Internet of Things

Presented by

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Outline

- IoT definition
- Objectives of IoT
- Major components of IoT
- IoT enabling technologies
- IoT main tasks
- Characteristics of IoT

Understanding IOT

Internet

- When two or more networks are connected , it is called an internetwork or internet
- The network consists of computers, devices, actuators, controllers etc.,

Things

- Things in IoT can be anything that operates or functions by electrical or electronic means
- It includes electrical machinery, sensors and transducers, actuators and controllers, processors etc.,
- These devices have unique identities.
- They should be capable of remote sensing, processing, controlling, actuation and monitoring.
- IoT devices exchange data with each other

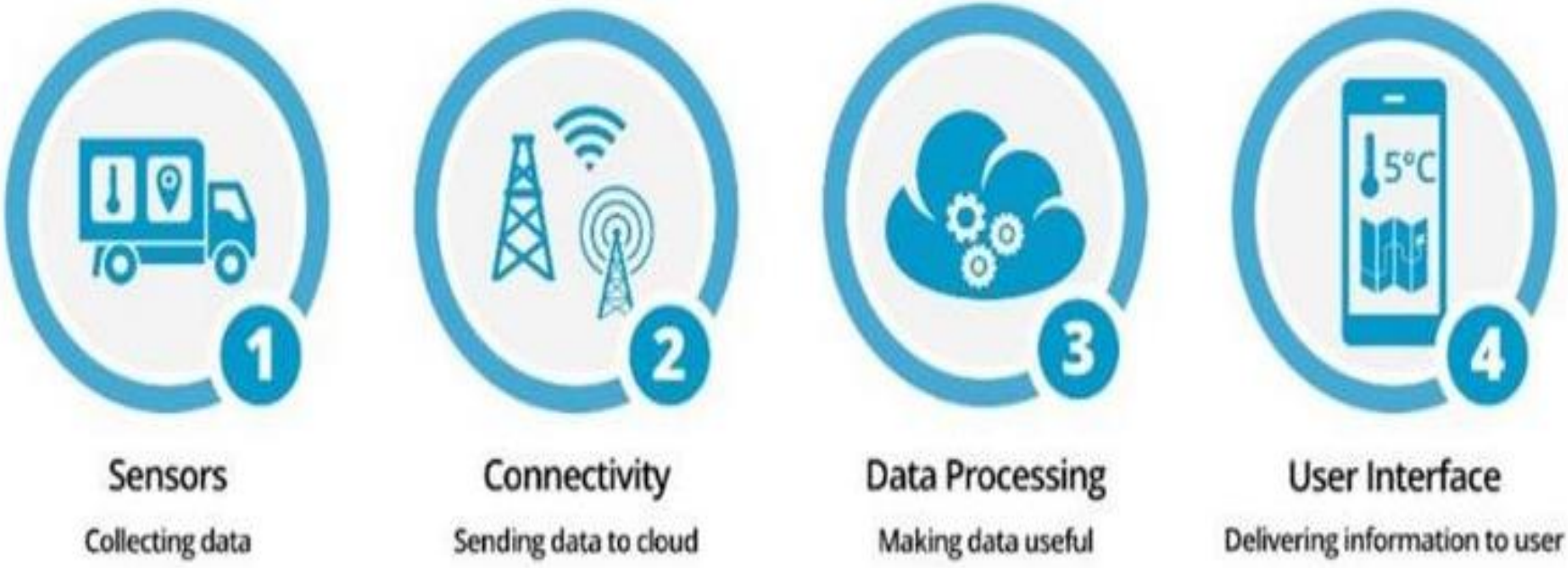
What is IOT?

- IoT is a world of interconnected things
- These things are capable of sensing, actuating and communicating among themselves and with the environment.
- IOT is a system of interrelated computing devices, mechanical and digital machines, objects or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human –to-computer interaction

Objectives of IoT

- Connecting things (devices, appliances, machines, etc.,)
- Exchange of data and information
- Sensing, processing, control, actuation and monitoring
- Providing services

Major Components of IoT



Internet of Things - Use Cases

Smart Wearables

Smart Home

Smart City

Smart Agriculture

Connected Car

Health Care

Industry Automation

Smart Energy

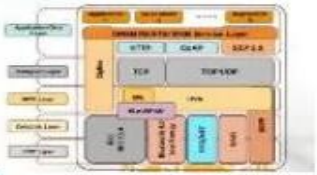
IoT enabling Technologies

- Wireless Sensor Network

- Cloud Computing

- Big Data Analytics

- Communication Protocols



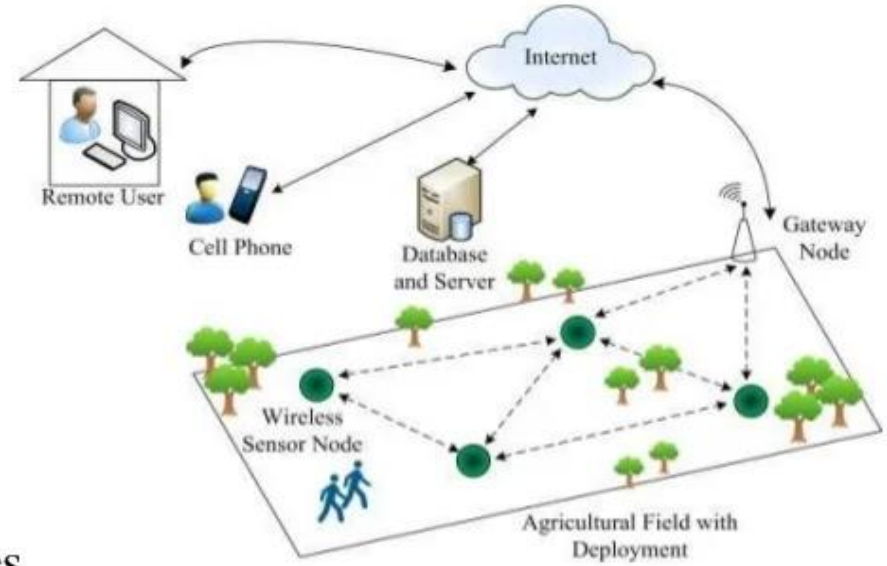
- Embedded Systems

Wireless Sensor Network

- **Distributed Devices with sensors** used to monitor the environmental and physical conditions

Or

- It is a network formed by **large no. of sensor nodes** to detect light, heat , pressure ect.
i.e. used to monitor environmental and physical conditions.
- Each node can have several sensors attached to it.
- Each node can also acts as a routers
- **Coordinator** collects data from all nodes
- Coordinator acts as **gateway** that connects WSN to the internet.



Examples of WSNs

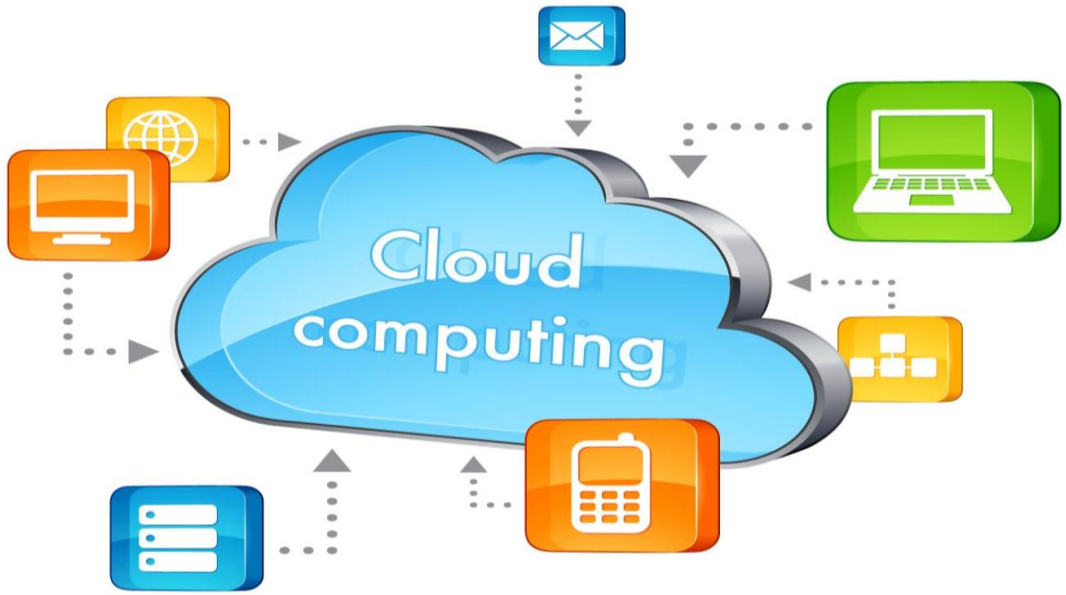
- Indoor Air Quality Monitoring system
- Weather Monitoring System
- Soil Moisture Monitoring System
- Survelliance Systems
- Health Monitoring Systems

Protocols used

WSNs are enabled by wireless communication protocols such as **IEEE802.15.4**
Zigbee is one of the most popular wireless technology used by WSNs. Zigbee specifications are based on **IEEE802.15.4** which is used for low powered devices.
Data rate: up to **250KBps**. Range: upto **100 Meters**

Cloud Computing

A scalable distributed computing environment in which a large set of virtualized computing resources, different infrastructures, various development platforms and useful softwares are delivered as a service to customers as a pay-as-you go manner usually over the Internet.



Cloud Computing Advantages

- Access your data at all times not just while in the office
- Easily scalable
- World-class service delivery
- No hardware or software to install
- Instant software updates

Cloud Computing Deployment Models

Cloud Deployment Models

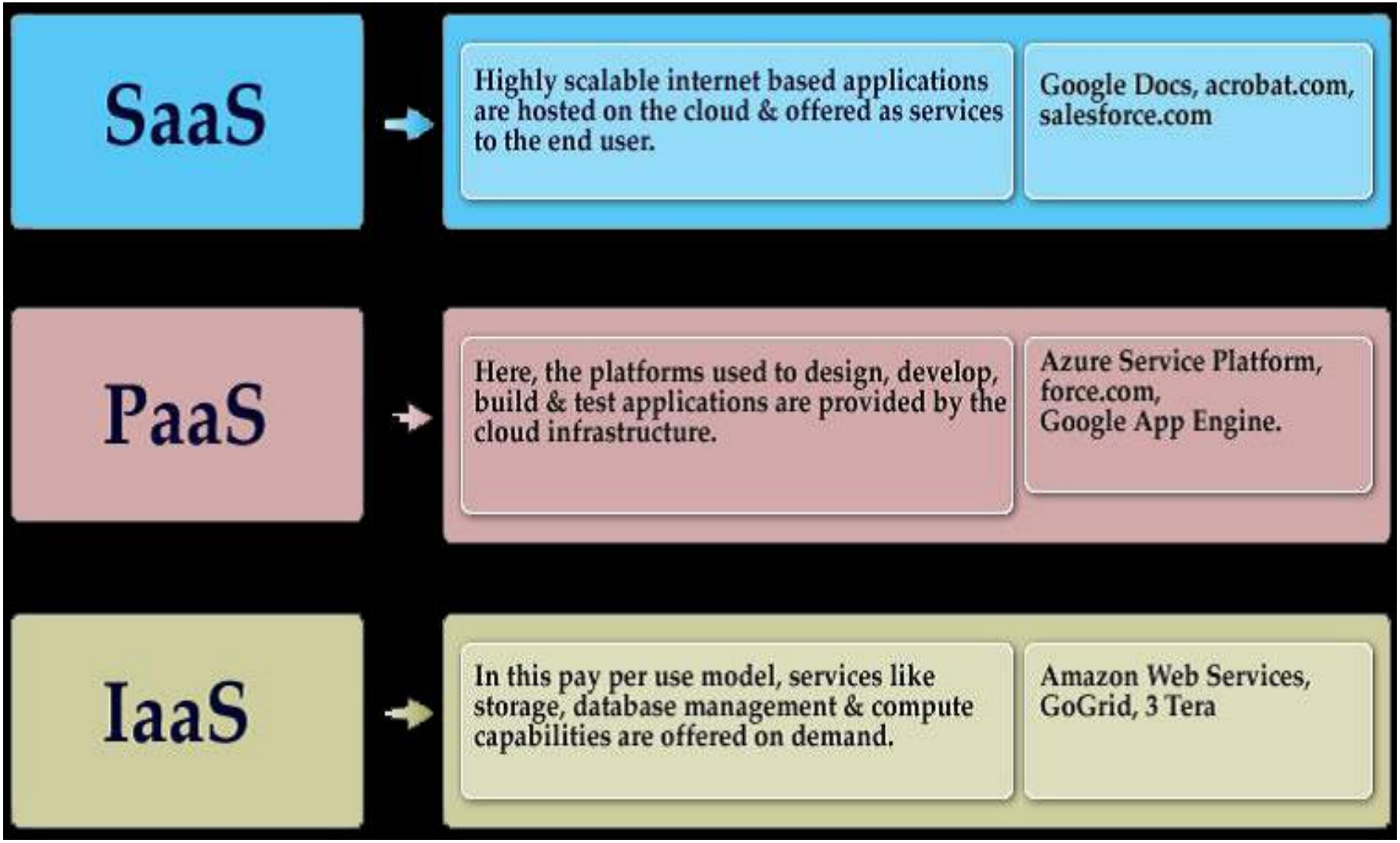
Manufacturing organization has its own private cloud

Manufacturing organization shares cloud with general public

Combination of cloud deployment models

Manufacturing organization shares cloud with other organizations with similar interests

Cloud Service Models



Big Data Analytics

- Collection of data whose volume, velocity or variety is too large and difficult to store, manage, process and analyze the data using traditional databases.

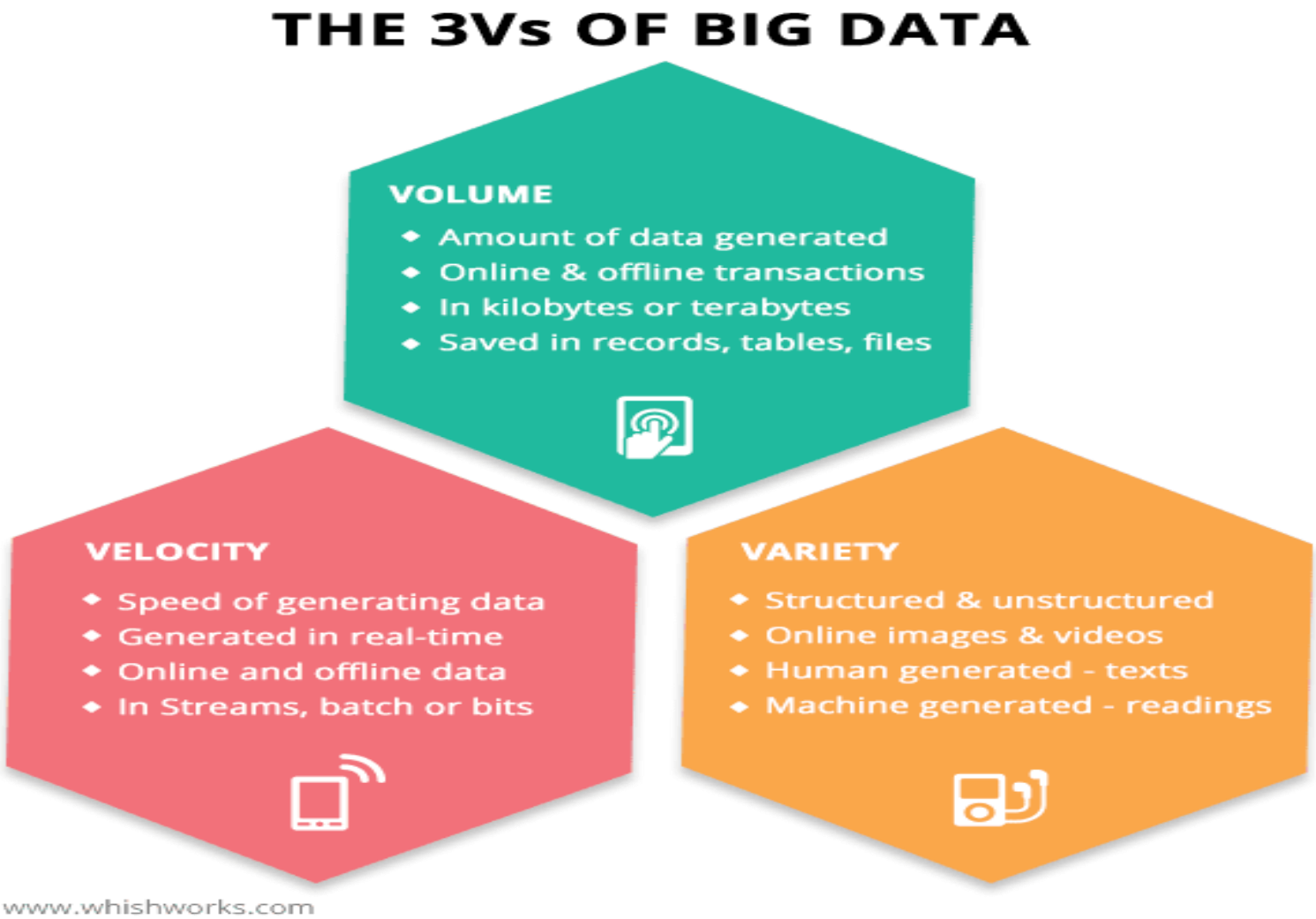
Big data Analytics involves

Data cleansing
Data munging (Data Wrangling)
Data Processing and
Data Visualization

Correcting
Removing
Replacing

Converting data from one format to other

Big Data Analytics Characteristics

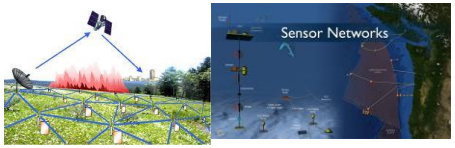


Real-time/Fast Data

Social media and networks
(all of us are generating data)

Scientific instruments
(collecting all sorts of data)

Mobile devices
(tracking all objects all the time)



Sensor technology and networks
(measuring all kinds of data)

- The progress and innovation is no longer hindered by the ability to collect data
- But, by the ability to manage, analyze, summarize, visualize, and discover knowledge from the collected data in a timely manner and in a scalable fashion

Communication Protocols

- Backbone of IOT system
- Allows devices to exchange data over networks.
- Define data exchange formats
  - Data encoding
  - Addressing Schemes
  - Routing of packets from sources to destination
- Other Functions
  - Sequence control(ordering data packets)
  - Flow control(controlling transfer rate)
  - Retransmission of lost packets

Embedded Systems

- A microcontroller-based, software-driven, reliable, **real-time control system**, designed to perform a **specific task**..
  - **It can be thought of as a computer hardware system having software embedded in it.**
  - **An embedded system can be either an independent system or a part of a large system.**

What is the difference between a PC and an Embedded system?

Embedded Systems found in..

Key Components

- Microprocessor or micro controller
- Memory (RAM, ROM ect.)
- Storage (Flash Memory)
- Networking units(Ethernet, Wifi adaptors)
- I/O units (Keyboard, display ect)

Some Embedded systems have

- DSP(Digital Signal Processor)
- Graphics Processor
- App Specific Processor

IoT – Main Tasks

- **Gathering information from things** and send commands to things
  - Monitoring: state information
  - Control: command enforcement
- **Send information back and forth** remote locations (private/public cloud)
- **Store and aggregate** information
- **Analyse** information to improve system knowledge
- **Take decisions**, in a human-assisted or autonomous manner.

Characteristics of IoT

- **Dynamic & Self Adapting**: IoT devices and systems may have the capability to dynamically adapt with the changing contexts and take actions based on their operating conditions.
- **Self Configuring:** allowing a large number of devices to work together to provide certain functionality.
- **Interoperable Communication Protocols:** support a number of interoperable communication protocols and can communicate with other devices and also with infrastructure.
- **Unique Identity:** Each IoT device has a unique identity and a unique identifier (IP address).
- **Integrated into Information Network:** that allow them to communicate and exchange data with other devices and systems.

Questions