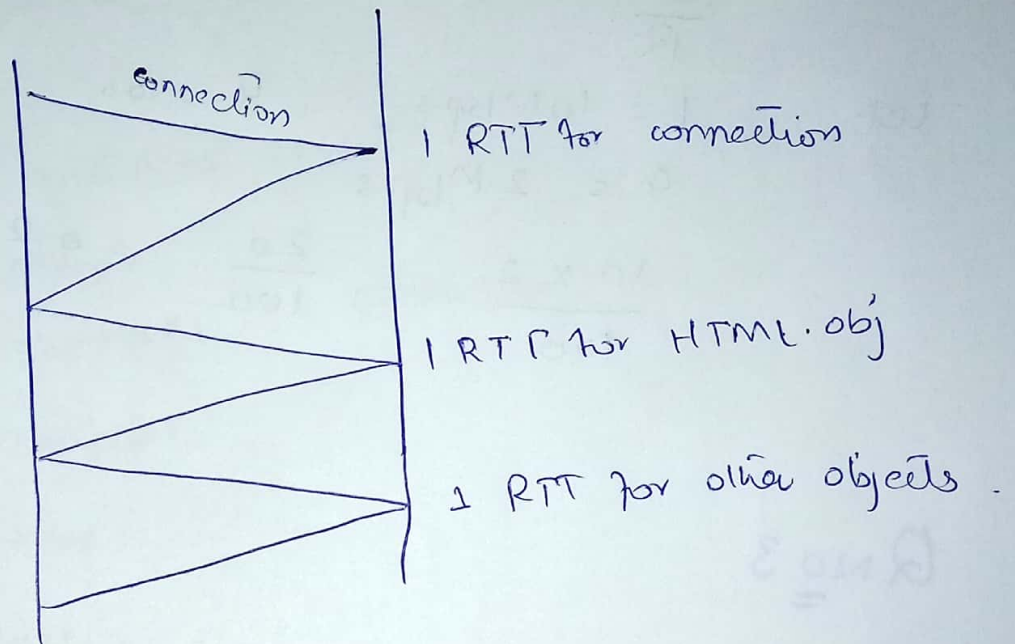


Q NO 1 .

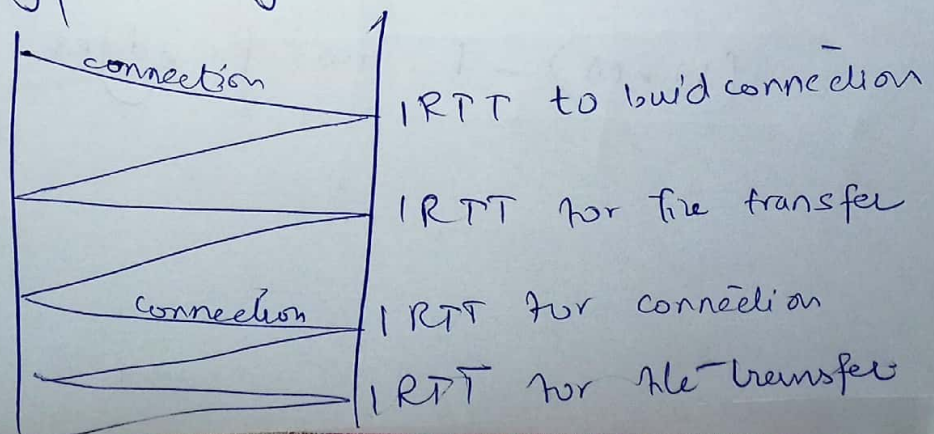
Persistent Connection :

If the connection was persistent then servers leave connection open after sending 1RTT for all objects . Bob should check the connection whether its open or not .



Non-persistent Connection

If connection was non-persistent, then it requires 2RTTs / object . One for connection and 1 for object sending / receiving .



Q No 2 $R_1 = 100 \text{ MBps}$
 $R_2 = 30 \text{ MBps}$

Bottleneck $= \min(R_1, R_2)$
 $= \min(100, 30)$

Bottleneck $= 30$

average delay

$$\frac{L}{R}$$

let

$$L = 10 \text{ Mbps}$$

$$R = 100$$

$$q = 2 \text{ Mbps}$$

$$= \frac{10 \times 2}{100} = \frac{20}{100}$$

$$= 0.2 \text{ average delay}$$

Q No 3

UDP is a connection less protocol. It is not reliable.
 So no nodes and edges created. But if we consider
 it as N peers sending data through m routers
 then

It has $(N \times M)$ no. of nodes

$(N \times M) - 1$ no. of edges.

Q No 4

Non-persistent HTTP with no parallel TCP connections

$$7RTT_0 + RTT_1 + \dots + RTT_n$$

Persistent HTTP as follows

$$RTT_1 + \dots + RTT_n + \underset{\substack{\uparrow \\ \text{for connection}}}{2RTT_0} + \underset{\substack{\uparrow \\ \text{for all objects}}}{RTT_0}$$

Q No 5

Let $F = 1 \text{ GBits} = 1024 \text{ bits}$

$$U_s = 2 \text{ Mbps}$$

$$U_{c1} = 500 \text{ Kbps} = 0.488 \text{ Mbps}$$

$$U_{c2} = 2 \text{ Mbps}$$

$$d_{\min} = 2 \text{ Mbps}$$

Client - Server

$$D = \max \left\{ \frac{NF}{U_s}, \frac{F}{d_{\min}} \right\}$$

	10	200
500 Kbps	5120	102400
2 Mbps	5120	102400

P2P

$$D = \max \left\{ \frac{F}{U_s}, \frac{F}{d_{\min}}, \frac{NF}{U + \sum U_i} \right\}$$

	10	20
500kbps	5124.88	2056.22
2 Mbps	5140	102800

Explanation:

- In client Server-distribution, the N files uploaded by server for N clients and each client download it.
- whereas in P2P, each client is server as well. So they can share files at the same time.

Q No 6:

- Here the concepts of Dynamic Adaptive Streaming over HTTP will be used. Clients determines when to request chunk of video.
- Here 300kbps is more effective on 3G.
- Because MPEG4 often used in internet connections that is less than 1Mbps. So for 3G, 300kbps is good.

Q No 7

* A TCP connection is established in 3 steps of handshaking.

1- Process of initiating a connection

2. acknowledging

3. When the connection is established and data transfer begins.

* In UDP, no handshaking is required because it is not a reliable data transfer protocol and handshaking is used for reliable data transfer purposes.