RFC (894) Ethernet

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* What does RFC 894 Specifies?

- Standard method of encapsulating Internet Protocol (IP) datagrams on an Ethernet.
- Standard protocol for the ARPA-Internet community.

* What is IP Datagram Encapsulation?

- Data is passed to IP mainly through either TCP or UDP.
- Data contains message and respective Headers.
- Encapsulated into the body of an IP message, usually called an IP datagram or IP packet.

* What is Ethernet?

- Communication protocol that connects numerous devices to LAN (Local Area Network) or WAN (Wide Area Network).
- Switches, printers, and computers exchange data uninterruptedly.
- Wired connection that connects devices using ethernet switches and hubs.
- Works with a hierarchical setup, including a gateway, router, ethernet port, switch, hub, and servers.

* History of Ethernet

- 1973, Robert Metcalfe was on a mission to create a fast, secure, and cost-effective alternative for connectivity.
- (In Past) Ethernet was not as fast and efficient as it is currently.
- Businesses used because affordable and secure than others.
- Complies with IEEE standards.
- (Today) CAT5e or CAT6 ethernet cable, and enjoy a data transfer speed of up to 10 Gbps.

* Why Ethernet?

- Faster, secures, and more reliable when compared to Wi-Fi.
- Uses CSMA/CD
- Various Types of Ethernet Networks:

->Fast Ethernet(10BaseT cabling, Max 100Mbps).
-> Gigabit Ethernet(CAT5e or fiber optic, Max 100Mbps).
->10 Gigabit Ethernet(CAT6e cable.Max 10 Gbps).

- Hybrid model(Connect Fast Ethernet and Gigabit Ethernet)
- PAM3 (Pulse Amplitude Modulation) reduce the signal-to-noise ratio.
- Sensitive data stays safe from DDOS(fake traffic) attacks and other cybercrimes.
- Cost-Effective(Than Wif over Range).

* Components of Ethernet Frame

- Preamble ->pattern of alternative 0's and 1's allow bit synchronization.
- Start of frame delimiter (SFD) —>1-Byte field which is always set to 10101011.
- Destination Address -> 6-Byte field MAC address.
- Source Address -> 6-Byte field MAC address.
- Length -> 2-Byte field, length of entire Ethernet frame.Length value between 0 to 65534, but length cannot be larger than 1500 Bytes because of some own limitations of Ethernet.
- Data -> This is the place where actual data is inserted, also known as Payload.Size 46B(Collision Detection) to 1500B.

● Cyclic Redundancy Check (CRC) —>4 Byte field.Destination Address, Source Address, Length, and Data field verification.

* Addressing Mapping

The mapping of 32-bit Internet addresses to 48-bit Ethernet addresses can be done several ways. A static table could be used, or a dynamic discovery procedure could be used.

● Static Table->Each host could be provided with a table of all other hosts on the local network with both their Ethernet and Internet addresses.

● Dynamic Discovery ->Mappings between 32-bit Internet addresses and 48-bit Ethernet addresses could be accomplished through the Address Resolution Protocol (ARP).

● Broadcast Address ->Should be mapped to the broadcast Ethernet address (of all binary ones, FF-FF-FF-FF-FF-FF hex).

* ARP

● The acronym ARP stands for Address Resolution Protocol which is one of the most important protocols of the Network layer in the OSI model.

- Finds Media Access Control (MAC) address, of a host from its known IP address.
- An ARP request is a broadcast, and an ARP response is a Unicast.

* How ARP Works?

- ARP Cache-> Stored MAC address in a table for future reference.
- ARP Cache Timeout-> Time for which the MAC address in the ARP cache can reside.
- ARP request: This is nothing but broadcasting a packet over the network to validate whether we came across the destination MAC address or not.

->The physical address of the sender.
->The IP address of the sender.
->The physical address of the receiver is FF:FF:FF:FF:FF:FF or 1's.
->The IP address of the receiver

- ARP response/reply: It is the MAC address response that the source receives from the destination which aids in further communication of the data.