Assignment 2

Due February 27^{th} 2009

Errors, error correction, frame management

The problem

For this assignment, your task is to implement a simulator of a hardware driver (NIC) for one local line unidirectional. The lines are point–to–point (the NIC is at one end; another identical NIC is at the other end which is located at an unknown but small distance).

You need to implement the receiver and the manager at the near end **NIC** and the transmitter at the far end **NIC**.

The basic components of a card are 2 buffers (input and output) and 3 processors: receiver, transmitter and manager. Each of these processors is driven by its own clock ticking at a rate of 50 GHz.

The performance of the manager is the object of this assignment. You need to implement the interface between the receiver and the manager: the receiver puts a whole frame (correct or not) into the input buffer and interrupts the manager. The role of the receiver ends here.

The manager assumes that the frame is an 802.3 frame:

Preamble	8 bytes
Destination Address	6 bytes
Source Address	6 bytes
Length Field	2 bytes
Data Field	Between 46 and 1500 bytes
Pad Characters	only to make the min. 46 bytes
Frame Check Sequence	4 bytes
Min Frame Length	64 bytes
Max Frame Length	1518 bytes

None of the fields include the preamble.

You will need to implement two versions of the manager: $\mathcal{M}_1$ and $\mathcal{M}_2$.

$\mathcal{M}_1$

The $\mathcal{M}_1$ performs two tests on the frame:

Length test: the frame length must match or is unacceptable.

Checksum test: the checksum must match.

If a test fails, $\mathcal{M}_1$ applies BEC.

$\mathcal{M}_2$

In this scenario, the transmitter sends an (11,5) block code. CRC is used (you pick the generator). $\mathcal{M}_2$ applies FEC first; if it fails, it asks for a partial retransmission by indicating the first block it wants to see again (and the transmitter obliges by resending only the tail of the frame starting with the named block).

The 4 byte frame checksum should be ignored unless you find some use for it.

Control communication

Your transmitter (at the opposite end of the link) will transmit one frame at a time and will wait for an acknowledgment. If the acknowledgment is negative, the frame will be retransmitted as indicated.

If the acknowledgment is positive (frame accepted), the transmitter will immediately start transmitting a new frame.

The feedback to the transmitter will come directly from the manager through a special channel called magic, which works instantaneously and is error–free. There is no need to set up a format for passing messages; the information just happens to become known to the transmitter.

Assignment requirements

A simple simulator needs to be written; its only randomised part, the frame arrivals, can be done in any reasonable way.

Your solution must satisfy these requirements:

1. All your clocks will operate at their individual rates (there will be at least 3 different rates: 1 receiver, 1 transmitter and UTC). The manager uses UTC time (probably does not use any timer at all).

2. You will simulate successfully the transfer of at least 10^5 bits per simulation run.

3. The manager is the important part now. The main outcome of the assignment is to find out what is the overhead of $\mathcal{M}_1$ and $\mathcal{M}_2$ measured as the ratio: $\frac{bitssent - bitsaccepted}{bitssent}$. Remember that any redundant bits are overhead by definition.

4. A demonstration will be necessary to get credit for the assignment.