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Comparative Study of Adhoc Routing Protocol DYMO, LANMAR, XMESH, and ZRP in Mobile Adhoc Network

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***Abstract* — A mobile Ad-hoc network are self-organized wireless network which are able to connect on a wireless medium without the use of a infrastructure or any centralized administration. The mobile nodes perform both as a host and a router forwarding packets to other nodes routing in these network is highly complex nodes within each other's radio range communication directly via wireless links while those that are far apart use other nodes as relays in a multi-hop routing fashion.**

This paper present performance comparison of four mobile ad-hoc network routing protocols i.e Dynamic MANET on demand(DYMO),Landmark Ad-hoc routing(LANMAR), XMESH, Zone routing protocol(ZRP) using Qualnet 5.0.2 The performance analysis is based on different network metrics such as End-to-End delay(s), Average Jitter(s), Total packet received and Throughput.

***Key Words* — DYMO, LANMAR, MANET, QUALNET, XMESH, ZRP.**

I. INTRODUCTION

An ad-hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any stand-alone infrastructure or centralized administration [1]

Mobile Ad-hoc networks are self-organizing and self-configuring multihop wireless networks where, the structure of the network changes dynamically. This is mainly due to the mobility of the nodes [3]. Nodes in these networks utilize the same random access wireless channel, cooperating in a friendly manner to engaging themselves in multihop forwarding.

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The node in the network not only acts as hosts but also as routers that route data to/from other nodes in network [2].

II. AD-HOC ROUTING PROTOCOLS

2.1 Types of routing protocols

Ad-hoc routing protocols can be divided into three categories, Proactive (Table driven) routing protocol, Reactive (On demand) routing protocol and Hybrid routing protocol.

2.1.1 Proactive (Table driven) routing protocol

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. Changes in network topology are propagated throughput the network.

2.1.2 Reactive (On demand) routing protocol

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.

2.1.3 Hybrid routing protocol

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.

2.2 The protocols studied here are :

2.2.1 The Dynamic MANET On-demand (DYMO)

The Dynamic MANET On-demand (DYMO) protocol is a reactive routing protocol being developed within IETF's MANET working group. The Dynamic MANET On-demand DYMO routing protocol is a newly proposed protocol currently defined in an IETF Internet-Draft in its sixth revision and is still work in progress. DYMO is a successor of the AODV routing protocol. It operates similarly to AODV.DYMO can work as both a pro-active and as a reactive routing protocol, i.e. routes can be discovered just when they are needed. In any way, to discover new routes the following two steps take place:

A special "Route Request" (**RREQ**) messages is broadcast through the MANET. Each RREQ keeps an ordered list of all nodes it passed through, so every host receiving an RREQ message can immediately record a route back to the origin of this message. When an RREQ message arrives at its destination, a "Routing Reply" (**RREP**) message will immediately get passed back to the origin, indicating that a route to the destination was found. On its way back to the source, an RREP message can simply back trace the way the RREQ message took and simultaneously allow all hosts it

passes to record a complementary route back to where it came from.So as soon as the RREP message reaches its destination, a two-way route was successfully recorded by all intermediate hosts, and exchange of data packets can commence.

2.2.2 Landmark Ad-hoc routing(LANMAR)

This protocol combines properties of link state and distance vector algorithm and builds subnets of groups of nodes which are likely to move together [11] LANMAR consists of two complementary and cooperating routing schemes: (a) a local "myopic" proactive routing scheme that operates within a limited scope centered at each node and exchanges route information about nodes up to only a few hops; and (b) a "long haul" distance vector routing scheme that propagates the elected landmark of each subnet and the path to it into the entire network . if the packet's destination node is much farther. The packet is first routed to its nearest landmark node. As the packet gets closer to its destination, it acquires more accurate routing information, thus in some cases it may bypass the landmark node and routed directly to its destination. The link state update process is again similar to the FSR protocol. Nodes exchange topology updates with their one-hop neighbors. A distance vector, which is calculated based on the number of landmarks, is added to each update packet. As a result of this process, the routing tables entries with smaller sequence numbers are replaced with larger ones [12].

2.2.3 XMESH

XMesh is a multi-hop routing protocol developed by Crossbow to run on the MICA family of motes using the Tiny OS environment [35]. It is an ad-hoc mesh networking protocol capable of network formation without the need for human intervention. It is also capable of adding and removing network nodes automatically without having to reset the network. It uses a routing beacon from the base station to establish route paths back In the XMesh routing algorithm [6], the cost metric is one that minimizes the total number of transmissions in delivering a packet over multiple hops to a destination and is termed the Minimum Transmission (MT) cost metric. This differs from the traditional cost metric of distance vector routing which is hop count. In highly reliable links, retransmissions are infrequent and hop count would suffice in capturing the cost of packet delivery. However, with links of varying quality, a longer path with fewer retransmissions may be better than a shorter path with many retransmissions. That is, the energy required to transmit a packet over a distance with a single hop will be far greater that the energy required transmitting a packet over that distance with multiple hops.

2.2.4 Zone routing protocol(ZRP)

ZRP [7] is the first hybrid category protocol which effectively combines best features of reactive and proactive routing protocols. It employs concept of proactive routing scheme within limited zone (within the r-hop neighborhood of each node), and uses reactive approach beyond that zone. The two routing schemes used by ZRP are: (i) Intra-zone routing protocol (IARP) and (ii) Inter-zone routing protocol (IERP). In ZRP, the distance and a node, all nodes within - hop distance from node belongs to the routing zone of node. ZRP is formed by two sub-protocols, a proactive routing protocol: Intra-zone Routing Protocol (IARP) [8] is used inside routing zones and a reactive routing protocol: Inter-zone Routing Protocol (IERP) [9] is used between routing zones, respectively. A route to a destination within the local zone can be established from the proactively cached routing table of the source by IARP,

Therefore, if the source and destination is in the same zone, the packet can be delivered immediately. Most of the existing proactive routing algorithms can be used as the IARP for ZRP.

III. SIMULATION ENVIRONMENTS

To evaluate and compare the effectiveness of these routing protocols in a Mobile Ad-Hoc network, we performed extensive simulations in QualNet5.0.2 each simulation is carried out under a constant mobility. The simulation parameters are listed in Table 1.

Table 1: Simulation Parameters

PARAMETER	VALUE
Data Rate	1 Mbps
Buffer Size	150000
Antenna	Steerable
Terrain Range	1500mx1500m
Traffic Type	CBR
No. of nodes	50
Channel Type	Wireless channel

3.1 PERFORMANCE METRICS

The following performance metrics are used to compare the performance of the routing protocols in the simulation:

3.1.1 Average Jitter

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

3.1.2 Average End-To-End Delay(s)

End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination

3.1.3 Total Packet Received

It is the number of packets received by the server.

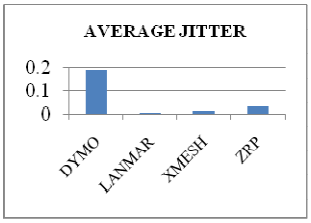
3.1.4 Throughput (bit/s)

Throughput is the average rate of successful message delivery over a communication channel

IV. RESULT

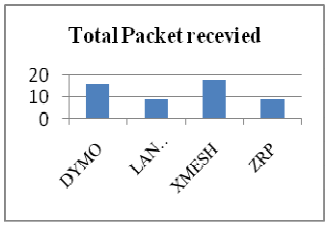
I have studied the performances of routing protocols DYMO, LANMAR, XMESH & ZRP at a data rate of 1Mbps. Steerable antenna is used here. As per the results the average jitter is high in DYMO as compared to other three. Although the packet delivery is higher in XMESH & DYMO as compared with LANMAR & ZRP. Delay in the arrival of packets is also high in case of DYMO. But the throughputs of DYMO & XMESH are greater than LANMAR & ZRP. If a overall performance is taken into account then XMESH is better compared with the DYMO, LANMAR & ZRP.

Average Jitter



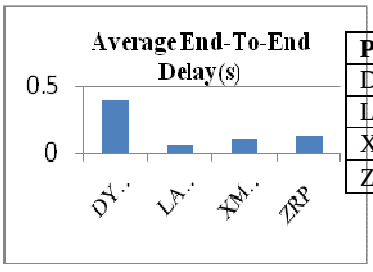
Protocol	Value
DYMO	0.185366
LANMAR	0.003342
XMESH	0.0130201
ZRP	0.0278622

Total Packet Received



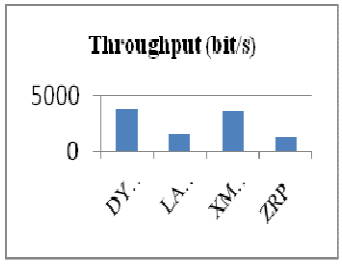
Protocol	Value
DYMO	0.397351
LANMAR	0.0483571
XMESH	0.101318
ZRP	0.122934

Average End-To-End Delay(s)



Protocol	Value
DYMO	16
LANMAR	9
XMESH	18
ZRP	9

Throughput (bit/s)



Protocol	Value
DYMO	3749
LANMAR	1479
XMESH	3509
ZRP	1298

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