CHAPTER 1
INTRODUCTION

MANETs are used in various thrust application areas in the real world like war field, natural calamities, emergency search and rescue sites, classrooms, and conventions where participants share information dynamically using their mobile devices that lend themselves well to multicast operations. It improves the efficiency of the wireless links, when sending multiple copies of messages, by exploiting the inherent broadcast property of the wireless medium when multiple mobile nodes are located within the transmission range of a node. Improved transmission efficiency can reduce energy consumption, which is an important consideration in MANETs [1]. The constraints need to be addressed are dealing with unconstrained mobility, membership management, lowering of transmission redundancy, control overhead and reliability in packet delivery. Design of a multicast protocol for MANET to address the above mentioned constraints is very much required and this motivated us to take up the current research problem.

1.1 TYPES OF WIRELESS NETWORK

1.1.1 Peer-to-Peer (P2P) or Ad-Hoc NETWORK

In this type of network, computers are connected wirelessly with the help of wireless Network Interface Card (NIC). Computers can access the printers and shared files apart from accessing of the Wired LAN using bridging.

Fig. 1.1.1: Peer – to – Peer or Ad-Hoc network
1.1.2 Access point or Infrastructure wireless LAN Network

It is different from peer-to-peer or Ad Hoc network. In this type of wireless network, Wireless device connects to the access point for connecting to the network. The Access point acts as a hub to connect two wireless devices and act as Wireless Bridge. Apart from that, it is used to connect a wireless network to a wired network.

![Diagram of Access Point Infrastructure](image)

Fig. 1.1.2: Access Point or Infrastructure Wireless LAN

1.2 WIRELESS STANDARDS

There are Variety of Wireless standards accepted worldwide and offer different levels of security. The different standards available are namely IEEE 802.11, Bluetooth, IrDA, HomeRF and WiMAX.

1.2.1 IEEE 802.11 Protocols

The IEEE 802.11 protocol standard was developed by the Institute of Electrical and Electronic Engineers (IEEE) for defining different aspects of Radio Frequency and Wireless networking. Based on Data rate, Maximum Range and Frequency compatibility aspects these protocols are named as 802.11, 802.11a, 802.11b, 802.11g and 802.11n. Out of all these standards IEEE 802.11n has higher data Transmission rate.
1.3 MOBILE AD HOC NETWORK

A multi-hop, wireless Ad Hoc network (or MANET) operates without any fixed infrastructure. Hosts communicate with each other through wireless packets. Because of the limited radio propagation range, routes can often be multi-hop. Hence, every host may act as a packet forwarder as well as source or destination of traffic. Because of their ease of deployment, MANETs are an attractive choice for scenarios where the fixed network infrastructure is non-existent or unusable. Some of the applications of Mobile Ad Hoc Network are search and rescue, disaster recovery, digital battlefield, and covert military operations.

Both unicast and multicast routing in MANETs have been well-studied and, as a result, a number of protocols have been proposed. Several research efforts have also focused on transport-layer approaches to achieve end-to-end reliable point-to-point communication. This includes the work on improving TCP performance in “last-hop” wireless networks and MANETs.

In this environment, there will be a dynamic collection of nodes with mobility and sometimes rapidly changing multi-hop topologies that are composed of relatively low-bandwidth wireless links. There is no assumption of an underlying fixed infrastructure. To provide communication through the whole network, a source-to-destination path could pass through several intermediate neighbor nodes [6].

1.4 MOTIVATION FACTORS FOR RESEARCH

The main goal of MANETs is to extend mobility into the domains, namely autonomous, mobile, and wireless where a set of nodes form the network routing infrastructure are in an ad hoc fashion. This technology is more suitable in the situations where the rapid deployment and dynamic reconfiguration are necessary and the wired network is not available. These include war fields, emergency search and
rescue sites, classrooms, and conventions where participants share their information dynamically with the help of mobile devices. These applications use multicast operations. It is more crucial to reduce the transmission overhead and power consumption in a wireless medium.

It improves the performance of the wireless link during sending of multiple copies of the messages by exploiting the inherent broadcast property of wireless transmission. The audio/video distribution applications, can tolerate loss of data content. The applications like file distribution, monitoring applications (stock prices, sensor readings, etc.), synchronized resources (directories, distributed databases, etc.), concurrent processing, collaboration/shared document editing, and online auction applications cannot tolerate loss of data [6].

It is very difficult to design MANETs with reliable multicast transport mechanism due to its distinct features. Some of these features are (a) Loss due to MANET’s heterogeneous characteristics such as mobility, node density, time-varying channel conditions (b) Effects of lower layer protocols, e.g., inherent unfairness and unreliability of contention-based medium access control protocols and (c) MANET’s extreme sensitivity to offered load [13]. Three things needed to be taken care are: error control, effective multicast delivery, and congestion control. MANETs function under severe constraints such as limited bandwidth and energy, group communications should be performed efficiently and at low control overhead cost [14]. MANETs are susceptible to both inside and outside attacks. Some of the MANET Routing Challenges [15] are given below.

- Flat addressing – no hierarchy which leads to scaling issues.
- Mobility – frequently changing topology, by this it very difficult in terms of adaptability, and reactivity to the dynamic environment.
•Heterogeneity - where all nodes are not made equal

•Network-to-network connectivity criticality in terms of – Internet access

1.5 PROBLEM OF THE THESIS

The goal of this thesis is to develop a new multicast routing protocol that assures high degree of reliability of transmission of data from source to the destination nodes in a MANETs with node mobility. The new proposed protocol is comprised of both Proactive Component and Reactive Component. The proactive nature is needed to setup the multicasting, and the reactive component is needed to deal with the events that occur in between the communication. By this proposed protocol, Improved ODMRP with motion detection (IOMD), there is a reduction of communication overhead and improvisation of performance in MANETs with mobility for content-based publish/subscribe system. The Publish-Subscribe model has potential to become the most fundamental importance in mobile computing domain. The middleware designing this model poses several challenges in mobility area. ODMRP [2] is extended using aggregated summaries of content-based subscriptions in Bloom filters expression for the dynamic construction of an event dissemination structure. In this thesis, experimental results including comparison with regular ODMRP and mobility simulation were described. Apart from that, a comparative performance analysis among different multicast protocols namely ODMRP, Adaptive Demand-Driven Multicast Routing protocol (ADMR) [5] and MAODV Routing protocol with IOMD are evaluated. The effects of performance are studied for these protocols by further extending the number of receivers or sources and also increasing the number of nodes in various mobility scenarios using statistical methods / techniques. Performance metrics like Packet deliver ratio and End-to-End delay etc. are also considered for comparative analysis among these protocols.
1.6 ORGANIZATION OF THE THESIS

The rest of the thesis is organized as follows

Chapter 2

This chapter gives the brief study of all the existing protocols in MANETS apart from GLOMO SIM tool functionality. Apart from that comparative result summaries existing in literature are also discussed.

Chapter 3

ODMRP protocol functionality and the proposed protocol IOMD are discussed. Performance based comparisons are also made in this chapter and proved that IOMD has better performance than ODMRP. Different models like Mobility model, Random way point mobility model, uniform model and Manhattan models were discussed.

Chapter 4

In this chapter the proposed IOMD for content based publish / Subscribe system in MANETs are discussed. Apart from that how effectively it works compared to ODMRP with publish / subscribe system. These results shows that how the mobility factors affect the multicast routing performance. The special case of high density and high traffic rate were also investigated. In performance evaluation the parameters like Average delivery ratio and control overhead etc were considered.

Chapter 5

A comparative performance analysis of various multicast protocols of MANETs like ODMRP, ADMR and MAODV with IOMD were done and results were discussed. Prediction of node life time, Link life time, recovery mechanism and receiver join mechanism were considered in the discussion. The performance comparison was made on parameters like packet delivery ratio, control overhead and end-to-end delay.
Chapter 6

In this chapter we show all the results carried out with the help of various graphs prediction curves, regression curves fitted with polynomial equations.

Chapter 7

This chapter discusses about the conclusion and future scope of the thesis work.

Chapter 8

The chapter has all the references used in the literature survey.

1.7 SUMMARY

The basic concepts of Wireless Network, IEEE 802.11 Protocols, and multicasting in MANETs are discussed. Various Issues and challenges related to multicasting in MANETs were also discussed. The problem of the thesis and the motivation factors that led to the research problem are described.