Transport Layer - Additional Clarity Keywords

Study-Ready Notes

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Contents

1 Transport Layer in Computer Networks

1.1 Core Definitions

- **Transport Layer:** Layer 4 of the OSI model responsible for end-to-end communication and data delivery between hosts.
- **Segment:** A unit of data encapsulated by the transport layer for transmission.
- **Port:** Logical endpoint identifying specific applications/services on a host.
- **Flow Control:** Mechanism to prevent sender from overwhelming the receiver.
- **Error Control:** Mechanism to detect and correct errors in transmitted data.

1.2 Keyword Breakdown

- **TCP (Transmission Control Protocol):** Connection-oriented, reliable, ensures ordered delivery.
- **UDP (User Datagram Protocol):** Connectionless, faster, but unreliable and unordered.
- **Three-Way Handshake:** Process to establish TCP connection (SYN, SYN-ACK, ACK).
- **Checksum:** Field used for error detection in segments/datagrams.
- **Sliding Window:** Technique for flow control and efficient data transmission.

1.3 Stepwise Mechanism

1. **TCP Connection Establishment:**
    - Client sends SYN.
    - Server responds with SYN-ACK.
    - Client sends ACK; connection established.
2. **Data Transmission:**
    - Segmenting large messages.
    - Sending segments with sequence numbers.
    - Receiver acknowledges received segments.
    - Retransmit lost or corrupted segments.
3. **Connection Termination:**
    - Four-way handshake: FIN, ACK, FIN, ACK.

1.4 Examples & Applications

- **Web Browsing:** HTTP/HTTPS over TCP.
- **Video Streaming:** UDP for live low-latency streams.
- **Email:** SMTP, IMAP, POP3 over TCP.
- **Gaming:** Real-time multiplayer using UDP.

1.5 Comparisons / Contrasts

- **TCP vs UDP**
  - TCP: Reliable, connection-oriented, slower.
  - UDP: Unreliable, connectionless, faster.
- **Flow Control vs Congestion Control**
  - Flow Control: Manages sender vs receiver speed.
  - Congestion Control: Manages network congestion to avoid packet loss.

1.6 Analogies

- Transport layer = postal service: ensures letters (data) reach the correct recipient (port) reliably (TCP) or quickly without guarantee (UDP).

1.7 Visual / Diagram Description

- TCP Three-Way Handshake diagram:
  - Client $\rightarrow$ SYN $\rightarrow$ Server
  - Server $\rightarrow$ SYN-ACK $\rightarrow$ Client
  - Client $\rightarrow$ ACK $\rightarrow$ Server
- Optional figure: Segmentation and reassembly of a large message using sequence numbers.

1.8 Concept Integration

- Interfaces with the Network Layer (IP) for addressing and routing.
- Provides reliable delivery for Application Layer protocols.
- Supports end-to-end communication across heterogeneous networks.

1.9 Summary & Study Aids

[Summary: The transport layer ensures end-to-end data delivery, providing reliability, flow control, and error management, mainly through TCP and UDP protocols.]