



# **SNS COLLEGE OF ENGINEERING**

**An Autonomous Institution**

**Coimbatore-107**



## **19IT503-INTERNET OF THINGS**

### **UNIT-1 IoT INTRODUCTION AND APPLICATIONS**

#### **Topic:2-Overview and Motivations**



## Overview and Motivations-1



- The proliferation of an ever-growing set of devices able to be directly connected to the Internet is leading to a new **ubiquitous-computing paradigm**.
- Internet—its deployment and its use has experienced significant growth in the past four decades,
- Evolving from a network of a few hundred hosts to a platform capable of linking billions of entities globally.
- Recently, the Internet has connected servers of all kinds to users of all kinds seeking access to information and applications of all kinds.
- Now, with social media, it intuitively and effectively connects all sorts of people to people, and to virtual communities.



## Overview and Motivations-2



- The next evolution is to connect all “things” and objects that have embedded wireless/wired connectivity to control systems that support data collection, data analysis, decision making, and (remote) actuation.
- “Things” include, but are not limited to, machinery, home appliances, vehicles, individual persons, pets, cattle, animals, habitats, habitat occupants, as well as enterprises.
- Interactions are achieved utilizing a plethora of possibly different networks; computerized devices of various functions, form factors, sizes, and capabilities such as iPads, smartphones, monitoring nodes, sensors, and tags; and a gamut of host application servers.



## OVERVIEW AND MOTIVATIONS-3



- The new paradigm seeks to enhance the traditional Internet into a smart Internet of Things (IoT) created around intelligent interconnections of diverse objects in the physical world.
- In the IoT, commonly deployed devices and objects contain an embedded device or microprocessor that can be accessed by some communication mechanism, typically utilizing wireless links.
- The IoT aims at closing the gap between objects in the material world, the “things,” and their logical representation in information systems. It is perceived by proponents as the “next-generation network (NGN) of the Internet.”



## OVERVIEW AND MOTIVATIONS-4



- The IoT has two attributes:
- (i) being an Internet application
- (ii) dealing with the thing's information.
- The "things" are also variously known as "objects," "devices," "end nodes," "remotes," or "remote sensors," to list just a few commonly used terms.



## OVERVIEW AND MOTIVATIONS-5



- The IoT generally utilizes low cost information gathering and dissemination devices—such as sensors, tags and actuators—that facilitate fast-paced interactions in any place and at any time, among the objects themselves, or/and with people.
- The IoT is a new-generation information network that enables seamless and continuous machine to machine (M2M)2 and/or human-to-machine (H2M) communication.



## OVERVIEW AND MOTIVATIONS-6



- Next goal is to be able to have the “thing” provide back appropriate, application-specific telemetry; an intermediary next step is to provide a web-based interface to the “thing” (especially when human access is needed);
- The final step is to permit actuation by the “thing” (i.e., to cause a function or functions to take place).
- Certain “things” are stationary, such as an appliance in a home; other “things” may be in motion, such as a car or a carton (or even an item within the carton) in a supply chain environment (either end-to-end, or while in an intermediary warehouse).



## OVERVIEW AND MOTIVATIONS-7

- The thing's information is typically coded by the **unique identification (UID)** and/or **electronic product code (EPC)**; the information is (typically) stored in a **radio frequency identification (RFID)** electronic tag; and, the information is uploaded by noncontact reading using an RFID reader.
- In fact, UID and RFID have been mandated by the Department of Defence (DoD).
- RFID and EPC were also mandated by Wal-Mart to all their suppliers as of January 1, 2006, and many other commercial establishments have followed suit since then.
- Even these days smart cards (SCs) will also play an important role in IoT; SCs typically incorporate a microprocessor and storage.



## OVERVIEW AND MOTIVATIONS-8

- The “mid range” application, finds devices with embedded intelligence (microprocessors) and embedded active wireless capabilities to perform a variety of data gathering and possibly control functions.
- In biomedical sensors, home appliance and power management and industrial control.



## OVERVIEW AND MOTIVATIONS-9



- **Sensors employed in the IoT**
- The sensor approaches use distributed wireless sensor network (WSN) systems that
  - (i) can collect a wide variety of environmental data such as temperature, atmospheric and environmental chemical content, or even low- or high resolution ambient video images from geographically dispersed locations
  - (ii) can optionally pre-process some or all of the data;
  - (iii) can forward all these information to a centralized (or distributed/virtualized) site for advanced processing. These objects may span a city, region, or large distribution grid.
- Other “things” can associated with personal area networks (PANs), vehicular networks (VNs), or delay tolerant networks (DTNs).



## OVERVIEW AND MOTIVATIONS-10

- The IoT can establish and support pervasive connections between objects (things) and data collection and management centres located in the network's "core" or "cloud".
- The IoT operates in conjunction with real-time processing and ubiquitous computing.
- The IoT is a global network that connects physical objects with virtual objects through the combination of data capture techniques and communication networks.



## Conti...

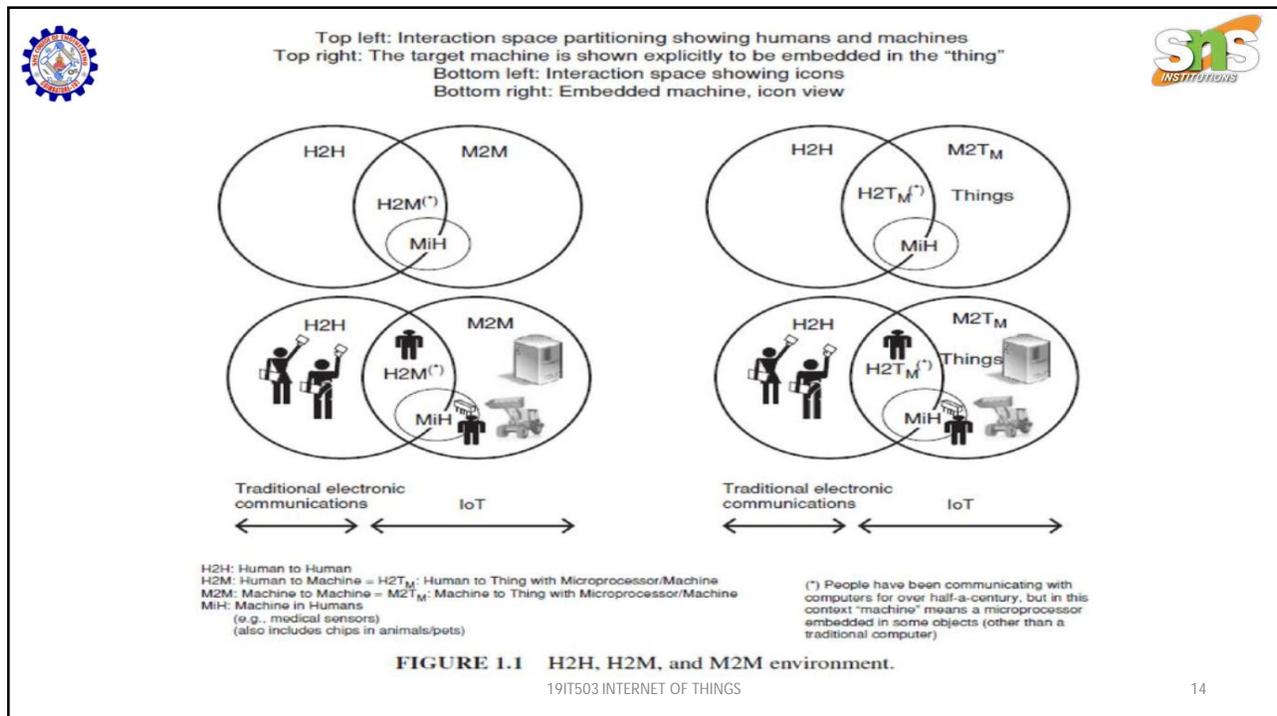


- The IoT is predicated on the expansion of the scope, network reach, and possibly even the architecture of the Internet through the inclusion of physical instrumented objects, such expansion fused with the ability to provide smarter services to the environment or to the end user, as more in situ transferable data become available.
- The IoT in the context of ambient intelligence; for e.g. a vision where environment becomes smart, friendly, context aware, and responsive to many types of human needs.



## OVERVIEW AND MOTIVATIONS-11

- The IoT effectively eliminates time and space isolation between geographical space and virtual space, forming what proponents label as “smart geographical space” and creating new human-to-environment (and/or H2M) relationships.
- A smart environment consisting of networks of federated sensors and actuators and can be designed to encompass homes, offices, buildings, and civil infrastructure; from this granular foundation, large-scale end to-end services supporting smart cities, smart transportation, and smart grids (SGs), among others, can be contemplated.





## OVERVIEW AND MOTIVATIONS-12

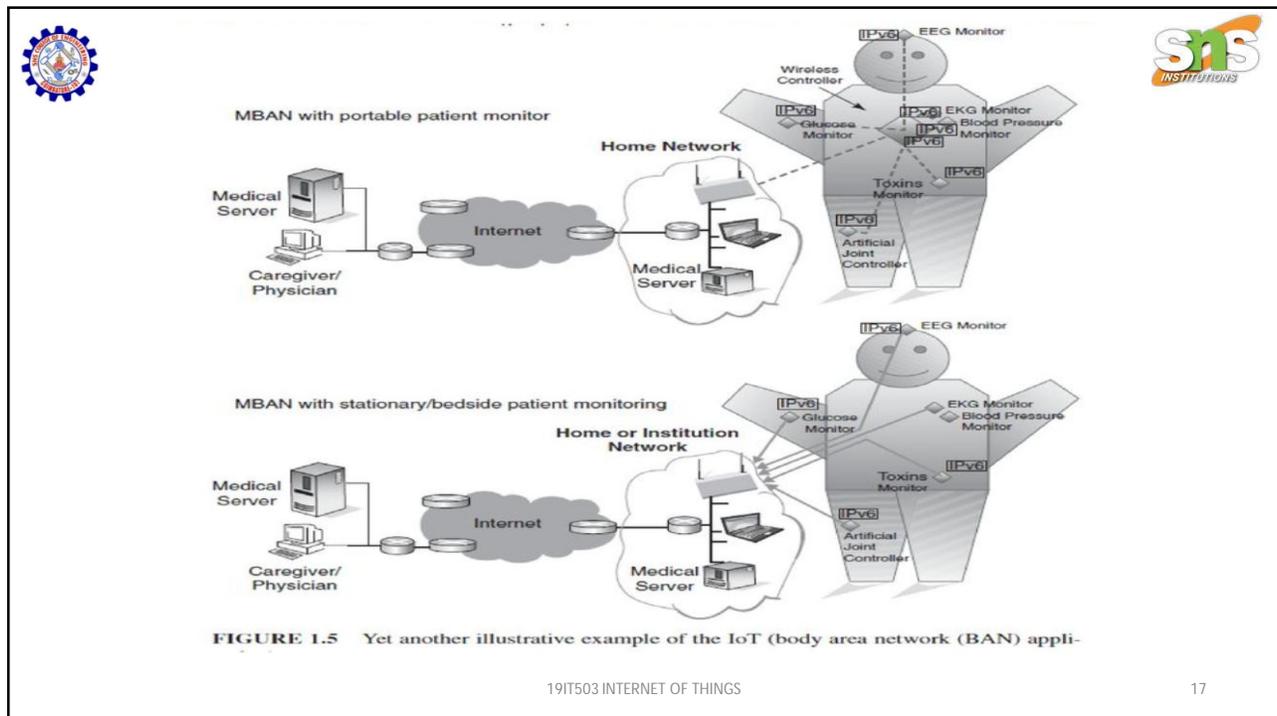


- M2M
- Aim at automating decision and communication processes and support consistent, cost-effective interaction for ubiquitous applications like e.g. fleet management, smart metering, home automation, and e-health.
- M2M is the communication between two or more entities, it is the communication between remotely deployed devices with specific roles and requiring little or no human intervention.
- M2M communication modules are usually integrated directly into target devices:



## Conti...

- E.g. automated meter readers (AMRs), vending machines, alarm systems, surveillance cameras, and automotive equipment, industrial, trucking/transportation, financial, retail point of sales (POS), energy/utilities, smart appliances, and healthcare.
- The emerging standards allow both wireless and wired systems to communicate with other devices of similar capabilities.
- M2M uses, typically connected to an application server via a mobile data
- communication network.





## OVERVIEW AND MOTIVATIONS-13

- Initial vision of the IoT in the mid-2000s was of a world where physical objects are tagged and uniquely identified by RFID transponders.
- The concept has recently grown in multiple dimensions, encompassing dispersed sensors that are able to provide real-world intelligence and goal-oriented collaboration of distributed smart objects via local interconnections (such as through wireless LANs, WSNs, and so on), or global interconnections (such as through the Internet).



## Conti...

- WSNs are likely the “outer tier” communication apparatus of the IoT.
- IoT covers a diverse range of technologies.



Thank you