Performance Analysis of MANET Routing Protocols under different Traffic Loads in OPNET

A.Gowthami[1], B.Jenitha[2],R.Meena[3],R.Parthiban[4]
Student of Department of Information Technology
M.Kumarasamy College of Engineering (Autonomous) Karur, Tamil Nadu.
Email id- gowthamianbazhagan@gmail.com[1],jenithamkce@gmail.com[2],meenaswt3@gmail.com[3], parthiban008296@gmail.com[4]

ABSTRACT

A Mobile Ad-Hoc Network is a special type of dynamic network where no infrastructure is required for communication. The mobile node uses multiple hops to communicate with one another across the network. In recent years, the development of routing protocols for MANET has been increased, but in literature only few realistic performance comparison among the protocols are available. This study compares the performance of three routing protocols (AODV, DSR and OLSR) over different traffic loads. The QoS metrics End-to-End delay, throughput and network load are considered for the analysis of the routing protocols. OPNET tool has been used for simulation.

1. INTRODUCTION

MANET is a dynamic wireless network, where all the nodes act as both host and Router. The important characteristic of MANET is that no special infrastructure is required for communication among nodes; this feature powers the wireless communication technology. The nodes in MANET environment are dynamic and the mobility of the node depends on its type. The mobile nodes could be mobile phones, Laptops and PDA's. MANET protocols are broadly categorized as proactive and reactive protocols. Proactive protocols update the routing table of all mobile nodes significantly, where as Reactive protocols seek for routing table update only when demand for communication arises. Since the performance of routing protocols differ from application to application, evaluating the performance of routing protocols become more essential. This study was undertaken to analyze the performance of AODV, DSR and OLSR routing protocols under various traffic load.

To determine the performance of the MANET routing protocols, various Open source and commercial simulator tools are available. This study was to simulate and compare the performance of three MANET routing protocols under different scenarios in OPNET. Various routing protocols are developed to address the challenges in the Ad-Hoc network. The working of MANET protocols are not unique, it differs from one application traffic to other. The objective of this study is to identify the best routing protocol for a particular type of node. The basic concept is to simulate the mobile nodes with various routing protocols under different traffic and analyze the results. In order to predict the best routing protocol for a particular application, we use OPNET tool to simulate the mobile nodes using different routing protocols and analyze the performance of each protocol.

The performance analysis of protocols is based on the parameters such as, network load, delay and throughput. the hypothesis behind this is to select the protocol which is best suited for a particular traffic. Since the behavior of MANET protocols differ from each other, we need to capture the simulation events in a table for analysis. Real time implementation of MANET is much expensive and finding the best routing protocol among a list takes much time and money. To determine the best routing protocol we use a simulating tool called

OPNET.

The significant advantage of OPNET is that, it is user friendly. Network modeling and configuration are easy to create. OPNET tool network modeler is used to design the network environment. Then the application and profile configurations for mobile nodes are described. Here three parameters such as delay, throughput and network load are configured on the mobile nodes.

2. SIMULATION AND MODELS

OPNET simulator is used for evaluating the performance of various routing protocols under different network load. In our campus network model 60 mobile nodes were randomly placed in a 1000m x 1000m area. The mobile node trajectory is configured as wlan_roaming4. The routing protocols taken for analysis were AODV, DSR and OLSR. These protocols are assigned to mobile nodes under the network traffics such as, HTTP, FTP and E-Mail. To analyze the performance of the routing protocols three metrics namely, average End-to-End delay, Network load and throughput are considered.

Average End-to-End Delay:

It describes the time interval between the packet transmitted and received at the source and destination respectively. This delay is the sum of transmission delay, propagation delay, processing delay and queuing delay.

Average Network load:

It describes the ratio between the numbers of routing packets sent per the data packet received at the destination.

Throughput:

Throughput determines the useful utilization of channel capacity for data transmission. Throughput is described as the total number of packets delivered in the entire simulation period.

Parameter	value
	1000m x 1000m
	60 minutes
Total Mobile Nodes	60
MAC Type	802.11
Mobile node range	250m
Data rate	11 Mbps
Traffic types	HTTP, FTP and E-Mail
Packet size	512 kb
Seed	128
Update Interval	10000 events
Simulation Kernel	Optimized

Table 1: Simulation Parameters

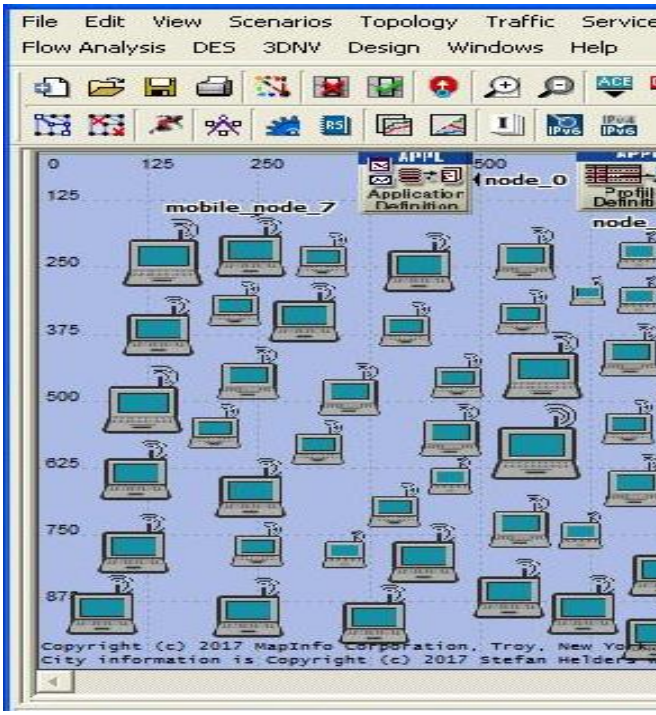

Fig 1: Network Model

3. ANALYSIS AND DISCUSSION

HTTP Traffic:

The below graph depicts the performance of routing protocols over HTTP traffic. Fig 2 shows the average delay. Initially average delay in mobile nodes running DSR and AODV protocols was having longer delay and it reduces gradually over time. Comparatively DSR

records higher delay over other two protocols. Fig 3 shows the average network load of the routing protocols. Three routing protocols impose different sets of overhead. Comparatively DSR routing protocol witnesses less over head. Fig 4 depicts the average throughput of routing protocols for the network. AODV shows better Throughput compared to DSR and OLSR.

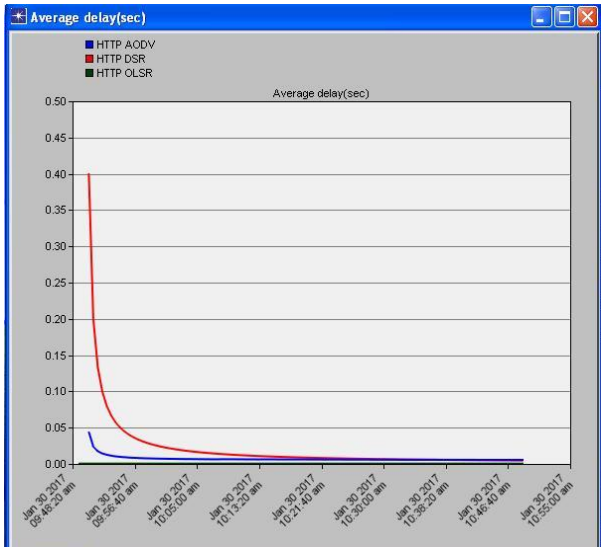

Fig 2. Average End-to-End Delay

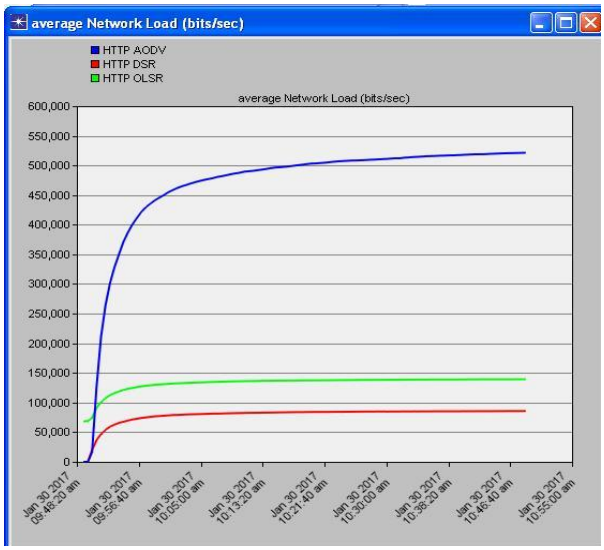

Fig 3. Average network load

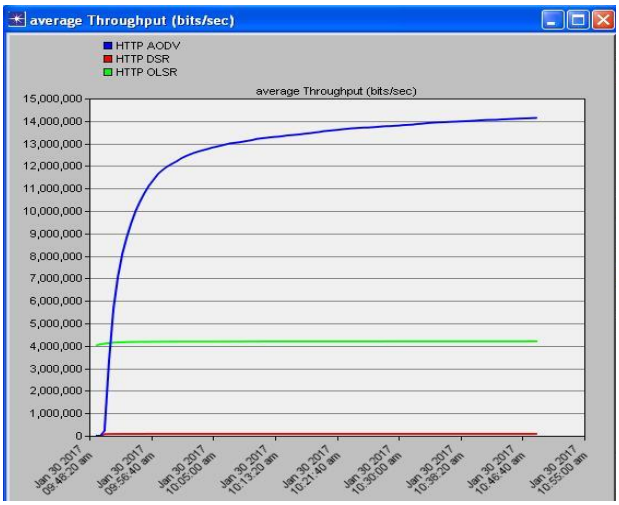

Fig 4. Average Throughput

FTP Traffic:

The performances of routing protocols over FTP traffic is showed in the below graph. When we compare the results of FTP traffic with HTTP traffic, AODV has high throughput in FTP traffic. The other performance metrics shows slight deviation in FTP traffic results when compared with HTTP traffic.

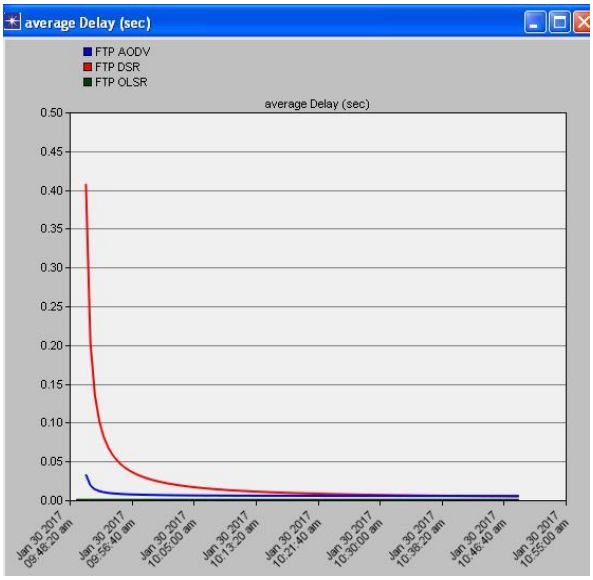

Fig 5. Average End-to-End Delay

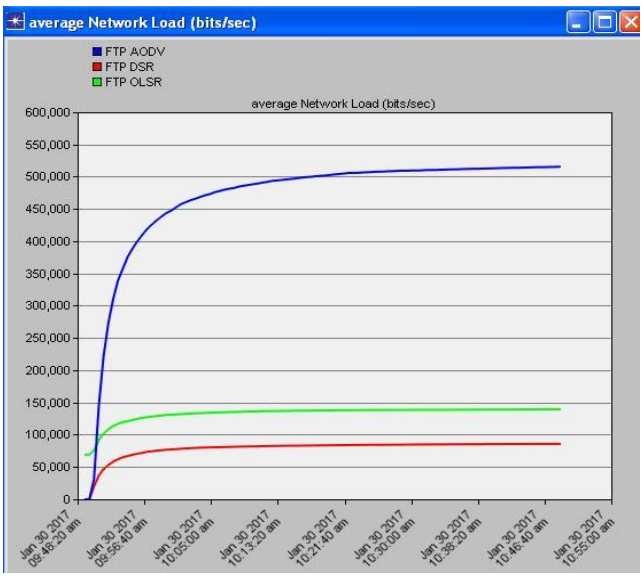

Fig 6. Average network load

Fig 7. Average Throughput

E-Mail Traffic:

The following graphs depict the performance of routing protocols over E-Mail traffic. The performances of protocols in E-Mail traffic and FTP traffic show similar results.

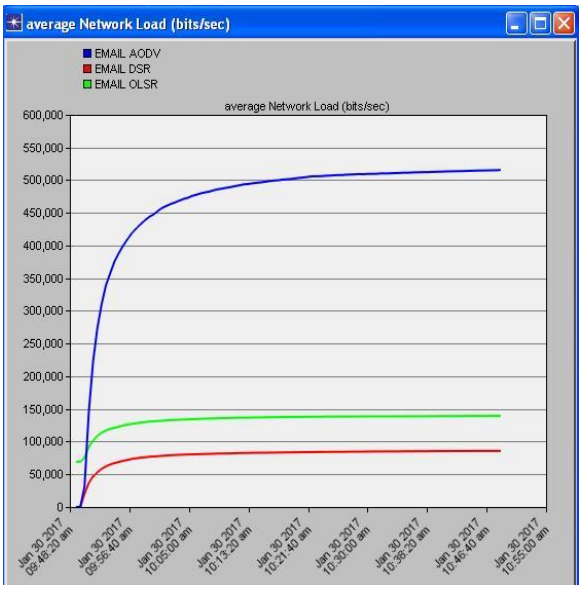

Fig 8. Average network load

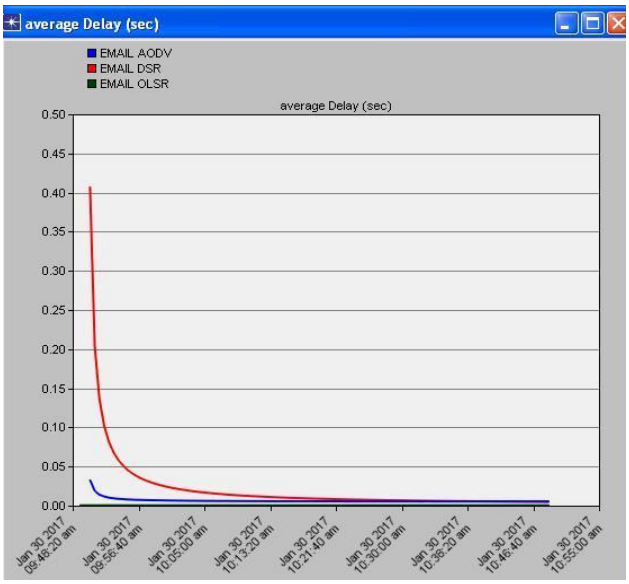

Fig 9. Average End-to-End Delay

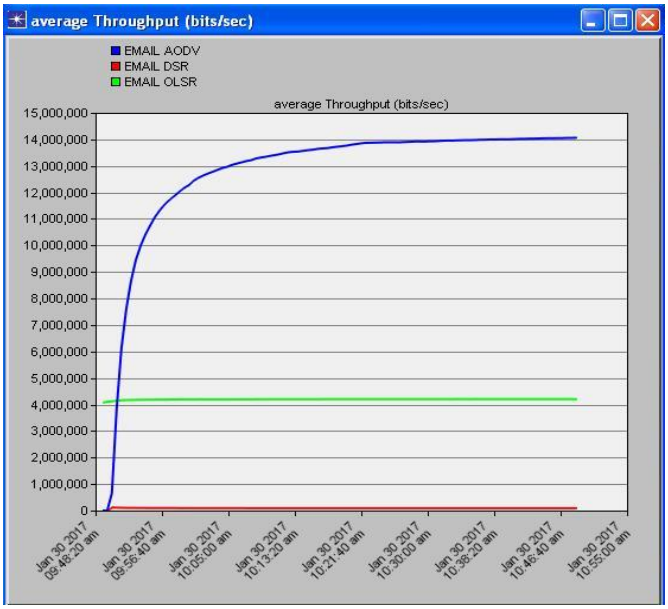

Fig 10. Average Throughput

4. CONCLUSION

The performance of routing protocols over different traffics had been discussed. The simulation result shows that AODV has high throughput in FTP and E-Mail traffic comparing to HTTP traffic. DSR throughput over HTTP traffic is low compared over other two traffics. The performance results of OLSR remains similar for all network traffics. AODV protocol shows better throughput over all other routing protocols. The study on routing protocol performance has given merits of one protocol over other.

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