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Wireless Communication and Networked Embedded Systems

Home Assignment - Energy

Q1_a

Antenna utilizes fixed amount of energy per unit time.

Time for Transmission:

$$\text{Mode 1} = 1000\text{b}/250\text{kb} = 4\text{ms}$$

$$\text{Mode 2} = 1000\text{b}/500\text{kb} = 2\text{ms}$$

So using mode 2 will use half the amount of energy since antenna is utilized for only half the amount of time.

Q1_b

$$P = 0.5$$

$$\text{ETX} = 1/(1-P)$$

$$\text{ETX} = 2$$

So for each packet to be successfully received, there will be 2 packets transmitted.

Q1_c

2 transmissions on 500kbps link will take 4ms and 1 transmission on 250kbps link will also take 4ms. So if losses are independent and have no effect on cost transmission then both the modes will have same response.

Q1_d

Redundancy for error coding adds 50 percent to the frame size. In contrast, retransmission with $P = 0.5$ sends a frame twice to be successfully received.

For larger data, using error coding will be far more efficient than retransmissions. For instance say data is 10 frames. In retransmission we will have to send 20 frames. In error coding we will have to send 15 frames (50 pc more)

1/P: Smallest fraction of P that is needed for receiver to sense Preamble.

Q2_a

It has to be at least $T - R + 1/P$ for reliable reception.

Q2_b

Best case: $(D + R + 1/P)$

Worst case: $(T + D + 1/P + 2R)$

Q2_c

At Sender: $N/2 (P + D)$

At Receiver: $N/2 (P + 2R + D + 1/P)$

Q2_d

+ Receivers will be asleep for longer periods of time.

- Sender will have to send a longer Preamble (P) in order to successfully operate. Longer preamble means sending a frame can be high energy consumption.

Q2_e

M will not have any effect on the effect due to higher value of T. Number

Q2_f

Sender's bandwidth will be wasted plus such long lengths of preambles will be inefficient. For unicast design, sender and receiver should just synchronize so time spent in transmitting preamble can be saved.