

AMERICAN INTERNATIONAL UNIVERSITY BANGLADESH

Faculty of Engineering

Laboratory Report Cover Sheet

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Laboratory Title: Study of PC-to-PC, Star, and Bus Topology using LAN TRAINER ACT-14

Experiment Number: 10 Due Date: 03/05/2023 Semester: Spring 2022-2023

Subject Code: - COE 3201 Subject Name: Data Communication

Section: K Group No: 1 Course Instructor: DR. SHUVRA MONDAL Degree Program: BSc CSE

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Group Number (if applicable): 01 ☒ Individual Submission ☐ Group Submission

No.	Student Name	Student ID	Contribution
1	SHEAKH, MOHAMMAD BIN AB. JALIL SHEAKH	20-42132-1	Abstract
2	AURTHY, MOST. LILUN NAHAR	20-43997-2	
3	NISHAT, TARIKUL ISLAM	21-44632-1	Performance Task (a,c)
4	MULLICK, IFTEKHAR UDDIN	21-44649-1	Discussion, Conclusion,
5	ULLAH, MD ISMAIL JOBI	21-44747-1	Introduction,
6	ALANSAR, SADIAH	21-45612-3	Performance Task (b)

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Title: Study of PC-to-PC, Star, and Bus Topology using LAN TRAINER ACT-14

Abstract:

The objective of the report is to investigate a number of LAN topologies and LAN file transmission using the Trainer board and software. We experimented with File transfer to look at how network parameters affected performance. We also discussed the advantages and disadvantages of the bus, ring, star, and mesh topologies. This study is useful for network designers who wish to build scalable, dependable, and efficient LANs.

Introduction:

A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus, or office building. By contrast, a wide area network (WAN) not only covers a larger geographic distance but also generally involves leased telecommunication circuits. Ethernet and Wi-Fi are the two most common technologies in use for local area networks.

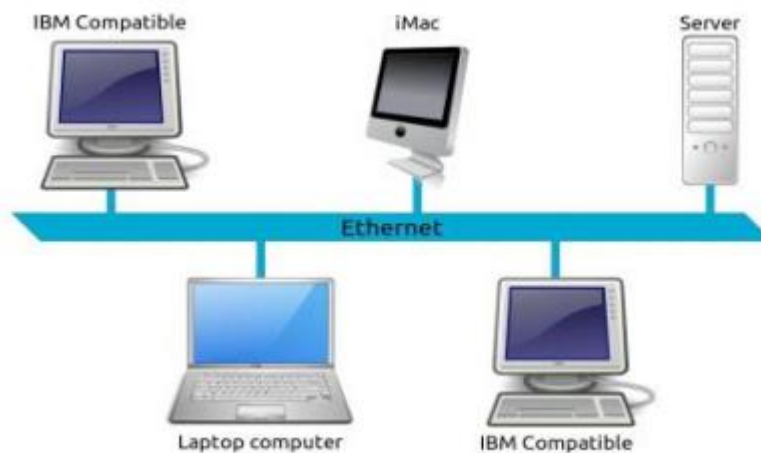


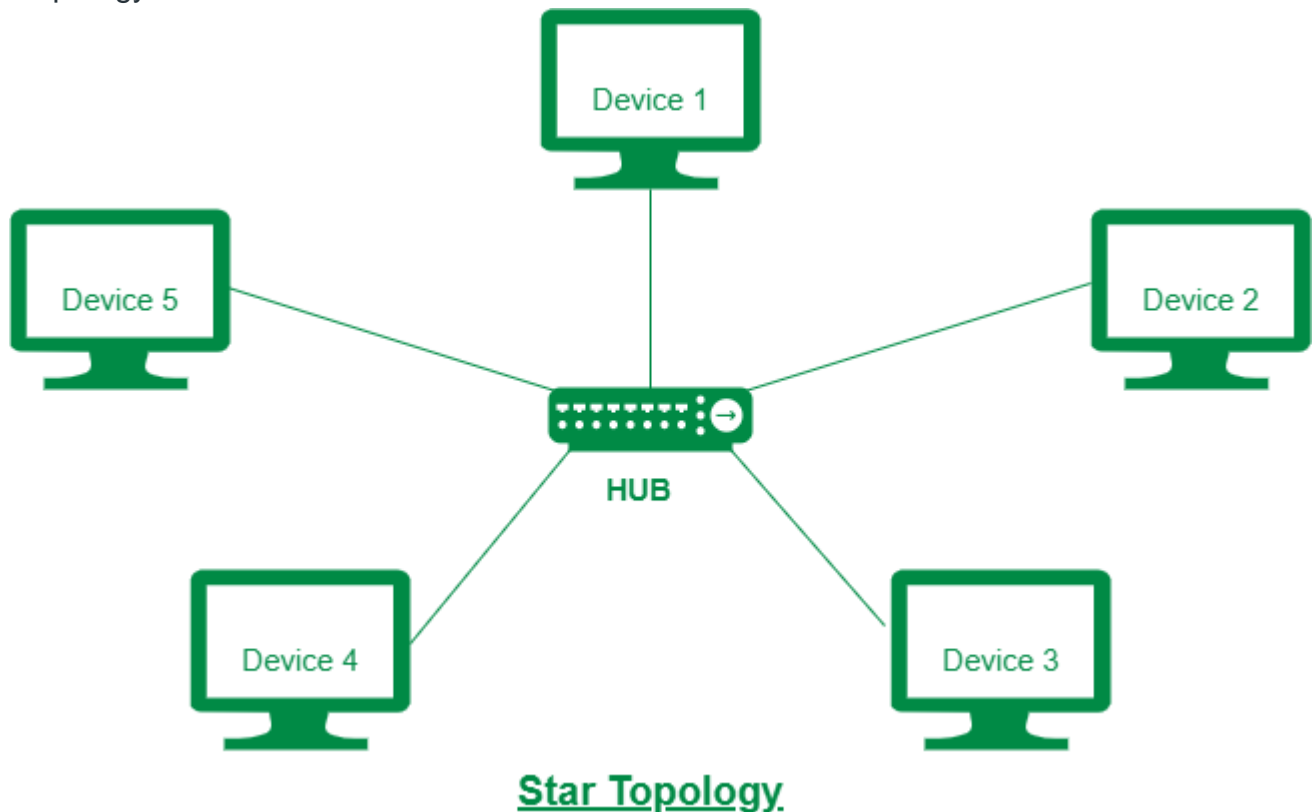
Figure 1: Conceptual Diagram of Local Area Network

Network topology describes the layout of interconnections between devices and network segments. At the data link layer and physical layer, a wide variety of LAN topologies have been used, including ring, bus, mesh, and star. At the higher layers, NetBEUI, IPX/SPX, AppleTalk, and others were once common, but the Internet Protocol Suite (TCP/IP) has prevailed as a standard of choice. Simple LANs generally consist of cabling and one or more switches. A switch can be connected to a router, cable modem, or ADSL modem for Internet access. A LAN can include a wide variety of other network devices such as firewalls, load balancers, and network intrusion detection. Advanced LANs are characterized by their use of redundant links with switches using the spanning tree protocol to prevent loops, their ability to manage differing traffic types via quality of service (QoS), and their ability to segregate traffic with VLANs. LANs can maintain connections with other LANs via leased lines, leased services, or across the Internet using virtual private network technologies. Depending on how the connections are established and secured, and the distance involved, such linked LANs may also be classified as a metropolitan area network (MAN) or a wide area network (WAN).

STAR TOPOLOGY:

Star Topology A star may be a topology for a Local Area Network (LAN) during which all nodes are individually connected to a central connection point, sort of a hub or a switch. A star takes more cable than e.g. a bus, but the benefit is that if a cable fails, just one node is going to be brought down. Each device within the network is connected to a central device called a **hub**. If one device wants to send data to another device, it's to first send the info to the hub then the hub

transmits that data to the designated device. The number of links required to connect nodes in the star topology is N where N is the number of nodes.



Advantages of Star Topology

- 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 needs one I/O port and wishes to be connected to a hub with one link.
- Easier to put in
- Robust in nature
- Easy fault detection because the link is 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 . So, it's easy to line up.

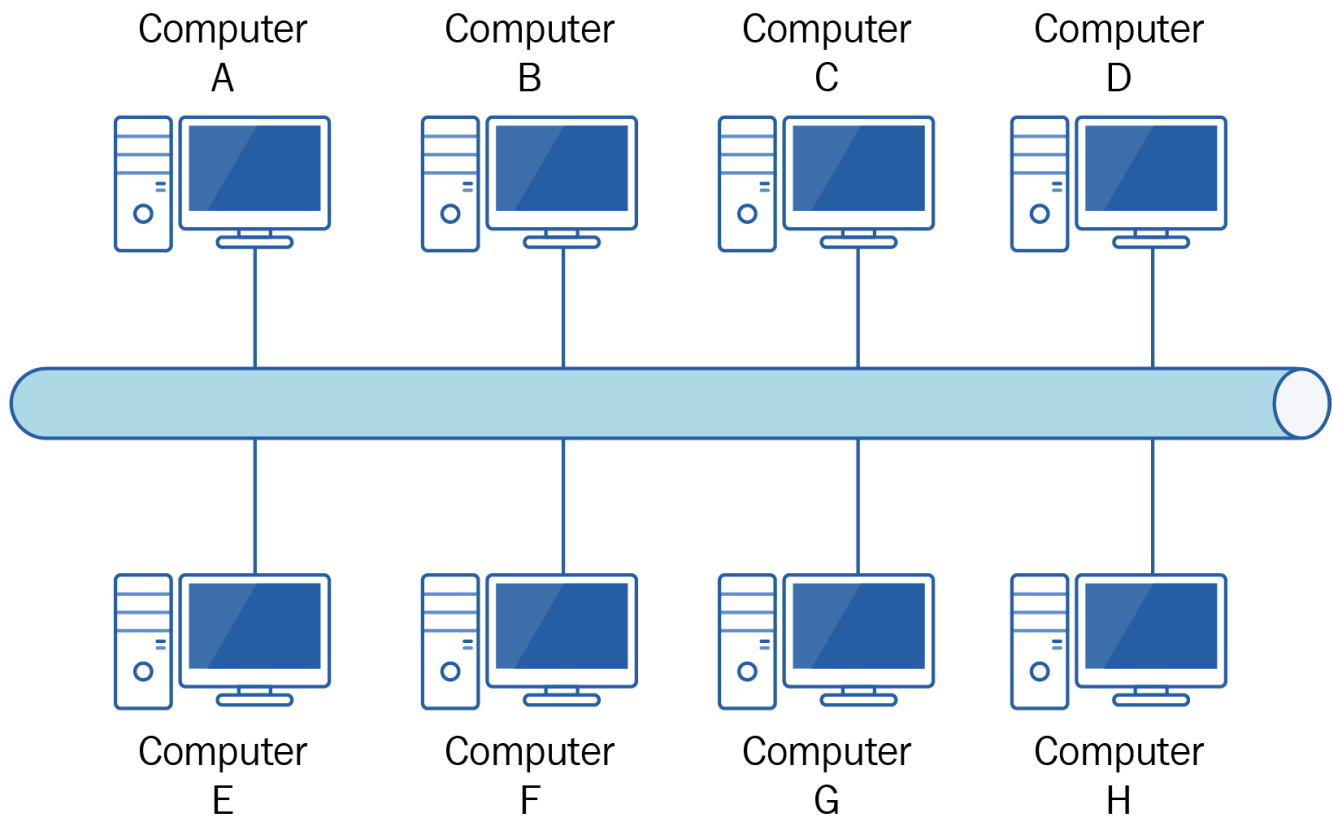
Disadvantages of Star Topology

- ✓ Requires more cable than a linear bus.
- ✓ If the connecting network device (network switch) fails, the 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 the hub goes down everything goes down, none of the devices can work without the 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 the cost
- ✓ Performance is predicated on the one concentrator i.e. hub.

BUS TOPOLOGY:

Bus Topology: Alternatively mentioned as line topology, bus topology could even be a specific quiet topology during which each computer and network device is connected to a minimum of one cable or backbone. In general, the term refers to how various devices are acknowledged during a network. Counting on sort of network card, coax or an RJ-45 network cable is employed to attach them.

Bus topology carries transmitted data through the cable. because data reaches each node, the node checks the destination address (MAC/IP address) to work out if it matches their address. If the address does not match with the node, the node does nothing more. But if the addresses of nodes match to address contained within data then they process on knowledge. In the bus, communication between nodes is done



Advantages of Bus Topology:

- 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 topologies i.e. mesh and star
- It is easy to understand topology.
- Easy to expand by joining the two cables together.

Disadvantages of Bus Topology:

- 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.
- 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 compared to other topologies.

Hardware Description:

The LAN TRAINER ACT-14 includes a built-in power supply, LAN connection, and an integrated network interface card. The trainer is outfitted with several LED indicators that allow students to monitor the network's condition and identify any issues. It also comes with a complete user manual that explains how to set up and use the trainer.

PC TO PC COMMUNICATION:

The PC-to-PC connectivity offered by the bus topology in LAN Trainer ACT-14 allows individuals to learn and comprehend the functioning of a bus network architecture, where each network component is connected to a separate bus. The LAN Trainer ACT-14 has two Ethernet ports that enable the connecting of two computers to the bus, facilitating PC-to-PC communication in a bus network. These ports offer a quick and efficient way to transfer data between the two connected devices as they communicate via the Ethernet protocol. We used **Bus Topology** for this experiment.

Procedure:

A.PC to PC Connection: Initially, we connected the RJ45 connection between the PC-1 kit and Computer-1, and then we repeated the process with the PC-2 kit and Computer-2. The power supply was then switched on, and both computers were operated as administrators with the yes option selected. After choosing the network on both computers, we highlighted the IP address and chose one as the transmitter (Computer-1) and one as the receiver (Computer-2). Figure A depicted a snap of Computer 1 functioning as a transmitter, while Figure B depicted Computer 2 acting as a receiver.

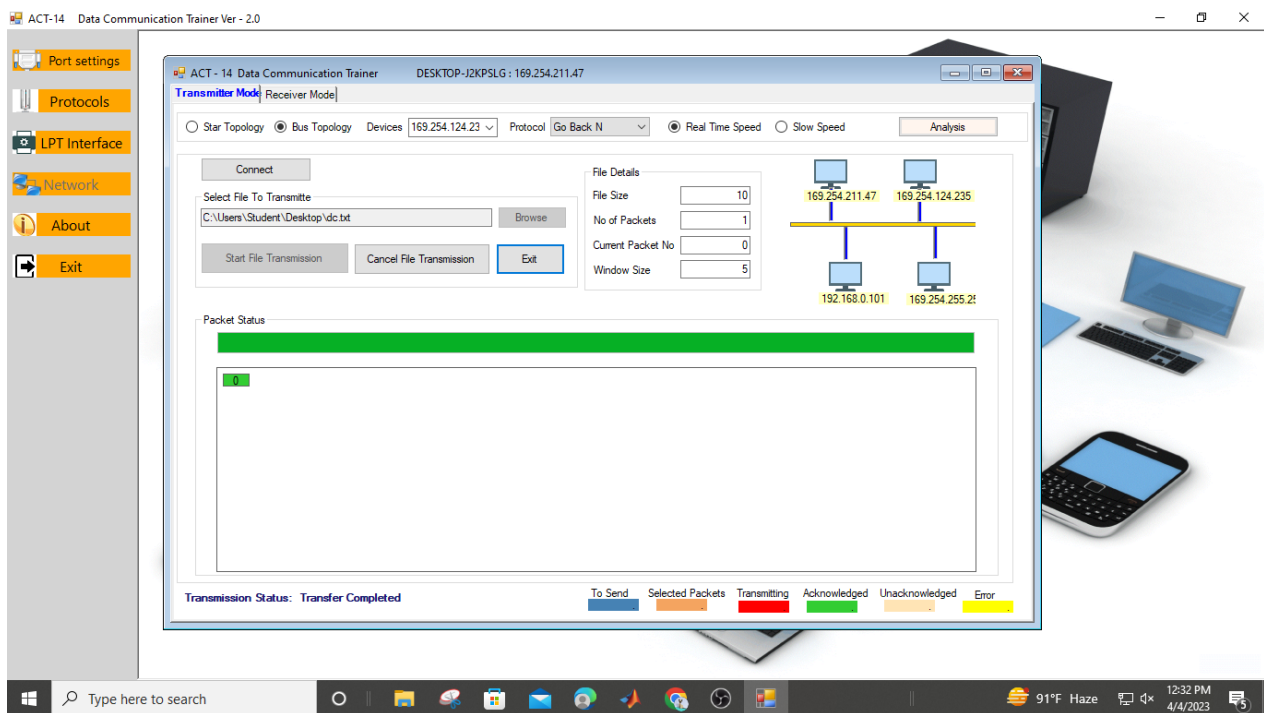


Figure a: Computer-1 as transmitter

In receiver mode, we first chose "Go back N" and users connect to connect with computer-1, following which we transmitted a file from computer-1 to computer.

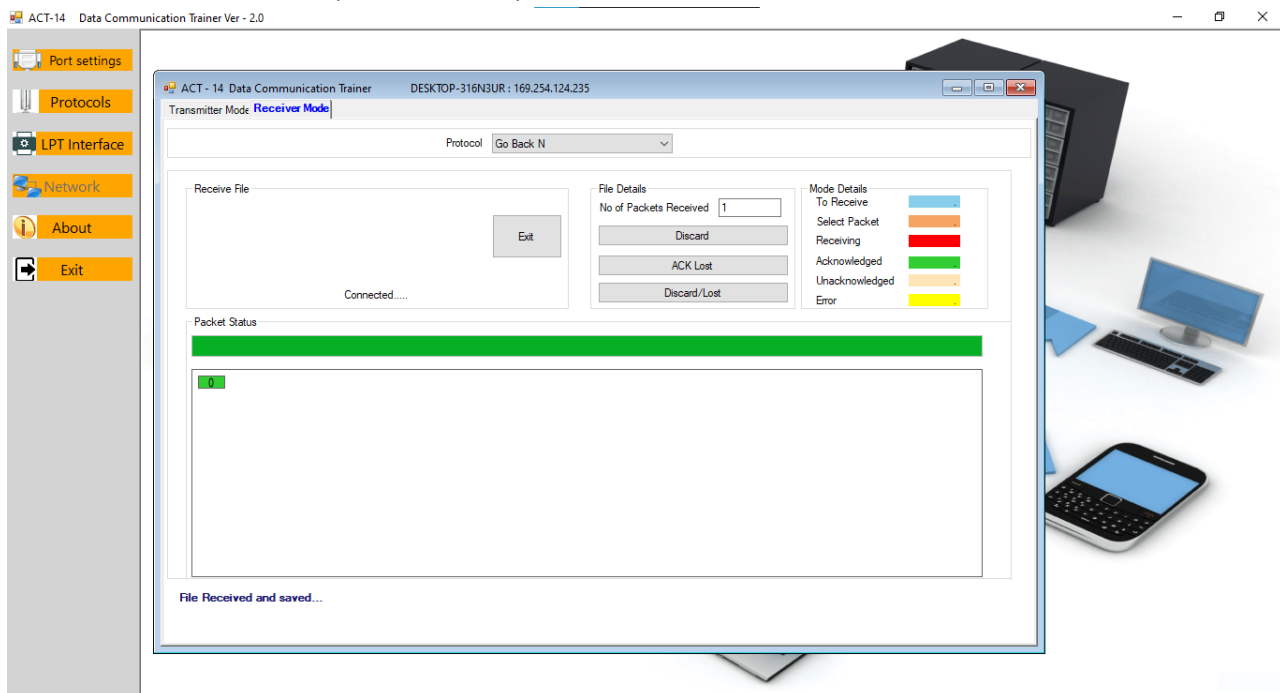


Fig b: Computer-2 as the receiver

A file was sent from Computer-1 and after receiving the file, the file was opened and showed (fig: c)

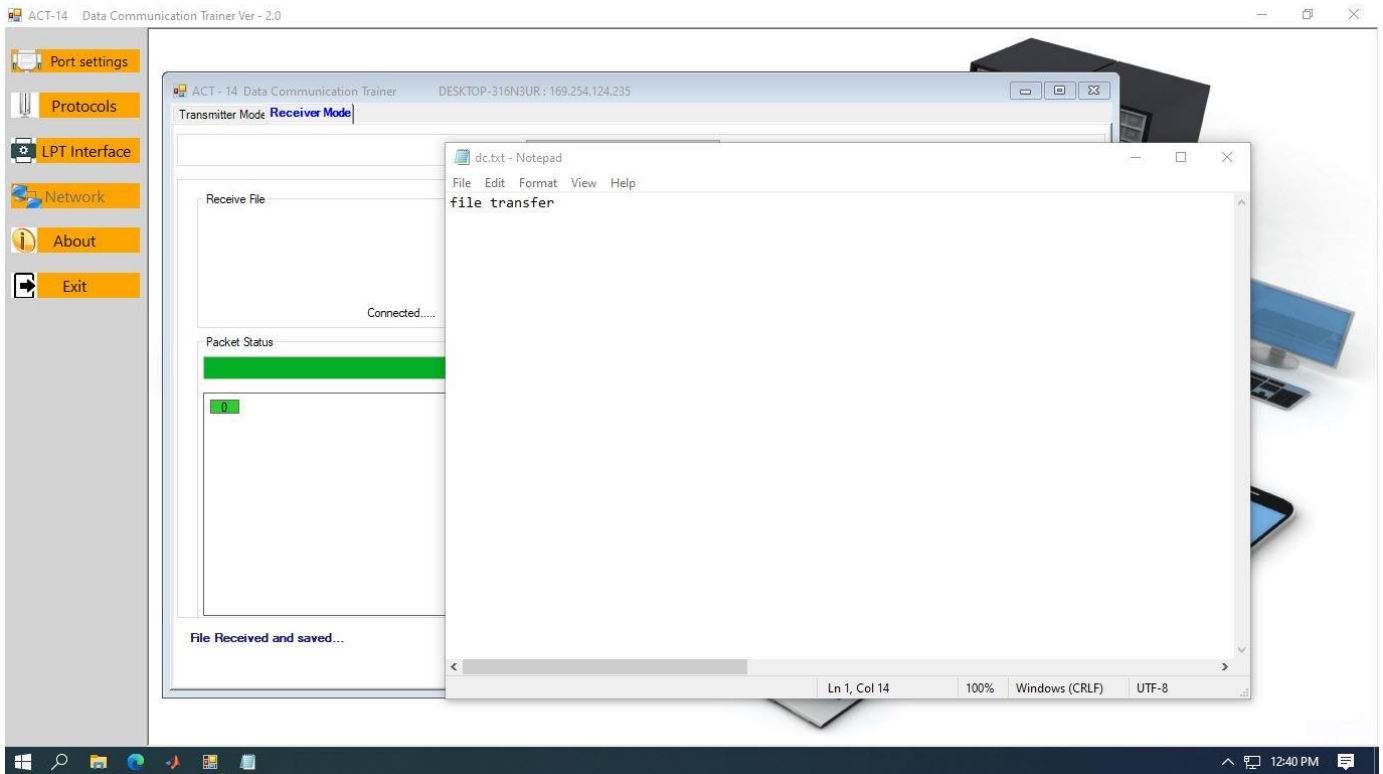


Fig c: Received file display

B. Bus Topology:

What Is Bus Topology? In a LAN (Local Area Network), a bus topology is used when multiple nodes are connected to a single cable rather than a single backbone. Different devices are connected via a coaxial cable/RJ-45 connection. In a bus topology, if one of the cables fails, the entire network will fail. Alternate cables may be used for network security purposes. In comparison to other topologies, this is a very simple sort of network topology since it can be readily arranged.

Bus Topology in Computer Network:

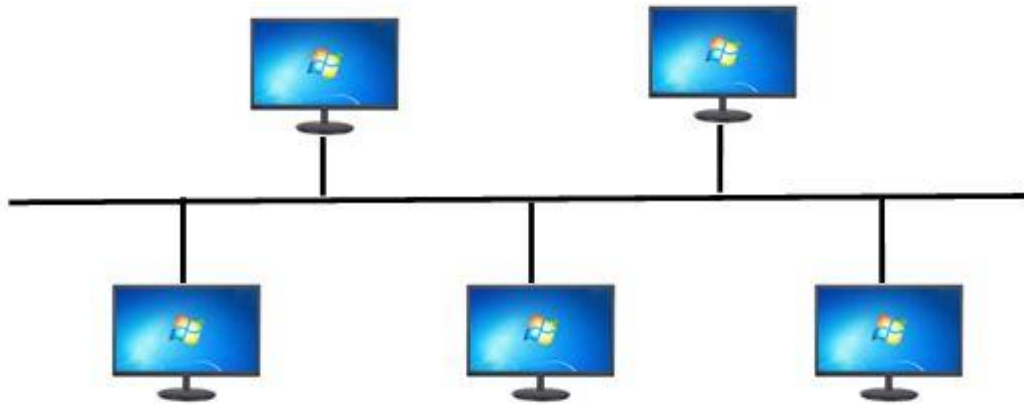
In comparison to other types of topologies, bus topology in a computer network does not require additional connections throughout the installation. If one of the network's nodes fails, the remaining nodes will continue to function. As a result, it is highly straightforward to add the most recent nodes to the network without delaying other nodes.

Due to data loss, this topology is not appropriate for long-distance networking. This type of topology will not work if the nodes are spread out in different directions, hence mesh, star, or ring topologies should be used instead.

As a result, this topology is suitable for short-distance networking. In comparison to a star topology, it requires fewer cables. The data transfer rate will be slowed if more devices are added to this architecture. Terminators are necessary on both sides of the cable. If an error occurs in this network topology, it is extremely difficult to discover and resolve the problem.

Bus topology diagram:

Bus Topology Diagram is as below.



Bus Topology

One type of network topology is bus topology. A single cable with a terminator is used at each end of this configuration. This one wire is quite beneficial for connecting all of the nodes that are currently available. There is no limit to how many nodes can be connected to a network, however, these nodes will have an impact on network performance.

One of the nodes in this topology acts as a server, allowing data to be sent from one end to the other in a specific manner. The terminator will remove the data from the line once it reaches the endpoint.

Because this design holds the sent data through the cable, one large cable serves as the backbone for the entire network. When this data arrives at each node, the node will check the destination address to see if it matches their address or not.

The node will stop working if the destination address does not match. However, they process the data if the node's destination address is the same as the address included within the data. The backbone cable in this topology is primarily determined by the network card installed on each computer. This card can be connected using either a coaxial cable or a network cable.

Examples of bus topology:

The following are some instances of bus topologies.

1. To connect two levels with a single line, a bus network typology is employed.
2. An Ethernet network employs a bus network typology.
3. One computer acts as a server, while the other acts as a client in this network arrangement.
4. The server's primary function is to share data between different client PCs.
5. In companies or at home, a bus topology network is used to connect printers and I/O devices.

C. Star Topology

What is Star Topology: The star network topology is characterized as a networking topology in which components are connected to a central part, which is commonly referred to as the HUB, via independent cables. Because there are no directions between the devices, this architecture will not generate traffic congestion.

In this case, the controller acts as an exchange, which means that when a device wants to communicate with another device, it sends information to the controller, which then passes the data to the receiving device.

Each device in the star topology just needs one link and one input-output port to connect to a large number of others. In this case, the hub/switch is referred to as a server, and the nodes that connect to it are referred to as clients.

What is the central device in star topology?

Hosts are the nodes in a star architecture, and the connections used to connect them can be optical/twisted fibers, coaxial cables, or RJ-45 connectors. The network's traffic regulation is handled by a central device known as a hub/switch.

The network's performance is determined by the hub's capabilities. There should be no new nodes added if the hub/switch is incapable of supporting multiple nodes.

Because the physical arrangement of nodes and hubs resembles a star shape, the network topology is known as STAR. There are four types of central Devices that can be employed in a star topology:

1. Hub/Repeater,
2. Router/Gateway,
3. Computer
4. Switch/Bridge

Star network topology Explain In detail:

When a host device wants to send information to another host, the information is first sent to a central hub, and then to the receiver host. As previously stated, the central hub might be a computer that simultaneously serves as a server.

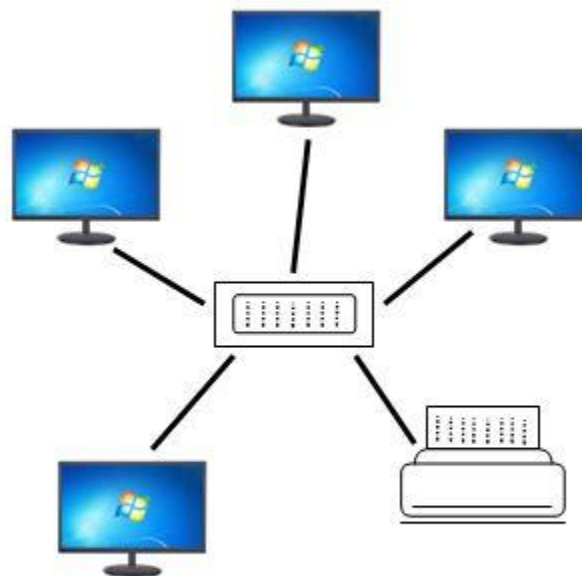
Every node in this topology has a unique address that aids in message transmission and reception in the network. When a switch operates as a server, for example, it is used to store the complete addresses of nodes connected to it. When a certain node needs to send data, the switch recognizes which node needs to send data since it contains all of the nodes' addresses.

When the hub serves as a server, however, it lacks the ability to store addresses. In this situation, the hub sends messages to all nodes in the network, and the receiving device locates the transmission node's matching address and gets the data.

When one of the nodes in the network fails, it has no effect on the other nodes, but when the central hub fails, the entire network goes down.

Star Topology Diagram:

Star Topology Diagram is as below.



Star Network Topology

Restarting the Hub:

The hub is considered either failed or overloaded when none of the star topology networks has access to network resources. In this situation, the reset switch must be pressed to reset the hub.

When resetting is required frequently, there is a risk of device failure or a network bandwidth limit being exceeded. As a result, based on the failed activity, the appropriate action must be taken.

Conclusion:

In conclusion, the LAN Trainer ACT-14 is an effective tool for learning various network topologies, such as the star and bus topologies. It enables people to learn about the foundations of networking and the transport of data between various devices thanks to its PC-to-PC interface. It provides a thorough grasp of network topologies and aids in the development of networking abilities thanks to its varied exercises and real-world applications. Networking experts and students may learn about the various network topologies and how they operate by using the LAN Trainer ACT-14, which can be helpful in the business of developing and implementing computer networks.

References:

- 1) www.study.com
- 2) <https://www.geeksforgeeks.org/types-of-network-topology/>
- 3) Lab Manual