Zaiba Ishrat , Pankaj Singh / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 3, May -June 2013, pp.1252-1256

AN ENHANCED DSR PROTOCOL USING PATH RANKING TECHNIQUE

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ABSTRACT

Mobile Adhoc networks are infra structure-less and are categorized by multi-hop wireless connectivity and dynamic changing network topology. They are self organized networks without dependency on any fixed infrastructure. Application area of MANET is varied, ranging from small, static networks to large scale highly mobile and highly dynamic networks. Routing is an important issue in wireless adhoc networks. Routing protocols plays a very important role because MANET use dynamic changing network topology. Most famous categories are Proactive, Reactive and Hybrid. Proactive routing protocols setup route based on continuous control traffic information. All routes and maintained all the times. On the other hand Reactive routing protocols does not take any initiative for finding routes. It establishes routes 'on demand' basis. Hybrid protocol have the advantages of both proactive and reactive protocol. In this paper, an attempt has been made to compare performance of ZRP (hybrid), DSDV (Proactive) and reactive (DSR and modified DSR) on the basis of their performance in MANETs using NS2 simulator. A comparative study on reactive and proactive has been done by some modification that how DSR can be modified for its performance enhancement from average to something extra to make MANETs more reliable. To achieve this goal DSR is modified by using route ranking technique in order to load balancing, to avoid congestion and lower packet delivery.

Keywords: Proactive protocol, Reactive protocol, Hybrid protocol, NS2, Performance evaluation

I. INTRODUCTION

A mobile ad-hoc network is a collection of wireless nodes that can communicate with each other without any dependence on a fixed infrastructure or centralized administration. Therefore MANET is a "spontaneous network "that automatically "emerges" when nodes gather together. Each node in a MANET can perform as a router and a host. Nodes in the MANET can communicate with other all nodes within their radio range or can use intermediates nodes to communicate with the nodes that are not present in their radio range. MANET is characterized by

dynamic topology, use unidirectional links, constrained resources and network partitions. The main two attributes are mobility and multihop communication between the nodes. One tries to find the route which has lower cost in comparison to other routes in the network [1][2]. The nodes can communicate directly with nodes in their range, or communicate with nodes outside of their range by using other nodes to forward their packets [1]. Nodes are free to move in any direction, at any time, thus frequently make new links with other nodes. Therefore Each nodes work as router. In infrastructure dependent wireless networks access Point are used for all the peer to peer communication between existing nodes as shown in Fig1.But in Ad hoc networks with the help of direct peer-to-peer communications, all the routes are discovered and established between the nodes without depending on an infrastructure.

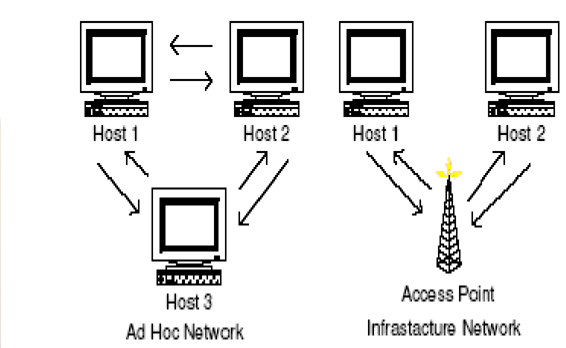

Fig 1. Ad Hoc Networks vs. Infrastructure Networks [1]

1.1 Characteristics OF MANET

The mobile ad hoc networks have several characteristics such as:

- Rapidly deployable and self-configuring
- Each nodes can work as hosts and routers
- No infrastructure dependency
- Wireless links are used for the communication.
- Nodes are always in mobile condition.
- Routing updates very frequently
- Less physical security and bandwidth constrained

1.2 Applications area of MANET

MANET facilitates communication in different fields such as:

- Military and police work
- Mine cite work
- Disaster relief work
- To arrange urgent business meeting

II. PROTOCOLS IN AD-HOC NETWORKS

2.1 Destination-Sequenced Distance Vector (DSDV)

DSDV is a Proactive protocol. Proactive protocol maintains routing Information independently of need for communication, Update messages send throughout the network periodically or when network topology changes. It provides Low latency and suitable for real-time traffic but Bandwidth might get wasted due to periodic updates that is the main disadvantage of this. It maintain O(N) state per node, N = #nodes.

DSDV was invented by Perkins and Bhagvat in 1994. This is based on Bellman Ford algorithm. Each node maintains routing tables and exchange of routing tables with the neighbor's nodes by flooding. Routing table have the way to the destination, cost. Each node advertises its position that has Sequence number to avoid loops therefore nodes continuously updates the table to provide the fresh view of whole network. So every node knows "where" everybody else is. Thus routing table O(N).[4] DSDV works as follows [5][6]

In DSDV each node maintains a routing table which stores next hop towards each destination, cost metric for the path to each destination, destination sequence number that is created by the destination itself and sequence numbers used to avoid formation of loops. Each node periodically forwards this routing table to all its neighbors. Each node increments and appends its sequence number when sending its local routing table. This sequence number will be attached to route entries created for this node. The sequence numbers assigned by the destination are generally even. If the broken link is detected, then the metric is assigned as infinity and the sequence number is assigned to odd. In order to maintain consistency, each node periodically broadcasts its route and updates its routing table on the basis of received information from the neighbor routing table.

2.2 Dynamic Source Routing (DSR)

DSR is reactive protocol. Reactive protocol discovers route only when you need it means it works on traffic demand. Therefore it saves energy and bandwidth during inactivity. It supports bursty data so congestion can occurs during high activity. It offers significant delay as a result of route discovery. For finding the route from source to destination , source node flood the route request packets, that will transfer from one node to another until it reaches to the destination. Destination node sends the route reply packet for the confirmation of route has been established.[5][6][7]

Dynamic Source Routing (DSR) divides the task of routing into two phases that allows the discovery and maintenance of routes. When node S(sender) wants to send a packet to node D(destination), but does not know a route to D, node S initiates a route discovery Source node S floods Route Request (RREQ) Each node appends own identifier when forwarding RREQ. Destination D on receiving the first RREQ, sends a Route Reply (RREP). RREP is sent on a route obtained by reversing the route appended to received RREQ.RREP includes the route from S to D on which RREQ was received by node D.[5][7] Node S on receiving RREP, caches the route included in the RREP .When node S sends a data packet to D, the entire route is included in the packet header. Hence the name is source routing because source define the route for transferring the data. Intermediate nodes use the source route included in a packet to determine to whom a packet should be forwarded.

The optimization of DSR is Route cache. Each node caches a new route it learns by any means.e.g. When node S finds route [S, E, F, J, D] to node D, node S also learns route [S, E, F] to node F. When node K receives Route Request [S, C, G] destined for node, node K learns route [K, G, C, S] to node S. If a link is broken between the nodes than node sends the route error packet to the sender to inform the broken link, therefore sender again tries to find out the new route by RREQ packet.

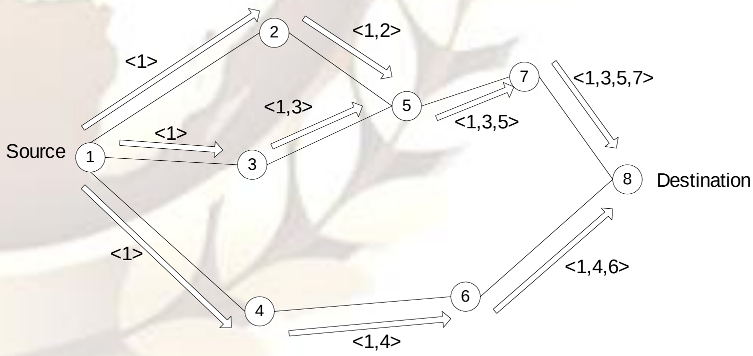

Fig 2.Building Record Route during Route Discovery [7]

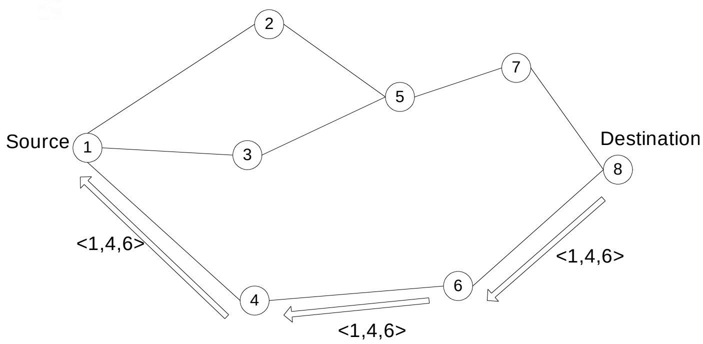

Fig 3 .Propagation of Route Reply with the Route Record [7]

2.3 Zone Routing Protocol

Hybrid Routing is the combination of proactive and reactive protocol. This attempts to strike balance between the two protocols. ZRP falls under the category of hybrid routing protocols with both proactive and reactive routing components. ZRP overcome the disadvantage of control overhead caused by proactive protocol and also decreases the latency in reactive protocols. It takes advantage of proactive discovery within a node close immediacy/ local neighborhood, and using a reactive approach for communication between these neighborhoods. With this ZRP reduces the proactive scope to a zone and reactive approach outside the zone. When a node has a data packet for a particular destination, a check is carried out whether a destination is within its zone or not. Packet is routed proactively if it is within the zone and if the destination is outside the zone reactive routing is used.[5]

The zone is defined as a collection of nodes whose minimum distance from the node in question is not greater than a value known as “zone radius”. Each node creates its own neighborhood separately. The size of a zone is given by a radius of length β where, β is number of hops to the perimeter of the zone [5]. Each zone may have different size and each node may lie within multiple overlapping zones. ZRP avoids hierarchical map of the network and the overhead involved in maintaining map by dividing the network into variable size, overlapping zones. [6][5].

III. MODIFICATION IN DSR ROUTING PROTOCOL

While comparing original DSR with DSDV and ZRP we notice that DSR gives better performance at high TCP transmission rate but not so much good at low rate [4]. Our main idea is to modify DSR in such a way so that instead of simple hop count as in DSR, a new routing metric decide a route in Modified DSR (MDSR). This new routing metric depends on assigning a ranking to a node so that whole path can be ranked. So in case of multiple paths from source to destination, a path which has highest path ranking is chosen.

a) Path Ranking

On the basis of packet forwarding successfully and dropping probability each node maintains rank of every other node in the Ad-hoc network. Path ranking is determined by taking average of the rankings of each node in the path as this allows choosing shortest path algorithm if no metric is given to nodes. In case of more than one (multiple) path to the destination a path with highest ranking is chosen.

Algorithm for assigning rank to a node

1. For a neutral node, that is a new node, is given a ranking of 0.5.
2. Ranking of each node is done with highest ranking of 1.0 to make sure that if all are neutral nodes then shortest path first is chosen.
3. For every 200ms the ranking of nodes on active path is incremented by 0.01.
4. Neutral node ranking assigned 0.8.
5. Packet is dropped on a link and if a node becomes un-reachable to other nodes than its ranking is reduced by 0.05
6. Lower limit of a neutral node is assigned 0.0.
7. Changes on the rankings of other nodes than one mentioned above are not performed.
8. Any misbehaving node given a ranking of -100.
9. If the simulation is run for long period of time then the negative rankings can be reset after a long timeout period.
10. In case when no node is found that can be given packet to forward, Send Route Request is given.

Therefore, we will choose the path which is having highest path metric .

IV. NS 2 SIMULATION AND IMPLEMENTATION

Ns-2 is a discrete event simulator using in networking research. It provides significant support for simulation of TCP, routing and multicast protocols over wired and wireless networks. It consists of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (nam) ,which is use to visualize the simulations. Ns-2 can fully simulates a layered network from the physical radio transmission channel to high-level applications. Ns-2 is an object-oriented simulator written in C++ and OTcl. The simulator supports a class hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. There is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compile hierarchy.[7][8]

Table 1 Simulation Parameters Used

Parameter	Value
Platform	Linux CentOS 5
NS Version	Ns-2.33
Mobility Model	Random Way Point
Traffic Type	CBR
Area	500 * 500 m
Experiment Duration	150 sec
MAC Layer Protocol	Mac/802_11
Packet Size	512 bytes

Radio Propagation	TwoRayGround
Packet Interval	0.2 second
Protocols	DSDV, DSR, ZRP, Modified DSR
Antenna Type	OmniAntenna
Packet Size	512 bytes
Pause Time	5, 10, 20, 40, 100
Number of nodes	10, 20, 30, 40, 50

4.1Performance Metric

1. Packet Delivery Fraction: It is defined as the ratio of all received packets at the destinations to all transmitted packets from CBR source. The packet delivery ratio is the fraction of packets that successfully arrive at their destination.

2. Throughput: It is defined as the ratio of data packets received to the destination to those generated by source. Throughput is average rate of packets successfully transferred to their final destination per unit time.

3. End-to-End Delay: It is the average delay time for a data packet travelling from its source to destination. It signifies the amount of time taken by packet from source to destination. The delay time of all successfully received packets is summed, and then the average delay time is calculated

All the above mentioned performance metrics are quantitatively measured. For a good routing protocol, throughput should be high where as other three parameters value should be less. We used the above performance metrics and quantitatively measured against number of nodes and pause time.

V. RESULT AND DISCUSSION

In this paper we analyze the packet delivery faction ratio, ends to end delay and throughput of routing protocol against the number of nodes and pause time.

5.1 Packet Delivery Fraction

Figure 5.1(a) show that all routing protocols have higher packet delivery ratio when number of nodes is less, but as number of nodes increases packet delivery fraction decreases. The main reason for this loss is packet collisions, invalid routes, or packet drops. However it is evident from the graph that after doing the modification in DSR its packet delivery fraction increases as compared to existing DSR.

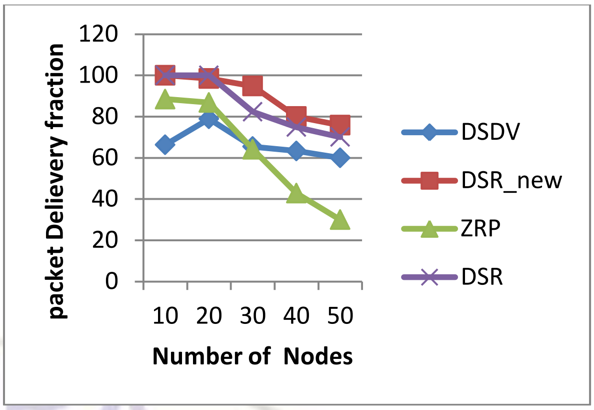

Fig 5.1(a) Packet Delivery fraction Vs number of Nodes

From figure 5.1(b) it is evident that Packet Delivery Fraction is more when pause time is less and as pause time increases Packet Delivery Fraction tends to decrease. but MDSR shows better performance.

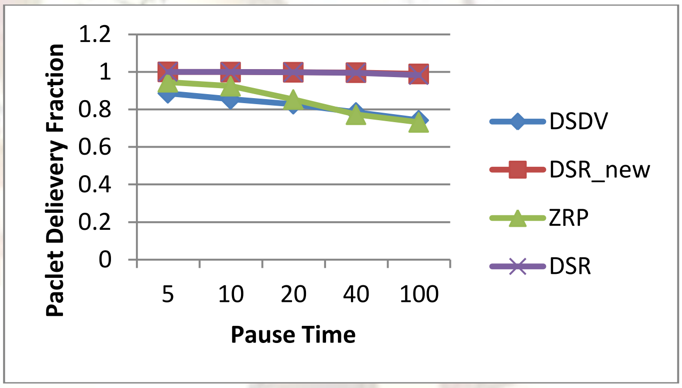

Fig 5.1(b) Packet Delivery Fraction Vs Pause time

5.2 End To End Delay

It is shown from the graph that average end-to-end delay is lower when number of nodes is lower and it increase when number of node increases. It is clear from the graph that after doing the modification in DSR it is showing less average end-to-end delay. A same condition exist in case of pause time.

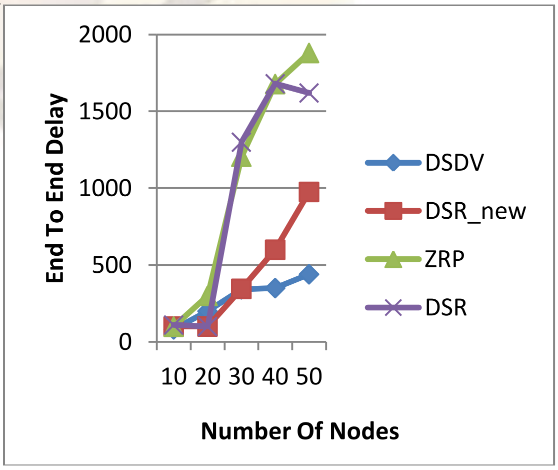

Fig 5.2(a) End to End delay Vs Number of Nodes

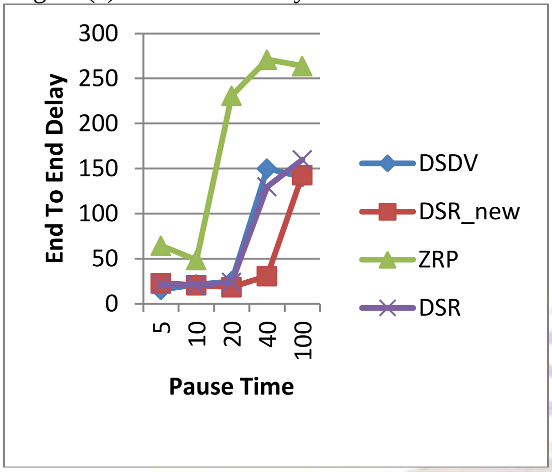

Fig 5.2(b) End To End Delay Vs Pause Time

5.3 Throughput

It is shown by the graph that throughput is less when number of nodes is lower and it increase when number of node increases. It is clear from the graph that after doing the modification in DSR it is showing increased throughput as compared to existing DSR.

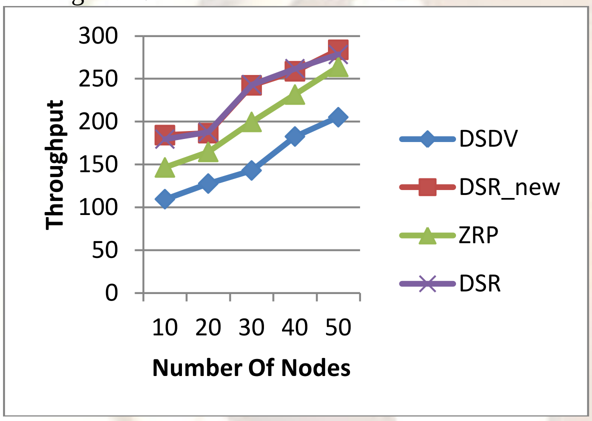

Fig 5.3(a) Throughput Vs Number of Nodes

After comparing the throughput against the pause time , throughput increase for less number of nodes in M**DSR.** Fig 5.3(b)

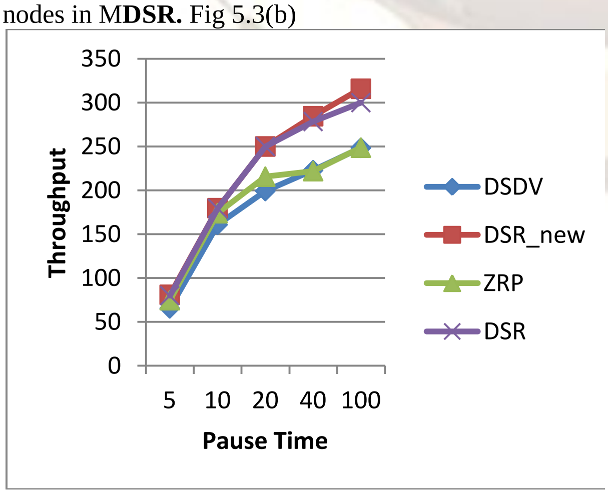

Fig 5.3(b) Throughput Vs Pause Time

VI. CONCLUSION

In this study we have concluded that each protocol performs well in some cases while have drawbacks in other cases. We also use the concept of path ranking in DSR and shown that it has very good effect on the performance of existing DSR. Simulation results demonstrated in terms of throughput, end-to-end delay and packet delivery fraction against number of nodes and pause time shows that the modified DSR performs lot better as compared to existing DSR.

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