Global Forum
Shaping the future 2015

5G and intelligent infrastructure

Session S6:
Towards Greater Intelligent Infrastructures
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Knowledge Intensive Products and Services
VTT Technical Research Centre of Finland Ltd

VTT – Technology for business

VTT Technical Research Centre of Finland Ltd is the leading research and technology company in the Nordic countries. We provide expert services for our domestic and international customers and partners, and for both private and public sectors. We use 4,000,000 hours of brainpower a year to develop new technological solutions.

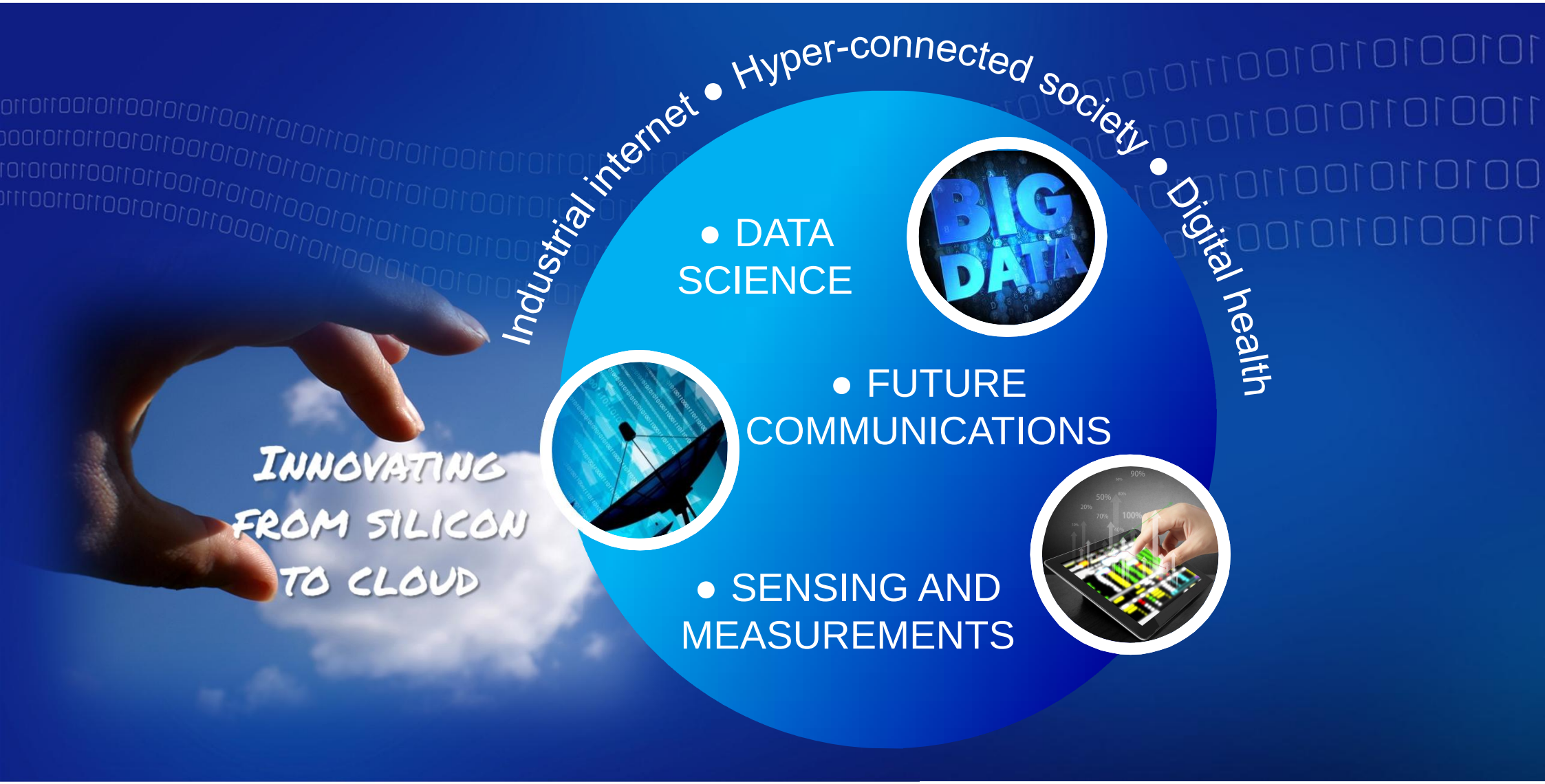
We develop new smart technologies, profitable solutions and innovative services. We cooperate with our customers to produce technology for business and build success and well-being for the benefit of society.

VTT is a non-profit organization and a crucial part of Finland's innovation eco-system. VTT operates under the mandate of the Ministry of Employment and the Economy.

- Turnover 277 M€ (2014 VTT Group),
- Personnel 2,600 (1.1.2015 VTT Group)
- Business Areas
  - Knowledge Intensive Products and Services
  - Smart Industry and Energy Systems
  - Solutions for Natural Resources and Environment

*) Source: Roles, effectiveness, and impact of VTT, VTT & Technopolis Group, 2013.

Enablers of intelligent infrastructure



5G challenges

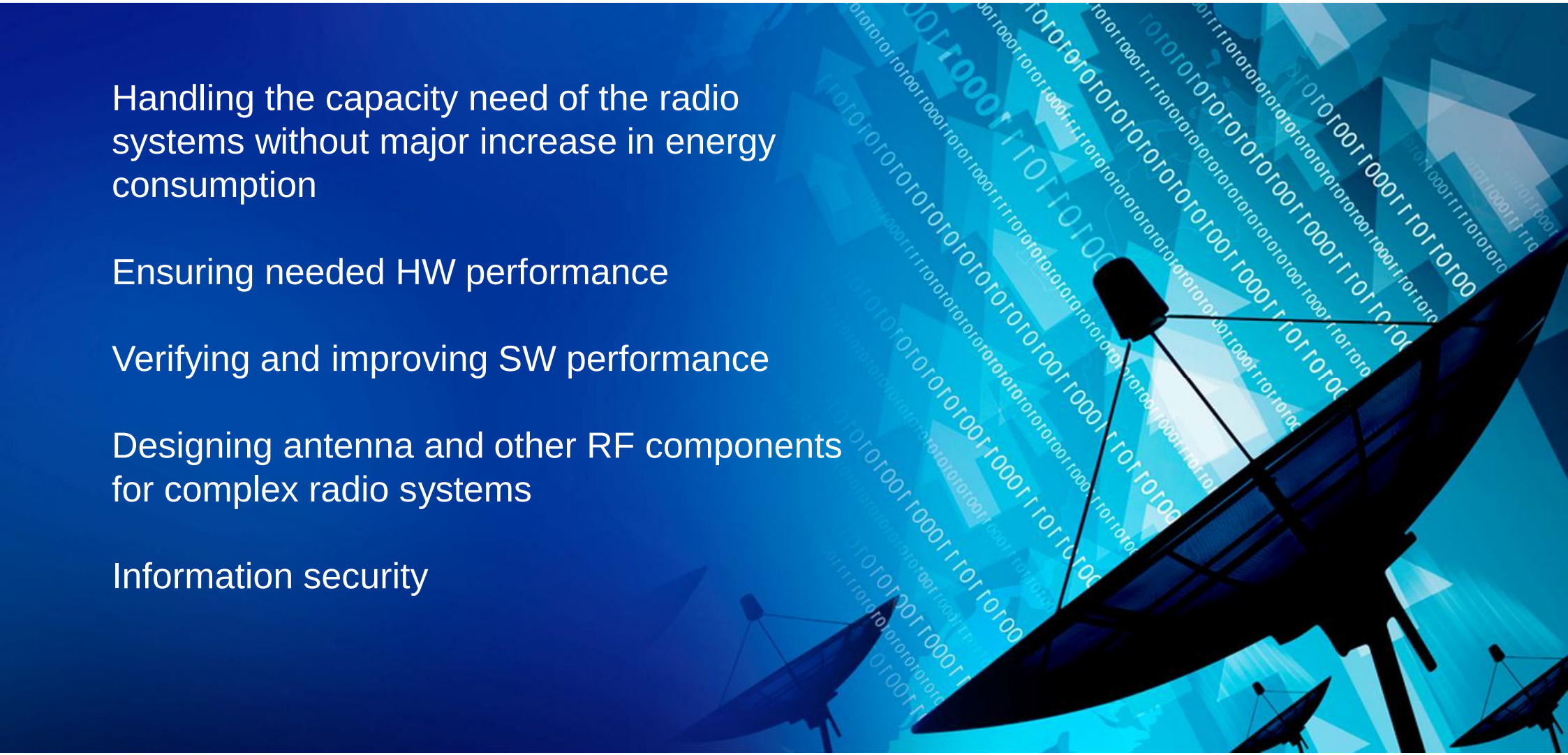
Handling the capacity need of the radio systems without major increase in energy consumption

Ensuring needed HW performance

Verifying and improving SW performance

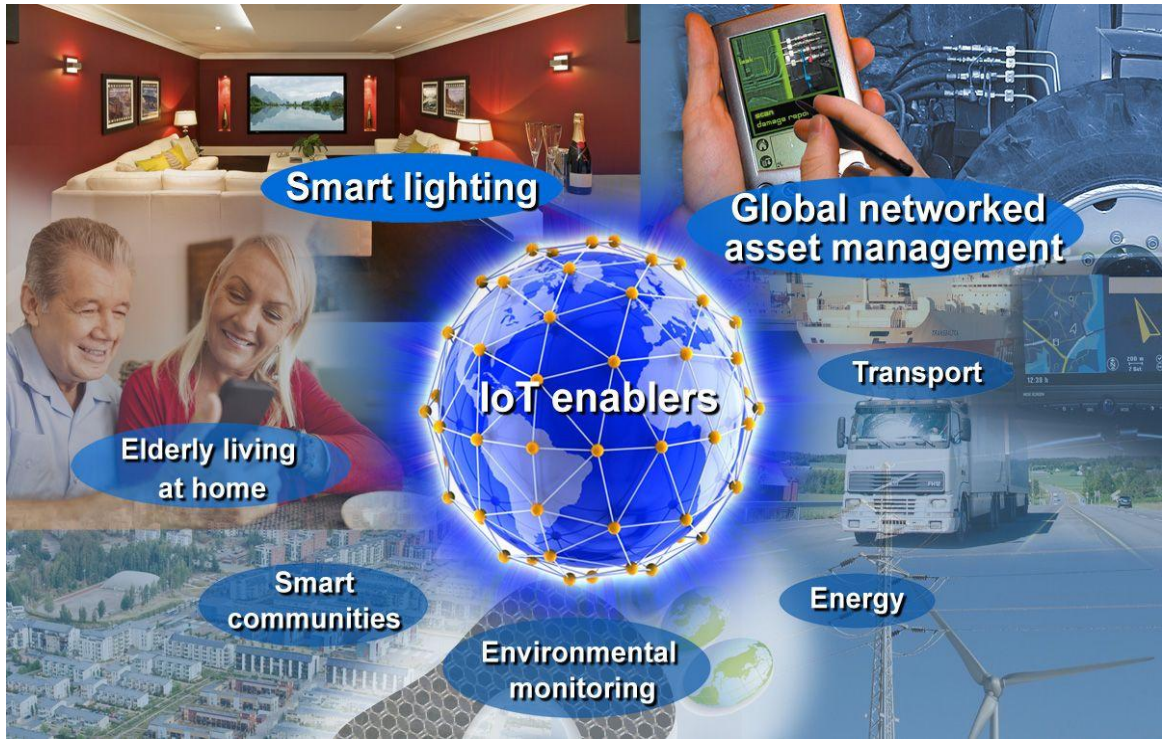
Designing antenna and other RF components for complex radio systems

Information security



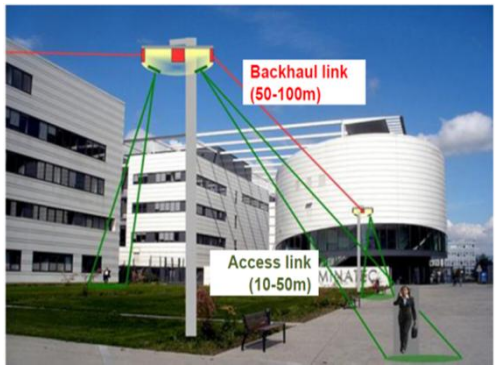
Key 5G system requirements (by Horizon2020/5G PPP)

- 1000 times higher wireless area capacity and more varied service capabilities
- Saving up to 90% of energy in mobile communication, especially the radio access network
- Very dense deployments of wireless communication links (over 7 trillion wireless devices serving over 7 billion people)
- Advanced user controlled privacy



Highlights of our 5G research

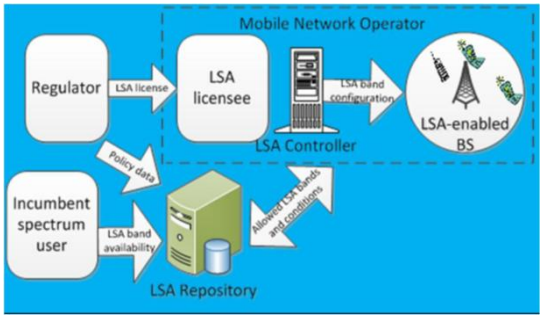
Millimeter wave radiolinks for 5G



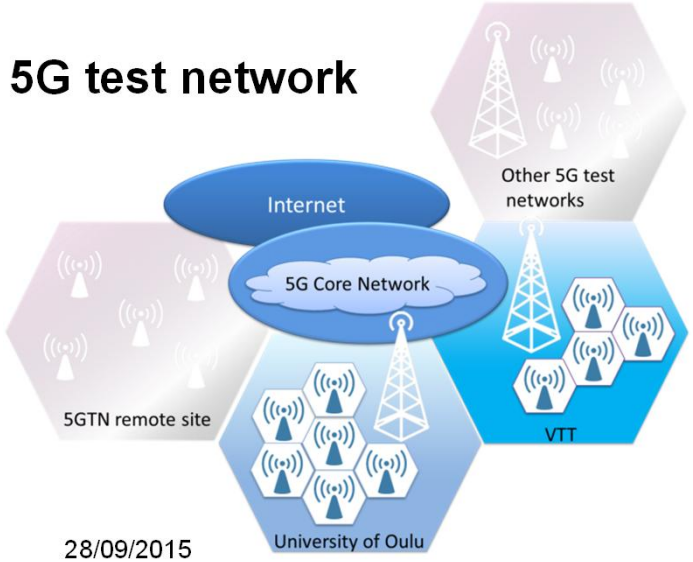
Network management and virtualisation

Wireless mesh network solution in Singapore harbour

Licensed Shared Access (LSA) for faster access to new spectrum



5G test network



VTT-driven 5G research programs

- EU-5GPPP Coherent – Spectrum sharing in EU space
- EU-5GPPP ENSURE – 5G security architecture
- EU-5GPPP Flex5Gware - 5G hardware (Intel)
- 5G Test network - National Flagship
- Joint research projects with USA and China

Micro and millimetre wave radio links

Value proposition: First class design and prototyping of microwave and millimetre wave modules.

Competitive edge: Substantial amount of experience in the field of microwave and millimetre wave antennae, components, and systems. The space related activities include ESA-projects.

Offering: Design of millimetre wave components, circuits, and sub-systems. Experience includes technologies such as, CMOS, SiGe, GaAs, InP and RF MEMS.

R&D infrastructure: MilliLab; Measurement capabilities span from 30 GHz to 300 GHz, in addition to specialised measurement capabilities up to 2 THz.

Wireless mesh networks in harbour communications

IoT Challenge:

- Cargo handling goes automated in harbours due to the need to intensify operations and cut expenses.
- Automaton implemented using AGVs (Automated Ground Vehicles) which are controlled by wireless networks.
- Harbours are challenging for wireless communications making it difficult to offer required connectivity, i.e., support for mobility, routing, and handover performance and guarantee latency requirements.

Solution/Result:

- Specifications for a wireless control network that is able to support automated and remotely controlled devices (AGVs)
- Survey of applicable wireless mesh technologies for AGVs
- Comparison and selection of best matching technology
- Design and implementation of a proof-of-concept wireless mesh network demo

Outcome:

Wireless mesh test and demo network implemented in Singapore harbour .

Benefits:

- Solution enables control and use of AGVs in container handling in harbours
- Parallel networks can be utilised to guarantee connectivity at all times
- Latencies within required limits

Follow-up:

- Accurate location of AGVs and other harbour vehicles is mandatory to have fully automated harbours
- Discussions to utilise VTT's expertise in solving the positioning issue

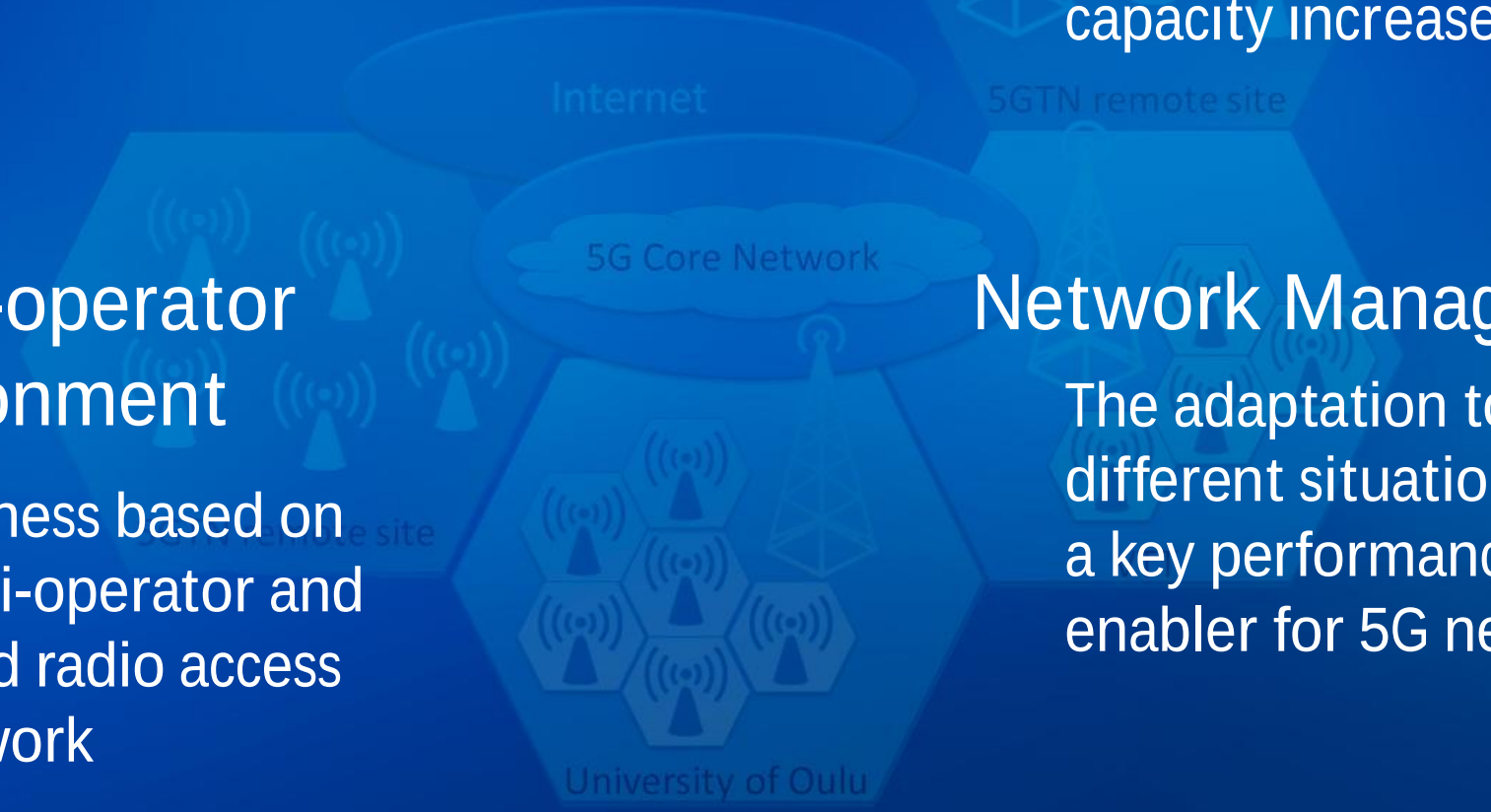
Test network

5G Components

Introducing the new 5G features and frequency bands

IoT & Small Cells

5G is the booster for the internet of things. Dense urban small cells enable capacity increase



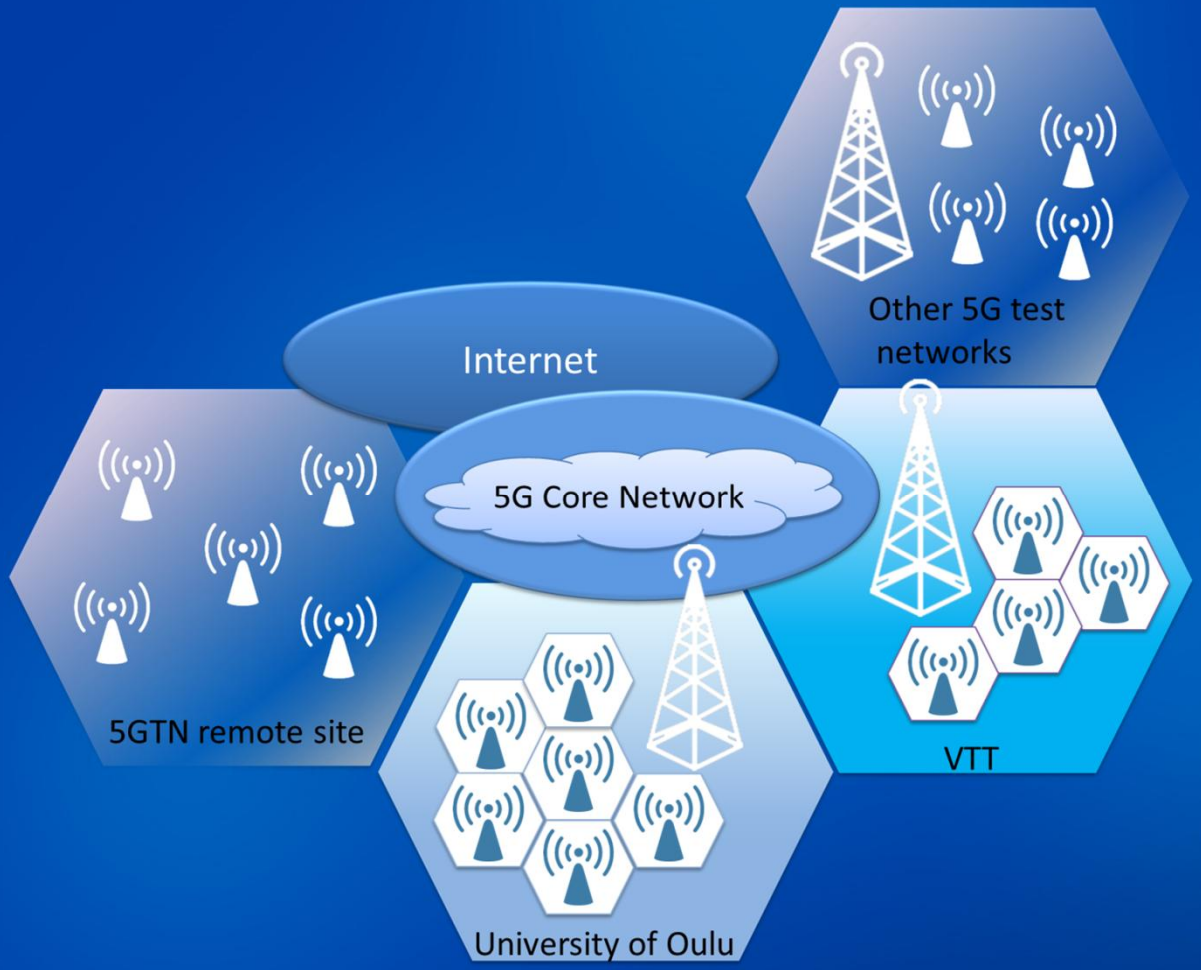
Multi-operator Environment

Business based on multi-operator and cloud radio access network

Network Management

The adaptation to different situations will be a key performance enabler for 5G network.

Test network

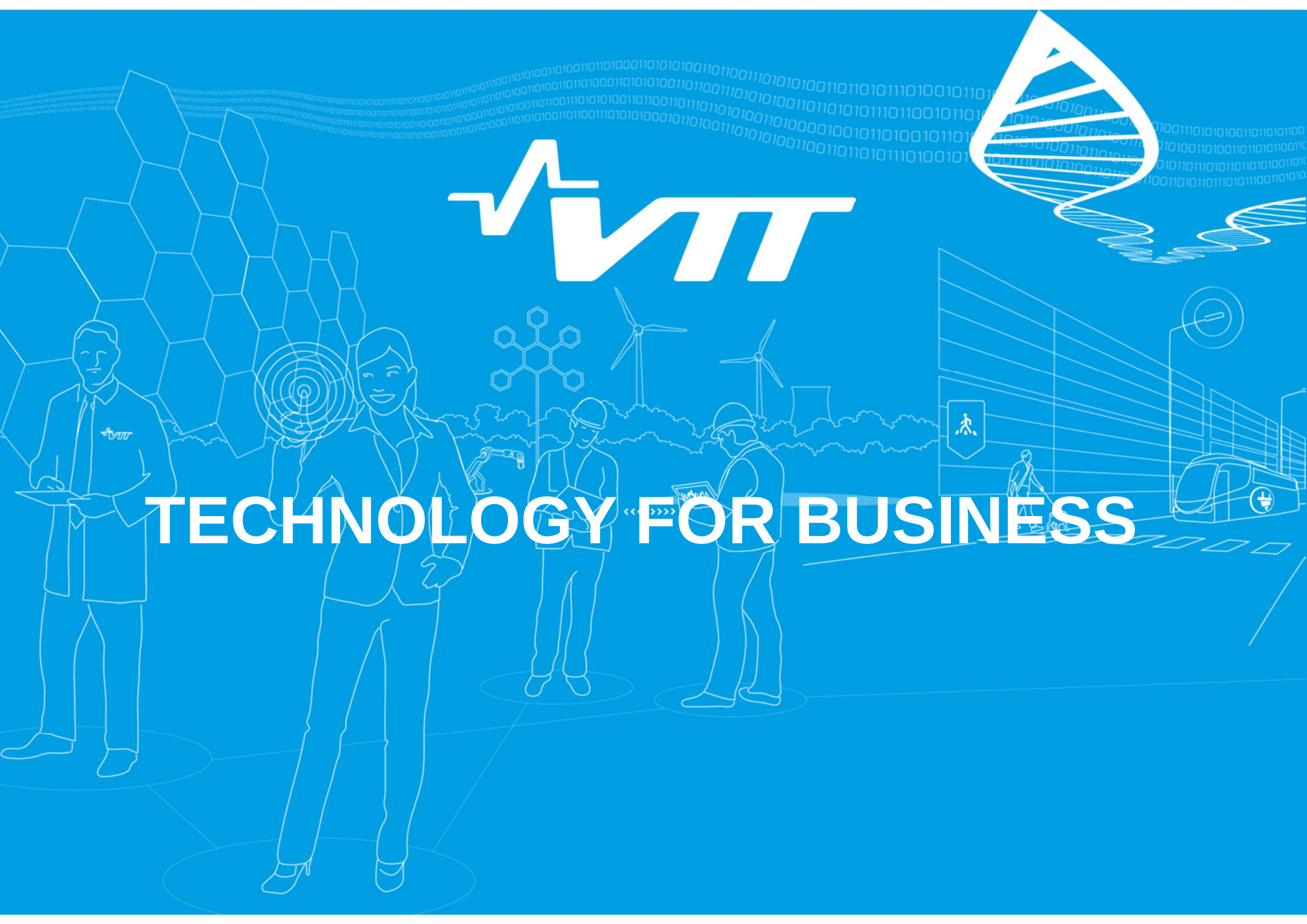


Restricted network at VTT

In restricted network, partners can test the functionality of their technologies, tools, and applications in a controlled environment.

Open network at the University of Oulu

The network offers an open platform where interactive value creation with users and customers can happen.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