# Internet of Things
## ITI Opportunities & Space for collaborations

**Dr. Jyoti Kaul**

**AGM- Marketing**

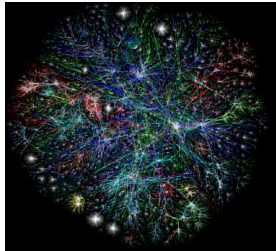**ITI, Corporate Marketing**

# Overview of Internet of Things (IoT)

**Device**

**IoT**

**Thing**

- **Device: An equipment having mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, storage and processing.**
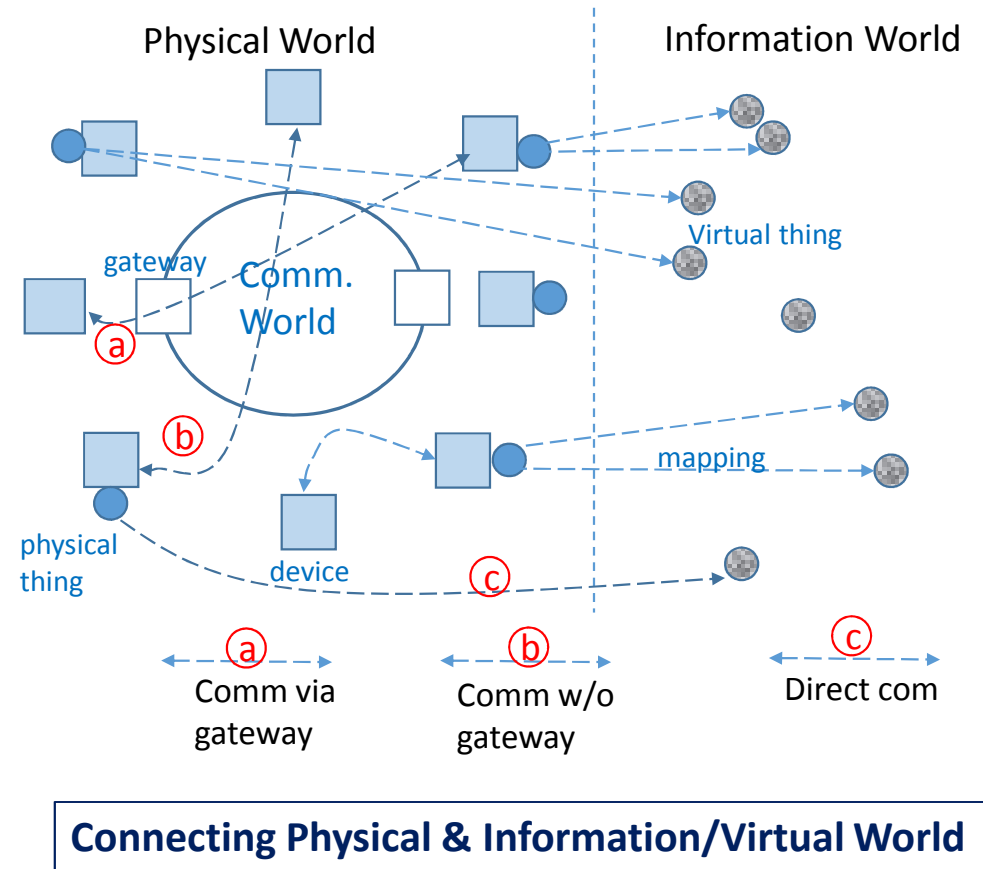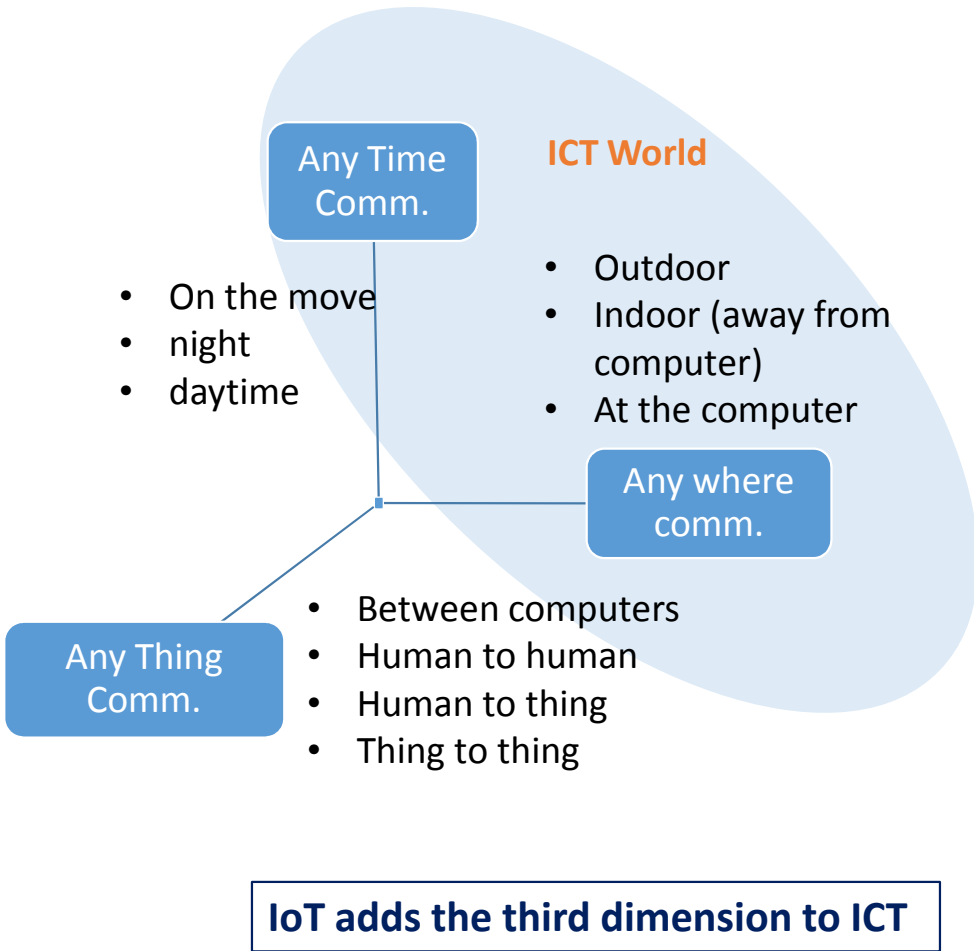
- **IoT: A global infrastructure for the info. Society, enabling advanced services by interconnecting (physical & virtual ) things based on existing and evolving interoperable and communication technologies.**

- **Thing: An object of the physical world(physical things) or the information(virtual things) which is capable of being identified and integrated into communication networks.**

ITU-T Definitions

# Communication interplay in IoT

**Any Time Comm.**

- On the move
- night
- daytime

**ICT World**

- Outdoor
- Indoor (away from computer)
- At the computer

**Any where comm.**

**Any Thing Comm.**

- Between computers
- Human to human
- Human to thing
- Thing to thing

**IoT adds the third dimension to ICT**

Physical World                    Information World

gateway

**Comm. World**

Virtual thing

physical thing

gateway

device

mapping

(a) Comm via gateway

(b) Comm w/o gateway
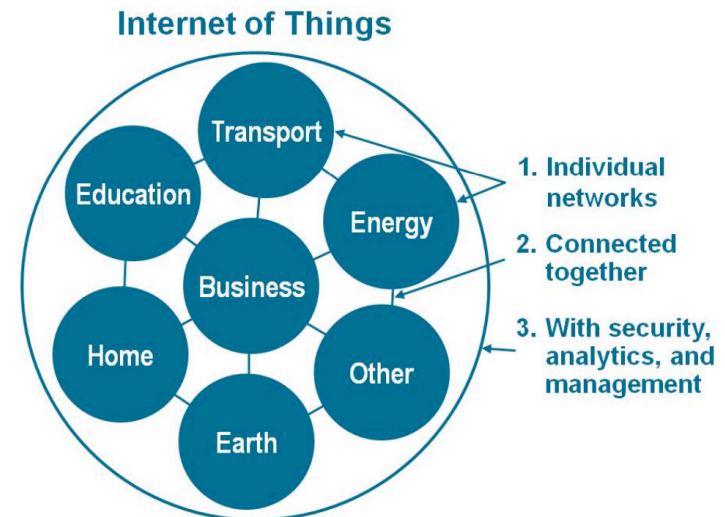
(c) Direct com

**Connecting Physical & Information/Virtual World**

# Internet of Things

**Internet of things was born between 2008-2009**
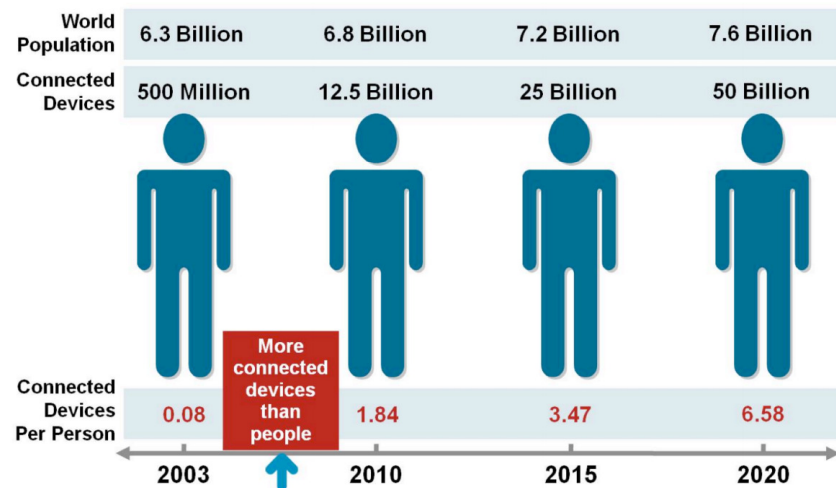
**IoT can be viewed as Network of Networks**
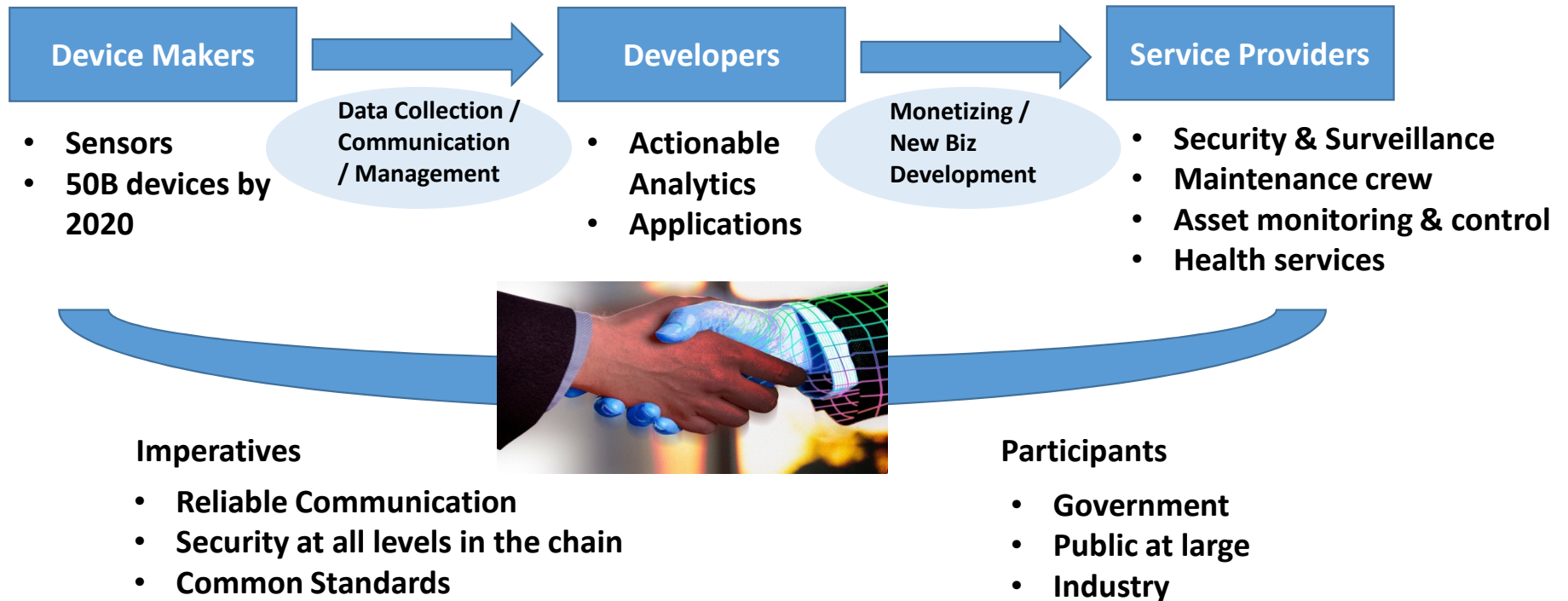


Source : CISCO IBSG, April 2011



Source : CISCO IBSG, April 2011

With 50 B devices connected & estm. population of 7.6 B more than 6 devices per person by 2020

IOT goes beyond individual vertical networks, it aims at interconnecting networks

# Internet of Things – Eco System

**Device Makers**

*Data Collection / Communication / Management*

**Developers**

*Monetizing / New Biz Development*

**Service Providers**

- Sensors
- 50B devices by 2020

- Actionable Analytics
- Applications

- Security & Surveillance
- Maintenance crew
- Asset monitoring & control
- Health services

**Imperatives**

- Reliable Communication
- Security at all levels in the chain
- Common Standards

**Participants**

- Government
- Public at large
- Industry

**Seamless handshake between physical and digital worlds**

# Why IOT Now – Developed vs Developing Nations

**Developed Infrastructure**

### Global Context

- Cost of Sensors has come down
- Cost of Connectivity has come down
- Cost of computing has come down
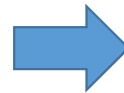
### Value Proposition

- Revenue generation under an "industrial slow down"; from hardware to software & IoT in industrial seg. being adopted
- Improvement in Productivity and Cost saving

**Developing Infrastructure**

### Indian Context

- High penetration of wireless com.
- Large users of Internet (Google, Facebook, LinkedIn, Tweeter etc.)
- Huge scope for improving productivity and governance
- Well timed with other key initiatives; NOFN, Digital India, Smart Cities, Smart Grid, Skill Development etc.
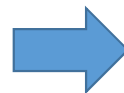
### Value Proposition

- Optimum use of best global technology just like the country benefited from Mobile technology advancement.
- Improved governance and social sector impact most promising vs the industrial IoT till 2020.
- IoT enabled Infrastructure can be deployed and not depend upon legacy infra. which west has to deal with at this stage.

# Connected vs Largely Disconnected World
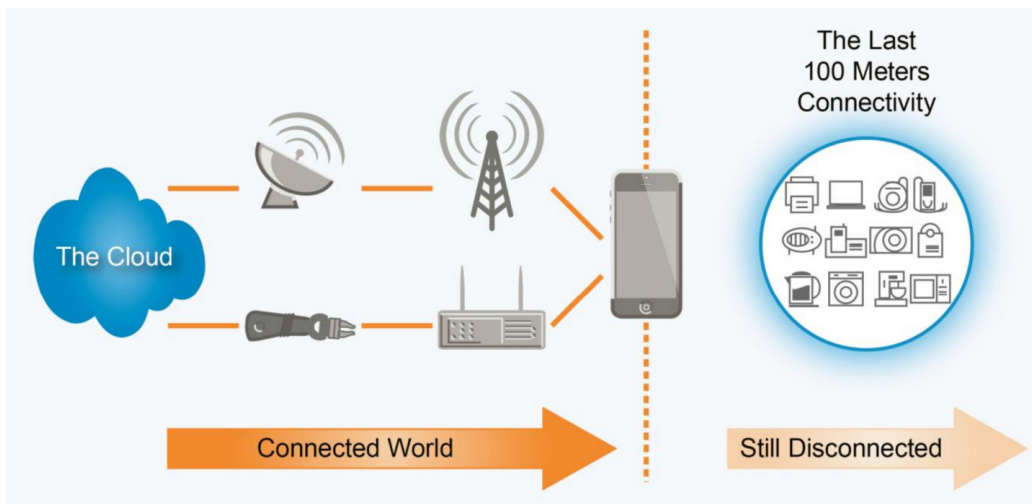


Paper by Mats Andersson, CTO, connectBlue
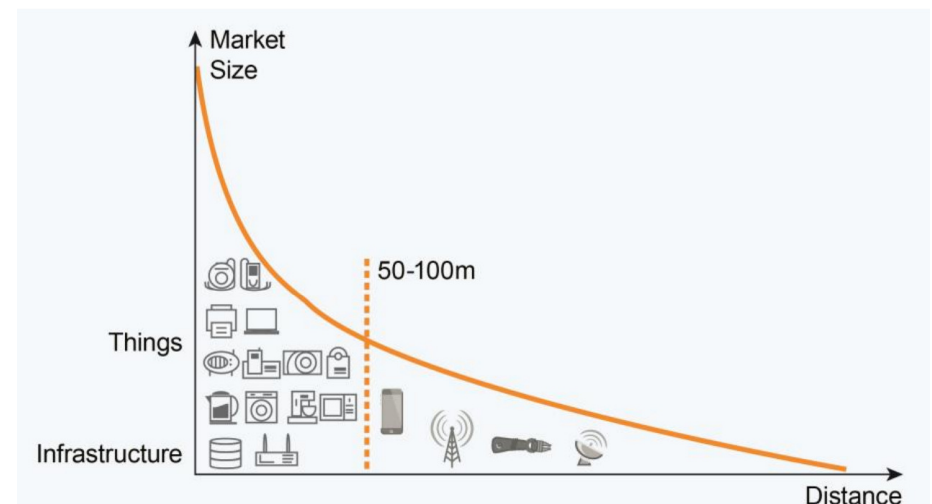


Paper by Mats Andersson, CTO, connectBlue

- Wide Area Network to a large extent is connected through Smart Phones, Home Routers (ADSL. WiFi) , GSM (3G/4G)
- Devices in the last 100m are typically not connected

- Most of the "things" / devices / sensors within short range represent much larger market opportunity by size.

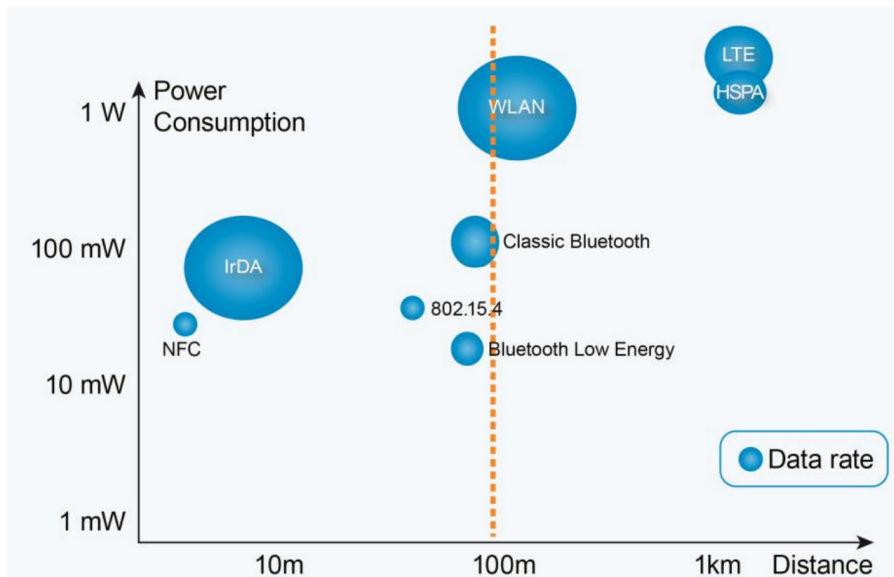# Communication technologies under consideration
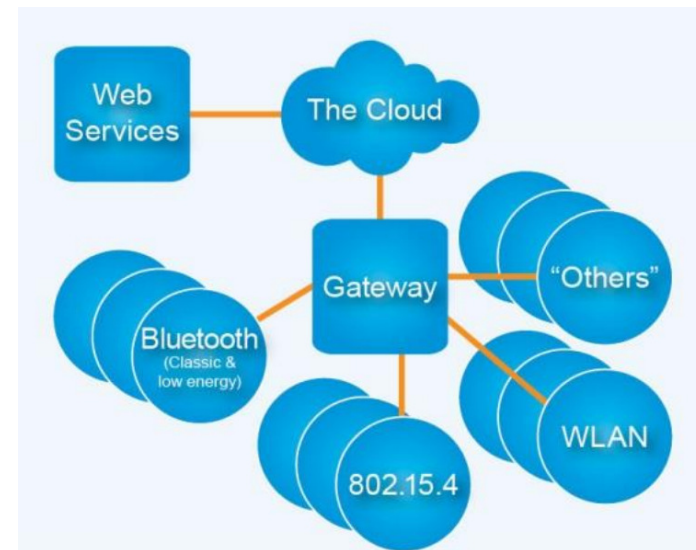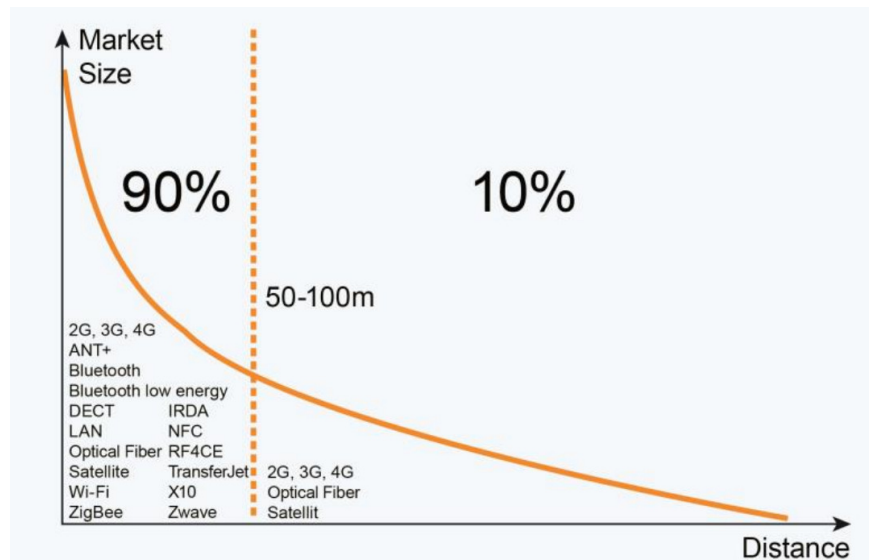




- **Host of technologies exist for short range connectivity that include many domain specific standards and proprietary tech.**
- **90% of market is in the short range is untapped &only 10% in long range**

- **Short range low power network architecture**
- **gateway serves as an interface between Wide Area Network (Internet) and short range network**

# Technologies with most promise



| | Bluetooth Low Energy | 802.15.4 | WLAN |
|---|:---:|:---:|:---:|
| Cost | ✓ | ✓(✓) | ✓ |
| Security | ✓ | ✓ | ✓ |
| Power consumption | ✓ | ✓ | ✗ |
| Ecosystem | ✓ | ✗ | ✓ |
| Reliability | ✓ | ✓ | ✓ |
| Ease of use | ✓ | ✓ | ✓ |
| Range | ✓ | ✓(✓) | ✓ |
| Comment | | Mesh gives range. | |

- **NFC: low power but very short range**
- **IrDA: Needs line of sight**
- **ISM band technology**

- **Bluetooth Low Energy: Largest ecosystem (phones, tablets…. Low power)**
- **IEEE 802.15.4: low power but closed ecosystem (e.g. Smart Energy)**
- **WLAN: Large ecosystem but higher power, infra use**

# IPv4 vs IPv6

## Push Model with IPv4

Physical Device
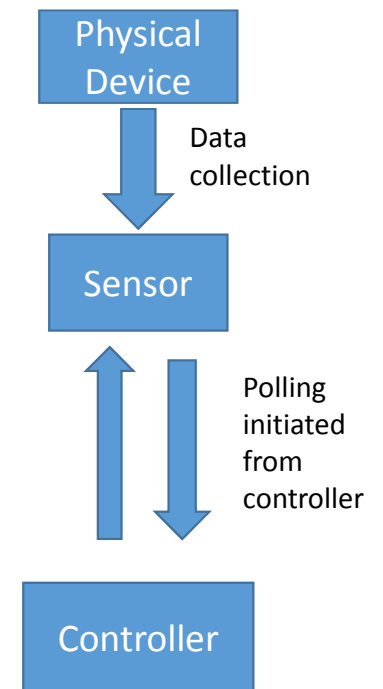
Data collection

Sensor

NAT
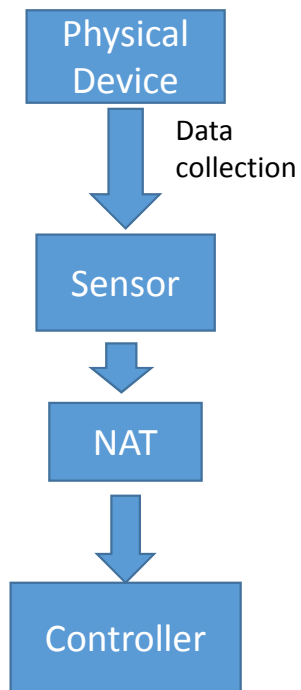
Controller

- Sensor collects data & stores
- Sensor sits behind NAT
- Periodically connects with Controller via NAT and passes data
- Device is assigned external IP address only during the duration of each PUSH
- Model essentially hides the sensor from external internet

- Each sensor gets polled directly with a unique IP address
- Exposes unattended micro-device to polling from the internet.

## Pull Model with IPv6

Physical Device

Data collection

Sensor

Polling initiated from controller

Controller

- **10-15b devices connected to internet in 2016**
- **Internet routes 2.8b unique IPv4 addresses, located behind NAT**
- **One address gets shared across multiple devices**
- **IPv4 is a 32 bit system and maximum IP addresses it can support is $4.3 \times 10^9$ (4.3b). Not sufficient when 50b devices are expected to get connected by 2020.**
- **IPv6 supports $3.4 \times 10^{38}$ addresses (340 undecillion) but now we security aspects will need to be addressed head-on**

# Internet of Things – Market size



THE INTERNET OF THINGS LANDSCAPE

INDUSTRIAL INTERNET
CONNECTED HOMES
TRANSPORTATION
WEARABLES
CONNECTED CITIES
CONNECTED CARS
OIL & GAS
HEALTH CARE
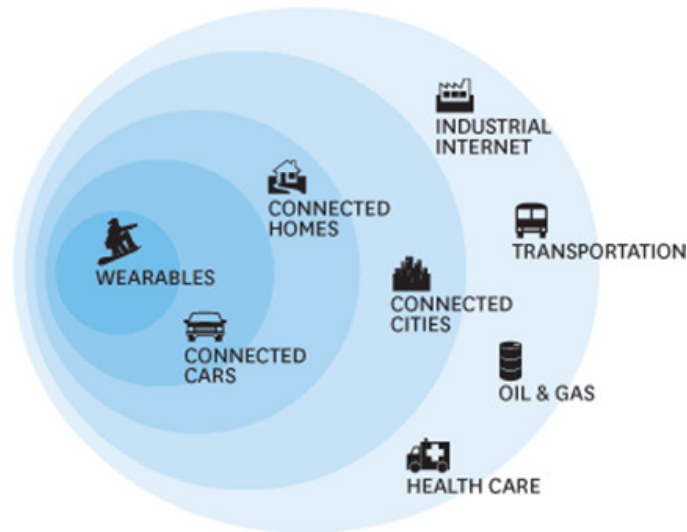
SOURCE GOLDMAN SACHS GLOBAL INVESTMENT RESEARCH          HBR.ORG

## Global

- Global Growth estimates $300b IOT market Inc. Revenue
- Industrial IOT estimates at $10-$15 T in next 20 year (GE); $19T in 2020 per CISCO.
- Globally outer layer (Industrial) represents 70% of IOT market in next 3 years

## Indian

- India estimates $15b market by 2020 (5% of Global)
- Connected devices are expected to increase from 200m to 2-7B by 2020.
- Will 70% demand come from Industrial?

# IoT Business verticals
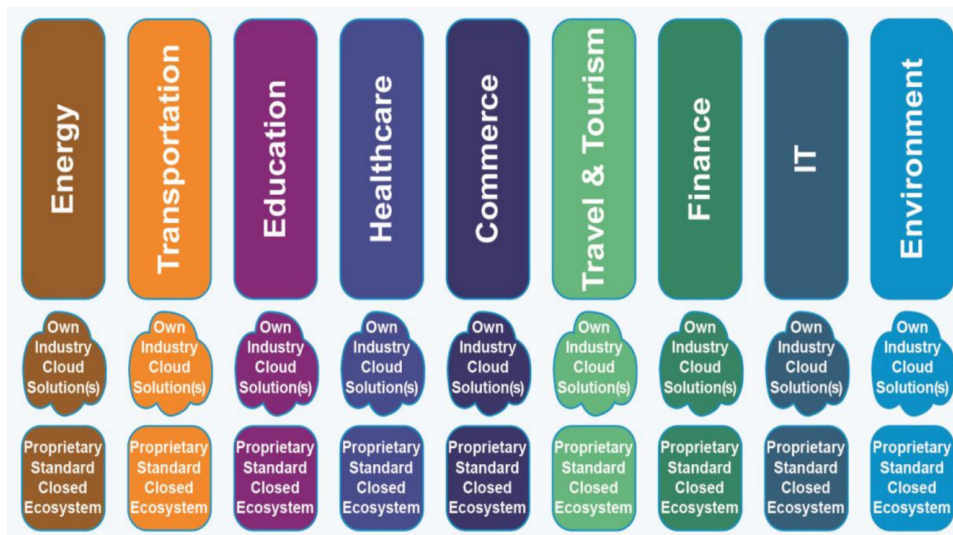


Most IOT applications currently are in Vertical Silos

Real Potential of IOT when data is available across Silos

# Opportunities in Smart Infrastructure
(Source: KPMG Report)

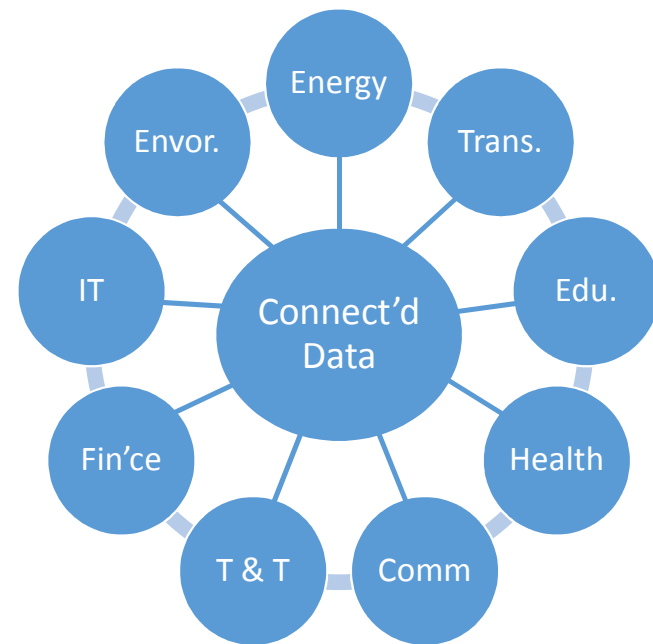- **Smart Governance** : **US $ 83 million allocated for Digital India initiative.**

- **Smart Meters** : **130 million numbers by 2021**

- **Smart Environment** : **US $ 50 billion in the water sector**

- **Smart ICT** : **Cloud Computing - US $ 4.5 billion**

  **Safe City Projects US $ 333 million in 7 cities**

- **Smart Health & Education** : **US $ 5.26 billion**

- **Intelligent Building Mgmt** : **US $ 1891 million**

# Current Indian Market Requirements for Smart Infrastructure Business

| (A) | Product/Solution | City | Project Cost (Rs in Cr) |
|---|---|---|---|
| 1 | Traffic Signaling System , Blinkers and Pelican Signals with Solar Powered Adaptive System | Bhubaneswar | 6 |
| 2 | Wi-Fi, Smart LED Street Light, City Surveillance, command and Control Centre | NMDC, Delhi | 75 |
| 3 | Smart Pole with LED Street light, Wi-Fi Services in 100 Hot Spots, Optical Fiber, Surveillance, Environmental Sensors, EV Charging Points, Smart Bill Board, SOS Application, Centralized Command and Control Centre | Bhopal | 5 |
| 4 | GIS services | Delhi | 25 |
| 5 | City Network Back bone, City Wi-Fi, City Surveillance, City Kiosk,  Smart Strip | Nagpur | 250 |

# Current Indian Market Requirements for Smart Infrastructure Business

| (A) | Product/Solution | City | Project Cost (Rs in Cr) |
|-----|------------------|------|-------------------------|
| 6 | Wireless E-Class room solutions | Andhra Pradesh | 13 |
| 7 | Smart Grid | Gujarat | 12.5 |
| 8 | Citizen Service Delivery and Collaboration Platform | Bhopal | 0.5 |
| 9 | Grid connected Rooftop Solar PV Systems | Kakinada | 2.5 |
| 10 | Smart Parking Management System | Telengana | 0.5 |

(B) Business Model:    Public Private Partnership (PPP)

Build, Own, Operate & Transfer

(C) Project Management Consultant :Ludhiana, Jabalpur, Jaipur, Kakinada, Vishakhapatnam, Davenegere, Bhopal, Kochi, Kakinada

# IoT- Objectives of ITI

- To get into Smart Infrastructure business which is expected to grow in billions in three to four years.

- To be a Lead System Integrator of the Smart infrastructure projects.

- Smart Infrastructure development activities should facilitate intrinsic growth of ITI- focus on owning technology and develop innovation & manufacturing capabilities.

- Leverage synergy of Govt. organizations and create niche in this domain.

- To be at par with the industry standard.

# Smart Solutions Implemented by ITI

- Data Center
  - ITI has set up a state of the art (Tier 3 plus) Data Center in PPP mode in Bangalore.
  - Colocation Services/Hosting/Managed Services are provided.
  - It has Carrier Neutral network comm. & separate security operating center
  - Experience in establishment of Data Center, Disaster Recovery Center, call center etc.

- Smart Energy Solutions
  - ITI has in-house capability for manufacturing Solar Photovoltaic Panels(SPV)

# Smart Solutions Implemented by ITI

- **Smart Meters**
  - **Implementing R-APDRP Project for Tamil Nadu & Puducherry**

  - **Modules include Automatic Meter Reading Solutions, Energy Audit, New Connection , GPS based GIS survey.**

- **Surveillance & Tracking Solutions**
  - **Experience of implementing Video Surveillance for various Govt departments**

  - **Established Police Control Room (Lucknow) with GIS, GPS, Vehicle Tracking & CCTV surveillance for UP Police.**

# Smart Solutions Implemented by ITI

- Smart Network Infrastructure
  - Implementation of State Wide Area Network, GSM Network, Managed leased Line Network, Campus Wide Area network
  - Multi Services Network – voice, data & video
  - Carrier grade Network for Service Providers
  - Enterprise Network for Captive Network users

- Wi-Fi
  - ITI has supplied wireless broadband (Wi-Fi) equipment for wireless solution
  - ITI has signed ToT agreement with C-DOT for manufacturing of Wi-Fi equipment

# ITI Strengths - Smart Infra. Business

State of the art manufacturing infrastructure.

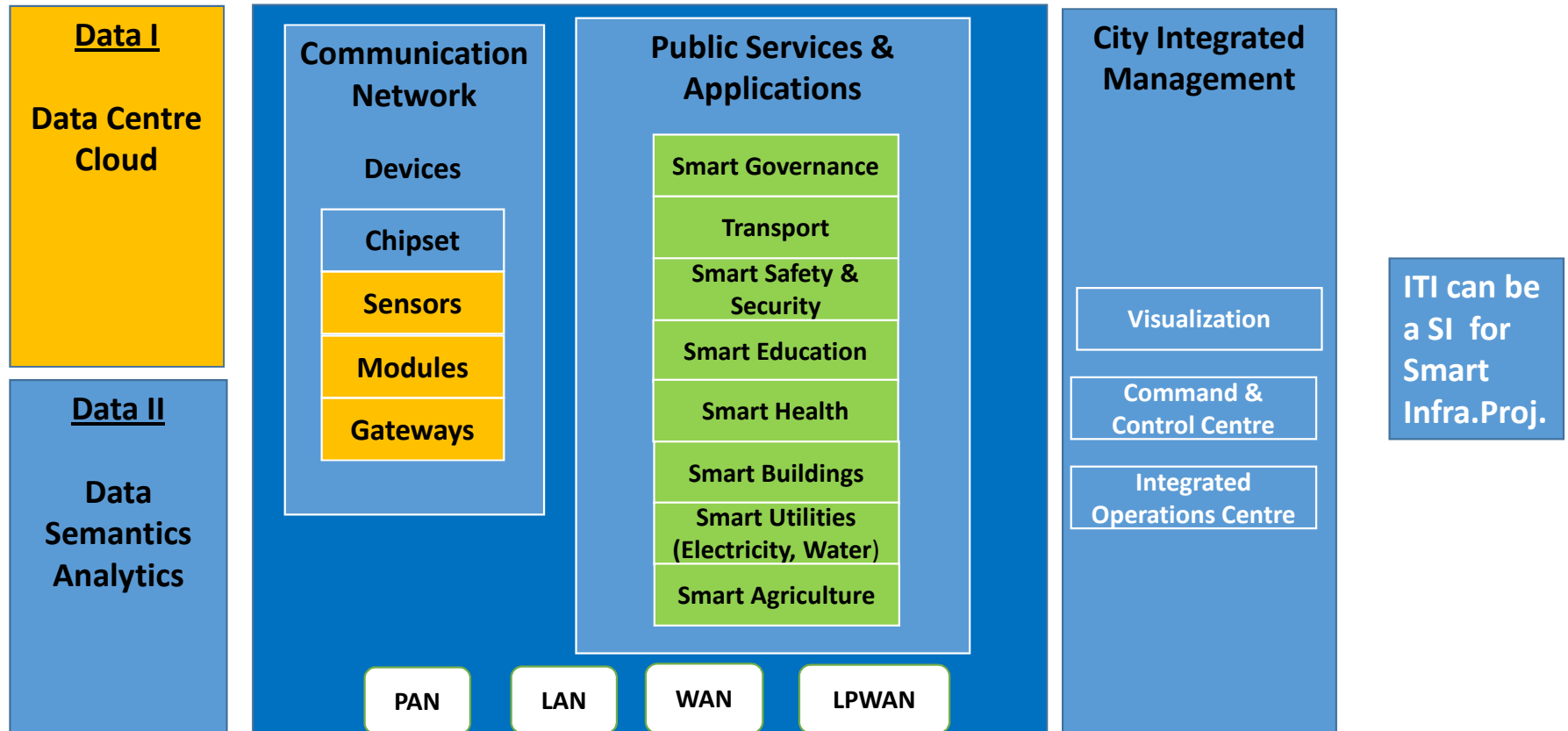Domain expertise in Telecom & ICT Sector.

Experience in Implementing various Smart Solutions for various customers.

Countrywide presence thro' 8 Regional offices & 21 Area offices and 6 Plants for Business Development activities.

Past experience in execution of large turnkey projects.

Experience in providing long term services support for telecom/IT infrastructure projects .

# Example – Smart City Infrastructure



**Data I**

Data Centre Cloud

**Data II**

Data Semantics Analytics

**Communication Network**

Devices

- Chipset
- Sensors
- Modules
- Gateways

**Public Services & Applications**

- Smart Governance
- Transport
- Smart Safety & Security
- Smart Education
- Smart Health
- Smart Buildings
- Smart Utilities (Electricity, Water)
- Smart Agriculture

**City Integrated Management**

- Visualization
- Command & Control Centre
- Integrated Operations Centre

ITI can be a SI for Smart Infra.Proj.

PAN | LAN | WAN | LPWAN

■ Areas where ITI can play a **lead** role (mfg.)   ■ Possible areas of co-operation for ITI (Srvcs. & Sol.)

# Some everyday Indian issues needing solutions

**Transportation**

- **Fleet management. Overall Fuel saving & emissions reduction**
- **Better monitoring to regulate traffic when crossing cities**
- **Accident prevention and response**

**Healthcare**

- **Access to basic health care for even remote locations**
- **Reduced cost for avoided hospitalization**
- **Remote patient monitoring (heart, diabetes ….)**
- **Behavioural modification (obesity, smoking etc.)**

**Agriculture**

- **Better decision support to farmers especially with unpredictable monsoon patterns in years to come.**
- **Pesticide spraying, remote monitoring & control etc.**
- **Better live stock monitoring & health care**

**Water**

- **Prevent water wastage due to leakages in pipes; smart water meter & pipeline monitoring**
- **Water quality monitoring**

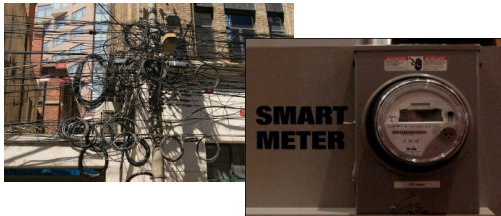# Some everyday Indian issues needing solutions (Cont'd)

**Disaster Mgmt.**



- Advance warning system
- Disaster Mode enabled devices for prioritization
- Bluetooth smarts in absence of internet services etc.

**Smart Energy**



- Smart meters; better data analytics, reduction in AT&C losses, remote control/disconnection
- Improved asset management & outage management services
- Optimized despatch of various generation sources etc.

**Smart Home**



- Better analytics & decision support system
- Smart appliances; optimized consumption and reduced bills
- Ease of conducting day to day choruses
- Home security & neighbourhood watch systems.

**Waste Mgmt.**



- Smart Dustbins
- Waste segregation; Organic, Non-organic, Construction & Demolition
- Enable people participation in reporting issues for faster response from Municipals and better accountability as part of Swach Bharat

# Strategy for addressing Smart Infra. Market

- Assess market potential & approach various State and Central Governments, Municipal corporations through Regional offices and Plants.

- Develop a business plan with clear understanding of the business and its implications.

- Identify and tie up with the technology partner/ODMs to offer end-to-end solution to the customers.

- Work on Proof of Concepts to show case solution capabilities to the end users .

- Leverage existing expertise from the Industry , sister PSUs and other Institutions to provide customized end-to-end solutions.

- Work towards ToT proposals to manufacture IoT Devices and other Smart Solution components.

- Take a lead role as a System Integrator to address the upcoming market

# Roadmap for Smart Infrastructure business

- ITI is building up cloud based data centres to cater to the rising need of data storage & cloud services from IoT.

- Definitive plan under implementation to create data centres to host IoT based solutions for the Smart Surveillance, Smart Energy, Intelligent transport system, Smart Health.

- We are in dialogue with number of ODM technology providers for possible ToT and business tie-up.

- With the upgraded mfg. infrastructure in place -Sensors, RFID & other components for (IoT)/Smart Cities/M2M communication can assembled.

- Communication for IoT is primarily on wireless connectivity, and Wi-Fi is going to be key communication standard for IoT. Manufacturing of Wi-Fi products .
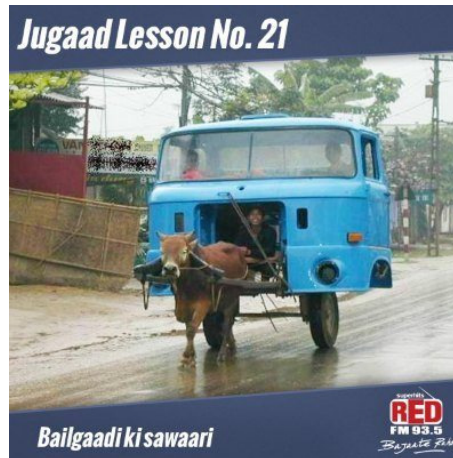
# Action Plan for Smart Infrastructure business

- We have formed specific teams, comprising engineers from ITI manufacturing Plants, Regional Offices, Network System Units., across India to address these opportunities.

- A core IOT team has been formed at Bangalore to finalise partnerships with potential IOT devices ODMs/Solution Providers.

- The core team at Bangalore is in the process of finalising business tie ups.

- Teaming agreements have been signed with four of the potential partners.

- There is a plan for creation of first IoT Centre of Excellence in Bangalore plant by Feb'2017.

- Show case the various customised smart solutions  through the centre of excellence.

# From Jogaad to Scalable Smart Solutions

THANK YOU

Back-up