

# 1.4 IoT Enabling Technologies

- **Wireless Sensor Network**



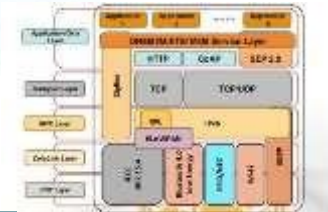
- **Cloud Computing**



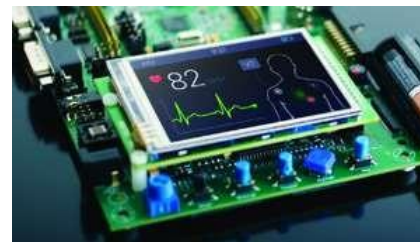
- **Big Data Analytics**



- **Communication Protocols**



- **Embedded Systems**

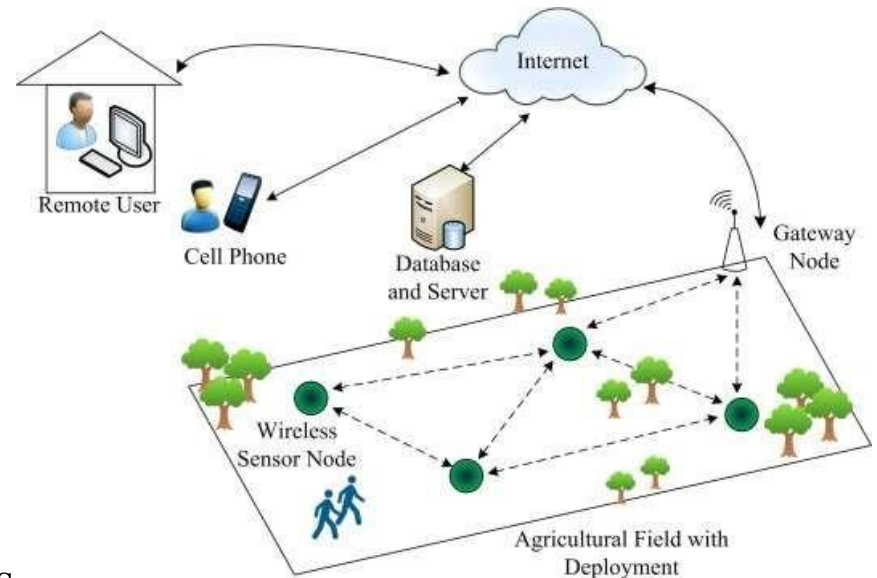


## 1.4.1 1. Wireless Sensor Network

• **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
- Surveillance Systems
- Health Monitoring Systems

## Protocols used

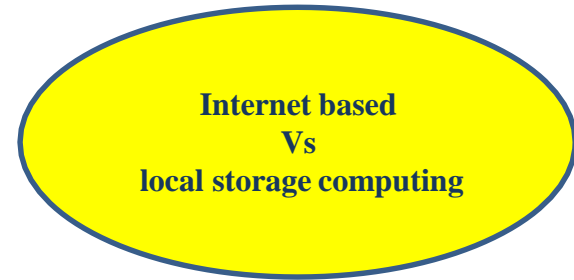
WSNs are enabled by wireless communication protocols such as

**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**

## 1.4.2 2. Cloud Computing



- Deliver applications and services over internet

Provides computing, networking and storage resources on demand

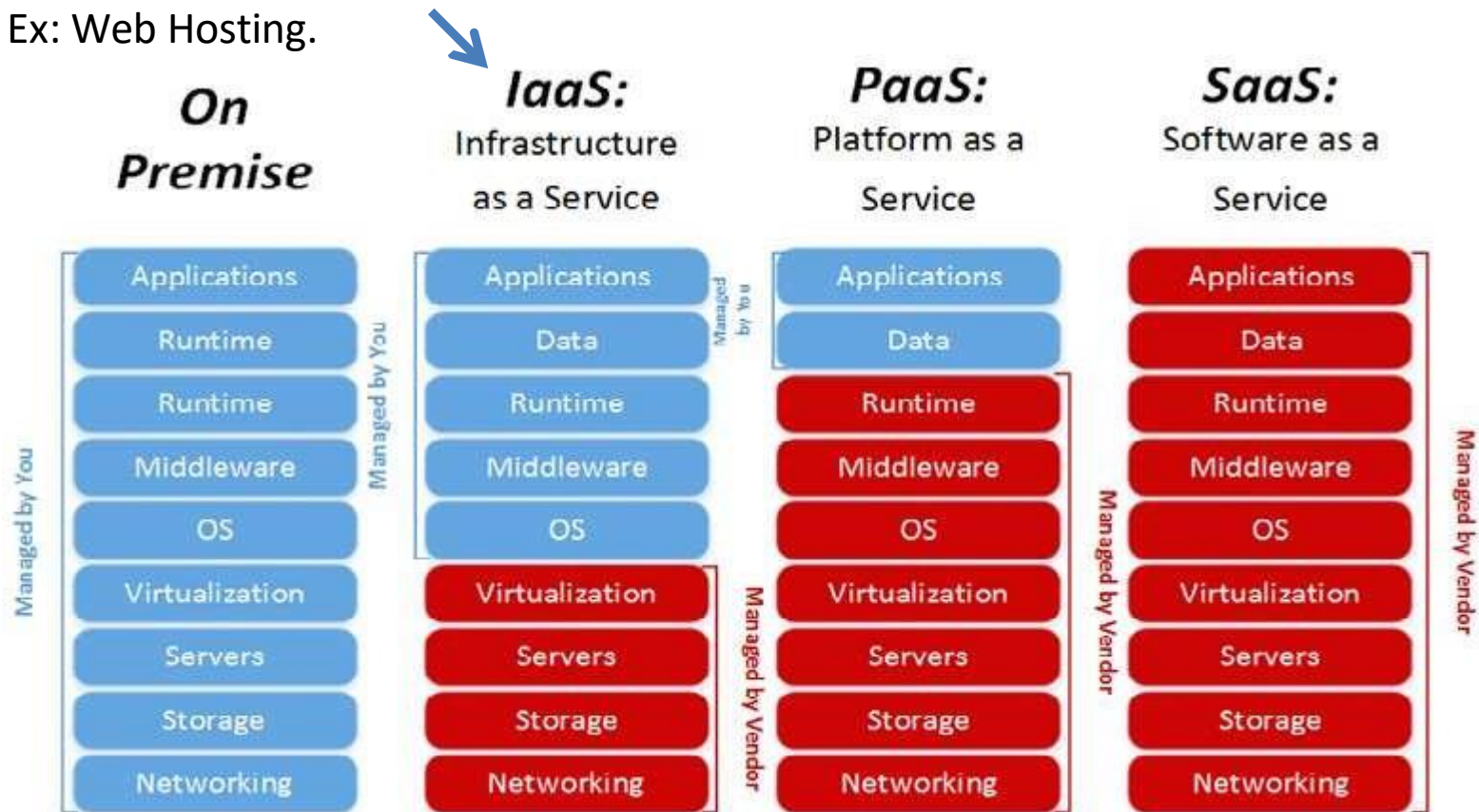
Cloud Computing is a way of making use of virtual computer world wide using the same personalized experience.

### Types of Cloud computing services

1. IaaS(Infrastructure as a Service),
2. PaaS(Platform as a Service and
3. SaaS(Software as a Services)

**IaaS:** Clients can use **storage** to install and manage **operating systems** and any **desired applications**. (i.e Virtual machines + virtual storage)

Ex: Web Hosting.



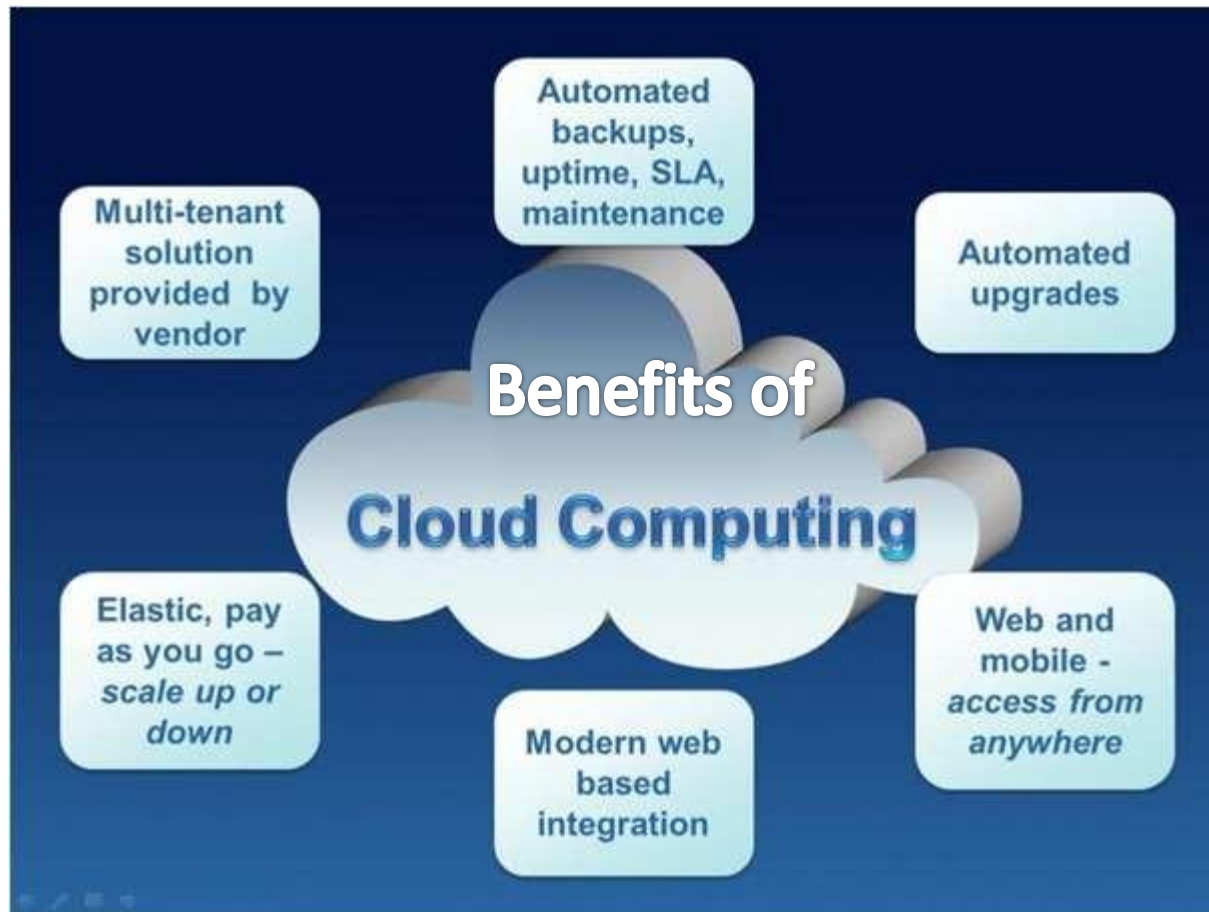
- **Paas** : Clients can install, build and modify or control applications.

Ex: App cloud, Google App Engine

- **Saas** : Clients can access and use software at remote location using a web browser.

Ex: Google documents

# Benefits of Cloud Computing

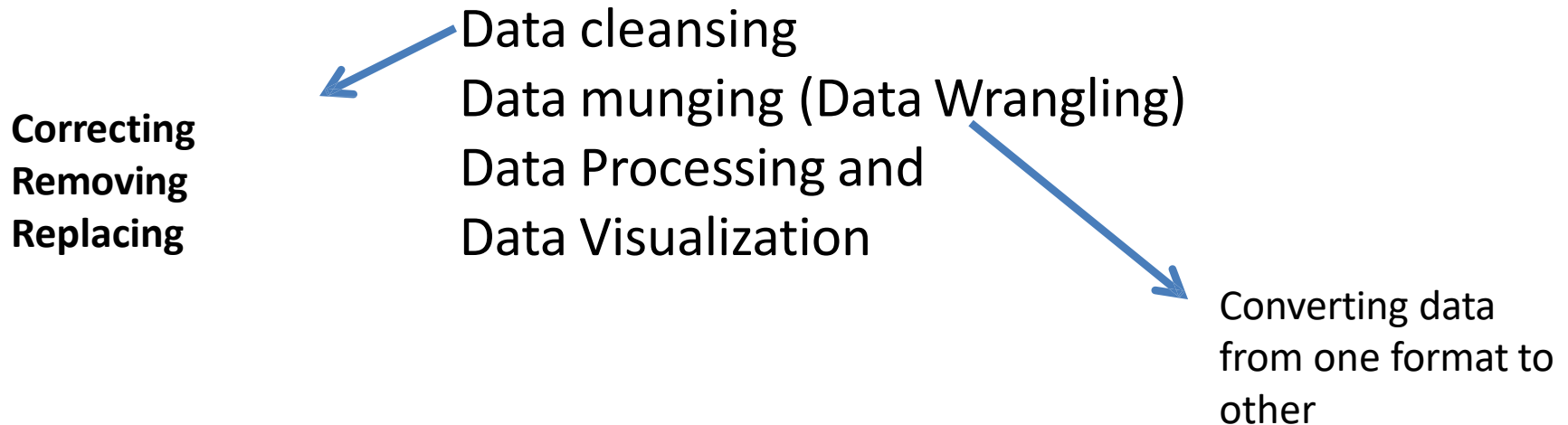


1. It **doesn't require you to maintain** or manage it(no need to have an IT expert).
2. Effectively **infinite size**, so no need to worry about running out of capacity.
3. You can **access** cloud based applications and services from **anywhere**(  
Device independent ).

### 1.4.3 3. 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



# Big Data Analytics

## Characteristics of Big Data is 3V

**Variety** Includes different types of data

- Structured
- Unstructured
- Semi-Structured
- All of above
- text, audio , video

**Velocity** Refers to speed at which data is processed

- Batch
- Real-time
- Streams

**Volume** refers to the amount of data

- Terabyte
- Records
- Transactions
- Files
- Tables

Acc to IBM in 2012: **2.5 Billion GB** data was generated **everyday!**  
Forbes states: in 2020, **1.7 MB** of **new information** is will be created



# Examples

- Lots of data is being collected and warehoused
  - Web data, e-commerce
  - purchases at department/ grocery stores
  - Bank/Credit Card transactions
  - Social Network



## 1.4.4 4. 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

## 1.4.5 5. 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.

**Embedded Systems found in..**



Industrial Robots



GPS Receivers



Digital Cameras



DVD Players



Wireless Routers

Embedded Systems



MP3 Players



Set top Boxes



Gaming Consoles



Photocopiers



Microwave Ovens

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

# 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

### •**Embedded systems run embedded OS**

Ex: RTOS(Real Time OS)(like symbian, Vxworks , Windows embedded compact ect.)