

Wireless Sensor Networks

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Office Hours:
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Credits: 6

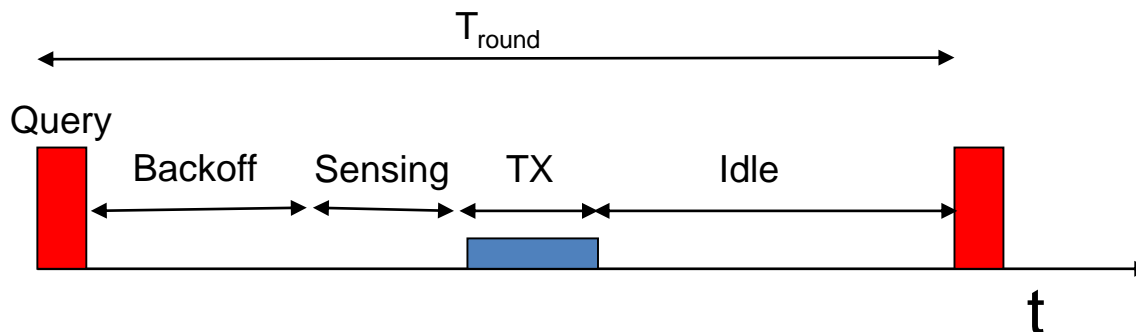


To fix the Ideas..

Discussion & Exercise

Sec. 1: Energy Consumption

Exercise



Consider one node transmitting data through a CSMA/CA protocol toward a sink. The sink periodically sends a query and waits for the data.

We set:

- Query size = 20 bytes; Data packet size = 30 bytes
- $P_t = 0$ dBm, $R_b = 250$ kbit/s
- Average backoff duration per round = 1.12 ms
- Sensing duration = 0.64 ms

Compute the average Energy per round spent by the node, assuming:

- $P_{rx} = P_{sens} = 79.2$ mW, $P_{tx} = 104.4$ mW (at 0 dBm), $P_{backoff} = 11.88$ mW, $P_{idle} = 0$

Compute the minimum T_{round} allowing the node to have a lifetime larger than 1 year, assuming a battery charge of 5000 J



To fix the Ideas..

Discussion & Exercise

**Sec. 2: The IEEE 802.15.4
PHY Layer**

Exercise

N nodes uniformly distributed in a circle, having radius r and transmitting with a power P_t data blocks to a sink, located in the center of the circle.

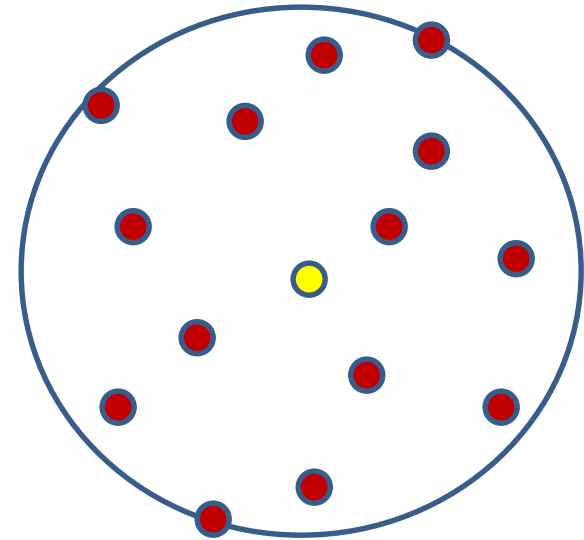
Assume that:

- The Loss in dB between two nodes at distance d is:
 $L[\text{dB}] = k_0 + k_1 \ln(d)$
- A data block is correctly received in case $P_r \geq P_{r\min}$

By setting: $P_t = 0$ dBm, $P_{r\min} = -95$ dBm, $k_0 = 40$ dB, $k_1 = 13.03$, $r = 50$ m

Discuss if:

- The network is fully connected
- The hidden terminal node problem occurs



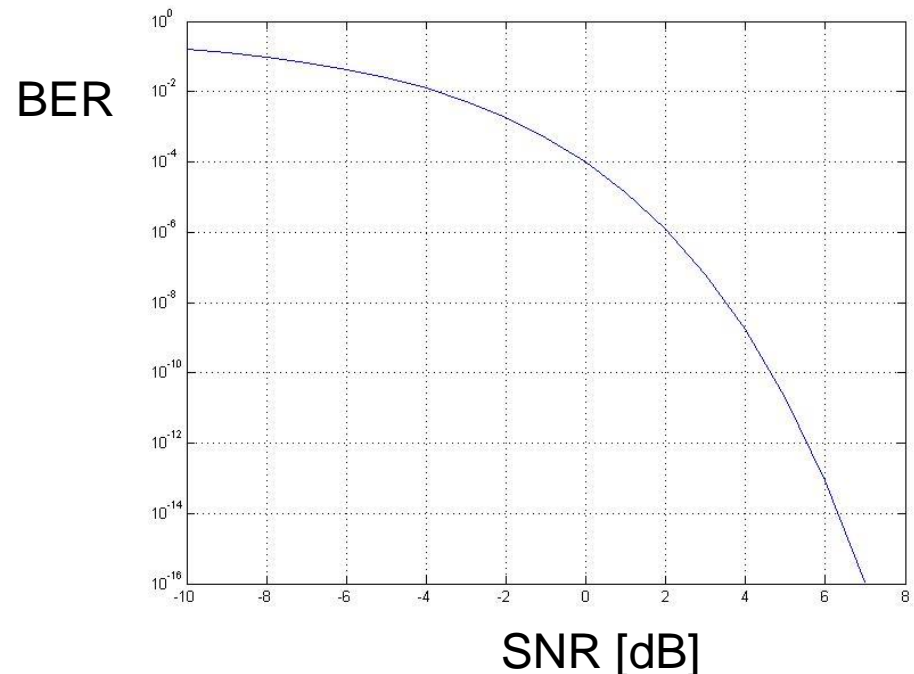
Exercise

Removing the assumption

- A data block is correctly received in case $P_r \geq P_{rmin}$

And setting: $P_t = 0$ dBm, $k_0 = 40$ dB, $k_1 = 13.03$, $N_0 = 7.1 \cdot 10^{-19}$ W/Hz, $R_b = 250$ kbit/s

Compute the BLER when a block of 10 bytes is transmitted by a node at a distance of 50 m from the sink.



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