Abstract

Cost optimization is an important criterion in technology deployment for developing regions. While IEEE 802.11-based long-distance networks may provide a cost-effective option to connect remote villages, planning such a network to cover the villages in a given region can be a non-trivial task. This is especially so since the antenna tower cost is the dominant cost in such scenarios. In this thesis, we consider the problem of topology planning in the context of 802.11-based long-distance rural networks. Our first contribution is the formulation of this problem in terms of its constraints and the optimization metric. We find the problem to be of combinatorial nature, and hence not scalable for large input sets. Our next contribution is in breaking down the problem into its constituent sub-parts some of which are independent, this makes the solution procedure tractable. Next we propose several searching and pruning strategies in generation of an optimal solution.

We then present a set of results generated by the algorithm. We have been able to find topologies for sets of nodes of size 31 (so far). For a sub-set of the Ashwini (31 out of 34 nodes) project, a long distance rural network currently being deployed in the West Godavari district of Andhra Pradesh we have been able to show a potential cost benefit of the order of 15 times on their tower cost budget (based on available data for already commissioned towers), by improving the process of assigning tower heights. Also careful topology planning led to a further 22 % savings over their current deployment plan. Another fact to be borne in mind is the current deployment utilizes three independent WiFi channel while our solution only uses one channel. A final contribution of this thesis is the discussion of further work necessary in this domain.