

subnet └─ Most  
 192.168.2.30  
 └─ device address  
 └─ network address

\* Control plane in network layer creates these network table creates path for these routers.

Every router is kind of nodes and links are edges

① Static Routing :  
 ↳ adding addresses manually.

② Dynamic Routing  
 Evolves accordingly.  
 ↳ Uses data structures & Algorithms.

# Internet Protocol : (IP)

Protocol which lies in networking layer.

→ IPv4 (Version 4) :  
 32 bits number with 4-words  
 defines server, client, node or a router (uniquely)

→ IPv6 (version 6) :  
 128 bits

Ex: 5.6.9.14

└─ 8 bit

└─ 8 bit

00000101

└─ 8 bit



The hoping thing happens over your  
 ISP = Internet Service Provider.

A router must know the subnet of destination

# class (IP address) : It's a basic Range.

A 0.0.0.0 , 255.255.255.255

B 128.0.0.0

C 192.0.0

D 224.0.0.0

E 240.0.0.0

# Subnet Masking:

Subnet is going mask the network thing of IP address and leave the host part to use for us.

# Variable length Subnet:

You can set your length of subnet networks

255.255.0.0

└─┐

└─┐ You can add here.

Start

192.0.1.0 → 192.0.2.255 end.



It comes on first come first basis.

Internet engineering assign these taskforces.

## # Reserved Addresses.

Some special addresses are reserved ones.

$127.0.0.0/8 \rightarrow$  localhost

↳ Reserved ip: local host.

## Loopback addresses.

↳ The processes we are going to be running on our machine using TCP/IP protocols will contact the same addresses.

## ## Packets :

### IPv4 packets —

Apart from the data, header is of 20 bytes

↳ IP version, length, identification no., flags, protocols, checksum etc.

TTL → time to live

↳ when data stuck in a router loop.



## # IPv4 vs IPv6 :

$$V_4 = \frac{32 \text{ bits}}{\approx 2^{32}} \quad / \quad V_6 = 128 \text{ bits}$$

↓

New version (4-times larger)

$$2^{32} \times 4 = \text{number of addresses.}$$

$$3.4 \times 10^{38}$$

Cons.

- Not backward Compatible  
 IPv4 cannot work with  $V_6$ .
- Requires lot of efforts.  
 ISP have to shift + lot of work.

Ex:  $a : a : a : a : a : a : a : a$

↓  
 Each one a Hexadecimal.  
 16 bit string.

# ABFE: R00L : 3210 : 9182 : 0 : 0 : 1 : 3

## # Middle Boxes :

Router devices which interacts with packets

- ① Firewall : → Global Internet.  
 ↳ your trusted network.

filter out IP packets based on various rules.



→ Address / Modify packets / port nos / flags / protocols.

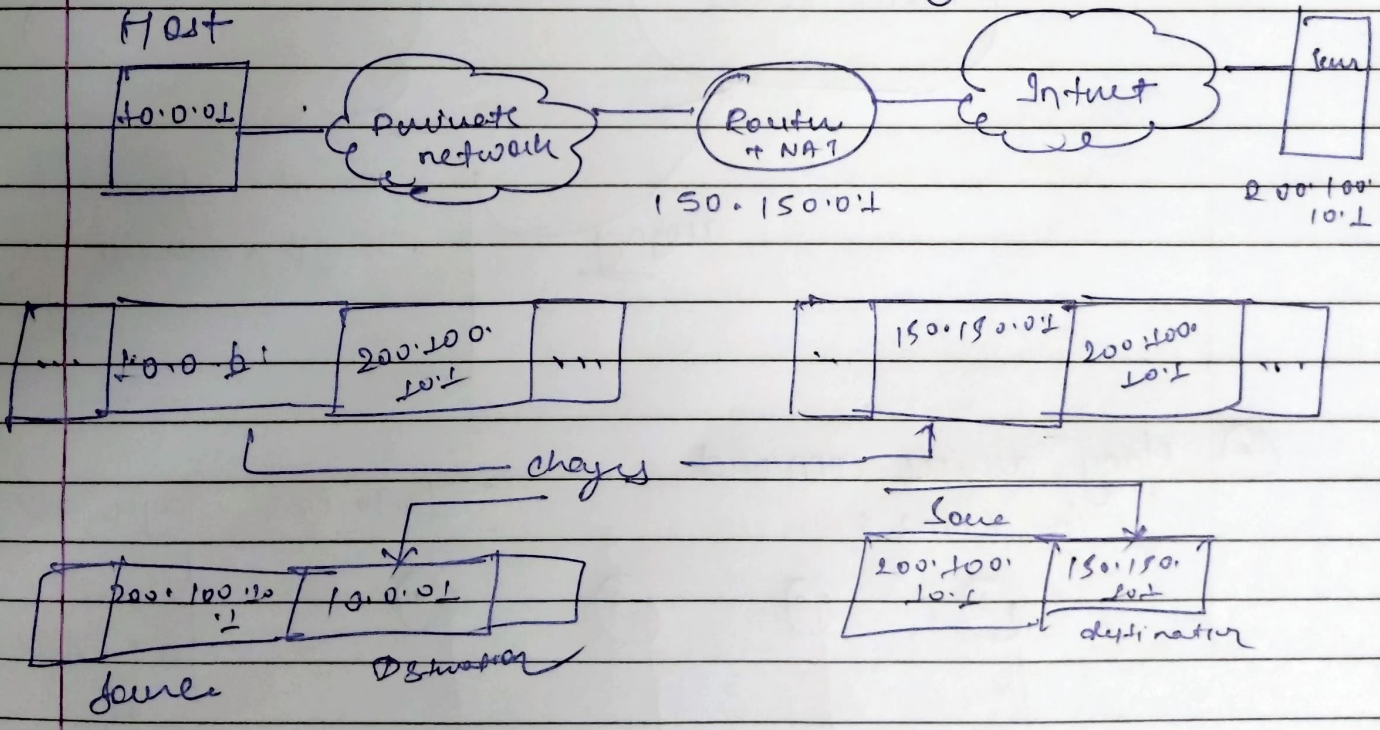
A security system that is used to monitor the incoming and outgoing traffic.

① Stateless firewall : Doesn't maintain state

→ Statefull firewall : Maintains state (more efficient)

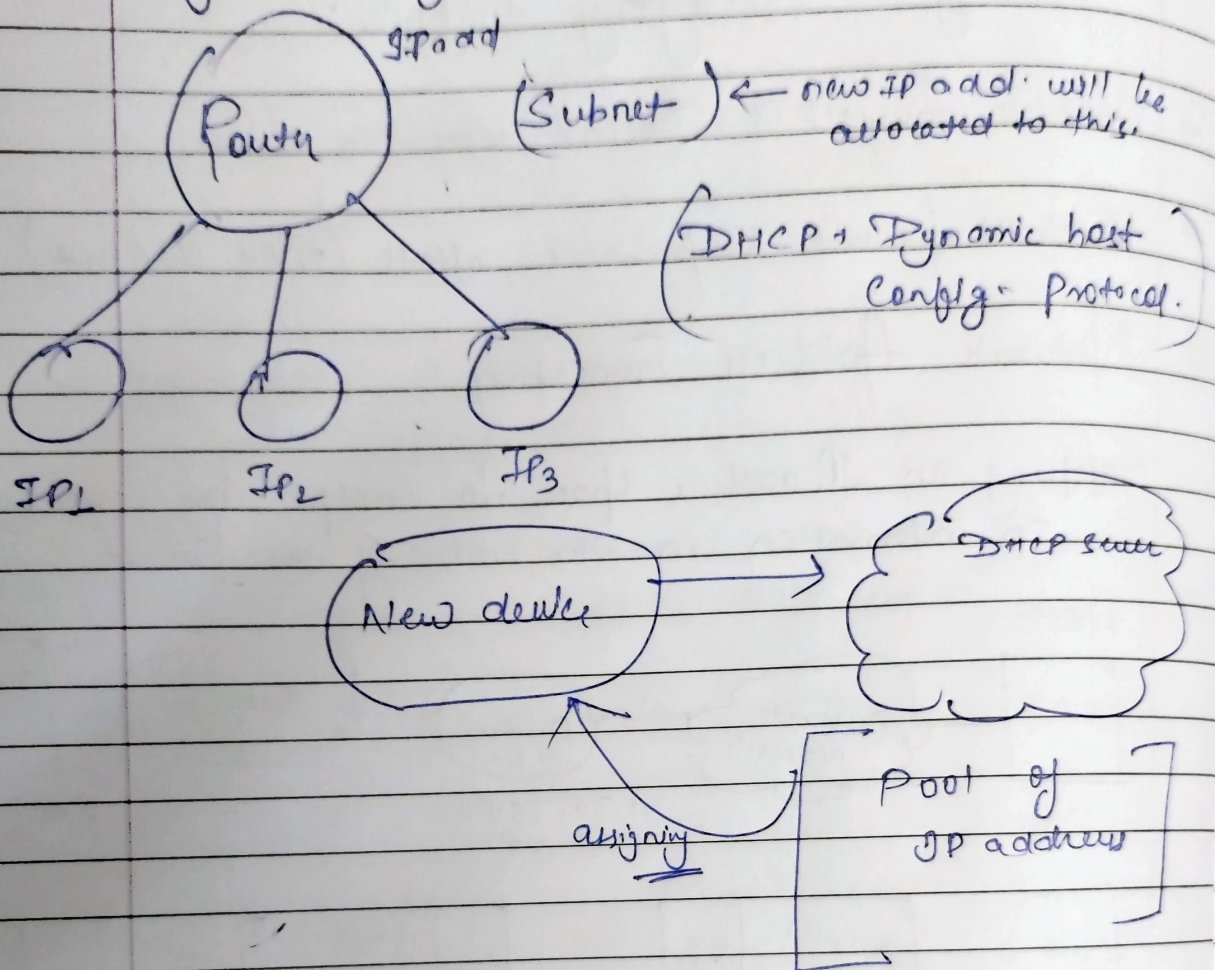
# Network Address Translation :

Mapping an IP address space to another by modifying IP information in the header of the packet.



# # TCP (Data link layer):

Data link distributes packets from network layer over physical layer.



(\*) Many devices connected in LANs:

