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PERFORMANCE COMPARISON OF TWO EMERGING WIRELESS TECHNOLOGY WIFI AND WIMAX USING NS-2

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Abstract: **Due to fast development of technology, future communication and transmission are totally depends upon wireless network. Wireless networking has become an important area of research in academic and industry. This thesis is provides the analysis of the two emerging broadband wireless technology Wi-Fi and WIMAX, both of this IEEE MAC standard. With emerging technologies and higher data rate requirements new ways of communications are being developed. In Main challenges of Wi-Fi is security, limited Area, lower rate of data speed etc... We have solved these challenges using WiMAX. In this thesis we have implemented WiMAX MAC/802.16 standard and compare with Wi-Fi MAC/802.11 using AODV routing scheme. and we have found from simulation experimental Analysis the behavior of the network And finally have evaluated their performances in terms of delay and load. And It has been observed that the performance of the WiMAX is better than the Wi-Fi.**

Keywords: **MANET, AODV, Wi-Fi, WiMAX, NS-2.**

I. INTRODUCTION

Due to fast development of technology, future communication and transmission are totally depends upon wireless network. The wireless medium has limited bandwidth, higher packet error rate, and higher packet overheads that in total to limit the capacity of the network to offer guaranteed Quality of services. WiMAX system has been widely accepted as the next-generation high-speed wireless communication system for future broadband services due to the high capacity, large coverage, and strong QoS support it can provide.

As one of the most well-known and commonly used protocols, Wireless Fidelity (WiFi) network is based on the IEEE 802.11 standard that is used specifically for local network access. In response to the increasing QoS challenge in wireless networks, researchers have made significant modifications in Wireless Fidelity (WiFi) in the legacy IEEE 802.11 standards is based on IEEE 802.16, the Worldwide Interoperability for Microwave Access (WiMAX) is a standard with similar principles that is used in mobile devices to support high speed, long-range information exchange. It has been observed that the main advantage of WiMAX over WiFi is that it is capable of covering larger areas along with having higher data rates.

Now, Wi-Fi and WiMAX are two broadband technologies but these technologies may have few similarities, and they differ in the technical execution and ultimately their business case is very different. And depth knowledge about the Wi-Fi and WiMAX technology and how it works and understand the problems about the WiFi and how to solved using WiMAX technology in maintaining and deployment. WiMAX is the upcoming wireless system which uses IEEE standard 802.16. By using WiMAX technology we can overcome the limitations of the existing Wi-Fi like short coverage area, lack of security and low data rate. In our thesis, initially we analyzed the basic concept of WiMAX and comparison with Wi-Fi using AODV routing scheme.

The rest of the paper is organized as follows. In Section 2, we introduce overview of overview of AODV, Section 3 Wi-Fi and Next Sections presents a WiMAX for increase network efficiency, result and lastly discussed conclusion.

II. OVERVIEW OF AODV ROUTING PROTOCOL

AODV is a reactive routing protocol used to find a route between a source and a destination, and allows mobile nodes to obtain new routes for new destinations in order to establish an ad hoc network. In this order several messages are exchanged, different types of link are established, and many information can be shared between the participant's nodes. In AODV protocol we find hello message and three others significant type of messages, route request RREQ, route reply RREP and route error RERR. The Hello messages are used to monitor and detect links to neighbors, every node send periodically a broadcast to neighbors advertising it existent ,if a node fails to receive an hello message from neighbor a link down is declared. In order to communicate every node must create routes to the destinations, to achieve that the source node send a request message RREQ to collect information about the route state; if the source receives the RREP message the route up is declared and data can be sent and if many RREP are received by the source the shortest route will be chosen. Any nodes have a routing table so if a route is not used for some period of time the node drop the route from its routing table and if data is sent and a the route down is detected another message (Route Error RERR) will be sent to the source to inform that data not received. The Protocol consists of two phases:

Route Discovery: The route discovery process is initiated when a source needs a route to a destination and it does not have a route in its routing table. To initiate route discovery, the source floods the network with a RREQ packet specifying the destination for which the route is requested. When a node receives an RREQ packet, it checks to see whether it is the destination or whether it has a route to the destination. If either case is true, the node generates an RREP packet, which is sent back to the source along the reverse path. Each node along the reverse path sets up a forward pointer to the node it received the RREP from. This sets up a forward path from the source to the destination. If the node is not the destination and does not have a route to the destination, it rebroadcasts the RREQ packet. At intermediate nodes duplicate RREQ packets are discarded. When the source node receives the first RREP, it can begin sending data to the destination.

***Route Maintenance*:** When a node detects a broken link while attempting to forward a packet to the next hop, it generates a RERR packet that is sent to all sources using the broken link. The RERR packet erases all routes using the link along the way. If a source receives a RERR packet and a route to the destination is still required, it initiates a new route discovery process. Routes are also deleted from the routing table if they are unused for a certain amount of time. It is performed by the source node and can be subdivided into: i) source node moves: source node initiates a new route discovery process, ii) destination or an intermediate node moves: a route error message (RERR) is sent to the source node. Intermediate nodes receiving a RERR update their routing table by setting the distance of the destination to infinity. If the source node receives a RERR it will initiate a new route discovery. To prevent global broadcast messages AODV introduces a local connectivity management. This is done by periodical exchanges of so called HELLO messages which are small RREP packets containing a node's address and additional information [2-5].

III. WI-FI

Wi-Fi technology builds on IEEE 802.11 standards and Wi-Fi technology is still using local area network for the predictable future. Wi-Fi can be used as various handheld devices. The handheld devices are connected to internet by using the connection of Wi-Fi. The access of the Wi-Fi network is limited to a specific area and should not expend the network. This network is only for within the specified area only. And its established limited in some restricted place. Productivity and convenience has dramatically increased by WLAN due to the distribution of high speed internet access from cables, DSL (Digital Subscriber Line) and other fixed broadband connections within wireless hotspots. At present millions of offices, homes and public locations such as hotels, cafes, and airports are provided with higher WLAN connections.

IV. WIMAX

IEEE 802.16 Work Group develops standards and recommended practices to support the development and deployment of Broadband Wireless Metropolitan Area Networks (Wireless-MAN). World Wide Interoperability for Microwave Access is a telecommunication technology designed to provide effective transmission of data using different modes of transmission like mesh and PMP (Point to multipoint). 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 with less packet delay. There are two main types of WiMAX services: mobile and fixed. Mobile WiMAX enables users to access internet while travelling whereas fixed WiMAX stations provide wireless internet access to clients within a fixed radius. So this WiMAX concept is introduced to increase the range of network.

WiMAX as an extension to WLAN is taking Wireless Internet Access to the next level and with the increase of time; it would have been achieving similar attach rates to devices as WLAN. WiMAX can be considered as an extension to WLAN and can deliver internet access miles away from the nearby WLAN and blanket large areas i.e. WMANs. It's standards for worldwide interoperability for Microwave Access and also known as 802.16.it was designed for the longer range of wireless network connections such as to provide internet access to a particular geographic area. It can be established the range from 39 miles to 6 miles to 30miles. WiMAX technology is a standard based wireless technology which is used to provide internet access and multimedia services at very high speed to the end users.

Advantages over Wi-Fi: WiMAX is different from Wi-Fi in many respects. In fact, Wi-Fi can operate at distances as great as WiMAX but there are two reasons why it doesn't. One of the reasons is that radios operating in the unlicensed frequencies are not allowed to be as powerful as those operated with licenses; and from convention, less power means less distance. These regulations are based on the dated assumption that devices can't regulate themselves but the assumption may be correct over great enough distances. The second reason as to why Wi-Fi access points don't serve as wide an area as WiMAX access points do is the common engineering belief that the problem of everybody shouting at once, even if it's surmountable in a classroom, would be catastrophic in a larger arena.

V. SIMULATION PARAMETERS

Simulation Parameters is as follows:

Parameter	Values	Values
	Wi-Fi	WiMAX
Traffic Agent Type	CBR	CBR
Channel	Wireless(MAC/802.11)	Wireless(MAC/802.16)
Network Size	1500x800m	1500x800m
Routing Protocol	AODV	AODV
Number of Nodes	50	50
Node Placement	Random	Random
Simulation time	2000s	2000s
Mobility Model	Random Way Point	Random Way Point
Connection rate	2 Mbps	2 Mbps
Pause Time	10.0s	10.0s
Seed	1	1
Maximum Speed	10, 20, 30, 40, 50 m/s	10, 20, 30, 40, 50 m/s

VI. PERFORMANCE METRICS

It is the value of information is computed using mathematical methods, which shows that even performance metrics choose, measures the value. And shows the performance using these below given parameters follows:

Average end-to end delay: It is defined as the time taken for a data packet to be transmitted across an MANET from source to destination.

$$D = (Tr - Ts)$$

where Tr is receive Time and Ts is sent Time.

Throughput: Throughput is used to calculate the overall performance of network it is a degree of successfully delivered messages in unit time over communication network [12]. It is computed as:

$$Throughput = Packets\ Rec \times 8 / Transmission\ Period$$

VII. SIMULATION MODEL

In this section discussed the simulation model of different number of parameters used in network scenario. And have given all the parameters and its value in below section. A tcl script is created for the implementation, which consist of the creation of the nodes, connection between the nodes, setting the topography area in which the nodes are located according to the x axis and y axis. The simulation is run for 2000 seconds. The simulation process was carried out for 50 numbers of nodes. The nodes were randomly distributed in the simulation in the area of 1500x 800 m2 rand function of network. To create path between source and destination AODV on demand Routing Algorithm was used. The author considered mobility of nodes, and have also found Average Delay and Throughput with node variations.

VIII. SIMULATION RESULT AND DISCUSSION

We have demonstrated the network scenarios are taken into Consideration i.e. based on speeds. In both the cases the effect of mobility in speeds discussed and gives a result in graphical form. The Simulation was run at different speeds from 10, 20, 30, 40, 50 m/s were sent with traffic CBR. In graph presents the averages values of results. Based on the simulation results, presents an analysis of the behavior of the two emerging wireless technology Wi-Fi and WiMAX, the change of speeds Transmission Ranges of Base Station over Mobile WiMAX network. This research work may guide the Mobile WiMAX service providers to figure out the appropriate Transmission Ranges to select to provide their expected network performance.

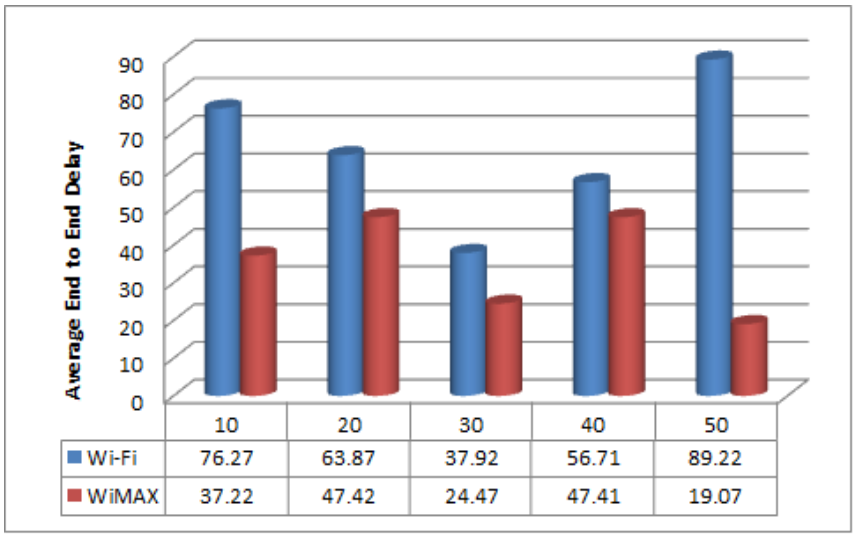

Figure-1 Average End to End Delay with Variations of Speeds

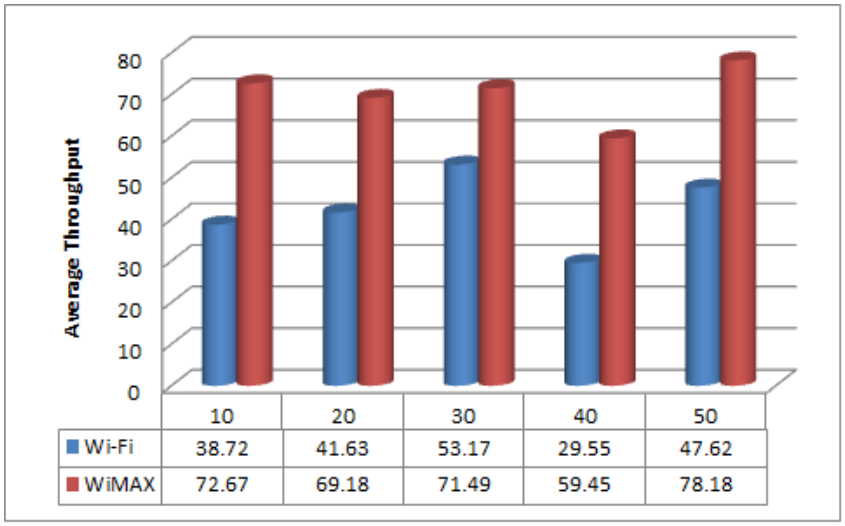

Figure- 2 Average Throughput with Variations of Speeds

In wireless communication in mobile computing is a prominent area of research in today's scenario. It has gained significant impetus in the area of mobile communication to transfer multimedia data at very high speed without any delay and loss in data transfer. The researchers have been constantly working on various aspects of mobile communication like congestion control, QoS a lot more to be done in the major fields of congestion control in networks.

In figure 1 and 2 present the average results of Average delay and Throughput. Average delay as a function of number of received packet in the destination end. The better speed of transmission, but as an exception in the scenario, as the speeds of nodes increases, the average end to end delay increases for Wi-Fi environment and also decrease in WIMAX Environment. Throughput is a function of number of received packet in the destination end. The number of packets being transmitted source node to destination node by using reactive on demand routing protocols for Wi-Fi and WiMAX Environment. The goal is to compare different types of QoS parameters, such as; throughput and average delay are analyzed for Wi-Fi and WiMAX Environment. Results indicate that better quality of service is achieved by using service flows designed for specific applications. The reliability feature of Wi-Fi also makes it stable in mobile WiMAX environment. According to the simulation outcomes clearly perform better in terms of Throughput and decrease the delay in WiMAX environment. The result presents using Graphical Method.

IX. CONCLUSION

Our thesis reports have contained two parts, First is Theoretical study and another is simulation study. From Theoretical study the selection of suitable protocol according to the network definitely increases the reliability of that network, for example in case of mobile ad hoc networks routing protocols should be loop free according to our research. This thesis is provides the analysis of the two emerging wireless technology with Wi-Fi and WIMAX. Figures display the results with variations and Average values of performance metrics in previous section. The simulation obtained in WiMAX environment less delay and higher throughput, the result presents in graphical form in previous section.

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