Improving The Stability of GRP Routing Protocol

Dr. Turkan A. Khaleel
Engineering College, University of Mosul/Mosul
Email :Turkan@uomosul.edu.iq
Dr. Ahmed M. Fadhil
Engineering College, University of Mosul/Mosul
Email :ahmedalkababji72@gmail.com
RanaKh. Sabri
Engineering College, University of Mosul/Mosul
Email :engineer.rana87@yahoo.com

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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

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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 to enhance GRP routing protocol to obtain better link stability. The restof this paper is organized as follows: section 2reviewbriefly the related works. Problem formulationis describedis in section 3, and modified GRP routing protocol are in Section 4.Simulation environment and the results are explained insection 5, Section 6 concludesthe paper.

Related Work

Zarei and others in 2008[6] presented a new on-demand routing protocol formobile Ad-hoc networks based on link/route stabilityevaluation. 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 routingfor stable transmission. In the proposed routingalgorithm, no information about neighborhood needed tokeep up by nodes, and the link expiration time (LET) is calculated, forassessing the link stability with the discovery of some availablestable 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 tomake a correct balance between the link stability, path, neighbor node and total mobile nodes to expand the networklifetime. They planned to decrease thepacket loss and offer better stability using the stabilitymodel. Manager and Patil in 2012 [9] described a different technique proposed for improving the AODV performance, by providing a review of piggyback mechanism andweighted neighbor stability algorithm to get best routecost and smaller delay respectively. [10]Al-Hemyariand 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 Kamalakkannanin 2013 [11] propose a new protocol, Route Stability andEnergy Aware Ad-hoc On-demand Distance Vector (RSEA-AODV) protocol, which isan enhancement of AODV protocol. They designa bi-objective optimization formula to compute the reliability factor based onstability 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 theperformance of the proposed PH-AODV in terms of averagedelay, average dropped packets and average throughput. The new protocol combines the power coefficient and the hop count measure to improve AODV stability. Ahirwar and Raiin 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 problemsare [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 manychallengesfacing uswhen dealing withthis type ofnetworks.One of thesechallengesis thetime delayhappeningwhen transferringpackets fromone party to anotheras

well as thetime-delayhappeningas a result ofre-sendingpacketswhenlost andchangesthe direction oftransportconstantlybecause of the node movement and limitedenergy (battery), used inmobiledevices, andthe importance of these types of networks appears when using it in many application as military purposesandrescueand explorethe environmental risksthat always need transmission and receiving datato seeany state changing inreal 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 exploit 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 define a routing protocol called GRP protocol, which depend 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 getting lost because of the collision, so the main goal is to obtain a stable GRP in order to get high performance. MANET challengesare thetime delay thateffect on 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 rout with a minimum length in the available set of routes and maximum stability. To obtain the stability it can calculate as the equation below:

$$new_{stability} = \left(old_{stability} * (1 - C)\right) + \left(dcurrent_{stability} * C\right) \ldots\ldots (1)$$

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 thelocation of the broadcasting node toward its neighbors and when
received a Hello packet from node modified *no_hello */*
no_hello= no_hello+1;

Step3. :/*The*no_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. Form 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.

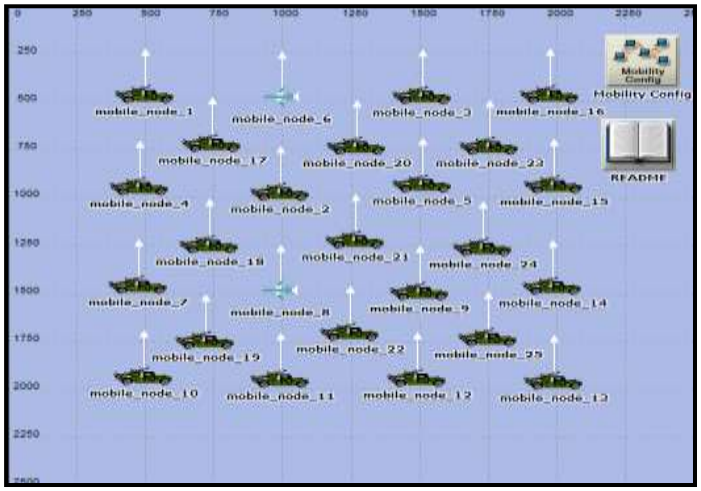
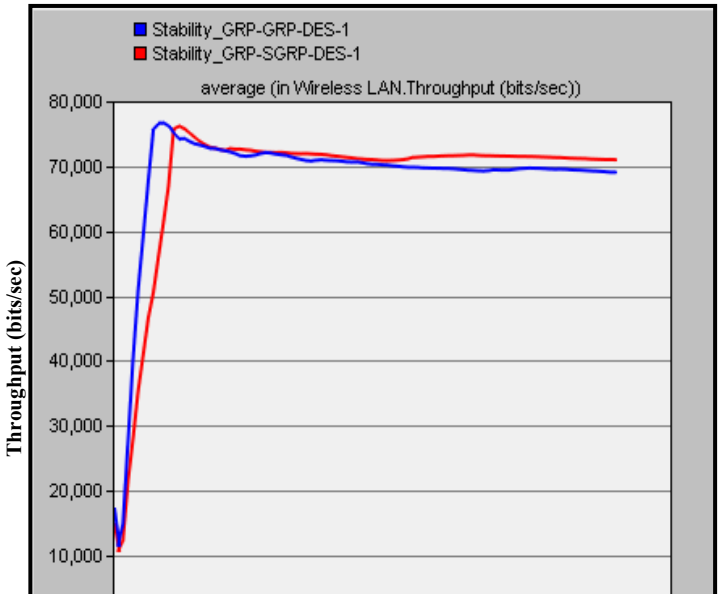


Figure (1) MANET network model scenario



Simulation time

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

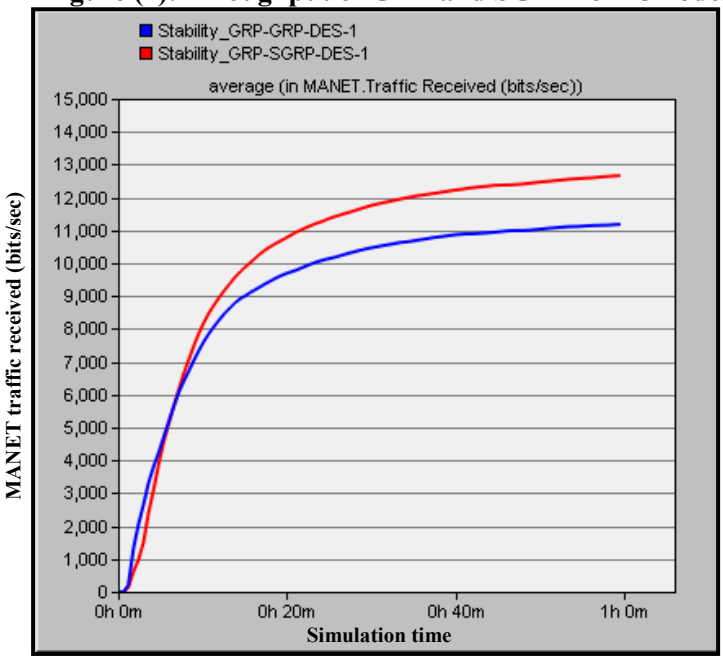


Figure (3):Traffic Received of GRP and SGRP for25 nodes

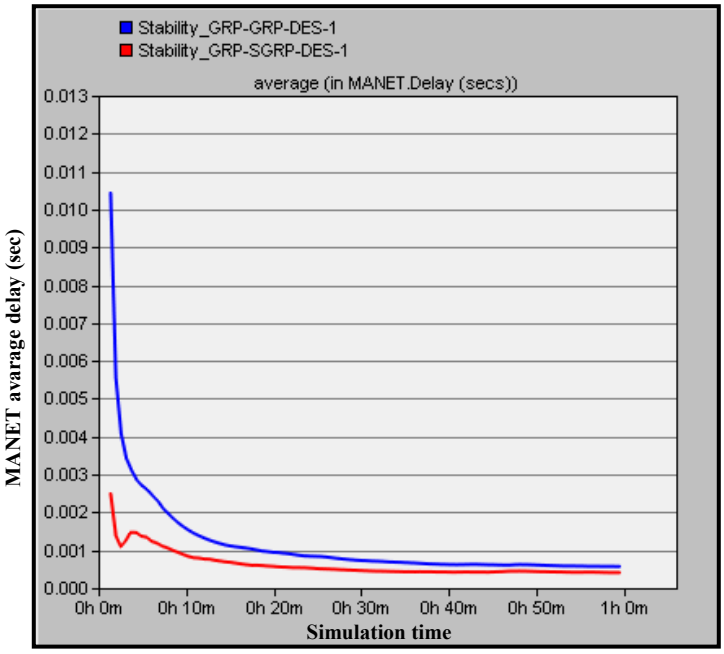


Figure (4):Delay of GRP and SGRP for 25 nodes

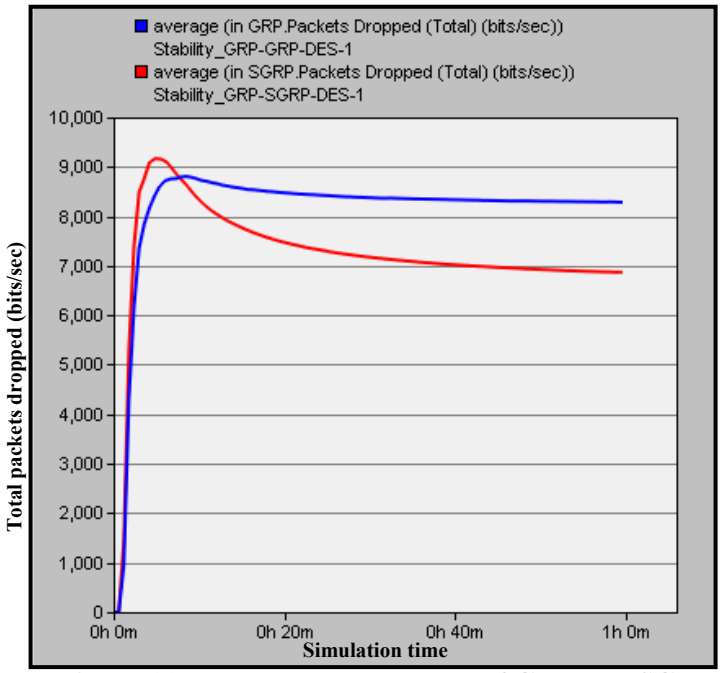


Figure (5):Total packets dropped of GRP and SGRP for 25 nodes

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.

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