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A QoS Oriented Handover Scheme for WiMax/ WLAN Integrated Networks

Ahmed Abdul Kadhim Basheer[1], Dr. P. Chandrasekhar Reddy[2],

[1]MTech Student, ECE Department, Jawaharlal Nehru Technological University Hyderabad, India

[2]Professor, Jawaharlal Nehru Technological University Hyderabad, India
Communication ministry of Iraq

Abstract: ***The integration of WiMAX and WLAN provides better environment for 4G Network. Different important issues for the interworking of Mobile WiMAX and WLAN networks is analyzed in this paper. The handoff procedures when the station moves across the border of WLANS is evaluated. A tightly coupled interworking structure is presented in the paper where WLAN works as a radio access network of cellular system . The proposed schemes can keep stations always being best connected due to ad-hoc nature . An ad hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration, but in this project the device which has free channel it can share to requester otherwise no is considered. The integration and VHO issues in WiMAX/WLAN overlay networks is presented in the paper and tightly coupled internetworking structure with proactive handoff method is proposed.***

Keywords: Wimax, Wifi, mobility, 4G, Ad-hoc Network, Handover.

1. Introduction

Wireless cellular communication system offers mobility. A handoff (or handover) from one cell to another is usually implemented to make continuous communication for a mobile user. Smaller cells because an active mobile station (MS) to cross several cells during an process of conversation. This working call should be transferred from one cell to another one in order to achieve call continuation during boundary crossings. The handover process mean to transfer an active call from one cell to another. The process of deciding when to request a handoff is called initiation. The RSS from the BS and neighbor BS decides handoff. It is assumed that distance indirectly proportional to distance. Handover can be classified using the network type involved into horizontal and vertical cases as an MT moves within or between different overlays of a WON.

Horizontal handoff or intra-system handoff exists in between the APs or BSs of same network technology. Also, a horizontal handoff occurs between the homogeneous cells of a wireless access system. Vertical handoff otherwise called as inter-system handoff is a handoff that occurs between the different points of attachment belonging to different network technologies. Handoffs can also be classified by number of connections involved respectively termed as soft or hard. A handoff is hard if the MT can be associated with only one point of attachment at a time. In other words, an MT may set up a new connection at the target point of attachment after the old connection has been torn down. A make before break handoff occurs if the MT can communicate with more than one point of attachment during handoff. In this case, mobile terminal connection may be created at the target point of attachment before the old point of attachment connection is released. For example, Mobile terminal equipped with multiple network interfaces can simultaneously connect to multiple points of attachment in different networks during soft handoff.

Mobile ad hoc networks are dynamic networks in which nodes are free to move. A main performance constraint comes from path loss and multipath attenuation. Many Mobile ad-hoc network routing protocols exploit multi-hop paths to route packets. Probability of successful packet transmission on a path is dependent on the reliability of the wireless channel on each hop. In this paper, we assume that all nodes know their positions and velocities, and each and every node can measure the distance from AP and BS. And we are assuming bandwidth by number of users. In our project, whenever number of user increases then bandwidth will reduce. We are setting maximum 4 users mean Qos is good otherwise it will reduce.

2. Review

An overview of issues related to horizontal and vertical handoffs [1] and also the architecture of integrated WLAN and WAAN networks based on Mobile IPv6 is discussed by ching Lee in 2005. The Overlay Network is considered to improve the different characteristics of wireless access network technologies to satisfy the anytime, anywhere, and any service needs of mobile users but author used the wide area access network in which Setting up a network can be an expensive and complicated and also the bigger the network the more expensive it is and the Security is a real issue.

Nasser, Ahmed and Hossam presents efficient handoff schemes to enhance quality of service and provide flawless mobility [2], and it presents different and novel aspects of handoff and discusses handoff related issues of fourth generation systems. The classification of handoffs, handoffs in 4G heterogeneous networks, handoff process and vertical handoff decision functions are clearly explained.

Chuanxiong Guo, Zihua Guo, Qian Zhang and Wenwu Zhu in 2005, presents a novel end-to-end mobility management system for seamless and proactive roaming across heterogeneous wireless networks[3] and this system

integrates a connection manager that intelligently detects the condition of the wireless networks and a virtual connectivity-based mobility management scheme that maintains connection's continuity using the end-to-end principle. A Heterogeneous wireless network is proposed which has advantages like capable of reacting to roaming events proactively and accurately and maintaining the connection's continuity with small handoff delay but the technical details such as network bandwidth and delay estimation, as well as end-to-end mobility management were not fully addressed.

The analysis of the most recent research efforts in the area of handover management in integrated WLAN/cellular networks, and attempt to categorize and comment on the proposed solutions is presented in the paper [4]. The focus is placed mainly on the methods to integrate two different architectures and on the supported functionality of the integrated system. A integrated WLAN/cellular network is proposed to handle interference problems and also to increase the bandwidth in limited geographical areas but in this paper author uses WLANs and GPRS/UMTS technology which has some drawbacks like speed, reliability and distance factor.

The analysis of the most recent research efforts in the area of handover management in integrated WLAN and wireless metropolitan area networks (WMANs) is presented in paper [5]. This integrated network will bring a synergetic improvement to the services provided to mobile users. An integrated WLAN and wireless metropolitan area network which considers the handover decision algorithm based on MIH framework but it does not consider the packet delay and bandwidth while handoff is occurring.

A movement-aware vertical (MAV) handover algorithm between WLAN and Mobile WiMAX for seamless ubiquitous access isddressed in paper [6]. MAV handover algorithm is proposed in this paper to exploit movement pattern for avoiding unnecessary handovers in the integrated WLAN and Mobile WiMAX networks. [7]In this paper, author considers the quality-of-service oriented intersystem handover between the IEEE 802.11b network and the overlay network. He proposes the handover scheme and algorithm that guarantee to simultaneously meet the three key QoS values, that is, minimum data rate; the maximum data block delay and the maximum data error rate, for the number of downlink and uplink multiservice connections. A handover scheme and algorithm is proposed that guarantee to simultaneously meet the three key QoS parameters as well as the maximum call-dropping probability and the maximum average number of ping-pong event constraints but When the number of fixed stations in the IEEE 802.11b cell is high, station collision probability is also high and the QoS requirements of the mobile stations arriving at the IEEE 802.11b cell cannot be satisfied at least for the real-time traffic.

The networks were integrated in a loosely coupled manner although it was not definitely addressed. User preference related metrics have been studied relatively well in literatures [8], [9], [10]. In [11], [12], and [13], QoS metrics were taken into account in the handoff decisions. However, the network condition detection schemes have not been provided. In [14] and our paper [15], QoS aware handoff solutions were addressed. But only bandwidth was taken as the QoS metric. Meanwhile, the details on the network integration as well as the handoff management have not been fully addressed.

[16]In this paper, author proposes a scheme, named Bandwidth Recycling, to recycle the unused bandwidth without changing the existing bandwidth reservation. The theme of the scheme is to allow other SSs to utilize the unused bandwidth when it is available An algorithm is proposed which considers about the subscriber stations to utilize the unused bandwidth and it shows that it can further improve the overall throughput by 40 percent when the network is in the steady state but it is only for homogeneous network and a light overhead is present. [17]In this paper, author proposes a handover scheme with geographic mobility awareness, which considers the historical handover patterns of mobile devices. HGMA can conserve the energy of handover devices based on triggering of mobile devices from unnecessary handovers according to their received signal strength and moving speeds and it contains a handover candidate selection method for mobile devices to intelligently select a subset of Wi-Fi access points or WiMAX relay stations to be scanned. A method is proposed to reduce the energy consumption of a handover operation and also to improve QoS satisfaction ratio to handover devices but in this paper author discuss only about the energy consumption but not about the remaining factors in taking handoff decision.

3. Existing system

The QoS based VHO methods for overlay networks that were published in previous papers, Quality of service parameters are considered in handoff decisions. Although, the handover procedures are normally started when the stations move across the border of WLANs because of which, the fixed stations and the mobile stations within overlapped areas cannot benefit from VHOs. A tightly coupled interworking structure was proposed. Further, seamless and proactive vertical handoff scheme is designed based on the architecture with aims to provide always the best quality of service for users. There are certain flaws present in the existing propositions. Because of the newly developed WiMAX, there have been some advantages, but still limited proposals made for VHOs in WiMAX/WLAN overlay networks. The proposed schemes would keep stations always being best connected. But when system is out of the range then no communication in that model

4. Proposed Method

The ad-hoc technology in infrastructure system called as cognitive radio network is implemented. Whenever system is out of range of all the base station and AP in the model. The communication thus becomes possible even though the primary user when PU is free. In this model we are considering requesting device as the secondary device and which one is helping to make communication that is primary user.

Advantage

Our proposed schemes can keep stations always being best connected, more than previous method, when it's in outside also. The Qos offers better connection and reduces loss of packet to considerable measure and is helpful in analysis of delay and bandwidth with the use of VHOM(Medium independent Handoff).

Algorithm

In this paper, we investigate the integration and VHO issues in WiMAX/WLAN overlay networks. And we present the theory implementation model as bellow.

Step1: Initializing a mobile node it can access both WiMAX/WLAN.

Initialize WiMAX/ WLAN networks.

Step2: Node will check the available networks.

Step4: If { network available } {

If {only one network } {

Get communication from that.

} else {

For {each network} {

Checks which are the best network… {Bandwidth and packet delay}

Theory calculation…

Bandwidth calculation for wimax

$$\begin{cases} B_d = \left(1 - \frac{AAS_d}{s_d}\right)\frac{\delta_d s_d}{T_f} \\ B_u = \left(1 - \frac{AAS_u}{s_u}\right)\frac{\delta_u s_u}{T_f} \end{cases},$$

Delay calculation wimax

$$t = t_s + t_q + t_m + t_t.$$

Bandwidth for wifi

$$BW = B_0 - L\frac{NAV}{T_n + \frac{1}{2}T_{n,c}(N-1)},$$

Delay for wifi

$$t = t_q + t_a = \frac{\lambda t_a^2}{1 - \lambda t_a} + t_a.$$

}

Step5: Mobile node compares both networks

VHOM selects best

Step6:

If no AP or BS detected

Checks whether any other mobile station available with AP or BS connection and have enough bandwidth limit

If mobile station detected with enough quality and then switch to Mobile station communication

Step 7:

Else

No communication

5. Performance Evaluation

For our analyzing purpose we are using NS2. By using Tcl we are calculating the bandwidth and delay and Ns2 is for showing the prototype model of VHO with enhancement such as ad-hoc property.

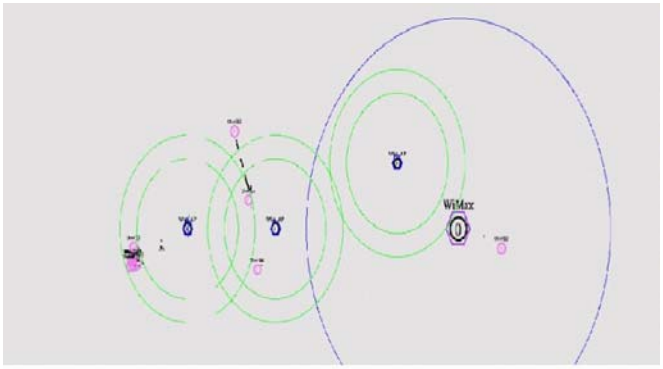

Figure 1: AdHoc Mode while Out of Range

In figure 1, the users is connected without horizontal or vertical handoff, using adhoc between two users, the users receive coverage from WiMax. DSR protocol is implemented to implement adhoc connection between the users.

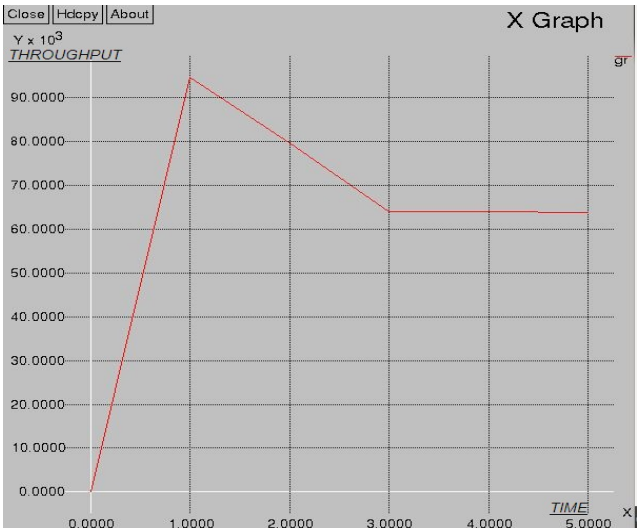

Figure 2: Graphical representation, when user is moving out of horizontal and vertical handoff region

When the user inside WLAN get connection between Wimax (vertcal handoff), delay is seen is observed which is illustrated in the graph provided in figure 4. After handoff The packets are recieved s the signal strength is increased gradually. We get QoS parameters of existing system with WiMax.

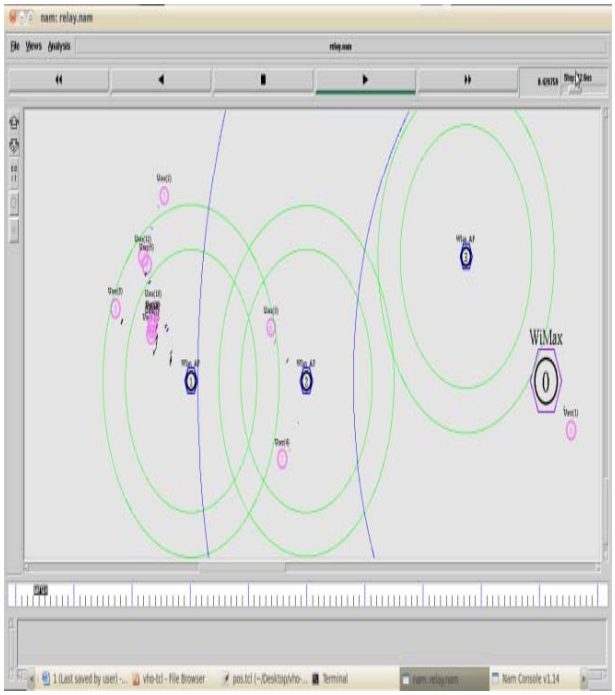

Figure 3: Nam output for VHO-with ad-hoc type

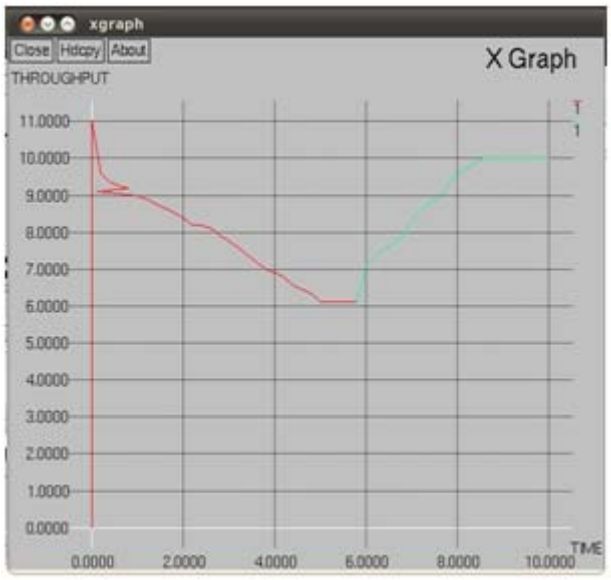

Figure 3: Graphical represtation of Wimax with WLAN vertical handoff

6. Parameter Analysis

The analysis of the proposed QoS oriented handover schemes with respect to various parameters like in/out signal, loss nad Packed Data Frame(PDF) is plotted which is illustrated in figure 5,6 and 7.

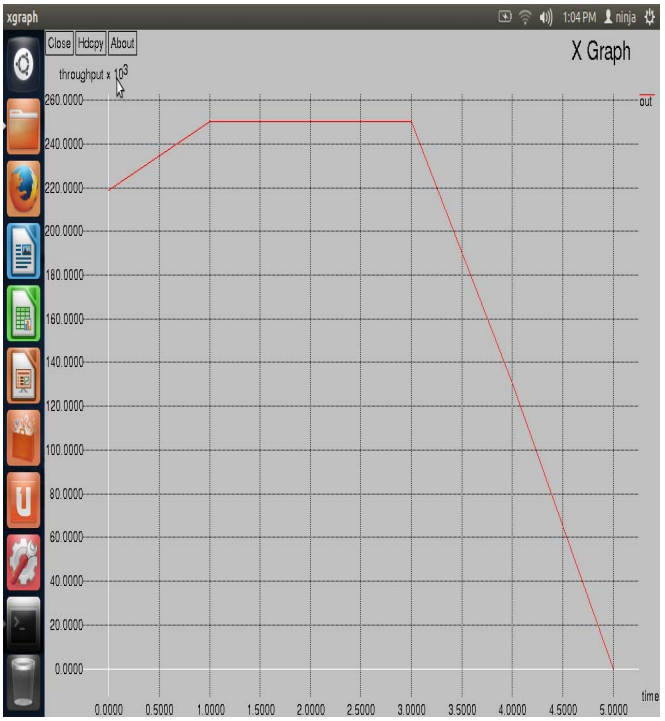

Figure 5: Output analysis using Vertical Handoff Scheme

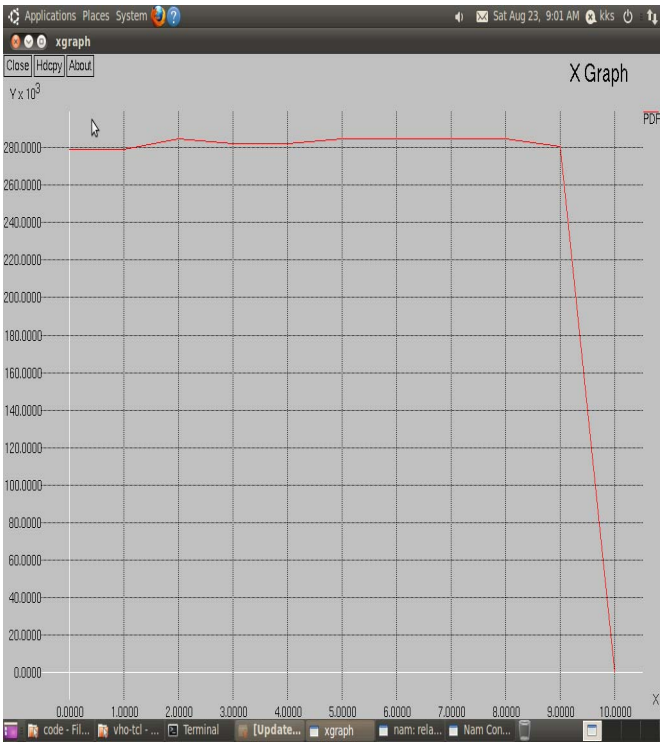

Figure 6: Analysis of Packet Data Frame over time

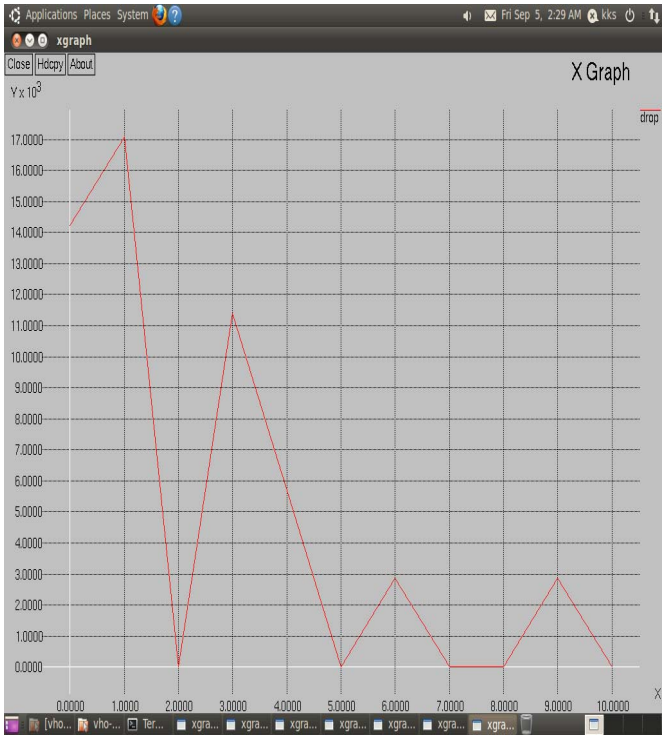

Figure 7: Analysis of Packet Drop

The comparative analysis of Loss between existing and proposed system is presented in figure 8. It is clearly observed that the signal loss is qualitatively decreased with the introduction of proposed scheme in the mobile network.

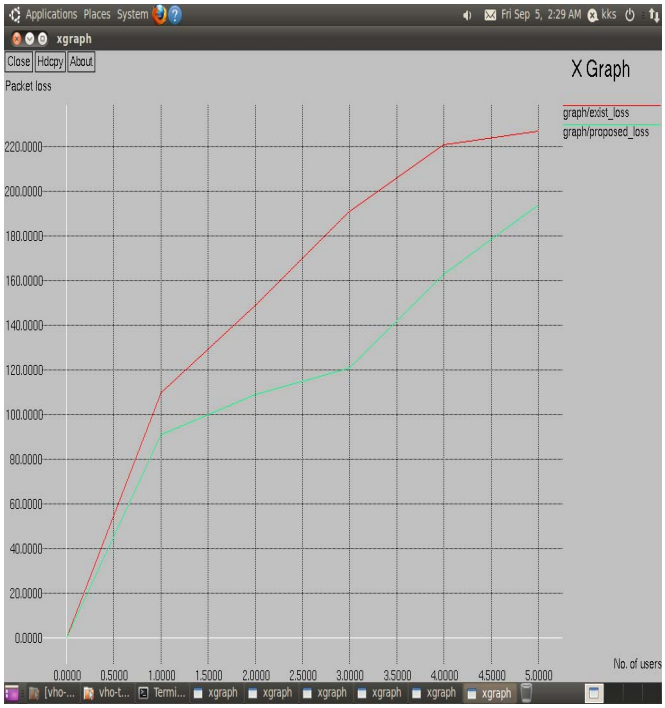

Figure 8: Comparative analysis of Loss between existing and Proposed System.

7. Conclusions and Future Scope

Several important issues for the interworking of WLAN and WiMAX networks were understood and analyzed. A tightly coupled interworking architecture as the platform of our scheme is resolved. And An improved efficiency of the network by including Ad-hoc property is proposed with QoS oriented schemme. The analysis of the proposed scheme with respect to parameters bandwidth, pdf and loss is computed and comparison is done with the existing system. In the future scope the design and analysis can be extended to analyze how broadcasting can be made over long distances for wimax handoff with WLAN. Security mechanisms can also be put in place in the handoff between wimax and WLAN.

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Author Profile

Ahmed Abdul Kadhim Basheer: Completed his BTech at Technical College of Najaf, Iraq. He is persuing his MTech towards Digital Systems and Computer Engineering at JNTUH, India. His research areas are towards Wireless Communication, Network Security, VLSI and Robotics.

Dr. P.Chandra Sekhar Reddy did his B. Tech (ECE) from JNTU, Anantapur in the year 1983, M.Tech applied electronics from Baratiar University. He did his Ph.D. from JNTU, Anantapur in the year 2001 on "Routing in Adhoc Networks". He worked as trainee at ISRO for 10 months. Currently he is working as Professor of ECE Department at JNTU, Hyderabad, A.P., India