

- a) Transport layer is responsible for process-to-process delivery. Process-to-process delivery indicates to the delivery of a message from a specific application process on the sending host to a specific application process on the receiving host. The transport layer does this delivery by using port numbers to identify the specific processes. Whereas, host-to-host delivery indicates to the delivery of a packet from the sending host machine to the receiving host machine. The "Data Link" layer and the "Network" layer are responsible for this. This delivery happens between devices or hosts in a network which is different than process-to-process delivery.
- b) A DNS request differentiates between a mail server and a web server, even if they share the same aliased name, by the "Type" field in the DNS Query. To find the IP address of a web server, the client requests an "A" record which is address record and to find the name of a mail server, the client requests an "MX" record which is mail exchange record.

For example, if a company's alias name is `company.serve.com`. A web browser will send a DNS query for "Type A" for `company.serve.com` to get the IP address of the web server. Whereas a mail user agent will send a DNS query for "Type MX" for `company.serve.com` to get the domain name of the mail server which can be `mail.company.serve.com` and then another query for the address record.

c) i) The top four uploaders are Client B, E, F and A. This conclusion can be reached with the information of the upload speed referred in the table.

Now, if client 'G' needs to download the file from the current top four uploaders, the top uploaders must have all the file pieces which can be referred to the 'X's in the table. Since, some parts of the file such as part 4 is not available among the top four uploaders, client 'G' can not download the file.

II) After client 'D' s upload increases to 40mbps, the new top four uploaders are Client B, D, E and F.

Now,

$$R_{\text{total}} = (100 + 40 + 15 + 14) \text{ mbps}$$

$$\text{File size} = 169 \text{ mbps}$$

$$\text{File size} = 890 \text{ Mb}$$

$$\therefore \text{Download time}, T = \frac{s}{R_{\text{total}}} = \frac{890 \text{ Mb}}{169 \text{ mbps}} \approx 5.266 \text{ s}$$

Client 'G' will be able to download the file now and time it will take is 5.27 s.

- d) The benefits 'DASH' provides to a user are -
- i) DASH (Dynamic Adaptive Streaming over HTTP) allows the client to switch video quality during playback based on the current network bandwidth and device capability. This prevents buffering or poor video quality.
 - ii) As it uses standard HTTP, it can easily traverse firewalls and leverage the global infrastructure of HTTP caches, improving content delivery performance and reliability.
 - iii) It provides a smoother, uninterrupted viewing experience by adapting to network fluctuations, ensuring the highest possible quality is delivered at any given moment.

The purpose of a manifest file in a streaming multimedia setting is -

- i) It lists all the available versions of the video or audio stream, including different bit rates, resolutions, encoding and languages.
- ii) It defines how the media is segmented and provides the URL for each segment for each available version.
- iii) The client first downloads the manifest file, which allows the adaptive streaming algorithm on the client side to decide which segment of which quality to download next based on its current buffer status and measured network throughout.

Ans: no. 2

- a) The reason behind the situation mentioned in the question is that cookies are browser specific. As google chrome was used the first time and then Mozilla Firefox, the ~~cookie~~ the former treated it as a new session from Mozilla Firefox, resulting in no view of previous history.

- b) The HTTP request method that allows proxy servers to request the same object, which the proxy server already has a copy in its cache is the GET method.

The ways it saves time are -

- i) The proxy server checks its cache.
- ii) If the object is present but potentially stale, the proxy sends a conditional GET request to the origin server. This request includes the date the proxy's copy was last modified or its entity tag. If the object has not been modified, the server responds with "304 Not Modified". But if the object has been modified it responds with "200 OK" and the entire new object which saves time.

Q) I) As the local DNS server used iterative DNS lookup, and RTT = 19 ms

$$\text{Total RTT} = 1\text{RTT} + 3\text{RTT}$$

$$= 19\text{ms} + (3 \times 19)\text{ms}$$

$$= 76\text{ms}$$

Ans:

II) Total RTT = ~~1 TCP (8.5)~~ + 20(19 + 5 + 125) } ms

$$= 3050\text{ ms}$$

Ans:

III) circuit has 839 ms of latency only with

$$\text{Total time PC A takes} = 76\text{ms} + 3050\text{ms}$$

$$\text{delay received segment} = 3126\text{ ms}$$

Ans:

Ans: no. 3

- a) Checksum field is used for error detection. The sender calculates the checksum over the entire UDP segment and a pseudo header and places this value in the checksum field. The receiver then calculates the checksum over the received segment and the same pseudo header. If the

calculated value does not match the value in the checksum field, the receiver concludes that an error has occurred during transmission.

- b) PCA can inform PCB by using two fields
- i) URG flag
 - ii) Urgent Pointer field

i) PCA sets the URG flag in the TCP header to '1'. This flag signals to PCB that there is urgent data within the current segment. ii) PCA uses the Urgent Pointer field in the TCP header to indicate the end of the urgent data.

The value in the Urgent Pointer field is an offset from the segment's sequence number that points to the byte following the last urgent byte. The Urgent Pointer will be set to 700.

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