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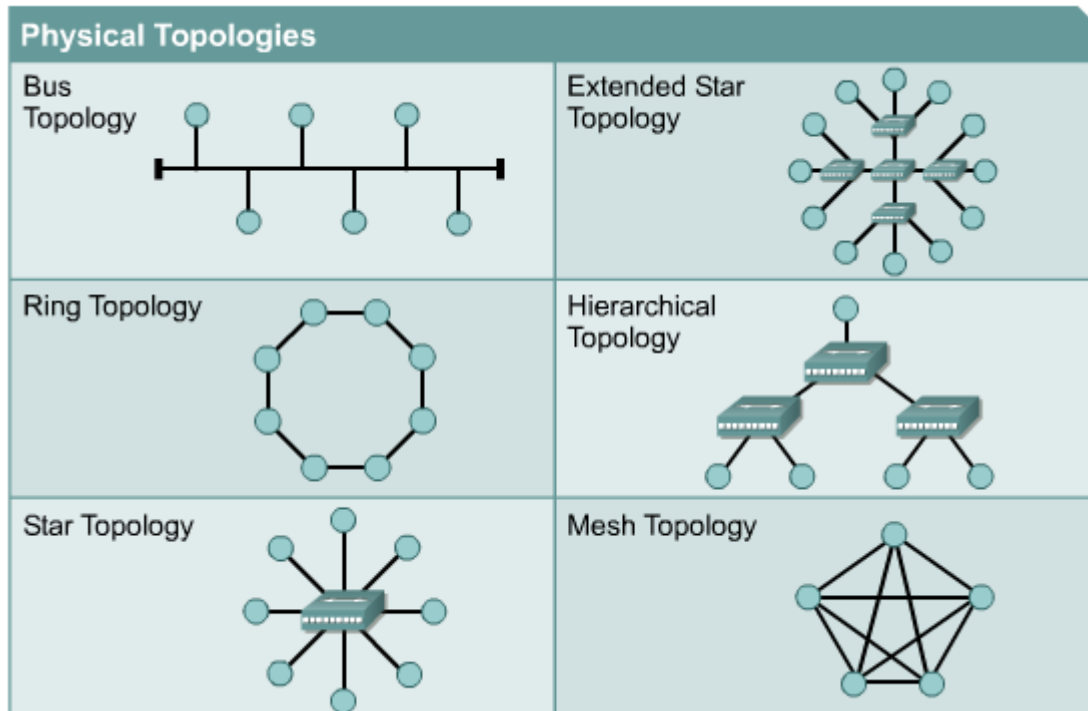
CLASS NOTES

Computer Networks

Network Topology

Network topology defines the structure of the network. One part of the topology definition is the physical topology, which is the actual layout of the wire or media. The other part is the logical topology, which defines how the media is accessed by the hosts for sending data.

Physical Topology:



Logical Topology

A logical topology is a concept in networking that defines the architecture of the communication mechanism for all nodes in a network. Using network equipment such as routers and switches, the logical topology of a network can be dynamically maintained and reconfigured.

Physical vs. Logical Topology:

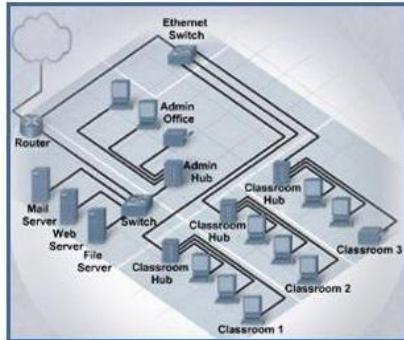


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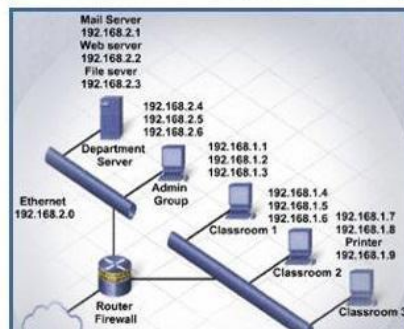
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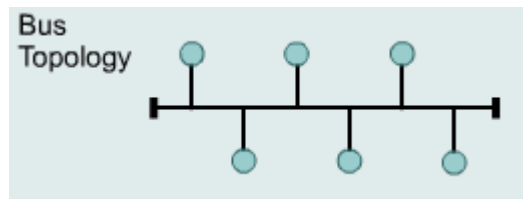
Physical topology is the physical layout of the components on the network.



Logical topology determines how the hosts access the medium to communicate across the network.

Bus Topology

A bus topology uses a single backbone cable that is terminated at both ends. All the hosts connect directly to this backbone.



Advantages:

- ☐ It is the easiest network topology for connecting peripherals or computers in a linear fashion.
- ☐ It works very efficiently well when there is a small network.
- ☐ The length of cable required is less than a star topology.
- ☐ It is easy to connect or remove devices in this network without affecting any other device.
- ☐ Very cost-effective as compared to other network topology i.e. mesh and star
- ☐ It is easy to understand topology.
- ☐ Easy to expand by joining the two cables together.

Disadvantages:

- ✓ Bus topology is not great for large networks.
- ✓ Identification of problems becomes difficult if the whole network goes down.
- ✓ Troubleshooting individual device issues is very hard.
- ✓ Need terminators are required at both ends of the main cable.



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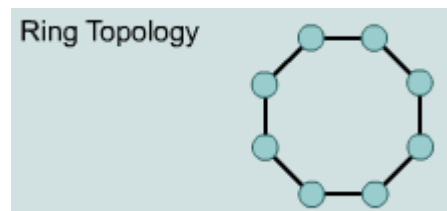
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- ✓ Additional devices slow the network down.
- ✓ If the main cable is damaged, the whole network fails or splits into two.
- ✓ Packet loss is high.
- ✓ This network topology is very slow as compared to other topologies.

Ring Topology

A ring topology connects one host to the next and the last host to the first. This creates a physical ring of cable.



Advantage:

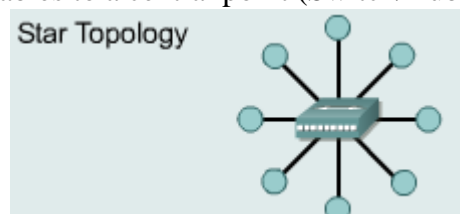
- In this data flows in one direction which reduces the chance of packet collisions.
- In this topology additional workstations can be added after without impacting performance of the network.
- Equal access to the resources.
- There is no need of server to control the connectivity among the nodes in the topology.
- It is cheap to install and expand.
- Minimum collision.
- Speed to transfer the data is very high in this type of topology.

Disadvantage:

- Due to the Uni-directional Ring, a data packet (token) must have to pass through all the nodes.
- If one workstation shuts down, it affects whole network or if a node goes down entire network goes down.
- It is slower in performance as compared to the bus topology
- It is Expensive.
- Addition and removal of any node during a network is difficult and may cause issue in network activity.
- Difficult to troubleshoot the ring.

Star Topology

A star topology connects all cables to a central point (Switch/Hub) of concentration.





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Advantage:

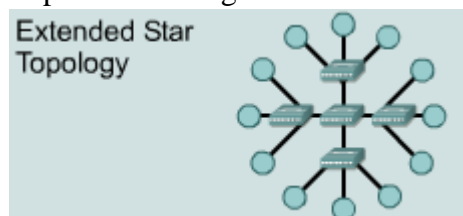
- ☐ It is very reliable – if one cable or device fails then all the others will still work
- ☐ It is high-performing as no data collisions can occur
- ☐ Less expensive because each device only need one I/O port and wishes to be connected with hub with one link.
- ☐ Easier to put in
- ☐ Robust in nature
- ☐ Easy fault detection because the link are often easily identified.
- ☐ No disruptions to the network when connecting or removing devices.
- ☐ Each device requires just one port i.e. to attach to the hub.
- ☐ If N devices are connected to every other in star, then the amount of cables required to attach them is N.

Disadvantage:

- ✓ Requires more cable than a linear bus.
- ✓ If the connecting network device (network switch) fails, nodes attached are disabled and can't participate in network communication.
- ✓ More expensive than linear bus topology due to the value of the connecting devices (network switches)
- ✓ If hub goes down everything goes down, none of the devices can work without hub.
- ✓ Hub requires more resources and regular maintenance because it's the central system of star.
- ✓ Extra hardware is required (hubs or switches) which adds to cost.
- ✓ Performance is predicated on the one concentrator i.e. hub.

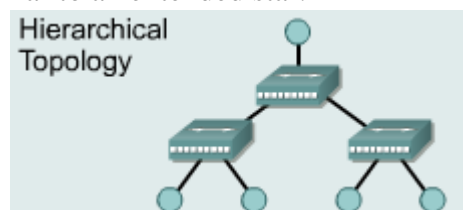
Extended Star Topology

An extended star topology links individual stars together by connecting the hubs and/or switches. This topology can extend the scope and coverage of the network.



Hierarchical Topology

A hierarchical topology is similar to an extended star.





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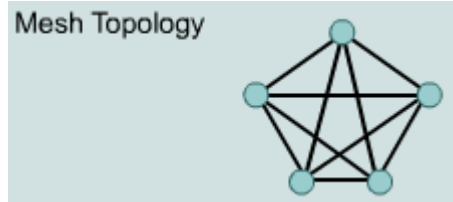
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Mesh Topology

A mesh topology is implemented to provide as much protection as possible from interruption of service. Each host has its own connections to all other hosts. Although the Internet has multiple paths to any one location, it does not adopt the full mesh topology.



Advantage:

- Failure during a single device won't break the network.
- There is no traffic problem as there is a dedicated point to point links for every computer.
- Fault identification is straightforward.
- This topology provides multiple paths to succeed in the destination and tons of redundancy.
- It provides high privacy and security.
- Data transmission is more consistent because failure doesn't disrupt its processes.
- Adding new devices won't disrupt data transmissions.
- This topology has robust features to beat any situation.
- A mesh doesn't have a centralized authority.

Disadvantage:

- It's costly as compared to the opposite network topologies i.e. star, bus, point to point topology.
- Installation is extremely difficult in the mesh.
- Power requirement is higher as all the nodes will need to remain active all the time and share the load.
- Complex process.
- The cost to implement mesh is above other selections.
- There is a high risk of redundant connections.
- Each node requires a further utility cost to think about.
- Maintenance needs are challenging with a mesh.