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SYSTEMICS Group

Challenges in e2e user experience measurements in 5G implementations

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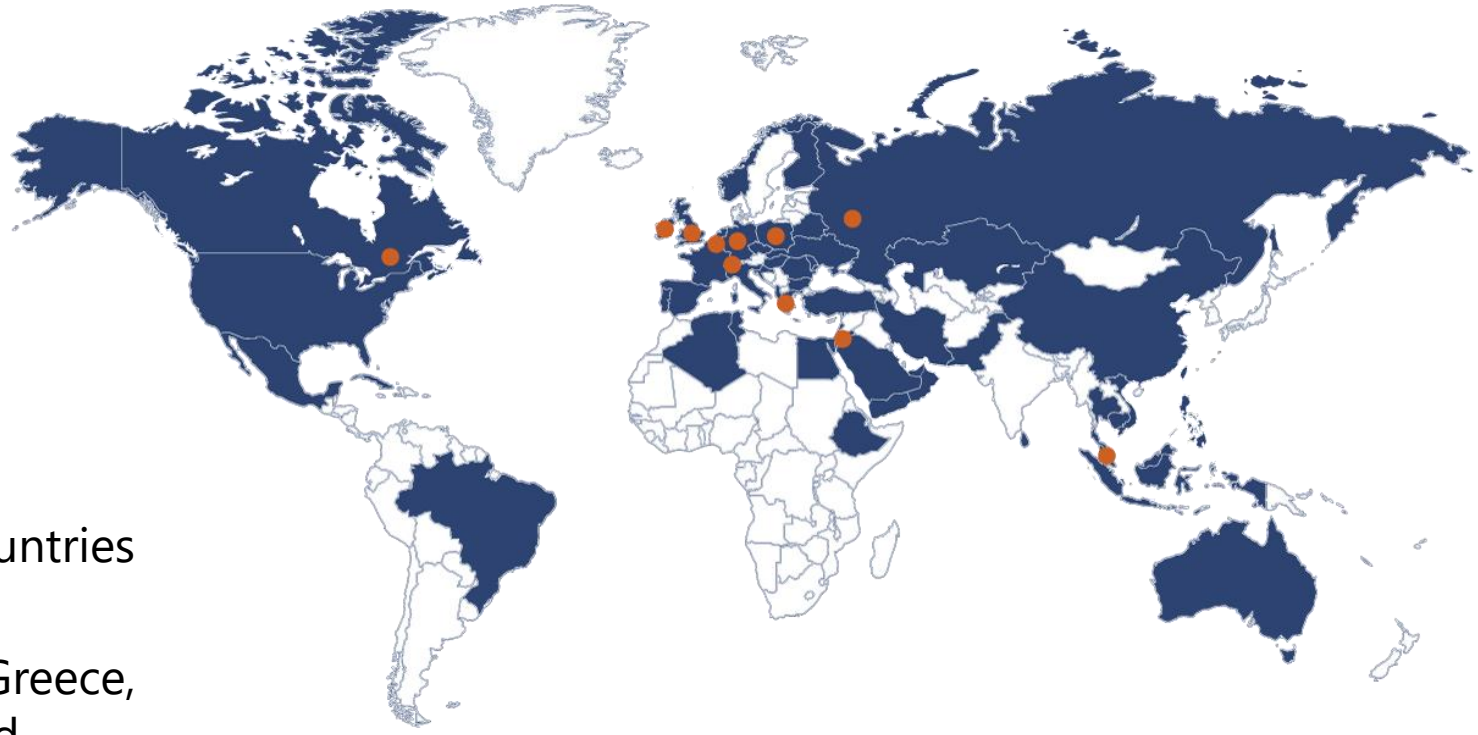

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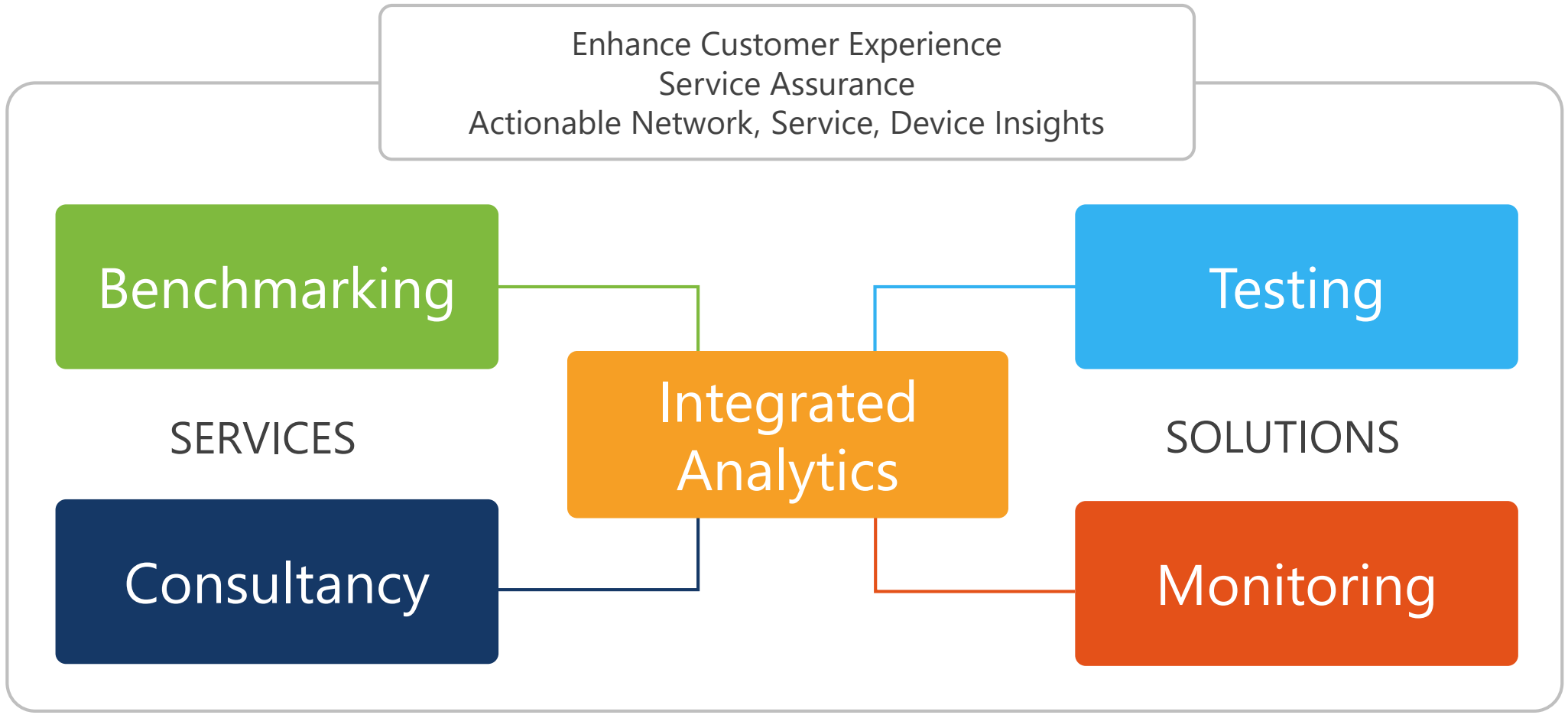
How we can help improving mobile services QoE



Contents

- New services to be tested in 5G
- Evolution of legacy services testing
- Testing and benchmarking in pre-5G era

Services to be present in 5G

According to Metis II there are three use case families contained in the system concept of the METIS-I project (and are referred to as generic services).

Extreme Mobile BroadBand (xMBB) - provides both extreme high throughputs and low latency communications and extreme coverage improving the Quality of Experience (QoE) by providing reliable moderate rates over the coverage area

Massive Machine-Type Communications (mMTC) - provides wireless connectivity for dozens of billions of network-enabled devices (+100k per access point). Scalable connectivity for an increasing number of devices over wide area coverage and deep indoor penetration have priority over peak rates as compared to xMBB.

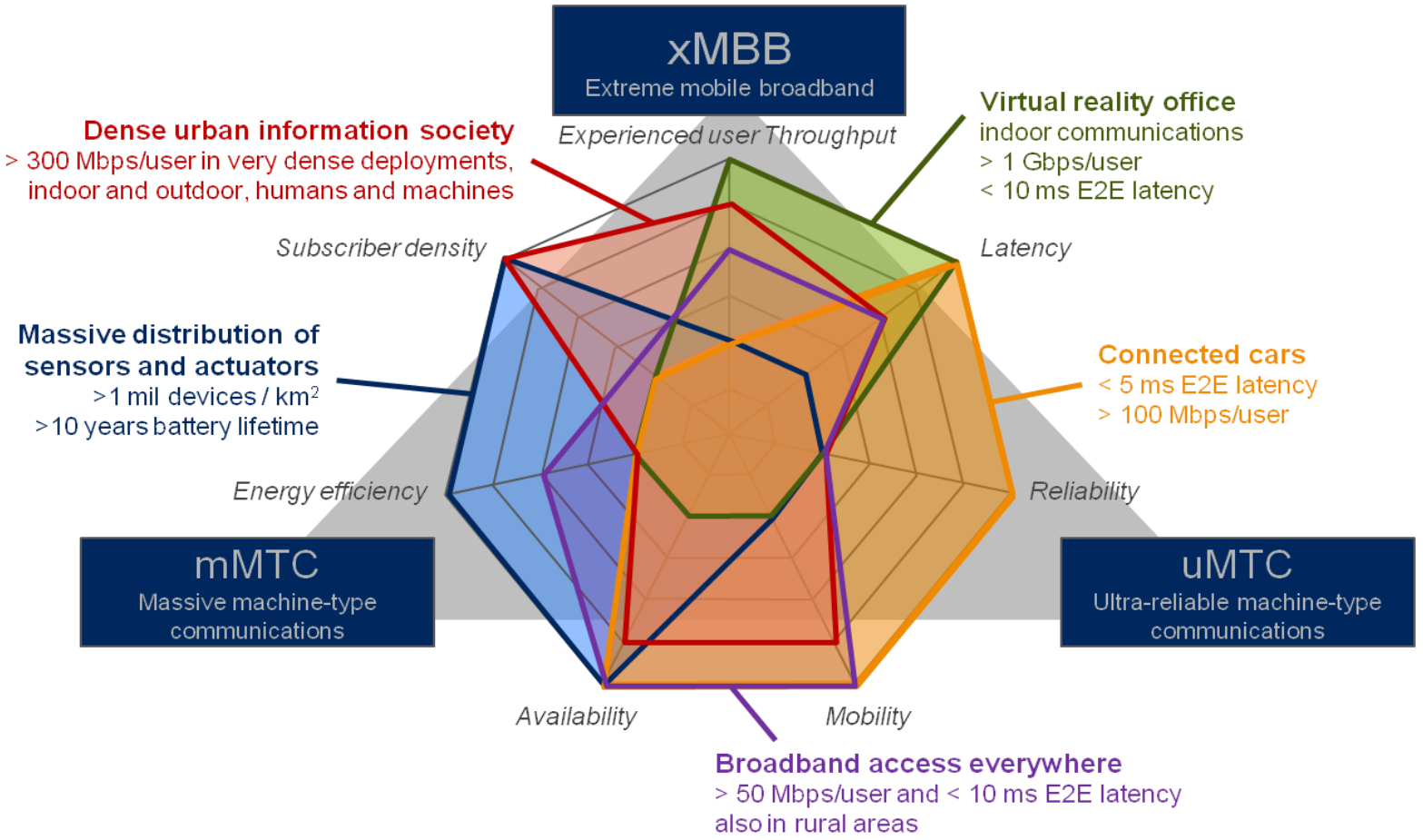
Ultra-reliable Machine-Type Communications (uMTC) - provides ultra-reliable low-latency and/or resilient communication links for network services with extreme requirements on availability, latency and reliability, e.g. Vehicle-to-Anything (V2X) communication, healthcare and industrial control applications.

5G use cases and use case families

Use Case (UC)	Scope of requirements (network/user perspective)	Scope of services (service perspective)	Source
xMBB mMTC Dense urban information society	Experienced user data rate / Traffic vol. per subscriber / Nb. of users and devices / Energy efficiency	Broad range of communication services covering needs related to both indoor and outdoor urban daily life (excl. office and factory)	METIS-I test case enriched by NGMN UC Mobile video surveillance
xMBB Virtual reality office	Experienced user data rate / Traffic volume per subscriber / Latency	Broad range of communication services in the (indoor) office context	METIS-I test case
xMBB Broadband access everywhere	Experienced user data rate / Availability / Mobility / Energy efficiency	Full coverage topic addressing outdoor/indoor communication needs especially in rural areas	NGMN use case 50+ Mbps everywhere incl. METIS-I test case Blind spot
mMTC Massive distribution of sensors and actuators	Availability / Number of devices / Energy efficiency	Broadest range of IoT services covered	METIS-I test case Massive deployment of sensors and actuators
xMBB uMTC Connected cars	Latency/ Reliability / Mobility	Strong expectation from the (automotive) industry Belong to the first uMTC services expected to be commercialized	METIS-I test case Traffic efficiency and safety complemented by MBB aspects

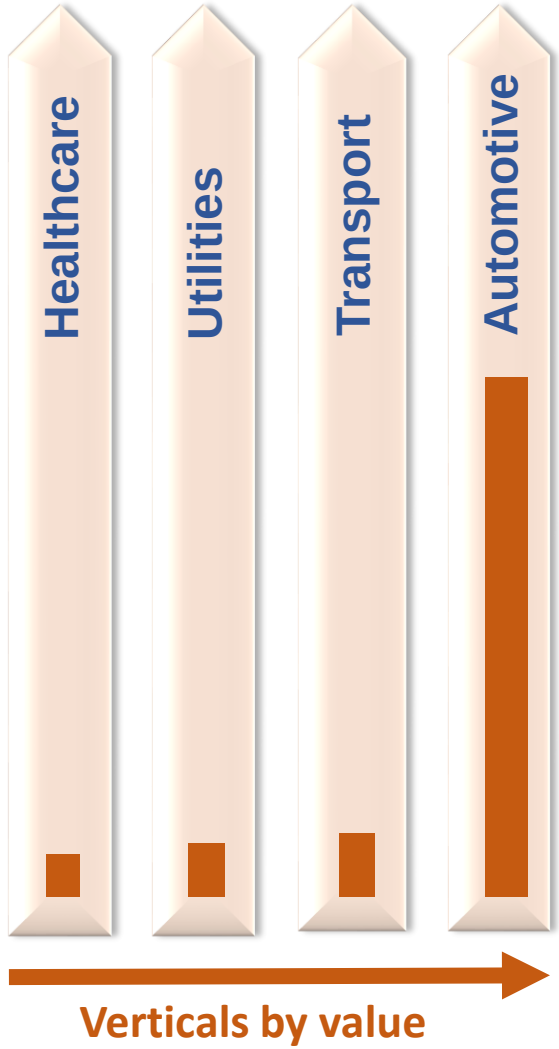
Source: METIS II, D1.1

5G use cases' mapping to 5G requirements

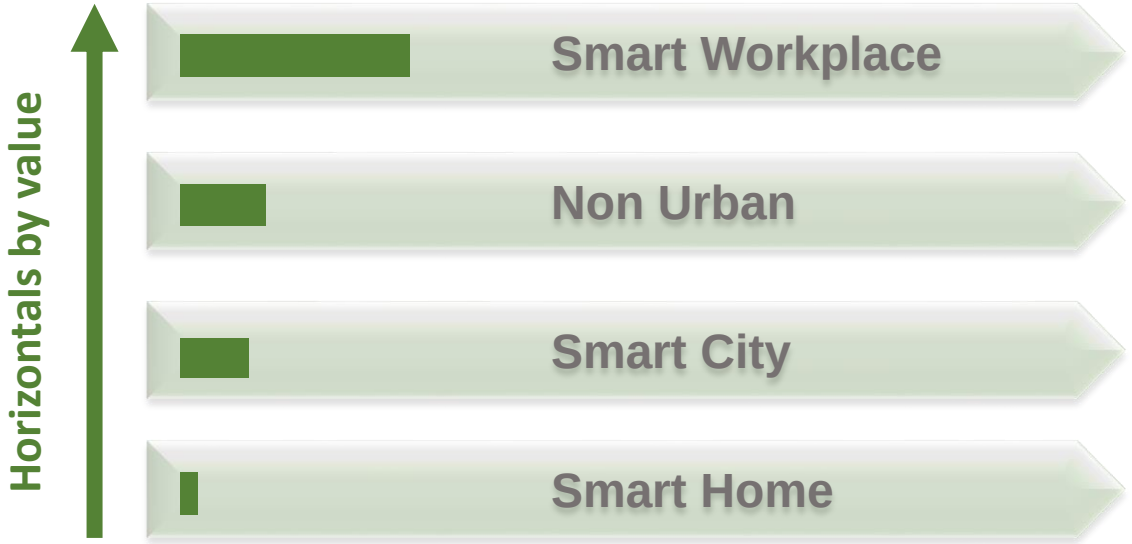


Source: METIS II, D1.1

New services in 5G, are they all to be tested?



- The value of the market for 5G applications will determine deployment priorities
- Wide area services will set the pressure on network availability and reliability
- Where to measure and what to measure is still in an early phase



Source: RealWireless for UK SPF Plenary

Evolving landscape of mobile services

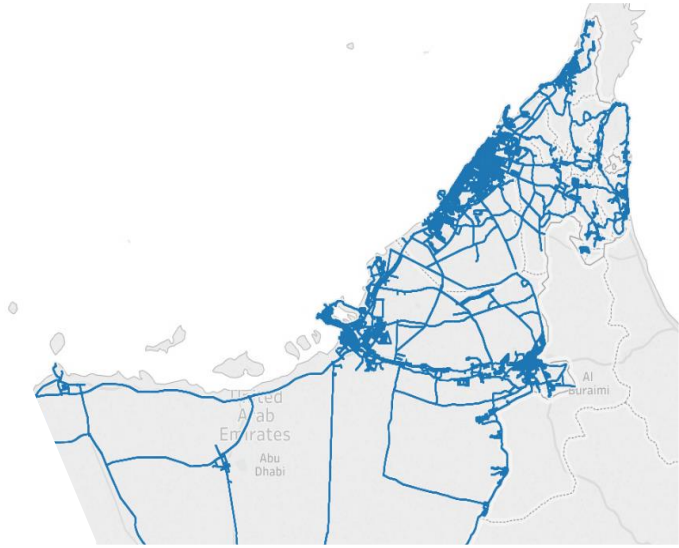
- The evolution of mobile networks continues and before 5G takes off additional revenue comes from improving the quaality of experience of legacy services using 4G+ technologies
- Voice is still the key service by which customers perceive the qulity of mobile operators
- Video watching and changes in communications needs of young generations are round the corner
- Technology development brings new challenges for implementation and testing:
  - 256QAM
  - Multiple carrier aggregation
  - New voice codecs
  - Social applications challenges
- Network availability and hotspots capacity, especially for indoors is important and will become even more challenging for 5G services

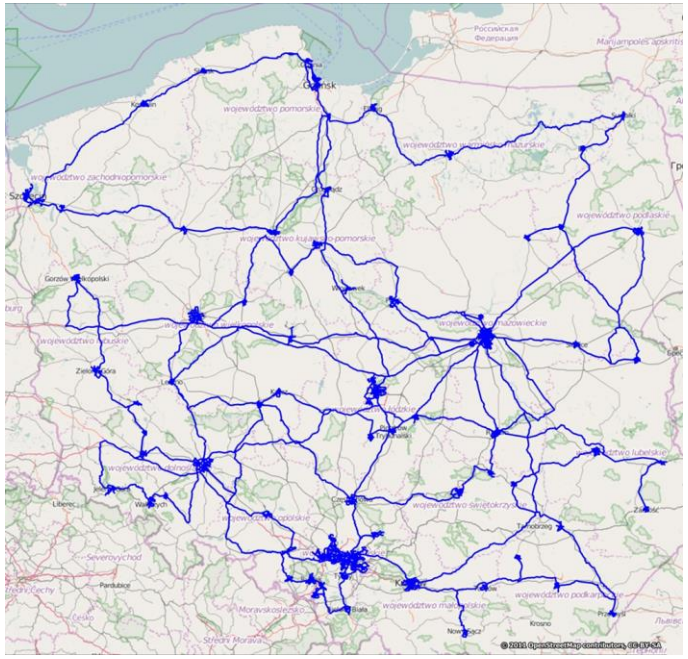
State of 4G+ networks today

KPI	2016	Technology evolution	End of 2017
Voice Quality			
MOS Score	3.5 – 3.7 out of 4.5	EVS in VoLTE	4.2 - 4.4 out of 4.5
Data throughputs (mobility)			
Average data download speed in large cities	60 – 80 Mb/s	3 Carrier Aggregation	90 – 120 Mb/s
Data throughputs (stationary)			
Maximum data download speed	225 Mb/s	256QAM, Cat. 12 devices	400 – 500 Mb/s
Latency			
Ping	25 – 35 ms	Network optimisation	20 – 25 ms

State of todays projects by Regulators

- Wide area presence - country wide measurements
- Availability of the services - minimum expected grade of service
- Quality of the services - how operators differ each to the other
- Fairness toward customers - contractual promises delivered





Changing needs for drivetests and walktests

- Testing of very high speed hotspot areas is becoming realilty today – 400 – 500 Mb/s with 256 QAM
  - Testing in stationary mode
  - Testing capacity of hotspot, rather than user experience
  - When testing 400 – 500 Mb/s throughputs the focus of testing is on end to end delivery capabilities of the network, not neceserily on radio interface
- Testing short latency requires careful setup of test server outside and inside the network, we need to rethink where low latency services servers will reside in the network
- Testing VoLTE to ensuring excellent quality of VoLTE is something customers will see as a making a difference this year.

Will we need drive testing and benchmarking going forward?

- The importance of legacy services to operators is still there
- The quality of services is one of the key differentiation factors for operators and it may decide which operators will have credibility for launching 5G-like services
- In 5G networks the number of connected devices is going to exceed human users and will require to deliver service to the exact location – hotspot capacity testing will be a key requirement
- Crowdsourcing will deliver only an indication of the quality of services but the most of IoT devices will deliver no relevant data due to power limitations
- End to end testing needs to include real end user devices

How Regulator approach may change facing 5G

- Which is the best network is still an important knowledge?
- 5G looks to be less regulated then today. What is responisibility of the Regulator for the launch of 5G specific services in the country?
- How to monitor the safety of OTT services which use new networks?
- Is e2e monitoring approach good enough? What are the limits?

Thank you