CS4222/5422: Wireless Networking
Solutions for Tutorial 10

Answer 1:

(a) Data packet size is 127 bytes, So, there are 127 * 8 = 1016 bits in a data packet.
The PHY supports a bit rate of 250 kilobits/second, which is 250,000 bits/second.

Transmission time = (Data packet size in bits) / (Bitrate)
Transmission time = 1016 bits / 250,000 bits/second
= 0.004064 seconds or 4.064 milliseconds

(b) The transmitter employs a mechanism like X-Mac and Contiki MAC, it repeatedly sends data packets instead of transmitting an explicit preamble message.

Let's find out how many data packets can be sent within the 100-millisecond radio cycle, considering the channel sensing time.

Available time for transmission in one radio cycle = Total cycle time

Available time for transmission in one radio cycle = 100 ms

Now, we find maximum number of data packets that can be sent within this available time:

Max number of packets = Available time for transmission / Transmission time data packet

Max number of data packets = 100 ms / 4.064 ms ≈ 25 Since we can't send a fraction of a data packet, we round down to the nearest whole number.

Maximum number of data packets the transmitter needs to send = 25

(c)

When no data transmission occurs, we are only performing channel sensing task.
The device spends most of its time in the sleep mode.

Sleep period duration = Total radio cycle time - Channel sensing time
Sleep period duration = 100 ms - 4.064 ms = 95.936 ms
Channel sensing period duration = Transmission time for a data packet = 4.064 ms

Energy consumption during sleep mode = Sleep current * Voltage * Sleep period duration

Energy consumption during sleep mode = 0.01 mA * 3 V * 95.936 ms = 2.87808 micro joules

Energy consumption during channel sensing mode = Channel sensing current * Voltage * time

Energy consumption during channel sensing mode = 0.1 mA * 3 V * 4.064 ms = 1.2192 micro joules

Total Energy consumption during a radio cycle without transmission = Power consumption during sleep mode + Power consumption during channel sensing mode

Total power consumption during a radio cycle without transmission = 2.87808 + 1.2192 = 4.09728 micro joules

Now, let's consider the case when transmission occurs:

In the case of data transmission.

Transmitter would send 25 data packets (preamble, and for it to be sensed):

Energy consumed for transmissions (Transmitter): 100ms * 3V * 10 micro joules

Energy consumed reception (Reception): 1 Reception + 1 sleep = 4.064* 0.1*3 95.036 * 3 * 0.01 micro joules

Answer 2:

(a) 1 ->2, 2->4, 4->9

(b) Can be estimated using PRR

1->2: 1/0.99
1->3: 1/0.96
1->8: 1/0.98
1->7: 1/0.95

And so on

(c) 1->2 , 2->5 , 5->9

(d) Any of the above, as all are of same number of hops 😊