**Why does NAT violate the end to end principal of Transport Layer?**

Transport Layer is an end to end protocol which means that it happens at the end systems or edges and it does not happening inside network. NAT changes the IP address and port number of TCP or Transport Layer header for source or destination inside the network. It should not be changed or processed inside the network, instead, at the end systems which are the host and receiver.

**The checksum is completely eliminated in IPv6. There is no checksum in IPv6 in order to reduce the processing time of the routers but it is possible that a packet is transmitted over a link and it can face some bit errors. What would be the case when the packet s transmitted over a link and bit error occurs ?**

There is a more comprehensive error detection code in the link layer which is CRC. If a bit error occurs, the link layer will detect it and packet will be retransmitted. There is only one possibility where error detection is not possible which is inside the router while a packet is forwarded. However, this is a very rare case.

**Dijkstra is a centralized and link state algorithm. Each node needs to know the entire topology of the network before execution?**

Link state broadcast occurs. Each node in the network computes the link costs which are adjacent to them. After, it prepares a link state advertisement message which contains the information about all the links that are adjacent to itself and broadcasts this information to the network. Flooding is used to transmit these advertisement messages.

**What are the reasons that we have a hierarchical routing architecture in the network layer?**

- We are not trying to use Dijkstra algorithm for the entire network. Dijkstra is 0(n^2). Hence, the number of operations increases quadratically with the number of nodes. Hence scalability becomes an issue. Hierarchical routing divides the network into autonomous systems and we run Dijkstra in each of these autonomous systems.

- Link State Algorithms enables to gain information about the topology of the network and non of the ISP would want to share this information with their competitors. That’s why, every ISP has it’s own autonomous system and topology.

**What is the weakness of Distance Vector Algorithm?**

Counting to the infinity problem. When a link becomes unavailable and its cost increases to infinity, the route cost can be as large as the large number. The larger the range, the more counting to infinity problem.

**Why do you think RIP is implemented in the router as an application layer protocol?**

RIP was implemented in 1990’s and at those times, the routers were in essence actual computers and to run the routing algorithm, an application was installed that handled the routing operations on the application and hence, the forwarding table was updated by the courtesy of the application. They did not have dedicated hardware for the router operations. Cisco started to produce dedicated routers.

**Why IP fragmentation is done at the receiver host and not in the router ?**

Reassembling in the router is not done because in order to reassemble at the router, all packets need to arrive to the router until then, buffer gets allocated and congested. Also, if one fragment gets lost between router, the related other fragments will stay in router. In addition, fragments might follow up different routes, hence, reassembly will occur in destination host.

**What are the penalties of reassembling the packets in host?**

- Overhead increases due to transmitting excess headers.

- In order to merge the fragments, the arrival of each individual fragment belonging to the same packets needs to be waited.

- If one of the fragments get lost at the host, the entire packet needs to be retransmitted.

**What are the mechanisms that makes use of efficient address space possible in IPv4?**

- CIDR (Classless Inter Domain Routing)

- DHCP (Dynamic Host Configuration Protocol)

- NAT (Network Address Translation)

**Why is the TTL field present in the IP header?**

If there is a routing failure, the packet cannot be transmitted to the destination host and it might exist in the network or loop somewhere. It will occupy some buffer space at the links and routers. The TTL field enables the packet to be removed so that it does not occupy space in the network.

**What is the purpose of higher order bits which constitues the subnets? Part of the address ? Why are the higher order the same?**

In this way, we can obtain a hierarchical way of addressing. That way, the size of the forwarding table in routers can be reduced drastically. By the courtesy of this hierarchical subnet infrastructure, instead of representing each of these entries, only subnet addresses are replaced(prefix). That way, the table shrinks and performance increases.

**Why does each intermediate router need to recompute the checksum, if necessary change the checksum and insert a new checksum?**

Some fields in the IP header may be changed by the intermediate routers such as the options. Since the checksum of the IP protects the header, so, it needs to be recomputed. The first thing that the router is doing is when it receives a packet, it computes whether the checksum checks or not and then, if correct, it makes some changes within the header and then, once the new header is obtained, it recomputes a new checksum and inserts the new checksum.

**How a change might occur in the topology of the network?**

- New router can be introduced.

- Link Speed can be upgraded

- A router might fail.

- A link can be broken. (Construction)

- Congestion might occur.

**How will network operate with mixed IPv4 and and IPv6 routers ?**

By the courtesy of tunneling. IPv6 datagram is carried as payload in IPv4 datagram among IPv4 routers.

RIP distance vectors are updated every 30 seconds because an error might occur.