CS547 Network Programming
Possible Quiz Questions (Quiz #1)
on January 17th, 2023

The following is a list of possible questions for our quiz on January 17th. Some of the questions will not be asked in the quiz. All the questions that will appear in the quiz will appear exactly as shown below (however, numeric parameters may be changed). The quiz is closed textbook, closed notes and closed neighbors. Note that the questions, which did not appear in this quiz, still may appear in the exams. You will find a solution for these questions during lectures.

#1: Show the network programming structure that assumes application processes (application programs), a network protocol suite, and network hardware.

![Network Programming Structure Diagram]

#2: In the network programming structure, which layer(s) of network application processes (application programs), a network protocol suite, and network hardware does (do) physically transmit network traffic for network application processes (name all that apply)?

Only the physical layer

#3: What does a network protocol suite performs?

Each protocol suite offers interfaces to network applications (network programs) to perform any networking tasks (establishing connections, transmitting payload data, receiving payload, closing an existing connection).
#4: What are “protocols”? What are “interfaces”?

Both are a set of rules, however, the difference is:

**Interface:** a set of rules between the two layers that are vertically (in the same host).

**Protocols:** a set of rules that governs communication between instances of protocol at the same layer (between two hosts)

#5: What is “OSI seven-layer model”? Show the seven layers in the OSI seven-layer model (make sure to identify the name each of the seven layers).

OSI 7-layer model is (1) a reference model to any network protocol designers/developers to follow (OSI 7-layer model suggests (2) what networking functions/tasks to be performed and (3) where in the structure that are supposed to be implemented.

<table>
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<th>Application Layer</th>
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<td>Presentation Layer</td>
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<td>Physical Layer</td>
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#6: Show the four layers in the Internet protocol layers (as overlaps on top of the ISO seven-layer model).

#7: What is “connection-oriented communication mode”? What are its primary advantages?

#8: What are the primary disadvantages of “connection-less communication mode”?

#9: Is it possible for a client host to establish more than one connection with a server process at a server host? If no, explain why not. If yes, explain how.

Port numbers

#10: Which network protocol layer (as an OSI layer) does “TCP/UDP ports” belong to? Which network protocol layer (as an OSI layer) does “IP addresses” belong to?

Transport layer
#11: Show (visualize) how TCP/UDP ports and IP addresses are used to identify each destination server (or client) process.

Network layer

#12: What is “the client-server communication model”?

#13: Show how “the client-server communication model” is typically implemented using “socket APIs”.

#14: What are “blocking APIs”? What are “non-blocking APIs”?

#15: Mention at least three blocking APIs.

#16: Why is “accept (socket) API” a blocking API?

#17: Why is “connect (socket) API” a blocking API?

#18: Why is “recv (socket) API” a blocking API?

#19: What is “the peer-to-peer communication model”?

#20: Show how “the client-server communication model” is typically implemented using “socket APIs”.

#21: What is “unicast data transmissions”? What are its primary weaknesses?

- The term, “unicasting”, means a mode of network payload transmission that requires each sender (i.e., server) to transmit each requested payload data to each requesting receiver (e.g., if there are 100 receivers request the same piece of information/data, the sender has to transmit the same piece of data once for each requesting receiver (i.e., 100 times)).

- Unicasting is not “scalable” in the following senses:

  (a) The workload at a server (the processor utilization and the network transmission bandwidth at a server) can be prohibitively high especially for network applications that are expected to have a large number of receivers (“clients”) at a time.

  (b) Serving a large number of receivers can cause high transmission bandwidth on the networks that need to carry the high volume of data transmissions. For example, if the size of the payload requested by a receiver is $S$ (bytes) and if as many as $M$ receivers, then the total required network transmission bandwidth to accommodate the service will be $((S \times M) + V)$ bytes, where $V$ represents overhead from protocols (e.g., packet headers and trailers).
(c) Unicasting takes long time for serving a large number of receivers, especially before the last receiver receives its requested data, since a server has to transmit the requested payload once for each receiver.

#22: What is “multicast data transmissions”? Explain how “multicast data transmissions” solves the major weaknesses of “multicast data transmissions”.

- Multicasting is a method of network payload transmissions, in which a transmitter of network payload data (i.e., “server”) transmits its payload only once no matter how many receivers (“clients”) need to receive the payload with the helps from the routers on their ways.

- Since a transmitter needs to transmit a piece of payload only once in multicasting, multicasting solves the following problems in unicasting:
  
  (a) The workload at a server (the processor utilization and the network transmission bandwidth at a server) will be significantly reduced especially for network applications that are expected to have a large number of receivers (“clients”) at a time.

  (b) For the network transmission paths, where many receivers exist going through the paths, each requested payload is transmitted only once, the transmission bandwidth on the paths will be reduced.

  (c) Since each transmitter does not have to transmit requested payload one at a time for each requesting receiver, the delay for receivers (especially the last receiver) to receive the requested payload will be improved (shortened).