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Performance Evaluation of Mobile Ad- hoc Networks Routing Protocol AODV, DSR & DSDV in Different Mobility Models with Varying Speed of Nodes

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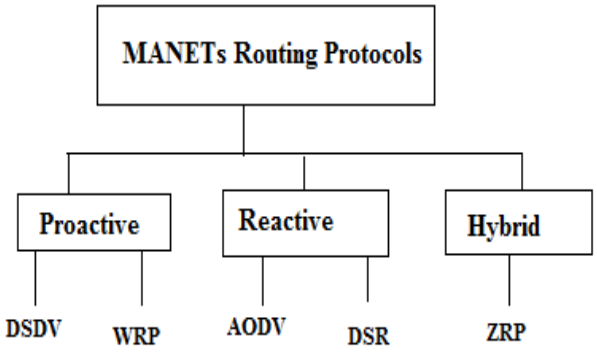
***Abstract*— Mobile Ad-Hoc Network is a collection of wireless mobiles nodes. Where mobile nodes are connected without any infrastructure or any centralized control. The mobile nodes can receive and forward packet as a router. Due to high mobility of mobile nodes routing is critical issue in mobile ad-hoc networks. In this paper we are doing performance evaluation of AODV, DSR (Reactive) and DSDV (Proactive) routing protocols based on Packet delivery ratio and Average end to end delay, under the different mobility model with varying the speed of mobile nodes. Simulation is done using Network Simulator-2 (ns-2.34).**

***Keyword*—AODV, DSR, DSDV, MANET, RWP**

I. INTRODUCTION

Mobile Ad-Hoc Network is a self configuring infrastructure less network consist of mobile nodes (Laptops, wireless phones, PDAs etc.) with routing capability [3, 4]. In MANET each node operate both as host as well as router to forward packet to each other, with the characteristics of self configuring and self organization which enable it to form a new network quickly. Quick and easy establishment of such networks make them feasible to use in military, disaster area recovery and in other environment where no infrastructure exists.

In the simplest scenarios, nodes may be able to communicate directly with each other, for example when they are within wireless transmission range of each other. However, ad hoc networks must also support communication between nodes that are only indirectly connected by a series of wireless hops through other nodes. Routing is well studied feature of such networks because mobile nodes may move in various directions, which can cause existing link to break and the establishment of new routes. Due to high mobility of nodes they form random topologies depending on their connectivity with each other in the network. The dynamic topology makes the routing protocol design complex. Efficient routing in an ad hoc network requires that the routing protocol operate in an on-demand fashion, and requires that the routing protocol limit the number of nodes that must be informed of topology changes. A good routing protocol should minimize the computing load on the host as well as the traffic overhead on the network [2]. There are three types of routing protocol in Mobile Ad-Hoc Networks Proactive (Table Driven) routing protocol, Reactive (Demand Driven) routing protocol and Hybrid Routing Protocol. Routing protocol is use to find the route between communication nodes. Proactive routing protocol provide a fast response to topology change continuously monitoring topology change and disseminating the related information as needed over the network. However rapid response to topology changes is the increase in routing overhead, and this can lead to smaller packet delivery ratio and longer delay when topology changes increase. Reactive routing protocols form a route if needed and reduce the routing overhead. However the long setup time in route discovery and slow response to route changes can offset the benefit derived from on-demand and lead inferior performance.



A. Proactive (Table Driven) Routing Protocol

Table driven routing protocols attempt to maintain consistent, up-to date routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store routing information. The routing table information up-date either periodically or in response to change in the network topology. The advantage of these protocols is that a source node does not need route discovery procedures to find a route to a destination node. On the other hand drawback of these protocols is that increasing the messaging overhead on the network. There are various types of routing protocol DSDV (Destination Sequence Distance Vector), WRP (Wireless Routing Protocol), CSGR (Cluster Switch Gateway Routing).

B. Reactive (On Demand) Routing Protocol

These types of routing protocols create routes only when desired by the source node. When a source node requires route it initiates a route discovery process to find the route to the destination. This type of protocols find route by flooding the network with route request packet. This process is completed once a route is found or all possible route permutations have been examined. Once a route has been established, it is maintain by a route maintain procedure. Then this route is used for further communication [5, 6]. There are some reactive routing protocol AODV (Ad-Hoc On-Demand Distance Vector Routing), DSR (Dynamic Source Routing), AOMDV (Ad-hoc On Demand Multipath Distance Vector Routing), etc.

C. Hybrid Routing Protocol

Hybrid routing protocol has advantage both proactive and reactive routing protocols. Firstly it behave like proactive routing protocol, because in starting nodes have tables. Then whenever nodes find that they does not have routes to destination, they start route discovery and behave like reactive routing protocols. Hybrid protocol is ZRP [5].

II. OVERVIEW OF SELECTED ROUTING PROTOCOLS

A. AODV

AODV (Ad-Hoc On Demand Distance Vector Routing) does not attempt to maintain routes from every node to every other node in the network. It only require route when necessary and do not need maintain route that are not use currently [1]. When a source node need route to certain destination, It broadcast a route request (RREQ) packet to all other neighbours. This packet contain a IP address and sequence number as well as the destination IP address and last known sequence number. The RREQ also contain the broadcast ID. When a node receives a RREQ it first checks IP address and broadcast ID. If it has already seen a RREQ with same IP address and broadcast ID then discard the packet otherwise rebroadcast the packet. Once the RREQ reaches the destination node respond by unicast a route reply (RREP) to the source. This route is use for communication between sources to destination [7].

B. DSR

The DSR (Dynamic Source Routing) is a on-demand routing protocol. The DSR routing protocol consist of two major phases route discovery and route maintenance [8]. When a source nose S want to sand a packet to destination D. It establish a route from S to D this phase is called route discovery. Route discovery use only when no route between source to destination. Second phase route maintenance phase requires in case of route failure, it involve another route to destination. Then the source S can be use an alternate route to destination D, if it known one, or invoke route discovery.

C. DSDV

DSDV (Destination Sequenced Distance Vector) is a proactive routing protocol. DSDV is based on distance vector algorithm. In DSDV routing each node in the network maintain a routing table to store the routing information. The routing information is periodically updated in the routing tables [9]. The routing information is updated as each node by finding the change in routing information about all the destinations with the number of node to that particular destination. DSDV routing is use sequence number for loop freedom routing. When a node receives routing information then it checks in it's routing table, if such entry already in routing table then discard otherwise update the routing table by this information [8].

III. OVERVIEW OF MOBILITY MODELS

A mobility model is representing the movement behaviour of mobile node. It describes how speed, acceleration and direction of the node change over time [11]. In this paper we use the three mobility models Random Waypoint, Random Walk and Random Direction Mobility Model.

A. Random Waypoint Mobility Model

The Random Waypoint Mobility Model is the most common mobility model used in MANET researches. The RWP model is random model for movement of mobile use, how their location, velocity and acceleration change over time. A mobile node begins the simulation by waiting a specified pause time. After this pause time it selects a random direction and random speed between 0 m/sec to Vmax m/sec in the network area. After reaching this destination node wait again pause time and then select a new direction and speed for movement [10]. The node keeps moving until reaches its direction at that speed. If a node selects a far destination and low speed travels for a long time.

B. Random Direction Mobility Model

In Random Direction the mobile node select a direction travel to the border of the network area. On reaching the boundary it wait for a specific pause time and then choose the new direction to follow [10]. This model does not suffer from the density waves in the centre of the simulation space that Random Waypoint Model does. Density wave are the clustering of nodes in one part of simulation area. For the Random Waypoint Mobility Model the probability of choosing a location near center is very high.

C. Random Walk Mobility Model

It is a simple mobility model based on random direction and speed. In this mobility model mobile node choose a random direction and speed for movement. The new direction and speed choose from predefined ranges. On reaching the boundary of simulation area the node reflect back with an angle determined by incoming direction.

IV. SIMULATION SETUP

Simulation has been carried out with the Network Simulator 2 (Ns-2.34) under LINUX platform. Constant bit rate (CBR) traffic is used in simulation. In the simulation we have used network load at the rate of 1 packet per second. The aim of the simulation is to evaluate the performance of AODV, DSR and DSDV routing protocol In MANET. The following table gives the simulation parameters used during simulation.

TABLE I
SIMULATION PARAMETER

Parameter	Value
Simulation Area	1000*1000m
No of Nodes	50
Pause Time	10sec
Simulation Time	300sec
Node Speed	10, 20, 30 40m/sec
Packet Size	512
Traffic Type	CBR
Routing Protocols	AODV, DSR, DSDV
Mobility Models	RWP, RW, RD
No of Connections	40

V. RESULTS

In this paper we evaluate the performance of AODV, DSR and DSDV routing protocol based on the two performance metrics Packet Delivery Ratio (PDR), Average and End to End Delay by varying the speed of mobile nodes.

A. Packet Delivery Ratio

Packet Delivery Ratio (PDR) is the ratio of total number of packet successfully received by the destination node to the number of packet generated by the source node. A high value of PDR indicates that most of the packets are being delivered and is a good indicator of the protocol performance.

PDR = (Packet Receives / Packet Sent)

First we analyse the Packet Delivery Ratio of AODV DSR and DSDV in different mobility models with varying the speed of nodes.

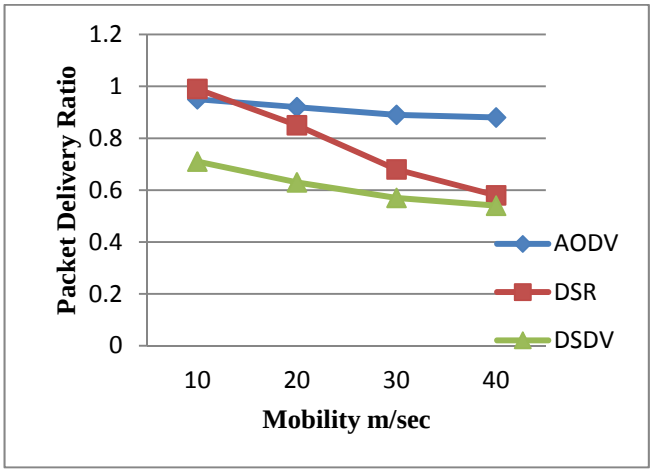


Figure 1: Packet delivery ratio for Random Waypoint

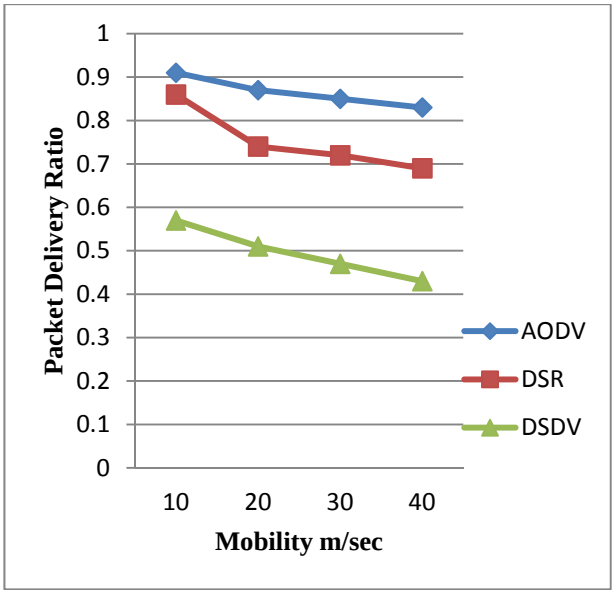


Figure 2: Packet Delivery Ratio for Random Walk

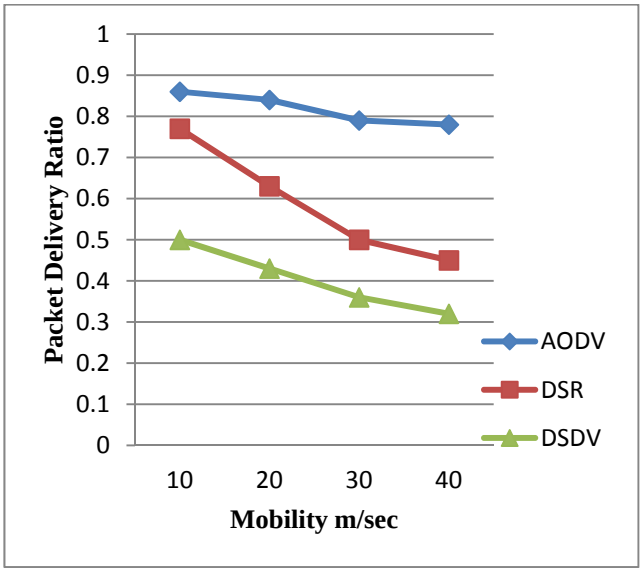


Figure 3: Packet Delivery Ratio for Random Direction

From the simulation result it observes that packet delivery ratio is decreases linearly with increasing the speed of nodes. When the speed of node is increased, the link failure also increases so the PRD decrease. Figures 1, 2, 3 shows that the packet delivery ratio for reactive routing protocols AODV and DSR were better than the proactive DSDV. If we compare the performance of two reactive routing protocols the PDR for AODV is slightly more than DSR protocol.

B. Average End to End Delay

Average end to end delay includes delay caused by latency, buffering, queuing, transmission and route discovery. The delay is measured in milliseconds. The end to end delay of a path is the sum of the node delay at each node plus the link delay at each link on the path.

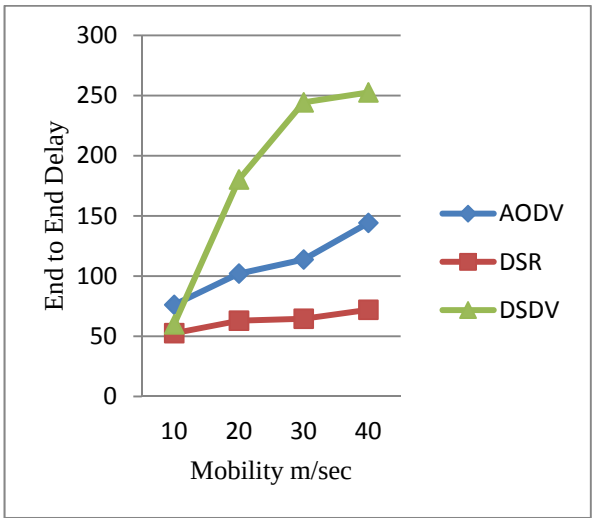


Figure 4: End to End Delay for Random Waypoint

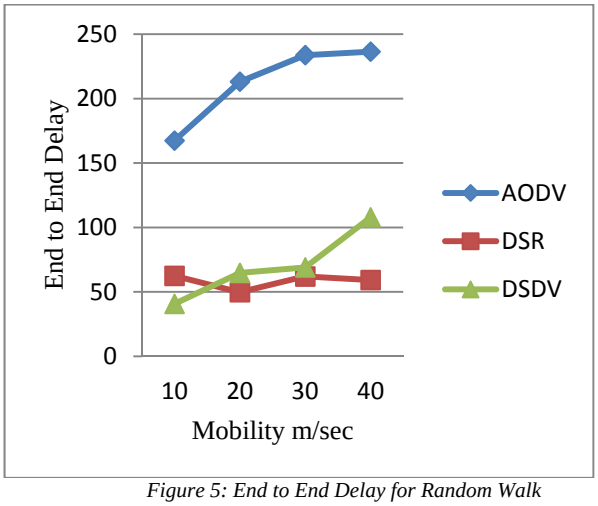


Figure 5: End to End Delay for Random Walk

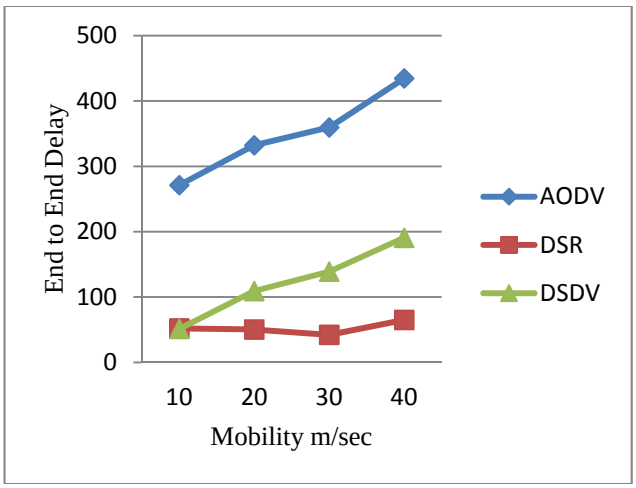


Figure 6: End to End Delay for Random Direction

It is clear from the figures that end to end delay increase as the speed of nodes increase. From the figure 4 end to end delays is high for the DSDV protocol and low for DSR, AODV protocols in random waypoint model. The delay for DSDV is better than the AODV and DSR protocols in the Random Walk and Random Direction models.

VI. CONCLUSION

In this paper we performed the simulation to evaluate the performance of two on-demand (AODV and DSR) and one table driven (DSDV) routing protocols on different performance metrics i.e. packet delivery ratio and end to end delay under the different mobility models with varying the speed of nodes. From the different analysis of graph and simulations it can be conclude that AODV performs better than DSR and DSDV in random waypoint mobility model. In the random waypoint and random direction as the speed of nodes increase the packet delivery ratio of DSR protocol decrease with high degree respect to the AODV and DSDV. AODV gives the better packet delivery ratio in the above three mobility models. The overall performance of AODV is better in random waypoint mobility model. In the random walk and random direction models the end to end delay is very high for AODV than DSR and DSDV protocols. If the speed of node is 10m/sec than the AODV perform better but if we increase the speed up to 40m/sec performance of AODV decrease because end to end delay is very high. The packet delivery ratio is high of AODV in random walk and random direction. But the end to end delay was also very high for AODV protocol. So the overall performance of DSR is better than the AODV and DSDV in random walk and random direction mobility model.

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