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Comprehensive Study of Proactive and Reactive Protocols in MANET

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Abstract: ***Mobile Ad-hoc Network is a collection of wireless mobile nodes which dynamically forms a temporary network without the aid of existing network infrastructure or centralized administrator. Each node in MANETS acts as host or router in the network. The nodes are free to move randomly . Mobile Ad Hoc Networks (MANETs) are characterized by a dynamic, multi-hop, rapid changing topology. The main types of routing strategies are Proactive, Reactive and Hybrid. In this paper, we analyze the performance and different characteristics of AODV, OLSR DSDV and TORA routing protocols. The basic aim of paper is to choose the best routing protocol to maximize the network performance.***

Keywords- AODV, TORA, OLSR, DSDV, MANET

I. INTRODUCTION

Wireless networks consist of the nodes which communicate with each other over a wireless channel. The type of wireless network, infrastructure less networks, is knows as Mobile Ad-hoc Network is one type of the wireless network [1]. Mobile Ad-hoc Network (MANET) is collection of mobile nodes that communicate with each other without any fixed infrastructure [1]. The nodes can directly communicate with all other nodes within their radio ranges or they can use intermediate node for communication. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile [2]. These networks are self- configurable and autonomous systems consisting of routers and hosts [1]. The various routing philosophies along with their routing protocols are discussed below in figure 1.1.

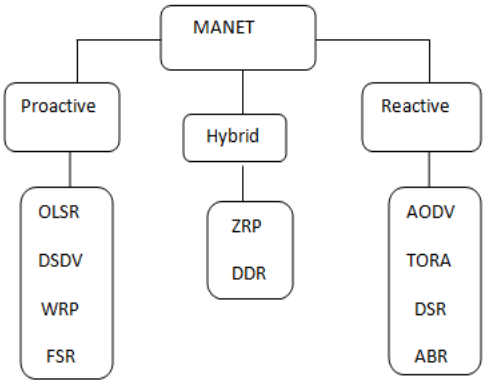

Fig 1.1: Classification of MANET Routing Protocols

(I). PROACTIVE PROTOCOL

Proactive protocols provide routes to all nodes, including with those to which no packets are sent. These are also called table driven protocols. In this each node maintain routing table which contains information about the network topology. The routing tables are updated periodically whenever the network topology changes [2]. Routing information in each node is periodically sent as packet data containing control information to other nodes as the broadcasting method. Then, each node of the network saves the network topology in the form of graph and updates as only when there is a change in the network or a new link is added [3]. The examples of Proactive routing Protocols are DSDV, OLSR and WRP etc.

(A). OPTIMIZED LINK STATE ROUTING (OLSR):

OLSR is Proactive, Link state Routing protocol. It usually stores and updates its routes. When a Route is needed, it present the route immediately without any initial delay. OLSR minimize the overhead by using some candidate nodes called multipoint relays (MPRs). Multipoint Relays (MPRs) are selected and responsible to forward packets in the network during the flooding process [4]. OLSR uses the concept of Multipoint Relays (MPR) to reduce the possible flooding in the network. Hello and Topology Control (TC) are two types of control messages used in OLSR. Hello message are used to find the link state and neighboring nodes [5]. Nodes broadcast "TC" or Topology control messages to determine its MPR's [4].

(B). DESTINATION SEQUECED DISTANCE VECTOR (DSDV):

The Proactive DSDV protocol is based upon Bellman-Ford algorithm to calculate shortest number of hops [2]. Each node maintains the routing table, all the required destinations within the network and the number of hops to each destination is recorded in this table. Each entry in the routing table is marked with a sequence number to avoid the formation of loops [6]. A sequence number is also associated with each route to the destination [7]. The route which is marked with the highest sequence number is used. The two types of route packets i.e. the full dump packet the incremental packets are used to reduce the amount of information carried in routing information packets.

(II). REACTIVE PROTOCOL

Reactive protocols are also called On-Demand protocols. Reactive protocols do not maintain routing information and do not need to maintain or update routing tables [1]. In this protocol, route is discovered whenever it is needed. Nodes initiate the route discovery only when it is demanded. The main role of reactive routing protocols is to minimize the traffic overhead in the network and less topology changes. The common element which is used in reactive protocols is the mechanism used for discovering routes in the network [2]. The examples of reactive routing protocols are AODV, DSR and TORA etc.

(A). AD HOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL (AODV):

AODV is a reactive protocol. It only request for a route when needed and it does not maintain routes for those nodes that do not actively participate in a communication. AODV can perform both unicast and multicast Routing [6]. AODV uses sequence number which corresponds to the destination node to ensure the loop freedom. When source node has data to transmit to the destination, source node sends RREQ message to the neighbors [5]. It will send the RREQ message backward at the same time if the neighbors have no information about destination node and if the neighbor node has either destination or information about the destination node[7] then it generates RREP message back to the source . The source node will send packets after receiving the RREQ message only when route is active, it will stop sending the packets when after the link times out[6].

(B) TEMPORALLY ORDERED ROUTING ALGORITHM (TORA):

TORA is a source-initiated on-demand routing protocol. TORA is specially proposed routing protocol for highly dynamic mobile, multi-hop wireless networks [5]. It establishes multiple routes from a source node to a destination node. The main feature of TORA is that the controls messages are localized to a very small set of nodes near the occurrence of topological variation [4] .The nodes maintain routing information about adjacent nodes to achieve this [7] . The basic functions involved in TORA are: Route creation, Route maintenance and Route deletion [5]. TORA uses the concept of Directed Acyclic Graphs.

II. RELATED WORK

Comprehensive Evaluation of AODV, DSR, GRP, OLSR and TORA Routing Protocols in MANETS is done by Gagangeet Singh aujla and Sandeep Singh Kang [5].]. They have analysed for the different reactive and proactive ad-hoc routing protocols. It was concluded that AODV is best suited protocol for video conferencing for low number of nodes. OLSR protocol shows best performance for email traffic and with larger no. of nodes. TORA shows poor performance with low load and low data drop.

Performance Comparison of AODV, DSDV, OLSR and DSR Routing Protocols in Mobile Ad Hoc Networks is done by S.A. Ade and P.A. Tijare [6]. The realistic comparison of three routing protocols DSDV, AODV and DSR is discussed. Reactive routing protocol AODV performance is the best considering its ability to maintain connection by periodic exchange of information. The different routing protocol has been compared by varying the number of nodes and with performance metrics like end-end delay, dropped packets. For packet delay and dropped packets ratio, AODV performs better than DSDV with large number of nodes. DSDV‘s performance is better for less no. of nodes and less mobility.

Performance Analysis of Proactive OLSR, Reactive Tora and Hybrid GRP Routing Protocols in MANET is done by Muhammad Asif Mehmood Khan [7]. His research results has shown that performance analysis of three mobile ad hoc routing protocols OLSR, AODV and TORA on the basis of throughput, network load, media access delay. It has been concluded that in Network load that OLSR performs better as compared to TORA and GRP. In Media access, the performance of TORA is also better than OLSR and GRP. The simulation result has shown that OLSR performs better than TORA and GRP regarding network density and pause time.

Reactive and Proactive Routing Protocol Performance Evaluation for Mobile ad-hoc network is done by Patil V.P [9]. He has done qualitatively the performance of the four MANET Routing protocols DSDV, AODV, OLSR and DSR. OLSR has the lowest end-to-end delay in almost all of the simulations. OLSR is a good compromise in terms of the packet delivery ratio and the end-to-end delay. AODV had better performance with higher mobility and a greater number of nodes. It has concluded that OLSR is the most efficient protocol for time-sensitive applications such as voice and video transmission and AODV in networks having 90 or more nodes.

III. RESULTS & COMPARISON

We have presented a comparison between various routing protocols. Based on imperative parameters and features of routing protocol, the different Proactive and Reactive routing protocols [2] [10] [11] are compared in Table 3.1.

To evaluate the performance of ad hoc network routing protocols, the following metrics are considered [6] [7] [9] :

Packet Delivery Fraction:

Packet delivery ratio is the ratio of number of packets received at final destination nodes to the number of packets originated from the source nodes. The performance of DSDV is better in more number of nodes. AODV is more reliable than DSDV in packet delivery ratio.

Table 3.1 Routing Protocol Comparison

PARAMETES	DSDV	OLSR	AODV	TORA
Route selection	Link state	Link state	Shortest and updated path	Shortest path
Route computation update	Distributed	Distributed	Broadcast	Broadcast
Loop free	Yes	Yes	Yes	no
Route updates	Periodic	Periodic	Non- periodic	Non- periodic
Method	Broadcast	Broadcast	Unicast	Broadcast
Routing overhead	High	Low	High	High
Throughput	Low	Low	High	Low
Caching overhead	Medium	High	Low	Medium
Update information	Distance vector	Link State	Route Error	Node's height

Throughput

It is used to measure the effectiveness of a protocol. It is the no. of requests fulfilled per second. The throughput of OLSR is high as compared to AODV, DSDV and TORA. .AODV performs well than DSDV and TORA since AODV is an on-demand protocol.

End to End Delay: It is the ratio of time difference between every packet sent and received to the total time difference over the total number of packets received. OLSR presented the lowest end-to-end delay. AODV performance was very close to that of OLSR in end to end delay. DSDV has the shorter End-to-End delay than AODV, because DSDV is a proactive protocol i.e. all routing information are already stored in table. As AODV takes time in route discovery, it produces more End-to-End delay. TORA produces the worst performance, it increase as the no. of nodes increases.

IV. CONCLUSION

In this paper, the comparison of four MANET protocols such as OLSR, AODV, DSDV and TORA are discussed including their types of routing. The comparison is based upon the different parameters and performance metrics. In protocol performance, OLSR is better in terms of Packet delivery fraction, Throughput & End-to-End Delay. AODV has better performance in networks with higher mobility and large number of nodes. AODV suits with the low number of nodes but OLSR suits better for large number of nodes. From the simulation results, AODV shows average performance and better results than DSDV. In DSDV, the packets are dropping. The received rate can very low or can very high. This means that performance of DSDV is worst than AODV and OLSR. TORA has low performance for all parameters throughput, delay and network load.

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