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11. In which case longest prefix matching is used? Explain with the help of suitable example.

A ⇒ Longest prefix matching is used in case of datagram nlw in order to send the data packets from source to destination. If the address provided by the host to deliver the packets to destination is not perfectly matched in the routing table then longest prefix matching algorithm is used to determine the suitable address. eg.

Destination address range	Link interface
11001000 00010111 00010xxx xxxxxxxx	0
11001000 00010111 00011000 xxxxxxxx	1
11001000 00010111 00011xxx xxxxxxxx	2
otherwise	3

Given destination address = 11001000 00010111 00010110 10100001

Thus the bits in the 3rd octet of interface 0 has the longest match so the packets are forwarded through interface 0.

12. Why fragmentation is required? Explain about IPv4 header fields that are related to fragmentation.

⇒ The maximum transmission unit (MTU) of the routers varies accordingly which implies that every routers do not have the same amount of MTU built in them. So for every data packets to be transmitted from one another routers without failure or with min failure fragmentation is required.

There are three fields which are related to fragmentation in IPv4 header. They are:-

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i) Don't fragment (DF)

Since each router has its own MTU. Likewise each routers has its own patching capabilities of how much pieces of data packets can it patch. Thus DF field determines if a router can handle more fragmentation or not.

ii) More fragment (MF)

This field is to ensure that all the fragments of the data packets have been transmitted to the destination address.

iii) Fragment offset

The field is used to let the MF field to know if any other fragments of the data packets are yet to arrive.

13. Define MTU. Give example that shows how fragmentation is done.

⇒ MTU stands for Maximum Transmission Unit which defines the size of packets which can forwarded via the router at a particular time.

e.g. 4000 byte datagram
MTU = 1500 bytes

length = 4000	ID = x	flag = 0	offset = 0	MTU

length = 1500 ID = x fragflag = 1 offset = 0
length = 1500 ID = x fragflag = 1 offset = 185
length = 1040 ID = x fragflag = 0 offset = 370

14. What are the deficiencies of IP? How ICMP overcome them?

⇒ Although there are numerous deficiencies in IPv4. Some are lack of address space, weak protocol extensibility security of communications, lack of quality of service support

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geographic limitations, but first and foremost on feedback whether the data packets have reached destination or was terminated in the process. Thus ICMP message are used for diagnostic control purpose or generated in response to errors in IP operations.

15. Explain about various error reporting messages used in ICMP?

⇒ The types of ICMP ~~are~~ error reporting messages are:-

i) Error reporting messages

It reports the problems that the router or a host may encounter when it processes an IP packet. The types of error reporting are

a) Destination unreachable

When a router cannot route a datagram or a host cannot deliver a datagram, the datagram is discarded and the message is displayed.

b) Source Quench

When a router or host discards a datagram due to the congestion, it sends a source quench message to the host of the datagram.

c) Time exceeded

When the TTL values reaches 0, the router discards the datagram & ~~sh~~ sends the message.

d) Parameter problems

Any ambiguity in the header part of a datagram can create serious problems which may result in discarding of data & sends a parameter problem messages back to the source.

ii) Query message

It occurs in pairs, helps a host or nlw manager get specific information from a router or another level. The types of query message are:-

a) Fetch request and reply.

This message is generated in response to an echo request. It is mandatory for all hosts and must include the exact payload received in the request.

b) Timestamp request and reply.

Two machines can use the timestamp request a timestamp reply messages to determine the round trip time needed for an IP datagram to travel between them.

c) Address mask request and reply

A host may know its IP address but it may not know the corresponding host thus ICMP returns this message.

d) Router solicitation & advertisement

A host broadcasts a router solicitation message then the router that receive the solicitation message broadcast their routing information using the router advertisement message.