Universidad de León
Bachelor Degree on Computer Science and Engineering
Course on Computer Networks

Weekly Homework no. 4 (WH$_4$-Lecture)

Note that this WH covers only the material given in the Lecture of Thursday 16th – April-2020. ***WH$_4$-Practice*** *will be published on Wednesday 22nd-April-2020.*

Exercises and examples about the lectures

1. **BySinc and HDLC datalink protocols offer a mechanism known as transparency.** This mechanism detects the presence of the sentinels used for delimiting the datalink header fields. If the payload given to the datalink protocol contains the bit pattern corresponding to a sentinel, the transparency mechanism ensures that it won't confuse the receiver. Respond to the following questions about the Ethernet technology:

    a. Does Ethernet use sentinels?

    No sentinel is specified in Ethernet.

    b. Explain how an Ethernet receiver becomes aware about the end of an Ethernet frame

    The electrical signal's extinction marks the end of an Ethernet frame

    c. Protocol P is using an Ethernet for transmission, is P allowed to submit any payload to the Ethernet datalink or some bit patterns are prohibited?

    No bit combination is prohibited in Ethernet: any combination of bits that honors the MTU is acceptable.

2. **An original Ethernet system uses a transmission speed of 10Mbps** (10M bits/s). If the cable length is the maximum acceptable (2500 m), then the resulting Rtt is 51,2μs.

    a. Calculate how many bits can be transmitted in the period of time of the Rtt.

The transmission rate (bits/s) times the duration of time of a transmission (s) yields the number of bits that were transmitted in that time:

$$10\,{}^{Mbits}/_{s} \times 51{,}2\ s = 10 \cdot 10^{6}\,{}^{bits}/_{s} \times 51{,}2\ s$$

$$512 \cdot 10^{6} bits = 512 \cdot 10^{6} bits \cdot {}^{1M}/_{2^{20}} = 488{,}281 Mbits$$

b. The collision detection (CSMA/CD) mechanism requires that an Ethernet not transmit a frame length less than 512 bits.

This is true.

c. Explain the reason for this minimum frame length.

An Ethernet frame which length is less than 512 bits, can undergo a collision that might pass unnoticed by the transmitter.

d. What adverse effect is derived when a transmitter doesn't comply with the preceding specification.

When the transmitter transmits a frame length less than 512 bits, it is detaching too early from the medium and some collisions will not be detected by it. The overall result is that the transmitted frame was corrupted by a collision and the transmitter will not retry its transmission.

3. **As for the Exponential Backoff algorithm which we introduced in the** lecture:

a. What is Ethernet's *Channel Capture effect?*

The Channel capture effect represents the fact that when a number of hosts are involved in a collision, the host that has undergone the *least* number of collisions is the one which *most likely* will win the backoff.

b. An Ethernet interface E_1 has undergone 1 collisions in its attempt to transmit a frame A; at the same time, an Ethernet interface E_2 has undergone 3 collisions in its attempts to transmit frame B. After the last collision, both hosts execute *Exponential Backoff,* whereby we ask you to compute the probability that E_1 wins the backoff.

E_1 1 collision; $2^1 = 2$ ---> {0,1}
E_2 3 collisions; $2^3 = 8$ ---> {0,1,2,3,4,5,6,7}
All cases card(E_1 x E_2) = 2 x 8 = 16, this is the number of possible cases

- E_2 only wins the backoff when it obtains a 0 and E_1 obtains 1
prob(E_2 wins) = 1/16 = 0,062500

- prob(E_1 and E_2 obtain the same value) = prob(ties)
prob(E_1 gets 0 and E_2 gets 0 | E_1 gets 1 and E_2 gets 1) =
(1 + 1)/16 = 0,125

- prob(E_1 wins) = 1 – (prob(E_2 wins) + prob(ties)) = 1 - 0,0625 - 0,125
prob(E_1 wins) = 0,8125

Notice, this is a clear example of the *channel capture effect.*

c. Now, compute the probability that another collision takes place.

A new collision will happen if both senders get the same value (ties):

prob(E_1 and E_2 obtain the same value) = prob(ties)
prob(E_1 gets 0 and E_2 gets 0 | E_1 gets 1 and E_2 gets 1) =
(1 + 1)/16 = 0,125

d. Last, compute the probability that the backoff time generated by E_2 be greater than or equal to 102,4 μs.

Assume generated random number = r;
Backoff time = 51,2μs x r >= 102,4μs; r >= 102,4μs/51,2μs = **2**

$P_{r>=2}$ = p{2,3,4,5,6,7} /p{0,1,2,3,4,5,6,7} = 6/16 = 0,375

4. **Imagine that you have to explain the difference between the shared** media Ethernet (Coaxial cable or with Hubs) and the switched media Ethernet (Bridges or Switches) to a person not knowledgeable with networking.

   a. Compose a clear and concise explanation.

   b. Now, assume that the person for whom you are devising the explanation knows how to program computers. Would you change your explanation in this case, somehow?