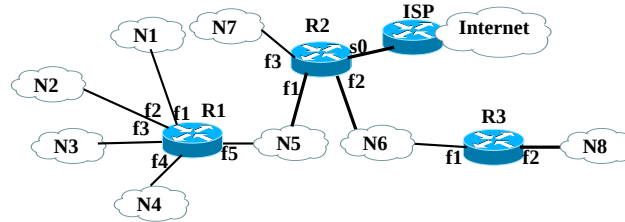


Examen final de Xarxes de Computadors (XC)		6/6/2011
NAME:	SURNAME	DNI:

Answer problems 1 and 2 in the same questions sheet, and problem 3 in exams sheets. Justify your answers.
The revision date will be announced in the racó Duration: 2h45. The quiz must be returned in 30 minuts.



Problema 1. (2.5 points) In the network of the figure we have the public addresses 150.0.0.0/22. Next to the routers' links there are the names of the interfaces. The number of stations we wish in each subnet is given in the following table (column hosts). In router R2 there is a default route towards the ISP.

1.A (0.5 points) Propose an addressing scheme filling the next table. We want that the addresses numerically lower are assigned to network N1, then to network N2, and so on until N8. For instance, 150.0.0.1 is numerically lower than 150.0.2.1.

Net	hosts	address/mask (bits)	mask (dotted notation)
N1	200		
N2	200		
N3	100		
N4	50		
N5	10		
N6	10		
N7	10		
N8	200		

1.B (0.25 punts) Say if after your assignment there is any free address from the rank 150.0.0.0/22 (i.e. that has been not assigned to any of the subnets N1-N8). If there are, give the rank in the form address/mask.

1.C (0.25 punts) Propose a possible address for each of the interfaces of the routers filling the following tables:

Router R1		
	Intf	Address
N1	f1	
N2	f2	
N3	f3	
N4	f4	
N5	f5	

Router R2		
	Intf	address
N5	f1	
N6	f2	
N7	f3	
	s0	

Router R3		
	Intf	address
N6	f1	
N8	f2	

1.D (0.5 punts) Suppose that the routers are configured with the previous addresses, and it is started RIP version 2 to advertize addresses from network 150.0.0.0. Additionally, R2 is configured such that the default route is advertized. Fill the following table with the routing table of R1 once RIP has converged. In the code column, write 'C' if it is a directly connected net, of 'R' if is an entry added by RIP. In the column M write the RIP metric.

Router R1				
Code	Dest	Interface	gateway	metric
	N1			
	N2			
	N3			
	N4			
	N5			
	N6			
	N7			
	N8			
	0/0			

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Problema 2. (2.5 punts) Two computers at Barcelona are connected through Internet. We just configure properly with public IP addresses in both machines (with Ethernet 100BaseT cards, MTU = 1500 B). In one machine we launch an HTTP server at port 80, at in the other we do a bunch of connections with a browser to the server.

Notes:

- $RTT = 50$ ms
- No TCP options are supported
- The terminals have infinite computing power
- There are no transmission errors
- In some questions you must define missing data for proper configuration

a) Which is the MSS?

The client sends a GET HTTP (request) and receives an HTML page (response). Both the request and the response are 1 kB long.

b) Draw the time diagram of this connection, clearly showing client and server states throughout the whole connection, and the segments with its needed TCP flags (draw all segments of this connection).

c) Figure out the connection time from client point of view (from client's CLOSED to CLOSED state)

Instead of reading such a small page, we now download a full 10 MB file:

d) Which factor or factors are limiting the total download time in this case?

- e) Calculate approximately this download time (from CLOSED to CLOSED as above)

- f) Approximately, say how much memory (maximum) is occupied on all routers traversed by this connection at any given time?

- g) Which modifications on TCP terminals are able to improve the download time of this large file?

- h) Show `netstat` output if executed on server.

Local Address::Port	Remote Address::Port	State
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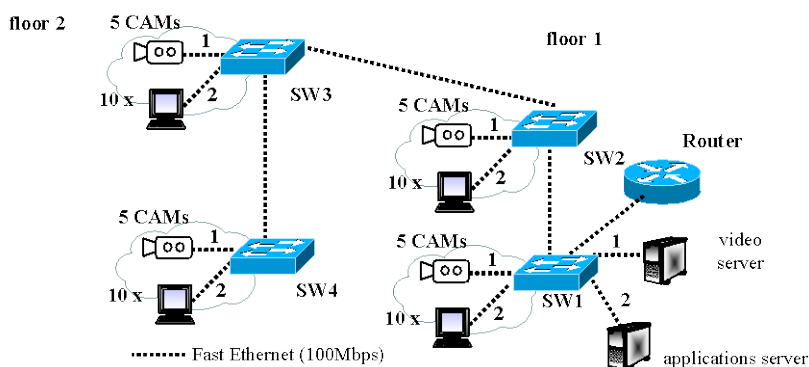
We knew that the RTT is 50 ms.

- i) Which command we use to measure such value?

- j) Afterwards we measure the RTT again and we find out another value. Why?

Answer problems 1 and 2 in the same questions sheet, and problem 3 in exams sheets. Justify your answers. The revision date will be announced in the racó Duration: 2h45. The quiz must be returned in 30 minutes.

Problema 3. (2,5 punts) FULL n.



The picture above shows the network architecture between 2 floors in a building. All links are FastEthernet Full Duplex. There are 2 VLANs configured. The numbers in the ports of the Switches show which VLAN they are configured. The other ports are configured in trunk mode. In each floor we have cameras recording video and computers. The cameras generate UDP traffic SENT TO THE Video Server. The throughput of the traffic generated by the cameras is constant and we can adjust it (fixing the resolution and the number of images captured per second). Computers use an application that opens a TCP connection and generates traffic SENT TO THE APPLICATION SERVER at the maximum speed allowed by the network.

- 3.A** Assuming that only the computers produce traffic, calculate throughput of the traffic produced by a computer in every switch. Describe where there is the bottleneck, and the mechanisms that regulate the traffic.
- 3.B** Assume that a new VLAN (VLAN3) is created, and the port where the Application Server is connected is configured in this new VLAN. Describe the changes that should be done in network configuration in order to allow the computers to access the Application Server. Repeat question 3.A with this new configuration.
- 3.C** Now assume that only the cameras generate traffic. Calculate the maximum throughput at which the cameras should be configured in order not to have losses.
- 3.D** With the conditions described in 3.A and 3.B, find out if it is possible to adjust the throughput of the cameras traffic in order the computers to send a throughput of at least 1Mbps. If it is possible, say in which case it is possible, and compute the throughput at which we should adjust the cameras.

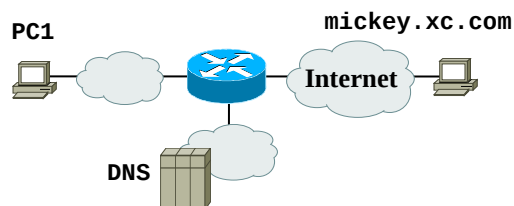
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The test counts for 2.5 points (0.25 per question). The test must be delivered after 30 minutes. All questions have at least one correct answer. A question could accept only one correct answer (UA) or any could be true or false (MA). A MA question with 1 error counts for 0.125 points, 0 points if more than 1 error.

1. **UA.** PC1 in the figure makes a ping to **mickey.xc.com**. The DNS caches in PC1 and DNS server are empty. Determine the number of IP datagrams transmitted in total to complete a ping cycle (transmit and receive one echo).



- ☐ 4
☐ 6
☐ 8
☐ 10
☐ 12

2. **MA.** In the context of Ethernet 802.3, say which statements are true.

- ☐ A switch uses ARP tables to transmit the frames
☐ The ack of the MAC protocol are 8 bytes in length
☐ If an hub is connected to three stations and a router, there are 4 collision domain in total
☐ A FastEthernet interface (for instance 100baseT) allows transmission bitrate of 10 and 100 Mbit/s

3. **MA.** In the context of WLAN 802.11, say which statements are true.

- ☐ In the frame header there are 4 MAC addresses
☐ RTS/CTS is the MAC protocol for the ad-hoc wireless networks
☐ To guarantee the detection of a collision, the minimum length of a 802.11 frame is 64 bytes
☐ It uses acks

4. **MA.** Two points at 50 km (with a propagation delay of $2 \cdot 10^8$ m/s) uses an ARQ protocol based on continuous transmission to transmit PDUs of 1000 bytes that are confirmed with ack of 20 bytes. The transmission bitrate is 10 Mbit/s. Say which statements are true.

- ☐ Without errors, the efficiency is 1
☐ A time-out of 2 ms is enough
☐ With a time-out of 3 ms and a mean number of retransmission of 1.05, the efficiency when using GBN is 0.95
☐ If it used S&W without errors, the efficiency would be less than 1

5. **UA.** Two hosts A and B establish a TCP connection where A sends data and B acks. The applications read and write very fast and the links are very rapid (approx. infinite). The capacity of each buffer (TX and RX) in A is 64kbytes, 16kbytes in B. Assuming that there are no lost and a ping between A and B gives 150 ms, determine the effective bitrate.

- ☐ 107 kbit/s
☐ 213 kbit/s
☐ 850 kbit/s
☐ 1.7 Mbit/s
☐ 3.4 Mbit/s

6. **MA.** A router with NAT/PAT and Ethernet interfaces.

- ☐ Stores ARP tables
☐ Routes the datagrams according to the IP destination address
☐ Can modify the port fields of the transport header
☐ Its routing table can have either static or dynamic entries but never both (that is, they are mutually exclusive)

7. **MA.** In TCP/UDP, say which statements are true.

- ☐ The MSS of TCP is always less than the MTU
☐ UDP uses the Nagle algorithm and the delayed ack mechanism to improve its efficiency
☐ The UDP and TCP headers are of variable length
☐ TCP is connection oriented while UDP not

8. **UA.** A laser transmitter and a photodiode receiver are connected through a 300 km of fibre cable which has an attenuation of 0.25 dB/km. The laser transmits an optical signal with a power of 0.5 W, while the photodiode has a sensible power of 10 mW. Determine how many amplifiers with a gain of 20 dB are needed.

- ☐ 0
☐ 1
☐ 2
☐ 3
☐ 4

9. **MA.** Say which of the following codifications do not have DC component.

- ☐ NRZ
☐ Manchester
☐ AMI bipolar
☐ AMI bipolar with 8 zeros substitution

10. **MR.** The signal in the figure is transmitted through a transmission channel with a bandwidth of 1 MHz. Say which statements are true

- ☐ There is no severe distortion or ISI
☐ A signal to noise ratio S/N of 20 dB is enough to guarantee a feasible transmission
☐ The transmission bitrate is 2.5 Mbit/s
☐ It is using a NRZ codification

