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RESEARCH ARTICLE

ANALYSIS OF ROUTING PROTOCOLS IN MANETs

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Abstract*— *Recent trends in wireless communication have expanded possible applications from simple voice services in early cellular network to new integrated data application.4G technology is now new promising application of mobile technology. In MANETs, the router connectivity many change frequently, leading to the multi-hop communication Para diagram that can allow communication without the use of BS/AP, and provide alternative connections inside hotspot cell. A MANETs is a type of ad hoc network that can change locations and configure itself on the fly. All nodes in this network are mobile and they use wireless connection to communicate with various network. Mobile nodes communicating through wireless channels network without any existing network infrastructure or centralized administration. In the recent years, several routing protocols have been proposed for MANETs, and prominent among them are AODV, DSR and DSDV. This paper provides an overview of these protocols by presenting their characteristics, functionality, benefits and limitations and makes their comparative analysis so to analysis their performance.

Keywords*— *MANETs; BS; AP; AODV; DSR; DSDV

I. INTRODUCTION

A Mobile Ad hoc Network is a temporary wireless network composed of mobile nodes, in which absents of infrastructure. There are no dedicated routers, servers, access points and cables. It is a self-organizing and self configuring multihop wireless network, where the networks are changes dynamically due to member mobility. Ad hoc wireless network are self creating, self organizing, and self administrating. The nodes are free to move randomly and organize themselves arbitrarily, thus the network’s links, while wireless topology may change rapidly and unpredictably. An Ad hoc network might consist of several home-computing devices, including laptops, cellular phones, and so on. Each node will be able to communicate directly with any other node that resides within is transmission range.

Most research effort has been put in the routing protocols since the advent of the MANETs. They can be divided in to three basic categories: Proactive Routing Protocol (DSDV, WRP, OLSR, CGSR, FSR, GSR), Reactive Routing Protocol (AODV, DSR, ACOR, SSR, TORA...) and Hybrid Routing Protocol (ZRP). Performance evaluation of Destination Sequenced Distance Vector (DSDV) and Ad hoc On-demand Distance Vector (AODV) routing protocol by considering various performance metrics like packets, normalized routing load

In MANETs each node acts both as a router and as host & even the topology of network may also change rapidly. Some of the challenges in MANETs include:

1. Unicast Routing
2. Multicast Routing
3. Dynamic network topology
4. Speed
5. Frequency of update or network overhead
6. Scalability
7. Mobile agent base routing
8. Quality of service
9. Energy efficient/power aware routing
10. Secure routing

They key challenges faced at different layers of MANETs are show in fig

	Application Layer	Security
Quality of Service	Transport Layer	
	Network Layer	Routing
Power Control	Physical Link Layer	

Fig 1 MANENT Challenges

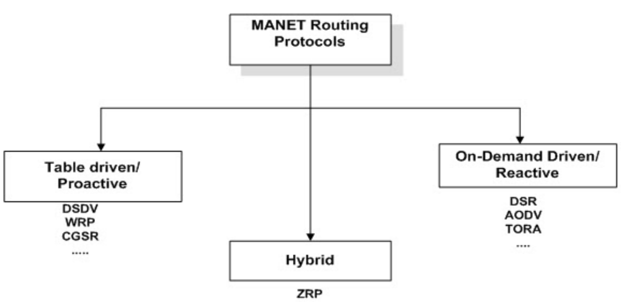

Fig 2 Types of Protocols

A. Proactive Routing Protocol (Table driven)

In this protocol, all the nodes continuously search for routing information within a network. In network utilizing a proactive routing protocol, every node maintains one or more tables representing the entire topology of the network. These tables are updated regularly in order to maintain an up-to-date routing in formation form each node to every other node. One the other hand, routes will always be available on request. If any want to send any information to another node, path is known, therefore, latency is low. There is a lot of node movement then the cost of maintaining all topology information is very high. Many protocol stem from conventional link state routing, including the Optimized Link Sate Routing protocol (OLSR).

The proactive routing protocol may waste bandwidth since control message are send out unnecessarily when there is no data traffic. The advantage of this category of protocols is that host can quickly obtain route information and quickly establish a session.

B. Reactive Routing Protocols

Unlike proactive routing protocol, reactive routing protocol does not make the node initiate a route discovery process until a route to a destination is required. This leads to higher latency than with proactive protocols, but lower overhead.

Routing information is collected only when it is needed, and route determination depends on sending route queries throughout the network. That is whenever there is a need of path from anu source to destination then a type of query reply dialog does the work. Therefore, the latency is high however; no unnecessary control messages are required. Once a route has been established, it is maintained by a route maintains process until either the destination becomes inaccessible along every path form the source or there route is no longer desired. A route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route search.

C. Hybrid Routing Protocols

This protocol incorporates the merits of proactive as well as reactive routing protocols. Nodes are grouped into zones based on their geographical locations or distance from each other. Inside a single zone, routing is done use table-driven mechanism while an on demand routing is applied for routing beyond the zone boundaries. The routing table size and update packet size are reduce overhead is reduced. One approach is to divide the network into zones, and use one protocol within the zone, and another between them.

II. Routing Protocols

A routing protocol is needed whenever a packet needed to be transmitted via number of nodes and numerous routing protocols have been proposed for such kind of ad hoc networks. The protocols find a route for packet delivery and delivery packet to the correct destination. The studies on various aspects of routing protocols have been an active area of research for many years. Many protocols have been suggested keeping applications and type of network in view.

A. Proactive protocols or Table driven:

In table driven routing protocols each node maintains one or more tables containing routing information to every other node in the network. All nodes keep on updating these tables to maintain latest view of the network. Some of the existing table driven we discus for DSDV.

DSDV Protocol

Destination Sequenced Distance Vector routing (DSDV) is adapted from the conventional Routing Information Protocol (RIP) to ad hoc networks routing. It adds a new attribute, sequence number, to each route table entry of the conventional RIP. Using the newly added sequence number, the mobile nodes can distinguish stale route information from the new and thus prevent the formation of routing loops.

DSDV Protocol is a Packer Routing and Routing Table Management. In DSDV, each mobile node of an ad hoc network maintains a routing table, which lists all available destinations, the metric and hop to each destination and a sequence number generated by the destination node. Using such routing table stored in each mobile node, the packets are transmitted between the nodes of an ad hoc network. Each node of the ad hoc network updates the routing table with advertisement periodically or when significant the consistency of the routing table with the dynamically changing topology of the ad hoc network.

Periodically or immediately when network topology changes are detected, each mobile node advertises routing information using broadcasting or multicasting a routing table update packet. The update packet starts out with a metric of one to direct connected nodes. This indicates that each receiving neighbour is one metric (hop) away from the node. It is different from that of the conventional routing algorithm. After receiving the update packer, the neighbours update their routing table with incrementing the metric by one and retransmit the update packet to the corresponding neighbours of each of them. The process will be reacted until all the nodes in the ad hoc network have received a copy of the update packer with a corresponding metric. The update data is also kept for a while to wait for the arrival of the best fourth for each particular destination node in each node receives multiple update packets. If a node receives multiple update packets for a same destination during the waiting time period, the routes with more recent sequence numbers are always preferred as a basis for packer are always preferred as the basis for packer forwarding decisions, but the routing information is not necessarily advertised immediately, if only necessarily advertised immediately, if only the sequence numbers have been changed. If the update packets have the same sequence number with the same node, the update packet with the smallest metric will be used and the existing route will be discarded or stored as a less preferable route. In this case, the update packet will be propagated with the sequence number to all mobile nodes in the ad hoc network. The advertisements of routes that are about to change may be delayed until the best routes have been found. Delaying the advertisement of possibly unstable route can damp the fluctuations of the routing table and reduce the number of rebroadcasts of possible route entries that arrive with the same sequence number.

The elements in the routing table of each mobile node change dynamically to keep consistency with dynamically change topology of an ad hoc network. To reach this consistency, the routing information advertisement must be frequent or quick enough to ensure that each mobile node can almost always locate all the other mobile nodes in the dynamic ad hoc network. Upon the updated routing information, each node has to relay data packet to other nodes upon request in the dynamically created ad hoc network.

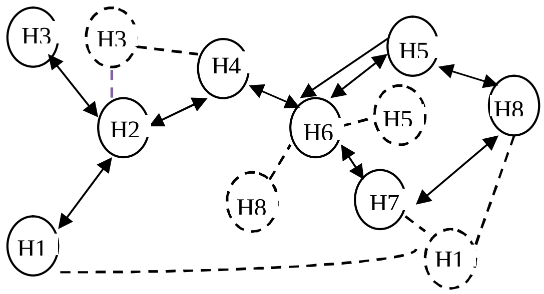

Fig 3 ad hoc networks

Destination	Next Hop	Metric	Seq.No.	Install
H1	H4	3	S406_H1	T001_H6
H2	H4	2	S128_H2	T001_H6
H3	H4	3	S564_H3	T001_H6
H4	H4	1	S710_H4	T002_H6
H5	H7	3	S392_H5	T001_H6
H6	H6	0	S076_H6	T001_H6
H7	H7	1	S128_H7	T002_H6
H8	H7	2	S050_H8	T002_H6

Table 1 Routing table of node H6

Next Hop Destination
H6 H5 Data

Dest	Next Hop
H1	H4
H2	H4
H3	H4
H4	H4
H5	H7
H6	H7

Table2. Node H6 look up the destination and route for forwarding the packet in its routing table

PROBLEM OF DSDV

The main purpose of DSDV is to address the looping problem of the conventional distance vector routing protocol and to make the distance vector routing more suitable for ad hoc networks routing. However, DSDV arises route fluctuation because of its criteria of route updates. At the same time, DSDV does not solve the common problem of all distance vector routing protocols, the unidirectional problem.

A. Damping Fluctuation

Fluctuation is a general problem arising in DSDV by the following criteria of route updates:

- Routes are always preferred if the sequence numbers are newer routes with older sequence number are discarded.
- A route with a sequence number equal to that of an existing route is preferred if it has a better metric, and the existing route is discarded or stored as less preferable.

B. Unidirectional Links

DSDV assumes that all wireless links in an ad hoc network are bi-directional. However, this is not true in reality. Wireless media is different from wired media due to its asymmetric connection. Unidirectional links are prevalent in wireless networks.

- Knowledge Asymmetry: over the unidirectional links, the sink nodes know the existence of the source nodes, but the source node cannot assume the existence of the sink nodes.
- Sink Unteachability: In DSDV, the destination node initiates the path updates. Over a unidirectional link, there might be no way that a sink node can broadcast its existence.

C. Other Drawbacks

It is difficult to determine the maximum setting time. DSDV does not support multipath routing. The destination central synchronization suffers from latency problem. It has excessive communication overhead due to periodic and triggered updates. Each node must have a complete routing table.

AODV (Ad Hoc on Demand Dissonance Vector)

AODV is a variation of Destination-Sequenced Distance-Vector (DSDV) routing protocol which is collectively based on DSDV and DSR. It aims to minimize the requirement of system-wide broadcasts to its extreme. It does not maintain rather they are discovered as and when needed & are maintained only as long as they are required.

They key steps of algorithm used by AODV for establishment of unicaste routes are explained below.

A. Route Discovery

When a node wants to send a data packet to a destination node, the entries in route table are checked to ensure whether there is a current route to that destination node or not. If it is there, the data packet is forwarded to the appropriate next hop toward the destination. If it is not there, the route discovery process is initiated. AODV initiates a route discovery process using Route Request (RREQ) and Route Reply (RREP). The source node will create a REQ packet containing its IP address, the destination's last sequence number and broadcast ID. The broadcast ID is incremented each time the source node initiates RREQ. Basically, the sequence numbers are used to determine the & the IP address together from a unique identifier for RREQ so as to uniquely identify each request. The requests are sent using RREQ message and the information in connection with creation of a route is sent back in RREP message. The source node broadcasts the RREQ packet to its neighbours and then sets a timer to wait for a reply. To process the RREQ, the node sets up a reverse route entry for the source node in this route table. This helps to know how to forward a RREP to the source. Basically a lifetime is associated with the reverse route entry and if this entry is not used within this lifetime, the route information is deleted. If the RREQ is lost during transmission, the source node is allowed to broadcast again using route discovery mechanism.

B. Ring Search Technique

The source node broadcast the RREQ packet to its neighbours which in turn forwards the same to their neighbours and so forth. Especially, in case of large network, there is a need to control network-wide broadcasts of RREQ and to control the same; the source node uses an expanding ring search technique. In this technique, the source node sets the Time to Live (TTL) value of the RREQ to a initial start value. If there is no replay within the discovery period, the next RREQ is broadcasted with a TTL value increased by an increment value. The process of incrementing TTL value continues until a threshold value is reached, after which the RREQ is broadcasted across the entire network.

C. Forward Path

When the destination node or an intermediate node with a route to the destination receives the RREQ, it creates the RREP and unicast the same towards the source node using the node from which it received the RREQ as the next hop. When RREP is routed back along the reverse path and received by an intermediate node, it sets up a forward path entry to the destination in its routing table. When the RREP reaches the source node, it means a route from source to the destination has been established and the source node can begin the data transmission.

D. Maintenance of Route

A route discovered between a source node and destination node is maintained as long as needed by the source node. Since there is movement of nodes in mobile ad hoc network and if the source node moves during an achieve session, it can reinitiate route discovery mechanism to establish a new route destination.

Conversely, if the destination node or some intermediate node moves, the node upstream of the break initiates Rout Error (RERR) message to the affected active upstream neighbour/nodes. Consequently, these nodes propagate the RERR to their predecessor nodes. This process continues until the source node is reached. When RERR is received by the source node, it can either stop sending he data or reinitiate the route discovery mechanism by sending a new RREQ message if the route discovery mechanism by sending a new RREQ message if the route is still required.

E. Benefits of AODV Protocol

The benefits of AODV protocol are that it favours the least congested route instead of the shortest route and it also supports both unicast and multicast packet transmission even for nodes in constant, movement. It also responds very quickly to topological changes that affects the achieve routes. AODV does not put any additional overheads on data packets as it does not put any additional overheads on data packets as it does not put any additional overheads on data packets as it does not make use of source routing.

F. Limitation of AODV Protocol

The limitation of AODV protocol is that it expects/requires that the nodes in the broadcast medium can detect each other's broadcasts. It is also possible that a valid route is expired and determination of a reasonable expiry time is difficult. The reason behind this is that the nodes are mobile and their sending rates may differ widely and can change dynamically from node to node. In addition, as the size of network grows, various performance metrics begin decreasing. AODV is vulnerable to various kinds of attacks as it based on the assumption that all nodes must cooperate and without their cooperation no route can be established.

1) Packet Delivery Ratio: The ratio of the data packets delivered to the destinations to those generated by the CBR source.
2) Average End-to-end Delay: Average amount of time taken by a packet to go from source to destination. This includes all possible delay caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC and propagation and transfer times.
3) Packet Dropped: It is the measure of the number of packets dropped by the routers due to various reasons.
4) Routing Overhead: The ratio between the total numbers of routing packets transmitted to data packets.

III Conclusion

In this paper we have provided description of several routing scheme proposed for mobile ad hoc network. We have provided a classification of these schemes according the routing performance driven and on demand and presented a comparison of these categories of routing protocols. Reactive was described. The basic actions related to the routing process were studied in details. Also merits and demerits of the protocols base on the routing processes were given in the end of the sessions for corresponding protocols. To create a algorithm to increases the input-packet rates that flows can support and decreases the end –to end delay. It is based on the ad hoc technique.

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