A Competitive Study among different Hybrid Routing Protocols using High Quality GSM Voice as Input

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ABSTRACT
Mobile adhoc networks are self-configuring networks having dynamic topology which don't require any type of pre-installed infrastructure. All the nodes in MANETs perform the operations of both host as well as router. The nodes in MANET should be able to relay the traffic from one node to another since the communicating nodes can be out of range. Due to various applications that use MANETs for the purpose of wireless roaming, it is a recent research area. There are different characteristics for research like synchronization, routing, bandwidth considerations etc. The main concentration of this paper is on routing protocols of MANETs. There are several routing protocols proposed for MANETs, out of which different types of hybrid routing protocols are chosen for the research work. This paper basically examines the performance of diverse routing protocols based on different performance metrics like number of packets sent, number of packets received, number of packets dropped etc[7,13].

Keywords
MANET,TORA, ZHLS,ZRP.

1. INTRODUCTION
Mobile Adhoc Network is an assembly of multi-hop wireless nodes that interacts with each other exclusive of established infrastructure or centralized control. The communication links available for wireless communication in this network are prone to error and can often drop down due to interference, mobility of nodes and infrastructure less environment. So, routing is a significant task in MANETs due to the presence of dynamic topology. The main objective of any MANET routing protocol is to face this type dynamic topology. The problem in designing such routing protocol is not easy since several challenges are introduced in MANET environment which are not present in infrastructure networks like cellular networks. The routing protocols are broadly classified into three categories:

1.Proactive Routing Protocols

2.Reactive Routing Protocols

3.Hybrid Routing Protocols

The research work carried out for comparative analysis in this paper is first and foremost based on hybrid routing protocols[9].

2. HYBRID ROUTING PROTOCOLS
These protocols integrates the merits of reactive as well as proactive routing protocols. The nodes present in the hybrid routing protocols are grouped into different zones based on the geographical location or distance between each other. Within a single zone, routing is performed by using proactive or table-driven method while reactive or on-demand routing is applied for routing at the exterior of zone boundaries[5]. In hybrid routing protocols, the proactive and reactive algorithms are used to route the packets. The route is created with proactive routes and uses reactive flooding for new mobile nodes[10]. The reactive and proactive protocols include the capability of other routing protocols exclusive of compromising with its own benefits[12]. The hybrid routing protocols have less time for route discovery and no overhead of routing information[8]. Hybrid routing protocols have the prospective to offer higher scalability than the pure reactive or proactive protocols. This is because they try to reduce the number of rebroadcasting nodes by defining a structure, which allows the nodes to work together in order to organize how routing is to be performed. By working together the most suitable nodes can be employed to carry out route discovery[4].

2.1 Zone Routing Protocol (ZRP)
It is a type of hybrid routing protocol having fundamental scheme that each node has a pre-defined zone centered at itself in terms of number of hops[6]. ZRP comprises of 2 components i.e. IARP and IERP. Within the zone, proactive Intrazone Routing Protocols (IARP) is used to maintain the routing information. IARP can be among any of the type of routing, it can be distance vector routing or link state routing depending on realization. For nodes outside the zone, reactive Interzone Routing Protocol (IERP) is used. IERP uses the route request (RREQ) /route reply (RREP) packets to discover a route in a way analogous to classic on-demand routing protocols. IARP always provides a route to the nodes within a node's zone. When the proposed destination is not known to the node i.e. missing in its routing table, that node must be present outside of its zone area. Therefore, a route request (RREQ) packet is broadcast through the nodes on the boundary of the zone. Such a RREQ broadcast is called Bordercast Resolution Protocol (BRP)[3].

2.2 Zone-Based Hierarchical Link State Routing Protocol (ZHLS)
In ZHLS, a particular area is divided into different zones. A node determines in which zone it exists with the help of location tool i.e. Global positioning System (GPS). This GPS is used to calculate the node ID as well as the zone ID of each and every node. Each node floods its Link State Packet (LSP) in the form of above said node ID and zone ID. The different zones created by dividing the area is further divided into sub-zones, which is regarded as as an suitable topology of significant MANET. With the advancement in GPS technology and also due to reduced cost of GPS, its receiver can be attached to any movable device without any difficulty and Within a distance of at least one meter, the geographical location of the device can be exactly calculated. So, ZHLS generates low overhead as compared to the flooding in reactive protocols[2,11].

2.3Temporarily Ordered Routing Algorithm (TORA)

It is a highly adaptive, scalable, distributed routing algorithm based on link reversal. The unique feature of TORA is to maintain multiple routes to the destination. No reaction is required in the if the topological changes occur. This protocol reacts only when all the routes to the destination are lost. Whenever, there is partitioning of networks, this network is capable to detect the partition and can also erase the invalid routes[5]. As it follows distributed routing algorithm , so the routers in this protocol are required to maintain the information about the adjacent routers i.e. they should have at least one-hop knowledge[9]. TORA has three basic functions: Route Creation, Route Maintenance and Route Erasure[1]. TORA is basically designed to reduce the communication overhead related to the network topological changes[9].

3. SIMULATION SETUP

NS-2 simulator is used to perform simulation by varying the simulation area. NS-2 is selected because it supports a plenty of hybrid routing protocols and offers easy graphical interface. All the simulation work is performed by taking constant number of nodes and by having different scenarios of 5000m*5000m, 6000m*6000m and 7000m*7000m .

Table 1. Simulation Setup of the research work.

Protocols	ZRP,ZHLS and TORA
Simulator	NS-2.34
Nodes	200
Simulation Area	5000m*5000m,6000m*6000m and 7000m*7000m
Packet Size	1kbps
Simulation Time	1100sec.
Traffic Type	High quality GSM voice

4. PERFORMANCE PARAMETERS USED

4.1Number of Packets Sent

During data communication in adhoc network, the routing traffic is sent by all the wireless nodes. In other words it shows that how much traffic is sent from source to destination with the help of intermediate nodes in a particular simulation area using different MANET routing protocols.

4.2 Number of Packets Received

It is the calculation of number of packets received by the destination node from the source node via intermediate nodes for particular simulation area. The number of packets received can be calculated by subtracting number of packets dropped from the number of packets sent. Mathematically, it can be represented as,

$$P_r = P_s - P_d$$

where P_r is number of received packets,

P_s is number of sent packets and

P_d is number of packets dropped.

4.3 Number of Packets Dropped

When one packet or a sequence of packets sent from source towards the destination fail to arrive at their destination and are dropped by the routers during the transmission because of any error condition in the network, they are considered as dropped packets.

5. RESULTS AND OBSERVATIONS

This section shows a comparative view of the different types of hybrid routing protocols by considering some performance parameters which are shown below graphically.

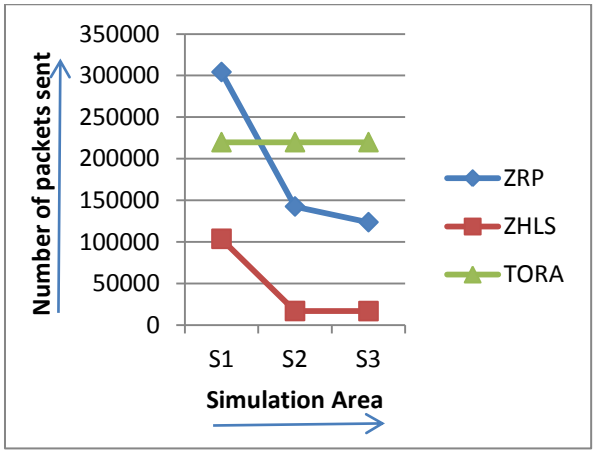

Fig 1:Number of packets sent for different hybrid routing protocols by varying the simulation area.

Figure1 reveals that the number of packets sent for TORA are more in comparison to ZRP and ZHLS except for first scenario ZRP has maximum number of packets sent. But on behalf of the all the scenarios, TORA performs wisely as compared to ZRP and ZHLS.

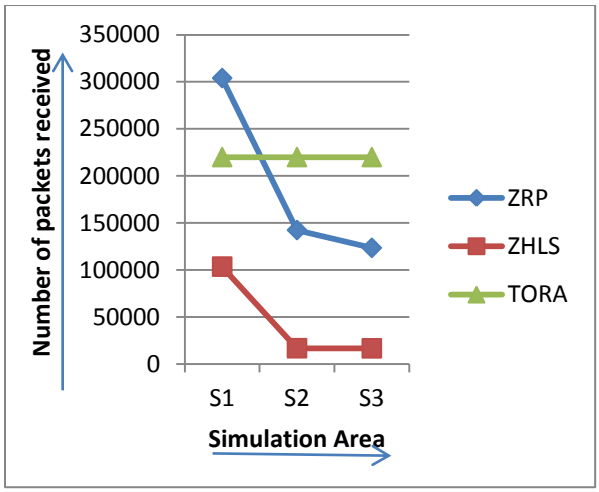

Fig 2:Number of packets received for different hybrid routing protocols by varying the simulation area.

Figure2 explains that the number of packets received for TORA are more in comparison to ZRP and ZHLS except for first scenario ZRP has maximum number of packets received. Similarly, on behalf of the all the scenarios, TORA performs better in comparison to ZRP and ZHLS.

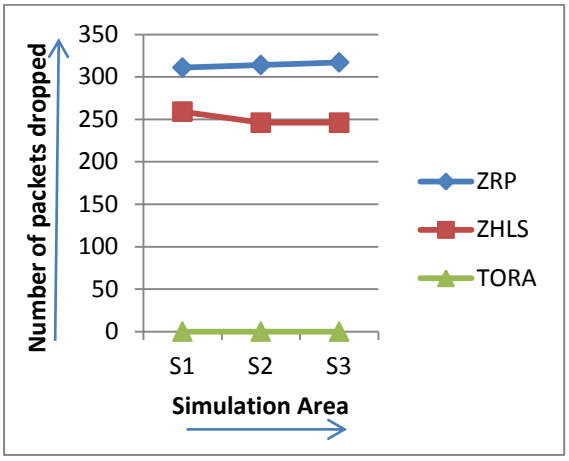

Fig 3:Number of packets dropped for different hybrid routing protocols by varying the simulation area

Figure3 justifies that the number of packets dropped for TORA are the least as compared to ZHLS and ZRP. So, to have maximum amount of throughput, the number of packets dropped should be minimum. So, again in this case for this performance parameter, the result is in favor of TORA.

6. CONCLUSION

This research paper is purely based on hybrid routing protocols where the analysis is done by varying the simulation area and keeping the number of nodes constant. The whole simulation is carried out to find out the number of packets sent, number of packets received and number of packets lost. By comparing these three different hybrid routing protocols, this paper concludes that among ZRP,ZHLS and TORA, TORA shows outstanding performance for all the above listed three parameters.

7. FUTURE SCOPE

In future, the simulation area can be extended and also the number of nodes can be increased. Also, the other simulators like MATLAB, opnet, optisim etc can be used for different types of routing protocols which are not covered in this research paper.

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