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Behavior of Reactive Routing Protocols for MANETs: a Review

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***Abstract*-A mobile ad hoc network (MANET) is a multi-hop wireless network, which has dynamically changing topology. There are various kinds of routing protocols developed over the years with minimum control overhead and network resources. One is On-demand (reactive) routing protocol consists of on demand algorithms such as AODV, AOMDV, DSR andTORA. Reactive routing protocols does not uses route discovery process until a route to a destination is required or we can say whenever there is a demand for communication between nodes. Thus in the reactive protocols overhead is low and latency of pings is higher than proactive protocols. AODV is single path, loop free protocol, while AOMDV uses multipath to communicate between a single node and a single destination. The mobile nodes in MANETs have limited resources such as battery power, limited bandwidth. Thus routing is a vital issue in the designing of MANETs.**

Keywords*:-*AODV, AOMDV, DSR, TORA and MANETs.

I. INTRODUCTION

MANETs are wireless networks which are characterized by dynamic topologies and no fixed organization. Each node in a MANETscan act both as a host and router. Moreover, it may be required to forward packets among nodes which cannot directly communicate with each other. In MANETs an ad hoc routing protocol is a way, or standard, that provides information how nodes should send data between each other for proper communication.There are mainly three types of protocols in MANETs.

- Proactive routing protocols
  Proactive routing protocols uses table driven approach. They maintain the fresh list of destination and their routes. *OLSR, DSDV, WRP* are the examples of proactive routing protocols.
- Reactive routing protocols
  Reactive routing protocols are based on the on demand driven technique [12]. Protocols find a route on demand by the source by flooding the network with RREQ (Route request) packets. Example:-*AODV, AOMDV, DSR, TORA.*
- Hybrid protocol
  Hybrid protocol is the mixture of proactive and reactive routing. It starts with proactive routing and in between it uses reactive,E.g. ZRP.

There are some protocols shown in figure below:-

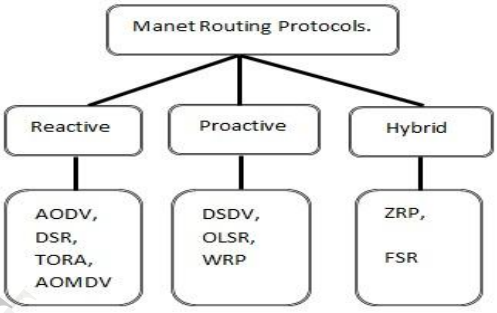

Fig:-1 Routing protocols

Hop by hop communication

Hop by hop mean device to device communication in which protocol controls the flow of data between nodes. A hop counts when one device sends data to another device. And nodes also act as router or gateway for communication as shown in figure 2:-

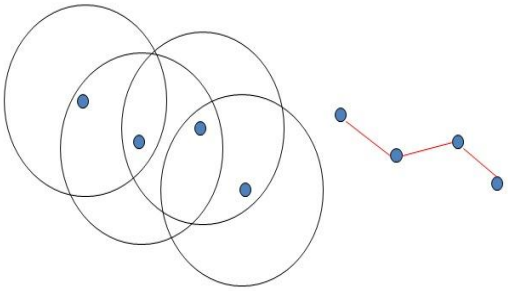

Fig 2. Hop by Hop communication

II. REACTIVE ROUTING PROTOCOLS

1. Ad hoc on demand distance vector routing Protocol (AODV)

The Ad hoc On-Demand Distance Vector (AODV) routing protocol[2]uses single path to communicate between different nodes active in communication. It uses hop by hop technique for communication and it will broadcast the message only if there is some node requesting to communicate with other node.AODV is based upon the distance vector algorithm. The main difference is that AODV is reactive, as opposed to proactive protocols like Distance Vector. AODV only requests a route when needed and does not require nodes to maintain routes to destinations that are not actively used in

communications. As long as the endpoints of a communicationconnection have valid routes [6] to each other, AODV does not play any role.Features of this protocol include loop freedom and that link breakages cause immediate notifications to be sent to the affected set of nodes, but only to that set.

- *Route Discovery*

First source node broadcast route request packet then each intermediate node gets a RREQ then it establish a reverse link to the node it gets route request from. If request received before it will discard message else it will return RREP using reverse link. Otherwise it will rebroadcast the RREQ. When destination is reached it will send RREP using reverse link.If the reply is not received within a certain time, the node may rebroadcast the RREQ or assume that there is no route to the destination.

- *Route Maintenance*

When a link is broken due to the movement of nodes or any other reason, then the current node which found out the error in the link sends RERR [10] message to the source then source searches for another route in the cache if not then it will send RREQ again to nodes.

2. Ad hoc on demandmultipath distance vector routing protocol (AOMDV)

AOMDV is Ad hoc On-Demand Multipath Distance Vector routing protocol.It is based on the distance vector concept and useshop-by-hop routing approach. AOMDV uses multiple paths [11] to find routes from source to destination. The main difference lies in the numberof routes found in each route discovery.In AOMDV RREQ propagation from the source towards thedestination establishes multiple reverse paths bothat intermediate nodes as well as the destination. Multiple RREPs traverse these reverse paths back toform multiple forward paths thus causing problem [6].AOMDV uses route update rule between nodes which tells about advertised hop count of a node. The hop counted should be lower than the maximum hop count in a network if any node is having greater hop count than maximum hop count of a network, the destination won't select that path. Note thatAOMDValsoprovides intermediate nodes with alternate paths asthey are found to beuseful in reducing route discoveryfrequency [10].

- *Route discovery*

In AODV node may receive several copies of the same RREQ the first copyof the RREQis used to form reverse paths; the duplicatecopies that arrive later are simply discarded. In AOMDV duplicate copies [6] can be used toform alternate reverse paths. AOMDV uses only those alternate reverse pathswhich have loop-freedom and dis-jointnessamong them, and also provides set of paths to the source.

Intermediate node checks for forwarded path and uses RREP to source with destination path. If not used in previous RREP then source uses that forwarded path [9].In this case, the intermediate node doesnot propagate the RREQ further. Otherwise, nodere-broadcasts the RREQ to all destinations.

- *Route maintenance*

Route maintenance in AOMDV is a simple. AOMDVuses RERR packets [6], forwardsa RERR for a destination when the *last* path tothe destination breaks. AOMDV also includes anoptimization to *salvage* packets forwarded over failedlinks by re-forwarding them over alternate paths. This is similar to the packet salvaging mechanism inDSR[2].

3. Dynamic Source Routing protocol (DSR)

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It uses source routing instead of table driven approach. Determining source routes requires accumulating the address of each device between the source and destination during route discovery [3]. The intermediate nodes use cache system to store routes. To accomplish source routing, the cache system in nodes contains the total path a node will go through. The main problem of cache system is that it will cause large overheadfor large addresses, like IPv6 [4]. Large overhead could affect bandwidth consumption and energy of a particular network. This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) by mobilenodes. Major phases of source routing are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).

- *Route Discovery*

First source node broadcast route request packet and intermediate nodes checks if it is received before and also checks its id if yes then it will discard else it will send route reply message to source with path otherwise rebroadcast the message. Destination sends reply with full path and intermediate nodes caches the in between path so that source could have all the paths and then source will select shortest path to destination.

- *Route maintenance*

First if there is an error in between nodes then the node having communication problem will send error message to source and source will delete that path from cache and try another path already stored in cache but if there is no path stored in cache then it will broadcast the RREQ message to all other nodes.

4. Temporally Ordered Routing Algorithm (TORA)

The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive, efficient distributed routing protocol based on the concept of link reversal. TORA is mainly build where there is high mobility between nodes and which uses multi-hop wireless networks. TORA is a source-initiated on-demand routing protocol[9]. It finds multiple routes from a source node to a destination node. The main feature of TORA is that the control messages are localized to a very small set of nodes near the occurrence of a topological change. To achieve this, the nodes maintain routing information about adjacent nodes.

The protocol has three basic functions:-*Route creation, Route maintenance and Route erasure*. During the route creation and maintenance phases, nodes use a "height" metric to establish a directed acyclic graph [9] as shown in figure 3, rooted to the destination. Timing is an important factor for this protocol because the "height" metric is dependent on the logical time of a link failure and it assumethat all nodes have synchronized clocks. TORA has a unique feature of maintaining multiple routes to the destination so that topological changes do not require any reaction at all. The protocol reacts only when all routes to the destination are lost.

III. Tables

Table 1: Comparison

Protocols	Packet Delivery		Energy Consumed	
	Higher no. of node network	Lower no. of node network	Higher no. of node network	Lower no. of node network
AODV [8]	Low	High	High	Low
AOMDV [6]	Low	High	Very High	Low
DSR [7]	High	High	High	Low
TORA [1]	Low	High	Low	High

Table 2: Comparison

Protocol	Throughput		Delay	
	Higher no. of node network	Lower no. of node network	Higher no. of node network	Lower no. of node network
AODV [8]	Very Low	High	High	Low
AOMDV [6]	Low	High	Low	Low
DSR [7]	Low	High	High	High
TORA [1]	Low	High	Bit high	Low

IV. CONCLUSION& RESULTS

On-demand routing protocols with multipath capabilitycan effectively deal with mobility-induced routefailures in mobile ad hoc networks as opposed totheir single path counterparts. In this paper, we have considered an on-demand multipath protocol calledAOMDV that extends the single path AODV protocolto compute multiple paths. From comparison tables it is observed that TORA is showing good performance for smaller networks but it is not true for networks with higher number of nodes.

From our study we have found that overall performance of DSR is better than all others. As shown in comparison tables for small networks PDR and THROUGHPUT of DSR is high. It is also observed that for smaller networks energy consumption of DSR is low.

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