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Performance in Wimax Networks Using Vertical Handoff

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Abstract- Handover means transferring an ongoing call or data sessions one cell to another. Handovers occur due to the movement of the mobile user from one area to another area. Handovers are used to prevent an on going call to be disconnected. If we don't use handovers then whenever a user leaves the area of a particular cell then it's on going call is immediately disconnected. The process of handovers requires a number of parameters e.g. what is the handover scheme we are using, how many channels are free. In the handover process we should also keep the QoS up to the standard. Vertical handover may be referred to a process of transferring call connected to a network/data session from one channel connected in a cell to the core network of another. In this paper WiMax performance evaluated using vertical handoff.

Index Terms- AP, DCF, PCF, LAN, Wimax.

1. INTRODUCTION

The fiber optic transport services providing the high bandwidth and data rates is replaced by WIMAX wireless technology all across the world. WIMAX is emerging technology to fulfil the high data rate and QoS requirements of the customers, also it is the cheap deployment of voice services with no need of line of sight wireless channel [1].

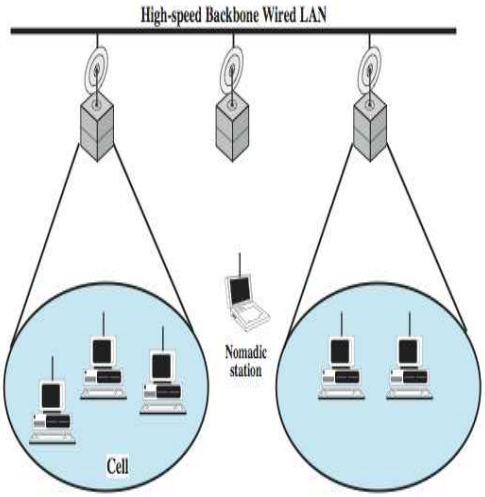

Fig. 1: Infrastructure Wireless LAN

WIMAX signals have the property to adopt the atmospheric conditions everywhere. WIMAX electromagnetic waves also offer the support of adoptive coding and different operation modes, so voice and data services can easily be transported by WIMAX network platform.

Wireless Broadband (WiBro)

The Wireless Broadband is recently developed wireless technology offering high speed data service over internet [2]. Actually it is newest technology developed by Korean research group often referred as (Next G) communication system. WiBro is capable to provide high data rate communication with diversity of QoS according to the demands of users over wireless channels.

In WiBro Orthogonal Frequency Division Multiple Access (OFDMA) is used according to IEEE 802.16a standard, to provide the services in Heterogeneous network system. Since different broadband services offer different amount of data rates according to different priorities (e.g. video streaming requires the high bandwidth, whereas voice services require higher priority) [3].

Orthogonal Frequency Division Multiple Access (OFDMA) operates under the different conditions (e.g. as the requirements of users data rate are given when the sub carrier assignment and transmit power allocation occur), this problem is solved by non linear programming techniques in WiBro [4].

High Speed Downlink Packet Access (HSDPA)

High Speed Downlink Packet Access (HSDPA) is introduced in (3G) wireless network obtain high speed data rates. By implementing HSDPA some problems arisen to address the major business topics, one of these problems is radio. The transmission scheme designed for GPRS is upgraded by EDGE also has limited features. The optimization of only radio is not enough; also

transmission strategy should be designed to overcome these problems in every day growing traffic[5].

HSDPA is modified interface version of UMTS in 3GPP. It provides not only down link packet access but also it can be used for uplink data up to 14 Mbps per user.

High Speed Packet Access (HSPA)

It is revised version of HSDPA. It also offers the high data rate for downlink as well as uplink 14 Mbps.

2. WIMAX SYSTEM

WiMAX, an acronym for ***Worldwide Interoperability for Microwave Access***, is a telecommunications technology that provides fixed and fully mobile internet access. The current WiMAX revision provides up to 40 Mbps with the IEEE 802.16m update expected offer up to 1 Gbit/s fixed speeds. (WiMAX is based on the IEEE 802.16 standard, also called Broadband Wireless Access). The name "WiMAX" was created by theWiMAX Forum, which was formed in June 2001 to promote conformity and interoperability of the standard. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL".

Terminology

WiMAX refers to interoperable implementations of the IEEE 802.16 wireless-networks standard (ratified by the WiMAX Forum), in similarity with Wi-Fi, which refers to interoperable implementations of the IEEE 802.11 Wireless LAN standard (ratified by the Wi-Fi Alliance). The WiMAX Forum certification allows vendors to sell their equipment as WiMAX (Fixed or Mobile) certified, thus ensuring a level of interoperability with other certified products, as long as they fit the same profile.

The IEEE 802.16 standard forms the basis of 'WiMAX' and is sometimes referred to colloquially as "WiMAX", "Fixed WiMAX", "Mobile WiMAX", "802.16d" and "802.16e." Clarification of the formal names are as follow:

- **802.16-2004** is also known as 802.16d, which refers to the working party that has developed that standard. It is sometimes referred to as "Fixed WiMAX," since it has no support for mobility.
- **802.16e-2005**, often abbreviated to 802.16e, is an amendment to 802.16-2004. It introduced support for mobility, among other things and is therefore also known as "Mobile WiMAX".

Mobile WiMAX is the WiMAX incarnation that has the most commercial interest to date and is being actively deployed in many countries. Mobile WiMAX is also the basis of future revisions of WiMAX. As such, references to and comparisons with "WiMAX" in this Wikipedia article mean "Mobile WiMAX".

3. Simulation system and results

Horizontal handoff in WiMax network

This scenario demonstrates the mobile station performance during horizontal handoff in WiMax network. This set-up has eight BS, these BSs support WiMax technologies. The MS roaming from BS0 to BS7 with the mobility speed of 29 m/sec. Figure 5.7 shows the set-up of the WiMax. All the links used are 100 BASE T links. The throughput of the MS during the movement that is around 65k bit per sec. The drop points represent the connection time during the handoff. The maxim delay point is 0.025 sec. This value is acceptable delay for most applications [6].

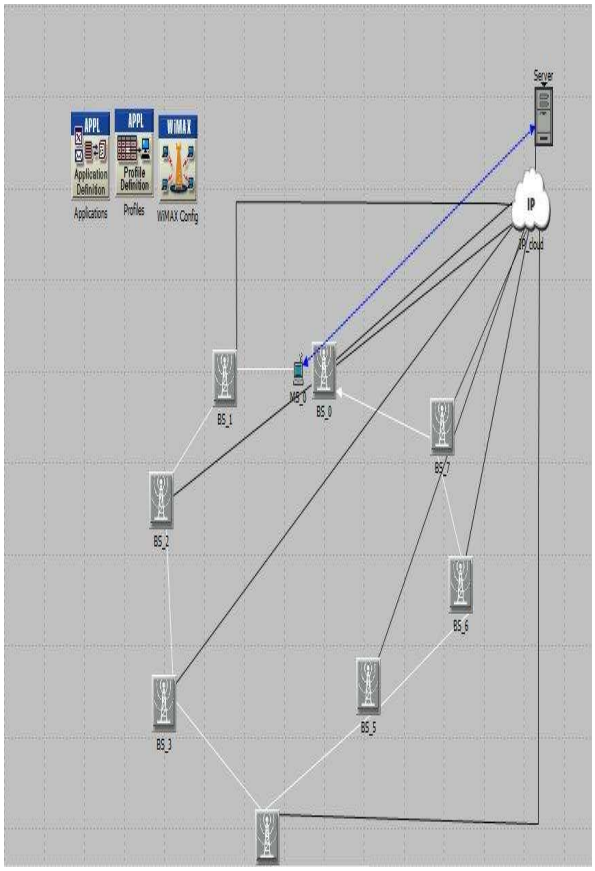

Fig 2: Set-up of WiMAX Handoff

The throughput and handover delay graphs are obtained for the mobile station as shown below. Throughput drops during handoff. Throughput is total data traffic in bits/sec successfully received and forwarded to the higher layer by the WiMAX MAC. While the delay is the time in between handover.

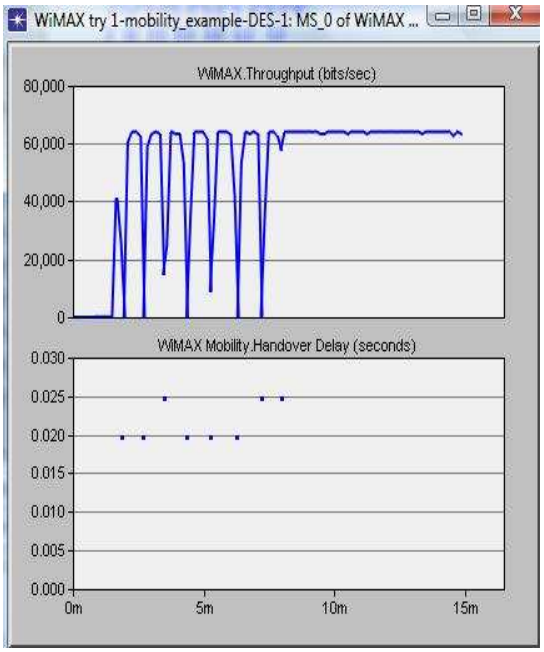

Fig 3 : Throughput and handover delay for WiMAX set-up

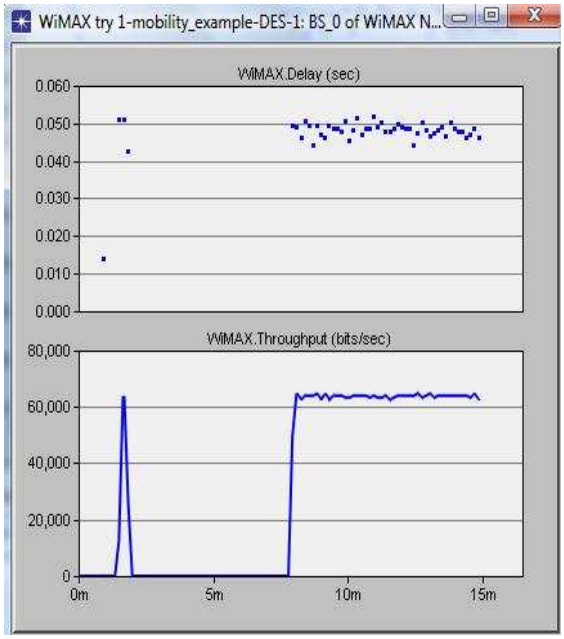

Fig 4: Delay and throughput for a Wimax BS_0

Initially the mobile station starts moving from BS_0 to BS_1 and so on. Hence there is throughput for some duration of time for BS_0. As the mobile node leaves its area the throughput is 0. And then after some time it again increases and becomes nearly constant when the mobile node reaches back to BS_0. Simulation time is 15 minutes. Delay here represents the end-to-end delay of all the data packets that are successfully received by the WiMAX MAC and forwarded to the higher layer.

Table 1 : WiMAX Parameters for MS

Antenna Gain (dBi)	-1 dBi
MAC Address	Auto Assigned
Maximum Transmission Power (W)	0.5
PHY Profile	WirelessOFDMA 5 MHz
PHY Profile Type	OFDM
BS MAC Address	Distance Based
Pathloss Parameters	Vehicular
Ranging Power Step (mW)	0.25
Scanning Threshold (dB)	27
Scan Duration (N) (Frames)	4
Interleaving Interval (P) (Frames)	240
Scan Iterations (T)	10
MS Handover Retransmission Timer(ms)	30
Maximum Handover Request Retransmissions	6
Handover Threshold Hysteresis (dB)	0.4

The **fig. 5** below shows the graph for Wimax Mobility- scanning interval activity which indicates the current state of the scanning mode for the MS node. The following values can be written in this statistic:

(-1) => Scanning Mode is off

(0) => Interleaving period (regular operation while scanning mode is on)

(1) => Scanning period (MS is scanning neighbor BSs while scan mode is on) 1 when Wimax is in scanning mode, 0 when not in scanning mode and -1 when in intermediate node.

The Serving BS ID depicts the BS ID of the current Serving BS for the Mobile Station.

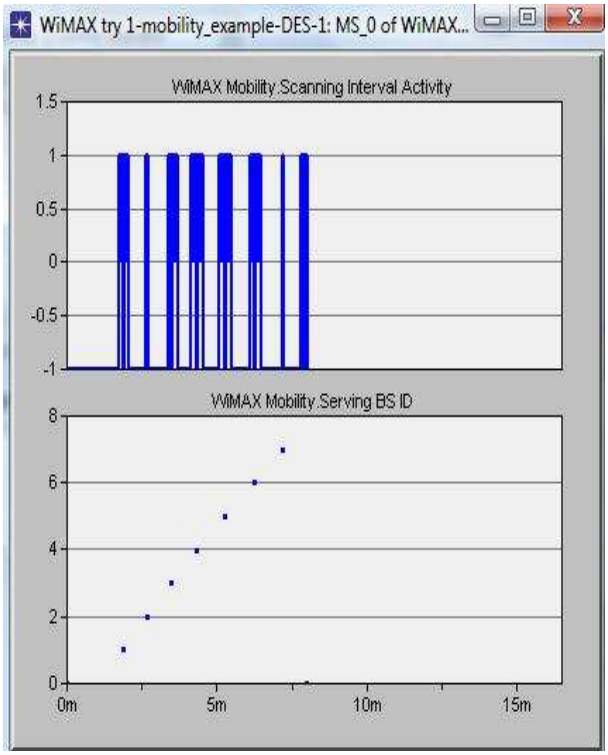

Figure 5 : Scanning Interval Activity and Serving BS ID graph for Wimax MS

Vertical Handoff

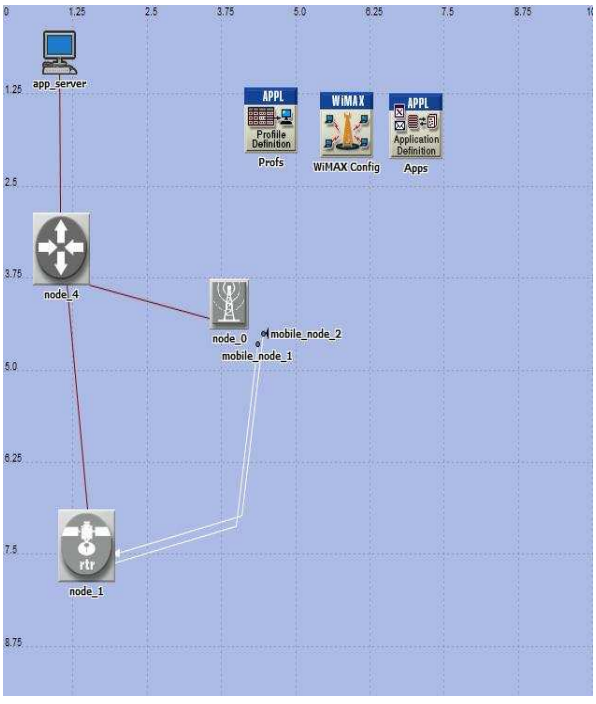

Fig. 6 : Set- up for vertical handoff

The above set-up comprises of a ethernet_wkstn (app_server) node model, ethernet4_slip8_gtwy node model (node_4), router (node_1), MS for wlan as well as for Wimax, Wimax BS, Application config, Profile Config, Wimax Config. MS for Wlan is mobile_node_1 and for Wimax is mobile_node_2. Both the MS roam in some desired trajectory with the speed of 24 m/s.

Initially both the mobile_node_1, mobile_node_2 are placed near to the Wimax BS from where they start roaming towards the wlan router.

So the throughput for wlan MS is 0 for some time while Wimax MS depicts some throughput (bits/sec). And that some time is the time in which both the mobile nodes reach in close vicinity or the range of the wlan router. And then the throughput of Wimax MS is reduced to 0, while throughput for wlan MS starts increasing and becomes almost constant after some time. Simulation done for 500 sec.

Hence we observe that the Communication server performed hard handoff. The application running on the MS will stay connected to the application/communication server(GSM quality voice). The throughput is affected but one of the two MS stays connected.

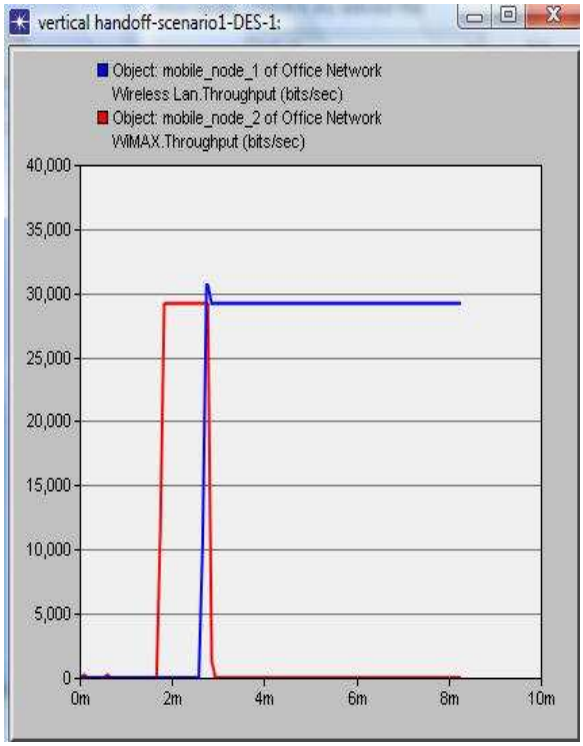

Fig. 7 : Throughput (bits/sec) for Wimax MS(stacked statistics)

4. CONCLUSION

In the Wimax handoff setup the MS node moves away from the Home Agent and visits 7 Foreign Agent BS nodes, before returning back to the care of the Home Agent. As it moves away from BS_0, it attaches itself with the BS_1 and so on etc. Hence horizontal handoff takes place and the throughput, delay, scanning BS ID graphs are obtained.

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