

UNIT-4

Networks Layer.

- handles service request from transport & forward to data ll.
- it translate logical address into physical address.
- it determines route from source to destination.

main function -

⇒ Routing - When a packet arrives the router's input link, the router's ~~link~~ will move the packets to the router's output link.

⇒ Logical Addressing - The data link layer implements the physical add. & network layer implements logical addressing.

Logical addressing is also used to distinguish the source & destination system. The nl adds a header to packet which include logical add. of both sender & the receiver.

⇒ Internetworking - This is the main role of the network layer that it provides the logical connection b/w different types of networks.

⇒ Fragmentation - It is the process of dividing the packets into the smallest individual data units that travel through

different networks.

### Services provided by network layer

→ **Guaranteed delivery** - it guarantees that the packet will arrive at its destination.

→ **Guaranteed delivery with bounded delay** will be delivered within a specified best-to-best delay bound.

→ **In-order packets** - it ensures that packets arrives at destination in order they are sent.

→ **Guarantees max jitter** - the amount of time taken b/w two successive transmission at the sender is equal to time b/w their receipt at destination.

→ **Security services** - the network layer provides security by using a session key b/w the source & destination host.

The nl in the source host encrypts the payloads of datagrams being sent to the destination host.

The network layer in the destination host then decrypt the payload.

The nl maintains the data integrity and source authentication services.

## Design Issues

### → Store & forward packet switching

The host sends the packet to nearest router. This packet is stored there until it has fully arrived once the link is fully processed by verifying the checksum (error) then it is forward to next router till it reaches the destination.

### → Services provided to Transport layer offering services must not depend on router technology.

Based on connections

### → connectionless - the routing & insertion of packet into subnet is done individually. No added setup is required.

### → connection oriented - subnet must offer reliable service & all packets must be transmitted over a single route.

eg:-  
MultiProtocol  
Label  
Switching  
(MPLS)

### Providing Connection-oriented service

In connection-oriented service, a path or route called a virtual circuit is setup b/w the source & the destination nodes before the transmission starts.

All the packets in the message are sent along this route. Each packets contain an identifier that denotes the virtual circuit to which it belongs.

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INTERNET  
PROVIDED  
(5F)

### Provided Connectionless service

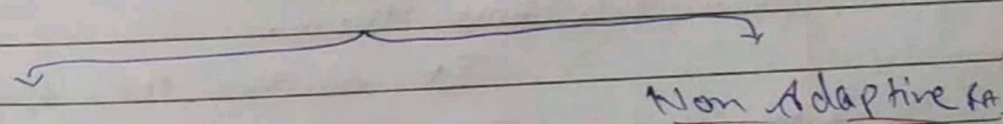
In connectionless, each package is transmitted independently; each package contains its routing information & is termed as datagram.

The network using datagrams for transmission is called datagram network or datagram subnet. No prior setup of routes are needed.

### Routing Algos

When a device has multiple paths to reach a destination, it always selects one path by preferring it over others. This selection process is termed as Routing.

Routing is the process of forwarding the packets from source to destination but the best path has "least cost path" determined by algos.



#### Adaptive RA

- also known as dynamic algos.
- makes routing decisions based on topology & network traffic.
- The main parameters are Hop count, distance & estimated transmit time.

#### Non Adaptive RA

- also known as static routing algos.
- do not take decision based on
- when booting up the networks, the routing info stored to routers.

- Centralized algo (Global RA)
- Isolation algo
- Distributed algo (decentralised)
- more complex
- construct routing table based on network condition
- flooding
- random walk
- one hop
- construct the table to determine which node to send the packet.

## Hierarchical Routing

It is the method of routing in networks that is based on hierarchical addressing. Most transmission control protocol, Internet protocol (TCP/IP).

Routing is based on two level of hierarchical routing in which IP address is divided into a network, subnet & a host portion.

It addresses the growth of routing tables. Routers are further divided into regions and they know the route of their own regions only.

It works like a telephone exchange.

## Broadcast Routing

By default, broadcast packets are not routed & forwarded by the network on any network routers.

Router create Broadcast domains. But it can be configured to forward Broadcast in some special case. A Broadcast message is destined to all network's devices.

It can be done in two ways—

⇒ A router creates a data packet & then sends it to each host one by one. In this case, the router creates multiple copies of single data packet with diff. destination addresses.

This method consumes lots of bandwidth & router must destination add. of each node.

⇒ When router receives a packet that is to be Broadcasted, it simply floods those packets out of all interfaces. All routers are configured in the same way.

This method is easy on router's CPU but may cause the problem of duplicate packet received from peer routers.

## Multicast Routing

In this, the data is sent to only nodes which want to receive the packets.

The router must know that these are nodes, which wish to receive multicast packets then only it should forward. It works on spanning tree protocol to avoid looping. It also uses shortest path Forwarding technique.

to detect & discard duplicates & ...

## Transport Layer

- 4<sup>th</sup> layer from top
- main role is to provide the communication services directly to the app processes on different hosts. (Logical communication)
- TL protocols are implemented in end systems but not in network routers
- All TL protocols provide multiplexing/demultiplexing service.

### Services Provided

similar to DLL

→ End-to-end delivery:

transmit entire message to destination.

→ Addressing: TL interacts with functions of session layer.

TL provides the user address which is specified as a station use part.

→ Reliable delivery: TL provides reliability services by retransmitting the lost & damaged packet.

→ Error control } Sequence control } Loss control } Duplication control

