

# **Chapter I**

## **Introduction**

### **1.1 Introduction**

In recent years, the wireless access technologies as well as mobile users have grown rapidly, promising the vision of “user can be connected anywhere anytime”. This is achieved by Next Generation Wireless Networks (NGWN) which provide a ubiquitous environment, including the integration of various access technologies such as wireless access networks with different characteristics such as IEEE 802.11(WLAN), IEEE 802.16 (WiMAX), GPRS, UMTS using the Internet Protocol (IP) to offer a various range of high data rate multimedia services to end users. The limited coverage range of WLAN makes it difficult to provide “always-on” connectivity services anywhere and anytime. 3G technology offers universal network access but the access rate is very limited. WiMAX can provide high speed internet access in wide area. Therefore, the solutions of WLAN and WiMAX integrated networks can combine their

best features while overcoming weakness of both technologies to provide a complete wireless scheme for offering high speed Internet access.

The integration of NGWN brought many issues. The most challenging one is providing consistent and continuous seamless services while considering Quality of Service (QoS) requirements during the mobility between two different access networks which is known as Vertical Handover (VHO).

The ability to maintain service provisioning and avoid flow interruptions while users are roaming is known as service continuity. However, the heterogeneity of wireless networks make service continuity a complex task due to hard issues, such as bandwidth fluctuations and temporary loss of connectivity. This calls for the need of context awareness which claims the full visibility of all characteristics describing service execution environments and enables management operations to adapt service provisioning to current system conditions [1]. To satisfy user needs and improve his/her experience, different context information should be considered. Examples of such information include; user preferences (e.g. preferred network), application requirements, and network conditions.

SIP (Session Initiation Protocol) [2] is a signaling protocol widely used in real-time applications that allows creation, modification, and termination of sessions among one or more users. It is used for both voice and video applications, for instance, Skype and IP PBX. Moreover, SIP is the protocol used for signaling in future multimedia architecture such as IP Multimedia Subsystem (IMS).

In this thesis, we proposed Context-Aware Management Scheme (CAMS) which maintains service continuity by taking different context information into consideration in WiMAX/WLAN integrated solution. Our scheme exploits the high flexibility and

service-specific-knowledge provided by application layer to maintain service continuity. Also, it adopts a hierarchical approach, which includes distributing context information over several components such as mobile nodes and context servers. Since the characteristics of the two networks differ significantly in terms of the achievable data rates and QoS, session adaptation is needed.

In our scheme, we propose to use SIP protocol along with SDP (Session Description Protocol) [3] for this task. Thus, mobile node sends the new session parameters to the real-time application server. Then the server modifies the application parameters to adjust the new network characteristics. For context messages exchange, we employ UDP (User Datagram Protocol) [4] due to its lightweight messages.

### **1.1.1 Problem Statement**

Integrating different wireless access technologies which vary in characteristics and conditions brought challenges to research community. One of the most challenging issues is the continuity of services in real-time applications.

Our proposed solution solves that problem by considering context awareness which involves the adapting of services according to user preferences, application requirements and network status in WiMAX/WLAN integrated networks.

### **1.1.2 Thesis Objectives**

The proposed research is seeking to achieve the following objectives:

- Study and Compare the current methods proposed in the literature.
- Define context-aware WiMAX/WLAN integrated scheme solution which based on context-awareness.

- Evaluate our scheme using simulation in terms of different performance parameters.

### **1.1.3 Research Methodology**

In this section, we present the phases to achieve the desired objectives.

First, background is needed to describe different wireless networking technologies such as UMTS, WIMAX, and WLAN. Also, the review will include concepts of handover, seamless services continuity, context awareness. After that, we present a comparison study of different approaches existed in the literature, which consider Context-Awareness to facilitate service continuity.

After the literature review, we present our work details which include the scheme architecture, signaling, and operation flow. In the evaluation phase, several techniques could be used to evaluate the performance of the proposed scheme such as mathematical model, or simulation. In this work, computer simulation will be chosen as the evaluation and modeling tool such as OPNET. Performance evaluation will be conducted in terms of different performance measures.

### **1.1.4 Thesis Organization**

This thesis is divided into eight chapters. Introduction, problem statement and research methodology are presented in Chapter I. Chapter II presents background information of this work. In Chapter III, a survey the literature and comparison of existing research efforts is discussed. Next, our solution is presented in Chapter IV. Chapter V presents OPNET simulation setup used to evaluate our scheme. Then, Chapter VI presents simulation results. In Chapter VII, we present the analysis of simulation results. Finally,

Chapter VIII summarizes the contribution of this work and list findings and proposed future work.

### **1.1.5 Publications**

Out of this work, we have published one journal paper and one conference paper. In addition, we are planning to submit another paper. The following is a list of these papers.

- Hanan Alhazmi and Nadine Akkari,"An Overview Of Context-aware Vertical Handover Schemes In Heterogeneous Networks", International Journal of Computer Science & Engineering Survey (IJCSES) Vol.2, No.4, November 2011
- Hanan Alhazmi and Nadine Akkari Adra ,” Context-aware Management Scheme for Service Continuity”, 19th International Conference on Telecommunications ( ICT2012), IEEE ,2012.
- Hanan Alhazmi and Nadine Akkari Adra , " A Wifi/WiMAX Context-Aware Approach for Service Continuity " , journal paper, in progress ( to be submitted)