

Networks Integration between Wireless LAN and UMTS Networks– A Brief Study

¹Salawu Nathaniel, ²Elizabeth Nonye Onwuka, ³Abolarinwa Joshua Adegboyega, ⁴Dauda Umar Suleiman

^{1, 2, 3}Department of Telecommunication Engineering, Federal University of Technology P.M.B. 65 Minna, Niger State, Nigeria

⁴Department of Electrical and Electronics Engineering, Federal University of Technology P.M.B. 65 Minna, Niger State, Nigeria

¹salawunathaniel@gmail.com, ²onwukaliz@futminna.edu.ng, ³abolarinwajoshua@yahoo.co.uk, ⁴usdauda@gmail.com

ABSTRACT

This paper presents a brief study on issues associated with network integration between wireless LAN (WLAN) and Universal Mobile Telecommunications System (UMTS) networks. Network integration of WLAN and UMTS networks is an area that requires continuous research attention. It gives service providers the opportunity to offer additional services such as “always on service” on their heterogeneous networks for the benefit of their subscribers and for overall Quality of service improvement of the networks. Since heterogeneous networks are involved, vertical handoff (VHO) has an important role to play in achieving seamless data mobility in the next generation networks. Issues and problems of VHO have to be adequately studied and addressed if both the service providers and their subscribers should get satisfactory results such integrations. In this paper therefore, we presented an overview study of handoff management in mobile communication networks, vertical handoff requirements and the different types of network integration. Our study shows that loosely-coupled architecture of network integration far outweighs that of the tightly-coupled architecture of network integration except under a critical and specified conditions. We therefore proposed that loosely-coupled architecture should always be considered first for network integrations where ever possible. It is hoped that critical issues of loosely-coupled architecture such as network Quality of service, security, and latency will be addressed in future works.

Keywords: WLAN, UMTS, GPRS, CDMA, TDMA, horizontal handoff, vertical handoff, mobile terminal, network integration architecture, multimode device, heterogeneous network.

1. INTRODUCTION

Universal Mobile Telecommunications System (UMTS) is comprised of many cellular networks classified according to their generations. Some of these networks include: Global System for Mobile Communication (GSM) which belongs to the second generation (2G), General Packet Radio Service (GPRS) is another one classified as 2.5G technologies while the 3G technologies include code division multiple access (CDMA) etc. Presently, a new generation of network technologies generally known as the 3G+ or beyond 3G (B3G) or 4G are currently available and are aimed to work with multimode handheld devices [1]. The problem of integrating these heterogeneous networks for better quality of service delivery as perceived by the users is now of major interest to the research community. However, we limit our scope of study in this paper to the integration of Wireless LAN and UMTS Networks.

The release of the IEEE 802.11 WLAN standards in 1997 gave rise to a number of other related standards which form the 802.11 family of standards [2]. These standards were made to facilitate the interoperability of wireless local area networks (WLANs), and allow for the introduction of several new services. One of these services introduced is the public wireless access data networks more commonly known as “hot-spots”. The great success and massive recent deployment of WLAN technology indicates that these networks will play an important role in the development of the 4G networks [3].

To achieve the dream of universal mobile telecommunications as specified by the international

telecommunications union (ITU), it is necessary to integrate WLAN and UMTS networks. This integrated network wall form part of the 4G network and it has proved to provide better services for both operators and end users. According to Albert Einstein’s aphorism, customers need not know what wireless technology, base station, access point or router they are using at a given moment, instead they only need to experience seamless service. It therefore means that technical details about seamless mobility and handoff across heterogeneous networks are simply the problem of engineers not the end users. This however calls for more research in this area in order to provide a platform for inter-network transfer of end user’s mobile terminal (MT) as easy, economical, and transparent as possible.

UMTS cellular network and WLAN hotspots are complementary wireless access technologies. Their integration could give fantastic services to meet end user’s demand for improved access to services using a single multi-mode MT. Multi-mode mobile devices (e.g. CDMA2000-WLAN PCMIA cards, WLAN- CDMA2000 PCMIA cards etc) are also fast becoming affordable and a growing number of portable computer systems such as laptops, personal digital assistants (PDAs), hand-helds etc. are now equipped to connect to different networks [4].

UMTS offers wide area coverage with high mobility support however, constrains of limited bandwidth with high cost of transferring data through this network is one of its shortfalls. Large file downloading is also difficult if not impossible with this network as there