

{ Network Layer }

① Network Layer : i.e Internet layer. Responsible for transmitting and routing packages across networks.

Key Roles :

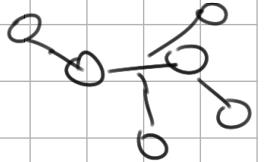
F address resolution Router Forwarding
A R P F = Acronym

A Addressing : Logical address across networks.

R Routing : Determining path for packets to reach DST.

P Packetisation : Putting transport layer segments into packets

F Fragmentation and Assembly : Handling large packets for the network



(Network) Internet Layer

VS Transport Layer

Figure

Hop to hop
IP address
Handles packets
Minimum reliability

End to end
Port numbers
Handles segments
Ensures reliability

IL TL

Router forwarding too
correct output interface
Packet-filtering
firewall
e.g.

②

Data Plane : 1) Physically forwards packets

2) Ensures packets get SRC → DST

Exchanging router information between autonomous systems on the internet.

Route table
e.g.



Control-Plane : Determines the route that the packets take.

where go ?



Aspect	Data Plane	Control Plane
Function	Packet Forwarding	Path Determining
speed	Fast	Slower
Protocol	IPv4 executes routing decisions	RIP, BGP
Routing		Updates and creates routing tables

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Internet Protocol IP addressing

- IPv4: 32-bit conversion
too binary



Subnet Mask Classes of IP
usage

A	255.0.0.0	Large Networks
B	255.255.0.0	medium Net
C	255.255.255.0	Small Net
D	N/A	Multicast
E	N/A	Future

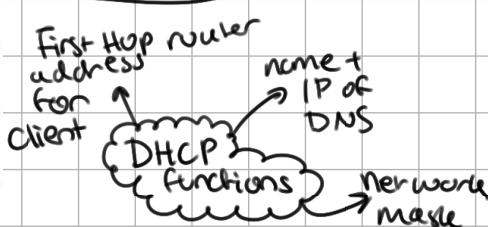
CIDR: Classless Interdomain Routing

200.23.16.0
Subnet Host

5

Automatically: DHCP
manually: static IP
SysAdmin e.g. IPconfig

(Dynamic Host Configuration Protocol)



Host

H

DHCP server:

goal: give hosts

dynamically receive an IP address

Are you there?

S

Here is an IP

I want this one!

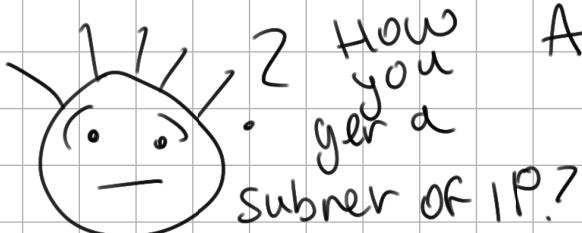
Its all yours!

S

= happy host w/ ip

Hierarchical Addressing

- Route aggregation
more efficient
- Allows for more specific routes and organisations.



A: Gets portion of its address from ISP.

Internet Service Provider

6



Routing and Forwarding

Routing: Deciding the best route to travel SRC \Rightarrow DST

considers:

- Bandwidth
- Latency
- Topology
- Link Quality

uses:
→ Route tables
→ Protocols
→ Algorithms

Type

Static (manually config routers)

Pros

- Simple
- Predictable

Cons

- needs manual updating

Dynamic automatically learns and updates routes.

Pros

- Scalable
- Self Healing

Cons

- complex
- more power

Forwarding

= moves package from one interface to another.

Key Functions:

- Uses routing table for next hop
- Occurs at each router
- Hardware for speed

IPv6 = Evolution



IPv4 = 32

IPv6 = 128 bits

We run out!!
∴

Dual Stack: Device runs both IPv4 & IPv6

Tunnelling: Encapsulates v6 inside v4 for transport across v4 networks

Translation: Converts v6 to v4 for communication

Routing Protocols

Distance e.g. RIP
Vector

uses hop count,
slower convergence

Path Vector e.g. BGP
inter-AS routing
policy based decisions

Link-state e.g. OSPF
uses complete network map
Faster convergence.