

Next Generation IoT/IoT beyond industrial 5G Observations and Conclusions



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Ultra Reliability and Low Latency



Massive M2M Connectivity



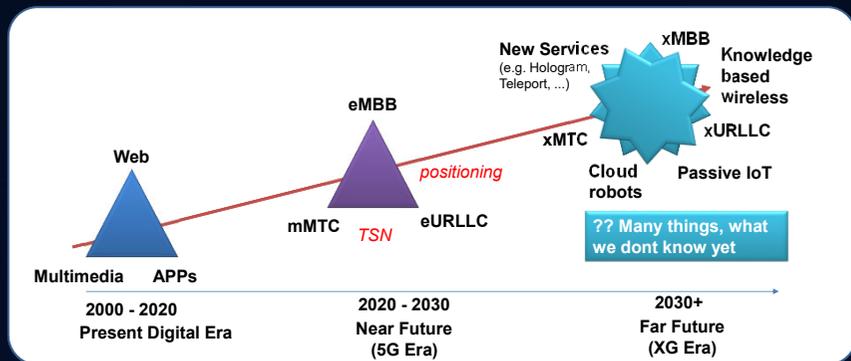
Enhanced Mobile Broadband



And much more after 5G has prepared the field

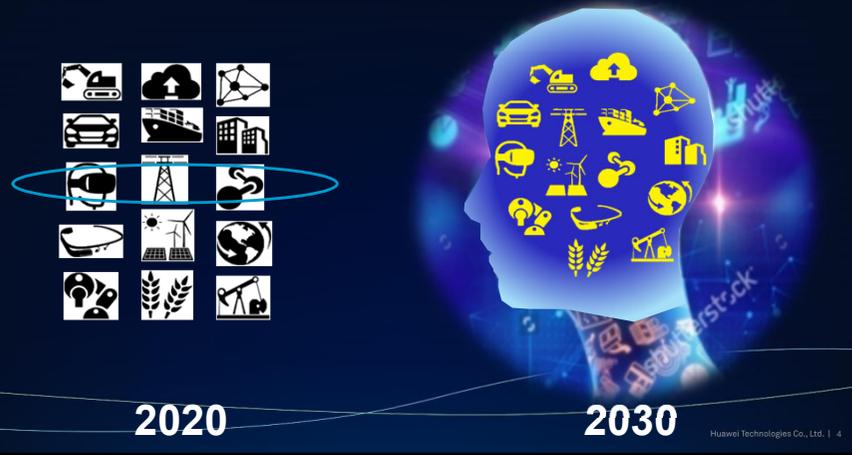
IoT = Internet of Things
IIoT = Industrial Internet of Things = Realtime, delay bounded communication. TSN, integration of Industrial Ethernet etc. Ltd. | 2

Mobile Radio Services: Past, Present, Future



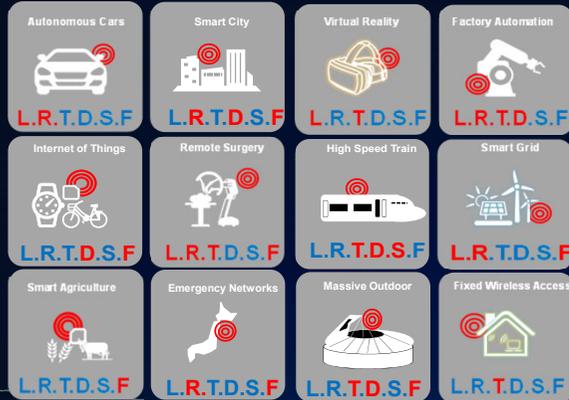
Reference: Towards a New Internet for the Year 2030 and Beyond
Richard Li, Ph.D. Chief Scientist, Future Networks Huawei USA renwei.li@huawei.com
Third Annual ITU IMT-2020/5G Workshop and Demo Day Geneva, Switzerland July 18, 2019
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From Connected Things to Integrated Intelligence



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Smart Network Use Cases Become Mainstream



- Latency
- Reliability
- Throughput
- Density
- Speed
- Flexibility

Each use case requires different combination of KPI

Smart Network Use Cases Become Mainstream



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■ In Reality there are combinations for the same vertical segment

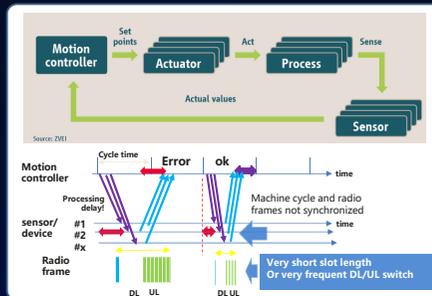
■ Example: Factory

■ Similarities to Hospitals?

Observation 1: Latency

- Latency is a traditional term in Mobile Radio
- Cycle time is the key KPI in control automation
- Specifies the interval for actions and the reaction collected from x devices within the guaranteed time

Requirements for Wireless Machine I/O Network					
BECKHOFF					
Connected devices					
	Cycle Time	Communication Time	No. of devices	Process Data In (Byte per device)	Out (Byte per device)
Motion Control	62.5 µs	10 µs	8..64..128	16	16
PLC Control	62.5 µs	10 µs	8..64..128	1..8	1..8
	125 µs	10 µs	8..64..128	1..8	1..8
	1 ms	100 µs	64..1924	1..8..128	1..8..128
	10 ms	1 ms	64..1924	1..8..128	1..8..128
Measurement	125 µs	10 µs	8..64..128	1..8..128	1..8..128
	1 ms	100 µs	64..1924	1..128..1k	1..8..128..1k
	10 ms	1 ms	64..1924	1..128..1k	1..8..128..1k
Vision	1 ms	100 µs	1..16..64	1..8..64	10kByte..4MByte
	10 ms	1 ms	64..1924	1..8..64	10kByte..4MByte
	20 ms	1 ms	64..1924	1..8..64	10kByte..4MByte
HMI	1 ms	100 µs	1..16..64	128..1k	1..8..64
	10 ms	1 ms	1..16..64	128..1k..10k	1..8..64
	20 ms	1 ms	1..16..64	128..1k..10k	1..8..64



- Cycle times of << 1 ms are the target for high performance I/O
- 100 devices polled within one single cycle
- End2 End Latency of < 0.1 to 0.01 ms

Observation 2: mMTC – increasing packet size

- 5G addresses 1 000 000 connections / km2 with mMTC (massive Machine Type Communication)
- mMTC is defined for small packet sizes e.g. few bytes

- New sensors are more complex
 - More information added, e.g. location
 - Packet size increases dramatically, e.g. > 250 byte



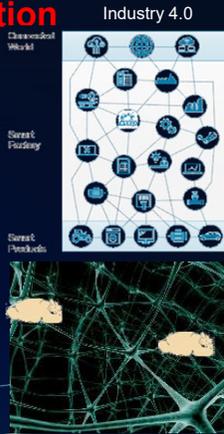
- New types of sensors
 - Not just simple measurements
 - Traces of vibration over time, sound samples,
 - Much more data
- New type of MTC → xMTC



Challenge: coverage – Mesh/Relay nodes

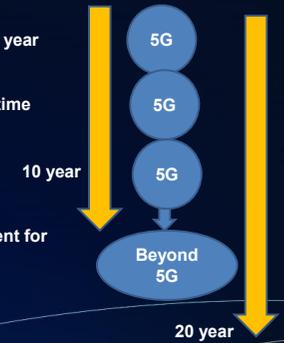
Observation 3: AI is not just an application

- Each drive, engine gets sensors
- Both simple and complex sensors distributed everywhere
 - Today some machines produce 800MB/day. Example: Trumpf
 - Question of scalability, if ALL data is forwarded to a single AI node
- Results in extremely high aggregated data rates
- Synapses are not just connections of something to the brain
- **Challenge:**
Introduce decentralised data processing by AI (learning, classification)
- **AI = Augmented Intelligence**



Observation 4: update cycle of OT don't match to 3GPP

- Update Cycle in Factories > 20 years - in process industry up to 30 year
- Vendor of industrial equipment has to provide replacements any time
- 3GPP generation cycle is 10 years
- Concurrent implementation of 5G and beyond 5G is not cost efficient for e.g. Low power industrial devices
- **Proposal: compatibility mode for 5G?**



Thank You!