UNIT-5

TRANSPORT LAYER -

Transport layer offers peer-to-peer and end-to-end connection between two processes on remote hosts.

1. Design Issues of transport layer -
   (1) Acknowledgment
   (2) Error control
   (3) Flow control
   (4) Multiplexing
   (5) Demultiplexing
   (6) Routing

UDP (USER DATAGRAM PROTOCOL) - Connection-less protocol

It takes UDP like a packet switching. It provides a way for applications to send encapsulated IP datagrams without having to establish a connection.

2. UDP Header Format -

   ![UDP Header Diagram]

   - Pre-segment checksum → Error checking
   - Carrying Unicast/Multicast Real-Time Traffic -
     Retransmission is meaningless; NO pre-flow integrity needed.
     Bit rate is determined by codec used; NO flow control needed.

TCP (TRANSFER CONTROL PROTOCOL) - Connection-oriented protocol

It determines how to break application data into packets that networks can deliver, sends packets to and accepts packets from the network layer, manages flow control.
(3) TCP Header Format

<table>
<thead>
<tr>
<th>Field</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Port</td>
<td>16</td>
</tr>
<tr>
<td>Destination Port</td>
<td>31</td>
</tr>
<tr>
<td>Sequence Number</td>
<td></td>
</tr>
<tr>
<td>Acknowledgement Number</td>
<td></td>
</tr>
<tr>
<td>Header Length</td>
<td>4</td>
</tr>
<tr>
<td>Reserved</td>
<td>6</td>
</tr>
<tr>
<td>Code Bits</td>
<td>6</td>
</tr>
<tr>
<td>Window</td>
<td></td>
</tr>
<tr>
<td>Checksum</td>
<td></td>
</tr>
<tr>
<td>Options</td>
<td>0-32</td>
</tr>
<tr>
<td>Data</td>
<td></td>
</tr>
</tbody>
</table>

20 bytes

(4) TCP Connection Management

3-Way Handshake Protocol:

- Establishment
- Termination

- SYN
- ACK of SYN
- FIN
- ACK of FIN
- FIN
- ACK

(1st) SYN is used to establish connection.
(2nd) FIN is used to release a connection.

(5) Reliability of data transfer:

- Data Reliability and Data Integrity
- Per segment integrity: Checksum
- Per flow reliability: Sequence numbers and ACK

(6) TCP Congestion Control: Using AIMD (Additive Increase, Multiplicative Decrease)

Opening and shrinking of window size
TCP flow control -
Senders won't overrun receivers buffer by transmitting too much, too fast.

TCP Tuning Management:
1. Retransmit timer - to start retransmitting
2. Poll timer - to prevent deadlocks
3. Keepalive time - non-standard, to clean up redundant TCP states

APPLICATION LAYER -

WWW -> World Wide Web
HTTP -> Hypertext Transfer Protocol
SSH -> Secure Shell (Cryptographic, encrypted network protocol)
SNMP -> Simple Mail Transfer Protocol

email
- MIME -> Multipurpose Internet Mail Extensions
to exchange different data types like audio, video etc.
- IMAP -> Internet Message Access Protocol
  (for email retrieval and storage)
- DNS -> Domain Name Server
- SNMP -> Simple Network Management Protocol
  (managing devices on IP networks like routers)

SESSION LAYER -
Service -> Authentication, Authorization, Protocols
PAP -> Password Authentication Protocol
SIP -> Session Initiation Protocol
H.245 -> Call control protocol for multimedia communication
PRESENTATION LAYER

- Data Conversion
  - Character Code Translation
  - Compression, Encryption, and Decryption

- Protocols:
  - LPP (Lightweight Presentation Protocol)
  - TELNET (Remote Terminal Access Protocol)
  - X.25 Packet Assembly/Disassembly (PAD)