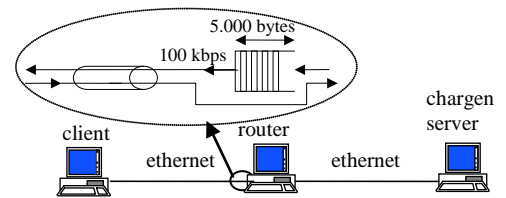


Tercer control de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		10/6/2014	Primavera 2014
NAME:	SURNAME	GROUP	DNI

Duration: 1h15m. The quiz will be collected in 30 minutes. Answer in the same exam sheet.

Pregunta 1. (4 points, each row in the table is 0,2 points) In this problems we wish investigating the TCP behavior in the corresponding lab session (see the figure). Recall that the client connects to a chargen server, which transmits at the maximum throughput allowed by the network. In this problem we shall do the following simplifications: The router transmits towards the client with a bitrate of 100 kbps (as shown in the figure). Therefore, the transmission time of a 1500B datagram from the router to the client takes **120ms**. We shall not consider the transmission time of acks. Propagation delays in the cables are 0, and the processing time of the PCs is infinite. **TCP only implements SS/CA and does not use options.** Assume that **RTO=360ms** and the advertised window is the maximum that can be used. Besides, assume that TCP is as efficient as possible. We shall denote data segments as s_1, \dots and acks that confirm them as a_1, \dots . Fill the following table. The meaning of the columns is the following:



- First column is time in 120ms intervals. The time origin is the transmission time of s_1 .
 - SS/CA: shows if the server window is in Slow Start/Congestion Avoidance.
 - ssthresh and cwnd: give their value (in segments) in server side.
 - Segment Tx: shows the segments (s_1, \dots) transmitted by the server. Note that they arrive instantaneously to the router.
 - Ack Tx: shows the ack send by the client. Note that they arrive instantaneously to the server.
 - Q: shows the segments in the queue of the router, in the order they are stored (the one on the left is the one being transmitted).
- Assume that packets are in the queue until completely transmitted. Note that there is room for 3 packets.
- Losses: shows the lost segments (because the router cannot store them).

t/120 ms	SS/CA	ssthresh segments	cwnd segments	Segments Tx	Ack Tx	Q	Losses
0	SS	∞	1	s_1		s_1	
1	SS	∞	2	s_2, s_3	a_1	s_2, s_3	
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

Tercer control de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		10/6/2014	Primavera 2014
NAME:	SURNAME	GROUP	DNI

Duration: 1h15m. The quiz will be collected in 30 minutes. Answer in the same exam sheet.

Pregunta 2. (2,5 points) We have to send **an electronic mail which includes an attachment** that is a JPEG image. We send it from the webmail service of the FIB (located at webmail.fib.upc.edu) to a user called alumneXC from the domain google.com (alumneXC@google.com). In this scenario, and assuming that the cache of the local DNS server **contains** all records needed, answer the following questions:

- a) The first step to send the message is to write its contents on a HTML form and send it to the server. Explain what HTTP commands will server and client exchange. For each of them, indicate clearly the method in the request line (you can suppose any required data for the contents of the message), as well as how many TCP connections will be required in the case that they use the non-persistent model of HTTP/1.0. The format of the HTML form is the following:

```
<FORM action="accions/registrar.php" method="post">
<INPUT type="text" name="nom">
<INPUT type="submit" value="Send">
</FORM>
```

- b) The following step is to encapsulate the contents of the form in a message in the format RFC822/RFC5322 (Internet Message Format) and to send it using SMTP. Use the following table to mark what properties of the message are parts of the message itself and/or of SMTP commands.

	SMTP commands	Internet Message Format
Source Address		
Destination Address		
Subject		
Sending Date		

- c) The domain of FIB has a machine (relay.fib.upc.edu) that is configured as a local SMTP outgoing server for all the machines of the faculty. The web server sends the message, using its HTTP<->SMTP gateway capabilities (transform from one protocol to the other), to the SMTP server of the destination domain (google.com). Considering that DNS works on top of UDP, how many TCP connections will be established and between what machines to deliver the message?

- d) The email message contains an image as an attachment. Explain what message headers, of what type and with what associated value will be required to transport the binary data of the image together with the text body of the message.

Tercer control de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		10/6/2014	Primavera 2014
NAME:	SURNAME	GROUP	DNI

Duration: 1h15m. The quiz will be collected in 30 minutes. Answer in the same exam sheet.

Quiz. (3,5 points) All questions are multi-answer: 0,5 points if correct, half if one error, 0 otherwise.

1. A user wants to download a web page consisting of a single file containing a formatted text from a server, identify which method or methods are faster

- ☐ HTTP no persistent
- ☐ HTTP persistent
- ☐ HTTP persistent with pipelining
- ☐ It cannot be know because it depends on the length of the text

2. Identify which of the following commands are used by SMTP

- ☐ HELO
- ☐ GET
- ☐ RCPT TO
- ☐ QUIT
- ☐ POST

3. MIME

- ☐ It is a basic format to codify text in ASCII exclusively
- ☐ It can be used to send mails
- ☐ It can be used in webs
- ☐ It is a protocol to send mails substituting SMTP when the message contains images, videos, audios, etc.

```
150.214.5.135.80 > 172.168.137.128.39599: . 2921:4381(1460) ack 437 win 5240
150.214.5.135.80 > 172.168.137.128.39599: . 4381:5841(1460) ack 437 win 5240
172.168.137.128.39599 > 150.214.5.135.80: . ack 2921 win 36240
150.214.5.135.80 > 172.168.137.128.39599: . 5841:7301(1460) ack 437 win 5240
150.214.5.135.80 > 172.168.137.128.39599: . 7301:8761(1460) ack 437 win 5240
172.168.137.128.39599 > 150.214.5.135.80: . ack 4381 win 36240
150.214.5.135.80 > 172.168.137.128.39599: . 8761:10221(1460) ack 437 win 5240
(1)
...
172.168.137.128.39599 > 150.214.5.135.80: . ack 614268001 win 36240
150.214.5.135.80 > 172.168.137.128.39599: F 614268001:614268001(0) ack 437 win 5240
172.168.137.128.39599 > 150.214.5.135.80: F 437: 437(0) ack 614268002 win 36240
150.214.5.135.80 > 172.168.137.128.39599: . ack 438 win 5240
```

4. Considering the above tracedump and knowing that the RTT is 100 ms and the applications read the buffers faster than TCP sending them, identify the correct statements

- ☐ The trace has been captured in the server (port 80)
- ☐ During the first part of the trace (before (1)), TCP is using Slow Start
- ☐ The three-way handshaking lasted 300 ms
- ☐ Assuming no losses, the client (port 39599) downloaded the file in less than 1700 seconds

5. What do TCP and UDP have in common?

- ☐ They are connection oriented protocols
- ☐ They are protocols of the transport layer
- ☐ They use ports to identify applications
- ☐ They define the parameter MSS as maximum size for encapsulating data

6. In TCP, identify the correct statements

- ☐ It is a protocol like Stop&Wait
- ☐ Its transmission window depends on the congestion window and the free space in its transmission buffer
- ☐ The value of the congestion window changes each time an ack confirms new segments
- ☐ The RTO time-out depends on RTT

7. In ARQ systems

- ☐ Without losses, Stop&Wait, Go-Back-N and Selective Retransmission obtain 100% efficiency independently of the propagation time or the length of a PDU
- ☐ If the propagation time is 1 ms and the duration of a PDU and ack is 1 ms too, the optimal window is 2 PDUs
- ☐ Independently if there is losses or not, Go-Back-N and Selective Retransmission always reach 100% efficiency
- ☐ A continuous transmission protocol with window set to 1 is equivalent to the Stop&Wait