

# Introduction of IP

- IP is a set of rules governing data transmission.
- It enables global data communication.
- IP is essential for Internet and network communication.
- IPv4 and IPv6 are the two main versions.
- **IP addressing** – The IP addressing conventions are part of the IP protocol. Designing an IPv4 Addressing Scheme introduces IPv4 addressing and IPv6 Addressing Overview introduces IPv6 addressing.
- **Host-to-host communications** – IP determines the path a packet must take, based on the receiving system's IP address.
- **Packet formatting** – IP assembles packets into units that are known as **datagrams**. Datagrams are fully described in Internet Layer: Where Packets Are Prepared for Delivery.
- **Fragmentation** – If a packet is too large for transmission over the network media, IP on the sending system breaks the packet into smaller fragments. IP on the receiving system then reconstructs the fragments into the original packet.

# IP Addressing

- IP assigns unique numerical addresses.
- IPv4 uses 32-bit addresses (e.g., 192.168.1.1).
- IPv6 uses 128-bit addresses (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).
- Addresses identify devices on a network.
- IPv4 addresses consist of network and host parts.
- IPv6 provides an almost limitless address space.
- DHCP assigns IP addresses dynamically.
- DNS resolves human-readable domain names to IPs.
- IP addresses can be public or private.
- NAT allows multiple devices to share one public IP.

# Choosing IP address for your Network

- Factor to consider :
  - ◆ IP version : IPv4 or IPv6
  - ◆ Network Size: small Or large
  - ◆ Multihomed/Router: Multiple Interface
  - ◆ DHCP: Efficient address management
- IP Addressing Options:
  - ◆ IPv4 Address: class-based, subnets
  - ◆ DHCP Address : Dynamic assignment
  - ◆ IPv6 Address: Long-term Scalability
- Address Assignment Authority:
  - ◆ Centralized Control
  - ◆ No duplicate network numbers

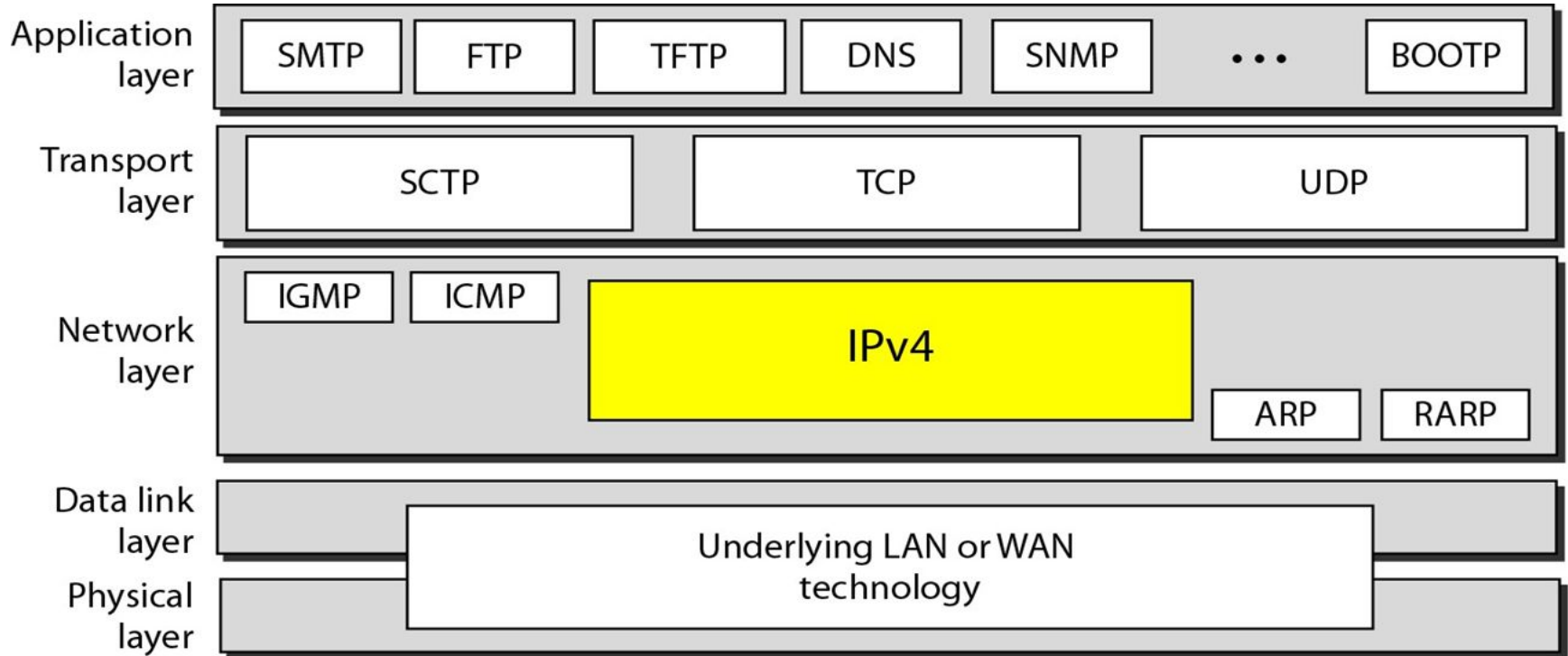
# What is IP (Internet Protocol)...?

- IP is a connectionless protocol, meaning that there is no established connection between the sender and receiver before data is transmitted.
- IP divides data into packets, each of which is assigned a unique IP address.
- IP packets are routed through a series of routers, which are devices that connect different networks.
- Each router uses the IP address in the packet header to determine the next router in the path to the destination.
- Once the packets reach the destination device, they are reassembled into the original data.
- **Purpose:** To provide a universal way to route and address data on the Internet.

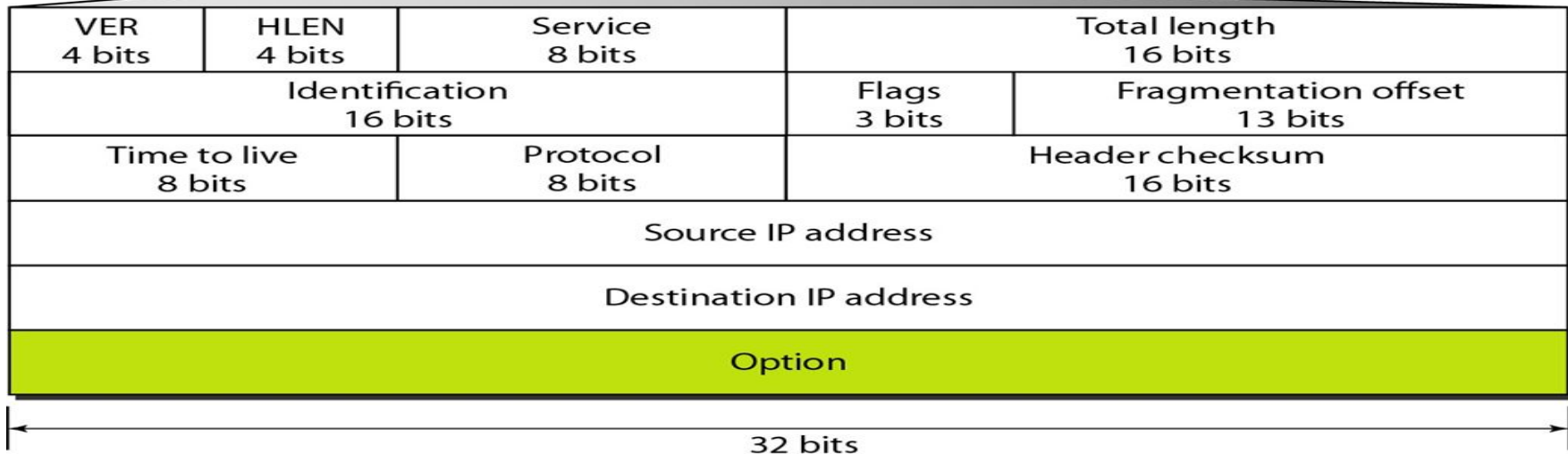
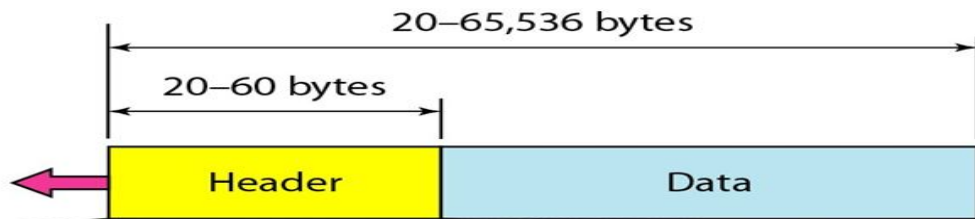
# IPv4



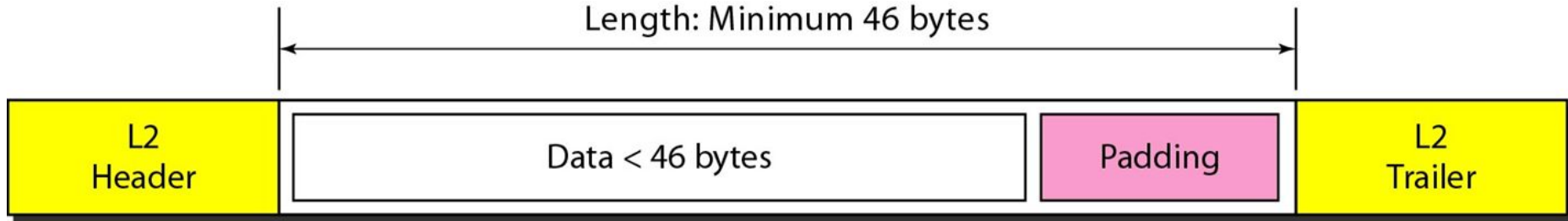
# Position of IPv4 in TCP/IP protocol



# IPv4 datagram format

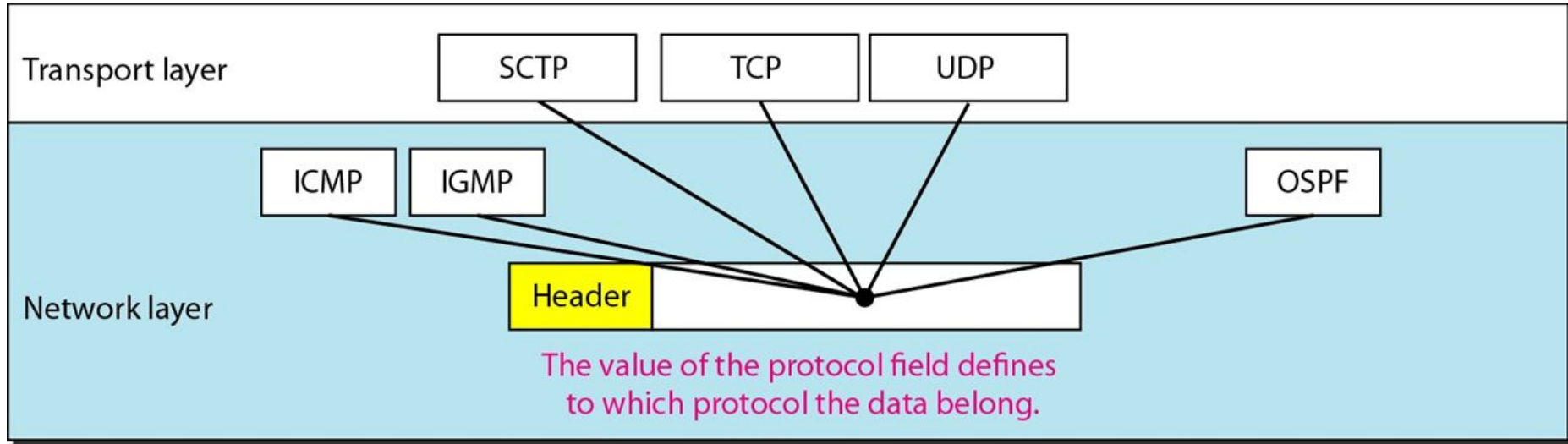


# Encapsulation of a datagram in an Ethernet Frame





# Protocol field and encapsulated data



# example-1

Q-1: An IPv4 packets has arrived with the first 8 bits as shown 01000010 the receiver discard the packet why?

Solution:

There is an error in this packet. The 4 leftmost bits (0100) show the version, which is correct. The next 4 bits (0010) show an invalid header length ( $2 \times 4 = 8$ ). The minimum number of bytes in the header must be 20. The packet has been corrupted in transmission.

## Example-2

Q-2: In an IPv4 packet, the value of HLEN is 1000 in binary. How many bytes of options are being carried by this packet?

Solution:

The HLEN value is 8, which means the total number of bytes in the header is  $8 \times 4$ , or 32 bytes. The first 20 bytes are the base header, the next 12 bytes are the options.

