Term Exam 1, CN 4th/April/2019   Universidad de León, EIII   A
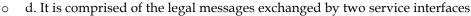
- *All electronic devices such as mobile phone, tablets, smart watches, etc must be turned off before the exam sheets are handed to students*

1. Explain the *traceroute* Linux utility by responding to the following questions. Employ as rich and accurate a terminology as possible:

    a. What it serves for
    b. The protocol stack it uses
    c. The relevant fields in the exchanged PDU's
    d. Explain how the initiator matches each packet sent to the received response

2. Calculate how much time it takes to transfer a file which size is 1499 Bytes from a host A to a host B assuming a direct Ethernet connection between them. The distance between the sender and the receiver hosts is 2000 m and the transmission speed is 10 Mbps. Assume that the sending application at host A uses the UDP transport protocol.

    The *payload* size of each resulting IP packet must be a multiple of 8 Bytes, thus, you must make sure that the amount of Bytes that you encapsulate in each *possible* IP packet must be divisible by 8 Bytes. This affects all the sent IP packets, except the first in case only 1 IP packet is to be sent since it is also the last; this requirement does not apply to the last sent packet.

    If multiple packets are to be sent back-to-back, each must be encapsulated into a separate frame, and in that case, if more than one frame is necessary, the sender will necessarily have to wait for 96-bit times before sending the next frame.

    a. Depict the resulting protocol stack
    b. Calculate the total time that it takes to have the file fully transferred from host A to host B
    c. Calculate the throughput attained
        - *Size of a UDP datagram header is 8 Bytes*
        - *Size of an IP packet header is 20 Bytes*
        - *Ethernet Datalink header is comprised of:*
            o *Dest. Address (DST MAC): 6 Bytes*
            o *Src. Address (SRC MAC): 6 Bytes*
            o *Ethertype: 2 Bytes*
        - $MTU_{Ethernet}$ *= 1500 Bytes*
        - *The Physical-layer Ethernet header has two sections:*
            o *Preamble or prolog: 64 bits*
            o *Epilog containing the CRC: 32 bits*
        - *The inter-frame gap is 96 bit times*

3. Cite an Internet Application that is elastic from the standpoint of application requirements. Explain the meaning of the word elastic in this context.

4. Contrast the addressing used in LANs vs. that used in Internet

5. Contrast the Internet and the OSI network architectures

6. Develop the client protocol stack and the server protocol stack corresponding to an ssh connection. (The TCP port used by the server is the Well Known Port no. 22). Expand the multiplexing/encapsulation hierarchy from the standpoint of the server, *i.e.,* you must detail all the addresses and multiplexing keys involved in this communication when the server receives a new frame from the client.

7. The following questions are related with the Libpcap library:

    a. Which service interface does it provide access to?
    b. The programs that use this library, do they run in kernel or in user mode? Explain why.
    c. Why is it convenient to write network programs against this library?

8. [M] Tick which of the following statements about the concept of peer-to-peer interface are true
    o a. It's a term that has the same meaning as protocol
    o b. It's a term that has the same meaning as service
    o c. It is comprised of the legal messages exchanged by two protocol entities

- d. It is comprised of the legal messages exchanged by two service interfaces
- e. The communication medium between any two layers in two communicating hosts is any kind of physical link
- f. The communication medium between any two layers in two communicating hosts is a virtual link except in the case of the physical layer

Table 2.2 4B/5B Encoding	
4-Bit Data Symbol	5-Bit Code
0000	11110
0001	01001
0010	10100
0011	10101
0100	01010
0101	01011
0110	01110
0111	01111
1000	10010
1001	10011
1010	10110
1011	10111
1100	11010
1101	11011
1110	11100
1111	11101

9. Calculate the connectivity of 4 separate networks, each containing 21 nodes.

10. The Shannon's channel capacity of a link is 1Mbps. Explain what that means.

11. Depict in a timing diagram the transmission of the bitstream 010100100000 using the NRZ and Manchester line encodings.

12. Using the bitstream from the preceding question, depict the timing diagram corresponding to the 4B/5B + NRZ-i encoding

13. Design a code based on the even parity of 1's. Data words use 3 bits and the resulting codewords use 4 bits. Calculate the Hamming distance of this code and tell how many errors this code can detect.

14. A datalink protocol uses a CRC that is based on the following generator polynomial: $C(x) = x + x^4$

    a. Calculate the CRC polynomial resulting when transmitting the following data: (Leftmost bit is the MSB): 1011101
    b. What operation is executed at the receiver for checking whether some error took place? Calculate the result of that operation and tell whether or not an error took place (That is, probabilistically).
    c. If the execution of the operation you explained on section b. of this question reports that no error took place, what interpretation should be derived from this fact?

15. Explain the 10 Mbps Ethernet technology and CSMA/CD

16. Which of the following statements about the transparency mechanism included in the HDLC protocol are true:
    □ a. It's based on the use of sentinels
    □ b. Sentinels are the EBCDIC characters SOH and EOH
    □ c. It consists of bit stuffing
    □ d. It consists of bit stuffing only when the data to transmit contain the special sequence SOH/EOH
    □ e. It consists of transmitting a DLE character before sending any special character

17. Assume you want to transmit a block of data using the BiSync protocol and the last two Bytes in that block are the characters DLE (one byte) then character ETX (one byte). Which of the following sequences of bytes can be sent by the transmitter right before the CRC? (The format of the BiSync frame specifies that payload is to be transmitted right before the CRC).
    □ a. [DLE] [ETX]
    □ b. [DLE] [ETX] [DLE] [ETX]
    □ c. [DLE] [DLE] [DLE] [ETX] [ETX]
    □ d. [DLE] [DLE] [ETX] [DLE] [ETX]
    □ e. [DLE] [DLE] [DLE] [DLE] [ETX]
    □ f. [DLE] [DLE] [DLE] [ETX]
    □ g. None of the options included above

18. [M] Which of the following layer functions belong to the datalink layer

    - a. Maintaining an acceptable level of end-to-end quality
    - b. Building frames that will encapsulate a specific type of upper-layer payload
    - c. Properly delimiting the standard fields that comprise a frame
    - d. Turning the frame's bits into signals appropriate for transmission (Line encoding)
    - e. Adding redundancy to the frame that allows the receiver to establish whether or not some error took place
    - f. Accessing the physical medium in an orderly manner that create no problems to the rest of network elements connected to it, etc.