A Review of Evaluating the performance using AODV, DSDV and DSR protocols at node level for of IEEE 802.16 Based Network

Anuj Kumar
Department of Computer Science & Engg.
SSCET, Badhani(Pathankot)
Punjab 145001

Mr. Deepak Kumar
Department of Computer Science & Engg.
SSCET, Badhani(Pathankot)
Assistant Professor

Abstract: Wimax stands for World Wide Interoperatability for Microwave Access. This technology is based on the IEEE 802.16 standard (also called as Broad band Wireless Access). Wimax is a telecommunication technology that provides wireless transmission of data in different transmission modes from Point-to-Point, Point-to-Multipoint providing the 75 mb/s broadband speed without the need of cables. Different Routing Protocols have been used in wireless network. This paper presents the three routing protocols AODV, OLSR, TORA. For simulation we have used OPNET simulator to find the best routing protocol on wimax.

I.INTRODUCTION

The IEEE standard 802.16-2001 defines the wireless MAN air interface terms for wireless metropolitan area network. The completion of this standard signs the entry of broadband wireless access as a major new tool in the special effects of link end station to the core telecommunication network worldwide. Wimax can be used for wireless networking like the popular Wi-Fi. Wimax allow higher data rates over longer distances efficient use of bandwidth and avoid interference almost to the minimum. The Bandwidth and reach of Wimax makes it suitable for the following applications: connecting Wi-Fi hotspots with each other and to other parts of the internet, providing a wireless alternative to cables and DSL for last mile broad band access, providing high speed mobile and telecommunication services [1]. Wimax is the solution for such wireless networks when this technology is considered for mobile networks. It is expected to provide around 15 mbps of channel capacity contained by a particular cell [7].

II. Protocols at Node Level

This section describes the main features of three protocols AODV (Adhoc on demand routing protocols), OLSR (Optimized Link State Routing Algorithm), TORA (Temporary Ordering Routing Algorithm) deeply studied using OPNET 14.0.

A. AODV(Adhoc On-Demand Distance Vector)

Ad Hoc on Demand Distance Vector Protocol is a Reactive Protocol. They don't retain routing information if there is no communication. They don't retain or constantly update their route tables with the latest route topology. AODV enables multihop routing between participating mobile nodes wishing to establish and maintain an ad-hoc network. AODV is based upon the distance vector algorithm. AODV only requests a route, when needed and does not require nodes to maintain routes to destinations which are not actively used in communication. Features of this protocol contain, loop freedom and the link breakage cause immediate notification to be sent to the affected set of nodes. AODV uses Destination Sequence Number (DSN) to keep

away from counting to infinity that is why it is loop free. This is the quality of this algorithm .When a node send request to a destination, it sends its DSN simultaneously with all routing information. There are three AODV messages i.e. Route Request (RREQs) and Route Reply (RREPs) and Route Errors (RERRs) when the source node requests to create a new route to the destination. The RREQ message is broad cast from source node A to the destination node B. The source node broadcast the RREQ message to the neighbor nodes. Once the neighbor node receives the RREQ message it creates a reverse route to the source node A. This neighbor node is the subsequently hop to the source node A. The hop count of the RREQ is incremented by one. The neighbor nodes ensure if it has an active route to the destination or not. If it has a route so it will forward a RREP to the source node A. If it does not have an active route to the destination it will broadcast the RREQ message to their neighbor nodes yet again with an incremented hop count value. The RREQ packet propagates throughout the network until it reaches to the destination or a node with a fresh enough routes to the destination. The algorithm uses “hello message” that are broadcasted periodically to the intermediate neighbors. If the “hello message” stop coming from the particular node, the neighbor can suppose that the node has moved away and mark that link as broken and inform the affected set of nodes by sending a link failure notification to that set of nodes.

B. OLSR(Optimized Link State Routing Protocol)

Optimized Link State Routing Protocol is Proactive routing protocol and is also called as table driven protocol because it permanently stores and updates its routing tables. In proactive routing, every node has one or more routing tables that hold the latest information of the routes to any node in the network. The proactive protocols are not excellent in case of large networks for the reason that they need to maintain node entries for each and every node in the routing table. In OLSR all node builds a global view of network topology. The periodic nature of the protocol creates a large amount of overhead. In order to minimize the overhead, it restrict the number of mobile nodes that can forward network wide traffic and for this purpose it uses Multi Point Relay (MPRs), which are responsible for forwarding routing messages. Mobile nodes which are preferred as MPRs, can forward control traffic and minimize the size of control message. Each node independently elects a group of MRPs from its one hop neighbor. MRPs are elected by a node such that it may reach each two hop neighbors through at least one MRP. The MRP are responsible for forwarding the control traffic generated by that node. All mobile nodes periodically broadcast a list of its MRP selectors instead of whole list of neighbors. Mobility causes the route change and topology change very frequently and topology control (TC) message are broadcast through the network. All mobile nodes retain the route table that contains the routes to all accessible destination nodes. OLSR does not inform the source immediately after detecting a broken link and source node comes to recognize that route is broken, when the intermediate node broadcast its next packet.

C. TORA(Temporally Ordered Routing Protocol)

Temporally Ordered Routing Protocol just maintains the routers information regarding the adjacent routers. During reactive operation, source initiates the establishment of routes to a certain destination on demand. In dynamic networks, it is efficient as it does not maintain the routes all the times. It does not continuously perform the shortest path computation. TORA maintains multiple routes to the destination when topology changes frequently. TORA build the Directed Acyclic Graph (DAG) and also maintain it. Information may flood from nodes with higher heights to nodes with lower heights. Information can therefore be thought of as a fluid that may only flow downhill.TORA achieves loop-free multipath, as information cannot 'flow uphill' and cross back on itself.

The protocol performs three basic functions:

- Route creation
- Route maintenance
- Route erasure

During the route creation and maintenance phases, nodes use a height metric to establish a directed acyclic graph (DAG) rooted at destination. After that links are assigned based on the relative height metric of neighboring nodes. During the times of mobility the DAG is broken and the route maintenance unit comes into picture to reestablish a DAG routed at the destination.

Timing is a key factor for TORA for the reason that the height metric is dependent on the logical time of the link failure.

TORA's route erasure phase is essentially involving flooding a broadcast clear packet (CLR) throughout the network to erase invalid routes.

TORA uses MANET encapsulation protocol (IMEP) for the link status and neighbor connectivity sensing. IMEP provides reliable, in-order delivery of all routing control messages from a node to all of its neighbors and notification to the routing protocols every time link to the neighbors is created or broken. TORA is for multihop network, which is considered to minimize the communication overhead. It is bandwidth efficient and highly adaptive and quick in route repair during link failure providing multiple routes to the destination in wireless networks.

III. Related Work

Sanjeev Dhawan (2007) had described the functionality and usage of wireless technologies like Bluetooth, Wi-Fi IEEE 802.11n and Wimax for transferring the high resolution data and also compares these Wireless technologies. After comparing these technologies the result shows that Bluetooth is a well designed wireless technology but it doesn't address high bandwidth for transferring the high resolution video, images, music files, video data and it also have security threats. Therefore the Bluetooth is likely to make best use of its low power and low speed operations in the short range such as personal computers the portable devices. The Wi-Fi 802.11n is being superior in maintaining and transferring the high resolution data from one device to another which are in the range. The Wimax technology is designed to provide high resolution, mobile broadband multimedia services. It increases the Quality of service and increase the number of users that connect to the internet.

A.Bacioccola et al. (2009) first presented a historical overview of the IEEE 802.16 standard first released in 2001 to the current version which are expected to be published in 2010 and also, provided technical detailed analysis of the PHY, MAC layer, and other new standard, including a architecture and description of the self organizing networks . He had also presented a comparison of downlink control overhead between IEEE 802.16-2009 and IEEE 802.16m. The biggest problem in IEEE 802.16-2009 and its previous revisions was the high signaling overhead.

Arun Kumar B.R et al. (2008) had compared the performance of AODV, DSDV, DSR, OLSR protocols for variable bit rate (VBR) in Mobile Adhoc Networks (MANET) by using the NS2 Simulator. The results shown that the Reactive Protocols performed better than the Proactive protocols. DSR performed well for the performance parameter routing overhead and Delivery ratio whereas AODV performed better in average delay.

Dr. Mayyada Hammoshi (2011) had presented a Wimax simulation model designed with OPNET modeler 14 to measure the delay, load and the throughput performance factors. The result shows average wireless LAN load versus throughput two of these parameters are of bit/sec unit. The load and throughput are equal whereas the delay value varies among the different Base Stations.

Ruhani Ab Rahman et al. (2011) had analyzed the routing protocols which are designed for wireless networks. The performance evaluation of three routing protocols (AODV,DSR,DSDV)for mobile wimax environment is done and the performance matrix include packet delivery fraction (PDF) , Throughput , End to End Delay and Number of Packets Dropped were Identified. NS2 Simulator is used for performance evaluation. The result found that AODV outperforms DSR and DSDV protocols. AODV has less packets loss because when a link fails, a routing error message is passed back to the transmitting node. The reactive routing protocol AODV perform best for exchanging the information.

M. Rehan Rasheed et al. (2010) had investigated different routing protocols and evaluates their performances on 802.16 WiMAX networks. Using simulation, different routing protocols have been tested with various network parameters. It has been seen that the table-driven DSDV protocol has the best performance in terms of the packet delivery fraction parameter which outperforms both DSR and AODV but the delay experienced by DSDV packets are greater than the delay experienced by the on-demand routing protocols.

Mohammad Rehan Rasheed et al.(2012) had investigate different routing protocols and evaluate their performances on 802.16 WiMAX networks and also present a comparison between 802.16 and 802.11 ad hoc networks based on the performances of various rerouting protocols. The simulation result shows that the DSDV table driven protocol has the best performance in term of delivery fraction but the packet delay in the DSDV is very high. On Demand routing protocols such as DSR and AODV has less packet delay.

S.A. Ade et al. (2010) had evaluated the performance of AODV, DSDV, OLSR and DSR routing protocols in Mobile Adhoc Networks. In MANET the wireless nodes that can connect through a wireless medium dynamically change their topology. The parameters for evaluating the performance of routing protocols are PDF (Packet Delivery Fraction), Average End to End DeLay, Number of Packets Dropped. The result shows that on demand (DSR and AODV) protocols performed well in end to end delay, packet dropped and varying no. of

nodes than the Table Driven (DSDV) routing protocol and also DSR and AODV performs better than DSDV with large no of nodes. Hence for real time traffic AODV is preferred over DSR and DSDV. For less no. of nodes had less mobility DSDV protocol performed best.

IV. Performance Parameters

The following Performance Metrics has been used for evaluating the performance of various WIMAX Routing Protocols:

Network Load: The statistic represents the total data traffic (in bits/sec) received by the entire WLAN BSS from the higher layers of the MACs that is accepted and queued for transmission.

Delay: There are possible delay caused by buffering during route discovery latency .The end-to-end delay is an average end-to-end delay of data packets. Once the time difference between every CBR packets 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 metrics describes the packet delivery time: the lower the end-to-end delay the better the application performance.

$$\mathbf{D} = \frac{\mathbf{1}}{N}\sum_{\mathbf{i=1}}^{\mathbf{s}}(\mathbf{ri} - \mathbf{si})$$

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

Throughput: Throughput is defined as the ratio of the total data reaches a receiver from the sender. The time it takes by the receiver to receive the last message is called as throughput. It can be measured in (byte/sec or bit/sec). Some factors affect the throughput as; if there are many topology changes in the network, unreliable communication between the nodes, limited bandwidth available or limited energy. A high throughput is absolute choice in every network. Throughput can be represented mathematically as in equation below.

$$\textit{Throughput} = \frac{\textbf{Number of delivered packets} * \textbf{Packets size} * \textbf{8}}{\textbf{Total duration of simulation}}$$

V. Conclusion and Future Scope

In this paper we discussed the three routing protocols (AODV, OLSR and TORA) based on OPNET simulation. Our intention was to analysis the performance of these three routing protocols in WIMAX on the above mentioned parameters. We analyzed for different reactive and proactive routing protocols with different

mobile nodes transmitting ftp, http and voice traffic data. As future work we propose to increase the throughput of the protocols which will result in better performance of protocols AODV, OLSR AND TORA.

REFERENCES

[1] Sanjeev Dhawan.” Analogy of Promising Wireless Technologies on Different Frequencies: Bluetooth, Wi-Fi, and WiMAX” The 2nd IEEE International Conference on Wireless Broadband and Ultra Wideband Communications.AUS – 2007.

[2] A. Bacioccola, C. Cicconetti et al. “IEEE 802.16: History, status and future trends.” In the proceeding of Computer Communication, p.p. 113-123, vol. 33, November 2009.

[3] Arun Kumar B.R et al."Performance Comparison of Wireless Mobile Ad-Hoc Network Routing Protocols." In the proceeding IJCSNS International Journal of Computer Science and Network Security, VOL.8 No.6, p.p.337-342 , June 2008.

[4] Dr. Mayyada Hammoshi"WiMAX Simulation Model to Investigate Performance Factors." In the proceeding Journal of Convergence Information Technology, Volume 6, Number 1.p.p.266-276, January 2011.

[5] Y. Li, C. Wang, X. You, H.-H. Chen, W. She, “Delay and throughput performance of IEEE 802.16 WiMax mesh networks." IET Communications, p.p.107-115, Vol. 6, Issue 1, January 2012.

[6] Ruhani Ab Rahman et al." Performance Analysis of Routing Protocol in WiMAX Network." In the proceeding IEEE International Conference on System Engineering and Technology (ICSET), p.p.153-157.2011.

[7] Mohammad Rehan Rasheed et al." Performance Analysis of 802.16 (WIMAX) Networks under Various Routing Protocols and Traffic Loads." In the proceeding I.J. Information Technology and Computer Science, p.p. 18-25, 2012.

[8] M. Rehan Rasheed et al." Performance of Routing Protocols in WiMAX Networks." proceeding in IACSIT International Journal of Engineering and Technology, Vol.2, No.5, p.p.412-417 October 2010.

[9] S. A. Ade et al.” Performance Comparison of AODV, DSDV, OLSR and DSR Routing Protocols in Mobile Ad Hoc Networks. International Journal of Information Technology and Knowledge Management, Volume 2, No. 2, pp. 545-548, July-December 2010.

[10] Rohit A. Talwalkar et al." Analysis of Quality of Service (QoS) in WiMAX networks." In the proceeding IEEE ICON 2008.