Several Topics in Ad Hoc Wireless Networks

In this talk, I will talk about two topics in ad hoc wireless networks. One is the maximum necessary hops to deliver a packet from a source to a destination. Another is the broadcast algorithm.

The talk first investigates a fundamental characteristic of a mobile ad-hoc network (MANET): the maximum necessary number of hops needed to deliver a packet from a source to a destination. Without loss of generality, we assume that the area is a circle with a radius of r, $r > 1$, and the transmission range of each mobile station is 1. The maximum necessary number of hops needed to deliver a packet from a source to a destination is $\frac{4\pi}{\sqrt{3}}\left(r + \frac{1}{\sqrt{3}}\right)^2 - 1 = \frac{4\pi r^2}{\sqrt{3}} + O(r) \approx 7.255r^2 + O(r)$. We show that this result is very close to optimum with only a difference of $O(r)$.

Broadcasting is an important communication mechanism in ad hoc wireless networks. The simplest way to do broadcasting is pure flooding, in which each node retransmits a packet after receiving it, thus generates many redundant retransmissions. The rule based on dominating sets can reduce the number of retransmissions. A *dominating set* is a set of nodes such that any node in the network is a neighbor of some element in the set. However, computing a minimum size connected dominating set is NP hard. Several existing algorithms use the idea of multipoint relays to reduce the size of the connected dominating set. We observed that these algorithms can be further improved. Thus, three improvements are introduced here. It is proved that these improvements can compute a connected dominating set of the network, and simulation results show that they can further reduce the size of the dominating set. Also, extensions to power-aware broadcasting algorithms are discussed.