



## Multicast Ad hoc On-demand Vector with Backup Branches

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**Abstract:** *Mobile Ad hoc Networks (MANETs) play an important role in emergency communications where network needs to be constructed temporarily and quickly. Since the nodes move randomly, routing protocols must be highly effective and reliable to guarantee successful packet delivery. Based on the data delivery structure, most of the existing multicast routing protocols can be classified into two folders: tree-based and mesh-based. We observe that tree-based ones have high forwarding efficiency and low consumptions of bandwidth, and they may have poor robustness because only one link exists between two nodes. As a tree-based multicast routing protocol, MAODV (Multicast Ad hoc On-demand Vector) shows an excellent performance in lightweight ad hoc networks. As the load of network increases, QoS (Quality of Service) is degraded obviously. In this paper, we analyze the impact of network load on MAODV protocol, and propose an optimized protocol MAODV-BB (Multicast Ad hoc On-demand Vector with Backup Branches), which improves robustness of the MAODV protocol by combining advantages of the tree structure and the mesh structure. It not only can update shorter tree branches but also construct a multicast tree with backup branches. Mathematical analysis and simulation results both demonstrate that the MAODV-BB protocol improves the network performance over conventional MAODV in heavy load ad hoc networks.*

**Index terms:** *MANETs(mobile adhoc networks),MAODV(Multicast adhoc on-demand vector),QOS(Quality of service),MAODV-BB(Multicast adhoc on-demand vector with backup branches).*

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### I. INTRODUCTION

#### 1.1 General Information

Mobile ad hoc networks (MANETs) are self-organizing wireless networks without any fixed infrastructure and centralized management. All the nodes move randomly, which communicate with each other through multi-hop wireless links. If two mobile nodes are not within radio range, the communication between them can be established through one or more intermediate nodes. Multicast is an efficient way to transmit packets from one point or multi-points to multi-points, which can reduce the consumptions of network bandwidth and host power by sending the same data to multiple recipients. Consequently, multicasting plays an important role for communication in MANETs, where group tasks are often deployed. Based on the structure used for data delivery, most of the existing multicast routing protocols can be classified into two categories: tree-based and mesh-based protocols.

In tree-based multicast routing protocols, all the routers form a tree structure with the source node as the root, thus there is only one single path between every pair of source and receiver. In contrast with tree-based protocols, the mesh-based multicast routing protocols maintain more than one path between each pair of source and receiver, and provides a more robust data delivery path; however, it brings on more control overhead to maintain multiple paths. The study reviews the operation of tree-based and mesh-based multicast routing using MAODV (Multicast Ad hoc On-demand Vector) and ODMRP(On-Demand Multicast Routing Protocol) as examples of tree-based and mesh-based protocols, respectively. Comparing MAODV with ODMRP, the general trend we observe from the simulation results is that, especially at high mobility, ODMRP exhibits better (by roughly 10%) packet delivery ratios than MAODV. Since MAODV delivers packet along a multicast tree, a single packet drop upstream can prevent a large number of downstream multicast receivers from receiving the packet. The absence of red conclude that ODMRP has a greater routing overhead than MAODV on account of the mesh structure. Routing protocol overhead can be especially harmful in typical MANET scenarios where nodes are both bandwidth constrained and energy constrained. Considering the advantages of tree-based multicast routing protocols that high forwarding efficiency and low consumptions of bandwidth, several researchers have managed to optimize existing tree-based multicast routing protocols and improve robustness of the protocols in various methods. In this paper, we consider a tree-based case and propose an optimized protocol MAODV-BB (Backup Branches) to improve the performance of MAODV in heavy load ad hoc networks. The key idea of MAODV-BB algorithm is to make full use of GRPH (Group-hello) messages that the group leader broadcasts periodically to update shorter tree branches and construct a multi-cast tree with backup branches. The shorter branches reduce the resource occupied and the existence of backup branches avoids large numbers of tree reconstructions and enhances robustness of the protocol.

### 1.2 On Demand Multicast Routing Protocol (ODMRP)

The On-Demand Multicast Routing Protocol (ODMRP) falls into the reactive protocol category since group membership and multicast routes are established and updated by the source whenever it has data to send. Unlike conventional multicast protocols which build a multicast tree (either source or shared by the group), ODMRP is mesh-based. It uses a subset of nodes, or forwarding group, to forward packets via scoped flooding. Similar to other reactive protocols, ODMRP consists of a request phase and a reply phase. When a multicast source has data to send but no route or group membership information is known, it piggybacks the data in a Join-Query packet. When a neighbor node receives a unique Join-Query, it records the upstream node ID in its message cache, which is used as the node's routing table, and re-broadcasts the packet. This process side effect is to build the reverse path to the source. When a Join-Query packet reaches the multicast receiver, it generates a Join-Table packet that is broadcast to its neighbors. The Join-Table packet contains the multicast group address, sequence of (source address, next hop address) pairs, and a count of the number of pairs. When a node receives a Join-Table, it checks if the next node address of one of the entries matches its own address. If it does, the node realizes that it is on the path to the source and thus becomes a part of the forwarding group for that source by setting its forwarding group flag.

It then broadcasts its own Join-Table, which contains matched entries. The next hop IP address can be obtained from the message cache. This process constructs (or updates) the routes from sources to receivers and builds the forwarding group. Membership and route information is updated by periodically (every Join-Query-Refresh interval) sending Join-Query packets. Nodes only forward (non-duplicate) data packet if they belong to the forwarding group or if they are multicast group members. By having forwarding group nodes ood data packets, ODMRP is more immune to link/node failures (e.g., due to node mobility). This is in fact an advantage of mesh based protocols. Figure illustrates how the mesh is created in ODMRP.

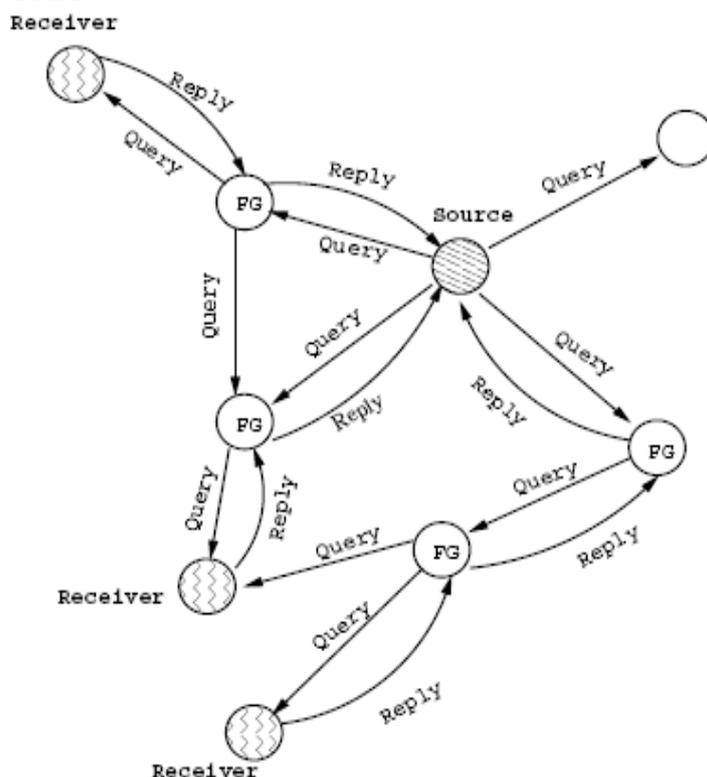


Figure1.1: Mesh formation in ODMRP

### 1.3 Multicast Ad hoc On-Demand Distance Vector (MAODV)

MAODV is an example of a tree-based multicast routing protocol (Figure 1.2 illustrates MAODV tree formation). Similar to ODMRP, MAODV creates routes on-demand. Route discovery is based on a route request Rreq and route reply Rrep cycle. When a multicast source requires a route to a multicast group, it broadcasts a Rreq packet with the join flag set and the destination address set to the multicast group address. A member of the multicast tree with a current route to the destination responds to the request with a Rrep packet. Non members rebroadcast the Rreq packet. Each node on receiving the Rreq updates its route table and records the sequence number and next hop information for the source node. This information is used to unicast the Rrep back to the source. If the source node receives multiple replies for its route request it chooses the route having the freshest sequence number or the least hop count. It then sends a multicast activation message Mact which is used to activate the path from the source to the node sending the reply. If a source node does not receive a Mact message within a certain period, it broadcasts another Rreq. After a certain number of retries (Rreq-Retries), the source assumes that there are no other members of the tree that can be reached and declares itself the Group Leader. The group leader is responsible for periodically broadcasting group hello (GRPH) messages to maintain group connectivity.

Nodes also periodically broadcast Hello messages with time-to-live = 1 to maintain local connectivity.

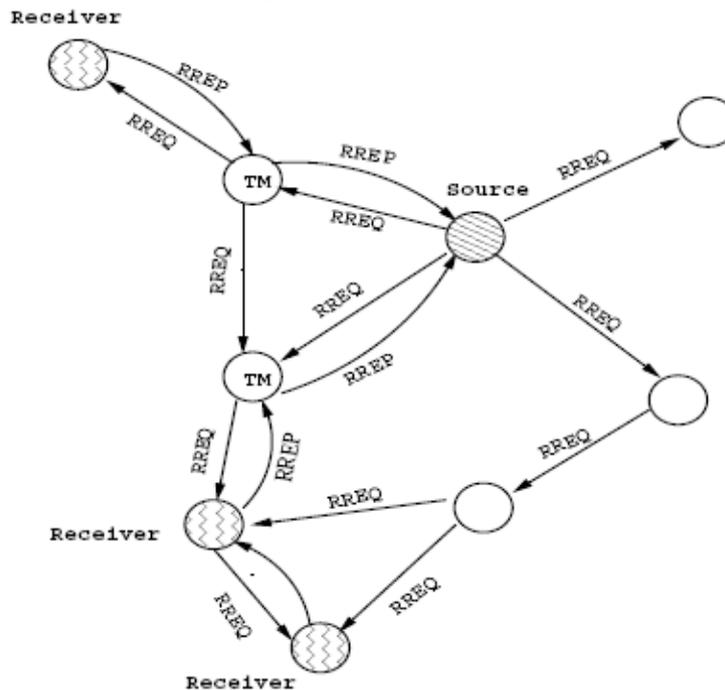


Figure1. 2: Tree creation in MAODV

#### 1.4 MANET Scenarios

We use two type of MANET scenarios in our simulations. In “synthetic” scenarios, parameters such as mobility, multicast group size, traffic sources, and number of multicast groups are varied over an arbitrary range of values. We also define more “concrete” environments reflecting specific MANET applications, namely impromptu teleconferencing and disaster relief/recovery scenarios. These more concrete MANET scenarios were generated using the scenario generator. In the synthetic scenario simulations, 50 nodes are randomly placed in a 1000 m<sup>2</sup>field. Each node transmits a maximum of 1000 packets (256 bytes each) at various times during the simulation. Nodes' channel bandwidth is set to 2 Mbit/sec and their transmission range is 225 meters. For these simulations, senders are chosen randomly from the multicast group members. All member nodes join at the start of the simulations and remain members throughout the duration of the simulation.

#### 1.5 Routing Protocols for MANETS

##### 1.5.1 Unicast Routing Protocols

Routing is the most fundamental component in networks to support data communications. To make MANETs practical, efficient and effective unicast routing protocol is being a critical issue. Many different unicast routing protocols have been developed for MANETs. They can be classified into two types of unicast routing methodologies as follows: A proactive unicast routing protocol is also called a “table driven” unicast routing *protocol*. Using the proactive unicast routing protocol, nodes continuously evaluate routes to all reachable nodes and attempt to maintain consistent, up-to-date routing information. Therefore, the source node can get a routing path immediately if it needs one. In the proactive unicast routing protocols, all nodes need to maintain a consistent view of the network topology. When a network topology change occurs, respective updates must be propagated throughout the network to notify the change. Most proactive unicast routing protocols proposed have inherited properties from algorithms used in wired networks. To adapt to the dynamic features of MANETs, necessary modifications have been made on traditional wired network unicast routing protocols. Using the proactive unicast routing algorithms, MNs proactively update network state and maintain a route regardless of whether the data traffic exists or not, the overhead to maintain up-to-date network topology information is high. The Optimized Link State Routing protocol (OLSR) and Dynamic destination-Sequenced Distance-Vector protocol (DSDV) are examples for proactive routing protocols for MANETs. A different approach from the proactive unicast routing is the reactive unicast routing. The reactive routing protocol is also called source-initiated “on-demand” unicast routing protocol. This type of unicast routing creates routing only when desired by the source node. When a node requires a routing to a destination, it initiates a routing discovery process within the network. This process is completed once a route is found or all possible routing permutations have been examined. Active routes may be disconnected due to node mobility in MANETs. Therefore, route maintenance is an important operation of reactive routing protocols. The Dynamic Source Routing protocol (DSR) and Ad-hoc On-demand Distance Vector protocol (AODV) are examples for reactive routing protocols. Compared to the proactive routing protocols, less control overhead is a distinct advantage of the reactive routing protocols. Thus, reactive routing protocols have better scalability than proactive routing protocols. However, when using reactive routing protocols, source nodes may suffer from long delays for route searching before they can forward data packets.

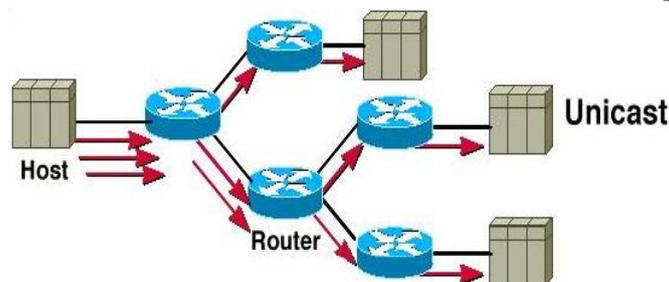


Figure1. 3: Sending Data Packet in unicast routing protocol

### 1.5.2 Multicast Routing Protocols

Applications of MANETs are in areas where rapid deployment and dynamic reconfiguration are necessary, but the wired network is not available. These include military battlefields, emergency search, rescue sites, classrooms, and conventions where participants share information dynamically using their mobile devices. These applications lend themselves well to multicast operation. In addition, within a wireless medium, it is even more crucial to reduce the transmission overhead and power consumption. Multicasting can be used to improve the efficiency of the wireless link when sending multiple copies of messages to exploit the inherent broadcast property of wireless transmission. So multicasting plays an important role in MANETs. In the wired environment, there are two popular network multicast approaches, namely, the shortest path multicast tree and core-based tree. The shortest path multicast tree guarantees the shortest path to each destination. But each source needs to build a tree. Usually, there exist too many trees in the network, so the overhead tend to be large. In contrast, the core-based tree constructs only one tree for each group and the number of trees is greatly reduced. Unlike typical wired multicast routing protocols, multicast routing for MANETs must address a diverse range of issues due to the characteristics, such as, low bandwidth, mobility and low power. MANETs delivers lower bandwidth than wired networks. Therefore, the information collection is expensive during the formation of a Routing Table (RT). Mobility of nodes, which causes topological changes of the underlying network, also increases the volatility of network information.

In addition, the limitation of power often leads users to disconnect mobile units. Recently, many multicast routing protocols have been newly proposed. The Ad-hoc Multicast Routing protocol utilizing increasing Id numbers (AMRIS) builds a shared-tree to deliver multicast data. Each node in the multicast session is assigned an ID number and it adapts to connectivity changes by utilizing the ID numbers. The Multicast Ad-hoc On-Demand Vector (MAODV) stems from the use of a destination sequence number of each multicast entry. The sequence number is generated by the multicast group-head to prevent loops and to discard stale routes. The Ad-hoc Multicast Routing (AM Route) is also a shared-tree protocol which allows dynamic core migration based on group membership and network configuration. The Lightweight Adaptive Multicast (LAM) algorithm is a group shared-tree protocol that does not require timer-based messaging. Similar to the On-Demand Multicast Routing Protocol (ODMRP), the Core Assisted Mesh Protocol (CAMP) uses a mesh. However, a conventional routing infrastructure based on enhanced distance vector algorithm or link state algorithm is required for CAMP to operate. Core nodes are sued to limit the traffic required when a node joins a multicast group. The Location Guided Tree (LGT) is a small group multicast scheme based on packet encapsulation. It builds an overlay multicast packet distribution tree on top of the underlying unicast routing protocol. The Differential Destination Multicast (DDM) can be viewed as flooding with “limited scope,” wherein the flooding is contained within selected Forwarding Group (FG) node.

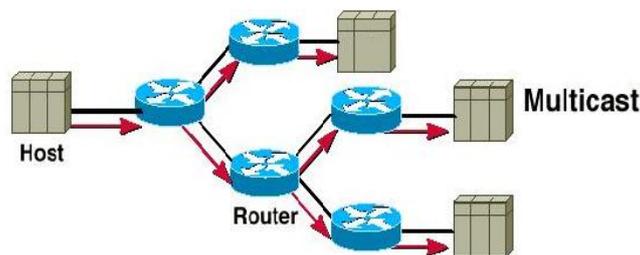


Figure1. 4: Sending Data Packet in multicast routing protocol

## II. LITERATURE SURVEY

### 2.1 Multicast Routing

The emerging trends in group communications and Quality of Service (QoS) oriented applications over MANETs have accelerated the need for scalable and efficient network support. These group communications include applications like video conferencing, battle field, disaster management etc. The traditional unicast routing in ad hoc networks is extremely inefficient for such group-based applications, since the same data packet is transmitted repeatedly across the network to each receiver. In all these applications, communication and coordination among a given set of nodes are necessary. A multicast group is a set of mobile nodes sharing a common multicast address, all receiving the data packets addressed to this multicast address by senders. Multicast routing protocols play a vital role in mobile ad hoc networks to provide this communication efficiently. It is always advantageous to use multicast rather than multiple unicast.

### **2.1.1 Multicast Routing in Wired Networks**

Multicasting is the ability of a communication network to accept a single message from an application and to deliver copies of the message to multiple recipients at different locations. The applications associated with group communication, along with recent advancements, have increased the need for efficient multicast communication services satisfying the user requirements of such applications. Initially conducted a study of learning algorithms for multicast routing which are used for shared multicast trees, in order to minimize some performance index such as average received packet delay or path length. It is shown that automata converge to optimal shortest path tree solution and compromise solution for single and multiple sources respectively. The problem of finding feasible solutions for the delay constrained group multicast routing. The routing problem in this case involves the construction of a set of delay bounded multicast trees with bandwidth requirements, one for each member of the group, to multicast messages to other members of the group. Results from an empirical study show that the given approach has, indeed, a high probability of finding a feasible solution when one exists.

### **2.1.2 Multicast Routing in MANETs**

In MANETs, nodes are constantly moving and the topology is dynamic; under this scenario, sending data packets from one node to multiple receivers is a challenging task. Even then lot of work has been contributed in this focused area, since it is an active field of research. Due to unrestricted node movements, the topology of the mobile ad hoc network is constantly changing; hence, it is difficult to maintain a complete network topology at each node. It is desirable that the core selection method be based on local topology information which can be easily gathered at each node. It is proved that core migration is more beneficial when the group membership is relatively sparse and the group size is moderate.

The protocol for unified multicasting through announcements in adhoc networks,- which establishes and maintains a shared mesh for each multicast group, without requiring a unicast routing protocol. The results from a wide range of scenarios of varying mobility, group members, number of senders, traffic load, and a number of multicast groups show that the proposed approach has a higher packet delivery ratio than the ODMRP and MAODV, while incurring much lesser control overhead. An ad hoc QoS multicast scheme that achieves multicasting efficiency by tracking the availability of resources for each node within its neighborhood. The presented Ad hoc QoS Multicast (AQM) scheme provides ad hoc networks with QoS support and multicasting features, which improves multicast efficiency through resource management.

## **2.2 Survey of Multicast Routing**

To provide an important taxonomy of the field of multicast routing protocols in wired and wireless networks, which are comprehensive and up-to-date, a lot of surveys have been conducted. These studies have identified the basic components and issues related to these protocols, tried to break them down into separate mechanisms, and categorize the multicast routing protocols according to their properties, mechanisms and functionalities. They also identify the challenges and features related to designing a new multicast protocol.

### **2.2.1 Study of Issues in Wired Multicast Routing Protocols**

The notation of multicast routing in wired networks has attracted different approaches to the problems. Nowadays, this research has matured because of the availability of several test beds. A Multicast Routing Algorithms and Protocols by divides Multicast Routing Algorithms on the basis of their properties into three priority levels: high, medium and low. The various multicast routing parameters like cost optimization, delay optimization, cost delay trade off, scalability, survivability and fairness are discussed. Also, multicast routing protocols like Internet Group Management Protocol (IGMP), Reverse Path Multicast (RPM), Distance Vector Multicast Routing Protocol (DVMRP), Multicast Extensions to Open Shortest Path First (MOSPF), Core Based Tree (CBT), Protocol Independent Multicast (PIM), and Border Gateway Multicast Protocol (BGMP) are examined.

### **2.2.2 Issues in MANETs Multicast Routing Protocols**

A large number of multicast routing protocols have been proposed to support group oriented applications in MANETs. This section aims to Present the various reliable multicast protocols that have been explicitly designed for this purpose. The issues associated with the implementation of MANET routing protocols on actual wireless networks. The implementations of two distance vector MANET routing protocols are experimented. The route discovery process of both the protocols is fooled by the transient availability of network links to nodes that are more than one hop away. Finally several recommendations for future work in MANET research are listed based on the implementation experience.. A performance comparison shows that the SRMP provides better route lifetime and battery lifetime compared to the other two protocols have identified the issues in reliable multicasting for ad hoc networks where the busy packet losses are common when a link breaks due to node mobility. The scheme has been simulated on GloMoSim and has shown to be effective in removing busy data losses due to link failures.

## **2.3 QoS MULTICAST ROUTING**

The escalating use of QoS aware applications coupled with the limited availability of network resources, demands efficient mechanisms to Support QoS multicasting. QoS defines a guarantee given by the network to satisfy a set of predetermined service performance constraints for user applications in terms of delay, jitter, bandwidth and packet delivery ratio.

### **2.3.1 QoS Multicast Routing in Traditional Networks**

The process of finding feasible paths subject to connection QoS constraints while utilizing network resources efficiently.

To support multicast routing on the Internet, a Quality of service Multicast Routing Protocol (QMRP) is a pivotal in enabling new receivers to join a multicast group. QMRP achieves scalability by significantly reducing the communication overhead of constructing a multicast tree, yet it retains a high chance of success. With real-time streaming applications becoming more and more popular on the Internet, it is essential to find QoS routes. QoS routing is The experimental results reported in this work show a better performance than the approaches discussed so far. A Single Probe Multi Destination (SPMD) protocol for QoS multicasting, which aims at alleviating the traffic concentration around the core, The effectiveness of the proposed routing protocol through extensive simulation studies, and by evaluating its performance in terms of the average call acceptance rate and average call setup time, is also demonstrated. In conclusion, the proposed SPMD protocol is shown to be effective for QoS multicast routing, especially when the multicast groups are resource intensive.

### 2.3.2 QoS Multicast Routing in MANETs

This section explores the various protocols proposed to solve QoS constrained multicast routing problems in MANETs. These algorithms consider multiple QoS metrics such as bandwidth, delay, jitter and packet loss rate. A multicast routing protocol, with mechanisms to ensure QoS guarantees to multicast session, is also proposed. Based on the preliminary analysis of the problem, a distributed admission control based solution is proposed. An extended load balancing QoS Multicast Routing to make it effective has been proposed by Mohammed Saghir et al (2006). A cross layer framework to support QoS multicasting and an enhanced IEEE 802.11 MAC layer to estimate the available bandwidth at each node is proposed. The results of simulation reflect a good packet delivery ratio associated with lower control overhead and lower packet delivery delay. A QoS multicast routing scheme in NGI (Next Generation Internet).It is mathematically proved that, QoS multicast routing is NP-Complete and can be solved by heuristic or intelligent algorithms. Moreover, simulations have been done on NS 2 platforms, showing that the proposed scheme is effective.

## III. SYSTEM ANALYSIS

### 3.1 Existing System

As an extension of our earlier project, as a tree based multicast routing protocol, MAODV(Multicast Ad hoc On-demand Vector) shows an performance not in lightweight ad hoc networks. As the load of network increases, QoS (Quality of Service) is degraded Obviously takes Some Drawback for this way , to repair broken tree branches. Here the node will be transmitting the data from one node to other none. So the flow the data within the network works very well when there is no load or no traffic in the networking system. The data in the lightweight network is easy go, i.e. is in lightweight network means that when in a network or in a network there is no chances of getting data congestion or data traffic in a network. This lightweight network is only used in office purpose or in military purpose where the enterprise buys a full network for its office only. So having a lightweight network is very costly or financial have a big impact. The danger of having the lightweight network is that there is fixed amount of data could be only send so there is limit in sending the data and if the data count increases the maximum data count the there could be total network breakdown. Here the data is send to a fixed node by using some routing algorithm to help the data to reach to its destination. The data will be send on demand like when a node request for a data then only data can be send without the request of the data or file the sending of data is not possible. Here the data transmission is fast as the data have a fixed route or the path to follow and there is no traffic in the way. So the transmission of data is very fast and quick.

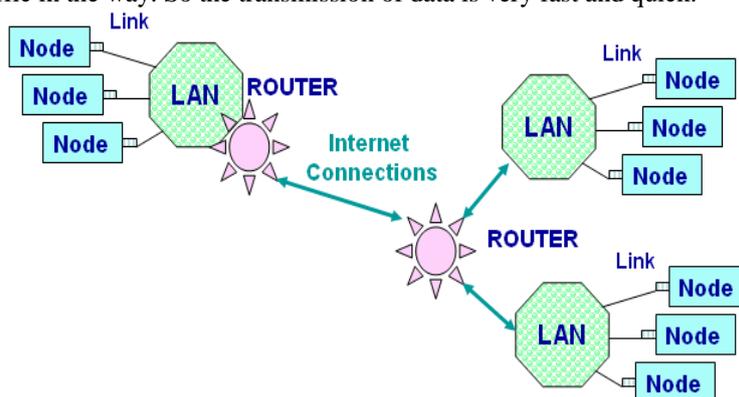


Figure3.1: Sending data packet in an existing system

### 3.2 Problems of the Existing System

The main problem of use this system is it is very expensive. The cost of maintaining the lightweight network is very high as they have to maintain such network there is a very costly work. Here when a data is send there is no copy is kept so this brings a very big disadvantage to the system. Once a data is being sent and on the way if data is lost that data is lost for permanent. Here this system is not possible to implement in a open network where anyone can access the data. As on this prototype there will be no security. as in open network there is a high level of data to data to get damage or data to get stolen by the hacker or the virus. As once the data have been corrupted then there is no chance of getting the data back. There is also a chance of getting the data stolen and then from the data which have been stolen there could a mischief could be done. There is also no security to data packet while sending the data so it is very risky to send the data in open network. So sending the data from this protocol could be very risky.

### 3.3 Proposed System

This paper proposes an optimized protocol MAODV-BB based on MAODV, which improves robustness of the MAODV protocol by combining advantages of the tree structure with the mesh structure. The key idea of MAODV-BB is to make full use of GRPH messages that the group leader broadcasts periodically to update shorter tree branches and construct a multicast tree with backup branches. It not only optimizes the tree structure but also reduces the frequency of tree re- construction. Mathematic modeling derivation and simulation results both demonstrate that MAODV-BB protocol improves the network performance over conventional MAODV in heavy load ad hoc networks, which meets QoS requirements for communication in a MANET. When the upstream node detects the link broken, it will delete the downstream node in its next-hop list and set pruning timer. When the downstream node detects the link broken, it needs to determine whether there is an available backup branch in its backup routing .

## IV. SYSTEM MODULES

### 4. Design modules

#### 4.1 Multicast Ad hoc On-demand Vector (MAODV)

To provide reliable multicasting suitable for mobile ad hoc networks, several researchers have kept trying to optimize existing multi- cast routing protocols. The main approaches to improve the robustness of tree-based mul- ticast routing protocols are the optimization of selecting route mechanism, node mobility prediction, the establishment of multiple trees, the utilization of multipath routing and so on presents an Entropy-based long-life multicast routing protocol in MAODV (E-MA- ODV ). It uses entropy concepts to develop an analytical modeling, and selects the long- life multicast routing according to entropy metric. This improvement reduces the number of route reconstruction and ensures the route stability in dynamic mobile networks, but it increases complexity of route establishments. Furthermore, this paper takes no extra measure to repair broken tree branches. NMP-MAO- DV (Node Mobility Prediction-MAODV) ensures non- disconnection communication by active-link switch before mobile node breaks away from upstream node's signal range. The multicast group members set the unified cycle and calculate the predicted departure time. If the result is less than threshold, then turn to the active-link switch process. If the link switch process fails, it will initiate the MAO- DV repair process. The improved protocol can operate properly in highly mobile network.

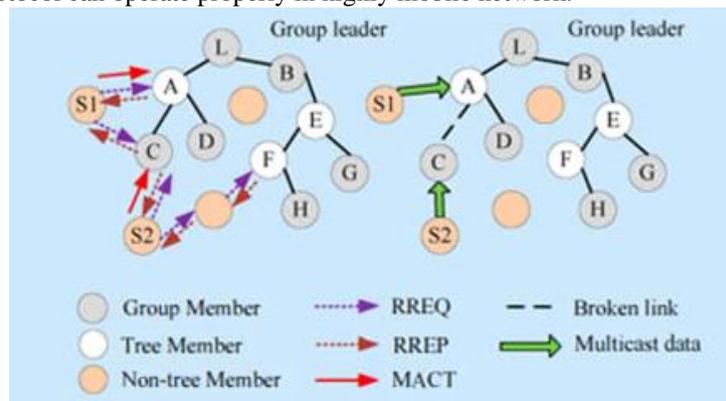


Figure6.1: Multicast Ad hoc On-demand Vector(MAODV)

#### 4.2 Packet loss model and insensitive to loss correlations

Probe traffic of a relative large packet bursts are neither independent nor strongly correlated. Once the loss rate for each packet type is obtained, we need to determine whether the loss rates difference among them is large enough to conclude that they are treated differently. When packet losses can be described with a good mathematical model, e.g. independent and identical distribution (i.i.d) process, we can determine if the loss rates of different packet types were evidently different or not by comparing all  $\pi_i$ , the loss rate of packet type  $i$ , using parametric statistical methods. However, our probe packets are sent in large packet bursts. Packet losses in one burst are not independent but correlated. We are not aware of any well-known model for packet losses in a large packet burst in the Internet. Hence, we employ a nonparametric method based on ranks, which is independent to underlying packet loss model and insensitive to loss correlations.

#### 4.3 Grouping is needed for multiple Routing Algorithm

When the upstream node detects the link broken, it will delete the downstream node in its next-hop list and set pruning timer. When the downstream node detects the link broken, it needs to determine whether there is an available backup branch in its backup routing table. MAODV is a routing protocol designed especially for ad hoc networks. In addition to unicast routing, MAODV supports multicast and broadcast as well. MAODV protocol constructs a shared delivery tree to support multiple senders and receivers in a multicast session. The route mechanism in MAODV mainly consists of route establishments and route maintenances.

#### 4.4 Multicast Ad hoc On-demand Vector with Backup Branches

We add one backup routing table for each on-tree node to save the information of its backup tree branch in MAODV-BB. In order to accomplish the improvement, the operation after receiving a GRPH message is modified as followed:

- (a) If it is the first time for the on-tree node to receive the GRPH message, then turn to b), otherwise discard the GRPH message.
- (b) Determine whether the GRPH message is received from its upstream node or not. If it is, the node needs to perform the same operation as MAODV, otherwise turn to c).
- (c) If the hop to the group leader in the GRPH message is less than that in multicast routing table and the number of active down- stream branches is under the limit, then update the tree branch, otherwise tum to d).
- (d) Judge whether there is a available back- up branch or not. If there is, turn to e), other- wise add a new backup branch in the backup routing table.
- (e) If the hop to the group leader in the GRPH message is less than that in the backup routing table, then update its backup branch, otherwise abandon the GRPH message. For example, in figure 2, node K firstly receives a GRPH message from node B and then determines that the hop to the group

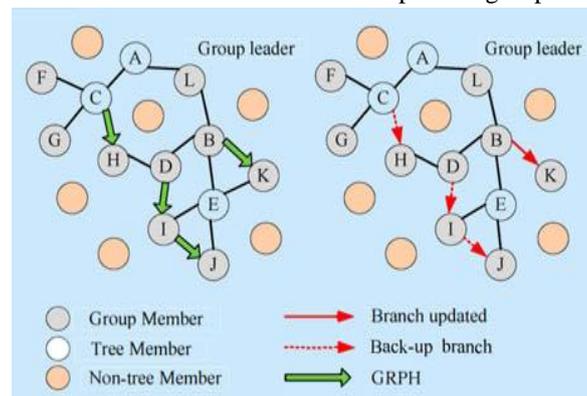


Figure6.2: Multicast Ad hoc On-demand Vector with Backup Branches

## V. IMPLEMENTATION

### 5. Algorithms

#### 5.1 Multicast algorithm

In computer networking, multicast (one-to-many or many-to-many distribution) is group communication where information is addressed to a group of destination computers simultaneously. Multicast should not be confused with physical layer point-to-multipoint communication. Group communication may either be application layer multicast or network assisted multicast, where the latter makes it possible for the source to efficiently send to the group in a single transmission. Copies are automatically created in other network elements, such as routers, switches and cellular network base stations, but only to network segments that currently contain members of the group. Network assisted multicast may be implemented at the Internet layer using IP multicast, which is often employed in Internet Protocol (IP) applications of streaming media, such as Internet television scheduled content (but not media-on-demand) and multipoint videoconferencing, but also for ghost distribution of backup disk images to multiple computers simultaneously. In IP multicast the implementation of the multicast concept occurs at the IP routing level, where routers create optimal distribution paths for datagram's sent to a multicast destination address Network assisted multicast may also be implemented at the Data Link Layer using one-to-many addressing and switching such as Ethernet multicast addressing, Asynchronous Transfer Mode (ATM) point-to-multipoint virtual circuits (P2MP) or Infiniband multicast.

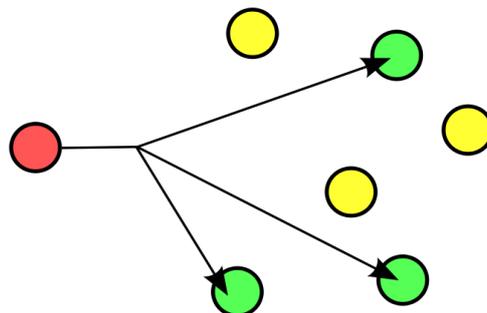


Figure7.1 :Multicast routing algorithm Diagram

#### 5.2 MADOV algorithm

The multicast operation of the Ad hoc On-Demand Distance Vector (AODV) routing protocol (MAODV) is intended for use by mobile nodes in an ad hoc network. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, and low network utilization. It creates bi-directional shared multicast trees connecting multicast sources and receivers. These multicast tree are maintained as long as group members exist within the connected portion of the network. Each multicast group has a group leader whose responsibility is maintaining the

group sequence number, which is used to ensure freshness of routing information. The multicast operation of the Ad hoc On-Demand Distance Vector (AODV) routing protocol (MAODV) is intended for use by mobile nodes in an ad hoc network. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, and low network utilization. It creates bi-directional shared multicast trees connecting multicast sources and receivers. These multicast trees are maintained as long as group members exist within the connected portion of the network. Each multicast group has a group leader whose responsibility is maintaining the group sequence number, which is used to ensure freshness of routing information.

### 5.3 MAODV Terminology

This protocol specification uses conventional meanings for capitalized words such as MUST, SHOULD, etc., to indicate requirement levels for various protocol features.

- Group leader  
A node which is a member of the given multicast group and which is typically the first such group member in the connected portion of the network. This node is responsible for initializing and maintaining the multicast group destination sequence number.
- Group leader table  
The table where ad hoc nodes keep information concerning each multicast group and its corresponding group leader. There is one entry in the table for each multicast group for which the node has received a Group Hello
- Multicast tree  
The tree containing all nodes which are members of the multicast group and all nodes which are needed to connect the multicast group members.
- Multicast route table  
The table where ad hoc nodes keep routing (including next hops) information for various multicast groups.
- reverse route  
A route set up to forward a reply (RREP) packet back to the source from the destination or from an intermediate node having a route to the destination.

## V. CONCLUSION

Optimized protocol MAODV-BB based on MAODV, which improves robustness of the MAODV protocol by combining advantages of the tree structure with the mesh structure. The key idea of MAODV-BB is to make full use of GRPH messages that the group leader broadcasts periodically to update shorter tree branches and construct a multicast tree with backup branches. It not only optimizes the tree structure but also reduces the frequency of tree reconstruction. Mathematic modeling derivation and simulation results both demonstrate that MAODV-BB protocol improves the network performance over conventional MAODV in heavy load ad hoc networks, which meets QoS requirements for communication in a MANET. As further work, we intend to study the reliability of tree-based multicast routing protocols in varying conditions such as node mobility, group size. We also consider enhancing our protocol with a global congestion control mechanism to slow the data rate of the senders when the network is highly loaded.

## VI. FUTURE ENHANCEMENT

It should be more optimized in send data while sending the data from backup node to other backup node. The time taken to be send data from the backup data have to be optimized by increasing speed of data packet sending.

The space optimization is also important as there will a lot of copy of a same data while sending the data through backup node. These have to be kept in mind while optimizing the network.

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