PERFORMANCE EVALUATION OF TCP AND CBR TRAFFIC IN WIMAX ENVIRONMENT USING NETWORK SIMULATOR

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Abstract: **This paper mainly consists of the implementation of IEEE 802.16 and provides a comparative evaluation of the different traffic sources of TCP and CBR in WiMAX networks. TCP is a connection-oriented transport layer protocol. It provides reliable byte stream services for data applications. Its key features are reliability, flow control, connection management and congestion control. AODV is used to compare and demonstrate the performance of TCP and CBR traffic, typically implemented in mobile ad-hoc environments. And in it various parameters like packet delivery ratio and throughput have been explored with change of speed. And found that the use of transmission control protocols is capable of achieving data transmission reliability in wireless systems. Therefore, this research proposes that TCP performs better than other CBR traffic. The overall simulations have done in Network Simulator.**

Keywords: **MANET, AODV, WIMAX, TCP, CBR, Performance Metrics, NS-2.**

I. INTRODUCTION

In recent years, due to the high demand for Internet access and cellular services, its demand has increased in which data can be sent anywhere without any wires. It has rapidly gained popularity as an alternative to last mile connections replacing broadband wireless access cable modems and DSL connections. Wi-Fi is a wireless local area network technology designed for home and small area implementation. Wi-Fi is able to provide ad-hoc network facilities at a low level, while it had many drawbacks such as speed, distance ... etc. This gap has been overcome with the help of WiMAX. Both of these are IEEE standard, one of them is IEEE 802.16 standard which is also known as Mobile WiMAX. Worldwide interoperability for microwave access forums promises to offer a large number of high data rates to a large number of users where broadband is not available. WiMAX promises to deliver the last mile of communications services via the Internet. It provides very high data throughput over long distances.

The above mentioned advantages of the IEEE 802.16 wireless network create a platform to fully fill this standard with other wireless communication technologies such as Wi-Fi. The requirement from IEEE 802.16 is to provide QoS for all possible. IEEE 802.16 is likely to emerge as a recent technology to support integrated voice, video and animation data services for broadband wireless access, fixed, roaming, portable and fully mobile operations everywhere. An algorithm is needed to manage and distribute traffic flow. The AODV protocol is used for data transmission in this work.

The objectives of this paper are to get accurate perception and finding the best behavior of the MANET reactive on demand routing protocols under mobility, scalability and heavy, medium and low traffic load.

The rest of the paper begins the analysis of TCP and CBR traffic based performance under different network scenarios. The results show that the variation of speed with constant no of connections. Section II, III and IV AODV, Problem Statement, WIMAX. Section- V, VI and VII, Data traffic, Simulation Model, performance metrics are carried out to evaluate the effectiveness of the proposed scheme. And section VIII Simulation Results analysis last section discussed about conclusion and References.

II.   AODV ROUTING

AODV routing algorithm is designed for MANETs. It is used on demand strategy, means when builds path between desired by every source nodes. It maintains these paths or routes when they are needed by the sources [3, 5]. AODV make routes using a route request or route reply query cycle. If destination node initiates for packets to source node, it does not have a route then broadcasts RREQ packets across the network. Nodes receiving data packet and update information regarding network nodes for the source node and set up backwards paths in the route tables. As long as the route remains active means data packets periodically travelling from the source to destination. Once the primary nodes stop sending data packets, if the links will time out and eventually to be deleted from the mediate node routing tables. If a link break occurs while acknowledge RERR message to the primary node to inform it of the now unreachable destination [1, 3, 6]. AODV routing protocol offers a quick adaptation to dynamic link conditions, low processing and memory overhead and low network utilization. It avoids problems associated with classical distance vector.

III.   PROBLEM STATEMENT

The reach of a Wi-Fi network is limited to a specific area, and the limited network has to high cost to grow network range. This network is only within the specified area. And its installation is limited in some restricted space. Many applications can be used in this but the main issues are limited area, bandwidth and data travel rate, which are the biggest problems of today's time.

SOLUTION MODEL: The methodology used in the research process is started with a literature survey of the problem, analyzes related problems and then constructs a model of the problem. Then we use the key defining characteristics of the model to obtain an efficient solution. In our solution has been verified and refined through simulation work on many and different scenarios.

The results obtained from the proposed solution are compared with other existing solutions to verify its efficiency. Background actions on each of the problems addressed are provided in the sections. For our work on increasing data transmission using WiMAX networks in TCP traffic. The purpose of this architecture is to implement high data rates, quality of services, long distance, and low deployment costs for a wireless access technology on a metropolitan scale. WiMAX technology and architecture is the focus of the paper, and more specifically the higher bandwidth its capacity.

IV.   WIMAX

IEEE 802.16 Stands for WiMAX. World Wide Interoperability for Microwave Access is a telecommunication technology designed to provide effective transmission of data using various modes of transmission such as lattice and PMP (point to multipoint). Developed standards and recommended practices to support the development and deployment of networks (wireless-man). IEEE (Institute of Electrical and Electronics Engineers) is an international professional organization about engineering on fields such as aerospace systems, computers, telecommunications, biomedical engineering, etc. WiMAX is a high-performance end to end network protocol. Its features are growth rate, high performance, unbiased QoS, highly secure communication of data with low packet delay. There are two main types of WiMAX services: mobile and fixed. Mobile WiMAX enables users to use the Internet during travel while fixed WiMAX stations provide wireless Internet access to customers within a certain radius. Hence the concept of WiMAX has been introduced to extend the range of the network.

It is also known as standards for microwave access and 802.16 for worldwide differences. It was designed for long distance wireless network connections to provide Internet access in a particular geographic area. It can be installed over a range of 39 miles and more. WiMAX technology is a standards-based wireless technology that is used to provide Internet access and multimedia services to high-end users.

V.   DATA TRAFFIC

Data and traffic agents who take responsibility for transporting data across the network are of different types and offer different characteristics in the network [9–11]. It is necessary to understand the characteristics and hence the performance to find the suitability of each type in the network. The two types of data / traffic agent types used in the network are the following:

TCP: TCP represents the data type and FTP represents the application traffic agent of any application that uses TCP data Transports. Here TCP is a transport layer protocol and FTP is an application layer protocol. This scenario provides a

connection-oriented transmission environment, where communication takes place in stages, namely, connection establishment, data transmission, connection termination. There are three basic features offered:

Reliable: TCP / FTP provides reliable communication, as it provides guaranteed data by employing acknowledgments that guarantee the delivery of data to a destination. If approval is not received by the time period, retransmission is performed to ensure delivery of data to the receiver. We can say that positive acceptance, timeout, and retransmission are required to guarantee the delivery of data in a network.

Bi-directional: Here in TCP / FTP, in one direction i.e. in forward direction, the sender transmits data and in the other direction i.e. in reverse direction, receiver accepts by sending acknowledgment to sender. So, this is how bi-directional communication occurs.

Conforming: The network confirms the nature when working with TCP / FTP. The network is analogous in terms of broadcasting as it provides both flow and congestion control. Flow control by preventing overflow of recipient buffer, and crowd control by keeping track of confessions, time outs, and retractions

UDP: This type of traffic generates the data CBR of the UDP type and application traffic agent. Here, the former is a transport layer protocol and the latter is the application layer protocol. It provides transmission of data at a constant bit rate and does not communicate in stages, and traffic moves in one direction from source to destination without any response from the destination. It presents the three basic features mentioned below:

Unreliable: Network quiet is unreliable because it does not establish communication in stages and does not rely on acknowledgment to recover lost messages. The sender node does not take responsibility for successful delivery of data.

Unidirectional: Since no acknowledgment is transmitted from the receiver, only one way communication is done i.e. over the forward link. The destination does not send any data packets to the receiver, so it provides indirect traffic.

Predictable: UDP / CBR has the approximate nature of transmission, as it provides constant bit rate, fixed and known packet size, fixed and known packet interval, and fixed and known packet stream duration

VI. SIMULATION PARAMETERS

Simulation Parameters is given below:

Parameter	Values
IEEE Standard	802.16 WiMAX
Traffic Agent Type	CBR/TCP
Channel	Wireless
Network Size	1600x1600m
Routing Protocol	AODV
Number of Nodes	50
Node Placement	Random
Simulation time	1500s
Mobility Model	Random Way Point
Connection rate	2 Mbps
Pause Time	1.0s
Seed	1
Maximum Speed	10,20,30,40,50 m/s
Simulator	NS-2

Figure 1:

VII. PERFORMANCE METRICES

It is the value of information calculated using mathematical methods, and shows performance using the following criteria:

 Packet Delivery Fraction: This is the fraction of number of packets received at the destination to the number of packets sent from the source multiply by 100. In other words, fraction of successfully received packets, which survive while finding their destination, is called as packet delivery fraction.

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:

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

VIII. SIMULATION MODEL

The NS2 (version 2.31) network simulator has been used for simulation work. This part covered the simulation model of various parameters used in the network scenario. And all the parameters and its values are given in the section below. A tcl script is created for the implementation, including the creation of nodes, the relationships between nodes, setting the topography region in which nodes are located according to the x axis and the y axis. The simulation is run for 1500 seconds. Simulation procedures were performed for 50 numbers. Nodes were randomly distributed in the simulation over the area of the network's 1600x1600 m^2 rand function. Routing algorithms have been used to route between source and destination AODV.

IX. RESULT AND DISCUSSION

In this project, the performance of TCP / FTP and UDP / CBR under the AODV routing protocol is compared in the WiMAX environment. And in this part we have introduced simulation analysis. The entire simulation is performed to provide clear trends for performance metrics such as throughput, packet delivery ratios. The simulations are run at different speeds of 10, 20, 30, 40 and 50 m / s. In both cases there is an analysis of the effect of network performance with the nodes discussed below using the graphical method. To test the protocol, the NS2 simulator is used.
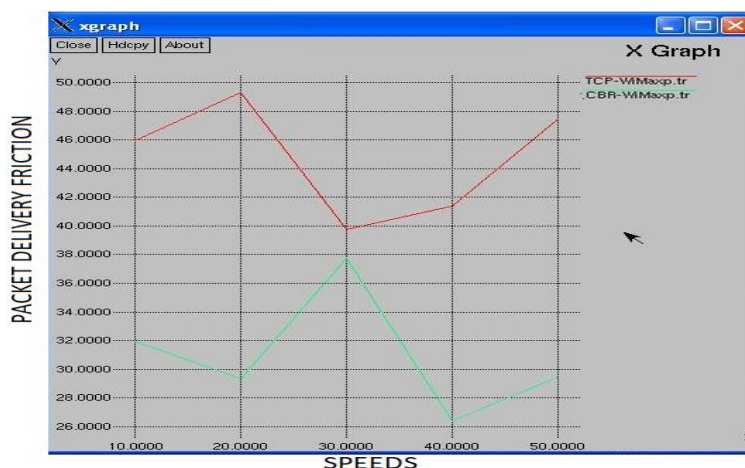

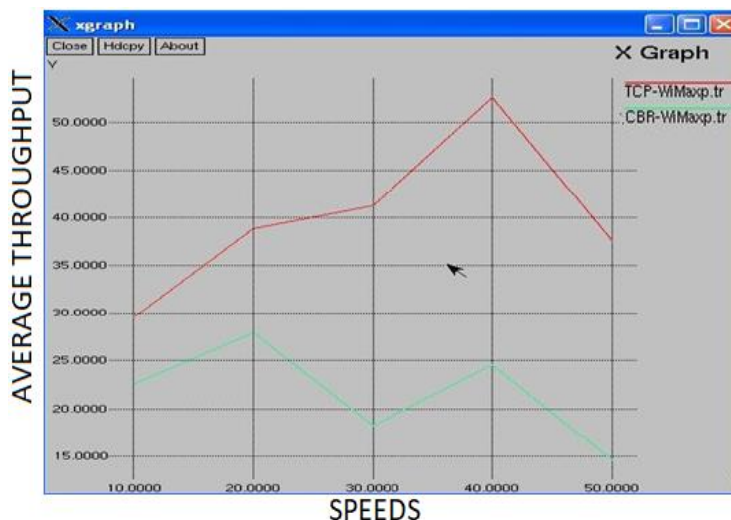**Figure 2: PDF with variations of speeds**

Figure 3: Average Throughput with variations of speeds

Here we have shown PDF and throughput through graphs 2 and 3. in these graphs, x axis represents speeds and y axis performance metrics. In which 50 mobile nodes are randomly placed, it transmits and receives packets properly. Here, this packet is transmitted between the source and the destination using the AODV routing protocol in the WiMAX environment. This graphical result is presented for the effect of speed variation in subscriber stations on TCP and CBR traffic. TCP has performed well compared to CBR. The transmission control protocol and the user datagram protocol are the two main transport protocols that provide connection-oriented and connectionless services, respectively. TCP ensures reliable and ordered data delivery, initiating processing overhead and bandwidth limitations due to congestion and flow control mechanisms. Light-weight UDP neither provides reliable delivery nor helps to meet overhead and bandwidth limitations and is therefore used in packet dropping. The obtained results showed that TCP provides better performances in term PDFs and Throughput than CBR because TCP is more reliable than UDP. The average value of the above parameters is shown by the graphical method of the results of the overall simulation. This chapter describes the simulation environment and presents the results or average values in above graph of our simulation experiments

X.   CONCLUSION AND FUTURE SCOPE

We have completed the paper report in two parts: one is a theoretical study and the other is simulation analysis. This paper has a theoretical part to study about the behavior of different traffic sources of wireless ad hoc networks. And we have used the second part of the paper network simulator for simulation analysis. The findings presented in this paper compare two traffic scenarios that are TCP and CBR, implemented in the network under test conditions. Comparisons are made to find the results and necessary conclusions are drawn. The various experiments, observations, and analyzes conducted on the basis of the paper are as follows: PDF and throughput out of the two traffic types TCP and UDP provide far better performance than the latter. It is noted that simulation results that increase the performance of TCP, our protocols increase the number of efficient performance nodes, and decrease the traffic load. On the other hand, it can be seen that when the speed of nodes increases TCP shows better performance for all TCP variants. And the related results are shown in the previous chapter with graph aid.

Future Works: For future expansion in this work, we plan to extend our study by incorporating HTTP traffic, where many TCP connections are opened and closed in short intervals. And furthermore this concept can be used with another application variant of TCP to give a broader performance.

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