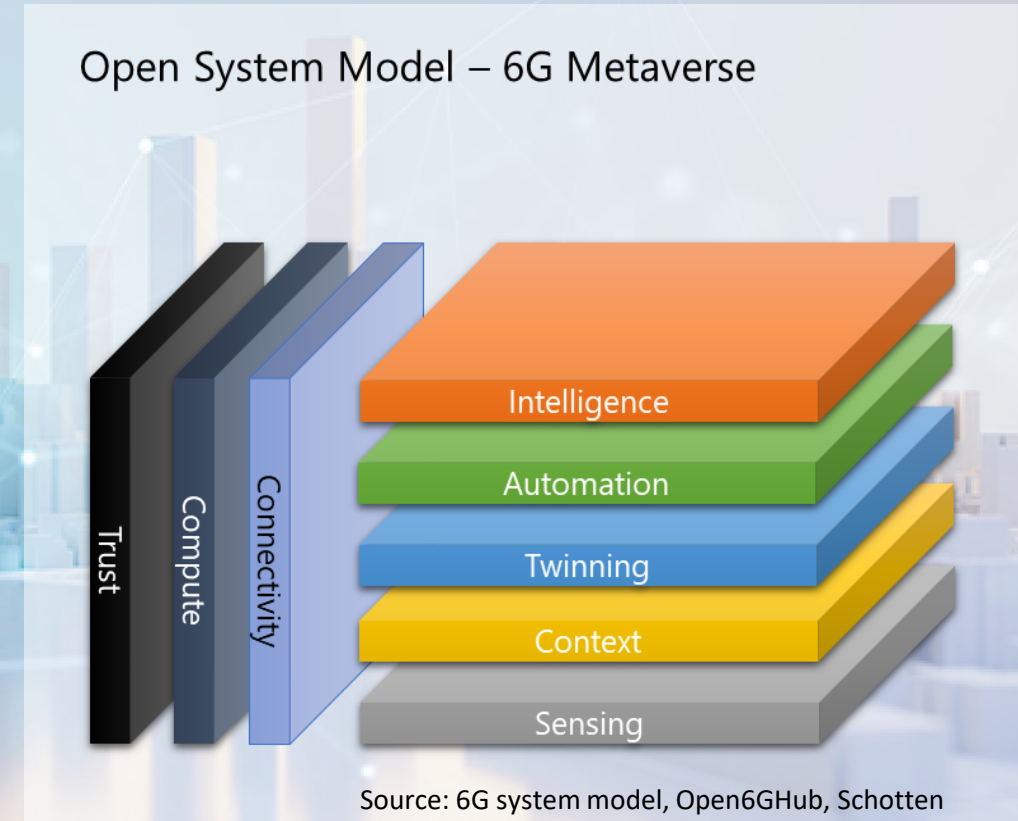
Integrating applications

5G killer application is still missing. Integration of new applications is slow.

Strong focus on enabling a simple integration of advanced applications

- XR (split computing, RAN adaptation, ...)
- Connected robotics
- Industrial metaverse
- Health applications and local edge intelligence
- 6G for distributed AI services and applications
- Trust as a Service

International collaboration on identifying and specifying key enablers (industrial metaverse, edge intelligence and federated learning, split computing, context management, trust) for application integration in 6G can help to make it a success and guarantee a fair Rol.



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