

CHAPTER 4

INTERNET OF THINGS(IoT)

Overview of IoT

The most important features of IoT include **artificial intelligence**, **connectivity**, **sensors**, **active engagement**, and **small device use**.

***AI** – IoT essentially makes virtually anything “**smart**”.

***Connectivity**: IoT creates **small networks** between its system devices.

***Sensors** – IoT loses its distinction without **sensors**. passive network of devices into an active system capable of real-world integration.

***Active Engagement**: IoT introduces a new paradigm for **active content**, **product**, or **service engagement**.

* **Small devices**: Devices, as **predicted**, have become **smaller**, **cheaper**, and more **powerful over time**.

What is Internet of Things

- ▮ **Internet of Things** is a platform where **regular devices are connected to the Internet**, so they can **interact, collaborate** and **exchange** data with each other without any human intervention.
- ▮ **The Internet of Things (IoT)** is the **network of physical objects or "things"** embedded with **electronics, software, sensors**, and **network connectivity**, which enables these objects to collect and exchange data.
- ▮ **Internet of Things (IoT)** refers to the **ever-growing network of physical objects** that feature an IP address for **internet connectivity**, and the **communication** that occurs between these objects and other Internet-enabled devices and systems.

Internet of Things

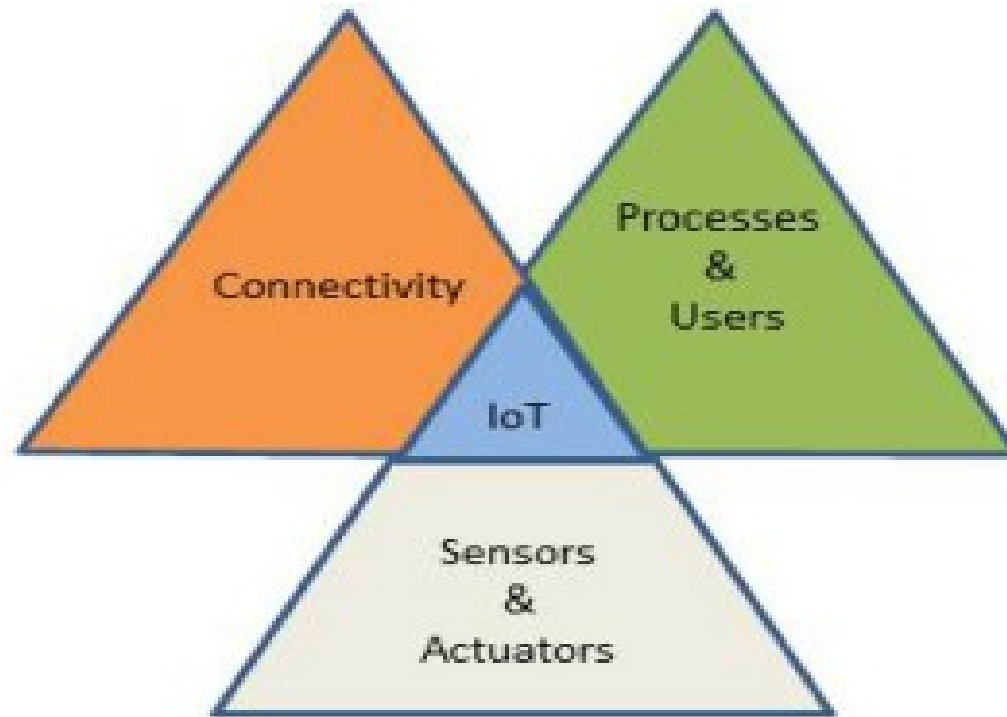
- **Internet of Things (IoT)** is an ecosystem of **connected physical objects** that are accessible through the **internet**.
- It is also referred to as Machine-to-Machine (**M2M**), **Skynet** or **Internet of Everything**.

IoT= Services+ Data+ Networks + Sensors



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*The **IoT** can be seen as a combination of **sensors** and **actuators** providing and receiving information that is digitalized and placed into **bidirectional networks** able to transmit all data to be used by a lot of different **services** and **final users**



History of IoT

- Early 1800s: Machine **communicating** with one another.
- 1830-1840s: Machine direct communication, **telegraph**(first landline)
- 1900: wireless telegraphy. first **radio voice transmission**
- 1950: **development** of computer begin
- 1962: **internet** started out
- 1980s: Commercial **service provider** begin
- 1993 : Global positioning satellites(**GPS**)
- until 1999: **IOT** as a concept wasn't officially
- Early 1980s: first IoT example called **coca cola machine**.₆

Con't...

- The concept of the Internet of Things first became popular in 1999, through the **Auto-ID Center at MIT** and related market-analysis publications.
- Radio-frequency identification (**RFID**) was seen as a prerequisite for the IoT at that point.
- If all **objects** and **people** in daily life were equipped with identifiers, computers could manage and inventory them.
- Besides using RFID, the tagging of things may be achieved through such technologies as near field **communication**, **barcodes**, **QR codes**, **bluetooth**, and **digital watermarking**.

Merits of IoT

- The advantages of IoT span across every area of lifestyle and business.
- Here is a list of some of the advantages that IoT has to offer:
 - ✓ Helps people live and work smarter
 - ✓ Enables companies to automate processes and reduce labor costs
 - ✓ Reduced Waste and improves service delivery, making it less expensive to manufacture and deliver goods as well as offering transparency into customer.
 - ✓ Monitor their overall business processes
 - ✓ Improve the customer experience
 - ✓ Save time and money

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- ✓ Enhance **employee** productivity
- ✓ Integrate and **adapt** business models
- ✓ Make **better business decisions**
- ✓ Generate **more revenue**
- ✓ Improved **Customer Engagement**
- ✓ **Technology** Optimization
- ✓ Enhanced **Data Collection**

Dis-merits of IoT

Here is a list of some of the disadvantages of IoT. these are:

***Security:** The number of **connected devices increases** and more **information is shared between devices**, the potential that a hacker could steal **confidential information also increases..**

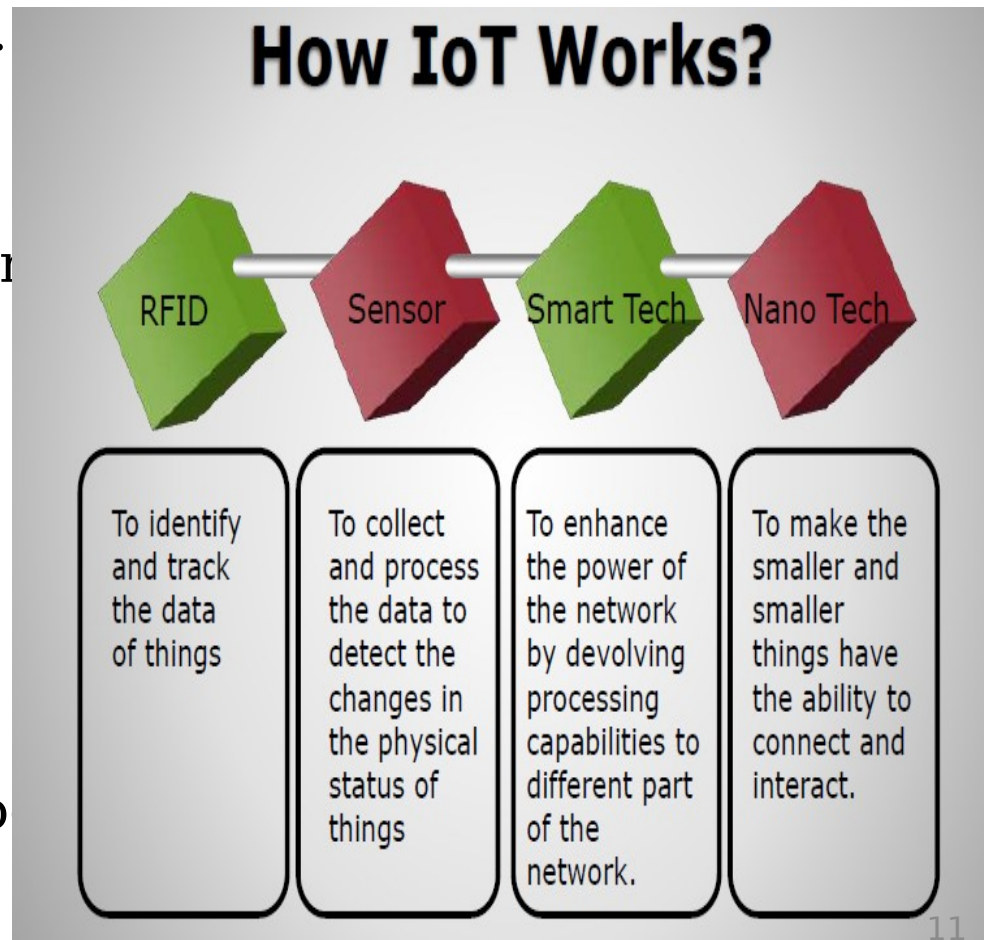
***Privacy:** **sophistication** of IoT.

***Complexity:** IoT systems complicated in terms of **design**, **deployment**, and **maintenance**.

***Flexibility** – Many are concerned about the flexibility of an IoT system to integrate easily with another.

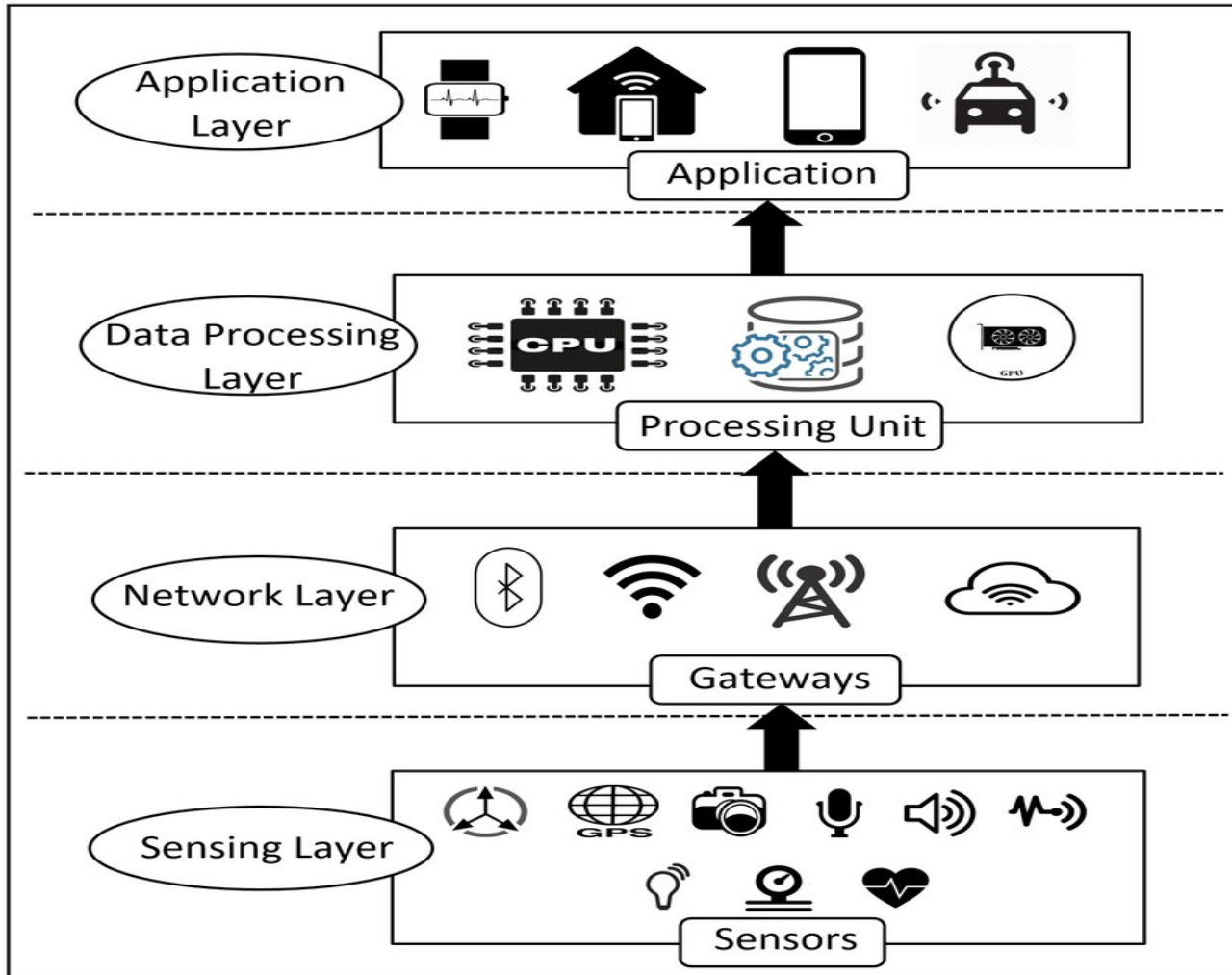
How IoT works

- **Internet of Things** is not the result of a **single novel technology**; instead, several complementary technical developments provide capabilities that taken together help to **bridge** the gap between the **virtual** and **physical** world.
- These capabilities include:
 - ❖ Communication and cooperation
 - ❖ Addressability
 - ❖ Identification
 - ❖ Sensing
 - ❖ Actuation
 - ❖ Embedded information processing
 - ❖ Localization



Architecture of IoT

*The architecture of IoT devices comprises four major components: **sensing, network, data processing, and application layers**.



Sensing Layer

- * **Obtain data** from the real world.
- * Sensors in IoT devices are usually integrated through **sensor hubs**.
- * A **sensor hub** is a common connection point for multiple sensors that accumulate and forward sensor data to the processing unit.
- * **Sensors** in IoT devices can be classified into three: Motion Sensors, Environmental Sensors, Position sensors.
 - a. **Motion sensors** :measure the **change in motion** as well as the orientation of the devices.
 - b. **Environmental Sensors**: Sensors such as **Light sensors**, **Pressure sensors**, etc. are embedded in IoT devices to sense the change in environmental parameters.

Network Layer

- * It is the **brain** of conventional IoT architecture.
 - * The **network layer** acts as a **communication channel** to **transfer data**, collected in the sensing layer to other connected devices.
 - * Basically, this layer is a convergence of the **internet** and **communication-based** networks.
- e.g., Wi-Fi, Bluetooth, Zigbee, ZWave, LoRa, cellular network, etc...
to allow data flow between other devices.

Data processing Layer

- * This layer consists of the main **data processing unit** of IoT devices.
- * The data processing layer takes **data collected in the sensing**

Application Layer

- *Application Layer - The application layer **implements** and **presents** the results of the data processing layer.
- *The application layer is a **user-centric layer** that executes various tasks for the users.
- * Its main responsibility is
 - To link the major gap between **users** and **applications**.
- *Eg: Smart transportation, smart home, personal care, healthcare, etc

Devices and Network

❖ The IoT devices can be categorized into three main groups: **consumer**, **enterprise** and **industrial**.

* **Consumer** connected devices include smart TVs, smart speakers, toys, wearables, and smart appliances. smart meters, commercial security system.

* Monitor traffic and weather conditions are examples of **industrial** and **enterprise** IoT devices.

* Smart air conditioning, smart thermostats, smart lighting, and smart security are **enterprise** and **industrial uses**.

❖ IoT devices include **computer devices**, **software**, **wireless sensors**, and **actuators**.

❖ These IoT devices are **connected over the internet** and **enabling**

Properties of IoT devices

- Some of the essential properties of IoT devices are mention below:
 - ❖ **Sense**: The devices that sense its surrounding environment in the form of **temperature**, **movement**, and **appearance of things**, etc.
 - ❖ **Send and receive data**: IoT devices are able to **send** and **receive the data** over the network connection.
 - ❖ **Analyze**: The devices can able to **analyze the data that received** from the other device over the internet networks.
 - ❖ **Controlled**: IoT devices may control from some endpoint also. Otherwise, the IoT devices are themselves communicate with each other endlessly leads to the system failure.

IoT-Platform

- All the IoT devices are connected to other IoT devices and application to **transmit and receive information using protocols**.
- There is a gap between the IoT device and IoT application. An IoT Platform fills the gap between the devices (**sensors**) and application (**network**).
- **IoT platform** is an integrated service that fulfills the gap between the **IoT device** and **application** and offers you to bring physical object online.

The following are some parts of IoT platform. Those are:

1. KAA:

- ✓ Manage an unlimited number of connected devices.
- ✓ Set up cross-device interoperability.
- ✓ Perform real-time device monitoring.
- ✓ Collect and analyze sensor data.
- ✓ Analyze user behavior and deliver targeted notifications

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2. SiteWhere:

- ❖ Run any number of IoT applications on a single SiteWhere
- ❖ Add devices through self-registration

3. ThingSpeak:

- Collect data in private channels
- Event scheduling
- App integrations

4. Google Cloud Platform IoT: Google Cloud Platform is a global cloud platform that provides **a solution for IoT devices and applications.**

- ✓ It handles a **large amount of data** using Cloud IoT Core by connecting various devices.

How IoT platform help:

- IoT Platform connects **sensors** and **devices**.
- IoT platform handles different **software communication protocol** and **hardware**.
- IoT platform provides **security** and **authentication** for sensors and users.
- It **collects**, **visualizes**, and **analyzes** the data gathered by the sensor and device.

Application of IoT

***Agriculture:** devices using IoT technology can sense **soil moisture** and **nutrients**, in conjunction with weather data.

***Consumer Use:** Wearables cover accessories such as smartphones, Apple watches, health monitors.

***Healthcare:** wearable IoT devices let hospitals monitor their patients' **health at home**.

***Transportation:** The GPS, which if you think of it is another example of IoT, is being utilized to help transportation companies **plot faster** and more **efficient routes**.

***Utilities** - IoT sensors can be employed to monitor environmental conditions such as **humidity, temperature, and lighting**.

IoT based smart home

*Monitor different home devices from anywhere via smartphones or over the web with no physical distance limitations.

***Remote Control Appliances(Devices):** Switching on and off remotely appliances to avoid accidents and save energy.

***Smart Home Appliances:** Refrigerators with LCD screen telling what's inside, food that's about to expire, ingredients you need to buy.

***Safety Monitoring:** cameras, and home alarm systems making people feel safe.

IoT based smart city

***Structural Health:** Monitoring of vibrations and material conditions in buildings, bridges.

***Safety:** Digital video monitoring, fire control management, public announcement systems.

***Transportation:** warning messages and diversions according to climate conditions and unexpected events like accidents or traffic.

***Smart Parking:** Real-time monitoring of parking spaces available in the city.

* **Waste Management**

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IoT based smart farming

***Green Houses:** Control micro-climate conditions to maximize the production of fruits.

***Compost:** Control of humidity and temperature levels.

***Animal Farming/Tracking:** Location and identification of animals grazing in open pastures or location in big stables

* **Offspring Care**

* **Field Monitoring**



Thank You