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Routing Protocol In MANET – A Survey

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***Abstract*— In recent years, the vast research is going on in the area of Mobile Adhoc Networks (MANETs). The resource of the MANET is limited. So it is difficult to design an efficient and reliable routing strategy .It is still a challenge to know that which protocol suits better in which scenario? The nodes are easily communicated directly using the wireless scenario in the host to host fashion, and can route the message with the help of intermediate nodes. In this paper we provide an overview of the different MANET routing protocols. We will also highlight their characteristics and functionality.**

***Keywords*— Mobile Adhoc Network, AODV, DSDV, ZRP, ZHLS, DSR, TORA, OLSR, WRP.**

I. INTRODUCTION

A mobile ad-hoc network consists of mobile nodes moving randomly and communicating with each other in a self-organized way for data transmission [1]. The basic issue in routing is efficient delivery of data packets in case of dynamic changing topology and without aid of centralized control. Proactive routing protocols maintain up-to-date routing information of the network topology and changes occurring in network topology are broadcasted through the network but the maintenance of unused paths can occupy a large part of the network bandwidth when topology changes are frequent. In reactive Routing protocols, the routes are created on demand reducing the network overhead and load.They also have an inherent limitation of Morelatency and huge amount of traffic is generated with frequent change in network .

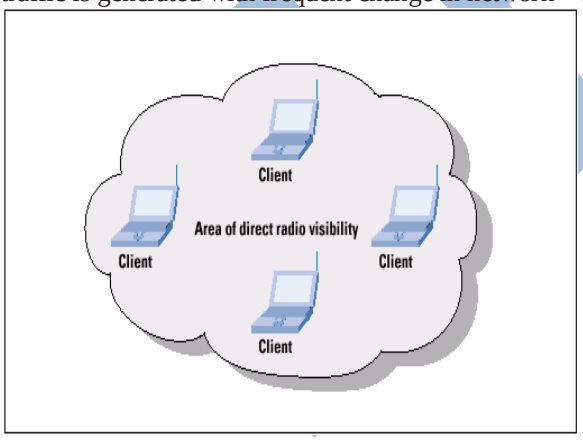

Fig. 1 (MANET)

Topology and packets to the destination are lost if any link on established route breaks. Several performance comparisons have shown that on-demand protocols achieve lower routing overhead as Compared to proactive protocols. Existing routing protocols like AODV, DSDV utilize the single route and dynamic node mobility makes route invalid. This problem can be solved by having multiple paths between source and destination node in a single route discovery. On demand protocols like DSR and TORA have built-in capability of computing multiple paths but they suffers from other performance problems like stale caches, reply storms and very high overheads. This paper is organized as follows: Section 2(ROUTING IN MANET) and 3 overviews AODV, DSDV and ZRP. Section 4 deals with simulation results and section 5 concludes the paper.

II. ROUTING IN MANET

Routing is basically an act of moving the information from a source to destination. If a source is very much nearer to the destination then the information can sent without the help of any node. At least one node is encountered if the destination is far from the source node. There are some metrics that are used as a standard measurement to calculate that which one is the best routing path for the packets to reach the destination. Routingprovide the maximum possible reliability during the routing one can use alternative router if an intermediate node fail.

Goals of routing: -

- The routing protocol must be able to work or adjust according to the network and respond rapidly to the topological changes in the network.
- In these type of network, each host must be capable of work as a router.one must has to choose a route with the least cost metric.
- Multicasting of packets is reliable as compare to broadcasting.
- There should be the quick access to the routers on demand by the node.
- There should be the distribution of the root computation .each node must concerned about its destination routes.
- The best possible response time is necessary for the node, so that it can provide the best throughput.

III. CHARACTERISTICS OF MANET.

- **Dynamic Topology:** Adhoc network provide dynamic topology that is network topology may change.
- **Limited Physical Security:** Because of wireless network limited physical security is required.
- **Node As Router:** Each node act as router.

- **Limited Bandwidth:** Limited bandwidth is required.
- **Infrastructure**: There is no fixed infrastructure required.
- **Energy Constrained**: Each node contains energy.
- **Unidirectional Links**: Links are mostly unidirectional.

IV. ROUTING CLASSIFICATION'S

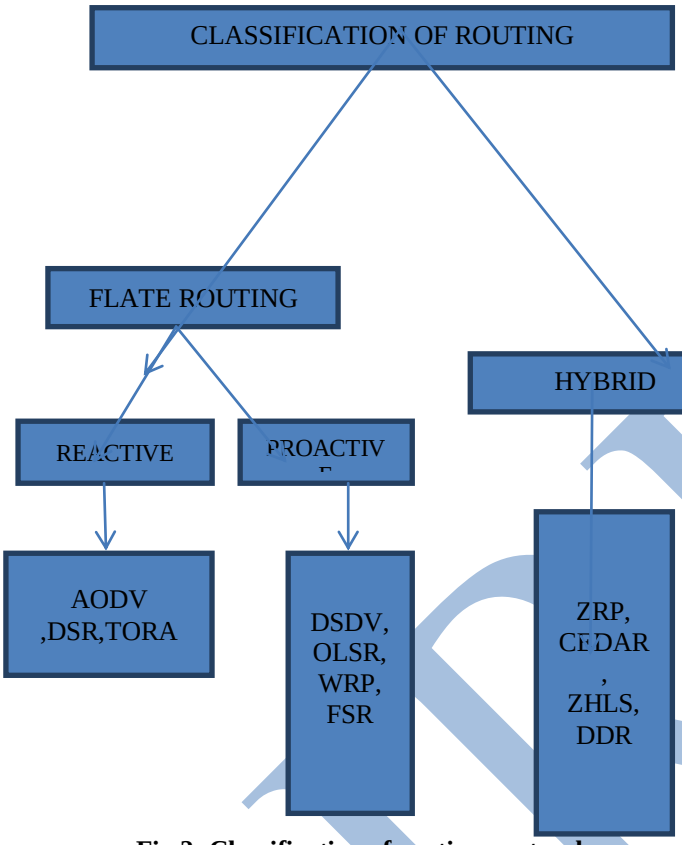

Fig 2: Classification of routing protocols.

PROACTIVE ROUTING:
Proactive routing protocol are based on the routing table's and these routing tables contain information about the destination's that we already known. Routing table does also contain the information about the network topology. According to the changes in the network topology the routing tables are updated periodically. These protocols are also named as table driven protocols. But for large networks these protocols are not suitable. Whenever there is a need to forward a packet the route is already known. In the network each node maintains the routing information to all other nodes. Within the change in the topology, the updates are propagated throughout the network.DSDV, OLSR, WRP, FSR are the examples of proactive routing protocols.

- Table driven.
- Classic routing strategy: distance vector, link state.
- Most of the routing information may not be used.
- Keep track of roots to all destinations.
- Routs are evaluated continuously.

DSDV(Destination Sequenced Distance Vector**)**

DSDV is a table driven routing protocol, is developed by Bellman Ford and is based on Bellman Ford algorithm with some applied modifications. Here we calculate the shortest number of nodes to the destination. Each mobile host keeps a routing table. Routing table contains number of fields which stores number of hops, sequence number, destinations, and next hop address. Periodic updation of the
routing table is required. Sequence number Is used to mark the each entry in the table that
will help to differentiate stale routs from new routes. Because of that the looping is avoided. Variable size packets are used to minimize the routing updates and the packets which are used depend on the number of changes in the topological structure.

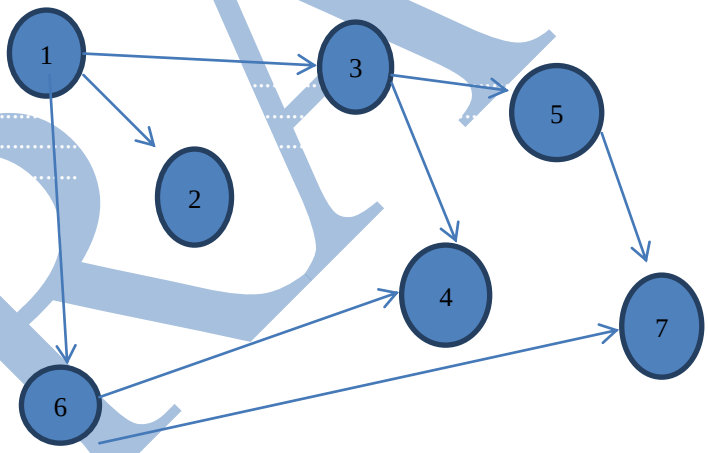

Fig 3 DSDV (Destination Sequenced Distance Vector)

DESTINATION	METRIC	SEQUENCE NUMBER

Fig 4 Routing table entry in DSDV

OLSR(Optimized Link State Routing)
OLSR is a proactive link state routing protocol proposed by Clausen and Jacquert. Multipoint relaying is used by the protocol. Hop by hop
Routing is performed here; most recent information is used by the node for routing the packet. The link that is used for forwarding the link state packets and the size of control packets both is reduced to meet the optimization. With the use of shortest path algorithm the optimal route is obtained neighbor sensing is done by the protocol and is also minimize the flooding of packets so that the selected nodes are use only that provide efficient flooding.
WRP(Wireless routing Protocol)
A table driven protocol proposed by Murthy and Garcia-Luna-Aceves.The properties of Bellman Ford Algorithm is inherited by WRP .The number of cases are reduced where a transitory routing lop can occur. Four properties are preserved for the purpose of routing. A routing table, A distance table, A link cost table, MRL (Message Retransmission List). Periodic update message transmissions are used by WRP. Acknowledgement should be sent by the

nodes that are in the response list of update messages. The essential goal is to keeping the routing acquaintance around the all nodes in the network as regards the shortest distance to every destination. There is no formation of loops in this network so it is also called loop free routing protocol. WRP belong to the class of path finding algorithm. WRP provide the faster route convergence.

V. REACTIVE PROTOCOLS:

Reactive routing protocols discover routes to the destinations on demand. Global search help to discover the routes. There is no latest route discovery is used to maintain and update the tables. Route query that is requested is flooded to the network when a packet is require to be routed. The main goal of the reactive routing is to minimize the traffic overhead of the network. The source node send a request message to the destination node for requesting a route. This message is then broadcast or flooded or we can say that this message is forwarded by all nodes in the network until it reaches the destination. Whenever a communication is desired the connection is established by flooding the route request packets throughout the network also called as route discovery. The main on demand protocols are AODV, DSR.

- Discover routes to destination on demand.
- Global search help to discover the routes
- Less bandwidth is consumed but experience substantial delay.
- Latency of route discovery.
- The reactive protocols are not be appropriate for real time communication.

AODV:

Adhoc on demand distance vector routing protocol uses on demand route discovery technique to ensure loop free, single path, hop by hop distance vector routing. AODV operates in two sub phases. Route discovery phase is initiated by source node having valid route to a destination node to which it wants to send data. Route maintenance phase for handling dynamic topology in MANET changes as the node moves on when some error persists. When a node wishes to send data to some destination it floods Route Request (RREQ) messages to all its neighboring nodes. An intermediate node receiving RREQ updates its routing table with reverse route entry to the source node if RREQ is unique. Source id and broadcast id determines uniqueness of a RREQ packet. An intermediate node can further rebroadcasts RREQ to its neighbors or unicasts RREP message back to the source node if it already has unexpired route to that destination in its routing table otherwise destination node replies. I n AODV, a node can receive multiple RREP messages for one route discovery message sent but it maintains only one entry per destination in its routing table. An intermediate node always forwards first RREP message received after making entry for forward path towards destination in its routing table and second RREP for a particular RREQ is used for updating table and forwarded only if RREP has higher destination sequence number for the destination or hop count is smaller in case of same destination sequence number otherwise RREPs are suppressed. Higher sequence number ensures fresher route. HELLO message are exchanged for maintaining neighborhood connectivity.

Destination ID	Sequence Number	Hop count	Lifetime of a route	Next hop

Fig. 5 Routing Table Entry in AODV

Once a route is established between source and destination nodes it is maintained in routing table as long as source needs this route for data transfer and timer does not expires. Whenever a source node moves during active session of data transfer a new route discovery process is initiated and if an intermediate or destination node moves or a link break, RERR message including lists of unreachable destinations along with their sequence numbers is broadcasted back to source node. Each node upon receiving a RERR message from a downstream neighbor and using failed link must invalidate the route and source node reinitiates new route discovery. RERR message is rebroadcasted if at least one destination becomes unreachable.

DSR (Dynamic Source Routing)

DSR is also a Route on demand MANET protocol like AODV ad designed by D.B Johnson. It allow the node to dynamically discover source node and create a route across number os network hops to any destination the disk protocol is broken in to route discovery and route maintenance phases these phases are encountered on demand, when a packet needs to be routed within the network or when a packet needs routing. It is basically designed to limit the bandwidth consumed by control packets and the bandwidth is restrict because here we eliminate the use of periodic table message updates. The different feature of DSR is it uses the Source Routing. It generates the route when necessary. The name dynamic clears its working that the nodes are generated dynamically ie on demand. The sender calculates the route from source to destination and adds the address of the intermediate node as a route record in the packet and is based on the link state algorithm basically it is used for small diameters and for multi hop networks.

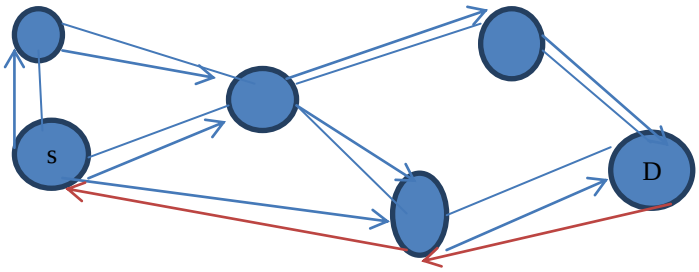

Fig 6 DSR (Dynamic Source Routing)

TORA (Temporally Ordered Routing Protocol)

Park and Corson are the developers of TORA. TORA is a uniform, highly adaptive, destination based , hop free protocol. It is a reactive routing protocol but having some

proactive enhancements .Where a link is established between the nodes that creates the DAG(Direct Acyclic Graph) this graph shows the route from the sourse node to the destination node. Tora is a distributing routing algorithm and it is based on the concept of link reversed. Upstream and Downstream both routes are defined by DAG.

This graph is better because it help TORA to provide better route for networks that has large population of nodes. Because of the change in the connectivity the nodes reverse the direction towards some or entire inbound links because of losing outbound links. Each node is must aware about the changes in the links and intermediate neighbors each node should be informed timely about the changes. It broadcast the request again and again if the source node does not find the destination node the request is rebroadcast until it find or reaches the destination. After reaching the destination it broadcast the updated message about its height and every node that receive this updated message also update their height to be one higher then the height of updated message and also broadcast the updated message about their own updated height. Synchronization is used in TORA.

VI. HYBRID ROUTING PROTOCOL:

The Disadvantages of reactive and proactive protocols are recovered in the hybrid routing protocol. Hybrid routing protocol combines the features from both reactive and proactive routing protocols. The main protocols that are recovered in this protocol is that it reduce the control traffic overhead and reduce the route discovery delay. This delay's and overhead is suffered by the proactive and reactive protocols. Control traffic overhead is from proactive systems and route discovery delay is suffered by reactive protocols. Proactive fits better for small network and reactive routing protocol is used for large network. ZRP combine the advantage of both reactive as well as proactive routing protocols and known as hybrid protocol .Hybrid protocol is also called new generation protocol. It provide a higher scalability any number of node can perform routing

- ORGANISATION DIFFICULTY: How to organize a network.
- The zone is defined in this network so it reduces the broadcasting nodes.
- Difficult to maintain the high level topological or routing information, because it requires more memory and power.

ZRP:

Zone routing protocol is proposed by Haas and Pearlman. In this type of mobile adhoc network the nodes are described in an area called zone. ZRP combines the merits from both proactive and reactive protocols. The problem of both proactive and reactive protocols is resolved by this protocol. The area is divided according to the zones. Zone radius term is used here to define the size of routing Zone. The routes to destination is maintained with in the local neighborhood and this local neighborhood is known as zone. Intrazonerouting protocol or Interzone routing protocol is used to discover the route to the destination. Query route mechanism is used for route creation.

The node must know about its neighbor's, a neighbor is basically a node with whom a node can direct communicate. This comes under Intrazone Routing Protocol, because the communication of nodes are within the zone. If the destination node is not with in the localized range then the Interzone routing protocol is used.

Table 1 Comparison Of Routing Protocol

Parameters	DSDV	AODV
Route Update	PERIODIC	NON PERIODIC
Routing Overhead	HIGH	HIGH
Throughput	LOW	HIGH
Periodic Updation	YES	NO
Caching Overhead	LOW	MEDIUM

ZHLS(Zone – Based Hierarchical Link State Routing Protocol)

Here comes an concept od non overlapping zones two routing tables are built in ZHLS that is Intrazone and Interzone tables. ZHLS is based on hierarchical Structure. The network is divided in to Overlapping zone and they are looking like a cellular network for this link state routing here is two levels node level and global zone level. ZHLS is based on hierarchical structure but there is no cluster head in the network. The needed id of the destination are zone id and node id , with the help of these two id's the routing is performed. The both id's are contained by each node in the network and id's are calculated using geographical information. There are two types of link state updates that is levels and id's. Intrazone routing table is checked first before the transmission of source node. If the routing information is already presents in its zone. Otherwise through nodes the source node sent the location request to all other nodes As compare to AODV and DSR , ZHLS has a low routing overhead.

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