

A Survey on Mobile Ad Hoc Network (MANET)

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Abstract— Nowadays, nearly every individual carries mobile devices. Everyone wants to get connected with others through these devices. Mobile network allows people to carry the mobile links to others. This is only feasible with the technique referred to as an ad-hoc network. This paper encompasses the compendious dissertation of wireless Ad-Hoc Network and MANET. MANET is the network of mobile devices that can move in any direction and communicates with any node involved in the network. This study includes the various type of MANET network, some of the routing algorithms used by MANET to forward data packet around the network. Moreover, this review states the protocols used by algorithm. Finally, the study provides the comparative performance of diverse protocols.

Key words: MANET, VANET, Algorithms, Mobile Network, Protocols, Ad-Hoc Network

I. INTRODUCTION TO WIRELESS AD-HOC NETWORK

An Ad hoc network is a wireless distributed network that does not require an infrastructure to operate its functions. In a wireless ad hoc network every nodes work like a router that travels data packet to other nodes according to the requirement. The nodes in a wireless ad hoc network can be PDA's or Workstations or even personal computers. The node that will send data to other node is decided dynamically and that node finds the best available path to route the packet to its destination. This can become possible only with network connection. Ad Hoc network is not only capable to route data, but also it uses flooding technique to forward data to network. A wireless ad-hoc network can sometimes also be known like 802.11 wireless networks.

II. MOBILE AD-HOC NETWORK (MANET)

Mobile Ad-Hoc network is a class of wireless ad-hoc network i.e. an infrastructure less network of mobile devices that are connected by some wireless media. In MANET every mobile device is connected for a particular session. Each Mobile device acts like a router to travel data packets to other mobile devices, by finding best available path by following different routing algorithms. MANET is useful in places that have no communication infrastructure or when that infrastructure is completely damaged [2,3,4,5].

III. CLASSIFICATION OF MANET

Classification of MANET		
Vehicular Ad-Hoc Network (VANET)	Internet Based Mobile Ad-Hoc Network (iMANET)	Intelligent Vehicular Ad-Hoc Network (InVANET)

Fig. 1: Classification of MANET

A. Vehicular Ad-Hoc Network (VANET)

Vehicular ad-hoc network refers to the technology in which moving cars are connected as nodes for travel messages to other moving cars in a node. This type of network is very useful in providing the various information, like information about the traffic at certain path to the connected nodes. In VANET nodes are connected to communicate within the range of 100m to 300m geographical area [1]. The communication in VANET may be of 3 types.

- Inter-Vehicle Communication (IVC): In inter-vehicle mode of communication, the communication is done in between the vehicles directly by some wireless media, radio waves. It does not usually used for long distance nodes [1].
- Vehicle to Roadside Communication (VRC): VRC also termed as vehicle to infrastructure communication. In this mode of communication the vehicles are communicated to road side units (RSU). RSU's are the devices established to provide the knowledge about the immediate infrastructure to the vehicles that connected to it dynamically [1]. This type of communication is relatively slow as compared to Inter-Vehicle Communication.
- Inter-Roadside Communication (IRC): This type of Communication is done in between the road side units and base stations, to which these RSU's are connected. This type of communication is required to provide the various information about the traffic or other information to the base station. This is basically used in traffic control system of maps like Google Maps uses this to gather the information about load on a particular road [1].

B. Internet Based Mobile Ad-Hoc Network (iMANET)

iMANET is a transpire technique in which mobile nodes are self-organized. This technology is very reliable for commercial applications and military aspect [3]. iMANET includes the network of mobile devices that are connected to fixed-internet gateways to provide services.

C. Intelligent Vehicular Ad-Hoc Network (InVANET)

In VANET uses Vehicle2Vehicle communication and vehicle2RSU communication. It offers very high security than others. It facilitates easy and effective communication between vehicles with dynamic mobility.

IV. ALGORITHMS FOR MANET

A. Proactive Routing Algorithm

Proactive Routing Algorithm is also termed as table driven routing algorithm. This algorithm follows link state routing approach. This algorithm maintains a list of destinations in network by flooding the routing table to entire network

periodically. The main benefit of these algorithms is fast delivery of data packet, as all the routes are known in advance to each node involved in the network. However, this will also leads to the overhead on the network, as it continuously use the network communication resources even when, there is no traffic [2,4,6,7,8]. Some of the proactive routing algorithms are discussed in following sub sections.

1) *Optimized Link State Routing Algorithm (OLSR)*

OLSR algorithm works like the link state protocol but it works in an optimized way. This algorithm select the Multipoint Relays (MPR) to send the routing information, instead, flood the routing information in the network. This removes the basic disadvantage of overhead involved in link state routing protocol. The MPRs are selected from the neighborhood of the node [3,4,5,6,7,11].

a) Advantages of OLSR

In OLSR the less bandwidth is consumed as, it only sends the routing information to the MPR nodes whenever they are available.

b) Disadvantages of OLSR

The main disadvantage of OLSR is that it provides the route from source node to destination node which is not guaranteed, that it is shortest path available between source and destination.

2) *Destination Sequenced Distance Vector (DSDV)*

In DSDV every node maintains path information about every possible destination, whether or not it is required by the node. Routing tables are exchanged between nodes periodically. Every entry corresponds to, routing table specifies the destination address, number of nodes involved in reaching the packet to the destination, distance of destination node etc and a sequence no. that specifies the updated information present in the table [4,7,8,10,13].

a) Advantage of DSDV

The main advantages of DSDV approach is that packet is forwarded to the network immediately if there is an entry about destination nodes is present in routing table.

b) Disadvantages of DSDV

If the delay involved in updating the routing table, then there is no mechanism involved sending the packet to the destination, as DSDV only sends the packet when there is updated route defined in the routing table.

B. *Reactive Routing Algorithm*

Reactive Routing Algorithm also referred to as On-Demand Routing Algorithm. In this type of algorithm, the router finds the best available path to particular node when it has to send data packet to that node. The main benefit of On-Demand routing algorithm is that, it remove overheads as, there is no need to periodically flood the network with the routing tables. But this include disadvantages like the nodes take more time to search the path as compared to proactive, as source node only starts searching of path to destination when the data packet arrived in the subnet [4,7,9,14,15,16]. Some of the reactive algorithms are discussed in following sub sections.

1) *Dynamic Source Routing (DSR)*

DSR is purely reactive algorithm that makes queries for the route from source to destination, only when requirement occurs. When a node wants to send data packet to other node, it searches its cache for a route. If route is found, it

inserted necessary information to the packet and send the packet towards destination. If in between the travelling of packet, the link is broken, the error message is send to the source node. If route for particular node is not found in cache, then route discovery is done by source node, by sending of the ROUTE REQUEST message to the destination node [3,7,8,9,10,12].

a) Advantages of DSR

DSR allow the data packet to be send even if the fresh route in not available in cache. This offers the lesser delay in the time of peak load.

b) Disadvantage DSR

In DSR packet carries complete route and extra overhead involved in each packet. This leads to increase in size of the data packet.

2) *Temporally Ordered Routing Algorithm (TORA)*

In TORA every node maintains piece of information about the path of the nearest neighbor. The route establishment between nodes can be done in a proactive manner or reactive manner. It is a multi-hop network. TORA establishes the route between the source and destination nodes by Direct Acyclic Graph (DAG) [4,5,7-9,12].

a) Advantages of TORA

TORA not only finds the shortest path between source and destination, but also finds the optimized path between source node and destination node.

b) Disadvantages of Ad-Hoc On-Demand Distance Vector

Delay involved in sending of message when network is on peak load.

C. *Hybrid Routing*

Hybrid Routing is the union of proactive algorithms and reactive algorithms. In Hybrid routing, initially the routing information of different nodes, is flood in the network, so that each node maintains the information about path of every other node in network i.e. proactive routing is done, then as when packet arrive to travel then on demand routing is done, i.e reactive Routing is performed. Some of the Hybrid Routing Algorithms are discussed in following sub sections.

1) *Zone Routing Protocol (ZRP)*

ZRP is a category of hybrid routing protocols that uses both proactive as well as reactive routing algorithm strategy. In ZRP the large network is divided into parts, which are termed as Zones and each zone follows proactive approach to find the route within that zone. Moreover, each zone follows reactive routing technique to find path between multiple zones. ZRP is used to reduce latency involved in finding path in large network of mobile devices [2,4,7,8].

a) Advantages of ZRP

ZRP reduces latency involved in finding routes in bigger network of mobile devices

b) Disadvantages of ZRP

Extra time required dividing the network in zones and each zone can contain only few number of nodes.

2) *Location Aided Routing Protocol (LAR)*

Location Aided Routing sends the routing information only to the nodes include in the limit scope by finding their locations with the help of Global Positioning System (GPS), instead of flooding the routing table to entire network [4].

a) Advantages of Location Aided Routing Protocol

It reduces the scope of route flood request.

b) Disadvantages of Location Aided Routing
Every sending nodes require the location of the every node involve in path from source to destination.

D. Hierarchical Based Routing Algorithm

In Hierarchical based routing algorithm, the choice of proactive and reactive algorithm is performed according to

the level of hierarchy. If the routing information is to be maintained at the top level of the network then proactive routing is performed, otherwise, reactive routing is performed [1].

V. PERFORMANCE COMPARISON OF DIFFERENT ALGORITHMS

Parameter	Proactive (Table Driven)		Proactive (Table Driven)		Hybrid	
	OLSR	DSDV	DSR	TORA	ZRP	LAR
Approach Followed	Link State Routing	Bellmen Ford	ANT colony Algorithm	Park's Algorithm	Interzone Routing	GPS based routing
Routing Structure	Flat	Flat	Flat	Flat	Hierarchical	Hierarchical
HELLO Message Required	Yes	Yes	No	No	Yes	Yes
Route Request & Route Reply messages Required	No	Yes	Yes	Yes	Yes	Yes
Other Messages	Topology Control, Multiple Interface Declaration	N.A	N.A	N.A	Zone Notification, RREQ, Route Repair	Route Error Message.
Complexity	Low	High	Medium	High	High	High
Loop Free	Yes	Yes	Yes	Yes	Yes	Yes
Scalability	Upto 100 nodes	Upto100 nodes	Upto few nodes	Upto few nodes	Highly Scalable	Highly Scalable
Overhead	High	High	Low	Low	Medium	Medium
Bandwidth Required	High	High	Low	Low	Medium	Medium

Table 1: Comparison of different MANET Routing Protocols

VI. CONCLUSION AND FUTURE WORK

Ad-Hoc network is a wireless distributed network that does not require an infrastructure to communicate with the other nodes involved within the network. MANET is the most popular class of wireless ad-hoc network which includes mobile devices, that can move in any direction and link are established dynamically. MANET uses various technologies to communicate among other nodes in the network. These technologies uses different routing algorithm and protocols to find the best available path and travel data along with necessary information required to send to destination. This study presents the summarized study of various MANET Algorithms and protocols. The future perspective of this study is to include different other protocols and metrics involved in MANET and simulation tools required for MANET.

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