Topologies

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}
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What is Network Topology

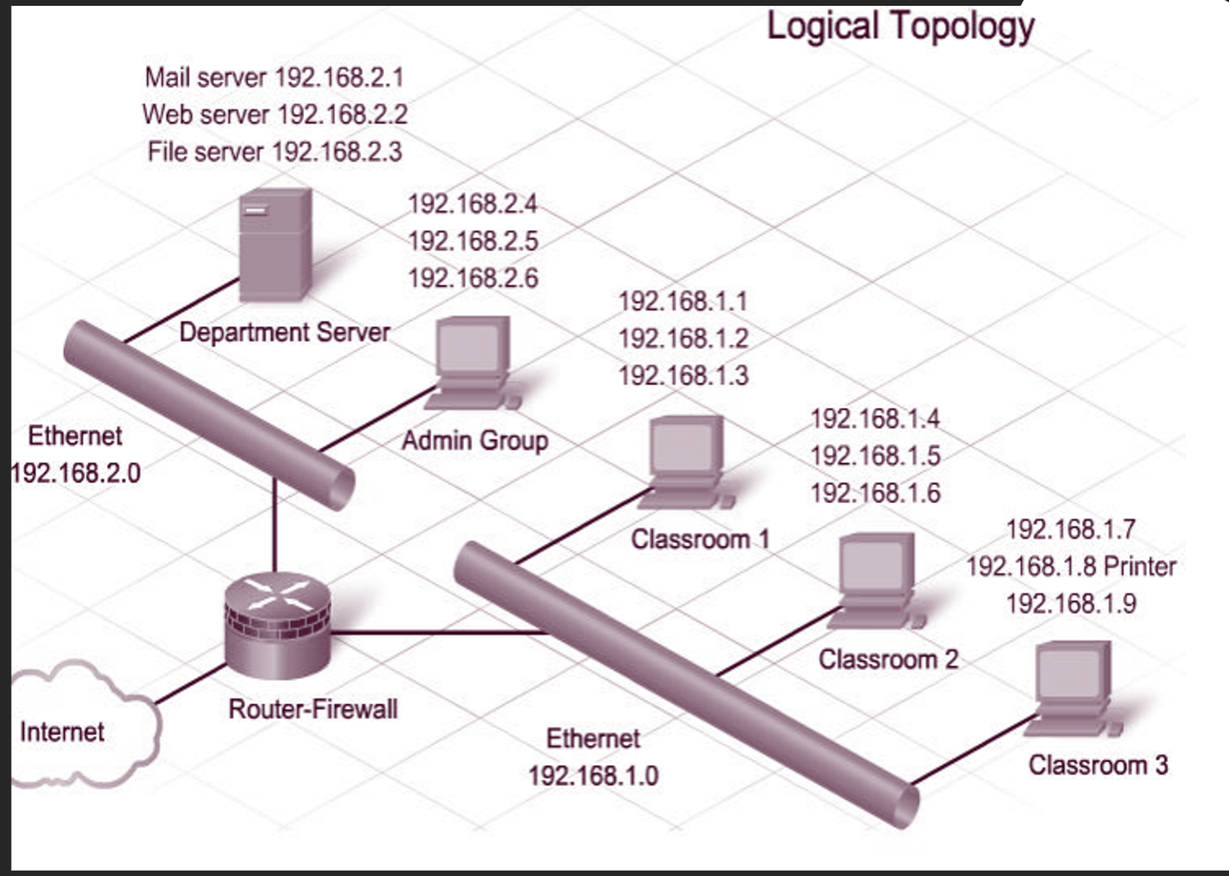
- Network topology is the **description** of the arrangement of nodes (e.g. networking switches and routers) and connections in a network.

- Network topologies outline how devices are connected together and how data is transmitted from one node to another.

- The configuration, or topology, of a network is key to determining its performance. Network topology is the way a network is arranged, including the **physical** or **logical** description of how links and nodes are set up to relate to each other.

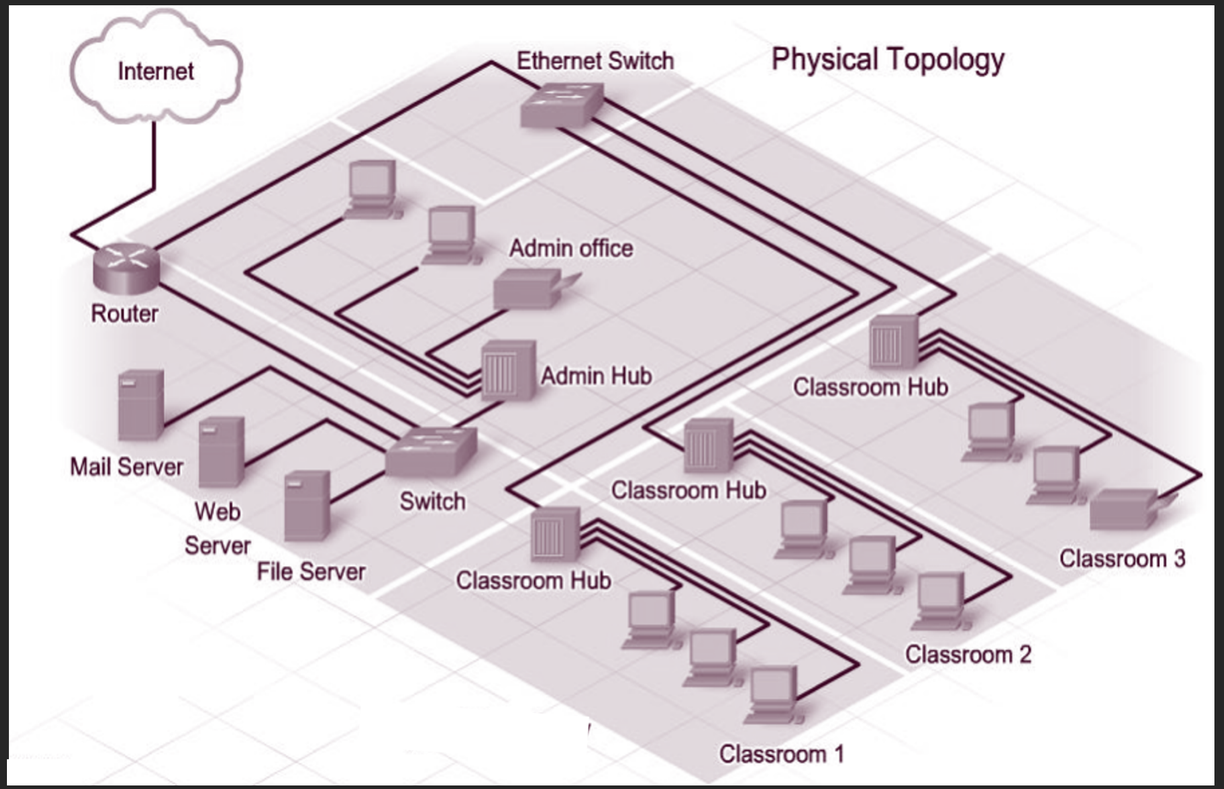
Logical Network Topology

- Logical network topology is a higher-level idea of how the network is set up, including which nodes connect to each other and in which ways, as well as how data is transmitted through the network.
- Logical network topology includes any virtual and cloud resources.
- A logical network topology is a conceptual representation of how devices operate at particular layers of abstraction.



Physical Network Topology

- The physical network topology refers to the actual connections (wires, cables, etc.) of how the network is arranged.
- Setup, maintenance, and provisioning tasks require insight into the physical network.
- A physical topology details how devices are physically connected



Types of Network Topology

- Building a local area network (LAN) topology can be make-or-break for your business, as you want to set up a resilient, secure, and easy-to-maintain topology.

- A network topology map is a map that allows an administrator to see the physical network layout of connected devices

- There are many different types of **basic** network topologies that networks are built on today and in the past:

  - Bus
  - Ring
  - Star
  - Tree
  - Mesh
  - Hybrid

Bus Topology

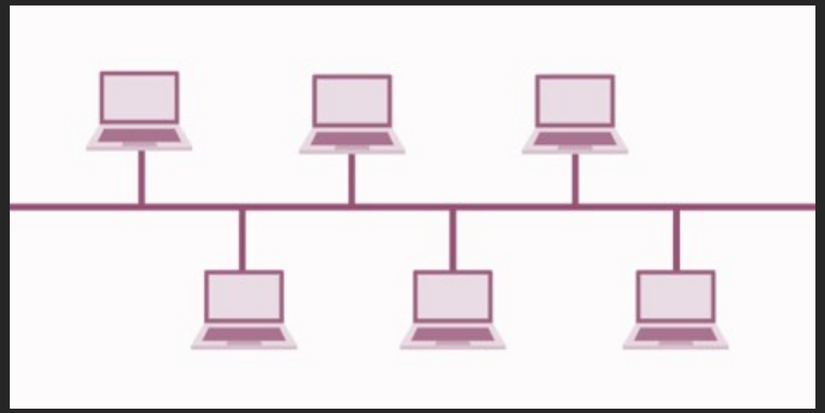
Bus topology is a network type where every device is connected to a single cable that runs from one end of the network to the other. This type of network topology is often referred to as line topology.

Advantages

- Simple layout, single cable, cost effective

Disadvantages

- Single point of failure, cost lot of time to fix as whole cable needs replacing, high network traffic would decrease network performance.



Half-duplex -> data can only be transmitted one way at a time

Ring Topology

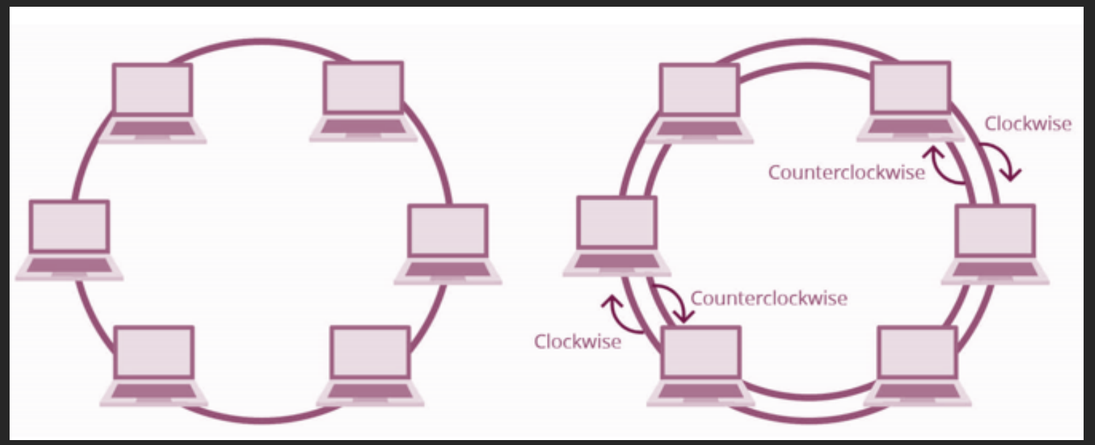
In networks with **ring** topology, computers are connected to each other in a circular format. Every device in the network will have **two** neighbours and no more or no less. Was used more often in the past than present day.

Advantages

- the risk of packet collisions is very low due to the use of **token-based protocols**, which only allow one station to transmit data at a given time, data can move through network nodes at high speeds

Disadvantages

- failure of one node can take the entire network out of operation, raised scalability concerns (more devices longer to transmit)



half-duplex but can also be made full-duplex (Dual Ring Topology)

Star Topology

A star topology is a topology where every node in the network is connected to one central **switch**. The relationship between these elements is that the central network hub is a **server** and other devices are treated as **clients**

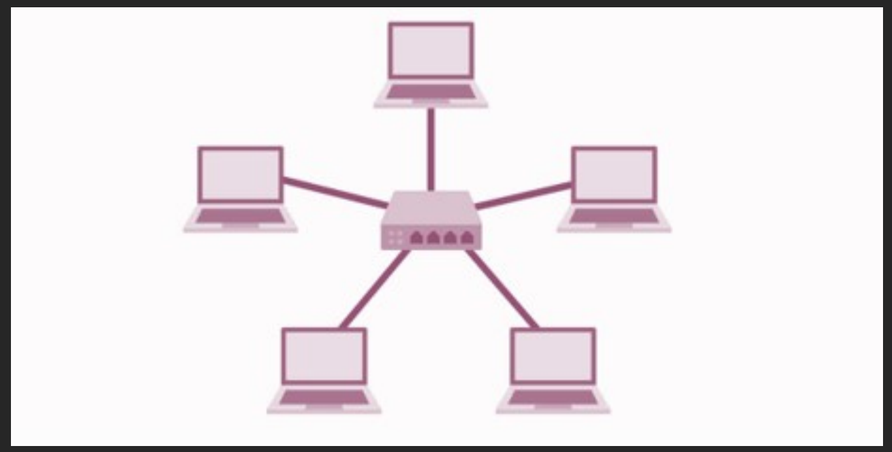
The devices are usually configured in **primary-secondary** relationship.

Advantages

- can manage the entire network from one location, can add new computers without having to take the network offline, simple to set up and manage

Disadvantages

- if the central switch goes down then the entire network will go down, performance of the network is also tied to the central node’s configurations and performance



Tree Topology

A tree topology network is a structure that is shaped like a tree with its many **branches**, they have a **root node** that is connected to another node hierarchy, **parent-child**. Tree topology needs to have **three levels** to the hierarchy to be classified this way, and this form is used withing **WANs.**

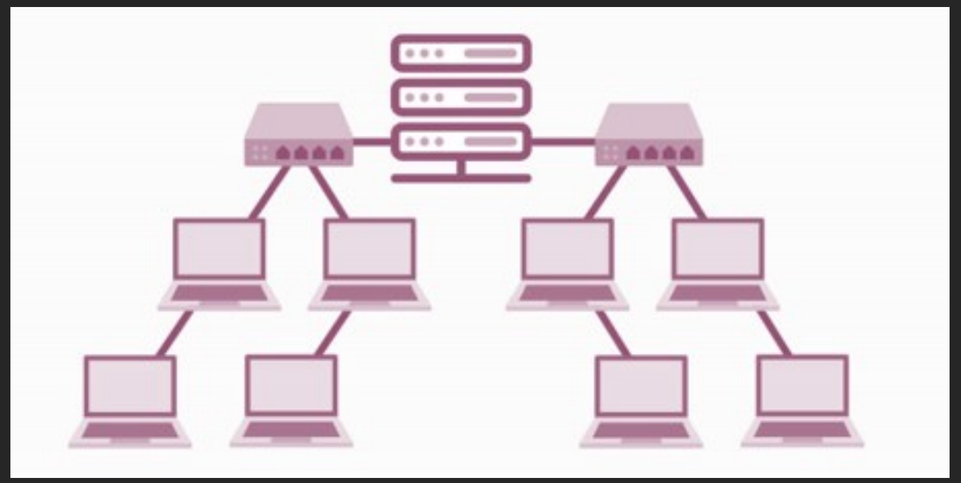
The devices are usually configured in **primary-secondary** relationship.

Advantages

- used is to extend bus and star topologies, room for growth, systematically search for issues throughout each branch of the tree.

Disadvantages

- If the root node fails then all of its subtrees become partitioned, he more nodes you add, the more difficult it becomes to manage, more cables, more complex



Mesh Topology

A mesh topology is a **point-to-point** connection where nodes are interconnected. In this form of topology, data is transmitted via two methods: **routing** and **flooding**.

Routing is the shortest path, and **flooding** is data is sent to everyone, ergo no routing logic.

Partial Mesh, most nodes are interconnected but there are a few that may have extra two or three connected nodes.

Full Mesh, every node is connected to every node

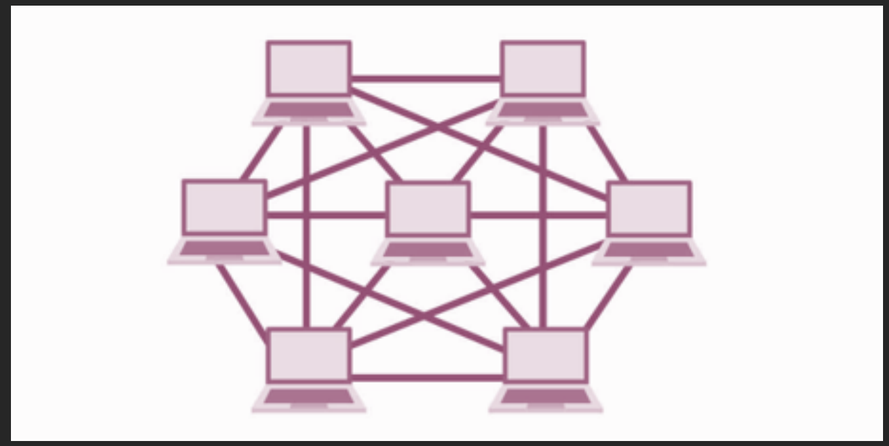
Links required per node $N-1$ & Links for fully connected network $L_N = \frac{N(N-1)}{2}$

Advantages

- Extremely resistant to failure due to the amount of possible paths, no single point of failure

Disadvantages

- Requires an immense amount of time to configure, lots of wiring, costly



Hybrid topology

Composed of two or more different topologies and are most-commonly encountered in larger enterprises. A mixed bag of capabilities and vulnerabilities.

Advantages

- Flexible, incorporate multiple typologies, very scalable

Disadvantages

- Complex, each sub typology is managed independently of the whole, can be costly to set up, tough job to manage