Performance Comparison of Routing Protocol (Proactive & Reactive) of MANET

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Abstract - In Mobile Ad hoc network (MANETS), no fixed infrastructure is available. Mobile Ad-hoc Networks (MANETs) are future wireless networks consisting entirely of mobile nodes that communicate on-the-move without base stations. Nodes in these networks will both generate user and application traffic and carry out network control and routing protocols. Rapidly changing connectivity, network partitions, higher error rates, collision interference, and bandwidth and power constraints together pose new problems in network control—particularly in the design of higher level protocols such as routing and in implementing applications with Quality of Service requirements. The MANET routing protocols have mainly two classes: Proactive routing (or table-driven routing) protocols and Reactive routing (or on-demand routing) protocols. In this paper, we have analyzed Random based mobility models: Random Waypoint model using AODV and DSDV protocols in Network Simulator (NS 2.35). The performance comparison of MANET mobility models have been analyzed by varying number of nodes type of traffic (TCP) and maximum speed of nodes. The comparative conclusions are drawn on the basis of various performance metrics such as: Routing Overhead (packets), Packet Delivery Fraction (%), Normalized Routing Load, Average End-to-End Delay (milliseconds) and Packet Loss (%).

Keywords - Mobile Ad hoc, AODV, DSDV, TCP, CBR, routing overhead, packet delivery fraction, End-to-End delay, normalized routing load.

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a self-configuring infrastructureless network of mobile devices connected by wireless. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. Today we see two kinds of wireless networks. The first one which is a wireless network built on-top of a wired network and thus creates a reliable infrastructure wireless network. The wireless nodes also connected to the wired network and these nodes are connected to base stations. An example of this is the cellular phone networks where a phone connects to the base-station with the best signal quality.

The second type of wireless technology is where no infrastructure exists at all except the participating mobile nodes. This is called an infrastructure less wireless network or an Ad hoc network. The word Ad hoc means something which is not fixed or not organized i.e. dynamic. Recent advancements such as Bluetooth introduced a fresh type of wireless systems which is frequently known as mobile Ad-hoc networks.

A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time because the nodes are mobile. The network is decentralized where all network activity, including discovering the topology and delivering messages must be executed by the nodes themselves. Hence routing functionality will have to be incorporated into the mobile nodes. Mobile ad hoc network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes can directly communicate to those nodes that are in radio range of each other, whereas others nodes need the help of intermediate nodes to route their packets. These networks are fully distributed, and can work at any place without the aid of any infrastructure. This property makes these networks highly robust.

In late 1980, within the Internet [1] Engineering Task Force (IETF) a Mobile Ad hoc Networking (MANET) Working Group was formed to standardize the protocols, functional specification, and to develop a routing framework for IP-based protocols in ad hoc networks. There are a number of protocols that have been developed since then, basically classified as Proactive/Table Driven and Reactive/On-demand Driven routing protocols, with

their respective advantages and disadvantages, but currently there does not exist any standard for ad hoc network routing protocol and the work is still in progress. Therefore, routing is one of the most important issues for an ad hoc network to make their existence in the present world and prove to be divine for generations to come. The area of ad hoc networking has been receiving increasing attention among researchers in recent years. The work presented in this thesis is expected to provide useful input to the routing mechanism in ad hoc Networks.

II. PROTOCOL DESCRIPTIONS

2.1 Ad hoc On Demand Distance Vector (AODV)

AODV routing algorithm is a source initiated, on demand driven, routing protocol. Since the routing is "on demand", a route is only traced when a source node wants to establish communication with a specific destination. The route remains established as long as it is needed for further communication. Furthermore, another feature of AODV is its use of a "destination sequence number" for every route entry. This number is included in the RREQ (Route Request) of any node that desires to send data. These numbers are used to ensure the "freshness" of routing information. For instance, a requesting node always chooses the route with the greatest sequence number to communicate with its destination node. Once a fresh path is found, a RREP (Route Reply) is sent back to the requesting node. AODV also has the necessary mechanism to inform network nodes of any possible link break that might have occurred in the network.

2.2 Destination Sequenced Distance Vector (DSDV)

The Destination Sequenced distance vector routing protocol is a proactive routing protocol which is a medications of conventional Bellman-Ford routing algorithm. This protocol adds a new attribute, sequence number, to each route table entry at each node. Routing table is maintained at each node and with this table; node transmits the packets to other nodes in the network. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station.

III. SIMULATIONS

Both routing techniques were simulated in the same environment using Network Simulator (ns-2). Both AODV and DSDV were tested by the traffic i.e. TCP. The algorithms were tested using 50 nodes. The simulation area is 1000m by 1000m where the nodes location changes randomly. The connection used at a time is 30. Speed of nodes varies from 1m/s to 50m/s. by using CBR traffic we calculate performance of these two protocols.

IV. SIMULATION RESULT

The results of our simulation will be presented in this section. First we will discuss the results of both AODV & DSDV protocol for different matrices and after that we make the comparison between the two protocols.

4.1 AODV & DSDV Performance Result

4.1.1 Throughput (KB/S)

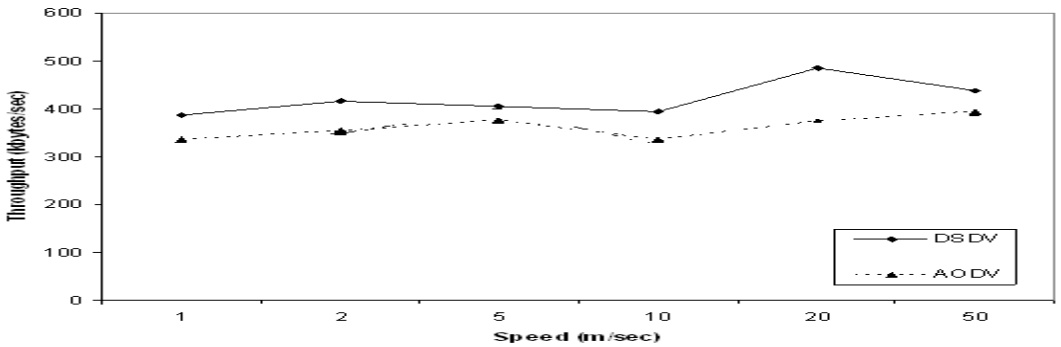

Fig 1 Throughput as function of maximum speed

DSDV performs better than all the remaining protocols. Figure 1 shows that the throughput of DSDV near about 400 Kbytes/second, which is better than the other source routing protocols AODV which shows throughput between 300 Kbytes/second to 393 Kbytes/second.

4.1.2 Packet Delivery Fraction (%)

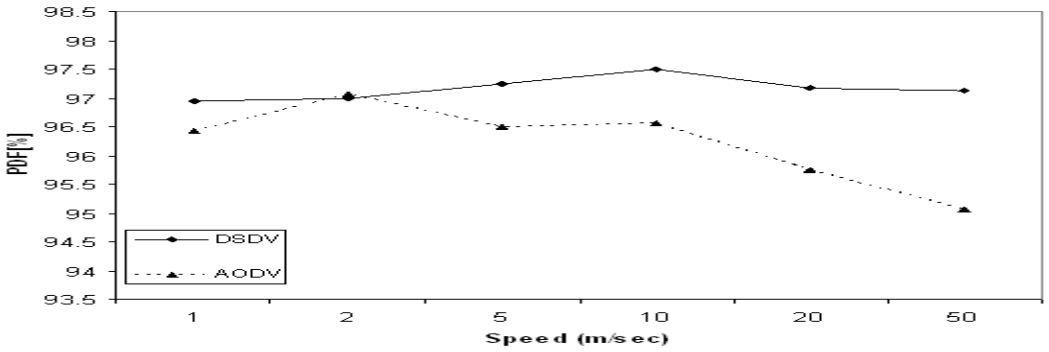

Fig 2 Packet Delivery Fraction as a function of maximum speed

It is observed that DSDV perform particularly well delivering 97% of the packets irrespective of their node speeds (Figure 2). AODV delivers 96% of the packets at low speed but indicates drop in packet delivery ratio upto 95% at higher speeds.

4.1.3 Average End to End Delay

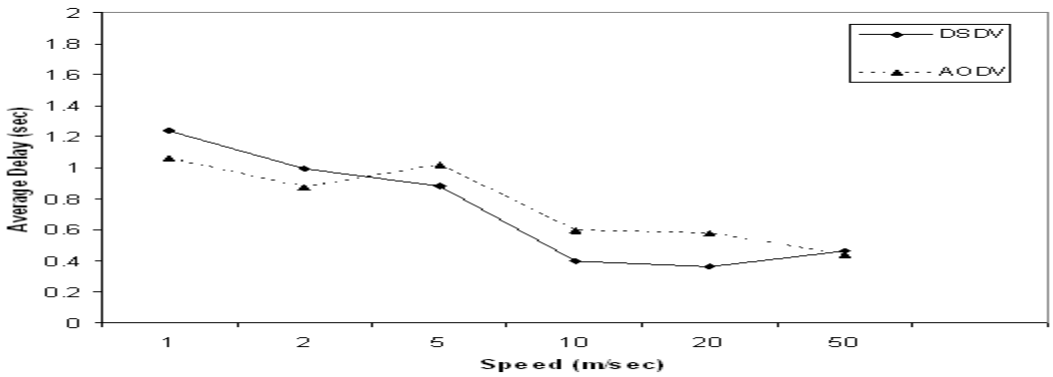

Fig 3 Average end-to-end delay as a function of maximum speed

AODV's performance is relatively poor delivering 95-96% packets and packet delivery ratio decreases with the increase in speed. Since DSDV is a proactive routing protocol, it uses already established route and thus resulting in low average delay of 0.3 seconds at speed of 20 meters/second, as shown in Figure 3

4.1.4 Routing Overheads (Packets)

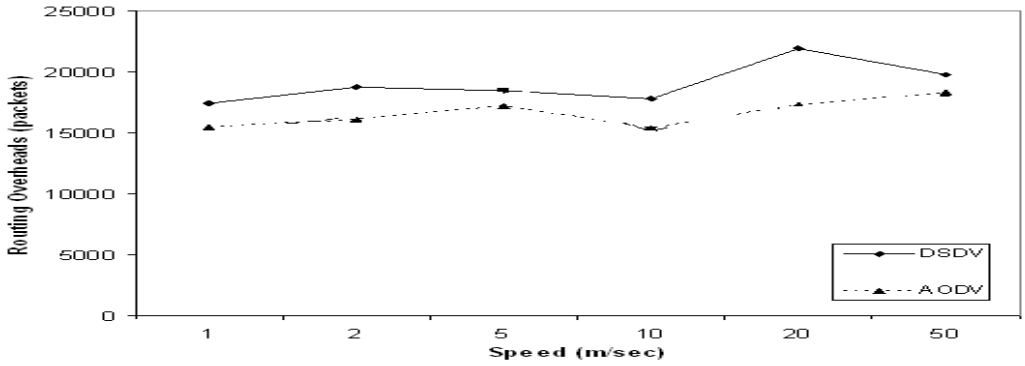

Fig 4 Routing overhead as a function of maximum speed

Routing overhead of DSDV is significantly greater than AODV, transmitting more than 17432 packets whereas AODV is able to transmit between 15035-14847 packets, as indicated in the Figure 4.

4.1.5 Packet Loss (%).

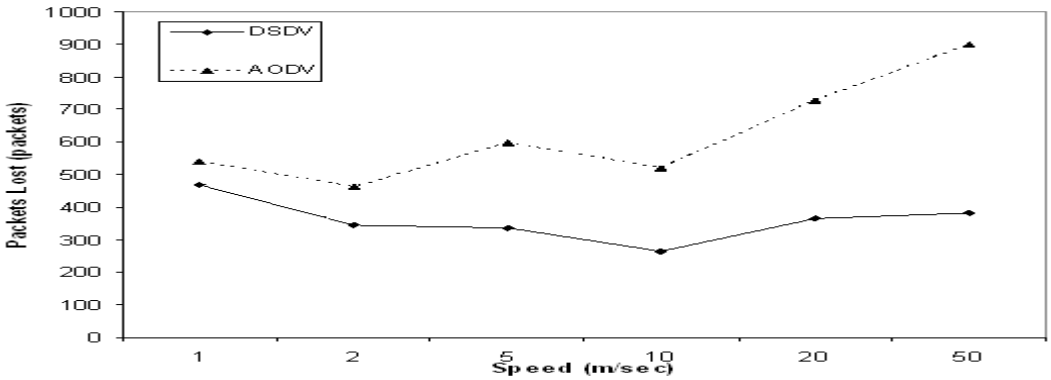

Fig 5 Packets Lost as a function of maximum speed

DSDV shows the best performance as it shows the drop of 264 packets in comparison to AODV which shows drop of 521 packets, as indicated in Figure 5. Overall performance of DSDV is better than the other source routing protocol AODV.

V. COMPARISON & CONCLUSION:

This paper presents the effect of TCP on the performance ad hoc network routing protocols. It is observed that TCP transport protocol should not be used in MANET because TCP offers a conforming load to the network, meaning that it changes the times at which it sends packets based on its perception of the network's ability to carry packets. As a result, both the time at which each data packet is originated by its sender and the position of the node when sending the packet would differ between the protocols, preventing a direct comparison between them. Results indicate proactive routing protocol DSDV performance is best considering its ability to maintain connection by periodic exchange of information, which is required for TCP, based traffic. It is observed that TCP is not appropriate transport protocol for highly mobile multihop wireless networks and thus UDP may be preferred in MANETs. For UDP traffic, performance of reactive routing protocols is better than proactive routing protocols.

VI. FUTURE WORKS:

In this paper we have focused on the two routing protocols but there are still many topics and issues that can be taken into consideration for further research which are as follows:

1. Investigation of other MANET mobility models using different protocols under different types of traffic.
2. Different number of nodes and different node speeds.
3. Security aspects of MANETs.

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