Impact Of Random Waypoint Mobility Model On Hybrid Routing Protocols Of Scalable Mobile Ad Hoc Network

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Abstract:
MANET being the decentralised wireless network and due to the ease of deployment gain popularity very rapidly and have a wide acceptance. Due to the increasing use of MANET technology in recent years, different routing protocols are developed. Some of them are under the category of Hybrid Routing protocol. But before their deployment in the real world their performance need to be tested. This is done with the help of simulation tools available. In this paper we discuss the two Hybrid routing protocols i.e. ZRP and LANMAR. This paper discusses the performance measure of application and transport layer parameters of these two routing protocols with the Random Waypoint Mobility Model chosen over scalability of network with the network size ranging from 10 to 120 nodes and compares them over various parameters.

Key words: Pause Time, Random Waypoint Mobility Model, Qualnet5.0, ZRP, LANMAR, MANET

1.Introduction
Mobile ad hoc networks are wireless self configured network which is suitable during
Rescue operations, surveillance and natural disaster. MANET has mobile nodes which are connected to each other temporarily during communication and don't need any kind of infrastructure [8]. In MANET mobile nodes keep on moving, thus entering into new network and making new connection due to which performance of MANET rely on scalability and mobility of the network. Different routing protocols are available for communication between mobile nodes which are divided under the category of proactive, reactive and hybrid routing protocols.
In this paper, we discuss about Hybrid routing protocols (ZRP, LANMAR) which are useful for large networks as they combine the best feature of both proactive and reactive routing protocols. The hybrid routing protocol uses Proactive routing protocols up to some hops and then for long distance communication it uses a Reactive routing protocol. To check the performance of routing protocols we use QualNet5.0 simulator of scalable network.
The aim of this research is to evaluate the impact of pause time which is a parameter of Random Waypoint Mobility Model on application and transport layer parameter of the ZRP and LANMAR routing protocol. The rest of this paper is organized as follows: Section 2 contains the information about ZRP and LANMAR routing protocols. Mobility Model is discussed in the next section and Section 4 contains the simulation environment. Section 5 and section 6 contains result and future work respectively.

2.Routing Protocols
The different Hybrid routing protocols that we will discuss in this paper can be explained as follows:

2.1.Zone Routing Protocol
Zone routing protocol combines the advantages of both proactive as well as reactive routing protocol. ZRP uses proactive routing protocol to communicate within the local neighbourhood and uses reactive routing protocol to communicate over long distances. The local neighbours of a node are its zone. A single node can belong to multiple zones. Radius of a zone is determined by the number of hops to the perimeter of the zone. Within the zone ZRP uses IARP (Intra zone routing protocol) for communication and outside the

zone it uses IERP (Inter zone routing protocol). The nodes within the zone are discovered with the help of Neighbour Discovery Protocol. In IERP when packets are to be transferred then Border cast Resolution Protocol (BRP) which transfer the packets only to peripheral nodes and is used to remove redundancy and improve efficiency [1] [2] [3].

2.2.Landmark Ad-hoc Routing Protocol
LANMAR combine the feature of the Fisheye State routing protocol and Landmark routing. In this each node has a physical identifier and a logical identifier (combination of subnet field and host field) associated with it. In LANMAR nodes which have the same feature form a group which is called as a subnet. Each subnet has a landmark node. It uses a modified version of FSR [6]. FSR maintains a list of all the nodes in the network whereas, LANMAR maintains the list of local nodes and landmark nodes only. When a packet is to be sent to some local node then they are directly transferred but if the destination node is far away then they are first directed to landmark node and from there they are transferred to the destination [3] [5].

3.Mobility Model
Mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. These models are categorized as: File mobility model, Random Waypoint mobility model and Group Mobility Model. File Mobility Model provides us the facility of creating our own specification for the network and then attach it to the simulator. Random Waypoint Model is a model in which nodes randomly move in any direction. On Group mobility model nodes move in a group but inside group, nodes have relative speed [7] [8]. This paper shows the study of the ZRP and LANMAR routing protocols with the RWP mobility model. RWP has a crucial parameter of pause time which indicates the time in which all nodes in the network are motionless but transmitted in continued. In our research, this pause time taken is 10 Sec. If the node can discover its route to the destination from the source node in the given time and till it is in the network of source node, it replies. Otherwise either other routes have found by the node or the packet has to be dropped by the moved node. So, pause time gives the more time to the node to discover the route.

4.Simulation Environment
In this paper, we analyse the behaviour of two Hybrid routing protocols i.e. Of ZRP and LANMAR. To analyse performance of protocols, simulation is required for which different simulation tools are available. For this study, simulation tool used is QualNet5.0 of Scalable Networks [4]. The different specification taken in our research can be explained as the number of nodes taken varies from 10 to 120 nodes which are randomly distributed over an area of 1500*1500 unit area. Mobility Model, energy model and battery model taken is a Random Waypoint Mobility model, mica motes and the Linear Model respectively [5]. Pause time which is a parameter of the RWP mobility model is 10 Sec for all simulations.
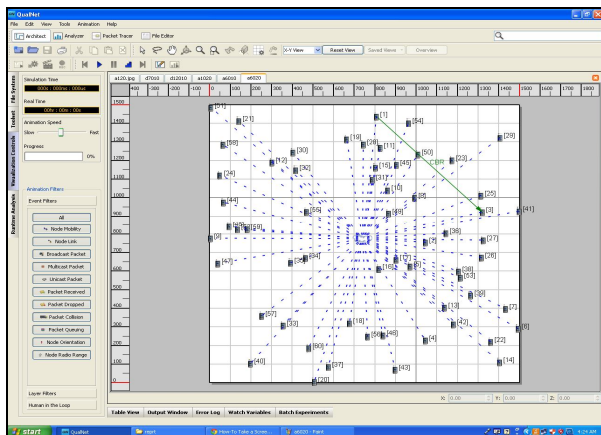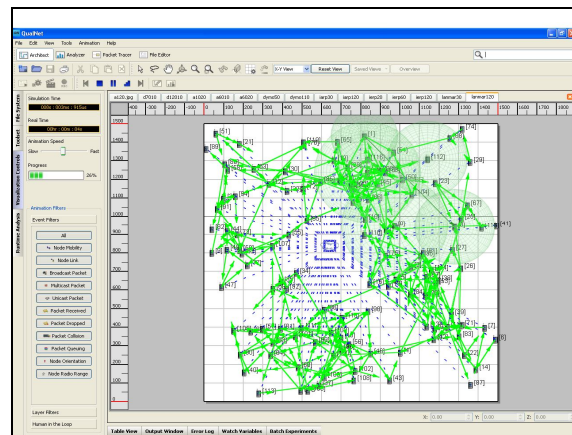

Figure 1: Scenario Of 60 Nodes

Figure 2: Scenario In Simulation Mode

5.Simulation Results
This section contains the simulation results which are obtained by varying the number of nodes from 10 to 120 and with the pause time of 10 sec. The protocol with the consistent values and best performance is the preferred protocol. Initially, we discuss about the application layer parameters.
Average Jitter: Figure 3 shows that average jitter of LANMAR is less and thus delay in packets in also less. Also it is most consistent in LANMAR.
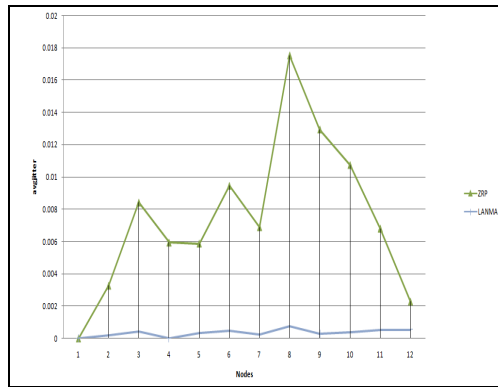
Figure 3: Average jitter

First Packet Received: As shown in Figure 4 LANMAR is better for this parameter. Although at 80 nodes its value decreases sharply but otherwise its value is consistent throughout. On the other hand, ZRP has also consistent value but its value is very less.
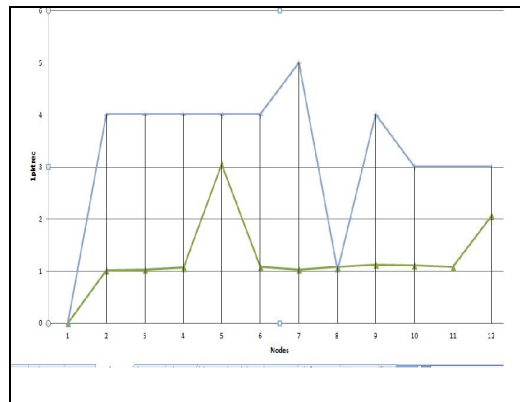

Figure 4: First packet Received

Average Delay: As illustrated by Figure 5 average
delay in delivering of packets is less and consistent in LANMAR whereas, that of ZRP has high values and inconsistent too.
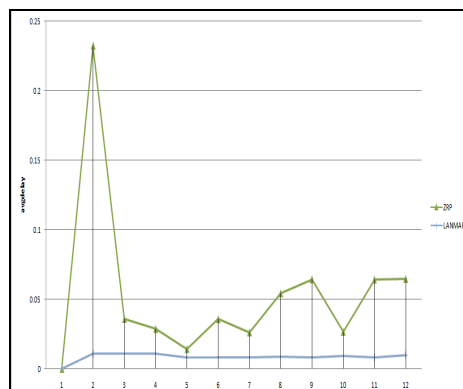

Figure 5: Average delay

Last Packet Received: The study as depicted in Figure 6 shows that last packet received parameter has constant values in LANMAR and is fluctuating in zone routing protocols
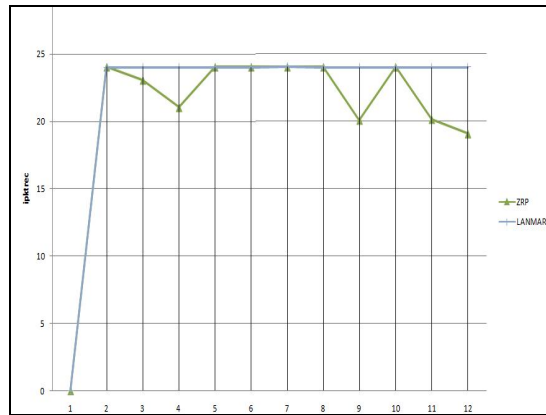
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Figure 6: Last Packet Received

Total Byte Received: This parameter has a peak value in ZRP but zone routing protocol is very inconsistent too. Thus, despite of having the best value in ZRP, LANAMR is considered as the best protocol which is depicted by Figure 7.
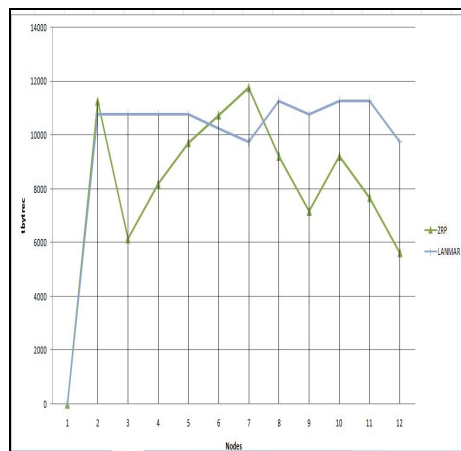

Figure 7: Total Byte Received

Total Packet Received: This parameter has the same behaviour as that of total byte received and thus Figure 8 proves that LANMAR is best in this case too.
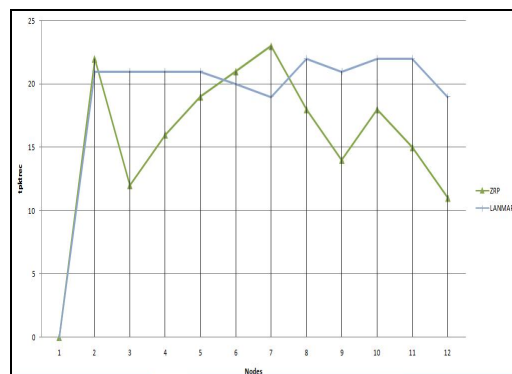

Figure 8: Total Packet Received

Packet from application: Figure 9 shows that ZRP and LANMAR both routing protocols have the same and constant value for this transport layer parameter.
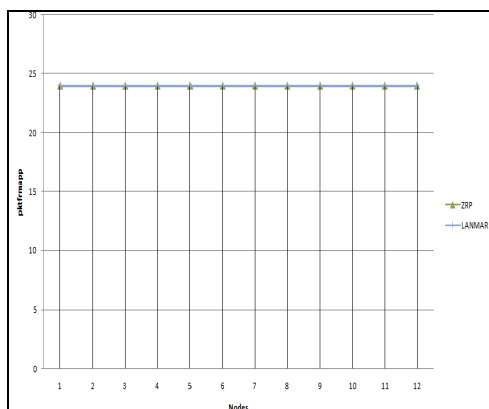
Figure 9: Packet From Application

Packet to application: As shown in Figure 10 packet to application which is a parameter of transport layer has the same behaviour as that of total byte and total packet received parameter of application layer.
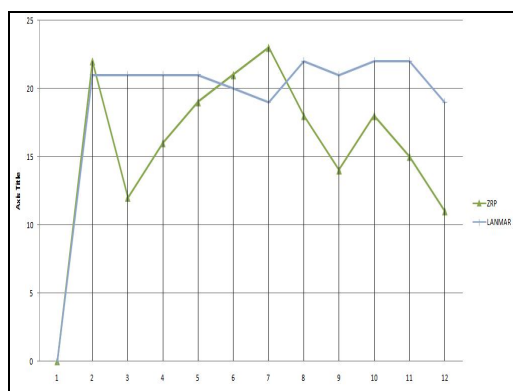

Figure 10: Packet To Application

6.Conclusion And Future Work
In this paper, we study the behaviour of two Hybrid routing protocols i.e. ZRP and LANMAR and our study shows that for almost all parameters LANMAR is best among the two. In future, this work can be extended by comparing the behaviour of all routing protocols and find the best among them. Also the behaviour of security routing protocols can also be compared on various parameters and by taking different mobility models.

7.References
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