ABSTRACT

Mobile Ad-Hoc Network (MANET) is a group of wireless nodes without any central infrastructure, which self-organize into a network in order to communicate with each other. Every node in this type of network can take the role of a router and forwards data packets to other nodes. Due to their inherent broadcast capability, MANET is well suited for multicast applications. In a MANET, multicasting has an advantage of saving bandwidth, whenever same data or message packet has to be delivered to multiple receivers. By combining the applications of ad hoc networks with multicasting, it is possible to provide a large number of the group application in which mobile users may communicate with a static controller or group head effectively. Multicast communications are also called as one-to-many and many-to-many communication. In many-to-many situations, more than one source is available.

A multicast session is established in a network by creating a multicast structure through which the data is delivered. Protocols differ in the way of establishing such multicast structure. Tree based and Mesh based structures are used in many of the routing protocols for ad hoc networks. Both tree based and mesh based protocols use some kind of ‘flooding’ to find the routes, and store the route information in the routing table of the intermediate nodes. It is found that, unnecessary flooding of control packets to establish and maintain the routing structure will incurs a large amount of
control overhead. Using the clustering structure, only a few cluster-heads need to maintain local information, thus prevents flooding of ineffective packets and to some extent reduce the control overhead.

Ad hoc networks operate in a highly bandwidth-scarce environment and control packets consume a considerable amount of bandwidth. The protocol design should ensure that, the total number of control packets used for establishing the route and maintaining it should be kept to a minimum. The adoption of wired multicast protocols to a MANET, which completely lacks any infrastructure, appears less promising. These protocols have been designed for infrastructure wireless networks and may fail to keep up with node movements and frequent topology changes due to node mobility.

In this thesis, Unicast Forwarded Cluster Based Multicast Protocol (UFCBMP) for wireless ad hoc network is proposed and its performance analysis is carried with static network condition. UFCBMP is a cluster based multicast protocol for static wireless ad hoc networks. In this cluster based protocol, the multicast table and cluster-head table maintained by the cluster-heads are used as a shared resource for route establishment and helps in data delivery. The performance analysis shows that UFCBMP use lesser amount of control message for route establishment and multicast data delivery.

Node mobility and frequent change in network topology are the important characteristics of wireless mobile ad hoc networks. Therefore, mobility feature is added in UFCBMP and proposed a Join Request Knowledge Based Multicast Protocol (JRBMP) for MANET. In this
protocol, a pair of junction node is selected to have communication between any two adjacent cluster-heads. The novelty of the proposed JRKBMP is in its source and receiver joining procedure which avoids the unnecessary flooding of control packets throughout the network. On completion of the source and receiver joining procedure, a complete path for data forwarding is established. In JRKBMP, cluster formation and cluster-head elections are based on the Weighted Cluster Algorithm. The source sends the data, only to its cluster-head. Source cluster-head takes care of delivering the data to the cluster-heads, which contains the receiver in their cluster region. During node mobility, the source node and the multicast receiver node may move within their cluster region or move out of their cluster region. To accommodate the mobility of nodes, rejoin procedure for source and multicast receivers are executed. Performance metrics such as control overhead, Normalized Routing Load (NRL) and Packet Delivery Ratio (PDR) are taken for analysis. The simulation results show that, the proposed method is effective in utilizing lower amount of control overhead without much degradation in packet delivery ratio.

Establishing a route between source and multicast receivers which are moving frequently and arbitrarily, that too in a wireless environment is really a difficult task. With multi-source multicasting the situation becomes even more complex. To achieve multicast data delivery under multi-source environment, this thesis proposed a Multi-source Multicast Routing Protocol (MMRP) for mobile ad hoc networks. The performance of the proposed method is analysed by varying node mobility, data transmission rate, group
size and number of sources. Their impact on control overhead and the packet delivery ratio are analysed for the proposed MMRP. It is interesting to note that, even at higher mobility, the control overhead is maintained at a lower value and only a small variation is noticed.

In this thesis, certain investigation on multi-source multicasting are done and finds a solution to the challenging problem of high control overhead incurred for multicast data delivery. The key contribution of this thesis is the establishment and maintenance of routing structures for multicasting without the need to flood the control message throughout the network. In the proposed methods, source joining and receiver joining messages are sent only to their cluster-heads. In addition to this, the multicast tables maintained by the cluster-heads are used as a shared resource for route establishment and helps in data delivery to the multicast receivers. The proposed methods gave an improvement by utilizing lower amount of control overhead for multicast data delivery in mobile ad hoc networks.