TCP Tutorial Sample Solutions

Question 1

A TCP client sends a block of data 40 bytes long to a TCP server, split into two 20-byte segments. They both use port 9090. The client sets the initial sequence number to be 25. The segments are all received successfully. The server has a buffer size of 100 bytes, initially empty, and does not process any of the data until the whole message is received. No data is pushed or marked as urgent and no TCP options are used. No message data is simultaneously transferred in the other direction (from server to client).

Give the sequence of messages which could occur, from synchronisation to finalisation. For each TCP header fields (excluding Checksum), give the values of that field for each of the messages.

Sample Solution

Messages:

1. Client: Synchronise
2. Server: Acknowledge synchronise
3. Client: Acknowledge acknowledgement
4. Client: First segment
5. Server: Acknowledge first segment
6. Client: Second segment
7. Server: Acknowledge second segment
8. Client: Finalise
9. Server: Acknowledge finalise
10. Client: Acknowledge acknowledgement

Note that messages 3 and 4 can be merged: the client can send the first segment with the acknowledgement.

Fields:

- Source Port and Destination Port are 9090 in all messages.
- Sequence Number is 25 in message 1, 26 in message 4, 46 in message 6.
- Acknowledgement Number is 26 in message 2, 46 in message 5, 66 in message 7.
- Data Offset is 5 in all messages.
- Reserved is 0 in all messages.
- URG (Urgent), PSH (Push), and RST (Reset) flags are 0 in all messages.
- ACK (Acknowledgement) flag is 1 in messages 2, 3, 5, 7, 9, and 10; and is 0 in 1, 4, 6, and 8.
- SYN (Synchronise) flag is 1 in messages 1 and 2; 0 in the rest.
- FIN (Finalise) flag is 1 in messages 8 and 9; 0 in the rest.
- Window is 100 in message 2, 80 in message 5, 60 in message 7.
- Urgent Pointer is 0 in all messages.
- Options and Padding are 0 bits long (empty) in all messages.

Question 2

Why might the use of the pseudo-header be said to violate the layering principles of the Internet reference model?

Sample solution

The use of the pseudo-header somehow violates those principles, since TCP should not carry information about a layer underneath it (IP). It assumes an implementation of the internetworking layer which may not be true in the future (IP may be replaced with another protocol).