International Journal of Multidisciplinary and Current Research

Research Article

ISSN: 2321-3124
Available at: http://ijmcr.com

Comparative Analysis of Routing protocols in Wimax environment

Harmeet Kaur[a*] and Jyoti Saini[a]

Department of Electronics and Communication Engineering, KITM , Kurukshetra, Haryana, India

Accepted 10 November 2013, Available online 01 December 2013, (**Nov/Dec 2013 issue)**

Abstract

Worldwide Interoperability for Microwave Access (WiMAX) is a technology that bridges the gap between fixed and mobile access and offer the same subscriber experience for fixed and mobile user. Demand for such type of mobile broadband services and applications are growing rapidly as it provides freedom to the subscribers to be online wherever they are at a competitive price and other significant facilities such as increasing amounts of bandwidth, using a variety of mobile and roaming devices. The earliest version of WiMAX is based on IEEE 802.16 and is optimized for fixed and roaming access, which is further extended to support portability and mobility based on IEEE 802.16e, also known as Mobile WiMAX. However, frequent topology changes caused by node mobility make routing in Mobile WiMAX networks a challenging problem. The selection of an appropriate routing protocol is a key issue when designing a scalable and efficient wireless networks. Various routing protocols have been used in wireless networks. In this paper, we investigate different routing protocols and evaluate their performances on 802.16 WiMAX networks. Using simulation, two different routing protocols DSDV and OLSR have been tested. The performance of these routing protocols is evaluated with respect to throughput, end-to-end delay and packet delivery ratio. Results show that DSDV in general performs better than other routing protocols.

Keywords: *WIMAX, Routing Protocols*

1. Introduction

WiMAX (Worldwide Interoperability for Microwave Access) is a wireless communications standard designed to provide 30 to 40 megabit-per-second data rates, with the 2011 update providing up to 1 Gbit/s for fixed stations. The name WiMAX was created by the WiMAX Forum, which was formed in June 2001 to promote conformity and interoperability of the standard. The forum describes WiMAX as a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL. WiMAX refers to interoperable implementations of the IEEE 802.16 family of wireless-networks standards ratified by the WiMAX Forum.WiMAX Forum certification allows vendors to sell fixed or mobile products as WiMAX certified, thus ensuring a level of interoperability with other certified products, as long as they fit the same profile. WiMAX is called the next generation broadband wireless technology which offers high speed, secure, sophisticate and last mile broadband services. The evolution of WiMAX began a few years ago when scientists and engineers felt the need of having a wireless Internet access and other broadband services which works well everywhere especially the rural areas or in those areas where it is hard to establish wired infrastructure and economically not feasible. IEEE 802.16, also known as IEEE Wireless-MAN, explored both licensed and unlicensed band of 2-66 GHz which is standard of fixed wireless broadband and included mobile broadband application[1].

This paper presented an analysis of the performance for wireless routing protocols in Mobile WiMAX environment. A study and comparison on network performance of OLSR, DSDV routing protocols are evaluated and presented. The rest of the paper is organized as follows. In section II both routing protocols are discussed.In section III Simulation model and parameters are discussed. Performance parameters are discussed in section IV.Then results and conculsion are discussed in section V and section VI.

2. Wireless Routing Protocols

Two type of routing protocols have been analysed in this research as detailed.

A. Optimized Link State Routing (OLSR)

OLSR permanently stores and updates its routing table. It keeps track of routing table in order to provide a route if needed. OLSR can be implemented in any ad hoc network. Due to its nature it is called as proactive routing protocol. All the nodes in the network do not broadcast the route packets. Just Multipoint Relay (MPR) nodes broadcast route packets. These MPR nodes can be selected in the neighbour of source node. Each node in the network keeps a list of MPR nodes. This MPR selector is obtained from HELLO packets sending between in neighbour nodes. These routes are built before any source node intends to send a message to a specified destination. Each and every node in the network keeps a routing table. This is the reason the routing overhead for OLSR is minimum than other reactive routing protocols and it provide a shortest route to the destination in the network. There is no need to build the new routes, as the existing in use route does not increase enough routing overhead. It reduces the route discovery delay. Nodes in the network send HELLO messages to their neighbors. These messages are sent at a predetermined interval in OLSR to determine the link status [3].

B. Destination-Sequenced Distance Vector routing (DSDV)

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. The improvement made to the Bellman-Ford algorithm includes freedom from loops in routing tables by using sequence numbers [4]. The DSDV protocol can be used in mobile ad hoc networking environments by assuming that each participating node acts as a router. Each node must maintain a table that consists of all the possible destinations. In this routing protocol has an entry of the table contains the address identifier of a destination, the shortest known distance metric to that destination measured in hop counts and the address identifier of the node that is the first hop on the shortest path to the destination. Each mobile node in the system maintains a routing table in which all the possible destinations and the number of hops to them in the network are recorded. A sequence number is also associated with each route or path to the destination. The route labeled with the highest sequence number is always used. This also helps in identifying the old routes from the new ones. This function would avoid the formation of loops. In order to minimize the traffic generated, there are two types of packets used that known as full dump, which is a packet that carries all the information about a change. The second type of packet called incremental is used which carried just the changes of the loops. The second type benefits that increased the overall efficiency of the system. DSDV requires a regular update of its routing tables, which uses up battery power and a small amount of bandwidth even when the network is idle. Whenever the topology of the network changes, a new sequence number needed before the network re-converges. Thus, DSDV is not suitable for highly dynamic networks [2].

3. Simulation Environment

A. Simulation Model

The Network Simulator 2 (NS-2) is a discrete event simulator targeted at networking research, it provides extensive support for simulation of TCP, routing, and multicast protocols over wired and wireless networks. NS is an Object-oriented Tcl (OTcl) script interpreter that has a simulation event scheduler and network component object libraries, it is written in OTcl and in C++, figure 1 illustrates the simulation cycle of NS-2. In this paper,we evaluate the performance of two routing protocols under NS-2 simulator[5]. NS-2 is primarily useful for simulating local and wide area networks. Although NS is fairly easy to use but it is quite difficult for a first time user. Even though there is a lot of documentation written by the developers which has in depth explanation of the simulator, it is written with the depth of a skilled NS user. A user has to set the different components such as the event scheduler objects, network components libraries and setup module libraries up in the simulation environment. This project has derived the OTcl script, plumbs the network components together to the complete simulation as shown in Figure 1.

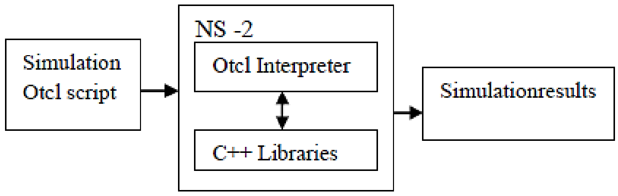

Figure 1 Simulation model of NS-2

Figure 1 shows that the data flow of one time simulation in ns-2, the user input an OTcl source file, the OTcl script do the work of initiates an event scheduler, sets up the network topology using the network objects and the plumbing functions in the library, and tells traffic sources when to start and stop transmitting packets through the event scheduler.

B. Simulation Parameters

The simulation parameters are listed in table 1

Parameters	Value
Simulator	NS-2
MAC type	802.16
Modulation type	OFDM/BPSK
Simulation time	200 sec.
Terrain area	400*400 m^2
Routing protocols	DSDV,OLSR

Then, this OTcl script file is passed to ns-2, in this view and treat ns-2 as Object-oriented Tcl (OTcl) script interpreter that has a simulation event scheduler, network component object libraries, and network setup module libraries. Detail network construction and traffic simulation is done in ns-2. After a simulation is finished, NS produced one or more text-based output files that contain detailed simulation data, and the data can be used for simulation analysis [6].

4. Performance Metrics

The project focuses on 3 performance metrics which are quantitatively measured. The performance metrics are important to measure the performance and activities that are running in NS-2 simulation as derived:

a). Packet Delivery Ratio (PDR): Packet delivery ratio signifies the total number of packets successfully delivered to the destination. Equation(1) shows how to calculate PDR (Packet Delivery Ratio).

∑ Number of packet receive / ∑ Number of packet send

The higher for the value give use the better results. This metric characterizes both the completeness and correctness of the routing protocol also reliability of routing protocol by giving its effectiveness[8].

b) Throughput (Th): Throughput is measure of number of packets successfully delivered in a network. It is measured in terms of bits /second or bytes/second. The value of throughput should be high or else it affects every service class defined in Wimax. Equation 2 shows how to calculate throughput. Some factors affect the throughput as; if there are many topology changes in the network, unreliable communication between nodes, limited bandwidth available and limited energy [8]. A high throughput is absolute choice in every network. Throughput can be represented mathematically as in equation below.

$$Th = \frac{\text{number of delivered packets*packet size*8}}{\text{Total duration}}$$

are possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. The project use Average end-to-end delay as in equation (3) expression. Average end-to-end delay is an average end-to-end delay of data packets. It also caused by queuing for transmission at the node and buffering data for detouring. Once the time difference between every CBR packet sent and received was recorded, dividing the total time difference over the total number of CBR packets received gave the average end-to-end delay for the received packets. This metric describes the packet delivery time: the lower the end-to-end delay the better the application performance [6].

$$D = \frac{1}{N} \sum_{j=1}^{s} (r_i , s_i)$$

where N is the number of successfully received packets, i is unique packet identifier, r_i is time at which a packet with unique id i is received, s_i is time at which a packet with unique id i is sent and D is measured in ms. It should be less for high performance.

5. Results and Discussion

A. Packet delivery ratio result and analysis

Figure 2 shows comparison between the routing protocols on the basis of Packet delivery fractions and number of nodes. DSDV shows the best overall performance as compare to OLSR.DSDV have PDR of 100% at nodes 5.

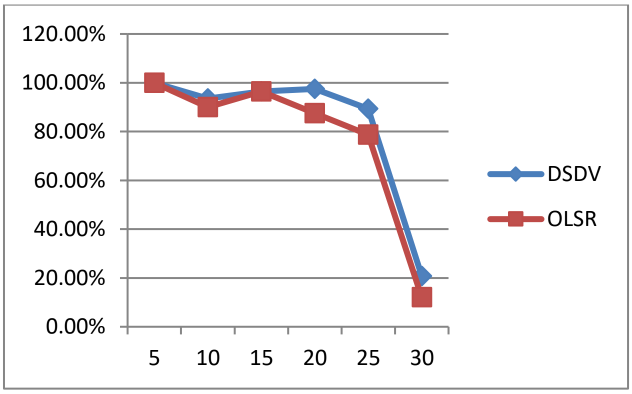

Figure 2 A comparison between routing protocols on the basis of PDR

B. Throughput result and analysis

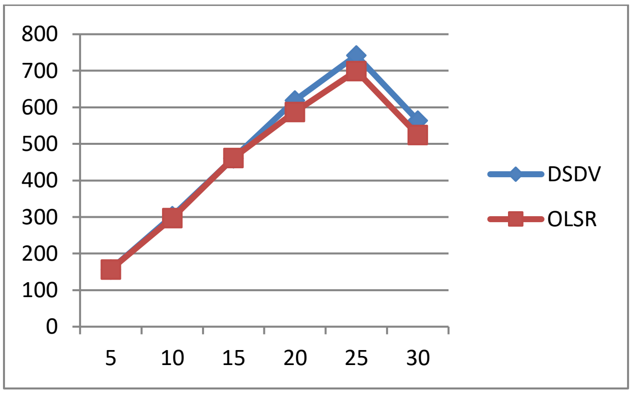

Figure 3 A comparison between routing protocols on the basis of throughput

Figure 3 shows the graphs for throughput and number of nodes. For the 5 nodes the both protocols shows a minute change but as the number of nodes increases the difference in the values of both protocols increases. The graph shows maximum throughput values for 25 nodes. By taking the average values for both the protocols it is seen that the throughput value is maximum for DSDV protocol. The results shows that DSDV has more throughput i.e. maximum packets are received at the receiver and has better performance.

C. Average end to end delay result and analysis

Figure 4 shows the performance of both the protocols DSDV and OLSR for Average end point delay. As the number of nodes increases, the average delay values are increases for OLSR. By taking the average for all the nodes the performance shows that the Average delay is reduced for DSDV i.e. shows better results for DSDV.

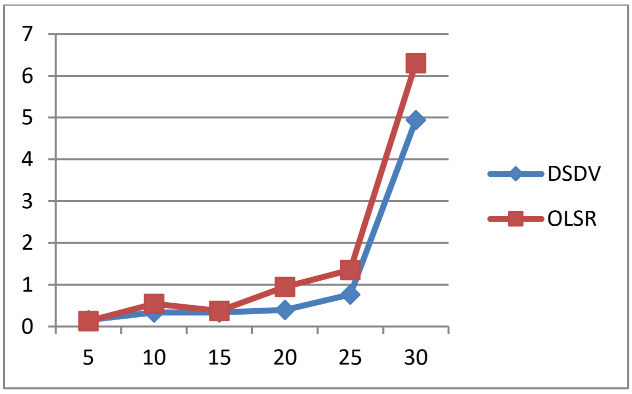

Figure 4 A comparison between routing protocols on the basis of Average end to end delay

Conclusion

This paper compared the two popular ad hoc routing protocols OLSR and DSDV.Simulations results have shown that average of throughput and packet delivery ratio is more for DSDV as compared to OLSR. Whereas for the average value of end to end delay OLSR gives the worst performance.

References

[1]. http://en.wikipedia.org/wiki/WIMAX
[2]. Priyanka Dubey, Brajesh Patel, An Improved routing efficiency for WiMAX Network using Random 2D direction model in NS3 simulator, *International Journal of Engineering Research and Applications* ,Vol. 2, Issue 5, pp.420-424, September- October 2012.
[3]. Hari Shankar Mewara, Saurabh Porwal , Throughput Performance Comparison of Reactive and Proactive Routing Protocols in Mobile Ad Hoc Networks using OPNET v14.5,*International Conference in Recent Trends in Information Technology and Computer Science*,2012
[4]. C.E. Perkins , P. Bhagwat, Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers, *IGCOMM, London, UK*, August 1994.
[5]. Tarik Anouari Abdelkrim Haqiq,Performance Analysis of VoIP Traffic in WiMAX using various Service Classes, *International Journal of Computer Applications* ,Volume 52, No.20, August 2012.
[6]. Ruhani Ab Rahman , Murizah Kassim, Cik Ku Haroswati Che Ku Yahaya, Mariamah Ismail , Performance Analysis of Routing Protocol in WiMAX Network, *IEEE International Conference on System Engineering and Technology*,2011.
[7]. Vikram Mehta, Dr. Neena Gupta,Performance Analysis of QoS Parameters for Wimax Networks, I*nternational Journal of Engineering and Innovative Technology*, Volume 1, Issue 5, May 2012 **.**
[8]. R.Samir Das, Charles E. Perkins, Elizabeth E. Royer, Performance Comparison of Two On-demand Routing Protocols for Ad HocNetworks,2000.