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Chapter: 7
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Computer Networks
Assignment Chapter №7

Task 1. *File Transfer Protocol (FTP) uses ——– for control connection and ——- for data connection.*
A. Stateless connection. Non persistent TCP connection
B. Persistent TCP connection, non-persistent TCP connection
C. Non-persistent TCP connection, persistent TCP connection
D. FTP is a connection less protocol

Solution. Control Connection: FTP uses a persistent TCP connection to maintain the communication channel between the client and the server for sending commands and receiving responses.
Data Connection: FTP uses non-persistent TCP connections for transferring files. Each file transfer typically opens a new connection.
Thus, the correct answer is:
B. Persistent TCP connection, non-persistent TCP connection

□

Task 2. *Consider different activities related to email.*
s1: Send an email from a mail client to a mail server
s2: Download an email from mailbox server to a mail client
s3: Checking email in a web browser
—— is the application level protocol used in each activity.
A. s1 : HTTP , s2 : SMTP , s3 : POP
B. s1 : SMTP , s2 : FTP , s3 : HTTP
C. s1 : SMTP , s2 : POP , s3 : HTTP
D. s1 : POP , s2 : SMTP , s3 : IMAP

Solution. SMTP is a protocol used between the sender and sender's mail server.
POP is a protocol used between receiver and the receiver's system.
HTTP is a protocol used mainly to access data on the world wide web.
Thus, the correct answer is:
C. s1 : SMTP , s2 : POP , s3 : HTTP

□

Task 3. *Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT1, . . . , RTTn. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?*

Solution. When a client clicks on a link and the IP address is not cached, the DNS lookup involves visiting multiple DNS servers:
DNS Lookup Time: The total round-trip time (RTT) for visiting n DNS servers is the sum of the individual RTTs: $RTT_1 + RTT_2 + ... + RTT_n$
Fetching the Object: After the DNS lookup, an additional RTT is required to establish a TCP connection to the server containing the object and one RTT to fetch the object.
Total time: $T = RTT_1 + RTT_2 + ... + RTT_n + 2 \cdot RTT$

□

Task 4. *Referring to Problem 3, suppose the HTML file references eight very small objects on the same server.*
Neglecting transmission times, how much time elapses with
(a) Non-persistent HTTP with no parallel TCP connections?
(b) Non-persistent HTTP with the browser configured for 5 parallel connections?
(c) Persistent HTTP?

Solution. a) Non-persistent HTTP opens a new TCP connection for each object. This means each object fetch involves a complete connection setup (RTT) and data transfer (RTT).
2 RTTs to establish connection and fetch the main HTML file.
For each of the 8 objects, there is a new RTT for establishing the connection and another RTT for the data transfer.
$T = RTT_1 + RTT_2 + ... + RTT_n + 18 \cdot RTT$
b) We need 2 RTTs to establish connection and fetch the main HTML file.
For the first 5 objects, there is a new RTT for establishing the connection and another RTT for the data transfer. And for the last 3 objects, there is a new RTT for establishing the connection and another RTT for the data transfer.
$T = RTT_1 + RTT_2 + ... + RTT_n + 6 \cdot RTT$
c) Persistent HTTP reuses the same TCP connection to fetch multiple objects, significantly reducing the number of RTTs needed (without pipe-lining).
2 RTTs to fetch and transfer the main HTML file
8 RTTs for each subsequent object fetch since the connection remains open
Therefore, the total time elapsed T is: $T = RTT_1 + RTT_2 + ... + RTT_n + 10 \cdot RTT$
c.*) Also pipe-lining is default in HTTP/1.1. Lets also calculate with pipe-lining.
2 RTTs to fetch and transfer the main HTML file.
Single RTT to receive all 8 objects using pipe-lining.
Therefore, the total time elapsed T is: $T = RTT_1 + RTT_2 + ... + RTT_n + 3 \cdot RTT$

□