The Internet Protocol (IP) – Version 4

The Internet Protocol (IP) Version 4 is specified in RFC-791. The role and function of the IP protocol is to route data across a network. The structure of the IPv4 is as follows:

IPv4 header format

Offsets	Octet	0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Version				IHL				DSCP						ECN		Total Length															
4	32	Identification																Flags			Fragment Offset											
8	64	Time To Live								Protocol								Header Checksum															
12	96	Source IP Address																															
16	128	Destination IP Address																															
20	160	Options (if IHL > 5)																															
⋮	⋮																																
56	448																																

The meaning of the components in the IP packet is as follows:

- Version
  - This is the four-bit version field, and for IPv4, this is always equal to 4.
- Internet Header Length (IHL)
  - The IHL field contains the size of the IPv4 header.
- DSCP
  - This field specifies differential services. (This is defined in RFC 2474)
- ECN
  - Explicit Congestion Notification. (This is defined in RFC 3168)
- Total Length
  - This field defines the entire packet size in bytes, including header and data.
- Identification
  - This field is an identification field and is primarily used for uniquely identifying the group of fragments of a single IP datagram.
- FLAGS
  - A three-bit field follows and is used to control or identify fragments. They are (in order, from most significant to least significant):
    - bit 0: Reserved; must be zero.
    - bit 1: Don't Fragment (DF)
    - bit 2: More Fragments (MF)
- Fragment Offset
  - This field specifies the offset of a particular fragment
- Time to Live (TTL)
  - An eight-bit time to line field limits a datagram's lifetime in a network.
- Protocol
  - This field defines the protocol used in the data portion of the IP datagram. A value of 1 is used for ICMP, a value of 6 is used for TCP, and a value of 17 is used for UDP
- Head Checksum
  - This field is used for error-checking of the header.
- Source Address
  - This field is the IPV4 Address of the sender of the packet.
- Destination Address
  - This field is the IPV4 Address of the receiver of the packet.
- Options
  - This field is not often used and is generally ignored.
- Data
  - The packet payload is not included in the checksum. Its contents are interpreted based on the value of the Protocol header field.