

## GSM Based Comparative Investigation of Hybrid Routing Protocols in MANETS

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**Abstract:** The field of Adhoc Network has gained an important art of the awareness of researchers and become very popular in last few years. Adhoc network can operate without fixed infrastructure and can survive rapid changes in the network topology. This paper presents a survey on the art of energy efficient routing protocols for Mobile Ad-Hoc Network (MANET). Since the nodes in MANET are movable, the routing and power management become significant issue. In this paper, the performance comparisons of mobile ad hoc network's protocol with its quality of service factors has been considered. The main concentration of the paper is on hybrid routing protocols which is basically combination of proactive and reactive routing protocols. In this paper three different types of hybrid protocols are chosen for performance comparison on the basis of diverse simulation parameters.

**Keywords:** IARP, IERP, MANET, PDR, TORA, ZHLS, ZRP.

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### I. Introduction

In this global scenario, with the advance of the wireless communication technologies, small size and high performance computing and communication devices have been increasingly used in daily life and computing industry (e.g., commercial laptops and personal digital assistants equipped with radios). The network used in this paper does not rely on a fixed infrastructure and works in a shared wireless media. Such a network, called a mobile ad hoc network (MANET), which is a self-organizing and self configuring multi-hop wireless network, where the network structure changes dynamically due to member mobility[3]. Due to these special features, the design of routing protocols for MANET becomes a challenging task. Routing is one of the key issues in MANETs due to their highly dynamic and distributed nature.[10]. The performance of a mobile ad-hoc network depends on the routing scheme employed, and the traditional routing protocols do not work efficiently in a MANET. Developing routing protocols for MANETs has been an extensive research area in last few years, and many proactive, reactive and hybrid protocols have been proposed from a variety of perspectives. These protocols try to satisfy various properties, like: distributed implementation, efficient utilization of bandwidth and battery capacity, optimization of metrics, fast route convergence and freedom from loops[11].

### II. Introduction to routing protocols

Routing protocols define a set of rules which governs the journey of message packets from source to destination in a network[9]. In MANETs there are three types of routing protocols which are listed below:

1. Reactive routing protocols
2. Proactive routing protocols
3. Hybrid routing protocols

These protocols can be summarized as:

#### 1. Reactive routing protocols

In reactive routing protocols a route discovery procedure is started whenever a node demand for a route for packet transmission. This type of routing protocol is also known as on-demand routing protocol or source-initiated routing protocol. The main feature of reactive protocol is that it imposes less overhead due to route messages on the network. e.g. AODV, DSR, ABR etc[4,8].

#### 2. Proactive routing protocols

These protocols require each node to maintain one or more tables to store routing information and they respond to changes in network topology by propagating updates of routes throughout the network in order to maintain a consistent network view. e.g. DSDV, OLSR, WRP etc[2].

### 3. Hybrid routing protocols

Hybrid routing protocols combine the advantages of both proactive and reactive routing protocols. The routing is initially launched with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. e.g. ZRP, ZHLS, TORA etc[4].

### III. Brief Description of ZRP, ZHLS and TORA

- **ZRP (Zone Routing Protocol):**

ZRP is a combination of both proactive and reactive routing protocols. Proactive protocols are used for finding neighbors within the zone. In the same way, reactive protocols are used for routing purposes between different zones. ZRP is proposed to reduce the control overhead of proactive routing protocol and decrease the latency caused by route discovery in reactive routing protocol. ZRP is created from two sub-protocols:

- a) IARP (Intra zone routing protocol) is a proactive routing protocol which is used inside the routing zone.
- b) IERP (Inter zone routing protocol) is a reactive routing protocol which is used between routing zones[8].

- **ZHLS (Zone-based Hierarchical Link State Routing Protocol):**

In ZHLS, the network is divided into no-overlapping zones as in cellular network. Each node knows the node connectivity with its own zone and the zone connectivity information of the entire network. The Link state routing is performed by employing two levels: node level and global zone level. Each node has a node ID and zone ID calculated with the help of location tool GPS (Global Positioning System). Source node on the transmission of data packets will first check its intra-zone routing table and if the destination resides in its zone then the routing information are already present, no need for broadcasting[5].

- **TORA (Temporary Ordered Routing Algorithm)**

TORA is a highly adaptive, efficient and scalable distributed routing algorithm based on the concept of link reversal. It is proposed for highly dynamic mobile, multihop wireless networks. It is a source-initiated on-demand routing protocol. It finds multiple routes from a source node to a destination node. TORA has a unique feature of maintaining multiple routes to the destination so that topological changes don't require any reaction at all[1].

### IV. Simulation Setup

The performance comparison work is done using NS-2 simulator running on windows-7 operating system. The table shown below gives description about the hybrid routing protocols and the mobility model.

**Table 1: Simulation arrangement**

Routing protocols used	TORA, ZHLS, ZRP
Packet Rate	50 packets/sec
Simulation Area	5km x 5km
Nodes	25, 50, 75, 100, 125
Traffic	High quality GSM voice
Simulation time	1000 sec.
Node speed	10 m/s
Physical Standard	802.11b

### V. Performance Parameters

**1. Number of packets sent:** During transmission of data in simulated ad hoc network routing traffic is sent by all wireless nodes. In other words it shows that how much traffic is sent by source node to destination node with the help of intermediate node in particular simulation area using MANET routing protocols.

**2. Number of packets received :** It is basically number of packets received by the destination node from the source node via intermediate nodes for specified simulation area. The number of packets received can be calculated by subtracting number of packets lost and number of packets dropped from the number of packets sent. Mathematically, it can be represented as,

$$P_r = P_s - (P_l + P_d)$$

where  $P_r$  is number of received packets,

$P_s$  is number of sent packets,

$P_l$  is number of packets lost and

$P_d$  is number of packets dropped[6].

**3.Number of packets dropped:** When one or more packets sent from source to the destination fail to reach their destination and are dropped by the routers in between the transmission due to any error condition in the network, they are considered as dropped packets.

**4.Throughput:** Throughput is the average rate of successful data packets received at destination. It is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second.

**5.Packet Delivery Ratio** It is the ratio of the packets received by destination to those generated by the sources. It measures the loss rate as seen by transport protocols and as such ,it characterizes both the correctness and efficiency of adhoc routing protocols. Mathematically, it can be represented as,

$$PDR = P_r / P_s$$

where  $P_r$  is number of received packets,

$P_s$  is number of sent packets.

A high PDR is desired in any network[6].

### VI. Results And Observations

In this research work, three hybrid routing protocols are discussed by varying the number of nodes in a standard area of 5000m\*5000m on the basis of the some performance parameters viz. number of packets sent, number of packets received, number of packets dropped, throughput and PDR which are discussed below with the help of line graphs:

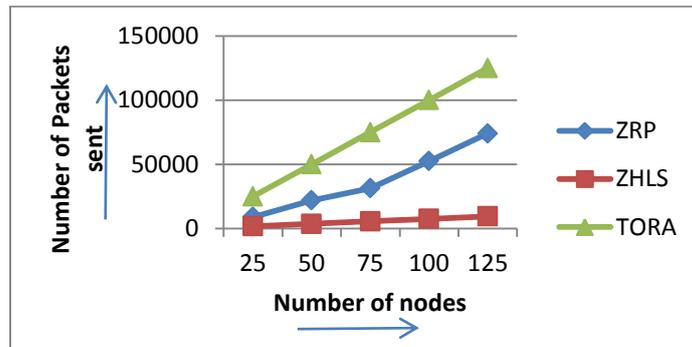


Fig. 1: Number of packets sent for ZRP,ZHLS and TORA by varying number of nodes.

In figure1 ,the number of packets sent are maximum in case of TORA as compared to ZRP which is further more than ZHLS.

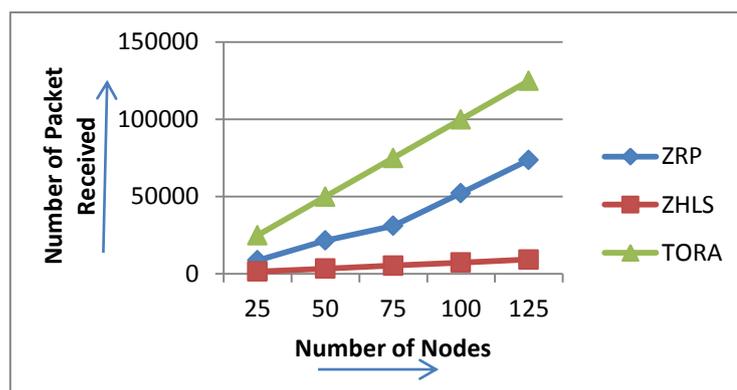


Fig.2: Number of packets received for ZRP,ZHLS and TORA by varying number of nodes.

In figure2 ,the number of packets received are maximum in case of TORA as compared to ZRP which is further more than ZHLS.

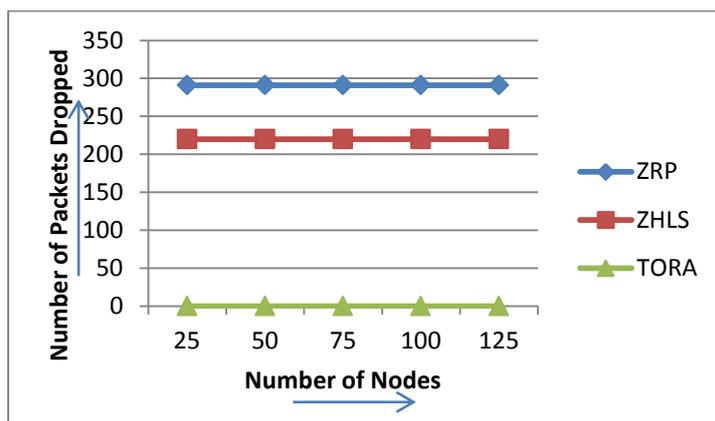


Fig. 3: Number of packets dropped for ZRP,ZHLS and TORA by varying number of nodes.

In figure3, the number of packets dropped in case of TORA is less in comparison to ZHLS which is further less than ZRP. So, here in this case TORA is counted better than ZRP and ZHLS.

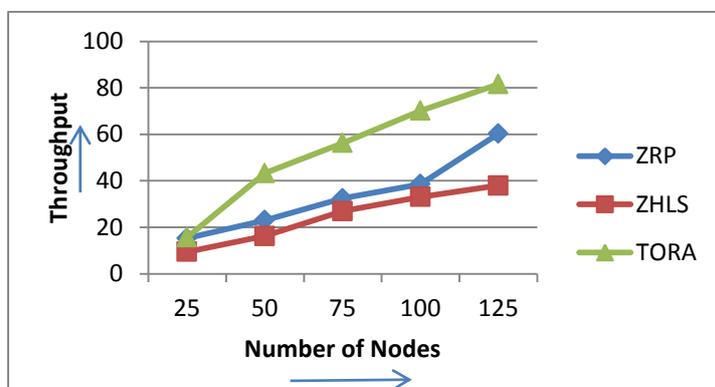


Fig. 4: Throughput for ZRP,ZHLS and TORA by varying number of nodes.

In figure4 ,TORA has maximum value of throughput as compared to ZRP as well as ZHLS. So, it gives better output response than the other two protocols.

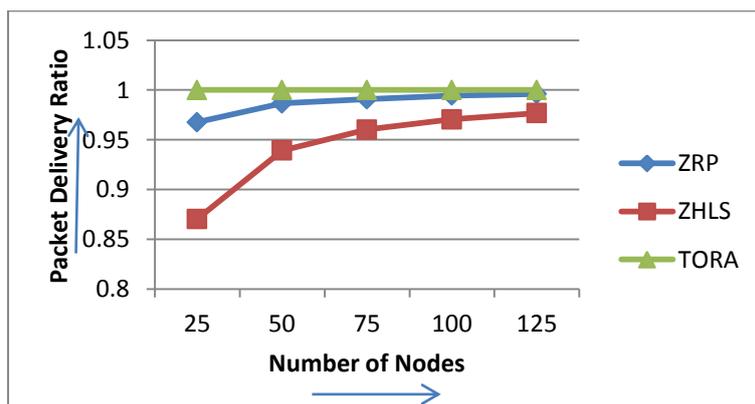


Fig.5: Packet Delivery Ratio for ZRP,ZHLS and TORA by varying number of nodes.

In figure5 ,the ratio of number of packets received to the number of packets sent i.e. packet delivery ratio is more in case of TORA as compared to ZRP and ZHLS.

### VII. Conclusion

On the basis of parameters discussed in results section, the overall result concludes that TORA sends maximum number of packets, receives maximum number of packets, drops less number of packets, gives nice throughput and PDR. Due to all these parameters, TORA gives overall outstanding results as compared to ZRP which is further better than ZHLS.

### **VIII. Future Scope**

In future, this work can be extended by increasing number of nodes, by increasing the simulation area or by using any other simulators instead of NS-2.

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