EEE 536 – INTERNET ARCHITECTURE AND PROTOCOLS
HOMEWORK 1

due Oct. 27 (in my mailbox before 5pm, submissions afterwards by Oct. 30, 5pm will be accepted with a 20% penalty)

1. (40 points) Consider a 10 Gbps Ethernet link supporting Energy Efficient Ethernet. The link parameters are

$$T_s = 2.5N\mu s, T_w = 5N\mu s, N = 1,2,..., \frac{P_A(\text{power in A,S,W states})}{P_L(\text{Power in L state})} = 10$$

for some parameter N representative of the variability in manufacturer's implementation. We are going to compare and contrast with simulations (possible using Matlab code if you wish) the following four coalescing schemes as a function of N:

- Ordinary Ethernet (method OE)
- Timer-based coalescing in which the first frame in the LPI mode will start service after T seconds (described in detail in class, will ake up after $T - T_W$. Use two values for $T = 100\mu s, 1ms$ (Methods TC100micros,TC1ms)
- Frame-based coalescing in which the link will wake up and subsequently start service after accumulating $N_{\max}$ frames. Use two values of $N_{\max} = 10,100$ (Methods FC10, FC100)
- The hybrid of the previous two, whichever condition is first satisfied the link will wake up (Methods TC100microsFC10, TC100microsFC100, TC1msFC10, TC1msFC100).

The packet arrival process is assumed to be a Poisson process with parameter λ and packets are distributed according to an expoential distribution with mean 800 Bytes and therefore the load ρ on the link is given by

$$\rho = \frac{\lambda \cdot 800 \cdot 8}{10\ Gbps} < 1$$

Tabulate the following quantities for all the 9 methods described above using a simulation of $5\ 10^6$ generated frames starting initially with a zero queue for three values of $\rho = 0.3, 0.6, 0.9$ and for three values of $N = 1,4,16$.

- Mean waiting time $E[W]$
- 99 percentile waiting time $W^{(99)}$: 99% of the frames encounter a delay less or equal to this number.
- Percentage power saving relative to OE

Comment on the results.