Reactive routing algorithms for MANETs -A Survey

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Abstract— *MANET are emerging adhoc based networks, which can be used in various fields such as in search operation, rescue operations, military battle field etc. The nodes in MANETS are dynamic due to the arbitrary movements of the nodes. This will make and break link often. Since the nodes have mobility, battery power is an important constraint. The routing algorithms used in this network should utilize minimum battery power.*

Keywords— *MANET, DSR, AODV, TORA..*

I. INTRODUCTION

Mobile Adhoc networks (MANET) are network which consist of nodes which are highly mobile in nature. They are communicated each other by using radio frequency waves. In this network no separate router are there. The nodes will act as routers. Nodes which are in the given range can communicate each other. This network does not have any particular infrastructure. So the normal routing algorithms used in wired network does not perform well in MANETs. Specialized routing algorithms are required in mobile Adhoc networks. Routing is an issue in mobile Adhoc networks as nodes are having limited power and also due to the mobility. In the Fig. 1 node A wants to send some data to node D. In reactive protocols route establishment process will be carried out only when it is required. All the algorithms are having its advantages and disadvantages. So based on the requirement the routing algorithms in Adhoc network is classified in to two Proactive and Reactive protocol. In proactive protocols every node has to maintain information about network topology. It will be stored in the form of tables. But In reactive protocol the path finding is carried out only when it is required.

Some of the famous reactive routing protocols are DSR [1][2], AODV [3], and TORA[4][5]. In this paper we are surveying three existing protocols in Adhoc networks

II. DSR(DYNAMIC SOURCE ROUTING PROTOCOL)

A. Working Model

This protocol has two phases one is route discovery and second is route maintenance. In this algorithm route construction phase will establish a route flooding request (RREQ). On receiving the RREQ the destination node will reply with the entire route i.e. Route Reply packet (RREP).The intermediate nodes on receiving RREQ, if it is not the destination it transmit the packet to next hop. The RREQ message consists of source address, destination address, and unique Id. This unique id is used to identify the various route requests.

Fig. 1 Data flow in DSR

Fig.1 shows the how route is established in the DSR algorithm. If node A wants to send a packet to node D, Initially there is no direct route. So node A will initiate a route discovery by sending RREQ. The request option inserted in to the header.RID in the route request is used to differentiate between various route requests. When the message reaches node D it will contain the valid route id (A-B-C-D).In this protocol there is no routing tables. The nodes have to maintain the information about the nodes in their caches. Whenever a ne w route is earned the node cache has to be updated.

The main advantage of this protocol is that it will eliminate the need to periodically update the table as in proactive protocols. Here the route is established only when it is required. The intermediate nodes can utilize the information in route cache. One of the main drawbacks of this protocol is that the performance degrades as the topology changes[6]. Even though one of the most commonly used protocol in the MANET is DSR.

III. AODV (ADHOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL)

A. Working Model

AODV is another example for reactive routing protocol. It uses a destination sequence number to identify the path. The main difference between AODV [7] and DSR [7] is that, in DSR the packet will carry the entire route to the destination. But in AODV the node swill store only the next hop corresponding to each flow for packet transmission. In reactive routing protocol a node needs to communicate with another node, it will flood RREQ in the network. This request will be forwarded by the neighbors till it reaches the destination. In this case the destination will receive more than one RREQ through various paths. In such case AODV uses the destination sequence number (DestSeqNum) to identify the most recent path. This destination sequence number also makes sure that there are no loops in the network. During the transmission of this RREQ the intermediate nodes will record the address of the neighbors. This intermediate nodes can reply to this request if they are having the route to the destination also the destination sequence number should be high. Since there are multiple paths between two nodes chances of duplication will be there. In such cases only the first received copy is considered. Once this request is received in the destination it will give a replay to the neighbor and it will reach the source via the neighbors and it will be the active path.

In this protocol a packet will consist of Source identifier, destination identifier, the source sequence number, destination sequence number, broadcast identifier and time to live.

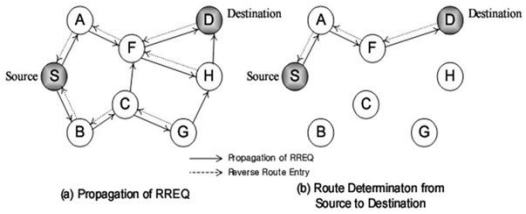

Fig. 2 Route Request in AODV

The Fig.2 shows the propagation of RREQ through the network. The destination node D will receive more than one copies of the route request through different paths. The node D will silently discard the packets. As shown in the figure once the request reaches destination it will respond along the reverse path which is shown by doted lines. If any of the nodes is moved then again the same process is to be carried out again. And also that link failure notification should be given to all other intermediate nodes using that link.

The main advantage of this protocol is that by using DestSeqNum it can identify the latest route. So the delay for connection setup[8] is less. The drawback of this protocol is that, there will be inconsistent routes if the sequence number is old. Also multiple route request packet will increase the overhead.

IV. TORA(TEMPORALLY ORDERED ROUTING ALGORITHM)

TORA[5] is one of the distributed routing algorithms used in MANET. This algorithm is designed for high dynamic networks. It is based on the concept of link reversal. This is a source initiated algorithm, which provides multiple routes between source and destination. In this protocol the control messages are localized to a small set of neighboring nodes on topology changes. In this protocol all the nodes will maintain the information about the nodes with hope value1. The steps involved in this routing algorithm are 1) Create Route 2) Erasing Route 3) Route Maintenance.

In route creation phase it will find out the suitable path for transmission. Erase route is used to delete the invalid routes in the network. For this the node will use a height metric which is used for further processing. Based on this height every link is assigned a direction (upstream/downstream) based on this height. By using this height it will create a DAG (Directed Acyclic Graph. Every link should have a height based on the link. The height is a five tuple [5] value (τ, oid, r, δ, i).The first three of this is used for reference, τ is the time in which the reference is created. Oid is the id of the node. The remaining two values define the height level. Height is nothing but measure of distance from intermediate nodes to destination node. Initially the height will be zero for the destination node and then the height will be null for other nodes. In this algorithm the node will establish a directed acyclic graph. This protocol relies on link reversal. During each iteration every node (say a node i) keeps a list of its entire neighbor node, so that a link from node i to node j can be used for both upstream and downstream communication. It then reverses directions of links to only those nodes that do not belong to the list.

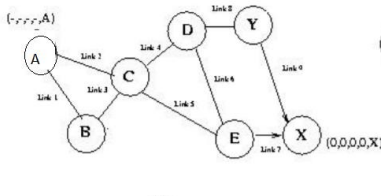

Fig. 3 Route Request in TORA

Fig.3 shows the route establishment in the TORA. Here node A wants to find route to destination X. Node a will forward the request to the neighbors. While c and b broadcast the messages to its neighbors with hop count one. This message will

contain the height also. Now it will be NULL. The node e will create a reference level and it will indicate that offset height of 1.Then node e will sent and uplink stream message. Based on this height value a directed acyclic graph is build. This process is continued till the request will reach the destination.

The main advantage of this algorithm is that it is on demand that means a DAG is constructed only when it is required. There will be multiple paths from a single source to destination. So this protocol can be used in highly dense networks. The main drawback of this protocol is that it is not scalable. Also DSR and AODV will perform well when compared to this protocol.

V. CONCLUSIONS

In this paper we have reviewed three routing protocols for MANET. The routing protocols are classified in to two, reactive and proactive protocols [9]. The algorithms we reviewed here are reactive routing algorithms. In reactive routing protocol route is established only when it is required. The selection of the suitable protocol [10] will increase the performance of the mobile Adhoc network. For each protocol, we summarize the properties, describe the operation, and list the strengths and weaknesses.

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