

## **Joint Hub Location, Node Clustering and Network Design of Two-Tiered Meshed Networks**

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In this talk we discuss design of two-tiered meshed networks. A two-tiered meshed network consists of clusters of nodes comprising the access network tier and a backbone tier which interconnects the clusters. Each cluster contains exactly one hub node which routes the traffic between clusters.

Designing a two-tiered meshed network involves a number of interrelated problems: Hub location, clustering of nodes and network design. These problems have often been carried out independently, but since the problems are interrelated, this may lead to suboptimal designs. We determine hub location, clustering of nodes and network design jointly. A mathematical model is presented for the problem and a bound is derived. Also a GRASP heuristic is implemented to obtain feasible solutions.

Tiers exist because of limitations in communication equipment, e.g. hop limits, organizational advantages, e.g. easier upgrade and the observation, that a two-tiered network seems to cope with changes in the traffic better than a network without tiers. However, enforcing tiers does incur some additional cost. This is clear, since any two-tiered network is also a feasible solution when networks without tiers are considered. For that reason we investigate how much cost is incurred by enforcing two tiers, i.e. we compare with networks without tiers.