

Chapter III

Handoff Management in Next Generation Wireless Networks

Nidal Nasser

University of Guelph, Canada

Tarek Bejaoui

University of Carthage, Tunisia

ABSTRACT

Major research challenges in the next generation of wireless networks include the provisioning of worldwide seamless mobility across heterogeneous wireless networks, the improvement of end-to-end Quality of Service (QoS), supporting multimedia services over wide area and enabling users to specify their personal preferences. The integration and interoperability of this multitude of available networks will lead to the emergence of the fourth generation (4G) of wireless technologies. 4G wireless technologies have the potential to provide these features and many more, which at the end will change the way we use mobile devices and provide a wide variety of new applications. However, such technology does not come without its challenges. One of these challenges is the user's ability to control and manage handoffs across heterogeneous wireless networks. This chapter proposes a solution to this problem using Artificial Neural Networks (ANNs). The proposed method is capable of distinguishing the best existing wireless network that matches predefined user preferences set on a mobile device when performing a vertical handoff. The overall performance of the proposed method shows 87.0 % success rate in finding the best available wireless network.

INTRODUCTION

Next generation wireless networks (NGWN) will utilize several different radio access technologies, seamlessly integrated to form one access network.

This network has the potential to provide many of the requirements that other previous systems did not achieve such as high data transfer rates, effective user control, seamless mobility, and others which will potentially change the way us-

ers utilize mobile devices. NGWN will integrate a multitude of different heterogeneous networks including (a) Cellular networks, passed through multiple generations – 1G, 2G, 3G and 3.5G; (b) Wireless LANs, championed by the IEEE 802.11 WiFi (Wireless Fidelity) networks; and (c) Broadband wireless access networks (IEEE 802.16, WiMAX). As well, multi-hop/ad hoc variable topology networks, where portable devices are brought together to form a network on the fly, are emerging as a viable alternative to enhance connectivity and flexibility.

Objective and Context

It is envisaged that next generation wireless networks will consist of multiple access technologies, integrated to form a heterogeneous network. An interesting example is the heterogeneous environment consisting of the Universal Mobile Telecommunications System (UMTS) cellular network, based on the WCDMA radio access technology and a WLAN. Both are characterized by their soft capacity and the support of multiple heterogeneous services with diverse quality requirements.

In UMTS, both packet and circuit switched services can be freely mixed, with variable bandwidth and delivered simultaneously to the same user with specific quality levels. It will support real-time and non-real-time multimedia services with data rates up to 2 Mb/s with wide coverage and nearly universal roaming. However, the costs of acquiring the necessary radio spectrum and the required network equipment upgrades are very high. This is in contrast to WLAN systems such as IEEE 802.11 a/b/g, which provide affordable services and bit rates surpassing those of 3G systems, up to 11 Mb/s with 802.11b and 54 Mb/s with 802.11a/g. However, the coverage offered by WLANs is quit limited and lacks roaming support.

Thus, each network access technology provides different levels of coverage and quality of service (QoS) as well as cost to the end user.

The complementary characteristics of 3G cellular systems (slow, wide coverage) and WLAN (fast, limited coverage) make it attractive to integrate these two technologies to provide ubiquitous wireless access. The purpose of integrating 3G systems and WLANs is to make it possible to use the best parts of both systems. High bandwidth WLANs are used for data transfer where available and 3G systems can be used where WLAN coverage is lacking.

Integrating two very different access technologies, introduced a number of technical and logistical issues that must be resolved in order to maximize the benefits reaped from such integration. Transfer an active call between access points (AP) or base stations (BS) are called horizontal handoff. The horizontal handoff has long been an issue within the wireless telecommunication field. However, a higher level of handoff complexity, and thus issues, is introduced to the differences between inter-networked heterogeneous wireless networks. This transfer between different types of wireless networks is known as a vertical handoff (Guo, 2004). Example of vertical handoff is when a mobile user moves back and forth between 3G and WLAN networks. Seamless intersystem mobility across such access heterogeneity will be the capital feature in next generation, labeled Fourth Generation (4G), wireless networks. In such networks, it will be necessary to support seamless handoffs of mobile users without causing disruption to their ongoing connections. As a result, the need for seamless handoff across the different wireless networks is becoming increasingly important.

One of the chief issues that aid in providing seamless handoff is the ability to correctly decide whether or not to carryout vertical handoff at any given time. This could be accomplished by taking into consideration two key issues: network conditions for vertical handoff decisions and connection maintenance (Yang, 2005). These two issues need to be tightly coupled in order to move seamlessly across different network interfaces. To attain posi-

20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/handoff-management-next-generation-wireless/22020

Related Content

Technologically Innovative Approaches for Understanding Organizational Commitment and Worker Performance in the Textile Industry

Bindu Binduand Hardeep Kaur (2024). *Navigating the World of Deepfake Technology* (pp. 312-330).

www.irma-international.org/chapter/technologically-innovative-approaches-for-understanding-organizational-commitment-and-worker-performance-in-the-textile-industry/353625

Adult Learning and Virtual Worlds Simulations

Dr. Michele D. Estesand Mr. Randell Snow (2011). *Gaming and Simulations: Concepts, Methodologies, Tools and Applications* (pp. 1270-1279).

www.irma-international.org/chapter/adult-learning-virtual-worlds-simulations/49448

Multimedia Digital Library as Intellectual Property

H. Sasakiand Yasushi Kiyoki (2008). *Multimedia Technologies: Concepts, Methodologies, Tools, and Applications* (pp. 279-290).

www.irma-international.org/chapter/multimedia-digital-library-intellectual-property/27089

Interaction through Textures

(2011). *Interactive Textures for Architecture and Landscaping: Digital Elements and Technologies* (pp. 171-186).

www.irma-international.org/chapter/interaction-through-textures/47245

Prediction and Diagnosis of Heart Diseases Using Data Mining and Artificial Intelligence-Based Algorithms

Subhani Shaikand Vijayalakshmi Kakulapati (2023). *Using Multimedia Systems, Tools, and Technologies for Smart Healthcare Services* (pp. 160-175).

www.irma-international.org/chapter/prediction-and-diagnosis-of-heart-diseases-using-data-mining-and-artificial-intelligence-based-algorithms/314931