

Computer Network Homework 2

You are given 3 cases and 3 problems below, You are expected to select one case out of the three and solve all the problems according to the case you selected.

Cases

C1- You are a network engineer who has a job of building a communication network for a company whose offices are located in different cities.

C2- You are an IT manager who is responsible for building and managing a university network.

C3- You are a CEO of a company whose employees are multinational. That is, all employees are living in different countries and you need a network to distribute tasks and to arrange meetings.

Assumption Table

Cases	Time	Money	Error Rate of Channel	Data needed to transfer per sec	Channel capacity
C1	Fast (4k)	Normal budget (3)	Low risk (%10)	50 Kilobyte	12Kbps
C2	Very Fast (5k)	Tight budget (1)	Almost No risk (%1)	1500 Byte	39,5bps
C3	OK (2k)	Big budget (5)	High risk (%35)	12,5 Megabyte	3,4Mbps

Problems

Problem 1: In data link layer, selecting protocol.

a- How many protocols are there in the data link layer? Why is only one protocol not enough for data link layer? What are the differences between the protocols?

b- Which one is best for your case? Please explain How to implement it and why it is needed.

c- Please verify the protocol. Assign frame size and calculate how many bits are risky, how many bits are needed as check bit and what the length of codeword should be.

Problem 2: The Channel Allocation Problem

a- How to allocate the broadcast channel to multiple users in your network? Please define users in your network. Do you have channel allocation problem? What do you think about solving this problem?

b- Which channel allocation method is best for your case? Please give detailed explanation with a scenario.

c- According to frame size (which you assigned in 1c) Calculate the mean time delay.

Problem 3: Multiple Access Protocols

a- Consider about Point to point link and broadcast link. What do you think about these terms? Which one is needed for your case?

b- Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer.

c- Recall that with the CSMA/CD (Carrier-sense multiple access with collision detection) protocol, the adapter waits $K \times 512$ bit times after a collision. How long does the adapter wait until returning to step 2? (For C1, $K=10$, for C2 $K=100$, for C3 $K=1000$)

Question: Slotted Aloha

Suppose four active nodes — nodes A, B, C and D— are competing for access to a channel using slotted ALOHA. Assume each node has an infinite number of packets to send. Each node attempts to transmit in each slot with probability p . The first slot is numbered slot 1, the second slot is numbered slot 2, and so on.

a. What is the probability that node A succeeds for the first time in slot 5?

b. What is the probability that some node (either A, B, C or D) succeeds in slot 4?

c. What is the probability that the first success occurs in slot 3?

d. What is the efficiency of this four-node system?