UNIVERSITY COMPUTER SCIENCE • EXERCISE SHEET

9.4 Transport (TCP/UDP)

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS TCP • UDP

Objective

Track TCP sequence and ACK numbers through a loss, and choose transport honestly.

1 Key knowledge and worked examples

■ **The ledger**

SYN consumes 0; 100 bytes: seq 1, ACK 101; 50 bytes: seq 101, ACK 151; a lost 30 at seq 151 holds the ACK at 151 until retransmission, then ACK 181 ✓.

■ **Worked example: the two headers**

UDP: 8 bytes – ports, length, checksum. TCP: 20 minimum – ports, sequence, ACK, flags, window ✓.

2 Practice

2.1 After SYN (seq 0), the client sends 60 bytes. What is the first ACK the server can send? [3]

2.2 Name the three packets of the handshake and their flags. [3]

2.3 One line each: flow control versus congestion control. [3]

3 Exam-style questions

3.1 From a fresh connection (both ISNs 0), the client sends 40 bytes, then 80 bytes, then a 25-byte segment that is lost, then (after timeout) retransmits it, then sends 10 more.

Give the sequence number of each segment and the cumulative ACK after each, including the stall at the loss. Give the final ACK and the total bytes delivered. State what the receiver never does with out-of-order data above the gap. [8]

3.2 Choose TCP or UDP with a reason for each: a DNS lookup; a file download; a live audio call; a chat message.

State the one property TCP adds over UDP that the file download needs, and the one property of UDP that the call needs. State what the application must add itself if it chooses UDP for the chat. [7]

Solutions

2.1

- ACK 61 – cumulative: $1 + 60$ bytes expected next ✓.

2.2

- SYN; SYN-ACK; ACK ✓.

2.3

- Flow control protects the receiver's buffer; congestion control protects the network ✓.

3.1

- 40 bytes: seq 1, ACK 41 ✓.
- 80 bytes: seq 41, ACK 121 ✓.
- Lost 25 at seq 121: ACK stalls at 121 ✓.
- Retransmitted 25: ACK 146; final 10 bytes: seq 146, ACK 156 ✓.
- Total delivered: $40 + 80 + 25 + 10 = 155$ bytes ✓.
- The receiver never delivers data above the gap to the application – it buffers it until the gap fills ✓.

3.2

- DNS lookup: UDP – one request-sized packet; loss means re-ask ✓.
- File download: TCP – ordered, complete delivery ✓.
- Live audio call: UDP – delay is worse than loss ✓.
- Chat message: UDP with application-level ACK/retry is acceptable ✓.
- The download needs the retransmission ledger (order + completeness) ✓.
- The call needs no retransmission: a late frame is worthless ✓.
- On UDP the chat must add its own acknowledgement and retry logic ✓.

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