Improving Remote Asset Management

How the 5G revolution can drive better outcomes

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HMS Core Value

HMS Connecting Devices™

Years in	Globally over	Number of	Public Stock	Countries
30+	600	30	20%	156
Business	Employees	Global Office	YoY Growth Avg.	Worldwide

Manufacturing

Buildings

Transportation

Power/Energy

Waste/Water

HMS Extends Industrial Edge to Every Asset

7+ Million Devices Sold

160+ Success Stories

90% of Top Manufacturers

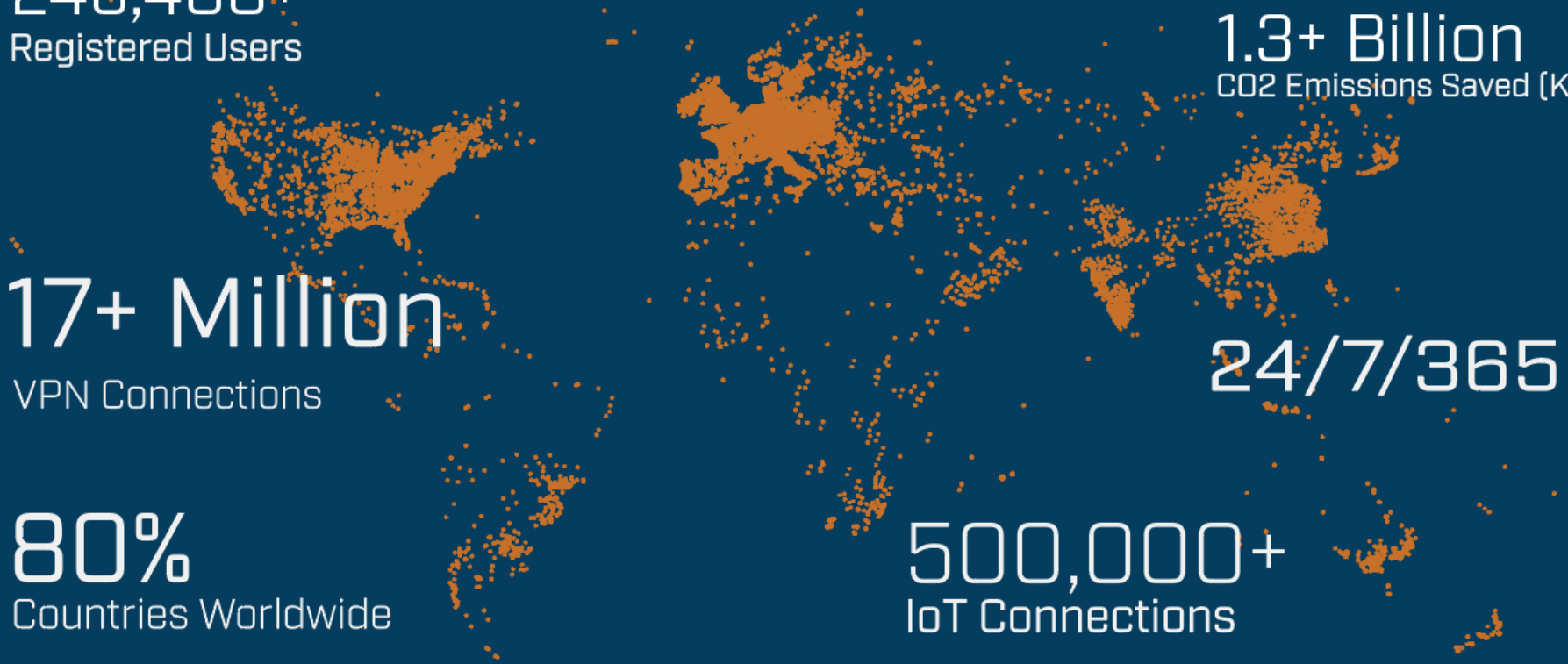
17+ Million VPN Connections

HMS- World‘s Largest IIoT Network

246,400+
Registered Users

12+ Billion
Travel Miles Avoided

1.3+ Billion
CO2 Emissions Saved (Kg)



17+ Million
VPN Connections

24/7/365

80%
Countries Worldwide

500,000+
IoT Connections

Connecting Devices™ with strong product brands

HMS Connecting Devices™

Anybus® BY HMS NETWORKS

With Anybus, devices and machines get connected to industrial networks and IIoT-systems, with or without wires.

Ewon® BY HMS NETWORKS

With Ewon remote solutions, you can access, monitor and control machines remotely/over the web.

Ixxat® BY HMS NETWORKS

Ixxat products enable communication in machines, in smart grids, in automotive testing and functional safety solutions.

Current Connectivity
Considerations

Current Wireless Network Standards

Long Range Technologies

Public

4G LTE

LoRa®

sigfox

802.11ah

Private/Semi-Private

4G LTE

CBRS

802.11af

Short Range Technologies

Public

802.11a/b/g/n/ac

ZigBee®

Bluetooth™

Bluetooth™ 4.0 Low Energy

Long Range Network Considerations

Benefits

LoRa®
- Up to 15km range
- Low power consumption

4G LTE
- Extensive network
- Managed access for reliability

sigfox
- Lightweight protocol
- Ultra narrowband for scalability

802.11ah
- Extended range
- Better scalability

802.11af
- Extended range
- Low power consumption

Challenges

LoRa®
- Low data rate
- Not easily scaled

4G LTE
- High latency
- Not optimized for control

sigfox
- Low data rate
- Can interfere with wideband

802.11ah
- High latency
- Not optimized for control

802.11af
- Licensed in UHF/VHF space
- Inconsistent spectrum availability

Short Range Network Considerations

Benefits

802.11a/b/g/n/ac
- High throughput
- Easy roaming

ZigBee
- Scalable
- Low power consumption
- Lightweight protocol

Bluetooth
- Adaptive frequency hopping
- Stable jitter and latency

Bluetooth 4.0 Low Energy
- Low power consumption
- Lightweight protocol
- Infinitely scalable

Challenges

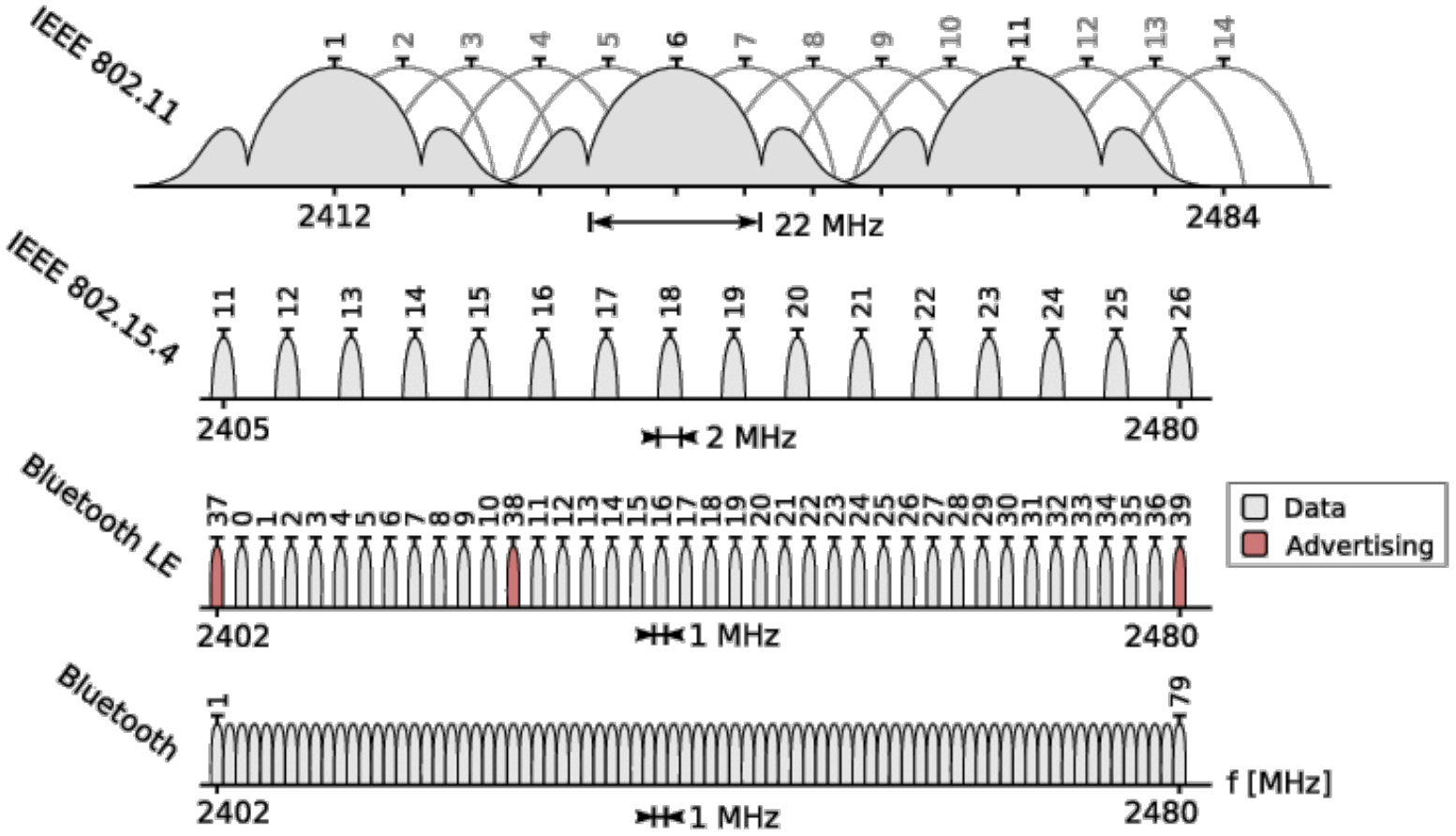
802.11a/b/g/n/ac
- Congestion/Noise
- Not easily scaled
- Variable latency
- Absorption/Reflection

ZigBee
- Too unsecure for critical data
- Low data rates

Bluetooth
- Low data rate
- Scaling network is complex

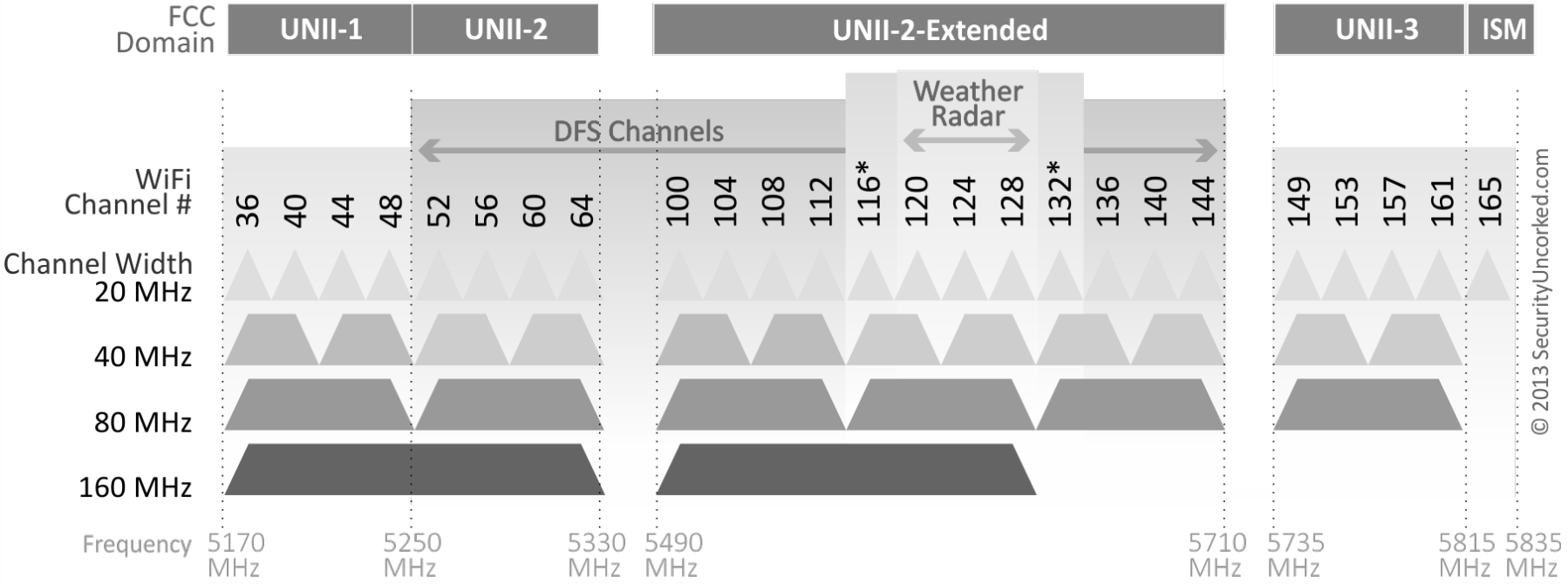
Bluetooth 4.0 Low Energy
- Licensed in UHF/VHF space
- Inconsistent spectrum availability
- Very short range

Channels/Bandwidth-2.4 GHz



Channels/Bandwidth-5 GHz

802.11ac Channel Allocation (N America)



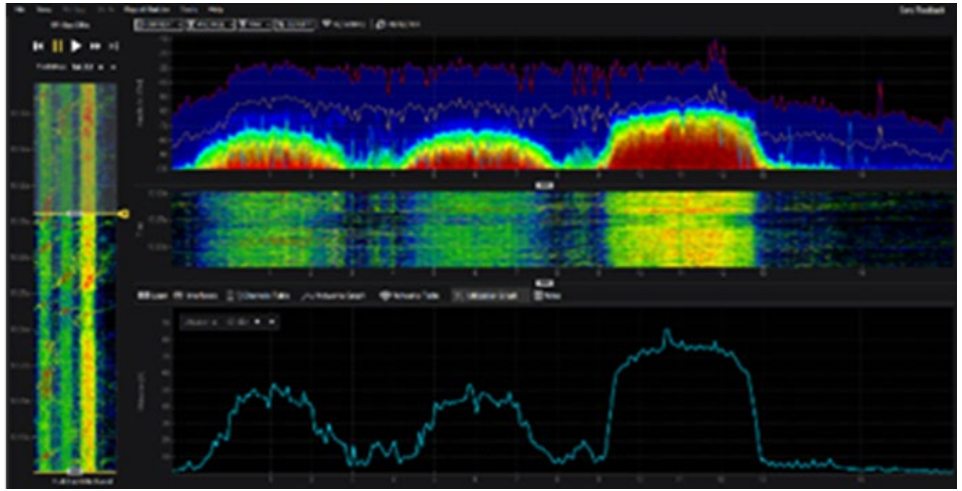
*Channels 116 and 132 are Doppler Radar channels that may be used in some cases.

Application Considerations-Obstructions/Materials

Material	Signal Loss-2.4 GHz	Signal Loss-5 GHz
Wood	-3 dB	-3 dB
Glass (Non-Tinted/Non-Polarized)	-3 dB	-7 dB
Drywall	-3 dB	0 dB
Non-Solid Metal Structure (ex. Rack)	-6 dB	-12 dB
Solid Metal Obstacle (ex. Elevator)	-10 dB	-45 dB
Concrete Block	-12 dB	-15 dB
Solid Concrete	-15 dB	-26 dB

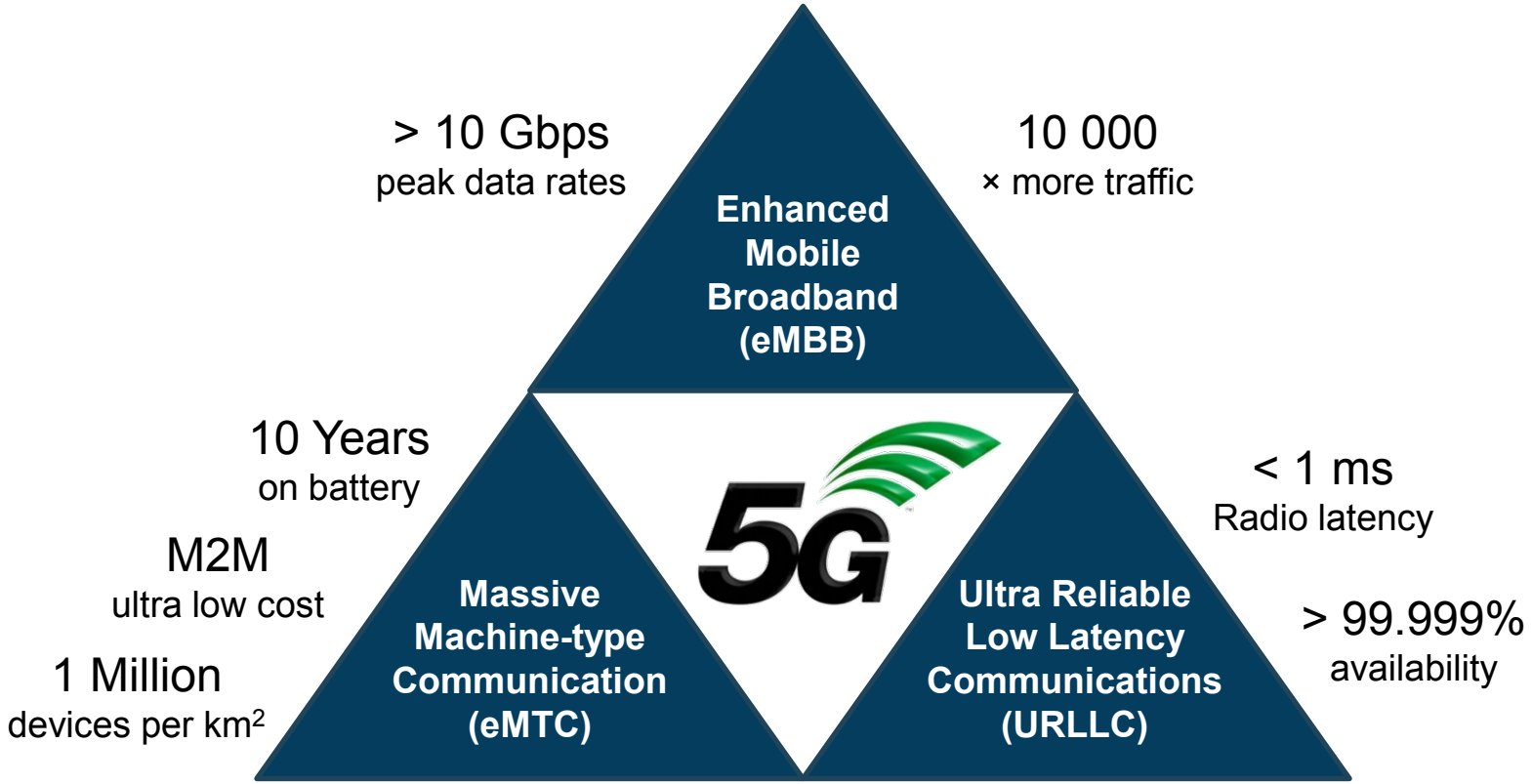
Application Considerations-Interference/SNR

Devices Transmitting 2.4 GHz
Portable phones
Microwave Ovens
Bluetooth
802.11 b, g, n
Wireless Microphones
Zigbee/802.15.4
Devices Transmitting 5 GHz
Weather Radar
Military Wireless Communications
802.11 a, n, ac

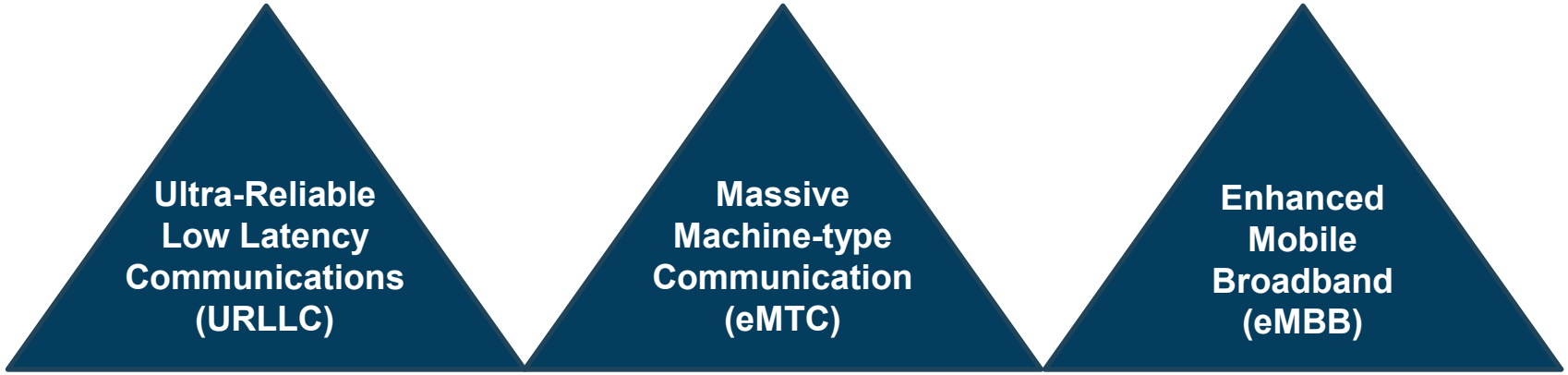


5G Basics

5G Mobile Network Services



5G Use Cases



- Motion control
- Mobile robots
- Human remote control
- Mobile control panels with safety function

- Wireless sensor networks
- Location & asset tracking

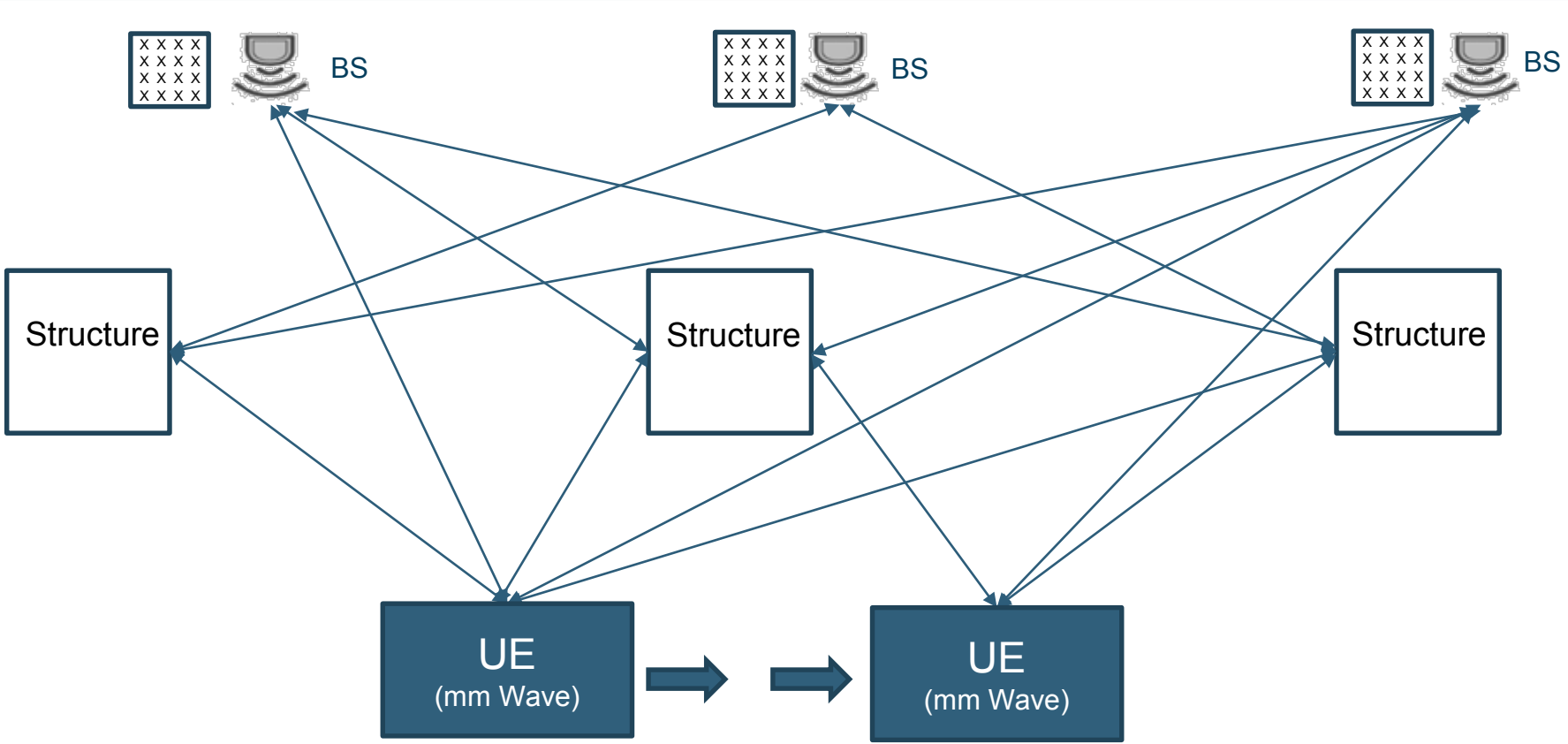
- AGVs
- Augmented reality
- Remote access
- Inbound and outbound logistics

Spectrum Availability

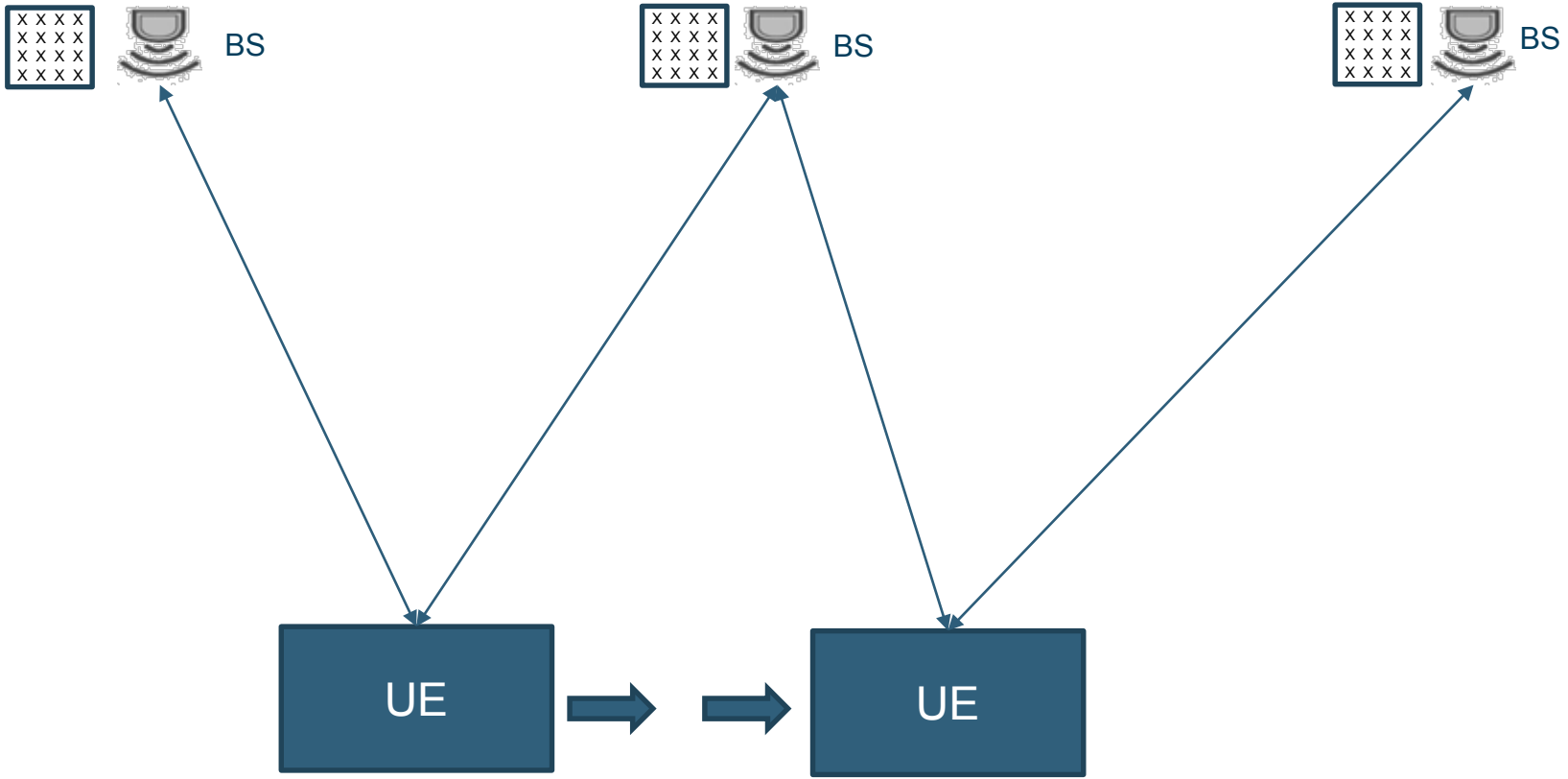
- 5G is primarily intended for public networks in licensed bands, but it is also possible to use as a private network:
  - Private network in unlicensed band
  - Private network in licensed band (own radio license or borrowed from cellular operator)
  - Semi-private network using network slicing of public network.

	< 1 GHz	1-3 GHz	3-5 GHz	5-8 GHz	24-28 GHz	37-40 GHz	64-71 GHz
US	600 MHz	1900 MHz 2500 MHz	3100 – 3550 MHz 3550 – 3700 MHz 3700 – 4200 MHz	5180 - 5350 MHz 5470 - 5835 MHz 5925 - 7125 MHz	27.50 – 28.35 GHz	37-40 GHz	64 – 71 GHz
EU	694 – 790 MHz		3400 – 3800 MHz	5150 - 5350 MHz 5470 - 5875 MHz	24.25 – 27.50 GHz		
China			3300 – 3600 MHz 4400 – 4500 MHz 4800 – 4990 MHz	5170 - 5330 MHz 5735 - 5835 MHz	24.25 – 27.50 GHz 37.00 – 43.50 GHz		
Japan			3600 – 4200 MHz 4400 – 4900 MHz	5180 - 5330 MHz 5490 - 5710 MHz	27.50 – 28.25 GHz		
Korea			3400 – 3700 MHz	5150 - 5330 MHz 5490 - 5650 MHz	26.50 – 29.50 GHz		
Australia			3400 – 3700 MHz	5150 - 5330 MHz 5490 - 5835 MHz	24.25 – 27.50 GHz		

Massive MIMO and Beamforming (eMBB)

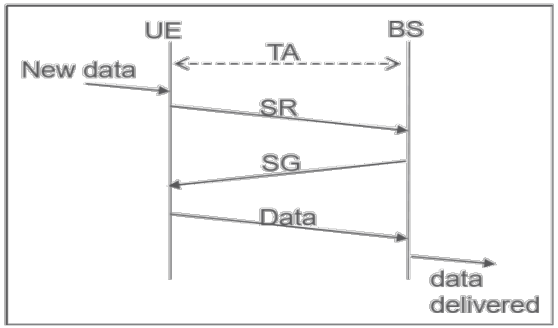


Seamless Transition (eMBB)



Ultra Reliable Low Latency Communications

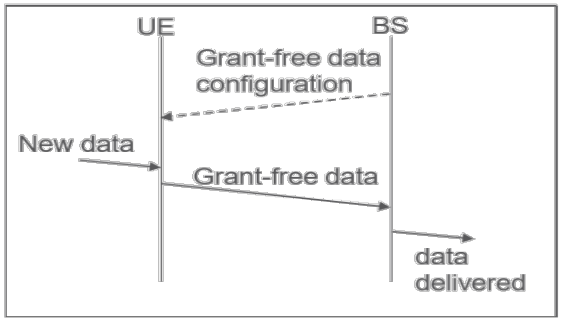
4G LTE



~6 ms

Standard Messaging

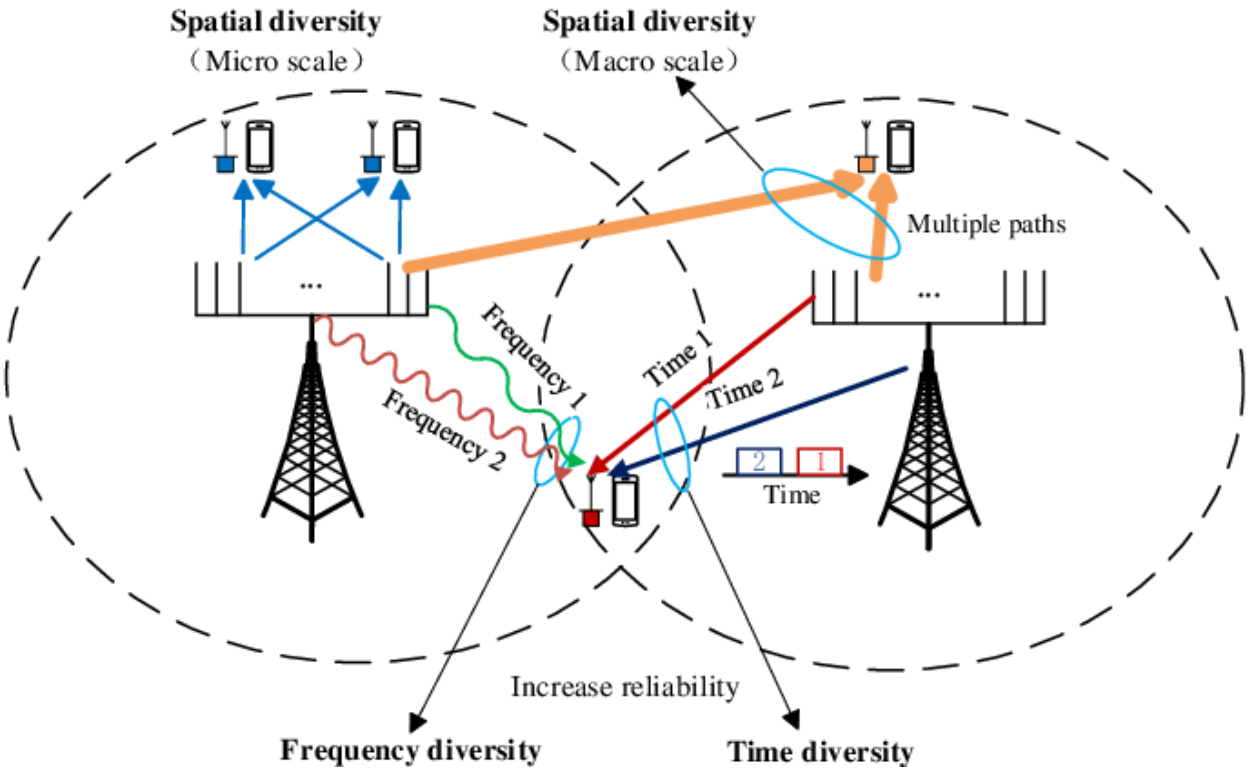
5G



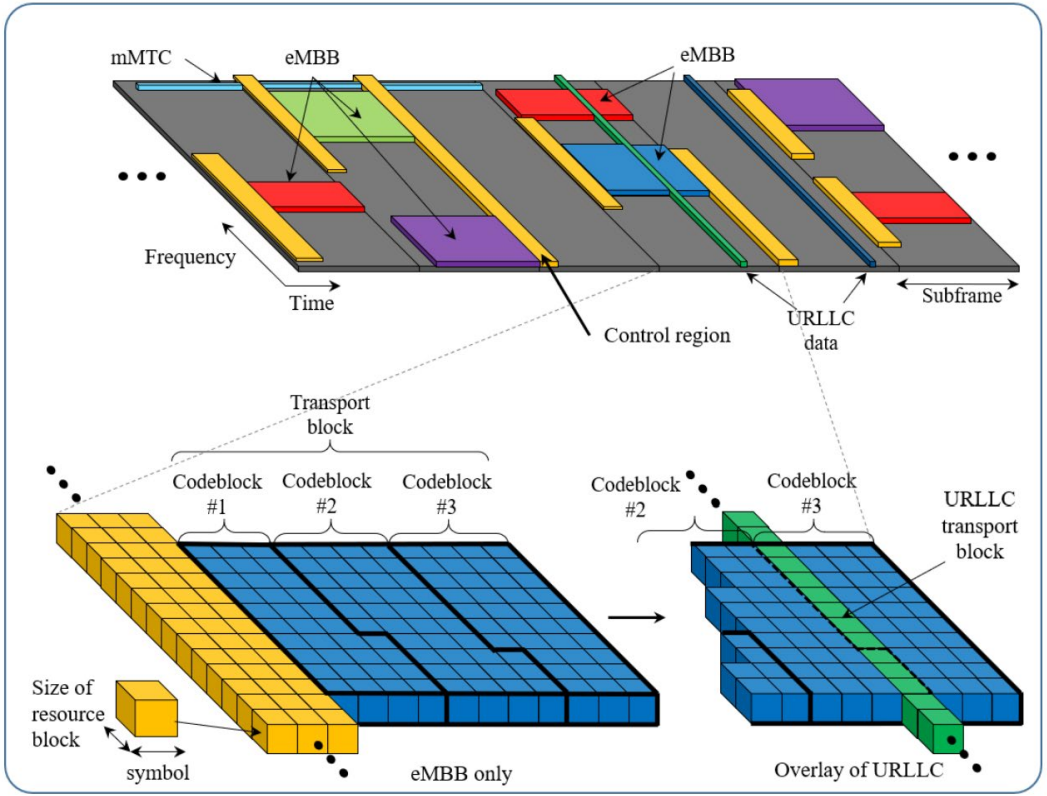
<1 ms

URLLC Messaging

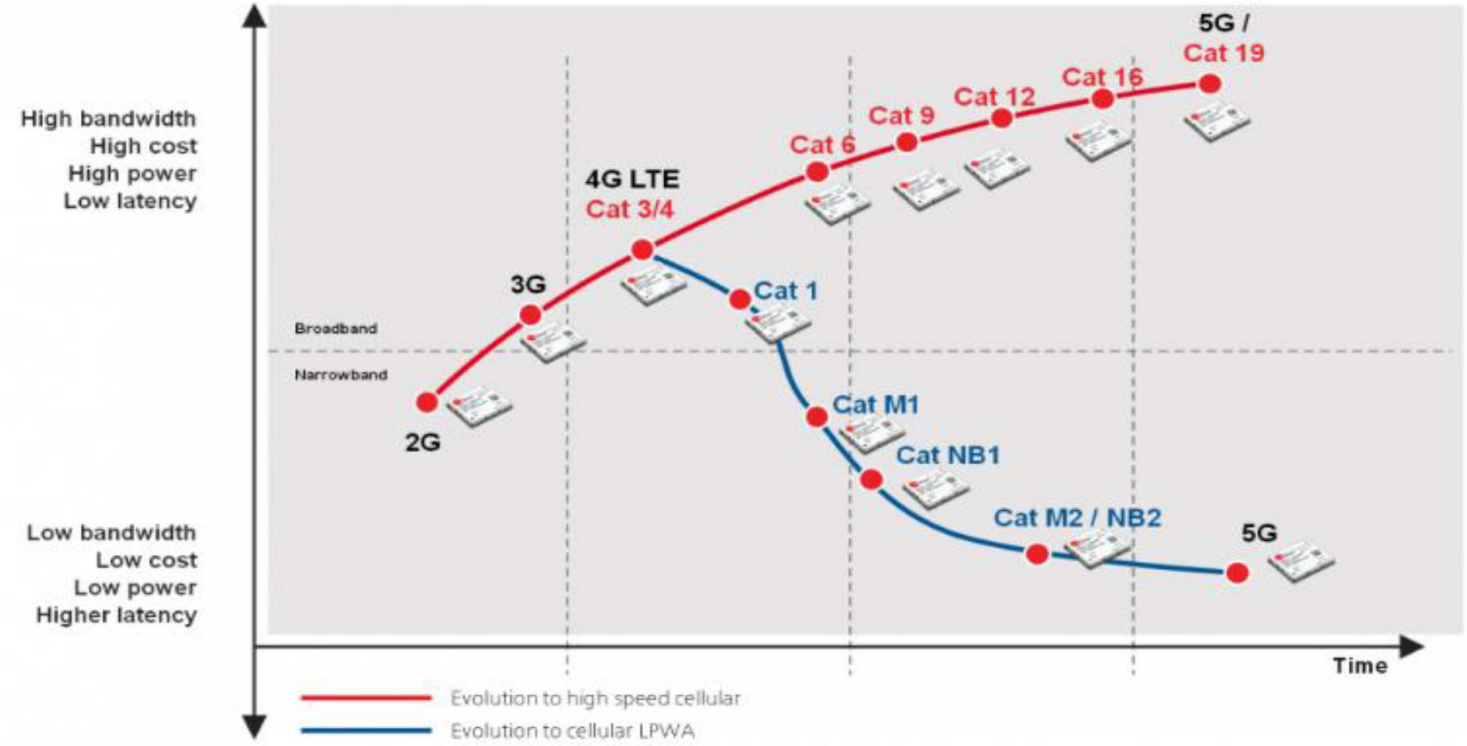
URLLC-Reliability through diversity



URLLC-eMBB Preemption

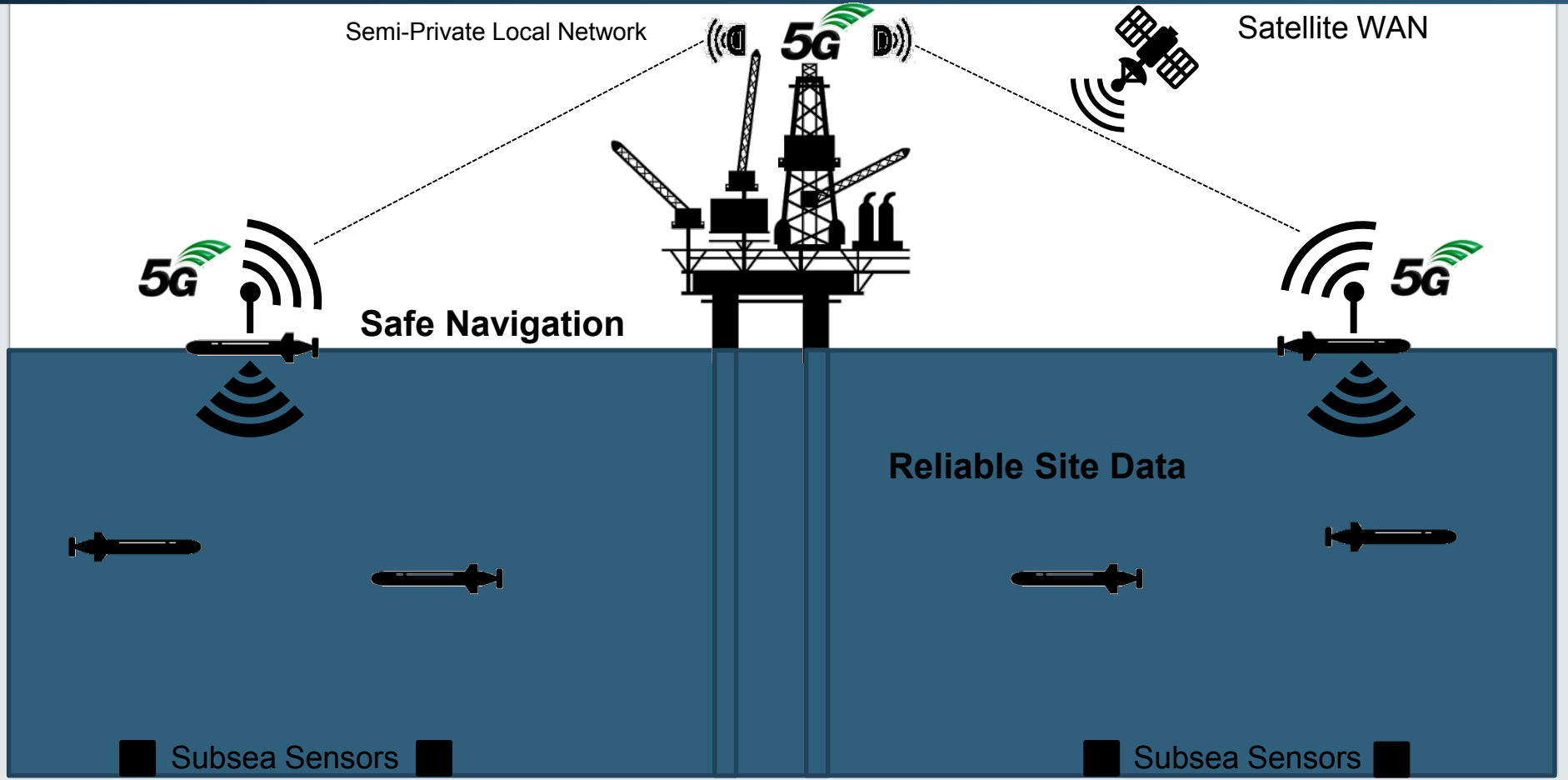


mMTC Evolution

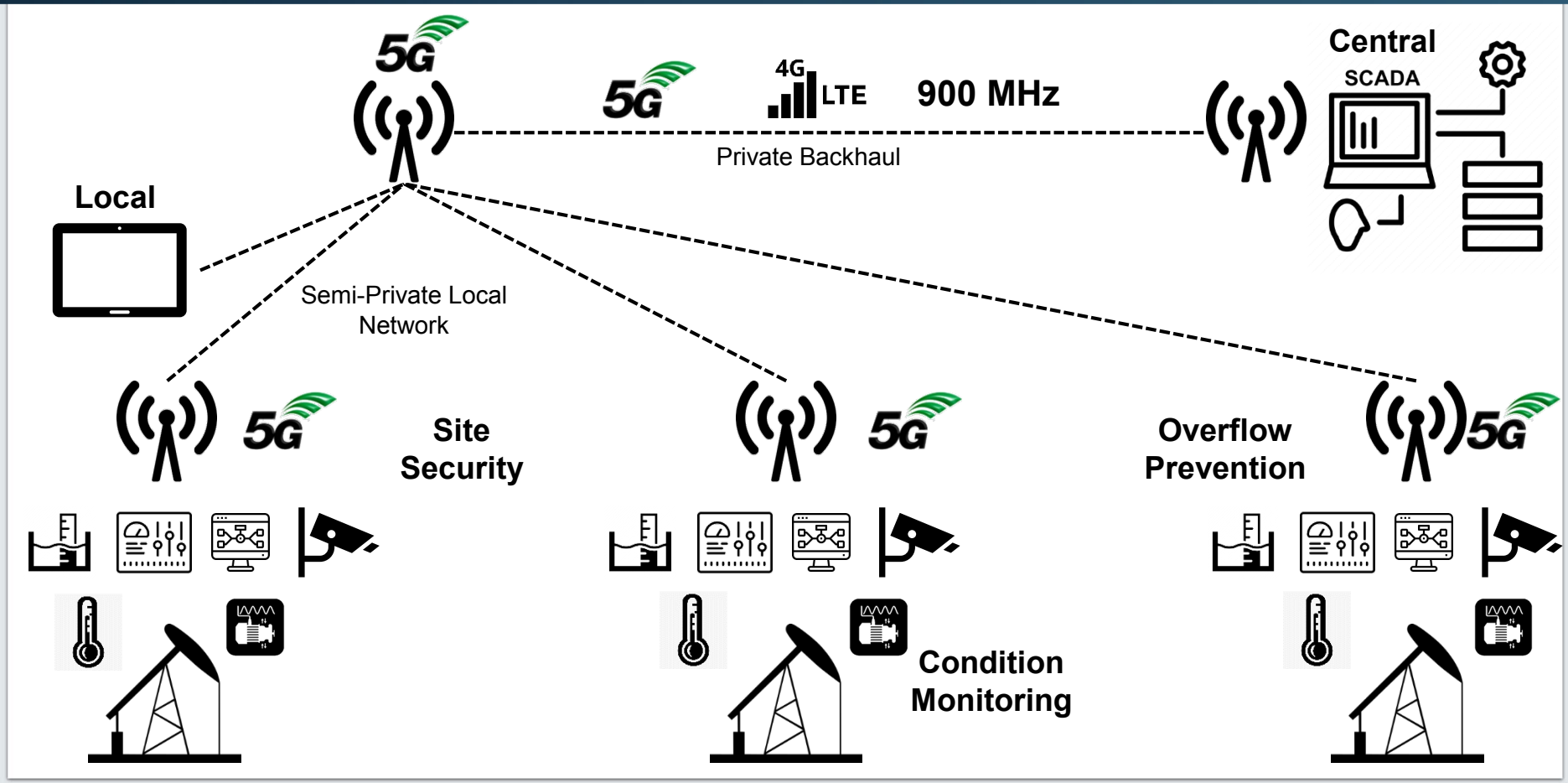


5G Remote Asset
Applications

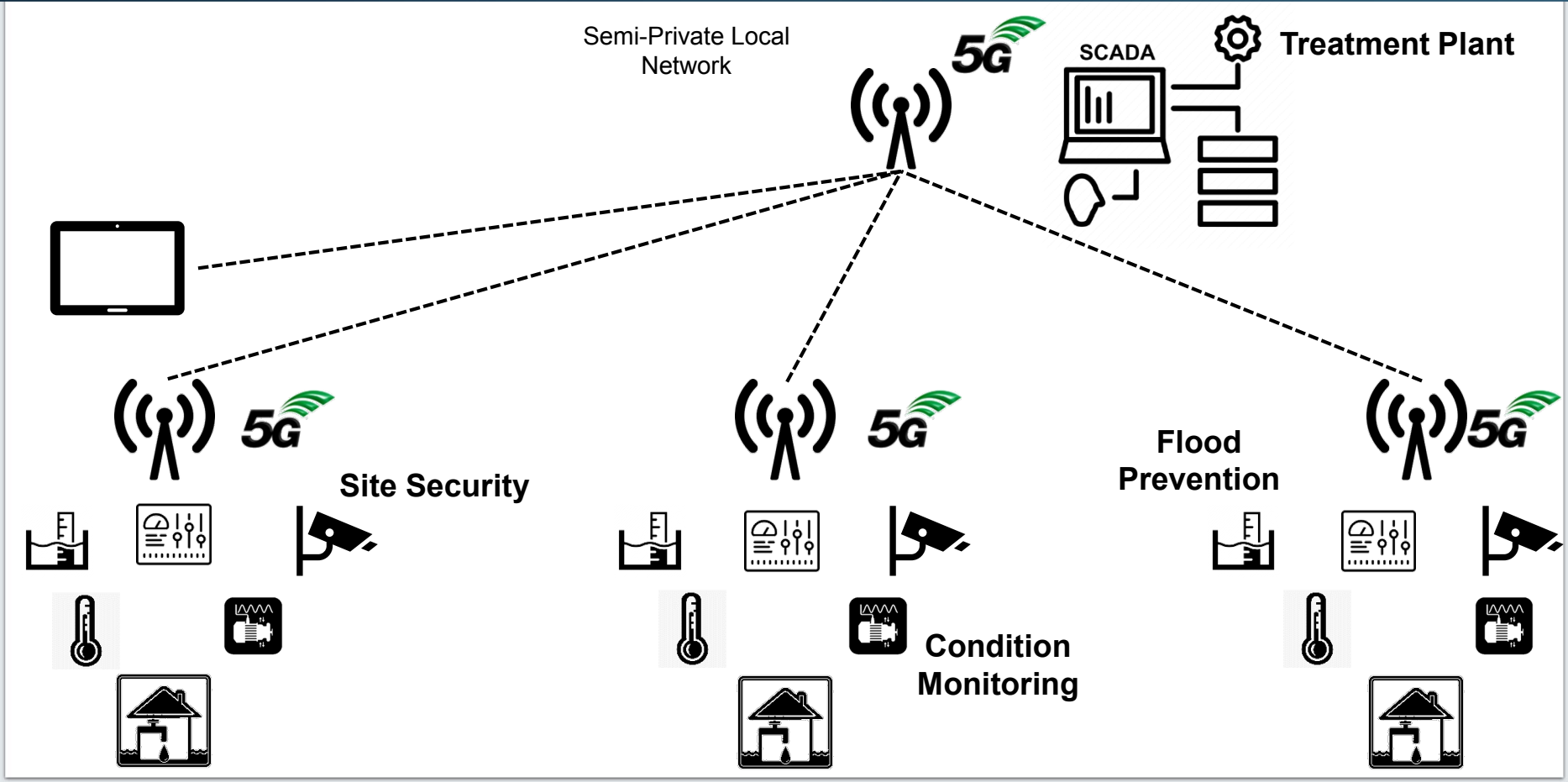
Autonomous Underwater/Surface Vehicles



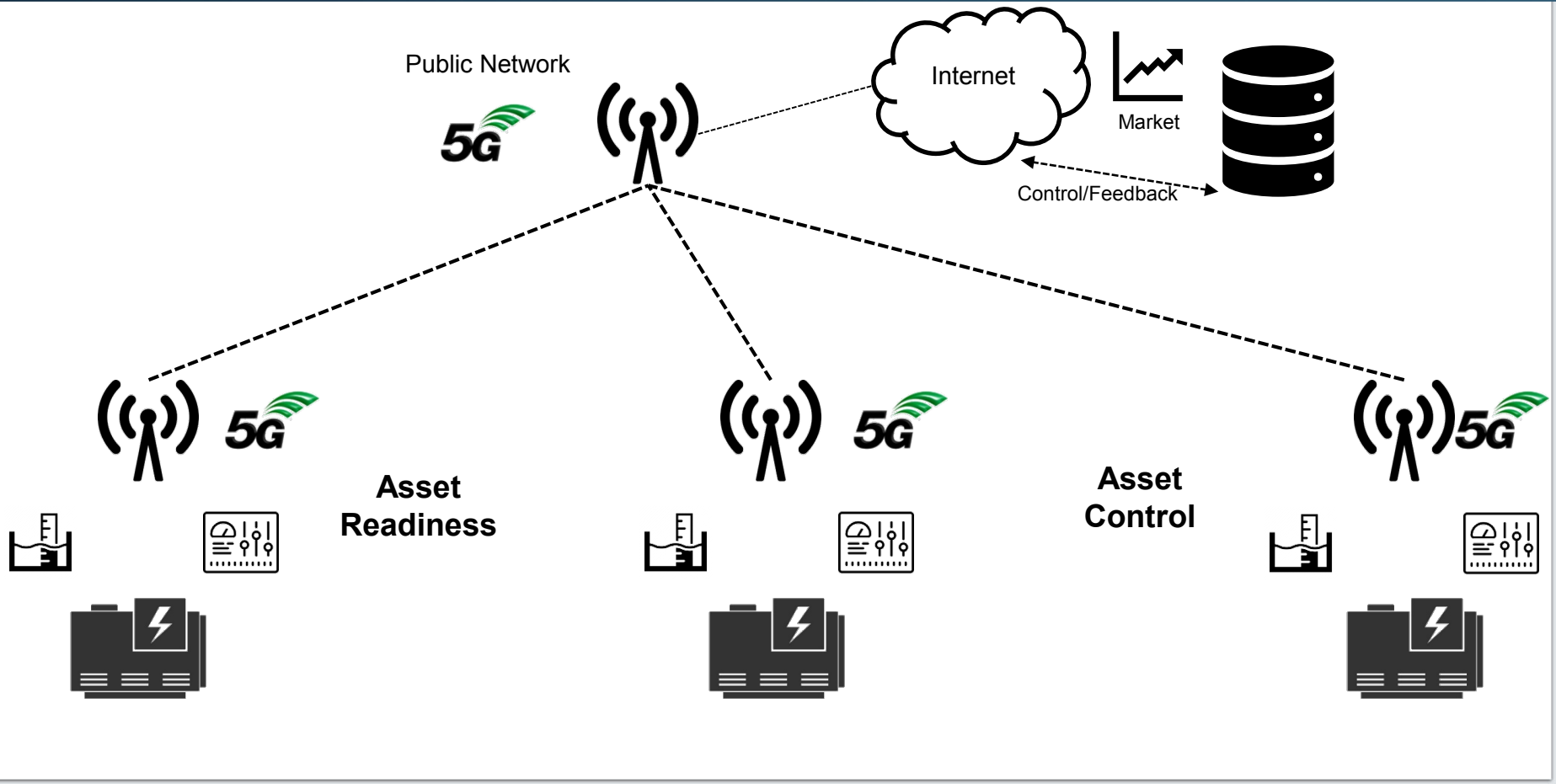
Multi-Site Management-Onshore O&G



Pump/Lift Stations

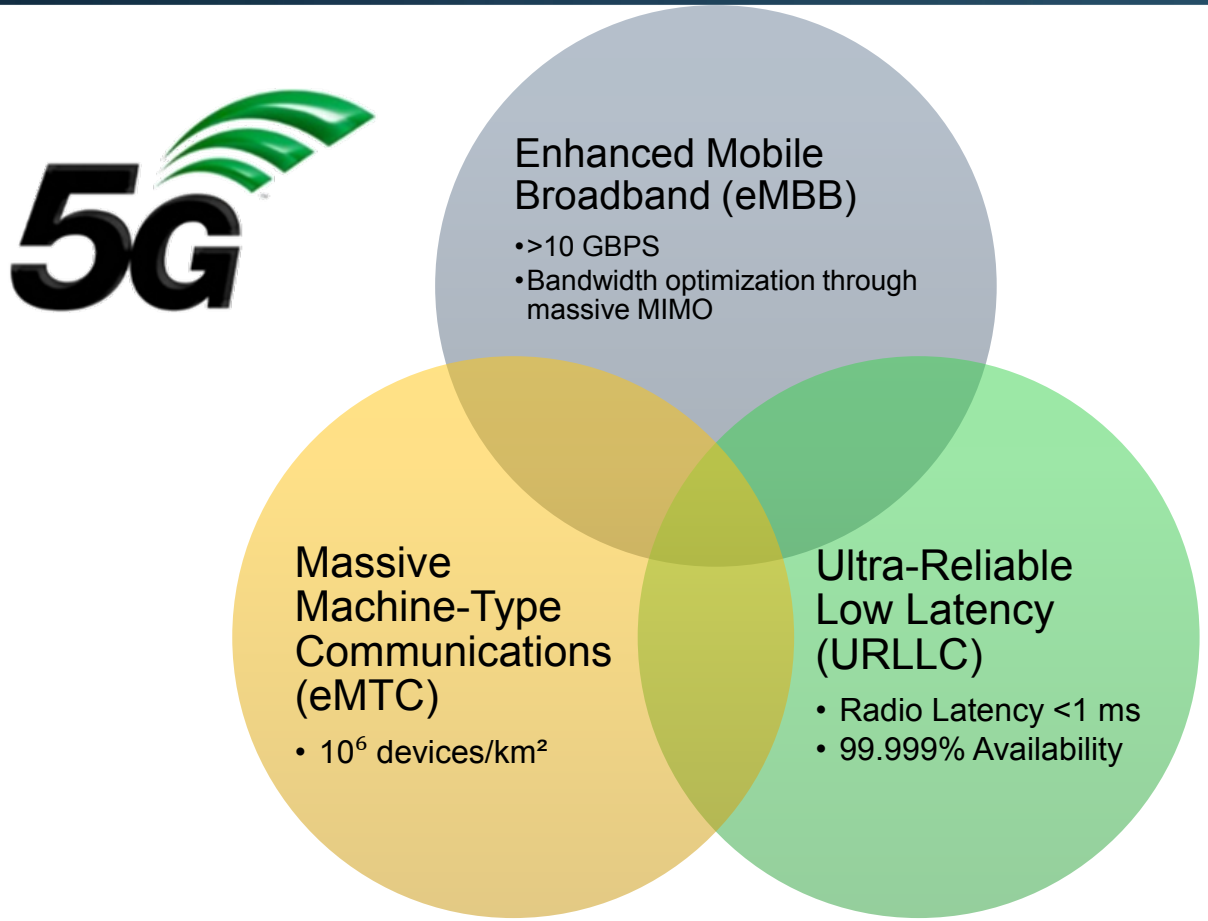


Energy Demand Response



Summary

Performance with Scalability



Why 5G?

- ✓ Scalability
  - Has the available bandwidth to overcome congestion and handle dense networks
- ✓ Reliability
  - High availability is necessary for time critical and error sensitive control applications
- ✓ Performance
  - Low latencies and faster speeds allow for faster responses to critical safety events

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