Chapter 3

Comparison of performance of routing protocols under NS2 and Qualnet

3.1Introduction

Routing protocols are used to route packets from source to destination. Many of them have been proposed in literature. The performance of any routing protocol depends on the duration of interconnection among the nodes in the network for transferring the data. This interconnection results in an average connected path for whole network. The node mobility is one of the parameter that affects the performance of the routing protocols.

Simulators are software tools, which simulate the actual working of network in pre-defined scenarios. Many simulators have been developed to model the networks e.g. NS2, Qualnet, GloMoSim, NS3, Maryland packet simulator etc. Each simulator has been effectively designed for different scenarios.

This chapter aims to compare performance of some of the widely used routing protocols viz. OLSR [65] and AODV [69] under two widely used simulators NS2 [81] and Qualnet [82], using similar set of parameters. We wish to observe how the routing protocols perform under different simulators. We have considered two parameters namely throughput and end to end delay.

Organization of the rest of chapter is as follows. In section 3.2, state of the art is discussed followed by a description of the simulation setup in section 3.3. Results are given in section 3.4. Chapter is concluded in section 3.5.

3.2 State of the Art

We inspected past few years works on MANET which included simulations done on NS2 [81] and Qualnet [82]. The researchers have chosen random way point mobility model [5] and analysed the general performance characteristics.

Cavin et.al [4] suggested that the learning curve for NS-2 is steep and debugging is difficult due to the dual C++/OTcl nature of the simulator. An important limitation of

NS2, is its large memory footprint and its lack of scalability as soon as simulations of a few hundred to a few thousand of nodes are undertaken.

Imran Khanet.al [84] evaluated the performance of AODV and OLSR. It was observed that OLSR was able to give better PDR and less End-to-End delay than AODV.

Jerome Haerri et.al [85] simulated AODV and OLSR for varying metrics such as node mobility and vehicle density with varying traffic rates. The goal was to provide a qualitative assessment of the applicability of the protocols in different vehicular scenarios.

3.3 Simulation Setup

We have used NS2 and Qualnet for simulations. AODV and OLSR have been simulated to assess the performance. The channel frequency is set to 2.4 GHz for random waypoint mobility model. The simulations are carried out at node density of 0, 50, 100, 150, 200, 250, 500, 750 and 1000 with CBR traffic and packet size of 512 bytes. The simulation parameters are listed in table 3.1.

Parameter	Value
Channel Type	Wireless
Radio Propagation Model	Two ray ground
Network Interface Type	Phy. /Wireless
MAC Type	Mac/ 802.11
Antenna	Omni Antenna
Maximum Packet	50
Area	1500m x 1500m
Number of Nodes	0 to 1000
Simulation Time	500 sec
Routing Protocol	AODV, OLSR
Speed of Nodes	2 m/s

Table 3.1: Simulation Parameters

We have evaluated throughput and end to end delay.

Throughput: It is defined as the percentage of the number of packets that are received by the destination(s) against the number of packets received by the source(s).

Throughput = (Data packets received / Data packets sent) x 100 (eq. 1)

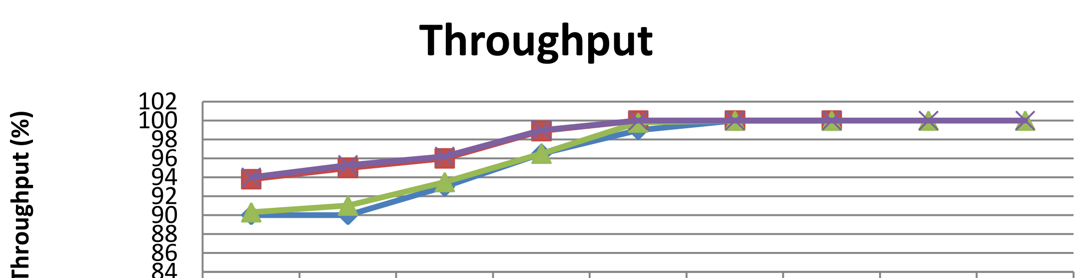
End to end delay: It is the average amount of time that is taken by a packet to reach final destination from source. It is the sum of delays at links.

$$\text{Average delay} = \frac{tr - ts}{Pr}, \qquad \text{(eq. 2)}$$

where ts is the packet send time and tr is the packet receive time.

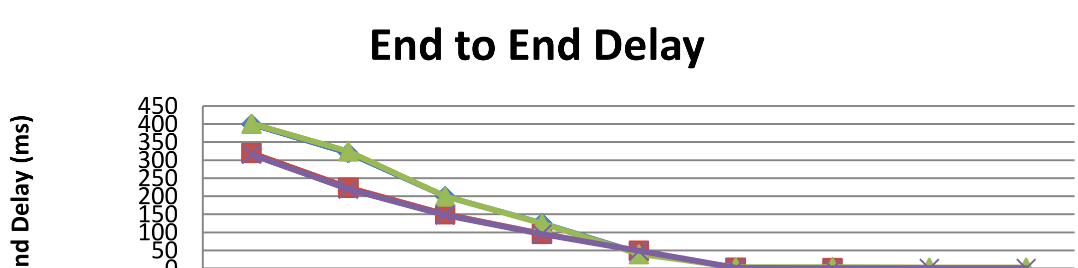
3.4 Results

Figure 3.1 shows the throughput for AODV and OLSR under both NS2 and Qualnet. Similarly, figure 3.2 and 3.3 shows the end to end delay. When node density increases, the throughput increases up to a certain point and then becomes constant. This is due to the fact that as density increases, more nodes become reachable. It happens because more nodes are covered by transmission range, so packets can be transferred with high success probability. Similarly, with increase in density the end to end delay decreases. OLSR performs better than AODV. This is due to the fact that, OLSR being a proactive protocol stores the whole route information before communicating packets. And with increase in density, the link breakage is not so often. Reverse is the case with AODV, as it is a reactive protocol. We observed that NS2 fails to simulate the network under heavy load, while Qualnet easily does the job.



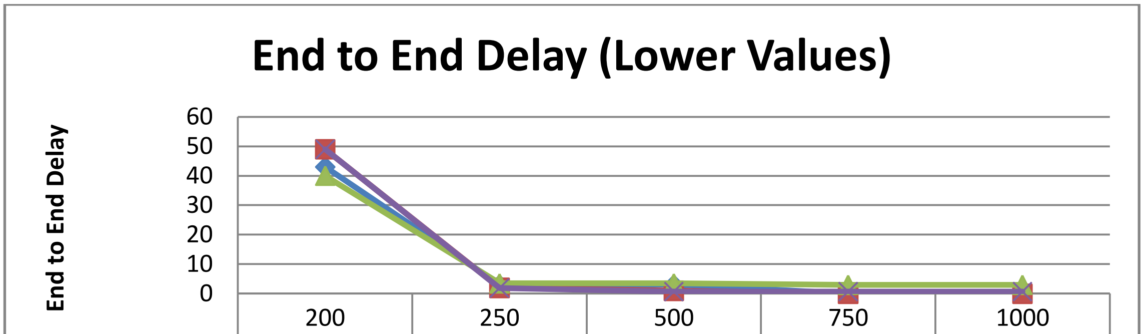
	0	50	100	150	200	250	500	750	1000
AODV-NS2	90	90	93	96.5	99	100	100		
OLSR-NS2	93.8	95	96	98.9	100	100	100		
AODV-Q	90.3	91	93.5	96.5	99.8	100	100	100	100
OLSR-Q	94	95.3	96.2	99	100	100	100	100	100

Figure 3.1: Throughput under variable node density



	0	50	100	150	200	250	500	750	1000
AODV-NS2	400	320	200	126	43	3	3		
OLSR-NS2	320	224	150	96	49	2	1		
AODV-Q	402	325	200	125	40	3.5	3.5	3	3
OLSR-Q	316	220	148	95	49	1.9	0.7	0.7	0.7

Figure 3.2: End to end delay for variable node density



	200	250	500	750	1000
AODV-NS2	43	3	3	0	0
OLSR-NS2	49	2	1	0	0
AODV-Q	40	3.5	3.5	3	3
OLSR-Q	49	1.9	0.7	0.7	0.7

Figure 3.3: End to end delay for variable node density (lower values)

3.5 Conclusion

In this chapter, we simulated two widely used protocols namely AODV (reactive) and OLSR (proactive) under varying node density. The same set of conditions was employed on two simulators Qualnet and NS2. OLSR was able to perform better. NS2 was unable to perform under heavy load.