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Performance Evaluation of Aodv and Dsr Routing Protocols for VBR Traffic in Mobile Adhoc Networks

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Abstract

Mobile Ad hoc network (MANETs) is rapidly growing as an important area of wireless communication with the revolutionary inventions in the mobile devices. Efficient routing protocols make MANETs reliable. Despite the considerable simulation works, still more investigation is required in the performance evaluation of routing protocols for multimedia traffic especially Variable Bit Rate(VBR).In this paper, we will conduct a number of simulations for the performance evaluation of two popular routing protocols of MANET, namely AODV and DSR, for VBR multimedia traffic using Real Time Protocol(RTP).We will investigate the performance using four metrics-packet received, throughput, routing overhead and network load.

Keywords*:* MANETs; AODV; DSR; VBR; RTP.

I. INTRODUCTION

A Mobile Ad hoc network (MANET) [1] [2] is an autonomous collection of mobile routers or nodes communicating over radio links. MANET is a temporary network without infrastructure. The wireless routers or nodes moves randomly and organize themselves arbitrarily. The nodes directly communicate via wireless links within each other's radio range, while that are distant apart use other nodes as relay in a multihop routing function. As the nodes are mobile, the structure of the network changes dynamically and unpredictably over time.Adhoc networks are self-configuring and self-organizing, so to maintain communication between nodes in the network, each node behaves as a transmitter, a host and a router.

Due to growing usage of the portable devices and progress in the wireless communication, Mobile Ad hoc networks are gaining importance due to its wide range of applications [3].Mobile Ad hoc networks are used in military communication and operations, home appliances, emergency services, educational applications and entertainment.

MANET has few challenges and limitations that have to be addressed [4].Limited radio transmission range, routing overhead, battery constraints, security, etc. are some of inefficiencies in a MANET environment.

In [5], the performance of three popular routing protocols AODV, DSR and OLSR is evaluated for multimedia data in a multihop mobile network by taking different performance metrics. In this paper, we will evaluate the performance of two reactive protocols AODV and DSR by taking the VBR multimedia transmission in a multihop mobile network. The mobility scenario simulates the environment of a modern city, where mobile nodes are connected to each other and communicates.

This paper is organized as follows: The next section presents the main Ad hoc routing protocols AODV and DSR that are used in the performance evaluation process. Section III presents the simulation set up and the performance evaluation metrics. In section IV, we present the simulation results and performance comparison. And finally, we conclude the paper and present the plans for the future work in section V.

II. MOBILE ADHOC ROUTING PROTOCOLS

There are many different ways to classify the routing protocols of MANETs depending upon their network structure, communication model, routing strategy and state information [6]. Depending upon the routing strategy, there are two types of routing protocols: Table Driven and Source Initiated (On Demand).

The first type is a proactive approach i.e. table driven. Routing information in the network maintained up to date. Table driven protocols have lower latency but have high routing overhead. The routing overhead is high due to periodic updations of routing tables. Some of main proactive protocols of MANET are DSDV, FSR and OLSR.

The second type is source initiated. It is also known as On Demand or Reactive. Route id created only when demanded by the source node. When a node wants to communicate in the network, it initiates a route discovery process within the network. So, there is no need of periodic updates. Hence, the routing overhead is low but the latency is high. Some of main reactive protocols of MANET are AODV, DSR and TORA. The mobile Ad hoc routing protocols considered in this study are described below.

A. DYNAMIC SOURCE ROUTING (DSR)

DSR [7] [8] is an On Demand routing protocol. DSR is based on the theory of source

based routing and is a very simple and efficient routing protocol. DSR is designed for use in multihop wireless Ad hoc networks of mobile nodes. The DSR protocol works into two main mechanisms called Route Discovery and Route Maintenance. Route Discovery is the mechanism in which a source node tending to send a packet to a destination obtains a source route to destination. It is initiated only when a source node wants to send packet to a destination and doesn't already know the route to it. And, then it maintains that route in the cache of the nodes. Route Maintenance is the mechanism in which source node is able to detect the link failures to the destination. It then repairs the route or finds an alternate route. It is used only when source is sending packets to a destination.

B. ADHOC ON DEMAND DISTANT VECTOR PROTOCOL (AODV)

AODV [7] [9] is a reactive distant vector protocol. It mixes the property of DSR and DSDV. Routes discovered on demand are maintained as long as they are required. AODV routing table maintains routing information of any route that has been used recently within a time interval. The operation of AODV is loop free by use of sequence numbers which indicate the freshness of the route. When links break, AODV causes the affected set of nodes to be notified to invalidate the route. Route Request (RREQs), Route Replies (RREPs), and Route Errors (RRERs) are three message types defined by AODV for its working.

III. SIMULATION ENVIRONMENT

To evaluate and compare the performance of these routing protocols in Mobile Ad hoc network, we performed extensive simulations using NS-2 simulator [10]-[13]. Each simulator is carried out under the constant mobility.

TABLE 1
THE SIMULATION PARAMETERS

Experiment Parameter	Experiment Value	Description
Simulation Time	200 S	Simulation Duration
Terrain Dimension	1000*1000 m	X,Y Dimension of Motion
No. of Mobile Nodes	50	No. of nodes in a network
Node Placement	Random waypoint	Change Direction Randomly
Mobility Speed	0-50 mps	Mobility of Nodes
Mobility Model	Random	Mobility Direction
Routing Protocols	DSR, AODV	Path-finding
MAC protocol	802.11g	Wireless
Traffic	VBR	
Traffic rate	25 pkt/sec	
Packet Send rate	256kb	
Packet Size	1 kb	
Pause Time	100 sec	

Performance Metrics

Packet received [14]: It is the number of packets received by the application layer of destination nodes.

Throughput [14]: It is the average at which data packet is delivered successfully from one node to another over a communication network. It is usually measured in bits per second.

Throughput = (no of delivered packets * packet size) / total duration of simulation

Routing Overhead [14]: This is the total number of routing control packets generated by all nodes to the total data packets during the simulation time.

Network Load *[15]:* It is the total traffic received by the network layer from the higher MAC that is accepted and queued for transmission. It is measured as bits per second.

IV. SIMULATION RESULTS AND PERFORMANCE COMPARISON

Performance of AODV and DSR routing protocols is evaluated under Variable Bit Rate multimedia traffic.

1) Packet Received

In the reactive protocols, AODV and DSR, AODV outperforms the DSR in terms of number of packets received by all destination nodes.

DSR	AODV
5373	20415

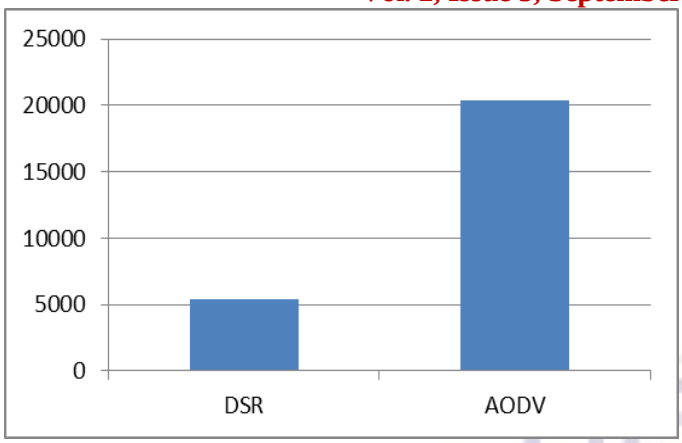

Figure 1: Number of Packet Received of AODV and DSR for 50 nodes

From the above figure, we have seen that the number of packets received in AODV protocol is very high than the number of packets received in DSR protocol for 50 nodes.

2) Throughput

Throughput is better for AODV protocol than DSR protocol.

DSR	AODV
98.67	265.44

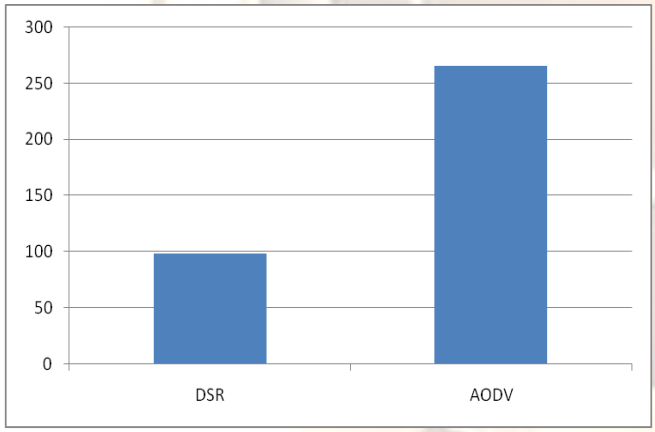

Figure 2: Throughput of AODV and DSR for 50 nodes

From above figure, it is observed that the AODV protocol outperforms the DSR protocol in terms of throughput when the number of nodes is 50.

3) Routing Overhead

Routing Overhead is higher in case of DSR than AODV.

DSR	AODV
43903	20438

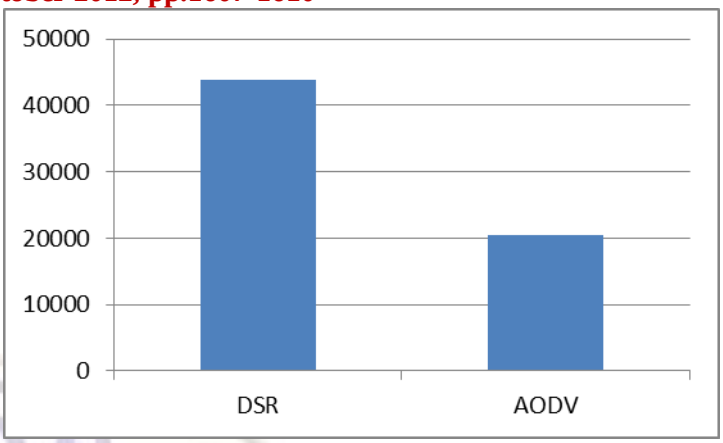

Figure 3: Routing Overhead for AODV and DSR for 50 nodes

It is observed from the figure above, in which DSR present the worse behavior in terms of routing overhead measurements. Although both AODV and DSR are reactive protocols but in terms of Routing Overhead for VBR traffic both present a very different behavior.

4) Network Load

Network Load is very high for DSR protocol than AODV protocol.

DSR	AODV
8.17	1.003

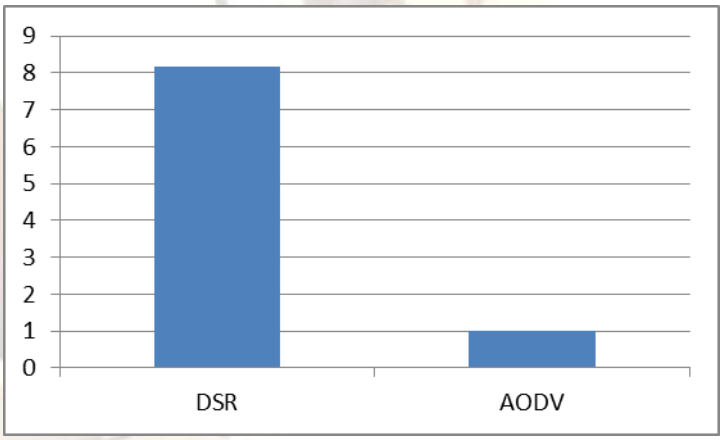

Figure 4: Network Load for AODV and DSR for 50 nodes

As shown in the above figure that DSR has higher Network Load than AODV. It increases as the number of hops increases.

V. CONCLUSION AND FUTURE WORK

This evaluation work is carried out using network simulator NS-2 to compare the performance of AODV and DSR protocols under VBR traffic. The performance is compared in terms of number of packet received, throughput, routing

overhead and network overload when number of nodes is constant. Simulation results show that in case of number of packets received AODV is ahead of DSR. And for throughput, AODV outperforms DSR. This means that AODV has high reliability. And high routing overhead and network load of DSR worsen the performance of DSR as compared to AODV. This is due to source routing for route discovery and hop by hop packet forwarding in DSR. So, AODV is best suited for delay sensitive RTP applications which do not allow latency in the network. Thus from above investigations we conclude that AODV is a better option for VBR multimedia traffic.

In our future work, we will intend to do more simulations to evaluate more multimedia centric metrics for multimedia data transmission. In addition to it, we plans to investigate the performance of these protocols for congestion control mechanism by varying the number of nodes for VBR traffic.

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