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The Effect of the Handover in WiMax Wireless Communication

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Abstract

Worldwide Interoperability for Microwave Access(WiMAX) deployment is growing at a rapid pace. Wireless communications is the transfer of information between two or more of the items that are not physically connected.Considered WiMAX an extension of WiFi technology in terms of the development of wireless services with a wide space. It also aims to supply sites used for WiFi to the Internet wirelessly. The aim of this paper is a study the handover that occurs in WiMAX and the solution.

Keywords :WiMax,WiFi,Handover,Wireless

Introduction

WiMAX (Worldwide Interoperability Microwave Access) is a wireless system based on the IEEE 802.16e [1] standard. This standard, published in September 2005, is innovating previous version IEEE 802.16- 2004 [2], which was published in October 2004. In the 802.16-2004 is not implemented support of handovers between cells. This version allows only fixed and nomadic access [3]. The handover mechanism is implemented in the newest version802.16e. There is introduced support of soft and hard handovers. Rest of the paper is organized subsequently. Next section describes the kinds of the access used in mobile WiMAX. The third section describes types of WiMAX handover. Further section is focused on updating procedures which are used during movement of the mobile stations. In the last section are the main differences between handovers summarized.

(WiMAX)

WiMAX (Worldwide Interoperability for Microwave Access Forum) is a wireless network standard approved by Institute of Electrical and Electronics Engineers (IEEE). There are still ongoing researches on developing the standard and there are also several research groups have investigated QoS mechanisms, such as admission control and scheduling algorithms as presented by (Chen et al., 2005), (Fonseca et al., 2007) and (Sun et al., 2006). The implementation of WiMax on NS-2 will be done based on the module presented in [2] Figure 1 illustrate the structure of WiMax module.

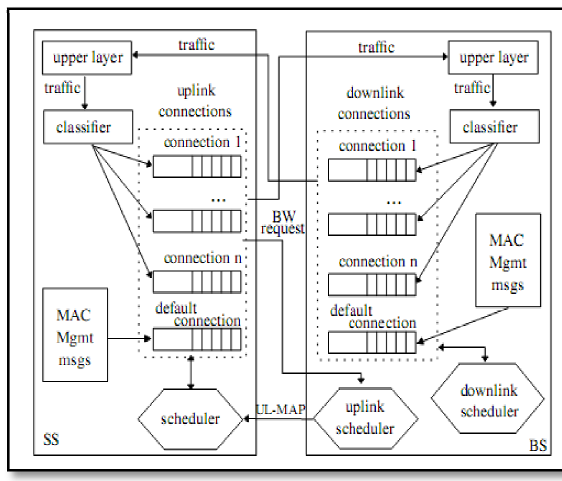


Figure 1:Structure of the WiMAX module

WiMAX is the promising technology for broadband wireless access for the near future. The excessive demand for providing mobile users with broadband wireless access has attracted tremendous investment from the telecommunications industry in the development and deployment of WiMAX networks (Haghani, De, & Ansari, 2007).

Voice over IP (VoIP) over WiMAX will be one of the killer applications for rapid deployment of WiMAX networks. The legitimate desire for bundling voice and data will increase the portion of voice traffic in the WiMAX networks [3] Hence, VoIP, as the current technology for making voice calls through packet switch networks, will be a key application in WiMAX networks. The scarcity of available bandwidth in wireless networks has called for efficient resource management. The IEEE 802.16 standard, which has been adopted by WiMAX, has defined different scheduling services and QoS mechanisms, but the details of traffic scheduling are intentionally left open for vendors' innovation to design the best scheduling method suitable for their networks.

To design the optimum scheduling algorithm, it is crucial to understand the traffic features and service requirements of different applications consuming network resources. An imprecise model of the traffic leads to waste of bandwidth and lower efficiency. The main VoIP traffic model used in research literature is the ON-OFF model (Kitroser, Chai, Ben-Shimol, & Yarkoni, 2008). In this model, it is assumed that the source generates equal-size packets separated equally in time during the ON period and either does not generate any packet or generate smaller packets during the OFF period (Kostas et al., 2008). Although natural voice might conform to the ON-OFF model, experimental traces of VoIP packets, incorporating the impact of the application codes, transport layer, and IP layer, do not exhibit the characteristics of an ON-OFF traffic [4].

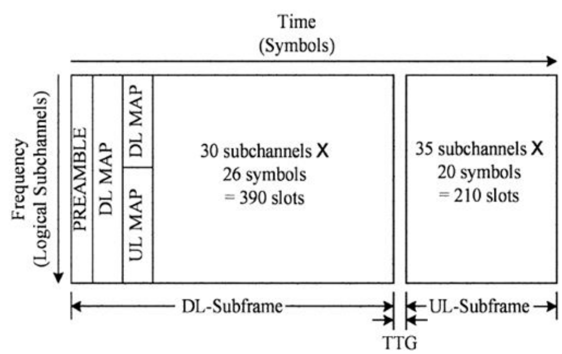
The importance of efficient resource management has prompted a keen interest in the research community on scheduling VoIP traffic in WiMAX networks. Many scheduling method based on the ON-OFF model were proposed. They use the ON-OFF model to perform a predictive scheduling of VoIP traffic in IEEE 802.16 systems (Jijun, Dillinger, & Schulz, 2002). An analysis of the voice packet transmission in IEEE 802.16 is presented in many works (Haseeb & Tralli)(Dongmei & Xuemin, 2007). They have studied the performance of conventional service scheduling methods on VoIP traffic in IEEE 802.16 systems.

They also assumed that the packet generation process can be modeled by the ON-OFF model. A qualitative experimental study of VoIP traffic in a WiMAX test bed is reported in [4,5]. They measured the performance of different transmissions schemes in terms of cumulative goodput, packet and sample loss rates, and calculated the objective mean opinion scores using the R-Score specified by ITU. They found that VoIP flows carrying single sample payloads generated by the G.723.1 codec are clearly underperforming.

In both uplink and downlink. Indeed the header overhead introduced by RTP, UDP and IP lead to significant waste in wireless bandwidth resources. The strategy of sending a single sample encapsulated in an RTP/UDP/IP packet is, to say the least, suboptimal. They found that application layer VoIP aggregation can more than triple the number of lossless VoIP flows in the downlink, without any network or hardware support. The results are of the same order for the uplink as well.. A simple network-layer VoIP aggregation algorithm can also increase the effective capacity of conventional (non-aggregated) VoIP flows. Network-layer aggregation can more than double the number of lossless flows that can be sustained in their WiMAXtestbed, and could be easily adopted in cases where application-layer aggregation cannot be implemented.

2.1.WiMAX Frame Structure

IEEE 802.16e Orthogonal Frequency Division Multiple Access (OFDMA) air interface is framebased. The frame is divided into a downlink (DL) subframe and an uplink (UL) sub frame. The DL sub frame starts with a preamble followed by the DL and UL MAP messages respectively. The DL and UL MAP messages specify all the allocation information :or the DL sub frame and UL sub frame respectively, i.e. they carry the control information. The MAP messages are followed by the DL allocations for individual users. Similarly, the UL sub frame consists of UL allocations. Figure 2.4 shows an example frame structure for 10 MHz channel bandwidth and 5 ms frame length for a given DL to UL ratio.



Proposed Work

The scenario of simulation presents a MN that is connected to WiMAX networks enters a hotspot. For cost and bandwidth performance, the MN executes a vertical handover to the WiMAXnetwork. When leaving the cell, the MN reconnects to WiMAX. The MN uses the LGD trigger on the WLAN interface. The parameters used in this scenario are summarized in Table 5.1 below:

	WiMax parameters
Coverage area	Coverage: 1 km radius
Becons's configuration	DCD/UCD interval: 5s
Frames	Frame duration: 4ms
Contention period	Contention opportunity per

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	frame: 5
Scanning configuration	Scanning: duration=250 frames, interleaving=40 frames, iteration=5

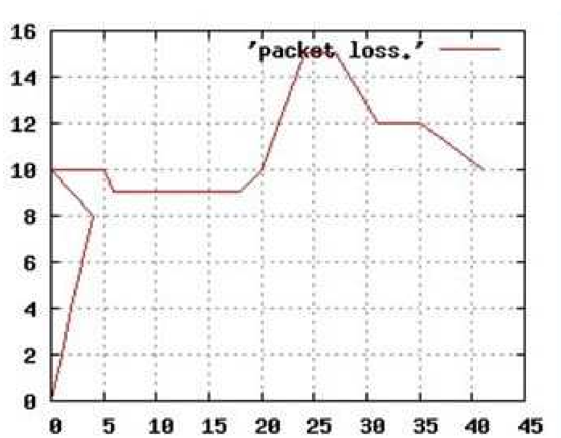
Table 1:parameters of scenario

The results gained from simulation are presented in the Table 2 below. The application traffic is a video streaming generated by CBR traffic over UDP as a transport protocol. The size of transmitted packet is around 500 bytes with an interval of 0.1s which means 100 packets per second to generate a rate of 396.8Kb/s. The packet size of UDP datagram is 1240 byte.

	Interface 802.16 is always turned on, redirect on Link Down	Interface 802.16 always turned on, redirect on Link Going Down	Interface 802.16 activated upon Link Down of interface 802.11	Interface 802.16 activated upon Link Going Down of interface 802.11
Handover 802.16-802.11 latency (s)	0.395	0.512	0.395	0.364

Table2:Simulation Results

Referring to this table 2, the next simulation will focus on validating the scenario which is in Blue. To simulate the case of that handover process start after the generation of link down, the movement of the MN is the parameter to vary while leaving WiMAX. This variation is limited in distance because we have to evaluate the handover latency and packet loss at the moment when the event Link Down is generated, that's why when leaving Wi-Fi, the MN have to move away slowly from the access point boundary. The result of simulation of packet loss during the roaming period is shown in Figure 5.1 below:



If we compare the published result and the simulated one, we notice that they are approximately equal: in the draft the packet loss is around 13 packets and the simulation gives 11 packets. So we can conclude that this difference of only 2 packet loss could be caused by the instability of the tool Network simulator.

Furthermore, handover latency was determined by the same steps used with the packet loss: The MN is moving with a constant speed in WiMAX coverage when he reaches the AP boundary we limited the time of simulation to be close to the moment of generation of Link Down and by result have the precise delay of handover which represent the handover latency.

The results are shown in the curves below, for 802.16-802.11 Handover latency it is around 0,357322(s).

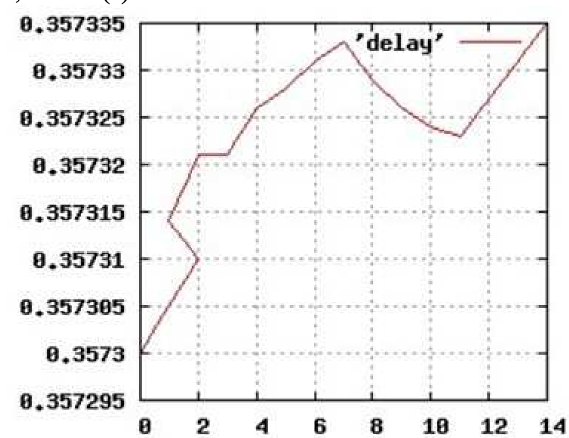


Figure 3: 802.11-802.16 Handover latency(s)

We summarize the result in the table below:

	Published result	Result of simulation
Handover Latency WiMAX ,	0.395	0,357322(s).
Packet Loss	13.98	11

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Table 3: Summarized result

Table 3 implies that the package we used in the simulation is close in results to the ones published by the IEEE 802.21 draft.

Simulation Analysis

When the MN goes in the WLAN's coverage area, upon a Link Detected event, the MN triggers the association with the WLAN AP and solicits a RA message. However, when the MN is leaving the WLAN hotspot, it will no longer wait for losing its connection with the AP in order to trigger a handover. Rather, the MN anticipates the degradation of signal quality and generates a LGD event as it gets close to the AP's coverage area boundary.

The detailed procedures when the MN is leaving the WLAN hotspot are summarized as follows:

- The MN is in the WLAN coverage area and is moving out.
- As the MN is approaching the border of the WLAN hotspot, the MAC generates a LGD event based on the power level threshold.
- Upon the receipt of a LGD event, the MIH forwards the information to the Handover module, leading to a flow redirection on to the WiMAX interface.

The generation of LGD, as explained previously, is done using the power level of received packets. To configure the power level threshold, a coefficient pr_limit is used to set this threshold as shown below in the Figure:4

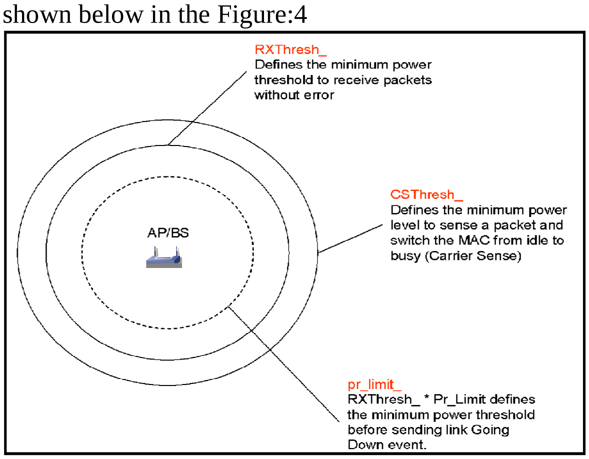


Figure 4:Power threshold before sending LGD (adopted from (Scalabrino et al., 2007))

This Figure remains the three parameters which contribute in setting the minimum power threshold before sending LGD. The pr_limit coefficient is associated with RXThresh_, which defines the threshold of received packet's power, to limit the generation of LGD and by the way bound its benefits: Using a LGD event in order to trigger WiMAX handover anticipates the loss connection. Therefore, if the anticipation is made soon enough, the handover can be smooth, (i.e. without any packet loss). If the redirection of the traffic flow is uninterrupted and is resumed on the WiMAXinterface. However, the sooner the anticipation is performed, the less time the MN will use the Wi-Fi hotspot.

Simulation's Result

Figure 4 shows the handover Delay factor for different Pr_limit coefficient. If the delay factor grows up to a critical value, it means that at this corresponding time the handover process to WiMAX has been occurred before the connection to the WiMAXhotspot is broken, and it represents the handover Latency.

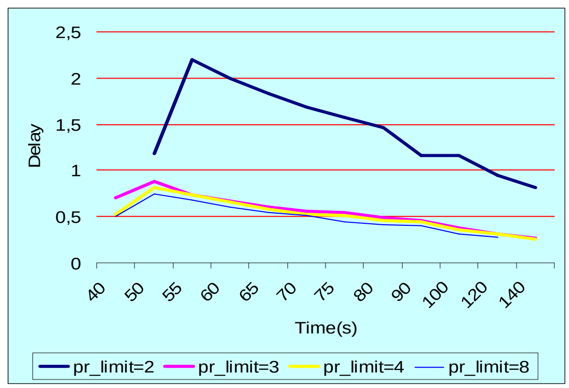


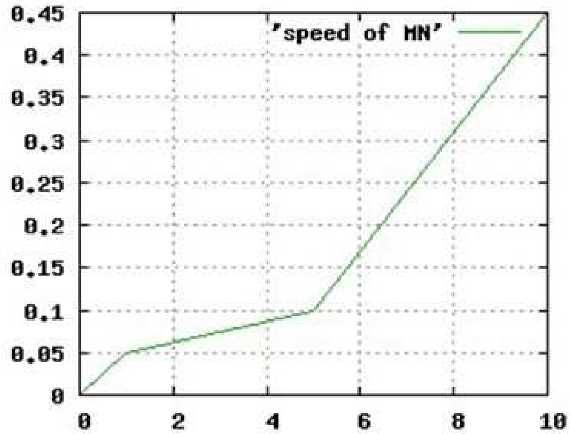
Figure 5:Impact of pr_limit in generating LGD

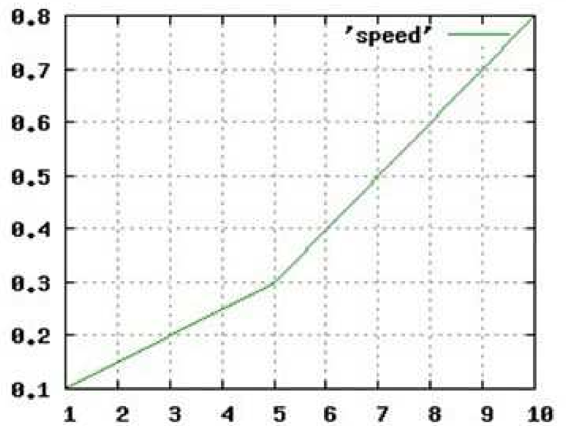
As the pr_limit increases the handover latency decreases, this signifies that the LGD event is more likely to be triggered when pr_limit>=2. In other words, the MN begins its handover earlier, when it is disconnected from the WLAN hotspot, due to the generation of this trigger. According to the result shown in the curve, the higher the pr_limit coefficient, the sooner the event will be generated. Note that if the power level coefficient for generating a LGD event is equal 2 we have a handover latency which is around 2.19s, then the handover is processed too late and the generation of Link Going Doing didn't take enough time to be generated earlier. In the case of pr_limit>=3 we can note that the handover process started before in the case of pr_limit=2, it means that the LGD trigger anticipate the handover before that the MN leaves the Access Point boundary.

Note that, first, a LGD event may be generated too early while the signal quality may be still acceptable, and second, setting the coefficient less than or equal to 1 will disable the generation of LGD events. The next table summarizes the different result of the simulation to see clearly the influence of LGD in handover latency:

Pr_limit	2	3	4	8
Handover Delay(s)	2.19	0,88393	0,812755	0,7524269

Table 3:impact of Pr_limit in Handover Delay





Conclusion

The first experimental studypresented on network-based handover and host-based handover in WiMAX. The results are promising for the applicability of network-based handover technology, and encouraging for network-based handover research. WiMAXnetwork providers are particularly satisfied with the ASNanchored protocol because of the fact that it is their own protocol , and also the changes to the protocol will not affect the devices of their users.

References

[1] *Dao, N. T., Malaney, R. A., Exposito, E., & Xun, W. (2005, 2-2 Dec. 2005). Differential VoIP service in Wi-Fi networks and priority QoS maps. Paper presented at the Global Telecommunications Conference, 2005. GLOBECOM '05. IEEE.*

[2] *Dongmei, Z., & Xuemin, S. (2007). Performance of packet voice transmission using IEEE 802.16 protocol. Wireless Communications, IEEE, 14(1), 44-51.*

[3] *Eng Hwee, O., & Khan, J. Y. (2008, 19-21 Nov. 2008). QoS provisioning for VoIP over wireless local area networks. Paper presented at the Communication Systems, 2008. ICCS 2008. 11th IEEE Singapore International Conference on.*

[4] *Garg, S., & Kappes, M. (2003, 1-5 Dec. 2003). Admission control for VoIP traffic in IEEE 802.11 networks. Paper presented at the Global Telecommunications Conference, 2003. GLOBECOM '03. IEEE.*

[5] *Haghani, E., De, S., & Ansari, N. (2007, 26-30 Nov. 2007). On Modeling VoIP Traffic in Broadband Networks. Paper presented at the Global Telecommunications Conference, 2007. GLOBECOM '07. IEEE.*

[6] *Haseeb, A., & Tralli, V. (13-16 Feb. 2011). QoS performance analysis for VoIP traffic in heterogeneous networks with WiMAX access. Paper presented at the Advanced Communication Technology (ICACT), 2011 13th International Conference on.*

[7] *Jijun, L., Dillinger, M., & Schulz, E. (2002, 29 June-1 July 2002). Investigations of scheduling strategy for low data rate real time IP based service in wireless LAN. Paper presented at the Communications, Circuits and Systems and West Sino Expositions, IEEE 2002 International Conference on.*

[8] *Kalama, M., Acar, G., Evans, B. G., & Mourgues, S. (2008, 11-14 May 2008). VoIP over DVB-RCS Satellite Systems: A Novel Capacity Request Mechanism for Improved Voice Activity Detection. Paper presented at the Vehicular Technology Conference, 2008. VTC Spring 2008. IEEE.*

[9] *Kitroser, I., Chai, E., Ben-Shimol, Y., & Yarkoni, N. (2008, 8-11 Sept. 2008). Efficient mapping of VoIP traffic in wireless OFDMA systems using semi-fixed allocations. Paper presented at the Broadband Communications, Networks and Systems, 2008. BROADNETS 2008. 5th International Conference on.*

[10] *Kostas, P., Esa, P., Jarno, P., Frerk, F., Tuomas, N., & Ilkka, H. (2008). Empirical evaluation of VoIP aggregation over a fixed WiMAX testbed. Paper presented at the Proceedings of the 4th International*

ISSN: 2277-9655
Impact Factor: 1.852

Conference on Testbeds and research infrastructures for the development of networks \& communities.

[11] *Kwan-Wu, C. (20-23 April 2010). On the Impact of Wi-Fi Multmedia Power Save Mode on the VoIP Capacity of WLANs. Paper presented at the Advanced Information Networking and Applications Workshops (WAINA), 2010 IEEE 24th International Conference on.*