

# Internet Protocol



# IP Protocol

- This is host to host network layer connection less datagram protocol with no guarantee of reliability.
- It is a unreliable protocol b'z it does not provide any error and flow control.
- It can only detect the error and discard the corrupted packet.

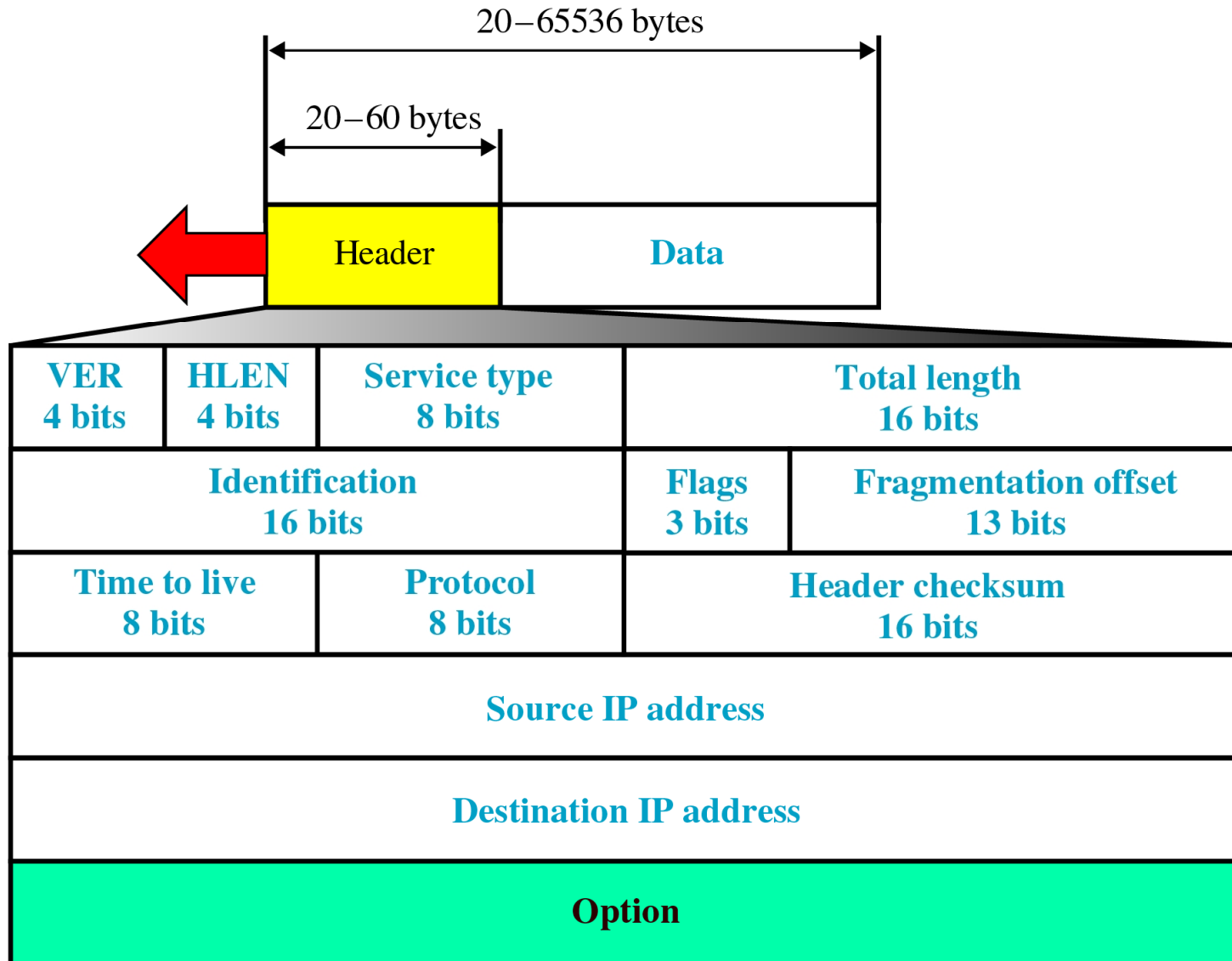




# IP Datagram

- Packet in IP layer are called datagram.
- Datagram is a variable length packet with two parts **Header** and **Data** .
- The header is 20-60 bytes in length and contains information required for routing and delivery.
- Data field is of variable length.

# Structure of IP frame header



## Version (VER).

- This 4-bit field defines the version of the IP protocol.
- Currently the version is 4. However, version 6 may totally replace version 4 in the future.
- This field tells the IPv4 software running in the processing machine that the datagram has the format of version 4.
- All fields must be interpreted as specified in the fourth version of the protocol.
- If the machine is using some other version of IPv4, the datagram is discarded rather than interpreted incorrectly.



## Header length (HLEN)

- This 4-bit field defines the total length of the datagram header in 4-byte words.
- This field is needed because the length of the header is variable (between 20 and 60 bytes).
- When there are no options, the header length is 20 bytes, and the value of this field is 5 ( $5 \times 4 = 20$ ).
- When the option field is at its maximum size, the value of this field is 15 ( $15 \times 4 = 60$ ).



# Services

- This is 8-bit field. This field, previously called service type, is now called differentiated services. It defines the class of datagram for quality of service purpose.

# Total length

- field defines the total length of the datagram including the header.
- Length of data = total length - header length
- Since the field length is 16 bits, the total length of the IPv4 datagram is limited to **65,535 (2<sup>16</sup>-1) bytes**, of which 20 to 60 bytes are the header and the rest is data.

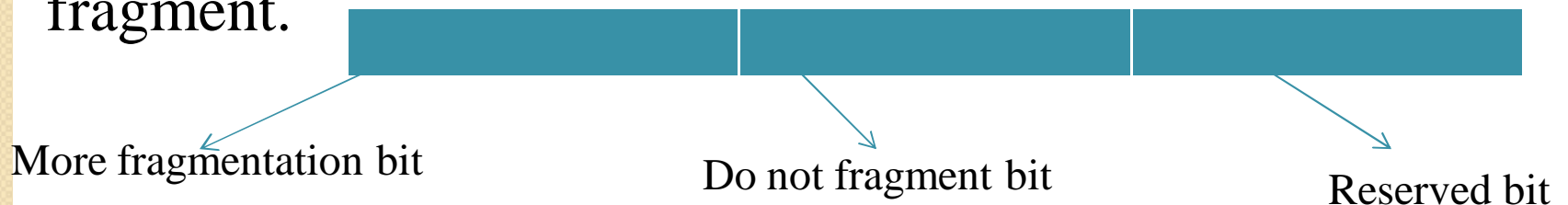
# Identification

- This 16-bit field identifies a datagram originating from the source host.
- When a datagram is fragmented, the value in the identification field is copied to all fragments .
- The identification number helps the destination in reassembling the datagram.
- It knows that all fragments having the same identification value must be assembled into one datagram.



# Flags

- This is a 3-bit field.
- The first bit is reserved and it should be zero.
- The second bit is called the do not fragment bit.
  - If its value is 1, the machine must not fragment the datagram .
  - If its value is 0, the datagram can be fragmented if required.
- The third bit is called the more fragment bit.
  - If its value is 1, it means the datagram is not the last fragment; there are more fragments after this one.
  - If its value is 0, it means this is the last or only fragment.



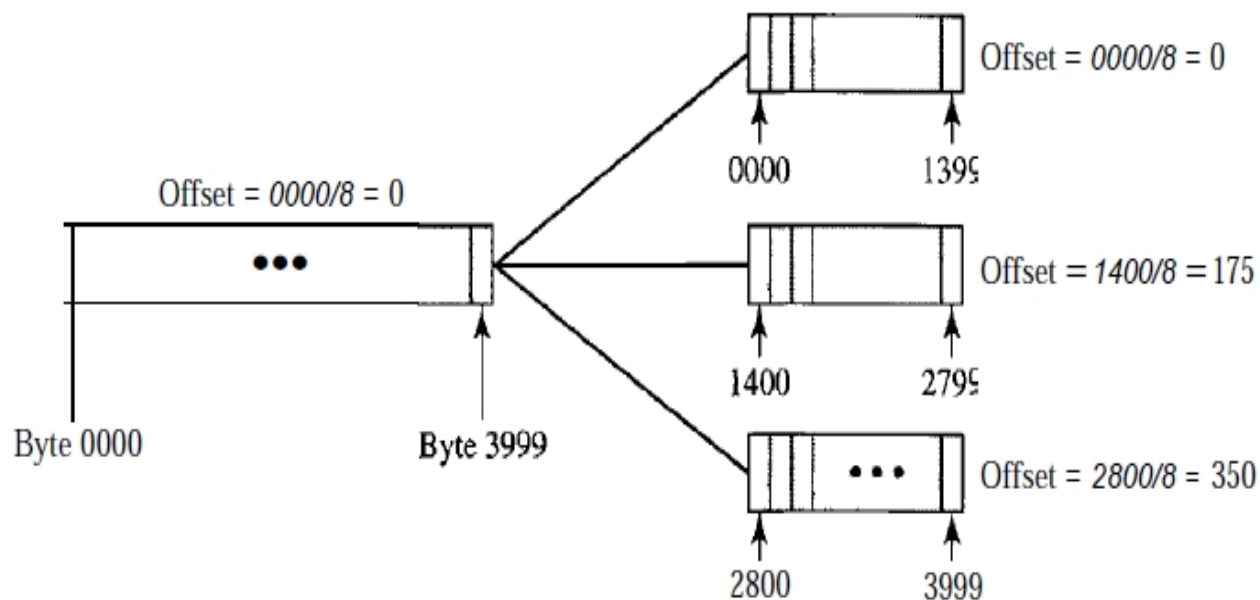


# Fragmentation offset

- This 13-bit field shows the relative position of this fragment with respect to the whole datagram.
- It is the offset of the data in the original datagram measured in units of 8 bytes.
- The bytes in the original datagram are numbered 0 to 3999.
- The first fragment carries bytes 0 to 1399.
  - The offset for this datagram is  $0/8 = 0$ .
- The second fragment carries bytes 1400 to 2799.
  - The offset value for this fragment is  $1400/8 = 175$ .
- Finally, the third fragment carries bytes 2800 to 3999.
  - The offset value for this fragment is  $2800/8 = 350$ .

# Fragmentation offset

- Remember that the value of the offset is measured in units of 8 bytes. This forces hosts that fragment datagrams to choose a fragment size so that the first byte number is divisible by 8.





## Time to live

- A datagram has a limited lifetime in its travel through an internet.
- This field was designed to hold a timestamp, which was decremented by each visited router.
- The datagram was discarded when the value became zero.
- All the machines must have synchronized clocks and must know how long it takes for a datagram to go from one machine to another.



# Time to live

- This field is used mostly to control the maximum number of routers visited by the datagram.
- When a source host sends the datagram, it stores a number in this field.
- This value is 2 times the maximum number of routes between any two hosts. Each router that processes the datagram decrements this number by 1. If this value is zero, the router discards the datagram .

# Time to live

- This field is needed because routing tables in the Internet can become corrupted . A datagram may travel between two or more routers for a long time without ever getting delivered to the destination host. This field limits the lifetime of a datagram .
- This field is also used to intentionally limit the journey of the packet. if the source wants to **confine the packet to the local network, it can store 1** in this field. When the packet arrives at the first router, this value is decremented to 0, and the datagram is discarded



# Services provided by IP

- **Addressing** – 32 bit address used by intermediate router to select a path through the network for the packet.
- **Fragmentation**– IP packet may be split in to smaller packets. This permit a large packet to travel through a n/w that can handle the smaller packets.
- **Packet time out** – time to live





# Address Space

- An address space is the total number of addresses used by the protocol.
- IP uses 32-bit addresses, which means that the address space is  $2^{32}$  or 4,294,967,296 (more than 4 billion).

# Various n/w layer protocols

- IP needs services of
  - ARP to find the MAC( physical) address ,
  - RARP to find IP address ,
  - ICMP for query and error reporting messages and
  - IGMP for the simultaneous transmission of a message to a group of receivers.





# Applications/Assignment

- From the discussion , students should find out all the applications of IP protocol.



# Scope of Research

- IP in mobile networks
- IP in Mobile adhoc networks
- IP in wireless domain