## Chapter 3 Transport Layer

1. What is the main purpose of the transport layer?

a) To route packets between networks

b) To provide logical communication between application processes

c) To manage physical connections

d) To encrypt data

Answer: b

2. Which of the following is NOT a function of the transport layer sender?

a) Breaking application messages into segments

b) Passing segments to the network layer

c) Routing packets to the destination

d) Determining segment header field values

Answer: c

3. What are the two main transport protocols available to Internet applications?

a) HTTP and FTP

b) TCP and IP

c) TCP and UDP

d) SMTP and POP3

Answer: c

4. Which transport protocol provides reliable, in-order delivery?

a) UDP

b) TCP

c) IP

d) ICMP

Answer: b

5. What is multiplexing in the context of the transport layer?

a) Combining multiple network connections

b) Encrypting data from multiple sources

c) Gathering data from multiple application processes and passing it to the network layer

d) Splitting a single connection into multiple streams

Answer: c

6. What type of transport protocol is UDP?

a) Connection-oriented

b) Reliable

c) Connectionless

d) Congestion-controlled

Answer: c) Connectionless

7. Which of the following is NOT a characteristic of UDP?

a) Best effort service

b) No handshaking

c) Segments may be lost

d) Guaranteed in-order delivery

Answer: d) Guaranteed in-order delivery

8. Why is UDP used in some applications?

a) It has a large header size

b) It establishes connections quickly

c) It has no connection establishment delay

d) It always ensures reliable delivery

Answer: c) It has no connection establishment delay

9. Which of the following applications typically uses UDP?

a) Email

b) File transfer

c) DNS

d) Web browsing

Answer: c) DNS

10. What does UDP stand for?

a) Universal Data Protocol

b) User Datagram Protocol

c) Unified Delivery Protocol

d) Unordered Data Protocol

Answer: b) User Datagram Protocol

11. What is the main goal of the UDP checksum?

a) To encrypt the data

b) To compress the data

c) To detect errors in the transmitted segment

d) To establish a connection

Answer: c) To detect errors in the transmitted segment

12. How does UDP handle congestion control?

a) By using a sliding window mechanism

b) By implementing slow start

c) By using acknowledgments

d) It doesn't handle congestion control

Answer: d) It doesn't handle congestion control

13. Which of the following is NOT a field in the UDP header?

a) Source port

b) Destination port

c) Sequence number

d) Checksum

Answer: c) Sequence number

14. What is the size of the UDP header?

a) 8 bytes

b) 16 bytes

c) 20 bytes

d) 32 bytes

Answer: a) 8 bytes

15. What does TCP stand for?

a) Transmission Control Protocol

b) Transfer Control Protocol

c) Transport Connection Protocol

d) Transmission Connection Protocol

Answer: a) Transmission Control Protocol

16. Which of the following is NOT a characteristic of TCP?

a) Point-to-point

b) Reliable

c) Connectionless

d) Full duplex

Answer: c) Connectionless

17. What does MSS stand for in the context of TCP?

a) Maximum Segment Size

b) Minimum Segment Size

c) Maximum Sequence Size

d) Minimum Sequence Size

Answer: a) Maximum Segment Size

18. What type of acknowledgments does TCP use?

a) Selective

b) Negative

c) Cumulative

d) Partial

Answer: c) Cumulative

19. In TCP, what does the sequence number represent?

a) Number of segments sent

b) Byte stream number of the first byte in the segment's data

c) Number of acknowledgments received

d) Total number of bytes transmitted

Answer: b) Byte stream number of the first byte in the segment's data

20. How is the TCP timeout interval calculated?

a) TimeoutInterval = EstimatedRTT + 2\*DevRTT

b) TimeoutInterval = EstimatedRTT + 3\*DevRTT

c) TimeoutInterval = EstimatedRTT + 4\*DevRTT

d) TimeoutInterval = EstimatedRTT + 5\*DevRTT

Answer: c) TimeoutInterval = EstimatedRTT + 4\*DevRTT

21. What is the typical value of α in the EstimatedRTT calculation?

a) 0.100

b) 0.125

c) 0.150

d) 0.200

Answer: b) 0.125

22. What happens when a TCP timeout occurs?

a) The connection is terminated

b) The segment that caused the timeout is retransmitted

c) All unacknowledged segments are retransmitted

d) The receiver is notified of the timeout

Answer: b) The segment that caused the timeout is retransmitted

23. What is the purpose of TCP flow control?

a) To prevent network congestion

b) To ensure reliable data transfer

c) To prevent the sender from overwhelming the receiver

d) To optimize routing paths

Answer: c) To prevent the sender from overwhelming the receiver

24. How does the TCP receiver advertise its free buffer space?

a) Through a separate control message

b) In the rwnd field of the TCP header

c) By sending periodic updates

d) Through the IP header

Answer: b) In the rwnd field of the TCP header

25. What is congestion in computer networks?

a) Too few sources sending data

b) Too many sources sending too much data too fast for the network to handle

c) A flow control problem

d) A routing issue

Answer: b

26. Which of the following is NOT a manifestation of congestion?

a) Long delays

b) Packet loss

c) Increased bandwidth

d) Buffer overflow at routers

Answer: c

27. What is the main difference between congestion control and flow control?

a) Congestion control deals with network-wide issues, while flow control is between a sender and receiver

b) Flow control deals with network-wide issues, while congestion control is between a sender and receiver

c) They are the same thing

d) Congestion control is only for TCP, while flow control is for UDP

Answer: a

28. In the simplest congestion scenario with one router and infinite buffers, what happens as the arrival rate approaches R/2?

a) Throughput increases linearly

b) Delays become very large

c) Packets start getting dropped

d) The router crashes

Answer: b

29. What is the maximum per-connection throughput in the scenario with one router and two flows?

a) R

b) R/2

c) R/4

d) 2R

Answer: b

30. In the scenario with finite buffers and retransmissions, what happens to the transport-layer input compared to the application-layer input?

a) It remains the same

b) It decreases

c) It increases due to retransmissions

d) It becomes unpredictable

Answer: c

31. What is one of the "costs" of congestion in the scenario with unnecessary duplicates?

a) Increased bandwidth

b) Faster packet delivery

c) More work (retransmission) for given receiver throughput

d) Improved network efficiency

Answer: c

32. What is an additional "cost" of congestion in the multi-hop scenario?

a) Increased security

b) Wasted upstream transmission capacity and buffering

c) Improved load balancing

d) Enhanced routing efficiency

Answer: b

33. Which approach does TCP take towards congestion control?

a) Network-assisted congestion control

b) End-to-end congestion control

c) Router-based congestion control

d) Application-layer congestion control

Answer: b

34. What does AIMD stand for in TCP congestion control?

a) Adaptive Increase Multiplicative Decrease

b) Additive Increase Multiplicative Decrease

c) Adaptive Increase Maximum Decrease

d) Additive Increase Minimum Decrease

Answer: b

35. How does TCP increase its sending rate in the Additive Increase phase?

a) By 1 maximum segment size every RTT

b) By doubling the rate every RTT

c) By increasing exponentially

d) By a fixed percentage every RTT

Answer: a

36. How does TCP decrease its sending rate when loss is detected by triple duplicate ACK?

a) Cut to 1 MSS

b) Cut in half

c) Reduce by 25%

d) Stop sending completely

Answer: b

37. What is cwnd in TCP congestion control?

a) Current window size

b) Congestion window

c) Connection width node

d) Control window number

Answer: b

38. How does TCP sending rate relate to cwnd and RTT?

a) TCP rate ≈ cwnd / RTT

b) TCP rate ≈ cwnd \* RTT

c) TCP rate ≈ cwnd + RTT

d) TCP rate ≈ cwnd - RTT

Answer: a

39. What are the two principal transport protocols that have been used for about 40 years?

a) HTTP and FTP

b) TCP and UDP

c) IP and ICMP

d) QUIC and HTTP/3

Answer: b) TCP and UDP

40. Which of the following is NOT mentioned as a challenge for TCP in specific scenarios?

a) Many packets "in flight" in long, fat pipes

b) Loss due to noisy wireless links

c) Extremely long RTTs in long-delay links

d) High bandwidth requirements

Answer: d) High bandwidth requirements

41. What does QUIC stand for?

a) Quick Universal Internet Connection

b) Quality User Internet Control

c) Quick UDP Internet Connections

d) Quantum Universal Internet Communication

Answer: c) Quick UDP Internet Connections

42. QUIC is deployed on top of which protocol?

a) TCP

b) UDP

c) HTTP

d) IP

Answer: b) UDP

43. How many RTTs does QUIC require to establish reliability, congestion control, authentication, encryption, and state?

a) One

b) Two

c) Three

d) Four

Answer: a) One