5G Application Use cases &

Architecture Frameworks

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Telecommunication Engineering Centre

- TEC is the Technical arm of Deptt. of Telecom.
- TEC develops telecom Standards and specifications including interoperability / Interface specifications for seamless working of telecom networks and devices. These also cover safety and security requirements.
- TEC strives to enhance Indian contribution in the development of international standards in ITU etc. so that the national interests are adequately safeguarded.
- National working Groups (NWGs), corresponding to ITU Study Groups, are being coordinated by TEC.
- TEC provides support and advice to DoT on technology, spectrum and licensing related issues and produces standards related documents.
Telecommunication Engineering Centre

- TEC is **Designated Authority** for **Mandatory Testing & Certification of Telecom Equipment (MTCTE) Scheme** of Govt of India.

- TEC designates Telecom Labs as **CAB (Conformity Assessment Body)** for testing of Telecom equipment against MTCTE Scheme.

- TEC has Telecom Labs for **IPv6 Ready logo**, **SAR Lab**, **NGN Lab**. More labs are being set-up.

- TEC is a part of 5G India HLF and is associated with 5G deployment in India including 5G Test-bed, Field Trial
5G India 2020 Vision & Mission

5G India 2020 VISION:
• 5G will be USED in INDIA to enable the DIGITAL India, SMART Cities & SMART Village missions for India.
• Leveraging the MAKE in INDIA and Start-Up India missions, India will emerge as a global player actively engaged in the Design, Development and Manufacturing of 5G based technology and products.

5G India 2020 Mission:
• To accelerate deployment of next generation ubiquitous ultra-high broadband infrastructure with 100% coverage of 10 Gbps across urban India and 1 Gbps across Rural India
• To ensure proliferation of affordable 5G services and technologies across all sectors (eg. healthcare, education, transport, utilities, manufacturing) across the nation hence enabling an inclusive knowledge society
• To reposition the mobile broadband device complemented by IoT sensors and M2M technologies as an instrument of socio-economic empowerment of citizens and rapid economic development
• To promote Research and Development in 5G technology, products and services
• To promote development of 5G standards, generation of IPR and Global Contribution
5G – It’s a paradigm shift
5G: Enabler of new Applications

5G is very much about enabling new types of applications.

In a digital society, consumers, governments, corporations and industries will make use of mobile telecommunications to improve all kinds of processes.

These so called ‘vertical’ sectors, often use specific applications, with a diverse set of requirements on mobile telecommunications.
Use of 5G in India

• 5G is going to be the core technology to enable the digital transformation of India. Hence it is important to study India Specific use cases and make them part of the requirements influencing the development and standards of 5G.

• The three broad use cases of IMT 2020 or 5G are:
  – Enhanced Mobile Broadband (eMBB)
  – Massive Machine Type communication (MMTC)
  – Ultra Reliable Low Latency communication (uRLLC)

• These broad use cases can be used to provide different types of services in India for example rural broadband, enhanced broadband in urban areas, enabling smart cities through support for IOT, enabling critical communication through support for ultra reliable low latency communication.
Mobile broadband - eMBB

• Providing connectivity and net services in rural India
  – Fixed Wireless Access (FWA)
  – One of the test configurations in rural eMBBB is LMLC or **Low Mobility Large Cell**.
  – This can be utilised to provide connectivity and net services in rural India
  – 5G technologies that support eMBB can be used to provide high speed data service in a hotspot example in the village community centre.
Massive Machine Type Communication

• MMTC can be extended to all public utility services.
• Use of MMTC can help in providing smart power supply to remote and rural areas through remote monitoring, detection and correction of faults etc.
• MMTC can be used to improve various aspects of traffic management through implementation of Intelligent Transportation System.
• This can be used to track containers (carrying grains etc.), fleet management from the villages to the town or depot for the benefit of the farmers through live tracking etc. which provides more control and features for optimisation.
Ultra Reliable Low Latency communication

• Connected Cars: URLLC can be used to support connected cars for example for vehicle-to-vehicle coordination and traffic control.

• E-Health: It can be used to provide e-health through remote diagnostics and remote surgery through tactile internet. This will enable healthcare in remote and rural areas.
5G: Enabler of new Applications for Vertical Sectors

Rather than designing specific wireless technology for each of these vertical applications, it is expected that 5G technology is flexible enough to support all kinds of applications, even together on a single network.

5G is going to be the core technology to enable the digital transformation of India. Hence it is important to study India Specific use cases and make them part of the requirements influencing the development and standards of 5G.
A unifying connectivity

Mobile connectivity beyond 2020: Every thing on wireless
: Extended and enriched wireless services

1. Mission critical services (Ultra reliable & low latency communication)
   - Industrial Automation,
   - e-health, hazardous environments, rescue missions, etc.
   - Self-driving vehicles
   - Drones
   - Vehicular communication (V2V, V2I, V2P)

2. Massive Machine type communication / Massive IoT
   - Smart home
   - Smart city

3. Enhanced Mobile broadband
   - UHD video (4K, 8K) 3D video
   - Virtual Reality (VR), Augmented Reality (AR),
   - Tactile Internet, Cloud gaming, Broadband kiosks,
   - Real time simulation & training
   - Remote class room, Hologram
M2M / IoT applications

**Smart Home**
- Security & alarm
- Light control
- HVAC control
- Remote control
- Door control
- Energy efficiency
- Entertainment
- Appliances

**Wearables**
- Health monitor
- Fitness trackers
- Smart watch
- Smart glasses
- Smart bands
- E-textiles
- Hearing-aid

**Smart City**
- Traffic management
- Water distribution
- Waste management
- Security
- Lighting
- Environmental monitoring
- Parking sensor

**Industry Automation**
- Smart machine
- Surveillance camera
- Factory automation
- Asset tracking
- Logistics and optimization of supply chain

**Smart Energy**
- Generation & trading
- Transmission
- Distribution & metering
- Storage
- Services

**Connected Car**
- V2V / V2X / V2I communications
- eCall
- Infotainment
- Traffic control
- Navigation
- Autonomous vehicles
- Maintenance
Five main challenges have to be overcome for IoT:

1. Robust connectivity: Latency, availability, coverage, cost
2. Standardization: Standard connectivity for billions of things
3. Interoperability and open interfaces: Enabling platforms to talk with each other
4. Privacy and security: Prevent malware injection and data misuse
5. Domain knowledge: Deep, vertical-specific insights
Framework for India Specific Use Case (In line with NDCP, Smart-Cities etc.)

- Study and Analysis of India specific Use Cases
- Development of Requirements, SLAs and Test Cases
- Market Enablement, Accelerated deployment, Research, Innovation, Standards, Applications, Services & Products
# Framework for India Specific Use Case

<table>
<thead>
<tr>
<th>USER GROUP</th>
<th>TECHNOLOGY GROUP</th>
<th>FACILITATORS</th>
<th>ACTIVITIES</th>
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<tbody>
<tr>
<td>End User Ministries</td>
<td>Technology Ministries</td>
<td>Govt. Agencies</td>
<td>DEMOs &amp; Simulations: Hands-on experience for USER Group</td>
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<tr>
<td>TSPs/ ISPs</td>
<td>Vendors, OEMs; Start-ups</td>
<td>Global Partners</td>
<td>Study, analysis and modelling of India Specific Usage Scenarios, challenges &amp; Use Cases</td>
</tr>
<tr>
<td>Domain / Management Institutes; Use Case Experts</td>
<td>Technology Institutes; Researchers &amp; Innovators</td>
<td>Professional Bodies</td>
<td>Proof of concept testing, Interoperability and pilot testing</td>
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USE CASE LAB Framework

- DEMO AND CONCEPT LAB (DCL)
- DEVICE TESTING LAB (DTL)
- NETWORK TESTING LAB (NTL)
- INTEROPERABILITY AND FIELD SCENARIO LAB (IFSL)
## Focus areas in 5G: Indian Perspective

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<tr>
<th>Focus Area</th>
<th>Department/Ministry</th>
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<tbody>
<tr>
<td><strong>SMART COMMERCE / BANKING:</strong></td>
<td>Department of Financial Services, AB @ IDRBT</td>
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<tr>
<td><strong>INTELLIGENT TRANSPORT:</strong></td>
<td>Ministry of Railways, Ministry of Road Transport &amp; Highways, ARAI</td>
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<tr>
<td><strong>SMART AGRICULTURE:</strong></td>
<td>Department of Agriculture &amp; Farmers Welfare</td>
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<tr>
<td><strong>SMART CITIES:</strong></td>
<td>Ministry of Housing &amp; Urban Affairs</td>
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<tr>
<td><strong>SMART GRID:</strong></td>
<td>Ministry of Power, Power Grid Corporation</td>
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<tr>
<td><strong>SMART WATER:</strong></td>
<td>Ministry of Water Resources, River Development &amp; Ganga Rejuvenation</td>
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<tr>
<td><strong>INDUSTRY 4.0</strong></td>
<td>Department of Industrial Policy and Promotion</td>
</tr>
<tr>
<td><strong>SMART EDUCATION:</strong></td>
<td>Department of Higher Education, Department of School Education</td>
</tr>
<tr>
<td><strong>SMART HEALTH:</strong></td>
<td>Department of Health &amp; Family Welfare</td>
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Use cases - e-Health care

E-Health use cases were studied in the working group w.r.t. type of communication Channel requirement, data bandwidth requirement, compliance to standards, challenges, criticality of QoS and patient safety requirements from the following prospective:

1. Remote patient monitoring

2. Rural Health:- Solution comprises of mobile device, connected to Medical Device and enabled with Biometric ID, Camera and GPS with network connectivity to the backend Server where data can be submitted individually or in a consolidated manner.

3. Patient identification : Aadhar, Phone number, iris, smart card

4. Assisted living : Fall condition, vital sign monitoring, schedule for medicine reminder, activity monitoring, home dialysis, geo fencing etc.
IoT framework for health monitoring: motivation to remain fit

Communications network

Field area network

Applications

Things representations

Linked things and digital representations

Devices

Blood pressure

Pulse oximeter

Pedometer

Smart phone serving as an M2M device/gateway

Smart bandage

Representations

Applications
Use Cases in the Power Sector

Power Sector has a number of use cases where M2M communications plays a vital role, these includes (but are not limited to):

- Automatic Meter Reading (AMR)
- Advanced Metering Infrastructure (AMI)
- SCADA / EMS (Supervisory Control and Data Acquisition / Energy Management System) for TRANSCOS
- SCADA / DMS (Supervisory Control and Data Acquisition / Distribution Management System) for DISCOMS
- Sub-station Automation and Distribution Automation
- Distributed Generation
- Electric Vehicles Charging
- Energy Storage
- Micro-grids
- Home Energy Management/Building Energy Management
- Enterprise Networks
- etc.
Various use cases in **Automotive sector**

- Intelligent transport System
  - Vehicle tracking,
  - Traffic control,
  - Smart Parking
  - e-call (911 in USA and 112 in Europe)
  - V2V and V2I applications
  - Navigation, Infotainment,

- Fleet management,
- School bus tracking
- Asset tracking,
- Manufacturing and logistics,
V2V Communication scenario
Connected vehicle scenario

- Public Cloud
  - Subscription-based Services

- Private (OEM) Cloud
  - Data Center/Virtual Servers

- Enterprise Cloud
  - Enterprise Video, Voice, Data

VNO
- Policy Enforcement, Flow-based Management, DPI

- Energy Service Providers (Smart Grid)

- Communications Service Providers, "Fog"

- Mobile WiFi Offload
  - Wi-Fi Hotspots, 802.11u, 3G/4G

- DSRC Roadside Infrastructure
  - 802.11p (V2I)

- Consumer Network
  - Home/Dealership Wi-Fi Hotspots, Femtocells

- Electrical Charging Network
  - Charging Stations, Other Services (802.11p ?)

V2I/Upstream Communication (Wi-Fi, 3G/4G, 802.11p, etc.)

Software

V2V Communication (802.11p)

Source: CISCO
The Smart Home System

- Smart Home Monitoring
- Intrusion detection Sensors
- Panic Alarms
- Inbuilt Video calling, Advanced Apps for Public services
  - Connectivity: Wifi, Bluetooth, Zigbee, 3G/4G, Wi-SUN
- Smart Energy Metering
- Smoke Sensor
- Smart Water Meter
Modern home and Integration

**Smart home** of the future combines decentral generation (Solar roof panels, Micro-CHP, etc.) with intelligent demand side management.

- **Steering of decentral generation via demand side management**
- **Pro-active charging management for E-car**
- **Demand side management for electronic applications**

**Generation, consumption and energy need displayed via online interface:**
Power market interaction (prices, available RES, etc.)

**Mobility:**
- Company parking / charging / billing
- Public parking / charging / billing

**Smart phones** will allow customers to interact with home energy management devices (via apps, etc.).
5G as a Disruptive Technology is leading the next wave of Transformational Change
Thank you

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