Chapter 15
SIP–PMIP Cross–Layer Mobility Management Scheme

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ABSTRACT

Heterogeneous networks have attracted a lot of interest due to its support provision for a large number of networks at an effective cost. Mobility Management also plays an important role in the heterogeneous network in providing a seamless mobility support for both devices and users, which poses a serious challenge. In this chapter, the researchers propose SIP-PMIP Cross-Layer Mobility Management in order to provide a seamless mobility in heterogeneous wireless networks. In effect, the researchers design a Cross-Layer Mobility Management Scheme, which can handle terminal, network, personal and session mobility. To demonstrate, video conferencing is included in the modeling, simulation and implementation of the module using Riverbed Modeler.

INTRODUCTION

The next generation all-IP network is expected to provide access to all the services required at anytime and anywhere at a data rates of 100Mb/s and 1Gb/s for high and low mobility scenarios. As of now, no single radio access technology can deliver such services in rather different networks in an area providing services (Anderson, K; 2012). In order to benefit from the existing infrastructure, the 4G network architecture will be designed in such a way that it will accommodate all the existing networks. That is, it is a heterogeneous network with increased capacity efficiency in the area. Another important feature of the next generation mobile system is the mobility between the heterogeneous networks consisting of different networks. Mobility management which is a necessity in the 4G system is made up of mobility

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and handover management. “The Session Initiation Protocol (SIP) makes this experience achievable” (Atayero et al., 2012:16). Also, the Proxy Mobile Internet Protocol (PMIP) is a protocol which enables mobility in a heterogeneous network with additional hardware and software (Ruckus wireless, 2013), like middleware. The above mentioned mobility management protocols work at different layers of the protocol stack and thus each layer in the stack contributes to the development of a mobility management in the 4G systems. This entails the need for a cross-layer design which is termed as the violation of the protocol stack.

The Session Initiation Protocol is an application layer signalling protocol designed by IETF between 1996 and 1999 at Columbia University for initiating, modifying, monitoring and terminating internet sessions such as video, messages, online games, etc. It is a negotiating protocol, which uses the Real-time Transport Protocol/ Real-time Transport Control Protocol (RTP/RTCP) for transport/control of media, and Session Description Protocol (SDP) for negotiating media.

SIP defined two major networks elements, namely: User Agent (UA) and Network Server. The user agent contains both the User Agent Client (UAC) and the User Agent Server (UAS) while the network server contains the proxy, location, registration, redirect and universal resource locators (URL). The UAC creates the session by issuing an invitation and the UAS responds by sending a reply message. The SIP request message is made up of the following basic messages: Register, Invite, ACK, Options, Bye and Cancel.

SIP is used in facilitating PSTN- internet interworking and also to control services that are terminal and network independent. It provides some level of session mobility management support in that the location services and SIP re-negotiation features allow a user to remain in contact even if they change terminals during session (Wisely et al., 2002).

The proxy Mobile Internet Protocol (PMIP) is an IP mobility management network protocol introduced by IETF in order to assist in the support of IP mobility in a low latency, high data-rate across a heterogeneous network with various access technologies. It gives mobile terminal access to mobility without involvement in the management of their IP mobility signalling (Sanchez, M. I. et al; 2013) and hence depends on an additional software and hardware implemented on the mobile terminal (Ruckus wireless, 2013).

Mobility management is supported in PMIP by two key elements: the Mobile Access Gateway (MAG) and the Local Mobility Anchor (LMA). The LMA in the mobile core is responsible for maintaining the location of the mobile terminal in the Localized Mobility Domain (LMD) and forwarding the data traffic of the mobile terminal by maintaining an IPv6-in-IPv6 channel with the MAG which is in the core network.

In PMIP, the mobile terminal always maintains its IP address as it moves from one point to another within the LMD managed by an LMA. Similarly, “the operation of PMIPv6 does not require the mobile node (MN) to implement any modification or extra software in its layer-3 stack, although it may require the assistance of some layer-2 mechanisms to work more efficiently. These mechanisms are known as link-layer triggers, and are required to quickly detect a change of layer-2 Point of Attachment (PoA)” (Sanchez et al., 2013).

Thus, the main aim of the chapter is to devise and assess a set of intelligent strategies and workable algorithms for multi-layer mobility management architecture and cross-layer methodologies and mechanisms for a fifth generation heterogeneous mobile network over a real-time test bed applications.