

Internet of Things (IoT)

Requirements and Challenges

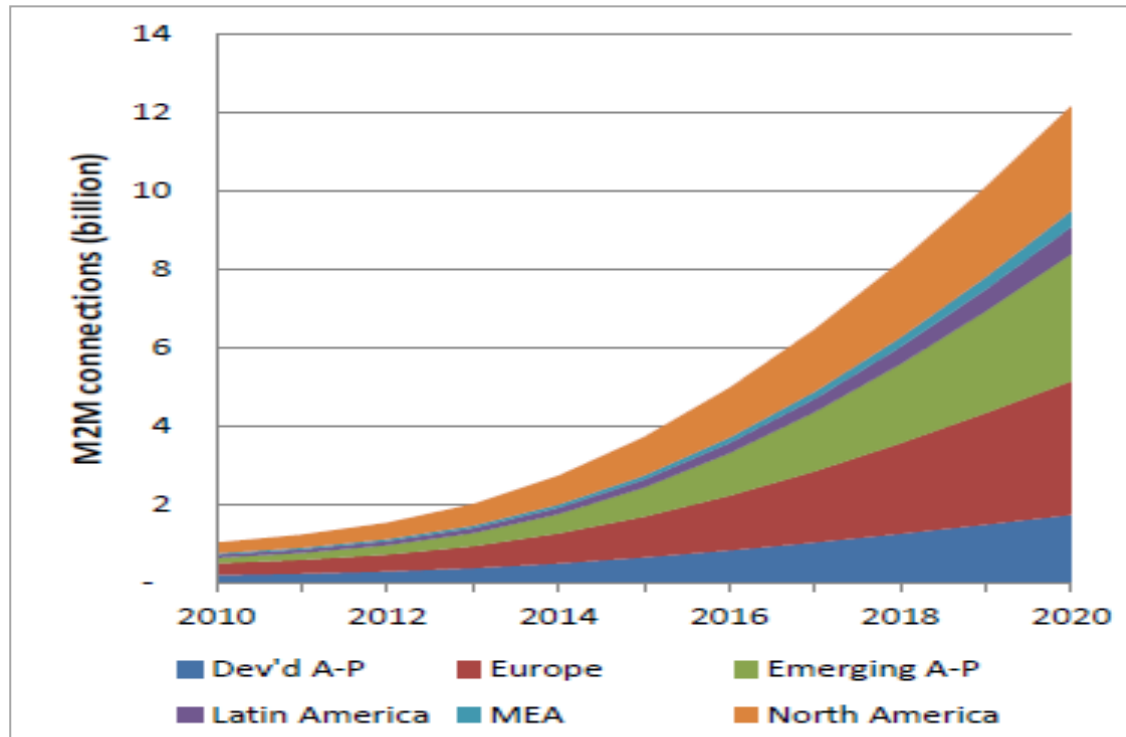
26.06.2014

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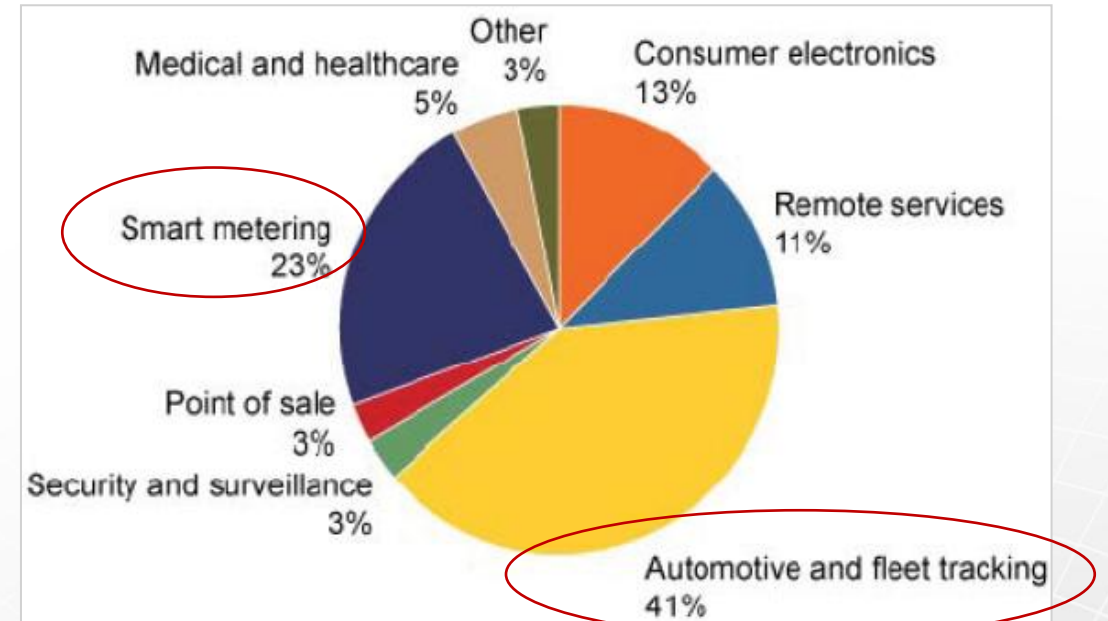
Markus Dillinger
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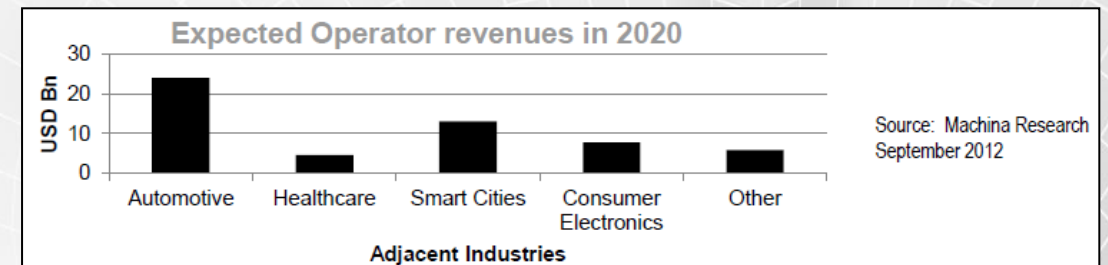
IoT Building Opportunity



Source: Machina Research 2011



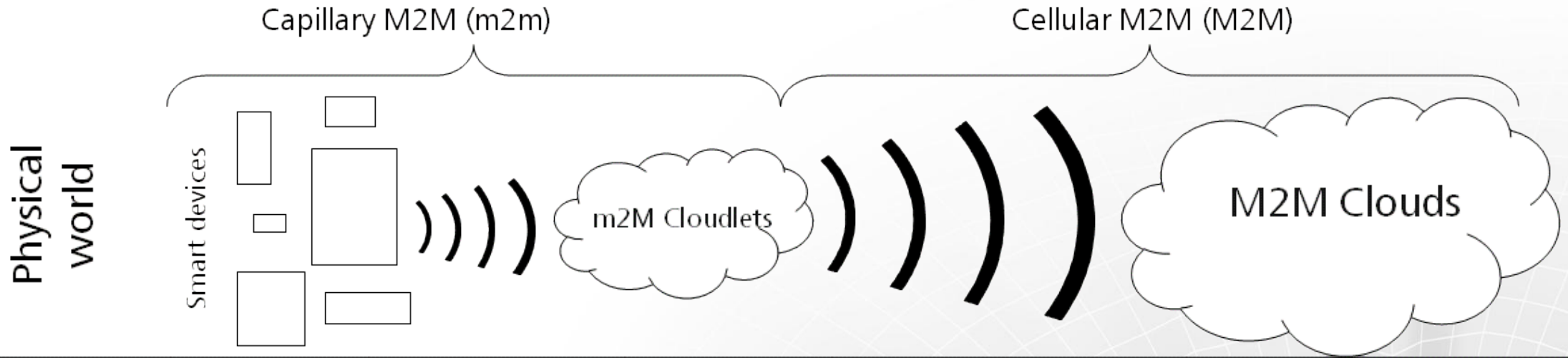
Source: Informa Telecoms & Media



Source: Machina Research September 2012

- ✓ IoT services have huge potential in all regions. Europe, AP & North America are ahead of others
- ✓ **Automotive and Smart Metering** are the biggest industries.

IoT's, M2M's Current View, Architecture and Terminology



SCADA (M2M)	Sensors / Actuators	wired	RTU	Modbus, DNP3, Internet, wireless	MTU (HMI, Historian, Analytics)
WSN (m2m)	Sensor motes	zigBee, WirelessHART	Sink		
M2M			SIM-based Device	GSM, GPRS, UMTS, HSPA+, WiMAX, LTE..	Server, cloud, enterprise network
IoT (m2M2m)	Sensor motes	zigBee, WirelessHART	SIM-based Sink/phone	GSM, GPRS, UMTS, HSPA+, WiMAX, LTE..	Server, cloud, enterprise network

IoT's, M2M's Future View, Architecture and Terminology for NEW use cases

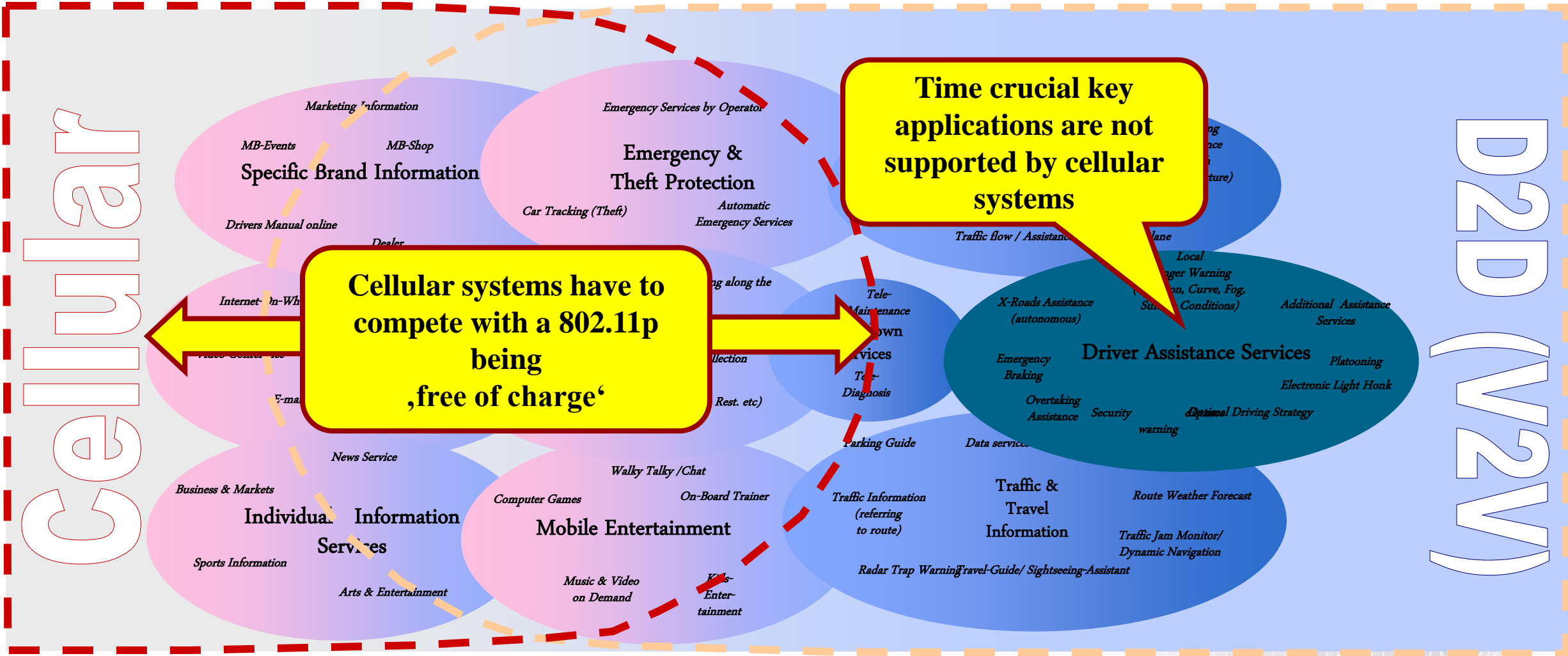


5G-SCADA (M2M)	Sensors / Actuators	5G	RTU	Modbus, DNP3, Internet, wireless @ 5G	MTU (HMI, Historian, Analytics)
WSN (m2m)	Sensor nodes	5G	Sink		
M2M			SIM-based Device ?	5G	Server, cloud, enterprise network
IoT (m2M2m)	Sensor nodes	5G	SIM-based Sink/phone ?	5G	Server, cloud, enterprise network

Car Communications and Requirements

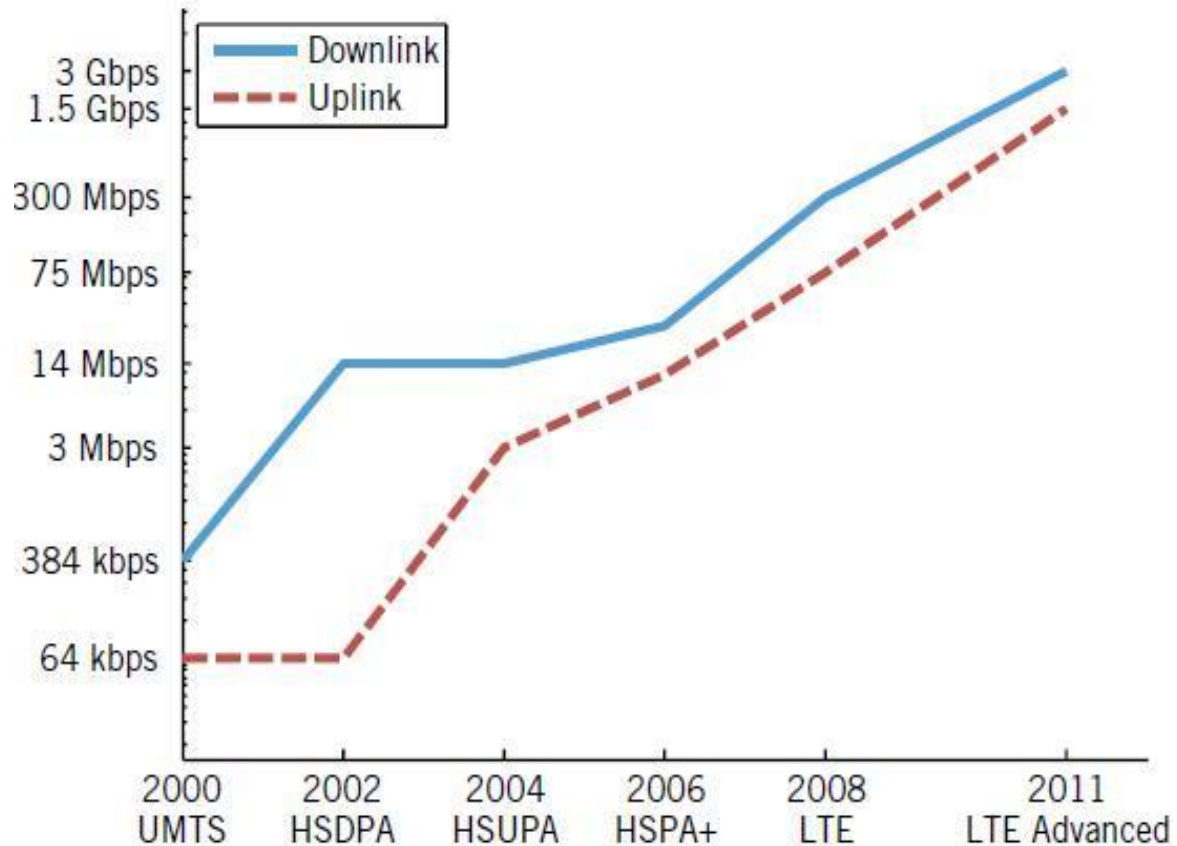


V2V requirements



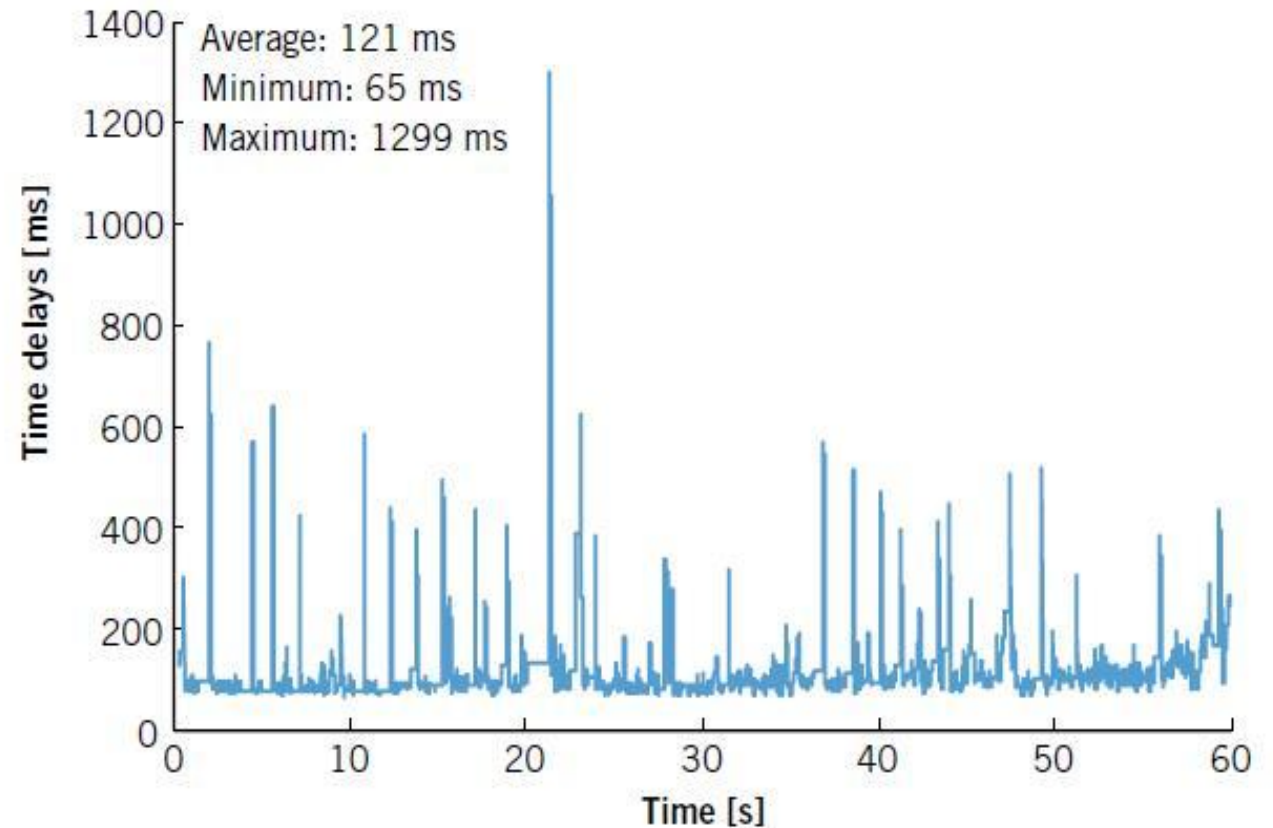
Measured Delay Spreads in 3G Networks

Specified data rates for cellular connections



② Data rates for mobile connections specified by the 3GPP increased by a factor of 1000 in the last ten years (logarithmic plot)

Transmission time delays in 3G networks



③ The time delays for the transmission of video data in 3G networks vary considerably

Future Spectrum Analysis

Current spectrums in regions: R1: 650MHz, R2:750MHz, R3: 845MHz.

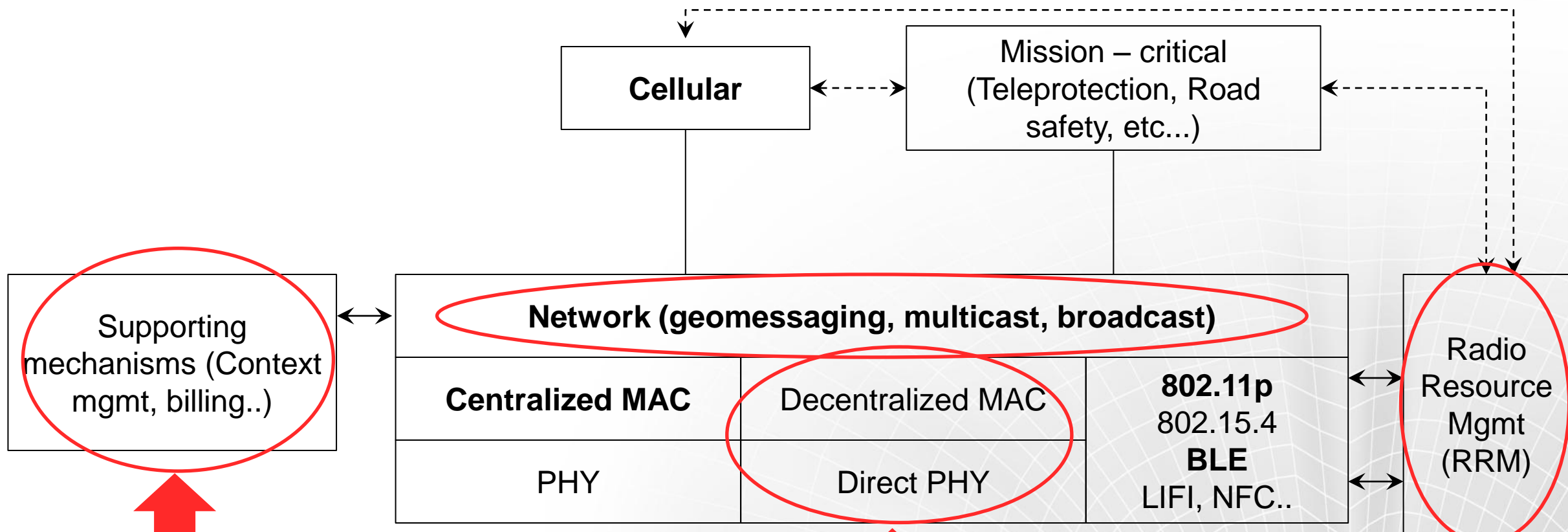
By 2020: **1720MHz** required. To **identify additional 500MHz at WRC-15.**

Possible WRC-15 candidates for IMT usage:

500-600M (470-694M)	Coverage	High Priority	Great propagation characteristics for coverage and indoor penetration
1.4G (1350-1525MHz)	Coverage Capacity	High Priority	Key candidate band for IMT, special effort required due to occupation of other services and suplications, including GPS and DAB applications
3.6-3.8G	Capacity	High Priority	Especially suitable for small coverage allowing focused capacity
3.8-4.2G	Capacity	Low Priority	Currently heavily used for the FSS (Fixed Satellite Service).
4.4-4.99G	Capacity	Low Priority	Currently heavily used for the FSS (Fixed Satellite Service)

Technical Direction for Future MTC Research

(Extension of 3GPP, ETSI, IEEE, ARIB scope)



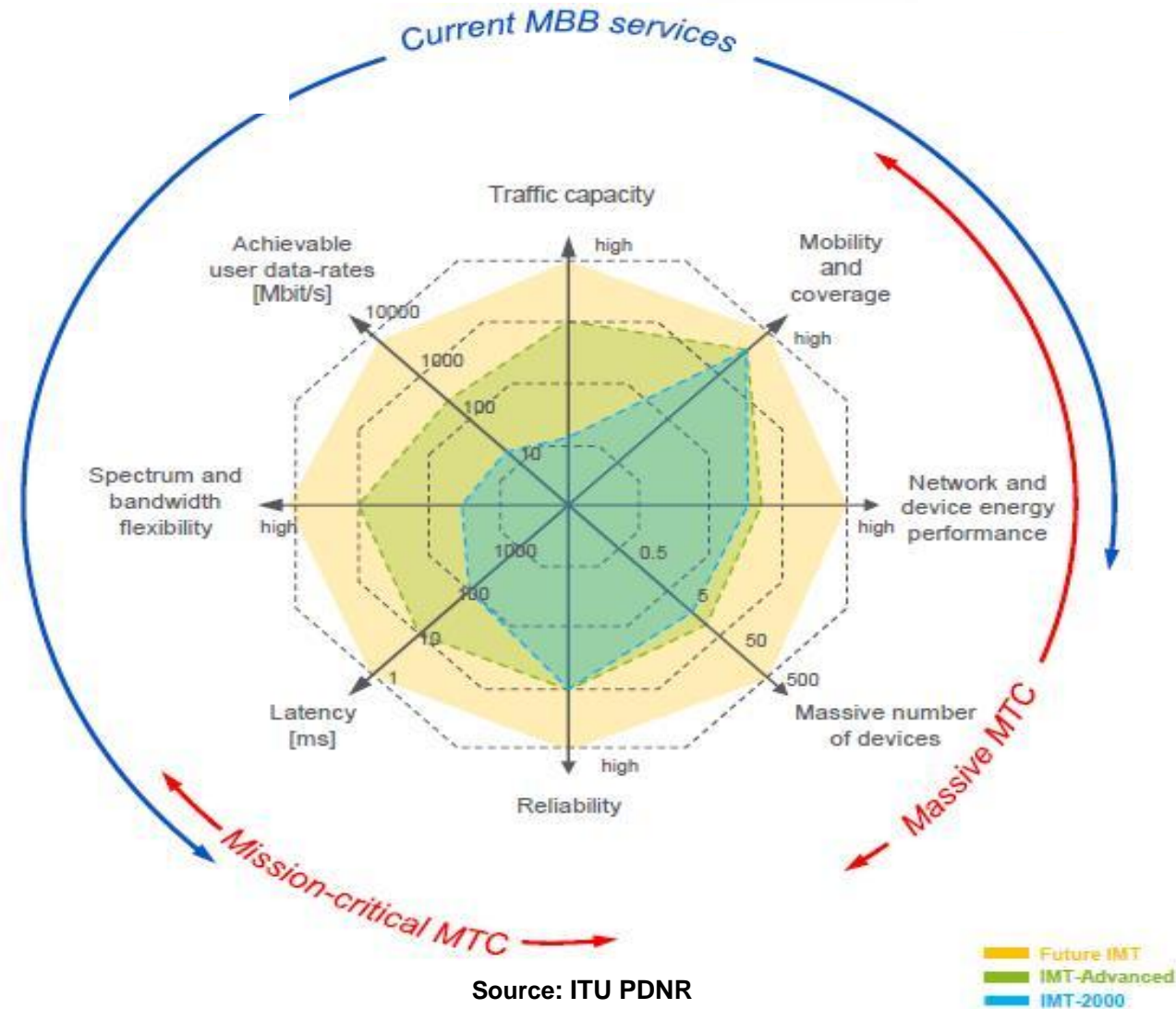
Needed for high device densities to assign adhoc resources between road users, substations, ..

- Relative high velocities require Direct C2C communication
- Teleprotection
- High speed trains

- Needed for high road user densities to control interference, faster connection times..
- Teleprotection
- etc.

Future IoT/M2M supported by 5G

- Extending MBB services
- Mission-critical Services
 - ITS
 - Energy
 - Automation
- Massive deployments
 - Dense Traffic
 - Industrial sensors
 - Decentralized energy resources



Source: ITU PDNR
"IMT VISION"

Future IMT
IMT-Advanced
IMT-2000

Thank you

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