
UNIT 2: NETWORK INTERFACE DEVICES

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2.0 Learning Objectives

After learning this unit, you will be able to understand:

- About Network Adaptor Cards
- About Hubs and Switches
- About Routers

2.1 Introduction

Networks are built by adding a network interface card (NIC) or other network adapter to computer and then connecting that adapter to the medium--a wire or radio frequency--over which the data flows. Depending on network

topology, there may also be a central hub or router to which each of the computers connects. If the hub also routes data between the local network and another network, it is then called a router.

2.2 Network Adaptor Cards (both wired and wireless)

In order to connect to a network, a computer must be equipped with a device called a network card. A network card, or a network adapter, also called a network interface card, or NIC, permits a computer to attach to the exterior. If you buy a computer from one of those popular stores or big companies on the web, most of their computers have a network card tested and ready. If you go to a store that sells or manufactures computers, you will ask them to install or make sure that the computer has a network card.

Types of Network Adapters

A network adapter is a unit of computer hardware. Several types of hardware adapters exist:

- Many new computers contain integrated (built in) wireless network adapter chips
- A USB network adapter plus into a standard USB port to enable computer network connections (typically Wi-Fi or Ethernet)
- A wireless game adapter (sometimes called a "media adapter") connects to an Xbox or Play station game console or other home entertainment product, providing a bridge to Wi-Fi wireless capability.
- On older PCs, a PCI adapter (often called a NIC) was a type of add-in card installed inside a desktop personal computer. A variant PCI adapter called "PC Card" (also known as PCMCIA cards) inserted into the side of a notebook computer to provide similar capability.

Wired Network Cards: External

We have mentioned that a network card could also be used or installed externally. This can be done using USB. Before using it, you can purchase it from a computer store or a web store as shown in fig 2.1.



Fig 2.1 USB drive

Wireless Network Cards

Depending on your network or budget of customers, instead of using wired network cards, you can use wireless ones. Most laptops already have a built-in wireless card so you may not have to acquire one. Many new desktop computers now have built-in wireless capability as shown in fig 2.2.



Fig 2.2 Wireless Network Card

Overall, the physical installation of a wireless network card follows similar rules as that of a wired NIC. They usually come with simple to follow instructions but it may be a good idea to install the wireless network adapters once installing the wireless router. Also, it may be a good plan to purchase the network cards and the wireless router from the same manufacturer.

Most desktop computers come without a wireless network card. If you buy a computer from a store and if you wish to use wireless networking, you'll buy a wireless network card separately. As stated already, a wireless network card isn't particularly tough to install.

Besides the wireless network cards that can be installed within the computer, you'll use external cards. These are installed using a USB port known as USB adapter as shown in fig 2.3.



Fig 2.3 USB Adapter

These adapters, like most USB objects, are easy to connect and use. Like any other hardware parts, when you connect these, the computer detects them and helps you to get them ready for use.

Unlike desktop computers, nowadays mostly laptops come equipped with a wireless network card. This means that, after purchasing or acquiring a laptop, you should simply check whether it has a wireless adapter. Therefore, check its documentation properly.

Check your progress 1

1. Network cards can be _____.
 - a. Wired
 - b. Wireless
 - c. Both of these
 - d. None of these

2.3 Hubs

A hub is a rectangular box that is used as the central object on which the computers and other devices are connected. To make this possible, a hub is equipped with small holes called as ports. Fig 2.4 shows such type of hub:



Fig 2.4 Hub

It comes with 4 ports, depending on its type and is equipped with 4, 5, 12, or more ports. Fig 2.5 shows hub with 8 ports:



Fig 2.5 8 Bit Hub

When configuring 8 bit hub, you need to attach an RJ-45 cable from the network card of a computer to one port of the hub. In most cases for a home-based or a small business network, you will not need (or should not use) a hub.

Hubs are the simplest way to connect 2 or more computers, servers and peripherals to form a simple network. A hub receives signals from each machine through wired connections, and then broadcasts them to all the other connected machines. So if computer A sends out a signal, Computers B, C and D can all receive it, even though the signal was meant only for computer D.

Hubs are of 2 types:

- **Active Hub:** they are smarter than the passive hubs. They not only provide the path for the data signals in fact they regenerate, concentrate and strengthen the signals before sending them to their destinations. Active hubs also are termed as 'repeaters'.
- **Passive Hub:** they're more like point contact for the wires to inbuilt the physical network. They have nothing to do with modifying the signals.

Check your progress 2

1. Which is known as repeaters?
 - a. Active Hub
 - b. Passive Hub
 - c. Both of these
 - d. None of these

2.4 Switches

A switch is a network device that selects a path or circuit for sending a unit of data to its next destination. A switch may additionally include the function of the router, a device or program that can determine the route and specifically what adjacent network point the data should be sent to. In general, a switch could be a simpler and quicker mechanism than a router, which needs knowledge about the network and the way to work out the route.

A switch is effectively a higher-performance alternative to a hub. People tend to benefit from a switch over a hub if their home network has four or a lot of computers, or if they want to use their home network for applications that generate significant amounts of network traffic, like multiplayer games or heavy music file sharing. Technically speaking, hubs operate using a broadcast model and switches operate using a virtual circuit model.

Switches are capable of determining the destination of each individual traffic element (such as an LAN frame) and selectively forwarding data to the one computer that actually needs it. By generating less network traffic in delivering messages, a switch performs higher than a hub on busy networks.

When a signal enters a port of the switch, the switch looks at the destination address of the frame and internally establishes a logical connection with the port connected to the destination node. Other ports on the switch have no part within the connection. The result's that each port on the switch corresponds to an individual collision domain, and network congestion is avoided. Thus, if a 10-Mbps Ethernet switch has 10 ports, every port effectively gets the complete bandwidth of 10 Mbps-to the frame, the switch's port seems to provide a dedicated connection to the destination node. {Ethernet|local area network|LAN} switches

are capable of building multiple internal logical connections at the same time, while routers usually process packets on a first-come, first-served.

There are 2 main types of switches. Layer-2 switches operate at the data-link layer of the OSI model and are based on bridging technologies. They establish logical connections between ports based on mac addresses. Use layer-2 switches for segmenting your existing network into smaller collision domains to improve performance. Layer-3 switches operate at the layer 3 of the OSI model and are based on routing technologies. They establish logical connections between ports based on network addresses. Use these for connecting different networks into an internetwork. Layer-3 switches are typically known as routing switches or multilayer switches.

Check your progress 3

1. Which of the following operates at data link layer of the OSI model?
 - a. Layer-3 switch
 - b. Layer-2 switch
 - c. Hub
 - d. None of these

2.5 Routers

Routers are network layer devices and are notably known as Layer- 3 devices of the OSI Model. They process logical addressing information within the Network header of a packet like ip Addresses. Router is used to form larger complex networks by complex traffic routing. It's the ability to connect dissimilar LANs on the same protocol. It additionally has the ability to limit the flow of broadcasts. A router primarily comprises of a hardware device or a system of the computer that has more than one network interface and routing software.



Fig 2.6 Router

When a router receives the data, it determines the destination address by reading the header of the packet. Once the address is determined, it searches in its routing table to get know how to reach the destination so forwards the packet to the higher hop on the route. The hop may be the final destination or another router.

Routing tables play a very pivotal role in letting the router makes a decision. So a routing table has to be compelled to be updated and complete. The 2 ways through which a router will receive information are:

- **Static Routing:** In static routing, the routing information is fed into the routing tables manually. It doesn't solely become a time-taking task but gets prone to errors as well. The manual change is additionally needed just in case of statically configured routers when change within the topology of the network or within the layout takes place. So static routing is feasible for tinniest environments with minimum of one or two routers.
- **Dynamic Routing:** For larger environment dynamic routing proves to be the practical solution. The process involves use of peculiar routing protocols to hold communication. The purpose of these protocols is to enable the routers to transfer information about to other routers, so the other routers can build their own routing tables.

Check your progress 4

1. Which of the following is true about routers?
 - a. Routers operates on network layer
 - b. Routing table is maintained b 2 ways
 - c. Routers have the ability to limit the flow of broadcasts.
 - d. All of these

2.6 Access Points (Wireless)

In a wireless local area network, an access point may be a station that transmits and receives data. An access point connects users to different users among the network and can also serve as the point of interconnection between the WLAN and a fixed wire network. Every access point can serve multiple users within a defined network area; as people move beyond the range of 1 access point, they're automatically handed over to the next one. A small WLAN might solely need a single access point; the number required will increase as a function of the number of network users and therefore the physical size of the network.

A wireless access point is largely a hub with no wires that uses radio signals to try to its talking. Each one will handle some number of clients, usually about 30, very similar to a hub. They come available } in lots of sizes and shapes and have many different feature sets: those you'd use at home are completely unsuited to be used in a campus environment (and vice versa).



Fig 2.7 Wireless Access Point

Wireless access points (APs or WAPs) are the special-purpose communication devices on wireless local area networks (WLANs). Access points act as a central transmitter and receiver of wireless radio signals. Mainstream wireless APs support Wi-Fi and are most commonly used to support public Internet hotspots and other business networks where larger buildings and spaces need wireless coverage.

Check your progress 5

1. What are WAPs?
 - a. Software used for routing.
 - b. Layers used in communication
 - c. Communication device on WLAN
 - d. None of these

2.7 Repeaters

Repeaters are network device used to regenerate or replicate a signal. Repeaters are employed in transmission systems to regenerate analog or digital signals distorted by transmission loss. Analog repeaters frequently will solely amplify the signal while digital repeaters will reconstruct a signal to near its original quality.

In a data network, a repeater will relay messages between sub networks that use different protocols or cable types. Hubs will operate as repeaters by relaying messages to all connected computers. A repeater cannot do the intelligent routing performed by bridges and routers.

In a wireless communications system, a repeater consists of a radio receiver, an amplifier, a transmitter, an isolator, and 2 antennas. The transmitter produces a signal on a frequency that differs from the received signal. This so-called frequency offset is critical to prevent the strong transmitted signal from disabling the receiver. The isolator provides additional protection in this respect. A repeater, once strategically located on top of a high building or a mountain, will greatly enhance the performance of a wireless network by permitting communications over distances much greater than would be possible without it.

Check your progress 6

1. Repeater comprises of _____?
 - a. Amplifier
 - b. Transmitter
 - c. Isolator
 - d. All of these

2.8 Let Us Sum Up

In this unit we have learnt that networks are built by adding network interface card to the computer and connecting adapter to the medium which can be wire or radio frequency over which the data flows. A network card allows a computer to attach to exterior. If you buy a computer from one of those popular stores or big companies on the web, most of their computers have a network card tested and ready.

Unlike desktop computers, mostly laptops are equipped with wireless network card. A hub is a rectangular box that is used as central object on which the computers and other devices are connected. A switch is a network device that selects a path or circuit for sending a unit of data to its next destination and include the function of router, a device or program that can determine the route and specifically what adjacent network point the data should be sent to.

Routers are network layer devices and are notably known as Layer- 3 devices of the OSI Model which process logical addressing information in Network header of a packet like IP Addresses. Repeaters are network device used to regenerate or replicate signals which are used in transmission systems to regenerate analog or digital signals distorted by transmission loss.

2.9 Answers for Check Your Progress

Check your progress 1

Answers: (1 –c)

Check your progress 2

Answers: (1 -a)

Check your progress 3

Answers: (1 -b)

Check your progress 4

Answers: (1 -d)

Check your progress 5

Answers: (1 -c)

Check your progress 6

Answers: (1 -d)

2.10 Glossary

1. **Network** - It is an arrangement of network interface card or network adapter to computer.
2. **Network card** - It is a type of adapter which allow computer to attach externally.
3. **Hub** - Rectangular box on which computers and other devices are connected and carry many ports.
4. **Switch** - A network device which sends unit of data to next destination and has the function of router.
5. **Router** - A network layer devices which process logical addressing information in Network header of packet.

2.11 Assignment

Explain the purpose of Wireless Routers?

2.12 Activities

Explain the features of Network Switch?

2.13 Case Study

Compile the information about the type of network used in University.

2.14 Further Readings

1. Basic of Internet by Er. Nishit Mathur
2. Internet and the World by Ahmed Ansari