Network Layer Functionalities and IP Address

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Previous Session

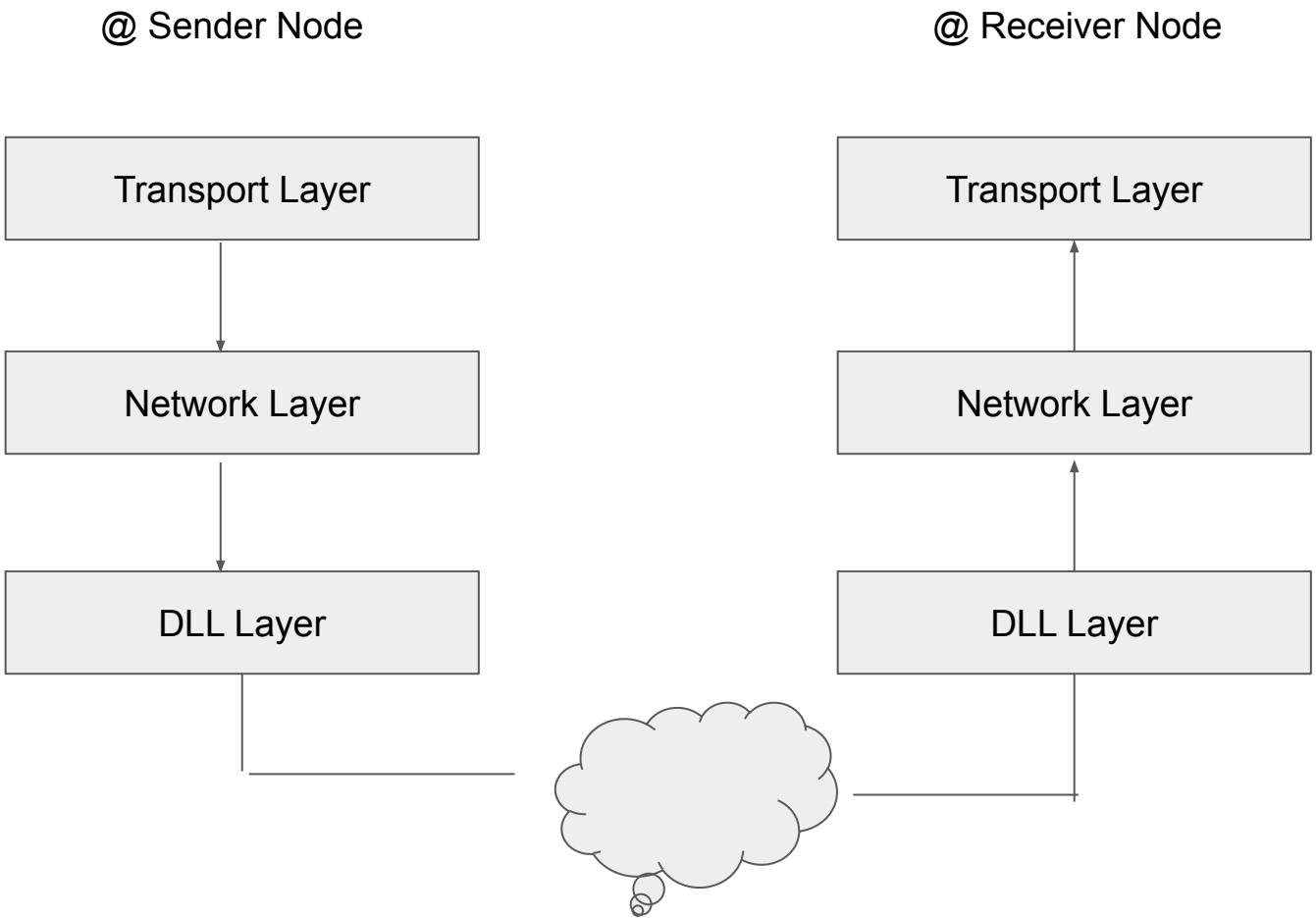
- Routers contains Routing Tables
  - Helps in finding the optimal path between two ends.
- Connection Less Service - Datagram Subnet
  - Packet Switching
- Connection Oriented Service - Virtual Circuit Subnet
  - Virtual Circuit

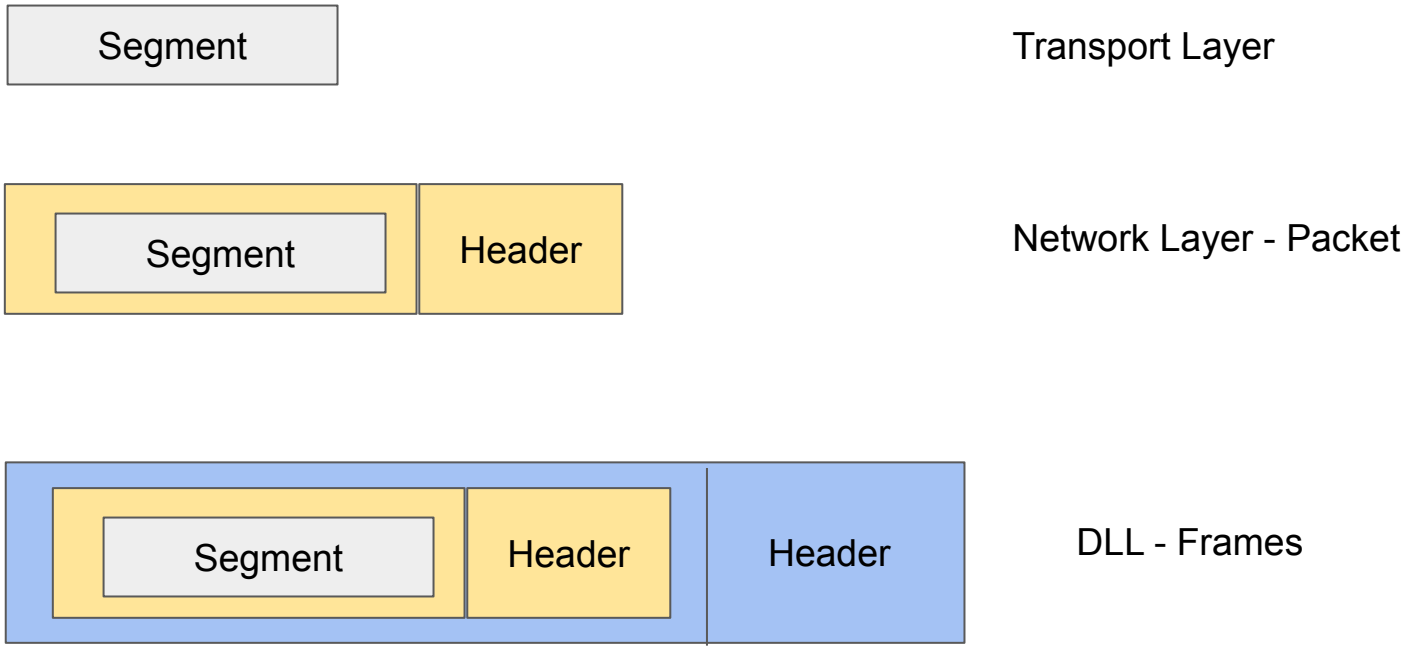
Role of Network Layer

- Receives segments from Transport Layer
- Converts it into packets
- Transfers down to DLL.
- Finding the optimal path for data transfer.
    - If path breaks up, find the suboptimal path
- Quality of Service (QoS)
    - Higher bandwidth path
    - Less End to End Delay path.
    - Less Traffic Path

Router

- Network Layer Device
- Keeps up to date Routing Tables.
- Forwards the packet in the right path towards the destination.
- How ?
    - Based on routing table entries.


@ Sender Node
@ Receiver Node
Transport Layer
Network Layer
DLL Layer
Transport Layer
Network Layer
DLL Layer

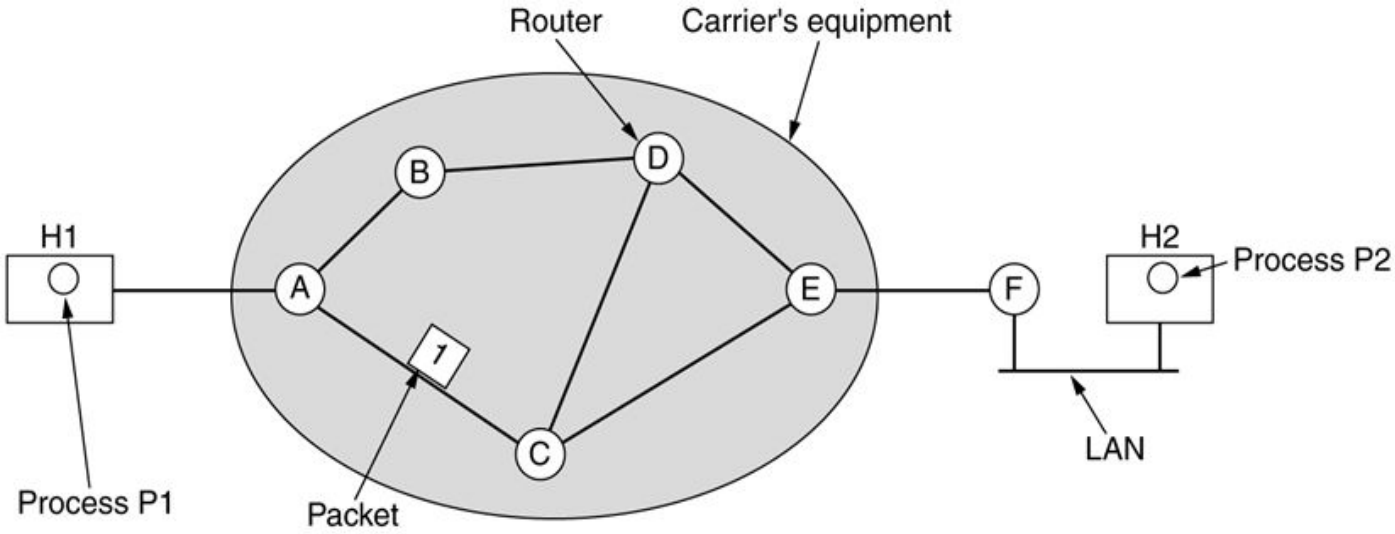

Segment
Transport Layer
Segment
Header
Network Layer - Packet
Segment
Header
Header
DLL - Frames

Connection Less Service

- For each packet a new path has to be found.
- Path is not dedicated.
- Packet can take different route/path to reach the destination.
- Packets can reach out of order @ the destination.

Virtual Circuit Subnet

- Virtual Circuit will be established between the source and the destination node.
  - Dedicated Path
  - Packets will reach in same order @ the destination.
  - The path will be stored in the router (routing table).
  - Virtual Circuit ID
- Avoids finding a new route everytime
  - Unlike Datagram Subnet.



A Routing Table

H1	1	1	C

IN OUT

C Routing Table

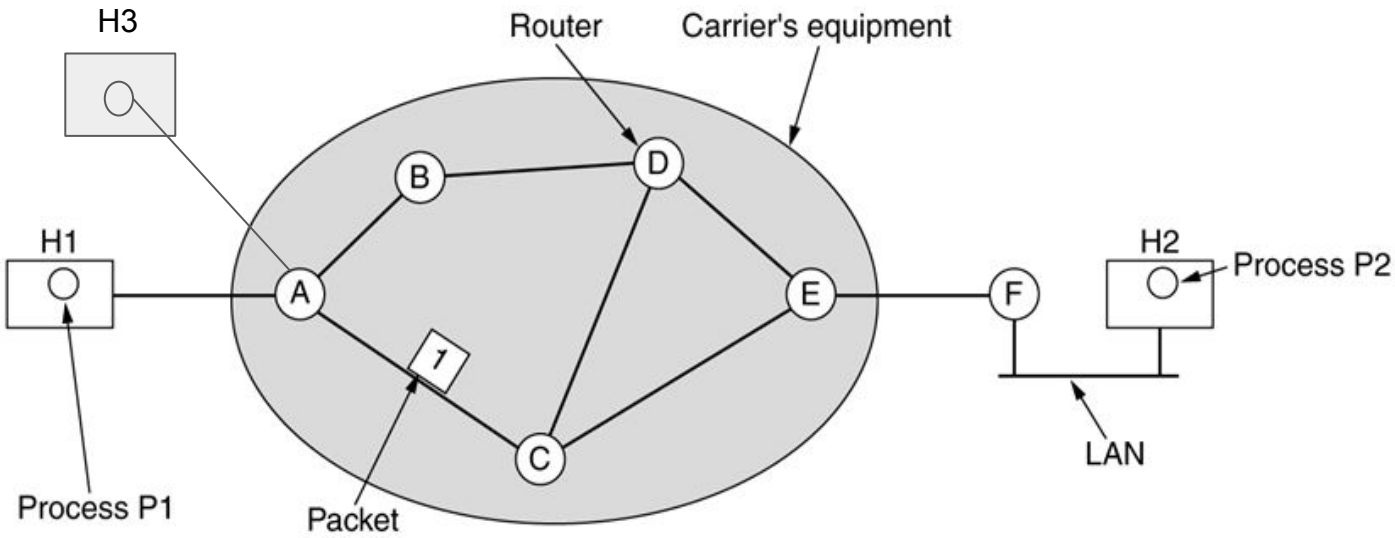
A	1	1	E

IN OUT

E Routing Table

E	1	1	F

IN OUT



A Routing Table

H1	1	1	C
H3	1	2	C

C Routing Table

A	1	1	E
A	2	2	E

E Routing Table

E	1	1	F
C	2	2	F

Difference Between Data Gram Subnet and VC Subnet

	Data Gram Subnet	**VC Subnet**
Circuit Setup	Not Needed	Needed
Addressing	Source and Destination Address	VC Number
Routing	Each Packet takes independent route	All packet follows same VC
Robustness	If a router fails, network will not be affected	If a router fails, all VCs going through that router terminates.
QoS	Difficult	Easy

Internet Protocol Address

- Each system in the internet has IP address
- Unique ID for identifying the system
- Who Gives this IP address?
  - Internet Corporation for Assigned Names and Numbers (ICANN)
  - Internet Assigned Number Authority (IANA)
  - Regional Internet Registries (RIR)
  - Internet Service Providers (ISPs)
- IPv4 and IPv6 addressing.

Asia Pecific Network Information Center (APNIC)

Sources: 20160927-Curran-IPAddress-Security.pdf

How to Manage ?

- Entire World Needs IP Address
- Can Not Restrict People
- @ NITK - 500 + systems
  - IP address for 500 systems (Hostels are not included)?
  - What about the cost of the 500 + IP Addresses ?
- Solution
  - Public and Private Address
  - Increase the IP addresses
  - Remember IPv6 ?

Private and Public IP addresses

	Private IP Address	**Public IP Address**
Visibility	With in the Network (With in NITK) Used within the LAN/Network	Outside the Network (Outside NITK) Used Globally
Communication	It is used to communicate within the network	It is used to communicate outside the network
Where Can I Find ?	Not over the Internet	Over the Internet
Who Assigns It ?	Network Administrator	ISPs
How Much Should I Pay ?	Free of Cost	Depends on the ISPs

Does your mobile have IP Address?

- YES.
- Settings > About device > Status
  - Both IP address and MAC address.

Mobile IP Address is private or public ?

- It is Public.

IPv4 Addressing Schemes

32 bit - 8 bytes - 2^{32}

Total Addresses - 429,496,7296