CSCI_6320_AS1_Brunovsky_Lee

Q1_Answer: The Internet is an immense global network infrastructure of connected devices that enables communication and information exchange between complex systems and distributed application via data transmission, routing, and protocols.

Q2_Answer: Packet switching and circuit switching are two different methods for transmitting data. In packet switching, data is divided into smaller packets that are individually transmitted across a network. Each packet can take a different route to reach its destination and may arrive out of order. This method is efficient at sharing network resources among multiple users. With Circuit switching, a dedicated and continuous communication path (circuit) is established between two devices for the duration of the communication. This method is commonly used in traditional networks such as telecommunications systems.

Q3_Answer: Routers are devices that play a crucial role in forwarding data packets between the source and destination and influence a packets path across a network (Kurose & Ross, 2013). Some of their main functions include:

1. *Packet Forwarding:* Routers examine the destination address in incoming data packets and determine the best path to forward them to their intended destination.
2. *Routing*: Routers use routing protocols to exchange information with other routers, and build a map of the network topology in routing tables. This enables them to make informed decisions about the most efficient paths for data transmission at any given current network configuration.
3. *Network Address Translation (NAT)*: Routers can modify the source or destination IP addresses of packets to allow multiple devices on a local network to share a single public IP address.

4. *Firewall and Security*: Many routers include firewalls to protect the network from unauthorized access and threats.

Q4_Answer. Four main types of delays in networking include:

1. *Propagation Delay:* The time it takes for a signal to travel from the sender to the receiver such as the delay for an aircraft transmission signal to reach a satellite.
2. *Transmission Delay*: The time taken to push all the bits of a packet onto the link-- for example the time it takes to send a large PDF attachment over a slow internet connection.
3. *Processing Delay*: The time spent by routers and switches to process the packet headers and make forwarding decisions.
4. *Queuing Delay*: The time a packet spends in a queue waiting to be transmitted; Specifically, when multiple packets arrive at a router faster than they can be processed, then they need to wait in a buffer.

Q5_Answer. Traceroute is a network diagnostic tool often used in-terminal to trace the route that data packets take from your computer to a destination server or website. It shows the intermediate routers (as hops) that the packets travel through, along with the time it takes. Traceroute is useful to identify points of failure or high latency in a network path. I have used this built-in tool on many occasions to troubleshoot LAN based Aerospace systems such as in-flight entertainment and satellite communications.

Q6_Answer. The TCP/IP stack consists of five layers:

1. *Application Layer*: This is where user applications interact with the network. Examples include HTTP for web browsing, FTP for file transfer, and SMTP for email.
2. *Transport Layer:* Responsible for end-to-end communication and data segmentation: Transmission Control Protocol (TCP) ensures reliable, ordered, and error-checked delivery,

while User Datagram Protocol (UDP) provides faster but less reliable communication (Kurose & Ross, 2013).

3. *Internet Layer:* Handles addressing and routing of data packets across different networks. Internet Protocol (IP) is the primary protocol at this layer.
4. *Data Link Layer*: Deals with the physical connection between devices on the same network segment. It includes protocols for addressing, error detection, and local network communication (Kurose & Ross, 2013).
5. *Physical layer*: consists of the physical medium (twisted pair, single- or multi-modal fiber, etc.) to transport the individual bits of a message across nodes in the network.

Q7_Answer. Persistent HTTP (1.1+) is the common default today since it allows for multiple requests and responses to be exchanged over a single TCP connection, which reduces the overhead of repeatedly establishing and closing connections for each resource and therefore improves efficiency: Conversely, with non-persistent HTTP (1.0) a new TCP connection is established for each individual request-response pair that often results in increased overhead due to the repeated connection setup and teardown (Kurose & Ross, 2013). This TCP protocol was commonly used in legacy SATCOM systems that I supported for BGAN services over L-band.

Q8_Answer. There are distinct server and client roles in the ‘Client-Server Architecture’ where the former provide services or resources, and the latter requests and consumes said resources. Servers are typically more powerful, while clients are often portable lightweight devices such as laptops, smartphones and IoT devices. In the Peer-to-Peer (P2P) Architecture model, devices are both clients and servers that share resources directly between themselves. Since there's no centralized server, each device has the ability to simultaneously initiate requests and provide resources. In general, P2P

networks have a higher level of decentralization and resilience, but may also face challenges in coordination and security.

References

Kurose, J. F., & Ross, K. W. (2013). *Computer networking: A top-down approach* (6th ed.). Pearson.