Department of Computer and Software Engineering
SE100L: Information and Communication Technologies Lab

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LAB 13 Introduction to Communication Devices

Name	Roll. No.	Total Marks (35)
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13.1. Objective

Study of following Network Devices in Detail

- Repeater
- Hub
- Switch
- Bridge
- Router
- Gate Way
- Classification of IP address
- Sub netting
- Super netting

13.2. Repeater

Functioning at Physical Layer. A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. Repeater have two ports, so cannot be use to connect for more than two devices.

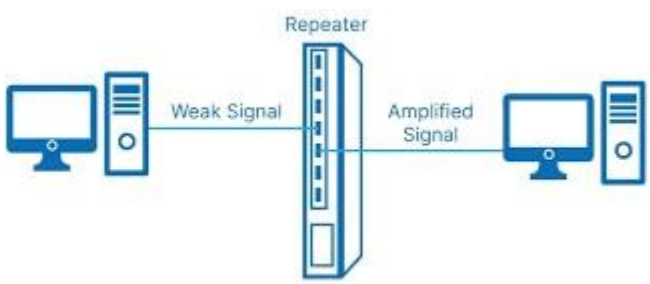

Figure 13-1: A repeater that inputs a weak signal and outputs a signal at higher level

13.3. Hub

An Ethernet hub, active hub, network hub, repeater hub, hub or concentrator is a device for connecting multiple twisted pair or fiber optic Ethernet devices together and making them act as a single network segment. Hubs work at the physical layer (layer 1) of the OSI model. The device is a form of multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision.

Figure 13-2: A hub which is capable of connecting multiple devices

13.4. Switch

A network switch or switching hub is a computer networking device that connects network segments. The term commonly refers to a network bridge that processes and routes data at the data link layer (layer 2) of the OSI model.

Switches that additionally process data at the network layer (layer 3 and above) are often referred to as Layer 3 switches or multilayer switches.

13.5. Bridge

A network bridge connects multiple network segments at the data link layer (Layer 2) of the OSI model. In Ethernet networks, the term bridge formally means a device that behaves according to the IEEE 802.1D standard. A bridge and switch are very much alike; a switch being a bridge with numerous ports. Switch or Layer 2 switch is often used interchangeably with bridge. Bridges can analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.

13.6. Router

A router is an electronic device that interconnects two or more computer networks, and selectively interchanges packets of data between them. Each data packet contains address information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transferred from one network to another. Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table showing the preferred paths between any two systems on the interconnected networks.

13.7. Gate Way

In a communications network, a network node equipped for interfacing with another network that uses different protocols.

- A gateway may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolators, or signal translators as necessary to provide system interoperability. It also requires the establishment of mutually acceptable administrative procedures between both networks.
- A protocol translation/mapping gateway interconnects networks with different network protocol technologies by performing the required protocol conversions.

13.8. Study of Network IP

As show in figure we teach how the ip addresses are classified and when they are used.

Class A	Address Change	Supports
Class A	1.0.0.1to 126.255.255.254	Supports 16 million hosts on each of 127 networks.
Class B	128.1.0.1 to 191.255.255.254	Supports 65,000 hosts on each of 16,000 networks.
Class C	192.0.1.1 to 223.255.254.254	Supports 254 hosts on each of 2 million networks.
Class D	224.0.0.0 to 239.255.255.255	Reserved for multicast groups.
Class E	240.0.0.0 to 254.255.255.254	Reserved.

13.9. Tasks

13.9.1. Task 1

Why do we develop sub netting and how to calculate subnet number and how to identify subnet/network address?

Ans: Subnetting is a fundamental practice in computer networking, essential for the effective management of IP addresses. It plays a pivotal role in optimizing address space utilization, minimizing network congestion, and fortifying security through the segmentation of larger networks into more manageable subnets. The process of calculating subnet numbers and identifying subnet/network addresses involves several key steps. One must carefully select an appropriate subnetting mask, determine the required number of subnets and hosts per subnet, convert the chosen subnet mask into its binary representation, and then execute a bitwise AND operation between the IP address and the subnet mask. This systematic approach enables a structured and organized division of networks without the need for specific numerical examples, ultimately contributing to improved overall network performance and security.

Example: There is an IP address 192.168.1.25 with a subnet mask of 255.255.255.224.

The subnet/network address is 192.168.1.0.

13.9.2. Task 2

Why we develop super netting and how to calculate super net mask and how to identify super net address?

Ans: Supernetting, or route aggregation, serves as a crucial network optimization technique primarily aimed at enhancing the efficiency of routing tables and judiciously managing IP address space. The development of supernetting stems from the need to mitigate the proliferation of routing table entries within routers, thereby facilitating quicker and more streamlined routing processes. By consolidating multiple contiguous subnets into larger supernet addresses, this technique reduces the burden on routing resources and contributes to more expedient routing table lookups. Supernetting is instrumental in addressing challenges associated with limited IP address space, allowing for a more economical use of addresses. To calculate a supernet mask, one must analyze the binary representations of the subnet masks involved, identifying their common prefixes to establish the new, aggregated mask. The supernet address is then derived by applying this mask to the shared network portion of the original subnets. It is crucial to implement supernetting judiciously, ensuring the subnets being aggregated are contiguous and possess identical supernet masks, while also maintaining a comprehensive understanding of network topology to prevent complications related to routing and subnet boundaries.

Example: suppose there are two subnets:

Subnet 1: 192.168.1.0

Subnet 2: 192.168.2.0

The supernet address would be 192.168.0.0.

13.9.3. Task 3

Sketch and describe a connection diagram which includes computers with a single router and LAN cable.

Ans:

Router ➔ LAN Cable ➔ Computer 1 ➔ LAN Cable ➔ Computer 2

13.9.4. Task 4

Sketch and describe a connection diagram which includes the computers, repeater, hub, router and bridge.

Ans: