Authentication in Ubiquitous Networking

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ABSTRACT

Mobile authentication is an essential service to ensure the security of engaging parties in a ubiquitous wireless network environment. Several solutions have been proposed mainly based on both centralised and distributed authentication models to allow ubiquitous mobile access authentication; however, limitations still exist in these approaches, namely flexibility, security and performance issues and vulnerabilities. These shortcomings are influenced by the resource limitations of both wireless networks and the mobile devices together with inter-technology and inter-provider challenges. In this paper, the authors reviewed the major techniques in the field of ubiquitous mobile access authentication, which has attracted many researchers in the past decade. After investigating existing mobile authentication models and approaches, the common challenges are summarised to serve as the solution key requirements. The identified key solution requirements allow analysing and evaluating mobile authentication approaches.

Keywords: Authentications, Mobile User, Security Protocols, Ubiquitous Wireless Access, Wireless Roaming

1. INTRODUCTION

Ubiquitous mobility is a trend to allow mobile users (MUs) connectivity anywhere, anytime in a heterogeneous wireless network that consists of wireless networks of multiple technologies operated by multiple network providers. The wireless network has passed through different phases and generations of evolution since its beginning early in the 1970s (Frattasi, Fathi, Fitzek, Prasad, & Katz, 2006). The steady worldwide enormous rise in the number of MUs each year has enhanced the development of more technologies. Today a variety of different generation of wireless technologies exists around the world. The 4G (fourth generation) network aims to solve still-remaining problems of 3G (third generation) network and to provide a wide range of new services, from high definition video to high data rate wireless communication. Interestingly, the term 4G is used to include not only cellular network system, but also several types of wireless systems. The terms used to describe 4G are anytime anywhere, global mobility support, integrated

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The increasing heterogeneity and number of wireless access technologies available (e.g., UMTS, WiMAX, Wi-Fi) lead to the existence of network heterogeneity. These heterogeneous wireless access networks typically differ in terms of coverage, data rate, latency, and loss rate. Therefore, each technology is designed to support specific services. Integration of heterogeneous wireless systems is the real technical step-up of 4G with respect to 3G network (Frattasi et al., 2006). However, providing authentication services in a ubiquitous and heterogeneous mobile access environment is a challenging task.

This growing number of wireless technologies and providers, as well as users’ increasing need and desire to be connected and reached at all times, call for the development of ubiquitous wireless access. Traditionally, for MUs to be able to roam into foreign networks (FNs), the FN and the MU’s home network (HN) must trust each other and have a roaming agreement established beforehand. However, HN cannot establish service agreement with all FNs. Therefore, MUs will not be able to get the service unless they could identify themselves to the FN. In this paper, we survey the existing authentication models and approaches in ubiquitous mobile access environments.

The paper is organised as follows. The existing approaches in the area of ubiquitous mobile authentication are investigated and their strengths and limitations are discussed in section 2. We classified these approaches into three main models namely, traditional, centralised, and distributed models of authentication. The challenges presented by each model for ubiquitous networking authentication are summarised in section 2.5. Based on the review conducted, solution key requirements are stated, in section 3, in order to evaluate the flexibility, security, and efficiency of the existing authentication approaches, which are shown in section 4. Finally, our conclusion of this paper is presented in section 5.

2. EXISTING MODELS ON UBIQUITOUS NETWORKS AUTHENTICATION

In ubiquitous networking, a mobile user is required to be authenticated to control access to network resources. Mobile user receives authentication credentials from the network provider to assist in the identification process such as Subscriber Identity Module (SIM) card for Global System for Mobile Communications (GSM) network. However, since mobile user demand is to be connected anywhere anytime, authenticating mobile users to multiple wireless technologies operated by multiple network providers is a challenge. There are a number of approaches which have been proposed to resolve this problem based on different models.

In this paper, existing approaches to authenticate ubiquitous mobile access users are described and their strengths and limitations are discussed. They can be classified into three models namely, traditional, centralised (Akyildiz, Mohanty, & Xie, 2005; C. C. Chang & Tsai, 2010; Y. C. Chen, Chuang, Yeh, & Huang, 2011; Hwang & Chang, 2003; Y. Jiang, Lin, Shen, & Shi, 2006; Molva, Samfat, & Tsudik, 1994; O’Droma & Ganchev, 2007; Suzuki & Nakada, 1997; Tang & Wu, 2008; G. Yang, 2011; G. Yang, Wong, & Deng, 2007), and distributed (D. He, Bu, Chan, Chen, & Yin, 2011; Shrestha, Choi, Kwon, & Han, 2010; G Yang, Huang, Wong, & Deng, 2010) models of authentication. The challenges presented by each model for ubiquitous networking authentication are then summarised in section 2.5. Figure 1 illustrates the classification of the existing approaches.
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