



Exploring Physical Layer: Connecting Different Network Devices

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Abstract— *In a Computer Network, it is necessary to have the knowledge of all the interconnecting devices and the basics of how to connect them to each other.*

Keywords— *Computer Network, Hub, Switch, Gateway, NIC, Router, Modem*

I. INTRODUCTION

A computer network is telecommunication that allows computers to exchange data. There is a wide variety of networking devices which make this exchange possible. These devices fall into different categories according to their functions and are thus placed in different layers of OSI model. We need to understand the meaning of Backbone Network before studying the theory of connecting devices. Two different LAN's are connected using Backbone Network. It provides a channel for packets to transfer them from one LAN to another. The individual LAN is connected to the Backbone Network by using devices such as Hubs, Repeaters, Switches, Bridges, Routers and Gateways [1, 2].

II. MAJOR NETWORK DEVICES

Network Interface Card (NIC): Each computer in a network has a special expansion card (NIC). NIC prepares, sends, receives, and controls data flow between the computer and the network. NIC passes frames of data to the physical layer while transmitting, which sends it further to the physical medium. On the receiver's side, the NIC processes bits received from the physical layer and processes the messages based on its contents.

HUB: It is a common connection point for devices in a network. It is commonly used to connect the segments of a LAN. It serves as a central connection for our network equipments and handles the "Frames" which originate in Data Link Layer. This frame is passed along or 'broadcasted' to each one of its ports, thus passing it to every port ensuring that it will reach its intended destination.

Repeaters: They are used to extend the physical span of a network. Span is often limited by design considerations.

Bridge: It is a device used for connecting two LANs operating usually under the same protocol. There are also bridges that connect LAN segments operating under different protocols. Currently, the term bridge is loosely being used to describe different interconnecting devices.

Switches: A switch is defined as a device that allows a LAN to be segmented. The segments will operate under the same protocol. They improve the network performance and reliability. Some switches operate at Layer 3 (Network Layer) of the ISO-OSI model these switches perform routing as well. As the typical inter-networking connection involves multiple segments, the use of a switch is more common than the use of a bridge.

Routers: A Router connects LANs operating under different protocols. Such LANs are better known as sub-networks instead of network segment. Each segment basically represents a subnet. A router is a true internetworking device as it connects different sub-networks. It establishes a logical path of communication between the sub-networks & contributes to the modular construction of a Network.

Modem: A modem is the primary way to connect to the Internet with Windows 9x through a dialup network connection. A modem is a device that converts the digital data used by computers into analog signals that is suitable for transmission over a telephone line, and converts the analog signals back to a digital signal at the destination.

Gateway: Gateways are comprehensive internetworking devices. They can be computers themselves. They are used when neither of the internetworking devices could be used for connecting the sub-networks together. Example- Connection of a legacy mainframe system to a bus LAN.

III. CONNECTING DIFFERENT NETWORK DEVICES

According to CISCO, networking devices are divided into two categories –

Category 1: Switch and hub.

Category 2: Router and PC.

If two network devices, one from category 1 and the other from category 2, are to be connected then they are connected using Straight-through Cable e.g. Switch to PC and Router to Hub. If two networking devices, both from same category are to be connected they are connected using Crossover Cable e.g. Router to PC, Switch to Switch and Router to Router. Connecting PC to Switch: Switches use the Ethernet interface to quickly make a connection & transfer data between the network & the computer [3].

Connection to the internet can be done fairly quickly if there is an Ethernet port provided in the computer.

Steps are:

- a. Locate the Ethernet port in the computer.
- b. Insert one end of the cable into the port on the computer.
- c. Plug the other end of the cable into one of the available ports in the switch.

Connecting Switch to Router:

1. All the devices which are to be connected to the switch must be powered off. Then an Ethernet cable should be connected to one of the numbered ports on the switch.
2. The other end of the cable is then connected to a wired device such as a computer or to another switch.
3. Ethernet cable is connected to one of the port located at the back of the switch, and then the other end is connected to one of the Ethernet ports located at the back of the router.
4. The power port on the switch is connected, and then the other end is connected to an electrical circuit. Now, the devices connected to the switch are powered ON.

Connecting PC to PC: Data transfer between two PCs is done using a Crossover Ethernet Cable .By this we create a small network for sharing data , thus avoiding having a separate network facility for each computer .The two PCs must have network cards pre- installed & the LAN RJ-45 Ethernet cable plugged in between the two of them.

Connecting Router to Router: Connecting two routers is called Cascading, it helps to expand the network or manage network resources.

The steps are:

- a. First it is determined, which will be the main router(the one which is connected to the Internet) & which will be the secondary router(the one which is connected to the main router)
- b. Then the main router is connected to the internet connection & it is configured according to the instructions. Now a computer is connected to the main router using an Ethernet cable.

Connecting Switch to Switch: Cascading switches is an easy way to add more Ports to an existing network. It is good for connecting two or more groups of computer [4].

The Steps are:

- a. All the devices that are to be connected to the switch must be powered OFF.
- b. One end of an Ethernet cable is connected to one of the numbered ports on the secondary switch while the other end is connected to a computer.
- c. Ethernet cable is connected to one of the ports at the back of secondary switch. The other end of the cable is connected to one of the ports at the back of main switch.
- d. The supplied power adapters to both the switches are plugged in. Then the rest of the devices connected to the switches are powered ON.

IV. CONCLUSION

To fully comprehend the concepts on networking it is important to first understand how different network devices are connected to each other .It is also essential to understand the different types of cable & connectors used.

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