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Enhancement in ZRP Protocol for Load Balancing During Link Failure in MANET

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Abstract: MANET is a self configuring network which has no fixed infrastructure. Topology in MANET changes frequently. During data transmission, there is a problem of link failure which degrades the performance of the network. The nodes are deployed in the network and path is established according to ZRP protocol from source to destination. There are some nodes in the path having much movement than other nodes. Due to these nodes link failure problem occurs. So link failure problem is responsible for performance degradation and low reliability of the network. In this paper, a novel technique is proposed to overcome link failure problem in ZRP.
Keywords: ZRP, EZRP, MANET, Link Failure.

I. INTRODUCTION

Wireless network refers to the type of networks in which the communication between devices is implemented without use of wires.Wireless networks have many properties such as mobility, simplicity and very affordable and cost saving installation. Wireless networks can be classified into two types:
1. Infrastructure Network
2. Infrastructure less Network

Infrastructure networks has center controller that is Access Point. All the wireless devices, that is communicate to each other through Access point and Access point is responsible for data routing . Access point is a fixed base station and all wireless devices that are communicating to each other are connected to access point. It is also known as Adhoc Network.

Infrastructure-less networks has no central controller means no Access point. Ad hoc networks are decentralized type of wireless networks.In ad hoc network, each node participates in routing by forwarding data to other nodes, and so the determination of the nodes forward data is made dynamically based on the network connectivity.

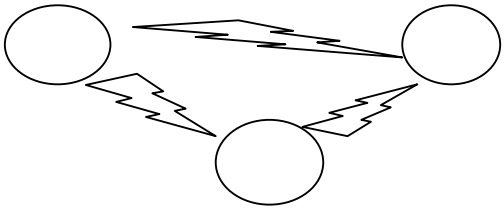


Fig 1.1 : Infrastructure less Network

1.1 Types of Adhoc Network: There different types of adhoc network available. These are as following:

MANET*:* MANET is a mobile adhoc network. It is self-configuring network which is infrastructure less in nature. In Manet different mobiles are connected through wireless link. Each mobile are free to move i.e. no central controller available.

Wireless Sensor Network: A wireless sensor network is collections of sensing device that can be wirelessly communicate. Each device is capable of talk to its peer, sense, process. It is centralized system. It is inexpensive to install and no wiring is required for data transfer.

Wireless Mesh Network*:* Wireless mesh network is a communication network made up of radio nodes which are ordered in a mesh topology. Wireless mesh networks made up of gateways, mesh routers, mesh clients and. The mesh clients are may be laptops, cell phones and other wireless devices. The traffic is forwarded by mesh routers to and from the gateways but not connect to the internet.

1.2 Routing Protocol in MANET: One of the most important and a difficult mechanism to maintain in ad hoc networking is the routing mechanism. An ad hoc routing protocol is nothing but an agreement amongst nodes as to how they control routing packets amongst themselves. The nodes in an ad hoc network discover routes as they do not have any prior knowledge about the network topology routing protocols in MANETs are classified into three different categories according to their functionality:

1.2.1 Reactive Routing Protocol: It is also called the On Demand routing protocol. They don't maintain routing information or routing activity at the network nodes if there is no communication. It means that it creates the routes only when desired by the source node. E.g. AODV, DSR

1.2.2 Proactive Routing Protocol: It maintains the routing information even before it is needed. They attempt to maintain up to date information from each node to every other node in the network. Routes information is generally kept in the routing tables and is periodically updated as the network topology changes. Proactive routing protocols are table driven routing protocols. E.g. DSDV, WRP

1.2.3 Hybrid protocols: This type of protocols combines the advantages of proactive and of reactive routing. E.g. Zone Routing Protocol (ZRP) and temporally-ordered routing algorithm (TORA).

2. Review of Literature

Gagandeep Kaur et.al, 2014 proposed[1] that in mobile adhoc network there is an routing protocol that transfer the packets for destination in the most efficient manner. Adhoc multipath routing protocol AOMDV with load bathe scheme to distribute the traffic evenly in the network the packet loss decrease. This paper is motivated factors in a unified way. In this paper they propose is energy efficient dynamic queue based that uses load balancing. The routing is energy based mu (EAOMDV) in which we define an energy factor threshold value. The life time of proposed E-AOMDV are limited but routing as compared to AOMDV without including the energy factor. The performances of proposed scheme are better in limited life time. The performance metrics shows better results in proposed scheme.

Rachida Aoudjit et.al, 2009 explained [2] about mobile ad hoc networks consist of freely moving nodesresponsible of not only forwarding packets for other nodes but can also perform extensive computations. One of the most critical issues in these networks is the significant differences in term of processing and energy capacity between the nodes, inducing a load imbalance. Thus, sharing the load between the overloaded and idlenodes is a necessity in ad hoc networks. In this paper, they present a new load balancing algorithm based on clustering where a subset of nodes clusterheads is elected to maintain some balance within their respective clusterswhile minimizing the overall communication cost. Their primary goal is to minimize the total execution time of the tasks by distributing the workload among nodes. Another goal is to extend the overloaded nodes lifetime inducing a stability of the network. The simulation results have shown that network performance can be reached by distributing load to idle nodes within the network.

Prof. S.A. Jain, 2012 presented [3] the ad hoc connections, which opens many opportunities for MANET applications. In ad hoc network nodes are movable and there is no centralized management. Routing is an important factor in mobile ad hoc network which not only works well with a small network, but also it can also work well if network get expanded dynamically. Routing in Manets is a main factor considered among all the issues. Mobile nodes in Manet have limited transmission capacity, they intercommunicate by multi hop relay. Multi hop routing have many challenges such as limited wireless bandwidth, low device power, dynamically changing network topology, and high vulnerability to Failure. To answer those challenges, many routing algorithms in Manets were proposed. But one of the problems in routing algorithm is congestion which decreases the overall performance of the network so in this paper we are trying to identify the best routing algorithm which will improve the congestion control mechanism among all the Multipath routing protocols.

Mohammad Amin Kheirandish Fard, 2011 introduced [4] standard congestion control cannot detect link failure losses which occur due to mobility and power scarcity in multi-hop Ad-Hoc network (MANET). Moreover, successive executions of Back-off algorithm deficiently grow Retransmission Timeout (RTO) exponentially for new route. The importance of detecting and responding link failure losses is to prevent sender from remaining idle unnecessarily and manage number of packet retransmission overhead. In contrast to Cross-layer approaches which require feedback information from lower layers, this paper operates purely in Transport layer. This paper explores an end-to-end threshold-based algorithm which enhances congestion control to address link failure loss in MANET. It consists of two phases. First, threshold-based loss classification algorithm distinguishes losses due to link failure by estimating queue usage based on Relative One-way Trip Time (ROTT). Second phase adjusts RTO for new route by comparing capabilities of new route to the broken route using available information in Transport layer such as ROTT and number of hops**.** oriented discrete event simulator environment. Simulation results shows that the ODBEERP achieves good throughput, less delay, high packet delivery ratio and good energy efficiency than the existing protocol PEER.

Narendra Babuji and Yadla, Suresh, 2013 implemented [5] a new distributed routing protocol i.e., Temporally-Ordered Routing Algorithm for mobile, multi-hop, wireless networks. TORA can be used for highly dynamic mobile ad hoc networks. The protocol's reaction is structured as a temporally-ordered sequence of diffusing computations; each computation consisting of a sequence of directed link reversals. The protocol is highly adaptive, efficient and scalable; being best -suited for use in large, dense, mobile networks. The protocol is designed to minimize reaction to topological changes. A key concept in its design is that it decouples the generation of potentially far-reaching control message propagation from the rate of topological changes. It guarantees all routes are loop-free, and typically provides multiple routes for any source/destination pair which requires a route.

Harpreet Kaur et.al, 2014 proposed [6], an enhanced AODV protocol is used. The techniques will follow only the path which has the highest signal strength. Header part is added in RREQ message which helps to find out the destination. Destination nodes check the vicinity of the adjacent nodes and those nodes further checks the vicinity of their adjacent nodes. After that source find out the average of the path. The path which has the maximum average value is selected as the final path. This work will help to reduce the problem of link failure and packet lost problem.

3. Link Failure in MANET

Link failure is a main problem in ZRP which is responsible for the degradation of the network and packet lost. There are number of nodes in the network. Source is host node from where data has to be send and destination node is final node. An active node which is responsible for updations of table entry. When source node move, new route discovery initiated. If intermediate nodes or the destination move then following conditions possible:

i) The next hop links break resulting in link failures.

ii) Routing tables are updated when link failure occurs.

iii) All active neighbors are informed by Route Error message.

During link failure, the source is informed about the failure in the network so that either it may slow down the packet transmission rate or find an alternate route which may not necessarily be an optimal route. It must be pointed out that all the congestion control methods are able to inform the source about the congestion problem because they use Transmission Control Protocol. To maintain and allocate network resources effectively and fairly among a collection of users is a major issue. The resources shared typically are the bandwidth of the relations and the queues on the routers or switches. Packets are queued in these queues awaiting transmission. When too many packets are challenging for the similar link, the queue overflows and packets have to be dropped. When such drops become common events, the network is said to be congested and link failure problem occurs. In Ad-hoc networks, since there is no fixed infrastructure there are no separate network elements called routers and hence the mobile nodes themselves act as the routers.

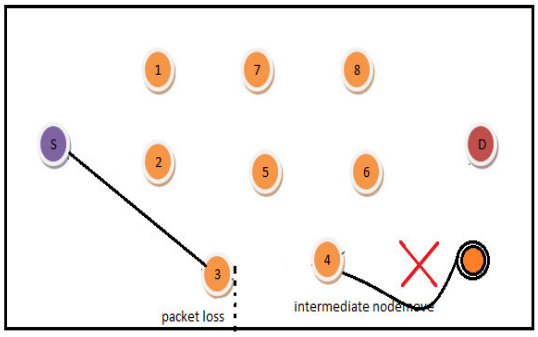
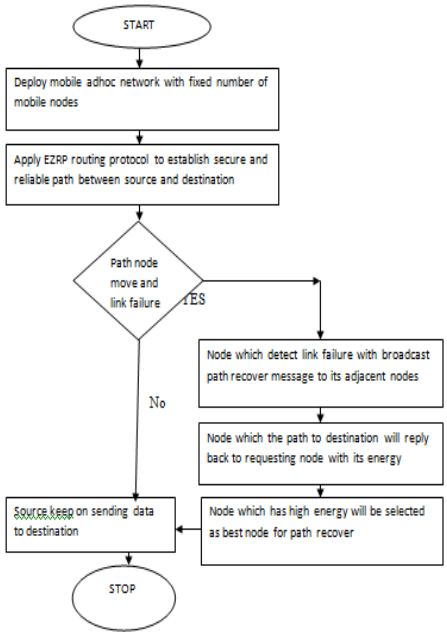


Fig. 1.2 Link Failure in MANET

In fig.1.2, Network is deployed having finite numbers of nodes. After that, Path is established between source and destination. In this case node 7,which is intermediate nodes moves from its position. So packet loss occurs at node 3.

4. Proposed Methodology

The main problem occurs during transfer of data from source to destination is of congestion problem in ZRP protocol. As we discussed earlier in MANET number of nodes are present which can move freely in the area. There is no controller in the MANET. So moves are free to move easily. It is self configuring system. So when the data send from source to destination congestion control problem occur easily due to free or easily movements of the nodes. To overcome the problem of congestion in the network various techniques of load balancing had been proposed in the previous times. Among all the proposed techniques multipath routing is the most efficient and advanced technique for load balancing in energy efficient mobile adhoc networks. In the proposed technique dynamic queues are defined on the basic of threshold values for load balancing in MANET. As discussed earlier, MANET is the self configuring network in such network it is very difficult to define threshold values. In this work, we will enhance the proposed EZRP protocol for load balancing in MANETs. The enhancement will be based on the actual values of the networks. The most advanced and energy efficient technique is multipath routing which is based on dynamic queue threshold values. In this work enhancement in the proposed technique will be done to increase its efficiency in terms of energy, throughput and delay.



Flowchart of Methodology

5. Experimental Results

In proposed work, a new technique has been proposed to increase efficiency of the network which is implemented at NS2 Simulator. The following graphs shows the comparison b/w old scenerio and new scenerio.

5.1 Throughput : An efficient routing protocol should achieve high throughput and less delay. Figure 1.3 shows Throughput graph is plotted in which the old throughput in which link failure scenario is analyzed. The new throughput is shown with green line in which link failure problem is resolved. The graphs shows that throughput of new scenario is better than existing scenario.

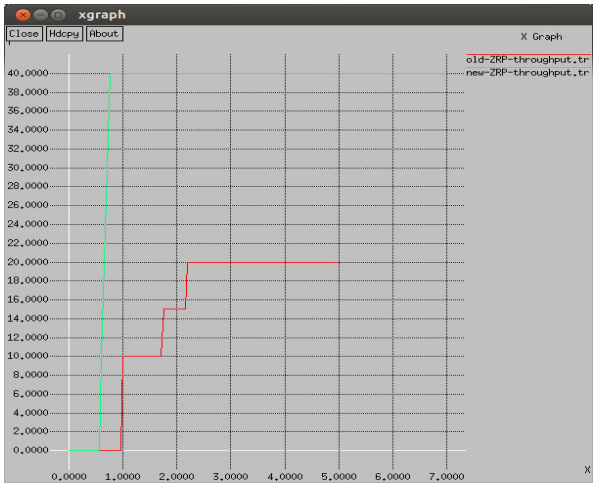


Figure 1.3 Comparison Between Throughput of AODV and ZRP

5.2 End to End Delay:

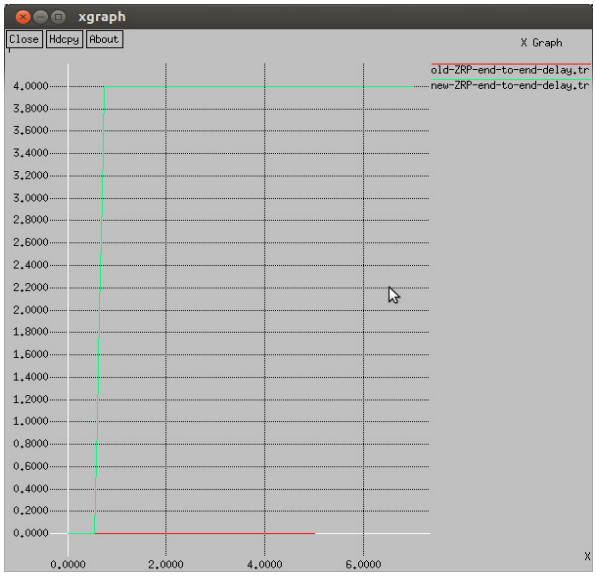


Figure 1.4 Comparison of End-to-end delay B/w AODV and ZRP

The graph is plotted of end-to-end delay in the network. X-axis shows time in seconds and Y-axis shows no of packets. In this graph red lines shows the graph of old scenario in which link failure caused. The second green line is of new scenario in which problem is link failure is resolved. The delay in new scenario is less as compared to old scenario.

5.3 Packet Loss:

Packet Loss graph shows the packet loss comparison of old technique i.e AODV with new technique i.e ZRP. X-axis shows time in seconds and Y-axis shows no. of packets lost during the process. The red line is of AODV Protocol in which packet-loss is more due to link failure. After problem of link failure is resolved in the network, No. of packets lost in the network are less.

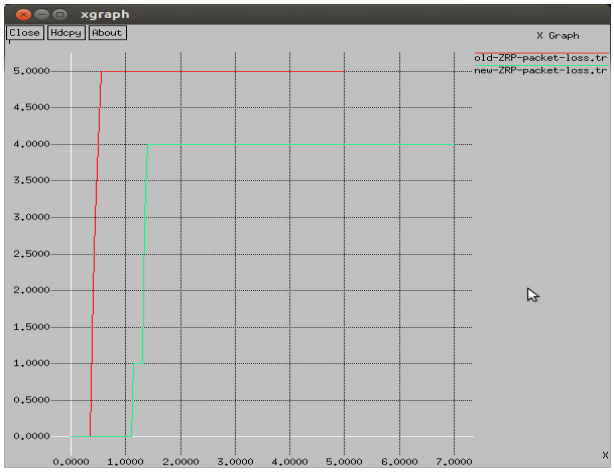


Figure 1.5 Comparison between Packet Loss in MANET b/w AODV and ZRP

5.4 Energy Consumption in the Network:

Graph shows the energy consumption in AODV protocol during link failure and enegy consumption in the network after link failure problem is resolved. Clearly, In Zone Routing protocol, energy consumption is less as compared to AODV protocol.

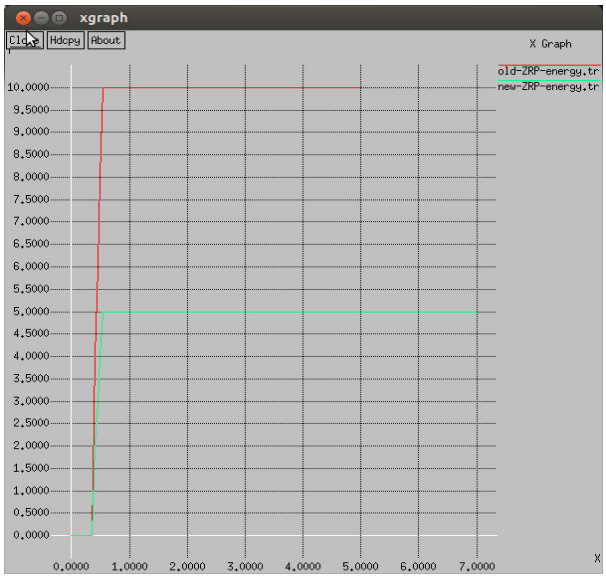


Figure 1.6 Energy Comparison b/w AODV and ZRP

6. Conclusion

As MANET is the self configuring type of network, the problem of load unbalancing generally exists. During data transmission there is a problem of link failure in manet which decreases network performance and reliability. In the previous type various techniques had been proposed for load balancing. The most advanced and energy efficient technique is multipath

routing which is based on dynamic queue threshold values. In this work enhancement in the proposed technique will be done to increase its efficiency in terms of energy, throughput and delay.

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