IoT (Internet of Things) IEEE

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Institut Teknologi Bandung
2020

From many sources in internet

IEEE Indonesia CSS/RAS Joint Chapter

IEEE Indonesia IMS/ITS Joint Chapter

IEEE Indonesia VTS/ITSS Joint Chapter

IEEE

- A not-for-profitsociety
- World's largest technical membership association with over 423,000 members in 190+countries
- Five core areas of activity
  - Publishing
  - Conferences
  - Standards
  - Membership
  - E-learning

IEEE's Mission

IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity

The Founding of IEEE

1884 — 1912 — 1963 — Present

AIEE
American Institute of Electrical Engineers

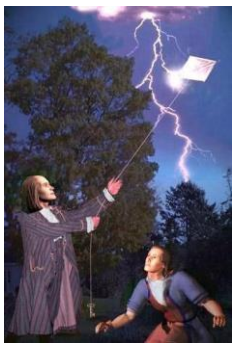
IRE
Institute of Radio Engineers

Thomas Edison, Alexander Graham Bell, and other notables founded the **American Institute of Electrical Engineers**.

130 years +

Pioneers of wireless technologies and electronics founded the **Institute of Radio Engineers**.

AIEE and IRE merged to become the Institute of Electrical and Electronic Engineers, or **IEEE**.



June 10, 1752, **Benjamin Franklin flies a kite** during a **thunderstorm**

IEEE at a Glance

Our Global Reach

425,000+
Members

46
Technical Societies and Councils

190+
Countries

Our Technical Breadth

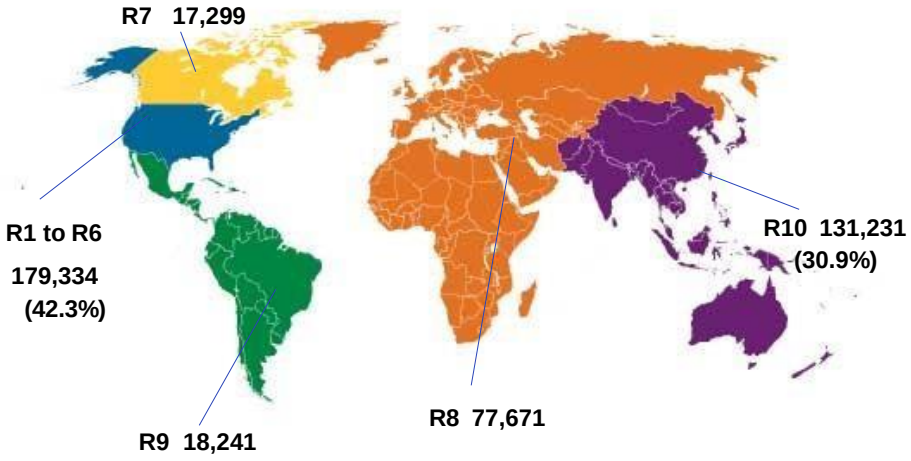
1,800+
Annual Conferences

4,000,000+
Technical Documents

Is170+
Top-cited Periodical

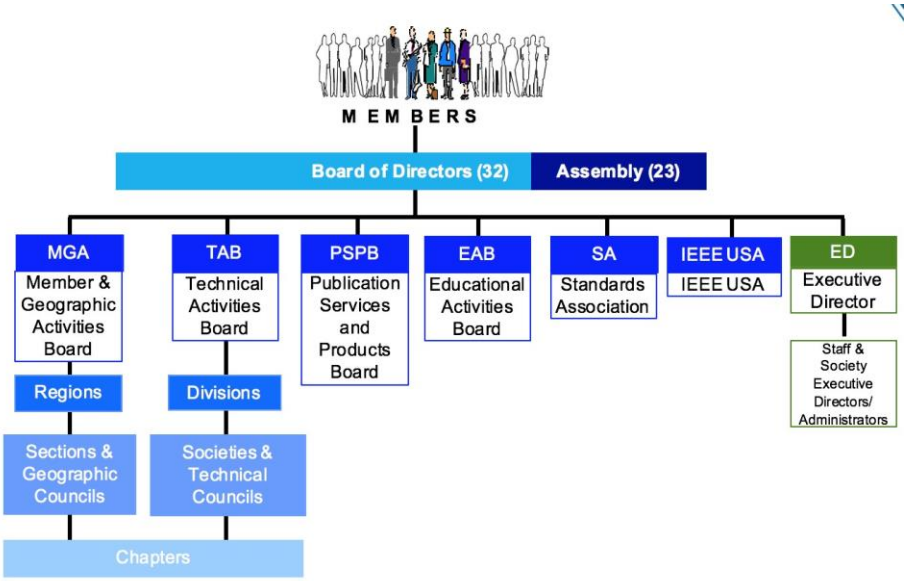
IEEE Membership By Region

As of January 2019



TOTAL MEMBERSHIP – 423,778

IEEE Organizational Governance



Member Benefits

- Keeping technically current
- Career resources and recognition
- Professional networking
- Continuing education
- Discounts
- Humanitarian programs
- Global benefits finder

Member Benefits

- Networking
- Discounts
- Dosen☞Kum Pengmas
- Institusi ☞ BAN, meningkatkan portofolio
- Bisa mendatangkan Pembicara IEEE (distinguish lecture)
- Mengadakan seminar kerjasama IEEE ☞ terindeks scopus
- Member elevation ☞ ada jenjang karir dan bisa berkiprah di Indonesia sampai tingkat internasional
- Mendapat berbagai pendanaan dari IEEE seperti beasiswa, lomba- lomba dan kegiatan community engagement, contoh sukses dari Indonesia: Dr.dr.Yoke
- Cari di website IEEE ☞ Grant ☞ ada banyak hibah yang bisa diikuti
- Project untuk mahasiswa **epics.ieee.org (usd5K-10K)**

Priorities for IEEE as a 21st-Century Professional Membership Organization

2018 IEEE Board of Directors Retreat Focus

Develop a strategy to position IEEE to purposefully serve our members
Continued, long-term success
Focus: Publications and Membership
Respond to challenges
Developing our next generation of leaders

Technology leaders rely on IEEE publications and tutorials

IEEE Journals & Magazines—Top-cited in the fields of electrical engineering and computing—174 in all.	**E4M+ Technical Documents**
IEEE Conference Proceedings—Cutting-edge papers presented at IEEE conferences globally.	**1,800+ Annual Conference**
IEEE Standards—Quality product and technology standards used by worldwide industries and companies to ensure safety, drive technology, and develop markets.	**1,300+ Active Standards**
IEEE Educational Courses—Over 300 IEEE educational online learning courses, plus IEEE English for Engineering.	**More Courses, New Series**
eBooks Collections— Two eBook collections now available, IEEE-Wiley eBooks Library, MIT Press eBooks Library and NEW in 2015! **Morgan & Claypool eBooks**	**IEEE-Wiley, MIT Press and Morgan & Claypool**

Full text content from all 39 IEEE Societies

- IEEE Aerospace and Electronic Systems Society
- IEEE Antennas and Propagation Society
- IEEE Broadcast Technology Society
- IEEE Circuits and Systems Society
- IEEE Communications Society
- IEEE Components, Packaging, and Manufacturing Technology Society
- IEEE Computational Intelligence Society
- IEEE Computer Society
- IEEE Consumer Electronics Society
- IEEE Control Systems Society
- IEEE Dielectrics and Electrical Insulation Society
- IEEE Education Society
- IEEE Electron Devices Society
- IEEE Electromagnetic Compatibility Society
- IEEE Engineering in Medicine and Biology Society
- IEEE Geoscience and Remote Sensing Society
- IEEE Industrial Electronics Society
- IEEE Industry Applications Society
- IEEE Information Theory Society
- IEEE Instrumentation and Measurement Society
- IEEE Intelligent Transportation Systems Society
- IEEE Magnetics Society
- IEEE Microwave Theory and Techniques Society
- IEEE Nuclear and Plasma Sciences Society
- IEEE Oceanic Engineering Society
- IEEE Photonics Society
- IEEE Power Electronics Society
- IEEE Power & Energy Society
- IEEE Product Safety Engineering Society
- IEEE Professional Communications Society
- IEEE Reliability Society
- IEEE Robotics and Automation Society
- IEEE Signal Processing Society
- IEEE Society on Social Implications of Technology
- IEEE Solid-State Circuits Society
- IEEE Systems, Man, and Cybernetics Society
- IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society
- IEEE Vehicular Technology Society

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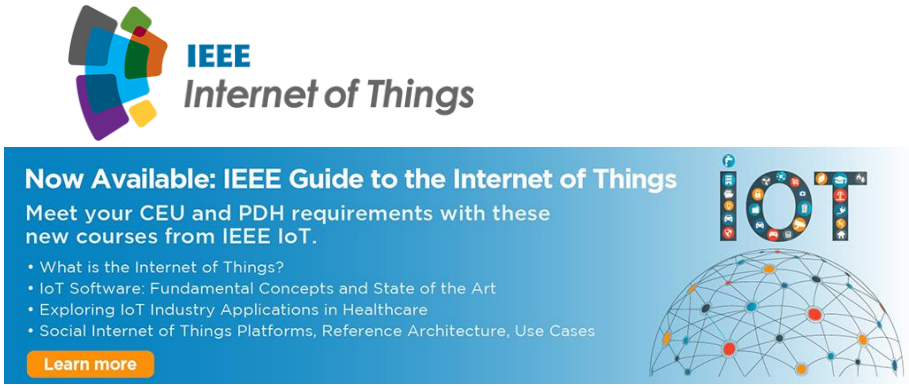

IoT? (Some Industry Definitions)

- *A network connecting (either wired or wireless) devices, or 'things', that is characterized by autonomous provisioning, management, and monitoring. The IoT is innately analytical and integrated* **(IDC)**
- *IoT is the next evolution of the Internet, connecting the unconnected people, processes, data, and things in your business today* **(Cisco)**
- *IoT devices as those capable of two-way data transmission (excluding passive sensors and RFID tags). It includes connections using multiple communication methods such as cellular, short range and others.* **(GSMA)**
- *Sensors & actuators connected by networks to computing systems. These systems can monitor or manage the health and actions of connected objects and machines. Connected sensors can also monitor the natural world, people, and animal"* **(McKinsey)**

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IoT? (IEEE)

"An IoT system is a network of networks where, typically, a massive number of objects, things, sensors or devices are connected through communications and information infrastructure to provide value-added services via intelligent data processing and management for different applications (e.g. smart cities, smart health, smart grid, smart home, smart transportation, and smart shopping)."

-- IEEE Internet of Things Journal

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IoT?

- **Resolution ITU-R 66** *(recognizing "c")*

IoT is a concept encompassing various platforms, applications, and technologies implemented under a number of radio communication services

- **ITU-T Recommendation [Y.2060 renamed as Y.4000]**

A global infrastructure for the information society, enabling advanced services by interconnecting (physical & virtual) things based on existing and evolving interoperable information and communication technologies

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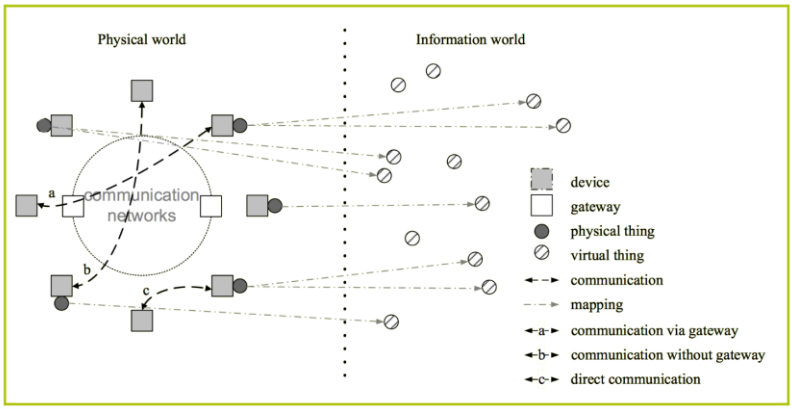
Internet of Things - ITU Definition

- **Physical things**
  - Exist in the physical world and are capable of being sensed, actuated and connected.
  - Examples: industrial robots, goods and electrical equipment.
- **Virtual things**
  - Exist in the information world and are capable of being stored, processed and accessed.
  - Examples: Multimedia content, application software.



Source: Recommendation **ITU-T Y.2060**

Why IoT?

- **Open platforms**
  - Designed to make building and deploying applications easier, faster, secure and more accessible for everyone.
- **Allows**
  - To create the low-power, wide-area sensor and/or actuator network (WASN) systems for Machine Type Communications (MTC), Smart cities and Ubiquitous Sensor Networks (USN) applications.
- **Contributes**
  - To socio economic development such as in Agriculture, health sector and many more.
- **Efficient Management**
  - Manage utilities efficiently such as smart power, water grids, and transport management

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Sensor devices are becoming widely available

- Programmable devices
- Off-the-shelf gadgets/tools

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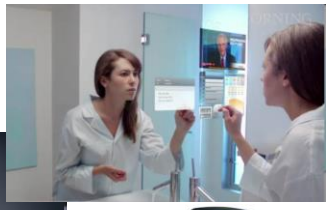
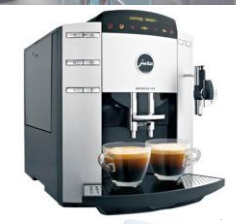
More "Things" are being connected

Home/daily-life devices
Business and
Public infrastructure
Health-care
…





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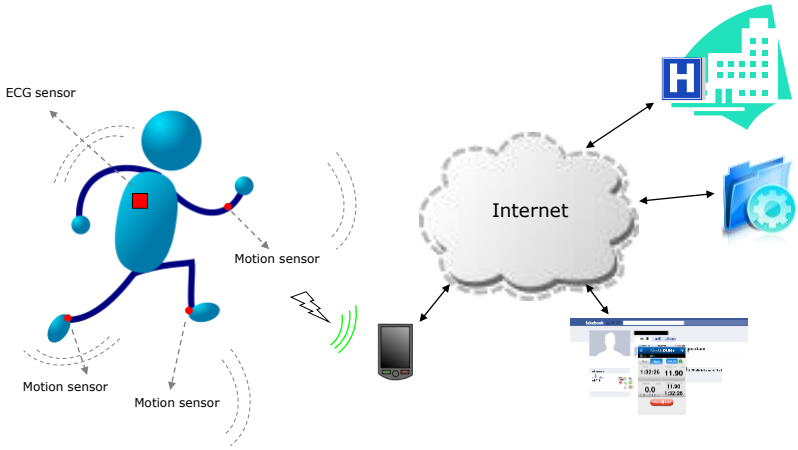
People Connecting to Things



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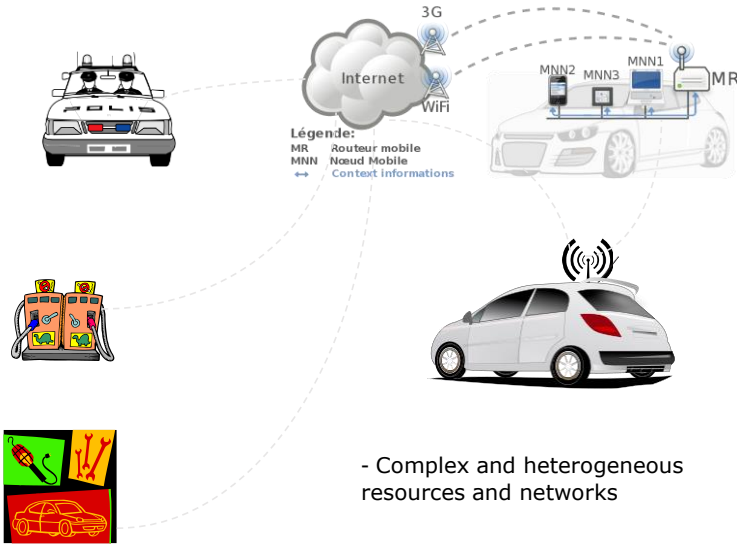
Things Connecting to Things



- Complex and heterogeneous resources and networks

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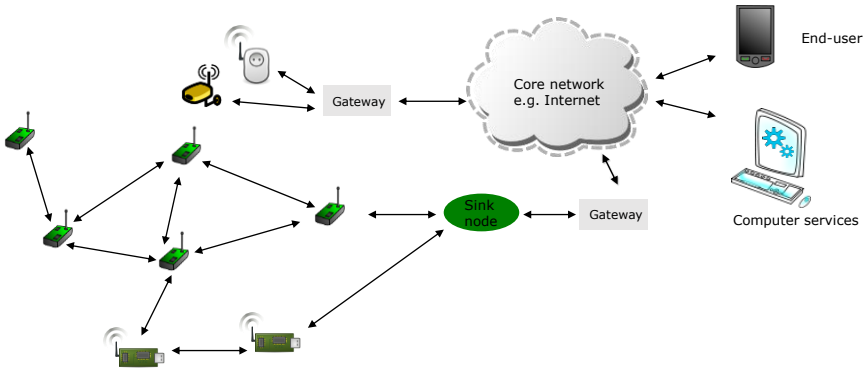
Wireless Sensor Networks (WSN)



- The networks typically run Low Power Devices
- Consist of one or more sensors, could be different type of sensors (or actuators)

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How are the networks changing?

- Extensions
  - More nodes, more connections
  - Any TIME, Any PLACE + Any THING
  - M2M, IoT
    - Billions of interconnected devices,
    - Everybody is connected.
- Expansions
  - Broadband
  - LTE, 5G
- Enhancements
  - Smart networks
  - Data-centric and content-oriented networking
  - Context-aware (autonomous) systems

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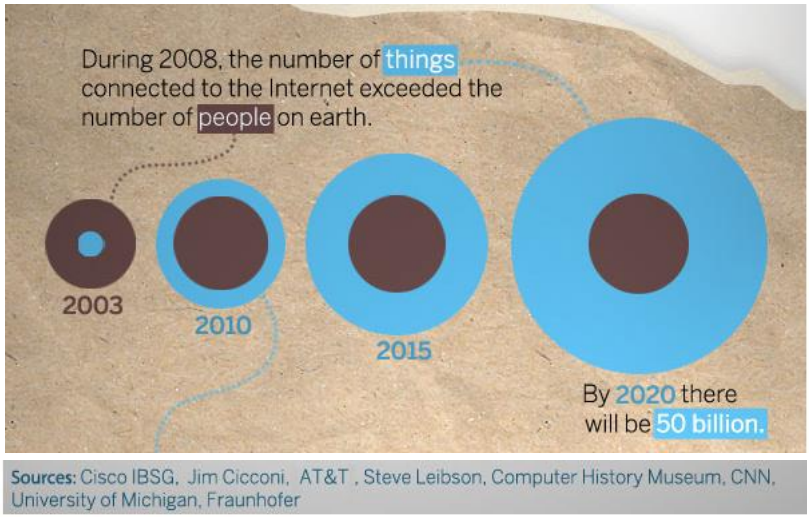
"Thing" connected to the internet



Source: CISCO

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Internet of Things (IoT)

- Extending the current Internet and providing connection, communication, and inter-networking between devices and physical objects, or "Things," is a growing trend that is often referred to as the *Internet of Things*.

- "The technologies and solutions that enable integration of real world data and services into the current information networking technologies are often described under the umbrella term of the Internet of Things (IoT)"

Why should I learn about IoT?

- Emerging technologies
- Growing IoT Services and Applications in various areas including smart cities, healthcare, transport, logistics, retail, safety and security, etc.
- Business trends and new opportunities

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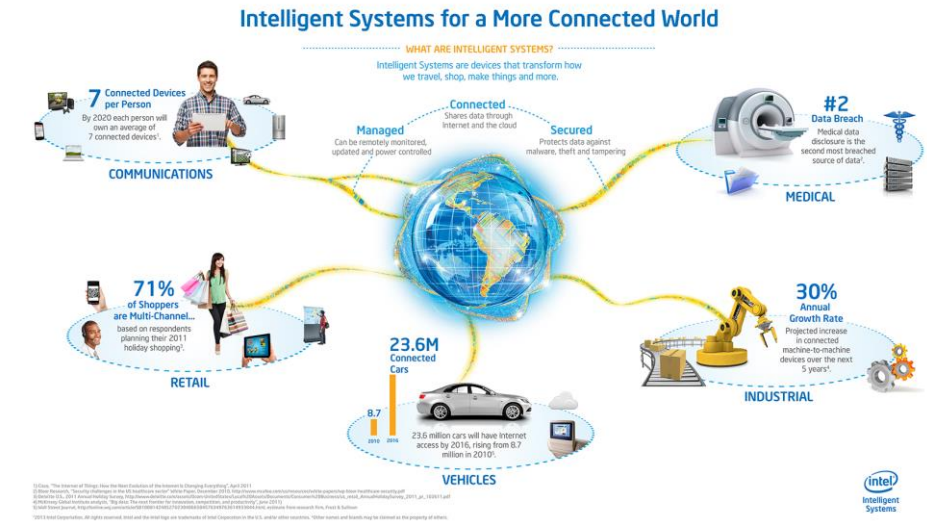
Opportunities



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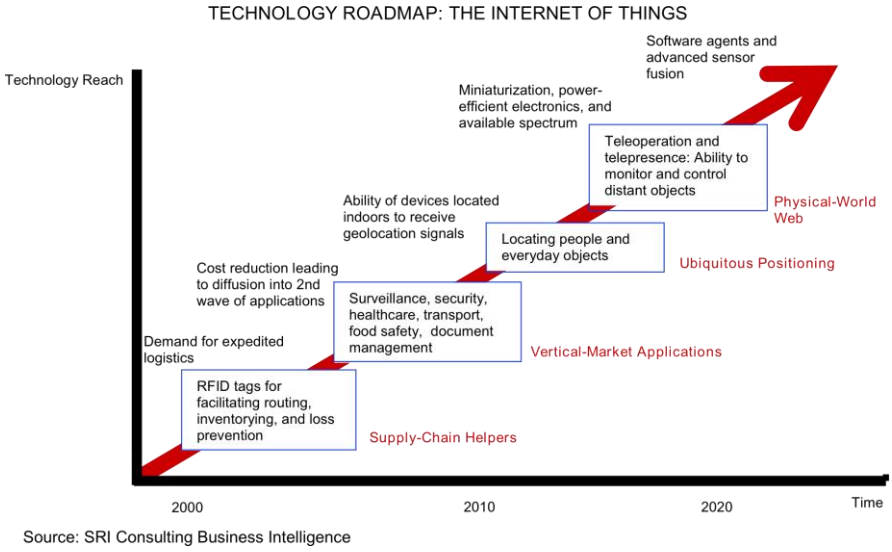
Source: http://blog.trentonsystems.com/internet-of-things-crosses-business-personal-boundaries/

Technology trend



Source: SRI Consulting Business Intelligence

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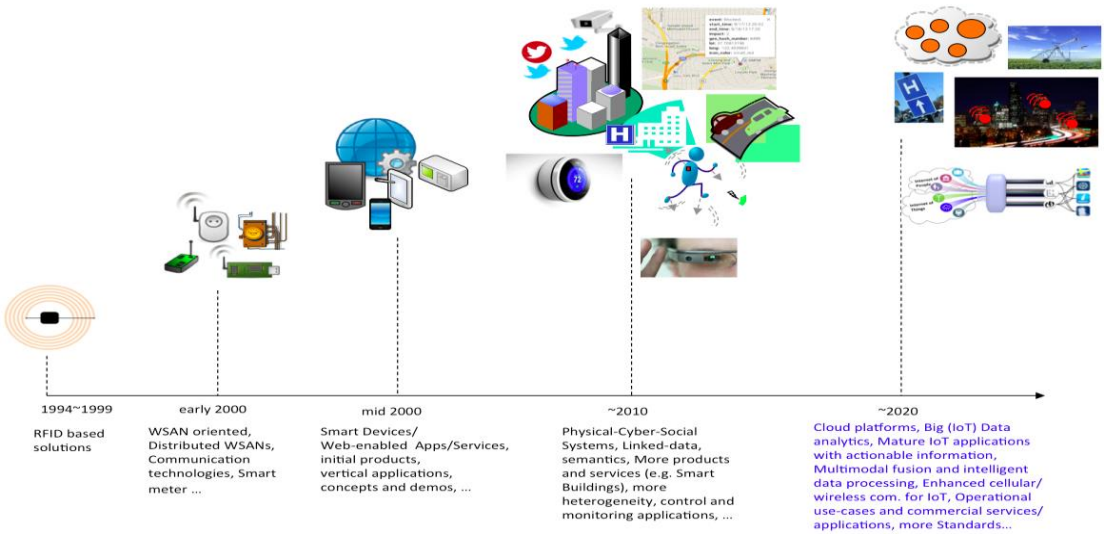
Internet of Things



P. Bamaghi, A. Sheth, "Internet of Things, The story so far", IEEE IoT Newsletter, September 2014.

Internet of Things Module

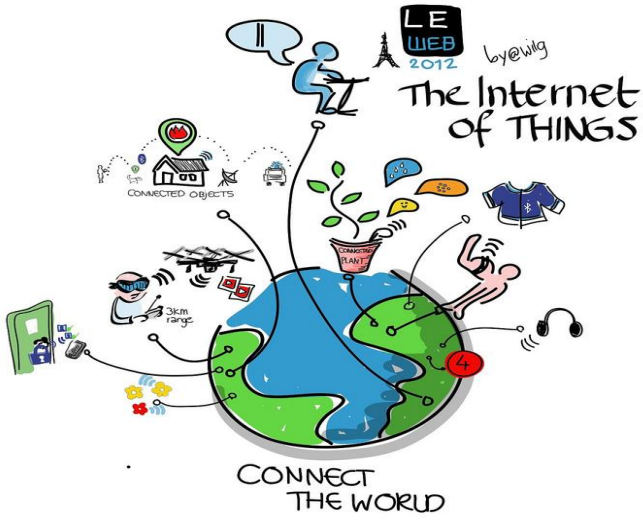


Image courtesy: Wilgengebroed

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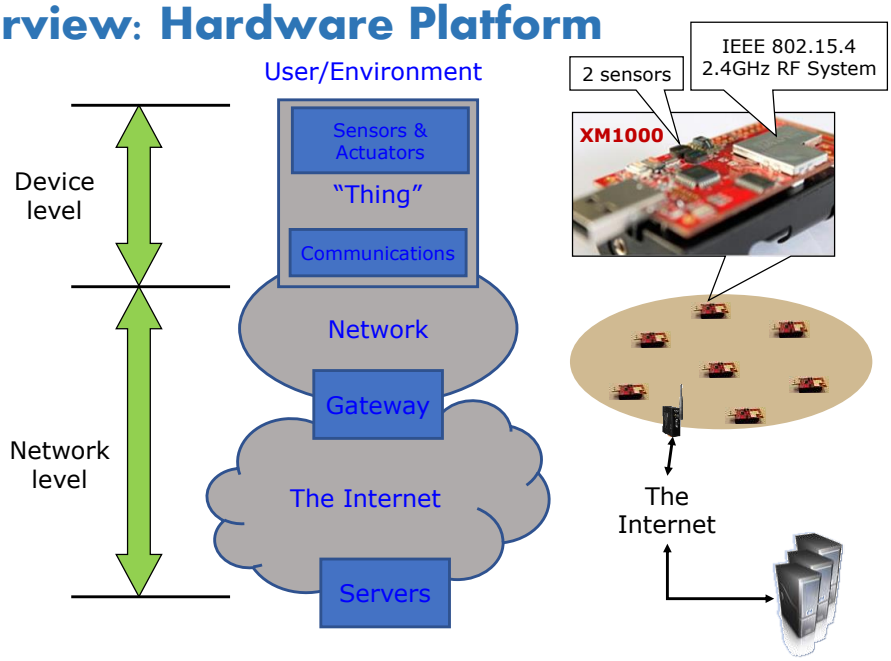
Overview: Hardware Platform



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Sensors & Actuators

- Sensors:
  - They are mainly input components
  - They sense and collect surrounding information
  - Basically three types:
    - Passive, omnidirectional (e.g. mic)
    - Passive, narrow-beam sensor (e.g. PIR)
    - Active sensors (e.g. sonar, radar, etc.)
- Actuators:
  - They are mainly output components
  - They alter the surrounding. Some examples:
    - Adding lighting, heat, sound, etc.
    - Controlling motors to move objects
    - Displaying messages
    - and others…

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Things

- We can turn almost every object into a “thing”.
- A “thing” still looks much like an embedded system currently.
- A “thing” generally consists of four main parts:
  - Sensors & actuators
  - Microcontroller
  - Communication unit
  - Power supply
- A “thing” has the following properties:
  - It’s usually powered by battery. This implies limited source of energy.
  - It’s generally small in size and low in cost. This limits their computing capability.
  - It doesn’t usually perform complicated tasks.
- Power consumption is the main design issue.

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Communications

- A “thing” always feature communications for “team working”
- The Role of Communications
  - Providing a data link between two nodes
- Communication type:
  - Wireline (e.g. copper wires, optical fibers)
  - Wireless (e.g. RF, IR). RF-based communication is the most popular choice (and also our focus)
- Popular RF-based communication solutions:
  - IEEE 802.15.4 ← used in XM1000
  - IEEE 802.11 (or Wifi)
  - Bluetooth
  - Near Field Communication (NFC), e.g. RFID

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Networks

- The Roles of Networks
  - Managing nodes (discovery, join, leave, etc).
  - Relaying data packets from the source to the destination node in the network.
- Networks are a distributed system. All nodes need to perform networking related tasks.
- RF-based Network in IoT is usually a Wireless Multi-hop Network. Some examples:
  - Wireless Sensor Networks (WSNs)
  - Mobile Wireless Ad hoc Networks (MANETs)
  - Wireless Mesh Networks (WMNs)
  - Vehicular Ad Hoc Networks (VANETs)
  - and others...
- Main concern: Reliability & Performance

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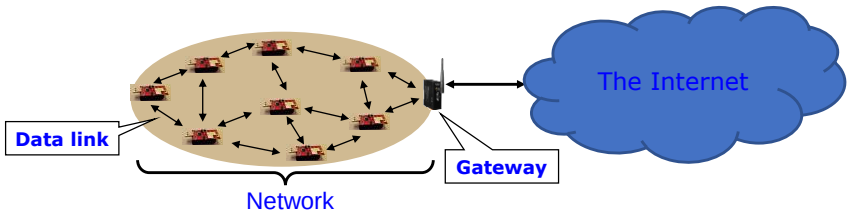
The Internet

- The Internet serves as a wide area networking for a local network.
- The Internet uses TCP/IP. This implies that things must also support TCP/IP.
- Gateway (or sink)
  - For a practical deployment, a gateway is often needed in a network.
  - It offers relaying packets between the network and the Internet.



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Security & Privacy

- Are they important?
- What is the risk?
- What are the challenges?
  - Device level
  - Network level
  - System level
  - User level
- Solutions?

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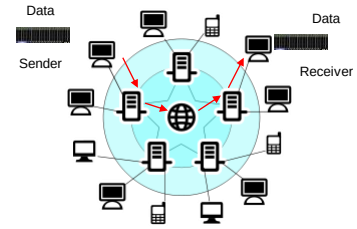
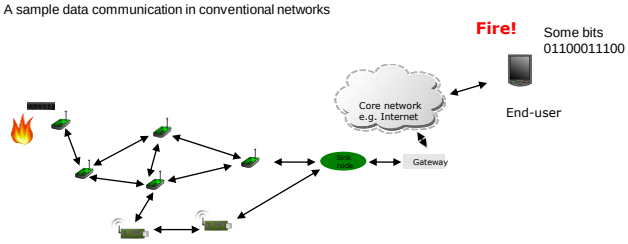
Example: Type of Services in IoT



A sample data communication in conventional networks



A sample data communication in WSN

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Intelligent Data Processing

- Sensing and data collection, sensor data and data-centric networks
- Access, subscription and integration
- Data processing and stream data analysis
- Query and discovery
- Data classification and clustering

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Things, Data, and lots of it

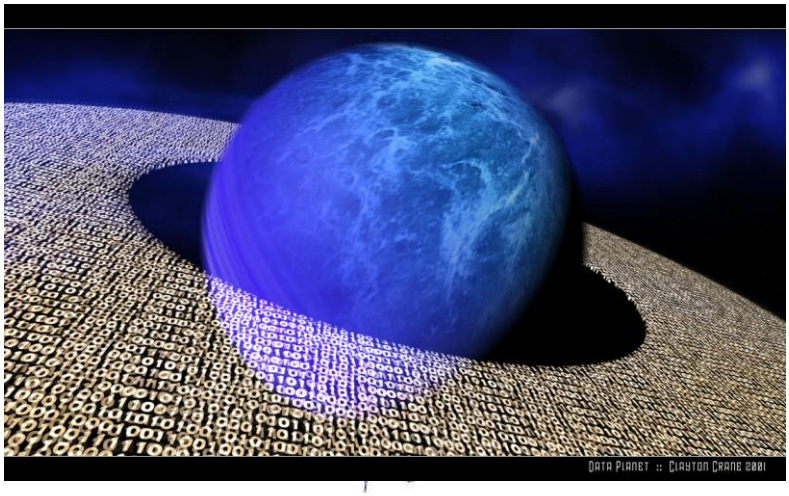

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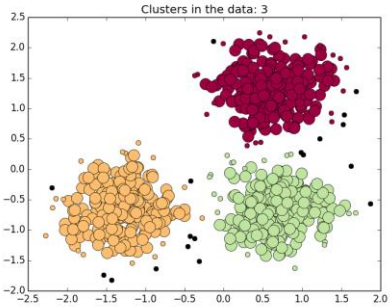
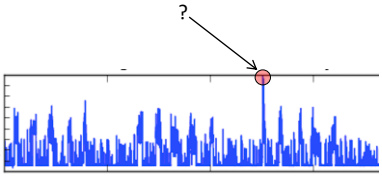
image courtesy: Smarter Data - I.03_C by Gwen Vanhee

"Each single data item is important."

"Relying merely on data from sources that are unevenly distributed, without considering background information or social context, can lead to imbalanced interpretations and decisions."





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IoT Data- Challenges

- Multi-modal and heterogeneous
- Noisy and incomplete
- Time and location dependent
- Dynamic and varies in quality
- Crowed sourced data can be unreliable
- Requires (near-) real-time analysis
- Privacy and security are important issues
- Data can be biased- we need to know our data!

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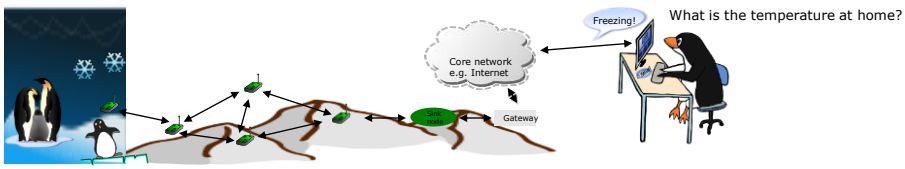
- "People want answers, not numbers" (Steven Glaser, UC Berkley)



Storing, Handling and Processing the Data

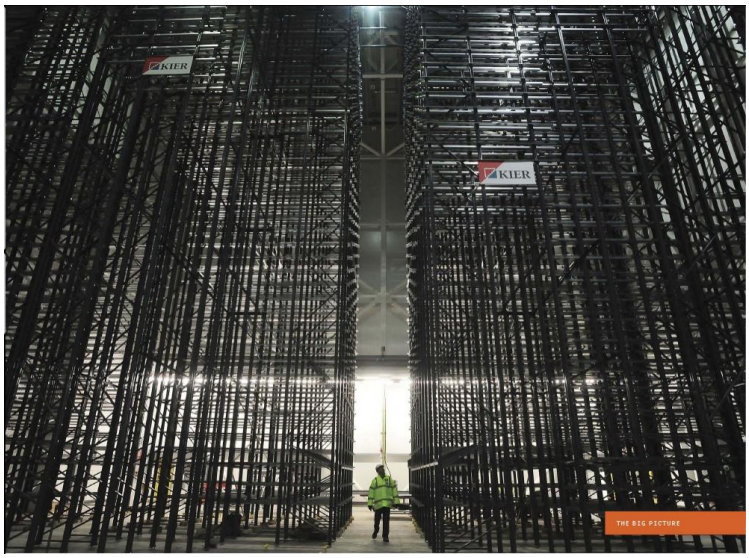


Image courtesy: IEEE Spectrum

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Semantic technologies and connecting Things to the Web

- Meta-data models and schemas
- Linked data and Linked IoT data concepts
- Semantic technologies and semantic sensor networks
- Interoperability issues
- Web of Things

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Device/Data interoperability

The slide adapted from the IoT talk given by Jan Holler of Ericsson at IoT Week 2015 in Lisbon.

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Characteristics (IoT v/s Cellular)

- **IoT communications are or should be:**
  - Low cost,
  - Low power,
  - Long battery duration,
  - High number of connections,
  - Different bitrate requirement,
  - Long range,
  - Low processing capacity,
  - Low storage capacity,
  - Small size devices,
  - Simple network architecture and protocols

IoT?

- **Wireless Technologies**

- **Diversity of IoT application requirements:**
  - Varying bandwidth requirements (how much information is sent)
  - Long-range vs short-range
  - Long battery life
  - Various QoS requirements

IoTs and cloud technologies and are the two unstoppable forces promoting digital capabilities

Spectrum needs to be made available in a range of frequency bands to cater for various cases

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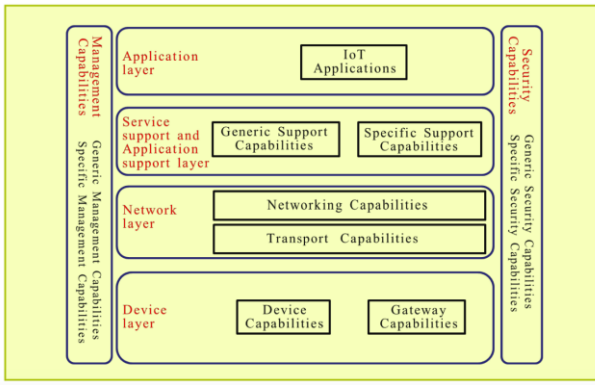
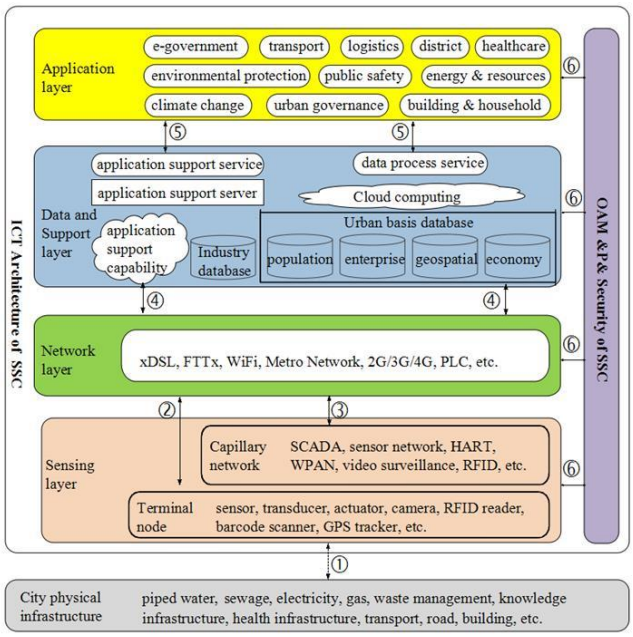
IoT reference model



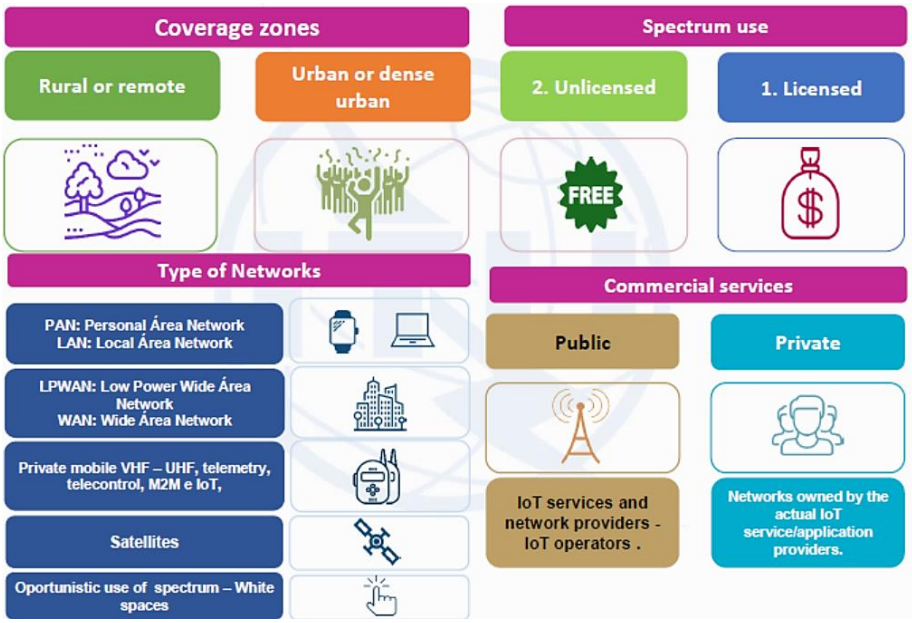
Source: Recommendation **ITU-T Y.2060**

In IoT solutions supporting FC part of the application processing is executed directly at IoT objects and only when needed. More complex and resource-consuming tasks are transferred to higher level units (FC units) or directly to the cloud.



A multi-tier SSC (smart sustainable city) ICT architecture from communication view
Source: ITU-T Focus Group on Smart Sustainable Cities: *Overview of smart sustainable cities infrastructure*

IoT Usage Cases



Source: ITU Workshop on Spectrum Management for Internet of Things Deployment, 22 November 2016, Geneva

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IoT: 4 layer Model

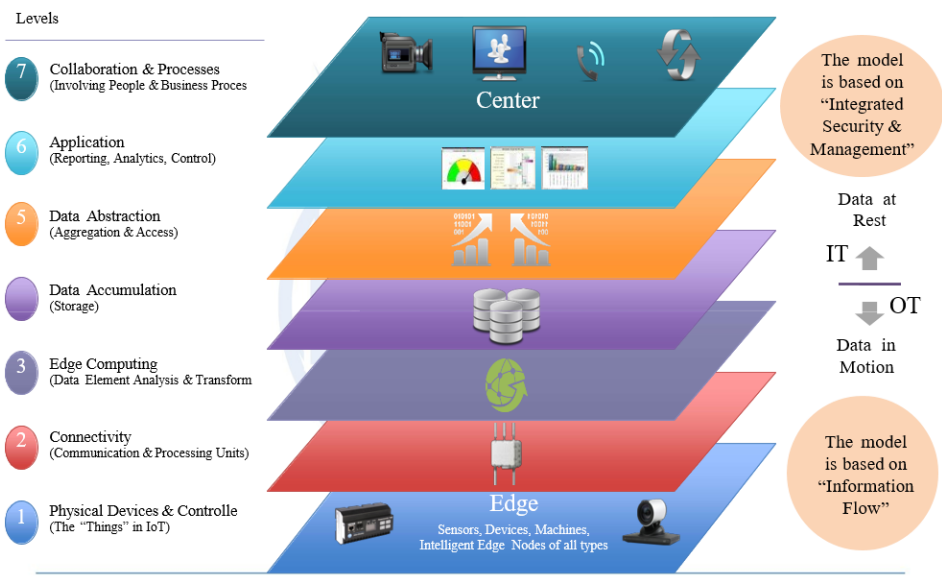
Integrated Applications

Information Processing

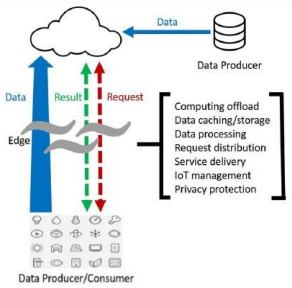
Network Infrastructure

Sensing and Identification

IoT: Reference Model



In IoT solutions supporting Fog Com putting (FC) part of the application processing is executed directly at IoT objects and only when needed. More complex and resource-consuming tasks are transferred to higher level units (FC units) or directly to the cloud.



IoT design requirements

IoT Network	Impact on IoT Systems Design
Scale	**Tens of thousand sensors in a given site; or millions distributed geographically** More pressure on application architectures, network load, traffic types, security, non-standard usage pattern
Heterogeneous end-points	**Vast array of sensors, actuators, and smart devices – IP or non-IP** Diverse data rate exchange, form factor, computing and communication capabilities, legacy protocols
Low Capex and Opex requirement	**May be deployed before activation, maybe or cannot-be accessed once deployed** • Low numbers of gateways Link budget: e.g: UL: 155 dB (or better), DL: Link budget: 153 dB (or better) • Devices deliver services with little or no human control, difficult to correct mistakes, device management is key
Criticality of services	**Human life critical (Healthcare), Critical infrastructure (Smart Grid)** Stringent latency (10ms for SG) and reliability requirements, may challenge/exceed network capabilities of today
Intrusiveness	**Things with explicit intent to better manage end-users (eHealth, Smart Grid)** Issues of Privacy become major obstacles
Geography	**Movement across borders** Issues of numbering for unique identification

Source: ITU CoE training on BB networks planning, Bangkok, Sep 2017

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IoT network connectivity requirements

IoT Network	Impact on IoT Systems Design
Resource-constrained endpoints	**Severely resource constrained (memory, compute)** Cost motivation: compute/memory several orders of magnitude lower, limited remote SW update capability, light protocols, security
Low Power	**Some end-point types may be mostly 'sleeping' and awakened when required** • Sensors cannot be easily connected to a power source • Reduced interaction time between devices and applications (some regulations state duty cycle of no more than 1%) • Idle mode most of the time (energy consumption of around 100 µW). Connected mode just for transmission (mA) • < 100 MHz clock frequency • Embedded memory of few Mb
Embedded	**Smart civil infrastructure, building, devices inside human beings** Sensors deployed in secure or hostile operating conditions, difficult to change without impacting system, Security
Longevity	**Deployed for life typically, have to build-in device redundancy** Very different lifetime expectancy, rate of equipment change in IoT business domains much lower than ICT Industry
High Sensitivity on reception	**Gateways and end-devices with a high sensitivity around** -150 dBm/-125 dBm with Bluetooth lower than -95 dBm in in cellular

Source: ITU CoE training on BB networks planning, Bangkok, Sep 2017

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Smart Safety Monitoring Systems for Sewage Workers with Two Way Communication

- A large number of sanitation workers die every year due to erratic and lack of facilities available, and harmful toxic gases released while cleaning the sewage.
- Real time health monitoring systems for such workers will prove helpful.
- The device presented will monitor the pulse rate of a person using a pulse oximetry sensor, the methane concentration and the atmospheric oxygen concentration and provide alert to worker and exterior unit.
- when parameters deviate from the safe range.
- This parameters in real time will promptly alert the workers to stay safe and detect toxic gases before any harm

Health Monitoring System for Elderly and Disabled People

- A great demand of modern earth is to get everything within a very short time.
- At present situation, people want to realize their current health condition and also want proper care rapidly.
- But older and disabled people are very incapable without someone's help. Even they have to face so many difficulties to inform someone about their health condition.
- To solve this problem a smart and automobile system has proposed. The proposed system consists of health monitoring systems with body temperature and heartbeat measurement.

Cultivation of Cash Crops under Automated Greenhouse using IoT

- Cultivation is the fundamental wellspring of pay of the general population in a nation adding up to 15-16% of the Gross domestic product of the nation.
- Occupation pay and time has come to acquaint a few changes with supplant those conventional cultivating rehearses with the development of money trims under computerized nursery utilizing IoT through remote sensors, actuators, microcontroller, raspberry pi, GSM module and associating links.
- A low cost greenhouse prototype model which can be afforded by the Indian farmers for the cultivation of cash crops such as saffron, vanilla, sugarcane, etc.

Forest Fire Alerting System with Co-ordinates using IoT

- Forest fires are one such catastrophe for environment.
- Once the fire inside deep forest starts, it burns and destroys everything and spreads everywhere within the forest. Fire spreads on hot days destroys trees and grasses due to drought conditions peaks in a forest region.
- Forest fires disasters should be curbed in order to protect fauna and flora habitats in the forest.
- The objective of this work is to design and implement an IoT based system which is self-sustaining and would predict and detect the forest fires and sends the exact location to concerned officials which would help fire fighting personnel to extinguish the fire in the location where it starts slowly.
- This would prevent the fire to spread over a huge area and also able to take precautionary measures in order to prevent the fire which may occur in near future.

A Secure IoT Enabled Smart Home System

- With the growing technology, the demand for smart things is drastically increased in daily-life. The IoT (Internet of Things) is one of the major components that provides facility to interact with IoT enabled devices.
- A secure and efficient smart home system that enable to protect homes from theft or unusual activities and parallelly saves power.
- A system is developed by exploiting the features of IoT that facilitates us to monitor an IoT enabled home from anywhere anytime over the Internet when data are stored in the cloud.
- This system uses a motion detector to detect a moving object from the environment where the system is deployed.

IoT-Based Intelligent Waste Bin

- The amount of the waste humans discards is rapidly increasing and will not be controlled without transformational changes.
- Waste management companies will be hugely impacted with such increments as they should provide resources for the collection of such waste with minimum or even zero income.
- This project aims to develop smart real-time waste management and monitoring system that optimized the resources and maximized the efficiency.
- The system is designed based on three main elements; Master station, Slave station, and Internet of things (IoT) platform. The master pin station gathers the data from the slave stations and transmits it to the IoT application for remote management and monitoring purposes. The system is powered up by using solar panels.
- Four parameters are used for monitoring and managing the waste: temperature value, level in percentage reading, smoke detection, and the global positioning system (GPS) location

IoT based smart vehicle presence sensor for smart parking system

- Due to the growing vehicle fleet in the cities, the management of parking spaces has become very important and with it the interest in developing smart parking systems that promote the efficient and intensive use of information and communication technologies.
- This work presents the design and development of a smart vehicular presence sensor (SPIN-V, in its Spanish acronym), which is the cornerstone of a smart parking system (SEI-UVM, in its Spanish acronym).
- The SPIN-V is composed by a distance sensor and a camera to detect the entry of a vehicle to the parking space, and a LED indicator to inform that space has been reserved through a mobile application.
- Information on the occupation of the parking spaces is sent in real time to the monitoring center. The SPIN-V allows the efficient management of parking spaces generating a saving of time in the search while reducing vehicular traffic.

Efficient IoT enabled Landslide Monitoring

- Landslides pose significant socio-economic threats to areas whose geography favors them. Currently existing landslide monitoring methods and techniques are characterized by significant limitations both in technical terms (quality and frequency of data) and in terms of usability (high inferred costs, requirement of very high expertise).
- This work presents an innovative landslide monitoring system that leverages state-of-the-art IoT technologies.
- The system consists of a set of autonomous sensing devices equipped with a sensor suit specifically tailored for monitoring landslides. The devices take sensory measurements at frequent intervals - while operating at a very low duty cycle - and transmit them over the SigFox network to a data server powered by ELK stack for curation and visualization.

IoT for Water Management: Toward Intelligent Anomaly Detection

- Given that the global water system is deteriorating and the supply and demand are very dynamic, smart ways to improve the water management system are needed so that it becomes more efficient and to extend the services provided to the citizens leading to smart cities.
- One of many water related problems that can be addressed by the Internet of Things is anomaly detection in water consumption.
- The analysis of data collected by smart meters will help to personalize the feedback to customers, prevent water waste and detect alarming situations. Water consumption data can be considered as a time series.
- Time series anomaly detection is an old topic but in this work we attempt to examine which techniques suits better for water consumption. We examine two very well-known methods for time series anomaly detection: an ARIMA-based framework anomaly detection technique which selects as outliers those points no fitting an ARIMA process and also a technique named HOT-SAX which represents windows of data in a discrete way and then discriminates them using a heuristic.

IoT based control systems for Solar Membrane Distillation Plant for Greenhouse Irrigation

- This presents a control strategy that uses the Internet of Things (IoT) technology to manage a smart-grid framework including a solar desalination facility and a group of greenhouses that demand water for irrigation.
- In addition, the water public utility network has also been considered an agent of this smart-grid framework.
- The controller is based on a Model Predictive Control (MPC) strategy which uses information, by means of an IoT platform, coming from each one of the facilities included in the smart-grid to calculate the optimal control actions in the Cloud.

IoT enabled t-shirt for log term monitoring of sleep disordered breathing

- Sleep Disordered breathing is an increasingly common condition among the general population. Conventional sleep disordered breathing diagnosis depends on in-lab polysomnography, while at-home sleep test devices are becoming a more widespread.
- Both systems are cumbersome and typically data is collected offline, typically limiting use to only a few nights recording. We present the design, implementation and preliminary results from a novel "IOT ready" sleep test device named "VitalCore".
- The device utilizes electro resistive polymer sensors and accelerometer to measure respiratory, cardiac and actigraphy information. The device uses Bluetooth 5 to stream and transfer data and is capable of reliably acquiring high quality sleep data.

IoT Solution for Hospitals

- Hospitals are challenging workplace with different levels of safety and hazards. This gives a brief idea about solutions designed to solve the problems faced in hospitals with the help of IOT.
- The main objective of this SMART hospital is patient safety and to regulate the excessive power consumption. Some of the problems identified by us are listed here and a possible solution for them is provided.
- Problems challenging patient safety are hospital fires and also a rare but fatal condition known as vascular air embolism.
- And that of optimal power consumption is excessive and neglected use of electricity. Integrating sensors with IOT to monitor environmental conditions can prove boon to the hospital industry as it not only enhances patient experience but also improves the staff flow decreasing the time-consuming activities.

IoT based Disaster Monitoring and Management Systems

- Dams are of major importance, primarily because of their use for generating hydroelectricity and irrigation purposes. This has resulted in the construction of a number of dams in potential areas over the years.
- As there are a lot of risk factors associated with the existence of these dams, it has become the need of the hour to develop a proper monitoring and regarding the opening of the shutters thereby management system for maintaining a safe water level in dams. Mismanagement of dams can lead to manmade disasters.
- To design and implement an IoT based Disaster Monitoring and Management System for Dams (IDMMSD). The system involves real-time monitoring of water levels of a group of dams under study. Water levels may vary due to drastic changes in water levels of connected rivers or lakes, or due to excessive rainfall in the catchment area.
- A mechatronics system to open the shutters at the heights pre calculated. The system comprises of sensor nodes, smart controller and communication system.
- The system is an app based IoT system which will monitor and send real time parameters related to Dam (gate position, water discharge, water level) and weather conditions (rain fall, temperature, humidity). There will be two modes for operating the software i.e.
- Autopilot mode and Manual data mode. The system also includes features like SMS alert to the people of the locality and SOS to rescue operations in case of adverse weather conditions.

IoT Based Poultry Environment Monitoring System

- The environmental problems and associated issues had been a source of worry for the world. Emerge of IoT (Internet of things) and the step towards the smart approach such as smart cities, smart buildings, and smart grid have really posed the successful implementation of IoT.
- The success is only possible in the real sense when the problematic issues can be addressed. This paper proposes an Internet of Things Technology based protection and monitoring of environment of a poultry house.
- The software based hardware is capable of monitoring the environment related parameters such as air temperature, air humidity, O2, CO2 level of concentration and NH3 concentration.
- The wireless sensor is responsible for the effective data collection of the described parameters and also these are source coordination and control.

IoT based Smart Garden with Weather Station System

- An IoT-based Smart Garden with Weather Station system, which can be used to monitor the growth of plant every day and predict the probability for raining.
- Why this IoT-based device is been created? Many people are interested in growing the plants are always forget on watering the plants.
- Hence, the device is equipped with a water pump, where it can be monitored and controlled by using a smartphone. In addition, the devices also consist of four main sensors, which are Barometric Pressure, DHT11 Temperature, and Humidity Sensor, Soil Moisture Sensor and Light intensity module sensor.
- The Soil and Light Intensity sensor used to measure the value by percentages. Besides, two actuators, which are the water pump and LED light can be used remotely or by using a button on the devices.
- The LED is purposely to replicate the sunlight and make the plant grow faster. This IoT-based Smart Garden with Weather Station System can record the data and send the result to user through the smartphone application named as Blynk apps

IoT based Wireless Controlled Smart Transportation System

- Vehicle theft is the major problem faced by the people in the society. The statistical survey shows vehicles which get stolen out of 4 only 1 get recovered.
- Present systems use key and remote to lock the vehicle. At many places CCTV cameras are present which are used to locate the stolen vehicle. But CCTV cameras are not present at all places. Control of vehicle and knowledge of their location even after theft can help recovery of the stolen vehicle fastly.
- The system helps to find the vehicle location using GPS and the vehicle speed is gradually reduced by reducing speed of ignition motor. It helps to find the vehicle immediately after knowing it's stolen.
- As GPS system is used, the location of the vehicle is also known. The command sent from the smartphone goes to the GSM system which is interfaced with controller which reduces the speed of ignition motor and immobilizes it.
- The system developed is reliable, low cost and user friendly which can help in the recovery of vehicle if it gets stolen.

IoT based Safety and Health Monitoring for Construction Workers

- Safety is a major problem in construction works. There is no proper solution to solve the problem. People's safety is not ensured in the construction works.
- In most of the cases, the problem occurs due to work stress or poor health conditions. Some of the accidents occur where people fall down from heights and left unnoticed which leads to death due to lack of medical attention.
- This project aims to develop smart wearable devices such as band and helmet using various sensors that will help in monitoring the health and safety of workers. The devices constructed using IoT help in detecting the fall of any workers and sends SMS notification for immediate aid.
- Moreover, the workers vitals such as heart rate and temperature are also monitored and warned regarding abnormal health conditions.
- To provide a secure and safer working environment for worker thus reducing the number of deaths happening in construction sites.

IoT Based Poultry House Monitoring

- Recently, the use of IoT (Internet of Things) based system has been expanded with inestimable Internet resources.
- The system demonstrates the creation of innovative systems that facilitate control and supervision regardless of distance and time.
- In a poultry house, both temperature and humidity levels should be monitored regularly in ensuring the system runs smoothly. It needs to be monitored 24/7 to avoid incidents that caused the temperature rises too high.
- The IoT solution in monitoring the temperature and humidity condition including the presence of electricity connectivity, regardless of time and place.

IoT Based speed control of Smart Fan

- An efficient speed control method of an electric fan module using Smart Android or IOS phone.
- Espino and Arduino circuits are used in this process to achieve the objective of this paper.
- Wi-Fi connection is used as a communication protocol between fan, Espino board and smart phone.
- The goal is to develop an existing fan into a smart fan, thereby the user can regulate the fan speed from his or her foot step.

Intelligent Shopping Cart based on IoT

- For example, consumers purchase the number of items in the supermarket using trolley. After purchasing they can face some problems like waiting the long queue in billing section and without knowing about the calculation of purchased items.
- These problem to find the remedies called as "Intelligent shopping cart using BOLT based on IOT". Our IOT kit consists of barcode scanner, LCD display, Bolt ESP8266.
- The broad clarification of its process is, when consumer takes an item and put inside the trolley, that time barcode scanner scan the item barcode and value as well as gain to show into the digital display panel.
- Later than consumer concluded their purchasing and the bill is send to the counter section. It will save the time and consumer early itself knowing the calculation of purchased items.

Gas Level Detection and Automatic Booking using IoT

- LPG is widely used for cooking in many countries for economic reasons, for convenience or because it is the preferred fuel source. This paper focuses on the application of the IoT which is used for measuring and displaying the gasoline content present in household LPG cylinder and this is helpful in automatic booking of new LPG cylinder and also detect the gas leakage. Usually the capacity of LPG in Cylinder is not determined, so we are going to display the level of LPG. The level of LPG is measured using load sensor (SEN-10245). The output of the sensor is connected with Arduino R3.By use of GSM Module, the information is sent to user by SMS (short messaging service) and also automatic booking is done by dialing the registered gas booking number. Then the gas leakage is detected by gas sensor (MQ-6). By using this, we can detect the current LPG level and it is continuously displayed on the LCD. We can know the validity of LPG usage from the date of initialization. By use of IOT the user is alerted by giving the message to their mobile phone when the LPG level is critically low(below 20%).Automatic booking of new LPG by auto dialing of gas booking number and by this we prevent pre-booking and late booking. Then by detecting the gas leakage we can prevent the LPG gas burst accidents in the home.

IoT Mobile-Air Pullutant Monitoring System

- Internet of Things (IoT) is a worldwide system of “smart devices” that can sense and connect with their surroundings and interact with users and other systems. Global air pollution is one of the major concerns of our era. Existing monitoring systems have inferior precision, low sensitivity, and require laboratory analysis. Therefore, improved monitoring systems are needed. To overcome the problems of existing systems, we propose a three-phase air pollution monitoring system. An IoT kit was prepared using gas sensors, Arduino integrated development environment (IDE), and a Wi-Fi module. This kit can be physically placed in various cities to monitoring air pollution. The gas sensors gather data from air and forward the data to the Arduino IDE. The Arduino IDE transmits the data to the cloud via the Wi-Fi module. We also developed an Android application termed IoT-Mobair, so that users can access relevant air quality data from the cloud. If a user is traveling to a destination, the pollution level of the entire route is predicted, and a warning is displayed if the pollution level is too high. The proposed system is analogous to Google traffic or the navigation application of Google Maps. Furthermore, air quality data can be used to predict future air quality index (AQI) levels.

IoT based online Access Control System for Vehicles

- A developed IoT-based access control system for vehicles passing through the entry and exit gates in Truck-Loading Fuels Terminals.
- The developed system follows a new design approach utilizing one of the most prominent IoT technologies, the Radio Frequency Identification (RFID), with its write capabilities.
- The novel design approach followed in developing the presented topic aims at offering enhanced system performance with regard to speed, security and allocated resources

IoT enabled patient assisting device

- The health and wellness sector is critical to human society and as such should be one of the first to receive the benefits of upcoming technologies like IoT.
- Some of the Internet of Medical Things (IoMT) are connected to IoT networks to monitor the day-to-day activities of the patients. Recently there has been attempts to design new medical devices which monitor the medications and help aged people for a better assisted living.
- One such attempt is made to design a multipurpose portable intelligent device named MEDIBOX which helps the patients take their medications at the right time. This box is a proficient system which maintains the parameters like temperature and humidity in a controlled range recommended by the drug manufacturer and thus maintains the potency of the medicines even if the patient is travelling.
- A Host Management System (HMS) which is capable of cloud-based installation and monitoring that stores and controls the MEDIBOX functionality for further analysis and future modification in design aspects.