Christian Schindelhauer

Freiburg, the 13th May, 2016
Discussion 25th May, 2016

Exercise for the lecture

Wireless Sensor Networks

Summer 2016

Sheet 4

EXERCISE 5:
Let us consider the following Back-Off Algorithms. We assume that we have devices $v_1, v_2, v_3, \ldots$ competing for communication slots. It is a broadcast channel, where everybody can reach everybody else. Before each slot they decide whether they send or listen. A message is transferred successful, if during a slot only one device has sent a message and the other ones have listened. After the slot ends, only the sending devices can detect whether a collision took place (based on the acknowledgment from the receiver.

1. Algorithm Random(p) for $p \in [0, 1]$. In each slot with probability p the device sends a message.
2. The Exponential Backoff Algorithm from the lecture.
3. The MILD algorithm from the lecture.

Now answer the following questions.

1. Consider n devices performing all Random(p). Compute the probability for a successful transmission during a round. Optimize p for given n such that the probability is maximal.
2. Assume that one device is using Random($\frac{1}{2}$) and $n - 1$ devices are using Random(p). Compute the probability for a success transmission again, optimize p for given n and compute the resulting optimal probability.
3. Assume two devices. One is using Random($\frac{1}{2}$) and one is using the exponential backoff algorithm. Who will send more messages? Why?
4. Assume two devices. One is using Exponential Backoff Algorithm and one is using the MILD backoff algorithm. Who will send more messages? Why?