IP Addressing

Ethernet frame has a header and footer, which encapsulates the data recieved form the IP layer. The IP layer recieves the TCP/UDP header and application data, and that is encapsulated with the IP header.

> *An IP address is a unique global address for a network interface*

It is a:

- 32-bit long integer
- encodes the network prefix and a host number

Dotted Decimal Notation

Each byte is identified by a decimal number of range 0..255. For example: 128.143.137.144

Network prefix and host number

The network prefix identfies the network and the host number identifies a specific host(rather an interface on the network).

The Network prefix is implicitly defined and indicated by the netmask. The netmask is 255.255.0.0. So if the network id is 128.143.0.0 and the host number is 137.144, then the prefix notation is 128.143.137.144/16 because the prefix is 16 bits long. So if the the network id is long, then the number of hosts would be small.

Classful IP Address

Each IP address was split into 3 classes for network classes of 8-bit(Class A, starts with `0`), 16-bit(Class B, starts with `10`), 24-bit(Class C, starts with `110`).

Subnetting

> *Subnetting is the process of borrowing bits from the host number bits, in order to divide the larger network into small subnets.*

- Subnetting does NOT give you more hosts, but actually costs you hosts.
- You lose two host IP Addresses for each subnet, and perhaps one for the subnet IP address and one for the subnet broadcast IP address.
- You lose the last subnet and all of it's hosts' IP addresses as the broadcast for that subnet is the same as the broadcast for the network.

So we split the host number portion of the IP address into a subnet number and a new host number.

Classless Interdomain Routing - CIDR

Goals:

- Restructure IP address assignments to increase efficiency
- Heirarchical routing aggregation to minimize route table entries

To do this we keep the length of the network id arbitrary. CIDR notation is like `IP-address/length-of-net-prefix` like `192.0.2.0/18` `18` means that the network prefix is 18 bits long.

The switch inside a subnet knows whther to keep the packet inside the subnet or send to the gateway ip address by using a local ip address.

In each subnet, the first and last ip address is reserved for identification and brodcasting.

IPv6

IPv6 increased size of IP addresses to 128 bits(16 bytes). It is written as eight 16-bit integers, using hexadecimal digit for them.