International Journal of Multidisciplinary and Scientific Emerging ResearcH (IJMSERH)

| ISSN: 2349-6037 | www.ijmserh.com ||Impact Factor: 9.274||Quarterly, Peer Reviewed & Refereed Journal|

|| Volume 12, Issue 4, October 2024 ||

Comprehensive Study and Review Various Routing Protocols in MANET

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ABSTRACT: Mobile Ad-hoc networks are composed of various interconnections among large number of nodes deployed for monitoring the system by means of measurement of its parameters. Recent research in wireless sensor networks has led to various new protocols which are particularly designed for routing in MANETs. To design these networks, the factors needed to be considered are the coverage area, mobility, power consumption, communication capabilities etc. These papers discuss characteristics and performance of AODV, DSR, GRP, OLSR and TORA routing protocol. The paper attempts to explores the best suited routing protocol in various conditions and environments.

KEYWORDS: AODV; DSR; GRP; OLSR; TORA; MANET

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is collection of mobile nodes that communicate with each other without any fixed infrastructure. These networks are self configurable, autonomous systems consisting of routers and hosts [1]. These networks have no fixed access points while every node could be host or router. All nodes are capable of movement and can be connected dynamically in arbitrary manner. These networks are self- configurable and autonomous systems consisting of routers and hosts. These nodes are constrained in power consumption, bandwidth, and computational power MANETS have different characteristics like autonomous behaviour, Multi- hop transmission, dynamically changing topology [2] and absence of infrastructure. It is difficult to determine may protocols perform well under different network scenarios. The various routing philosophies along with their routing protocols are discussed below

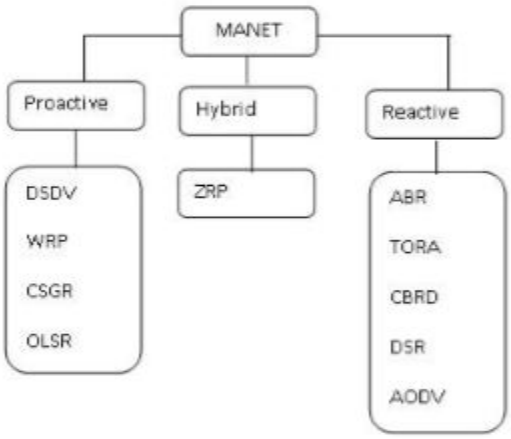

Fig 1.1 Various Routing Protocols

A. 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. This reduces the control traffic overhead due to maintaining routing tables. Routing tables are updated whenever is topology changes [2]. Proactive routing is unsuitable for highly dynamic networks because routing tables must be updated with each topology change [3]. Optimized Link State Routing Protocol (OLSR) is an example of Proactive Protocol.

OPTIMIZED LINK STATE ROUTING (OLSR):

OLSR is Proactive, Link state Routing protocol. Link state routing algorithms choose best route by determining characteristics like link, delay, bandwidth [5]. It usually stores & updates its routes when it is needed, also present the route immediately. In OLSR, Multi point relays (MPRs) are selected and responsible to forward broadcast packets. The idea of MPR is to minimize overhead of flooding message [5]. OLSR perform Hop by Hop routing, in which each node

uses recently routing information to route packets. In OLSR, information about neighbour nodes are gathered with "HELLO" messages what are send over network periodically [6].

DESTINATION SEQUECED DISTANCE VECTOR (DSDV):

The Proactive DSDV protocol is based upon Bellman-Ford algorithm to calculate shortest number of hops [2]. Each node in DSDV maintains a routing table and no. of hopes, containing entries for all the devices in the network. Each entry in routing table is marked with sequence no. to avoid the formation of loops [7]. In order to keep the routing table updated at all the time each device periodically broadcasts routing message to its neighbor devices. When a neighbor device receives the broad castedrouting message, it compares this value and the corresponding value stored in its routing table. If changes were found, it updates the value [9] and re-computes the distance of the route which includes this link in the routing table.

B. REACTIVE PROTOCOL

Reactive protocols are also called On-Demand protocols. These protocols do not maintain routing information and do not need to maintain or update routing tables. They can significantly reduce routing overhead when the traffic is lightweight and less topology changes [3]. Ad-hoc On Demand Distance Vector (AODV) is an example of Reactive protocol.

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 is capable of both unicast and multicast Routing [4]. It is an on demand algorithm, as it builds routes between nodes only as desired by source nodes.The important feature of AODV is that it uses a destination sequence number, which corresponds to a destination node that was requested by a routing sender node[8].When a route request message is created. It will check the sequence no.and the address of the initiator [7]and discarded the message if it had already processed that request.

DYNAMIC SOURCE ROUTING (DSR):

Dynamic Source Routing (DSR) is a Reactive routing protocol and is based on a method known as source routing [4]. It is designed for use in multi hop ad hoc networks of mobile nodes. There are two basic parts of DSR protocol [9]: route discovery and route maintenance. Every node maintains a cache to store recently discovered paths. When a node wants to send a packet, it first checks the cache whether there is an entry for that. If yes then it uses that path to transmit the packet. Which it doesn't have in its route cache, it broadcasts a Route Request (RREQ) message, which is flooded throughout the network. Each RREQ packet is uniquely identified by the initiator's address and the request id. It does not need any existing network infrastructure or administration [7]. DSR doesn't use periodic updates. It computes the routes when necessary and then maintains them

II. RELATED WORK

Performance Evaluation of MANET Routing Protocols with Scalability using QoS Metrics is done by Sumit Mahajan and Vinay Chopra [1]. They have analysed for different reactive and proactive ad-hoc routing protocols. It was concluded that the overall performance of OLSR is better choice for small and large networks.

The performance of routing protocols varies with network. Proactive protocol OLSR outperforms in terms of throughput jitters and gets the same low delay as OLSR. Performance Comparison of AODV, DSDV, OLSR and DSR Routing Protocols in Mobile Ad Hoc Networks is done by S.A. Ade [4]. There alistic comparison of three routing protocols DSDV, AODV and DSR have discussed. Reactive routing protocol AODV performance is the best considering its ability to maintain connection by periodic exchange of information. DSR was very good at all mobility rates and DSDV performs almost as well as DSR, but still requires the transmission of many routing overhead packets. Review paper on performance analysis of AODV, DSDV, and OLSR on the basis of packet delivery is done by Raman deep Kaur and Chandan Sharma [8]. They have evaluated the performance of widely used ad hoc network routing protocols. The simulation characteristics used in this is packet delivery. It is very important for performance evaluation of any networking protocol. Comparative Analysis of Routing in MANET is done by Anju Gill and Chander Diwakar [10]. Classification of routing protocols on the basis of routing information updates mechanism, highlighting their characteristics and done comparative analysis for wireless ad hoc networks routing protocols.

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III. RESULTS AND COMPARISONS

We have presented a comparison between existing routing protocols. The comparisons basically consider the characteristic properties of routing protocols in network.Based on imperative parameters and features of routing protocol, a variety of table-driven (Proactive) routing protocols [4] [10] are compared in Table 3.1:

Table 3.1 Routing Protocol Comparison

PARAMETES	DSDV	OLSR	AODV	DSR
Route selection	Link state	Link state	Shortest and updated path	Shortest and updated path
Route computation update	Distributed	Distributed	Broadcast	Broadcast
Loop free	Yes	Yes	Yes	Yes
Routes maintained	Route table	Route table	Route table	Route table
Method	Broadcast	Broadcast	Unicast	Unicast
Routing overhead	High	High	High	High
Throughput	Low	Low	High	Low
Caching overhead	Medium	High	Low	High
Update information	Distance vector	Link State	Route Error	Route Error

In order to evaluate the performance of ad hoc network routing protocols, the following metrics are considered**[6][4][11]**

a. Packet Delivery Fraction (PDF):
PDF is the ratio between the numbers of packets originated by the application layer sources and the number of packets received by the final destination. DSR performs well when the number of nodes is less as the load will be less. The performance of DSDV is better with more number of nodes than In comparison with the other two protocols. The performance of AODV is consistently uniform**.**

b. Throughput:
Throughput is total packets successfully delivered to individual destination over total time divided by total time. The average throughput is defined as the average receiver throughput divided by the number of senders. OLSR performance - which is the proactive routing protocol, is the best in term of throughput. AODV performs better than DSR. DSR does not use any periodic routing advertisement, link status sensing, or neighbor detection packets,

c. 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 performance in terms of delay is best. The performance of DSR and AODV are almost uniform. However, the performance of DSDV is degrading due to increase in the number of nodes and load.

IV. CONCLUSION

In this paper, the comparison of four MANET protocols such as OLSR, AODV, DSDV and DSR are discussed including its types of routing. The comparison is based upon the different parameters and performance metrics. In protocol performance, OLSR best in terms of Packet delivery fraction, Throughput & End-to- End delay. AODV has better performance in networks with high mobility and size. DSR/DSDV performs better than DSDV with large no. of nodes. For real time traffic AODV is proffered over DSR and DSDV. For less number of nodes and less mobility, DSDV's performance is better.

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