Conference

INTERNET OF THINGS ENABLING TECHNOLOGIES
FROM VIRTUAL NETWORKS AND CLOUD COMPUTING TO SMART INTEGRATED COMMUNICATION SYSTEMS

Research for future networks and smart telecom

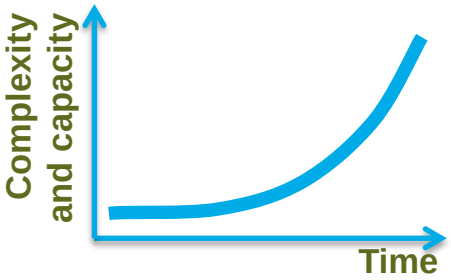
Patrick Waldemar,
VP Telenor Research, Norway

02nd of April, 2014,
09:00-17:00, Telenor, Oslo, Norway.

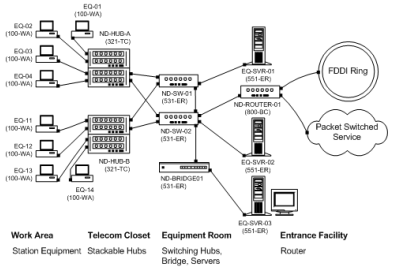
Auditorium Voice, Telenor Expo,
Snarøyveien 30, 1331 Fornebu

The next generation mobile system is 5G
There will be change!

- Technology push and service pull make networks complex with traffic explosion



- Large number of terminals, new type devices and sensors require a far more efficient network to handle both data and signalling traffic



- Heavy investments in new generation technology and radio frequencies push towards smart choices and clever utilisation of innovative solutions

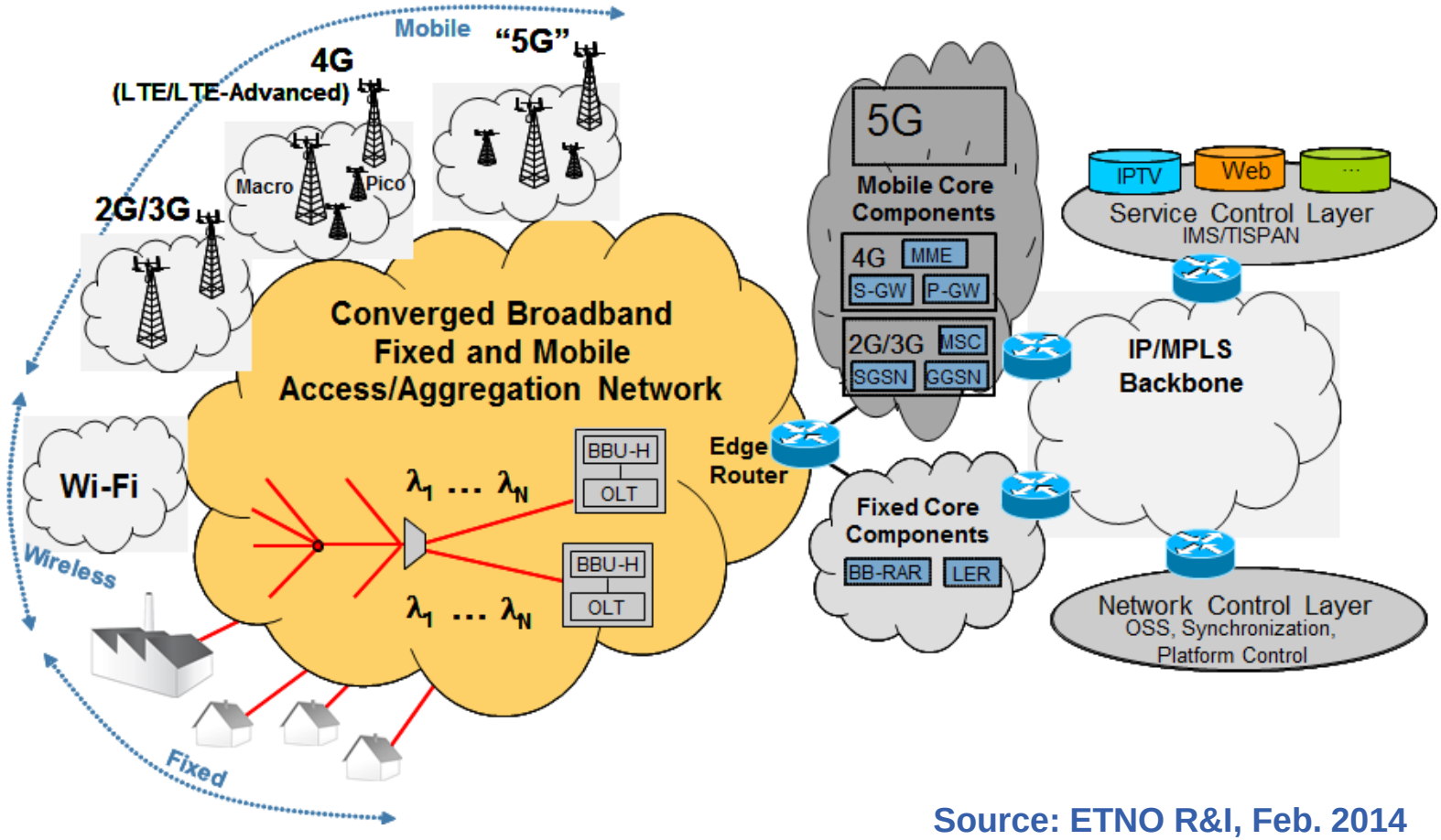
Expected impact from 5G PPP by 2020[1] "a 7-year research programme on 5G"

- 1000 times higher mobile data volume per geographical area
- 10 to 100 times higher number of connected devices
- 10 to 100 times higher typical user data rate
- End-to-end latency reduced to 1/5
- Ubiquitous 5G access including low-density areas
- Network function implementation through generic IT servers
- Fast deployment of large scale service platforms on top of network infrastructure, from 90 days to 90 minutes
- Trustworthy interoperability across multiple operational domains, networks, and data centres

[1] Public private partnership (PPP) as part of the Horizon 2020 "ICT" Work Programme

Future networks and smart telecom

5G domain overview

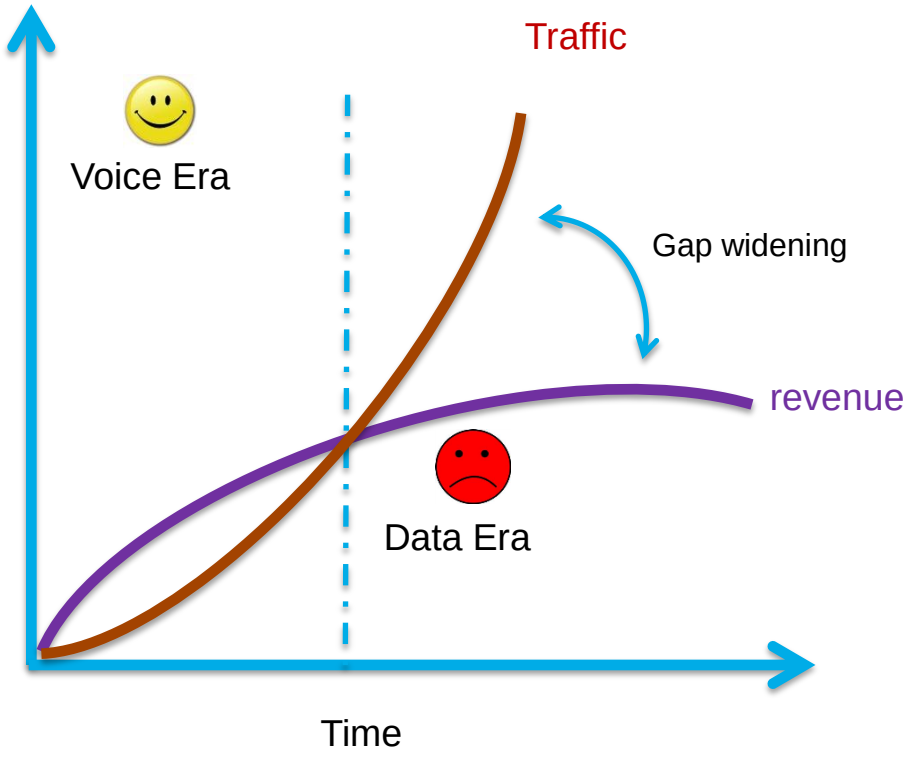


Source: ETNO R&I, Feb. 2014

Research for future networks and smart telecom

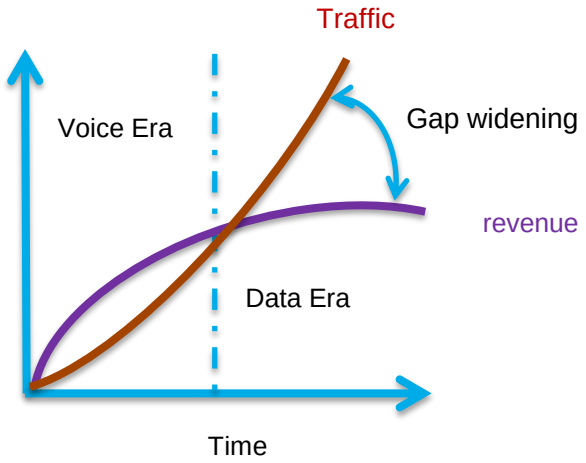
Competition	Data Analytics	Service Innovation	Next Generation Network Technology	Next Generation Services
Develop **insight on competitors, customers and regulations** in order to navigate the complex competitive landscape	**Leveraging our data,** using all tools and sources available, to enhance customer insight and improve decision making	Develop efficient and seamless **delivery of experiences** across manual and digital touch-points driven by **customer behavior** and **needs**	Researching the **future network technologies** and service **network architectures** with focus on disruptive changes	Explore the use of next generation **mobile**, **web** and **Internet** technologies for developing and delivering services on various devices
				

Challenges

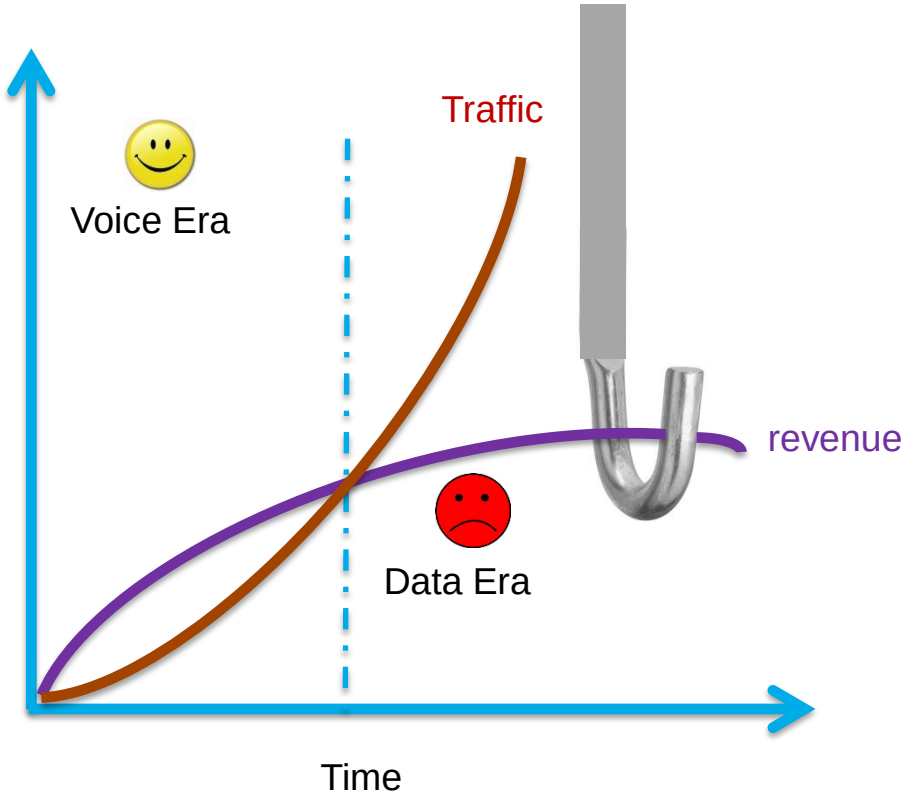


Challenges ➡ Solutions give increased revenue

- Takes a long tome to roll out new services
  New services means new equipment in todays inflexible networks.
  → **Networks Virtualization (NFV/SDN)**
- Spectrum is an expensive and limited resource
  → **Efficient spectrum utilization**
- Need to understand the air interface better.
  → **Over-The-Air (OTA) research**
- Traditional cellular design is interference limited
- Management of the network as the network is growing
- Communication devices are becoming bandwidth demanding
  → **Importance of backhaul and SON**

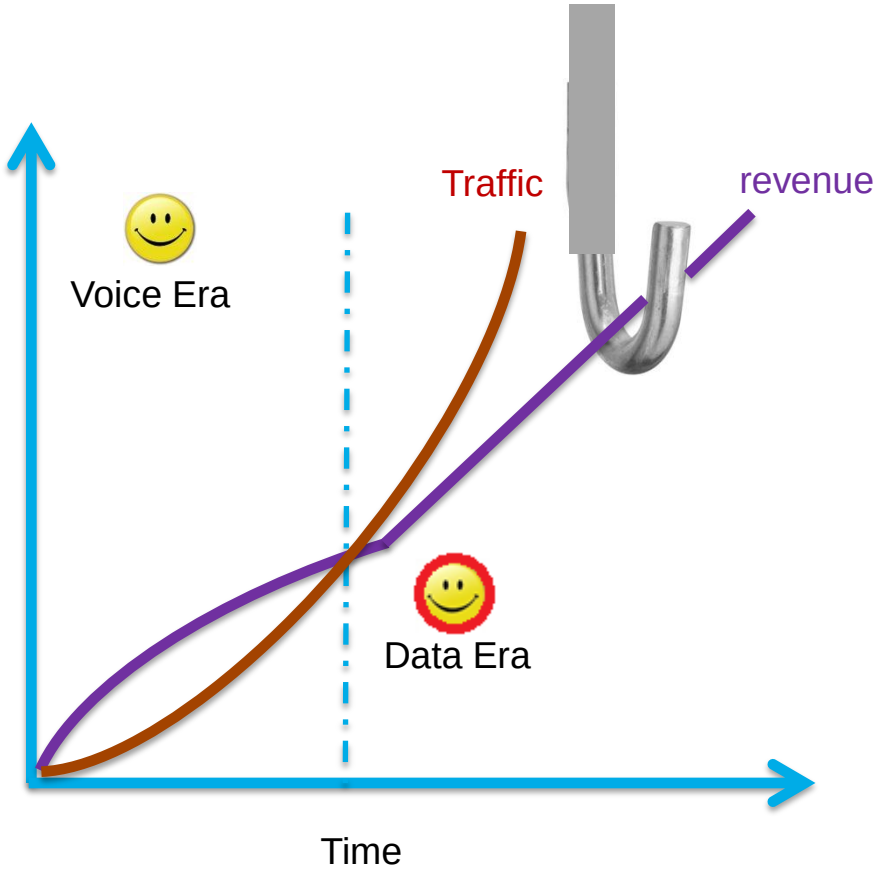


Enablers



Enablers

- Network virtualization
- Efficient spectrum utilization
- Over-The-Air (OTA) research
- Importance of backhaul and SON



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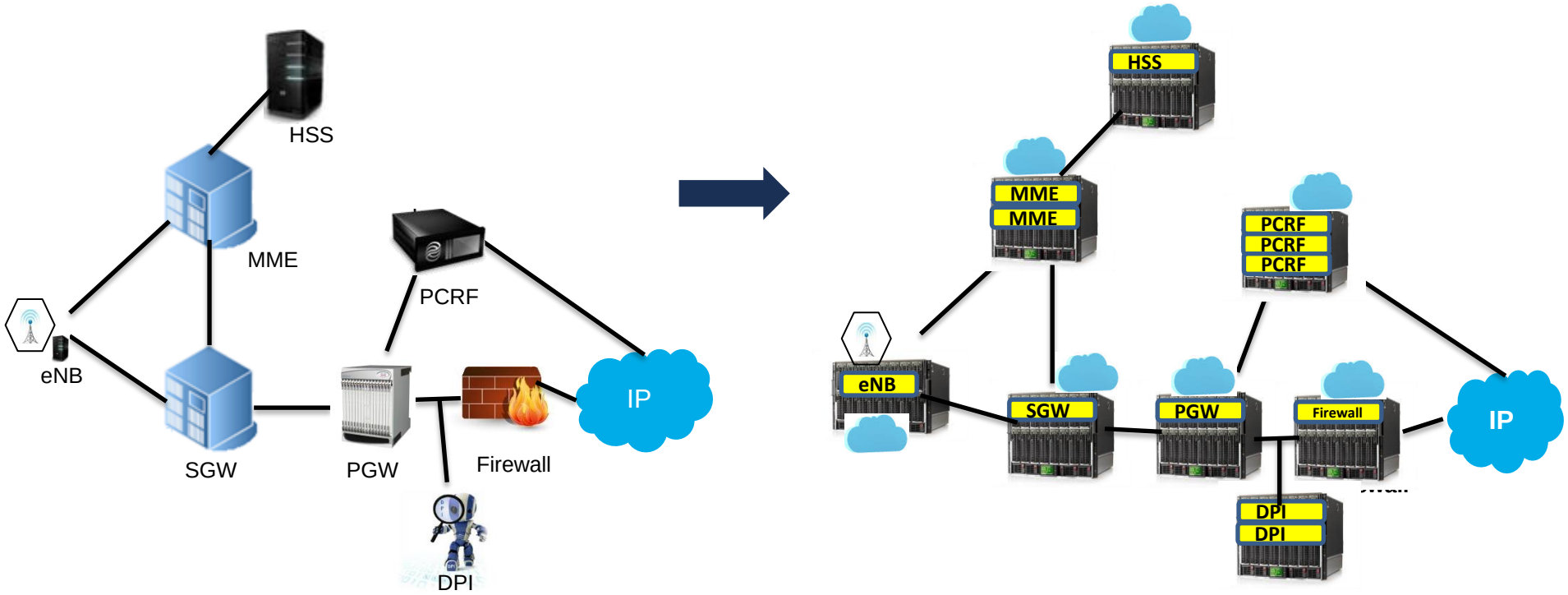
Network Virtualization

A framework to isolate the virtual networks from physical networks
Scale up/down and move functions



Traditional network

Virtualized network

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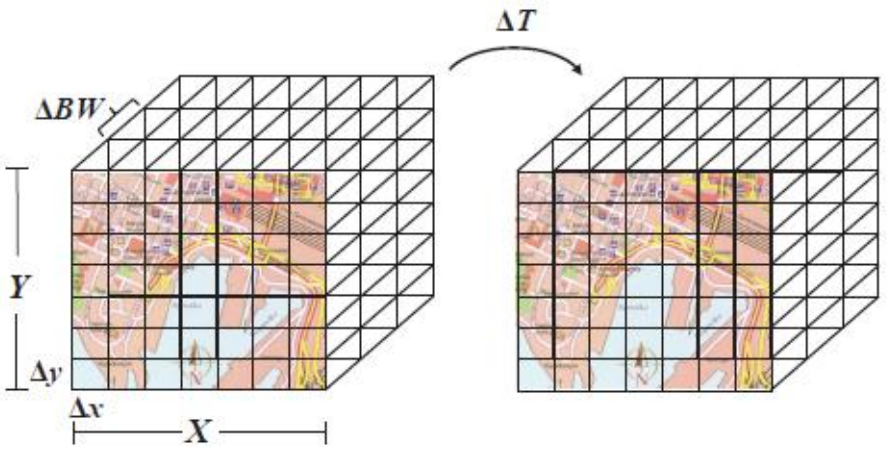
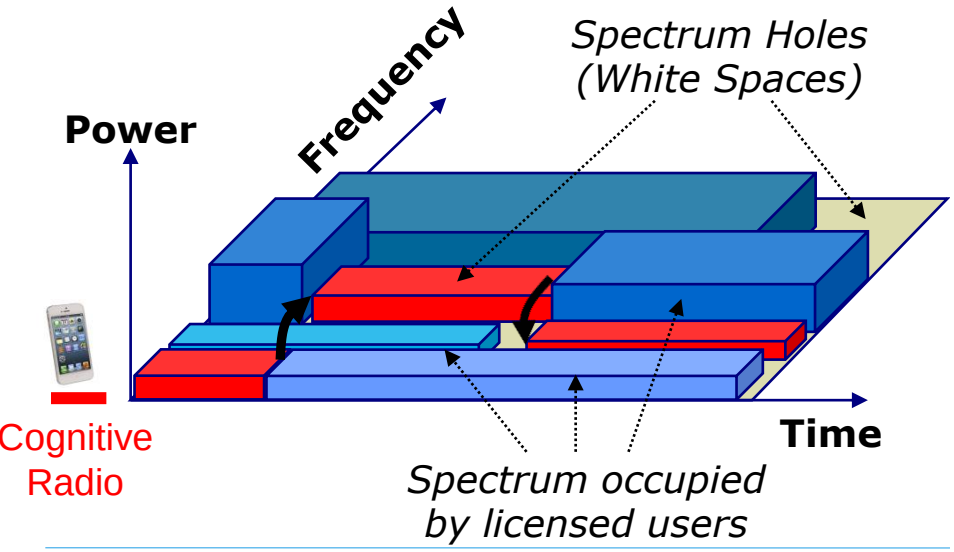
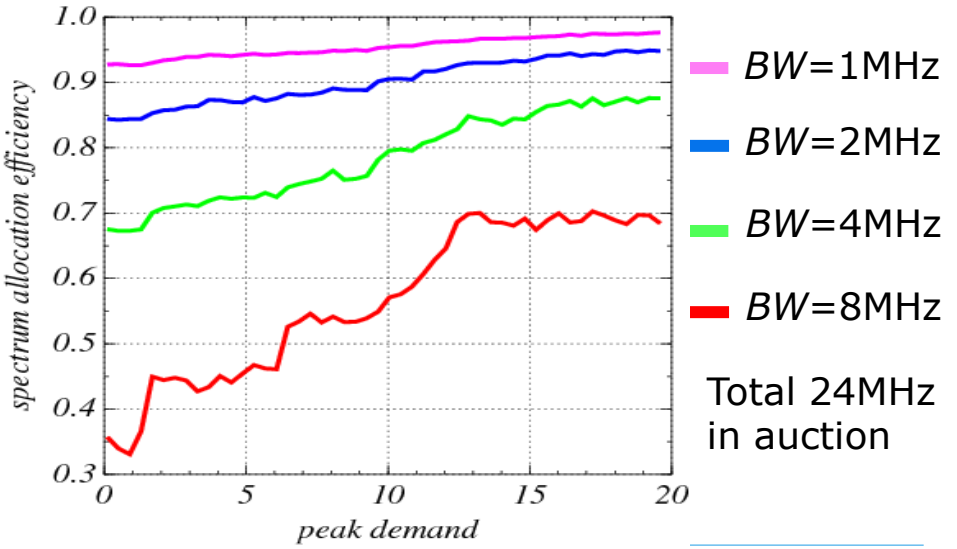
Efficient spectrum utilization

1. Spectrum micro-trading
2. More spectrum commons
3. Cognitive radio for opportunistic access to unused spectrum





4 LTE operators bidding for additional spectrum



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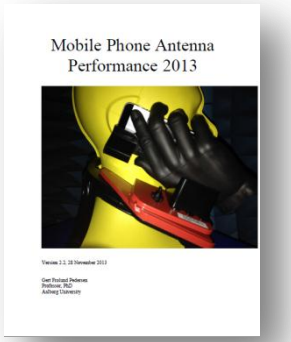
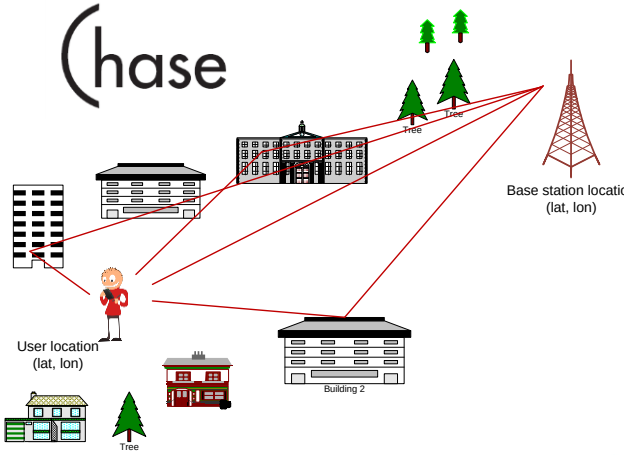
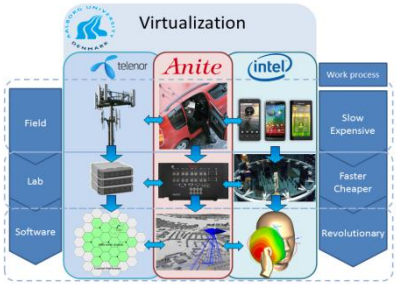
Over-the-Air (OTA) research

The importance of terminal performance for an operator





Using a smart phone app to collect data on user-randomness



Virtualizing drive tests and benchmarking for terminals and network performance

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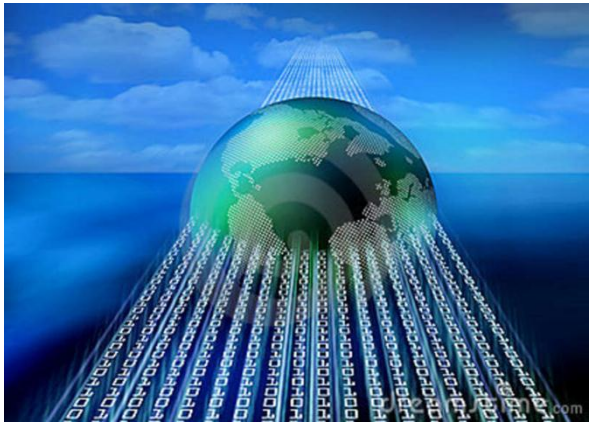
Importance of backhaul and SON



Motivation

- Mobile networks become more heterogeneous
- The number of small cells will explode
- Backhaul costs will increase significantly

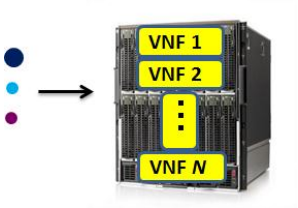
Research focus:

To find novel backhaul architectures and solutions that are:

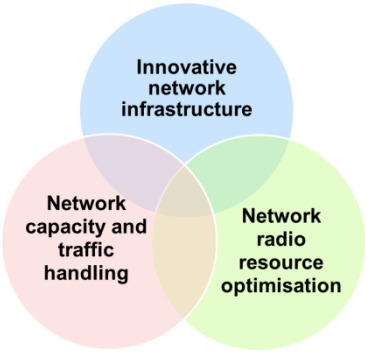
- **Adaptable and robust**
  - Reconfigurable to move capacity according to demand
- **Intelligent**
  - Self-Organizing capabilities
- **Ubiquitous**
  - To make it easy to add or move small cells anywhere within the served area.

Future networks and smart telecom

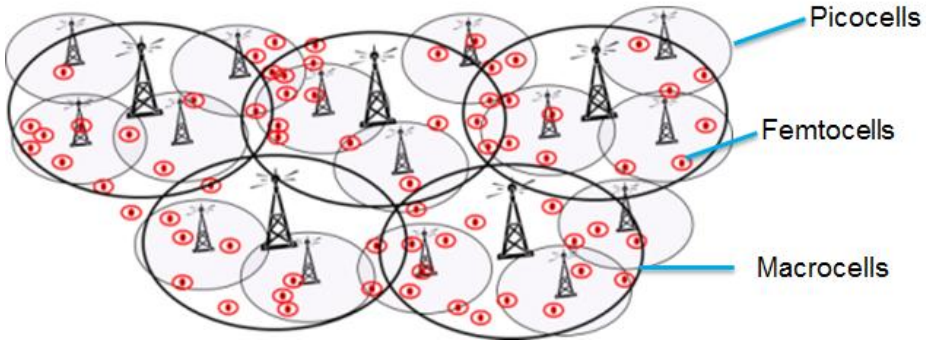
Key message: Smart-5G



New network infrastructure using advantages from both telecommunication networks and information technology towards soft networks

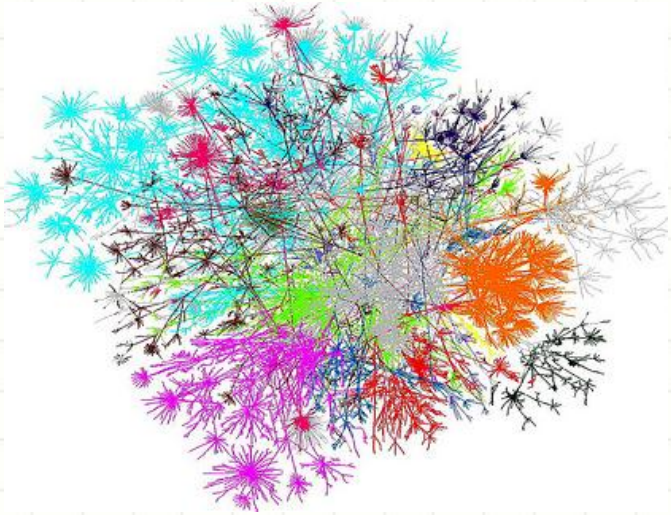


New ways to utilise and share spectrum along with advanced radio technology, self-organised networks, and terminal feed-back



New network topology such as small-cell structure, traffic engineering for heterogeneous technology, and efficient backhaul

Thank You!



INTERNET OF THINGS:
INTERNET OF ANYTHING, ANYTIME, ANYWHERE

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building knowledge to define the future

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