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SIMULATION AND ANALYSIS OF AODV, DSDV AND ZRP PROTOCOL IN MANET

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ABSTRACT

AODV is a reactive protocol which establishes a route from source to destination only on- demand. DSDV is a proactive protocol in which node maintains a route table and ZRP is a hybrid protocol which includes both the properties of proactive and reactive. In this work, the performance comparison of these three protocols is being done to analyze which protocol is best suited for which type of network. The analysis of these protocols is done on the basis of various performance matrices like throughput, end to end delay, jitter and packet delivery ratio. This work presents the simulation of these protocols based on the above mentioned parameters and evaluation of the results which of protocols is best suitable for MANET.

KEYWORDS: AODV, DSDV, ZRP, Throughput, Jitter, Packet Delivery Ratio, Drop Packets

1. INTRODUCTION

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.

Routing in MANET's is a very challenging task. There are basically three types of routing strategies in MANET's- proactive, reactive and hybrid. Proactive techniques are those in which all routing information is present at the very start of transmission. This greatly increases the throughput with minimum delay and high packet delivery ratio but it also increases the overhead of maintaining route tables. As mobile nodes are not stationary in MANET's, therefore it is quite impossible to maintain information about all nodes in a network. Therefore, to overcome this scenario, reactive protocols are used which are also known as on-demand. They create the routing path only when a user needs it. This technique decreases the overhead of maintaining routing tables but it also increases the delay and throughput of the network is also not up to the mark. Hence, a new technique is been derived which has the properties of both proactive and reactive known as hybrid. At small scale of network, it can be treated as table-driven and at large scale of network; it can be treated as on-demand.

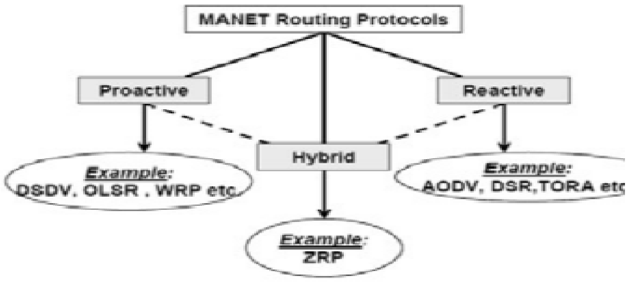

Figure 1: Classification of MANET Routing Protocols

This paper is divided into four sections where Section I deals with an introduction to Mobile adhoc networks and a brief overview on ZRP, AODV and DSDV Protocols, Section II deals with the simulation methodology and section III gives the detailed analysis of the result obtained from the experiments and section IV concludes the work and also provides the future scope of the work.

1.1 Description of Protocol

1.1.1 Adhoc-on Demand Distance Vector Routing Protocol

AODV is an on-demand and distance-vector routing protocol, meaning that a route is established by this protocol from a destination only on demand. AODV is capable of both unicast and multicast routing. It keeps these routes as long as they are desirable by the sources. Additionally, AODV creates trees which connect multicast group members. The trees are composed of the group members and the nodes needed to connect the members. The sequence numbers are used by AODV to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes [1].

In AODV, each node maintains a routing table which is used to store destination and next hop IP addresses as well as destination sequence numbers. Each entry in the routing table has a destination address, next hop, precursor nodes list, lifetime, and distance to destination [2]. AODV defines three types of control messages for route maintenance- *RREQ*- A route request message is transmitted by a node requiring a route to a node.

RREP- A route reply message is unicasted back to the originator of a RREQ if the receiver is either the node using the requested address, or it has a valid route to the requested address.

RRER- Nodes monitor the link status of next hops in active routes [7].

1.1.2 Destination Sequenced Distance Vector Protocol

The Destination Sequenced Distance Vector (DSDV) Routing Algorithm is based on the idea of the Distributed Bellman Ford (DBF) Routing Algorithm with certain improvements. The primary concern with using a Distributed Bellman Ford algorithm in Ad Hoc environment is its susceptibility towards forming routing loops and counting to infinity problem. DSDV guarantees loop free paths at all instants. Each node maintains a routing table, which contains entries for all the nodes in the network [9]. Each entry consists of:

- the destination's address
- the number of hops required reaching the destination (hop count)
- the sequence number as stamped by the destination.

Whenever a node B comes up, it broadcasts a beacon message ("I am alive message") stamping it with a locally maintained sequence number. The nodes in its neighborhood listen to this message and update the information for this node. If the nodes do not have any previous entry for this node B, they simply enter B's address in their routing table, together with hop count and the sequence number as broadcasted by B. If the nodes had previous entry for B, then sequence number of broadcasted information is compared to the sequence number stored in the node for destination B. If the message received has a higher sequence number, then this means that the node B has propagated a new information about its location so the entry must be updated in accordance with the new information received [11].

1.1.3 Zone Routing Protocol

The ZRP protocol, developed by Haas and Pearlman, incorporates a localized zone approach to routing. The fundamental approach is to incorporate a hybrid protocol that exploits the benefits of both a reactive and a proactive protocol [3]. It was designed to mitigate the problems of those two schemes. Proactive routing protocol uses excess bandwidth suffers from long route request delays and inefficient flooding the entire network for route determination. ZRP addresses these problems by combining the best properties of both approaches. In ZRP, the distance and a node, all nodes within -hop distance from node belongs to the routing zone of node [4]. However, size of a routing zone depends on a parameter known as zone radius. In ZRP, each node maintains the routing information of all nodes within its routing zone. Components of ZRP are

IARP- It is responsible for maintaining routes within each node's routing zone through periodic routing table updates.

IERP- Routing outside the zone is done based on a reactive or on-demand approach, by using IERP[5].

BRP- BRP is a subset and the workhorse of IERP. It provides bordercasting, route accumulation, route optimization, and query control [6].

2. SIMULATION METHODOLOGY

A well known network simulator NS-2.33 is used as a framework to compare the performance of three well known protocols- AODV, DSDV and ZRP. Various performance matrices are evaluated like average throughput, average end to end delay, average jitter and packet delivery ratio. These parameters are calculated as follows:

Throughput: It is defined as the total amount of data a receiver receive from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in bits per second [12].

Average Jitter: Jitter is the variation in the time between packets arriving, caused by network congestion, timing drifts, or route changes. It should be less for a routing protocol to perform better.

Average End-to-End Delay: End to end delay includes how long it a packet takes to travel from the source to the destination[13].

Packet Delivery Ratio: It is defined as the ratio of number packets received by the destination to the number of packets originated by the source.

3. EXPERIMENTAL SETUP

To get the simulation results for the comparison of three protocls, following parameters are used which are described in table format:

Table 1

ENVIRONMENT SIZE	500 X 500
NUMBER OF NODES	10-100
DATA RATE	16 bits/sec
PACKET SIZE	512 bytes
SIMULATION TIME	150 mins
TRAFFIC TYPE	CBR
PROTOCOLS	AODV, DSDV,ZRP

On the basis of following parameters, performance of AODV, DSDV and ZRP was compared. In simulation results, it has been shown that which protocol is best suited for adhoc environment among the three protocols

Average Throughput: The graph showing simulation result is also attached to this section as in figure: 4.2. Here, from the graph, the average throughput of AODV is much better than the other two has been shown. DSDV also performs equivalent to AODV after some initial nodes. ZRP performs worst in case of these protocols. AODV performs well throughout the varying number of nodes. The main reason behind that at high number of nodes, proactive routes takes much time due to maintaining routing tables as compared to reactive routes.

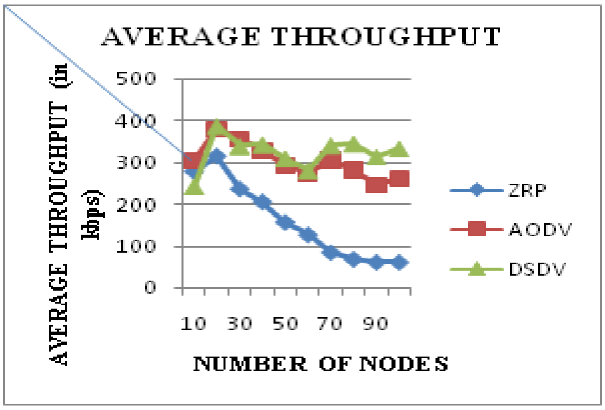

Figure 2

Average End to End Delay: As one can predict from the graph, ZRP has more average end-to-end delay than the AODV and DSDV. End-to- end delay should be least for the performance of any protocol. Being proactive in nature, DSDV has least average end-to-end delay as compared to other two protocols. AODV also performs better than the ZRP in case of end-to-end delay.

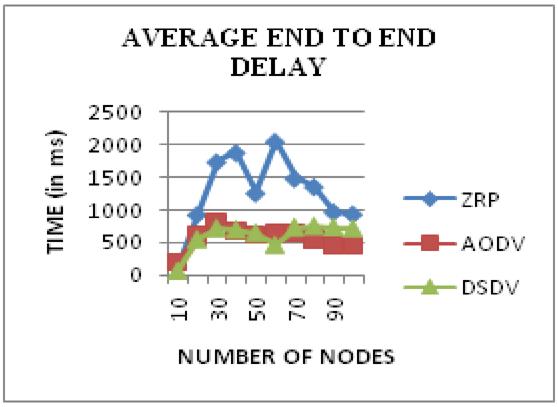

Figure 3

Packet Delivery Ratio: The graph showing packet delivery ratio of the three protocols is illustrated as follows From the graph, the packet delivery ratio of AODV is much better than the DSDV and ZRP. After 20 nodes, AODV and DSDV has approximately same packet delivery ratio. But in terms of ZRP, it performs not well as compared to AODV and DSDV. Its results are not up to the mark. The main reason behind that at high number of nodes, proactive routes takes much time due to maintaining routing tables as compared to reactive routes.

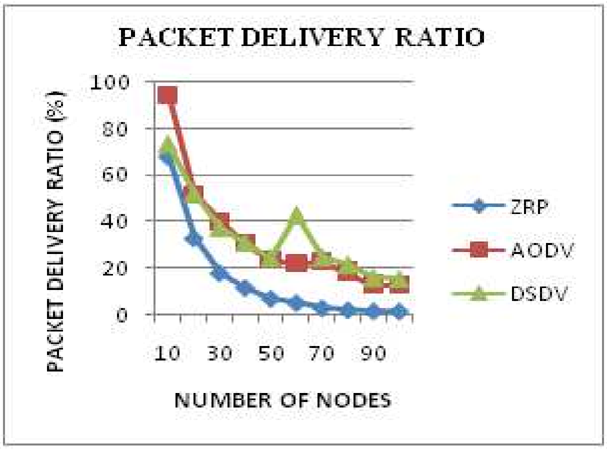

Figure 4

Generated Packets: Generated packets are those packets which are generated by the sender during the simulation. ZRP has the highest number of packets generated as compared to AODV and DSDV. This is approximately due to zone radius. At high number of nodes, if zone radius is kept constant, then more packets are generated due to IARP component of ZRP.During the whole simulation, AODV and DSDV has least number of packets generated. DSDV has least number of packets generated as in proactive protocols, there is no need to transmit request packets.

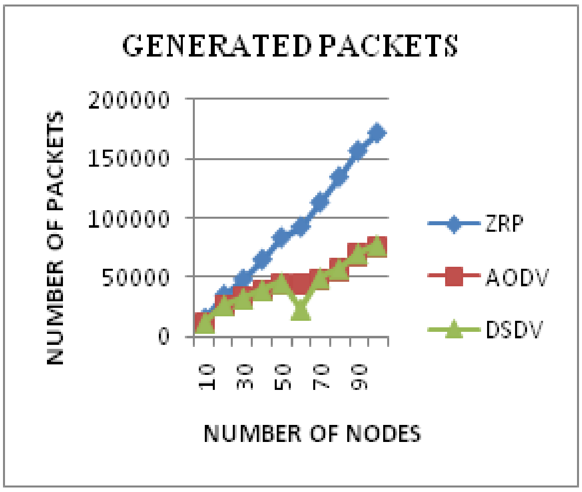

Figure 5

Received Packets: Received packets are those packets which are received by the receiver during the simulation. DSDV has the highest number of received packets due to its proactive nature. ZRP has the least number of received packets. Therefore, its throughput and packet delivery ratio is least as compared to AODV and DSDV. The simulation results are shown in the graph as follows:

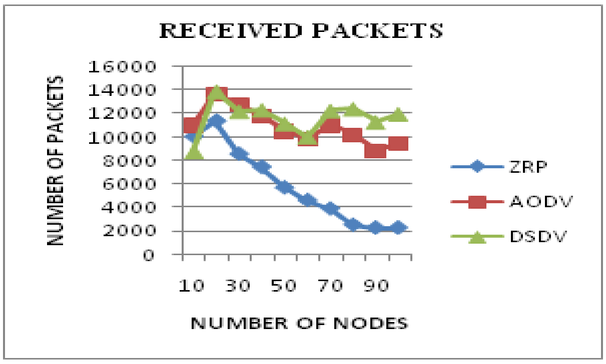

Figure 6

Drop Packets: Drop packets are those packets which are dropped during the simulation. Dropped packets means which are not received by the receiver but are generated during simulation. From the graph 4.7, ZRP has the least number of dropped packets. AODV has the highest number of dropped packets. After 50 nodes, DSDV has also encounters in great reduction of drop packets but after that it has the same ratio as AODV.

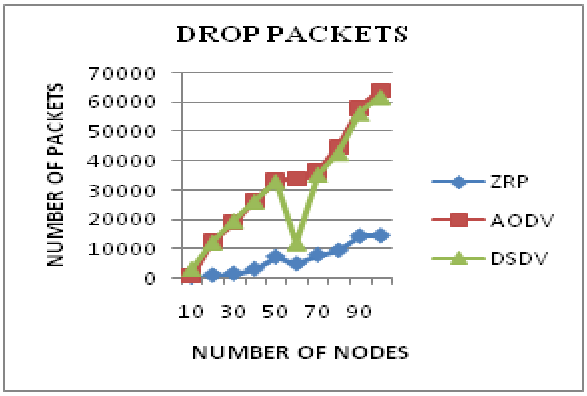

Figure 7

Average jitter: It is termed as calculating end to end delays of the adjacent packets. The prediction from the graph is that the average jitter of AODV is least when compared to DSDV and ZRP. This is basically due to pure reactive nature of AODV. DSDV has more average jittering than AODV. DSDV has more jittering effect because of the reason that it firstly checks the routing table and then transmit the request packets. ZRP has also less average jitter than the DSDV as ZRP works on both principles-proactively it has less jitter than the DSDV and reactively- it has more jitter than the AODV.

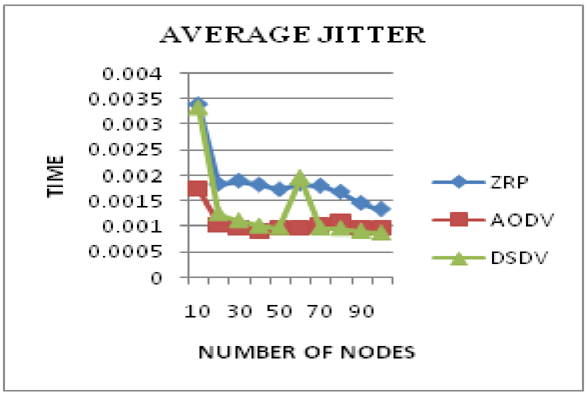

Figure 8

4. CONCLUSIONS & FUTURE WORK

The comparison between AODV, DSDV and ZRP have been shown with the help of some graphs taken under various performance matrices. The average throughput and packet delivery ratio of AODV is better than the both at some initial nodes. At large number of nodes, DSDV performs well due to its proactive nature. AODV and ZRP does not compete with DSDV because of the latency caused in the network due to periodic transmissions of request packets. The average end-to-end delay of ZRP is much larger than the AODV and DSDV. The average jitter of AODV is better than the ZRP. Number of drop packets are less in ZRP as compared to the other ones. The performance of ZRP is very low as compared to the other two routing protocols. Hence, one can say that ZRP is not an efficient protocol used for routing purposes. AODV shows best results at less number of nodes. As the node density increases, DSDV performs well due to table- driven system. At higher number of nodes, AODV and DSDV shows approximately same packet delivery ratio and end-to-end delay.

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