Bibliographic work*

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1 Results analysis

Five access point topologies have been considered to compare their connectivity and how do they affect the placement and movement trends of the jammers. To achieve this the simplified bilevel mixed-integer program [BLMIP] has been used.

The Partite topology had three clusters of APs separated far enough apart that a demand point located between two clusters might not be able to connect to any access point in either cluster. The Perimeter topology distributed APs along the region's perimeter, allowing free movement of demand points and causing them to be separated. The Dense topology featured a central hub with clustered APs, it resembles a critical location which demands constant connectivity. The Spacious topology randomly distributed access points to avoid proximity, resulting in demand points within range of one or two access points. The Median topology had uniformly distributed access points along diagonals and central lines, with clustering in the center, resembling a campus with a central area of high connectivity demand.

For all five topologies, three experiments with 10, 25 and 50 APs, each with a capacity of 15, 5 jammers with jamming radius of 150 feet, and 5 time periods. Each region was 1 square mile. The demand was realized ten times, with 100 demand points, and the results were averaged. This showed that the Spacious and Median topologies were closest to the optimal access point placement.

It was found that access point placement near concentrations of demand points was crucial for ensuring robust network connectivity. However, access points too clustered together give jammers an easier time on severing connections. Therefore, the optimal solution should find a balance between these two factors.

Sensitivity has also been proved, concluding that adding a set of new access points did not improve overall connectivity. Meanwhile, were more jammers to be added to the original problem, the set of new APs would become significantly important.

?? is a generalized utility function considering three aspects: range, unity and tolerance. The comparison of this utility function, both when the jammers were optimally deployed and when they were not, revealed that the Dense and Spacious topologies were the most affected by jammers.

2 Conclusions

The optimal placement of access points is crucial to ensure maximum connectivity for demand points in various environments, including university campuses. This optimal topology will also maximize connectivity in the presence of jammers, considering both non-additive and additive models. Achieving a proper placement requires striking a balance between placing access points near concentrations of demand points and avoiding the formation of clusters. In this regard, the Partite and Median topologies demonstrated greater robustness against jamming attacks when considering utility as total signal strength, number of connections, or tolerance allowance.

While this research considers the placement of both access points and jammers, the placement of demand points has not been taken into account. Considering this would lead to a stochastic problem rather than a deterministic one.

References

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