Exercise Sensor Networks – (till may 2nd, 2005)

Lecture 1: Motivation

Exercise 1.1: Estimation of a node's lifetime

The following data about a sensor node is known:

Consumption in sleep-mode:	50 uA = 0,05mA [1u = 10^(-6)]
Consumption while CPU running (for doing calculations):	8mA
Additional consumption for sending (via radio):	10mA
Additional consumption for receiving (via radio):	6mA

The battery provides an amount of energy of 1800 mAh. The node is driven with the same voltage that is provided by the battery.

How long can a node be driven if every 200ms a measurement has to take place but sending is required only once per second? We assume that each attempt to send a packet requires to receive one packet as well and that a node knows exactly when a foreign packet will arrive. Each packet consists of 200 bytes of data. The wireless radio connection has a capacity of 9600 bits/s. A single measurement takes 5ms.

(1) How long can a node be driven?
(2) To what extend does the lifetime decrease if a node does not know when a packet of another node arrives and thus has to listen to the radio channel all the time?
(3) A couple of influences have not been taken into account in the above calculation. Find some of them and quote why they shorten or prolong a node's lifetime.

Aufgabe 1.2: Antenna length

The length of an oscillation should be denoted with lambda. It is known from communication engineering that a sender's optimal efficiency is achieved if lambda is 1/4 of the oscillation's length. Note that the signal travels approx. at the speed of light (300000 km/s). How long should the antenna of the sensor node be if it sends within the 2.4 GHz frequency band?