Computer Networks

Tutorial 2:

Bit Coding and Representation of IP Addresses

Scope of This Tutorial

- Asynchronous vs synchronous transmission
- Manchester and MLT-3 encoding
- Representation of IPv4 & IPv6 addresses

Asynchronous vs Synchronous Transmission

Asynchronous transmission

- No data on link ⇒ no signal on link & no energy spoiled
- Beginning of the start-bit starts sampling input line with predefined frequency
- Data bit is sampled in the middle of its duration

Synchronous transmission

- Clock signal is transmitted all the time
  ⇒ immediate data reception, thus better efficiency
  ⇒ energy is spoiled while data in not transmitted
- Clock signal together with data
  ⇒ preamble is needed for clock synchronisation, thus lower efficiency
  ⇒ no energy spoiled

Exercise 1

There is 1 KB data to be sent at once.

A. What is efficiency of asynchronous transmission?

B. What is efficiency of synchronous transmission (the frame header length is 20 B)?

Efficiency = (data bits / all sent bits) * 100%

The answer is:

A. We assume 1 start-bit, 1 parity-bit, 2 stop-bits.

Efficiency = (8 / (8+1+1+2)) * 100% = 66.67%

B.

Exercise 2

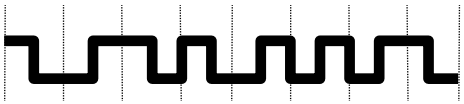
There is 1 KB data to be sent, however the bytes are produced in 1 s intervals.

A. What is efficiency of asynchronous transmission?

B. What is efficiency of synchronous transmission (the frame header length is 20 B)?

Manchester and MLT-3 Encoding

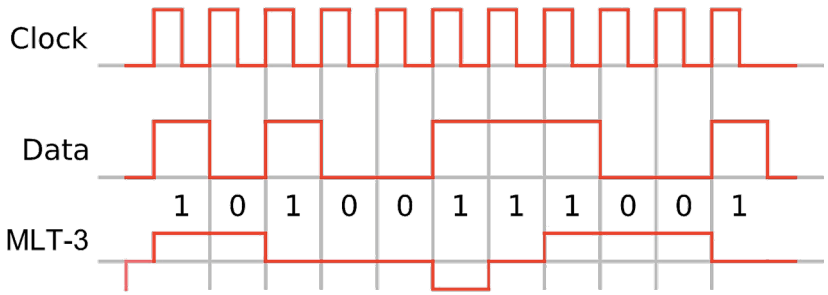
Manchester



1 ↑ in the middle of bit frame
0 ↓ in the middle of bit frame

J – no edges in the beginning and in the middle
K – an edge in the beginning no edge in the middle
J & K symbols are used for frame synchronization

MLT-3



Exercise 3

Draw the signal shape of Manchester encoding for the following bit patterns

A. 1111 0000

B. 1010 1010

Exercise 4

Draw the signal shape of MLT-3 encoding for the following bit patterns

A. 1111 0000

B. 1010 1010

Representation of IP Addresses

Look for an IP address calculator – there are many such tools in the Internet

Exercise 5

For the following IPv4 subnets, indicate the smallest and the largest IPv4 address inside the subnet:

- 8.0.0.0/8

  The answer is: 8.0.0.1 – the smallest address 8.255.255.254 – the largest address
  The subnet mask has 8 bits, thus it is: 1111 1111.0000 0000.0000 0000.0000 0000
  A host cannot get address composed from all 0's or all 1's – they are reserved
  8.0.0.0 is an unknown source or default destination, 8.255.255.255 is the broadcast address

- 172.12.0.0/16

- 200.123.42.128/25

- 12.1.2.0/13

Exercise 6

For the following IPv6 subnets, indicate the smallest and the largest IPv6 address inside the subnet:

- FE80::/64

  The subnet mask is: FFFF:FFFF:FFFF:FFFF::0
  The answer is: FE80::1 – the smallest address
  FE80::FFFF:FFFF:FFFF:FFFE – the largest address

- 2001:db8::/48

- 2001:6a8:3080::/48