CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 CONCLUSION

Wireless, dynamic, multi-hop network established by a collection of mobile nodes without any centralized infrastructure is the characteristic of a MANET. Every node in this type of network can take the role of a router and forwards data packets to other nodes. In 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 like disaster relief, disseminations of warning, rescue operations and military communication in which mobile users may communicate with a static controller or group head effectively.

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. Also, the protocol overheads may increase substantially. As the impact of multicast spans numerous domain, analysing, and indicating the suitability of a protocol is very hard, especially when considering multicast for MANET.
Ad hoc networks operate in a highly bandwidth-scarce environment, and hence bandwidth efficiency is one of the key design criteria for multicast protocols. Control packets consume a considerable amount of bandwidth. The design should ensure the utilization of minimum number of control packets for maintaining the established route and proper data delivery. Unnecessary flooding of control packets to establish and maintain the routing structure leads to increase in control overhead and inefficient utilization of bandwidth. Therefore, to reduce the control overhead, a new technique has to be found, which avoids the unnecessary flooding of control packets and use minimum number of transmissions for multicast data delivery.

In this thesis, Unicast Forwarded Cluster Based Multicast Protocol for wireless ad hoc network is proposed and its performance analysis is done. UFCBMP is a cluster based multicast protocol for static wireless ad hoc networks. It uses a novel technique to establish and maintain the routing structures for multicasting. In this proposed method, 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 to the multicast group receivers.

The performance analysis shows the utilization of lesser amount of control message for route establishment and multicast data delivery by the UFCBMP. Increase in data packet size will increase the amount of data transmission and reception. UFCBMP utilize almost the same amount of control overhead on varying data transmission time, as well as on varying the data packet size. The proposed method also shows a reduction in the normalized routing load and provides a good packet delivery ratio with the increase in the amount of data sent.
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 for MANET. In this protocol, a pair of junction node is selected to have communication between any two adjacent cluster-heads. One junction node is used for communication in upstream direction and another for downstream direction. 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. 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.

In JRKBMP, cluster formation and cluster-head elections are based on the Weighted Cluster Algorithm. Communication between the cluster-heads takes place through the junction node. Selection of junction node is a critical factor and definitely it has influence on the performance of any cluster based protocol. Under mobility condition, the junction nodes may change its position and the proposed method quickly selects a new junction node and the communication between cluster-heads takes place smoothly.

The source sends the data, only to its cluster-head. Source cluster-head takes care of delivering the data to the adjacent cluster-heads, which contains the receiver in their cluster region. Performance metrics such as Control Overhead, Normalized Routing Load and Packet Delivery Ratio are taken for analysis. The simulation result shows the effectiveness of the proposed method in utilizing lower amount of control overhead without much degradation in packet delivery ratio. Even for a larger number of data packet
transmission and delivery, the proposed method has a lower value of the normalized routing load.

Establishing a route between source and multicast receivers which are moving frequently and arbitrarily in a wireless environment is really a difficult task. With a 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 for mobile ad hoc networks. Due to the limited bandwidth associated with wireless networks, it is necessary to construct the route and deliver the multicast data with a lower amount of control overhead. Variation in node mobility and data transfer rate are the two main factors which influence the performance metric. Therefore, the performance of the proposed method is analysed by varying node mobility and data transmission rate. In addition to the network size, the multicast group size may be a more interesting factor affecting the multicast performance. The impact of multiple sources and increasing number of multicast receivers (group size) on control overhead and the packet delivery ratio are analysed for the proposed MMRP. Even at higher mobility, the control overhead is maintained at a lower value and only a small variation is noticed without much degradation in packet delivery ratio.

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. Certain investigations on multi-source multicasting for mobile ad hoc networks are done and new protocols are proposed in this thesis. The proposed methods gave an improvement by utilizing lower
amount of control overhead for multicast data delivery in mobile ad hoc networks.

6.2 FUTURE WORK

This thesis finds a solution to the challenging problem of high control overhead incurred for multicast data delivery in mobile ad hoc networks. There are still some open research points that can be investigated further to extend the presented approach done in this thesis. This section gives some suggestions for future work as follows:

- Video transmission and voice based applications consumes more bandwidth. In future, the analysis can be extended with audio and video multicast transmission over a mobile ad hoc network.

- In multi-source multicast routing protocol for mobile ad hoc network, an improvement can be done to have multiple sources within a group.

- In the proposed protocols, the section of cluster-head can be done with recent clustering algorithms and mobility to cluster-heads may be given as future enhancement.

- In the proposed protocols, security needs further investigations as a future work.