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PES University, Bengaluru-85

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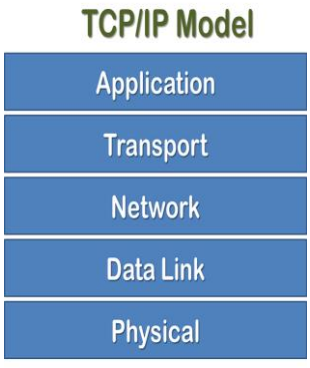
UE19CS253

March 2021: In Semester Assessment(ISA)
B.TECH, IV-SEMESTER
SCHEME and Sloution
UE19CS253– COMPUTER NETWORKS

Time: 02 Hours **Answer All Questions** **Max Marks: 60**

All the questions are compulsory
Draw the diagrams wherever necessary
Figures to the right indicates marks

1	a)	What is Access network and Network core? Briefly explain the connection devices which are implemented at these networks? [1+1+1+1] **Answer:** An access network is a user network that connects subscribers to a particular service provider and, through the carrier network, to other networks such as the Internet. **Core network** and backbone **network** typically refer to the high capacity communication facilities that connect primary nodes. **Core**/backbone **network** provides path for the exchange of information between different sub-**networks**. Edge **network** provides information exchange between the **access network** and the **core network**. Access Network: Switches Network core: Routers. A **switch** is designed to connect computers within a network, while a **router** is designed to connect multiple networks together.	4
	b)	Draw TCP/IP protocol stack and brief the responsibilities of Transport and network layers in the Internet protocol stack.[1-Diagram+1+1] Answer:  Transport: Service Point addressing, Segmentation and Reassembly, Connection Control, Flow control, Error control Network: Logical Addressing, Routing	3
	c)	Consider the scenario given below: [1+1+1] Three different servers connected to three different clients over three three-hop paths.	3

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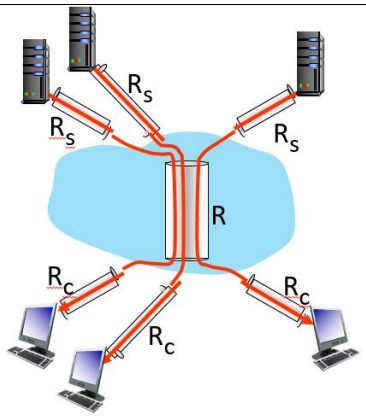


The three pairs share a common middle hop with a transmission capacity of R = 600 Mbps.

The three links from the servers to the shared link have a transmission capacity of R_S = 80 Mbps.

Each of the three links from the shared middle link to a client has a transmission capacity of R_C = 90 Mbps.

Answer the 8 questions: (Answer as a decimal)

1. Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the server links (R_S)?
2. Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the client links (R_C)?

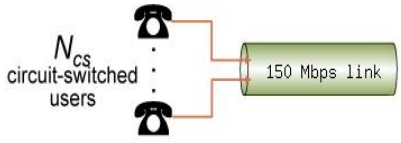
Assuming that the servers are sending at the maximum rate possible, what is the link utilizations for the shared link (R)?

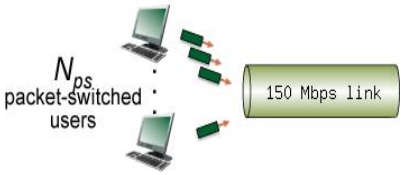
Answer:

1. The server's utilization = $R_{bottleneck}$ / R_S = 80 / 80 = 1.
2. The client's utilization = $R_{bottleneck}$ / R_C = 80 / 90 = 0.89
3. The shared link's utilization = $R_{bottleneck}$ / (R / 3) = 80 / (600 / 3) = 0.4.

2	a)	Consider the two scenarios below: [1+2+2, For subquestion 2 and 3 calculation 1 mark and final answer 1 mark]	5

A circuit-switching scenario in which N_{cs} users, each requiring a bandwidth of 20 Mbps, must share a link of capacity 150 Mbps.





A packet-switching scenario with N_{ps} users sharing a 150 Mbps link, where each user again requires 20 Mbps when transmitting, but only needs to transmit 20 percent of the time.

		Answer the following questions: 1. When circuit–switching is used, what is the maximum number of circuit–switched users that can be supported? Explain your answer. 2. Suppose packet switching is used. Suppose there are 13 packet–switching users, what is the probability that one user (*any* one among the 13 users) is transmitting, and the remaining users are not transmitting? 3. Suppose packet switching is used. Suppose there are 13 packet–switching users, what is the probability that any 4 users (of the total 13 users) are transmitting and the remaining users are not transmitting? (Hint: you will need to use the binomial distribution) Answer: 1. 7 2. 13 * .2* (1-0.2)^12 = 0.18 3. (13, 4) * $p^{4*}(1-p)^9$ = (13!/(4!*9!))* (0.2)^4 * (0.8)^9 = 0.15	
	b)	Define Cloud Computing. What is cloud enabled networking and cloud based networking?[Definition 1+1+1] Answer: Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access. It is a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services). It can be rapidly provisioned and released with minimal management effort or service provider interaction. **Cloud enabled networking** Network is on premises, but some or all resources used to manage it are in the cloud. Core network infrastructure – packet forwarding, routing, and data— remains in-house. Others like network management, monitoring, maintenance, and security services are done through the cloud. **Cloud based networking** Entire network is in the cloud. Includes network management resources and physical hardware	3
	c)	Assume that you are using Mozilla firefox as browser in your laptop computer which provides standard Ethernet interface, USB interface, Wi-Fi interface. Suppose at the end of this year, a physical interface using new Laser technology is introduced, ***is it required to replace or update Mozilla Firefox. Why or why not? [1+1- explanation]*** **Not required; Thanks to layered architecture; Browser is on the top of the application layer. Physical interface/laser technology belongs to physical layer. No need to do change application layer; Worst case, data link layer may have to be changed.**	2
3	a)	Consider distributing a file of F = 15 Gbits to N peers. The server has an upload rate of us = 30 Mbps, and each peer has a download rate of di = 2 Mbps and an upload rate of u. For N = 100 and u = 300 Kbps calculate the minimum distribution time for both client-server distribution and P2P distribution. If the number of peers are gradually increasing, which one would be faster? Solution: [Dcs- 2(2 calculations)+ Dp2p – 2 (2 calculations)+1] For calculating the minimum distribution time for client-server distribution, we use the following formula:	

		Dcs = max {NF/us, F/dmin} Similarly, for calculating the minimum distribution time for P2P distribution, we use the following formula: $D_{P2P} > \max\{F/u_s, F/d_{min}, NF/(u_s + Su_i)\}$ Where, F = 15 Gbits = 15 * 1024 Mbits us= 30 Mbpsd min = di= 2 Mbps 300Kbps = 300/1024 Mbps. **Client Server:** U=300 Kbps and N = 100 The distribution time is 51200 **Peer to peer** U=300 Kbps and N = 100 The distribution time is 25904s P2p would be faster if the number of peers increase. **NOTE: Marks can be awarded if the Mb conversion is done using 10^9**	
	b)	Analyze the HTTP request below, sent by a client and answer the questions [1 Each] **GET** /CN/ esa.html HTTP/1.1<cr><lf> **Host**: www.pes.edu<cr><lf> **User-Agent:** Mozilla/5.0 <cr><lf> **Accept:** text/html, ext/xml<cr><lf> **Accept-Language:** en-us,en;q=0.5<cr><lf> **Accept-Encoding:** zip,deflate<cr><lf> **Accept-Charset:** ISO-8859-1,utf-8;q=0.7,*;q=0.7<cr><lf> **Keep-Alive:** 300<cr><lf> **Connection:** keep-alive<cr><lf> <cr><lf> a) What is the URL of the document requested by the browser? **Ans: www.pes.edu/CN/ esa.html** b) What version of HTTP is the browser running? **Ans: HTTP/1.1** c) Does the browser request a non-persistent or a persistent connection? **Ans: Persistent connection** d) Is it possible to fetch a jpeg image in this request? **Ans: No, Accept method is text/html only** **e)** If the request line contained HEAD method instead of GET, what change it will make in the response? **Ans: Only header will be returned and the entity body will be empty.**	5
4	a)	With suitable diagram describe how Web caching can reduce the delay in receiving	4

a requested object. Will Web caching reduce the delay for all objects? Justify your answer. [1 Diagram, 2 web caching + 1]

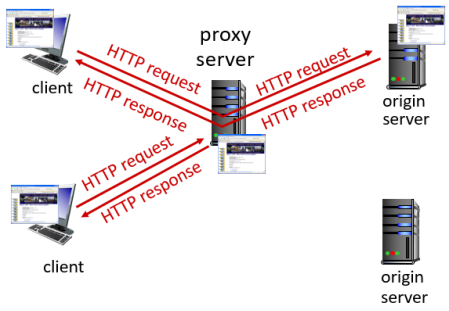
Answer:

The major goal of web caching is to satisfy client request without involving origin server. Here user configures browser to point to a *Web cache*

browser sends all HTTP requests to cache

if object in cache: cache returns object to client

else cache requests object from origin server, caches received object, then returns object to client



Web cache acts as both client and server

server for original requesting client

client to origin server

typically cache is installed by ISP (university, company, residential ISP)

Why Web caching?

reduce response time for client request (speed)

cache is closer to client

reduce traffic on an institution's access link (saves bandwidth)

internet is dense with caches

enables "poor" content providers to more effectively deliver content

- privacy – surf the internet anonymously
- activity logging

Web caching will not reduce the delay for all objects as it can return the object only if it is available in cache.

b) State True or False for the following. [1 Each] — 4

i. In a DNS query chain, if a local DNS server cache the IP addresses of TLD servers, it can bypass the root DNS servers. - **True**

ii. Using FTP a user can send files from local file system to remote file system but cannot send the files from remote file system to local file system. – **False**

iii. A cookie file is kept on server system and managed by the user's browser.- **False**

iv. The IP address of host on which process runs is suffice for identifying the process - **False**

c) For the client-server application over TCP why must the server program be executed before the client program? — 2

Answer:

A client-server application run over the TCP, server program is executed first, because the server must accept the request from the client and ready to execute the client's program.

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5 a) Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. In the end, all 5 data segments have been correctly received by Host B. Assuming no delayed acknowledgements, [4 values in table 4 marks + 1]

i. Fill the following table for GBN and SR protocols.

Protocol	# segment sent by A	#acknowledgements sent by B
GBN	9	8
SR	6	5

ii. If the TCP is used instead of GBN and SR, what will be the acknowledgement number of the last data segment?

Solution:

i.

Go-Back-N:
A sends 9 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later re-sent segments 2, 3, 4, and 5.
B sends 8 ACKs. They are 4 ACKS with sequence number 1, and 4 ACKS with sequence numbers 2, 3, 4, and 5.

Selective Repeat: A sends 6 segments in total. They are initially sent segments 1, 2, 3, 4, 5 and later re-sent 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.

ii. If the TCP is used instead of GBN and SR, the acknowledgement number of the last data segment will be 6. (Expected segment no.)

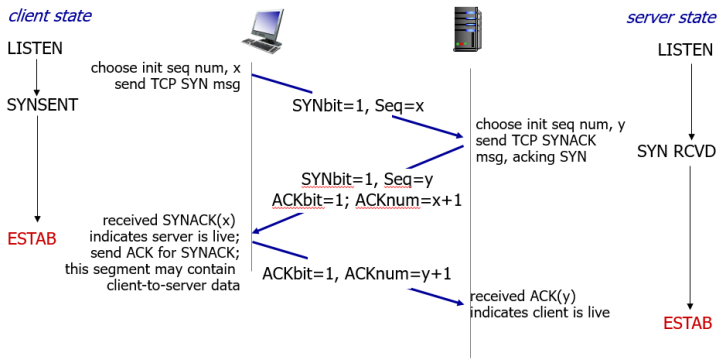
b) Describe why an application developer might choose to run an application over UDP rather than TCP. [Any 3 Advantages of UDP]
Answer:
An application developer might choose to run an application over UDP rather than TCP due to following advantages of UDP over TCP:

- Finer application level control over what data is sent and when.
- no connection establishment (which can add delay)
- small header size
- no congestion control
  - UDP can blast away as fast as desired
  - can function in the face of congestion
  - Simple

c) If the data words sent are : [1 for calculation + 1 for final answer]

- 1100 1010 1010 1010
- 1011 0101 1001 1000
- 1001 1001 1001 1011

And the checksum value sent is : 1110 0110 0010 0000

		Whether the data delivered is correct or not? Answer: No the data is delivered correctly.	
6	a)	Using stop and wait policy, how a reliable data transfer protocol can be built for a lossy channel with bit errors? What is the possibility of duplicate data packets in the sender to receiver channel? [Rdt 3.0 – 3 marks + 1 for duplicate possibilities] Answer: approach: rdt 3.0 checksum, seq. #, ACKs, retransmissions will be of help … but not enough sender waits "reasonable" amount of time for ACK and retransmits if no ACK received in this time If pkt (or ACK) just delayed (not lost), retransmission will be duplicate, but seq. #'s already handles this receiver must specify seq # of pkt being ACKed Requires countdown timer Thus the retransmission will happen if Packet is lost, Ack is lost or the Ack is delayed.	4
	b)	What is TCP Connection Management? What is the role of SYN bit in TCP three way handshake? Explain with suitable diagram. [Diagram 2 marks + 2 marks explanation] Answer: In TCP, the connections are established using three-way handshake technique. SYN bit – Used to initiate and establish a connection. It helps to synchronize sequence numbers between devices. One of the flag bits in the segment's header, the SYN bit, is set to 1. 	4
	c)	Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. [1+1] The MSS is 1000 bytes. The first segment has sequence number 80; the second has sequence number 120. a. How much data is in the first segment? Answer: 40 Bytes b. Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number? Answer: 80	2