Intern Assignment
Chapter 2 Summarization

Presented by
Obafemi Ayoola Adebayo-Oyetoro

Ethernet and Ethernet Protocols

What is ethernet?

Ethernet is network technology developed in the 1970s that uses wired connection to link computers on a network for the purpose of data transmission and communication. It is used the LAN and WAN to connect devices such as laptops, printers on a network, the introduction of routers and switches will allow wireless connection of devices on the network.

Ethernet protocols are series of standards and rules that governs how data is transmitted on an ethernet network. These protocols are known for being secure, efficient, reliable, and fast. They also have other advantages, such as being less expensive, requiring no hubs or switches, and being strong against noise.

Ethernet Protocols

Ethernet protocols can be categorized into 5 types based on the their speed, they are shown in the table below;

Types of ethernet names, speed and wire type

Name	Speed	Informal name	Formal name	Wire type
Ethernet	10 mbps	10base-T	802.3	Copper 100m
Fast ethernet	100 mbps	100base-T	802.3u	Copper 100m
Gigabit ethernet	1000 mbps	1000base-LX	802.3z	Fibre 5000m
Gigabit ethernet	1000 mbps	1000base-T	802.3ab	Copper 100m
10 gig ethernet	10 gbps	10Gbase-T	802.3an	Copper 100m

The most popular types of ethernet are the 10base-T, 100base-T and 1000base-T models. The 10base-T and 100base-T use two-wire pair while the 1000base-T use four wire pair in UTP(unshielded twisted pair).

IEEE 802.3 and it's parts

IEEE 802.3 defines the physical layer and the media access control (MAC) sub layer of the data-link layer for wired Ethernet networks. 802.3 is regulated by the body called IEEE(Institute of Electrical and Electronics Engineers). The 802.3 frame format has specification of a maximum data portion of 1500 bytes and minimum of 46 bytes, it is divided into 7 parts;

Preamble: This is a 7 bytes frame that alerts the receiver that a frame is about to begin, this enables the receiver to lock onto the data stream. It aids in sychronization of data between sender and receiver.

SFD(start of frame delimiter): It is a 1 byte field that indicates that the next frame are the starting of the frame which is the destination address, it is usually set to 10101011. It also serves as the last warning for the receiver to synchronize.

Destination address: It is a 6 bytes frame that contains information about the recipient of the data. It contains the MAC (media access control) address.

Source address: This is also a 6 bytes frame as the destination address, it contains information of the source of the data (sender).

Type: This a 2 bytes frame that contains the type of protocol the frame follows. I.e IPv4 or IPv6.

Data: It ranges from 46-1500 bytes, This where the actual data is placed, it may be referred to as Payload.When the actual data sent is smaller than the minimum requirement, padding of 0's may be added to the data in order to meet the minimum length of 46 bytes.

FCS(frame check sequence): It is a 4 bytes frame that contains method for receiving NIC to determine if there was error during data transmission.:

Ethernet cables and ports

Ethernet cables are either made of copper which is used in coaxial cables and twisted pairs or flexible glass used in Fiber optic cables.

Copper cables vs Fiber optics

1. Speed of light is greater than the speed of electrons, data is transmitted faster in fiber optics than copper
2. Isolation of light in fiber optics makes room for no interference, the only source of data transmission is the either ends of the cable.
3. Copper cables still generate electromagnetic field while moving signals which might lead to data loss from attenuation
4. High data security in fiber optics.

Ethernet ports also known as RJ-45 ports are used to connect devices together on a LAN over wired network. It is found on modems, routers, switches and used to connect laptops and desktops to servers to provide high speed communication and robust security. The most commonly used ones are Cat5 which are used in home networks, Cat6, Cat7 and Cat8 RJ-45 ports are used in data centers and cloud computing networks because of their high transmission speed.

Multimode and single mode fiber optics

Multimode fiber optics differs from single mode fiber due to various reasons such as:

1. Single mode fiber can only propagate on light mode whereas multimode fiber can support multiple light modes
2. Difference in bandwidth.
3. Difference in transmission distance, single mode fiber can only carry light over a short difference while multimode fiber can transmit light over long distance.
4. Single mode fiber cables are less expensive and efficient to produce unlike multimode fiber cables.

Cross section of a fiber optic cable

Core   Cladding   Coating

Tight Buffer   Strength Members   Cable Jack
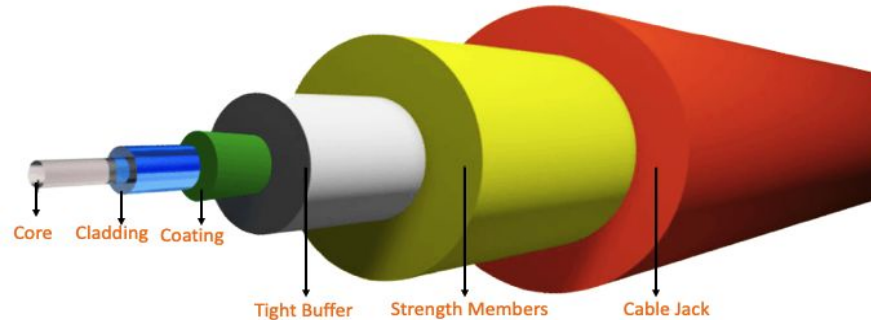
MAC address, Error detection and FCS

MAC refers media access control, it is a unique hexadecimal identifier that is assigned to a NIC (network interface controller). A MAC address is 6 bytes long, the first 3 bytes are assigned by IEEE while the last 3 bytes are assigned by the manufacturer. It is usually 48 bits long in binary.

A NIC is a hardware component that connects a computer or server by transmitting signals at the physical level and deliver data packets at the network layer.

Error detection in data transmission is the process of identifying and correcting errors caused by impairments during transmission between a sender and a receiver, FCS is used to detect such errors.

FCS(frame check sequence) is a 4 bytes frame that is added to added to a data packet to detect errors such as address field, information error or control field in frames transmitted over a network.