

# IPV4 Header

IPV4 is used at layer 3 to help send data between devices on separate networks (routing).  
IPV4 header/ packet encapsulates a TCP or UDP segment.  
IPV4 header is left to right top to bottom

## IPV4 header structure:

- 1- Version: 4 bits, identifies the version of IP used whether IPV4 or IPV6.
  - 2- IHL (internet header length): 4 bits indicating the total length of the header in 4 bytes increment ( $4 * N$ ) min: 5 , max 15.
  - 3- DSCP (differentiated services code point): 6 bits for QoS (quality of service) to prioritize delay-sensitive data.
  - 4- ECN (explicit congestion notification): 2 bits to provide end to end notification of network congestion without dropping packets (optional that requires both endpoints as well as the underlying network infrastructure to support it).
  - 5- Total Length Field: 16 bits describing the whole length of the packet including IPV4 header and the encapsulated segment in bytes, min value is 20 which is IIPV\$ header with no encapsulated data, max is 65535.
  - 6- Identification Field: 16 bits → is a packet is fragmented the value in this field is used to identify the packet that fragment belongs to (if a packet is larger than MTU (max transmission unit) its fragmented (1500 bytes) (fragments are reassembled by receiving host).
  - 7- Flags Field: 3 bits to control and identify fragments Bit0 → 0 reserved, Bit 1: DF or don't fragment packet flag and Bit2 if 0 meaning the=is is the last fragment otherwise its 1 (MF or more fragments) .
  - 8- Fragments Offset: 13 bits to indicate the position of the fragment within the original IP packet so that fragments can be assembled even if they arrive out of order.
  - 9- Time to Live: 8 bits was designed to indicate packet maximum live time in seconds to prevent infinite loops so that router can drop it, in practice it identifies hop count that decreases each time a packet arrives at a router to its destination. Recommended default TTL Is 64.
  - 10- Protocol: 8 bits to indicate the protocol of the encapsulated layer 4 PDU.
  - 11- Header Check Sum: 16 bits to check for errors in IPV4 header on receive if an error occurred it drops the packet.
  - 12- Source IP address: packet sender 13- destination IP address: packet receiver. (Each is 4 bytes).
  - 13- options field: optional and can be 0 bits in length if not used up to 320 bits, rarely used only if IHL > 5.
- ICMP → internet control message protocol.  
Standard ping command on Cisco router will send 100-byte pings.