Application	HTTP, FTP, SMTP
Transport	TCP, UDP
Internetwork	Datagrams
Link	MAC, Frames
Physical	Ethernet, WiFi

Glossary

MTU Maximum Transmission Unit

- Calculated as the smallest MTU of all links in the path.
- If a packet is larger than the MTU, it is fragmented.

ECN Explicit Congestion Notification

- A bit in the IP header that is set by the router to indicate congestion.
- Related to TCP's congestion control.

Subnetting Dividing a network into smaller networks.

- Done by borrowing bits from the host portion of the address.
- Done to reduce broadcast traffic and improve security.

Supernetting Combining multiple networks into a single network.

- Done by borrowing bits from the network portion of the address.
- Done to reduce routing table size.

Physical

CAT Category (twisted pair) cable for Ethernet.
Coax Coaxial cable for Ethernet.

Link

MAC Media Access Control

- Unique identifier for a network interface.
- 48 bits, often represented as 6 groups of 2 hexadecimal digits.
- First 24 bits are the OUI (Organizationally Unique Identifier).
- Example: `00:1A:2B:3C:4D:5E`

ARP Address Resolution Protocol

- Who has IP_B? Tell IP_A at MAC_A.
  1. Any listening devices may receive this request and update their local cache of IP_A's MAC_A.
  2. If the receiving machine is not IP_B, it will stop processing the request.
  3. Otherwise, it will send an ARP reply to MAC_A.
     Since this reply is *not* broadcasted, no other machines can update their cache.
- Typical cache timeout of 20 minutes.
- Gratuitous ARP is used to update caches.
  1. A machine sends an ARP request for its own IP.
  2. All machines update their cache with the new MAC.
  3. This is useful for updating caches after a machine has changed its MAC.

Switch A device that forwards packets based on MAC addresses. (Layer 2)
Hub A device that broadcasts packets to all connected devices. (Layer 1)

Link

Transmission

Direct and Indirect Deliver Direct is on the same network, indirect is on a different network.
Unicast, Broadcast, Multicast Unicast is one-to-one, broadcast is one-to-all, multicast is one-to-many.
Switching Forwarding packets based on MAC addresses.
Spanning Tree Protocol Prevents loops in a network.

Internetwork

IP Datagrams

Fragmentation

- Done by routers when the packet is too large for the next hop.
- `DF` (Don't Fragment) bit in the IP header can be set to prevent fragmentation.
- `MF` (More Fragments) bit is set on all fragments except the last.
- `Fragment Offset` field is used to reassemble the fragments.
- `Identification` field is used to identify the original packet.
- `Total Length` field is the size of the fragment.
- `Header Checksum` is recalculated for each fragment.

Transport

UDP

- Connectionless, unreliable.
- Includes psuedo-header in checksum calculation.

TCP

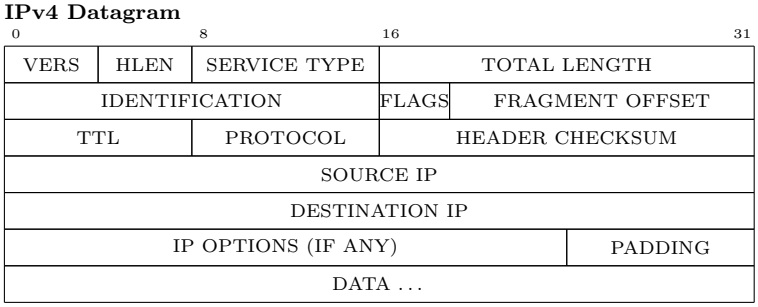
- Stream Orientation.
- Virtual Circuit.
- Buffered, unstructured stream.
- Full duplex.

Schemas

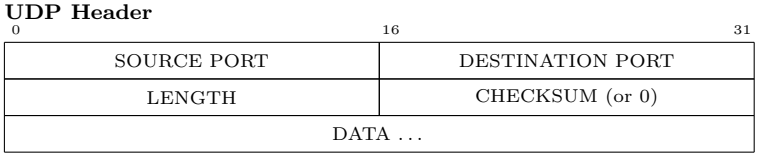
Ethernet Frame

Preamble	Destination Address	Source Address	Frame Type	Frame Data	CRC
8 octets	6 octets	6 octets	2	46 - 1500 octets	4 octets

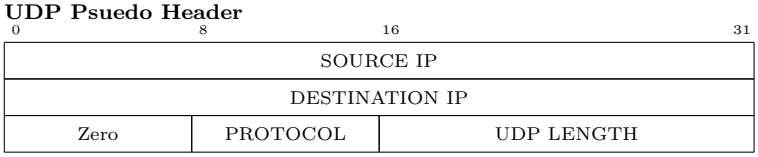
IPv4 Datagram



UDP Header



UDP Psuedo Header

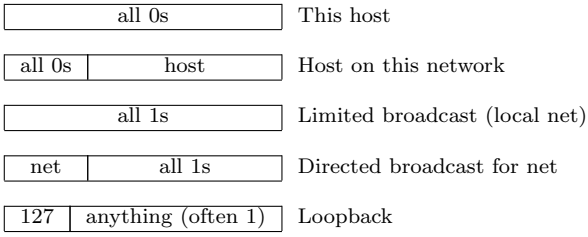


Addressing

Classful Addressing

Class A	`0XXXXXXX`	/8
Class B	`10XXXXXX`	/16
Class C	`110XXXXX`	/24
Class D	`1110XXXX`	/31
Class E	`1111XXXX`	/32

'This' network' has host bits set to 0.
Broadcast has host bits set to 1.



ARP