Evaluation of the performance of WiMax Access Network using NS-2

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Abstract- MAC/ 802.11 WiMax technology is going to be an emerging wireless technology for the future. Wireless network is not fully secure due to rapid change of new technologies, market competition and lack of physical infrastructure. In the IEEE 802.11 technology security was added later. In IEEE 802.16 security has been considered as the main issue during the design of the protocol. However, security mechanism of the WiMAX still remains a question. This work presents an existing wireless technology Wi-Fi and WiMAX. These works try to compare the performance of Wi-Fi and WiMAX, and which technology provides a better solution to build a wireless access infrastructure. In this work, we investigate the performance of 802.16 WiMAX over WiFi environment is done under varying mobility conditions. By using On-demand routing protocols analyzed the performance of Mac/802.11 and Mac/802.16 using simulation for mobile ad hoc networks discover and maintain only needed the design and follows the idea and compare various parameters like as average end to end delay, normalized routing load and average throughput with varying pause time. These simulations are carried out using the ns-2 Network simulator.

Keywords- CBR, AODV, MAC/802.11 and MAC/802.16, NS-2.

I. Introduction

IEEE 802.16 working group has developed a number of standards for WiMAX. The first standard IEEE 802.16 was published in 2001 and after this adds features and improved performances. WIMAX stands for Worldwide Interoperability for Microwave Access. It is the technology aimed to provide broadband wireless data access over long distances. Theoretically IEEE 802.16 can provide single channel data rates up to 75 Mbps on both the uplink and downlink. Downlink channel (from Base Station to Source station and Uplink channel from Source station to Base Station. Uplink channel is shared by all SSs while Downlink channel is used by Base Station. Providers could use multiple IEEE 802.16 channels for a single transmission to provide bandwidths of up to 350 Mbps [2]. IEEE 802.16-2004, has been developed to expand the scope to licensed and license-exempt bands from 2 to 11 GHz. IEEE 802.16-2004 specifies the air interface.

Including the Media Access Control of wireless access for fixed operation in metropolitan area networks. Support for portable/mobile devices is considered in IEEE 802.16e standard, which is published in December 2005. WiMAX networks consist of a central radio Base Station and a number of Subscriber Stations. In Mobile WiMAX network, Base Station is connected to public network and can handle multiple sectors simultaneously and SSs are mobile.

The rest of this paper is organized as follows; section II discusses the used routing methodology this work in the area of multipath routing. In section III, IV, and V we present the details of Wifi, WiMax, traffic and mobility. In last sections performance matrices, simulation parameter and simulation model. We then evaluate our protocol and present the results in section IX. Finally, section X provides our conclusions and then last section XI is References.

II Aodv Routing Protocol

This protocol is based on on-demand routing. This protocol consists of two phases Route Discovery and Route Maintenance. Route discovery process starts on demand by the source. When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a route discovery process to locate the other node. It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to their neighbors, and so on, until either the destination or an intermediate node with a fresh enough routes to the destination is located.

The second phase of the protocol is called route maintenance. AODV only supports the use of symmetric

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links. Routes are maintained. If a source node moves, it is able to reinitiate the route discovery protocol to find a new route to the destination. If a node along the route moves, its upstream neighbor notices the move and propagates a link failure notification message to each of its active upstream neighbors to inform them of the erasure of that part of the route. These nodes in turn propagate the link failure notification to their upstream neighbors, and so on until the source node is reached. The source node may then choose to reinitiate route discovery for that destination if a route is still desired.

III. WiFi

WiFi stands for a short-range wireless transmission technology. Wi-Fi technology builds on IEEE 802.11 standards and still using local area network. WiFi is a technology means to interconnect devices using wireless medium such as Laptops, smart phone etc. It is a service of wireless network communication technology which is held by the WiFi Alliance. The purpose is to improve the interoperability between wireless network products based on the IEEE802.11 standards. Generally, to set up a wireless network, an access point and wireless network adapters are the basic necessity. This way it can use the wireless medium and coordinate with the structure of the existing wired network to share network resources. Cost of this network compare the traditional wired network is Low.

IV. WIMAX

WIMAX stands for Worldwide Interoperability for Microwave Access. It is the technology that provides effective broadband wireless data transmission over long distances. It is based on IEEE 802.16 standards and the standard defines only the physical layer and MAC layer functionalities. The technology provides basic Internet Protocol connectivity and connection less and connection oriented wireless Communications to the end users. Worldwide Interoperability for Microwave Access is a technology that bridges the gap between fixed and mobile access and offer the same subscriber experience for fixed and mobile user. WiMax is a high performance end to end network protocol. Its features are increased data rate, high performance, fair QoS, highly secured communication of data.

V. Traffic and Mobility

1. Traffic: - Traffic Patterns describe how the [8] data is transmitted from source to destination. The widely used traffic pattern in CBR.

2. Constant Bit Rate - The qualities of Constant Bit Rate traffic pattern are

Unreliable: It has no connection establishment phase; there is no guarantee that the data is transmitted to the destination.

Unidirectional: there will be no acknowledgment received from destination for confirming the data transmission.

Predictable: In transmission fixed packet size, fixed interval between packets, and fixed stream duration.

VI. Simulation Parameters

Simulation Parameters is as follows

Parameter	Value
MAC Layer	MAC/802.16, MAC/802.11
Traffic Type	CBR
Simulation Time	100 sec.
Number Of Nodes	40
Pause Time	1.0 to 4.0 s
Maximum Connection	20
Maximum Speed	10 m/s
Transmission Rate	2.0 packets per second
Area of Networks	800m X 500m

VII. Performance Metrices

We report performance metrics for the protocols:

End-to-End Delay: It is the ratio of time difference between every CBR packet sent and received to the total time difference over the total number of CBR packets.

Normalized Routing Load: Normalized routing load is the ratio of the number of control packets propagated by every node in the network and the number of data packets received by the destination nodes.

Average Throughput: Average Throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second.

VIII. Simulation Model

In this section, The Simulation environment consists of an area of 800x500, where randomly 40 mobile nodes are placed. A source and a destination is selected randomly. Data sources generate data according to Constant

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bit rate traffic pattern. Source destination pairs are spread randomly over the network. A packet size of 512 bytes is used. Mobility pattern of the mobile nodes is generated using Random waypoint model. By observing the performance of the network under mobility we can test the stability of design in real time scenario with varying pause time 1sec to 4sec. Data rate of 2Mbps is used [6, 9].

IX. Simulation Results Analysis

In this section shows the result using X graph with discussion:

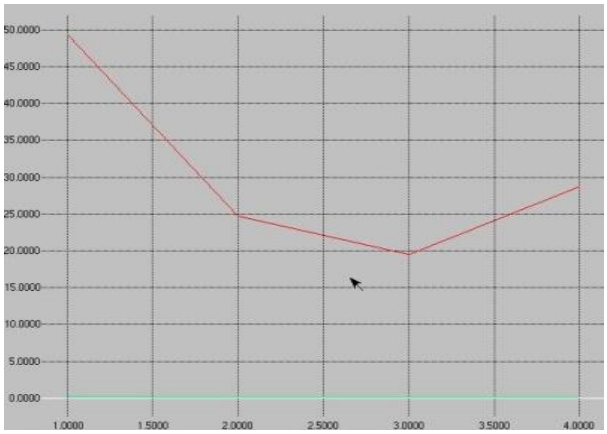

Figure 1: Average end to end delay with varying pause time 1sec to 4sec.

Figure-1 by using on demand routing approach find the performance of MAC/802.11 and MAC/802.16. Compare the overall WiMax performance end to end delay slightly better or very reduces as Compare to WiFi Routing Protocol. The Red line indicates wifi and violet line indicate WiMax performance this graphs shows result Average End to End Delay with varying pause time 1sec to 4sec..

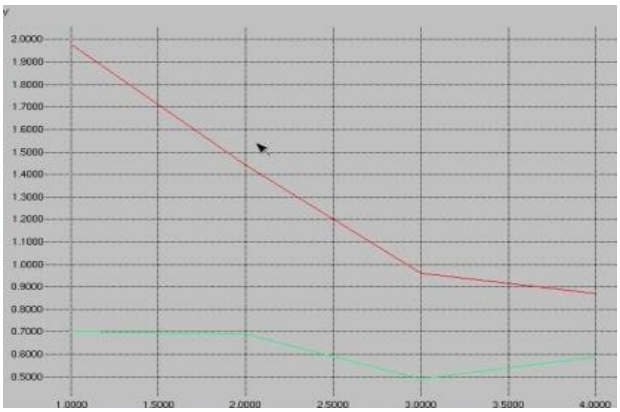

Figure 2: Normalized Routing Load with varying pause time 1sec to 4sec.

Figure-2 by using on demand routing approach find the performance of MAC/802.11 and MAC/802.16. Compare these WiMax technology traffic load is efficient As Compare to WiFi Routing Protocol. The Red line indicate wifi and violet line indicate WiMax performance this graphs shows result Normalized Routing Load with varying pause time 1sec to 4sec.

Figure 3: Average Throughput with varying pause time 1sec to 4sec.

Figure- by using on demand routing approach find the performance of MAC/802.11 and MAC/802.16. Compare these WiMax technology successful packet delivered maximum at the end of receiver. The Red line indicates wifi and violet line indicate WiMax performance this graphs shows result Average Throughput with varying pause time 1sec to 4sec.

X. Conclusion

In this paper evaluated and analyze the performance of WiMAX over WiFi through Network simulator NS-2. The data traffic received, Network Traffic Load and delays were measured. By using wimax technology effective data transmission average end to end delay and network traffic load very low. the overall result shows using x graph in the section of simulation and results.

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