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Chapter - 5

The network layer is responsible for packet forwarding including routing through intermediate routers.
It must take care to choose the routes to avoid overloading of communication lines and routers.

Services provided to transport layer :

1. The services should be independent of the routers technology.
2. The transport layer should be shielded from the number, type and topology of the routers present.
3. The network addresses made available to the transport layer should use a uniform numbering plan, even across LANs and WANs.

Connectionless Service :

→ In connectionless service packets are injected into the subnet individually and routed independent of each other.
→ No advance setup is needed.

packets = datagram
subnet = datagram subnet

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Connection Oriented service :

→ In connection oriented service a path from the source router to the destination router is established before any data packets can be sent.

→ All packets are routed through same path.

→ This connection is called a virtual circuit.

Routing Algorithm →

Routing algorithm is that part of the network layer responsible for deciding which output line an incoming packet should be transmitted on.

Optimality principle :

It states that if router J is on the optimal path from router I to router K then the optimal path from J to K also falls along the same route.

As a direct consequence of the optimality principle the set of optimal routes from all source to a given destination form a tree rooted at the destination. Such a tree is called a sink tree.

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Shortest path Routing :
The idea is to build a graph of the subnet with each node of the graph representing a router and each arc of the graph representing a communication line.

Flooding :
In this every incoming packet is sent out on every outgoing line except the one it arrived on.

Limitations of flooding →
(1) flooding generates vast number of duplicates packets, infact an infinite number unless some measures are taken to damp the process.
(2) It is wasteful if a single destination needs the packet since it delivers the data packet to all nodes irrespective of destination.
(3) The network may be clogged with unwanted and duplicate data packets.

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Use of flooding :

→ In distributed database applications : it is sometimes necessary to update all the databases at the same time in which case flooding can be useful.

→ In wireless networks : all messages transmitted by a station can be received by all others stations within its range.

Glue that holds the whole internet together is the network layer protocol, IP.

Unique identifier for a computer is called its IP address.

IPv4

→ All ip addresses are 32 bits long and are used in source address and destination address

→ It is important to note that an IP address does not actually refer to a host. It refers to a network interface so if a host is on two networks it must have two IP addresses.

→ The 32 bits of IPv4 address are broken into 4 octets.

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1 to 3 octect → identify the network
Last octet → identify the node

	IPV4	IPV6
→	It has a 32-bit addressing system.	It has a 128 bit addressing system.
→	The header is 20-60 bytes.	The header is 40 bytes.
→	Supports manual and DHCP configuration of address.	Supports auto and renumbering address configuration
→	Separated using dot notation.	Separated using colon notation.
→	address space of 4.29×10^9	3.4×10^{38}

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DHCP : Dynamic Host configuration protocol.

Every computer or device on a network has an IP address for communication.
A dynamic IP is where the computer gets an IP address automatically from a DHCP server.
If a host leaves the network and does not return its IP address to the DHCP server that address will be permanently lost. To prevent that from happening IP address assignment may be for a fixed period of time a technique called leasing.