An Overview of Routing Protocol

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Abstract— A mobile Ad-Hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an system in which mobile hosts are connected by wireless links. The Ad-hoc On-Demand Distance Vector (AODV) routing protocol is designed for use in ad-hoc mobile networks. AODV is a reactive protocol: the routes are created only when they are needed. It uses traditional routing tables, one entry per destination, and sequence numbers to determine whether routing information is up- to-date and to prevent routing loops.

Keywords—AODV, MANET, DSR, DSDV, OLSR

I. INTRODUCTION

Mobile Ad hoc network (MANET) is a self configuring infrastructure less network of mobile devices .MANET is a collection of wireless mobile nodes that dynamically form a network temporarily without any support of central administration. Mobile ad hoc network is a collection of wireless mobile nodes that establishes the network in absence of fixed infrastructure. MANET routing protocols possess two properties such as:

A. QUALITATIVE PROPERTIES.

Qualitative properties involves:

- Distributed operation
- Loop freedom
- Demand based routing
- Security

B. Quantitative properties involve:

- End to end throughput.
- Delay
- Route discovery time
- Memory byte requirement

II. RELATED STUDY

A Mobile Ad-hoc Network (MANET) is a temporary wireless network composed of mobile nodes, in which an infrastructure is absent. Nodes in these networks utilize the same random access wireless channel, cooperating in a friendly manner to engaging themselves in multihop forwarding. The nodes in the network not only act as hosts but also as routers that route data to/from other nodes in network.

Characteristics of MANETs:

1) Dynamic network topology:

MANET can be formed without any preexisting infrastructure. As the nodes move, the topology may change rapidly and the connectivity within the network varies with time.

2) Distributed operations:

Nodes collaborate operations to implement functions and not a single node is solely responsible for the overall operation.. Every node in the MANET can assist in routing of packets in the network.

3) It follows dynamic topology where nodes may join and leave the network at any time and the multi-hop routing may keep changing as nodes join and depart from the network. It does have very limited physical security, and thus increasing security is a major concern.

4) Limited Bandwidth & Limited Power:

5) The bandwidth available is limited than that of wired networks. The power is limited and the computation should be energy efficient.

6) Security: The wireless links lack defence against treats.

III. CLASSIFICATION OF ROUTING PROTOCOLS

Mobile Ad hoc network routing protocols are classified into three types:

- Proactive protocol
- Reactive protocol
- Hybrid protocol

A. Reactive Routing:

Reactive protocols are also called On Demand routing protocols where the routes are not predefined for routing.

Reactive Protocols use a route discovery process to flood the network with route query requests when a packet needs to be routed using source routing or distance vector routing.

Examples: DSR; AODV.

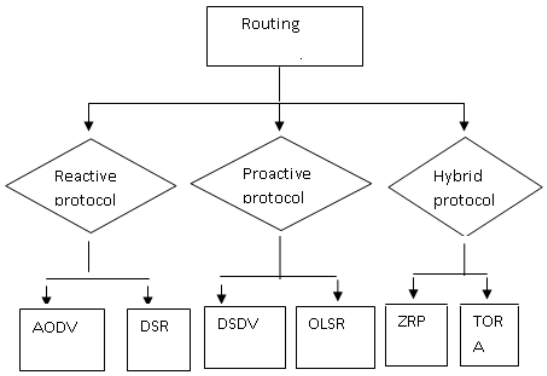

Fig. 1: Reactive Routing

B. Proactive Protocol:

These types of protocols are called table driven protocols in which routes to all nodes are maintained in routing table. Proactive protocols have low latency because all routes are maintained at all the times.

Example of proactive protocols: DSDV, OLSR.

C. Hybrid Routing:

Hybrid protocols combine features from both reactive and proactive routing protocols, typically attempting to exploit the reduced control traffic overhead from proactive systems whilst reducing the route discovery delays of reactive systems by maintaining some form of routing table .hybrid protocols are a combination of reactive and proactive

protocols and takes the advantages of two protocols and as a result routes are found quickly in the routing zone.

Example: ZRP (zone routing protocol).

IV. AD-HOC ON-DEMAND DISTANCE VECTOR (AODV):

AODV utilizes sequence numbers and routing beacons from DSDV but performs route discovery using on-demand route requests (RREQ); the same process as the DSR protocol [17]. AODV is different to DSR in that it uses distance vector routing; this requires every node in the route to maintain a temporary routing table for the duration of the communication. AODV has improved upon the DSR route request process using an expanding ring search mechanism based upon incrementing time-to-live (TTL) to prevent excessive RREQ flooding [2]. Nodes within an active route record the senders address, sequence numbers and source / destination IP address within their routing tables, this information is used by route reply (RREP) to construct reverse paths [11]. AODV deals with node mobility using sequence numbers to identify and discard outdated routes, this is combined with route error (RERR) messages which are sent when broken links are detected, RERR packet travel upstream to the source informing nodes to delete the broken links and trigger new route discovery if alternative routes are not available [4]. Reference [17] discusses the core principles of the protocol but provide no real insight into possible directions the protocol could take in the future, the network simulation collects data on a number of important metrics; dropped packets, transmission and receiving throughput (UDP and TCP), delay, send time vs. delay, jitter and round trip . time. These metrics are all important for quality of service considerations and useful indicators of network , er performance, however simulations are run only using AODV protocol.

Expanding upon AODV – Multicasting

The AODV protocol is considered by some researchers [17] to be the most popular MANET routing protocol, this has lead to many variants and improvements being proposed by researchers to address some of the many issues of wireless MANETs. One of these issues was the lack of multicast support in early MANET routing protocols, including DSR, DSDV and AODV, this functionality is useful for communicating with multiple nodes and increased available routing knowledge whilst reducing control traffic overheads [18]. In order to address this issue [18] proposed the Multicast Ad-hoc On-demand Distance Vector (MAODV) routing protocol, this protocol builds directly upon their previous work on AODV by adding support for multicast operation to the protocol.

V. DYNAMIC SOURCE ROUTING (DSR):

DSR is an On Demand routing protocol.DSR is based on the theory of source based routing. DSR protocol works into two mechanisms:

- Route Discovery
- Route maintenance

Route discovery is the mechanism in which a source node tending to send a packet to destination obtains a source node to destination.

Route maintenance is the mechanism in which source node is able to detect the link failures to the destination.

VI. OLSR (OPTIMIZED LINK STATE PROTOCOL):

OLSR is a proactive routing protocol.OLSR is an optimization version of a pure link state protocol. OLSR uses two kinds of the control messages: Hello and topology Control (TC).OLSR host can consider that the announcing host can act as a gateway to the announcing set of addresses. OLSR is a flat routing protocol; it does not need central administrative system to handle its routing protocol.

Advantages of OLSR:

- OLSR protocol does not require that the link is reliable for control messages.
- Due to OLSR routing protocol simplicity it is easy to integrate the routing protocol in the existing operating protocol.
- OLSR protocol is well suited for the application which does not allow the long delays.
- OLSR allows hosts to have multiple OLSR interface addresses and provide external routing information.

VII. DSDV (DESTINATION SEQUENCED DISTANCE VECTOR PROTOCOL):

In DSDV each node is required to transmit a sequence number which is periodically increased by two and transmitted along with any other routing update messages to all the neighboring nodes.

Advantage: Latency for route discovery is low and loop free path is guaranteed.

VIII. COMPARISON OF PROTOCOLS:

Comparison is made between the protocols on basis of following terms.

A. Performance and scalability:

The AODV protocol need to discover the route first in order to send the actual data, OLSR does not need to do the extra work for the discovery of the route so it provides low single packet transmission latency .The OLSR drawback is that it use constantly the bandwidth but AODV is trying to keep the bandwidth usage low for the maintaining of the routes. Extending the OLSR protocol the quality of service feature will result additional latency and overhead. . The AODV protocol performs better in networks with static traffic and OLSR has advantage in networks with high density and high traffic.

B. Resource Usage:

The storage complexity of the OLSR protocol is related on how much hosts are in the network but the storage complexity of AODV is related to the number of the communication pairs. The function for periodic maintainability of the routes consumes a lot of resources. In the AODV it is done by periodic Hello messages and in the OLSR by TC messages.

C. Security considerations:

The AODV needs less protection of the control messages it is enough to protect the RREP and RRER messages in order for the protocol to be secured but in case of OLSR all the control messages are needed to be secured. The AODV is more flexible to security solutions.

The three protocol namely AODV; DSR; DSDV are compared below in the tabular form in terms of pause time, speed and data rate. Also the total number of sent packets, routing packets and lost packets are determined.

Pause time[s]	Routing protocol	Sent packets	Routing packets	Lost packets
0	AODV	3421	3149	46
	DSDV	3398	715	109
	DSR	3433	859	29
10	AODV	3424	2866	31
	DSDV	3401	757	800
	DSR	3411	671	36

Fig. 2: Comparision on basis of time.

Max speed[m/s]	Routing protocol	Sent packets	Routing packets	Lost packets
10	AODV	21321	2461	458
	DSDV	21309	759	5267
	DSR	21309	280	46
20	AODV	21245	5508	2380
	DSDV	21288	731	8314
	DSR	21323	742	310

Fig. 3:.Comparision on basis of speed.

Sending rate[kbps]	Routing protocol	Sent packets	Routing packets	Lost packets
20	AODV	3421	3149	46
	DSDV	3398	715	1099
	DSR	3433	859	29
60	AODV	8485	3577	45
	DSDV	8488	741	1927
	DSR	8514	599	37

Fig. 4:.Comparision on basis of rate

IX. Conclusions

In this paper we have identified and reviewed a range of literature on the topic of MANET routing protocols, our initial work discussed early reactive, proactive and hybrid MANET routing protocols. Our review focuses upon protocols, namely the Destination Sequenced Distance Vector (DSDV) and Ad-hoc On-demand Distance Vector (AODV); DSR (dynamic source routing) which researchers claim is the most popular MANET routing protocol. In this paper comparison is done between the three protocols named as AODV; DSR; DSDV.The performance is compared on the basis of time; speed and rate and the total number of sent, routing and lost packets are calculated.

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