QoS Enhancement of AOMDV Routing Protocol using Queue Length Improvement

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***Abstract*— In mobile ad hoc networks, the quality of service (QoS) guarantees are more difficult when compared with wired networks due to mobility of nodes. The difficulties in the provision of such guarantees have limited the utility of MANETs. The AOMDV (Ad hoc On Demand Multipath Distance Vector) has a better routing protocol for efficient data delivery. In this paper we improve the QoS performance of AOMDV protocol and is called Enhanced AOMDV (EAOMDV) on the basis of queue length, which enhances the routing capability of AOMDV protocol. In this technique the queue length has handled the data and network performance has improved. The performance of both the protocol has been measured on the basis of performance metrics and packet loss.**

***Index Terms*—MANET, QoS, AOMDV, EAOMDV, Queue.**

I. INTRODUCTION

Wireless ad hoc network is the network having no infrastructure and any control centre. In the network, communication takes place between the nodes directly or indirectly using mutihop concept with dynamically changing topology. Routing protocols for such wireless network must handle changes in paths due to mobility. However, most of the existing Ad Hoc routing protocols do not consider the QoS [2] in network. The major challenge is to provide QoS solutions and maintain end-to-end QoS with user mobility. Most of the conventional routing protocols are used to minimize the average hops for delivering a packet. Some protocols such as ad-hoc on demand distance vector (AODV) [3] and dynamic source routing (DSR) [4] are designed without having explicitly considering QoS. When QoS is considered, some protocols may be unsatisfactory due to the lack of resources and the excessive computation overhead. QoS routing usually involves two tasks; one is collection and maintaining up-to-date state information about the network and second is finding feasible paths for a connection based on its QoS requirements. The multipath routing is the enhancement of unipath routing, in which advantage is to handle the load in network and avoid the possibility of congestion and increases reliability.

II. AOMDV ROUTING PROTOCOL

AOMDV protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths [7]. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts where next hops have the same sequence number and helps in keeping path of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination. Each duplicate route advertisement received by a node may define an alternate path to the destination. Loop freedom is assured for a node by accepting all alternating paths to destination if it has a less hop count as compare to advertised hop count for that destination. As the maximum hop count is used, the advertised hop count does not change for the same sequence number [7, 14]. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are reinitialized. AOMDV [7, 15] working on finding node-disjoint or link-disjoint routes. For finding node-disjoint routes, each node does not immediately reject duplicate RREQs and each RREQs arriving via a different neighbor of the source defines a node-disjoint path. This is mainly due to lake of broadcast of duplicate RREQs by node, and any two RREQs arriving at an intermediate node via a different neighbor of the source could not have traversed the same node. The prime advantage of AOMDV is that it allows intermediate nodes to reply to RREQs, while still selecting disjoint paths. However, it has more overheads during route discovery due to increased flooding and since it is a multipath routing protocol, the replies are also in longer overhead.

III. RELATED WORK

In [8] authors proposed an improved ad hoc On-demand multipath distance vector protocol, which uses a lightweight mechanism for determining network congestion and optimal route, which is based on the information acquired from the MAC layer, to improve algorithm performance. This algorithm uses the concept of congestion avoidance that prohibits the establishment of new routes through the congested area. Authors in [9] have modified the AODV protocol, which results in selection of zone-disjoint paths and results in achieving less end to end delay. Active neighbors are the neighbor nodes which have already received and replied to the Route Request packet (RREQ) and it’s probable that they exist on other paths for the same source and destination, so even though they are located on two disjoint paths they will still affect each other in simultaneous data transfer. The efficiency of the proposed protocol has been evaluated on different scenarios and there has been a noticeable improvement in the packet delivery ratio and also in the reduction of end-to-end delay comparing to AOMDV [11]. In [13] authors proposed a trust based reliable AODV [TBRAODV] protocol which implements a trust value for every node.

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For every node trust value is calculated and based trust value nodes are tolerable to contribute in routing or else identified to become a misbehaving node. This extends reliability in AODV routing and results in increase of Packet Delivery Ratio, decrease in delay and throughput is maintained. This trust based routing mechanism has proved in rising the performance of the TBRAODV protocol and also shows good enhancement of QoS parameters like Packet Delivery Ratio and delay. In [15] authors proposed an extension of AODV to support QoS, supercilious the accessibility of some stationary links in the network. In [11] introduced the notion of node stability, based on a node's history, which integrated both a node's mobility and packet processing ratio. Only stable nodes were considered for routing. Nevertheless, the authors did not consider the impact that unpredictable link failures would have on re-routing. In [16] QoS routing has received attention recently for providing QoS in wireless ad hoc networks and some work has been carried out to address this critical issue. In general, QoS routing can be classified into two basic paradigms: source QoS routing and hop-by-hop QoS routing. With source routing, the source node of a communication request locally computes the entire constrained path to the intended destination with the global state information that it maintained. Congregation and maintaining global state information can commence excessive protocol overhead in dynamic networks and thus have the scalability issue. Moreover, the calculation of constraint based routes would be computationally intensive for the calculating nodes. Passive Measurement-based Approach to admission control [17] is based on end-to-end delay and packet loss parameters. Source node marks each packet of every new data flow with a sequence number and timestamp. Every new data flow is admitted at the beginning and destination node monitors network parameters carried in packet headers and compares them with packet receiving time. Another one approach independent from routing protocol but using all network nodes along the path is QPART (QoS Protocol for Ad-hoc Real-time Traffic) [18]. The basic idea is to admit all data flows with low priority and to increase the priority periodically based on the information from routing and MAC layer. The request packet of data flow carries information for all nodes along the communication path about QoS requirements. Other group of admission control principles is those which depend on routing protocols.

IV. Proposed QoS Routing in MANET

QoS routing is a specialized routing scheme which finds a network path that satisfies a particular set of QoS requirements including the energy. QoS routing in MANETs is difficult because of the constantly changing network topology and link capacity. We proposed a new QoS model for MANETs which differs from the majority of current models. In this model the performance improves on the basis of queue length by that the performance of AOMDV protocol are enhanced and proposed EAOMDV protocol for the data in the network are handled efficiently.

One of the basic aims of the proposal was its simplicity and easy implementation into real MANET. We also required that access control has the minimal overhead to network nodes along the path and multipath routing should be supported. Admission control should provide soft QoS and make decisions based on available bandwidth and packet delivery fraction. As a result, it is very challenging to maintain up-to-date routing and network information in such highly mobile and dynamic wireless networks. In AOMDV protocol flooding is more by that the node buffer capacity are affected. A few promising techniques for QoS routing in MANETs have been proposed which tried to achieve satisfactory QoS performance. Routing operation consists to find routes between communicating entities (transmitter / receiver) able to convey data packets continuously using less bandwidth and less packets control. Routing in MANETs must also supervise constraints of nodes energy problems, topology recurrent changes due to nodes mobility and communication channel nature. QoS routing can be defined as the research for routes rewarding the desired QoS.

V. Simulation Environment

Network Simulator widely known as NS2 [15], is simply an event driven simulation tool is very useful in studying the dynamic nature of communication networks. Simulation of wired and wireless network functions and protocols can be done using NS2. In general, NS2 provides facilities to users with a way of specifying various network protocols and simulating their consequent behaviors.

A. Performance Parameter

In our simulation we use network simulator-2 and analyse the behaviour of the network on following parameter

1) Packet Delivery Ratio:
The [15] ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination.

2) Average End-to-end Delay:
This [15] is the sum of all the possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC and propagation and transfer times.

3) Packet Dropped:
The [15] routers may fail to deliver (or drop) some packets (or data) because when they arrive their buffer are previously full. Some, none, or all the packets or data might be dropped, it may be depending on the condition of the network, and it is difficult to determine what will happen in advance.

4) Routing Load:
Routing Load [15] is no. of routing packets transmitted per data packet delivered at the destination during the simulation. It is measured by dividing the sum of all number of routing packets sent (includes forwarded routing packets as well) by the sum of all number of data packets received.

VI. SIMULATION PARAMETER

We take Simulator Parameter as Number of nodes, Dimension, Routing protocol, traffic etc. According to table 1 (shown below) we simulate our network.

Table 1 Simulation Parameter

Number of nodes	50
Dimension of simulated area	800×600
Routing Protocol	EAOMDV, AOMDV
Simulation time (seconds)	100
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Nodes Mobility & Maximum Speed (m/s)	Random & 30 m/s

VII. SIMULATION RESULTS

Simulation results that are evaluated on the basis of performance parameters represent the improved performance of EAOMV protocol.

A. UDP Lost Analysis with Normal AOMDV and QoS with EAOMDV

User datagram Protocol (UDP) are not reliable because of their connection less behavior. If the network conditions are not favorable then in that case performance of UDP protocol is reduced. In this graph the packet loss analysis has been done in both the cases, normal AOMDV and QoS service Queue based AOMDV scheme. Here the packet loss is more in case of normal AOMDV it means only the concept of multipath routing does not provide the reliable packet delivery but if we enhance the performance of AOMDV by including the concept of queue it improves the QoS. In this technique the packet loss has minimized. We noticed only 60 packets drop in network that is much better than previous because in previous about 220 packets were dropped in network. It means that there is a massive difference in packet loss between normal AOMDV and QoS base AOMDV technique. In AOMDV routing the performance of network degrades but proposed QoS AOMDV scheme gives better performance.

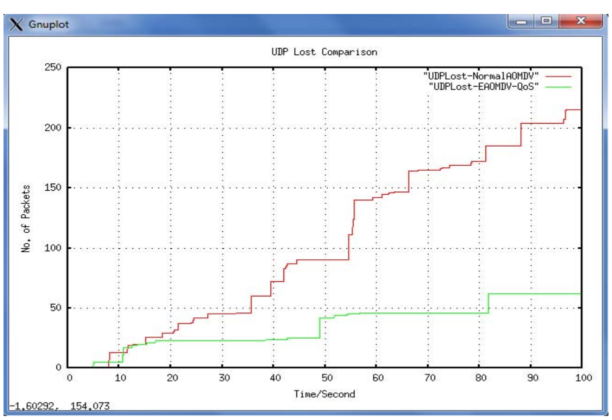

Fig. 1 UDP Packet Loss Analysis

B. UDP Receives Analysis Normal AOMDV and QoS with EAOMDV

This graph represents the packet received analysis in case of normal AOMDV and proposed QoS queue based AOMDV. Here we clearly visualized that in case of normal AOMDV about 280 packets are received at destination end but in case of proposed scheme about 430 packets are received at destination end. The result shows that our proposed QoS gives better result as compared to existing AOMDV routing protocol.

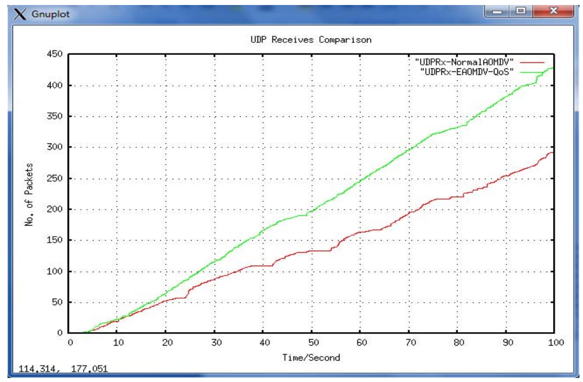

Fig. 2 UDP packet Received Analysis

C. PDR Analysis in Case of Normal AOMDV and proposed QoS with EAOMDV

Packet Delivery Ratio (PDR) is the ratio of number of packets received by number of packets send in network. This is the performance analysis depending on the ratio of packets in case of previous AOMDV and proposed AOMDV QoS queue based AOMDV scheme. Here the PDF performance of proposed scheme is about 98% but in case of previous normal AOMDV the PDF is about 94% that is lesser than previous. In case of normal AOMDV the queue concept are not added it means the nodes notify maximum packet drops and degrade the performance of the network. But in case of proposed scheme we apply queue approach in each node that handles incoming and outgoing data variation and if incoming rate is greater than the outgoing rate all the incoming packet insert into the queue and minimize the drop of data.

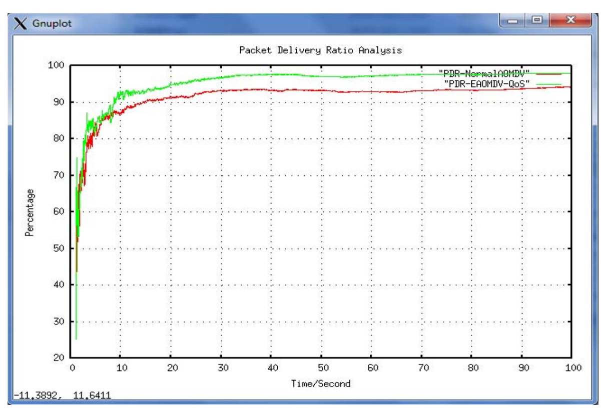

Fig.3 PDR Analysis

D. Hello Message Analysis in Case of Normal AOMDV and Proposed QoS based EAOMDV

The hello packet analysis is the connection control packet analysis or routing packet analysis in case of proposed and previous scheme. The routing packets in network are required to establish connection between sender and receiver and the less number of routing packets shows the better network performance. In this graph the performance of proposed AOMDV QoS Queue management based protocol is better as compared to previous normal AOMDV routing protocol. Here in case of proposed scheme about only 5250 routing packets are delivered in network but in case of previous normal routing about 5700 packets are delivered in network. It means about 450 packets are more delivered in network in case of normal AOMDV by that the data packets are affected in network and overhead increases, that means reduction in the performance

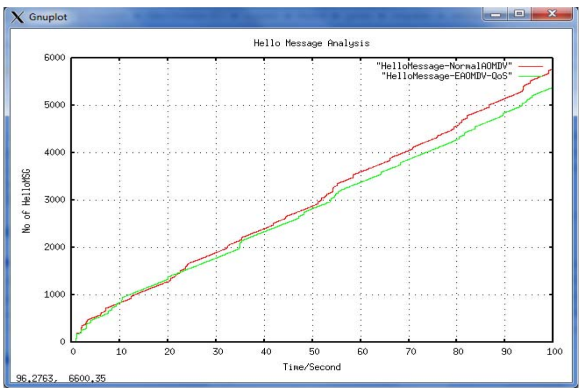

Fig.4 Hello Message analysis

VIII. Conclusion & Future Work

The multipath routing AOMDV has improved the routing capability and handled the load of network more efficiently to improve the QoS in MANET dynamic mobility environment. The proposed queue based approach has handled the data more efficiently and improved the routing performance. This paper presented the QoS provisioning being developed for MANETs. QoS provisioning in MANETs has improved on the basis of enhancement in the routing capability of AOMDV protocol. The proposed Enhanced (EAOMDV) multipath routing protocol has improved routing capability on the basis of queue length. However, the protocols for QoS provisioning that are being developed in routing approach does not provide a comprehensive solution. The result shows the improvement in case of proposed EAOMDV protocol.

One of the areas of future research would be to develop the synchronization and communication among the Adhoc network layers to attain QoS in MANETs. In future we also access the coordinate based method to improve the QoS parameter.

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