Assessing the significance of different terrainsizes on DYMO routing protocol in MANETs

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Abstract:

MANETs fall under wireless infrastructure less networks consist of number of nodes which communicate information with each other. Due to the node mobility, the routes are frequently changed and there is a necessityof finding new routes. Number of routing protocols was defined for MANETs to improve the QoSin routing protocols for ad hoc networks. The Dynamic MANET On-demand (DYMO) routing protocol, AODV version 2 is extension to the AODV protocol which works better for large networks with high mobility. Continuous changes of network topology and determining routes in MANETs is a challenging task, due to the movement of nodes in MANETs. The packets are received and transmitted by the node with the help of routing protocols in MANET. The terrain size or the area of the MANET nodes plays animportant role in routing protocols in order to evaluate the performance. Using the EXata 5.4 simulator, we investigate the effects of different terrain sizes – 500x500, 1000x1000, 1500x1500 on the performance metrics of the DYMO routing protocol in this paper.Simulation result shows lower terrain size (500x500)performs well than medium, higher terrain sizes.

Keywords: MANETs, DYMO, Terrain sizes, Exata Simulator, QoS

1. Introduction

A mobile ad-hoc network (MANET) is a collection of nodes that can join across a wireless medium to construct a flexible and dynamic network using radio frequency links.That is, the connections between the nodes can vary over time, new nodes can join the network, and existing nodes can leave the network [1]. The number of average connected paths is affected by the mobility of the nodes and this also affects the performance of the routing algorithm. MANETs are self-organizing and self-configuring multi-hop wireless networks with a dynamically changing network structure.Because of the changing topology, a routing protocol that delivers QoS while minimizing delay and power consumption while improving throughput is necessary.All nodes in MANETs share the available resources. These networks are characterized by bandwidth constraints, changeable capacity links, and a dynamic topology that is unpredictable.Environmental monitoring, remote rescue operations, construction sites in remote locations, and personal space Some of the uses of mobile adhoc networks include networking, emergency operations, military contexts, and civilian environments [2].

Routing is the process of choosing paths for data packets to travel through network traffic. In a MANET, relay nodes can operate as routers, forwarding data packets. Routing protocol is a term that refers to the relationship or algorithm that routers utilize to determine the best path for data to be relayed.There are three different types of routing protocols for mobile ad-hoc networks. These protocols are Proactive, Reactive, and Hybrid Routing. Reactive routing is also known as On-demand and dynamic routing, whereas proactive routing is also known as Table driven routing.OSPF, DSDV and OLSR are the pro-active routing protocols. AODV,DYMO, DSR are the reactive routing protocols [3]. In this paper, we analyze the impact of node placement models i.e. random, grid and uniform in DYMO routing protocol in MANETs.

The rest of the paper is organized as follows – section 2 presents the Literature survey of the related work, section 3 describes about the DYMO Routing protocol, Section 4 presents Research Methodology, Section 5 presents the Experimentation and Simulation Process, Section 6 presents Performance Evaluation and Result Analysis, Section 7 describes Conclusions and Future Scope of work.

2. Literature review of related work

E. P. Kamboj et al.[5] describes the performance of three MANET routing protocols like AODV, OLSR and GRP, when the node density varies and how the QoS impacts in MANETs.

Surinder Singh et al. [6] analyzes the performance of various routing protocols with different mobility and terrain sizes are carried out interms of packet delivery ratio, Throughput, end to end delay, routing overhead andenergy consumption using MATLAB.

Muhammad Fayaz et al. [7] assess the impact of several terrain areas and pause times on the performance of the two reactiverouting protocols; i.e. AODV and DSR and presents the results of simulations.

SatveerKaur et al. [8] investigates the effect of mobility and density of nodes changing in MANET and compared a number of reactive, hybrid and proactive routing protocols including AODV, DSR, DYMO, OLSR and ZRP using QualNet 5.0.

M.Uma and Dr.G.Padmavathi et al.[9] studied a comparison and performance evaluation of three reactive routing protocols AODV, DSR, and LAR1 using qualnet simulator to identify the protocol that is best suited for MANETs in their paper

D.V. DivakaraRao et al.[10] analyzed the impact of various node deployment models on LAR1 routing protocol and found that random deployment model performs better that grid and uniform.

Dr.S.P.Setty et al.[1] studied the QOS measures Average jitter, Average end-to-end latency, and Throughput by modifying network size and evaluated the performance of the DSR routing protocol in three different placement environments: Random, Grid, and Uniform. In comparison to other environments, the results showed that DSR performs better in the Uniform Environment.

3. DYMO Routing Protocol

Dynamic MANET On-demand routing protocol is one of the reactive routing protocols is the on-demand routing protocol. Route request (RREQ), route reply (RREP), and route error (RERR) are the three messages implemented by DYMO. RREQ is used by the source node to determine if there are any viable pathways to that specific destination node. The source node uses RREQ to find any viable paths to that specific destination node. The role of RREP is to establish up a route between the destination and source nodes, as well as all intermediate nodes in between. An improper path from any intermediate node to the destination node was indicated by RERR. Route discovery and route maintenance are the two primary activities of DYMO. If the source node does not have a route entry to the destination node, it will broadcast the RREQ message to its intermediate neighbor node during route discovery. The RREP message is sent if the neighbor node has an entry destination. Otherwise, an RREQ message is issued. The intermediary node will attach its address to the RREQ message when broadcasting it. The retrograde path or accumulation path is noted or marked by every intermediate node that distributes the RREQ message. The RERR message was used to do route maintenance. The RERR message will be generated if a link is broken or fails. The RERR message is only sent to nodes that are involved in a connection failure when a node multicast is generated. The route discovery process must be restarted if any nodes have a packet to the same destination after the deletion route entry [3][4].

4. Research Methodology

The research methodology used in the wireless and networks domain consists of three approaches: theoretical data analysis, experimentation, and simulations. If the goal of the research is to explain the research problems in a meaningful context, a descriptive theoretical analysis approach will be used.The method of experiments will be used to manipulate genuine processes, and certain guidelines will be followed. The simulation procedure will be used when you need to check the actual system performance in a variety of ways utilizing different parameters and are cost-effective and hardworking.Simulations are realism replicas that allow you to explore the model by arranging and formatting the algorithm properties. As a result, the simulation is carried out in order to conduct the experiment.

5. Experimentation and Simulation Process

Simulation Process:

The goal of this simulation study is to compare the performance of the DYMO routing protocol with several terrain sizes, such as 500x500, 1000x1000, and 1500x15000, in which nodes are arranged in different ways and moved randomly.The simulations were run on EXata version 5.4, software that allows for scalable wireless network simulations. The simulation is run for various network sizes, with the mobility speed, simulation time, and pause time being constant. Table 1 shows the simulation parameters used in the evaluation.

Table 1. Parameter setting for Simulation process

Parameter	Value
Simulator	Exata
Routing Protocol	DYMO
Propagation Model	Two ray ground
Packet size	512Kb
Network size	20,40,60
Mobility speed	10 m/sec
Pause Time	0 sec.
Data rate	11 Mbps
Node placement	Random
Traffic agent	UDP
Application Traffic	CBR
Antenna Type	Omni directional
Simulation Time	300 sec.
Terrain size	500 x 500,1000x1000, 1500 x 1500sq.mts
Mobility Model	Random way point

6. Performance Evaluation Results and Analysis:

The following metrics are considered to evaluate theperformance of the routing protocol.

6.1 Unicast Received Throughput (bits/second):

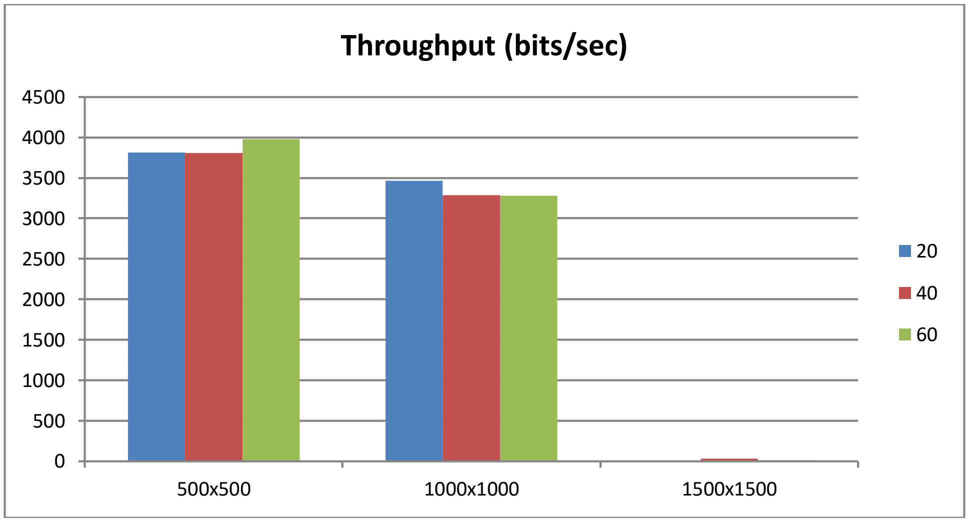

Fig. 1 Unicast Received Throughput (bits/second)

Fig. 1 shows the Throughput for DYMO protocol with varying network size using different terrain sizes. From the simulation results, we observed that, Throughput is high for thesmall terrain size (500x500) with different network sizes. For higher networks it is more in when compared to other terrain sizes.

6.2 Average Unicast End-to-End Delay (seconds):

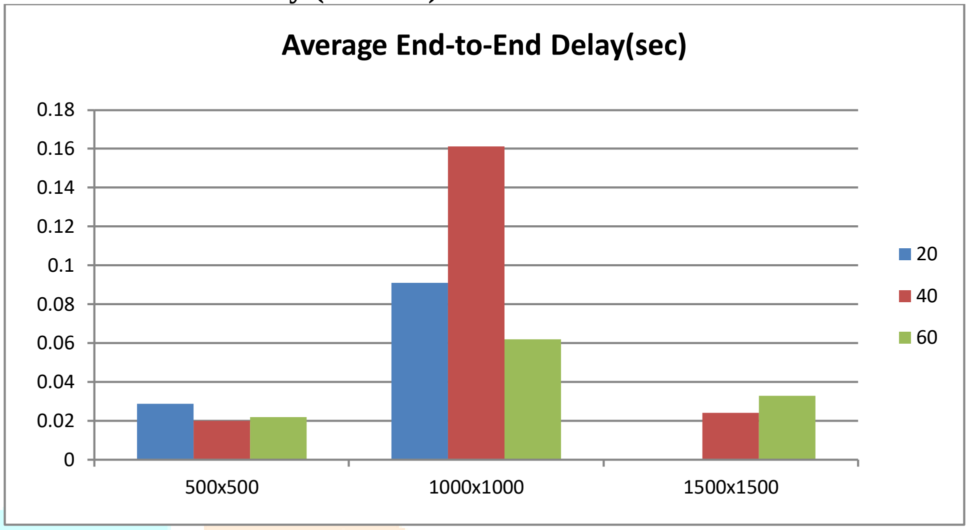

Fig. 2 Average Unicast End-to-End Delay (seconds)

Fig. 2 shows the Average End-to-End Delay for DYMO protocol with varying network size using different terrain sizes. From the simulation results, we analyzed that End-to-End Delay is very low for the small terrain size (500x500) when compared to other terrain.

6.3 Average Unicast Jitter (seconds):

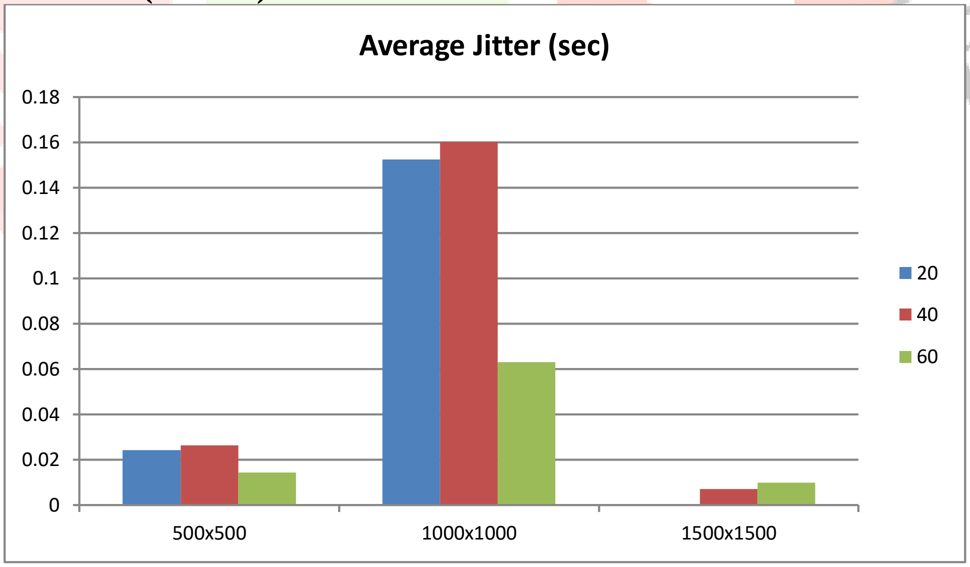

Fig.3 Average Jitter

Fig 3.shows the Average Jitter for DYMO protocol with varying network size using different terrain sizes.

From the simulation results, we analyzed that Average Jitter is low for smaller, larger terrains in all network sizes. For medium terrain, it is higher in all network sizes.

6.4 Energy consumed (in mWh) in Transmit mode:

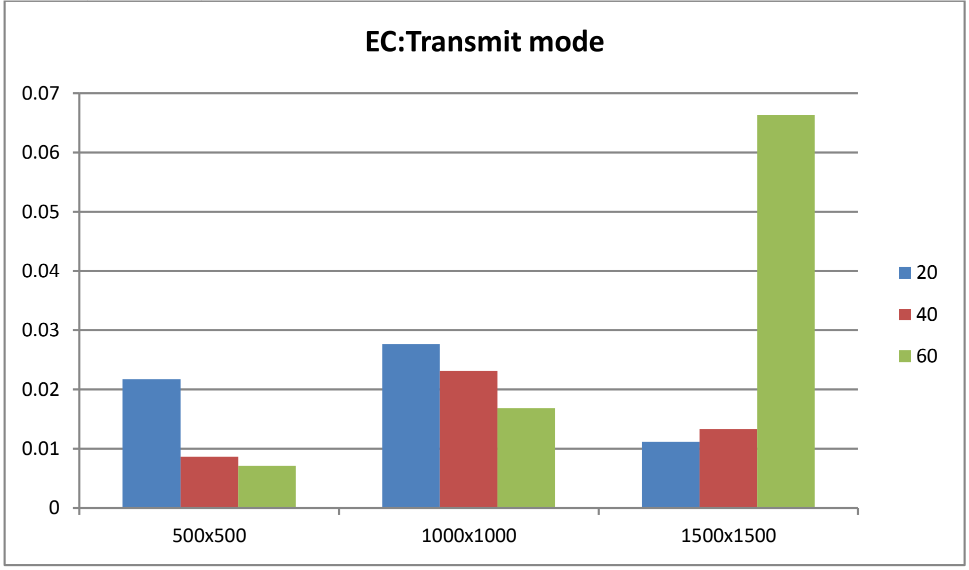

Fig. 4 Energy consumed (in mWh)in Transmit mode

Fig 4.shows the Energy consumed in transmit mode for DYMO protocol with varying network size using different terrain sizes.

From the simulation results, we analyzed that Energy consumed in transmit mode is higher for larger terrain with large network size.

6.5 Energy consumed (in mWh)in Receive mode

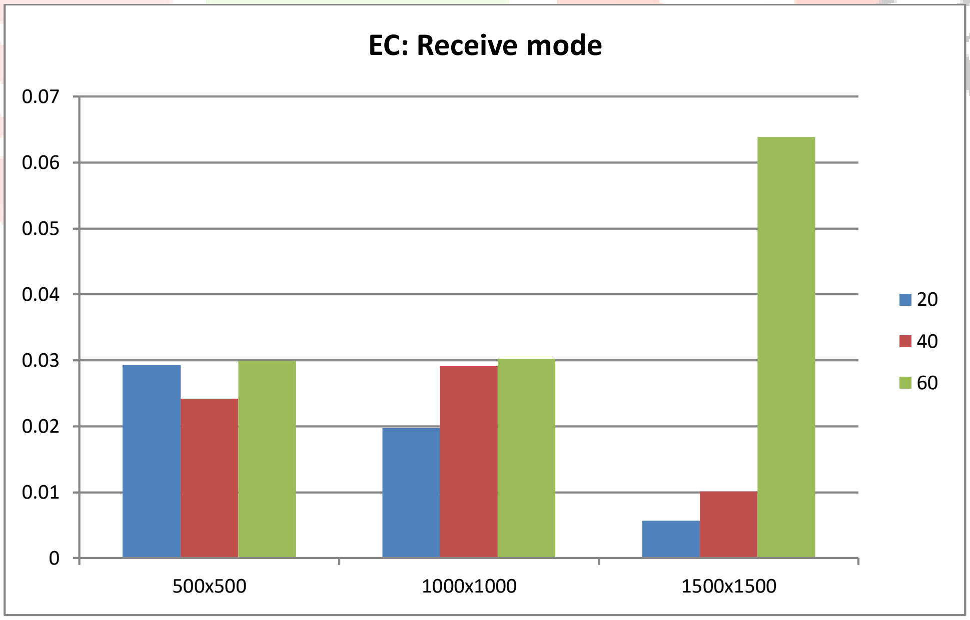

Fig.5Energy consumed (in mWh)in Receive mode

Fig 5.shows the Energy consumed in receive mode for DYMO protocol with varying network size using different terrain sizes.

From the simulation results, we analyzed that Energy consumed in receive mode is higher for largerterrain with large network size.

7. Conclusions

The performance of DYMO routing protocol is studied under different terrain sizes and arrangements. The simulation results shows that DYMO achieves better performance in smaller terrain sizes comparing all the performance metrics. We observed that, the DYMO is suitable for smaller terrain regions. Our future research work is to study the behavior of DYMO with various mobility models, pause time and simulation times.

References

[1] Prof.S.P.Setti, Narasimha Raju K, “Performance Evaluation of DSR in Various Placement Environments” IJCA Special Issue on “Mobile Ad-hoc Networks” MANETs, 2010.

[2]. Syed BashaShaik and Prof. S.P. Setty, “Performance Comparison of AODV, DSR and ANODR for Grid Placement Model.”, International Journal of Computer Applications, volume 11-No.12, December 2010.

[3] Manohar, M. P. (2018). Performance Analysis of Reactive Routing Protocols AODV, DYMO, DSR, LAR inMANETs. International Journal on Future Revolution in Computer Science & Communication Engineering, 4(3), 01-07.

[4]. Sukant Kishoro Bisoyi, Sarita Sahu, “Performance analysis of Dynamic MANET On-demand (DYMO) Routing protocol.” IJCCT Vol.1, International Conference [ACCTA-2010], August 2010.

[5] E. P. Kamboj, E. Jasbir, and S. Saini, “Formal Measure of the Effect of MANET size over the Performance of Various Routing Protocols,” vol. 2, no. 10, pp. 3891–3898, 2013.

[6] Surinder Singh, BS Dhaliwal, Rahul Malhotra, Mahendra Kumar, ”Impact of Mobility and Terrain Size on Performanceof Hybrid Routing Protocol in Mobile AdhocNetwork”, International Journal of Electronics Engineering Research,Volume 9, Number 1 (2017) pp. 105-119

[7] M. Fayaz, Z. Ur Rahman, M. Ur Rahman, and S. Abbas, “Effect of terrain size and pause time on the performance of reactive routing protocols,” J. Teknol., vol. 78, no. 4–3, pp. 89–94, 2016, doi: 10.11113/jt.v78.8258.

[8] S. Kaur and J. Singh Ubhi, “A Simplified Approach to Analyze Routing Protocols in Dynamic MANET Environment,” Int. J. Soft Comput. Eng., no. 1, pp. 2231–2307, 2015.

[9]. M.Uma and Dr.G.Padmavathi, “Comparative study and performance evaluation of reactive quality of service routing protocols inmobile ad hoc networks” *JATIT*, Vol.6, No.2, 2009.

[10] D.V.DivakaraRao, Dr.S.PallamShetty,” Analyzing The Impact Of Node Deployment Models On The Performance Of Lar1 Routing Protocol In Manets”, INTERNATIONAL JOURNAL OF CURRENT ENGINEERING AND SCIENTIFICRESEARCH,Vol.4,Issue 8, 2017, pg:37-42