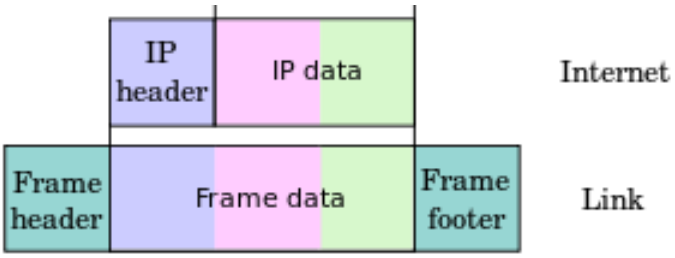
Lab 2 IPv4 Datagram and Address

1. The Introduction of Internet Protocol

Typically, the link layer encapsulates IP packets:



Please refer to the Textbook and corresponding lecture slides for the details of IP Protocols.

2. The format of IP packet

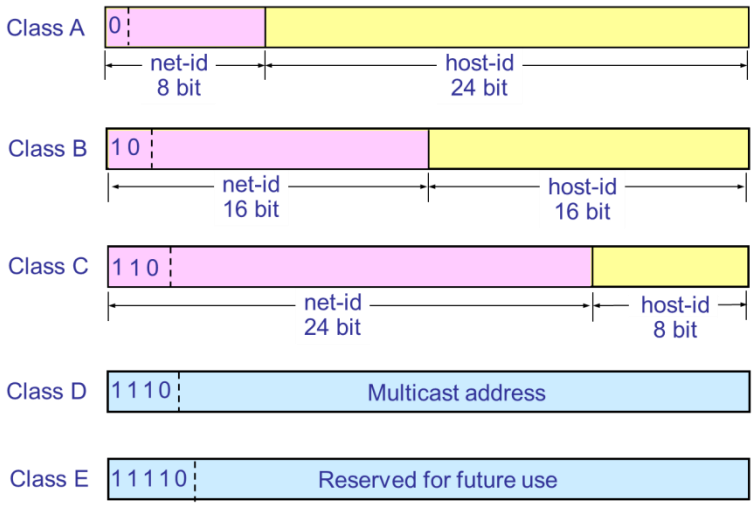
Offsets	Octet	0								1								2								3							
Octet	Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	Version				IHL				DSCP						ECN		Total Length															
4	32	Identification																Flags			Fragment Offset											
8	64	Time To Live		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

Figure 3-5 IP Header format

Please refer to the Textbook and corresponding lecture slides for the details of IP Packet, e.g., how to calculate header checksum.

3. IP Address

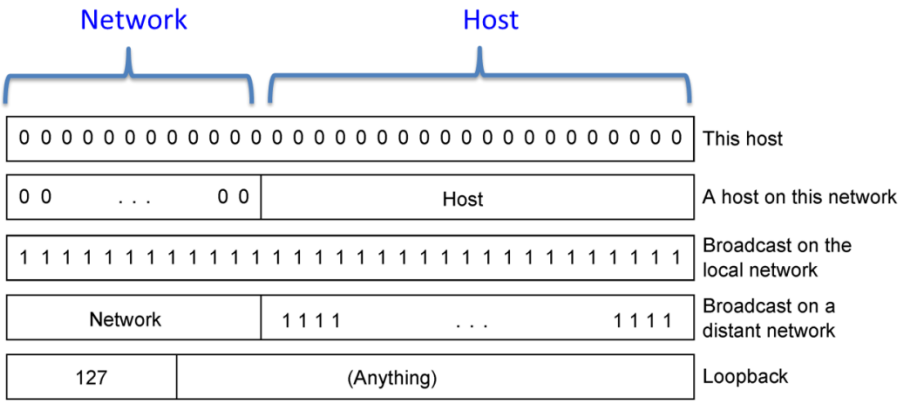
IP address space is divided into five address classes: A, B, C, D and E. Class A, B and C are defined as unicast addresses. Class B is used for multicast. Class E is reserved for future or experimental purposes.



IP address range of three common classes:

Classes	Max. # of networks	First network ID	Last network ID	Max. # of hosts in each network
A	126 ($2^7 - 2$)	1	126	16,777,214
B	16,383 (2^{14})	128.0	191.255	65,534
C	2,097,151 (2^{21})	192.0.0	223.255.255	254

Several Special IP Addresses:



- **Host address**: an IP address with all '0' (0.0.0.0) identifies the host itself.
- **Network address**: IP addresses with all '0' in the part of host-id are not allocated for any hosts. They are used to identify the network itself. For example, host '202.198.151.136' is in the subnet '202.198.151.0';
- **Directed broadcast address**: IP addresses with all '1' in the part of host-id are not allocated to any hosts. They are used as broadcast addresses. Sending a packet to a directed broadcast address will send this packet to all nodes in this network (depending on whether the physical network has the function of broadcasting). For example, the directed broadcast address of network '202.198.151.136' is '202.198.151.255';

- **Limited broadcast address**: An IP address with all '1' (255.255.255.255) is usually used by diskless workstation. When booting, a diskless workstation will obtain an IP address from the IP addressing server;
- **Loopback address**: The address '127.0.0.1' is used for testing software or communicating with different network applications on the local machine.

Private IP addresses

Three ranges of IPv4 addresses for private networks are not routed on the Internet and thus their use need not be coordinated with an IP address registry.

	Start	End	No. of addresses
24-bit block (/8 prefix, 1 × A)	10.0.0.0	10.255.255.255	16777216
20-bit block (/12 prefix, 16 × B)	172.16.0.0	172.31.255.255	1048576
16-bit block (/16 prefix, 256 × C)	192.168.0.0	192.168.255.255	65536