Libyan International Medical University

الجامعة الليبية الدولية للعلوم الطبية

NETWORK TOPOLOGY

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Most of the information were provided from CompTIA: Network+ N10-006, By Todd Lammle

Objectives

1. Define Network Topology.

2. Mention the types of network topology. And talk about the characteristics, advantages and disadvantages of each type of the network topology.

Define Network Topology.

The physical layout of a network is called a topology. It provides a solution to the problem that occurs when two computers try to access the LAN at the same time.
First, we have to distinguish between a physical topology and a logical topology. The actual traffic flow determines the *logical topology*, while the way components are physically interconnected determines the *physical topology*. {Page: 9}

Introductory, Computers. By Catherine LaBerta, Chapter 7: Page 319.

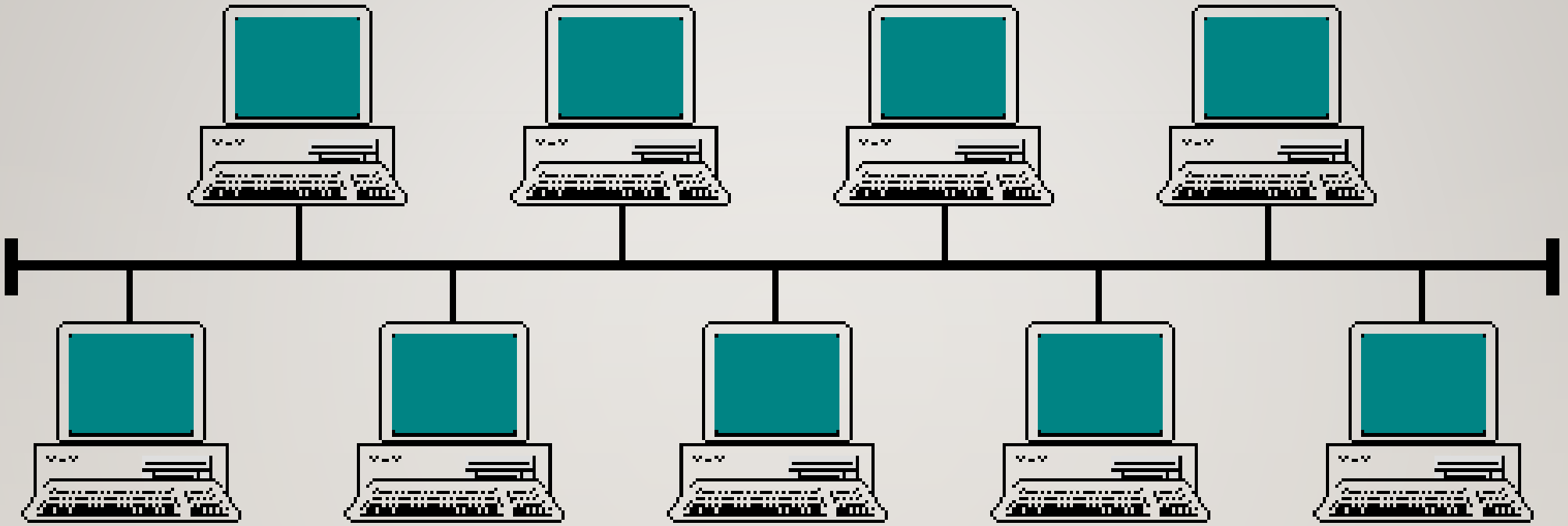
2. Mention the types of network topology. And talk about the characteristics, advantages and disadvantages of each type of the network topology.

Bus Topology: uses a cable running through the area requiring connectivity. A bus and all devices connected to that bus make up a *network segment*. a single network segment is a single collision domain, which means that all devices connected to the bus might try to gain access to the bus at the same time, resulting in an error condition known as a *collision*.

Characteristics: One cable is used per network segment… To maintain appropriate electrical characteristics of the cable, the cable requires a terminator (of a specific resistance) at each end of the cable. Early Ethernet networks commonly relied on bus topologies. A network tap might be in the form of a T connector (commonly used in older 10BASE2 networks) or a vampire tap (commonly used in older 10BASE5 networks).

Benefits: Less cable is required to install a bus topology compared with other topologies. Less expensive. Installation of a network on a bus is easier than other topologies.

Drawbacks: Because a single cable is used per network segment, the cable becomes a potential single point of failure… An error condition existing on one device on the bus can impact performance of other devices on the bus… Also, if two devices on the bus at the same time request access to the bus, an error condition results… Adding devices to a bus might cause an outage for other users on the bus… Troubleshooting a bus topology can be difficult because problem isolation might require an inspection of multiple network taps to make sure they either have a device connected or they are properly terminated.



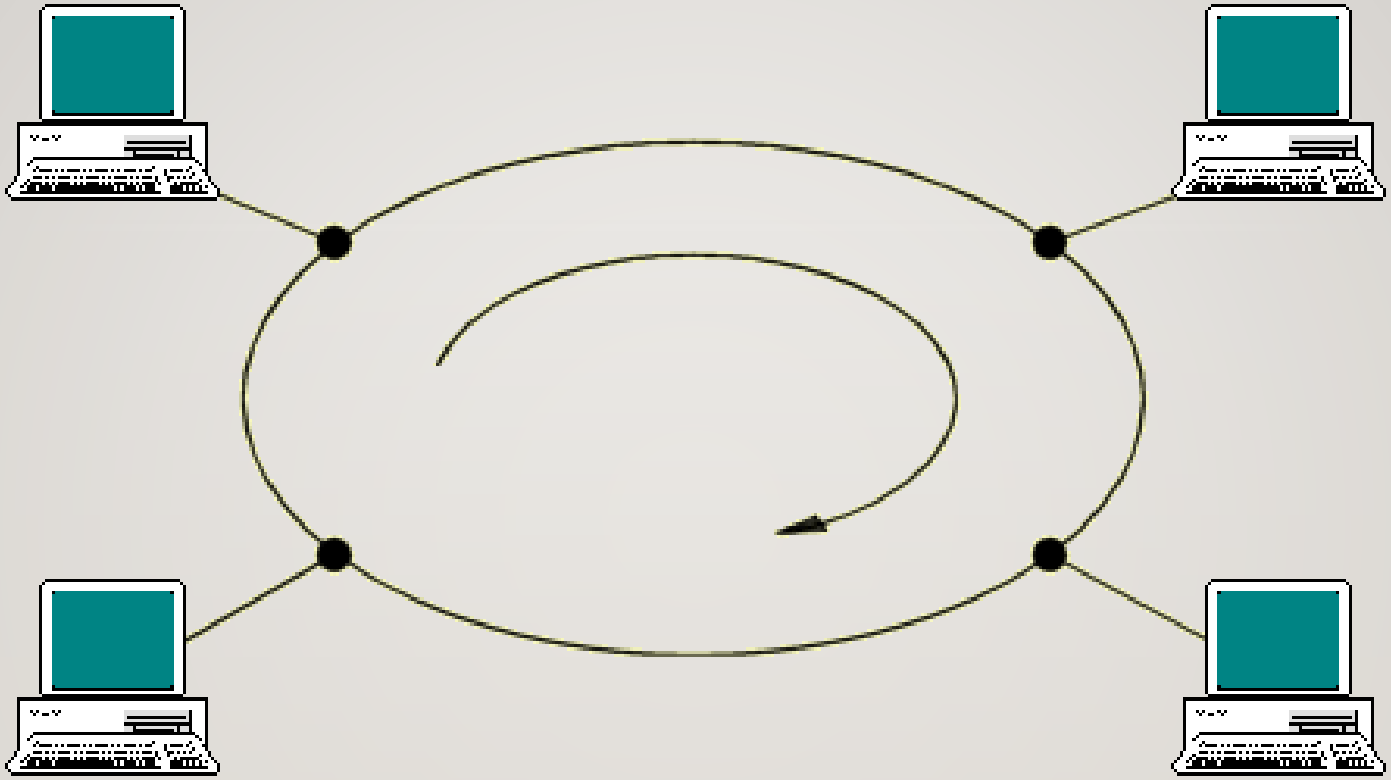
https://www.technologyuk.net/telecommunications/networks/network-topologies.shtml

Ring Topology: Traffic flows in a circular fashion around a closed network loop (that is, a ring). Typically, a ring topology sends data, in a single direction, to each connected device in turn, until the intended destination receives the data. Token Ring networks & Fiber Distributed Data Interface are typically relied on a ring topology, although the ring might have been the logical topology, whereas physically, the topology was a star topology. Each device on a ring includes both a receiver (for the incoming cable) and a transmitter (for the outgoing cable).

Characteristics: Devices are interconnected by connecting to a single ring or, in some cases (for example, FDDI), a dual ring… Each device on a ring includes both a receiver (for the incoming cable) and a transmitter (for the outgoing cable)… Each device on the ring repeats the signal it receives.

Benefits: if a cable break occurred, connectivity to all devices could be restored… Troubleshooting is simplified in the event of a cable break, because each device contains a repeater. When the repeater on the far side of a cable break does not receive any data within a certain amount of time, it reports an error condition.

Drawbacks: A break in a ring when a single ring topology is used results in a network outage for all devices connected to the ring… Because a ring must be a complete loop, the amount of cable required for a ring is higher than the amount of cable required for a bus topology serving the same number of devices… Rings have scalability limitations. Specifically, a ring has a maximum length and a maximum number of attached stations. Once either of these limits is exceeded, a single ring might need to be divided into two interconnected rings.



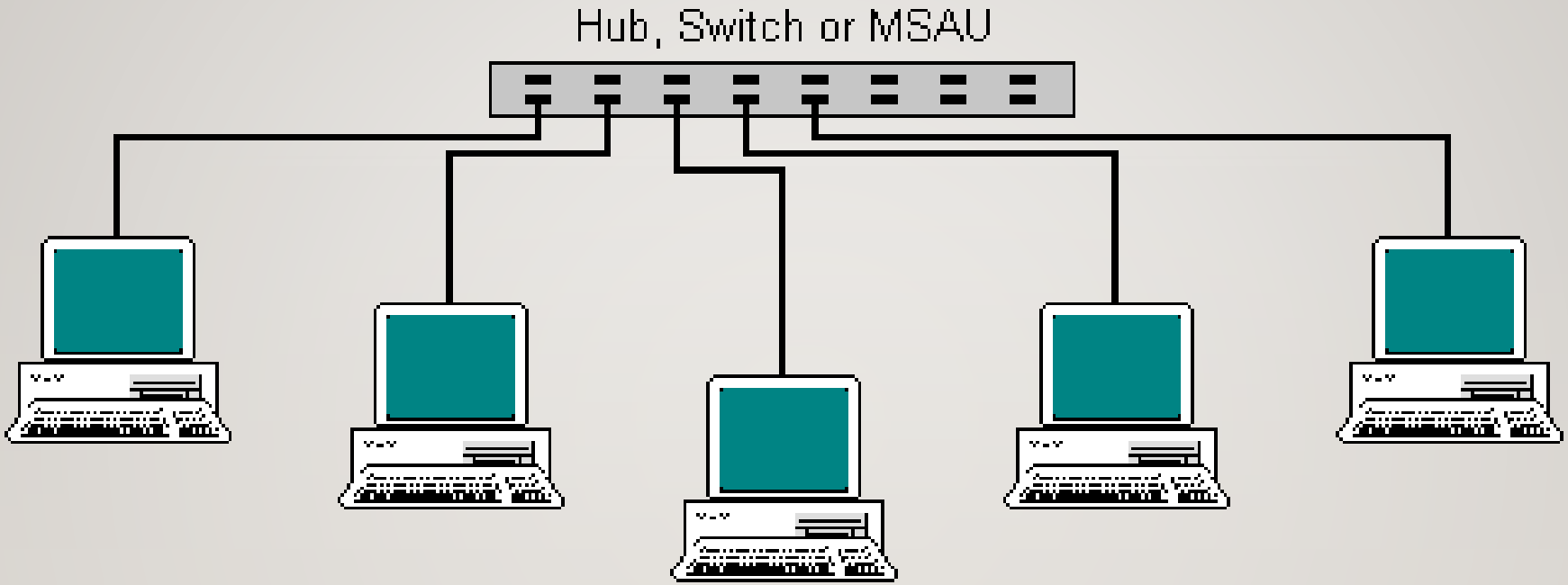
https://www.technologyuk.net/telecommunications/networks/network-topologies.shtml

Star Topology: has a central point from which all attached devices radiate. The star topology is the most popular physical LAN topology in use today, with an Ethernet switch at the center of the star and unshielded twisted-pair cable (UTP) used to connect from the switch ports to clients. Commonly used with Ethernet technologies.

Characteristics: Devices have independent connections back to a central device (for example, a hub or a switch)… Star topologies are commonly used with Ethernet technologies

Benefits: A cable break only impacts the device connected via the broken cable, and not the entire topology… Troubleshooting is relatively simple because a central device in the star topology acts as the aggregation point of all the connected devices.

Drawbacks: More cable is required for a star topology, because each device requires its own cable to connect back to the central device… Installation can take longer for a star topology, as opposed to a bus or ring topology, because more cable runs that must be installed.



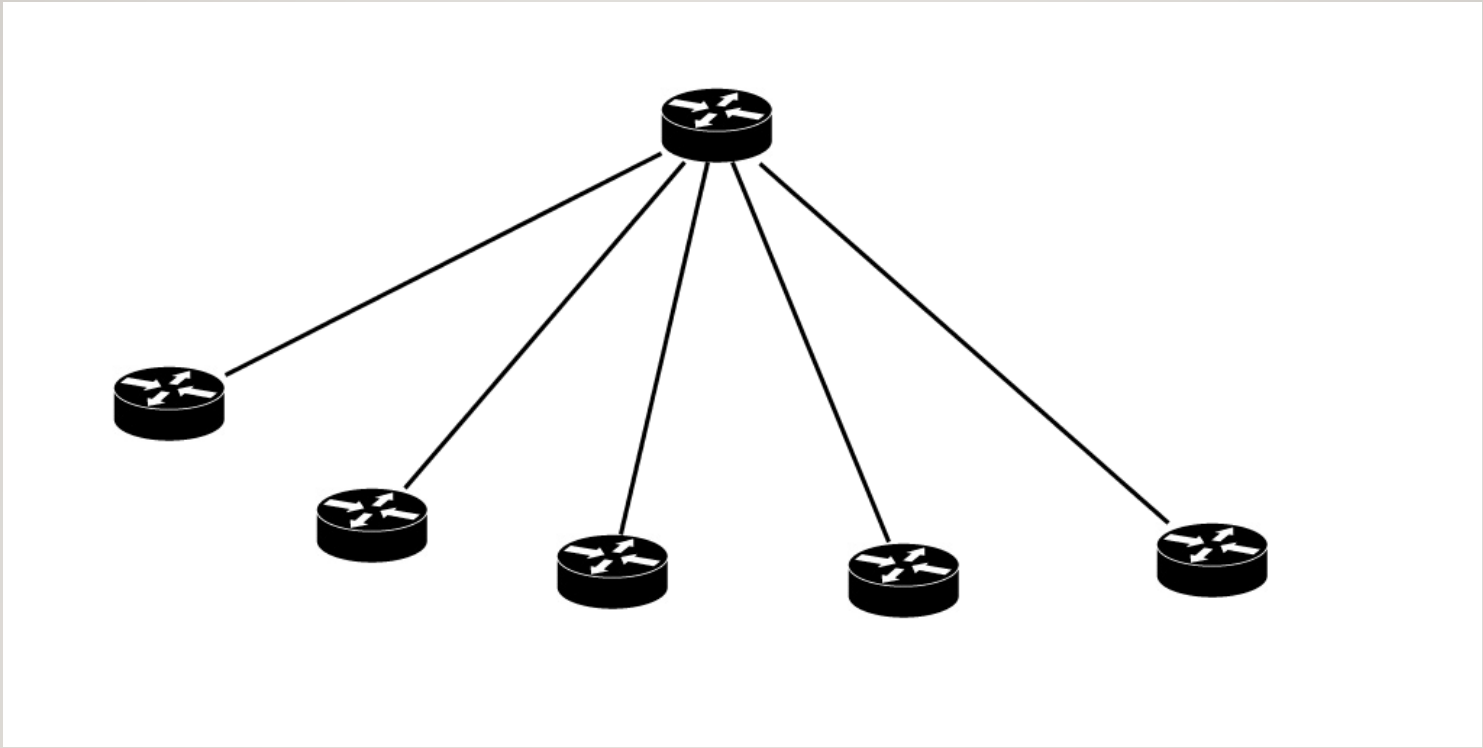
https://www.technologyuk.net/telecommunications/networks/network-topologies.shtml

Hub-and-Spoke Topology: has a WAN link from each remote site (that is, a spoke site) to the main site (that is, the hub site). Similar to the star topology used in LANs. With WAN links, a service provider is paid a fee for each link. Therefore, a hub-and-spoke topology helps minimize WAN expenses by not directly connecting any two spoke locations. If two spoke locations need to communicate between themselves, their communication is sent via the hub location.

Characteristics: Communication between two remote sites travels through the hub site.

Benefits: Costs are reduced (as compared to a full-mesh or partial-mesh topology) because a minimal number of links is used… Adding one or more additional sites is easy (as compared to a full-mesh or partial-mesh topology) because only one link needs to be added per site.

Drawbacks: Suboptimal routes must be used between remote sites because all site communication must travel via the main site… Because all remote sites converge on the main site, this hub site potentially becomes a single point of failure… Each remote site is reachable by only a single WAN link, so, the hub-and-spoke topology lacks redundancy.



Hub and spoke is a very popular WAN centralized model that is low cost since it only requires each spoke to have one connection back to the hub.

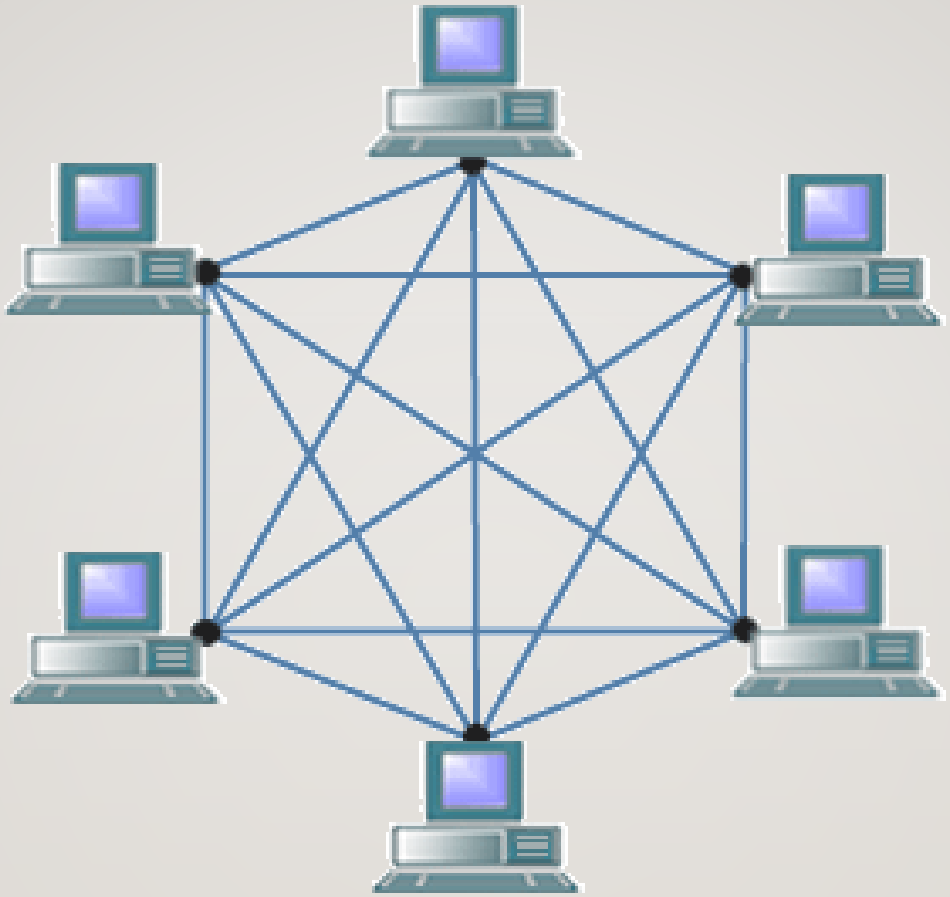
https://routingnull0.com/2017/12/28/physical-network-topologies/

Full-Mesh Topology: Although a hub-and-spoke WAN topology lacked redundancy and suffered from suboptimal routes, a full-mesh topology directly connects every site to every other site. An optimal path can be selected, as opposed to relaying traffic via another site. Also, a full-mesh topology is highly fault tolerant.

Characteristics: Every site has a direct WAN connection to every other site … The number of required WAN connections can be calculated with the formula $w = n * (n - 1) / 2$, where w = the number of WAN links and n = the number of sites. For example, a network with 10 sites would require 45 WAN connections to form a fully meshed network: $45 = 10 * (10 - 1) / 2$.

Benefits: An optimal route exists between any two sites… A full-mesh network is fault tolerant because one or more links can be lost and reachability between all sites might still be maintained… Troubleshooting a full-mesh network is relatively easy because each link is independent of the other links.

Drawbacks: A full-mesh network can be difficult and expensive to scale, because the addition of one new site requires a new WAN link between the new site and every other existing site.



http://units.folder101.com/cisco/sem1/Notes/ch2-topologies/toplogies.htm

Partial-Mesh Topology: Is a hybrid of the hub-and-spoke topology and full-mesh topology. Can be designed to provide an optimal route between selected sites, while avoiding the expense of interconnecting every site to every other site.
When designing a partial-mesh topology, a network designer must consider network traffic patterns and strategically add links interconnecting sites that have higher volumes of traffic between themselves.

Characteristics: Selected sites (that is, sites with frequent intersite communication) are interconnected via direct links, whereas sites that have less-frequent communication can communicate via another site.
A partial-mesh topology uses fewer links than a full-mesh topology and more links than a hub-and-spoke topology for interconnecting the same number of sites.

Benefits: provides optimal routes between selected sites with higher inter site traffic volumes, while avoiding the expense of interconnecting every site to every other site.
More redundant than a hub-and-spoke topology.

Drawbacks: Less fault tolerance than a full-mesh topology.
More expensive than hub-and-spoke topology.

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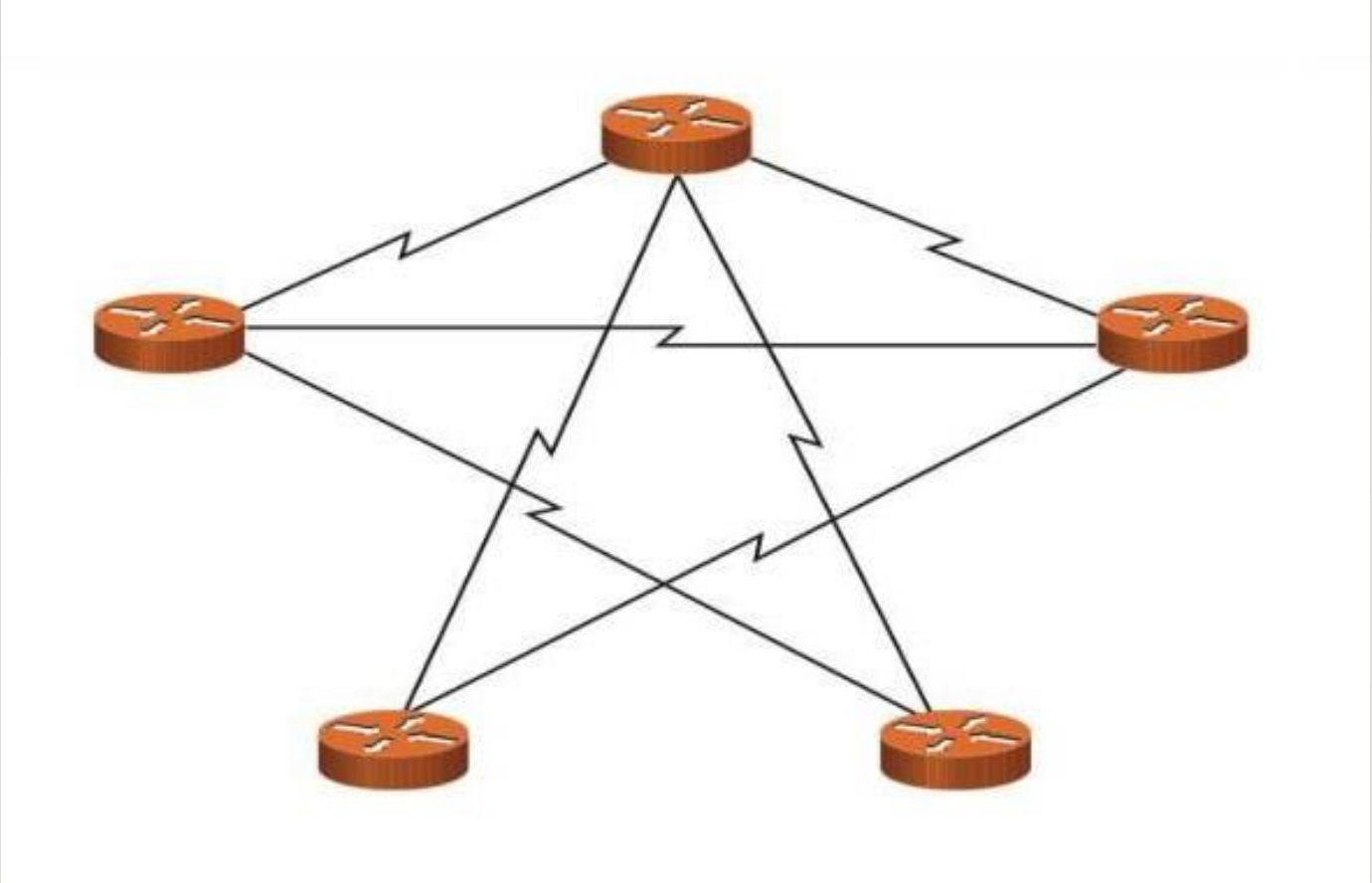

https://www.slideserve.com/clive/comptia-network

THANK YOU! ☺