

Physical layer

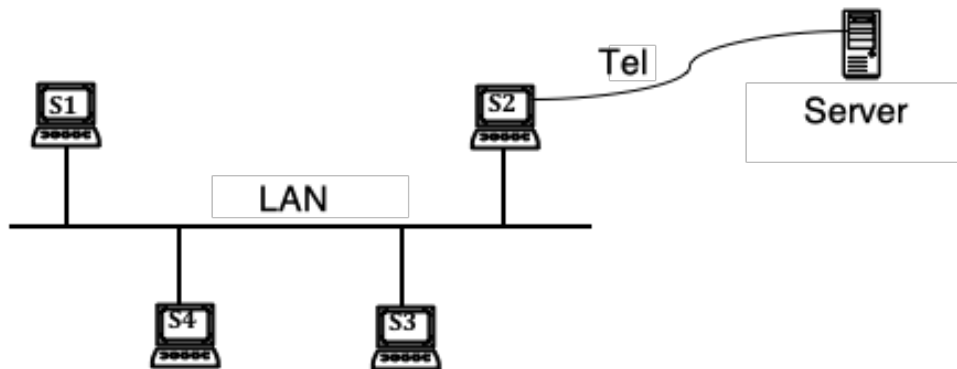
Exercise 1 We want to transfer a 320 KByte text file from one computer to another. Each character of the file is coded on 08 bits. The transmission is asynchronous with a Start bit, a Stop bit and a control bit on a line with a throughput of 9600bits/sec.

1. Calculate the durations T_1 and T_2 of transfer of this file such as :
 - duration T_1 : without taking into account the Start, Stop and control bits.
 - duration T_2 : taking into account the Start, Stop and Control bits.
 - Calculate then Comment the Ratio $R = \frac{T_2 - T_1}{T_2}$
2. Knowing that in the previous case the valence of the signal used was 2. Calculate the total transfer delay T_3 if we switch to a valence of the signal equal to 16.

Exercise 2 A full-duplex digital connection is established between 02 points A and B of the earth via a geostationary satellite located 36,000 km from each of the two points. A signal is emitted from A at a rate of 64 Kbits/sec and where the speed of propagation in the air is equal to 300,000 km/sec. Once the beginning of the signal has been received, B returns an acknowledgment (response).

1. Calculate the time T_1 it will take for the first bit to reach B.
2. How many bits can be sent by A before it knows that B has received the first information.
3. Knowing that station A wishes to send to B an information string of size equal to 96Kbits. Calculate the total transfer time T_2 of this chain.
4. If the connection between A and B is half-duplex, when can A know that B is not receiving.

Exercise 3 Consider the following network :



Stations S_1 , S_2 , S_3 , S_4 are linked by a local bus network offering a throughput of 10 Mbits/s. The station S_2 is connected to an Internet access server by a phone link whose frequency band is [300-3400 Hz]. Given that the line rate is 62 Kbits/s :

1. Calculate the valence of the signal,
2. Calculate the signal/noise ratio allowing the correct operation of the line, give its value in decibels.
3. Station S_1 wants to send the binary sequence [1 1 0 0 0 0 1 0 1] to station S_2 . Give the shape of the transmitted signal using Manchester and Miller coding.
4. Station S_1 wants to send the binary sequence [0 1 0 1 1 0 1 1 0 0] to station S_2 . Give the shape of the emitted signal using Differential and Bipolar Manchester coding.
5. Knowing that the coding of the signal on the telephone line uses a modulation with two phases (0 and 180°) and two amplitudes (V and 2V) :
 - Give the valence of the signal,
 - Give the shape of the signal used to send the previous string of bits from station S_2 to the Internet access server.

6. Knowing that the coding of the signal on the phone line uses a modulation with four phases (0, 90, 180 and 270°) and two amplitudes (V and 2V) :
 - Give the valence of the signal
 - Draw a diagram (circle of phases and amplitudes) representing the signals used and their corresponding codes.
 - Give the shape of the signal used to send the series of bits [001110111000101011101] from station S_2 to the Internet access server.
7. Calculate the average throughput between station S_1 and the Internet server.

Exercise 4 Four asynchronous terminals are connected to a temporal statistical multiplexer (dynamic MPX) integrating a buffer memory and having a transmission speed of 19200 bits/sec. Knowing that the throughput of one of the terminals is 9600 bits/sec and the others 4800 bits/sec each, you are asked to calculate the effective throughput D_e at the output of the multiplexer and the duration of a frame T_s by studying the different possible cases or :

1. 02 terminals are only connected at the same time.
2. Only 03 terminals are connected at the same time.
3. The 04 terminals are connected at the same time.

Good luck