A Execution & Analysis of AODV, AOMDV, DSR and DSDV Routing Protocols in MANET

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Abstract— **Wireless networks emerged in the 1970's, since then they have become increasingly popular. The reason of their popularity is that they provide access to information regardless of the geographical location of the user.**

A Mobile Ad-hoc network is a collection of wireless mobile nodes that dynamically establishes the networks in the absence of fixed infrastructure. One of the distinctive features of MANET is, each node must be able to act as a route to find out the optimal path to forward a packet. As nodes may be mobile, entering the network, the topology of the network will change continuously.

The objective of the paper is to evaluate and analyze different routing protocols namely Ad-hoc On-demand Distance Vector (AODV), Ad-hoc On-demand Multicast Distance Vector (AOMDV), Dynamic Source Routing (DSR) and Destination Sequence Distance Vector (DSDV) Protocols for MANET based on their Performance. This evaluation is to be carried out through exhaustive simulation using NS-2 Simulato

Index Terms— **MANET, AODV, AOMDV, DSDV, DSR**

I. Introduction

The Internet Engineering Task Force (IETF) is a large open international community of network designers, operators, vendors and researchers concerned with the smooth operation of the Internet [RFC 2501]. The IETF has a working group named MANET that is working in the field of Ad-hoc networks. This working group suggests two different types of metrics for evaluating the performance of routing protocols would be evaluated in terms of both qualitative metrics and quantitative metrics. The Qualitative Metrics contains Loop Freedom, On-demand Routing Behavior, Proactive Behavior, Security, Unidirectional Link Support, Sleep mode etc. by adding multicasting routing as an important attribute of a routing protocol, because multicasting, especially in tactical communication, will be broadly used. The Quantitative Metrics contains End-to-end Data Throughput, Delay, Route Acquisition Time, Out-of-order Delivery, Efficiency etc, should be based on the same network attributes, such as mobility, network density, bandwidth, energy resource, transmission and receiving power, antenna type and any other component that a simulation tool could provide. Our performance evaluation of routing protocols will be based on the quantitative metrics.

A. Ad-hoc On-demand Distance Vector (AODV)

AODV, as a reactive routing protocol, does not explicitly maintain a route for any possible destination in the network. However, its routing table maintains routing information for any route that has been recently used within a time interval; so a node is able to send data packets to any destination that exists in its routing table without flooding the network with new Route Request messages. In this way, the designers of AODV tried to minimize the routing overhead in the network caused by the frequent generation of routing control messages.

B. Ad-hoc On-demand Multicast Distance Vector (AOMDV)

AOMDV routing protocol shares many characteristics of AODV. The main difference is the number of route found in each discovery. In AOMDV, a node has multiple paths for forwarding data packets until there is no failure. Here the use of a simple approach when a link failure occurs. In that case, it simply choose route in order of their creation. It is based on distance vector and hop-by-hop routing approach.

C. Dynamic Source Routing Protocol (DSR)

The main concept of the protocol is "Source Routing". Each node caches the routes to any destination it has recently used, or discovered by overhearing its neighbors transmission. When there is not such route, a route discovery process is initiated. The protocol is designed for a MANET of up to 200s nodes with high mobility rates and is loop-free. Other important attributes are its support for unidirectional links and multicasting. DSR can provide interconnection of wireless devices with multiple network interfaces. This is an important attribute for tactical communications, as nodes in the military need to have different signal ranges and thus different network devices.

D. Destination Seduence Distance Vector (DSDV)

Bellman-Ford Algorithm based a loop free routing protocol in which the shortest-path calculated, is called a DSDV Protocol [Perkins 1994]. Between the nodes the Data packets are transmitted using routing table stored at each node. All the possible destinations are contains by each routing table from a node to any other node in the network and also the number of hope to each destination.

II. Quantitative Performance Metrics

The Performance metrics helps to characterize the network that is substantially affected by the routing algorithm to achieve the required Quality of Service. There are number of quantitative metrics that can be evaluating the performance of a routing protocol for MANET. In this paper, the following 4 quantitative metrics are considered.

A. Average Throughput

The Throughput is measure of how fast a node can actually sent the data through a network. It is the main parameter to show the speed of transfer of data. It is the rate of successfully transmitted data packets in a unit time in the network during

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the simulation. So it is the average rate of successful delivery over a communication channel.

B. Packet Delivery Ratio (PDR)

The PDR is ratio of the total data bits received to total data bits sent form source to destination. It is the ratio of number of packets successfully delivered to the destination (received packets) to the total packet generated by source (sent packets). As follows:

PDR = received packet / sent packets * 100

C. Average End-to-end Delay (EED)

The End-to-end delay is the time taken by a packet to travel from source to destination in MANET. It is combination of delays in the whole process of transfer from source to destination. Evaluation of End-to-end delay mostly depends on the following components i.e. Propagation Time (PT), Transmission Time (TT), Queuing Time (QT) and Processing Delay (PD).

EED = PT + TT + QT + PD

D. Packet Dropped Ratio

The Packet Dropped Ratio is the number of packets dropped during the transmission. The packet Loss is the difference between the total numbers of packets send by source and received by sink. A packet is dropped in two cases: the buffer is full when packet needs to be buffered and the time that the packet has been buffered exceeds the limit. For packet dropped ratio, first calculate the packet loss and then find the ratio.

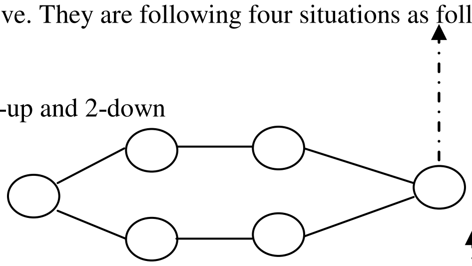
Packet Loss = Sent Packets – Received Packets

Packet Dropped Ratio = Packet Loss / Sent Packets * 100

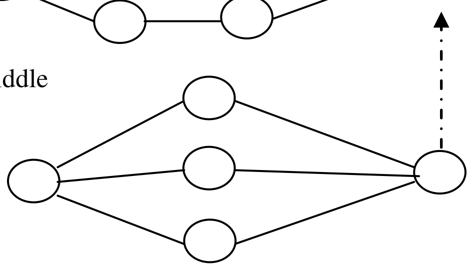
III. Diagrametial Representation

There are mainly two conditions which are Without Move and With Move. They are following four situations as follows:

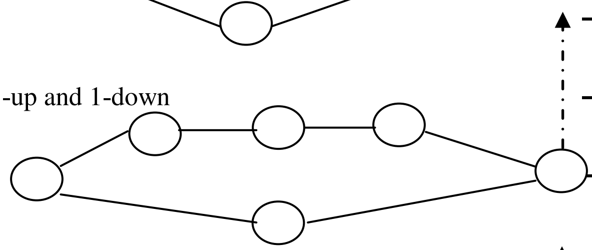
1. 2-up and 2-down



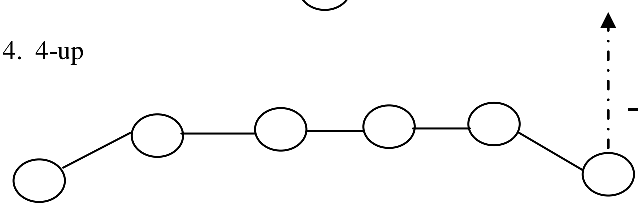
2. 3-middle



3. 3-up and 1-down



4. 4-up



In Without Move Situation, all the nodes are in static mode. But in With Move Situation, the Destination node is moving in upward direction as shown in dotted lines in all the diagrams.

IV. Tabulational Representation

The Tables of Performance Analysis of all the Protocols with respect to all the metrics: The Performance is analyzing in NS-2 Simulator. There are some more results are also generated like Start Time, Stop Time, Process Time, Generated Packets and Received Packets.

A. 2-up and 2-down situation's table:

Without Move	**2-up and 2-down Table**			
With Move	AODV	AOMDV	DSDV	DSR
Average Throughput (Kbps)	227.56 224.63	220.31 219.48	221.74 220.75	221.42 221.25
Packet Delivery Ratio(PDR)	99.2828 98.1095	99.2593 98.4678	96.9301 92.0306	99.1160 98.5009
Total Dropped Packets	19 66	20 90	20 95	19 0
Avg. End-to-end Delay (ms)	334.489 348.583	347.714 296.538	262.863 234.58	373.864 367.504

B. 3-middle situation's table:

Without Move	**3-middle Table**			
With Move	AODV	AOMDV	DSDV	DSR
Average Throughput (Kbps)	340.57 338.33	329.99 288.30	331.37 290.10	331.65 331.68
Packet Delivery Ratio(PDR)	99.7597 98.8688	99.7521 99.1817	98.7651 96.3149	99.6791 99.4694
Total Dropped Packets	7 57	11 60	13 13	8 0
Avg. End-to-end Delay (ms)	123.663 125.036	127.745 130.721	96.6437 102.739	127.962 119.902

C. 3-up and 1-down situatio's table:

Without Move	**3-up and 1-down Table**			
With Move	AODV	AOMDV	DSDV	DSR
Average Throughput (Kbps)	340.55 322.62	329.36 286.51	326.61 327.80	331.68 330.86
Packet Delivery Ratio(PDR)	99.7597 99.0967	99.7516 99.0244	98.4068 96.4729	99.6917 99.3915
Total Dropped Packets	9 66	13 82	30 52	11 0
Avg. End-to-end Delay (ms)	122.784 124.158	118.423 127.359	94.4698 105.793	127.795 75.417

D. 4-up situation's table:

Without Move	**4-up Table**

With Move	AODV	AOMDV	DSDV	DSR
Average Throughput (Kbps)	227.70	329.58	317.04	331.44
	321.55	292.83	317.93	331.15
Packet Delivery Ratio(PDR)	99.6407	99.7517	98.1041	99.6668
	99.2139	99.1379	96.5391	99.4618
Total Dropped Packets	8	8	12	11
	50	77	50	0
Avg. End-to-end Delay (ms)	184.982	128.105	118.192	126.008
	128.287	127.431	104.740	127.390

These all are some Tabular Results which are generated by the NS-2 Simulator. All the results are compared to each other and generated the proper response of all the results. The Average Throughput is measured in Kbps and Average End-to-end Delay is in ms. PDR is a Ratio of Received Packets to Sending Packets. The Total Dropped Packets are just counted.

V. Matrics Overall Result

A. Average Throughput

In all the situations, in without move condition, AODV Protocol is better and in with move condition AODV and DSR Protocols are better, but AOMDV Protocol is worst with respect to Average Throughput metrics.

B. Packet Delivery Ratio (PDR)

In all the situations, in without move condition, AODV Protocol is better but DSDV Protocol is worst with respect to Packet Delivery Ratio. In with move condition, DSR Protocol is better but DSDV Protocol is worst with respect to Packet Delivery Ratio.

C. Total Dropped Packets

In all the situations, in without move condition, AODV Protocol is better but DSDV Protocol is worst with respect to total dropped packets. In with move condition, AODV and DSDV Protocols are better but AOMDV Protocol is worst with respect to total dropped packets.

D. Average End-to-end Delay(ms)

In all the situations, in without move condition, DSDV Protocol is better because its delay in minimum but DSR Protocol is worst because its delay in maximum. In with move condition, DSDV Protocol is better but AOMDV Protocol is worst with respect to avg. end-to-end delay.

Summery of Work

With the comparisons of all the situations, the MANET's Performance is compared in AODV, AOMDV, DSR and DSDV Protocols. There are four metrics which are Average Throughput (Kbps), Packet Delivery Ratio (PDR), Total Dropped Packets and Average End-to-end Delay (ms).

In first situation which is, Without Move situation, the AODV Protocol is perfectly works but the AOMDV and DSDV Protocols are worst.

In second situation which is, With Move situation, the AODV and DSR Protocols is perfectly works but the AOMDV Protocol is worst.

Conclusion

This paper reveals the performance analysis of reactive routing protocols AODV, AOMDV and DSR in comparison with proactive routing protocol DSDV. Reactive routing protocols represent some similarities in terms of PDR, packet loss and number of dropped packets. However disparities among reactive routing protocols themselves are undeniable due to the different approach of routing storage and maintenance. Significant disparities between DSDV routing protocol and other reactive routing protocol makes this traditional routing protocol highlighted. Large amount of packet loss as well as a large number of dropped packets compels network administrations to revise on applying DSDV routing protocol on delay sensitive networks. Simulation of fundamental yet major parameters such as PDR, Average End-to-End delay, NRL, Packet loss amount and number of dropped packets based on variety of velocity and density for some reactive and proactive routing protocols in VANET results in some useful information. The simulation results reveal the fact that although MANET routing protocols could be applied on VANET but when the velocity and density of vehicles increase, in most of the time, the performance of both reactive and proactive routing protocols will decrease and this makes utilizing MANET routing protocols in vehicular ad hoc networks a major issue which requires tangible improvements.

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