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Enhancing the Transmission Amoung Networks by Using Border Nodes

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***Abstract*—In todays world transmitting a data from a source to destination is very easy. The various layers in the TCP/IP, mainly Network layer plays a vital role in this process. As there is a good, there should be an evil. In this way the transmission losses are equally spoiling the system with a larger process. In order to overcome this issue the normal nodes should be altered in such a way that, the nodes must not only act as a node, but at times it should be a multi-faceted. Thus the traditional method of ZRP is followed here, where in the border nodes are configured as Mobile Stations or BSC.**

***Keywords*—IERP, IARP, ZRP, RT, DVR.**

I. INTRODUCTION

Ad-hoc networks are mobile wireless networks that have no fixed infrastructure. There are no fixed routers – instead each node acts as a router and forwards traffic from other nodes. Ad-hoc networks were first mainly used for military applications. Since then, they have become increasingly more popular within the computing industry. Applications include emergency search-and rescue operations, deployment of sensors, conferences, exhibitions, virtual classrooms and operations in environments where construction of infrastructure is difficult or expensive. Ad-hoc networks can be rapidly deployed because of the lack of infrastructure. A MANET (Mobile Ad-hoc Network) is a type of adhoc network with rapidly changing topology. These networks typically have a large span and connect hundreds to thousands of nodes. Correspondingly, the term Reconfigurable Wireless Networks (RWN) refers to large ad-hoc networks that can be rapidly deployed without infrastructure and where the nodes are highly mobile. In this paper, we concentrate on routing in large ad-hoc networks with high mobility.

Since the nodes in a MANET are highly mobile, the topology changes frequently and the nodes are dynamically connected in an arbitrary manner. The rate of change depends on the velocity of the nodes. Moreover, the devices are small and the available transmission power is limited. Consequently, the radio coverage of a node is small. The low transmission power limits the number of neighbor nodes, which further increases the rate of change in the topology as the node moves. Because of interference and fading due to high operating frequency in an urban environment, the links are unreliable. Ad-hoc networks are further characterized by low bandwidth links. Because of differences in transmission capacity, some of the links may be unidirectional. As a result of link instability and node mobility, the topology changes frequently and routing is difficult.

1.1 Comparison of various Routing Protocols in Ad-hoc Networks

There are large number of Routing Protocols with their own advantages and disadvantages. In order to select the best protocol for this bordercasting issue let's compare some of the best Protocols. This comparison mainly comprises of topology, route selection and bandwidth allocation. Location based topology sometimes does not suite for terrain regions.This issue can be resolved by increasing the transmission. Increasing the transmission power leads to overhead problems. To overcome these issues we go for Zone Routing Protocol. In this protocol the overhead issues are corrected as well as with low transmission power it is possible to transmit over a longer distance. The existing and proposed methods are shown in the Table 1.2 given below.

Table 1.1 Comparison of various Routing Protocol

Protocol Name	Advantage	Disadvantage
Proactive Routing	Table based routing, so it is easy to get node information.	Maintain a route even when not in use. Occupies available Bandwidth
Reactive Routing	Maintain Routes that are currently in use.	First packet is sent with some delay, since it has to search for a route. If destination changes packet loss occurs.
Hybrid Routing	Global reactive and Local proactive	Periodic update of nodes includes network overhead
AODV	Uses reactive routing. Uses Destination Sequence Number. Uniform update to destination is sent. Reduces the need of memory and there by excludes the data's that are already present.	More time is needed for initial connection setup. Intermediate nodes should not contain old entries. If acknowledge packet come from more than one route, then it leads to inconsistency. Periodic Beacons consume more Bandwidth.
TORA	Creates Directed Acyclic Graphs i.e., no loop formation is seen here. Reduces overhead since there is no need to Re-broadcast. Performs in dense environment also.	DSDR and AODV perform well than this. Low throughput and overload to the network.
Geographic Routing Protocol	The neighbouring node is well known to the source through GPS. Routing table is not maintained. Route discovery and management is not needed. It's Highly Scalable. Suitable for High mobility pattern.	Requires position determining pattern. GPS doesn't work inside tunnels.
GPSR	To forward a packet the node has to remember only one hop neighbour location. Forward packet decisions are made dynamically.	Intermediate node is never updated. Information about the source is to be periodically updated to the neighbour node.
GSR	It depends on the topology of the node. Considers preselected shortest path. Packet delivery ratio is better and Scalable.	It neglects the situation where there are minimum nodes for forwarding. High overhead due to periodic hello and control messages.
LAR	Reduces overhead due to flooding. Sends packets to area where the destination node is present. Uses two zones request zone and expected zone.	No periodic updates are seen here. If the distance between two nodes is larger it leads to packet drop.
ZRP	Uses both proactive and reactive routing. Here the broadcast routing is used to flood the packets. Zone partitioning is done here.	When the radius is small then it does not perform well.
DSDV	Each node maintains a routing table. Periodic broadcast of shortest path to the neighbour. Considers neighbour node as routers.	Overhead problem occurs due to routing table. It limits the number of nodes in the network. It is not good in route updating mechanism. Topology should not change

II. ZONE ROUTING PROTOCOL

Zone Radius plays a vital role in ZRP. By extending the Zone Radius various applications can be implemented in VANET's. When the demands for the routes is high or when the zone has many slow moving nodes then we require larger routing zone. Similarly smaller routing zones are seen where the route demand is low or the nodes move at a faster rate. In common ZRP the Neighborhood Discovery mechanism is used, but here the Bordercasting mechanism is used. Bordercasting to peripheral nodes can be done in two ways they are, by maintaining a multicast tree for the peripheral nodes. Source is the root of this tree. Otherwise, Source maintains complete routing table for its zone and routes the packet to the peripheral nodes by consulting this routing table.

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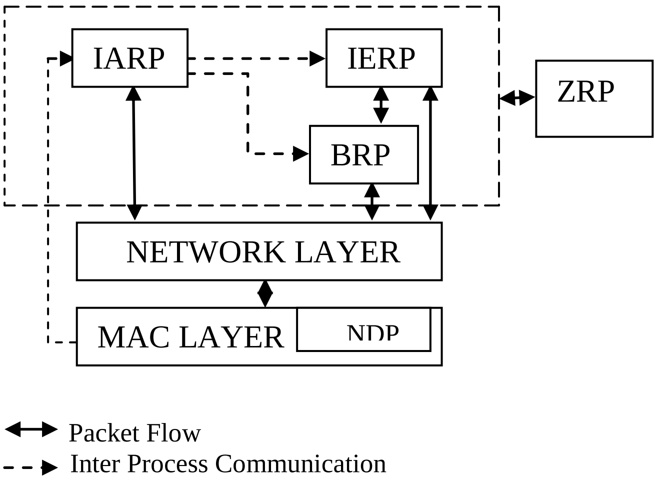
2.1 Archiecture

There are large number of components working for ZRP which makes it efficient. All the components work independently with different technology in order to get the best throughput. For example Reactive protocol such as AODV can be used as IARP [4]. Figure 2.1 explains different protocols and their functionalities.



2.1 ZRP Architecture

2.2 Intra Zone Routing Protocol

ZRP generally assumes that the neighbour discovery is processed on the linked layer and is provided by the Neighbour Discovery Protocol (NDP) [7]. IARP serves as the initial step in ZRP. It is used for communicating inside the routing zone. The routing zone is limited by the zone radius ρ (number of hops to the peripheral nodes). The local neighborhood of a node changes frequently and thus leading to bigger impact on the routing behavior. Another important parameter to be considered is that IERP is table driven.

The nodes have to maintain an updated routing table in order to maintain a clear map through which the nodes can reach locally.

Route optimization is seen in IARP which helps in eliminating the redundant routes and shortening the path with minimum number of hops.

It is essential for IARP to provide support for unidirectional links among the local nodes. This is because at times there may be connectivity problems as well as weak signal limitations.

2.3 Inter Zone Routing Protocol

The basic operation of zone routing based route discovery through a simple (and as we will see, inefficient) IERP implementation is seen here. The source node, in need of a route to a destination node, first checks whether the destination lies within its routing zone [5]. (This is possible since every node knows the content of its routing zone). If a path to the destination is known, no further route discovery processing is required. On the other hand, if the destination is not within the source's routing zone, the source bordercasts a route query to all of its peripheral nodes. Upon receipt of the route query, each peripheral node executes the same algorithm. If the destination lies within its routing zone, a route reply is sent back to the source, indicating the route to the destination. If not, this node forwards the query to ITS peripheral nodes. This process continues until the query has spread throughout the network.

2.4 Bordercast Resolution Protocol

The Bordercast Resolution Protocol initiates a direct route from reactive IERP to the peripheral nodes thus removing redundant queries and increasing the efficiency [6]. Utilizing the map provided by active IARP it is easy to construct a Bordercast tree. Unlike IARP and IERP, it is not so much a routing protocol, as it is packet delivery service. The BRP keeps a record of which node a query packet is sent in order to reduce duplication. When a node receives a query packet that does not lie within its routing zone it constructs a bordercast tree so that it can forward the packet to its neighbor.

In order to find out whether the query packet is in the routing zone or not two levels are query detections are provided. The first level of query detection detects whether the nodes is being covered in the respective zone. Secondly consider a network that uses single bordercast channel in which a node can determine the information by listening to the traffic broadcasted among the nodes.

Selective broadcasting is done in BRP in order to eliminate unnecessary broadcasting. Similar to ZRP, BRP also takes the advantage of both proactive and reactive.

III. PROPOSED METHOD

Comparing both the methods (IARP & IERP), IARP is considered to be the best because of its high PDR and throughput. This is because the transmission takes place inside the routing zone. IERP here suffers a series of problems such as low PDR and throughput. Let us now analyze the connectivity issues in ZRP. It is clear that IERP suffers a lot when compared to IARP. Thus a solution should be obtained to overcome the various issues in IARP.

The simulation scenario is explained in the table given below. The tool used here is Network Simulator-2.

Table 3.1 Simulation Parameters

Simulation Parameter	IARP	IERP
Propagation Type	Two Ray Ground	Two Ray Ground
Layer	Linked Layer	Linked Layer
Queue Length	800	500
Number of Nodes	35-40	20-30
Topology	1300 x 900	450 x 450
Energy of the Nodes	100 Joules	200Joules
Traffic Generated	Constant Bit Rate	Constant Bit Rate
Hello Packet Duration	0-8 S	0-6 S
Simulation Time	30 S	22 S
Transmit Power	1.2	1.5
Receive Power	1.0	1.0
Idle Power	0.8	1.2

IV. EXPERIMENTAL SCENERIO

The IARP and IERP scenario is depicted as mentioned above in the table. In IARP we consider the transmission that takes place inside one routing zone as shown in Figure 4.1. The source and destination are placed in one routing zone. This results in easier transmission. In figure 4.2 it is clearly seen that the packet drop is very low because of its simpler scenario considerations as explained before. The plane considered here is of dimension 1300 x 900. The transmission power used here is minimum, thus reducing the overhead issue and increasing the Packet Delivery Ratio.

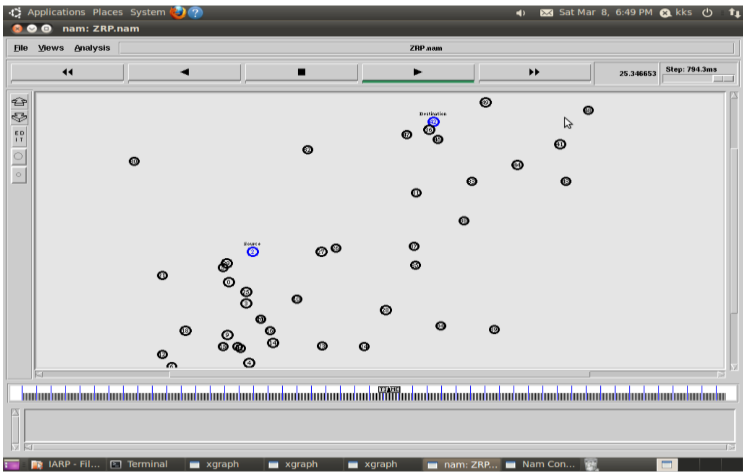


Figure 4.1 IARP Scenerio

Initially 45-50 nodes take part in the transmission process, in which all the nodes are placed in the same routing zone.

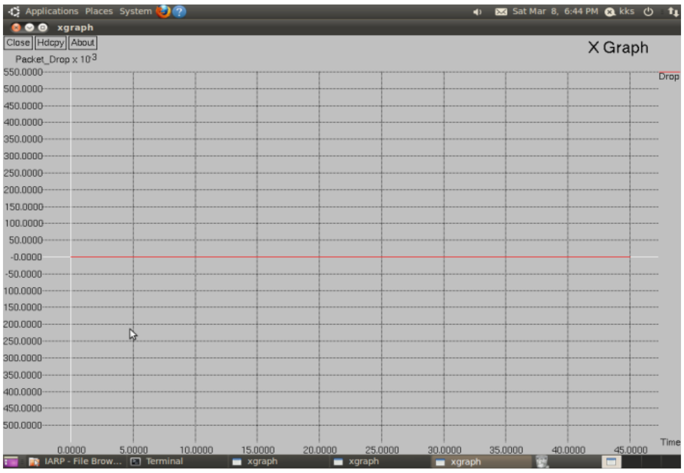


Figure 4.2 Packet Drop of IARP

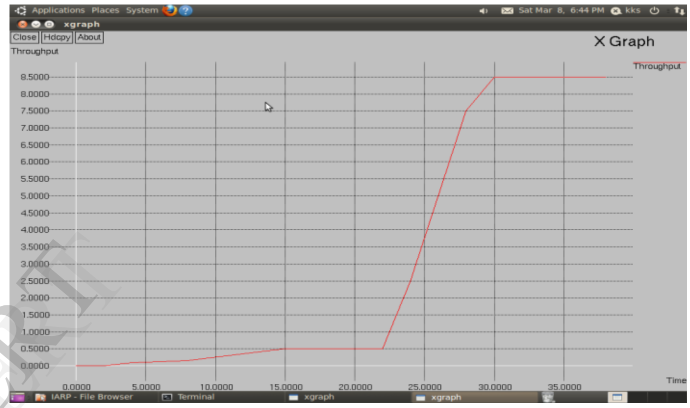


Figure 4.3 Throughput of IARP

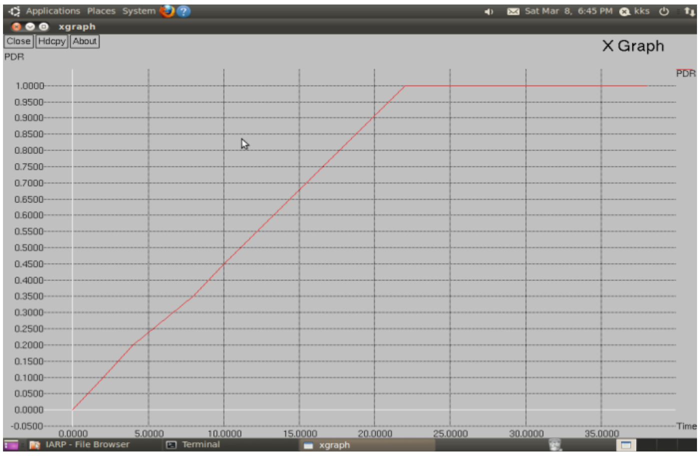


Figure 4.4 PDR of IARP

In IERP the transmission power is used at a higher rate resulting in increase of overhead. The results of IERP are no good as IARP. In order to overcome this IARP related issues

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we go for the bordercasting method, in which static nodes are placed at the edges of each routing zone. In this paper we deploy a master node that collects all the information about the nodes present in a zone. Thus when these two master nodes communicate with each other then the packet drop issue gets reduced.

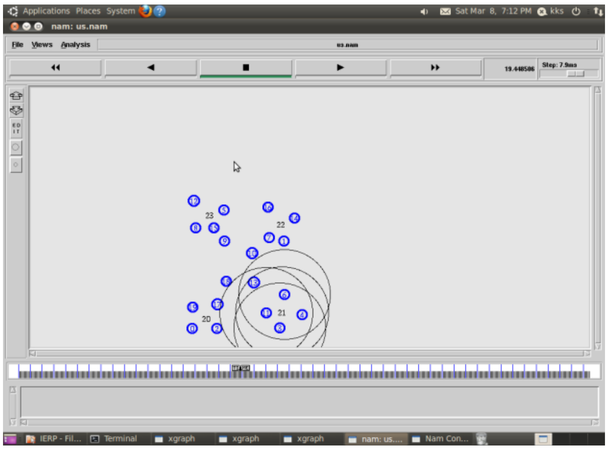

Figure 4.5 IERP Scenerio

In the above scenario we have partitioned the plane into four considering each partition to be a routing zone. In this type of routing the source and destination are not seen in the same routing zone. Thus the packet drop is higher and the PDR and the throughput are very low.

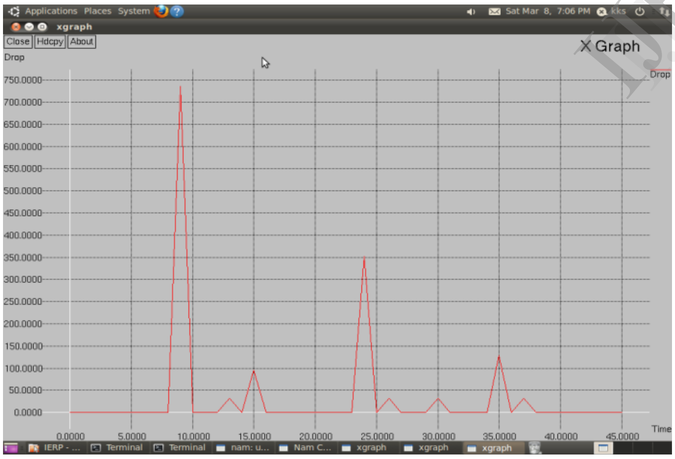

Figure 4.6 Packet Drop of IERP

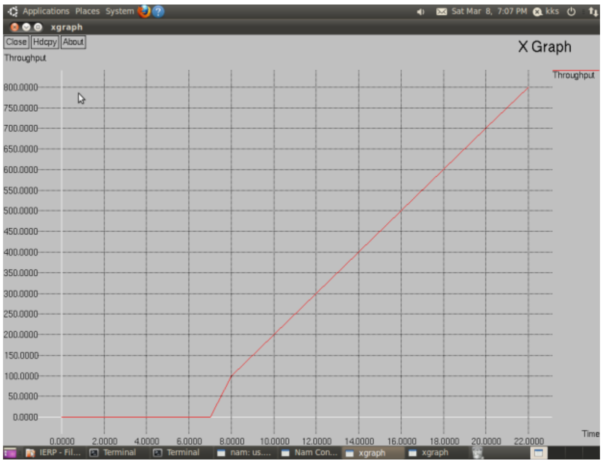

Figure 4.7 Throughput of IERP

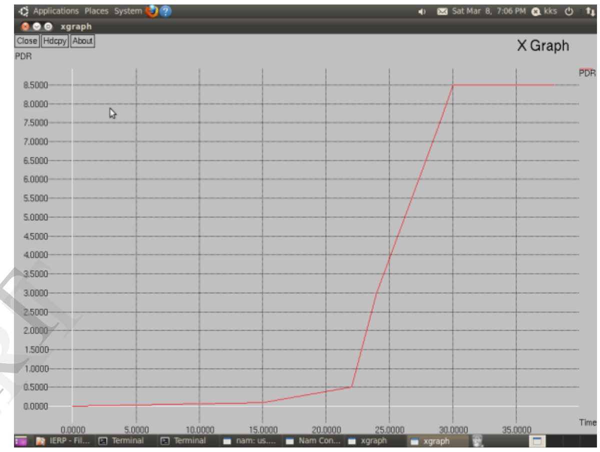

Figure 4.8 PDR of IERP

In bordercasting the RSU's are deployed in order to transmit over a longer distance. The RSU's takes care of the nodes that are weaker in their transmit range. These device collects the transmit signals and delivers to the destination either by broadcasting or by routing table. In this model the RSU's are converted into Cluster Heads which increases its efficiency and thus increases the Packet Delivery Ratio and throughput.

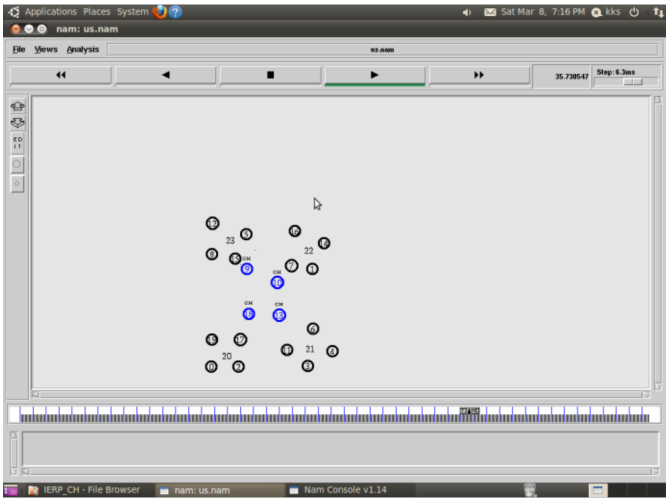

Fig 4.9 BRP Scenario

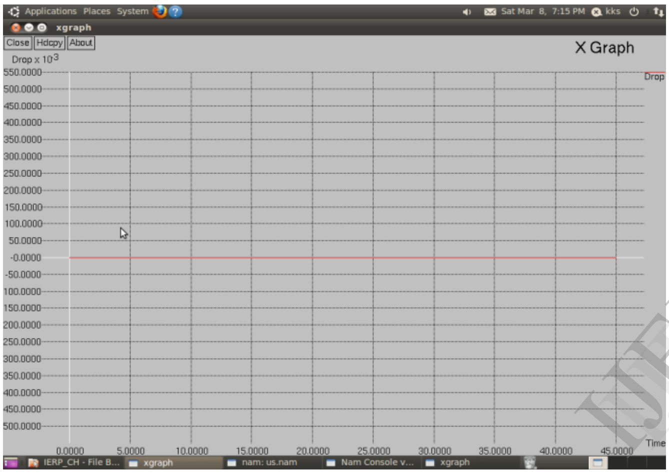

Fig 4.10 Packet Drop of BRP

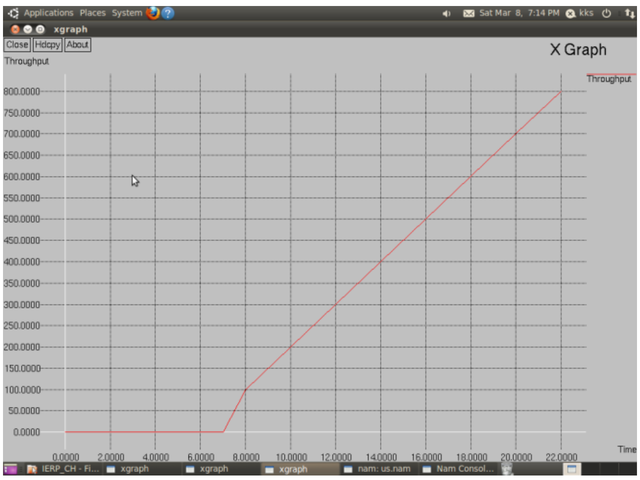

Fig 4.11 Throughput of BRP

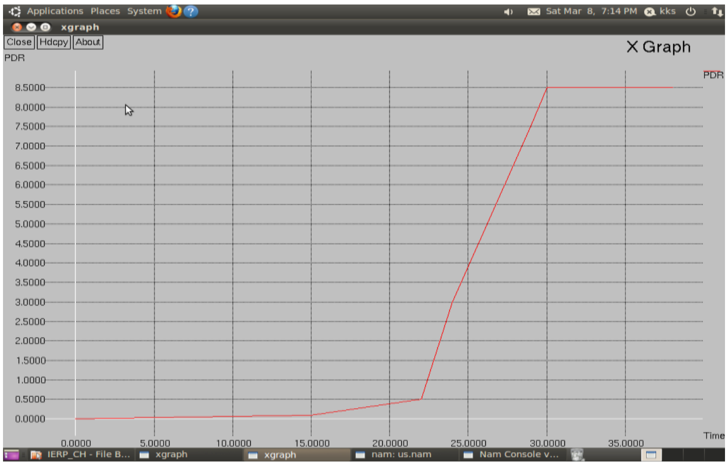

Fig 5.12 PDR of BRP

In this method the cluster head that is present in the borders of the zone collects information about the nodes that are present in their transmission area. So it is easier to transmit the data's from source to destination with lesser transmit power. The results using RSU and the Cluster Head method are the same, but in cluster head method the transmission power is reduced upto 25%.

V. CONCLUSION

ZRP can be classed as a hybrid reactive or proactive routing protocol. ZRP refers to the locally proactive component as the IntrA-zone Routing Protocol (IARP) and the globally reactive routing component is named as Inter-zone Routing Protocols (IERP).IARP maintains routing information for nodes that are within the routing zone of the node. Correspondingly, IERP offer enhanced route discovery and route maintenance services based on local connectivity monitored by IARP. Inter zone routing communication involves two processes namely route request and route reply for path identification.

The traffic and packet loss will be very less when communication takes place within the zone when compared in between the zones. It should be avoided for better and proper communication .ZRP controls traffic using different query control mechanisms. To prevent losses we undergo a concept called cluster head. Cluster heads acts as a base station and broadcast the information to the respected node. Cluster heads of different zones will act as the intermediate nodes through which the packet transmission will takes place. Automatically the loss of packets and traffic on transmission will get reduced. Based on the studies made, we can conclude that the ZRP is better than any single proactive and reactive protocol.

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