Chapter 37
Seamless Mobility Management: A Need for Next Generation All-IP Wireless Networks

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ABSTRACT

The next generation wireless networks will be heterogeneous wireless environments because of the coexistence of a large variety of wireless access technologies. The different networks have different architectures and protocols. So it is difficult for a user to roam from one radio system to another which can be solved by using the Internet protocol as a common interconnection protocol as it needs no assumptions about the characteristics of the underlying technologies. An all-IP wireless network is an IP-based wireless access system that makes wireless networks more robust, scalable, and cost effective. The nodes in such a network are mobile nodes as they change their location and point of attachment to the Internet frequently. The mobility management is an important research issue in an all-IP wireless network for providing seamless roaming facility to mobile nodes from one wireless system to another. The dynamic resource management is also required in this environment to ensure sufficient resource in the selected route for transmission or reception of the data packets during seamless roaming of the mobile nodes. This chapter is aimed at the researchers and the policy makers making them aware of the different means of mobility management and resource management for mobile nodes in all-IP wireless networks.

INTRODUCTION

In next generation wireless network, mobile users are capable of connecting to the core network through various heterogeneous wireless access networks, such as cellular network, wireless metropolitan area network, wireless local area network and ad hoc network. The next generation wireless network is expected to provide high bandwidth connectivity with guaranteed quality of service (QoS) to mobile users in a seamless manner; however, this desired function demands seamless coordination of the heterogeneous radio access network technologies. The integration of heterogeneous networks and technologies is a challenging problem mainly because of the following issues:

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- **Access Technologies:** Different networks apply different radio technologies for the air interface.
- **Network Architectures and Protocols**: Different networks have different architectures and protocols for transport and routing, resource and mobility management.
- Ser**vice Demands:** Mobile users demand different services with different resource and quality of service requirements.

To cope up with these heterogeneities a common interconnection protocol which makes no assumptions about the characteristics of the underlying technologies is required. The Internet protocol (IP) provides a universal network layer protocol for wireless packet networks, and is viewed as an attractive candidate to play the same role in wireless systems. An all-IP wireless network, i.e. IP-based wireless access and fixed core, could make wireless networks more robust, scalable and cost effective. It will also enable the applications and software technologies developed for wires IP networks to be used over wireless networks. An IP-enabled mobile device supporting multiple air interfaces could roam seamlessly among different wireless systems if IP is adopted as the common network layer protocol.

In the integrated scenario of radio access technologies, mobile terminals are allowed to seamlessly switch among various access networks and to be served at lower cost with better QoS. Although individual radio resource management schemes may work optimally within their respective radio access networks, they may not perform efficiently in next generation wireless network if different radio resource management schemes are not managed properly. Hence a major issue is how to jointly utilize the resources of the different radio access technologies in an efficient manner while achieving the desired QoS. Moreover wireless networks struggle with limited radio resources which intensifies the need for efficient resource management. The goal of efficient resource management is to achieve maximum radio resource utilization while providing a desired level of QoS to users.

Hence integration and interoperation of heterogeneous resource management mechanisms is of parameter importance for seamless roaming. Two schemes are elaborated in this chapter. Scheme_I (Mitra, 2008) is a dynamic mobility management scheme whereas Scheme_II (Mitra, 2008) is a dynamic resource management scheme in all-IP wireless network. Both the schemes consider an integrated architecture as shown in Figure 1. It is an integration of cellular network and wireless local area network (WLAN) to exploit the seamless roaming support of cellular network and high data rate of WLAN. WLAN found its application as a low cost high speed solution to cover the hot spot like Internet cafe, office building, apartment building etc., to solve the wideband data access problem and to utilize the existing infrastructure which helps to reduce the implementation cost of the network. On the other hand, cellular network has the excellence of wide coverage, seamless roaming support and better QoS.

The integration of cellular network and WLAN form a heterogeneous wireless networks environment in Figure 1. The global mobility agent (GMA) is the integration point of cellular network and WLAN. Each wireless network is considered as an individual domain having mobility agent (MA) at the root level, subnet agent (SA) at the intermediate level and local agent (LA) at the leaf level. MA1 is the mobility agent of cellular domain and MA2 is the mobility agent of WLAN domain. The MA is gateway general packet radio system (GPRS) support node (GGSN) for cellular network and gateway for WLAN. The SA is serving GPRS support node (SGSN) for cellular network and access router (AR) for WLAN. The LA is base station (BS) for cellular network and access point (AP) for WLAN. GMAs are MIPv6 nodes having 128 bit IP address. The home agent (HA) is a router located in the home network of a MN. It acts on behalf of the MN from the home link. M_1 is a MN in the coverage area of the LA B. A MN moves through different networks with seamless connectivity. A MN notifies it's HA on its home link after