

SAMSUNG Research

ITU-APT Foundation of India - 5G TECH SESSIONS

Emerging 5G Verticals

September 27, 2018

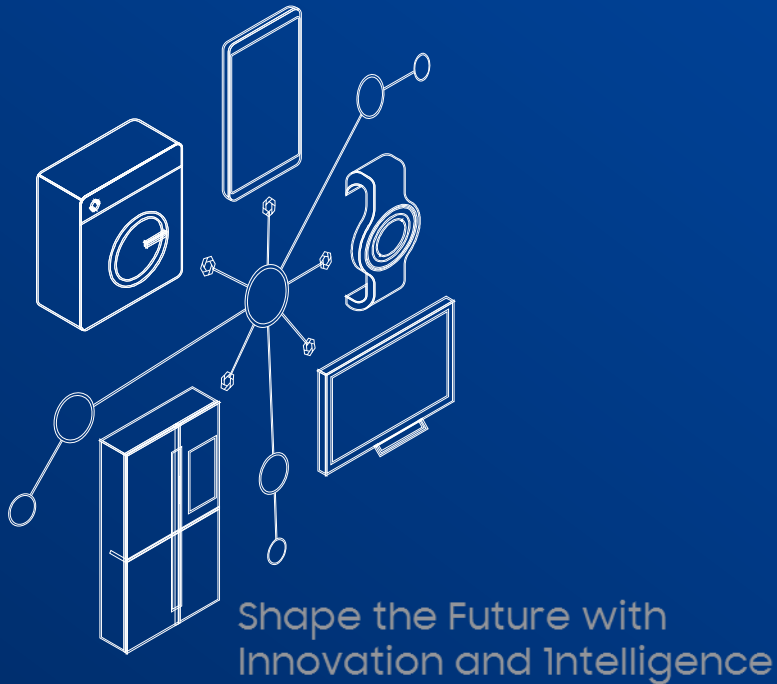
Samsung R&D, Bengaluru

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Disclaimer: Some of the images used in this presentation are sourced from public websites.

Mobile Services: from 1'G' to 4'G'

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Generation	Device	Specifications
<p>1G</p> 		<p>1G</p> <p>Year early 80s</p> <p>Standards AMPS, TACS</p> <p>Technology Analog</p> <p>Bandwidth –</p> <p>Data rates –</p>
<p>Start of personal analog voice calls</p>		

Generation	Device	Specifications
<p>2G</p> 		<p>2G</p> <p>Year 1991</p> <p>Standards GSM, GPRS, EDGE</p> <p>Technology Digital</p> <p>Bandwidth Narrow Band</p> <p>Data rates < 80 - 100 Kbit/s</p> 
<p>All about digital calls and text messaging</p>		

Generation	Device	Specifications
<p>3G</p> 		<p>3G</p> <p>Year 2001</p> <p>Standards UMTS / HSPA</p> <p>Technology digital</p> <p>Bandwidth Broad Band</p> <p>Data rates up to 2 Mbit/s</p>   
<p>Wireless internet and multimedia</p>		

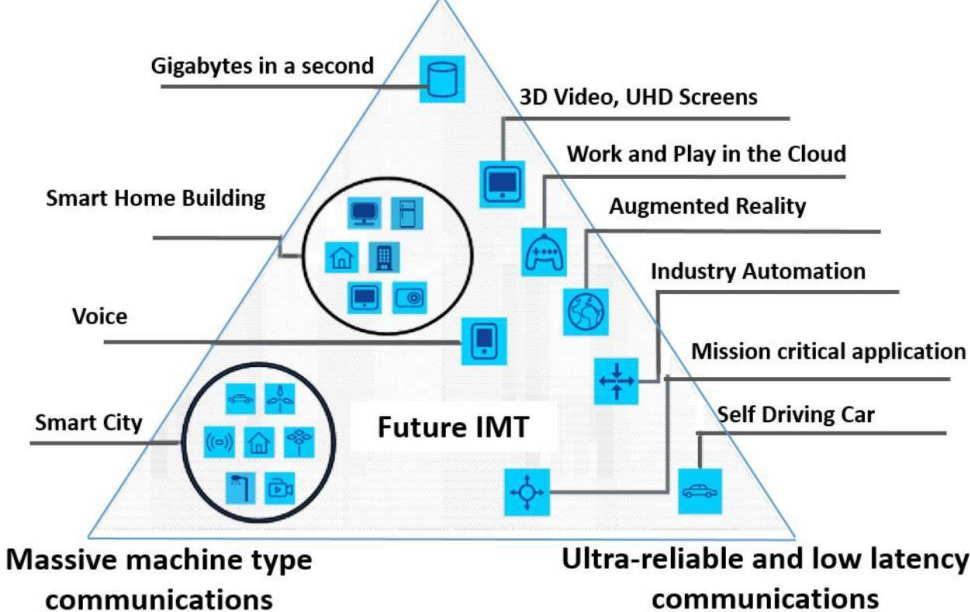
Generation	Device	Specifications
<p>4G</p> 		<p>4G</p> <p>Year 2010</p> <p>Standards LTE, LTE Advanced</p> <p>Technology digital</p> <p>Bandwidth Mobile Broad Band</p> <p>Data rates xDSL-like experience</p> <p>1 hr HD movie in 6 minutes</p>     
<p>Mobile broadband services and applications</p>		

Each phase brings new and exciting capabilities and services to **the end user.**

So, what 5'G' era will offer to the verticals?

5G Usage Scenarios (IMT for 2020 and beyond)

Enhanced Mobile Broadband



Item	4G	5G
Peak data rate	1Gbps	20Gbps
User experienced data rate	10Mbps	100Mbps
Spectrum efficiency	-	x 3
Area traffic capacity	0.1Mbps/m ²	10Mbps/m ²
Latency	10ms	1ms
Connection density	100,000/km ²	1,000,000/km ²
Network energy efficiency	-	x100
Mobility	350km/h	500km/h

enhanced Mobile-Broadband

- Peak speed 20 Gbps
- Edge area 100 Mbps



Ultra Reliable & Low Latency

- 1ms Latency
- 10⁻⁹ Error-rate, Ultra reliability



massive Machine-Type Communications

- 1 million device connections/km²
- High energy efficiency

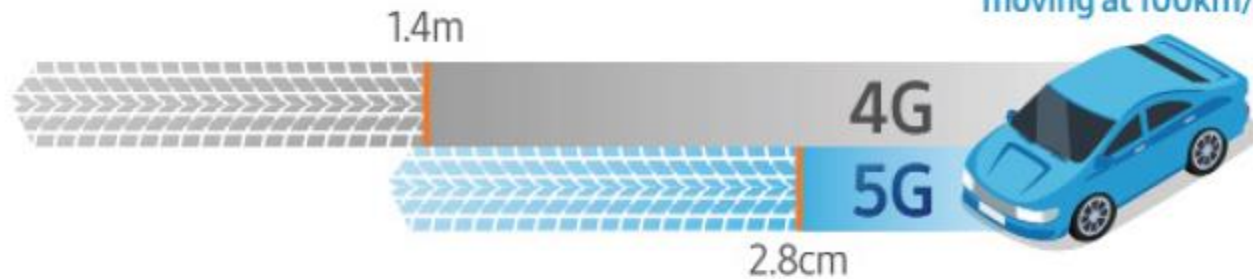


Promise of 5G

Download of 15GB HD video



Autonomous vehicle moving at 100km/h



Within an area of 1km²

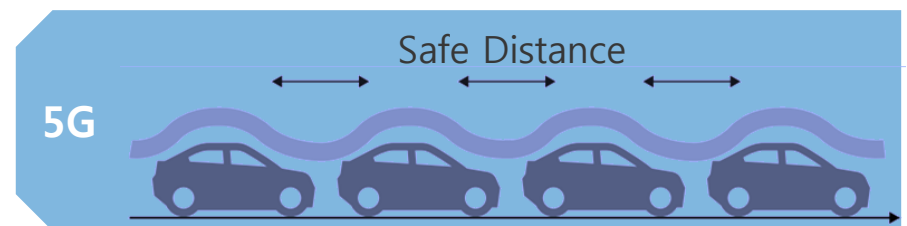
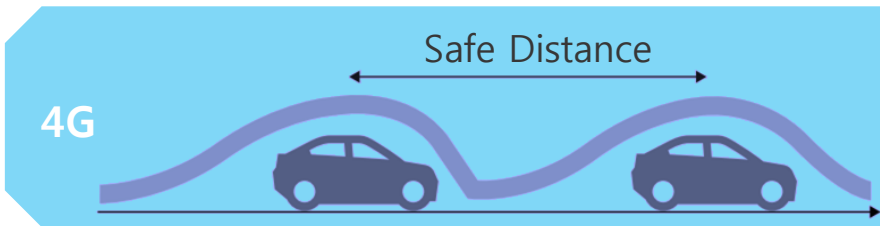
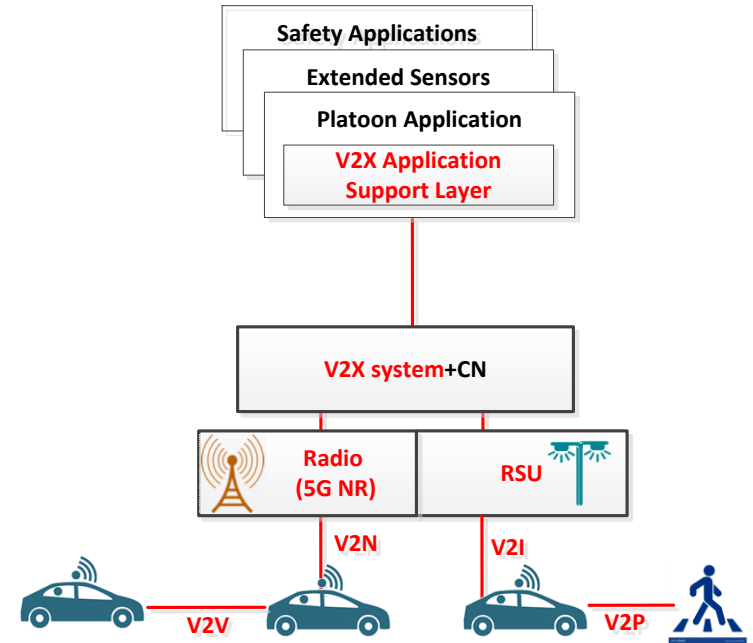


3GPP 5G Verticals (1/4)

Automotive (V2X)

- ◊ To enhance 3GPP transport layer support for both safety and non-safety V2X scenarios
 - ◊ **Safety-related V2X scenarios:** e.g. automated driving, vehicle platooning
 - ◊ **Non-safety-related V2X scenarios:** e.g., mobile high data rate entertainment, mobile hotspot/office/home, dynamic digital HD map update

3GPP Specifications: 22.186, 23.786, 23.795

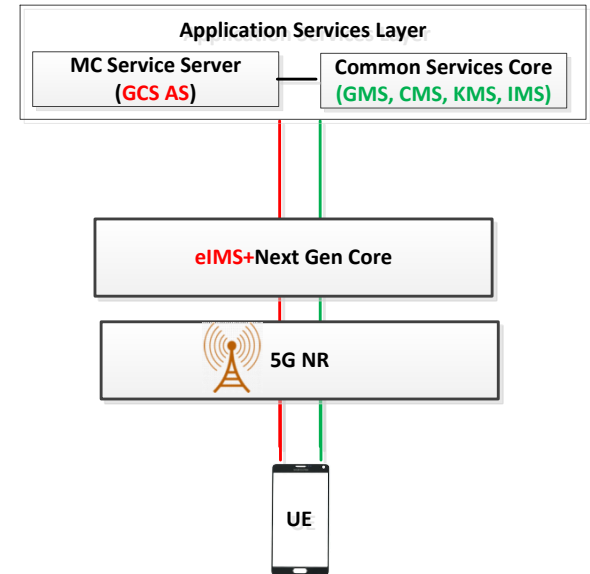


◊ **Benefits from 5G: Fuel Savings, Reduced Travel Time, Less Pollution**

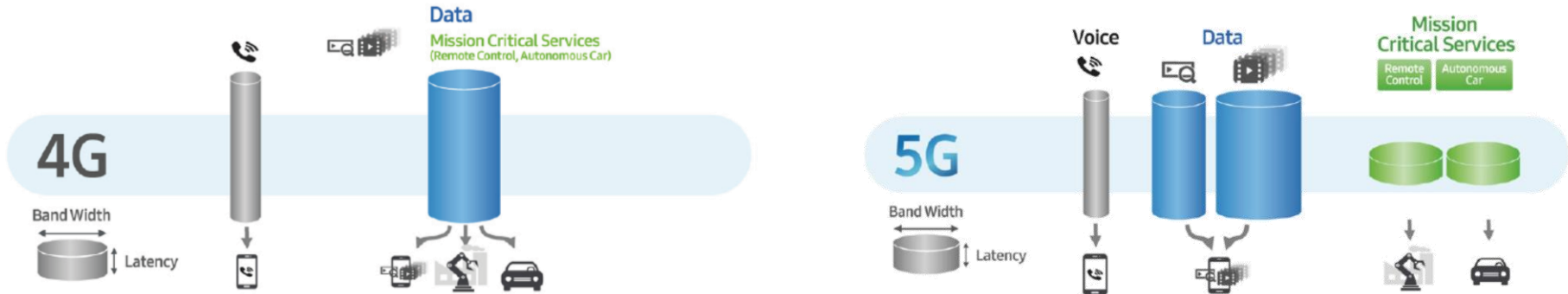
3GPP 5G Verticals (2/4)

Mission Critical Communication

- 5GS aspects (e.g. QoS, Priority, Pre-emption, network slicing) to support Mission Critical architecture
- HD Video, Simultaneous streaming sessions
- Ultra high reliability
- Enhancements to IMS (IMS Slicing, Artificial Intelligence) for new real time communication services (VR Telepresence)



3GPP Specifications: 22.279, 22.280, 22.282, 22.283, 22.228
23.783, 23.379, 23.280, 23.281, 23.282



Benefits from 5G: Expected QoS ensured for every service

3GPP 5G Verticals (3/4)

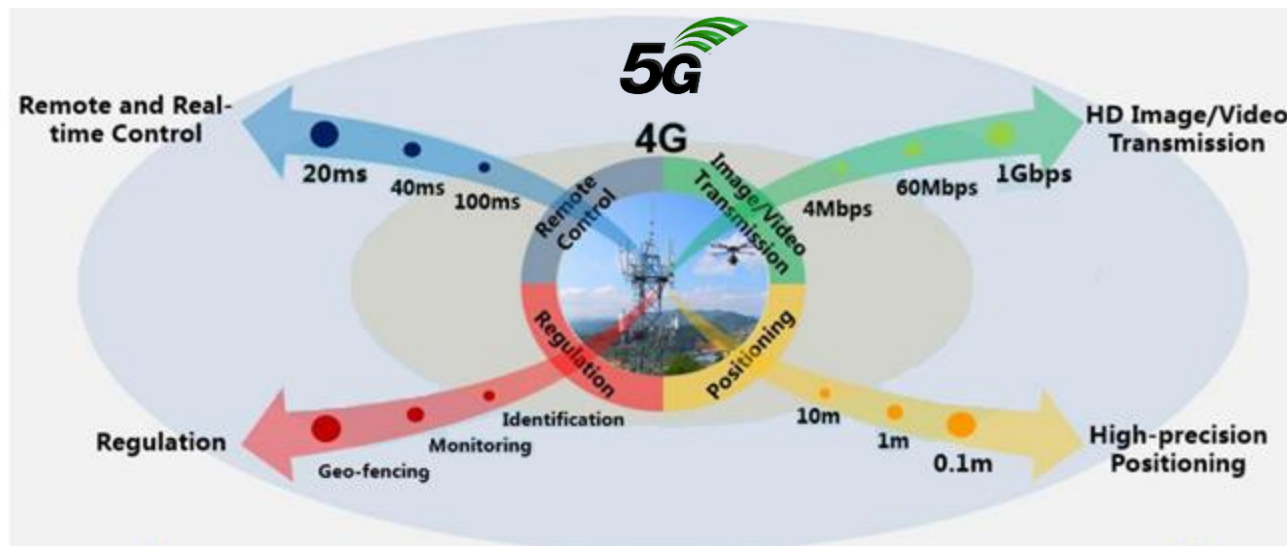
Unmanned Aerial Systems (UAV) e.g., Drones

- UAV identification and discovery by UAV Traffic Manager (UTM)
- Command and control traffic between UAV and UAV controller
- Potential usages of network slicing
- 5G Positioning (Horizontal and Vertical positioning)

Example use cases:

- Public safety
- Electric power inspection
- Environmental protection
- Film and TV shooting
- Oil monitoring
- Security surveillance

3GPP Specifications: [22.261](#), [22.872](#), [22.825](#)



- Benefits from 5G: Real-time HD Video, 3D Geo-fencing**

3GPP 5G Verticals (4/4)

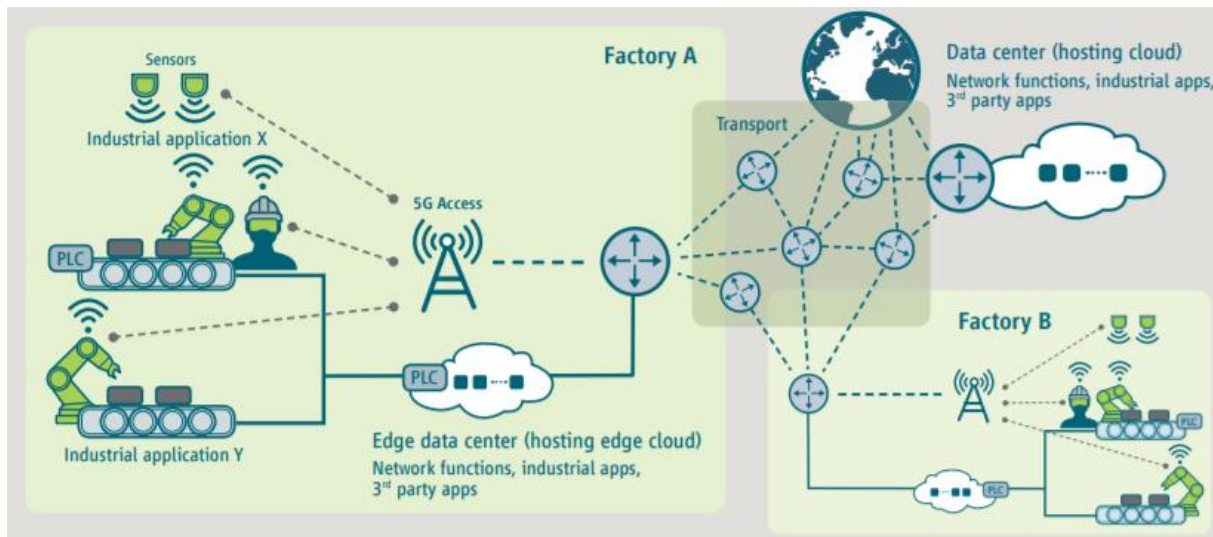
Smart Factory

- Support for High connection density, Ultra reliability, Low power consumption
- Replace Industrial Ethernet with Wireless Connectivity
- Communication paradigms in smart factory

Example use cases:

- M2M communication
- 3D AR/VR training
- Remote quality inspection
- Tracking of goods

3GPP Specifications: 22.279, 22.280, 22.282, 22.283

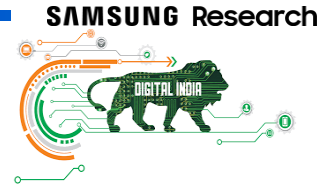


- Benefits from 5G:** Edge computing, IoT management, Private networks

5G Verticals – India Connection

Digital India

- High speed broadband experience – everywhere, anytime, always available for everyone
- New services and new user experiences, connecting new industries and devices



Rural Broadband

- BharatNet project to provide broadband connectivity across India's villages (village-level administrative units)
- High speed broadband services Rural India at reasonable costs, reducing the digital divide



Smart Cities

- High connection density – urban households and smart buildings
- Smart Utility Management Systems (reduce transmission loss in electricity distribution)



Healthcare

- Improve the performance of communications services used for public health, safety and security
- Emergency response and remote control of critical medical procedures



Agriculture

- Improve agricultural productivity by monitoring of weather, ground moisture content, soil quality etc through sensor network
- Efficient utilization of natural resources like water, soil, pesticides can be enabled in a smart village in large coverage areas



Transport

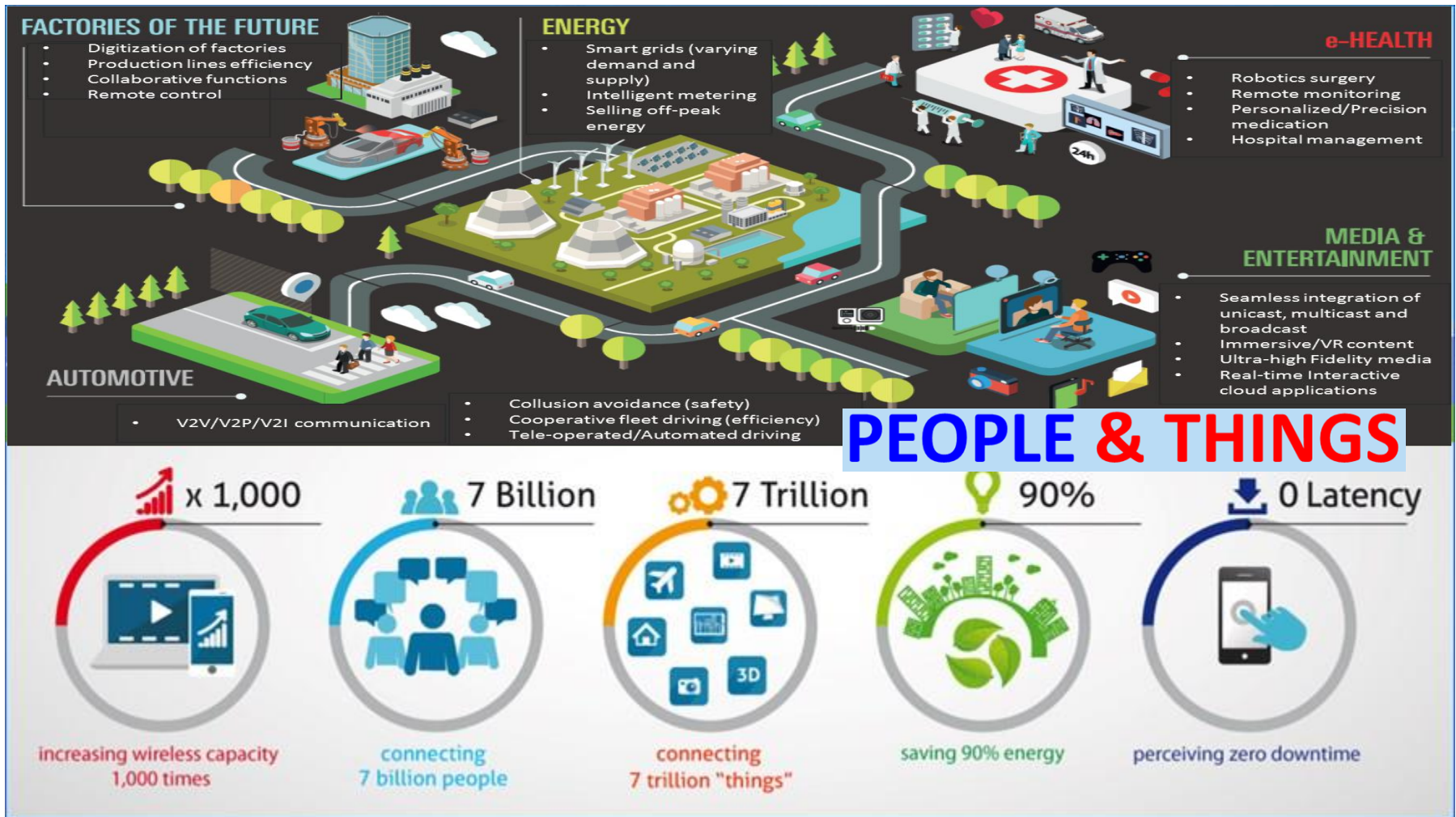
- Inter-vehicle and vehicle to infrastructure (e.g. traffic signal) communication
- Smart Traffic Management Systems: Intelligent traffic routing/monitoring/parking



5G USED in INDIA to enable the DIGITAL India, SMART Cities/Village missions.

Summary: 5G Services

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5G is not just another evolutionary 'G'. It is about a new ecosystem.

धन्यवाद!

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