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Performance Analysis of Routing Protocols in MANET

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ABSTRACT: During the last few years we have all witnessed steadily increasing growth in the deployment of Mobile Ad hoc network (MANET). They consist of nodes that are able to communicate through the use of wireless mediums and form dynamic topologies. Unfortunately, mostly broadly used routing protocols in MANET have no security considerations and trust to the participant nodes in order to correctly forward routing and data traffic. In order to maintain connectivity in such network all participating nodes have to perform routing of network traffic. The cooperation of nodes cannot be enforced by a centralize administration authority since one does not exist. Therefore, network layer protocols are key force to enforce connectivity and security requirements in order to guarantee the undisrupted operation of the higher layer protocols.
Keywords: Mobile Ad Hoc Network, Performance Parameters, AODV, DSR.

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I. INTRODUCTION

A Mobile Ad Hoc Network (MANET), is a network comprising of a set of mobile hosts proficient of communicating with each other without the help of base stations [1]. It signify complex distributed systems that contain mobile nodes that can animatedly self-form into arbitrary ad-hoc network topologies, tolerating people and devices to effortlessly work in areas with no previous communication infrastructure such as, disaster recovery environments. A abundance routing protocols have been proposed for this network in the Past. Such protocols can be categorized according to the routing approach that they follow to determine route to the destination. Routing protocols are categorized into 3 categories. Those are Proactive protocols, Reactive protocols and Hybrid protocols. A brief representation is shown below in the figure 1.

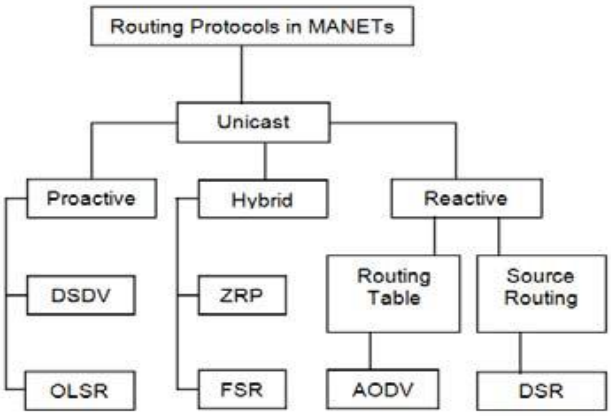

Fig. 1 Major Category of Routing Protocols in MANET

The Internet Engineering Task Force suggests two types of metrics for evaluating the performance of MANET. These are qualitative metrics and quantitative metrics. In the first phase, the routing protocols are located that may be appropriate in high speed wireless communications based on qualitative metrics. In the second phase, the chosen protocols are evaluated from the first phase based on quantitative metrics.

II. QUALITATIVE METRICS

2.1 Security: The wireless environments, along with the nature of the routing protocols in MANETs, which require each node to participate actively in the routing process, introduce many security vulnerabilities. Hence, routing protocols in MANET must follow security mechanisms to address such vulnerabilities.

2.2 Loop Freedom: Generally this refers to protocols that determine routing information based on the Bellman Ford algorithm. In a wireless environment with limited Bandwidth, interference from neighboring nodes transmissions and a high probability of packet collisions, it is essential to prevent a packet from looping in the network and thus consuming both processing time and bandwidth.

2.3 Sleep Mode: Nodes generally make use of batteries for their energy source. Hence, protocol in the MANET should be competent enough to operate without any adverse consequences in the node's performance.

2.4 Unidirectional link Support: Nodes in the wireless environment may be able to communicate only through unidirectional links. It is desirable that routing protocols in the network should support both unidirectional and bidirectional links.

2.5 Multicasting: Multicasting support is significant especially for the transmission of real-time data (for example, multimedia data) in many nodes at the same time.

III. QUANTITATIVE METRICS

3.1 Route Acquisition Time: This metrics describes how much time will be taken by the protocol to discover a better path? That is very important and primary concern in reactive type of routing protocols because the more time it takes, the more delay will be.

3.2 Efficiency: This metric is used to measure the efficiency of the protocol. It determines the packet delivery fraction (PDF) over the total number of packets delivered and the energy consumption of the protocol for performing the operations.

3.3 End-to-End data Throughput and Delay: Such type of metrics are used in the network to determine the effectiveness' of the routing protocol. These metrics are able to reveal increase delay and minimize data throughput in MANET.

Some traditional delay aware routing protocol which can be implemented for enhancement in the performance of MANET are presented.

IV. COMPARATIVE ANALYSIS OF DIFFERENT ROUTING PROTOCOLS ON THE BASIS OF DELAY AWARE METRIC

There are different kinds of the traditional routing protocols in MANET which are working for the delivery of the data packets from the source node to the destination node. Let us take the performance analysis of some very popular routing protocols of MANET using NS2 to quantify the qualitative metrics and quantitative metrics.

4.1 Simulation Result of Delay Metric for AODV against DS AODV Protocol.

Table1 Simulation Parameters

Simulation Tool	NS2
Topology area	100x100m
Simulation Time	500 sec
Application Traffic	CBR (Constant Bit Rate)
Number of nodes	60
Node Placement model	Uniform
Routing protocols under Comparison	DS-AODV, AODV
MAC Layer protocol	IEEE 802.11
Physical Layer protocol	802.11b
Data Rate	11 mbps
Node Mobility model	Random Waypoint model
Packet size	512
Flow specification	50 packets/second
Node pause time	20 m/s (for constant load)

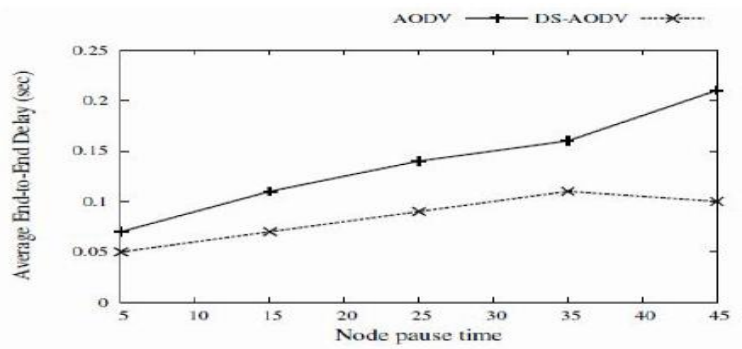

Fig. 2 Average End to End Delay versus Node Pause Time

4.2 Simulation Results of Delay Metric for DSDV and DSR Routing Protocol

table 2 Simulation Parameters Graphical Representation

Simulation Time	3000 s
Number of Nodes	50
Simulation Area	100 m * 100 m
Transmission Range	25 m
MAC layer Protocol	802.11b
Routing Protocol	DSDV and DSR
Transmission Layer Protocol	TCP
Number of Streams	2,6,10
Queue Length	100
MAC Layer protocol	IEEE 802.11
Physical Layer protocol	802.11b

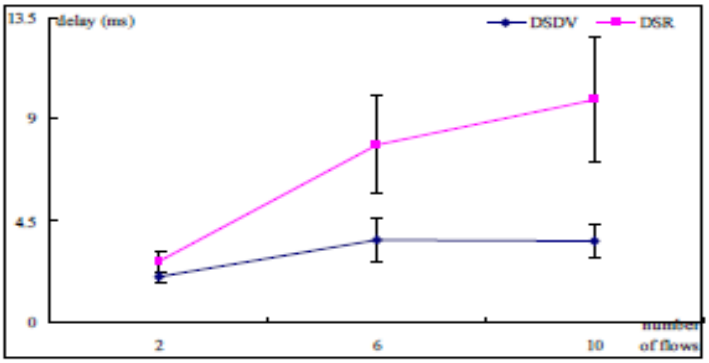

Figure 3 Delay versus number of flows

4.3 Simulation Result of Delay Metric for AODV and OLSR

table 3 Simulation Parameters

Connection Type	CBR/UDP
Simulation Type	1000*1000
Transmission Range	250m
Packet Size	512bytes
Number of Nodes	30-50-70-90
Duration	150 s
Pause Time	0 s
CBR_Start	30 s
Number of connection	10

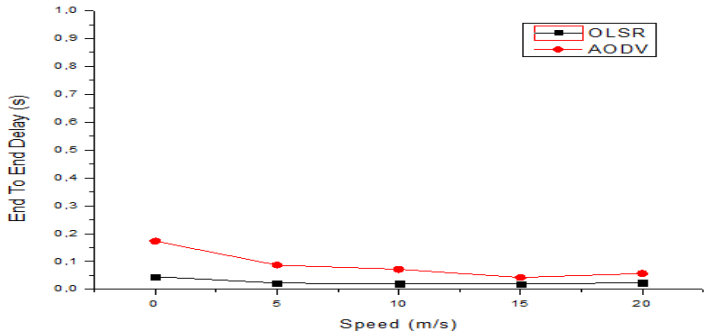

Fig. 4 Delay versus Speed Graph

V. CONCLUSION

On the observation using NS-2, it has been seen that quantitative metrics are more concern to identify end to end delay which is minimum in case of DS-AODV as compared to AODV as shown in figure 2. Also figure 3 shows the end to delay comparison between DSDV and DSR routing protocols, where with increasing number of flows, DSDV has lesser delay as compared to DSR. From the experiments 3, it can be concluded vey clearly that OLSR protocol has a very less delay than an AODV protocol when delivering a data packet to the destination node.

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