CS118 Discussion 1A, Week 5

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Boelter Hall 9436, Friday 12:00—1:50 p.m.
Logistics

• Homework 5 due: next **Tuesday** 6pm

• Midterm time: Thursday, Feb. 16th, in-class

• Policy:
  
  • closed book, no electronic devices
  
  • one two-sided US letter size (8.5x11) cheatsheet is allowed

• Regroup for project 2
Multiple choices with justifications

Which of the following statement on TCP is correct?

- (A) TCP provides the Internet’s connection-less service.
- (B) TCP uses a 4-tuple of (source-IP-address, destination-IP-address, source-port, destination-port) as its identifier.
- (C) TCP implements congestion control but does not have flow control.
- (D) TCP does not implement reliable data transfer.
- (E) TCP operates at the network layer.

Justification:
Multiple choices with justifications

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2. How many unique sequence numbers do we need in the Selective Repeat protocol? Assume that the sender has a window size that stores 15 packets.

• (A) 2;
• (B) 15;
• (C) 16;
• (D) 30;
• (E) 31.
Multiple choices with justifications

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Multiple choices with justifications

3. Which of the following statement is true?

(A) HTTP is a transport-layer protocol.

(B) Modularity through protocol layering makes it easier to update system components.

(C) FTP is not an application-layer protocol.

(D) SMTP uses UDP protocol at its transport layer.

(E) DNS is not needed for the Internet.
Multiple choices with justifications

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Multiple choices with justifications

4. Which of the following statement about HTTP is wrong?

(A) HTTP uses TCP as its transport-layer protocol.

(B) TCP connection setup is still needed initially if we use persistent connections.

(C) If we use persistent connections, data transfer with pipelining is typically faster than without pipelining.

(D) If we use non-persistent connections, data transfer using parallel connections is generally faster.

(E) HTTP never supports conditional GET.
Multiple choices with justifications

4. Which of the following statement about HTTP is wrong?

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Multiple choices with justifications

5. Which of the following statement is true for UDP protocol?

- (A) UDP only supports fixed-size data segment.
- (B) UDP never uses its port numbers in its header.
- (C) The checksum field in UDP header is used to verify whether bits in the UDP segment have been altered.
- (D) UDP protocol uses HTTP.
- (E) UDP ensures reliable data transfer.
Multiple choices with justifications

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• (E) UDP ensures reliable data transfer.
Multiple choices with justifications

6. Which of the following statement about DNS is wrong?

- (A) DNS uses UDP.
- (B) DNS caching is used to improve performance.
- (C) Some of DNS queries can be iterative and others recursive, in the sequence of queries to translate a hostname.
- (D) DNS follows hierarchical design approach.
- (E) DNS uses large, centralized database.
Multiple choices with justifications

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Short questions

• 1. How does the Web server (e.g., Amazon) identify users when you do the Internet shopping? Briefly explain how it works.

• 2. Explain how DNS uses recursive query to resolve a hostname translation.

• 3. Consider two TCP connections sharing a single link, with identical round-trip-times and segment size. It is well known that the additive-increase, multiplicative-decrease (AIMD) mode can ensure fair throughput for both TCP connections eventually. Now some one claims that additive-increase, additive-decrease (AIAD) can also ensure fair throughput eventually for these two connections, starting from an arbitrary window size. Show why this is NOT true. You can draw a figure to help your explanation.

• 4. Briefly explain the main steps for socket programming with TCP on the client side. You do not need to list the detailed function calls.

• 5. A group of users decide to develop a new Internet application running on their own computers, which are on and off all the time. Explain why the client-server model is not the right paradigm. What is the proper model to use to build this Internet application?
Socket programming API

- Joe is writing programs with a client and a server that use stream sockets. The following is the SERVER code that Joe wrote. Can you help Joe to find at least four errors in his code? You can mark your answers in his code, and label the errors in the code. You can use the Appendix for references.
HTTP connection calculation

• A web browser running on the client host is requesting a webpage from the server. We make the following assumptions:
  
  • TCP window is large once the TCP handshake is complete. TCP header size is h bits, and the maximum payload size is p bits.
  
  • The bandwidth is b bps, and the propagation delay is d seconds.
  
  • Ignore DNS related delays, and ignore the payload in three-way handshake packets, ACK packets, and HTTP request packets. In other words, those packets consist of header only.
  
  • The client requests a webpage consisting of an HTML file that indexes 5 binary files on the same server. Each of the file is 2p bits long. In other words, each of the file can be sent in exactly 2 TCP packets. Piggybacking is used whenever possible.
  
  • Each HTTP request is sent in one TCP packet. Please answer the following questions:
  
  • 1. Suppose pipelining of HTTP requests is allowed and no parallel TCP connections are used, calculate the minimal time it takes the browser to receive all the files.
  
  • 2. Suppose the non-persistent, non-pipelining mode with parallel TCP connections is used, repeat the calculation.
  
  • 3. Which mode gives the smaller latency? Briefly justify your answer.
TCP sequence number

Note that in TCP, both sequence numbers and ACK numbers are counted in bytes. Assume that the current TCP connection is using selective repeat with fixed window size (i.e., N = 200 bytes) at steady state say t = 100 s. Starting from t = 100 s, at the TCP sender, the series of segments labeled with #1, #2, #3, #4, #5, #6, #7, #8, ... are waiting for transmission, and the corresponding segment size (counted in bytes) is 100B, 20B, 80B, 150B, 100B, 50B, 60B, 100B, ..., respectively. Assume that at t = 100 s, the TCP sender sequence number starts from 1000 (in byte), and the receiver sequence number starts from 2000 (in byte). The receiver does not have data (except the ACK packets) to send back to the sender. Assume that the round trip time (RTT) is fixed and an ACK is sent when the receiver receives each TCP segment (i.e., no delayed ACK is used here). You are asked to draw the packet transmission flow chart to answer the following questions:

1. What is the sequence number and ACK number used when transmitting segment #8 (with packet size 100B)?

2. Counted from t = 100 s (when starting to transmit segment #1), how many RTTs are needed when the ACK for TCP segment #6 (50B) arrives at the sender?
TCP RTO estimation

• You are asked to compute the retransmission timeout (RTO) for TCP. The initial round-trip time (RTT) is set as 100ms. The RTT samples for 3 TCP segments are 200ms, 400ms, 250ms. In these 3 segments, the third TCP segment has been retransmitted twice. Compute all three RTO values upon receiving each of three TCP segments. Show all the intermediate steps in your calculation.
TCP congestion control

Consider the evolution of a TCP connection with the following characteristics. Assume that all the following algorithms are implemented in TCP congestion control: slow start, congestions avoidance, fast retransmit and fast recovery, and retransmission upon timeout. **If ssthresh equals to cwnd, use the slow start algorithm in your calculation.**

- The receiver acknowledges every segment, and the sender always has data available for transmission.

- Initially ssthresh at the sender is set to 6. Assume cwnd and ssthresh are measured in segments, and the transmission time for each segment is negligible. Retransmission timeout (RTO) is initially set to 500ms at the sender and is unchanged during the connection lifetime. The RTT is 100ms for all transmissions.

- The connection starts to transmit data at time t = 0, and the initial sequence number starts from 1. **Segment with sequence number 4** is lost once. No other segments are lost.

- How long does it take, in milliseconds, for the sender to receive the ACK for the segment with the sequence number 12? show your intermediate steps or your diagram.