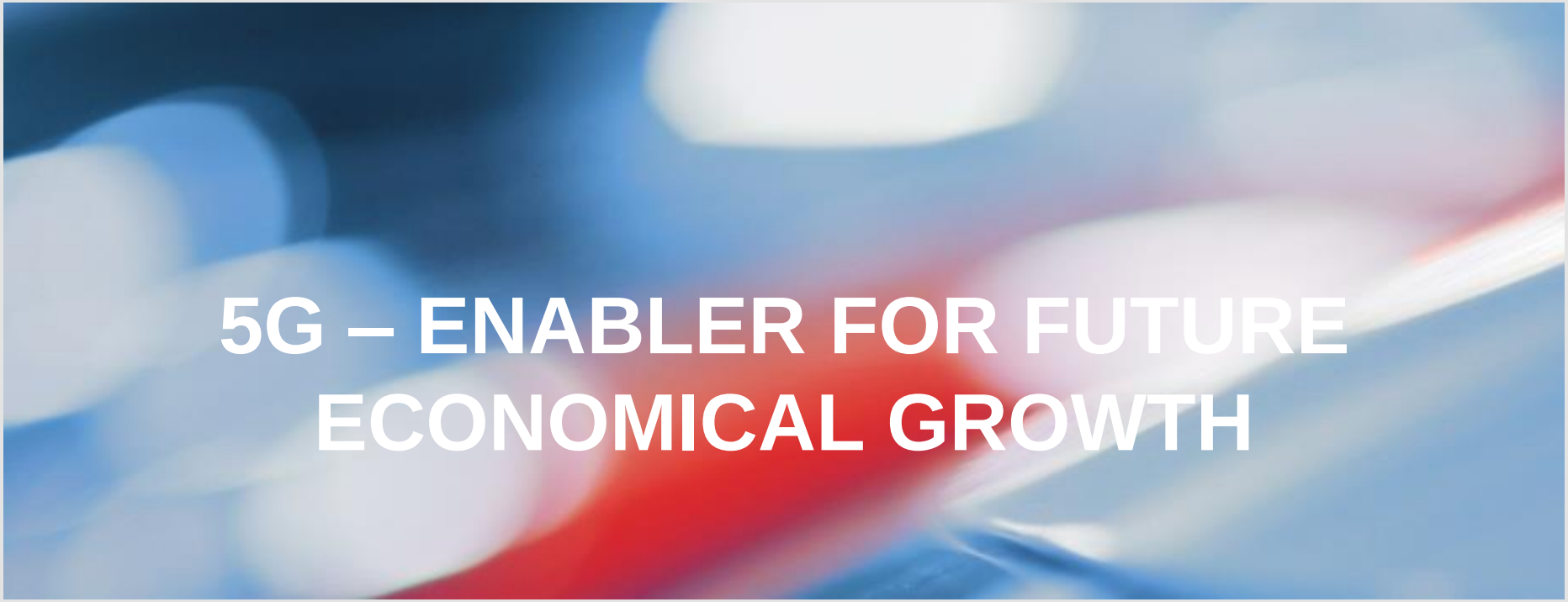
UNIVERSITY of OULU
OULUN YLIOPISTO
DEPARTMENT of COMMUNICATIONS ENGINEERING



5G – ENABLER FOR FUTURE ECONOMICAL GROWTH

Matti Latva-aho

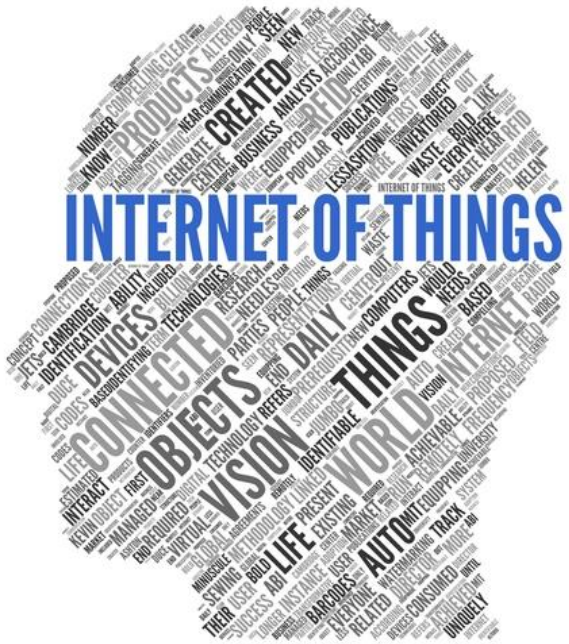
CWC Oulu CENTRE FOR WIRELESS COMMUNICATIONS
University of Oulu

From User Centricity towards IoT

From ABC (Always Best Connected)

2003

to the next 50 billion connected devices



2013

5G Is Not Just Radio Technology

- **Technology** boost is a key enabler for
  - New **services**
  - New ways for **spectrum** sharing **policies** and using higher frequencies
  - Creating totally new **business potential** through major changes in 5G networks operation.

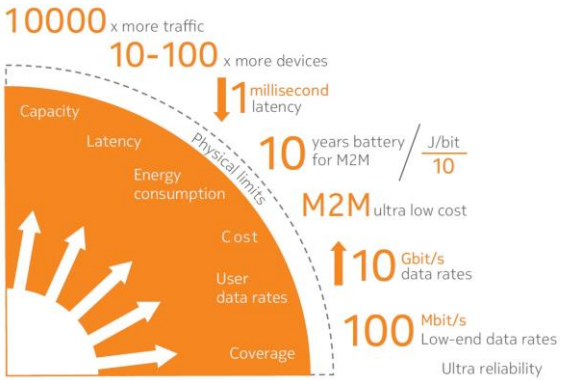
⇒ Although radio technologies are evolving fast, probably the biggest changes are business models related.

Timeframe for 5G

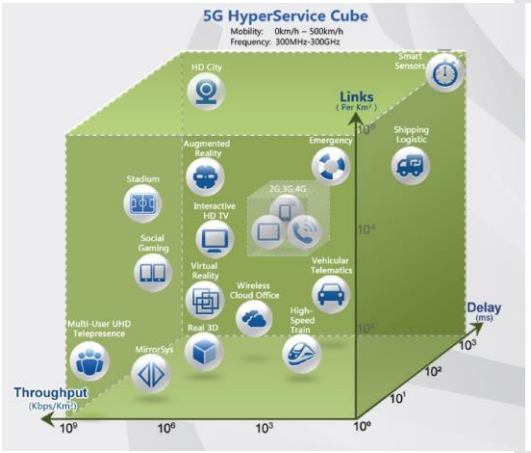
Industry Views on 5G

Qualcomm

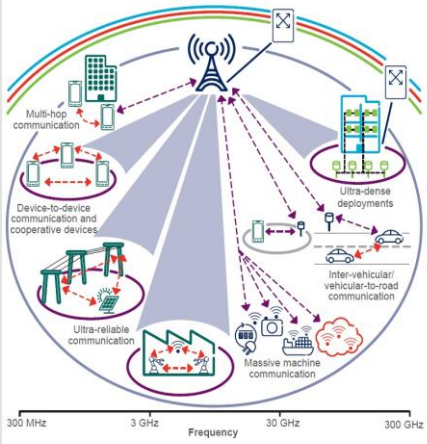
Nokia



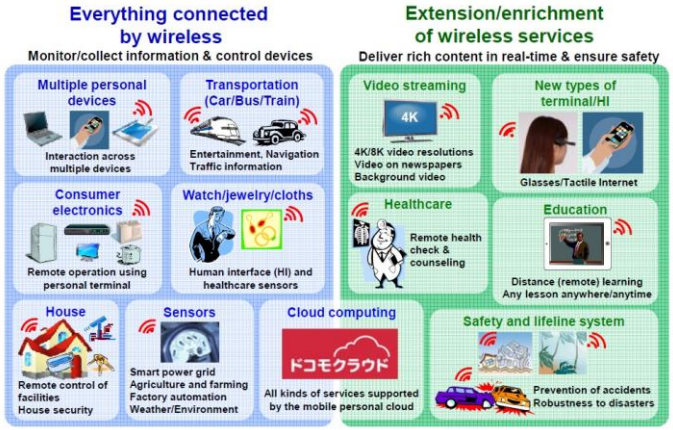
Huawei



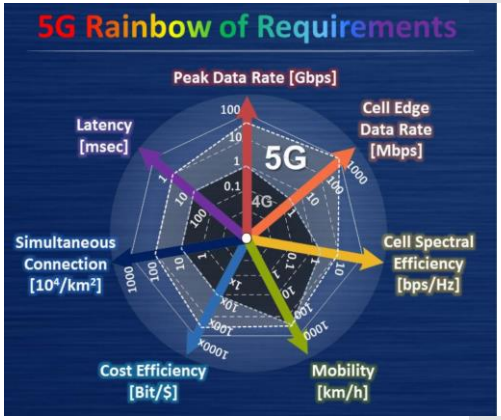
Ericsson



DoCoMo

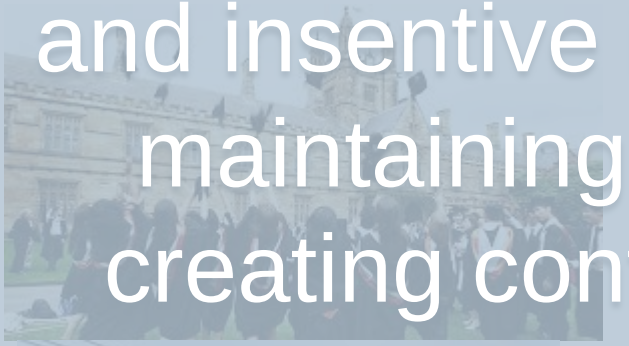
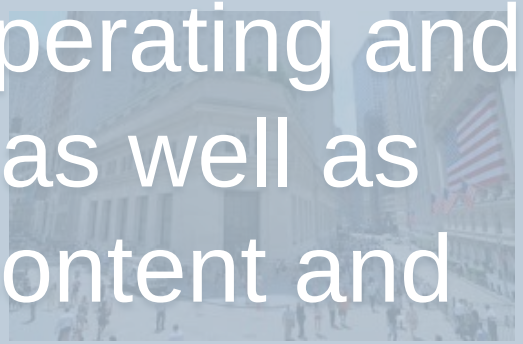


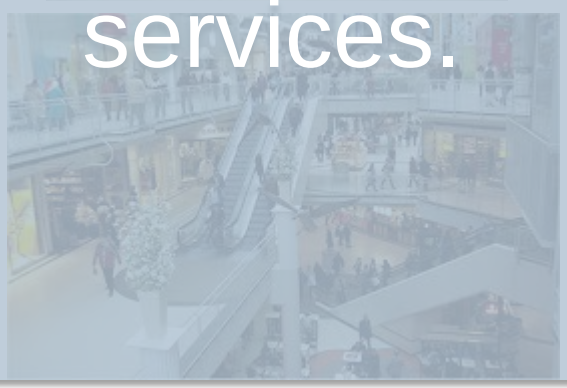
Samsung



Context & Insentives

The owner of the space must have a role and insentive in building, operating and maintaining the network as well as creating context related content and services.



How Operator Roles May Change in 5G?

- **Wide coverage** area expensive to maintain
  - Insentives for operators? Emergence of public operators?
- Lot of traffic in densely placed **small cells**
  - Network maintanance difficult in indoors
- Spectrum **regulation** likely to go towards shared spectrum
  - Spectrum and operator business less regulated
- Content will be changing much faster and lot of content relevant only to the context will be there; users/machines generate lot of content
  - Dynamic **local caching** to be shared by any operator customer
- Access and content provisioning will finally be separated
  - YouTube and Netflix have already done that in practise!
- Emergence of **micro operators**?

Micro Operator - μOP

- A virtual operator does not have own infrastructure but has own customer base.
- A micro operator (μOP) has own infrastructure but not necessarily own customer base.
- Revenue models for μOPs are not based on monthly fees of bytes.
  - Part of property offering – inclusion to rent
  - Part of customer service model
  - Improving the efficiency of public services
  - ...

5G Test Network

5G Test Network mission

Build a scalable 5G test network enabling future **business models** and **service development** as well as testing and developing key **5G technology components** and related **support functions**.

5G Test Network vision

The 5G research and test environment shall be linked to theoretical 5G research and will provide the opportunity to validate theoretical results. It will enable the resolution of potentially opposing views on real life, network-level performance. It will constantly evolve, as research and standardization progress. Hence, technologies will be comprehensively verified before they are standardized and implemented. By 2020, the environment will have evolved into a full-scale 5G network, which will be provided as a living lab for application and service testing.

5G Radio Components

Introducing the new 5G features and frequency bands.

IoT

5G is the booster for the internet of things.

Small Cells

The key for capacity increase in indoors resulting in new businesses.

Multi-operator environment

Business based on multi-operator and cloud radio access network.

Network Adaptation

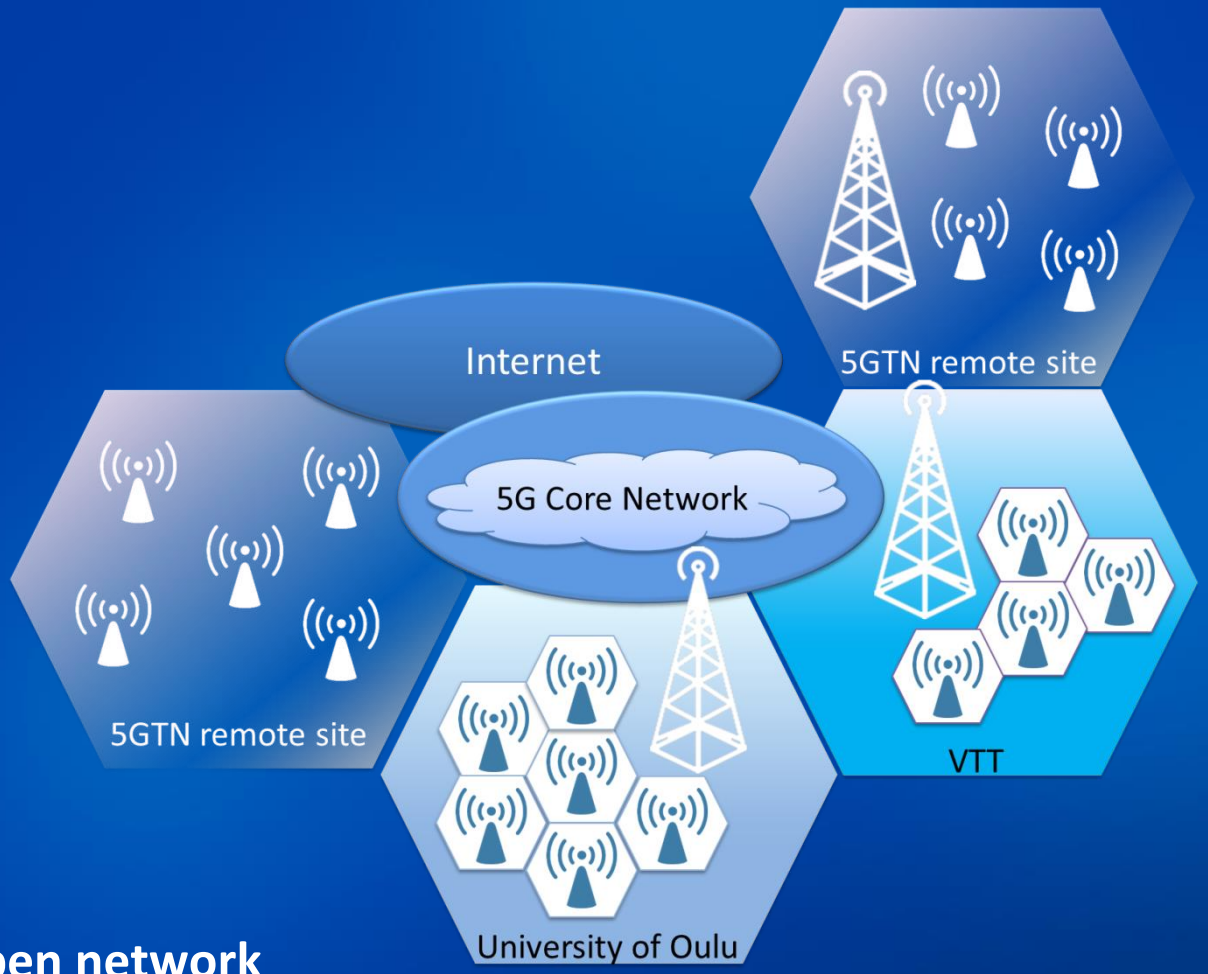
The adaptation to different situations will be a key performance enabler for 5G network.

Research platform where to study and explore 5G

Co-operation opportunities

5GTN enables new business opportunities

Strong consortium to support 5G related development



Restricted network

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

Open network

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

University of Oulu Builds Future Wireless Campus

- University wide platform for **research, education, daily life and business acceleration** including:
  - Open technology and service development platform for collaborators;
  - Big data collection, analysis and utilization;
  - Future wireless campus;
  - University wide navigation solution;
  - Rich content based interactive teaching;
  - 5G radio prototyping;
  - Crowd sourcing based service creation;
  - IoT applications with aggressive business acceleration.

Partners

- Anite Finland Oy
- City of Oulu
- Elektrobit Wireless Communications Oy
- Eltel Networks Oy
- EXFO Oy
- Finnish Communications Regulatory Authority
- Haltian Oy
- Indalgo Oy
- MediaTek Inc.
- Nokia Solutions and Networks Oy
- Oulu University of Applied Sciences
- PehuTec Oy
- Pulse Finland Oy
- Sarokal Test Systems Oy
- University of Oulu
- VTT Technical Research Centre of Finland Ltd
- Yleisradio Oy

5GTN is part of 5thGear program by Tekes

Project Part-Financed by the European Union

European Regional Development Fund