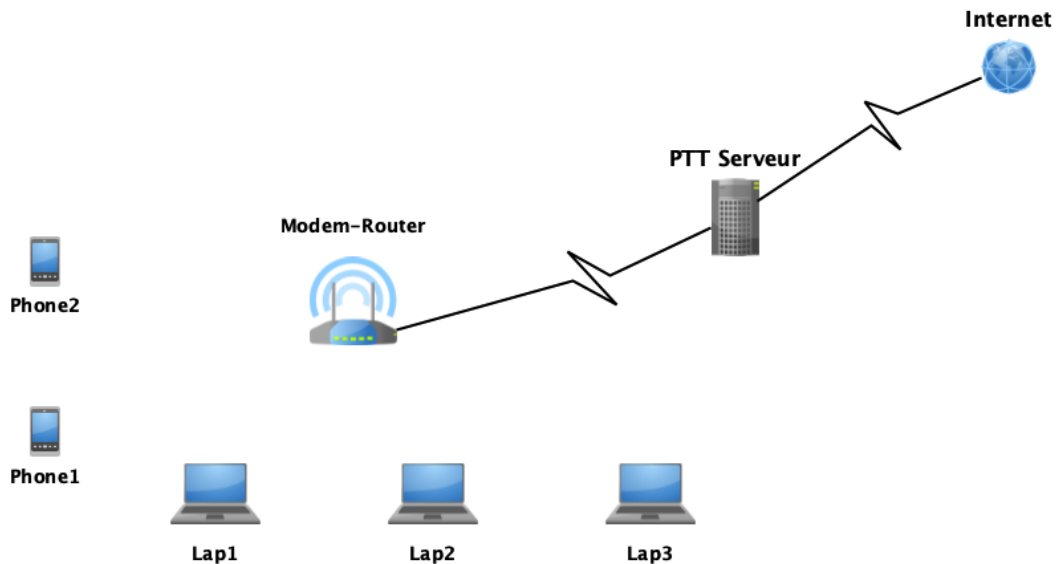


Resit Exam

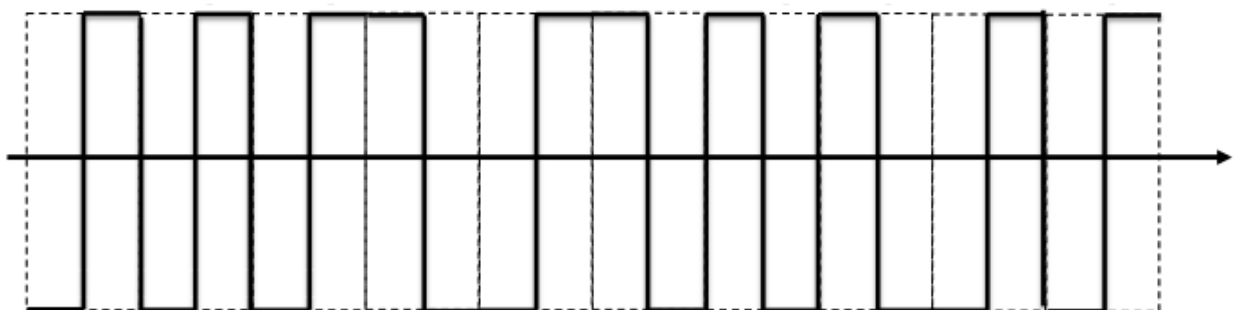
Consider the network represented in the following figure :



A Modem-Router connects three laptops and two telephones via a wifi network. The Modem-Router is also linked to a PTT server by a 32 Mbit/s ADSL link.

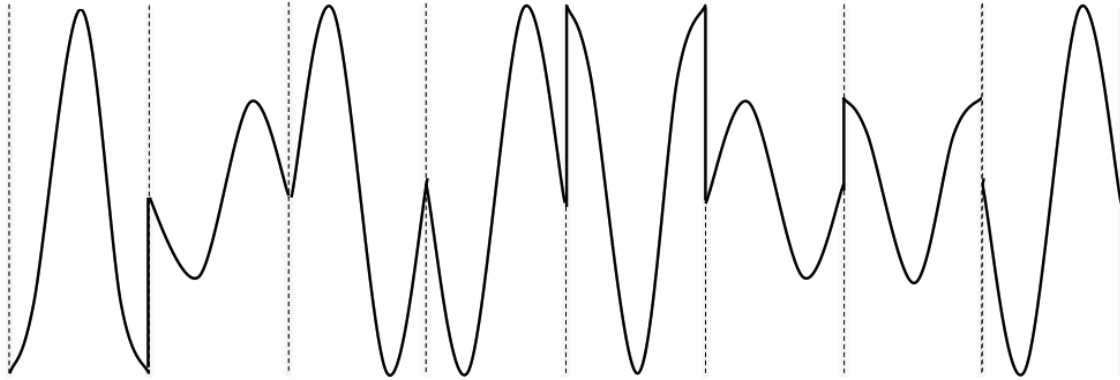
Exercise 1 Physical layer (10 pts : 2 + 2 + 2 + 1 + 3 + 2)

1. A 1 GByte file was transferred from Lap1 to the PTT server in 4 minutes and 24 seconds. Deduce the throughput of the Wifi network.
2. Lap2 receives the following signal :



- What kind of encoding do we use ?
- Deduces the binary string sent.

3. The modem-Router receives the following signal from the PTT server :



It decodes the hexadecimal string "4709E8" :

- What kind of modulation do we use ?
- Draw the modulation diagram used.
- Calculate line modulation rate.

Exercise 2 Data Link layer (10 pts : 3 + 2 + 5)

The LLC sub-layer of the Wifi network uses the HDLC protocol seen in the course, with the following characteristics :

- Generator polynomial $G(x) = x^6 + x^7 + x + 1$
- The number of this frame = 0
- The modem router has nothing to send to Lap2,
- The window width = 8 (0..7)
- A host can send 4 frames and wait for the response.
- The address field is put to 0.
- The P/F bit = 0;

1. Lap2 wants to send the hexadecimal string "A32C0B" to the Modem-Router, Give the CRC code corresponding to this frame.
2. Give the sent frame in hexadecimal.
3. The Modem-Router wants to send 10 frames to Lap2. Knowing that an error is occurred on the fifth frame, give the different frames exchanged between the two machines.

Good Luck

Corrigé type

Exercise 1 Physical layer (10 pts : 2 + 2 + 1 + 3 + 2)

1. Throughput of the Wifi network

$$\text{Transfer time} = 4\text{m } 24\text{s} = 264 \text{ seconds} = \frac{2^{30} \times 8}{\text{ThrWifi}} + \frac{2^{30} \times 8}{2^5 \times 2^{20}}$$

$$\frac{2^{30} \times 8}{\text{ThrWifi}} = 264 - 2^8 = 264 - 256 = 8$$

$$\text{ThrWifi} = \frac{2^{30} \times 8}{8} = 1\text{Gbits/s}$$

Throughput of the Wifi network = 1GBits/s.

2 pts

2. – The used encoding is Differential Manchester

1 pts

– The binary string sent ; 1001110010 or 0001110010

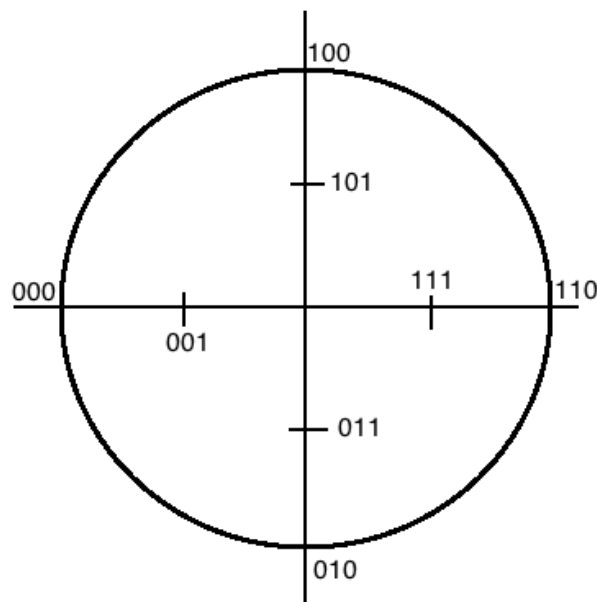
1 pts

3. – Kind of used modulation : Combined modulation : PSK + ASK

1 pt

– modulation diagram

3 pts



– Valence $V = 8$;

$$\text{Modulation rate} = \text{Throughput} / \text{Log}_2(V) = \frac{32 \times 2^{20}}{3} = 10,66 \text{ MBauds}$$

2 pts

Exercise 2 Data Link layer (10 pts : 3 + 2 + 5)

The LLC sub-layer of the Wifi network uses the HDLC protocol seen in the course, with the following characteristics :

- Generator polynomial $G(x) = x^{16} + x^7 + x + 1$
- The number of this frame = 0
- The modem router has nothing to send to Lap2,
- The window width = 8 (0..7)
- A host can send 4 frames and wait for the response.
- The address field is put to 0.
- The P/F bit = 0 ;

1. Lap2 wants to send the hexadecimal string "A32C0B" to the Modem-Router, Give the CRC code corresponding to this frame.

$$G(x) = x^{16} + x^7 + x + 1$$

$$M(x) = x^{23} + x^{21} + x^{17} + x^{16} + x^{13} + x^{11} + x^{10} + x^3 + x + 1$$

0.5 pts

$$r = 16$$

$$M(x) \times x^r = x^{39} + x^{37} + x^{33} + x^{32} + x^{29} + x^{27} + x^{26} + x^{19} + x^{17} + x^{16}$$

0.5 pts

$$\frac{M(x) \times x^r}{G(x)} = x^{23} + x^{21} + x^{17} + x^{16} + x^{14} + x^{13} + x^{12} + x^{11} + x^{39} + x^6 + x^4 + x$$

$$R(x) = x^{15} + x^{13} + x^8 + x^7 + x^6 + x^5 + x^4 + x^2 + x = 1010000111110110_2 = A1F6_{16}$$

2 pts

2. The sent frame in hexadecimal;

7E 00 00 A3 2C 0B A1 F6 7E

2 pts

3. The Modem-Router wants to send 10 frames to Lap2. Knowing that an error is occurred on the fifth frame, give the different frames exchanged between the two machines.

Modem-Router		Lap2	
SABM	→		
	←	UA	0.5 pt
I_0	→		
I_1	→		
I_2	→		
I_3	→		0.5 pt
	←	RR,04	0.5 pt
I_4	→		
I_5	→		
I_6	→		
I_7	→		0.5 pt
	←	SREJ,04	1 pt
I_4	→		
I_0	→		
I_1	→		0.5 pt
	←	RR,02	1 pt
DISC	→		
	←	UA	0.5 pt