Sensor Networks and Mobile Data Comminucation, Assignment 2

UID: 1690550

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1 Preparation and initial readings

Before we could attempt to compare the different models ran with different parameters, some initial readings had to be taken. Originally, the readings were taken over a very narrow range of distances between nodes and the transmission power. Namely, the power ranged from 0.1 to 0.12 dBm, and the distance ranged from 180 to 180.9 m. No packets were received during the original simulation.

We decided to look at a much wider range for both of these parameters. First we note that 802.11b standard lists 20 dBm as the standard transmission power for WiFi, with -100 dBm being the minimal received signal power. Using the default parameters for the model, we took readings at transmission power ranging from -10 dBm to 3 dBm, in 0.5 dBm intervals, and at distance in the range 10 m to 200 m, in 5 m intervals. Figure 1 show the maximum transmission distance for each of the power values.

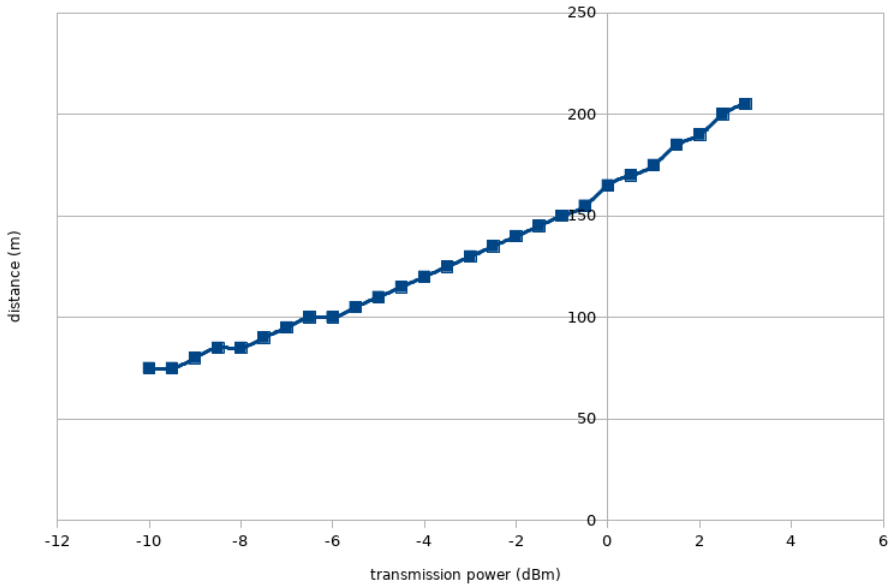

Figure 1: Maximum transmission distance for the given transmission power.

These results will be considered the "normal" output, to which we can compare the outcomes of any modifications.

2 Log-distance propagation loss model (Methods 1)

The equation to calculate loss in the log-distance propagation model[1] is:

$$L = L_0 + 10nlog_{10}(\frac{d}{d_0})$$

with L being the relative path loss, L_0 the path loss at reference distance d_0, n being the path loss distance exponent, and d the distance at which we're looking.

The model has 3 attributes: path loss exponent, reference distance, and reference loss. Reference distance and loss come together, and we shall look at them first. This pair of attributes describes how much power we lose at the reference distance from the source. It is included in the model to avoid taking $log_{10}(0)$ which tends to $-\infty$. NS-3 documentation mentions that if we are looking to find the loss at a distance smaller than the reference distance, the transmission power will be returned. Therefore there is no point in attempting to get a reading at a shorter distance, as it will not be meaningful.

Effectively, these attributes describe how much to add to the loss, to account for skipping the reference distance in the calculations. It should not come as a surprise that increasing the reference loss, decreases transmission range.

We have measured the transmission distance, with reference loss ranging from 7 to 20 dB in 0.5 dB intervals, at transmission power -10 dBm.

[1] https://www.nsnam.org/docs/release/3.19/doxygen/classns3_1_1_log_distance_propagation_loss_model.html