

CSE 123: Computer Networks
Fall Quarter, 2010
FINAL EXAM

Instructor: Alex C. Snoeren

Name SOLUTIONS

Student ID _____

Question	Score	Points
1	20	20
2	15	15
3	15	15
4	30	30
5	30	30
6	30	30
7	10	10
Total	150	150

This exam is **closed book**. You are allowed one 8.5x11-inch, double-sided sheet of paper containing whatever you would like (a “crib sheet”). The exam contains seven questions of differing point values. Each question is clearly labeled with its value. Please answer all questions in the space provided. You have three hours to complete this exam. As with any exam, I suggest you read through all the questions first before answering any of them. Note that the final question is a freebie; you will receive full credit regardless of your answer. I would, however, appreciate your feedback if you have time remaining after completing the remainder of the exam.

GOOD LUCK!

1. (20 pts) True/False. Determine whether each of the following statements is true or false. No explanation is necessary; partial credit will not be awarded.

a) All nodes connected to the Internet must implement UDP.

False

b) Channel noise leads to signal attenuation.

False; just a drop in the SNR ratio.

c) Media Access Control is a function of the data-link layer.

True

d) Switches decrement the TTL field in the IP header.

False; only routers do.

e) RTS/CTS combats the Hidden Terminal problem.

True

f) Token Ring is an example of a contention-based MAC protocol.

False

g) A one-bit parity scheme has Hamming distance 1.

False; it has a Hamming distance of 2.

h) FEC can be more efficient than ARQ in a broadcast environment with many receivers.

True

i) IS-IS is a distance vector routing protocol.

False; it's link state.

j) BGP exchanges link weights.

False; BGP exchanges path vectors.

2. (15 pts) Short answer. Concisely answer each of the following questions.

a) Why are digital encoding schemes with more frequent transitions preferred?

Assists in clock recovery and avoids baseline drift.

b) What is the minimum value for the timeout of a reliable transmission protocol? Why?

One RTT; anything shorter would timeout before the ACK had a chance to arrive.

c) How does 802.11 implement virtual carrier sense?

It uses both the NAV and, optionally, RTS/CTS.

d) What is the difference between congestion control and flow control?

Congestion control prevents overrunning buffers in the network, while flow control prevents overflowing the receiver's.

e) What are the drawbacks of sentinel-based framing?

Sentinel-based framing requires the sender to do some form of stuffing, and the receiver to reverse the process. This adds both complexity and overhead to the transmission process, as well as decreasing the efficiency of the link.

3. (15 pts) More short answer. Provide brief answers for the questions below.

a) What is the difference between the bit rate and baud rate of a signal?

Baud rate is the speed at which symbols can be communicated across a channel; bit rate depends on the information rate of each symbol. I.e., if each symbol corresponds to more than one bit, bit rate will exceed baud rate.

b) Why does distance-vector routing scale better than link-state routing? Be specific.

Routers in distance vector protocols only receive updates from their immediate neighbors, while routers must manage LSPs from every router in the network in link-state protocols.

c) Explain the difference between traffic shaping and traffic policing.

Traffic shaping controls the rate of sending by buffering excess incoming traffic, while traffic policing drops any excess.

d) Give one advantage and one disadvantage of window-based flow control vs. rate-based flow control.

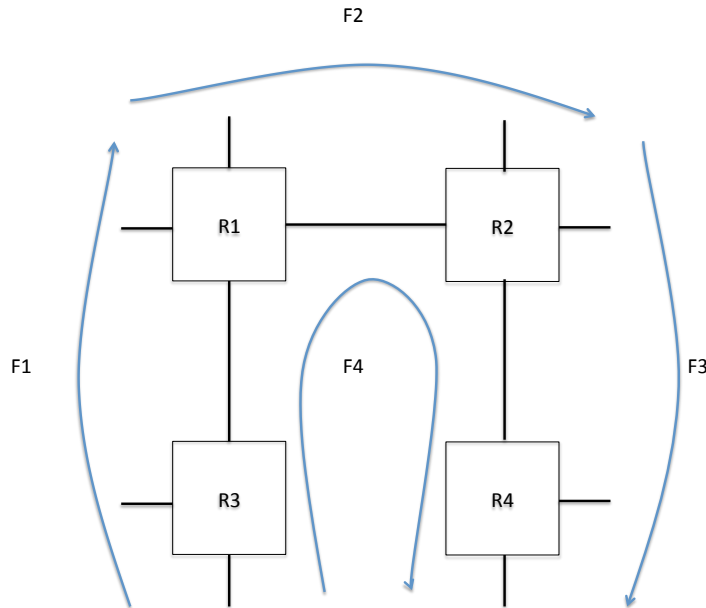
Window-based flow control is simple to implement and does not require fine-grained clocks, but leads to more bursty behavior than rate-based flow control.

e) List two reasons why intra-domain routing protocols are not suitable for inter-domain routing.

1) ASes do not wish to expose their internal topology to other ASes, and 2) as discussed in part b), the number of messages each router has to process scales with the number of routers in the network, not the number of neighbors, so link-state will not work well in very large networks.

4. (30 pts) Fair Queuing.

Answer the following questions about the network of four routers below. Each link has capacity of 1 Mbps. You can assume there is no contention on the access links, or for router backplane resources; i.e., the only constraints are the link capacities between routers. There are four flows in the network, labeled $F1 \dots F4$, that traverse the routers indicated. $F4$ shares links with every other flow, traversing $R3 \rightarrow R1 \rightarrow R2 \rightarrow R4$.



- a) Assume each router implements FIFO queuing. If each flow consists of an identical, 1-Mbps constant bit rate UDP flow with equal packet sizes, what will the resulting rate be for each flow? You can assume that FIFO drops packets with uniform probability.

F1 and F4 compete at R3 1:1, giving each 1/2 Mbps. F4 then competes at R1 with F2 at 1/2:1, giving F2 2/3 Mbps and F4 1/3 Mbps. Hence, F4 competes at R2 with F3 at 1/3:1, resulting in a final allocation for F3 of 3/4 Mbps and 1/4 Mbps for F4.

- b) Now consider the case where all routers implement fair queuing. What would be the throughput of each flow now?

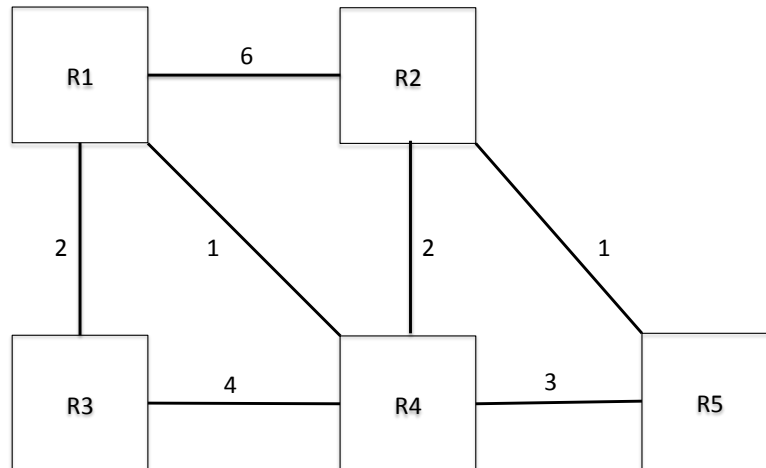
Every flow's fair share at each link is 1/2 Mbps. F4 will always be at least 1/2 Mbps when it competes with each other flow, so all flows get precisely their fair share: 1/2 Mbps each.

- c) Finally, assume all routers implement WFQ, and each flow is assigned a weight equal to its number (i.e., flow $F4$ gets weight 4). What are the resulting throughputs?

F1 and F4 compete 1:4 at R3, giving F1 1/5 Mbps and F4 4/5 Mbps. F4 then competes with F2 at 4:2, so F2's fair share is 1/3 Mbps, giving F4 2/3 Mbps. Finally, F4 competes with F3 at 4:3, so F3's fair share is 3/7 Mbps, resulting in a final allocation for F4 of 4/7 Mbps.

5. (30 pts) Routing & Token buckets.

a) Consider the network of five routers below, with edge weights labeled.



Show the step-by-step operation of Dijkstra's algorithm for $R3$ using the table below.

Step	Confirmed	Tentative	Comments
1	$(R3, 0, -)$		
2	$(R3, 0, -)$	$(R1, 2, R1) (R4, 4, R4)$	
3	$(R3, 0, -) (R1, 2, R1)$	$(R4, 4, R4)$	
4	$(R3, 0, -) (R1, 2, R1)$	$(R4, 3, R1) (R2, 8, R1)$	It is cheaper to reach $R4$ through $R1$
5	$(R3, 0, -) (R1, 2, R1)$ $(R4, 3, R1)$	$(R2, 8, R1)$	
6	$(R3, 0, -) (R1, 2, R1)$ $(R4, 3, R1)$	$(R2, 5, R1) (R5, 6, R1)$	It is cheaper to reach $R2$ via $R4$
7	$(R3, 0, -) (R1, 2, R1)$ $(R4, 3, R1) (R2, 5, R1)$	$(R5, 6, R1)$	
8	$(R3, 0, -) (R1, 2, R1)$ $(R4, 3, R1) (R2, 5, R1)$	$(R5, 6, R1)$	$R5$ is the same cost through $R2$ or $R4$
9	$(R3, 0, -) (R1, 2, R1)$ $(R4, 3, R1) (R2, 5, R1)$ $(R5, 6, R1)$		Done.

- b) Now consider a Bellman-Ford-based distance-vector protocol that uses split horizon and poison reverse. Assume that the protocol has converged, and then node $R5$ fails. Will the protocol reconverge? If so, show the sequence of updates that result. (After each update, show the nexthop and cost for $R5$ as seen by each of the remaining routers.) If not, explain why not.

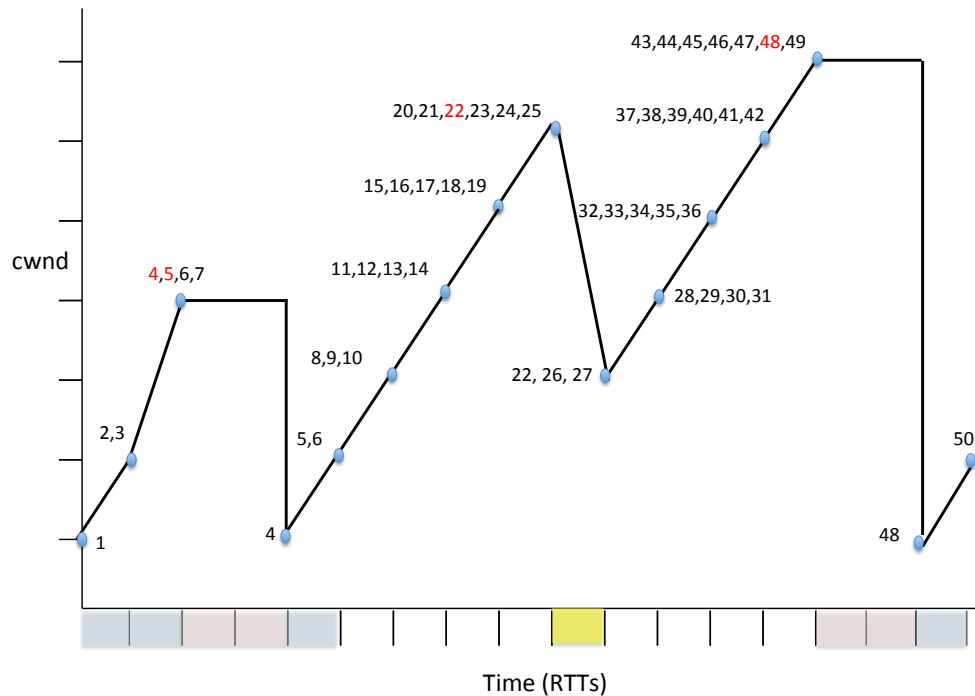
This will not converge, because the topology contains a cycle of three routers (e.g., $R1, R3, R4$) where only one is directly connected to the failed node, $R5$. (In fact, when analyzing this problem, you can safely remove $R2$ from the network as no router will ever use it as a nexthop for any other.) The remaining subset of the network looks just like the case on Slide 17 in lecture 13. Hence, the routers will count to infinity because they each only poison one of the others at a time.

- c) Consider a token bucket with maximum rate $R = 20$ Mbps. Suppose we want to make sure the maximum rate can only be sent for at most 5 seconds at a time, and at most 150 Mb can be sent over any 10-second window. Compute the required values for the token refresh rate, r , and the bucket depth, b .

If we send the maximum rate for 5 seconds, we send $20 * 5 = 100$ Mb. We can only send 150 Mb in any 10-second window, including those we send at max rate, so $150 - 100 = 50$ Mb, which we can send in the remaining 5 seconds, so $r = 50/5 = 10$ Mbps. Now, in order to ensure the bucket has enough tokens to sustain a 5-second burst at 20 Mbps, we require $b = (R - r) * 5 = (20 - 10) * 5 = 50$ Mb.

6. (30 pts) TCP congestion control.

- a) (15 pts) Consider a TCP Reno (i.e., one that implements fast retransmit and recovery) flow that has exactly 50 segments to send. Assume that during the transmission, exactly four packets are lost: the 4th, 5th, 22nd, and 48th; no other losses occur. Using the graph below, plot the evolution of the congestion window as each segment is sent. You may measure cwnd and time in whatever units you find convenient. (Do not inflate the window due to duplicate ACKs.)



- b) (10 pts) Label your plot above indicating the regions where slowstart, timeout, congestion avoidance, and fast retransmit occur.

Timeouts, shown in red, occur after the loss of segments 4, 5, and 48. Slowstart periods, depicted in blue above, are until the first loss, and one RTT after each timeout. A fast retransmit of segment 22 is highlighted in yellow. Everything else is congestion avoidance. (Note I picked 2 RTTs for timeout value, you could use anything 1 RTT or greater.)

- c) (5 pts) Give one reason why TCP performs poorly when traversing overflowing FIFO queues, and explain how RED attempts to address the issue.

TCP flows are bursty, so when they encounter a full FIFO buffer, they will experience large numbers of losses in a window. RED spreads losses out. Also, TCP doesn't realize there's congestion until the queue is full, but RED will signal congestion earlier by dropping before the queue fills.

7. (10 pts) You will receive full credit for this question regardless of how you respond, so **DO NOT ANSWER IT UNTIL YOU ARE FINISHED** with the remainder of the exam. There is no penalty if you don't get to it.

a) What topic covered in this course did you find the most interesting?

b) What topic did you find least interesting, and why?

c) How long did you spend on each project? Which one did you prefer?

d) Was there a networking topic you wish we had covered?

e) Is there anything you'd suggest the professor to do differently next time he teaches this course?



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Analyze requirements	Phase of network design does the network analyst interview users and technical personnel to gain an understanding of the business and technical goals.	☆
Logical design	Phase of network design deals with network layer addressing and switching and routing protocols	☆
Physical design	Phase of network design involves investigation of service providers.	☆
Phase involves building a prototype	test, optimize, and document the design	☆
Cladding	Reflective material surrounding the glass or plastic core of a fiber optic cable.	☆
Vertical	Wiring that runs between floors in a multi-floor structure.	☆
Horizontal	Wiring runs from a telecommunications closet to wall plates in offices.	☆
Segment	Raw data that is divided into a smaller unit; example 3877	☆



ROMMON	Low-level operating system commonly used for testing and troubleshooting on a Cisco router. CLI prompt in ROM Monitor mode.	
ifconfig	UNIX command will display the IP address and other configuration information about host's connection to the network.	☆
nslookup	Windows utility allows a user to query the configured name server to resolve a given host name. Network utility program used to obtain information about internet servers.	☆
ipconfig /displaydns	Windows command that will display the contents of the locally cached DNS entries. It is generally not necessary to view the contents of the DNS resolver cache, but this activity may be performed as a name resolution troubleshooting	☆
Fully qualified domain name (FQDN)	Attaching the name of a host to a domain name with a period in between them. host.domain example mystuff.somehighschool.edu	☆
Secure, monitor, test, improve	Network Security Wheel used for security policy compliance.	☆
File compression	Reduces the size of a file.	☆
Base lining	Create a starting point for ongoing evaluation of network health.	☆
Configuration Management	Records the operating system version which is installed on all switches and routers on your network.	☆
172.16.0.0 - 172.32.255.255	B class Private IP Address range	☆



Private IP address range	<div>A Class</div> <div>B Class</div> <div>C Class</div> <table><thead><tr><th>Address Range</th><th>Default Subnet Mask</th></tr></thead><tbody><tr><td>10.0.0.0 - 10.255.255.255</td><td>255.255.0.0</td></tr><tr><td>172.16.0.0 - 172.31.255.255</td><td>255.255.0.0</td></tr><tr><td>192.168.0.0 - 192.168.255.255</td><td>255.255.0.0</td></tr></tbody></table>	Address Range	Default Subnet Mask	10.0.0.0 - 10.255.255.255	255.255.0.0	172.16.0.0 - 172.31.255.255	255.255.0.0	192.168.0.0 - 192.168.255.255	255.255.0.0	
Address Range	Default Subnet Mask									
10.0.0.0 - 10.255.255.255	255.255.0.0									
172.16.0.0 - 172.31.255.255	255.255.0.0									
192.168.0.0 - 192.168.255.255	255.255.0.0									
Inside Local	NAT addressing referring to a host on the local network. Cisco defined.	☆								
Inside global	A legitimate IP address assigned by the NIC or service provider that represents one or more inside local IP addresses to the outside world. Cisco defined.	☆								
Outside local	The IP address of an outside host as it appears to the inside network. Not necessarily a legitimate address, it is allocated from an address space routable on the inside. Cisco defined.	☆								
Outside global	The IP address assigned to a host on the outside network by the host owner. The address is allocated from a globally routable address or network space. Cisco defined.	☆								
Permissive security policy	Permits access through all ports except those explicitly denied.	☆								
Gnutella	Protocol allows P2P (Peer to peer) applications to search for shared resources on peers across the Internet.	☆								
Dark fiber	Fiber Optic cable that is not in use or has not been terminated.	☆								
255.255.0.0	Subnet mask used to identify the range of class B private IP addresses.	☆								
Backup process	Copying data to media that is not stored on the device.	☆								
		☆								

Differential backup	Backup process archives all selected files that have changed since the last full or incremental backup and does not reset the archive bit.	
Full backup	A backup in which all of a defined set of data objects are copied, regardless of whether they have been modified since the last backup. Also resets the archive bit.	☆
Incremental backup	A security copy that contains only those files that have been altered since the last full backup.	☆
Network Attached storage	A specialized storage device of group storage devices that provides a centralized fault-tolerant data storage for a network.	☆
Raid	Redundant Array of Independent Disks, a disk subsystem that increases performance or provides fault tolerance or both.	☆
Raid level 0	Disk striping across independent hard disk drives. Increases speed performance but no fault tolerance. Lose one drive, lose all information.	☆
Raid 1	Disk mirroring and/or duplexing with the same information on two hard drives. Increases security but not speed.	☆
Raid 3	Data storage redundancy through a process involving writing data across multiple disks and using an ECC error correction code (parity) stored on a single disk.	☆
Raid 5	Block striping with distributed parity. Distributes parity across all drives rather than one drive. Provides fault tolerance and increase in read-write data transfer.	☆
DHCP request is broadcast.	To let all DHCP servers know which IP address is being accepted by the client.	☆
		☆

DHCP steps to addressing	1. Request or discover 2. returns unassigned IP address or offer 3. accepts the IP address by sending out an UDP broadcast to all network nodes 4. Server acknowledges the assigned IP address	
OSI model layers	Arranged from the lowest to the highest levels Physical, Data link, Network, Transport, Session, Presentation, Application.	☆
Physical Layer	Lowest layer consists of cable and connectors for constructing the network. Concerned only with moving the information through wires, fiber optic, and wireless	☆
Data Link Layer	How the raw data is packaged for transfer from one network interface card to another. Includes address of the source and destination and size of the file.	☆
Network Layer	Responsible for routing packets from one network to another using IP addressing format. Navigating between networks.	☆
Transport Layer	Layer of the OSI model has the role of providing error checking by sequencing packets and reassembling them into their correct order. Makes sure the packets are in the correct order or packet quality.	☆
Session Layer	Establishes connection between two different computers. and provides security based on computer and user name recognition. Like a hand shake at the beginning and end of the meeting.	☆
Presentation Layer	This ensures character code recognition. Converting code to make it recognizable to each computer.	☆
Application Layer	Works with specific networking applications such as web browsers, file transfer programs, and e-mail.	☆
Network Layer	Routes packets from one network to another, navigating networks following a path of least traffic.	☆

Application Layer	Works with specific networking applications such as Web browsers, file transfer programs, and e-mail. Establishes communication with a network.	☆
Presentation Layer	Ensures character-code recognition. Responsible for converting character codes into a code that is recognizable by a computer that uses a different character codes. Example PC to mainframe changes ASCII to EBCDIC.	☆
Session layer	Establishes a connection between two different computers and provides security based on computer and user name recognition. Session layer and transport layer are sometimes combined.	☆
CSMA/CD	Type of media access method used by NICs that listen to or "sense" the cable to check for traffic and send only when they hear that no one else is transmitting. Computers take turns transmitting.	☆
"50 service" on an HP printer	Fuser on the HP printer causes this error	☆
Fuser in a printer	A pair of heated rollers within the printer that fuses the toner onto the paper being printed on. Toner particles are pulled to the paper to create the desired text and images as the paper passes the imaging drum. This will smudge until the toner is fused to the paper.	☆
Half-duplex	Limits network equipment, so it cannot send and receive at the same time.	☆
Full-duplex	Communication between two components means that both can transmit and receive information between each other simultaneously. example Telephones	☆
RJ-45	Connector used on a UTP network cable.	☆



UTP	Unshielded Twisted Pair, cables made with twisted pair wire.	
EAP	Extensible Authentication Protocol, or EAP, is an authentication framework frequently used in wireless networks and point-to-point connections. Supports smart cards.	☆
Network administrators limit the size of failure domains because.....	Reduces the impact of a key device or service failure.	☆
BIND	(Berkely Internet Name Domain) is a popular software for translating domain names into IP addresses and usually found on Linux servers.	☆
DNS	Domain Name System, the Internet's system for converting alphabetic names into numeric IP addresses.	☆
Spanning Tree Protocol	A Layer 2 (Data Link) protocol that runs on bridges and switches. The specification for STP is IEEE 802.1D. The main purpose of STP is to ensure that you do not create loops when you have redundant paths in your network.	☆
IRQ	Interrupt request (PC architecture) is a hardware signal sent to the processor that temporarily stops a running program and allows a special program, an interrupt handler, to run instead. Such as a Network Interface Card NIC	☆
Configuration software for a NIC	Sends an IRQ to the processor to allow legacy ISA NIC to be used on a PC computer.	☆
Legacy card or network	Old hardware or software that is no longer supported on current protocols. Floppy disk are a legacy device. Netscape is a legacy browser	☆
GPO	Group Policy Object Windows organizes users into Groups to assign permissions	☆

Groups	Windows organizes user accounts into _____ that provide the same permissions to all members.	☆
The computer is not configured to use DNS	What does it mean if a network administrator can PING a resource server using its IP address, but not its Internet name?	☆
Fiber Optic cabling	Transfers information using light. Immune to electromagnetic or radio-frequency interference.	☆
ACL Statement	Access Control List - a network filter utilized by routers and some switches to permit and restrict data flows into and out of network interfaces.	☆
Implicit deny any statement placed at the end of the list will cause the packets to be dropped.	ACL statements operated in sequential, logical order. If a condition match is true, the rest of the statements are not checked. If all of the ACL statements are unmatched, what happens to the packet?	☆
Layer 2 of an OSI model	Workgroup network switches typically function at this layer of the OSI model.	☆
10000000.0000001.10000000.0000111	Binary representation of 128.1.128.7	☆
Tracert	TCP/IP utility used to check the pathways and status of network devices between two Internet paths/sites.	☆
Hardware RAID	Does not require the operating system to handle most of the data striping and parity calculations.	☆
Zone	Create by configuring DNS with a new Domain entry.	☆
Last Sunday and Tuesday	The administrator has set a backup routine that includes differential backups on Monday through Friday with a full (normal) backup on Sunday. Your system crashes on Wednesday morning. What tapes will be needed for the restore.	☆

Wrong printer driver	Your client reports that when they print their word processing documents it appears on the printer as X!####\$DF()+~~ and continues to print numerous pages with random characters. What is the most likely problem.	☆
Printer driver	<p>Small computer program that enables an application software (word processor, spreadsheet, graphics program, etc.) to communicate with a printer. Every printer brand (and every model under that brand) has its unique driver software for a specific operating system which must be installed for the computer to use the printer.</p> <p>Read more: http://www.businessdictionary.com/definition/printer-driver.html</p>	☆
FTP	File Transfer Protocol is a standard Internet protocol for transmitting files between computers on the Internet over TCP/IP connections.	☆
IP	Internet protocol, the method by which information is sent between any two Internet computers on the Internet.	☆
SMTP	Simple Mail Transfer Protocol, a protocol for sending e-mail messages between servers.	☆
POP	POP, Post Office Protocol, is an internet standard that defines an email server (the POP server) and a way to retrieve mail from it (using a POP client).	☆
TFTP	Trivial File Transfer Protocol. It's a technology for transferring files between network devices, and is a simplified version of FTP (File Transfer Protocol).	☆
		☆

TCP	Transmission Control Protocol is a standard that defines how to establish and maintain a network conversation via which application programs can exchange data. TCP works with the Internet Protocol (IP), which defines how computers send packets of data to each other. Together, TCP and IP are the basic rules defining the Internet.	
What does a switch do when it receives a frame and the source address is unknown?	Switch will map the source address to the port on which it was received.	☆
Switch	A computer networking device that connects devices together on a computer network by using packet switching to receive, process, and forward data to the destination device.	☆
Which is the first step to test of destination reachability?	Echo request issued by source.	☆
Bits per second	Units used to measure Internet bandwidth.	☆
Ports 1025 and above	Port numbers used by PAT to create unique global addresses.	☆
PAT	Port Address Translation, is an extension to network address translation (NAT) that permits multiple devices on a local area network (LAN) to be mapped to a single public IP address. The goal of PAT is to conserve IP addresses.	☆



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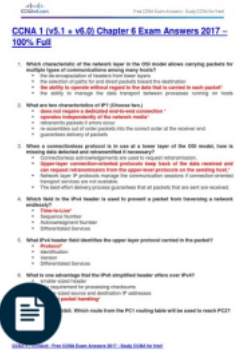
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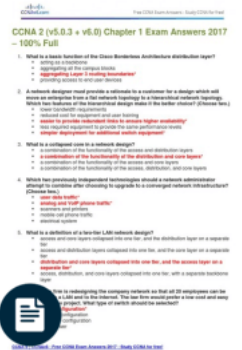
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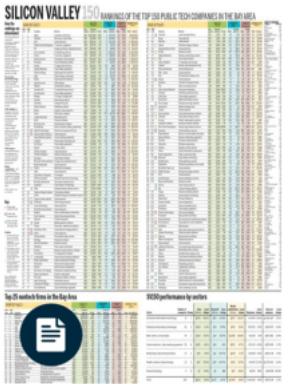


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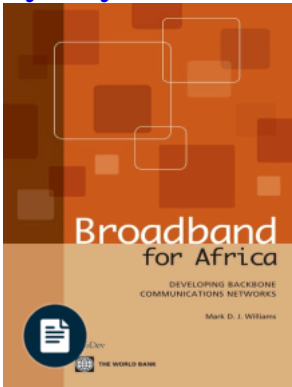
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any marks (error) called or the appearance of a page to the testimony of
false requests "acceptance" or "consent" for another site requires no
proven or entry on your account
When using Twitter from your phone, whether "Android" or the iPhone, .2
prefer to use the official Twitter application for its effort in Twitter of
encryption applied, and then downloaded from the official Apple Store or
Google Play, not only of the sites and forums
If your account is linked to Twitter actually private Baumeit, and .3
ty to access e-mail, so that you can retrieve the account
in case of a breakdown or arrest
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1. What are the structural engineering principles necessary for successful implementation of a network design? (Choose two.)
a. modularity
b. scalability
c. redundancy
d. security
2. What is a requirement that consideration when starting to design a network?
a. network security
b. size of organization
c. network topology
d. protocols to be used
3. Which two devices would contribute to be used at the access layer of the hierarchical network LAN design model? (Choose two.)
a. switch
b. router
c. layer 2 switch
d. hub
e. modular switch
4. In which layer of the hierarchical enterprise LAN design model would PoE for VoIP be implemented?
a. access
b. distribution
c. core
d. physical

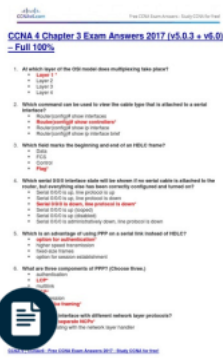


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CCNA 4 Chapter 2 Exam Answers 2017 (v5.0.3 + v6.0) – Full 100%
1. A server company with 10 employees uses a single LAN to share information between computers. Which type of connection to the internet would be appropriate for this company?
a. virtual private network that would enable the company to connect easily and securely
b. private broadband connection through the local service provider
c. a broadband service, such as DSL, through their local service provider
2. Which network scenario will require the use of a NAT?
a. Employee connections must be able to communicate through IP addresses
b. Employees must be able to connect to the internet through a single public IP address
c. Employees in the branch office must connect to the headquarters office that is connected to the internet through a single public IP address
d. Employees must be able to connect to the internet through a single public IP address
3. Which two devices are needed when a digital leased line is used to provide a connection between the customer and the service provider? (Choose two.)
a. router
b. layer 2 switch
c. layer 3 switch
d. digital modem
4. What are two advantages of packet switching over circuit switching? (Choose two.)
a. The transmission rate is faster.
b. There are fewer delays in the network.
c. Multiple paths of traffic can be utilized over the same network channel.
d. A dedicated circuit is established between two end systems.
e. A connection through the service provider network is established quickly before communication starts.
5. What is a requirement of a communications protocol network?
a. The network must be able to connect.
b. The network must be able to connect.
c. Full addressing information must be used in each data packet.
d. A clock must be used to keep the network in sync.



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Best Books About Transmission Control Protocol

- [TCP/IP Sockets in Java: Practical Guide for Programmers](#)
by [Kenneth L. Calvert](#) and [Michael J. Donahoo](#)
- [Practical TCP/IP and Ethernet Networking for Industry](#)
by [Deon Reynders](#) and [Edwin Wright](#)
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[Question 1](#): (QID=2961)

We want to assign port 3 of our Catalyst 2950 switch to VLAN 3. What command will achieve this?

1. switch(config)#switchport access vlan 3
2. switch#switchport access vlan 3
3. switch(config-if)#switchport vlan 3
4. switch(config-if)#switchport access vlan 3

Correct answer(s): 4

Explanation: The switchport access vlan [number] command will configure a switch port to that VLAN. You can also use the switchport access vlan dynamic command to configure the switch port automatically in a certain VLAN depending on the VLAN membership of the incoming packets. For both commands to work properly the switch port needs to be in access mode.

[Implement a small switched network]

[Question 2](#): (QID=25148)

Which command will allow only ssh connections to the router?

1. transport input telnet ssh
2. transport input ssh
3. transport ssh
4. transport ssh enable

Correct answer(s): 2

Explanation: The transport input ssh line configuration commands allows ssh connections only to the router.

[Implement a small switched network]

Question 3: (QID=2986)

Which utility would we use to test all 7 OSI layers?

1. Ping
2. Trace route
3. Telnet
4. Show arp

Correct answer(s): 3

Explanation: If we can telnet from one device to the other we have proven that the routing (layer 3) and the physical layer are working properly. Since telnet is an application layer utility it gives us confirmation that all 7 OSI layers are working correctly between the two devices.

[Implement a small switched network]

Question 4: (QID=1286)

You are the network administrator and are given the tasks to plan for the future expansion of the network. You decide to subnet the current network of 172.15.0.0. What will be the subnet mask be if every subnet has to allocate 500 hosts.

1. 255.255.0.0
2. 255.0.0.0
3. 255.255.240.0
4. 255.255.254.0

Correct answer(s): 4

Explanation: The requirement of having to allocate 500 hosts on each subnet can be achieved by the following: $2^9 = 512$. So deducting the broadcast and network address we have 510 possible hosts on each subnet. We used 9 bits to allocate the hosts, this leaves us 7 bits for possible subnets. Those 7 bits in binary is 1111 1110 or 254 in decimal.

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

Question 5: (QID=2359)

What address range is commonly used for testing purposes?

1. 10.0.0.0/16
2. Any available IP Address
3. 127.0.0.0/8
4. 240.0.0.0 – 255.255.255.255

Correct answer(s): 3

Explanation: The 127.0.0.0/8 address range in the Class A range is a reserved address range and used for testing purposes.

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

Question 6: (QID=2975)

If we have multiple IOS versions on our router, how can we view which ones are available?

1. Show version
2. Show memory
3. Show file systems
4. Show flash:

Correct answer(s): 4

Explanation: The show flash: command displays the contents of the flash file system.

[Implement a small routed network]

Question 7: (QID=2375)

What do you use when you want to display a message to all the terminals connected to a router?

1. banner login
2. banner motd
3. banner exec
4. banner slip-ppp

Correct answer(s): 2

Explanation: This MOTD banner is displayed to all terminals connected and is useful for sending messages that affect all users (such as impending system shutdowns). Use the no exec-banner or no motd-banner command to disable the MOTD banner on a line. The no exec-banner command also disables the EXEC banner on the line. When a user connects to the router, the MOTD banner appears before the login prompt. After the user logs in to the router, the EXEC banner or incoming banner will be displayed, depending on the type of connection. For a reverse Telnet login, the incoming banner will be displayed. For all other connections, the router will display the EXEC banner. Connection, Menu, and System Banner Commands

[Implement a small switched network]

Question 8: (QID=1294)

Given the following IP Address 172.16.0.0/27 what is the 4th subnet's network address, host range and broadcast address? The router is running IOS version 12.2.

1. Subnet address 172.16.1.0, host range 172.16.1.1 – 172.16.1.30, broadcast address 172.16.1.31
2. Subnet address 172.16.0.128, host range 172.16.0.129 – 172.16.0.158, broadcast address 172.16.0.159
3. Subnet address 172.16.0.96, host range 172.16.0.97 – 172.16.0.126, broadcast address 172.16.0.127
4. Subnet address 172.16.1.128, host range 172.16.1.129 – 172.16.1.158, broadcast address 172.16.0.159

Correct answer(s): 3

Explanation: The default subnet mask for a class B address is /16 so we will have 11 bits for subnets.

12.2 is the IOS mentioned and that has the IP Subnet-Zero command enabled by default.

So the total amount of subnets is $2^{11} = 2048$ subnets. On each subnet we will have $2^5 - 2 = 30$ hosts on each subnet.

Now we will calculate the subnet ranges. The following table is the binary version of the last octet.

subnet bits	host bits	IP address	role
-------------	-----------	------------	------

000 00000	172.16.0.0	1st subnet	network address
-----------	------------	------------	-----------------

000 00001	172.16.0.1	host # 1	
-----------	------------	----------	--

000 00010	172.16.0.2	host # 2	
-----------	------------	----------	--

000 11110	172.16.0.30	host # 30	
-----------	-------------	-----------	--

000 11111	172.16.0.31	broadcast address for 1st subnet	
-----------	-------------	----------------------------------	--

001 00000	172.16.0.32	2nd subnet	network address
-----------	-------------	------------	-----------------

001 00010	172.16.0.34	host # 2 on 2nd subnet	
-----------	-------------	------------------------	--

001 11111	172.16.0.63	broadcast address for 2nd subnet	
-----------	-------------	----------------------------------	--

010 00000 172.16.0.64 3rd subnet network address
010 11111 172.16.0.95 broadcast address 3rd subnet
011 00000 172.16.0.96 4th subnet network address
011 11111 172.16.0.127 broadcast address 4th subnet

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

Question 9: (QID=2995)

Which of the following symbols indicate that a ping was successful?

- 1. !
- 2. .
- 3. ?
- 4. U

Correct answer(s): 1

Explanation: The following table explains the output generated by ping:

- ! – reply received
- . – timed out
- U – unreachable
- C – congestion
- ? – unknown packet type
- & packet lifetime exceeded

[Implement a small routed network]

Question 10: (QID=25114)

Which layer of the OSI Model does a gateway operate at?

- 1. Session
- 2. Application
- 3. Network

4. Datalink

5. Physical

Correct answer(s): 2

Explanation: [Describe the operation of data networks]

Question 11: (QID=3629)

What are the 2 sublayers of the Data Link layer of the OSI model?

1. Logical Layer Control

2. Logical Link Control

3. Media Access Control

4. Medium Access Control

Correct answer(s): 2 3

Explanation:

Layer Name Protocol/Services Details

7 Application Telnet, FTP, WWW, SMTP Provides and interface by which user applications access the network

6 Presentation ASCII, EBCDIC, JPEG, MIDI Encryption, compression and translation

5 Session RPC, NetBIOS Establishing, maintaining and managing communication sessions

4 Transport TCP, UDP, SPX Flow and error control but for the end-to-end connection of 2 devices whose logical connection traverses a series of data links

3 Network IP, IPX, ARP, ICMP Routing of data across logical network paths is enabled here and defines packet and addressing format

2 Data Link (Sub-layers are Media Access Control and Logical Link Control) Frame Relay, LAPB, PPP, Ethernet, Token Ring, FDDI Controls how the medium is shared and accessed, how the devices are identified, how data is framed before transmission on the medium

1 Physical Electrical/optical protocols Voltage levels, timing of voltage changes, physical data rates, maximum transmission distances, physical connectors and other similar attributes are defined here

[Describe the operation of data networks]

Question 12: (QID=25126)

Which of the following are valid actions of port-security?

1. shutdown
2. restrict
3. protect
4. reset

Correct answer(s): 1 2 3

Explanation: The switchport port-security violation interface configuration command has the following options:

Shutdown (the default)

Restrict

Protect

[Implement a small switched network]

Question 13: (QID=2341)

Why would a network administrator implement VLANs?

1. Security
2. Higher latency
3. Performance enhancement
4. No more need for routers
5. Broadcast control

Correct answer(s): 1 3 5

Explanation: Here are some common reasons that a company might have VLANs:

Security – Separating systems with sensitive data from the rest of the network decreases the chance that someone will gain access to information they are not authorized to see.

Projects/Special applications – Managing a project or working with a specialized application can be simplified by the use of VLAN that brings all of the required nodes together.

Performance/Bandwidth – Careful monitoring of network use allows the network administrator to create VLANs that reduce the number of router hops and increase the apparent bandwidth for network users.

Broadcasts/Traffic flow – Since a principle element of a VLAN is the fact that it does not pass broadcast traffic to nodes that are not part of the VLAN, it automatically reduces broadcasts. Access lists provide the network administrator with a way to control who sees what network traffic. An access list is a table the network administrator creates that lists what addresses have access to that network.

Departments/Specific job types – Companies may want VLANs set up for departments that are heavy network users (such as Multimedia or Engineering) or a VLAN across departments that is dedicated to specific types of employees (such as managers or sales people).

[Implement a small switched network]

[Question 14:](#) (QID=2354)

Which of the following describe full-duplex Ethernet?

1. it uses point-to-point connections
2. is limited to speeds of 100Mb
3. stations can transmit and receive at the same time
4. it uses point-to-multipoint connections

Correct answer(s): 1 3

Explanation: Using full-duplex Ethernet makes it possible for devices to transmit and receive at the same time which results in bandwidth optimization. Point-to-point connections are used between the device and switch. The IEEE802.x committee designed a standard for full duplex that covers 10BaseT, 100BaseX and 1000BaseX.

[Implement a small switched network]

[Question 15:](#) (QID=25140)

Which of the following would you use if you wanted to transfer data securely across the internet?

1. VPN
2. Leased Line
3. URL Filtering
4. Anti-x

Correct answer(s): 1

Explanation: A VPN is used to securely transfer data across insecure media, like the Internet.

[Identify security threats to a network and describe general methods to mitigate those threats]

Question 16: (QID=25145)

The address field in a frame-relay header is called?

1. MAC
 2. DLCI
 3. PVC
 4. SVC
-

Correct answer(s): 2

Explanation: The DLCI (Data-Link Connection Identifier) is the address field in a frame-relay header.

[Implement and verify WAN links]

Question 17: (QID=3619)

What is the default encapsulation on a Cisco router serial interface?

1. Frame-Relay
 2. SDLC
 3. PPP
 4. HDLC
-

Correct answer(s): 4

Explanation: High-Level Data Link Control. Bit-oriented synchronous data link layer protocol developed by ISO. Derived from SDLC, HDLC specifies a data encapsulation method on synchronous serial links using frame characters and checksums.

[Describe the operation of data networks]

Question 18: (QID=25144)



What type of cable is shown in the exhibit?

1. AEIA/TIA-232
2. EIA-530
3. X.21
4. V.35

Correct answer(s): 4

Explanation: [Implement and verify WAN links]

[Question 19:](#) (QID=1282)

Which of the following OSI layers is responsible for reliable transmission of data segments?

1. Session
2. Application
3. Transport
4. Data-Link

Correct answer(s): 3

Explanation: Layer Name Protocol/Services Details

7 Application Telnet, FTP, WWW, SMTP Provides and interface by which user applications access the network

6 Presentation ASCIIIm, EBCDICm JPG, MIDI Encryption, compression and translation

5 Session RPC, NetBIOS Establishing, maintaining and mananging communication sessions

4 Transport TCP, UDP, SPX Flow and error control but for the end-to-end connection of 2 devices whose logical connection traverses a series of data links

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addressing format

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1 Physical Electrical/optical protocols Voltage levels, timing of voltage changes, physical data rates, maximum transmission distances, physical connectors and other similar attributes are defined here

[Describe the operation of data networks]

Question 20: (QID=1307)

Which of the following protocols operate at Layer 3 of the OSI model? [Select all that apply]

1. IP
2. TCP
3. ICMP
4. UDP
5. ARP
6. SPX

Correct answer(s): 1 3 5

Explanation: Layer Name Protocol/Services Details

7 Application Telnet, FTP, WWW, SMTP Provides and interface by which user applications access the network

6 Presentation ASCII, EBCDIC, JPEG, MIDI Encryption, compression and translation

5 Session RPC, NetBIOS Establishing, maintaining and managing communication sessions

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1 Physical Electrical/optical protocols Voltage levels, timing of voltage changes, physical data rates, maximum transmission distances, physical connectors and other similar attributes are defined here

[Describe the operation of data networks]

Question 21: (QID=1297)

What command will change the hostname of a router?

1. router#host name new name
2. router(config-router)#hostname new name
3. router>host name new name
4. router(config)#hostname new name

Correct answer(s): 4

Explanation: To specify or modify the host name for the network server, use the hostname command in global configuration mode.

[Implement a small switched network]

Question 22: (QID=2362)

What command do we use to find out how long our router has been online?

1. Show version
2. Show hardware
3. Show uptime
4. Show history

Correct answer(s): 1

Explanation: The results of the show version command are shown below:

[Implement a small routed network]

Question 23: (QID=25128)

802.11a uses which frequency range?

1. 900 MHz
2. 2.4 GHz
3. 5 GHz

4. 7 GHz

Correct answer(s): 3

Explanation: The 5GHz frequency band is used by 802.11a wireless standard.

[Explain and select the appropriate administrative tasks required for a WLAN]

[Question 24](#): (QID=25118)

Which of the following protocols are routing protocols? [Select all that apply]

1. BGP
 2. FTP
 3. OSPF
 4. SMTP
 5. SNMP
 6. RIP
 7. NNTP
 8. IGRP
-

Correct answer(s): 1 3 6 8

Explanation: Routing protocols are used by intermediate systems to build tables used in determining path selection of routed protocols. Examples of these protocols include Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (Enhanced IGRP), Open Shortest Path First (OSPF), Exterior Gateway Protocol (EGP), Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), and Routing Information Protocol (RIP).

[Implement a small routed network]

[Question 25](#): (QID=25123)

What is the meaning of amber SYST led on a 2960 switch?

1. This is normal operation
2. There is a bridging loop
3. The switch IOS is loading
4. The switch failed its POST

Correct answer(s): 4

Explanation: When the switch failed its POST, Power-On Self Test, the SYST led will turn amber and the IOS did not load.

[Implement a small switched network]

Question 26: (QID=2379)

We want to go back to user EXEC from privileged EXEC. What command do we use to achieve this without exiting the session?

1. Exit
 2. Log out
 3. Disable
 4. Logout
-

Correct answer(s): 3

Explanation: [Click here for more information.](#)

[Implement a small switched network]

Question 27: (QID=3632)

As a network administrator we want to make it easy to assign IP addresses to hosts. What protocol do we use?

1. DNS
 2. DHCP
 3. HSRP
 4. NTP
-

Correct answer(s): 2

Explanation: DHCP, as described by RFC 1541, or Dynamic Host Configuration Protocol is used for dynamically assigning network addresses and host specific configuration parameters.

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

Question 28: (QID=2343)

Which of the following Routing Protocols are considered Interior Protocols?

1. OSPF
2. EGP
3. RIP
4. EIGRP
5. BGP

Correct answer(s): 1 3 4

Explanation: Interior protocols are used for routing networks that are under a common network administration. All IP interior gateway protocols must be specified with a list of associated networks before routing activities can begin. A routing process listens to updates from other routers on these networks and broadcasts its own routing information on those same networks. Cisco IOS software supports the following interior routing protocols:

Internet Gateway Routing Protocol (IGRP)

Enhanced Internet Gateway Routing Protocol (Enhanced IGRP)

Open Shortest Path First (OSPF)

Routing Information Protocol (RIP)

Intermediate System-to-Intermediate System (IS-IS)

[Implement a small routed network]

Question 29: (QID=25116)

Wireless LANs are defined by which IEEE standard?

1. 802.10
2. 802.5
3. 802.3
4. 802.11

Correct answer(s): 4

Explanation: Introduction to Wireless LANs

[Explain and select the appropriate administrative tasks required for a WLAN]

Question 30: (QID=3685)

What are some advantages of having a layered OSI Model? [Select all that apply]

1. Changes at one layer do not affect the other layers
2. Networks are harder to design
3. Different vendor's equipment can easily interoperate
4. Changes at one layer are propagated throughout the other layers
5. Prevents routing loops

Correct answer(s): 1 3

Explanation: The main goal of the OSI model is to allow different vendors' networks to interoperate. Some benefits of the OSI model are:

changes at a certain layer do no affect the other layers.

various types of hardware & software can communicate with each other.

networks are more extensible.

[Describe the operation of data networks]

Question 31: (QID=3696)

Given the following network range 192.168.0.0/24. We want minimum 50 hosts on each of the available subnets. What will be the subnet mask?

1. /24
2. /25
3. /26
4. /27

Correct answer(s): 3

Explanation: 50 hosts require 6 bits of the last octet giving us $64 - 2 = 62$ possible hosts this satisfies our requirement and leaves us 2 bits over for the subnets. The default mask is /24 or 255.255.255.0 adding the 2 bits for the subnets it becomes 255.255.255.192 or /26.

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

Question 32: (QID=1299)

Which key-sequence would you use to move the cursor to the beginning of the line?

1. CTRL+ P
2. CTRL+ E
3. CTRL + A
4. CTRL + F

Correct answer(s): 3

Explanation: Keystrokes Purpose

Press Ctrl-B or press the left arrow key Moves the cursor back one character

Press Ctrl-F or press the right arrow key Moves the cursor forward one character

Press Ctrl-A Moves the cursor to the beginning of the command line

Press Ctrl-E Moves the cursor to the end of the command line

Press Esc B Moves the cursor back one word

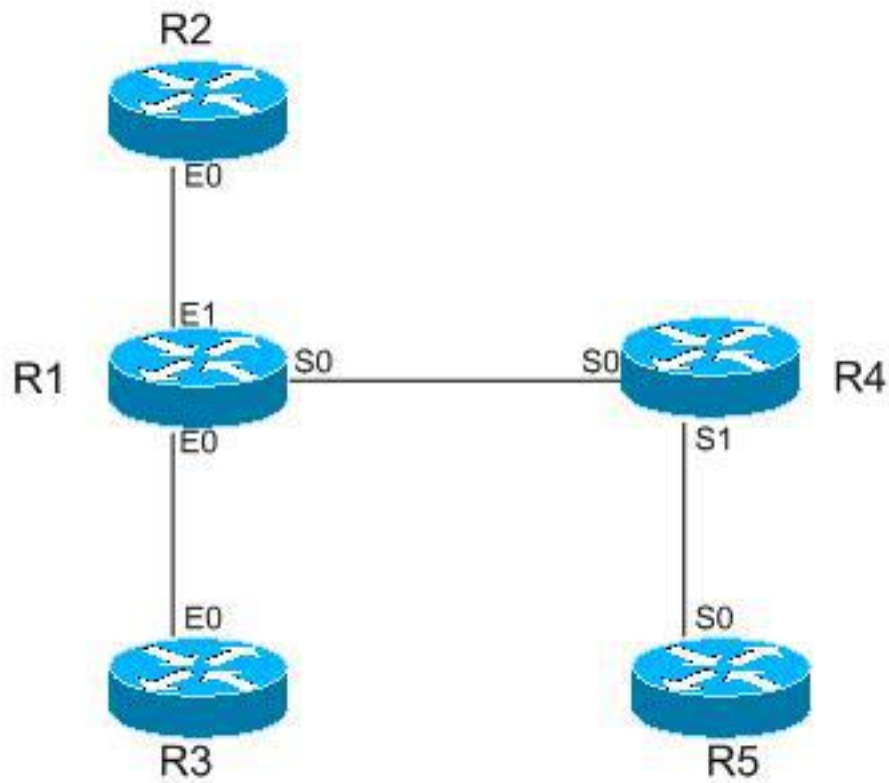
Press Esc F Moves the cursor forward one word

Ctrl-P or the up arrow key Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands

Ctrl-N or the down arrow key Returns to more recent commands in the history buffer after recalling commands with Ctrl-P or the up arrow key. Repeat the key sequence to recall successively more recent commands

[Implement a small switched network]

Question 33: (QID=1301)



You are the administrator of network X. You decided to implement RIP in the following topology (click exhibit). You do not want R3 to receive RIP updates. What configuration changes need to be implemented?

1. Implement a passive-interface on R1
2. Nothing needs to be configured
3. Create a sub-interface on R1
4. Change the routing protocol to OSPF

Correct answer(s): 1

Explanation: To block RIP broadcasts on an interface connected to a subnet of a RIP-enabled network add the passive-interface command to the RIP Process.

[Implement a small routed network]

Question 34: (QID=25124)

How do you enable SSH on your switch?

1. switch(config-line)#input ssh
2. switch(config-line)#transport input ssh
3. switch(config-line)#transport ssh
4. SSH is enabled by default

Correct answer(s): 3

Explanation: The transport input ssh command will allow SSH sessions to your switch. You also need to create a user and password and generate a public and private key pair.

[Implement a small switched network]

Question 35: (QID=25136)

When we have a variation in delay it is called?

1. Loss
2. Latency
3. Delay
4. Jitter

Correct answer(s): 4

Explanation: Jitter occurs when there is a variation in the delay.

[Describe the operation of data networks]

Question 36: (QID=2998)



After connecting two routers back-to-back we are unable to ping across the serial connection. A closer look reveals that both serial interfaces have the following status:

‘Serial0 is up, line protocol is down’

What needs to be configured on one of the routers to bring the serial interface up? [See the exhibit for network topology]

A) router1(config)# interface serial 0

router1(config-if)#clock rate 64000

B) router1(config)#interface serial 0

```
router1(config-if)#clockrate 64000
```

C) router2(config)#interface serial o

```
router2(config-if)#clockrate 64000
```

D) router2(config)#interface serial o

```
router2(config-if)#clock rate 64000
```

1. A

2. B

3. C

4. D

Correct answer(s): 4

Explanation: When connecting router back-to-back with a DTE/DCE cross-over cable we need to set the clocking on the DCE side of the connection. The show controllers serial [interface nr] command tells you what side is DTE or DCE.

[Implement and verify WAN links]

[Question 37](#): (QID=3002)

```
Router#show logging
Syslog logging: enabled (0 messages dropped, 1 messages rate-limited, 0 flushes,
0 overruns)
  Console logging: level debugging, 13 messages logged
  Monitor logging: level debugging, 0 messages logged
  Buffer logging: disabled
  Logging Exception size (4096 bytes)
  Count and timestamp logging messages: disabled
  Trap logging: level informational, 17 message lines logged
Router#
```

We try to look at the log on the router but we get the following [see exhibit]. What do we need to do in order to view the log?

1. Reboot the router

2. Use the logging buffered global configuration command

3. Use the enable log all global configuration command

4. We can not do anything since there is no such thing as a log

Correct answer(s): 2

Explanation: To enable system messages to a local buffer use the logging buffered [size] command in global configuration mode. The default size is 4096k and once this is full older messages will be overwritten with newer ones.

[Implement a small routed network]

[Question 38](#): (QID=3633)

HTTP and FTP are found at which OSI layer?

1. Network layer
2. Transport layer
3. Application layer
4. Presentation layer

Correct answer(s): 3

Explanation:

Layer Name Protocol/Services Details

7 Application Telnet, FTP, WWW, SMTP Provides and interface by which user applications access the network

6 Presentation ASCII, EBCDIC, JPEG, MIDI Encryption, compression and translation

5 Session RPC, NetBIOS Establishing, maintaining and managing communication sessions

4 Transport TCP, UDP, SPX Flow and error control but for the end-to-end connection of 2 devices whose logical connection traverses a series of data links

3 Network IP, IPX, ARP, ICMP Routing of data across logical network paths is enabled here and defines packet and addressing format

2 Data Link (Sub-layers are Media Access Control and Logical Link Control) Frame Relay, LAPB, PPP, Ethernet, Token Ring, FDDI Controls how the medium is shared and accessed, how the devices are identified, how data is framed before transmission on the medium

1 Physical Electrical/optical protocols Voltage levels, timing of voltage changes, physical data rates, maximum transmission distances, physical connectors and other similar attributes are defined here

[Describe the operation of data networks]

[Question 39](#): (QID=25117)

For the network 192.168.1.0/27, what is the 5th subnet's network address, broadcast address and host range? IP Subnet-zero is configured.

1. Subnet 192.168.1.0, Broadcast 192.168.1.31, hosts 192.168.1.1 – 192.168.1.30
2. Subnet 192.168.1.160, Broadcast 192.168.1.191, hosts 192.168.1.161 – 192.168.1.190
3. Subnet 192.168.1.96, Broadcast 192.168.1.127, hosts 192.168.1.97 – 192.168.1.126
4. Subnet 192.168.1.128, Broadcast 192.168.1.159, hosts 192.168.1.129 – 192.168.1.158

Correct answer(s): 4

Explanation: The default subnet mask for a class C address is /24 so we will have 3 bits for subnets.

So the total amount of subnets is $2^3 = 8$ subnets

On each subnet we will have $2^5 - 2 = 30$ hosts on each subnet

Now we will calculate the subnet ranges:

The following table is the binary version of the last octet.

Subnet bits	Host Bits	IP Address	Role
-------------	-----------	------------	------

000 00000	192.168.1.0	1st subnet network address
-----------	-------------	----------------------------

000 00001	192.168.1.1	host nr 1
-----------	-------------	-----------

000 00010	192.168.1.2	host nr 2
-----------	-------------	-----------

000 11110	192.168.1.30	host nr 30
-----------	--------------	------------

000 11111	192.168.1.31	broadcast address for 1st subnet
-----------	--------------	----------------------------------

001 00000	192.168.1.32	2nd subnet network address
-----------	--------------	----------------------------

001 00010	192.168.1.34	host nr 2 on 2nd subnet
-----------	--------------	-------------------------

001 11111	192.168.1.63	broadcast address for 2nd subnet
-----------	--------------	----------------------------------

011 00000	192.168.1.96	4th subnet network address
-----------	--------------	----------------------------

011 11111	192.168.1.127	broadcast address 4th subnet
-----------	---------------	------------------------------

100 00000	192.168.1.128	5th subnet network address
-----------	---------------	----------------------------

100 11111	192.168.1.159	broadcast address 5th subnet
-----------	---------------	------------------------------

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

[Question 40](#): (QID=25137)

What kind of attack is designed to gather information?

1. DoS attack
2. DDoS attack
3. Reconnaissance attack
4. Access attack

Correct answer(s): 3

Explanation: A reconnaissance attack is an attack aimed at gathering information as preparation for further attacks.

[Identify security threats to a network and describe general methods to mitigate those threats]

[Question 41](#): (QID=25143)

Which of the following are considered CPE?

1. CSU/DSU
2. Telco switch
3. Router
4. Demarcation point

Correct answer(s): 1 3

Explanation: The CSU/DSU and router are considered CPE, Customer Premises Equipment.

[Implement and verify WAN links]

[Question 42](#): (QID=2378)

What command do we use to determine if a Serial interface on a Cisco router is either DTE or DCE?

1. Show interface serialx
2. Show ip interface serialx
3. Show controllers serial x
4. Show role serial x

Correct answer(s): 3

Explanation: Click here for sample output of this command.

[Implement and verify WAN links]

[Question 43](#): (QID=25115)

Which of the following protocols can you find at the Transport layer of TCP/IP model? [Select all that apply]

1. ICMP
2. TCP
3. IP
4. FTP
5. ARP
6. UDP

Correct answer(s): 2 6

Explanation: The Transport layer of the TCP/IP model corresponds with the Transport layer of the OSI model. TCP and UDP is found at these layers of the TCP/IP or OSI model.

[Describe the operation of data networks]

[Question 44](#): (QID=2987)

Our router has restarted and we want to know what caused this. Which command can we use to find out?

1. Show history
2. Show version
3. Show startup-config
4. Show ip protocols

Correct answer(s): 2

Explanation: When issuing the show version command we the output displays a line ‘System restarted by’ followed by a reason. This line will give a good indication what the reason was why the router restarted.

[Implement a small routed network]

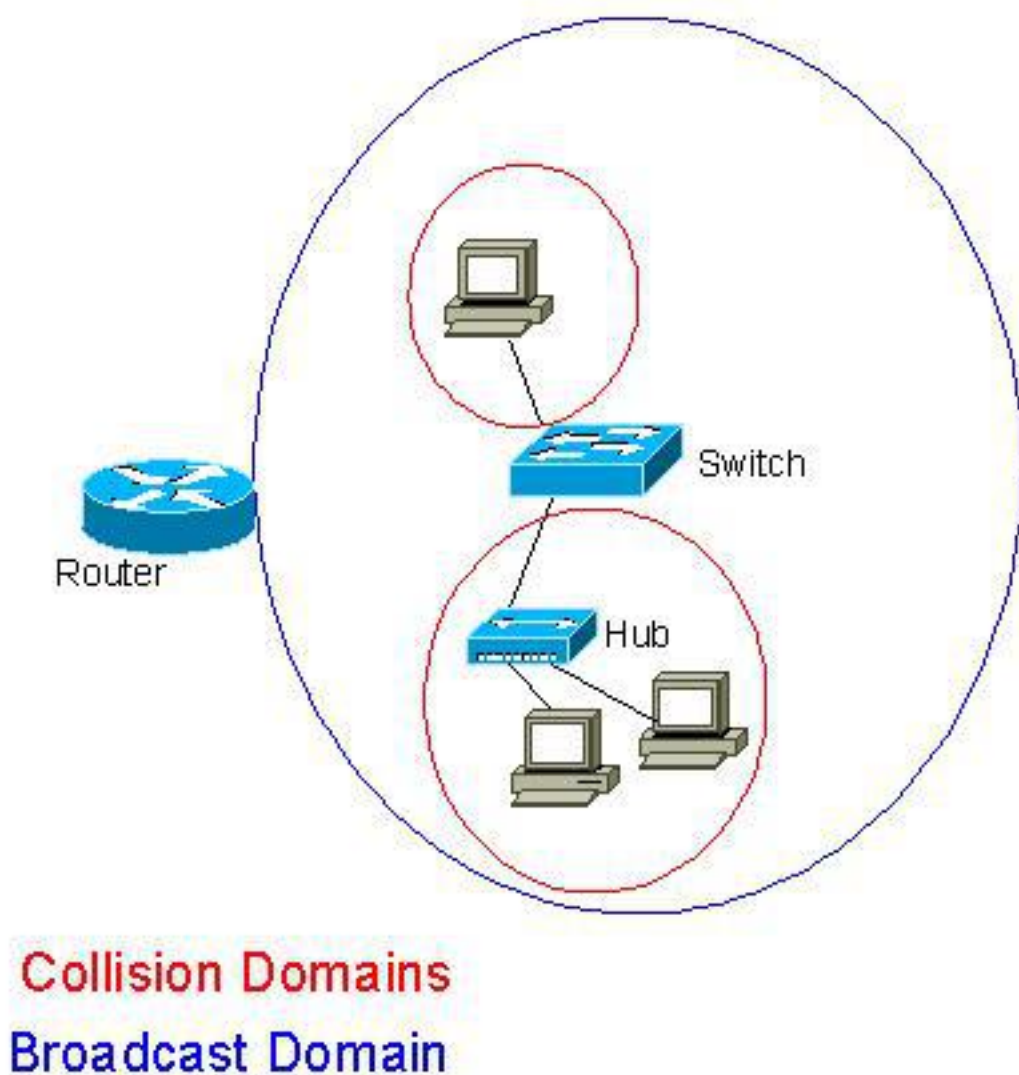
Question 45: (QID=1479)

Which of the following statements are true? [Select all that apply]

1. Switches control broadcast domains
2. Hubs control collision domains
3. Routers control broadcast domains
4. Hubs control broadcast domains
5. Switches control collision domains

Correct answer(s): 3 5

Explanation: Routers are the border of a broadcast domain because they don't forward broadcasts by default. A switch can control a broadcast domain if VLANs are configured on the switch otherwise they divided the network in separate collision domains.



[Implement a small switched network]

Question 46: (QID=25138)

What is described by a self-propagating piece of software that replicates itself on the network and usually used in DoS

attacks?

1. Virus
2. Trojan
3. Spyware
4. Worm

Correct answer(s): 4

Explanation: A worm is a program that self-propagates on the network without user intervention and is commonly used in DoS attacks.

[Identify security threats to a network and describe general methods to mitigate those threats]

[Question 47](#): (QID=25122)

Which of the following terms describes an IP address that represents a host on an enterprise network?

1. Inside global
2. Inside local
3. Outside global
4. Outside local

Correct answer(s): 2

Explanation: The inside local address is the IP Address of a host that is local to the enterprise network.

[Implement and verify WAN links]

[Question 48](#): (QID=25142)

How many bytes make up the network portion of a class C address?

1. 1
2. 2
3. 3
4. 4
5. 6

6. 8

Correct answer(s): 3

Explanation: The first 3 octets of a class C address represents the network part, an octet is 1 byte long.

[Implement an IP addressing scheme and IP services to meet network requirements for a small branch office]

[Question 49](#): (QID=2965)

We want to create an additional VLAN on our Catalyst 2950 switch. Which command do we use?

A) Switch1(config)#vlan 45

Switch1(config-vlan)#end

B) Switch1(config-vlan)#vlan 45

Switch1(config-vlan)#end

C) Switch1(enable)#vlan 45

D) Switch1(config-vlan)#vlan 45

Switch1(config-vlan-database)#end

1. A

2. B

3. C

4. D

Correct answer(s): 1

Explanation: We create a new VLAN in global configuration mode. After creating the VLAN with the vlan VLAN_ID command we exit the VLAN database by using the end command to update this database.

[Implement a small switched network]

[Question 50](#): (QID=25134)

Which of the following is a mechanism used by TCP/IP to protect buffer space and routing devices?

1. Flow control using windowing

2. Connection establishment and termination

3. Error recovery

4. Multiplexing using ports

Correct answer(s): 1

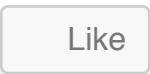
Explanation: Flow control using windowing is a mechanism used by TCP/IP to protect buffer space and routing devices in the transport layer of the OSI model.

[Describe the operation of data networks]

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This material has been very helpful through the course of my study for CISCO CERTIFICATION

Ojinuka

[January 4, 2011](#)



[Reply](#)

It has excellent information. Explanation, and answers at the bottom made me easy to understand. Thanks to the editor.

Aji

[June 11, 2012](#)



[Reply](#)

Question #34

The answer is wrong.

andoy

[September 9, 2012](#)



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questio 33 : the question and the answer doesn't match. The question souhd rather include :
"You do not want R3 to send RIP updates"

henri G

[September 19, 2012](#)



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Very helpful, thank you

Tex

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Awesome!!

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PART7 ICND1

August 20, 2014

[Reply](#)

Hello to all, the contents existing at this site are really remarkable for people experience, well, keep up the nice work fellows.

Autumn

September 19, 2014



[Reply](#)

Default AD for RIP is 110 not 90...it's confusing!

rahul g

May 17, 2015



[Reply](#)

AD for RIP is 120 : AD 110 is for OSPF: AD 90 is for EIGRP 😊

Azat Khanzadyan

June 5, 2015



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sunny champ

(@sunnychamp169)

October 8, 2015



[Reply](#)

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Ron

December 13, 2015



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This practice exam was very good for pointing out the weak spots in my knowledge, and the explanations were clear, concise, and very helpful. Thank you so much for your time and effort in putting this together.

Jim Boelter
[July 24, 2016](#)



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I have found by googling that website where to practice online ccent Practice the Cisco ICND1 v3.0(100-105) exam.
The questions from you test are from the same version?
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Thanks

J. smith

[December 2, 2016](#)



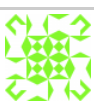
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Salut!

[kimu](#)

[December 6, 2016](#)



Reply

Which layer of the OSI Model does a gateway operate at?
Question No:10 = answer is '3' Network layer



Reply

some of these questions are taken from moon...



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Final Exam Solution

12/18/2013

1. (10 points). What is the queueing delay at a network link with a link rate of 100 Mb/s, an arriving traffic rate of 9,000 packets per second an average packet length of 1250 bytes and a queue length of 500 packets?

The traffic intensity is 0.9, so the average number of packets in the queue is 9. Since the time needed to send one packet is 100 μ s, the average queueing delay is 900 μ s.

What is the delay if the arriving traffic rate increases to 15,000 packets per second?

In this case, the queue fills, so the average delay is about 50 ms.

Consider an audio application that sends audio data using RTP and UDP over an Ethernet network. How many overhead bytes does each packet include, assuming that the RTP header is 12 bytes? You may ignore the Ethernet preamble and flag.

The overhead is $18+20+8+12=58$ bytes.

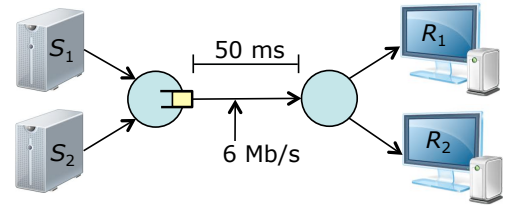
If audio is encoded at 32 Kb/s and we want our audio packets to be large enough so that the overhead is at most 20% of the total, how many audio bytes must each packet carry?

We need four times 58 or 232 bytes.

How long does it take to acquire the audio data needed to “fill” a packet?

At 32 Kb/s, we get four bytes of audio data per ms, so it takes 58 ms to fill the packet.

2. (15 points) The diagram at right shows two TCP senders at left and the corresponding receivers at right. The first sender uses TCP *Tahoe*, the second uses *Reno*. Assume that the MSS is 1 KB, that the one-way propagation delay for both connections is 50 ms and that the link joining the two routers has a bandwidth of 6 Mb/s. Let $cwnd_1$ and $cwnd_2$ be the values of the senders' congestion windows. What is the smallest value of $cwnd_1 + cwnd_2$ for which the link joining the two routers stays busy all the time?



The RTT is 100 ms in this case, so the link rate is equivalent to 600 Kb per RTT or 75 KB.
So, $cwnd_1 + cwnd_2 = 75$ KB.

Assume that the link buffer overflows whenever $cwnd_1 + cwnd_2 \geq 150$ KB and that at time 0, $cwnd_1 = 30$ KB and $cwnd_2 = 120$ KB. Approximately, what are the values of $cwnd_1$ and $cwnd_2$ one RTT later? Also, what are the values of $ssthresh$ for each of the two connections? Assume that all losses are detected by triple duplicate ACKs.

Since the first uses *Tahoe* and the second uses *Reno*, $cwnd_1 = 1$ KB and $cwnd_2 = 60$ KB, $ssthresh_1 = 15$ KB and $ssthresh_2 = 60$ KB.

After 8 more RTTs, approximately what are the values of $cwnd_1$ and $cwnd_2$?

19 KB and 68 KB

Approximately, how many more RTTs before $cwnd_1 + cwnd_2 \geq 150$ KB again?
What is $cwnd_2 - cwnd_1$ at this point?

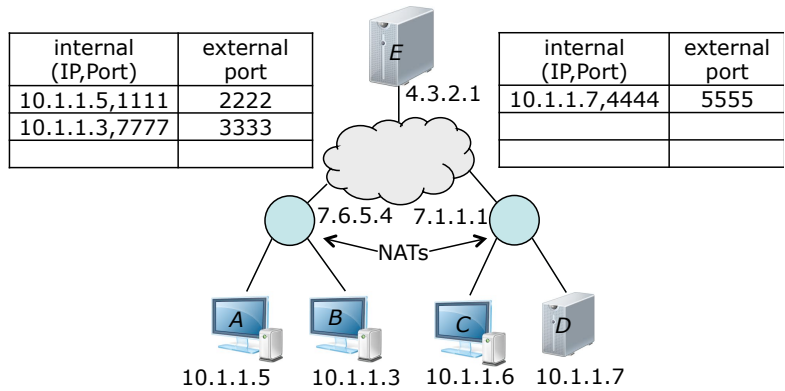
$(150 - 87) / 2 = 31.5$ RTTs $cwnd_2 - cwnd_1 = 49$ KB

Approximately, how many more RTTs pass before $cwnd_1 + cwnd_2 \geq 150$ KB and $cwnd_2 - cwnd_1 \leq 20$ KB?

The difference goes down by a little less than a factor of 2 after every cycle of the congestion control algorithm. So, 2 more cycles will be required to get the difference below 10 KB.
So it will take about $2 * (1 + 8 + 31.5) = 81$ RTTs.

3. (10 points). The figure at right shows two residential networks with routers that implement NAT. Suppose host A is connected to the web server at host E.

In the left-hand NAT table, add an entry that would allow A to communicate with E. You may choose any port numbers you like, but the internal port numbers should be different from the external port numbers.



Show the values of the address and port fields in the diagram below, for a typical packet sent by host A.

src adr	dest adr	src port	dest port
10.1.1.5	4.3.2.1	7777	80

Show the fields in the packet as it might appear when it reaches E.

src adr	dest adr	src port	dest port
7.6.5.4	4.3.2.1	2222	80

Suppose the user in the right-hand network runs a game server on host D and invites her friends to join her game sessions. Add an entry to the right-hand table that would allow remote connections to the game server. Again, you may pick your own port numbers, but the internal and external port numbers should be different. Assume host B connects to the game server at D. Add an entry to the left-hand NAT table for this connection. Show the address and port fields for a typical packet leaving host B, the fields in the same packet as it passes through the public internet, and the fields in the packet that is delivered to D.

src adr	dest adr	src port	dest port
10.1.1.3	7.1.1.1	7777	5555

src adr	dest adr	src port	dest port
7.6.5.4	7.1.1.1	3333	5555

src adr	dest adr	src port	dest port
7.6.5.4	10.1.1.7	3333	4444

4. (15 points) Does SSL use public key encryption? If so, what does it use it for and how does it use it, in a typical situation?

Yes. Typically a server's public key is signed using a certificate authority's private key, so that a client can use its copy of the CA's public key to verify that the key in the certificate really belongs to the server. The client then uses the server's public key to encrypt some secret information, which it sends to the server. This information is then used to generate additional keys.

Does SSL use symmetric encryption? If so, what does it use it for and how does it use it?

Yes. After the initial handshake, the client and server encrypt data using symmetric encryption.

How many different keys are created for a typical SSL session? What are they used for?

Four keys are created, two encryption keys (one for each direction) and two MAC keys (one for each direction).

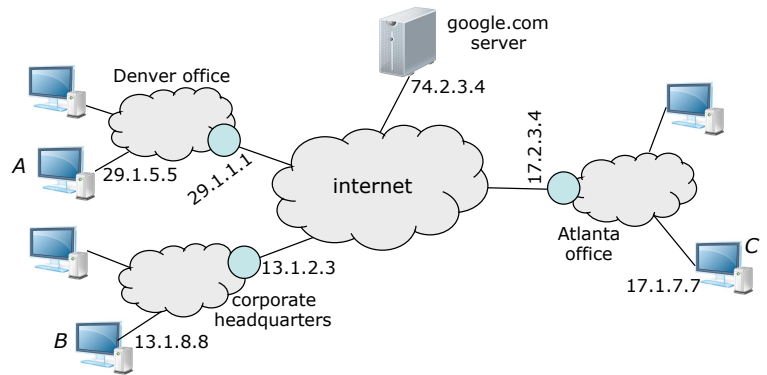
Is it necessary for a single SSL record to be sent entirely within one IP packet? Why or why not?

It is not. The TCP layer does not know about SSL records, it just sends bytes. So the IP packet boundaries may come in the middle of SSL records. This does no harm, as SSL is unaware of IP packet boundaries and simply operates on bytes.

Suppose an attacker learned the encryption key used by one endpoint of an SSL connection. Could the attacker use this to modify one of the records in the connection, without this being detected by the receiver? If so how, if not, why not?

No. While the attacker could encrypt the packet, without also knowing the MAC key, it could not compute a new MAC to go with the modified record. Consequently, the receiver would be able to detect the modification to the record.

5. (15 points) The diagram at right shows a corporate network with three sites connected by the internet. The company's network administrator has configured the gateway routers at the three sites to use IPsec to encrypt all traffic going between the three sites. How many Security Associations are needed to allow the sites to communicate securely with each other?



Six SAs are needed, two for each pair of offices (one in each direction).

If host A sends a packet to host C, what are the source and destination address fields in the packet header as it passes through the public internet?

Source address is 29.1.1.1, destination address is 17.2.3.4.

If host B sends a packet to the Google server shown, what are the source and destination address fields in the packet header as it passes through the public internet?

Source address is 13.1.8.8, destination address is 74.2.3.4.

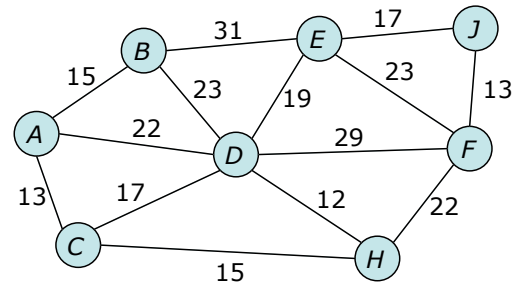
How does a gateway router decide if an outgoing packet should be encrypted using IPsec? How does it decide which Security Association to use, if it does require encryption?

It looks for a matching entry in its Security Policy Database (SPD), using the source and destination address fields in the packet as part of the lookup key. If there is a matching entry, the packet should be encrypted and the entry will include the Security Parameter Index (SPI) of the appropriate SA.

If the gateway router at Atlanta receives an IPsec packet from the public Internet, how does it determine which encryption key to use when decrypting the packet?

The packet will include the SPI of the Security Association in cleartext. The receiving router will lookup the entry for that SPI in its Security Association Database. This contains the encryption key for the SA.

6. (10 points) In the diagram at right, the nodes represent IP routers and the numbers on the links are OSPF link weights. If the network uses PIM with reverse-path forwarding, which links are never used for multicast packets going to a host connected to router J?



The shortest path tree rooted at J includes the links EJ, FJ, BE, DE, CH, AD and FH. So the links that would never be used for multicast packets going to a host at J are: EF, DF, DH, BD, AB, AC, CD.

Suppose that router C is the PIM DR for some layer 2 subnet, and that a host X in that subnet sends an IGMP report for address 229.1.2.3. Assume that J is the RP for 229.1.2.3 and that no other routers are currently participating in 229.1.2.3. What does router C do at this point? Which routers eventually add forwarding state for 229.1.2.3 as a result of C's action?

C would send a PIM Join packet to H. Eventually, routers C, H, F and J would add forwarding state for 229.1.2.3.

If a host connected to router B sent a packet to 229.1.2.3, which routers would the packet pass through in order to reach the host connected to the subnet at C? List them in the order in which the packet passes through them.

It would pass through routers B, E, J, F, H and C.

How would the previous answer change if router C issued a source-specific join on 229.1.2.3 for the host at router B.

This would cause packets from B to pass through routers B, A and C.

If the host connected to the subnet at C sends a packet to 229.1.2.3, which routers receive a copy? Assume that there has been no other activity on this multicast address, except for what has been described in the earlier parts.

Routers C, H, F and J would all receive copies. J would simply discard its copy.

7. (10 points) Consider an audio/video teleconferencing session with ten participants in the same switched layer 2 network. The application limits the number of simultaneous senders to two. If the RTP session bandwidth is 4 Mb/s, how much bandwidth can be used for RTCP packets, assuming the default behavior?

5% of the session bandwidth or 200 Kb/s.

Suppose that all participants send RTCP receiver reports and that at some point in time, two hosts are sending RTCP sender reports. How much bandwidth does each receiver have for its reports? How much does each sender have for its reports?

The RTCP bandwidth is split between senders and receivers with senders getting 25% of 200 Kb/s or 50 Kb/s. So each sender gets 25 Kb/s. Each receiver gets 15 Kb/s.

Suppose the number of participants in the conference increases to 20. In this case, how much bandwidth is available to each sender for its reports? How many for each receiver?

The senders still get 25 Kb/s each. The receivers get 7.5 Kb/s each.

When a participant in the conference receives an audio packet, how does it determine the actual time when the packet was sent, so that it can determine the appropriate playout delay?

The audio packet contains a timestamp that is based on the audio sample clock. This is essentially just the value of an audio sample counter maintained by the source. To relate this to real-time, the receiver uses information it received from the last sender report issued by the audio source. This sender report relates the audio sample clock to the actual real-time.

8. (10 points) Consider a residential network that connects to the internet with a DSL link that has a download rate of 4 Mb/s. Assume that there are three UDP flows sharing the link and the remote hosts are sending at rates of 1 Mb/s, 2 Mb/s and 3 Mb/s. Assume that the ISP router has a link buffer that can hold 300 packets (assume all packets have the same length). For each flow, what fraction of the packets it sends are discarded?

They each lose about 33% of the packets they send.

For each flow, about how many packets does it have in the queue.

The first flow has about 50 packets in the queue, the second flow has about 100 and the third has 150.

Now, suppose the queue at the ISP router is replaced by three queues that can each hold 100 packets and that the queues are scheduled using weighted-fair queueing, where the weights are all 0.33. In this case, what fraction of packets are discarded from each flow?

In this case, the first flow loses 0, the second loses 25% and the third loses 50%.

How many packets does each flow have in the queue?

The first flow's queue is empty or close to empty. The other two each have about 100 packets in their queues.

Now, suppose the weights are 0.2 for the first flow, 0.6 for the second and 0.2 for the third. In this case, what fraction of packets are discarded from each flow?

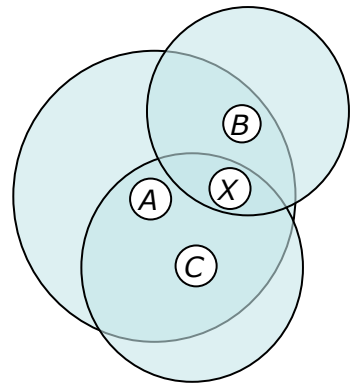
In this case, the first two flows each lose 0, while the third loses 67%.

How many packets does each flow have in the queue?

The second flow's queue is empty or close to empty. The third has about 100 packets in its queue.

The first flow is a little tricky, as its allocated portion of the link bandwidth exactly matches its data rate. If the packets arrive with uniform spacing, the queue will remain close to empty, but if the times between packets are more random, significant queueing can occur. Indeed, there can even be some packet loss in this case. For a single flow however, it's more likely that the queue will never accumulate a large backlog.

9. (10 points) The diagram at right shows a WIFI network with an access point, X and three hosts, A, B and C. The large circles indicate the *coverage areas* of the three hosts. The coverage area for X is not shown, but you may assume that it includes all three hosts. Assume RTS/CTS are not used.



Suppose X is transmitting a packet at time 0 and finishes sending it at time 100 μ s. Also,

- A gets a packet to send at time 50 that takes 100 μ s to send and is assigned a backoff timer of 100.
- B gets a packet at time 70 that takes 200 μ s and is assigned a backoff timer of 50.
- C gets a packet at time 90 that takes 150 μ s and is assigned a backoff timer of 150.

For each of the three hosts, what time do they start sending their packets? You may ignore the inter-frame spacing and the time required for acks.

A starts sending at time 200 and finishes at 300

B starts sending at 150 and finishes at 350

C starts sending at 350 and finishes at 500

Of the three packets sent, which are successfully delivered on the first attempt?

Only the one from C is successfully delivered.

For each packet that is not successfully delivered on the first attempt, approximately when does the sending host learn that the packet was lost and must be sent again?

Hosts learn of lost packets from the absence of ACKs. Here, A would expect an ACK at 300 and so would learn of the lost packet when the ACK fails to arrive at time 300. Similarly, B would learn of its lost packet at time 350.

Now, suppose RTS/CTS is enabled. In this case, approximately when does each host send its data packet? You may assume that the time needed to send RTS, CTS and ACK packets is negligible.

A sends at 400.

B sends at 150.

C sends at 550.

University of Uppsala

Department of Computer Systems (DoCS)

Final Examination

IT3 (Datorsystem II : Networks)

Data Communication and Networks

INSTRUCTIONS TO CANDIDATES

- This is a FIVE (5) hour examination
- Answer all questions
- All questions to be answered in English
- Dictionaries are Permitted
- Marks total 180
- This exam contributes 85/100 points to the final mark in this subject.

A: (Short Answer Questions)

Question 1

Name two well known data transport protocols provided by the Internet Transport Layer.

Provide a brief description of each service and indicate what type of application might use that service.

[8]

SOLUTION

TCP and UDP.

TCP is a connection oriented data service that provides a reliable loss free end to end connection. Peer to peer communication between applications is often managed using TCP.

[4]

UDP is an unreliable datagram service which provides end to end packet delivery without recovery and retransmission for applications that might wish to implement their own packet management and error recovery protocols such as streaming applications and NFS. UDP is also often used in Client/Server applications where no special packet handling is required.

[4]

Question 2

Describe the "token bucket" mechanism for congestion control.

With which other technique is token bucket usually combined to achieve complete flow control?

What problems in the simpler approach are addressed by using a "token bucket" mechanism?

[9]

SOLUTION

The token bucket approach to congestion tries to limit the impact of bursts of network packets on routers along the path, while retaining some flexibility in terms of allowing a brief increase in traffic in response to sudden demands/bursts.

The answer should include a picture indicating the burst response pattern that results from the use of token bucket, and show how that feeds into a leaky bucket in order to eliminate packet loss from the leaky bucket and provide overall loss free rate/flow control.

[4]

Token bucket is combined with leaky bucket, which buffers incoming packets and emits them in a constant rate stream.

[1]

The advantage of the combination is that token bucket provides some flexibility in responding to sudden requests for high traffic volume allowing an initial burst of traffic to saturate the link, and then enforcing a constant bandwidth utilisation after the initial free token pool has been exhausted.

[4]

Question 3

For three marks each define the following general terms used when discussing protocols.

Peers

IDU

SDU

PDU

[12]

SOLUTION

Peers - active elements of a protocol (processes) at the same protocol stack layer level on different hosts.

IDU - Interface Data Unit, data to be passed accross an access point. Generally SDU plus control information.

SDU - Service Data Unit, data/information to be sent to a peer process.

PDU - Protocol Data Unit, packet data to be transmitted. May be a part of an SDU with a header. N-PDU's are the packet format exchanged between peers at layer N of the protocol stack.

OVER/

Question 4

Give a definition of a **Service** and a **Protocol**. Use these definitions or any other discussion to illustrate the fundamental difference between a **Service** and a **Protocol**.

[10]

SOLUTION

Defn: A service is an operation or facility provided by protocol layer N to the layer $N+1$ above it.

[3]

Defn: A protocol is an algorithm operating at protocol layer N that uses services provided by layer $N-1$ to implement a style of communication.

[3]

*A service is a facility that can be used, such as **SendAPacket**. A protocol uses a number of services to manage the exchange of data. Thus a protocol may be compared to an algorithm, and the services to the instructions which are used to express that algorithm.*

[4]

Question 5

Give an overview of the distance vector method of updating routing table information. In particular, explain using an example how information about a node failure propagates using this algorithm.

What problem is encountered in deciding whether a host has become unreachable?

In what circumstances is it impossible to resolve this problem?

[16]

SOLUTION

Distance vector routing uses a distance metric, (round trip time, physical distance, number of network hops) to select the best current path to each reachable destination in the network.

To compute its routing table a host computes the value of the chosen metric with respect to all its neighbours, and also obtains the routing vectors of all its neighbours. It then computes the distance metric to a destination A for each (neighbour, destination) pair. The host then chooses the neighbour with the minimum distance value to be used to forward messages to the destination A. This process is repeated for all destinations in the network.

[8]

When a host fails in the network this information propagates very slowly, since each host updates its vector to be the minimum of its neighbours vector entries plus its delay to that neighbour. How do we decide that the delay vector entry has become high enough to register the host as unreachable? This is called the count to infinity problem.

[4]

The problem can be resolved if the distance metric is related to the number of hops to the destination. Then we can set infinity to be network diameter plus 1. If the metric is time based we need an estimate of the maximum acceptable delay. In this case it is possible that congestion will cause some hosts to be marked as unreachable from time to time. However, since host recovery propagates quite quickly this may not be a problem at least in relatively small networks.

[4]

Question 6

Provide the formal definition of a Petri-Net and describe each of the variables/operators in the 5 entries in the 5-tuple.

[8]

SOLUTION

The formal definition of a Petri-Net C is a 5-tuple as follows.

$$C = (P, T, I, O, \mu) \quad [1]$$

- [1] P *The set of places in the net*
- [1] T *The set of transitions in the net*
- [2] I *The input mapping function, applied to a transition generates the set of input places to that transition.*
- [2] O *The output mapping function, applied to a transition generates the set of output places to that transition.*
- [1] μ *The initial marking, which describes the initial location of tokens.*

OVER/

Question 7

Discuss the use of formal analysis techniques for protocols. Comment on why such techniques are used in analysing protocols, and give some examples of the types of problems that such an analysis can reveal.

[6]

SOLUTION

Formal analysis of protocols is an important part of establishing confidence in the correctness of proposed communications products. Formal analysis tools such as petri nets and finite state machines represent the logical structure of the protocol and allow designers to investigate the operation of the protocol in all possible situations.

State space expansion can identify failure modes, and deadlock situations that can arise if certain sequences of events occur. In addition, such analysis can reveal redundant states and thus be used to optimise the protocol. Safety properties can also be proposed and verified.

The use of some specification tools can assist in automatic verification using computer analysis which eliminates the possibility of human error, an important factor in many proof techniques.

OVER/

Question 8

It has been claimed that state machines are a natural tool for protocol analysis since protocol implementations can be derived directly from the state transition tables. Discuss this assertion and argue for or against the implementation of protocols using this approach.

[8]

SOLUTION

Since state/transition diagrams are directly related to table driven programming it can be argued that the type of specification and implementation flow directly from one another.

By deriving the implementation directly from the specification with little need for interpretation the possibility of erroneous implementations is decreased.

In addition it has been argued by Tannenbaum and others that state transition based programming is the natural way to implement protocols, and to visualise their operation. Thus the choice of state machines for the analysis and validation of protocols is both natural and effective. Especially since tools are available that are capable of generating implementation code directly from the specification.

Question 9

Define the role of a **firewall** and draw a diagram that shows where a firewall should be positioned with relation to protecting a local network. In defining the role of a firewall, you should discuss the techniques that a firewall uses at different levels to prevent external attacks on the network and control traffic flow through the firewall.

[6]

SOLUTION

The solution will show a local area network structure and the firewall as the single interface point or gateway to the outside world.

[2]

The characterisation of firewall activity will probably touch on a majority of the following points.

- *denying connection requests to known ports, such as ftp, sendmail on hosts within the local network.*
- *packet filtering based on keywords or encryption status.*
- *suspicious packet traffic patterns that represent denial of service or packet spoofing attacks on local hosts from external IP addresses.*
- *an exceptional answer might note that wireless networking often bypasses firewalls and represents a possible security hole.*

[4]

Question 10

Explain, using an example, how bit stuffing is used to preserve frame boundaries when transmitting binary data at the Data Link level of the protocol stack.

[8]

SOLUTION

Suppose we choose the bit pattern 01111110 to represent the frame boundary in a bit stream that we are transmitting. To prevent the occurrence of this bit pattern in the payload (and thus incorrect identification of a frame boundary by the receiver we will modify the payload by inserting a 0 bit into the stream after every consecutive five 1 bits seen in the payload.

Unstuffing at the receiving end will remove these zero bits and restore the format of the original frame payload.

[4]

As an example consider the following payload bit stream.

0011111111011111101111010001110011010

The transmitted stream would be

001111101110111110101111010001110011010

preventing incorrect identification of a frame boundary in the highlighted section of the bit stream.

B: (Topic Questions)

Question 11

Describe the OSI seven layer model. Name each of the layers in the model and draw a diagram that shows the ordering of these layers. Write a paragraph describing the areas of function that each layer is responsible for.

Contrast the OSI model you have just described with the TCP/IP reference model. Using a diagram show the correspondence between relevant protocol layers in the two models.

Discuss the relative merits of each of these models in the context of modern computer networking.

[30]

SOLUTION

Presentation of the OSI diagram and list of the functions carried out in each layer.

[10]

The contrast with the TCP/IP model should note the correspondence between the OSI and TCP layers at the Network and Transport level. The discussion will also indicate that the Host_to_Network layer of TCP/IP corresponds pretty well to the Data Link and Physical layers of the OSI model. Session and Presentation layers are not present in TCP/IP, and really are not needed as has been shown by experience over the last few years.

[8]

A discussion of the merits of TCP/IP vs OSI as a reference model for networking. In terms of discussing relative merits students should touch on the following key ideas.

- *Political influence on the OSI model, thus the OSI protocol stack represents a design philosophy created by committee*
- *OSI failed to gain wide acceptance in the industry and consequently is largely of academic interest.*
- *OSI provides a much better model of layering and clearly defines and separates protocols, interfaces and services. This allows for greater flexibility and allows the layers to be viewed and implemented independently of each other.*
- *TCP/IP describes a protocol, it is not really a standard.*
- *TCP/IP is in very wide use and is well understood.*
- *TCP/IP has proven very robust and well engineered.*

[12]

OVER/

Question 12

Discuss the hierarchy and addressing issues surrounding the construction of large networks.

[10]

Comment on the current status of IPv4 in this context. Identify the major emerging problems for IPv4 and discuss how they are addressed in IPv6.

[20]

SOLUTION

A good solution to this question should discuss the problems associated with flat address structures in large networks.

In particular the following points:-

- *length of addresses*
- *size of routing tables as a function of number of hosts.*
- *the concept of routing between network clusters on a backbone, and then routing within the destination cluster, so called "hierarchical routing".*

In the context of IPv4 the discussion will center on the issues surrounding the packet header fields, and the current IP address space.

Use of class B networks for small numbers of hosts and the resulting waste in the address space should be discussed, and the the use of CIDR to resolve some of these problems in the near future should be described.

Consideration of IPv6 should touch on the arguments associated with selecting the new address format, and the elimination of the checksum field and other changes to the packet header.

Question 13

Describe the physical construction characteristics of the following transmission media. If there is more than one type of each media then present the choices of type, and identify the differences between them.

- Twisted pair
- Coaxial cable
- Optical fibre cable

[9]

Possible choices for data communication infrastructure for long distance data transfer include microwave, optical fibre and radio transmission.

Discuss the advantages and disadvantages of each of these media, in terms of cost, political impact, ease of installation and adaptability in providing a range of services to clients.

[15]

What problem with data transmission in broadband coaxial cable networks is addressed using frequency splitting? Name two types of frequency splitting strategy, and identify how they are different.

[6]

SOLUTION

The discussion of communication media types should be structured similarly to the following.

- *Twisted pair is the common telecommunications wiring standard for office and domestic buildings throughout the 1970's and 1980's. In the late 1980's UTP, (Uninsulated Twisted Pair)*