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Performance Enhancement of Mobile Ad-Hoc Network Using Delay Aware Routing Protocol

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ABSTRACT

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. In view of the fact that MANET is an independent system of functionality equivalent mobile nodes, which have to be able to communicate while moving without any kind of wired infrastructure to this end, mobile nodes must work together to provide the routing services. A large number of MANET routing protocols have been projected in the last era. These protocols can be categorized according to the routing approach that they follow to determine route to the destination. These protocols execute variously depending on type of traffic, number of nodes, rate of mobility, etc. Routing protocols categorized into 3 categories. These are Proactive protocols, Reactive protocols and Hybrid protocols. There are Metrics which are accountable to the Performance of MANET & to achieve the Quality of Services for a mobile Adhoc network these metrics play a major role. Delay is one of the major metrics of Quality of Services. Which describes the delay of data packets at the destination node. This Paper presents the concept and approach that how we can improve the performance of MANET by decreasing the delay using any particular delay aware routing protocol. This paper also presents the comparison of different routing protocol on the basis of Delay Metrics.

Keywords: MANET, Delay, QoS, AODV, DSR, OLSR

I. INTRODUCTION

In early 1990's the use of database in web based application was the choice of MySQL due to its fast and flexible capabilities. "Monty" Widenius developed this database and named after his daughter name My and SQL that stands for structured query language. The alternate database won't be a choice for people if they want to have an ease of use, reliable and open source database. Over the years this database is more stable and reliable and it is used by small scale to large based organizations. The number of year's effort placed by MySQL Ab Company to produce such a capabilities based product into open source market.

Mobile Ad-hoc Network has many different definitions by different authors. Basically MANET is a collection of wireless network which do not require any infrastructure support for transferring data packets between nodes [1]. Due to the independent nature of the mobile Adhoc network there are various issues and challenges which are coming during the communication between the nodes in the network. So in the last era tremendous research has been done in the field of mobile Adhoc network and still the work is not completed yet.in this regards different routing protocols has been proposed by different scientist which are very successful depending on the basis of different criteria and issues associated with Mobile Ad-hoc Network. These protocols are majorly categorized as Reactive also known as Demand Routing

protocol [2]. Proactive also known as Table Driven Protocol [2]. And the last one is Hybrid which is the combination of above two routing protocols. The general overview of the MANET routing protocols is described from the diagram give below.

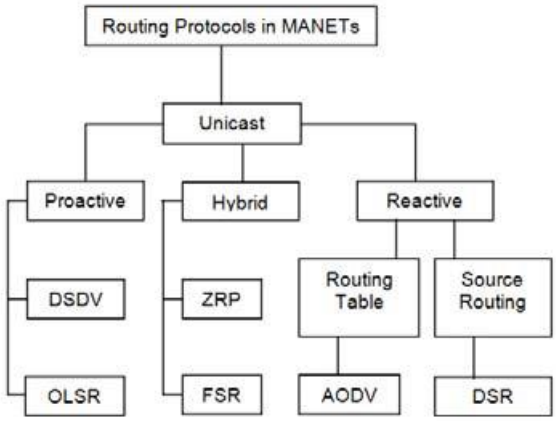

Figure 1. Major Category of Routing Protocols in MANET [2]

The Mobile Ad-hoc Network that implement on reactive routing protocol for the transmission of packets from source to destination does not maintains a routing information for all the nodes at all time. Instead of this the routing information is obtained on demand if a node wants to send a packet to the destination and it does not have enough information for sending the packet to the destination it obtained an information on demand. [3][5][6]. In the Proactive Protocol each node maintains a Routing table at its end and these routing table contains the information for the delivery of data packets coming from the source node. [4] Therefore there is an overhead problem associated with a proactive protocol [5]. Hybrid protocols is a combination of the pros of the reactive protocol and proactive protocol. [6] But hybrid protocol are also not able to meet the all those requirement which are essential for achieving the QoS in MANET [7].

II. METHODS AND MATERIAL

A. Historical Background

We can classify MANET life cycle into first, second and third generation. The Mobile Ad-hoc network currently in is use belongs to the third generation [3]. The first generation of ad hoc network started during the 1970s and was given a term as Packet Radio Network (PRNET) [4]. The Defence Advanced Research Project Agency (DARPA) initiated research of using packet switched radio communication to provide reliable communication between computers and urbanized PRNET. As the time passes development was at its pace and during the period of 1980 the PRNET has developed into the Survivable Adaptive Radio Network. (SU RAN)[5]. SURAN was smarter than PRNET and it provides some features by improving the radio performance (making them smaller, cheaper and power thrifty). SURAN also provides resilience to electronic attacks. At the same time United State Department of Defence (DOD) for continuing to an Ad hoc Network which can be used in practical or Real time and for developing this it continued funding for programs such Globe Mobile Information System (GloMo) and Near Term Digital Radio (NTDR). GloMo make use of CSMA/CA and TDMA molds, and provide self-organizing and self-healing network (i.e. ATM over wireless, Satellite Communication Network). The NTDR make use of clustering and link state routing and organized an ad hoc network. NTDR is worn by US Army [6]. By the enhancement of Ad- hoc Network number of research took place during the period of 1990's.The functioning group of MANET is born in Internet Engineering Task Force (IETF) who worked to standardized routing protocols for MANET and gives rise to the development of various mobile devices like PDA‟s palmtops, notebooks, etc.

B. Delay Aware Routing Protocols Classification

The Delay aware routing protocol makes a selection optimal route from source to destination which has a least delay. THE route discovery process is applied in the delay aware routing protocols for the selection of optimal path from the bunch of routes from source node to the destination node [7]. There are different types of conventional routing protocols such as AODV, DSR and OLSR use minimum hop count or shortest path as the main metric for path selection.[8][6].Delay defined as the total latency experienced by a packet to traverse the network from the source to destination. Delay over MANETs has many types such as routing delay, which is the required time to find the path from source to destination. A compression and decompression delay, which is related to transmitting audio files. Processing delay, this occurs while the node processes the packet for transmission. Propagation delay, related to propagating bits through wireless media. End-to-end Delay, which is the total time, requires for one bit traversing from source to destination. Media Access Delay, Acknowledgment and Retransmission delay, Delay jitter [8].

i. Delay aware protocols based on AODV

AODV is one of the most important reactive protocol which based on demand used in table based approach. AODV protocol uses the terminology of the shortest path from source to destination as the main metric in determining the optimum path. The proposed protocol QoS-AODV [9]. It is an advance AODV Protocol which decides the minimum path from source to destination based on three major factors i.e. Hop count, delay and bandwidth. The combination of both the protocol i.e. QoS-AODV and AODV multipath yields a new protocol called as DAAM [10]. Which uses a delay aware routing protocol technique. In DAAM there is a computation of multiple node-disjoint path without incurring the overhead generated by link state routing method. QoS-AODV routing protocol helps in choosing optimal path by the usage of hop in addition with delay and bandwidth. This protocol does not take care of the other factors which are positively or negatively responsible for the optimal path such as dynamic behavior of the MANET node mobility due to which there is a fear of link failure. EDAODV is also one of the modified version of AODV with additional delay and energy extensions, in this routing protocol the two parameters of minimum energy and maximum delay are added to the AODV routing table per entry.

ii. Delay aware protocols based on DSR

DSR i.e. Dynamic Source Routing protocol is the on demand routing protocol based on the source routing theory. This protocol determines the shortest path from source to destination based on the minimum number of hops. The additional mechanism proposed for AODV is now applied to DSR and route discovery in DSR uses these energy and delay extensions to ensure to give a new protocol called as EDDSR [11]. In this protocol node who receives route request will search within its route cache to this destination with the specified energy and delay. If both metrics values satisfied with the values in node's route cache the packet will be forwarded else it will be discarded.

iii. Delay aware protocols based on OLSR

In OLSR the basic mechanism is the selection of minimum hop path between source and destination node without concern about the quality of link. Different types of routing schemes are proposed by the authors over the OLSR such as QOLSR in which delay and bandwidth measurements are applied in order to improve the quality requirements in routing information [12]. Another approach is Link Quality aware Optimized Link State Routing (LQOLSR), which makes a selection between source and destination based on transmission delay [13].

The overall Representation of protocols using Delay as the Major Metric

Table-1 Main Features of Delay Aware Protocols [14], [15]

Protocol	**Added metrics**	**Routing Protocol Class**	**Simulation**	**Modify messages**	**Kind of Delay**
LQOLSR	Delay	Proactive	Real Implementation	Yes	Packet Transmission Delay
OLSR	Delay	Proactive	N/A	Yes	Media Access Delay
EDDSR	Delay and Energy	Reactive	Ns2	Yes	End-to-End
QOLSR	Delay and Bandwidth	Proactive	OPNET	Ye	Average Delay
OLSR_NN	Delay	Proactive	Ns2	Yes	Mean Queuing Delay
SMR	Delay and Multipath	Reactive	GloMoSim	Yes	End-to-End
DAAM	Delay and Multipath	Reactive	OPNET	Yes	End-to-End
EDAODV	Delay and Energy	Reactive	Ns2	Yes	End-to-End
QoS-AODV	Delay and Bandwidth	Reactive	N/A	Yes	End-to-End
EDC-AODV	Delay and energy	Reactive	Ns2	Yes	Current size of queues

III. RESULTS AND DISCUSSION

There are different kinds of simulating software's available in the market for calculating the performance of the MANET routing protocols. To date, a number of simulation tools (e.g., NS-2, GloMoSim, OPNET, QualNet and MATLAB) have been developed for wireless and ad hoc network simulations. GloMoSim is

a free simulation tool that depends on a discrete event mechanism [18]. OPNET (Optimized Network Engineering Tools) is a commercial simulator with a Graphical user interface. It is well-organized in that many components such as mobility patterns, propagation models, MAC layer protocols and many routing protocols (e.g., AODV, DSDV) are already included [19]. NS-2 (Network Simulator version 2) is the most popular free simulation tool used in the field of mobile ad hoc networks [20]. It is equipped with lots of protocols and models. In addition, there is substantial technical support available in the open source community. NS-2 is split into the OTCL language and the C++ language.

1 Simulation Results of Delay Metric for DSDV and DSR

Table :-1 Simulation Parameters

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

Graphical Representation

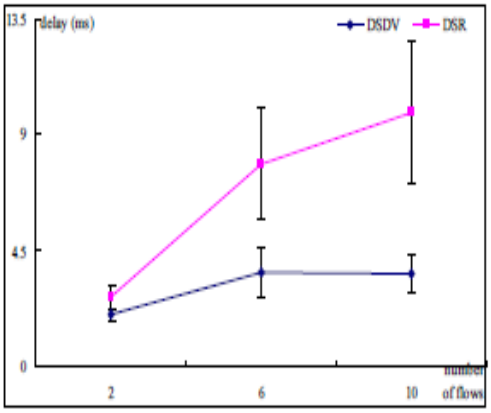

Figure 2. Delay versus number of flows

2 Simulation Result of Delay Metric for AODV against DSDV Protocol

Table :-2 Simulation Parameters

Parameter	Value
Simulator	NS-2
Simulation time	500 seconds
Area of the network	500 m x 500 m
Number of nodes	25, 50, 100, 200
Pause time	10 seconds
Maximum speed of nodes	20 meters per second
Mobility Model	Random waypoint

Graphical Representations.

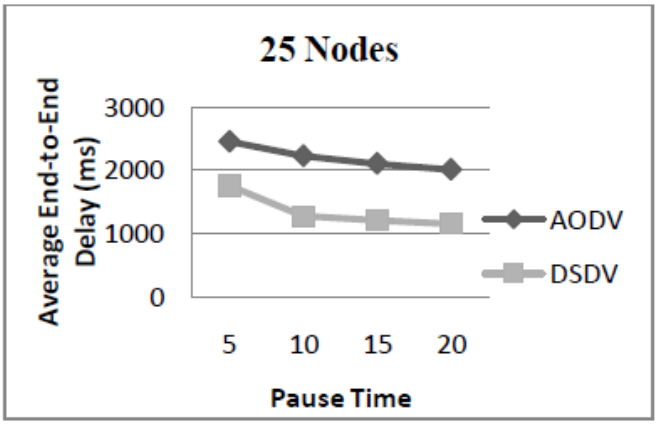

Figure 3. Average End to End Delay for 25 Nodes

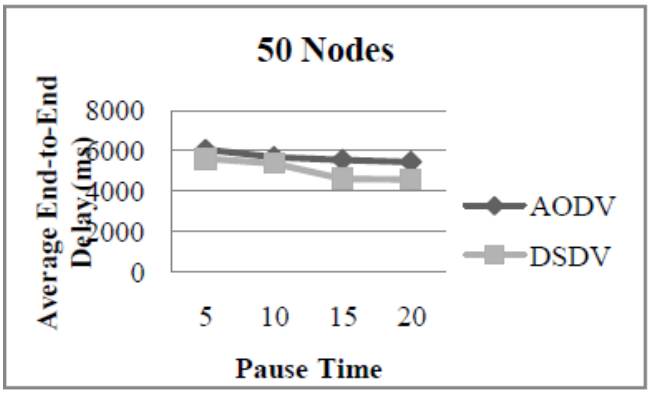

Figure 4. Average End to End Delay for 50 Nodes

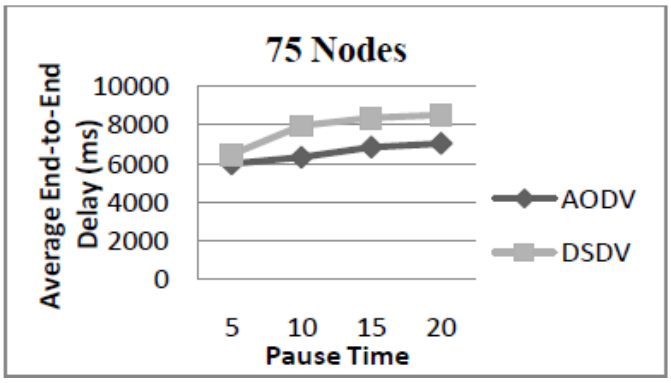

Figure 5. Average End to End Delay for 75 Nodes

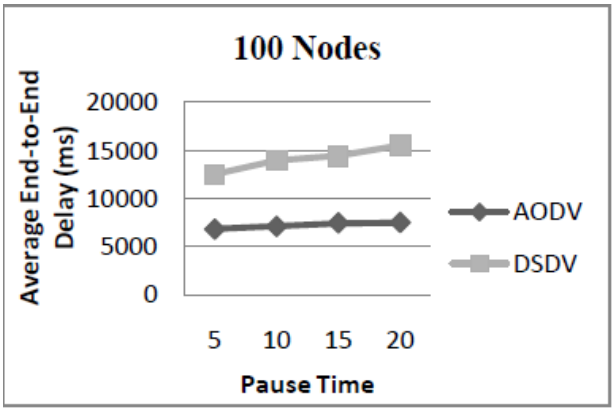

Figure 6. Average End to End Delay for 100 Nodes

The simulation result as indicated in Fig-5 and Fig-6 shows that in case of low node density, the average end-to-end delay of AODV is higher than DSDV whereas Fig2.3 and Fig 2.4 indicates that with an increase in node density, AODV outperforms DSDV. It also has been observed that with an increase in pause time there is a decline in the average end-to-end for both the protocols under low node density environment (Fig-5 and Fig-6). However, this is not true when there is a rise in the network density. The possible reason for such behavior is the presence of more number of nodes between source and destination which effects in increase of hop count thus resulting in increased average end-to-end delay.

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 connexions	10

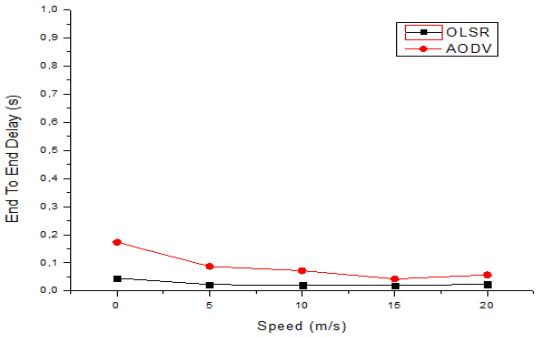

Figure 7. Delay versus Speed Graph

IV. CONCLUSION

On the observation the experiments it have has been concluded that proactive protocols give a minimum end to end delay than the reactive protocols this is because the already have the route information for the data packets saves lots of time in deciding the optimal path for a data packet to reach the destination node from a source node. From the experiments it is seen that OLSR protocol has a very less delay than an AODV protocol when

delivering a data packet to the destination node. Ad –hoc networking is a rather hot concept in computer communications. This means that there is much research going on and many issues that remains to be solved. In this paper, we have focused on performance evaluation of three routing protocols, AODV, DSDV and OLSR. However there are many issues that could be subject to further studies. First of all, it is important the practical implementation of those routing protocols, in real applications based on the scenarios that were studied. Also, the simulator environment could be improved. The objective of this thesis will be to Search, Enhance and implement the Most Efficient Delay Aware Routing Protocol so that all the requirement metrics for the QoS can be achieved.

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