Global Journal of Advanced Engineering Technologies and Sciences

PERFORMANCE ANALYSIS OF VARIOUS ROUTING PROTOCOLS WITH CONSTANT NETWORK SIZE IN MANET

Pushpendra Singh Chouhan*[1], Sheetesh sad [2], Achal Sharma [3]
*[1,2,3] Department of Electronics & Communication Engineering, Central India Institute of Technology, Indore (M.P.)
Pushp12.chouhan@gmail.com

Abstract

Ad-hoc network is a collection of wireless mobile nodes where wireless radio interface connects each device in a MANET to move freely, independently and randomly. Routing protocols in mobile ad hoc network helps to communicate source node with destination node by sending and receiving packets. Many protocols are developed in this field but it is not easier to decide which one is winner. In this paper the behaviour of three routing protocols AODV (Ad-hoc on demand distance vector), DSR (Dynamic Source Routing), DYMO (Dynamic MANET on demand), based on IEEE 802.11 protocol are analysed and compared using QualNet simulator on the basis of performance metrics such as average jitter, total packets received, packet delivery ratio, end-to-end delay, and throughput. To test competence and effectiveness of all three protocols under diverse network scenarios costing is done by means varying load by varying CBR data traffic load, and constant Nodes. Finally, results are scrutinized in from different scenarios to provide qualitative assessment of the applicability of the protocols.

***Keywords*-Ad-hoc, ADOV, DSR, DYMO**

I. INTRODUCTION

Mobile networks can be classified into infrastructure networks and mobile ad hoc networks (MANET) according to their dependence on fixed infrastructures. In infrastructure based mobile network wired access point is used and within the transmission range of access point all mobile device are free to move in any direction. In mobile ad-doc network, each device is free to move any direction so the routes use to reach from one device to another change frequently. In mobile ad-hoc networks each device need to forward traffic that is not related to its own. Routing paths in MANET potentially contain multiple hops, and every node in MANET has the responsibility to act as a router [1]. In this paper, we studied AODV, DSR, DYMO, and routing protocols. DSR and perform better in constant node density and varying CBR traffic. And performances of these are calculated on jitter, end-to-end delay, packet delivery ratio and throughput. The conclusion obtain is that DSR gives better performance in varying CBR traffic with the constant node density.

A mobile ad-hoc network (MANET) is a collection of nodes, which have the possibility to connect on a wireless medium and form an arbitrary and dynamic network with wireless links. That means that links between nodes can change during time, new nodes can join the network, and the other nodes can leave the network. Mobile Ad-hoc networks are self-organizing and self-configuring multi hop wireless networks where, the structure of the network changes dynamically.

II. ROUTING PROTOCOL CLASSIFICATION

Ad-hoc routing protocols can be divided into three categories, proactive (table driven) routing protocol, reactive (on demand) routing protocol and hybrid routing protocol. Figure 2 shown classification of ad-hoc routing protocol.

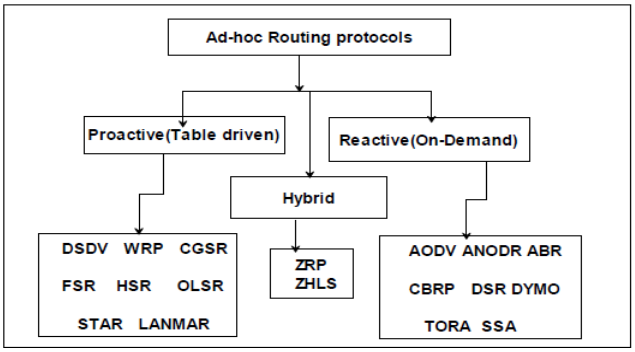

Fig-1Classification of routing protocols

1. ***Proactive (Table Driven) Routing Protocols***

Proactive routing protocols maintain information continuously. Typically, a node has a table containing information on how to reach every other node and the algorithm tries to keep this table up-to-date. Change in network topology is propagated throughput the network [2].

2. Reactive (On Demand) Routing Protocols

On demand protocols use two different operations to Route discovery and Route maintenance operation. In this routing information is acquired on-demand. This is the route discovery operation. Route maintenance is the process of responding to change in topology that happen after a route has initially been created [2].

3. Hybrid Routing Protocols

Hybrid routing protocols are a new generation of protocol, which are both are Proactive and Reactive in nature. Most hybrid protocols proposed to date are zone based, which means that the network is partitioned or seen as a number of zones by each node. Normally, Hybrid routing protocols for MANETs exploit hierarchical network architectures [2].

III. BACKGROUND

A. AODV overview

Authors of the AODV draft described in [15], when a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node. It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to their neighbors, and so on, until either the destination or an intermediate node with a fresh enough route to the destination is located. Figure 1 illustrates the propagation of the broadcast RREQs across the network. AODV uses destination sequence numbers to ensure all routes are loop-free and contain the most recent route information. Each node maintains its own sequence number, as well as a broadcast ID. The broadcast ID is incremented for every RREQ the node initiates, and together with the IP address of the node, uniquely identifies a RREQ. Along with its own sequence number and the broadcast ID, the source node includes in the RREQ the most recent sequence number it has for the destination. Intermediate nodes can reply to the RREQ only if they have a route to the destination whose corresponding destination sequence number is greater than or equal to that contained in the RREQ.

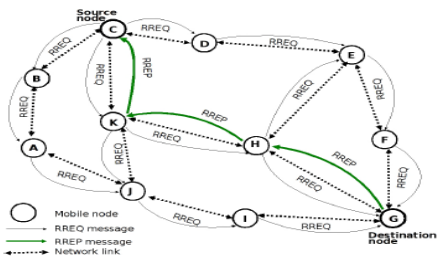

Fig.2. AODV route discovery

B. DYMO overview

In the DYMO (Dynamic On-demand MANET routing protocol) draft [1] is said that DYMO enables reactive, multihop unicast routing among participating DYMO routers. The basic operations of the DYMO protocol are route discovery and route maintenance. For a route discovery a source node initiates broadcasting of a route request (RREQ) (fig. 2) throughout the network to find a route to the destination node. During this hop-by-hop 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) (green lines in figure 2) sent hop-by-hop toward the source node. Each intermediate node that receives the RREP creates a route to the destination node, and then the RREP is unicast hop-by-hop toward the originator. When the source node receives the RREP, routes have then been established between the originating node and the destination node in both directions. Route maintenance consists of two operations. In order to preserve routes in use, DYMO nodes extend route lifetimes upon successfully forwarding a packet. In order to react to changes in the network topology, DYMO nodes monitor links over which traffic is flowing. When a data packet is received for forwarding and a route for the destination is not known or the route is broken, then the source node of the packet is notified. A route error (RERR) is sent toward the packet source to indicate the current route to a particular destination is invalid or missing. When the source node receives the RERR, it deletes the route. If the source node later receives a packet for forwarding to the same destination, it will need to perform route discovery again for that destination.

When a source needs to send a data packet, it sends an RREQ to discover a route to that particular destination shown in figure 3. After issuing an RREQ, the origin DYMO router waits for a route to be discovered. If a route is not obtained within RREQ waiting time, it may again try to discover a route by issuing another RREQ. To reduce congestion in a network, repeated attempts at route discovery for a particular target node should utilize an exponential back off. Data packets awaiting a route should be buffered by the source's DYMO router. This buffer should have a fixed limited size and older data packets should be discarded first. Buffering of data packets can have both positive and negative effects, and therefore buffer settings should be administratively configurable or intelligently controlled. If a route discovery has been attempted maximum times without receiving a route to the target node, all data packets intended for the corresponding target node are dropped

from the buffer and a Destination Unreachable ICMP message is delivered to the source.

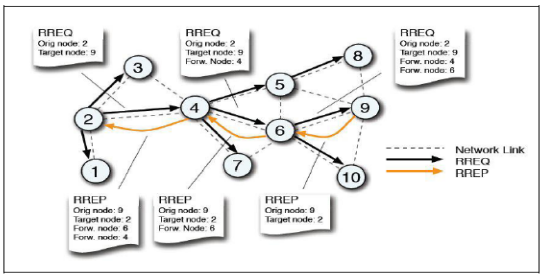

Figure 3. DYMO route discovery [2]

When a data packet is to be forwarded and it cannot be delivered to the next-hop because no forwarding route for the IP Destination Address exists, an RERR is issued shown in below figure. Based on this condition, an ICMP Destination Unreachable message must not be generated unless this router is responsible for the IP Destination Address and that IP Destination Address is known to be unreachable. In this diagram second number node is source and ninth number node is destination. their source are send request all off node and discover the destination. Request are going all over the node and it's dose not find destination then after some time search the destination and destination forward a route reply to the source.

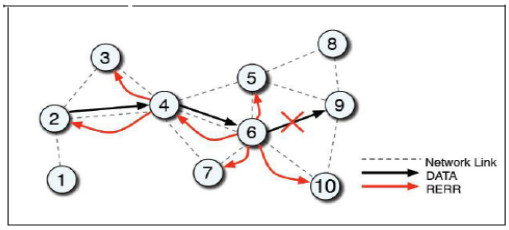

Fig-4 Generation and dissemination of RE [2]

Unless this router is responsible for the IP Destination Address and that IP Destination Address is known to be unreachable. Moreover, an RERR should be issued after detecting a broken link of a forwarding route and quickly notify DYMO routers that a link break occurred and that certain routes are no longer available. If the route with the broken link has not been used recently, the RERR should not be generated [2].

C. DSR overview

A. Dynamic Source Routing (DSR) Protocol: DSR is based on the concept of source routing protocol wherein the sender node knows the complete hop by hop route to the destination and every generated data packet carries this information in its packet header. DSR is composed of two main mechanisms: Route Discovery and Route Maintenance [3] [4]. For route discovery the source node floods the route request (RREQ) packets in the network. The nodes receiving RREQ rebroadcast it and the process repeats until the destination node or an intermediate node having a route to the destination is found. Such a node replies back to the source with a RREP packet Route request (RREQ) and route reply (RREP) packets accumulate source route so that once a route is discovered, the source learns the entire source route and can place that route into subsequent data packets. The source node places the destination IP address, into the RREQ and broadcasts the message to its neighbor's node. When a node with a route to the destination receives the RREQ, it responds by creating a RREP to the source. Intermediate nodes have only to transmit the packet according to the source route. These routes are maintained in a route cache and are cache entries need not have lifetimes). When a link break in an established path occurs, the node upstream of the break creates a route error (RERR) message and sends it to the source node. On receiving RERR the source node utilizes alternate routes from the route cache, if they are available, to prevent another route discovery [4]. The drawback with DSR is that it needs to place entire route in both the route replies and the data packets and thus requires greater control overhead. An advantage of DSR is that it does not make use of periodic routing advertisements so that there is saving in bandwidth and power consumption[8].

IV. SIMULATION ENVIRONMENTS

Simulation is done using QualNet5.0.2 simulator and AODV, DSR, DYMO routing protocols. Constant bit rate (CBR) traffic sources are used. The source-destination pairs are spread random waypoint model in a rectangular field with 1500m × 1500m field whereas network size is 20,20, and20 nodes and CBR varied 1,2,3,4 and another network size varied node are constant and only CBR is varied 1,2,3,4 and Simulation are run for 100 simulated seconds. We studied the performance of AODV, DYMO, DSR protocols. The performance metrics that we evaluated are Average Jitter, Average End to End delay, packet delivery Delay, Throughput and Packet Delivery Ratio.

Table 2.2: Network With Constant Nodes And Varying Traffic

rameters	**rameter Values**
potocol	ODV,DSR,DYMO
affic type	BR 1,2,3,4
o. of Nodes	,20,20
mulation area	00*1500
mulation Time	0s

Performance Metrics are-

Average jitter: Average Jitter is the variation (difference) of the inter-arrival times between the two successive packets received.

Average end to end delay: Average End to End Delay can be defined as a measure of average time taken to transmit each packet of data from Source node to Destination node.

Packet delivery ratio (PDR): Packet Delivery Ratio is defined as the ratio of the number of data packets successfully delivered to those generated by the source.

Packet Delivery Ratio = (Received packets/Sent Packets)*100.

Throughput: Throughput is the measure of the number of packets successfully transmitted to their final destination per unit time.

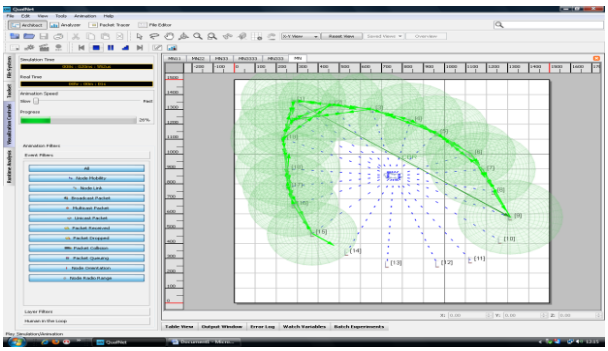

Fig.-5Scenario of 20 Nodes with 1 CBR

4.1 Average jitter

As can be observed from figure 6, the Average Jitter is very less in DSR. In DYMO it is less at less number of nodes and is more at high number of nodes. In LANMAR the Average Jitter is less at less network size but increases with higher network size.

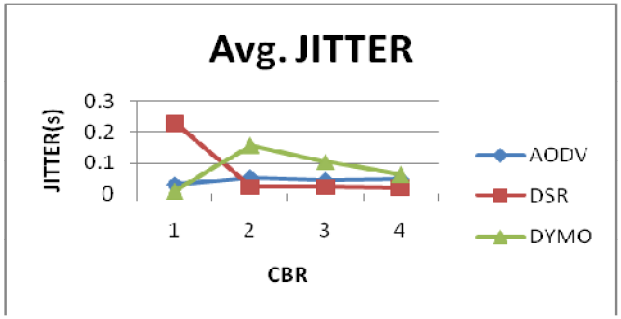

Fig-6 Average jitter

4.2. Average end to end delay

It can be observed from Figure 7, Average End to End Delay is less in AODV low traffic. In DYMO average, end to end delay high increases with CBR traffic lode. DYMO showing highest average end-to-end delay in traffic is increases with CBR lode.

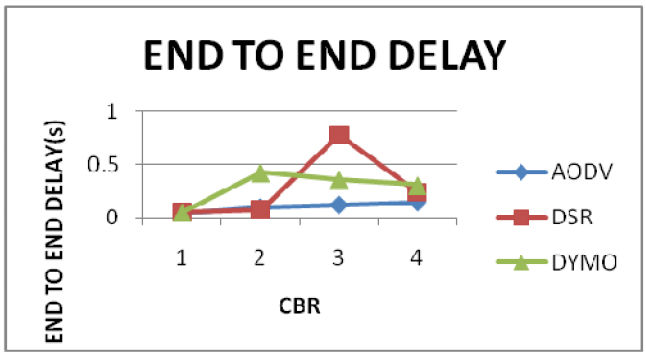

Fig-7 Average End to End Delays

4.3 PACKET DELIVERY RATIO

We can be observed from Figure 8 Packet Delivery Ratio is more in DSR and AODV compared to DYMO protocol. With traffic lode is less (CBR=1). But at traffic lode more than CBR=1 AODV performing poorly. Packet Delivery Ratio in AODV protocol is high with less CBR traffic but less with high traffic PDR is almost same as network size of s20 nodes. Overall DSR performing well compared to DYMO and AODV protocol. We can observe in this figure DSR is high packet received and then DYMO routing protocol in high traffic lode and then next one is s AODV

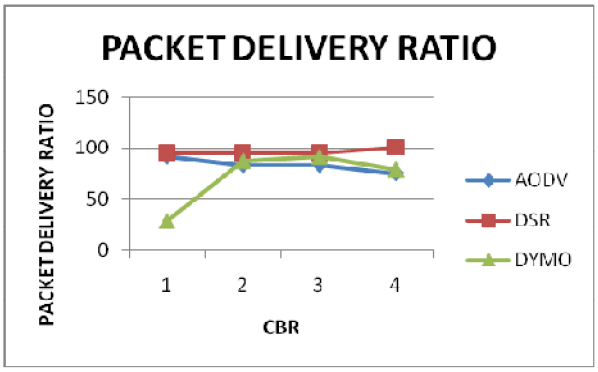

Fig-8 Packet Delivery Ratios

4.4 THROUGHPUT

It can be observed from Figure 9, CBR lode is high, and Throughput is minimum in ZRP. Where DSR performing well. But AODV routing protocol perform poorly at CBR lode high overall DSR routing protocol are performing well compared to ZRP and AODV. Overall

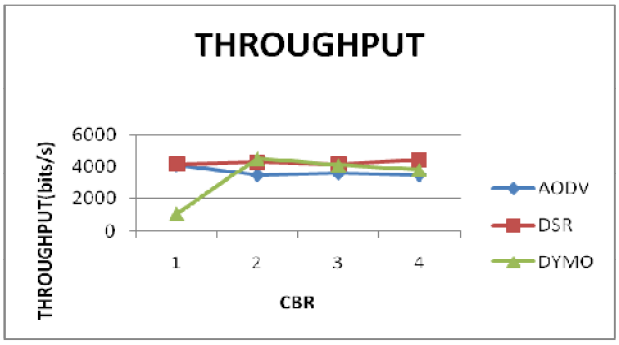

Fig-9 Throughput

V. CONCLUSION

In our simulation, the performance of AODV, DSR, and DYMO in random placement model is evaluated for constant network sizes with varying CBR, using Qual Net simulator. From different analysis of graph and simulation, we can conclude that DSR protocol in random placement is giving higher throughput and packet delivery ratio and minimum jitter when AODV, DYMO protocol is giving high Average End to End Delay and Average Jitter.

VI. ACKNOLEDGEMENT

The authors thank Director, IET DAVV Indore, for their support in allowing to do research on Qualnet simulator. Authors would also thank their research guides and Qualnet team.

REFERENCES

I. "Performance Analysis of DSR, AODV Routing Protocols based on Wormhole Attack in Mobile Ad-hoc Network" International journal of computer application (0975 – 8887) vol. 26 – No. 5, July 2011.

II. Dr. Ritika and Dr. Nipur, "Performance evaluation of reactive, proactive and hydrid routing protocols based on network size manet", international journal of computer science and security (IJCSS), vol. (6) issue (1): 2012.

III. Harish shakywar, sanjeev Sharma and Santoh sahu, "Performance analysis of DYMO, LANMAR, STAR routing protocols for grid placement modelwith varying network size", international journal of computer tech applications, vol. 2 (6), page no. 1775 – 1760.

IV. V.K.Taksande, Dr.K.D.Kulat, "An Extensive Simulation Analysis of AODV Protocol with IEEE 802.11 MAC for Chain Topology in MANET" International Journal of Internet Computing, Volume-I, Issue-1, 2011.

V. Kamaljit l. lakhtaria "Analyzing zone routing protocol in MANET applying authentic parameter" national conference.

VI. Julian Hsu, Sameer Bhatia, Mineo Takai, Rajive Bagrodia and Michael J. Acriche. "performance of mobile ad hoc networking routing protocols in realistic scenarios", issues 8 march 2003, page no. 1268 – 1274.

VII. Behrouz A. forouzan, "Data Communication and network", vol. 3, 2003, page no529.

VIII. Khushboo Tripathi & S. D. Dixit, "A Comparative Study of Channel Fading Effect on Ad Hoc Routing Protocols", International Journal of Engineering Trends and Technology- July to Aug Issue 2011, page no. 19 – 23.