

Routers can implement these different network layer protocols to operate concurrently over a network to and from the same or different hosts. The routing performed by these intermediary devices only considers the contents of the packet header that encapsulates the segment.

In all cases, the data portion of the packet—that is, the encapsulated transport layer PDU—remains unchanged during the network layer processes.

IPv4 Packet Header

The IP header holds the delivery and handling instructions for an IP packet. For example, when a packet arrives on a router's interface, the router needs to know whether the packet is IPv4 or IPv6. The router looks to a specific field in the header to see which type is arriving. The header also contains addressing information and other data about how to handle the packet along the way.

Figure 5-4 shows an outline of an IP packet header. There are several fields in the packet, and not every network uses every field. There are highlighted fields that are important to understanding how the IP header helps routers route IP packets successfully.

Figure 5-4 Components of an IP Header

| Byte 1 | | Byte 2 | | Byte 3 | | Byte 4 | |
|---------------------|-----|-----------------|------|-----------------|--|--------|---------|
| Ver. | IHL | Type of Service | | Packet Length | | | |
| Identification | | | Flag | Fragment Offset | | | |
| Time to Live | | Protocol | | Header Checksum | | | |
| Source Address | | | | | | | |
| Destination Address | | | | | | | |
| Options | | | | | | | Padding |

The key fields are as follows:

- **IP Source Address:** Contains a 32-bit binary value that represents the IPv4 address of the host sending the packet.*
- **IP Destination Address:** Contains a 32-bit binary value that represents the host that will receive the packet. Routers will use this data to forward the packet to the correct network.
- **Time to Live (TTL):** The 8-bit TTL field describes the maximum hops the packet can take before it is considered “lost” or undeliverable. Each router that handles the packet decrements the TTL field by at least 1. The packet will be dropped if the TTL value reaches 0. This keeps the Internet from being cluttered with lost packets.

*This field enables the destination host to respond to the source if necessary.