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Performance Evaluation of ASMR with QRS and RZLSR Routing Scheme in Mobile Ad-hoc and Sensor Networks

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Abstract

Mobile Ad-hoc Network (MANET) is referred as continuously self configuring and infrastructure-less network of mobile devices connected without wires. The Wireless Sensor Network (WSN) is an emerging area and some of the studies came out with association of MANET, which is referred as MASNET. This paper evaluates the performance of Adaptive Secured Multipath Routing (ASMR) when it is associated with QRS and RZLSR proposals. Multipath routing is an efficient technique in handling failovers and it improves the Quality of Service (QOS). Increasing the number of vulnerabilities imposed us to use the secured multipath routing. The proposed technique is adaptable for MANET and WSN, when they deal with unreliable data communications. ASMR is desperately outperforming when it is associated with RZLSR compared to QRS scheme and it is assisting for secure data transmission.

Keywords: *Multipath Routing, ASMR, QRS, RZLSR*

1. Introduction

A mobile ad-hoc and Sensor network (MASNET) is a dynamically reconfigurable wireless network that does not have a fixed infrastructure [7]. Host mobility can cause unpredictable network topology changes. Therefore, the task of finding and maintaining routes in MASNETs is very important. Many routing protocols have been proposed for MANETs to achieve efficient routing [1, 3].

In general, the routing protocols of MANETs can be divided into two classes: table-driven routing protocols and on-demand routing protocols. In table-driven routing protocols [4, 9], every node continuously maintains the complete routing information of a network. When a node needs to forward a packet, a route is readily available. The most popular table-driven protocols are DSDV [10] and OLSR [8]. In on-demand routing protocols [3, 5], mobile nodes maintain path information for destinations only when they need to contact the source node or relay packets. The source node will issue a search packet and transmit the packet using the flooding technique to look for the destination node. There are many applicable GPS routing protocols such as zone-based hierarchical link state (ZHLS) [8], hierarchical cellular-based management for mobile nodes in wireless ad hoc networks [1], location-aided routing (LAR) [6].

2. Proposed Routing Scheme

The proposed protocol is used to improve the packet delivery ratio from source to destination because it provide the optimal path in terms of bandwidth, automatically due to

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this the quality of service, throughput and its related parameters of this protocol may enhanced further. This approach provides solution of flooding and reduces the power consumption. The proposed scheme is secure multipath routing based on ASMR-QRS and ASMR-RZLSR technique. The proposed routing protocol consists of four stages which are listed as follows: (i) route discovery; (ii) route selection; (iii) route security; (iv) data forwarding.

Table 1. The Proposed Scheme Presented in Table Below

Stage	Operation
Route discovery	Initial discovery of two or more routes
Route selection	Selection of appropriate routes
Security	Implementation of security mechanism
Data forwarding	Forwarding of data from source to destination

2.1. Quadrant based Routing Scheme (QRS)

Location Aided Routing (LAR) is referred by QRS broadcasting scheme [11] with help of SeMuRAMAS to makes use of location information to reduce the routing overhead and keep the security, k-x connectivity in multipath environment. Global Positioning System (GPS) provides the location information used in the LAR protocol. With the help of GPS, mobile host identifies its physical location.

LAR is classified into two zones known as expected zone and request zone. The probability of finding a path (in the first attempt) can be increased by increasing the size of the initial request zone. However, route discovery overhead also increases with the size of the request zone. Thus, there occurs a trade-off between latency of route determination and the message overhead. QRS scheme is proposed to address the route discovery overhead problem. It limits the network space according to the source and destination nodes.

The role of LAR in QRS embeds the location information and timestamp of each node to its neighbours. The source node can identify the location of destination node with respect to the route cache. LAR with directional antenna reduces the routing overhead and provides effectiveness. In this study consideration of general scenario has found less impact on conventional method. In this connection, QRS plays an important role in reducing the broadcast region and improves the process of path establishment. The Figure 2 illustrates the region.

When QRS scheme is compared to SeMuRAMAS the packet delivery ratio is better. When the RREQ datagram is forwarded, every node which received a copy stores the route record in its list of received paths. Since this list is stored temporarily within the mobile node memory, the average number of stored paths in each node is evaluated in terms of the number of nodes.

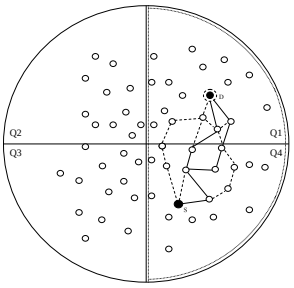

Figure 1. QRS Broadcasting Scheme

The result proved a similar performance between QRS scheme and SeMuRAMAS scheme in many situations. But it adopts some amount of efficiency which states that 7.56% of efficiency on memory overhead handlings.

2.2. Rectangular Zone based Location Specific Routing (RZLSR) Scheme

The proposed Rectangular Zone based Location Specific Routing (RZLSR) scheme [12] is energy efficient, adaptive, secure, and uses labels to carry the disjointness-threshold between nodes during the route discovery which in turn improves the quality of services. In this approach of broadcasting scheme it is based on RECT which forms an efficient framework for routing data between source and destination. A set of security mechanisms based on the use of Watchdog and digital signature, which is used to protect the route discovery process. The proposed approach provides significant performance with lesser overhead, energy efficient and better network lifetime as a result from simulation.

LAR protocol uses the geological location information to restrict the area for finding a new route to a smaller request zone. In its place of flooding the route requests interested in the whole network, only those nodes in the request zone will forward them. In the proposed algorithm, a middle node will forward a route request packet, merely if it fit in to the request zone. The request zone is supposed to have the expected zone to reach the destination node D. In normal LAR scheme, the sides of the rectangle are always parallel to the X and Y axes.

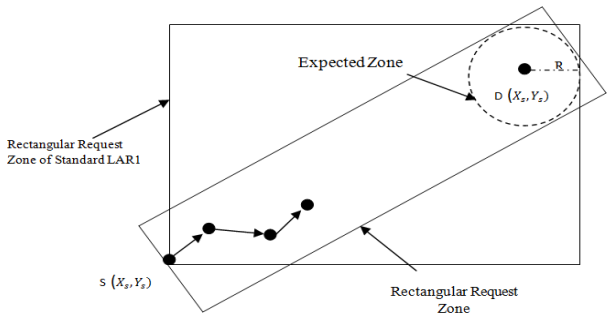

Figure 2. RZLSR Routing Sequence

In this scheme, the source node S finds out the coordinates of the four request zone vertices. These coordinates are comparative to the plane where the node S is the origin and the x-axis is parallel to the line between S and D. After that, the source translates these coordinates (for the four vertices) to the real coordinates. Coordinates are integrated in the route request packet when commencing the route discovery process. RREQ broadcast is limited to this rectangular request zone. Therefore in RECT method called (tilted rectangular

shaped) where the source node S includes the coordinates of the vertices of the request zone within the route request message.

3. Evaluation Methodology

This section discuss about the performance evaluation of ASMR scheme in association with RZLSR and QRS protocol. The performance is estimated through NS2 simulation software on top of Ubuntu 10.08 machine. The nodes are limited in a area of 1000 x 1000 m^2. The simulation carried out with 50, 100 and 150 nodes and random waypoint mobility is used. The main objective of this evaluation is to estimate the packet delivery ratio, packet overhead and delay.

Table 1. Simulation Parameters

Parameters	Value
Transmission Range	250
Bandwidth (Mbps)	512
Max. node speed (m sec^{-1})	7
Pause time (sec)	0
Packet size (Kb)	1000
Average TTL (sec)	40
No. of data items	1000
Traffic	CBR
Simulation time (sec)	20

The performance evaluation is measured by the graphs

i. Packet delivery ratio (PDR): PDR is the ratio of the number of data packets received by the destination to the number of data packets sent by the source. This metric shows the reliability of data packet delivery. In figure 1, PDR is plotted against the number of nodes.

ii. Packet overhead: The number of transmitted routing packets. For example, a HELLO or TC message sent over four hops would be counted as four packets in this metric.

iii. Average delay: This metric represents average end-to-end and indicates how long it took for a packets to travel from the source to the application layer of the destination. It is measured in seconds.

iv. Throughput: This metrics represents the total number of bits forwarded to higher layers per second. It is measured in bps. It can also be defined as the total amount of data a receiver actually receiver to obtain the last packet.

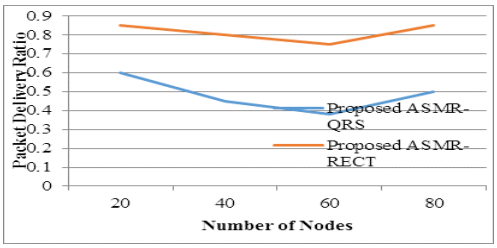

Figure 3. Packet Delivery vs Number of Nodes

The QRS and RZLSR proposals were intuitively trying to reduce the time taken to form a path between source and destination. Location Aware Routing (LAR) is the major backbone to these proposals. The QRS and RZLSR are two different proposals which are handling the probing activities in different manner. The Adaptive Secure Multipath Routing (ASMR) proposal is trying to hybrid the DMPR protocol with either QRS or RZLSR. Since, their objective is closely associated with one another. The Figure 3 exhibits the performance of ASMR-RZLSR and ASMR-QRS protocol with respect to packet delivery ratio, which proved that both are performing similar. For each node setup, five different scenarios were executed and the result showing the average performance of the respective protocol. The result reveals that QRS is slightly performing better in this case.

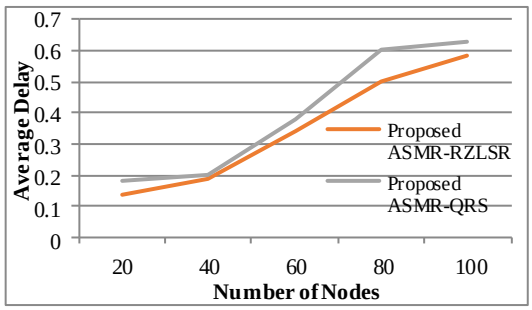

Figure 4. Average Delay vs Number of Nodes

In the similar fashion average delay is measured which is present in the Figure 2. In this case, the number of nodes is fixed at 100, but the observation is extracted on the specified intervals such as 20, 40, 60, 80 and 100. This result denotes that as number of nodes increases average delay also proportionally increased. The Figure 4 illustrates that ASMR-QRS scheme is having higher delay compared to ASMR-RZLSR. Thus, ASMR-RZLSR proposal seems better in this scenario.

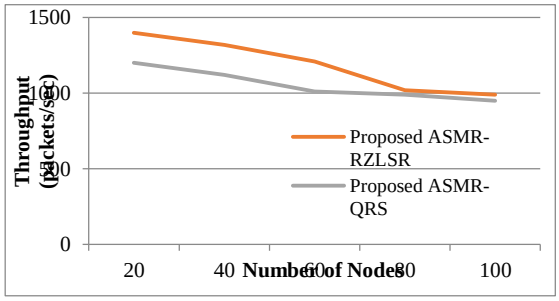

Figure 5. Throughput vs Number of Nodes

The Figure 5 is drawn for the Throughput versus Number of nodes. From the figure the proposed ASMR-RZLSR system which has high Throughput value when compared with another proposed ASMR-QRS scheme. The results illustrates that the proposed ASMR-RZLSR approach performs better when compared to other algorithm like ASMR-QRS.

Finally, the evaluated performance of throughput being an essential part of communication, the observation criterion is almost same as average delay. From the figure 5 it is proved that when the throughput rate is high when the number of nodes is less. The

throughput is gradually decreasing when the numbers of mobile nodes are more. In this scenario, ASMR-RZLSR proposal is performed better than ASMR-QRS.

4. Conclusion

Wireless Ad-hoc and Sensor Networks have the tendency to use multi-path routing, which specifies both the number of paths that is available between the source and destination, and the maximal number of nodes to be shared by these paths. This paper evaluates the performance of the adaptability of QRS and RZLSR in secure multipath routing protocol feasible for MASNET environment. The result depicts that RZLSR is outperforming in the ASMR scheme. Thus, it is confirmed that ASMR scheme will be better when associated with RZLSR.

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