IoT, Sustainable Development Goals and Urban Agendas

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A brief introduction

- TEC develops telecom product specification and interoperability (Interface) specification for seamless working of telecom networks and devices. These also cover safety and security requirement.

- TEC provides support and advice to Department of Telecom (DoT) on technology, spectrum and licensing related issues and produces standards related documents.
It strives to enhance Indian contribution in the development of international standards so that the national interests are adequately safeguarded.

Various divisions in TEC chair the National working Groups (NWGs) corresponding to the study group of ITU-T.

TEC also chair NWG-5 corresponding to study group 5 of ITU-R, which *inter-alia* deals standards for mobile radio systems.

TEC is having IPV6 Ready Logo test lab, Specific Absorption Rate (SAR) lab and Next Generation Network (NGN)/ Transport lab.

TEC also has MRA with Singapore for product certification.
Challenges of Major Indian Cities

- Transportation: Average speed in most of the congested roads – 10-15 Km/Hr
  - US $ 10 B worth fuel is lost due to congestion every year.

- Parking

- Pollution

- Waste management

- Power

- Safety & Surveillance

- Water management- Drinking Water shortage
  - Non revenue water (NRW) figure: Singapore < 5%, USA: 12-15%
    - India: 40-65%

- Health Care
How to address these challenges efficiently:

- needs to create **Smart Infrastructure** to manage complexities of public services, reduce expenses, increase efficiency and improve the quality of life.

- Use M2M/IoT and ICT to make all the verticals smart - will provide data in real time.

- Big data analytics to create intelligence.

- Use intelligence for planning and operational activities.

**Goal:** To improve the quality of life.
ITU-T in its Recommendation ITU-T Y.2060 (06/2012) has defined Internet of Things (IoT), as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

ITU-T created a Study Group (SG)-20 in 2015 to study IoT and its applications in Smart cities and communities.
M2M / IoT market: Projections

- 26 billion connected devices globally by 2020, business impact to be worth US$ 4.3 Trillion.
- $1.3 trillion revenue opportunities for mobile network operators

GSMA & Machina research

- 50 billion connected devices globally by 2020

CISCO / Ericson / ITU

Global projections varies from 26 billion to 50 billion

There may be around 2.6 billion connected devices by 2020 and 8 billion by 2026 and 24 billion by 2032 in India.
What is IoT?

Connectivity + Sensors + Data Processing/Analytics = IoT

Add connectivity to the basic functionality
Add smart sensors to increase functionality
New services based on the technological possibilities

Quality, Privacy, Affordability, Interoperability, Economies of Scale, Security
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Industry / Vertical</th>
<th>M2M applications</th>
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<tbody>
<tr>
<td>1.</td>
<td>Smart City</td>
<td>Intelligent transport System, Waste management, Smart Street Light system, Electric vehicle charging, Water management, Smart Parking, Intelligent buildings, Safety &amp; Surveillance, Remote health management, e-ICU</td>
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<td>3.</td>
<td>Safety &amp; Surveillance</td>
<td>Commercial and home security monitoring, Surveillance applications, Video analytics and sending alerts, Fire alarm, Police / medical alert</td>
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<td>5.</td>
<td>Health care</td>
<td>Remote monitoring of a patient after surgery (e-health), remote diagnostics, medication reminders, Tele-medicine, wearable health devices, e-ICU</td>
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<td>6.</td>
<td>Smart Homes</td>
<td>Video monitoring of home, Security &amp; Alarm, Door control, HVAC control, Smart lighting, Smart appliances.</td>
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<td>7.</td>
<td>Financial /Retail</td>
<td>Point of sale (POS), ATM, Kiosk, Vending machines, digital signage and handheld terminals.</td>
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<td>8.</td>
<td>Water</td>
<td>Smart metering, Water leakage management, quality of water in real time</td>
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<td>9.</td>
<td>Agriculture</td>
<td>Remotely controlling the irrigation pump by use of Mobile phone, Soil testing devices</td>
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<tr>
<td>10.</td>
<td>Industrial IoT</td>
<td>Industry automation, Remotely monitoring the machine parameters, Supply chain management etc.</td>
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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
Connecting “Things” to the Cloud

Source: Keysight technologies
Enabling technologies ..... 

- Static IP (IPv6 or dual stack) but in future IPv6 only.
- Digital Identity: e-KYC for individuals and digital certificates for companies.
- Smart Phone will work as a Smart device
- Wireless spectrum (Licensed / Un licensed)
- High speed and reliable internet services on fixed line and Smart phones.
- ICT backbone
- Cloud, Edge computing
- RFID Tags: e-tolling in 865-867 MHz band
- M2M SIM (Embedded SIM)

- 5G will bring ultra high reliability, ultra low latency, wide coverage and high security network, suitable for M2M / IoT.
Projections related to connectivity technologies

- GSMA study on IoT in 2014 – 40% of the total devices may be connected using SIM and a connection to mobile network.

- In MWC- 2016, Ericsson has dropped the number of cellular connected IoT devices in 2020 from their previous estimate of (40%) 20 billion to just over (2%) 1 billion.

- In MWC – 2017, Ericson projected 1.5 billion connected devices out of 28 billion, on cellular network by 2022.

- In India SIM based devices / Gateways may be around 15-20%.

- It shows that the low power wireless network and LPWAN will have a major share in device connectivity.
M2M Standardization at International level

Some of the standardization bodies are as given below:

- ITU
- ISO
- IEC
- IEEE
- OneM2M
- GSMA
- 3GPP
- Alliance for Internet of Things Innovation (AIoTI)
- Continua health alliance
11 Multi stake holders working groups have been created in the last 2-3 years.

First set of following Technical Reports were released by Hon’ble MoC&IT in May 2015 along with National Telecom M2M roadmap

a) M2M Enablement in Power Sector
b) M2M Enablement in Intelligent Transport System
c) M2M Enablement in Remote Health Management
d) M2M Enablement in Safety & Surveillance Systemssse

e) M2M Gateway & Architecture.
M2M/ IoT Standardization activities in TEC, DoT...

1. M2M Number resource requirement and options
2. V2V / V2I Radio Communication and Embedded SIM
3. Spectrum requirements for PLC and Low Power RF Communications.
4. ICT Deployments and strategies for India’s smart cities: A curtain raiser
M2M/ IoT Standardization activities in TEC, DoT...

- Technical Reports (TRs) released in 2017
  
  1. M2M/ IoT Enablement in Smart Homes
  2. Communication Technologies in M2M / IoT domain

- Technical reports (TRs) are available on www.tec.gov.in/technical-reports

- Work is in progress in Smart cities, Smart Village & Agriculture, Security and M2M Gateway & Architecture working groups (OneM2M specifications)
Indian participation in ITU-T SG-20

- National Working Group (NWG) - 20 formed in TEC, India, in 2015 to collaborate with ITU-T SG-20

- Based on the Technical reports released in TEC, contributions have been submitted in ITU-T SG-20 meetings and are in the work item Y.IoT use cases
  1. Vehicle emergency call system for automotive road safety
  2. Digitization and automation of Vehicle Tracking, Safety, Conformance, Registration and Transfer via the application of e-SIM and Digital Identity
  3. Remote monitoring the health of a patient
  4. Connected Smart homes.
Actionable points emerged from the Technical Reports (TRs):

Some are listed as below:

1. Based on Technical report and consultations with all the stake holders, TEC proposed 13 digit M2M Numbering plan for SIM based devices/ Gateways which will co exist with existing 10 digit numbering scheme being used for mobile phones.

   - DoT has approved this scheme and issued orders to all the TSPs for implementation.
   - Five codes of 3 digit each (559, 575, 576, 579 and 597) have been allotted as a M2M identifier.

2. Embedded SIM: Based on Technical report released in TEC, DoT has approved the use of Embedded SIM with over the air (OTA) provisioning in India.

   Ministry of Road Transport and Highways, India has already included Embedded SIM in AIS140 standard mandated for Vehicle location tracking services (VLTS) to be implemented for consumer vehicles in first phase.
3. Based on TR, additional Spectrum requirement for Low power RF communications in Sub GHz band was recommended and in discussion.

4. Any device / Gateway having direct connectivity with PSTN / PLMN should have static IP (IPv6 or dual stack). Bureau of Indian Standards (BIS) has mandated IPv6 for Smart meters to be connected on Cellular technologies, IS16444.

5. Multi protocol gateways.

6. M2M Network architecture and various Service delivery models for providing services in M2M domain.

7. Spectrum requirement for DSRC technology.

8. Licensing for LPWAN on non cellular technologies, providing public services.

9. Common service layer requirement at the platforms, important for data sharing, Security and interoperability.
Testing and Certification requirements


- Regulatory and legal compliance requirements - Devices with communication facility needs testing and certification against
  
  - EMC (Electro magnetic compatibility),
  - Safety,
  - Technical protocols including Interoperability & Conformance testing,
  - Security
  - Others (SAR, IPv6 or RoHS )

- Testing will be done in the accredited labs in India

- In case of MRA (Mutual Recognition Arrangement) with the other countries, devices may be tested there and no need of further testing in India.

- To be implemented from October 2018

  **Test Once : Use any where**
National Telecom Policy – 2012 :- thrust on high quality broadband services, Cloud computing, Mobile Internet, IPv6, Machine to Machine communication and telecom equipment manufacturing.

Telecom policy 2018 under preparation. It will focus on strengthening telecom infrastructure, IoT, 5G, AI, Cloud etc.


TRAI recommendations on Spectrum, Roaming and QoS related requirements on M2M Communications released recently are under discussion in DoT.

Major use cases

- Intelligent transport System
  - Vehicle tracking: around 8 million passenger vehicles are expected to be provided this facility.
  - Traffic control,
  - Smart Parking: 20% to 30% congestion is done by drivers searching the parking lot in big cities.
  - Emergency call system - 112 adopted in India
  - V2V and V2I applications
  - Navigation, Infotainment,

- Fleet management,
- Asset tracking,
- Waste management: Smart bin, geo fence of trucks, RFID, weight sensor
- Water distribution

- Feedback device
- Smart street lighting
- Smart metering
Major use cases

0.25 Million village panchayats are being connected on optical fiber cable to provide 100 Mbps bandwidth.

This bandwidth will be used to provide e-health, tele education, e-governance and other facilities in the rural areas.
Personal Health Devices: Interoperability
Architecture approved by ITU

Personal Device
- Thermometer
- Pulse Oximeter
- Pulse / Blood Pressure
- Weight Scale
- Glucose Meter
- Cardio / Strength
- Independent Living Activity
- Peak Flow
- Medication Adherence
- Physical Activity
- Electrocardiogram
- Insulin Pump

Aggregation Manager
- ISO
- IEEE
- Bluetooth
- USB
- ZigBee

Telehealth Service Center
- IHE
- HL7
- W3C
- IHE

Health Records/Networks
- WiFi, 2G, 3G & 4G

Personal Area Network (PAN) Interface
Wide Area Network (WAN) Interface
Health Record Network (HRN) Interface
How IoT will add value?

- Reduce congestion on the roads using Intelligent Transport Systems applications such as intelligent signalling, Electronic toll collection, Smart parking etc..

- Geo fence will help in monitoring the vehicles deployed for specific tasks such as garbage collection, pick & drop etc.

- Vehicle tracking will reduce crime.

- Surveillance will bring values to the cities as the citizens will feel safe. Real time video analytics may send alerts on the smart phones of police in that area.

- Wearable health devices may help in monitoring the health parameters especially in rural areas for remote monitoring and advising, help in reducing burden on hospitals.

- Save electricity by using smart lighting system in cities and homes.

- Share data across verticals to create value.

All these actions will improve the quality of life.
IoT as a Disruptive Technology is leading the next wave of Transformational Change
THANKS

(For detail, see the TR available on www.tec.gov.in/technical-reports/)

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