Tutorial n°2
Communication supports – link operations

Exercise 1: Half Duplex communications

Example 1

We consider two stations A and B, linked by a half-duplex transmission line, offering 1 Mbps throughput. Propagation time of a message through the line is equal to 10 ms. The length of a packet (generated by A or by B) is equal to 10 kbits. How many messages each station will transmit within a 1s time window in the two following situations:

(1) A and B transmit one packet in rotation

(2) A transmits all its packets before B. At the end of the second, A and B must have transmitted the same number of packets (±1).

Example 2

We consider a perfect satellite link at 64 kbps, used to transmit 512 Byte frames in one way (from earth to satellite). The other way (from satellite to earth) is used to return very short acknowledgment message (ACK). Propagation time from earth to satellite is 270 ms.

Compute the maximal link throughput assuming that the earth emission window is limited to 7 frames. (This means that earth can transmit at maximum 7 frames until receiving an ACK).

Exercise 2: Communication interfaces

Parallel Transmissions

How many wires are necessary to establish a parallel transmission of 32 bit- machine words, in the case of common return, and in the case of separated returns?

DTE

Can a DTE be connected directly to an operator's network?

Exercise 3: Synchronous and Asynchronous transmissions

Example 1

We consider a link where the receiver clock is synchronized only at the beginning of the transmission. A source has a 1 000 Hz (1 000 bps) clock, a stability of 0.01. To correctly read a bit at the receiver, the maximum tolerable clock drift is 10% of the bit duration.

In this case, how many bits can be transmitted between the bit “start” and the bit “stop”?

Example 2

We consider a data source providing 7 bit ASCII characters, which transmits through a line that has a capacity of B bps. Give the expression of effective data throughput in the two following situations:

(1) Asynchronous transmission: each character has 2 bits “stop” and 1 bit “parity”

(2) Synchronous transmission: a frame contains a part “control” (48 bits) and a part “information” (128 bits). The latter is formed by ASCII characters of 8 bits each (including the bit “parity”).

Exercise 4: **Frequency multiplexing**

We consider the transmission network AMPS (“Advanced Mobile Phone System”). This system uses the bandwidth 824 – 849 MHz for transmission, and the bandwidth 869 – 894 MHz for reception. Each user occupies a 30 KHz bandwidth in each direction. Among the available channels, 42 are used for control, in each direction.

How many users can connect simultaneously their cellular phones to this network in the two following situations:

(1) There is no frequency guard-band

(2) There is a 5 MHz total frequency guard-band in each direction.