PERFORMANCE ANALYSIS OF SOME MANET ROUTING PROTOCOLS USING OPNET MODELER

Sa'adatu Abubakar[1] and Bello I. Tijjani[2]

[1]**Department of Mathematics, Federal College of Education (Technical) Bichi, Kano, Nigeria**
[2]**Department of physics, Faculty of Science, Bayero University Kano, Nigeria**

Abstract

In this study the Performance of the four routing protocols Ad hoc on demand distance vector (AODV) Dynamic source routing protocol (DSR), Optimized link state routing protocol (OLSR) and Temporarily ordered routing algorithm (TORA) were analyzed using three metric parameters: (delay, network load and throughput).From the result,proactive protocols (TORA and OLSR) performed better interms of(delay, Networkload and Throughput) for small network while reactive protocols (DSR and AODV)performed better for large network. Therefore among the two reactive protocols DSR is more preferable because it reacts to multiple routes. At the end it comes to the point that the performance of routing protocols vary with the selection of accurate routing protocol according to the network.

Keywords: Performance, Proactive protocols, Reactive protocols, Metric parameters.

INTRODUCTION

MANET is referred to as a wireless adhoc network in which nodes are free to move arbitrarily and mobile nodes can transmit and receive the traffic [1]. Also mobile nodes can act like routers by forwarding the neighbor's traffic to the neighboring node as the routers are multi hop devices [2]. MANET does not need base stations of wired infrastructure. The mobile nodes in wireless network range can communicate with each other because it is a Self organized network. The mobile nodes form a network automatically without a fixed infrastructure and central management [2]. The mobile nodes have transmitters and receivers with smart antennas, which enable the mobile nodes to communicate with each other. The topology of the network changes frequently as mobile node leaves and joins the network. It was originaaly designed for military use but now it is used in many different areas, e.g. Disaster hit areas, data collection in some region in rescue missions, virtual classes and conferences [3]. The routing protocols efficiency can be determined by the battery power consumption. Energy is consumed during participation of a node in a network and also in routing of traffic.

There are different kinds of parameters for the performance evaluation of the routing protocol. These protocols have different behaviors of the overall network performance. Three parameters will be evaluated for the comparison of this paper on the overall network performance. The routing protocol gives much end to end delay so probably this routing protocol is not efficient as compare to delay. Similarly a routing protocol affecting low network load is not the efficient Protocol. The same case with the throughput as it represents the successful deliveries of packets in time. If a protocol shows high throughput so it is the efficient and best protocol than the routing protocol which have low throughput.

LITERATURE REVIEW

MANETs have a dynamic nature, a large number of applications make them ideal to use. Quick deployment and minimal configuration of MANET in emergencies such as natural disaster makes them more suitable. The growth of technology makes increase in Wi-Fi capable laptops, mobile phones, MP3 players and other small portable devices becomes a genuine reason for MANET popularity [3].Extensive research works have been done on the performance evaluation of routing protocols using NS2 network simulator. Different methods and simulation environments give different results for MANET routing protocols performance.

Corresponding Author**:** Sa'adatu A., Email: saadaabuahmadu@gmail.com, Tel: +2348065464910

Different routing protocols were simulated using different types of simulators. Tony & Nicklas [4] conducted a research on Routing protocols in wireless Ad-hoc Networks using Network simulator2 by considering three routings protocols DSDV, AODV and DSR. From their study they concluded that DSDV protocol has a dramatic decrease when mobility is high. DSR and AODV performedbetter when mobility is high.

Krishna [5] conducted a research on Routing protocols in mobile Ad-hoc Networks using DSDV and AODV protocols and reveals that DSDV routing protocols consumes more band width, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which result in less overhead and more bandwidth. He assumed that DSDV routing protocol work better for smaller networks but not for larger network, and finally concluded that AODV routing protocol is best suited for general mobile ad-hoc networks as it consumes less bandwidth and lower overhead when compared with DSDV routing protocol.

Sajjad & Asad[3] also conducted their own research on Routing protocols in MANET using AODV, DSR and OLSR and concluded that OLSR is the best protocol that gives the outstanding results compared to AODV and DSR routing protocols.

The aim of the research is to analyze the performance of four MANET routing protocols in which two are representative of reactive protocol (AODV & DSR) and the other two are proactive (OLSR &TORA/IMEP) through simulationsusing OPNET Modeler 11.5. The performance metrics used are delay, networkload and throughput. For all these comparisons FTP standard application was used to look at the effects of these Ad hoc network protocols. The wireless routing protocols are carrying FTP traffic and the simulation will have a strong link with theoretical concepts and the expected performance in practical and real time implementations. The effect of varying pause time and the speed of the mobile nodes will not be considered in the evaluation and will be kept constant in all the scenarios. Power consumption as a performance metric will also not be consideredfor the protocols evaluations.

METHODOLOGY

The simulation software used to simulate the ad-hoc routing protocols is the Optimized Network Engineering Tool (OPNET V 11.5). OPNET is a network operation, planning, research and development (R & D), network engineering and performance management [6]. OPNET 11.5 is designed for modeling communication devices, technologies, protocols and to simulate the performance of these technologies.

The metric parameters considered are the delay, Network load and through put. Five Scenarios are run and in every Scenario there are different numbers of mobile nodes.

In first Scenario there are 50 nodes, in second Scenario the number of mobile nodes is decreased to 40, the third Scenario contains 30 mobile nodes, the forth is 20 mobile nodes and the last one contains 10 mobile nodes. The five Scenarios were simulated. Each Scenario was run for 30 minutes (simulation time). All the simulation shows required result. Under each simulation the behavior of AODV, DSR, OLSR and TORA/IMEP were checked. Multiple graphs were obtained from the simulations i.e. for the delay, Network load and the throughput. The main goal of simulation was to model the behavior of the routing protocols. DES (global discrete event statistics) is collected on each protocol on the Wireless LAN. A campus network was modeled within an area of 10km x 10km. The FTP traffic is considered to analyze the effects on routing protocols. The profile is configured with FTP application. The nodes were wireless LAN mobile nodes with data rate of 11mbps. Random waypoint mobility model was used in this simulation. The mobile nodes move at a constant speed of 100m/s, and when reaches the destination, the pause time is 200 sec and after that it choose a random destination.

RESULTS AND DISCUSSIONS

Comparative Analysis using the three performance metrics (Delay, Network load and Throughput) are presented in table 1.

Table 1: The results of the simulations

| Nodes	Parameters	AODV	DSR	OLSR	TORA
10	Delay	0.00300	0.00146	0.00146	0.00424
	Network load	281688	273678	544225	509564
	Throughput	274776	268188	606989	606989
20	Delay Network load Throughput	0.00490	0.00450	0.00491	0.00248
		232615	214132	278953	154948
		309059	213229	414090	148805
30	Delay Network load Throughput	0.00435	0.00223	0.00188	0.00301
		346255	240814	248586	770197
		359160	269240	284670	746243
40	Delay Network load Throughput	0.00841	0.00117	0.00613	0.00372
		548481	429518	422458	249428
		590847	345746	533941	260763
50	Delay Network load Throughput	0.01178	0.01178	0.00685	0.00772
		684329	684329	326452	378485
		580365	580365	625321	602589
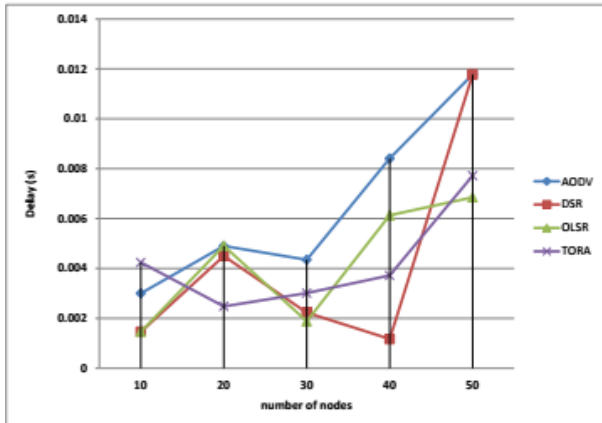
Figure 1: The plots of the Delay for AODV,DSR, OLSR andTORA using 10,20,30,40 and 50 nodes
Figure 1shows the plots of delay against number of nodes using the four routing protocols (AODV, DSR OLSR and TORA. The proactive protocols (OLSR and TORA) show high end to end delay while the reactive protocols (AODV and DSR) show least end to end delay.
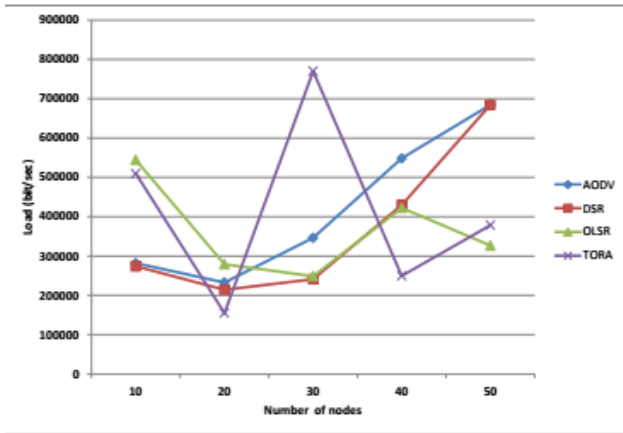

Figure 2: the plots of network load for AODV, DSR, OLSR and TORA using 10, 20, 30 ,40 and 50 nodes
Figure 2 shows the plots of network load against number of nodes using the four routing protocols (AODV, DSR ,OLSR and TORA. The proactive protocols (OLSR and TORA) show high network load while the reactive protocols (AODV and DSR) show least network load.
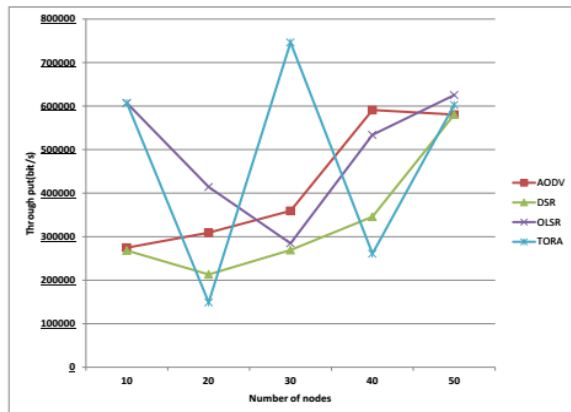

Figure 3: The plots of throughput for AODV,DSR,OLSR and TORA using 10,20, 30, 40 and 50 nodes
Figure 3 shows the plots of performance analysis of throughput against number of nodes using the four routing protocols (AODV, DSR ,OLSR and TORA. The proactive protocols (OLSR and TORA) shows high throughput while the reacive protocols(AODV and DSR) shows least end to end delay.

CONCLUSION

Routing protocols plays an important role to develop a better communication between end users. Different routing protocols have different attributes according to their environmental scenarios. It has been analyzed that there are two categories of routing protocols for MANET. From the simulation study it can be concluded that, for 10 nodes the two routing protocols OLSR and TORA are more efficient interms of delay, networkload and throughput. OLSR is the best for 20 mobile nodes, DSR is the best for 30 as well as 40 mobile nodes and DSR and AODV are the best for simulating 50 mobile nodes. It is indicated that the proactive protocol (OLSR) is more efficient for the simulation of small networks, while the reactive routing protocol (DSR)is the better protocols for large network. DSR is more preferable because of the use of multiple routes. The reactive protocols are demand based operations, meaning they only react when needed and do not periodically broadcast control information. At the end it comes to the point from the simulation study that the performance of a network depends on the selection of the most appropriate protocols.

REFERENCES

[1]   Andrew, K.(2010). *Ad-hoc on demand distance vector. Journal of computer studies, 29(3), 35-50. Retrieved from* http://www.Opnet.com

[2]   Todd L. (2005). *Study guide: Cisco Certified Network Associate. San Francisco: Neil Edde Publishers.*

[3]   Sajjad A. &Asad A. (2009) *Performance Analysis of AODV and OLSR in MANET* (Master thesis) Retrieved from https://www.diva.portal.org>smash>get visited on February 9, 2011.

[4]   Tony L. & Nicklass H. (1998).*Routing protocols in wireless Ad-hoc networks.* A Simulation Study. International journal of computer science 30(2), 201-212.

[5]   Krishna, G. (2011) Routing protocols in mobile Ad-hoc networks (Master thesis). Retrieved from http://www8.cs.umu.se>KrishnaGorantala on October 31, 2010.

[6]   OPNET Technologies, Inc., http://www.opnet.com Accessed on April14, 2010.