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An Improved Dynamic MANET On-Demand (M-DYMO) Routing Protocol For Mobile Ad-Hoc Networks

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ABSTRACT

In a Mobile Ad hoc Network (MANET), mobile nodes move around arbitrarily, nodes may join and leave at any time, and the resulting topology is constantly changing. Routing in MANETs is challenging because of the dynamic topology and the lack of existing fixed infrastructure. The Dynamic MANET On-demand (DYMO) protocol builds on previous proposed routing protocols for MANETs. Energy or Power consumption and End to End Delay, these are the main Challenging concerns for number of researches. Due to unbalanced node usage, some of the battery powered nodes drain out faster than others. This leads to route re-discovery with larger average, more end to end delay and more control overhead. In this paper we are presenting an improved DYMO (M-DYMO) protocol. The proposed protocol introduces a stability aspect which conserves and stabilizes energy or power among the nodes, and a delay decline method which reduces the average end-to-end delay of the network. NS-2 simulator is used to compare performances of DYMO and M-DYMO.

Key words: MANETs, AODV, DYMO, Energy or Power Consumption, End to End Delay

1. INTRODUCTION

In a MANET, the mobile nodes must work together in a distributed fashion to enable routing among the nodes. Because of the lack of centralized control, routing becomes a central issue and a major challenge as the network topology is constantly changing. The number of mobile nodes in the network can range from a few to several hundreds or thousands. In MANETs, routing is needed to find path from source to destination which is done with the help of routing protocols. Large amount of research is going on to make such a routing protocol which can work in a changing topology environment of a Mobile Ad-hoc network. Because of the diverse envisioned working conditions, several MANET routing protocols have been proposed.

An example of a routing protocol for MANETs is the Dynamic MANET On-demand (DYMO) routing protocol. The DYMO routing protocol is a recently proposed protocol defined in an IETF Internet-Draft. DYMO belongs to the category of MANET routing protocols called on-demand or reactive routing protocols. A reactive protocol only tries to discover a route to a destination, when it is actually needed by an application. DYMO routing protocol has been proposed by Perkins & Chakeres as advancement to the AODV protocol. It is also defined to as successor of AODV. DYMO operates similar to its predecessor i.e. AODV and does not add any extra modifications to the existing functionality but operation is moreover quite simpler. DYMO is a purely reactive protocol in which routes are computed on demand. The basic operations of the DYMO protocol are route discovery and route management. During route discovery, the source node initiates dissemination of a Route Request (RREQ) throughout the network to find the destination node. During this dissemination process, each intermediate node records a route to the source node. When the destination node receives the RREQ, it responds with a Route Reply (RREP) unicast toward the source node. Each node that receives the RREP records a route to the destination node, and then the RREP is unicast toward the source node. When the source node receives the RREP, routes have then been established between the source node and the destination node in both directions.

2. DYMO ROUTING PROTOCOL

DYMO is a routing protocol that was created for situations where clients are mobile and communications transport through several different clients over a wireless medium, like Mobile ad-hoc Network (MANET). When a node initiates communication with another node, a routing path is found, and this will result in a bidirectional unicast communication path. DYMO was created to dynamically handle changes in the network. The basic functions that DYMO introduces are **Route discovery** and **Route maintenance**. When a source node wants to send some data to destination node, the source broadcasts a route request (RREQ) to find a valid route to the destination. Then the request will be handled internally by each recipient node, and if the handling node is not the destination it will rebroadcast the RREQ. In this manner RREQ will be transported to the destination. When maximum number of hops has been reached the RREQ is discarded. Each node that retransmits the RREQ will record the path to the nodes that has handled this RREQ. In that way all nodes that pick up the RREQ will have a path to the source. When the RREQ reaches the destination that node will reply with a unicast message (RREP) to the source. This RREP will be transmitted through the reverse path that found the destination until it reaches the source. When the RREP has reached the source all intermediate nodes will know how to relay packets between source and destination. If an intermediate node, in an active transmission, finds that it cannot forward the transmission it must send a RERR addressed to the DYMO broadcast address. When the RERR reaches the source it will know that it needs to find a new path to the destination and will send a new RREQ, provided that it has more packets to send to the destination.

3. PROPOSED WORK

The proposed protocol M-DYMO is similar to DYMO with some constraints on route discovery process. In DYMO, during route discovery, the remaining energy or power of node is not considered. Therefore the node that has low energy or power level will die down earlier than others and that will result into more number of link breaks. In M-DYMO protocol, Stability aspect is used to keep the remaining energy or power of node in the network. The Stability aspect of a node is defined as the ratio of its remaining energy or power to the initial full energy or power.

Stability aspect = Remaining energy or power/ Initial energy or power

Generally in original DYMO, whenever a node receives a RREQ message it is processed without considering energy or power level of that node. In M-DYMO, when a source node sends a RREQ message and it reaches to its neighbor node, then that node first checks its stability aspect. If its aspect is higher than define threshold then only it will process the RREQ message. Due to this method, node saves its energy or power in processing of RREQ message also. So this modification put a constraint on how to broadcast a RREQ message and who should participate in route discovery process. With consideration of this stability aspect, energy or power consumption of the nodes and link breakage of network decreases and the network lifetime increases.

In order to reduce end to end delay, the proposed M-DYMO protocol uses a modification. M-DYMO uses predefined time to live (TTL) threshold value modification for finding a quicker path between source and destination. DYMO Protocol uses Expanding Ring Search (ERS) method for route discovery mechanism. The source node starts broadcasting the RREQ message with time to live (TTL) = 1. If the destination node is not present in one hop range and nodes in one hop range do not have route to destination node. Then TTL is increased by the increment of 2 i.e. TTL = 3. If the destination node is still not found, the source node again increases TTL by 2 i.e. TTL = 5 and broadcast the RREQ message. DYMO provides 3 retries for RREQ message. Finally, with that time to live (TTL), the RREQ message is broadcasted to entire network. When destination receives the RREQ message and then it acknowledges source node by sending a Route Reply (RREP) message via same path. M-DYMO uses the modified Expanding Ring Search (ERS) for quicker route discovery. In M-DYMO, the TTL increment is set to 3. So ring search covers the more number of nodes in lesser attempts and reduces the unnecessary end to end delay in the network. Performance is enhanced with small increase in threshold value for the network. The techniques used for the modification of the existing protocol will decrease the energy or power consumption of the nodes and the end to end delays in the networks during the data transmission processes.

4. SIMULATION RESULT AND ANALYSIS

All simulations are done on Network Simulator 2 (NS2). This simulator provides a comprehensive environment for designing protocols, creating and animating network scenarios, and analyzing their performance. NS is a part of experience simulator targeted at networking research. Simulations of proposed method were carried out according to nodes and environment characteristics in different scenarios and variations.

In this simulation, speed of the nodes was varied from 0-20m/s, the number of nodes is considered 100 and the packet size is 1024 bytes.

Energy Consumption:

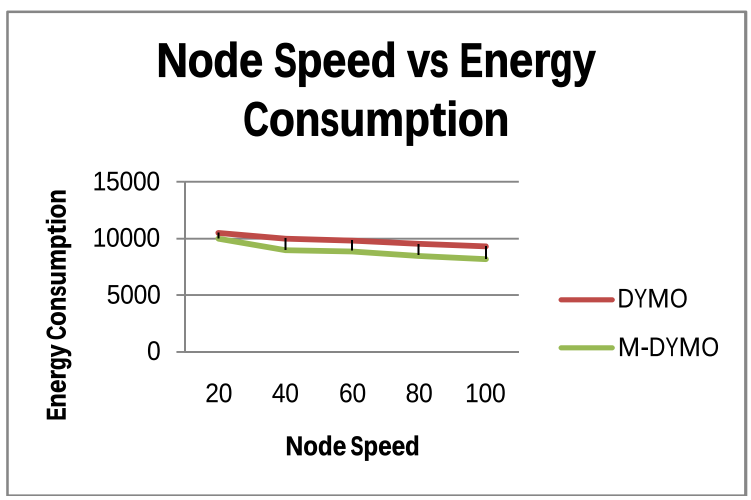

Figure 1: Node Speed vs Energy Consumption

Figure1. shows that the energy or power consumption is less for different speeds in M-DYMO. Energy or power consumption in M-DYMO significantly reduces for the different node speeds in network. The proposed protocol has typical lower energy consumption than the original DYMO protocol.

End to End Delay

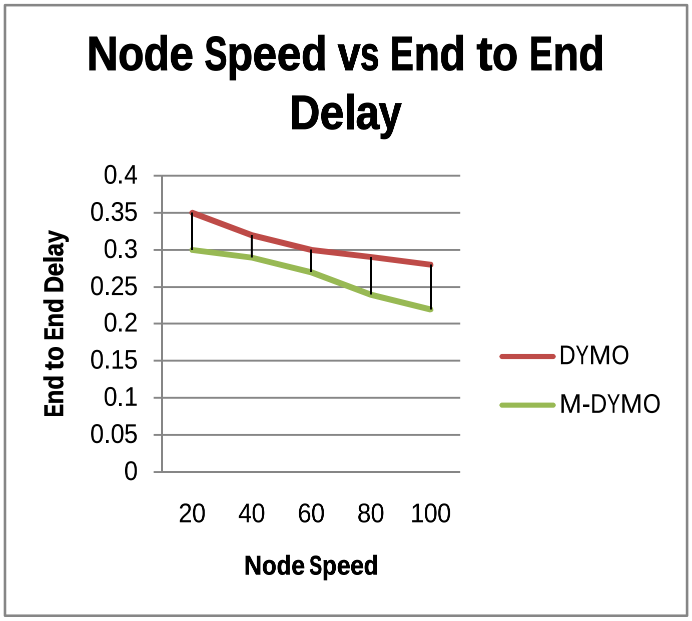

Figure 2: Node Speed vs End to End Delay

Figure 2. shows the comparison for End to End Delay of DYMO and M-DYMO in the network. The proposed protocol M-DYMO performs well with different node speeds than the original DYMO. The proposed protocol has lower End to End Delay than the original protocol.

5. CONCLUSION

In this Paper, we discussed about reactive routing protocol DYMO and its modification which includes energy or power consumption and end to end delay of the network. These DYMO modifications increase the life time of the network and lead to a longer battery life of the nodes. They achieve balanced energy or power consumption and decrease the end to end delay during the route discovery process with minimum overhead. This paper proposes the M-DYMO routing protocol for MANETs that effectively reduces the energy or power consumption and the end to end delay in data transmission process. The results show that the energy or power consumption and end to end delay in MANETs decreases significantly. The overall performance of the proposed protocol over the existing protocol is improved.

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