Computer Networks

Lab 1c
Network Devices

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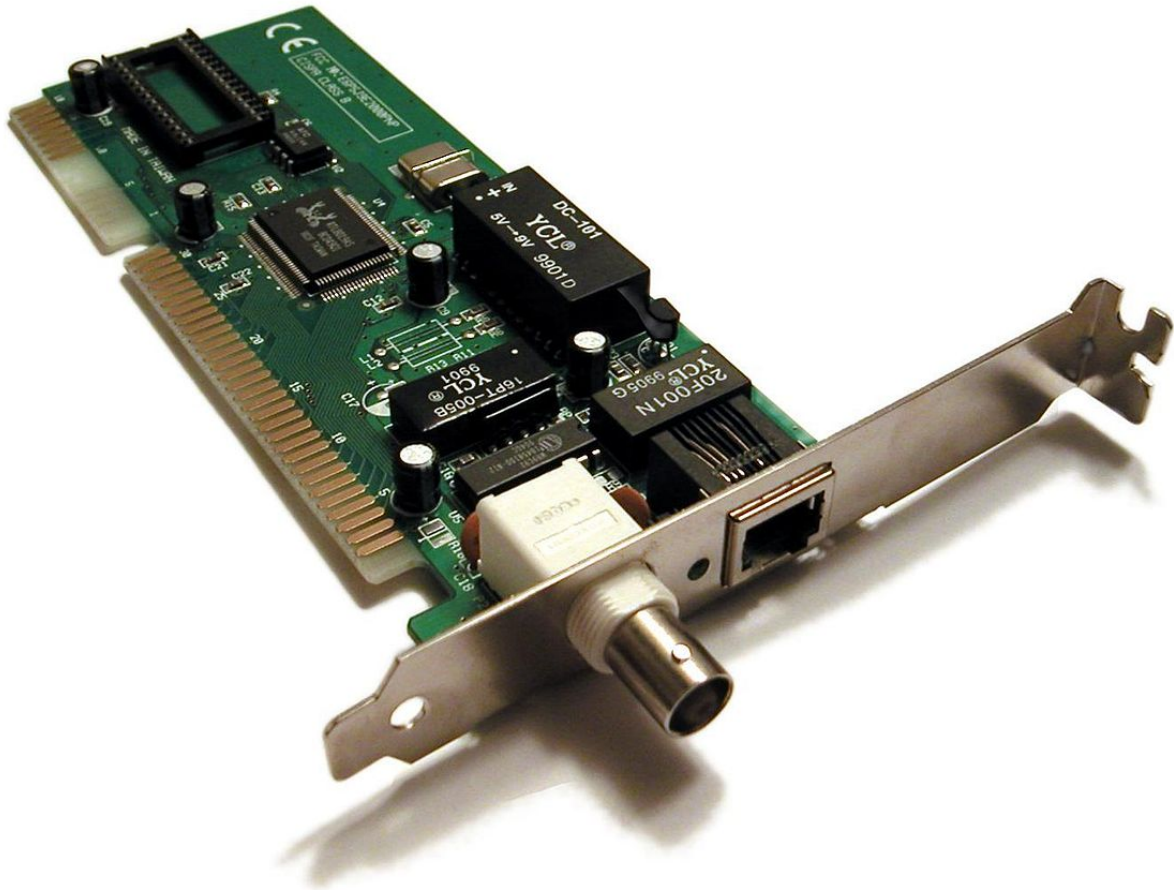**Student ID:** 1852033

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Contents

1   Understanding network devices

1.1   Network Interface Cards (NICs)

1.1.1   NIC functions:

- Network Interface Cards are used in order to convert electric pulse data into digital signals for convenient processing.

- In the Open System Interconnection model, NICs utilize the physical layer to transmit signals and the network layer to. transmit data packets. NICs operate on both physical as well as the data link layer.

- NICs support both wired and wireless data communication techniques.

- NIC is a intermediate hardware between a computer/server and a network.

1.2   Code of NIC processors

1 BNC and 1 RJ-45 port Ethernet NIC.

1.2.1   Check NIC of a computer, what is its MAC address?

- Ethernet MAC address: **0A-00-27-00-00-16**

- Wi-fi MAC address: **9C-DA-3E-A2-28-4E**

1.2.2   Cable to connect NIC to a network

Type: Ethernet cable Standards: CAT 5, CAT 6

1.3   Hubs
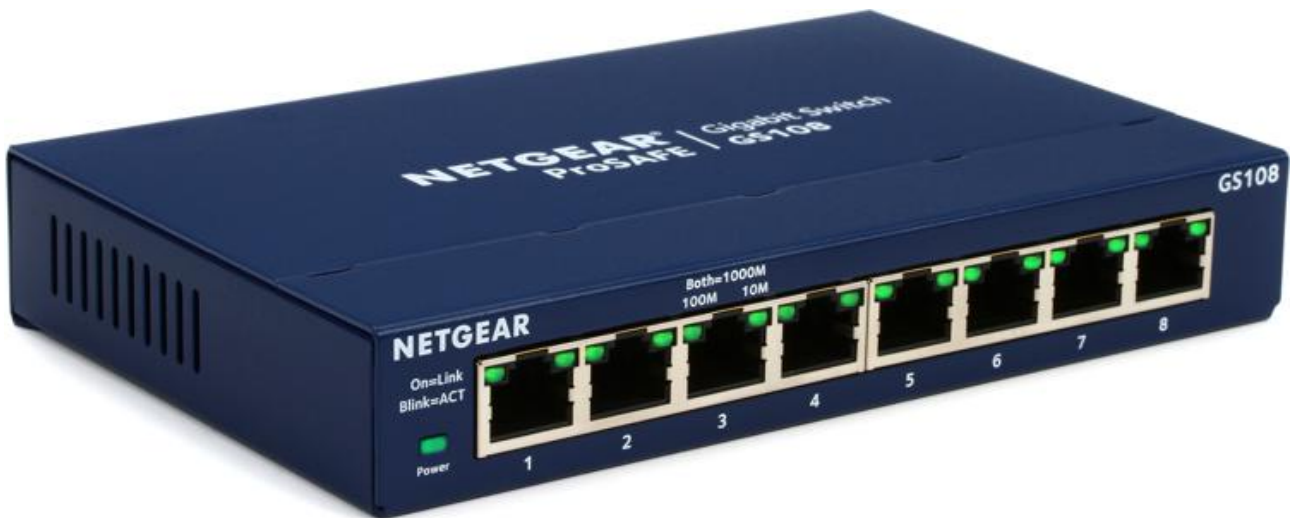
1.3.1   Role of hubs in a network

A hub forms a single network segment where all devices can communicate directly with each other.

1.3.2   Main characteristics

A hub can be used with both digital and analog data, provided that its settings have been configured into the appropriate format of the incoming data. For example, if the incoming data is in digital format,

the hub must pass it on as packets. However, if the incoming data is analog, then the hub passes it on in signal form.

1.3.3   Weaknesses of a hub

- Inability to differentiate between various devices on the network.

- Bandwidth consumption for each transfer since the computer will send the message to every other computer on the network if one computer is trying to reach another on a hub-based network.

1.3.4   Hub ports

10 port Gigabit Managed SFP Switch, G9-SFP, G10-SFP.

1.4   Switches

1.4.1   Roles of switches in a network

A switch is a device that is used at the Access or the second layer of the OSI model (data link layer). A switch can be used to connect multiple

hosts (PCs) to the network. Unlike a hub, a switch forwards a message to a specific host.

1.4.2   Main characteristics of switches

- Switches use MAC addresses (addresses of medium access control sublayer) to send data packets to selected destination ports.

- It uses packet switching technique to receive and forward data packets from the source to the destination device.

- It is supports unicast (one-to-one), multicast (one-to-many) and broadcast (one-to-all) communications.

- It is supports unicast (one-to-one), multicast (one-to-many) and broadcast (one-to-all) communications.

- Transmission mode is full duplex, i.e. communication in the channel occurs in both the directions at the same time. Due to this, collisions do not occur.

- Switches are active devices, equipped with network software and network management capabilities.

- Switches can perform some error checking before forwarding data to the destined port.

1.4.3   Differences between hubs and switches

Unlike a hub, a switch forwards a message to a specific host. When any host on the network or a switch sends a message to another host on the same network or same switch, the switch receives and decodes the frames to read the physical (MAC) address portion of the message.

1.4.4   Weaknesses of switches

- They are more expensive compare to network bridges.

- Network connectivity issues are difficult to be traced through the network switch.

- Broadcast traffic may be troublesome.

- If switches are in promiscuous mode, they are vulnerable to security attacks e.g. spoofing IP address or capturing of Ethernet frames.

- Proper design and configuration is needed in order to handle multicast packets.

- While limiting broadcasts, they are not as good as routers.

1.4.5   Switch ports

Switch ports are Layer 2-only interfaces associated with a physical port. A switch port can be an access port, a trunk port, or a tunnel port.

- Manageable switches: Manageable switch has a console port and IP address, which can be assigned and configured.

- Unmanageable switches: On an Unmanageable switch, configuration can't be made. It is not possible to assign IP address as there is no console port.

1.5   Routers

1.5.1   Roles of routers in a network

A router is the first line of security from intrusion into a network. Enabling the highest level of security on the router turns on things like the firewall, and is the best way to keep your computer system and information safe from attacks.

1.5.2　Main characteristics of routers

Physically, routers can connect with other types of networks together, from high-speed local Ethernet to low-speed long-distance phone lines.

1.5.3　Differences between routers and switches

The most basic explanation is that a switch is designed to connect computers within a network, while a router is designed to connect multiple networks together. Even though routers and switches are different, they can be used interchangeably. For example, a router typically has several LAN ports and a single WAN port.

1.5.4　Router ports

The router has 3 types of ports: LAN, WAN and console/AUX. LAN communication port can be fixed on the router or in the form of a separate card.

1.6　Access points

1.6.1   Roles of access points

An access point is a wireless network device that acts as a portal for devices to connect to a LAN. Access points are used for extending the wireless coverage of an existing network and for increasing the number of users that can connect to it. A high-speed Ethernet cable runs from a router to an access point, which transforms the wired signal into a wireless one. Wireless connectivity is typically the only available option for access points, establishing links with end-devices using Wi-fi.

1.6.2   Main characteristics of access points

Wireless Access Point is a configured device on wireless local area network. It features a transceiver and antenna that help it in transmitting and receiving wireless signals even Wi-fi. It is commonly used to support the public internet hot spot and is also used by businesses to extend their networks.

1.6.3   Access point's interfaces

IBSS, managed, AP, AP/VLAN, WDS, monitor, meshpoint

1.6.4   Compare access point and other networking devices mentioned above

Compared with Routers:

- The router acts as a hub that sets up a local area network and manages all of the devices and communication in it. An access point, on the other hand, is a sub-device within the local area network that provides another location for devices to connect from and enables more devices to be on the network.

- Wireless routers can function as access points, but not all access points can work as routers. While routers manage local area networks, communicate with outside network systems, acquire, distribute, and dispatch data in multiple directions, establish a point of connectivity, and ensure security, access points typically only provide access to the router's established network.

Compared with Hubs and Switches: Access points deals with wireless connection for other devices while the others mainly deal with wired connections.

1.7 Modems

1.7.1 Dial-up modem

Roles:

This type of connection uses telephone lines to transmit analog signals from the computer to the internet servers and vice versa. Computers, and other modern devices that use the Internet, are unable to process analog signals.

Characteristics:

A dial-up connection has the following characteristics: The remote user chooses to use dial-up networking with a standard modem and has access to the Public Switched Telephone Network (PSTN), ie: the ordinary telephone service, also known as Plain Old Telephone Service (POTS).

1.7.2 ADSL modem

Role:

An ADSL router consists of a box which has an RJ11 jack to connect to a standard subscriber telephone line. It has several RJ45 jacks for Ethernet cables to connect it to computers or printers, creating a local

network. It usually also has a USB jack which can be used to connect to computers via a USB cable, to allow connection to computers without an Ethernet port. A wireless DSL router also has antennas to allow it to act as a wireless access point, so computers can connect to it forming a wireless network. Power is usually supplied by a cord from a wall wart transformer.

Characteristics:

Basic function of an ADSL modem is to provide Ethernet connectivity over telephone wire so that a PC at customer site and the system at service provider site can exchange data. In order to validate the user,

a protocol, such as PPPoE (sometime using PPPoA or PPTP), is used for authentication.

1.7.3   Cable modem

Role:

A cable modem is a hardware device that allows your computer to communicate with an Internet service provider over a landline connection. It converts an analog signal to a digital signal for the purpose of granting access to broadband Internet.

Characteristics:

Cable modems provide faster Internet speed as compared to dial-up, satellite, and DSL connections. One can download and upload large files faster over cable modems. Cable modems do not dropout or lose connection as commonly as dial-up connections.

2   Connecting network devices

Identify the type of network cable can be used for below network connections.

Answer:

1. Computer and hub: straight cable

2. Computer and switch: Ethernet crossover cable

3. Computer and router: Ethernet cable

4. Computer hub and hub: Ethernet crossover cable

5. Hub and switch: crossover cable and straight-through cable

6. Hub and router: Crossover cable and straight-through cable

7. Switch and switch: Ethernet crossover cable

8. Switch and router: Ethernet crossover cable

9. Router and router: straight-through cable