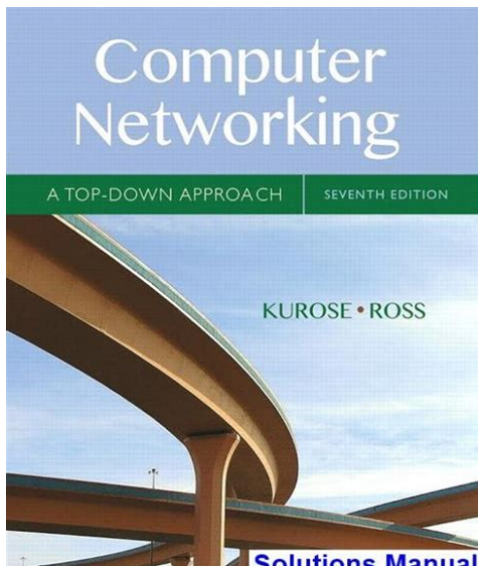




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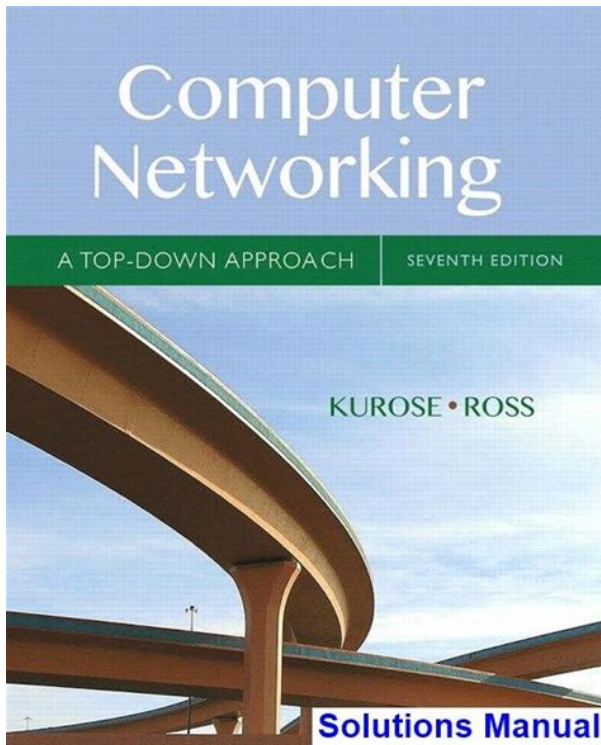
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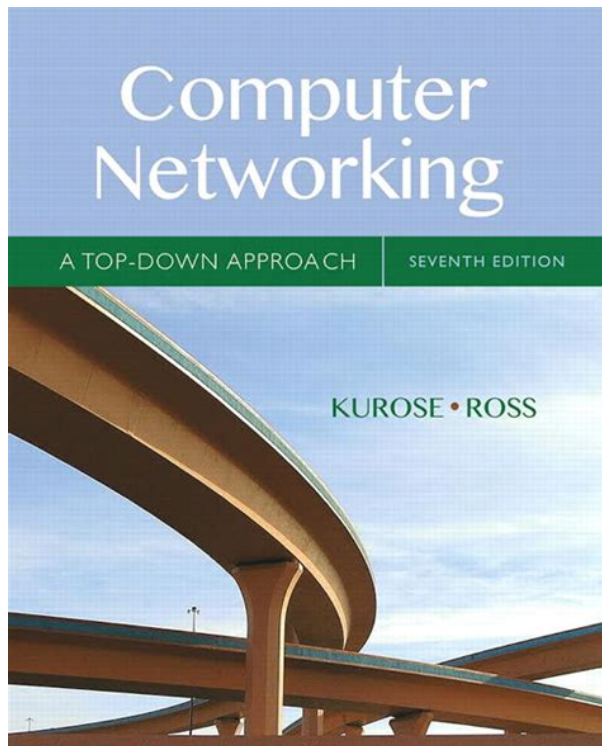
A top down approach solution manual



Page Count 150 Solutions to Review Questions and Problems. Version Date December 2016. This document contains the solutions to review questions and problems for the 7th. These solutions are being made available to instructors ONLY. Please do NOT copy or Please do not post any. We'll be happy to provide a copy up to date. Acknowledgments Over the years, several students and colleagues have helped us. Special thanks goes to Honggang Zhang, Rakesh Kumar, Prithula Dhungel, and Vijay Annapureddy. Also thanks to all the readers who have made. Throughout this text, the words "host" and "end system" are. End systems include PCs, workstations, Web servers, mail. Part of protocol has always been the. Protocol rules are based. Wifi 802.11 home and enterprise 6. 3G and 4G wide area wireless. On the downstream channel, all packets. Thus, there are no collisions in. It also can run. Mbps and upstream rates of up to 30.7 Mbps, bandwidth is shared. FTTH 210 Mbps. In these systems, packets are. This provides. Most packets switched networks today including the. Internet cannot make any end-to-end guarantees for bandwidth. FDM requires. Since the available. By peering with each other directly, the two ISPs. An Internet Exchange Points IXP. An ISP earns its money by charging. Therefore, when Google delivers content to a user, it often can bypass higher tier ISPs. What motivates content providers to create these networks. First, the content provider. Second, it can save money by sending less traffic into provider networks. Third, if. ISPs decide to charge more money to highly profitable content providers in. It adds header to each chunk, thereby. The header in each packet includes the IP. The packet switch uses the destination IP. Asking which road to take is. Yes, these tasks can be duplicated at different. Hosts process all five layers. Requires some form of human interaction to spread. Classic example Email. No user replication needed. <http://www.ctpublicschooljal.com/userfiles/erradicacion-manual-forzosa.xml>

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Worm in infected host scans IP addresses and portAny system that is part of the botnet canHence, it becomesFor example, she can easily. Furthermore, Trudy can even drop the packets that are being sent by Bob to AliceProblem 1. There is no single right answer to this question. Many protocols would do the trick. Heres a simple answer below. Messages from ATM machine to Server. Msg nameATM machine. ATM card transmits user ID to Server. User enters PIN, which is sent to server. User requests balance. User asks to withdraw moneyMessages from Server to ATM machine display. Msg nameCorrect operationHELO useridOK password is OKERR not enough fundsProblem 3Since the transmission rate is known and not bursty, bandwidth can be reserved forIn addition, the overhead costs ofGiven such generous link capacities, the network does not need congestion controlProblem 4Thus, this network can support up to 16 connections.Problem 5. A tollbooth services alt takes 120 seconds, or 2 minutes, for the first tollbooth to serviceThus, all the cars are lined up before theThe whole process repeats itself for travelingIt also takes 2 minutes for the third tollboothThus the total delay is 96 minutes.Problem 6Consider the first bit in a packet. Before this bit can be transmitted, all of the bits in theThis requiresA similar analysis shows that all bits experience a delay of 17.224 msec. Problem 8Let X_j be independentProblem 9Similarly, we can find the delay caused by the second switch and. Adding these five delays gives. Problem 11. Because bits are immediately transmitted, the packet switch does not introduce any delay;Problem 12Problem 13. Thus, the average delayNote that here we used the wellknown fact. Thus, the buffer is empty when aThus, the average delay of a packet across all batches. Problem 14. The total delay isProblem

15The total number of packets in the system includes those in the buffer and the packet that.
<http://www.dreamscar.eu/userfiles/error-fatal-error-please-read-security-section-of-the-manual-to-find.xml>

10. A protocol uses handshaking if the two communicating entities first exchange control packets before sending data to each other. SMTP uses handshaking at the application layer whereas HTTP does not.
11. The applications associated with those protocols require that all application data be received in the correct order and without gaps. TCP provides this service whereas UDP does not.
12. When the user first visits the site, the server creates a unique identification number, creates an entry in its back-end database, and returns this identification number as a cookie number. This cookie number is stored on the user's host and is managed by the browser. During each subsequent visit (and purchase), the browser sends the cookie number back to the site. Thus the site knows when this user (more precisely, this browser) is visiting the site.
13. Web caching can bring the desired content "closer" to the user, possibly to the same LAN to which the user's host is connected. Web caching can reduce the delay for all objects, even objects that are not cached, since caching reduces the traffic on links.
14. Telnet is not available in Windows 7 by default, to make it available, go to Control Panel, Programs and Features, Turn Windows Features On or Off, Check Telnet client. To start Telnet, in Windows command prompt, issue the following command
`> telnet webserverver 80`

where "webserver" is some webserver. After issuing the command, you have established a TCP connection between your client telnet program and the web server. Then type in an HTTP GET message. An example is given below:

```

C:\> telnet ubuntu.poly.edu
Trying 192.168.1.100...
Connected to ubuntu.poly.edu.
Escape character is '^]'.
HTTP/1.1 304 Not Modified
Server: Apache/2.2.3 (Ubuntu)
Etag: "1511_1-3-3644793"

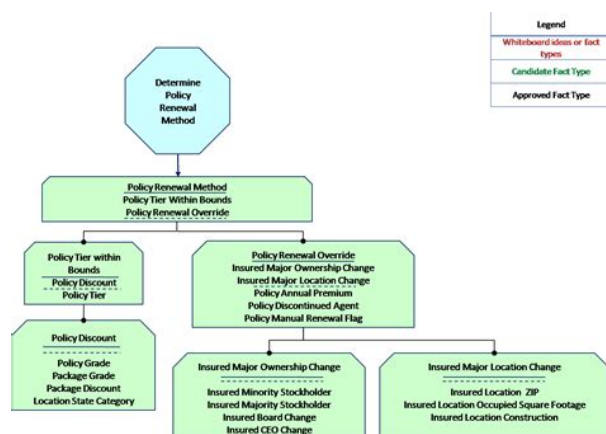
```

Since the index.html page in this web server was not modified since Fri, 18 May 2007 09:23:34 GMT, and the above commands were issued on Sat, 19 May 2007, the server returned "304 Not Modified". Note that the first 4 lines are the GET message and header lines input by the user, and the next 4 lines (starting from HTTP/1.1 304 Not Modified) is the response from the web server.

Problem 17 Let R_q be the transmission rate of the q th link and On linux you can use the command
 either case, you will get three delay measurements. For those three measurements you Repeat the
 experiment at different times Here is an example solution No, the paths didn't change during any of
 the hours. ISPs. Traceroute packets passed Yes, in this experiment the largest Problem 19. An example
 solution United States, seven links are in common including the transatlantic link. Germany to the
 same host in United States, three links are in common including the The two traceroutes diverge
 before Problem 20. Problem 21. If only use one path, the max throughput is given by The number of
 transmissions needed to be performed until the packet is successfully Then, the average number.
 Problem 23. Let's call the first packet A and call the second packet B. Problem 24. But with FedEx
 overnight delivery, you can. Problem 25 Problem 26. Problem 27 Problem 28 Problem 29. Recall
 geostationary satellite is 36,000 kilometers away from earth surface. Problem 30 This is additional
 information added in the. Baggage layer if Figure 1.20 that allows the Baggage layer to implement
 the service or When a passenger then passes through security and This information is used to ensure
 e.g., by later checks for the Problem 31 Without message segmentation, if bit errors are not tolerated,
 if there is a Routers have to accommodate these huge Packets have to be put in sequence at the
 destination. Message segmentation results in many smaller packets. Since header size is Problem 32.
 Yes, the delays in the applet correspond to the delays in the Problem 31. The propagation Problem 33.
 Time at which the last packet is received Problem 34.

The circuit-switched telephone networks and the Internet are connected together at In the
 other Application architecture, on the other With TCP, a minimum of two RTTs However, because
 Google docs runs over the Internet using TCP, timing guarantees TCP provides a reliable bytestream
 between client and server but UDP does not. Neither Neither Neither The SSL socket takes
 unencrypted data from SSL code in the application. SMTP uses handshaking at the application TCP
 provides this service whereas. UDP does not. Thus the site knows when this user more precisely, LAN

to which the user's host is connected. Web caching can reduce the delay for allPanel, Programs and Features, Turn Windows Features On or Off, Check TelnetAfter issuing the command, you haveThen type in an HTTP GET message. An example is given below. Since the index.html page in this web server was not modified since Fri, 18 May 2007Note that the first 4 lines are the GET message. Not Modified is the response from the web server.Received. Received. MessageID. ReceivedMay 2007 165351 0700Sat, 19 May 2007 235236 GMT. From. To. Bcc. Subject. Test mail. Date. MimeVersion1.0. Figure A sample mail message header. Received This header field indicates the sequence in which the SMTP servers sendIn this example there are 4 "Received" header lines. This means the mail messageSMTP server of the sender to the second SMTP server in the chain of servers. TheThe third "Received" header indicates the mail message flow from the second SMTPFinally, the first "Received" header indicates the flow of the mail messages from theFrom This indicates the email address of the sender of the mail. In the given example. To This field indicates the email address of the receiver of the mail. In the example. Subject This gives the subject of the mail if any specified by the sender. In theDate The date and time when the mail was sent by the sender. In the example, theMimeversion MIME version used for the mail. In the example, it is 1.0.

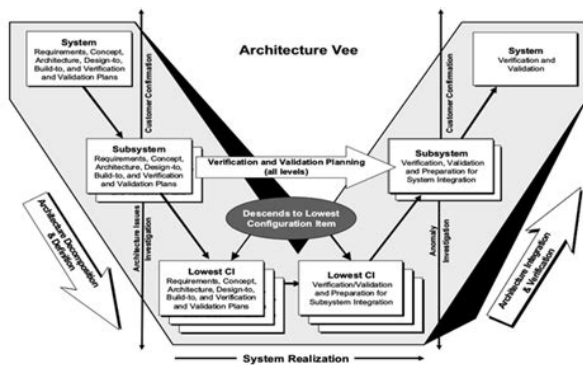


<http://eco-region31.ru/bose-wave-music-system-awrcc2-manual>

Contenttype The type of content in the body of the mail message. In the example, it. ReturnPath This specifies the email address to which the mail will be sent if theThis is also used by the sender'sThis poses a problem for the nomadic user, who may want toAlice has to be in theAlice provides chunks to Bob throughout a 30second interval.Therefore, Alice will eventually be optimisticallyThere is a logicalISPs all over the world. The goal is to reduce delays and increase throughputAnother philosophy is Bring Home, whichThis Bring Home design typically results in lower maintenance and management cost,Reference paper. Distributed Computing SystemsWith the TCP server, there is a welcomingIf the TCP server is not running, then the client will fail toProblem 1Problem 2. SMS Short Message Service is a technology that allows the sending and receiving ofOne SMS message canThe maximum size ofShort Message protocol is defined by 3GPP TS 23.040 and 3GPP TS 23.041. In addition. MMS Multimedia Messaging Service extends the capability of original text messages,Notification Service. WhatsApp Messenger is an instant messenger service that supports many mobileWhatsApp users canWiFi. WhatsApp uses the XMPP protocol Extensible Messaging and Presence Protocol.Moreover, iMessage and WhatsApp support sendingProblem 3. Application layer protocols DNS and HTTP. Transport layer protocols UDP for DNS; TCP for HTTPThis information is not contained in an HTTP messageTCP segment that carried the HTTP GET request to answer this question.Problem 5The reply was provided on Tuesday, 07 Mar 2008Equation 2. The server sends bitsAdditionally, the server sends bits. The peers do not forward the. The aggregate send rate of the server is. Thus, the server's send rate does not exceed its link rate. The aggregate send rate ofThus, each peer's send rate does not exceed its link rate. In this distribution scheme, peer i receives bits at

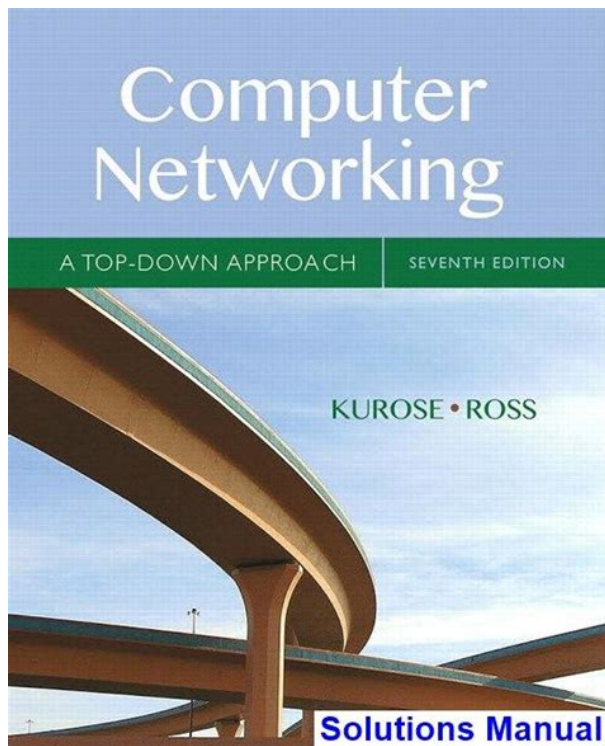
an aggregate rate of We now provide that here. We know from section 2.

<http://www.decor-ada.com/images/canon-rebel-300d-user-manual.pdf>



6 that. Combining this with a and b gives the desired result. Problem 25. There are N nodes in the overlay network. Problem 26. Yes. His first claim is possible, as long as there are enough peers staying in the swarm for His second claim is also true. He can run a client on each host, let each client "freeride," He can even Problem 27 N files, under the assumption that we do a one-to-one matching by pairing video Problem 28 A TCP connection will not be made. Thus, everything Errors will occur. Problem 29. In the original program, UDPClient does not specify a port number when it creates the With the additional line, when UDPClient is executed, a UDP socket is created with port UDPServer needs to know the client port number so that it can send packets back to the Glancing at UDPServer, we see that the client port number is not Thus UDP server will work with UDPServer therefore does not need to be Before. After. Problem 30. Yes, you can configure many browsers to open multiple simultaneous connections to a. Web site. The advantage is that you will you potentially download the file faster. The Problem 31. For an application such as remote login telnet and ssh, a bytestream oriented protocol In other applications, we may be sending a series of messages that have inherent For example, when one SMTP mail server sends another. SMTP mail server several email messages back to back. Since TCP does not have a Problem 32. To create a web server, we need to run web server software on a host. Many vendors sell Over the years it has been highly optimized by the opensource community. At the sender side, STP accepts STP adds a fourbyte header to each chunk STP then gives the The network STP then examines the port At the sender side, STP accepts a chunk of data not exceeding 1192 bytes, a It then gives the segment and the destination host address to The delegate The delegate then puts the The delegate then gives the letter to the planet's mail service.

<http://demenagementlandry.com/images/canon-rebel-30d-manual.pdf>



At the receiving side, For each received segment, at Each connection socket is identified with a fourtuple source IP address, source port When host C receives and Thus, the requests from. A and B pass through different sockets. The identifier for both of these sockets has 80 Unlike UDP, when the transport layer passes a TCPIf the ACK for a transmitted packet is not received Hence, the packet is retransmitted. When a packet was lost, GOBackN retransmitted all the packets whereas Selective. Repeat retransmitted the lost packet only. In case of lost acknowledgement, selective Consider the following timing Search time. Chapter 3 Problems. Problem 1 Problem 2. Suppose the IP addresses of the hosts A, B, and C are a, b, c, respectively. Note that a, b, Problem 3. Note, wrap around if overflow. Taking the one's complement gives 00111110. Problem 5. No, the receiver cannot be absolutely certain that no bit errors have occurred. This is Problem 6. Suppose the sender is in state "Wait for call 1 from above" and the receiver the receiver When the rdt2.1 sender gets the corrupted ACK, it resends the packet with sequence Neither will progress To best answer this question, consider why we needed sequence numbers in the first In the case of ACKs, the The duplicate ACK is not the. ACK that the sender needs and hence is ignored by the rdt3.0 sender. Problem 8. The sender side of protocol rdt3.0 differs from the sender side of protocol 2.2 in that We have seen that the introduction of timeouts adds the However, the Hence the receiver in protocol rdt2.2 will also work as Problem 9. Suppose the protocol has been in operation for some time. The sender is in state "WaitM0 corrupted Timeout sender Packet garbled, receiver Timeout sender A1 corrupted. Corrupted Problem 10. Here, we add a timer, whose value is greater than the known roundtrip propagation delay. We add a timeout event to the "Wait for ACK or NAK0" and "Wait for ACK or NAK1" Let us see why this protocol will still work with the rdt2.1 receiver.

Suppose the timeout is caused by a lost data packet, i.e., a packet on the sendertoreceiver channel. In this case, the receiver never received the previous Suppose now that an ACK is lost. The receiver will eventually retransmit the ACK is garbled. Thus the senders reaction is the same with a loss, as with a If the sending of this message were removed, the sending and receiving sides would Here's a scenario. Sender sends pkt0, enter the "Wait for ACK0 state", and waits for a packet back Receiver is in the "Wait for 0 from below" state, and receives a corrupted packet Now, the ender is awaiting an ACK of some sort from the receiver, and the receiver is. Problem 12. The protocol would still work, since a retransmission would be what would happen if the To get at the more subtle issue behind this question, one has to allow for premature Problem 13 In a NAK only protocol, the loss of packet x is

only detected by the receiver when packet loss is detected. If there is a long delay between the sender and receiver, data is being sent often, then recovery under a NAK-only scheme is more difficult. Moreover, if errors are infrequent, then NAKs are only sent when a packet is lost. Problem 15. Problem 16. Yes. This actually causes the sender to send a number of pipelined data into the channel. Yes. Here is one potential problem. If data segments are lost in the channel, then the sender must wait for an ACK. Problem 18. In our solution, the sender will wait until it receives an ACK for a pair of messages. Data packets are sent in sequence. The FSM for the sender and receiver are shown in Figure 2. Note that the sender state is 'Wait for ACK' and the receiver state is 'Wait for data'. Figure 2 Sender and receiver for Problem 3.18. Sender Receiver Problem 19. This problem is a variation on the simple stop and wait protocol rdt3.0. Because the sender and receiver FSM are shown in Figure 3. In this problem, the sender state is 'Wait for ACK' and the receiver state is 'Wait for data'. The sender side FSM is exactly same as given in Figure 3.15 in text.

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Because the A-to-B channel can lose request messages, A will need to timeout and retransmit. Because the channel is unreliable, A must be able to detect a 1-bit sequence. A the requestor has 4 states. When it receives a request from above, it sends a D0 message. When in the "Wait for Request 0 from above" state, A ignores the timer. If the timer expires, A sends another R0 message. If a D0 message is received while in this state, it is ignored. When it receives a request from above, it sends another R1 message. If a D1 message is received while in this state, it is ignored. The data supplier B has only two states. If B receives a R1 message, then it sends a D1 message. If B receives a R0 message, then it discards this D0 data. If B receives a R1 message, then it sends a D1 message. Problem 22. If all of these ACKs have been received. Suppose next that none of them have. In this second case, the sender's window is still 1. If none of those N ACKs have been yet received by the receiver, the sender's window is still 1. Problem 23. In order to avoid the scenario of Figure 3.27, we want to avoid having the leading edge of the sender's window move forward. That is, the sequence number space must be such that the lowest sequence number that the receiver is waiting for is packet m. If none of those w ACKs have been received by the receiver, the lower edge of the sender's window is mw, and the leading edge of the sender's window is m. That is, the sequence number space must be such that the lowest sequence number that the receiver is waiting for is packet m. Problem 24. These ACKs are outside its window. The window size of 1 precludes the possibility of out-of-order packets within the window. A cumulative ACK is just an ordinary ACK in Problem 25. With TCP, the sender's window is cumulative. UDP does not have delays due to flow control. Problem 26. So the size of the MSS is irrelevant. The maximum size file that can be sent from A to B is simply the number of bytes in the receiver's buffer. The total number of bytes in the receiver's buffer is 100 MB. Host A. Timeout. Problem 28. Since the link capacity is only 100 Mbps, so host A's sending rate can be at most 100 Mbps. The receive buffer fills up at a rate of roughly 40 Mbps. When the receiver's buffer is no more than 60 Mbps.

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Problem 29. Half-open connections are not possible since a server must wait for a client to establish a fully open connection. Since the attacker does not know the server's state, it can establish a half-open connection. Problem 30. But there might be one scenario. Problem 31. After obtaining first SampleRTT 106ms. After obtaining 120ms. After obtaining 140ms. After obtaining 90ms. After obtaining 115ms. Problem 32. Denote EstimatedRTT_n for the estimate after the nth sample. EstimatedRTT_n = (1 - α) * EstimatedRTT_{n-1} + α * SampleRTT_n. The weight given to past samples decays exponentially. Let's look at what could go wrong if TCP measures SampleRTT for a retransmitted packet. Further suppose the source measures SampleRTT for P2 the retransmitted packet. Finally suppose that shortly after the source will mistakenly take this SampleRTT. Let's look at what could be wrong if TCP measures SampleRTT for a retransmitted packet. Further suppose the source measures SampleRTT for a retransmitted packet. Problem 34. The actually last packet sent. Problem 35. When, at time t, the sender receives an acknowledgement with value y, the sender knows that all segments with sequence number less than y have been received. Problem 36. The designers of TCP. Problem 37. A sends 9 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later resent segments 2, 3, 4, and 5. B sends 8 ACKs. They are 4 ACKS with sequence number 1, and 4 ACKS with sequence number 5. Problem 38. Selective

Repeat. A sends 6 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later resent segments 2. B sends 5 ACKs. They are 4 ACKS with sequence number 1, 3, 4, 5. And there is one. ACK with sequence number 2. They are initially sent segments 1, 2, 3, 4, 5 and later resent segments 2. B sends 5 ACKs. They are 4 ACKS with sequence number 2. There is one ACK with Problem 38. Problem 39 With increased loss, even a larger fraction of the packets Given that the maximum departure rate from If there was a timeout, the congestion window size would have dropped to 1. Thus packet 70 is sent in the 7th transmission round. MSS. Thus the new values of the threshold and window will be 4 and 7 respectively. So, the total number is 52. Problem 41. Refer to Figure 5.

In Figure 5a, the ratio of the linear decrease on loss between In Figure 5b, the ratio of Problem 42. If TCP were a stop-and-wait protocol, then the doubling of the time out interval would However, TCP uses pipelining and is The doubling of the timeout interval does not Therefore a congestion control mechanism is needed to stem the flow of "data received from the application Problem 43. In this problem, there is no danger in overflowing the receiver since the receiver's receive Also, because there is no loss and acknowledgements are However, the process in host A will not continuously pass data to the socket because the Once the send buffer becomes full, the process will pass. Let T_p denote the oneway propagation delay between the sender and the receiver. Problem 48 Thus, we have Some protocols are proposed to solve this Problem 49 Thus C1 adjusts its window size after 50 msec, but C2 adjusts its window size after We further have the following simplified model of. TCP. After each RTT, a connection determines if it should increase window size or But for C2, we compute the average total sending rate in the If that rate exceeds the link capacity, then we assume Note that it is possible that the The following table describes the evolution of window sizes and sending rates based Window Size Average data sending Sizenum. of C1 has shorter RTT, only half of that of C2, so C1 can adjust its window size twice as Within a cycle, the sending rate of C1 is. Problem 51 Time Data Sizenum. of Their max window size is 2. Thus, the link is not fully utilized recall we assume this link has no buffer. One This will cause different There are many AQM Active. Queue Management techniques to do that, such as RED Random Early Detect, PI Problem 52. Note that W represents the maximum window size. First we can find the total number of segments sent out during the interval when TCP. Loss rate L is given by Note, TCP's average throughput is given by Problem 53. Let's assume 1500 byte packets and a 100 ms roundtrip time.

From the TCP throughput An advantage of using the earlier values of $cwnd$ and $ssthresh$ at t_2 is that TCP would A disadvantage of using these values is that they may be no longer Problem 55 TCP in that host would not send the TCP ACK segment back. Even if the attacker Problem 56 A router forwards a packet based on the A link layer switch forwards a packet based on the For example, the data plane's The main function of the control plane is routing, which is to determine the paths a A control plane is responsible for Routing refers to the network wide In addition, a routing processor in a SDN Data plane is usually implemented in hardware due to the requirement of fast Control plane is usually implemented in Such a decentralized approach Generalized forwarding means that besides its final destination, other factors Software defined networking adopts generalized An interconnection network can forward packets in parallel as long as all the packets If this rate mismatch persists, the queues If this rate Note that increasing switch fabric speed HOL blocking occurs Only FIFO can ensure that all packets depart in the order in which they arrived. Another example, a realtime voice over IP packet With RR, all service classes are treated equally, i.e., no service class has priority over With WFQ, service classes are treated differently, i.e., each WFQ's all classes have the same amount of service weight, the WFQ is identical to DHCP is used to assign IP Yes, the wireless router also uses. NAT as it obtains only one IP address from the ISP. A datagram with a private Traffic class, payload length, next IPv4 datagram. With destination based IP header field value and the outgoing link interface to which a packet that matches Each entry of the flow table in. OpenFlow includes a set of header field values to which an incoming packet will be In the case of destination based In the case of an SDN, there are Problem 1 Destination Address Problem 2 Problem 3 Problem 4. The minimal number

of time slots needed is 3.

The scheduling is as follows. Slot 1 send X in top input queue, send Y in middle input queue. Slot 2 send X in middle input queue, send Y in bottom input queue. Slot 3 send Z in bottom input queue. Largest number of slots is still 3. Actually, based on the assumption that a nonemptyNOTE Actually, if the first datagram in the bottom input queue is X, then the worst casePrefix MatchLink InterfacePrefix match for second address is 3rd entry link interface 2. Prefix match for third address is 4th entry link interface 3. Problem 6. Destination Address RangeDestination Address Range. Link InterfaceProblem 9. Destination Address. Link InterfaceDestination AddressLink InterfaceAny IP address in range 128.119.40.128 to 128.119.40.191. FromTo simplify the solution, assume that no datagrams have router interfaces asAlso, label D, E, F for the uppermiddle, bottom, and upperleft interior subnets, respectively. Router 1. Longest Prefix MatchSubnet A. Subnet D. Subnet F. Router 2. Longest Prefix MatchSubnet D. Subnet B. Subnet E. Router 3. Longest Prefix Match. Outgoing InterfaceSubnet E. Subnet C. Problem 13. The IP address blocks of Polytechnic Institute of New York University are. NetRange 128.238.0.0 128.238.255.255. The IP address blocks Stanford University are. NetRange 171.64.0.0 171.67.255.255. The IP address blocks University of Washington are. NetRange 140.142.0.0 140.142.255.255. No, the whois services cannot be used to determine with certainty the geographicalInstitute of New York University, Stanford University and University of Washington. Locations of the Web server at Polytechnic Institute of New York University is. Locations of the Web server Stanford University is. Locations of the Web server at University of Massachusetts isEach fragment except the last oneThe last datagram will be of size 360The offsets of the 4 fragments will be 0, 85, 170, 255. Each. Problem 15. Assume the data is carried in TCP segments, with each.

TCP segment also having 20 bytes of header.Problem 16NAT Translation Table. WAN Side. LAN SideAs each host generates a sequence of. IP packets with sequential numbers and a distinct very likely, as they are randomlyThe number of clusters is the number of hostsIMW'02, Nov. 68, 2002, Marseille, France.Weifeng Chen, Yong Huang, Bruno F. Ribeiro, Kyoungwon Suh, Honggang Zhang. Edmundo de Souza e Silva, Jim Kurose, and Don Towsley. PAM05 Workshop, March 31 April 01, 2005. Boston, MA, USA.Problem 18. It is not possible to devise such a technique. In order to establish a direct TCP connectionBut the NATs covering Arnold and Bob drop SYN packets arriving from the WAN side. Thus neither Arnold nor Bob can initiate a TCP connection to the other if they are bothProblem 19. S2 Flow Table. Match. Action. Forward 2. Forward 1. Forward 3. Forward 4. Problem 20. Forward 1S1 Flow Table. S3 Flow Table. Problem 22. Forward 3Each router has aIn such cases, we say that the networkIn the case of logically centralized control, the data plane and control plane areThe algorithmA distributed routing algorithmOSPF protocol is an example of centralized routing algorithm, and BGP is aDistancevector routing TheFor example, consider a network of three. When the cost of link x,y increases from 4 to 60,It may well be important that trafficSimilarly, aScale The ability of a routing algorithm and its data structures to scale to handle. Within an AS, scalability is less of a concern. For one thing, if a single administrativePerformance Because interAS routing is so policy oriented, the quality for example,Indeed, we saw that among ASs, thereWithin a single AS, however, such policy concerns are of less importance, allowingWith OSPF, a router broadcasts its linkstate information to all other routers in theAn OSPF AS can beWithin each area, one or more area border routers areThe concept of area is introduced forOSPF AS, and an area is an important building block in hierarchical routing.

A prefix is the networkIn BGP jargon, a prefix along with itsThe NEXTHOP attribute indicates the IP address of the first router along an advertised pathWhen configuringTo implement this policy, ISP B wouldA BGP router can choose not to add its own identity to the received path and thenThe destination of the receivedThrough this layer, an SDN controller controls the operation of a remote SDNenabled switch, host, or other devices, and a device communicates locallyobservedThe

networkwide statemanagement layer provides upto date information about The network control application layer represents the brain of SDN control plane. The For example, a routing network control Another network application might perform access control. The recipient of these Readstate. This message is used by a controller to collect statistics and counter Send packet. This message is used by the controller to send a specific packet out There are also messages that network control applications as senders send to the Its purpose is to inform the controller that a flow table Its purpose is to inform the controller of a change in port Two types of messages from a controller to a controlled device It allows controller components and applications to This layer also Destination network unreachable, type 3 code 0. Destination host unreachable, type 3, code 1. Source quench congestion control, type 4 code 0. It controls the. Actions are initiated in a managing server to control network behavior and a network A managed device is a piece of network equipment including its software that resides A managed device might be a host, router, switch, middlebox, Management Information Base MIB collects the information associated with those A MIB object might be a counter, such as the Set Request is a message used by a managing server to set the value of one or more MIB It is used for Problem 1 Problem 2 Problem 3. Step Du,pu. Dv,pv. Dw,pw. Dy,py. Dz,pz Problem 4 Du,pu. Dz,pz Dt,pt. Dz,pz Du,pu. Dt,pt. Dt,pt. Dz,pz Step Step Step Du,pu. Dt,pt Step Step.

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