TCP Header & Encapsulated Data Layout

Bit 0   **Bit 31**

Source Port 16 bits *Identifies the port of the sending application.*	Destination Port 16 bits *Identifies the port of the receiving application.*

Sequence Number 32 bits *It's the sequence number of the first data byte in this segment.*

Acknowledgment Number 32 bits *If the ACK flag is set, this is the sequence number of the next byte the sender is expecting.*

Header Length 4 bits *Size of the TCP header in 32-bit words (5 = 20 bytes, 15 = 60 bytes).*	Reserved 3 bits	NS 1 bit	CWR 1 bit	ECE 1 bit	URG 1 bit	ACK 1 bit	PSH 1 bit	RST 1 bit	SYN 1 bit	FIN 1 bit	Window Size 16 bits *Number of data bytes this sender will accept.*

Checksum 16 bits *Checksum for error-checking header & data.*	Urgent Pointer 16 bits *Points to the octet after urgent data.*

Options & Padding Variable (0-320 bits, padded to 32-bit boundary) ***Options**: up to 40 bytes (e.g. MSS, window scaling).* ***Padding**: zeros to align on 32-bit.*

Max IP Header: 60 bytes (IHL=15)
Max Encapsulated Data: 65 515 bytes (Total Length=65 535 - 20-byte min header)

IPv4 Header & Encapsulated Data Layout

Bit 0   **Bit 31**

Version 4 bits *IP version (always 4 for IPv4).*	IHL 4 bits *Internet Header Length in 32-bit words.*	Type of Service 8 bits *DSCP & ECN for QoS.*	Total Length 16 bits *Entire datagram size in bytes.*

Identification 16 bits *Fragment identification #.*	Flags 3 bits *DF, MF control flags.*	Fragment Offset 13 bits *Position of this fragment.*

TTL 8 bits *Time To Live (hops).*	Protocol 8 bits *Encapsulated protocol (e.g. TCP=6).*	Header Checksum 16 bits *Error-check for header only.*

Source Address 32 bits *IPv4 of sender.*

Destination Address 32 bits *IPv4 of receiver.*

Options & Padding Variable (0-320 bits, padded to 32-bit boundary) *Optional settings & alignment.*

Encapsulated Data Variable length *TCP Header + Payload (your TCP segment goes here).*