Introduction to Networks

Table of Contents

Table of Contents

Importance of Networking

- Global IT
  - Security
  - Performance
- Important for all streams
  - Full Stack
  - AWS&DevOps
  - Data Science
  - Cyber Security
- Understand and Analyze, if not design

1 What's a Network?

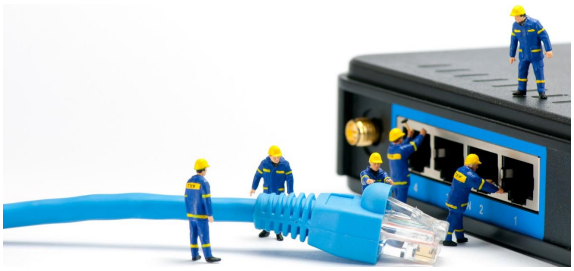
What's a Network?

A **network** is two or more computer systems linked together by some form of the transmission medium that enables them to share information

What's a Network?

Provides services like:

- Access to shared files/folders
- Access to printers/scanners
- Email applications
- Database applications
- Web applications
- Voice over IP (VoIP)
- Multimedia conferencing



What's a Network?

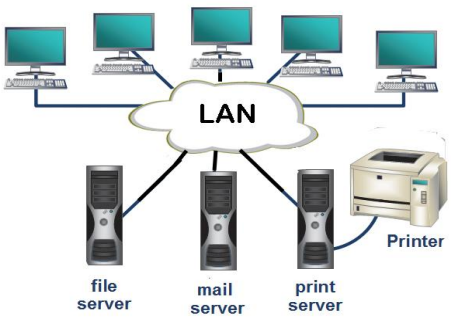
Features of Computer Network

- **Performance** → Response time, Throughput
- **Data Sharing**
- **Backup**
- **Reliability** → No failures!
- **Security** → Keep data safe!
- **Scalability** → New systems can be added
- **Software and hardware compatibility**

2 Local Area Network (LAN)

Local Area Network (LAN)

A LAN is a **local** network



- Could be as small as two computers or large, with thousands of devices connected
- Usually restricted to spanning a particular geographic location

A network in company having a single building is considered a LAN

A network for company that has multiple buildings in the same area is considered a LAN

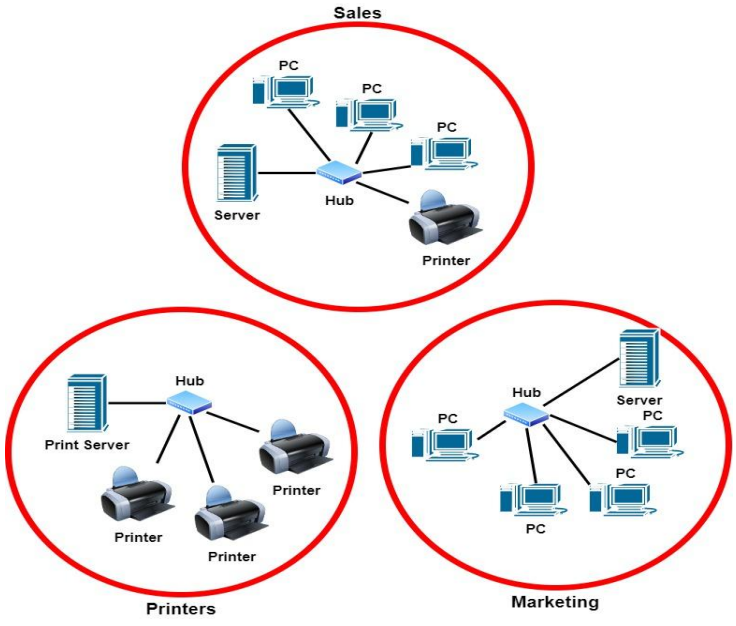
Local Area Network (LAN)

LAN's size and the distance a LAN can span is not restricted

But it's best to split a big LAN into smaller logical zones to make administration easier

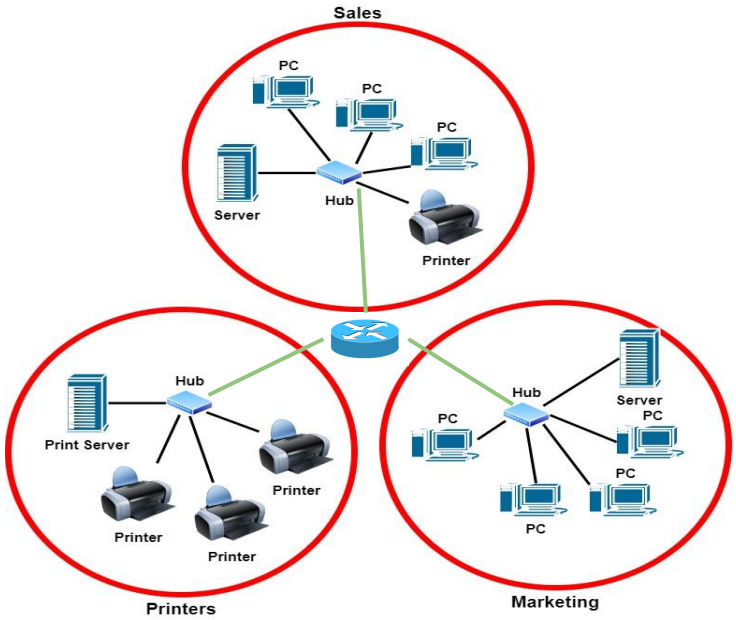
Local Area Network (LAN)

3 LANs, each has its own workgroup



Local Area Network (LAN)

A LAN with 3 workgroups



3

Common Network Components

Common Network Components

- **Node** → - A point or joint where a connection takes place
  - Can be a computer or device
- **Station** → A node on a wireless network

- PC	- Printer
- Laptop	- Router
- Server	- Switch
- Smartphone	- etc.

Some examples of Node

Common Network Components

- **Host** → - Requires IP Address
  - Can be a client or server
- **Workstation** → - Powerful computer designed for technical or scientific applications
  - Used by one person at a time

Common Network Components

- **Server** → A powerful computer used to store files and run programs centrally
- **Client** → A device that makes request from a server

- Web Server	- Application Server
- Proxy Server	- DNS Server
- Mail Server	- File Server
- Print Server	- Telephony Server

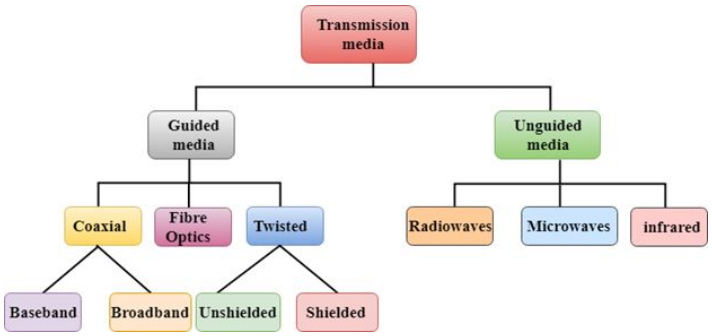
Common types of servers

Common Network Components

- **Segment** →
  - Refers to a specific physical region of a network
  - Typical usage is to describe the link between a computer and a switch
  - Another usage is to refer to a region of the network where all the nodes use the same type of transmission media
- **Backbone** → A fast link between other segments of a network

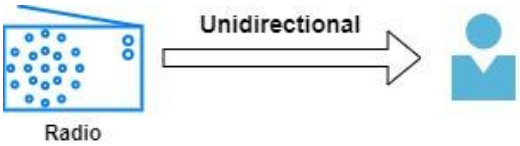
Common Network Components

- **Transmission Media** → - A communication channel between **nodes** that carries the information from the sender to the receiver
  - Data is transmitted through the electromagnetic signals

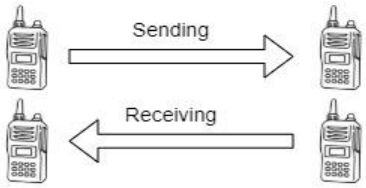


Cable Properties

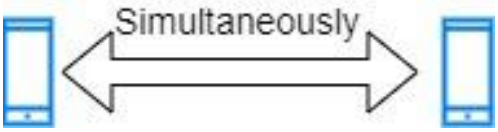
Simplex



Half-duplex



Full-duplex



CLARUSWAY
WAY TO REINVENT YOURSELF

Break
return @ 8pm

4

Wide Area Network (WAN)

Wide Area Network (WAN)

A **WAN** is a collection of computers and devices connected by a communications network over a wide geographic area

WANs are commonly connected either through the Internet or special arrangements made with phone companies or other service providers

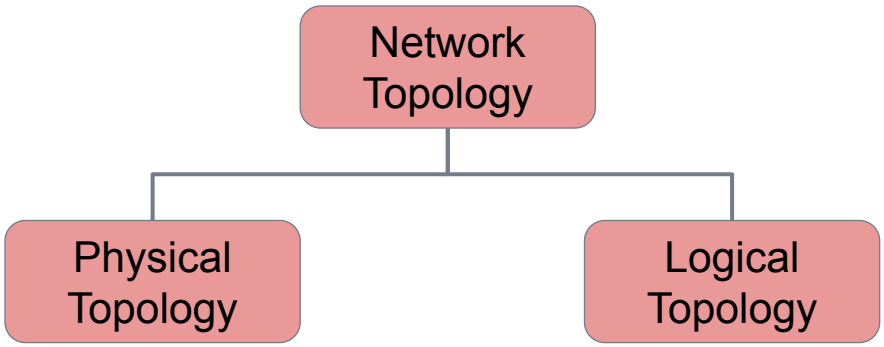
The **Internet** is considered the **largest WAN** in the world

5

Network Topology

Network Topology

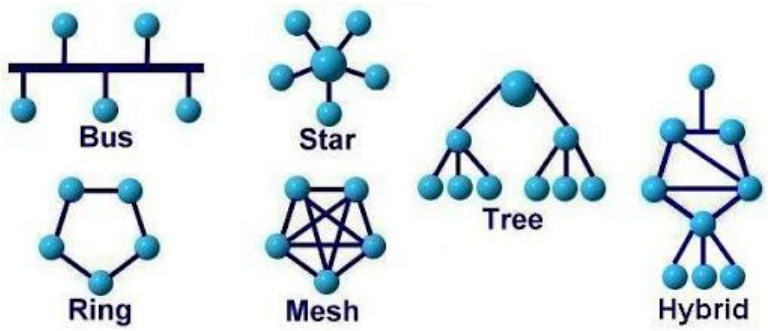
Network topology is the description of the arrangement of **nodes** and **connections** in a network



Network Topology

A **physical topology** details how devices are physically connected

Depends on:
- Capabilities of devices
- Desired fault tolerance
- Cost



Network Topology

Logical topology describes the way in which a network transmits information from network/computer to another

It's not the way the network looks or how it is laid out

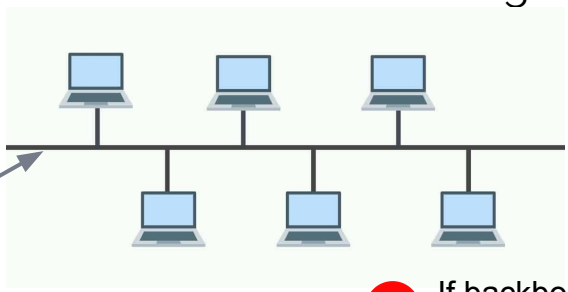
6 Physical Network Topologies

Bus Topology
Ring Topology
Tree Topology
Star Topology
Mesh Topology
Hybrid Topology

Physical Network Topologies

Bus Topology:

Every node is connected in series along a linear path

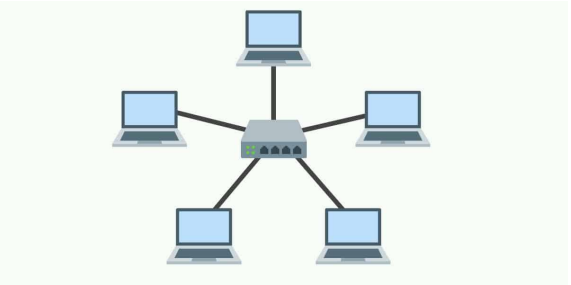


- ✓ Keeps the layout simple
- ✓ Cost effective
- ✗ If backbone fails entire network goes down
- ✗ Decreased network performance
- ✗ Not scalable

Physical Network Topologies

Star Topology:

Every node in the network is connected to one central switch

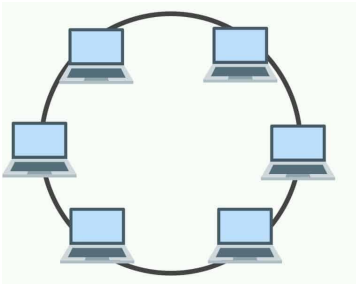


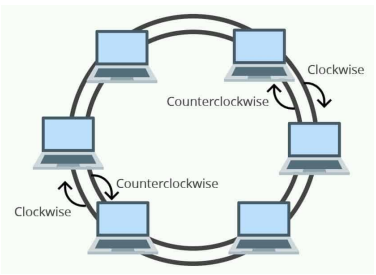
- ✓ Easy to manage
- ✓ Requires fewer cables
- ✗ If central switch fails entire network goes down
- ✗ Performance is up to central switch

Physical Network Topologies

Ring Topology:

Every node is connected to each other in a circular format.





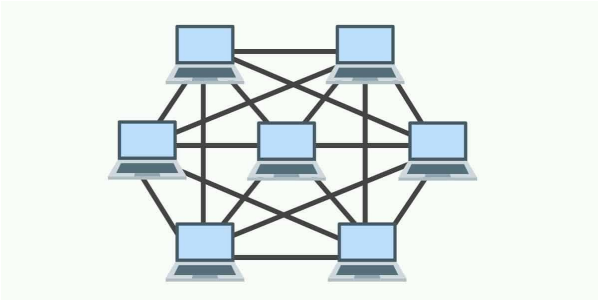
- Low risk of packet collision
- Easy to install

- Vulnerable to failure
- The more devices added the more communication delay
- To make changes the network should be shut down

Physical Network Topologies

Mesh Topology:

A point-to-point connection where nodes are interconnected



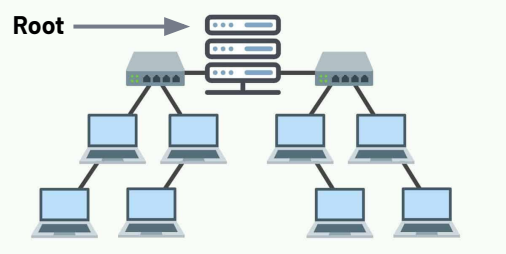
- Reliable

- Configuration is complex
- Expensive

Physical Network Topologies

Tree (Hierarchy) Topology:

A network structure that is shaped like a tree with its many branches

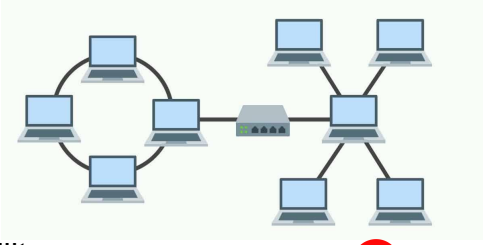


- ✓ Scalable
- ✓ Manageable
- ✗ Hard to maintain
- ✗ If root fails entire network goes down

Physical Network Topologies

Hybrid Topology:

A combination of two or more types of physical or logical network topologies working together within the same network



- ✓ Flexibility
- ✗ Quite complex
- ✗ Can be quite costly