

CSE 4215 :: Lab 3 Frequency Hopping

Issued March 8, 2012; Due March 23, 2012

In this lab, you will implement a simulator for the type of frequency hopping used in Bluetooth, and evaluate its performance in the presence of other Bluetooth networks, as well as in the presence of other interference.

Bluetooth networks use 79 “hop carriers”. Within a piconet, TDMA is used to share the bandwidth among the nodes, with 343 bits per slot: for example, with a master and two slaves, the TDMA slot allocations are: master, slave 1, master, slave 2, master, slave 1, master, slave2, ...

1. In the programming language of your choice, simulate the Bluetooth frequency hopping protocol as follows:
 - a. For each node (master and slaves), generate a sequence of hop carriers.
 - b. Assemble the hop carriers together in the correct TDMA sequence.
2. Simulate two independent Bluetooth piconets, A and B, operating simultaneously. You may assume that the slots of the two piconets are synchronized.
 - a. Consider the case where piconet A has a master and 1,2,...,7 slaves. Assume piconet B has a master and 3 slaves. Generate 1000 simulations, each consisting of at least 1000 slots.
 - b. For the master and each slave in piconet A, evaluate the probability that a slot will suffer interference from piconet B.
 - c. For the master and each slave in piconet A, evaluate the throughput (in bits/s) assuming any slot suffering interference is dropped.
3. Consider the same piconet A as in part 2, and generate the same results as in parts 2b and 2c, where the interference is constant on 3 randomly-chosen hop carriers throughout the duration of your simulation (different hop carriers from simulation to simulation).
4. Bonus (will help you get 100% if done correctly): Calculate the theoretical values for the interference probabilities and throughputs in all simulations, and include them in all plots.

Evaluation:

- Technical correctness: 40 marks
 - Correctly answering all the above questions is worth 32/40
 - To achieve a score greater than 32/40, you must provide additional results, insights, or analysis beyond the provided questions (including, *but not limited to*, the bonus question)

- Quality and clarity of report (including plots): 10 marks
 - For full marks, writing must be clear, grammatical, and detailed; plots must be clearly labeled and unambiguous.