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REVIEW ARTICLE

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Analysis of Metrics in Different Scenarios of Routing Protocols in Adhoc Networks

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Abstract—A Mobile Ad-hoc Network (MANET) is a collection of mobile devices dynamically forming a communication network without any centralized control and pre-existing network infrastructure. In this Research paper we have studied the performance of Routing Protocols AODV DSR, and DSDV. Simulations have been carried out using Network Simulator version 2(NS2)and its associated tools for analysis of results. The Performance differentials are analyzed using varying no of nodes ,data rates,speed and pause.Simulation Results are presented to demonstrate the performance metrics like Packet Delivery Ratio,Average end to end delay , Routing Load .

Key words: MANET, Packet Delivery Ratio, End to End Delay, Routing Overhead, AODV, DSR

I. INTRODUCTION

A Mobile Ad-hoc Network (MANET) is a collection of mobile devices dynamically forming a communication network without any centralized control and pre-existing network infrastructure. MANETs are extremely flexible and each node is free to move independently, in any Random direction. Considering procedures for route establishment and update, MANET routing protocols can be classified into proactive, reactive and hybrid protocols. Proactive or table-driven protocols attempt to maintain consistent up-to-date routing information from each node to every other node in the network. Each node maintains tables to store routing information, and any changes in network topology need to be reflected by propagating updates throughout the network.

Reactive or on demand protocols are based on source-initiated on-demand reactive routing. This type of routing creates routes only when a node requires a route to a destination. Then, it initiates a route discovery process, which ends when the route is found. Hybrid protocols combine proactive and reactive schemes [1].

The objective of this work is to compare the performance of reactive Protocols AODV, DSR and Proactive DSDV, in Randomway Point Mobility Model. Random way Point is the most commonly used mobility model in research community. At every instant, a node randomly chooses a destination and moves towards it with a velocity chosen randomly from a uniform distribution [0,V_max], where V_max is the maximum allowable velocity for every mobile node. After reaching, the destination, the node stops for a duration defined by the pause time parameter. After this duration, it again chooses a random destination and repeats the whole process until the simulation ends [2]. Recently a comparative study of routing protocols was made, based on result analysis obtained using simulations with different Load and mobility with Network Simulator version 2(NS-2) in Random way point Model[5]. In [6] Performance comparisons of Mobile Adhoc Network's protocol with its quality of service factors, here the results of simulation for mobile Adhoc routing protocols over the performance metrics of Packet Delivery Ratio , end to end delay, media access delay and throughput for optimized Linkstate routing, temporary ordered routing algorithm and Adhoc on demand distance vector protocol.In [7] an attempt has been made to compare the performance of prominent on-demand reactive and proactive routing protocols for mobile Adhoc networks.

II. OVERVIEW OF ROUTING PROTOCOLS

A. Adhoc Ondemand Distance Vector(AODV):

The Ad Hoc on Demand Distance Vector (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 [9].

B. Distance Source Routing:

The key distinguishing feature of DSR [4] is the use of source routing. That is, the sender knows the complete hop - by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route

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cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source.

RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network. The RREP routes itself back to the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for future use. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes any route using this link from its cache. A new route discovery process must be initiated by the source if this route is still needed. DSR makes very aggressive use ofsource routing and route caching. network. Only 512-byte data packets are used. The number of source-destination pairs and the packet sending rate in each pair is varied to change the offered load in the network.

C. Destination Sequenced Distance Vector(DSDV):

DSDV [9] belongs to the proactive or table driven family where a correct route to any node in the network is always maintained and updated. Although it was based on the famous distributed Bellman-Ford distance vector, some major modifications were introduced to make it suitable for wireless schemes, and specifically solve the count-to-infinity problem The regular methods for solving this problem (such as poison reverse or split horizon) are not suitable for mobile topologies because of the broadcast nature of the medium. Instead, DSDV adds a sequence number for each routing table entry, to distinguish old from new routing information. In DSDV, each node keeps a routing table that lists all available destinations, and the number of hops to each destination. Each entry is tagged by a sequence number created by the destination node .Any routing table changes are relayed to all the other nodes, which imposes a large overhead on the whole network. To reduce this potential traffic, routing updates are classified into two categories. The first is known as "full dump" which includes all available routing information. This type of updates should be used as infrequently as possible and only in the cases of complete topology change. In the cases of occasional movements, smaller incremental" updates are sent carrying only information about changes since the last full dump. Each of these updates should fit in a single Network Protocol Data Unit (NPDU), and thus significantly decreasing the amount of traffic.

III. SIMULATION SETUP

A. Network Simulator(NS-2):

NS2 is an open-source event-driven simulator designed specifically for research in computer communication networks. Network Simulator (Version 2), widely known as NS2[8], is simply an eventdriven simulation tool that has proved useful in studying the dynamic nature of communication networks. Table1 depicts the various simulation parameters needed for simulation. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done usingNS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviors. Due to its flexibility and modular nature, NS2 has gained constant popularity n the networking research community since its birth in 1989.

Table 1: Simulation Parameters

Parameter	Value
Simulator	Ns-2
Routing Protocol	AODV,DSR,DSDV
Transmission Range	250m
Propagation Model	Two Ray ground
Antenna	OmniAntenna
Terrain Area	1000m x 1000m

IV. PERFORMANCE METRICS

A. A Packet Deliver Ratio:

PDR shows how successful a protocol is in delivering packets from source to destination.

$$PDR=(\frac{1}{n}\sum cbr\_R / \frac{1}{n}\sum cbr\_S) \; X \; 100$$

B. Average end to end delay:

This is the average end to end delay of all successfully transmitted data packets from source to destination.

$$EED=((\frac{1}{n}\sum cbr\_s\_t - \frac{1}{n}\sum cbr\_r\_t) / \frac{1}{n}\sum cbr\_r)$$

n is the number of received packets.

C. Routing Load:

RL is the number of routing packets transmitted per data packet delivered at the destination.

$$RL=(\frac{1}{n}\sum Rp / \frac{1}{n}\sum cbr\_R$$

V. RESULTS AND DISCUSSION

Simulations were carried out to analyze the performance of Reactive and Proactive protocols by varying the number of nodes ,datarates,speed and pause in Randomway point mobility model.

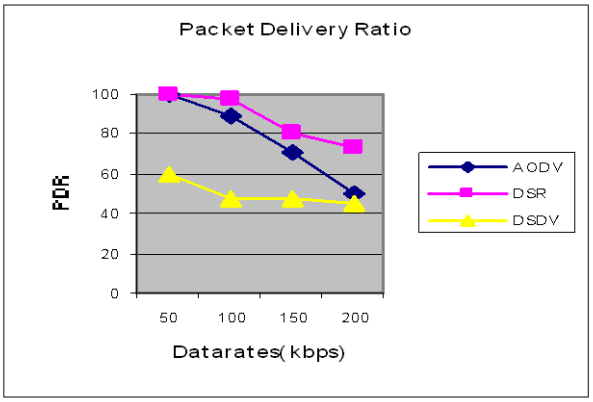

Figure1: Datarates vs PDR

AODV and DSR achieve high values of PDR for less rate of data transfer, As in Fig1 for AODV and DSDV when the network load increases PDR falls drastically below 60% regardless of node mobility but DSR outperforms by demonstrating above 70% PDR for increase in Network load

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and high Mobility not as in [5] where PDR is less for DSR. As in case of high mobility link failures happen very often these link failures initiate route discoveries in AODV since nodes have only one route per destination in their routing table. On the other hand DSR causes route discoveries less often as source routing and cached routes are used and multiple routes per destination are maintained.

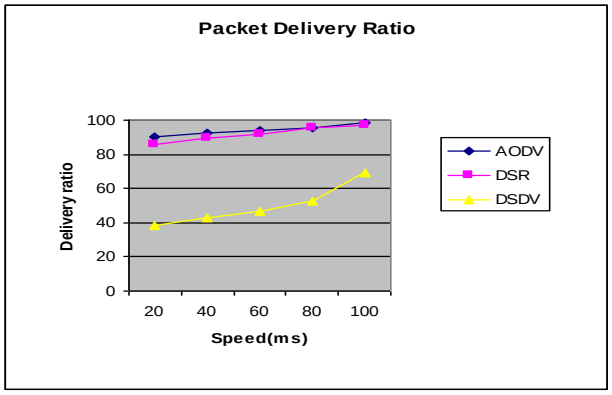

Figure 2 : Speed Vs Delivery Ratio

As in Fig2 AODV and DSR has a delivery ratio of about 90% regardless of the movement speed of nodes. In contrast DSDV has less PDR than AODV and DSR as DSDV cannot handle mobility at high speeds due to lack of alternative routes hence routes in routing table is stale.But when network load increases PDR is less for AODV and DSR in high movement speed of nodes.

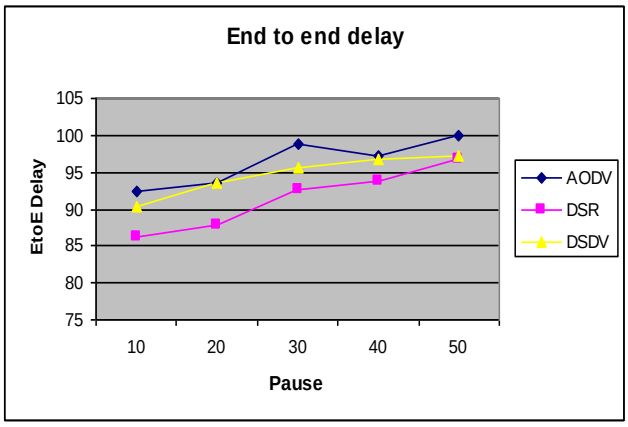

Figure 3: Pause vs End to End Delay

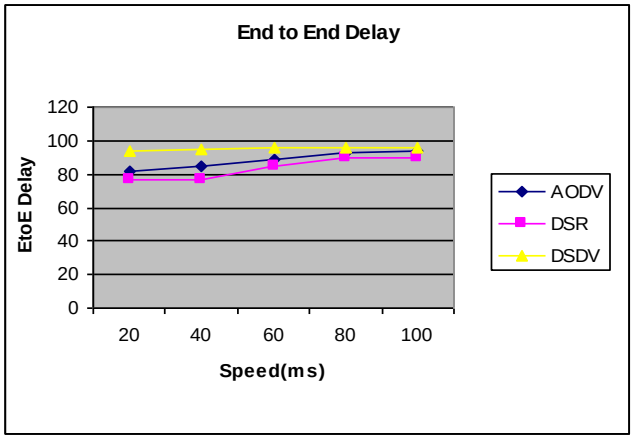

Figure 4: Speed vs End to End Delay

Fig3 demonstrates that DSR has less delay independent of node mobility than AODV and DSDV. There are only slight variations of delay for all protocols. As in Fig4 for increase of speed the delay is almost the same for all the protocols not as in [5] where DSR has very high delay for increase in speed.

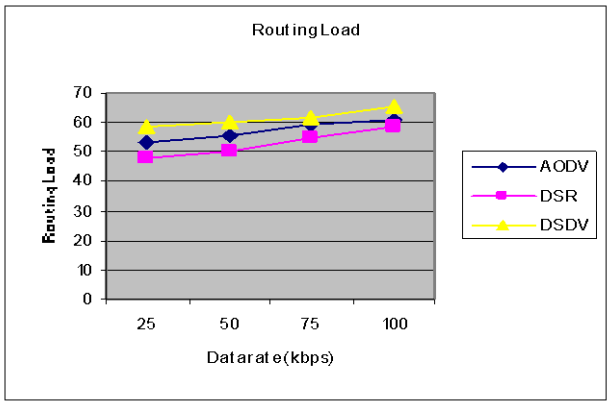

Figure 5:Datarates vs Routing Load

Fig5 depicts that DSR has less routing load than AODV and DSDV regardless of network load.Routing load in DSDV is more when the network is large and it becomes hard to maintain the routing tables at every node . But in [5] AODV has more routing load than DSDV, In our work for AODV routing load is less than DSDV as it maintains small tables to maintain local connectivity . For AODV overhead on bandwidth will occur compared to DSR when RREQ travels from node to node in the process of discovery of route on demand it sets up the reverse path in itself with the addresses of all nodes through which it is passing and it carries all this info all its way.

VI. CONCLUSION AND FUTURE WORK

In this paper the performance of AODV, DSR and DSDV where analyzed using Network Simulator [NS2]. The protocols were tested using different simulation parameters in different scenarios. After reviewing the result we conclude that as in Fig1 DSR is suitable when network load increases as well as in high mobility than AODV and DSDV not as in [5].But for less mobility both AODV and DSR perform well. As per Fig3 and Fig5 DSR also has less delay and less routing load than that of AODV and DSDV regardless of node mobility and network load as DSR uses route cache.Fig 4 indicates that DSR has less delay than AODV and DSDV for increase in speed in contrast to [5] where DSR has very high delay. DSDV is quite suitable for creating adhoc networks with smaller number of nodes.

DSDV requires a regular update of its routing tables which uses up battery power and small amount of bandwidth even when the network is idle . Added to it when the network topology changes a new sequence number is necessary before the network reconverges thus DSDV is not suitable for highly dynamic networks. Our Future work is to study the performance of protocols in different Mobility Models.

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