

CS252 Lab 1

Computer Networks Lab

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Case 1:

Map showing signal strengths

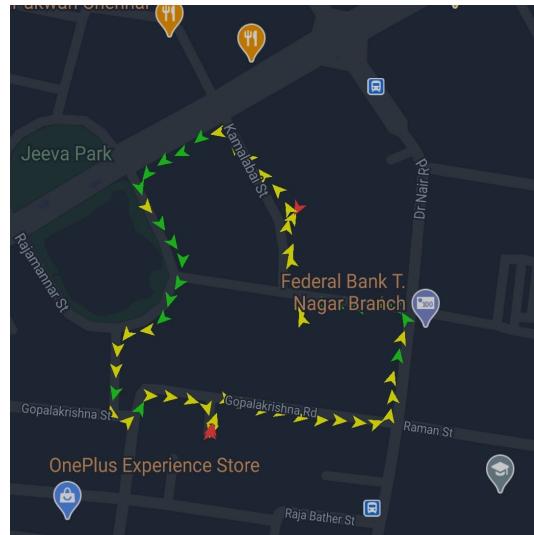


Figure 1: Green: -50 dBm to -85 dBm
Yellow: -85 dBm to -105 dBm
Red: -105 dBm to -130 dBm

Map showing signal strengths along with tower locations

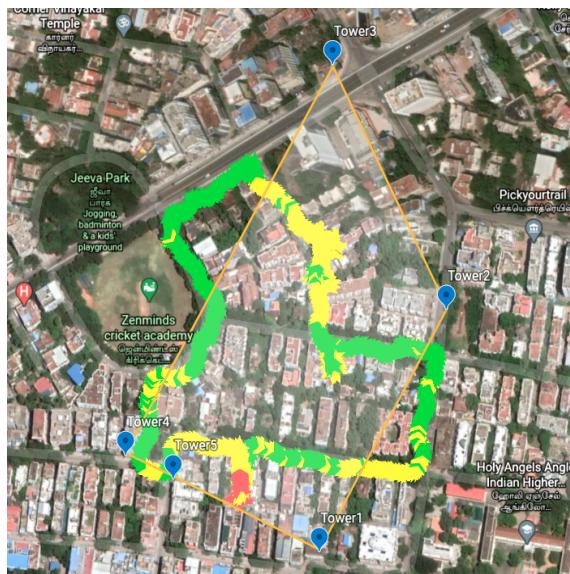


Figure 2: Green: -50 dBm to -85 dBm
Yellow: -85 dBm to -105 dBm
Red: -105 dBm to -130 dBm

eNodeBIDs

- 904222
- 904222
- 941480
- 904439
- 941524

Observations

In this case low signal is obtained at 2 points-

- Once at the center-bottom of the path, which was the starting point, in the staircase of my house, As this area was covered from all sides (Obstacles), the signal is extremely low.
- The other point was when i went through the basement like parking area of an apartment (almost at the center of the first image).

Other than that, average signal was observed at a lot of points on the path, which was mainly due to dense trees, or thin streets (particularly the section between Tower 4 and 5 and from Tower5 back to the starting point) or tall buildings. Another observation is that, in fairly open areas (like the wide road at the top left of the path) and sparsely populated ones (the path outlining a park just after that) show good signal strengths. Also the area around Tower2, consists of corporate buildings which are empty at night (when the signal was recorded), thus resulting in low tower load and good signal strength.

Observing from the data, we observe almost along the whole path, we received LTE strength from around -70 dBm to -120 dBm. Variance in tower loads, multi-path signals and obstacles are the major reason for this fluctuation.

Conclusion

Signal is poor in this case due to more obstacles and more signal sharing.

Case 2:

Map showing signal strengths

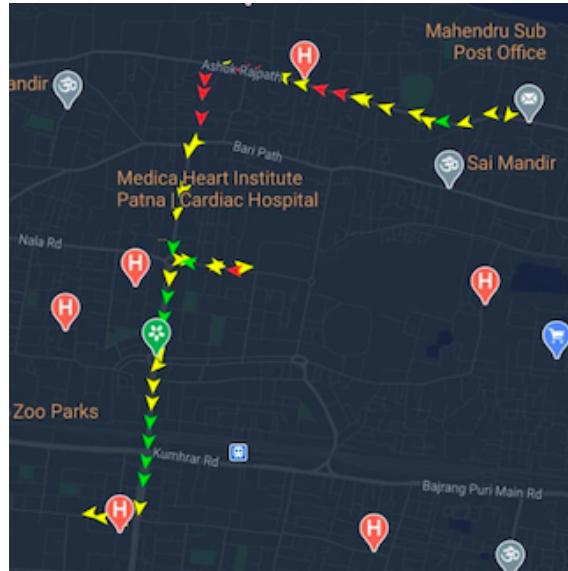


Figure 3: Green: -50 dBm to -85 dBm

Yellow: -85 dBm to -105 dBm

Red: -105 dBm to -130 dBm

Map showing signal strengths along with tower locations

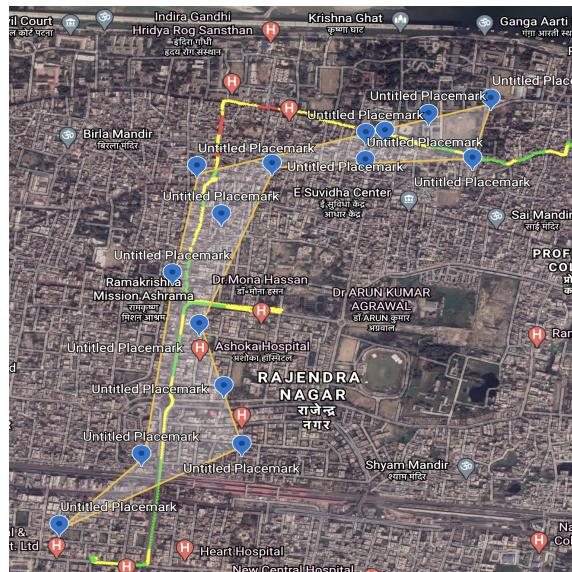


Figure 4: Green: -50 dBm to -85 dBm

Yellow: -85 dBm to -105 dBm

Red: -105 dBm to -130 dBm

eNodeBIDs

- 908228
- 905058
- 904752
- 906357
- 916164
- 906241
- 906490
- 906249
- 906419
- 901143
- 915775
- 902169
- 906244
- 916958
- 906439

Observations

In this case we observed particularly average to weak signals even when there were a lots of towers around the path. By intuition this is because of the heavy load on the tower. Since this is a crowded area, load on each tower is high as compared to other areas.

Observing from the data, we received LTE strength from around -70 dBm to -100 dBm . At some regions in the curving road in the above map, we received relatively bad signal in red region. Since for this observation, we used a larger data set (around 2-3 KM) we see a lot of fluctuations. Variance in tower loads, multi-path signals and interference are the major reason for this fluctuation.

Conclusion

Signal is poor in this case due to more crowding and more signal sharing.

Case 3:

Map showing signal strengths

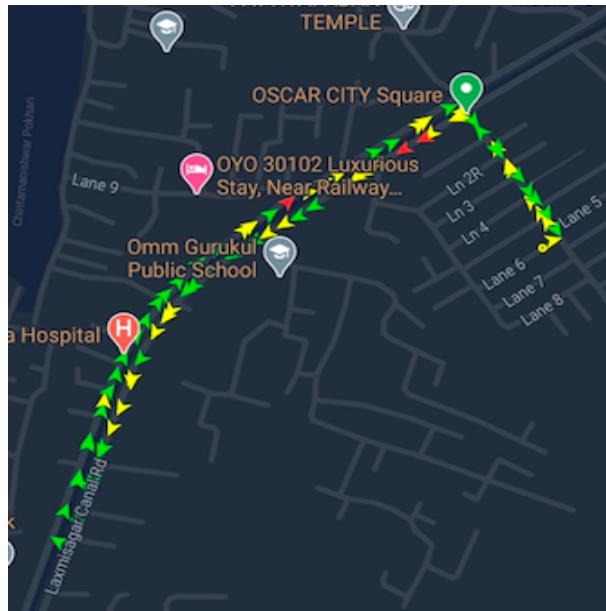


Figure 5: Green: -50 dBm to -75 dBm

Yellow: -75 dBm to -85 dBm

Red: -85 dBm to -130 dBm

Map showing signal strengths along with tower locations

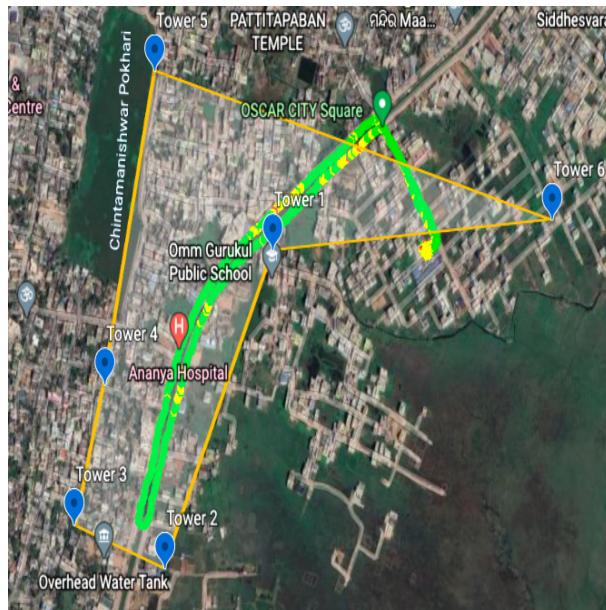


Figure 6: Location of towers

eNodeBIDs

List of unique eNodeBIDs connected are-

- 131802
- 3785
- 8586
- 1910
- 200
- 9336

Observations

In this case we observed particularly strong signals because around the path we had lot of 4G-base stations along the road, so to differentiate between the relatively weak signals in this case we had to change the default thresholds. The thresholds for color coding used in this case that were taken were: **Green:** -50 dBm to -75 dBm, **Yellow:** -75 dBm to -85 dBm, **Red:** -85 dBm to -130 dBm.

Observing from the data, we observe almost along the whole path, we received LTE strength from around -60 dBm to -80 dBm.

At some regions in the curving road in the above map, we received relatively bad signal in yellow region. At that region we see Tower 1, Tower 5 and Tower 6 were relatively farther apart.

So due to distance from base stations signal might have got attenuated.

From the raw data, we see that the signal has minor constant fluctuations so we can conclude that multi-path signals exist(signals travelling different distances) and their constructive interference gives higher signal strengths at some points and due to destructive interference we will have lower signal strengths at some points.

The road was a very less crowded and also had less number of large buildings, so it might have contributed to better signal strengths due to less obstruction.

Conclusion

Signal is better in this case due to lesser distance between device and towers, lesser signal sharing due to less crowding, lesser physical obstructions.

RSVP plot with time

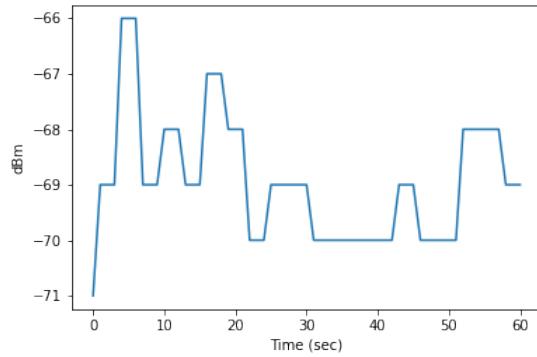


Figure 7: RSVP plot with time measured at a fixed location

Some comments for this graph are-

- The range of values of RSVP attained is fairly small (around 5dBm) compared to the data in the above maps (30-40 dBm variation). This is natural because the physical surroundings of the point of measurement do not change.
- Even though the physical surroundings are same, the signal strength is constantly varying around an average of about 69 dBm.

Link to data for Cases 1,2,3 and RSVP plot : [Measurements](#)