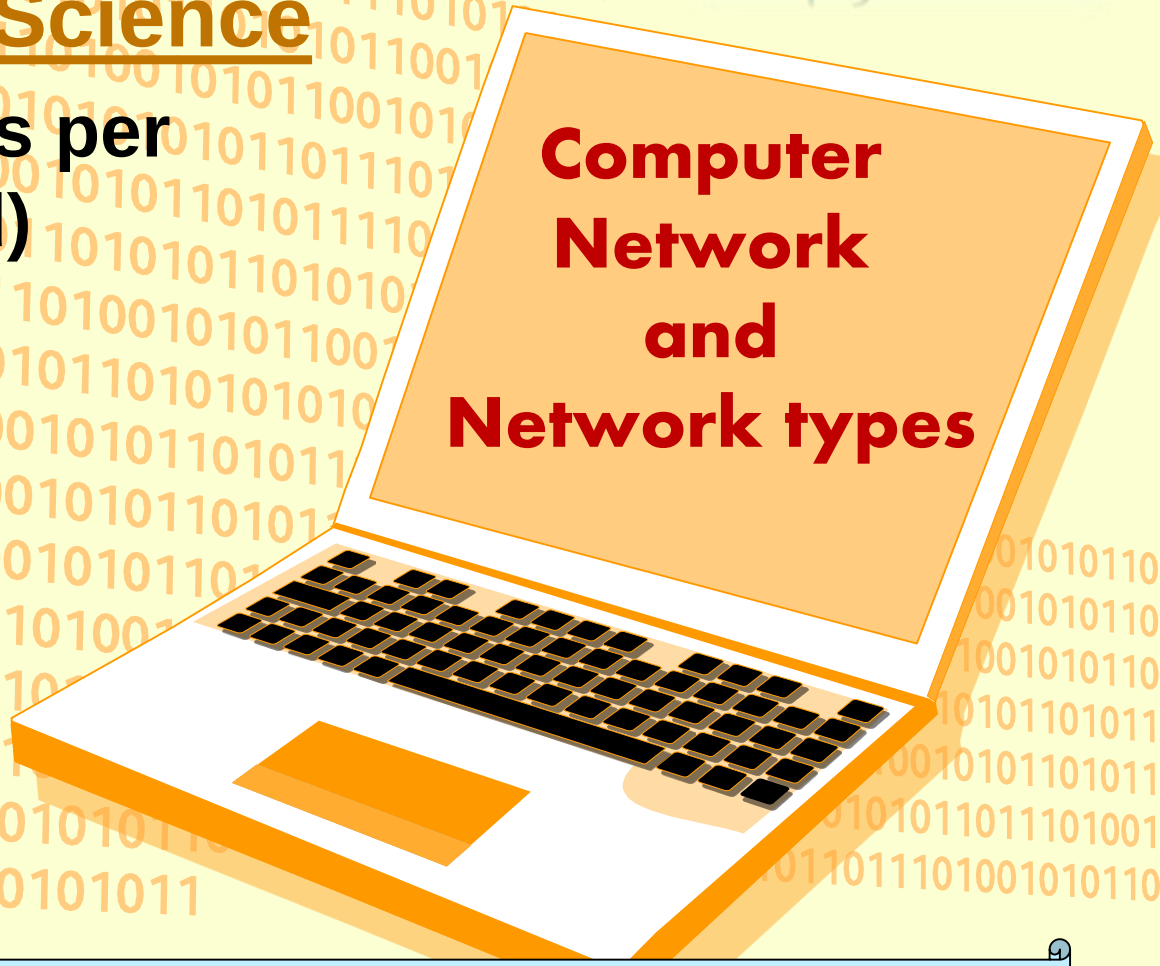
# Chapter 9 :

## Computer Science

**Class XII ( As per CBSE Board)**

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# Computer Network

A computer network is a set of nodes like computers and networking devices that are connected through communication for the purpose of communication and sharing resources(hardware/software) among the users.

**Networks are used to:**

**(Benefits of computer network)**

- Facilitate communication through email / video conferencing / instant messaging or any other mode.
- Share hardware devices like a printer or scanner
- Enable file sharing
- Share software or operating programs
- Share information

**Disadvantages of computer network**

Lack of robustness, security issue, cost of network

# Computer Network

**Structure of a network**

**The geometrical arrangement of computer resources, network devices along with communication channel is known as Network structure or Network topology.**

**Topology can be physical or logical**

- **Physical Topology - physical layout of nodes and cables in the network.**
- **Logical topology - the way information flows between different components.**

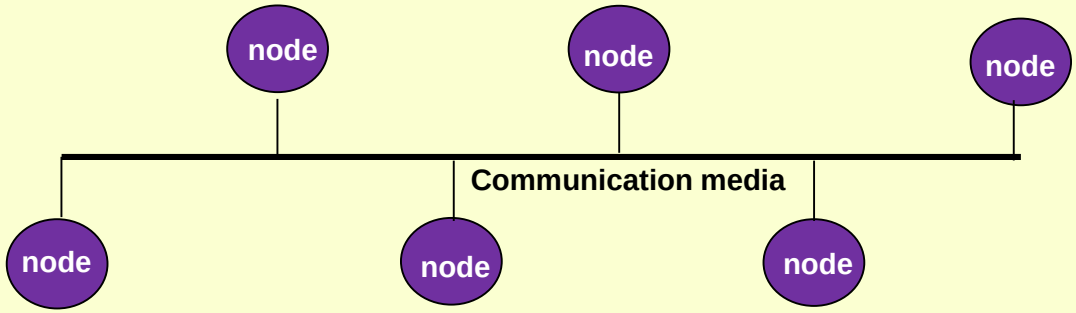
**Types of Physical Network Topologies**

- **Bus Topology**
- **Star Topology**
- **Ring Topology**
- **Mesh Topology**
- **Tree Topology**
- **Hybrid Topology**

# Computer Network

## Bus Topology

Nodes are connected through a common communication media like diagram given below.




### Advantages of a Bus topology

- Easy to install
- Minimal Cable

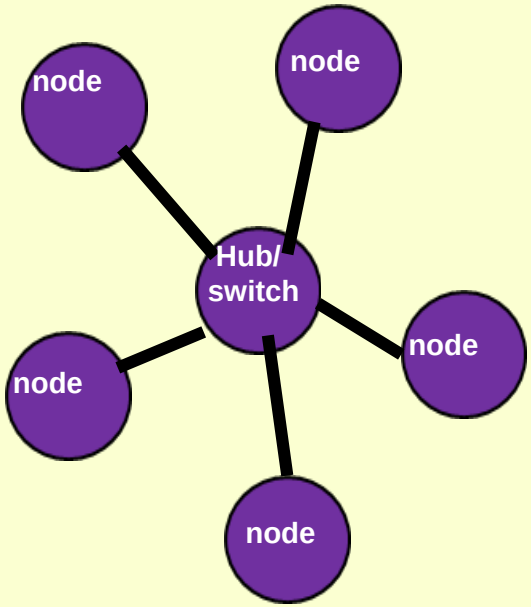
### Disadvantages of a Bus topology

- Difficult reconnection
- Difficult to find the problem
- Difficult to add new devices
- Break stops all transmission of data

# Computer Network

## Star Topology

The star topology uses a separate cable for each node/workstation.The cable connects the node to a central device typically a HUB.




### Advantages of a Star topology

- Less expensive than mesh
- Easy to install, easy to configure
- If one link fails the network can still function

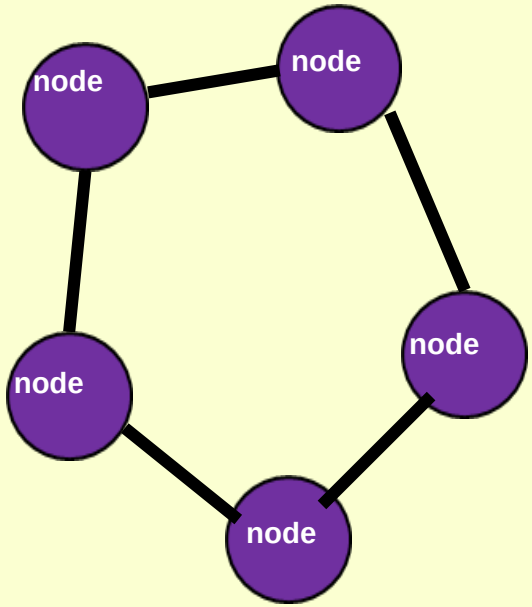
### Disadvantages of a Star topology

- Everything depends on the hub

# Computer Network

## Ring Topology

In ring topology every computer is connected to the next computer in the ring and each transmit the signal ,what it receives from the previous computer. The messages flow around the ring in one direction.




## Advantages of a Ring topology

- Easy to install
- Easy to reconfigure
- Easy to detect a problem

## Disadvantages of a Ring topology

- Break means the whole system is dead

# Computer Network

## Mesh Topology

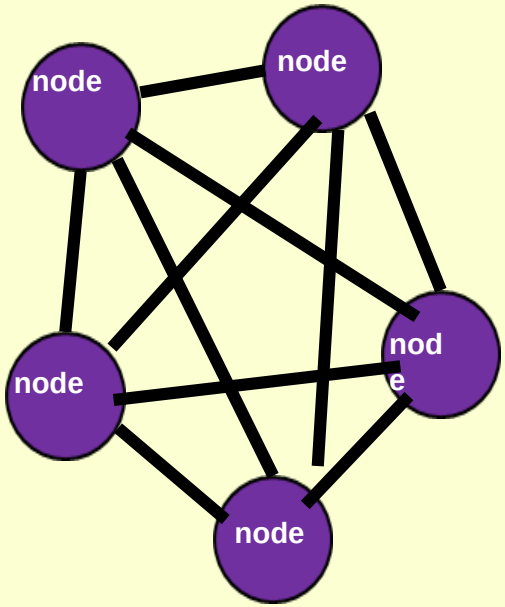
In mesh topology , separate cable is used to connect each device to every other device on the network, providing a straight communication path.

### Advantages of a Mesh topology

- Avoid traffic since each link can carry its own data and none are being shared
- If one link breaks, the rest of the network is still functional
- Easy to detect a problem in the network by discovering which device is having problems and examining the link that connects to it.

### Disadvantages of a Mesh topology

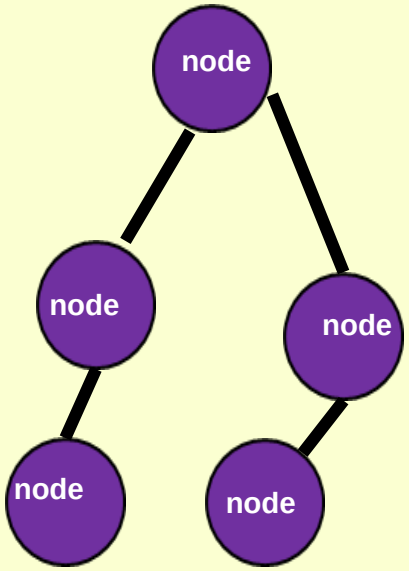
- A lot of cables are needed
- Too many cables means too much cost
- Too many cables means complex network



# Computer Network

## Tree Topology

In which a central root node (the top level of the hierarchy) is connected to one or more other nodes that are one level lower in the hierarchy




### Advantages of a Mesh topology

- It is scalable.
- Easier fault identification and isolation.

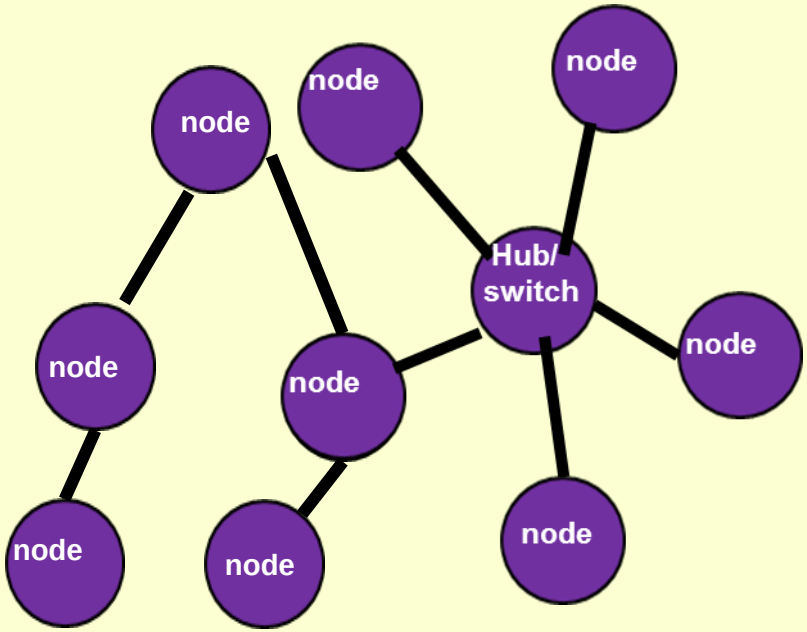
### Disadvantages of a Mesh topology

- Maintenance of the network may be an issue when the network spans a great area.
- if the backbone fails, the entire network is crippled.

# Computer Network

## Hybrid Topology

use a combination of any two or more topologies in such a way that the resulting network does not exhibit one of the standard topologies (e.g., bus, star, ring, etc.).



# Computer Network

**Types of network**

1. **Local Area Network (LAN) – limited area (within building)**
2. **Metropolitan Area Network (MAN) – within city**
3. **Wide Area Network (WAN) – within multiple city/state/ countries**

# Computer Network

1. **Local Area Network (LAN)** – LANs are the most frequently used/discussed networks.It is one of the most common one of the simplest types of network.It is designed for small physical areas such as an office, group of buildings.Any of different types of topologies can be used to design LAN like Star, Ring, Bus, Tree etc.

**Characteristics of LAN**

- private networks means no need of regulatory control.
- Operate at relatively high speed.
- Ethernet, Token ring etc type media access controls are used
- Connects computers in a single building, block or campus.

# Computer Network

## Advantages of LAN

- Resource Sharing
- Software Applications Sharing
- Easy and Cheap Communication
- Centralized Data
- Data Security
- Internet Sharing

## Disadvantages of LAN

- High Setup Cost
- Privacy Violations
- Data Security Threat
- LAN Maintenance Job
- Covers Limited Area

# Computer Network

**2. Wide Area Network (WAN) –Slightly more complex than a LAN, a WAN connects computers across longer physical distances. The Internet is the most basic example of a WAN, connecting all computers together around the world. Because of a WAN's vast reach, it is typically owned and maintained by any single person or owner.**

**Characteristics of WAN**

- **Covers large distances(states, countries, continents).**
- **Communication medium like satellite, public telephone networks etc and routers are used establish connection.**

# Computer Network

## Advantages of WAN

- Long distance business can connect on the one network.
- Shares software and resources
- Messages can be sent very quickly to wide range of nodes
- Hardware devices can be shared.

## Disadvantages of WAN

- Need a good firewall to restrict unauthorized access
- Setting up a network can be an expensive, slow and complicated.
- Maintaining a network is a full-time job
- Security is a mazor issue when many different people have the ability to use information

# Computer Network

**Difference between The Internet and The Web**

**The Internet is a global network of networks while the Web, also referred formally as World Wide Web (www) is collection of information which is accessed via the Internet.**

| | Internet | World Wide Web |
|---|---|---|
| **Estimated year of beginning** | 1969, though opening of the network to commercial interests in 1988 | 1993 |
| **First version** | ARPANET | NSFnet |
| **Components** | Network of Computers, wires, optical fiber, wireless network | Files/folders/ documents stored in computers |
| **Governed by** | Internet Protocol | Hyper Text Transfer Protocol |
| **Dependency** | Independent of the World Wide Web | Depends on Internet to work |
| **Nature** | Hardware | Software |

# Cloud computing

## Cloud Technologies/Computing

Cloud computing facilitates to access the applications as utilities ,over the internet.It allows us to create , configure and customize applications online.

It is a kind of distributed computing on internet or delivery of computing services over the internet.
e.g. gmail,Hotmail,yahoo etc.

Instead of running an email program on our computer , we log in to a web email account remotely,The software and storage of our account doesn't exist on our computer – it's on the service's computer cloud.

# Cloud computing

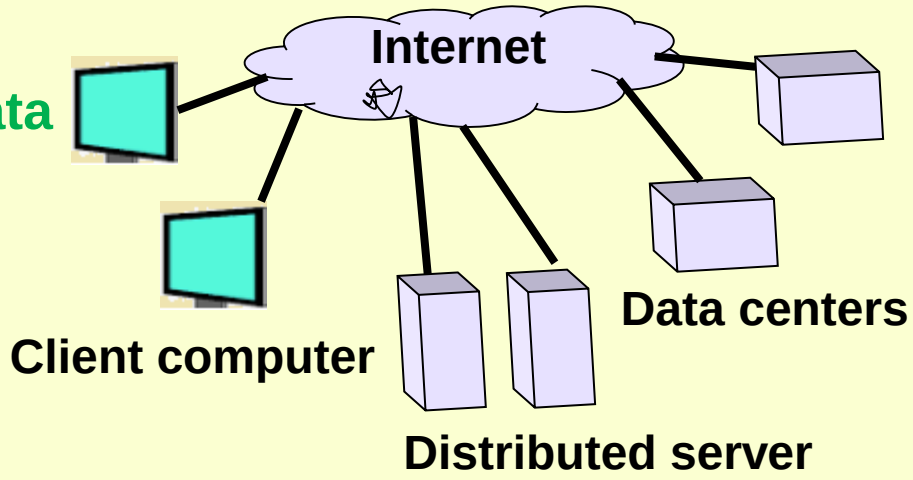
**History of Cloud Computing**

**The concept of cloud computing evolved in 1950(IBM) called RJE (Remote job entry process)**

**In 2006 amazon provided first public cloud AWS(Amazon web service)**

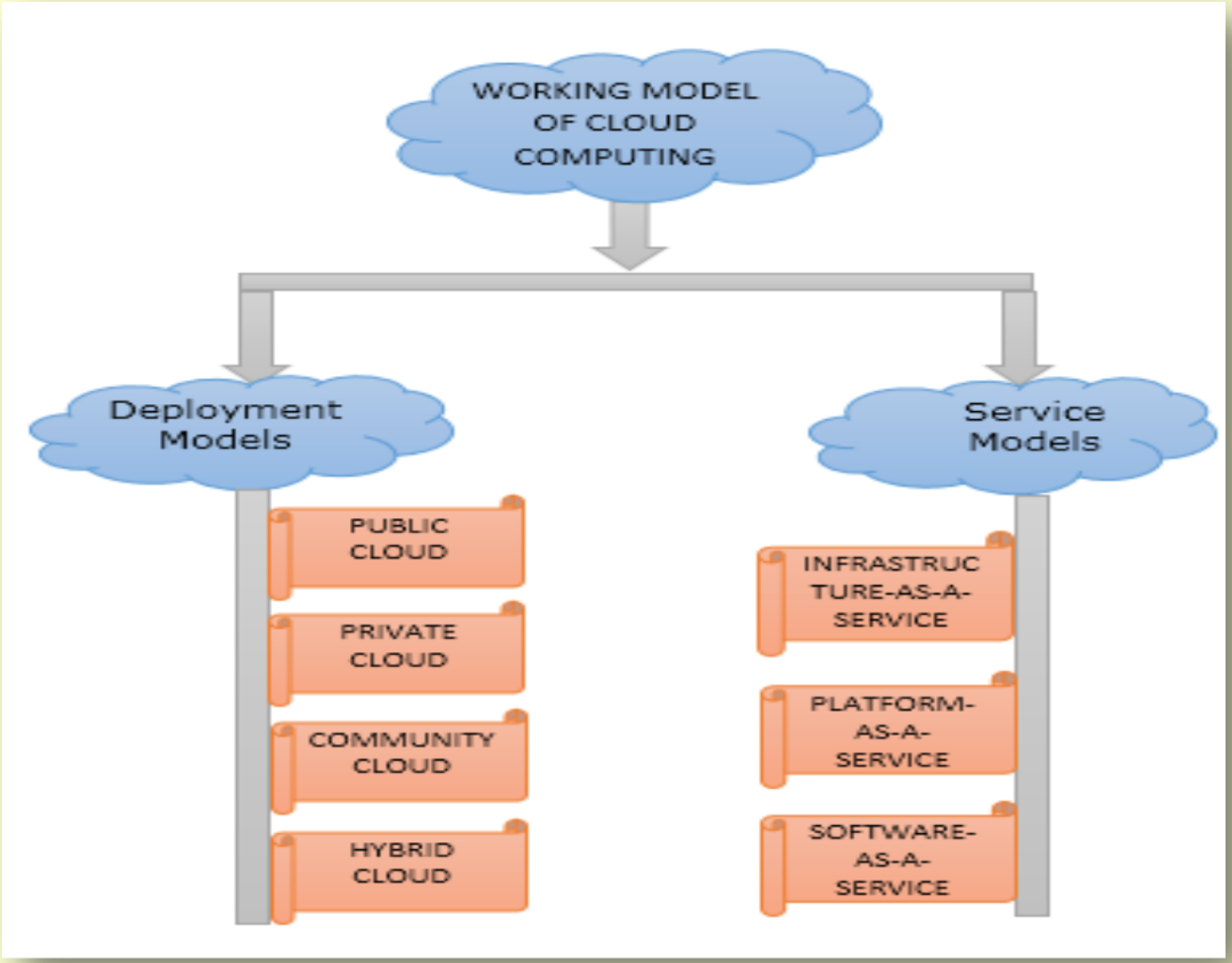
**Cloud components**

1. **Client – mobile, pc**
2. **Distributed servers - multiple servers to improve processing**
1. **Data centers – Collection of server where applications/data are stored**



# Cloud computing

## WORKING MODELS FOR CLOUD COMPUTING



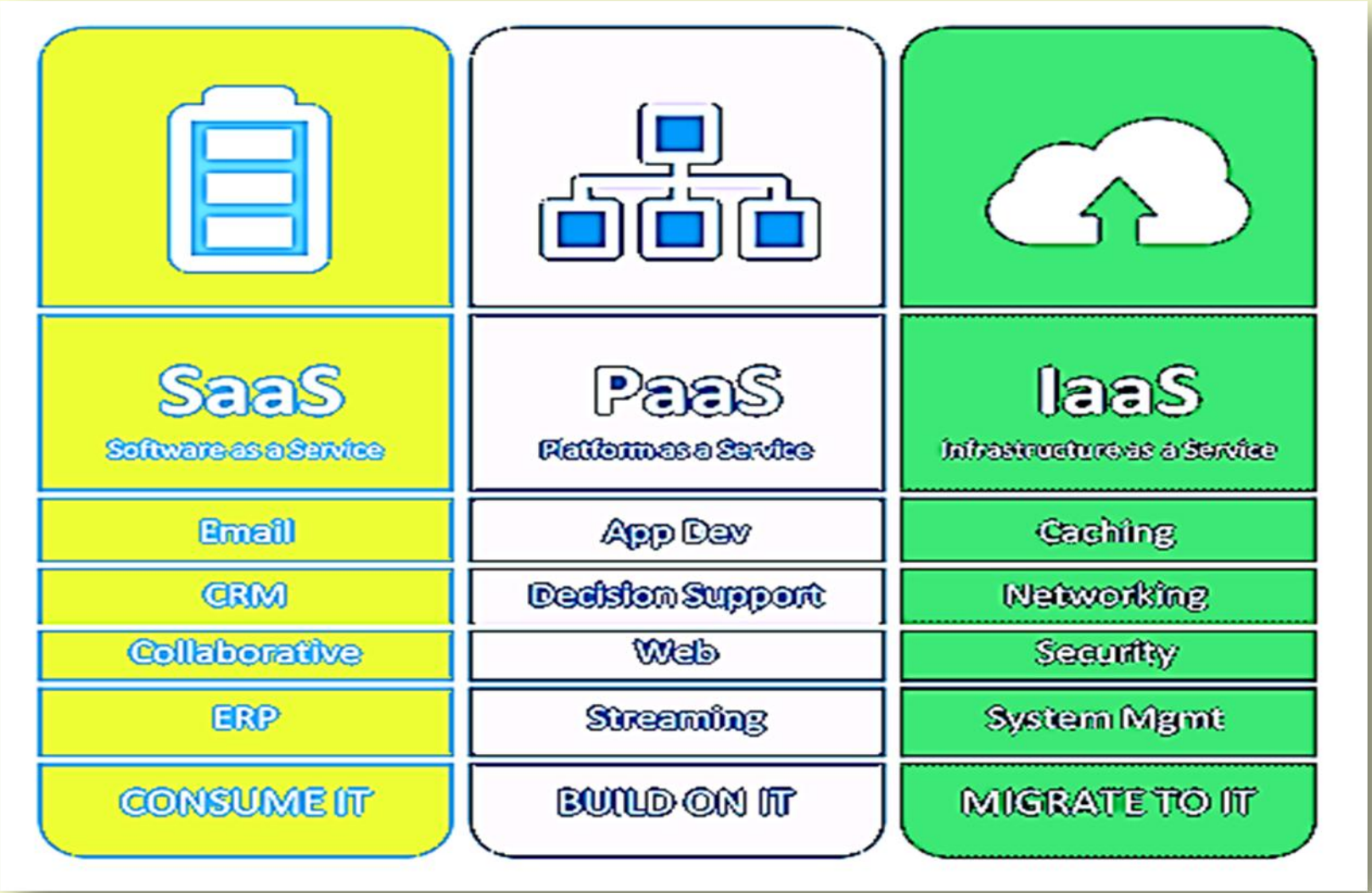
# Cloud computing

## DEPLOYMENT MODEL

- **PUBLIC CLOUD –**
  For general public.
- **PRIVATE CLOUD –**
  For an organization only
- **COMMUNITY CLOUD -**
  For group of organizations.
- **HYBRID CLOUD –**
  Mixture of public and private cloud

# Cloud computing

## WORKING MODELS FOR CLOUD COMPUTING



# Cloud Computing

## Private Cloud Storage

**It is a type of storage mechanism that stores an organization's data at in-house storage servers by cloud computing implementation.**

**It is not publicly accessible and is owned by a single organization and its authorized external partners.**

**Private cloud storage is also known as internal cloud storage.**

# Cloud Computing

## public cloud storage

It is also called storage-as-a-service, on-line storage or utility storage, is a service model for data storage on a pay-per-use basis.

It is often used for backing up data as disaster recovery plan (DRP) as well as archiving email and static non-core application data. It's Usage is generally charged on a dollar-per-gigabyte-per-month basis.

Provider public cloud is responsible for building and maintaining the storage infrastructure and its associated costs including power, cooling and server maintenance.

# Cloud Computing

| Features & Benefits | Private Cloud | Public Cloud |
|---|---|---|
| **Access and Storage** | Restricted access and Dedicated storage for one organization | Available to multiple organizations and Data stored on a shared infrastructure. |
| **Location Of The Data Center** | dedicated location on the service provider's infrastructure. | Location of the data center varies |
| **Investment** | Higher investment | Comparatively lower investment |
| **Security** | Superior security mechanism. | Offers a standard security protocol |
| **Customization** | Allow companies to customize their cloud | Offers a standard operating procedure for organizations |
| **Costs** | 1. Expensive | Less expensive |

# Cloud Computing

## Why cloud services are being popular?

- It reduces the complexity of networks
- No need to by software licenses
- Customization
- Scalable and reliable
- Information stored at cloud is not lost easily

## Application

- Email sites
- Social media/networking sites
- Search engines etc

# IOT

## Internet of Things-IOT

**The IOT concept was initially proposed by a member of the Radio Frequency Identification (RFID) development community in 1999, and now it has become more relevant to the practical world as the use of mobile devices, embedded devices,communication, cloud computing and data analytics has increased.**

**Internet connects all people means "Internet of People"**
**IoT connects all things means "Internet of Things"**

**Interconnection of Things/Objects/Machines, e.g., sensors, mobilephones, electronic devices, home appliances, any existing items and interact with each other via Internet.**

**Internet of Things technology can include any sensor, electronic devices or software which are connected to the internet and can be utilized remotely and can exchange data. Here devices works themselves without human intervention for the welfare of humans.**

# IOT

## MAJOR CHARACTERISTICS OF IOT

- Very Large Scale
- Heterogeneity
- Pervasivity - Computing and Communication technologies embedded in our environments

# IOT

## How Does the Internet of Things Work?

**The Internet of Things is an aggregation of internet enabled sensors, smart devices and software that can be manipulated by scripts, applications and user interfaces across long distances.**

**Applications of IOT**

- **Smart house - Suppose we are not at home and doubts starts in our mind. Did I turn the coffee maker off? Did I set the security alarm? etc.**
  **With a smart home,we can quiet all of these worries with a quick glance at smartphone/tablet. we can connect the devices and appliances in our home so they can communicate with each other and with us and can work with the commands given over smartphone remotely.**

- **Smart car - the driverless car (now a prototype) where taxis work based on AI and take the passengers safely and accurately to the desired destination.**

# IOT

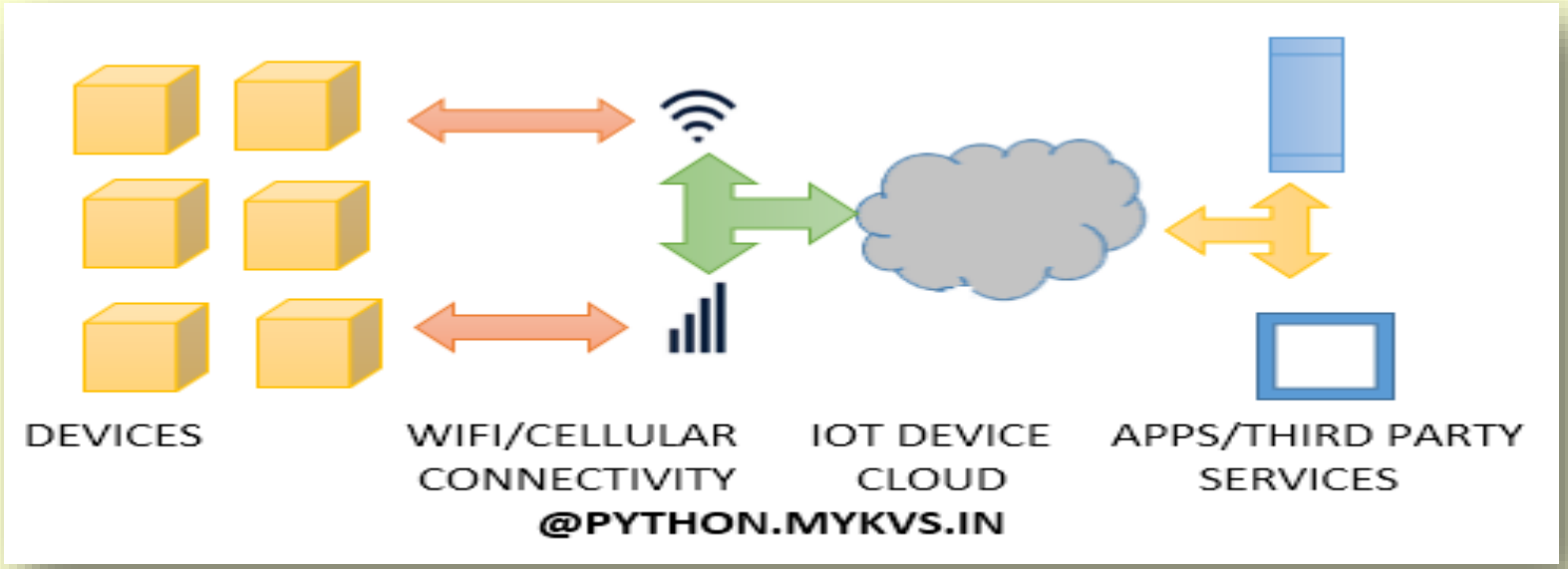
**Applications of IOT**

- **Elderly care-** Patient surveillance can be life-saving; automatically detecting when someone falls down or when they begin to experience a heart attack so that emergency care can be sent immediately.
- **Disaster warning-** Sensors can collect critical information about the environment, allowing for early detection of environmental disasters like earthquakes, tsunamis, etc., thus saving lives.
- **Delivery Drones –** drones being used to deliver item with the help of smart grid/geospatial data.
- **Smart Toothbrushes -** The smart toothbrushes allow users to visualize the inside of their mouths via mobile app. Users are able to see which areas of their mouth require brushing and can even keep a daily log of their brushing habits.

Many more things are there/under development as under IOT

# IOT

## What is an IoT Platform?




**It is an integrated service which offers the things to bring physical objects online. It easily allow to configure devices for machine-to-machine communication through millions of devices connects simultaneously .**

# IOT

## IoT Platform Types

- **End-to-end IoT Platforms** - provide the hardware, software, connectivity, security, and device management tools to handle connection of millions of concurrent device.
- **Connectivity Management Platforms –** It offer low power and low cost connectivity management solutions through Wi-Fi and cellular technologies.
- **IoT Cloud Platforms –** It's aim to get rid of the complexity of building our own complex network
- **Data Platform –** It deals with data in some way with the tools we need to route device data and manage / visualize data analytics.

# wired and wireless networks

**Wired Networks** - It is also known as Ethernet networks, that is most common type of LAN technology. A wired network is simply a collection of two or more computers, printers, and other devices linked by Ethernet cables/ any form of wired media. Ethernet is the fastest wired network protocol, with connection speeds of 10 megabits per second (Mbps) to 100 Mbps or higher. Computer must have an Ethernet adapter (sometimes called a network interface card, or NIC) to connect with wire. Most of the network topology uses wired networks

| Cable | Twisted pair | Coaxial cable | Fiber optic |
|---|---|---|---|
| Signal form | electricity | electricity | Light |
| cost | least | moderate | High |
| speed | low | moderate | High |
| Ease of use | Easy to install | Professional installation | Professional installation |
| reliability | low | moderate | High |
| Real life application | Telephone network | Tv cable | Data transmission & telephone line |
| Data transmission rate | 10Mbps – bps | 100Mbps | >100Gbps |
| Data transfer range | 100m | 185m - 500m | - |
| image |  |  |  |

# wired and wireless networks

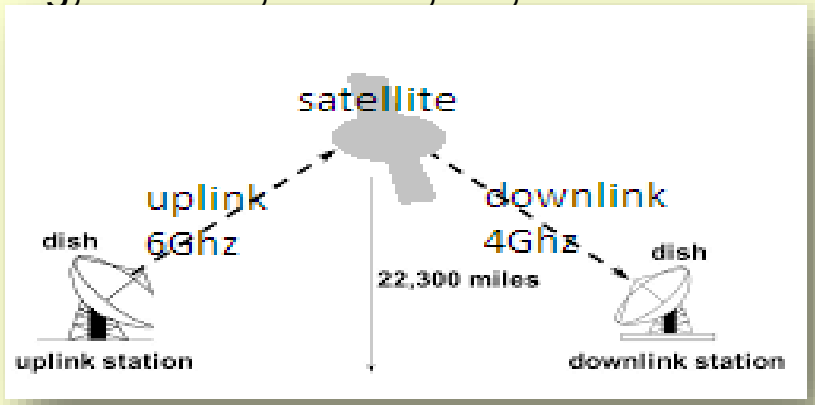
**Wireless Networks – It uses high-frequency radio waves rather than wires to communicate. Wireless allows for devices to be shared without networking cable which increases mobility but decreases range. There are two main types of wireless networking; peer to peer or ad-hoc and infrastructure.**

**An peer-to-peer wireless network consists of a number of computers each equipped with a wireless networking interface card. Each computer can communicate directly with all of the other wireless enabled computers. They can share files and printers this way, but may not be able to access wired LAN resources, unless one of the computers acts as a bridge to the wired LAN using special software. An infrastructure wireless network consists of an access point or a base station. Access point acts like a hub, providing connectivity for the wireless computers. There are four basic types of transmissions standards for wireless networking, produced by the Institute of Electrical and Electronic Engineers (IEEE). These standards define all aspects of radio frequency wireless networking. They have established four transmission standards; 802.11, 802.11a, 802.11b, 802.11g. 802.11 and 802.11b are the slowest at 1 or 2 Mbps and 5.5 and 11Mbps respectively. They both operate off of the 2.4 GHz radio frequency. 802.11a operates off of a 5 GHz frequency and can transmit up to 54 Mbps and the 802.11g operates off of the 2.4 GHz frequency and can transmit up to 54 Mbps**

# wired and wireless networks

**Satellite Communication**

It provide worldwide coverage independent to population density.Satellite ommunication Systems offer telecommunication (Satellite Phones), positioning and navigation (GPS), broadcasting, internet, Mobile, TV, etc.




**Microwave radio**, a form of radio transmission that use. Ultra-high frequencies. It is a point-to-point, rather than a broadcast, transmission system. Additionally, each antenna must be within line of sight of the next antenna. Frequency Bands Maximum Antenna Separation Analog/Digital 4-6 GHz 32-48 km Analog 10-12 GHz 16-24 km Digital 18-23 GHz 8-11 km Digital.

**Bluetooth**

It provides data, voice and audio transmission with a transmission range of 10 meters. Almost all mobile phones, tablets and laptops are equipped with Bluetooth devices. They can be connected to wireless Bluetooth receivers.

# wired and wireless networks

**Wireless Local Area Network (WLAN)**

WLAN (Wi-Fi) is an internet related wireless service. Using WLAN, different devices like laptops and mobile phones can connect to an access point and access internet.

**WiMAX(Worldwide Interoperability for Microwave Access)** - is a telecommunications protocol for mobile Internet access. The protocol is based on IEEE 802.16 Standard.

WiMAX's range is measured in kilometers, while Wi-Fi is measured in meters and local in nature. Wi-Fi uses an unlicensed spectrum, while WiMAX's spectrum could be licensed or unlicensed.

**Infrared Communication**

Infrared Communication is another commonly used wireless communication in our daily lives. It uses the infrared waves of the Electromagnetic (EM) spectrum. Infrared (IR) Communication is used in remote controls of Televisions, cars, audio equipment etc.

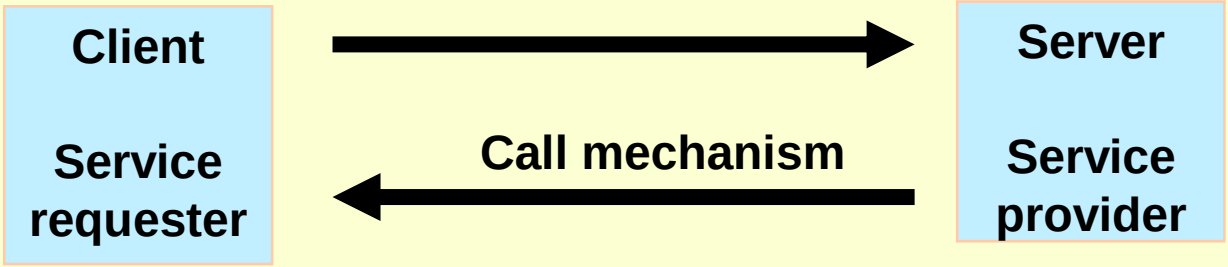
**Zigbee** is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs

# wired vs wireless networks

| Specifications | Wired network | Wireless network |
|---|---|---|
| **Speed of operation** | Higher | lower compare to wired networks, |
| **System Bandwidth** | High | Low |
| **Cost** | Less as cables are not expensive | More costly wireless routers/access points/ adapters are expensive |
| **Installation** | Hard to install,requires more time | easy installation and need less time |
| **Mobility** | Limited | Not limited |
| **Transmission medium** | copper wires, optical fiber cables, ethernet | radiowaves or EM waves or or infrared |
| **extension** | requires hubs and switches | More area is covered by wireless base stations which are connected to one another. |
| **Applications** | LAN (Ethernet), MAN | WLAN, WPAN(Zigbee, bluetooth), Infrared, Cellular(GSM,CDMA, LTE) |
| **Interference** | Less Interference | Interference is |
| **Quality of Service** | Better | Poor due |
| **Reliability** | High compare to wireless counterpart, as manufactured cables have higher performance due to existence of wired technology since years. | Reasonably high, This is due to failure of router will affect the entire network. |

# concept of a client and server

In client/server architecture a client is a consumer of services, and a server is service provider. Thus the term 'client' means 'service requester', and server means 'service provider'.




Web technologies and protocols built around the client-server model are:

- Hypertext Transfer Protocol (HTTP)
- Domain Name System (DNS)
- Simple Mail Transfer Protocol (SMTP)
- Telnet