**Webology**, Volume 18, Number 5, 2021
**ISSN:** 1735-188X
**DOI:** 10.29121/WEB/V18I5/95

# Superiority of Service AM Route, PUMA, and ODMRP: Optimisation of Multipathing Routing Algorithms in Mobile Ad-Hoc Networks

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## ABSTRACT

This QoS approaches are required to maximise the scarce resource given by MANETs due to the network's mobile nature, lack of centralised coordination, multi-hop communications, and resource constraints. The provision of QoS guarantee in MANETs has been the subject of much study. The packet delivery ratio, latency, throughput, and energy consumption are the most important QoS parameters. Adding quality of service to ad hoc multicasting is a difficult problem. In this study, we investigate the results of an NS2 simulation comparing the quality-of-service (QoS) metrics of three different multicast routing protocols: ODMRP, AM Route, and PUMA.

**Keywords:** Mobile Adhoc Network, On-Demand Multicast Routing Protocol, AM Route, Protocol For Unified Multicasting,Quality of Service.

## INTRODUCTION

Using a common wireless channel and ad hoc networking equipment, mobile ad hoc networks (MANETs) are formed by a collection of self-organizing mobile nodes. If the destination node is within direct range of the sending node, a single hop of transmission is all that's needed to complete a communication session. This is why MANETs are often referred to as "multi-hop packet radio networks" [1] . Each mobile node in an ad hoc routing system is able to independently find its own multi-hop routes across the network to any other node. Since it is the job of QoS protocols to meet the needs of an application, they play a significant role in a QoS mechanism. Almost all audio and video-based applications have strict requirements for quality of service (QoS) metrics as throughput, latency, energy efficiency, packet delivery ratio, etc. In this study, we use NS2 to provide Quality-of-Service (QoS) constraints for the multicast routing protocols AM Route, PUMA, and ODMRP. These constraints include throughput, latency, packet delivery ratio, and energy [2].

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## CATEGORIZATION OF MULTICAST ROUTING PROTOCOLS

Ad hoc networks are known as infrastructure-less networks since they don't rely on preexisting physical connections. As all nodes, even mobile hosts, need to compute, maintain, and store routing information, there is no difference between a host and a router [3].
As you may imagine, multicasting has several uses in MANETs. A few examples are:

To send information to several recipients at once; to ensure that each message is sent only once over the network; to make copies of data only when necessary due to connection failures; etc. Topology, routing techniques, maintenance strategy, initiation, etc. are only few of the categories that may be used to categorise routing protocols.

There are many different multicasting routing protocols, however they may be categorised according to how they construct routes in a MANET. These include tree, mesh, stateless, and hybrid [4].

### Using Tree-Based Methods

This method constructs a route from the source to the receiver by grouping together several different multicast trees of source and receiver pairs. Only one path exists between every given source and any given destination. The advantages of this method include low overhead and excellent data transmission efficiency. Because of the widespread dispersion of nodes in modern networks, the efficiency and dependability with which packets are delivered are diminished by this method. Due to mobility's unexpected effect on topology, poor resilience emerges from a lack of alternative pathways [5]. The construction of routing pathways is based on a source- or shared-tree based technique. Each transmitter and receiver node forms its own shortest multicast route in the source based approach. The mobility of a MANET increases the method's inherent traffic burden. In the shared tree technique, all of the sending nodes share a single distributed tree. There is a group meeting place there. Various receivers connect at the RP, which is driven by the packets from the senders' node. The latter method causes a greater imbalance in the volume of traffic, while the former reduces delays. Some protocols, such as AMRIS and MAODV, are based on this method.
Processes Relying on Meshes

In this method, there are many possible paths between the origin and the destination node. As a result of the mobility inherent in a MANET, there are many potential pathways, resulting in topological resilience. When compared to the tree-based approach, this one is much better for improved throughput, faster packet delivery, and less delays. The high cost is a consequence of the extra work involved in keeping track of many routes, making sure they're always available, and forwarding packets. It is expected that the convenience of many routes would lead to the reception of duplicate data packets at the destination node, which will have a multiplicative impact on the volume of traffic and burden on the network [6].

### Anarchical Broadcasting System

Overhead in maintaining the route and generating new routes owing to frequent topology changes increases when mobility in the MANET leads to new origins. Upholding trees and meshes both

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incur additional work in the tree-based and mesh-based approaches. The stateless multicast method reduces this cost by having the sending node publish the list of recipients in the packet's header. This kind of multicasting is best suited for smaller groups. As a further step, the packet is broadcast using a very simple routing protocol to all possible destinations. However, the increased operational expense of this strategy is only noticeable in very large groups because of the increased number of possible final locations. This method is implemented in the Differential Destination Multicast (DDM) protocol.

**Using a Compendium of Techniques**

The research on the topic also makes note of hybrid techniques, which are based on a combination of tree based and mesh based methodologies. The goal of this process is to combine the advantages of mesh (i.e., resilience) and tree-based approaches (i.e., reduced overhead) to achieve top-notch performance. This deliberate technique reduces network traffic and burden while providing more dependability than a tree-based approach. AM This method is used by multicasting protocols like Route and MCEDAR [7]

Third, an On-Demand Portrayal of Routing Protocols Message Transmission across a Network Using a Protocol for Multicasting (ODMRP). One of the dependable multicast routing mechanisms is Open Distributed Multicast Routing Protocol (ODMRP). ODMRP allows the source to dynamically set up and modify group membership and multicast routes. Like on-demand unicast routing systems, it features a request and response phase. The request phase starts whenever a member of a multicast group wants to transmit packets to the other members of the group. During the request phase, the initiating node regularly sends out a member advertising packet known as a JOIN REQUEST to the whole network. By sending out a JOIN REQUEST at regular intervals, you can keep your membership data current and your routing optimised.

A node learns the upstream node ID (through backward learning) and retransmits the packet when it gets a JOIN REQUEST that is not a duplicate.If the JOIN REQUEST packet reaches a multicast destination,

Destination, the destination must either add or modify the source record in its member
JOIN TABLES are regularly broadcast to the neighbours as long as there are valid items in the member table.

Upon receiving the JOIN TABLE packet, a node will examine the data to see whether its own ID appears as the next node ID in any of the records. If it's a match, the node knows it's on the way to the source and joins the group of forwarders.

The node then broadcasts its own JOIN TABLE, constructed from the matched items, and sets a flag called the forwarding group flag. Each member of the forwarding group then forwards the JOIN TABLE until it reaches the multicast source via the shortest way. This procedure creates (or refreshes) a forwarding group, a mesh of nodes that connects origins and destinations [8]. It is the job of the nodes in the forwarding group to relay multicast packets to the other nodes in the group. In a mesh network, all of the nodes in all of the forwarding groups are interconnected with each

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other. Shortest pathways between any pair of members are supported by the nodes in a forwarding group. Keep in mind that any node along the route between a multicast source and a multicast destination may act as a forwarding group node. Improved communication between members of a multicast group is made possible by a mesh-like network architecture [9].

**Advantages**

All existing nodes update their database to retain up-to-date routing information, and a soft state method is used for joining and departing member nodes.

ODMRP has a high packet delivery ratio and a low control overhead because it can easily handle link and node failures.

It may serve as either a unicast or a multicast, which is a huge benefit.

**Limitations**

In the event of a parent node failure, child nodes will be disconnected.

Maintaining connection during node movement requires periodic reinvigoration of the routes.

The cost of maintaining redundant mesh pathways

As the network expands, the quantity of control packets will rise at an exponential rate since they are broadcast.

**Ad Hoc Multicasting Routing Protocol (AM Route)**

At the outset, everyone in a group claims to be the centre of a smaller subgroup consisting of only themselves. On a regular basis, each core will send out a large number of Join Requests (JREQs) in an effort to find more disconnected mesh nodes for the cluster to use. To avoid adding multiple connections to a core, the JREQ message may be responded to by any member, core or non-core, in the mesh segment. With the help of the core resolution technique, we can determine which of the physical cores is indeed the logical one.

In order to construct a multicast shared tree once the mesh has been established, the logical core regularly broadcasts TREECREATE control packets to neighbouring nodes in the mesh. Whenever a node in a mesh gets a non-replicated TREECREATE from one of its connections, it sends that packet on to all of the other links in the mesh. If an identical TREECREATE packet is received, the incoming connection is rejected and a TREECREATE-NAK is sent back. If a node receives a TREECREATE-NAK (TREECREATE-negative acknowledgement), it will convert the connection to a mesh link. When a node decides to quit a group, it notifies its neighbours with a Join-Negative Acknowledgement (JNAK) message and stops relaying group data packets.

**Advantages**

Each group's shared tree is created using AM Route, which is both competent and resilient.

As long as pathways between tree members and core nodes persist through mesh connections, the multicast delivery tree is resilient to changes in network topology.

**Limitations**

In the presence of mobility, AM Route has problems with loop construction, produces non-optimal trees, and necessitates additional overhead when assigning a new core.

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Like AM Route, it is vulnerable to a failure at its central node.

PUMA is the Protocol for Unified Multicasting via Announcement, and it is utilised in ad hoc networks. It can function independently of both a core and unicast routing protocol, neither of which are allocated in advance. The multicast routing topology is established and maintained with the use of very basic multicast announcement signals. It takes a receiver-initiated approach, with the receiver choosing a small group of people to function as a hub for interacting with the outside world on behalf of the larger group. By using the shortest way between the core and each receiver, multicast receivers establish a connection to the core. The mesh is made up of the nodes that make up the shortest pathways between any given receiver and the hub.

For everything that PUMA does, it relies on a single control message: the multicast announcement. There's information regarding the parent and child relationships in this control message, as well as the sequence number, group ID, core ID, distance to the core, and core ID. The parent suggests the best neighbour for penetrating the inside. These multicast announcements are periodically sent from the group's hub once every three seconds. When a user's membership status changes, a new multicast notice is also created. Prior to joining a multicast group, a receiver checks to see whether it has received a multicast announcement for the group.

When a multicast announcement is received, the core indicated by that announcement is considered to be the multicast's core. If it doesn't get the message, it assumes it's the group's hub and begins sending the same message to its neighbours. The receiver having the highest ID at the time of joining was chosen as the group's central node if several receivers attempted to join at the same time. Hop-by-hop, the multicast packets in PUMA make their way to the mesh nodes. If the receiving node is the parent of the sending node, it will relay the multicast packet it received from the neighbours. The data packets are flooded inside the mesh after they have arrived. Duplicate packets may be spotted and discarded with the use of a packet ID cache.

Advantages
It has better channel access and more resilience. Constraints i. As the number of people in an area grows, the risk of intrusion increases. Quantifying Quality of Service and Evaluating Performance

## CONCLUSIONS

When comparing AM Route against other routing protocols like PUMA and ODMRP, it stands out as a clear winner. The throughput, power dissipation ratio (PDR), and energy consumption are all high compared to other protocols. Equally effective, from a performance standpoint, is PUMA in this context. The ratio of total packets transferred to data packets delivered is lower in PUMA than in the ODMRP, despite the fact that the number of packets sent is higher in PUMA. This indicates that PUMA provides more effective channel access than ODMRP. Additionally, it is discovered that PUMA keeps EED very stable even while dealing with many sender circumstances. Due to this, PUMA is a superior protocol for use in streaming media players.

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