SIMULATION BASED COMPARATIVE ANALYSIS OF MANET ROUTING PROTOCOLS USING MULTIPLE TRAFFIC TYPES

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Abstract — Ad hoc networks are self-configuring self-healing, self-managing and self-forming networks. If two or more parties want to communicate with each other with in radio range there is no need of any centralized node like conventional client server architecture. In ad hoc network each node has two roles at the same time, host and router. Nodes can communicate with each other if they are directly in range either other nodes help to communicate by forwarding packet from source to destination. Wireless routing is much difficult as compared to wired. Error correction and detection, channel access, hidden and exposed terminal problem, limited bandwidth, fading, mobility of nodes, weather problems etc. all things are big challenges in wireless routing. This paper is on behavioral analysis of ad hoc network routing protocols on different metrics by using OPNET Modeler Educational version. The metrics used are throughput, delay, load etc. while using different traffic types e.g. Video, Email, HTTP, FTP etc. Results showed that OLSR worked the best under the created scenarios.

I. INTRODUCTION

Ad hoc network is also one of the types of wireless communication. In ad hoc network nodes can communicate with each other if they are within the radio range without any pre configuring settings like GSM and WIMAX systems. Nodes can easily join and leave such network without any issues (if security is not implemented). Main problem in the ad hoc network is routing because of highly dynamic changes in topology. Nodes would be leaving and joining network continuously, topology and routing decisions are changing continuously due to mobility of nodes. Some protocols are scalable and some are not. Routing protocols [1] should be loop free. If there are loops present in the path from source to destination, packets will never reach to destination and will keep traversing in the network. Routing protocols should be energy efficient and should save the battery life span for network life. Routing protocols should save the redundant paths every time due to dynamic changes in topology and broken paths.

II. ROUTING IN MANETS

Routing protocols have different types according to their functionality and working mechanisms. Some routing protocols are reactive and some are proactive. In proactive routing tables are maintain by flooding in whole networks and receives all information of network then routing starts. Start of these kinds of routing protocols are slow because in start routes are calculate and then store in network table then nodes share hole tables in network. In reactive routing paths are computed only when needed to minimize the number of transmissions.

Some routing protocols send periodic updates all over the time. In event driven routing protocols update is only received when new event occurs. In hierarchal routing hierarchy it is created from top to bottom. These types of protocols are designed for dense networks in which numbers of nodes are high. In centralized routing only central node has information about all paths of the network and also has topology information. It is good for security point of view but it is not robust. In distributed system all nodes calculate paths and each node has information of whole network. In single path routing, single path is used for routing; no multiple paths are available for emergency. If a path is lost then path finding process starts. In multiple paths routing, multiple paths are used for routing, if one path is broken accidently alternative paths are ready for routing.

III. RELATED WORK

Gagangeet et al [2] performed comparative analysis of AODV, DSR, GRP, OLSR and TORA by varying number of nodes with ftp and http applications over MANETs using OPNET simulator. Results showed that OLSR exhibited highest throughput over http and ftp traffic. Parul et al [3] performed simulation based analysis of conventional routing protocols (AODV, DSR AND DSDV) and conventional traffic (CBR) by varying nodes using Mat-lab simulator. After simulation he found that AODV is the best protocol under the circumstances. Gagangeet et al [4] again performed simulation based comparative analysis of TORA, OLSR and GRP protocols and used OPNET for the traffic of Email and Video conferencing applications. Results showed that under varying number of nodes with same area and simulation time, OLSR showed the highest throughput with the lowest delay. Hossein et al [5] performed a survey of MANET routing protocols in large-scale and ordinary networks for constant bit rate traffic by varying nodes, varying simulation area and varying simulation time. OLSR overall performance was found better than other routing protocols. Deepinder et al [6] performed comparison of Single and Multipath Routing Protocols (AODV, AOMDV, DSDV) by varying number of nodes. AOMDV performed better because Packet Delivery Ratio was higher than others. Throughput of AODV was higher as compared to others. Kaur et al [7] performed comparison of AODV, OLSR, TORA, OSPFv3 using Opnet simulator with default settings. Throughput of AODV was higher as compared to others while OSPFv3 was better than TORA. Subramanya et al [8] used Qualnet built in protocols

AODV, DSR, LAR, OLSR, ZRP. Results showed that throughput of AODV was higher than other because of CBR traffic. ZRP, LAR and OLSR required much more time in starting for route establishment.

IV. RESULTS & DISCUSSION

OPNET MODLER is used for simulation to measure performance of ad hoc network routing protocols on different metrics (Table 1). One scenario is created in which 150 nodes are used in simulation; simulation area is 1km×1km and random way mobility model is used for mobility. Heavy load of ftp, http, Email, Database, Video conferencing and Print traffic are used in the network. All result graphs showed average values.

Table 1. Simulation parameters

Simulation Parameter	Values
Simulation time	10 minutes
Simulation Area	1km×1km
Routing protocols	AODV, DSR, GRP, OLSR
Number of Nodes	150
Data rate	54mpbs
Lan physical characteristics	OFDM 802.11a
Buffer size	256000bits
Mobility model	Random way point with 5m/s velocity
Application name	FTP, HTTP (heavy browsing), Email, Data Bases, Print (images), Video Conferencing (high video quality)

Throughput: after finishing simulation, by using ftp, http, database, print and email traffic we can see that OLSR shows the highest throughput from rest protocols and GRP shows the lowest throughput even lower than DSR.

Delay: it shows entire delay of this simulation on various traffics mentioned above. DSR shows the highest value of delay 18.9 seconds and AODV shows the second highest value of delay 8.18 seconds. OLSR and GRP show the lowest values of delay.

Media Access delay: DSR protocols show the highest value of media access delay about 20 seconds and AODV shows the 2nd highest value 9.8 seconds. OLSR and GRP has the lowest value of media access delay.

Network load: AODV shows the highest value of in this simulation 2825.31, in starting GRP also shows the second highest value of network load but this load is not consistent after a time thus it shows the lowest value. OLSR shows the 3rd highest value of network load 8025.62.

To sum it up (Table 2), OLSR outperformed all others routing protocols having maximum throughput and the lowest overall delay. AODV is the second best protocol under these circumstances having the second highest throughput but much lower than that of OLSR. DSR has the lowest network load but its throughput is minimum than rest of the protocols.

Table 2. Results of simulation

Metrics	AODV	DSR	GRP	OLSR
Throughput	282523 17.31	140407 75.307	127138 06.67	802548 09.62
Network Load	239996 2.507	149817 8.64	227761 3.333	166463 5.077
Media Access Delay	9.8055 59336	20.568 76424	0.0010 91405	5.2640 7E-05
Delay	8.1811 54206	18.901 6956	0.0010 79829	8.9904 3E-05

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