

Improving The Stability of GRP Routing Protocol

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ABSTRACT

More recent works aim at enhancing MANET performance, because of the multiple problems caused by the wireless transmission constraints. The problem that faces the routing protocol is to obtain the stable path with nodes movement. A route between a source to destination is called "stable" if it consists of mainly stable neighbors at each intermediate hops. In this paper, a Geographic Routing Protocol (GRP) algorithm was chosen as a MANET routing protocol to be modified for stability. A new protocol was then created called SGRP routing protocol which works like the GRP routing algorithm, but with some modification to obtain better link stability. The main objective of this research is to decrease the time delay caused by wireless network and enhance the network performance by selecting the best route in the set of available routes that will have the least distance and highest neighbor stability. The model for this research has been designed and simulated by using C/C++ language embedded in the OPNET Modeler 14.5 software package. The SGRP routing model has been compared with the original GRP protocol. Acceptable results have been obtained depending upon the performance of metrics (MANET delay, total packets dropped and Throughput). The average MANET Delay and total packets dropped during the use of SGRP have decreased, while the throughput was acceptable.

Keywords: Stability, GRP routing algorithm, MANET, OPNET.

INTRODUCTION

Mobile Ad-hoc network(MANET) is a group of wireless mobile nodes, which dynamically form a short-term network, without using any existing network infrastructure or centralized administration [1]. Each device in a MANET is free to travel independently in any path and perform a routing function to establish communication. Due to this it can change its links to other devices frequently [2]. A routing protocol used to route the source node to the destination and there are three categories of routing protocols for MANET: Proactive Protocols and Reactive Protocols and Hybrid Protocols [3]. The most popular routing protocols in MANET are: AODV, DSR both are reactive protocols, OLSR are proactive protocol and GRP are hybrid protocol. Reactive protocols are the protocol that finds the roots when they required. Proactive protocols are located routes before they need it. Hybrid routing protocols make an effective and strong structure that can simultaneously combine proactive and reactive routing protocols [4]. In this paper, GRP, routing protocol will be modified for network stability Geographic routing protocol (GRP) also identified as position based routing, is a fit-researched approach for Ad-hoc routing. GRP is based on two propositions, nodes are Informed oftheir own geographic locations and also of its immediate neighbors and source node are Informed ofthe position of the destination. The most commonly used geographic routing algorithms are greedy routing and face routing. In greedy forwarding

the data packet is fetched closer to a destination in each step by the nodes forwarding it to the most appropriate neighbor [5].

The main objective of this paper is to enhance GRP routing protocol to obtain better link stability. The rest of this paper is organized as follows: section 2 reviews briefly the related works. Problem formulation is described in section 3, and modified GRP routing protocol are in Section 4. Simulation environment and the results are explained in section 5, Section 6 concludes the paper.

Related Work

Zarei and others in 2008 [6] presented a new on-demand routing protocol for mobile Ad-hoc networks based on link/route stability evaluation. They applied link/route stability in RAODV for decrease overhead of discovery and maintenance of routing. Hu and others in 2011 [7] introduce a mobility-adaptive routing for stable transmission. In the proposed routing algorithm, no information about neighborhood needed to keep up by nodes, and the link expiration time (LET) is calculated, for assessing the link stability with the discovery of some available stable routes in a reactive way. The simulation results show that the proposed mobility-adaptive routing scheme can improve network performance effectively. Nair and Muniraj in 2012 [8] proposed prediction based link stability scheme to make a correct balance between the link stability, path, neighbor node and total mobile nodes to expand the network lifetime. They planned to decrease the packet loss and offer better stability using the stability model. Manager and Patil in 2012 [9] described a different technique proposed for improving the AODV performance, by providing a review of piggyback mechanism and weighted neighbor stability algorithm to get best route cost and smaller delay respectively. [10] Al-Hemyari and another in 2013 propose a new algorithm, based on Long Lifetime Multicast Routing Protocol, based on On-Demand Multicast Routing Protocol (ODMRP). The proposed algorithm modifies the route discovery process and data packets multicasting in original ODMRP to discover the most suitable route. Srinivasan and Kamalakkannan in 2013 [11] propose a new protocol, Route Stability and Energy Aware Ad-hoc On-demand Distance Vector (RSEA-AODV) protocol, which is an enhancement of AODV protocol. They design a bi-objective optimization formula to compute the reliability factor based on stability and residual energy of nodes. Sonawane and others in 2014 [12] modified the AODV routing protocol for secured communication and energy-efficient process instead of link failure and traffic congestion. The model reduces the link failure in dynamic topology during control messaging. It reduces failure of linkages increases the performance of the network. Abu-Ein and Nader in 2014 [13] compares the performance of the proposed PH-AODV in terms of average delay, average dropped packets and average throughput. The new protocol combines the power coefficient and the hop count measure to improve AODV stability. Ahirwar and Rai in 2014 [14] proposed protocol methods, developed for AODV protocol provided by link stability, minimizing the overhead, maintaining the route reliability & improve the link use, low delay, less packet drops and improve throughput.

Problem Formulation

Ad-hoc networks inherit some of the serious problems of wireless communication and wireless networking some of these problems are [15]:

A. The wireless medium does not have proper boundaries outside when nodes are known to be unable to receive network frames. B. The wireless channel is weak, unprotected from external signals and unreliable, and, which may cause lots of problems to the nodes in the network. C. The wireless channel has time-varying and asymmetric propagation properties.

There are many challenges facing us when dealing with this type of networks. One of these challenges is the time delay happening when transferring packets from one party to another as well as the time-delay happening as a result of re-sending packets when lost and changing the direction of transport constantly because of the node movement and limited energy (battery), used

immobile devices, and the importance of these types of networks appears when using it in many applications as military purposes and rescue and explore the environmental risks that always need transmission and receiving data to see any state changing in real time [16]. For that reason, a new set of routing schemes is required in the Ad-hoc wireless context [15].

Geographic routing is a directing rule that depends on geographic position data. It is for the most part proposed for wireless networks and in view of the thought that the source makes an impression on the geographic area of the destination as opposed to utilizing the network address. Geographic directing requires that every hub can decide its own area and that the source knows about the area of the destination. With this information a message can be routed to the destination without learning of the network topology or a prior route discovery. This sort of convention exploits the area data of hubs to give higher effectiveness and versatility. In wireless situations, the locations of hubs relate to their network availability, which makes geographic conventions normal parts in these situations and it is normal that they will become significant components for the advancement of MANET networks [17]. To overcome problems associated with the link-state and distance vector algorithms, OPNET simulation programming defines a routing protocol called GRP protocol, which depends on the position of the node in routing, so by improving this protocol the result will be better than the other protocols, also an enhancement making on the algorithm of GRP protocol to obtain a new routing protocol called SGRP to decrease the wireless time delay and obtain stability.

Modified Grp Routing Protocol

A good design of the MANET routing protocol is needed to get over the delay problem. When an environment is highly mobile many data packets get lost because of the collision, so the main goal is to obtain a stable GRP in order to get high performance. MANET challenges are the time delay that affects the stability of the MANET GRP algorithms choose the least path to the destination, but the new SGRP algorithm solves the delay problems with selecting the route with a minimum length in the available set of routes and maximum stability. To obtain the stability it can calculate as the equation below:

$$new_{stability} = (old_{stability} * (1 - C)) + (d_{current_{stability}} * C) \dots \dots (1)$$

Where:

$new_{stability}$: is newly calculated stability of the neighbor of node.

new_{old} : is old stability of the neighbor of node which is already written in the neighbor table.

$new_{current}$: is number of Hello messages the nodes have received from its neighbor. C: is moving average constant spans from (0-1), in this algorithm used (0.5). Periodically calculates the best path by using the arithmetic average of stabilities. The path Stability (Arithmetic Average) can be defined as the summation of neighbor stabilities of all the links in the path and divides the value by the total number of hops in that path. The following pseudocode explains the main idea of SGRP.

Step0. : Start SGRP

Step1. : /*Initialize the state variables for every node and initialize the number of hello_count to zero for every node*/

$no_hello=0;$

/* C: is moving average constant spans from (0-1) */

#define C 0.5

Step2. : /*Every node begins to estimate the stabilities of links to its neighbors and keeps track of the link stabilities between a node and its neighbors, periodically each node broadcasts a Hello message including the location of the broadcasting node toward its neighbors and when

received a Hello packet from node modified no_hello */

no_hello= no_hello+1;

Step3. /*Theno_hello variable saved in the neighbor table to be used later*/

nbr_table_updateno_hello ←

Step4. /* Obtain the new stability it must be know the previous stability before the node were moving*/

current_stability=no_hello;
 new_stability=old_stability* (1-C) +current_stability*C;
 old_stability=new_stability;

Step5. /*Calculates the best path by using the arithmetic average of stabilities*/

s=0;
 i=0;
 for (NUM = 0; NUM< nodes_traversed_size; num++)
 {
 s=s+new_stability;
 i++;
 /* Calculate the distance between the neighbor node and the destination quadrant entry point */
 av[k]=s/i;
 k++; }
 max=av[0];
 for(j=1; j<k;j++)
 if (av[j]>max) max=av[j];

/* Check if the distance is the least distance to the destination that has been found and Max stability */

if ((prev_dist_to_dest == -1.0) || (nbr_dist < prev_dist_to_dest)&& (new_stability==max))

/* This node is closest to the destination */
 prev_dist_to_dest = nbr_dist;
 /* Set the new distance to the destination*/
 new_dist_to_dest = prev_dist_to_dest;

Step6. : End SGRP

Simulation Results and Analysis

In this section, the simulation results for each scenario protocol (GRP and SGRP) and performance metric (throughput, average MANET delay, total Packets Dropped) are presented.The simulation scenario is summarized in table(1) as shown below.

Table (1): Simulation Parameters for MANET

Simulation Parameters	Values
Number of nodes	25
Simulation area (meters)	2500m × 2500m
Examined protocols	GRP and SGRP
Speed	Random Waypoint
Nodes' Speed	Uniform(0-10) m×sec ⁻¹
Simulation time	1 hour
Data Rate	11Mbps

In this research 25 wireless mobile nodes are simulated to analyze the behavior of each MANET routing protocol (GRP and SGRP). The results are as shown in Figures (from 2 to 5). Figure (2) shows results for throughput (bits/Sec). Throughput is an important factor which significantly affects network performance and stability of its value shows how success in network data transfer. In this case the throughput the SGRP has higher throughput than GRP, also traffic received (bits/Sec) when used SGRP is better than GRP as shown in Figure (3). In MANET delay Figure (4) shows the MANET delay (Sec) for GRP and SGRP. SGRP has a lower delay than GRP. Also SGRP has a lower total traffic dropped (bits/Sec) than GRP as shown in Figure (5). Table (2), shows the effect of the new protocol in MANET Delay, MANET Traffic Received, Packets Dropped and Wireless LAN Throughput. From Table (2), The SGRP protocol less effective of the network performance than GRP protocol, SGRP protocol gives less time delay and packet dropped than GRP protocol and it gives more Throughputs and traffic receive than GRP protocol, at the last SGRP protocol better than GRP protocol in the performance.

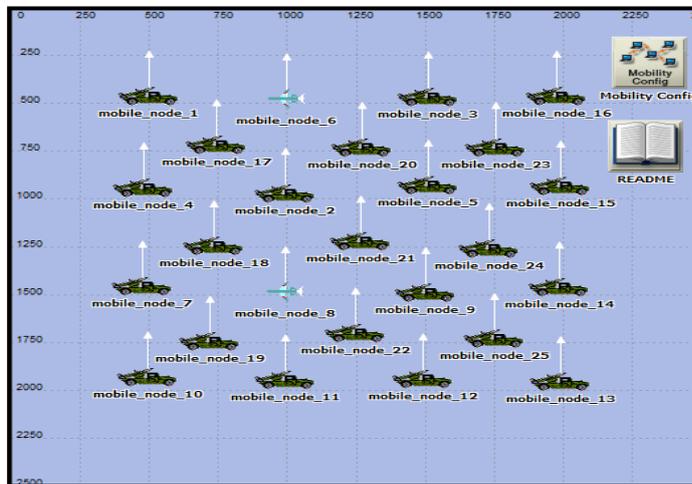


Figure (1) MANET network model scenario

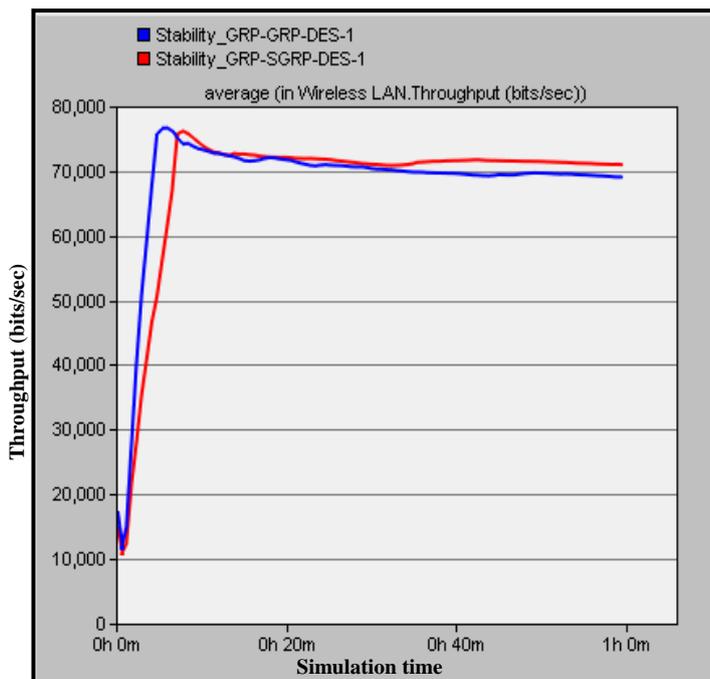


Figure (2):Throughput of GRP and SGRP for 25 nodes

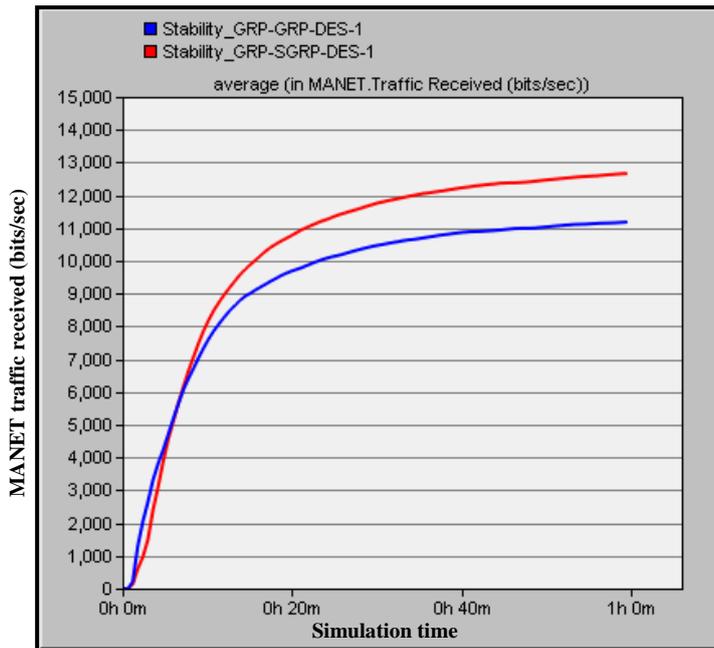


Figure (3):Traffic Received of GRP and SGRP for 25 nodes

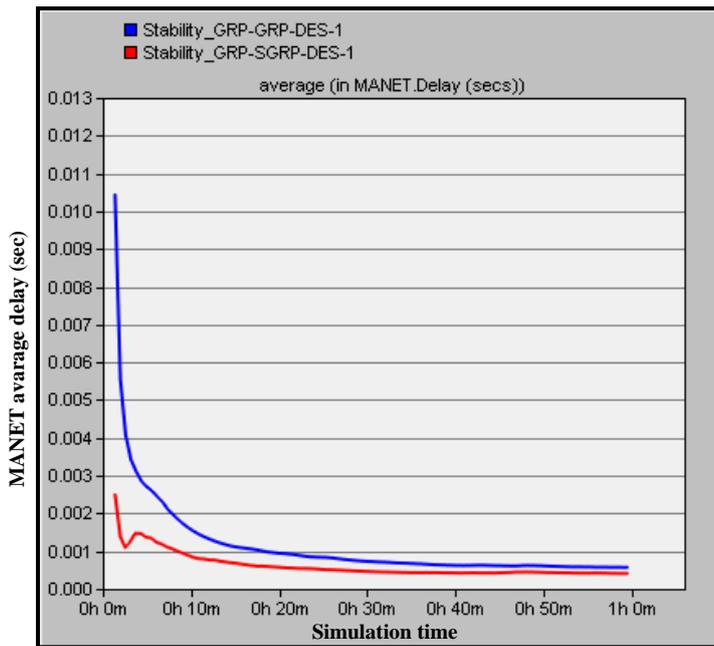


Figure (4):Delay of GRP and SGRP for 25 nodes

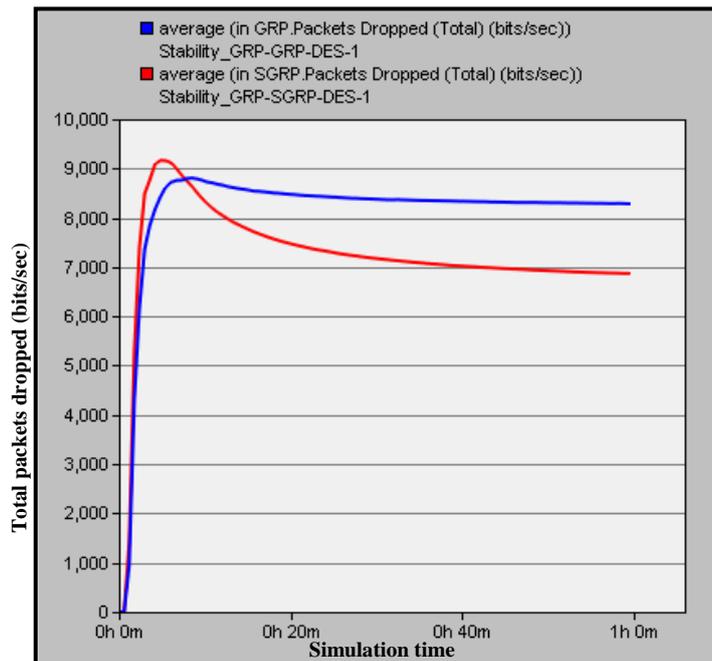


Figure (5): Total packets dropped of GRP and SGRP for 25 nodes

CONCLUSION:

In this research, we have implemented stable routing protocol, in the OPNET Modeler simulation and enhance GRP routing protocol to obtain better link stability. The simulation experiments show that the proposed method is a feasible and effective way routing protocols in MANET. It is also flexible in the dynamic environments and could easily be incorporated. We obtained good results depending on the performance metrics (throughput, average MANET delay, total packets dropped). SGRP has a higher throughput compared with GRP also the difference in average of MANET delay when using SGRP protocol is very small and the total packets dropped is also very small.

REFERENCES

- [1]LakramiF. and Najib E., 2012. "Energy and Mobility in OLSR Routing Protocol", Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Telecommunications (JSAT).
- [2]Kaur K. D. and Bhardwa M., 2015. "Effective Energy Constraint Routing with on-Demand Routing Protocols in MANET", American Journal of Networks and Communications, Vol. 4, No 2, pp. 21-24.
- [3] Ahmad, I., Ashraf, U., Siddique, U., and Zamir I.,2014. "Energy Based Enhanced AODV Routing Protocol for MANET", International Journal of Engineering Research & Technology (IJERT), Vol. 3, No. 7, pp.363-367.
- [4] Singh S.,2015. "Comprehensive Analysis of MANET Routing Protocols with Mobility and Scalability for FTP Delay Traffic Using OPNET Modeler", International Journal in Applied Studies and Production Management, Vol.1, No. 2.
- [5]Tamizhselvi A. and Banu W., 2012. "Performance Evaluation of Geographical Routing Protocol under Different Traffic Scenario" International Journal of Computer Science and Telecommunications, Vol. 3, No. 3, pp. 64-67.
- [6]Zarei M., Karim F. and Javad M. N.,2008. "Modified Reverse AODV Routing Algorithm Using Route Stability in Mobile Ad hoc Networks",IEEE International, pp.255-259.

- [7]Hu X., Wang J. and Wang C.,2011."Mobility-Adaptive Routing for Stable Transmission in Mobile Ad hoc Networks", Journal of Communications Vol. 6,No.1,pp.79-86.
- [8]Nair G. and Muniraj J.,2012. "Prediction based Link Stability Scheme for Mobile Ad Hoc Networks", International Journal of Computer Science Issues, Vol. 9, Issue 6, No 3, pp.401-408.
- [9]Mungare S. A. and Rekha S. P., 2012. "Review of Enhanced AODV Routing Protocol for Mobile Ad hoc Wireless Networks", International Journal of Advanced Research in Electronics and Communication Engineering, Vol. 1, No. 5, pp.1-6.
- [10] AL-Hemyari A., Ismail M., Hassan R. and Saeed S., 2013. "Improving Link Stability of Multicasting Routing Protocol in MANETS", Journal of Theoretical and Applied Information Technology, Vol. 55, No.1, pp.109-116.
- [11]Srinivasan, P., and Kamalakkannan P., 2013. "Enhancing Route Maintenance in RSEA-AODV for Mobile Ad hoc Networks" Intelligent Systems and Control (ISCO), 2013 7th International Conference on IEEE, Vol.8, No.6, pp.891-900.
- [12]Sonawane H. D., Utareja S. and Kumar P.,2014."Enhanced AODV Routing Protocol Methodology Using Leader Election Algorithm in MANET", Vol. 2, No. 12, pp.142-143.
- [13]Abu-Ein A. and Nader J.,2014. "An Enhanced AODV Routing Protocol for MANETS",International Journal of Computer Science Issues, Vol. 11, Issue 1, No. 1, pp.54-58.
- [14]Ahirwar D. and Rai S., 2014."Improvement of AODV Routing Protocol Algorithm with Link Stability and Energy Efficient Routing for MANET", International Journal of Computer Science Engineering and Technology, Vol. 4, No. 2, pp. 36-43.
- [15]Sarkar S. K., Basavaraju T. G. and Puttamadappa C.,2008. "Ad Hoc Mobile Wireless Networks Principles, Protocols, and Applications", Auerbach Publications, Taylor & Francis Group, LLC,SBN-13: 978-1466514461.
- [16]Sarangapani J.,2007. "Wireless Ad Hoc and Sensor Networks Protocols Performance and Control", CRC press, Taylor & Francis Group, LLC, Boca Raton, Florida, ISBN 978-0-8247-2675-1.
- [17]Popescua A. M., Tudorachea I. G., Peng B. and Kempa A. H.,2012. "Surveying Position Based Routing Protocols for Wireless Sensor and Ad-hoc Networks", International Journal of Communication Networks and Information Security, Vol. 4, No. 1, pp. 41-66.