Ch-1.1

1.Which of the following descriptions below correspond to a *"nuts-and-bolts"* view of the Internet? Select one or more of the answers below that are correct.

A collection of billions of computing devices, and packet switches interconnected by links.

A collection of hardware and software components executing protocols that define the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.

A "network of networks".

2. Which of the following descriptions below correspond to a *"services"* view of the Internet? Select one or more of the answers below that are correct below that are correct.

A platform for building network applications.

A place I go for information, entertainment, and to communicate with people.

3.Which of the following human scenarios involve a protocol (recall: "Protocols define the format, order of messages sent and received among network entities, and actions taken on message transmission, receipt")? Select one or more answers below that are correct.

A student raising her/his hand to ask a really insightful question, followed by the teaching acknowledging the student, listening carefully to the question, and responding with a clear, insightful answer. And then thanking the student for the question since teachers *love* to get questions.

Two people introducing themselves to each other.

One person asking, and getting, the time to/from another person.

CH-1.2

1.Match the access network with the approximate speeds that a subscriber might experience.

Ethernet-Wired. Up to 100's Gbps per link.

802.11 WIFI-Wireless. 10’s to 100’s of Mbps per device.

Cable access network-Wired. Up to 10’s to 100’s of Mbps downstream per user.

Digital Subscriber Line-Wired. Up to 10’s of Mbps downstream per user.

4G cellular LTE-Wireless. Up to 10’s Mbps per device.

2. Which of the following physical layer technologies has the highest transmission rate *and* lowest bit error rate in practice? **Fiber optic cable**

CH-1.3

1. Choose one the following two definitions that makes the correct distinction between routing versus forwarding.

Forwarding is the local action of moving arriving packets from router's input link to appropriate router output link, while **routing** is the global action of determining the source-destination paths taken by packets.

2.Which of the characteristics below are associated with the technique of *packet switching*?

This technique is used in the Internet.

Data may be queued before being transmitted due to other user's data that's also queueing for transmission.

Congestion loss and variable end-end delays are possible with this technique.

Resources are used on demand, not reserved in advance.

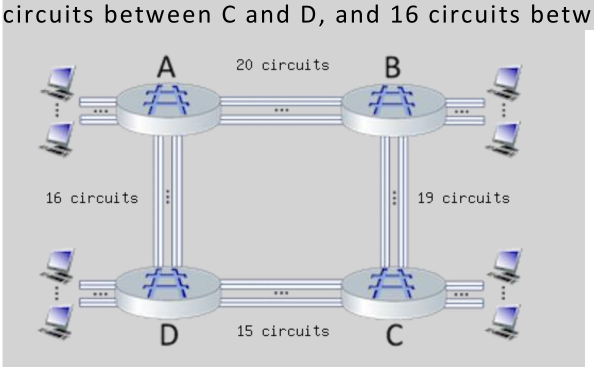
3. Which of the characteristics below are associated with the technique of *circuit switching*? Select all correct answers.

Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) are two approaches for implementing this technique.

Reserves resources needed for a call from source to destination.

This technique was the basis for the telephone call switching during the 20th century and into the beginning of this current century.

4. Consider the circuit-switched network shown in the figure below, with four circuit switches A, B, C, and D. Suppose there are 20 circuits between A and B, 19 circuits between B and C, 15 circuits between C and D, and 16 circuits between D and A.



What is the maximum number of connections that can be ongoing in the network at any one time?

70

5. Perform a traceroute from your computer (on whatever network you happen to be on) to gaia.cs.umass.edu. Use traceroute (on Mac terminal) or tracert (on Windows command line) or tracepath (on a Linux command line). Enter the missing part of the name of the router just before the host gaia.cs.umass.edu is reached:
nscs1bbs1

6. When we say that the Internet is a "network of networks," we mean? Check all that apply.

The Internet is made up of access networks at the edge, tier-1 networks at the core, and interconnected regional and content provider networks as well.

The Internet is made up of a lot of different networks that are interconnected to each other.

7. Consider a scenario in which 5 users are being multiplexed over a channel of 10 Mbps. Under the various scenarios below, match the scenario to whether circuit switching or packet switching is better.

Each user generates traffic at an average rate of 2.1 Mbps, generating traffic at a rate of 15 Mbps when transmitting- Neither works well in this overload scenario

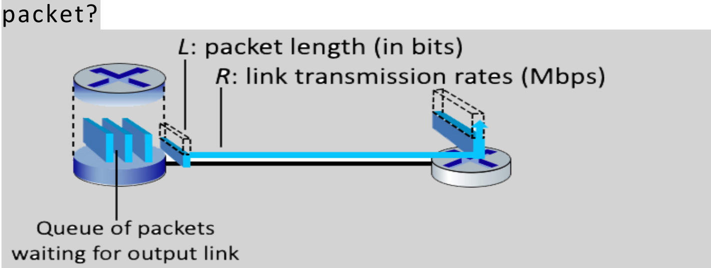
Each user generates traffic at an average rate of 2 Mbps, generating traffic at a rate of 2 Mbps when transmitting- Circuit switching

Each user generates traffic at an average rate of 0.21 Mbps, generating traffic at a rate of 15 Mbps when transmitting- Packet switching

Ch-1.4

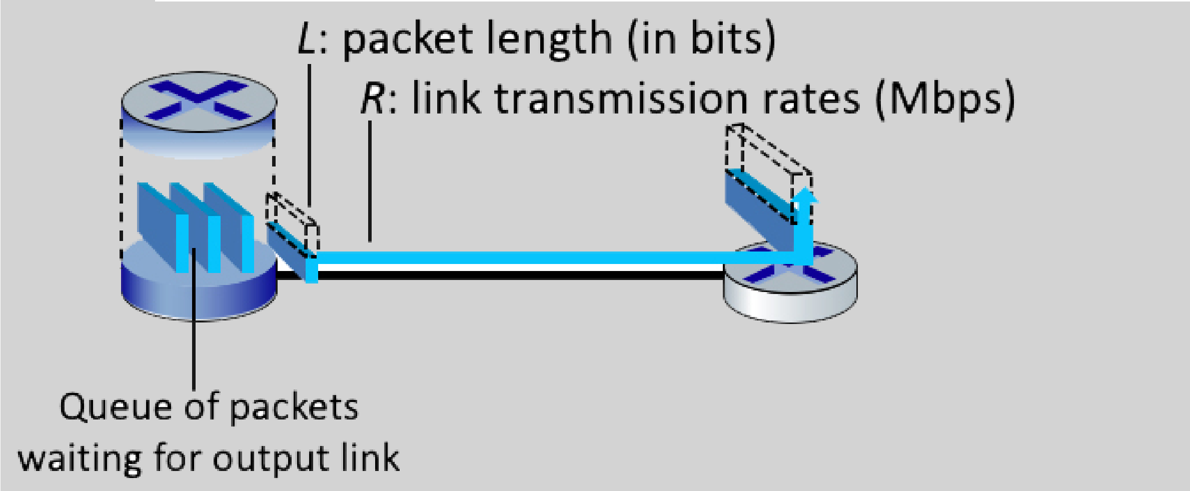
1.Match the description of each component of packet delay to its name in the pulldown list.
Processing delay: Time needed to perform an integrity check, lookup packet information in a local table and move the packet from an input link to an output link in a router.
Queueing delay: Time spent waiting in packet buffers for link transmission.
Transmission delay: Time spent transmitting packets bits into the link.
Propagation delay: Time need for bits to physically propagate through the transmission medium from end one of a link to the other.

2.
Suppose a packet is L = 1500 bytes long (one byte = 8 bits), and link transmits at R = 1 Gbps (i.e., a link can transmit bits 1,000,000,000 bits per second). What is the transmission delay for this packet?



000012 secs

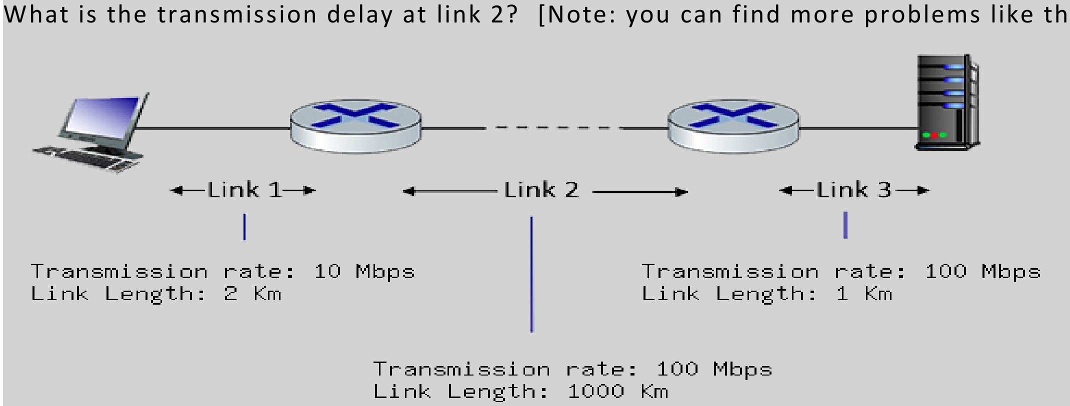
3. Suppose a packet is *L* = 1200 bytes long (one byte = 8 bits), and link transmits at R = 100 Mbps (i.e., a link can transmit bits 100,000,000 bits per second). What is the transmission delay for this packet?



.000096 secs

4. Consider the network shown in the figure below, with three links, each with the specified transmission rate and link length. Assume the length of a packet is 8000 bits.

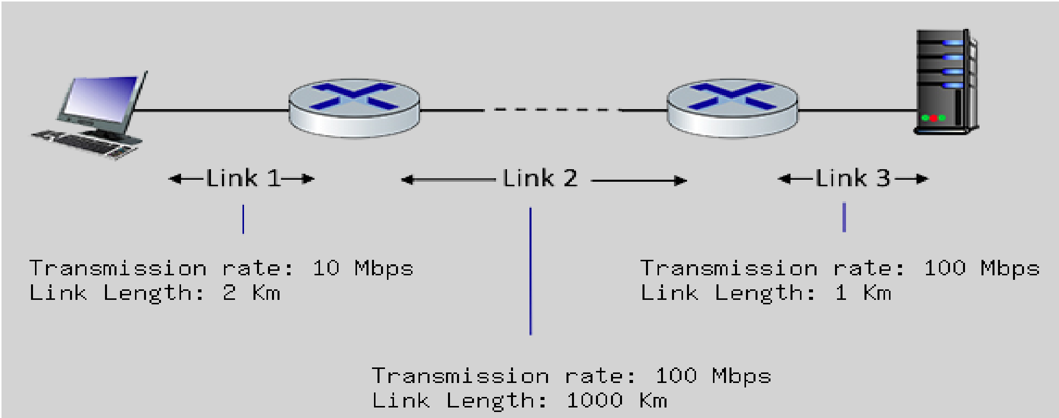
What is the transmission delay at link 2? [Note: you can find more problems like this one <u>here</u>.]



8 x 10^(-5) secs

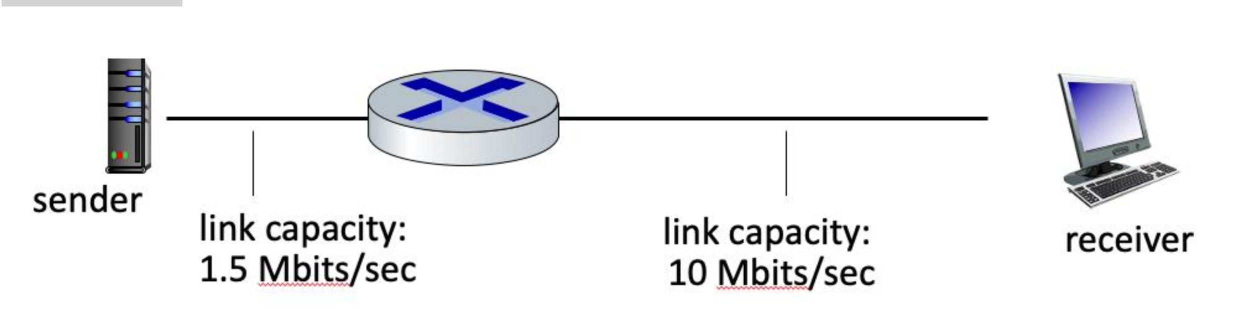
5.Consider the network shown in the figure below, with three links, each with the specified transmission rate and link length. Assume the length of a packet is 8000 bits. The speed of light propagation delay on each link is 3x10^8 m/sec

What is the propagation delay at (along) link 2?



.0033 secs

6.What is the maximum throughput achievable between sender and receiver in the scenario shown below?



1.5 Mbps

Ch-1.5

1. Match the function of a layer in the Internet protocol stack to its its name in the pulldown menu.

Protocols that are part of a distributed network application - Application layer

Transfer of data between neighbouring network devices - Link layer

Transfer of data between one process and another process (typically on different hosts) - Transport layer

Transfer of bit into and out of transmission media - Physical layer

Delivery of datagrams from source host to destination host - Network layer

2. Match the name of an Internet layer with unit of data that is exchanged among protocol entities at that layer, using the pulldown menu.

Network layer : Datagram

Data link layer/ link layer : Frame

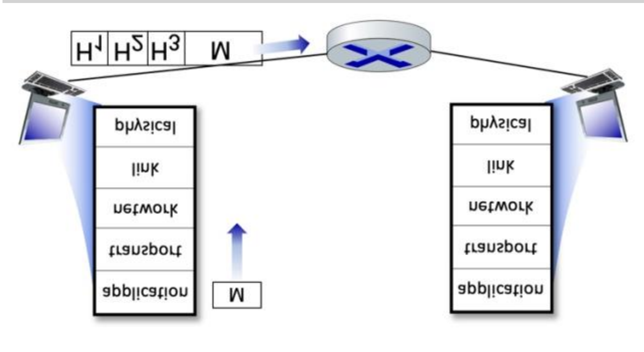
Physical layer : Bits

Transport layer : Segment (in TCP)

Application layer: Message

3.

Consider the figure below, showing a link-layer frame heading from a host to a router. There are three header fields shown. Match the name of a header with a header label shown in the figure.



H3: transport layer header

H2: network layer header

H1: data link layer header

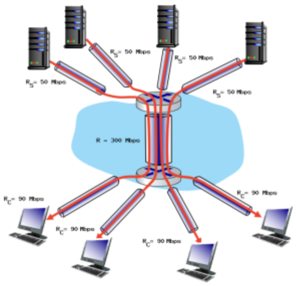
4. Which of the definitions below describe what is meant by the term "encapsulation"?

Taking data from the layer above, adding header fields appropriate for this layer, and then placing the data in the payload field of the “packet” for that layer.

Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 300 Mbps. The four links from the servers to the shared link have a transmission capacity of R_S = 50 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_C = 90 Mbps.

What is the maximum achievable end-end throughput (an integer value, in Mbps) for each of four client-to-server pairs, assuming that the middle link is fairly shared (divides its transmission rate equally) and all servers are trying to send at their maximum rate?

Your answer: [A] Mbps



[Note: more questions like this one can be found here.]

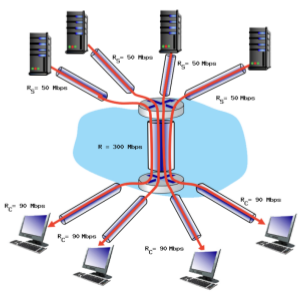
50

That's Correct!

Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 300 Mbps. The four links from the servers to the shared link have a transmission capacity of R_S = 50 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_C = 90 Mbps.

Assuming that the servers are all sending at their maximum rate possible, what are the link utilizations for the server links (with transmission capacity R_S)? Enter your answer in a decimal form of 1.00 (if the utilization is 1) or 0.xx (if the utilization is less than 1, rounded to the closest xx).

Your answer: The utilization of the server links is: [A]



[Note: more questions like this one can be found here.]

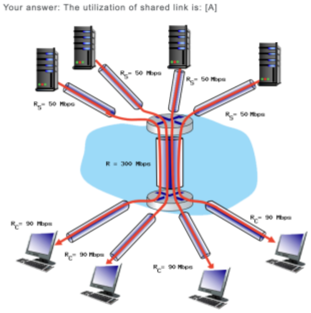
1.00

That's Correct!

Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 300 Mbps. The four links from the servers to the shared link have a transmission capacity of R_S = 50 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_C = 90 Mbps.

Assuming that the servers are all sending at their maximum rate possible, what are the link utilizations of the shared link (with transmission capacity R)? Enter your answer in a decimal form of 1.00 (if the utilization is 1) or 0.xx (if the utilization is less than 1, rounded to the closest xx).

Your answer: The utilization of shared link is: [A]



[Note: more questions like this one can be found here.]

0.67

That's Correct!

Ch-1.6

Match the description of a security defense with its name.

Digital Signatures-Used to detect tampering/changing of message contents, and to identify the originator of a message.

Firewall-Specialized "middleboxes" filtering or blocking traffic, inspecting packet contents inspections

Access Control-Limiting use of resources or capabilities to given users.

Encryption-Provides confidentiality by encoding contents

Authentication-Proving you are who you say you are.

Ch-1.7

Match the networking event with the time frame when the event occurred.

The Internet Protocol (IP) is standardized in RFC 791. - **Early 1980's**

Internetting: DARPA researchers connect three networks together. - **1970's**

First ARPAnet node operational - **Late 1960's**

Software-defined networking begins - **2000-2010**

Early studies of packet switching by Baran, Davies, Kleinrock - **Early 1960's**

The WWW starts up (note: the WWW design started at the end of previous decade) **- 1990's**

The number wireless internet-connected devices surpasses the number of connected wired devices - **2010-2020**

Congestion control is added to the TCP Protocol. - **Late 1980s**

CHAPTER-3

Chapter-3.1

1.Where is transport-layer functionality primarily implemented?

Transport layer functions are implemented primarily at each end of a physical link connecting one host/router/switch to another one host/router/switch.

2. The transport layer provides for host-to-host delivery service?

True

3. Check all of the services below that are provided by the TCP protocol.

A byte stream abstraction, that does not preserve boundaries between message data sent in different socket send calls at the sender.

Reliable data delivery. In-order data delivery

A flow-control service that ensures that a sender will not send at such a high rate so as to overflow receiving host buffers.

A congestion control service to ensure that multiple senders do not overload network links.

4. Check all of the services below that are provided by the UDP protocol.

A message abstraction, that preserves boundaries between message data sent in different socket send calls at the sender.

5. The transport layer sits on top of the network layer, and provides its services using the services provided to it by the network layer. Thus it's important that we know what is meant by the network layer's "best effort" delivery service. True or False:

> *The network layer's best-effort delivery service means that IP makes its "best effort" to deliver segments between communicating hosts, but it makes no guarantees. In particular, it does not guarantee segment delivery, it does not guarantee orderly delivery of segments, and it does not guarantee the integrity of the data in the segments.*

Correct! The network layer's best effort service doesn't really provide much service at all, does it?

Ch-3.2

1. What is meant by transport-layer demultiplexing?

Receiving a transport-layer segment from the network layer, extracting the payload (data) and delivering the data to the correct socket.

2. What is meant by transport-layer multiplexing?

Taking data from one socket (one of possibly many sockets), encapsulating a data chuck with header information – thereby creating a transport layer segment – and eventually passing this segment to the network layer.

3.True or False: When multiple UDP clients send UDP segments to the same destination port number at a receiving host, those segments (from different senders) will always be directed to the same socket at the receiving host.

True

4.True or False: When multiple TCP clients send TCP segments to the same destination port number at a receiving host, those segments (from different senders) will always be directed to the same socket at the receiving host.

False

5.True or False: It is possible for two UDP segments to be sent from the same socket with source port 5723 at a server to two different clients.

True

6.True or False: It is possible for two TCP segments with source port 80 to be sent by the sending host to different clients.

True

Chapter-3.3

1.True or False: On the sending side, the UDP sender will take each application-layer chunk of data written into a UDP socket and send it in a distinct UDP datagram. And then on the receiving side, UDP will deliver a segment's payload into the appropriate socket, preserving the application-defined message boundary.

True

2.Which of the fields below are in a UDP segment header?

Length (of UDP header plus payload)

Source port number

Internet checksum

Destination port number

3.Why is the UDP header length field needed?

Because the payload section can be of variable length, and this lets UDP know where the segment ends.

4. Over what set of bytes is the checksum field in the UDP header computed over?

The entire UDP segment, except the checksum field itself, and the IP sender and receive address fields

5.
Which of the following statements are true about a checksum? Hint: more than one statement is true.

A checksum is computed at a sender by considering each byte within a packet as a number, and then adding these numbers (each number representing a bytes) together to compute a sum (which is known as a checksum).

The receiver of a packet with a checksum field will add up the received bytes, just as the sender did, and compare this locally computed checksum with the checksum value in the packet header. If these two values are *different* then the receiver *knows that* one of the bits in the received packet has been changed during transmission from sender to receiver.

The sender-computed checksum value is often included in a checksum field within a packet header.

6. Compute the Internet checksum value for these two 16-bit words: 11110101 11010011 and 10110011 01000100

01010110 11100111

7. Compute the Internet checksum value for these two 16-bit words: 01000001 11000100 and 00100000 00101011

10011110 00010000

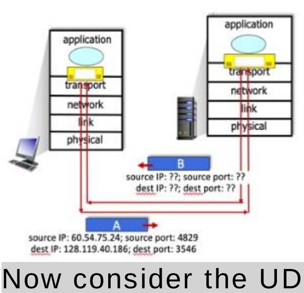
8.True or False: When computing the Internet checksum for two numbers, a single flipped bit (i.e., in just one of the two numbers) will always result in a changed checksum.

True

9.True or False: When computing the Internet checksum for two numbers, a single flipped bit in each of the two numbers will always result in a changed checksum.

False

10. Suppose a UDP segment (A in the figure below) arrives at a host with an IP address of 128.119.40.186. The source port in the UDP segment is 4829 and the destination port is 3546. The IP address of the sending host is 60.54.75.24.



Now consider the UDP datagram (and the IP datagram that will encapsulate it) sent in reply by the application on host 128.119.40.186 to the original sender host, labeled B in the figure above. Complete the sentences below ...

What are the source and destination port numbers and IP addresses? (Enter the integer port number or the 4-part dotted decimal IP address, included the period)

The source port number of the UDP segment (B) sent in reply is:

The source IP address of the IP datagram containing the UDP segment (B) sent in reply is:

The destination port number of the UDP segment (B) sent in reply is:

The destination IP address of the IP datagram containing the UDP segment (B) sent in reply is:

1. 3546
2. 128.119.40.186
3. 4829
4. 60.54.75.24

CHAPTER-3.5

1.True or False: On the sending side, the TCP sender will take each application-layer chunk of data written into a TCP socket and send it in a distinct TCP segment. And then on the receiving side, TCP will deliver a segment's payload into the appropriate socket, preserving the application-defined message boundary.

FALSE

2.

This field contains the source port number associated with the sending socket for this TCP segment-Source port number

This field contains application data that was written into a socket by the sender of this TCP segment. -Data (Payload)

This field contains the index in the sender-to-receiver byte stream of the first byte of that data in the payload carried in this segment-Sequence number.

This field contains the index in the byte stream of the next in-order byte expected at the receiver-ACK number field.

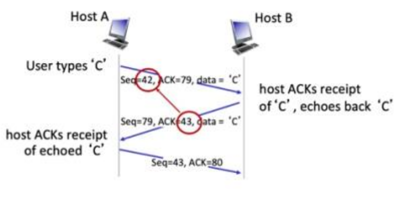
If set, this segment cumulatively ACKs all data bytes up to, but not including the byte index in the ACK value field of this segment. -ACK bit field

This field contains the number of available bytes in the TCP receiver's buffer. -Receiver advertised window

This field contains the Internet checksum of the TCP segment and selected fields in the IP datagram header. -Checksum

This field contains the number of bytes in the TCP header. -Header length field

3. Consider the TCP Telnet scenario below (from Fig. 3.31 in text). Why is it that the receiver sends an ACK that is one larger than the sequence number in the received datagram?



simple telnet scenario

Because the send-to receiver segment carries only one byte of data, and after that segment is received, the next expected byte of data is just the next byte (i.e., has an index that is one larger) in the data stream.

4. Suppose that as shown in the figure below, a TCP sender is sending segments with 100 bytes of payload. The TCP sender sends five segments with sequence numbers 100, 200, 300, 400, and 500. Suppose that the segment with sequence number 300 is lost. The TCP receiver will buffer correctly-received but not-yet-in-order segments for later delivery to the application layer (once missing segments are later received).

After receiving segment 100, the receiver responds with an ACK with value:200

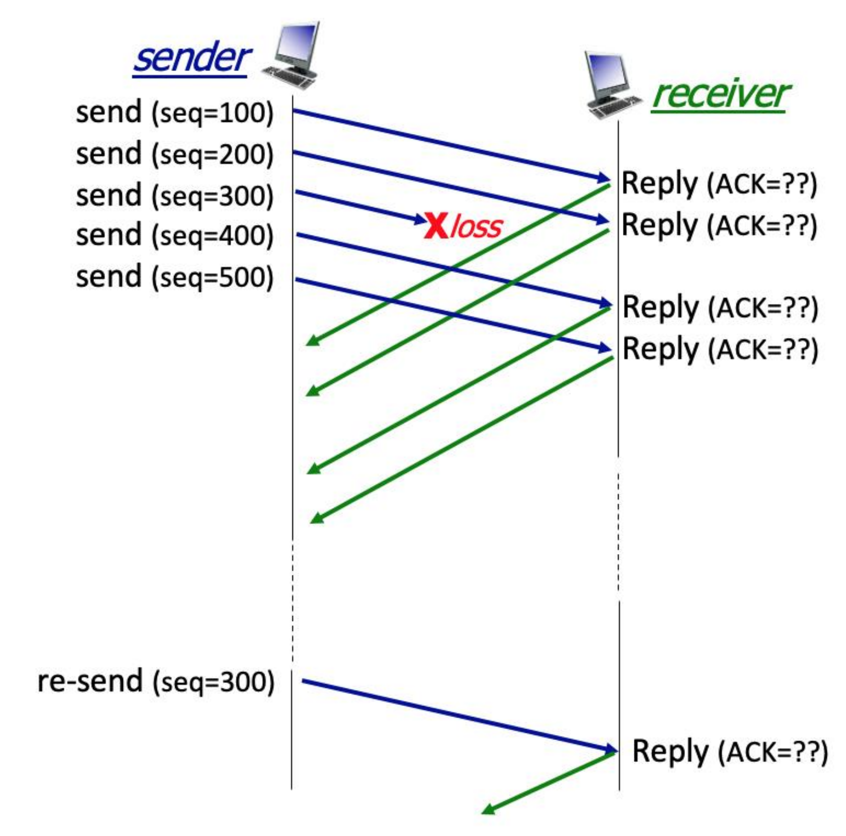
After receiving segment 200, the receiver responds with an ACK with value:300

After receiving segment 500, the receiver responds with an ACK with value: 300, a duplicate ACK

After receiving the *retransmitted* segment 300, the receiver responds with an ACK with value:600

The TCP receiver does *not* respond in the example, with an ACK with value:400

4.Consider TCP use of an exponentially weighted moving average (EWMA) to compute the nth value of the estimated RTT:

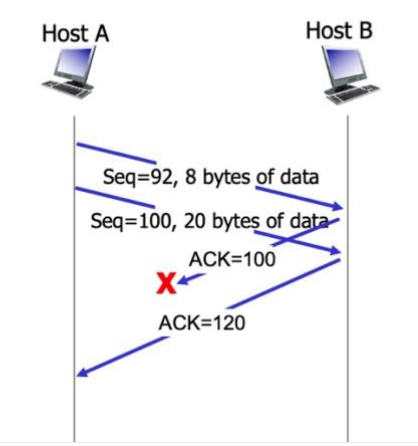


$EstimatedRTT_n = (1- a)*EstimatedRTT_{n-1} + a*SampleRTT_n$

True or False: with this EWMA algorithm the value of *$EstimatedRTT_n$* has no dependence on the earlier sample, *$SampleRTT_{n-1}$*

FALSE

5.Consider the TCP Telnet scenario below (from Fig. 3.36 in text). What timer-related action does the sender take on the receipt of ACK 120?



Cancels any running timers.

6.True or False: with TCP’s flow control mechanism, where the receiver tells the sender how much free buffer space it has (and the sender always limits the amount of outstanding, unACKed, in-flight data to less than this amount), it is not possible for the sender to send more data than the receiver has room to buffer.

True

7. Match the description of a TCP connection management message with the name of the message used to accomplish that function.

A message from client to server initiating a connection request.-SYN

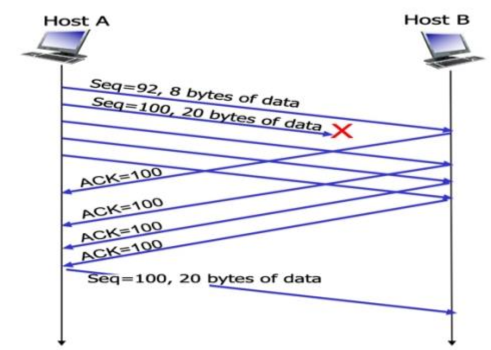
A message from server to client ACKing receipt of a SYN message and indicating the willingness of the server to establish a TCP connection with the client.-SYNACK

A message indicating that the sending side is initiating the protocol to terminate a connection.-FIN

A message sent in response to a request to terminate a connection, ACKing that the side receiving this message is also willing to terminate the connection-FINACK

A general purpose error message used during connection set up or tear down to let the other side know that an error has occurred, and that the referenced connection should be shut down.-RESET

8.Consider TCP’s Fast Retransmit optimization (see Figure 3.37 from the text, below). Of course, the sender doesn't know for sure that the segment with sequence # 100 is actually lost (it can’t see into the channel). Can a sender get three duplicate ACKs for a segment that in fact has *not* been lost? Which of the following statements are true? Suppose a channel can lose, but will not corrupt, messages.



A.

If the channel cannot reorder messages, a triple duplicate ACK indicates to the sender that a segment loss has happened for sure. Actually (again assuming the channel cannot corrupt or reorder messages), even a *single* duplicate ACK would indicate that a segment loss has happed for sure.

If the channel can reorder messages, a triple duplicate ACK can occur even though a message is not lost; since it's possible that a message has just been reordered and has not yet arrived when the three duplicate ACKs were generated.

CH-3.6

Consider the five images below. Indicate which of these images suggest the need for *flow* control (the others would suggest the need for congestion control).

A talking head

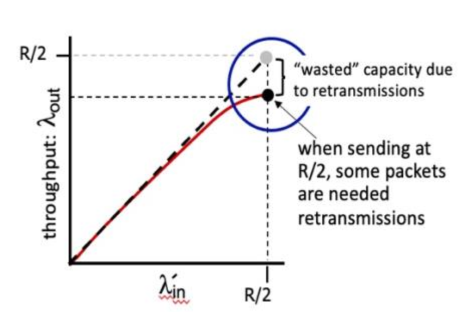
A glass overflowing

A penguin crowd

A crowd of people

Car traffic

2.Consider the figure below, which shows the application-to-application throughput achieved when two senders are competing at a shared bottleneck link. Suppose that when the overall arrival rate, lambda$_{in}$' (for each sender) is close to R/2, the throughput to the application layer (at each receiver), lambda$_{out}$, is equal to 0.8 * lambda$_{in}$'.



What fraction of the packets transmitted at the sender are retransmissions?

.20

CHAPTER-4

1) Check all of the statements below about where (in the network) the network layer is implemented that are true.

Ans: The network layer is implemented in hosts at the network's edge.

The network layer is implemented in routers in the network core.

2.Consider the travel analogy discussed in the textbook - some actions we take on a trip correspond to **forwarding** and other actions we take on a trip correspond to **routing**. Which of the following travel actions below correspond to *forwarding*? The other travel actions that you don't select below then correspond to routing.

Ans: A car stops at an intersection to “gas-up” and take a “bathroom break”

A car takes the 3rd exit from a roundabout.

A car waits at light and then turns left at the intersection.

3)For each of the actions below, select those actions below that are primarily in the network-layer data plane. The other actions that you don't select below then correspond to control-plane actions.

Ans: Moving an arriving datagram from a router’s input port to output port

Looking up address bits in an arriving datagram header in the forwarding table.

Dropping a datagram due to a congested (full) output buffer.

4) We've seen that there are two approaches towards implementing the network control plane - a per-router control-plane approach and a software-defined networking (SDN) control-plane approach. Which of the following actions occur in a per-router control-plane approach? The other actions that you don't select below then correspond to actions in an SDN control plane.

Ans: A router exchanges messages with another router, indicating the cost for it (the sending router) to reach a destination host

Routers send information about their incoming and outgoing links to other routers in the network.

5)Which of the following quality-of-service guarantees are part of the Internet’s best-effort service model? Check all that apply.

Ans:*None* of the other services listed here are part of the best-effort service model. Evidently, best-effort service really means no *guarantees* at all!

6)Where in a router is the destination IP address looked up in a forwarding table to determine the appropriate output port to which the datagram should be directed?

Ans: At the input port where a packet arrives.

7) Where in a router does "match plus action" happen to determine the appropriate output port to which the arriving datagram should be directed?
Ans: At the input port where a packet arrives.

8)
Consider the following forwarding table below. Indicate the output to link interface to which a datagram with the destination addresses below will be forwarded under longest prefix matching. (Note: The list of addresses is ordered below. If two addresses map to the same output link interface, map the first of these two addresses to the first instance of that link interface.) [Note: You can find more examples of problems similar to this here.]

Destination Address Range	Link interface
11001000 00010111 00010*** ********	0
11001000 00010111 00011000 ********	1
11001000 00010111 00011*** ********	2
otherwise	3

This is the first destination address in the list that maps to output port 0.
This is the first destination address in the list that maps to output port 1.
This is the first destination address in the list that maps to output port 2.
This is the first destination address in the list that maps to output port 3.
This is the second destination address in the list that maps to output port 1.
This is the second destination address in the list that maps to output port 0.
This is the second destination address in the list that maps to output port 2

Suppose a datagram is switched through the switching fabric and arrives to its appropriate output to find that there are no free buffers. In this case:

The packet will either be dropped or another packet will be removed (lost) from the buffer to make room for this packet, depending on policy. But the packet will definitely not be be sent back to the input port.

What is meant by Head of the Line (HOL) blocking?

A queued datagram waiting for service at the front of a queue prevents other datagrams in queue from moving forward in the queue.

What are the principal components of the IPv4 protocol (check all that apply)?

1. IPv4 datagram format
2. IPv4 addressing conventions
3. Packet handling conventions at routers (e.g. segmentation/reassembly)

CHAPTER-2

1. This procedure creates a new socket at the client, and connects that socket to the specified server.
   There is a server that is always on.

   HTTP uses this application structure.

   There is a server with a well known server IP address.

2. Which of the characteristics below are associated with a P2P approach to structuring network applications (as opposed to a client-server approach)?
There is not a server that is always on.

A process requests service from those it contacts and will provide service to processes that contact it.

3. When an application uses a UDP socket, what transport services are provided to the application by UDP? Check all that apply.
Best effort service. The service will make a best effort to deliver data to the destination but makes no guarantees that any particular segment of data will actually get there.
4. When an application uses a TCP socket, what transport services are provided to the application by TCP? Check all that apply.
Loss-free data transfer. The service will reliably transfer all data to the receiver, recovering from packets dropped in the network due to router buffer overflow.

Flow Control. The provided service will ensure that the sender does not send so fast as to overflow receiver buffers.

Congestion control. The service will control senders so that the senders do not collectively send more data than links in the network can handle.

5. What do we mean when we say “HTTP is stateless”? In answering this question, assume that cookies are not used. Check all answers that apply.

An HTTP server does not remember anything about what happened during earlier steps in interacting with this HTTP client.

6. What is an HTTP cookie used for?

A cookie is a code used by a server, carried on a client's HTTP request, to access information the server had earlier stored about an earlier interaction with this Web browser. [Think about the distinction between a browser and a person.]

7. What is the purpose of the HTTP GET message?

The HTTP GET request message is used by a web client to request a web server to send the requested object from the server to the client.

8. What is the purpose of the conditional HTTP GET request message?

To allow a server to only send the requested object to the client if this object has changed since the server last sent this object to the client.

9. A DETAILED LOOK AT AN HTTP GET (1).

Suppose a client is sending an HTTP GET request message to a web server, gaia.cs.umass.edu. Suppose the client-to-server HTTP GET message is the following:

GET /kurose_ross_sandbox/interactive/quotation2.htm HTTP/1.1
Host: gaia.cs.umass.edu
Accept: text/plain, text/html, text/xml, image/jpeg, image/gif, audio/mpeg, audio/mp4, video/wmv, video/mp4,
Accept-Language: en-us, en-gb;q=0.1, en;q=0.7, fr, fr-ch, da, de, fi
If-Modified-Since: Wed, 09 Sep 2020 16:06:01 -0700
User Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/535.11 (KHTML, like Gecko) Chrome/17.0.963.56 Safari/535.11

What version of HTTP is the client using?
[Note: you can find additional questions similar to this here.]

1.1

10. A DETAILED LOOK AT AN HTTP GET (2).

Again, suppose a client is sending an HTTP GET request message to a web server, gaia.cs.umass.edu. The client-to-server HTTP GET message is the following (same as in previous problem):

GET /kurose_ross_sandbox/interactive/quotation2.htm HTTP/1.1
Host: gaia.cs.umass.edu
Accept: text/plain, text/html, text/xml, image/jpeg, image/gif, audio/mpeg, audio/mp4, video/wmv, video/mp4,
Accept-Language: en-us, en-gb;q=0.1, en;q=0.7, fr, fr-ch, da, de, fi
If-Modified-Since: Wed, 09 Sep 2020 16:06:01 -0700
User Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/535.11 (KHTML, like Gecko) Chrome/17.0.963.56 Safari/535.11

What is the language in which the client would least prefer to get a response? [You may have to search around the Web a bit to answer this.]

[Note: you can find additional questions similar to this here.]

united kingdom English

11. A DETAILED LOOK AT AN HTTP GET (3).

Again, suppose a client is sending an HTTP GET request message to a web server, gaia.cs.umass.edu. Suppose the client-to-server HTTP GET message is the following (same as in previous problem):

GET /kurose_ross_sandbox/interactive/quotation2.htm HTTP/1.1
Host: gaia.cs.umass.edu
Accept: text/plain, text/html, text/xml, image/jpeg, image/gif, audio/mpeg, audio/mp4, video/wmv, video/mp4,
Accept-Language: en-us, en-gb;q=0.1, en;q=0.7, fr, fr-ch, da, de, fi
If-Modified-Since: Wed, 09 Sep 2020 16:06:01 -0700
User Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/535.11 (KHTML, like Gecko) Chrome/17.0.963.56 Safari/535.11

Does the client have a cached copy of the object being requested?

[Note: you can find additional questions similar to this here.]

Yes, because this is a conditional GET, as evidenced by the If-Modified-Since field.

12. A DETAILED LOOK AT AN HTTP REPLY.

Suppose now the server sends the following HTTP response message the client:

HTTP/1.0 200 OK
Date: Wed, 09 Sep 2020 23:46:21 +0000
Server: Apache/2.2.3 (CentOS)
Last-Modified: Wed, 09 Sep 2020 23:51:41 +0000
ETag:17dc6-a5c-bf716880.
Content-Length: 418
Connection: Close
Content-type: image/html

Will the web server close the TCP connection after sending this message?
[Note: you can find more questions like this one here.]

Yes, the server will close this connection because version 1.0 of HTTP is being used, and TCP connections do not stay open persistently.

13. WHY WEB CACHING?

Which of the following are advantages of using a web cache? Sselect one or more answers.

Caching uses less bandwidth coming into an institutional network where the client is located, if the cache is also located in that institutional network.

Caching generally provides for a faster page load time at the client, if the web cache is in the client's institutional network, because the page is loaded from the nearby cache rather than from the distant server.

14. HTTP/2 VERSUS HTTP/1.1.

Which of the following are changes between HTTP 1.1 and HTTP/2? Note: select one or more answers.

HTTP/2 allows objects in a persistent connection to be sent in a client-specified priority order.

HTTP/2 allows a large object to be broken down into smaller pieces, and the transmission of those pieces to be interleaved with transmission other smaller objects, thus preventing a large object from forcing many smaller objects to wait their turn for transmission.

15. WHAT'S IN AN HTTP REPLY?

Which of the following pieces of information will appear in a server's application-level HTTP reply message? (Check all that apply.)

A response phrase associated with a response code

A response code

16. IF-MODIFIED-SINCE.

What is the purpose of the *If-Modified-Since* field in a HTTP GET request message

To indicate to the server that the client has cached this object from a previous GET, and the time it was cached.

17. What is the purpose of a cookie value in the HTTP GET request?

The cookie value itself doesn't mean anything. It is just a value that was returned by a web server to this client during an earlier interaction.

18. HTTP GET (EVEN MORE).

Suppose a client is sending an HTTP GET message to a web server, gaia.cs.umass.edu. Suppose the client-to-server HTTP GET message is the following:

```
GET /kurose_ross_sandbox/interactive/quotation2.htm HTTP/1.1
Host: gaia.cs.umass.edu
Accept: text/plain, text/html, text/xml, image/jpeg, image/gif, audio/mpeg, audio/mp4,
video/wmv, video/mp4,
Accept-Language: en-us, en-gb;q=0.1, en;q=0.7, fr, fr-ch, da, de, fi
If-Modified-Since: Wed, 09 Sep 2020 16:06:01 -0700
User Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/535.11 (KHTML, like Gecko)
Chrome/17.0.963.56 Safari/535.11
```

Does the client have a cached copy of the object being requested?

Yes, because this is a conditional GET.

19. WHAT HAPPENS AFTER AN HTTP REPLY?

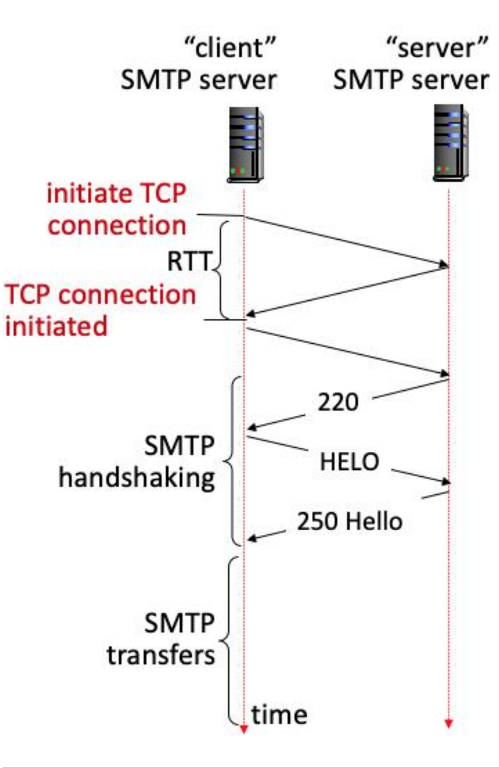
Suppose an HTTP server sends the following HTTP response message a client:

HTTP/1.0 200 OK
Date: Wed, 09 Sep 2020 23:46:21 +0000
Server: Apache/2.2.3 (CentOS)
Last-Modified: Wed, 09 Sep 2020 23:51:41 +0000
ETag:17dc6-a5c-bf716880.
Content-Length: 418
Connection: Close
Content-type: image/html

Will the web server close the TCP connection after sending this message?
Yes, because this is HTTP 1.0

20. E-MAIL DELAYS.

How many RTTs are there from when a client first contacts an email server (by initiating a TCP session) to when the client can begin sending the email message itself – that is following all initial TCP or SMTP handshaking required?
Recall the figure below from our class notes:



21. COMPARING AND CONTRASTING HTTP AND SMTP.

Which of the following characteristics apply to HTTP only (and do *not* apply to SMTP)? Note: check one or more of the characteristics below.

Uses server port 80.

Operates mostly as a "client pull" protocol.

Uses a blank line (CRLF) to indicate end of request header.

22. COMPARING AND CONTRASTING HTTP AND SMTP (2).

Which of the following characteristics apply to SMTP only (and do *not* apply to HTTP)? Note: check one or more of the characteristics below.

Uses server port 25.

Uses CRLF.CRLF to indicate end of message.

Operates mostly as a "client push" protocol.

23. COMPARING AND CONTRASTING HTTP AND SMTP (3).

Which of the following characteristics apply to both HTTP and SMTP? Note: check one or more of the characteristics below.

Is able to use a persistent TCP connection to transfer multiple objects.

Has ASCII command/response interaction, status codes.

24. Pushes email from a mail client to a mail server. - SMTP

Pulls mail from one mail server to another mail server. - Neither SMTP nor IMAP does this.

Pulls email to a mail client from a mail server. – IMAP

25.

Provides authoritative hostname to IP mappings for organization's named hosts. - Authoritative DNS server

Replies to DNS query by local host, by contacting other DNS servers to answer the query. - Local DNS server

Responsible for a domain (e.g., .com, .edu); knows how to contact authoritative name servers. - Top Level Domain (TLD) servers

Highest level of the DNS hierarchy, knows how to reach servers responsible for a given domain (e.g., .com, .edu). - DNS root servers

26. WHY DOES THE DNS PERFORM CACHING?

What is the value of caching in the local DNS name server? Check all that apply.

DNS caching provides for faster replies, if the reply to the query is found in the cache.

DNS caching results in less load elsewhere in DNS, when the reply to a query is found in the local cache

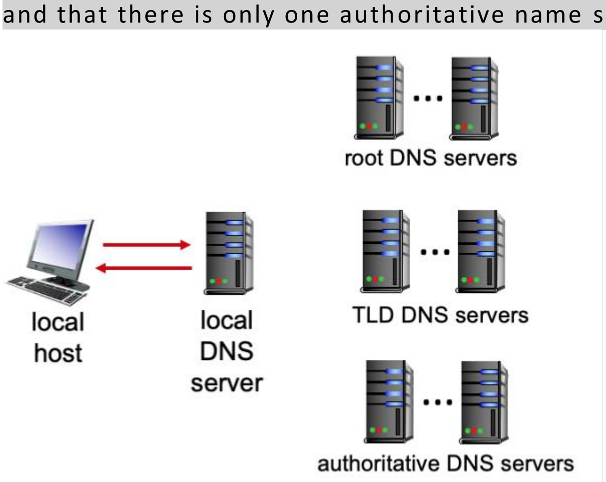
27. WHAT'S IN THE DNS TYPE A RESOURCE RECORD?

What information does the type “A” resource record hold in the DNS database? Check all that apply.

A hostname and an IP address.

28. DNS IN ACTION (1).

Suppose that the local DNS server caches all information coming in from all root, TLD, and authoritative DNS servers for 20 time units. (Thus, for example, when a root server returns the name and address of a TLD server for .com, the cache remembers that this is the TLD server to use to resolve a .com name). Assume also that the local cache is initially empty, that iterative DNS queries are always used, that DNS requests are just for name-to-IP-address translation, that 1 time unit is needed for each server-to-server or host-to-server (one way) request or response, and that there is only one authoritative name server (each) for any .edu or .com domain.



Consider the following DNS requests, made by the local host at the given times:

- *t=0,* the local host requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=1,* the local host requests that the name icann.org be resolved to an IP address.
- *t=5,* the local host requests that the name cs.umd.edu be resolved to an IP address. (Hint: be careful!)
- *t=10,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=12*, the local host requests that the name cs.mit.edu be resolved to an IP address.
- *t=30,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address. (Hint: be careful!)

Which of the requests require 8 time units to be resolved?

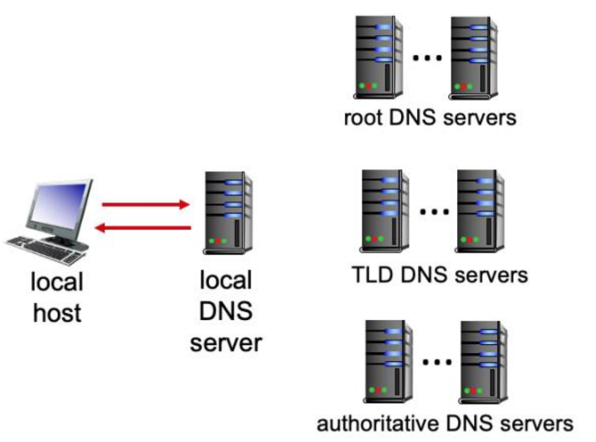
The request at t=1.

The request at t=30.

The request at t=0.

29. DNS IN ACTION (2).

[This question is the same as an earlier question, except for the question statement at the very end.] Suppose that the local DNS server caches all information coming in from all root, TLD, and authoritative DNS servers for 20 time units. (Thus, for example, when a root server returns the name and address of a TLD server for .com, the cache remembers that this is the TLD server to use to resolve a .com name). Assume also that the local cache is initially empty, that iterative DNS queries are always used, that DNS requests are just for name-to-IP-address translation, that 1 time unit is needed for each server-to-server or host-to-server (one way) request or response, and that there is only one authoritative name server (each) for any .edu or .com domain.



Consider the following DNS requests, made by the local host at the given times:

- *t=0,* the local host requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=1,* the local host requests that the name icann.org be resolved to an IP address.
- *t=5,* the local host requests that the name cs.umd.edu be resolved to an IP address. (Hint: be careful!)
- *t=10,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=12*, the local host requests that the name cs.mit.edu be resolved to an IP address.
- *t=30,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address. (Hint: be careful!)

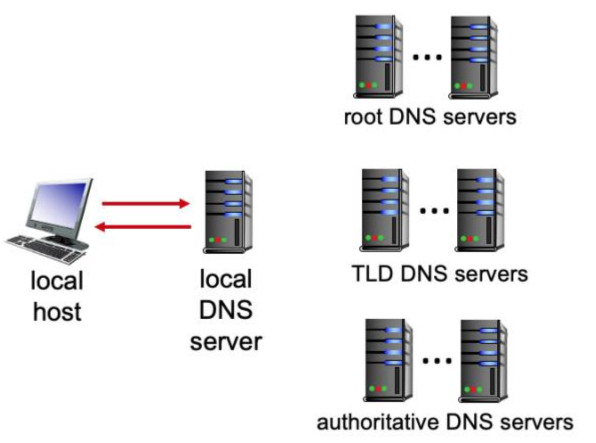
Which of the requests require 6 time units to be resolved?

The request at t=5.

The request at t=12.

30. DNS IN ACTION (3).

[This question is the same as an earlier question, except for the question statement at the very end.] Suppose that the local DNS server caches all information coming in from all root, TLD, and authoritative DNS servers for 20 time units. (Thus, for example, when a root server returns the name and address of a TLD server for .com, the cache remembers that this is the TLD server to use to resolve a .com name). Assume also that the local cache is initially empty, that iterative DNS queries are always used, that DNS requests are just for name-to-IP-address translation, that 1 time unit is needed for each server-to-server or host-to-server (one way) request or response, and that there is only one authoritative name server (each) for any .edu or .com domain.



Consider the following DNS requests, made by the local host at the given times:

- *t=0,* the local host requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=1,* the local host requests that the name icann.org be resolved to an IP address.
- *t=5,* the local host requests that the name cs.umd.edu be resolved to an IP address. (Hint: be careful!)
- *t=10,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address.
- *t=12*, the local host requests that the name cs.mit.edu be resolved to an IP address.
- *t=30,* the local host *again* requests that the name gaia.cs.umass.edu be resolved to an IP address. (Hint: be careful!)

Which of the requests require 2 time units to be resolved?

The request at t=10.

31. THE LOCAL DNS SERVER.

Check all of the phrases below that state a true property of a *local* DNS server.

The local DNS server record for a remote host is sometimes different from that of the authoritative server for that host.

The local DNS server can decrease the name-to-IP-address resolution time experienced by a querying local host over the case when a DNS is resolved via querying into the DNS hierarchy.

32. THE DNS AUTHORITATIVE NAME SERVER.

What is the role of an authoritative name server in the DNS? (Check all that apply)

It provides the definitive answer to the query with respect to a name in the authoritative name server's domain.

33. DNS AND HTTP CACHING.

We learned that in HTTP web browser caching, HTTP local web server caching, and in local DNS caching, that a user benefits (e.g., shorter delays over the case of no caching) from finding a local/nearby copy of a requested item. In which of the following forms of caching does a user benefit from its not only from its own recent requests (and cached replies) *but also from recent requests made from other users*?

HTTP local web caching

Local DNS server caching

34. What is the purpose of a manifest file in a streaming multimedia setting?

To let a client know where it can retrieve different video segments, encoded at different rates

35. What approach is taken by a CDN to stream content to hundreds of thousands of simultaneous users?

Store/serve multiple copies of videos at multiple geographically distributed sites.

36. A unit of video, each of which may be encoded at multiple different rates, stored in different files. - Chunk

A file containing the location and encoding rate of files corresponding to video segments in a video. - Manifest

An approach that allows a client to adapt the encoding rate of retrieved video to network congestion conditions. - DASH

A CDN approach that stores content in access networks, close to clients. - Enter deep

37. . WHAT IS DASH?

In DASH (Dynamic, Adaptive Streaming over HTTP), a server divides a video file into chunks that ... (pick best completion from below)

are stored, each encoded at multiple rates (video quality). The client plays the video chunk-by-chunk, with each chunk requested at encoding rate that fits the available bandwidth at the time.

38. UDP SOCKETS.

Which of the following characteristics below are associated with a UDP socket? Check one or more that apply.

data from different clients can be received on the same socket

the application must explicitly specify the IP destination address and port number for each group of bytes written into a socket

provides unreliable transfer of a groups of bytes ("a datagram"), from client to server socket(AF_INET, SOCK_DGRAM) creates this type of socket

39. TCP SOCKETS.

Which of the following characteristics below are associated with a TCP socket? Check one or more that apply.

socket(AF_INET, SOCK_STREAM) creates this type of socket

provides reliable, in-order byte-stream transfer (a "pipe"), from client to server

when contacted, the server will create a new server-side socket to communicate with that client

a server can perform an accept() on this type of socket

40. SERVER REPLY (UDP).

How does the networked application running on a server know the client IP address and the port number to reply to in response to a received datagram?

The application code at the server determines client IP address and port # from the initial segment sent by client, and must explicitly specify these values when sending into a socket back to that client.

41. Suppose a Web server has *five* ongoing connections that use TCP receiver port 80, and assume there are no other TCP connections (open or being opened or closed) at that server. How many TCP sockets are in use at this server?

6

42. What happens when a socket connect() procedure is called/invoked?

This procedure creaztes a new socket at the client, and connects that socket to the specified server.