Exercise Sensor Networks

Lecture 7: MAC in radio networks

Exercise 7.1: Wise-MAC

A sender wants to transmit a message to a receiver using Wise-MAC. Therefor it emits a preamble prior to the estimated wake-up time of the receiver and then adds the message.

a) In contrast to Aloha with preamble sampling a sender using Wise-MAC knows when the receiver will wake up. What is the preamble good for in Wise-MAC?

b) The type of clocks being used for specific sensor nodes exhibit a maximum inaccuracy of theta time units per time unit (theta can be considered to be a small fraction, e.g., in the degree of magnitude of 10^{-5} seconds). The authors of Wise-MAC claim that after L time units a sender has to extend its preamble up to 4 x theta x L. Explain why. When does a sender have to start sending the preamble if it expects the receiver to wake up at time t_0 and if the receiver was silent for L time units?

c) We consider a channel which is free at about 80% of the time and occupied for the rest. The occupied 20% are further subdivided into 10% preamble time and 90% time for the actual data. How long does a node have to listen who is i) the receiver of a message all the time or who is ii) always uninvolved (not addressed by a sender)? Short wake up times are not considered and we assume that the ID of the receiver is included into the message (actual data transmission phase) at the very beginning.

©Thomas Haenselmann – Applied Computer Science IV, University of Mannheim

Exercise Sensor Networks

Lecture 7: MAC in radio networks / using multiple frequencies

Exercise 7.2: AMRIS protocol

a) Is it possible that a msmID is used more than once in AMRIS. Why and when does it happen?

b) Is it possible to address a particular node from the root even though msmIDs are not pairwise different? And is it possible for every node to address the root (we don't consider packet loss or node failure)?

Exercise 7.3: SMACS

a) How does the SMACS protocol try to avoid collisions? What is the difference with regard to allocating a communication channel compared to the approaches we got to know to far?

b) How does SMACS solve the hidden/exposed station problem? How can collisions still happen?

c) If two clusters meet it can happen that one cluster can not connect the other. How can this happen and what is the rare resource? Design an example in which one cluster is unable to connect another one.

d) Can bottle necks identified in c) be resolved by sorting the schedules in another way? If yes how, if not why?

©Thomas Haenselmann – Applied Computer Science IV, University of Mannheim