Review - "An Inter-Cluster Communication Scheme for Self-Organized Transmission Power Control in MANET Clustering" by Vaibhav Kasturia

MANETS or Mobile-Ad Hoc Networks are wireless networks in which transmission and reception is carried out through mobile terminals called nodes. An important feature of this network is that communication is carried out in this network in a multi-hop fashion without any fixed infrastructure such as base stations and relay stations making them particularly effective in disaster environments.

One big issue with these mobile terminals is the limited battery they possess. If due to high energy consumption some mobile terminals go down, then this could have a severe effect on the whole network. On the other hand, if the power used for transmitting messages is too low then this could lead to messages not getting received at the receiver node. The authors of this paper have taken both these things into consideration and based on the limitations of the previous two approaches have presented a new approach for inter-cluster communication in MANETS.

For large scale MANETS covering a large area, "autonomous clustering" (1st method) has been proposed where the nodes are classified into disjoint sets called "clusters". In autonomous clustering we have hierarchical routing protocol (Hi-AODV) consisting of inter-cluster and intra-cluster routing. Intra-cluster routing is carried out in a tree fashion where one node acts as the Cluster Head(CH) and all the messages pass through the CH. In inter-cluster routing, each cluster communicates with the neighbouring clusters regarding the other clusters as virtual nodes. In autonomous clustering, however, some problems are faced. One problem is adapting to quickly changing node density. The second problem could be that the packet transmitting power of a node, which is closer to a receiving node, when it is higher than the transmitting power of the node which is sending packet, could cause radio interferences in transmission.

To overcome this problem, a "self-organized transmission power control" method (2nd method) was proposed in which nodes belonging to a particular cluster should have similar powers based on their node density. Although this approach works fine for intra-cluster routing, in inter-cluster routing it causes the problem of one-way communication as messages can be transmitting from a cluster having high power to a cluster having low power but conversely, transmitting messages from a low power cluster to a high power cluster does not work.

Taking into account the problem of one-way communication in the 2nd method, the authors presented a new approach for inter-cluster communication which involves keeping the power of the entire cluster based on the node density of the cluster but selectively increasing the power of the Border Nodes(BN), i.e., the leaf nodes of one cluster adjacent to the other cluster. The algorithm proposed increases the power of the BN which is minimum hops away to the neighbouring cluster to the power of the neighbouring cluster. If two or more BN are the same hops away to the neighbouring cluster then it randomly increases the power of one of the BN to the power of the neighbouring cluster. Also, if one BN is adjacent to two or more neighbouring clusters and is same hops away from all the clusters then the power of the BN is set to the power of the neighbouring cluster having the highest power. In this way, since the BN of one cluster with lower power has comparable power to the neighbouring cluster with higher power, successful two-way communication can be carried out between them.

Simulation experiment carried out by the authors shows that the total energy consumption in the new method is lesser than the previous two methods(1st and 2nd method)while data packet reachability %age remains the same as the previous two methods. The decrease in the total energy consumption can also be attributed to the decrease in the total packet size requiring lesser transmission power. Also, the rise in the energy consumption per unit time between the evacuation areas when all nodes have moved toward the evacuation areas is lesser as compared to the

previous two methods and the fall is quick as retransmission of packets to the disconnected clusters by border nodes is lesser.

So overall, the approach presented is indeed novel as in disaster situations the longer battery life of the nodes would be crucial in keeping the network alive for a longer time while at the same time ensuring reliable communication between the nodes.