Temporal Modeling of WI-MAX Network on the Basis of Traffic Load

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Abstract - One of the challenging tasks in the wireless network is Quality of service (QoS). The role of network engineering is that it will analyze and provide QoS. The multi-service is more complex as compared to single service hand off process. In this paper, we analyzed the performance of WI-MAX network using matrices average bandwidth with respect to data rate Vs different traffic stack. This study is based on the temporal modeling of WI-MAX network on the basis of traffic load and simulates the model using Matlab Software.

Keywords: WI-MAX, QOS, handoff, traffic load.

I. INTRODUCTION

Today's concept of homogeneous network for demanding of high data with large traffic capacity, WI-Max (Worldwide Interoperability for Microwave Access) is an appropriate network for existing wireless technologies.
WI-Max has been standardized by IEEE organization as standard IEEE 802.16 with several extensions using frequency spectrum 2 GHz to 11 GHz. Similar standard developed by European organization ETSI as Hyper-MAN, it is used in European countries.
WI-Max extension version 802.16e is evidently defined about handoff (HO) process with mobility procedure. Mobile node requires uninterrupted call, when it is going to our coverage to other coverage region, it is maintain by hand off process. WI-MAX has various hands off techniques such as Macro diversity HO, Hard HO and base station switching HO. Hard HO is obligatory but others are not obligatory.
WI-Max provides appropriate high data rate channel capacity; which is approximately up to 70 Mbps with up to 100 miles per hour vehicular speed that is much suitable for remote coverage area. It offers broad band service using OFDM multiple access technique.
It has competent data rate and coverage area for wireless LAN & 3rd Generation wireless standard, also current extension version 802.16 standard expected to dominate 4th generation wireless world. WI-MAX is large coverage area using non line of sight for communication as compare to wireless LAN.
In future, various network environments will have able coordinate services of Wi-Max, for example usually deployed data and 3rd generation cellular service. In addition to wireless LAN, cellular and satellite will have to integrate with promising technologies and networks. Next generation technologies as OFDM multiple accesses, differentiated QoS with method of resource allocation are used in WI-MAX networks. Network architecture and radio access are competent to offer scalable in WI-MAX networks, it is also convenient for hybrid network. [3, 8, 9, 10, 12]

II. STATISTICAL METHODOLOGY

In network design cost and service are most important factors around various variables, doesn't matter what type of networks. We need optimized service cost factor in network design because of effectiveness and customer satisfaction using various traffic models. Use of traffic probability may help the engineer to design robust and

efficient networks. For network, design can be used for past experience to make assumption for network capacity in proper size. [3, 5, 7, 12]

Number of message or quantity of data given a slot time over a circuit is known as traffic, it also associates speed and sensitive equipment to attempt call. Analysis of traffic complexity identifies the need of bandwidth in circuits for voice and data. Service complication has to be handled by engineer using blocking factor of grade of service, it needs high utilization of circuits with minimum blocking factor. So we can reduce the cost by increasing the service. To analyze the traffic, factors need to account there sampling method, grade of service, traffic load management and traffic type. [5, 9]

The traffic model is chosen on the basis of number of call sources, blocking probability depends on quantity of sources. The number of call request, number of call departure, number of call lost, holding time and number of transmit nodes define to select traffic model for suitable environment.

Traffic load is defined as ratio of arrival request rate (λ) and departure rate (μ) of base station.

$$\text{Traffic load} = \frac{\text{arrival request rate } (\lambda)}{\text{departure rate } (\mu)} \quad \ldots\ldots\ldots\ldots (1)$$

For simplicity buffer less handoff algorithm can be used. Service provider can also change service for higher priority request from mobile users.

Mainly Assume Transmission and operating power consumed in wireless networks, which is during the WI-MAX fame transmission, increase the cell capacity and during the operation such as scheduling, data processing and reception and relative activities[4].

The most important factor is lost calls probability of the wireless networks. It is defined as per the queue system models. In this work queue model $M/M/1/N_n$ is defined as:

$$\text{No. of channel available in the } \frac{N}{W} n \ (Nn) =$$

$$\frac{\text{Total bandwidth of network n}}{\text{Average data rate per user}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\text{Effective traffic load}(Rn) =$$

$$\frac{(\%\text{of total request network} \times \text{traffic load})}{100} \quad \ldots\ldots\ldots\ldots (3)$$

In this analysis effective traffic load change on the basis of receive signal strength handoff algorithm [4].

Percentage of Average user request satisfied is depends on session treated as collective or individual. In receive signal strength technique is consider collectively, if cannot satisfied collectively all request, it means blocked from the system. [4]

III. MODEL SIMULATION

We examined the four sitting time slots duration hours during the one day as shown in table 1 below:

Sitting	**Time Period**	**Call request time zone**
1st Sitting	6 AM to 10 AM	Morning Hour
2nd Sitting	10 AM to 6 PM	Business Hour
3rd Sitting	6 PM to 12	Night Hour

	AM	
4th Sitting	12 AM to 6 AM	Ideal Hour

Table 1: Time slot durations for one day

A. Average user request vs. traffic stack

Performance of simulation model describes graphically in the form of various percentages of average user requests with traffic stacks for different sittings, given in table-1.The performance result showed in figure-1 between two parameters as traffic stack and average user request percentage for four different sittings. Here sitting signify the time zone which has been taken for finding the traffic load on the network.

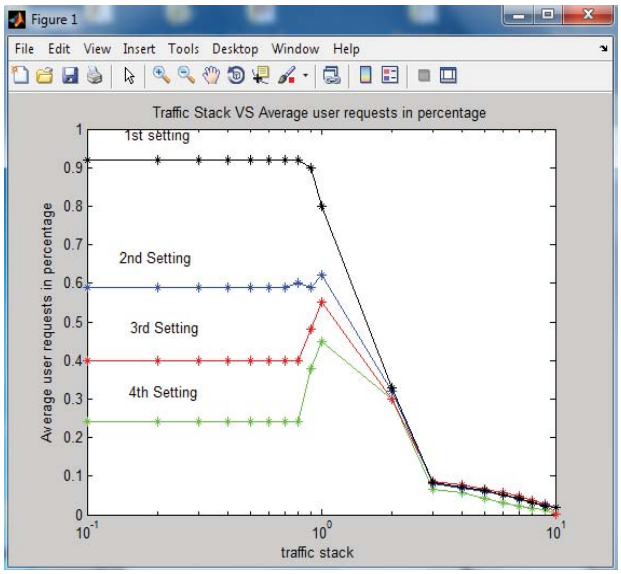

Fig 1: The graph between Traffic stack vs. Average user request in percentage

B. Average bandwidth and delay

The number of channel in the network (n) depends on bandwidth and data rate as in equation (2). The call delay or may be blocked due to not availability of channel. Figure-2 shows the delay on the basis of average bandwidth with respect to data rate vs. simulation time with four sittings.

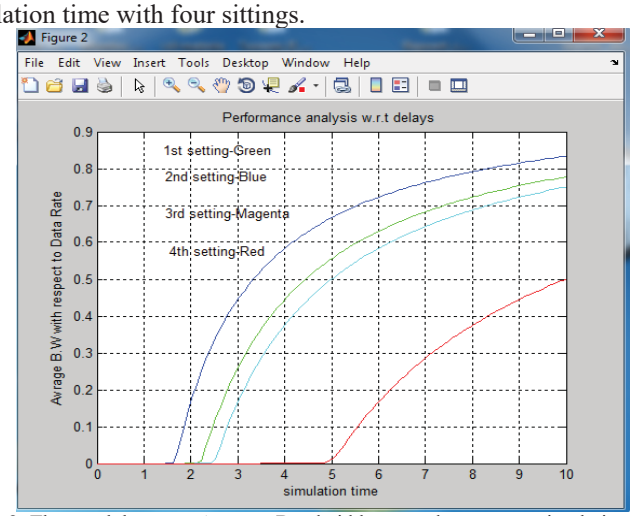

Fig 2: The graph between Average Bandwidth w. r. t data rate vs. simulation time

IV. CONCLUSION& FUTURE SCOPE

In this paper, we have introduced a statistical methodology for temporal modeling of WI-MAX wireless network using traffic stack. It explores the statistical properties, traffic dependencies and inter-relations. In WI-MAX district, most of the modeling effort has been on the base station level. Simulation results shown that effective capacity estimation of a base station (BS) introduces receive signal strength algorithm for traffic load with various time zone sittings.

In future, this method can improve the congestion problem and minimize the voice call drop or packet loss.

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