Lab 4: Radio Range Models – part 2

CSE 4215/5431: Mobile Communications

February 4, 2011

We will conclude our investigation of radio range models this week. There are many that have been used. Please refer to [1] for a survey of many of these models. For this exercise you are encouraged to read Section 4 of this paper.

In this laboratory assignment, you will explore another simple radio range model, the RIM model. This is described in Section 4.2 of [1].

1 Questions to be addressed

You will use the same metrics as last week. You will record the fraction of edges that are different for the same positions of nodes between the idealized circular radio range model and the RIM model. Specifically, record for each time instant the number of edges that fall in the following categories

1. communication is possible in the idealized model but no communication is possible in the RIM model.
2. communication is possible in the idealized model but asymmetric (1-way) communication is possible in the RIM model.
3. connunication is not possible in the idealized model but symmetric communication is possible in the RIM model.
4. communication is not possible in the idealized model but asymmetric (1-way) communication is possible in the RIM model.

Notice that for each edge and for each time step you will generate new random variables to simulate the radio range at that instant.

2 Details of your simulation

As before, you can work in Java or C/C++, or you can use MatLab. The latter makes it easier to plot data, and provides built in random number generators for many probability distributions.

Assume a field of size 100×100 and $n = 10000$ nodes. Assume radio range $r = 10$ for the idealized model.

For the RIM parameters, assume that the inner circle is of radius 8. The outer is of radius 12. For the Rand value, use a truncated Gaussian as before, with zero mean and unit standard deviation. Generate the radio range for all the integer angle values (0 to 359) and each time you need a radio range, lookup this table, and use the angle between the nodes. Note that radio range is possibly asymmetric, so be consistent when using it.

Let the simulation run for 1000 time steps in each case. If this is too time–consuming on your platform then you can use a smaller number. Let all nodes start from a uniformly distributed position and apply the random direction mobility model. Take measurements only in the last 100 time steps. Repeat your experiments for DoI = 0.001, 0.01, 0.05,0.1.

3 Report and code

You will submit a report and all your code using the submit command (a submit directory will be created before the deadline). The submission combines labs 3 and 4 and you will compare the two models you investigated.

Present your data in a way that makes it easier for the reader to draw conclusions. In the report, write a brief (a few paragraphs) description of what you did, design choices or assumptions you made (if any) and what you could infer from your results. Document your code so that the grader can easily follow what you are doing.

References

[1] Models and solutions for radio irregularity in wireless sensor networks, *Gang Zhou, Tian He, Sudha Krishnamurthy, John A. Stankovic*, ACM Transactions on Sensor Networks 2(2): 221-262 (2006) Can be downloaded from `http://www.cs.virginia.edu/papers/Models_Soln_RIM_TOSN.pdf`

[2] Range-free localization schemes for large scale sensor networks. *Tian He, Chengdu Huang, Brian M. Blum, John A. Stankovic, Tarek F. Abdelzaher*, MOBICOM 2003: 81-95. Can be downloaded from `http://www.cs.virginia.edu/~th7c/paper/APIT_CS-2003-06.pdf`