



**RESEARCH ARTICLE**

# A STUDY ON MANET INTEGRATION THROUGH INTERNET

A. Sharmila<sup>1</sup>, R. Selvakumar<sup>2</sup>, M. Preetha<sup>3</sup>

<sup>1</sup>Department of Computer Science, Periyar University, TamilNadu, India

<sup>2</sup>Department of Computer Science, Periyar University, TamilNadu, India

<sup>3</sup>Department of Computer Science, Periyar University, TamilNadu, India

<sup>1</sup> sharmiar@gmail.com; <sup>2</sup> ramselvamca@gmail.com; <sup>3</sup> preethasenthilkumar@gmail.com

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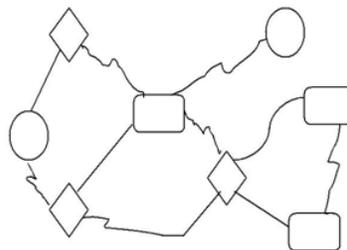
*Abstract— Mobile ad hoc network is easy to organize, flexible and independent of any pre-established infrastructure has become main component of research work. But the research in the field of ad hoc network is restricted to stand-alone isolated networks. To widen the network coverage and application domain of adhoc networks we need to integrate the mobile ad hoc networks with Internet. The connection between MANET and Internet is established using an interface. To access the Internet it is necessary for the mobile nodes in MANET to find out the available gateway which requires a gateway discovery mechanism. In this paper, we have discussed about the various approaches use to discover the mobile gateway in MANET.*

*Key Terms: - MANET; mobile gateway; AODV; internet access*

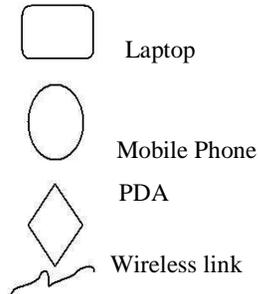
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## I. INTRODUCTION

Wireless ad hoc network is an interconnected collection of mobile nodes independent of any central administration. At some places when wired network is hard to establish the wireless ad hoc network is useful in such cases. Mobile ad hoc Network is self-organized and self-controlled network because there is no pre-established network infrastructure. Mobile Ad hoc Networks (MANET) are formed by a group of wireless mobile hosts without the need of established infrastructure. MANET consists of wireless nodes which can be connected to each using wireless link. There is no central administration in MANET. Nodes can enter and leave the network over time. So the topology keeps on changing. Each node in MANET acts as a router for another node to forward the packets. Now days we have so many wireless devices like PDA, mobile phones, laptops which can be connected together using wireless link. However the communication between the nodes in MANET is within ad hoc boundary.



Mobile Ad hoc Network



MANET nodes have limited transmission range, so area of coverage is often limited. To access the global services from the Internet and to widen the coverage area, we need to connect these ad hoc networks to the Internet. MANET is required to be integrated with Internet to assist the users in communication with fixed nodes in the Internet. The mobile nodes can be connected to Internet via mobile gateway. In MANET any node can act as router to forward a packet that further provides connectivity for other mobile nodes that are out of range of the network. There is no pre-established infrastructure in which nodes in MANET can communicate. The mobile nodes in MANET are made of small devices that can cause energy limitation and data storage problems. Nodes in MANET are highly mobile and topology changes frequently unpredictably, so network need to know the routing information.

## II. ROUTING PROTOCOL

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network

Routing protocols can generally be categorized into two types namely,

1. Proactive
2. Reactive protocols.

### 2.1. Proactive Routing Protocol

Proactive routing protocols are the extension of the wired networks. Routing information of the nodes is maintained in the tables. Each node in the proactive routing protocol has such tables containing routing information so that the data packets could be transferred to the destination. Each row in the tables contains the information about the cost of the route to be followed and the next hop for reaching a node or a subnet. As each node has table entries, it is difficult to maintain tables for each node in a large network which can cause more overhead in the tables with a large number of table entries. That is why the proactive protocols are not recommended for the large networks. Examples of such schemes are the conventional routing schemes, Destination Sequenced Distance Vector (DSDVS).

### 2.2. Reactive Routing Protocol

In reactive routing protocols the routes are created as and when required. They are also known as on-demand routing protocols. In these protocols, when a source wants to send the information to a destination, the route discovery mechanisms are invoked to find the path to the required destination. The routes are created on demand by flooding the network with Route Request packets. Example of reactive routing protocol is ad hoc on-demand distance vector routing (AODV).

## III. MOBILE GATEWAY APPROACHES

### 3.1. Proactive Gateway

Proactive gateway is initiated by the gateway itself and it broadcast gateway advertisement messages periodically. The advertisement interval must be selected such that the network is not flooded with the advertisement messages unnecessarily. The advertisements are received by those mobile nodes that are within the transmission range of the gateway. The nodes that receive the advertisement either create a new route entry or update the existing route entry in their routing table for the gateway after this, a mobile node checks to find whether a GWADV message with the same originator IP address and same RREQ ID has already been received within the same time interval. If it is not so then the new advertisement is rebroadcasted, otherwise it is discarded. This solved the problem of duplicate advertisement messages and the advertisement messages are flooded throughout the network with controlled congestion.

### 3.2. Reactive Gateway

In reactive gateway approach the mobile node itself initiates the gateway discovery whenever it requires a new route or updates an existing route to gateway. If a source mobile node wants to communicate with an Internet node, it first performs the expanding ring search technique to find the destination within the ad hoc network. When it obtains no corresponding route reply even after a network-wide search, the source mobile node broadcasts a RREQ\_I message to the ALL MANET GW MULTICAST address. It is the IP address for the group of all gateways. This message is received and answered only by the gateways. The intermediate mobile nodes receiving this message do not reply to it they just rebroadcast it. Gateways on receiving the request message send uni-cast reply back to the source node. Source node may receive reply from more than one gateway, on the basis of hop count the source nodes selects one of the gateway and forwards the data packet to the selected gateway. The data packet is then forwarded to the node in the internet by the gateway.

Advantage of such approach is that the gateway discovery is initiated only when required; it saves the limited resources such as power and bandwidth.

### 3.3. Hybrid Gateway

The hybrid gateway approach is combination of both proactive and reactive gateway discovery approach. The gateway uses proactive approach and sends gateway advertisement message proactively to the nodes that are within the transmission range of MANET. And the nodes that are outside the network use reactive gateway discovery approach to find default routes to gateways.

The advantage of this approach is that it overcomes the limitations of both proactive and reactive gateway discovery approaches.

## IV. PRINCIPLES OF AODV AS A GATEWAY ROUTING PROTOCOL

The routes are created on demand by flooding the network with Route Request packets. Ad hoc On Demand Distance Vector (AODV) is reactive routing protocol and it uses traditional routing table. There is only one entry per destination in the table and uses sequence number to verify the freshness of routing information and to prevent looping. The maintenance of time-based states is an important feature of AODV which means that a routing entry which is not recently used is expired. Whenever there is link failure the neighbours are notified. To find the route source create a request message and broadcast it. This broadcast message propagates through the network until it reaches an intermediate node that has recent route information about the destination or until it reaches the destination.

Control messages used for the discovery and breakage of route are as follows:

- Route Request Message (RREQ)
- Route Reply Message (RREP)
- Route Error Message (RERR)
- HELLO Messages.

### 4.1. Route Request Message (RREQ)

Whenever a source node requires a route to unknown destination node within or outside the network it broadcast a route request packet throughout the network destination from source. The intermediate nodes forward this packet until the packet reaches the destination.

### 4.2. Route Reply Message (RREP)

If the destination node is found or a valid route is found to the destination in the routing table of node receiving REQ message. The node creates a new RREP message and unicast this RREP message to the source node. The source node on receiving this message updates its routing table and start sending data to destination. If source node receives more than one RREP message from different nodes for same destination it selects route with minimum hop count to destination.

### 4.3. Route Error Message (RERR)

RERR packet is use for maintenance of routes. Whenever there is a link failure the neighborhood nodes are notified by route error message (RERR) on both sides of link. If it still need packet transmission the source node will generate a new REQ packet.

### 4.4. Hello Messages

To be familiar with the neighborhood nodes the HELLO messages are broadcasted. There is direct communication between the neighborhood nodes. In AODV, neighbours are notified about the link activation using HELLO.

## V. CONCLUSION

In this paper, various gateway approaches have been discussed to connect MANET with Internet to widen the coverage area. Also gateway discovery process in AODV protocol is discussed. Internet connection in MANET is typically established via gateways. Node that desire to connect with an Internet connection in MANET must discover the gateway first. That will further provide an internet access for MANET.

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