Context-Aware Identity Management in Pervasive Ad-Hoc Environments

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ABSTRACT

Contextual information and Identity Management (IM) is of paramount importance in the growing use of portable mobile devices for sharing information and communication between emergency services in pervasive ad-hoc environments. Mobile Ad-hoc Networks (MANets) play a vital role within such a context. The concept of ubiquitous/pervasive computing is intrinsically tied to wireless communications. Apart from many remote services, proximity services (context-awareness) are also widely available, and people rely on numerous identities to access these services. The inconvenience of these identities creates significant security vulnerability as well as user discomfort, especially from the network and device point of view in MANet environments. In this article, the authors address how contextual information is represented to facilitate IM and present a User-centered and Context-aware Identity Management (UCIM) framework for MANets.

Keywords: Contextual Computing, Mobile Ad-Hoc Networks, Pervasive Ad-Hoc Environments, Ubiquitous Computing, User-Centricity

1 INTRODUCTION

Due to technological development we now achieve the point whereby electronic devices are customary in every aspect of our life. Today, we encounter numerous mobile devices within home and office environments, including devices in emergency services and other public spaces. These devices coupled with the availability of various computing resources and communication technologies are making networks more versatile. Such devices are now essential tools that offer competitive business advantages in today’s growing world of ubiquitous computing environments. This has resulted in the proliferation of wireless technologies such as MANets, which offer attractive solutions for services that need flexible setup as well as dynamic and low cost wireless connectivity. A MANet can be considered simply as a collection of wireless mobile hosts able to form a temporary network, which does not depend on any fixed infrastructure, but instead develops in a self-organizing manner.

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With the proliferation and development of wireless networks, the notion of “Ubiquitous Computing” coined by Weiser (1999) has received increasing attention. Thus it makes Ubiquitous Computing and MANets as a complex and user-centric research and development area (Ciarletta, 2005). MANets form one of the fundamental building blocks for ubiquitous computing environments. Hence, MANets are increasingly used to support mobile and dynamic operations such as emergency services, disaster relief and military networks.

The emergent notion of ubiquitous computing makes it possible for mobile devices to communicate and provide services via networks connected in an ad-hoc manner. Context is information that can be used to characterize situations or an entity that is considered relevant in the interaction process of a user or application. The use of contextual information in ad hoc environments can extensively expand the adaptation and usage of such applications. The main focus of this article is on the area of context-awareness and user-centricity together with its security issues and implications. Context-awareness allows us to make use of partial identities as a way of user identity protection and node identification. User-centricity is aimed at putting users in control of their partial identities, policies and rules for privacy protection. The contribution of this article is based on these principles, which help us to propose an innovative, easy-to-use user-centred and context-aware identity management framework for pervasive ad-hoc environments. The framework makes the flow of partial identities explicit; gives users control over such identities based on their respective situations and contexts, and creates a balance between convenience and privacy.

In this article we introduce context-aware IM within the domain of pervasive ad-hoc crisis management environments, conducted an in-depth review and discussion on the importance of contextual information, highlighting the key weaknesses of currently research work, which serves as motives to our research. Finally, we present some discussion on our novel solution and its early results, while highlighting planed future research work.

The reminder of this article is structured as follows. In section 2 we analyze current related work. In section 3 the concept of the proposed framework is presented. Section 4 analyses the framework based on Cameron’s Seven Laws of Identity. Finally section 5 concludes the article with future directions for research in MANets.

2 RELATED WORK

As will emerge in the discussion of findings from this study, many different lines of research within the research community in the areas of Identity Management, Context-Awareness and User-Centricity have contributed to our understanding of the subject matter. This article has also addressed the issue of policy definition and usage for access control. More details on the analysis of related work and the weaknesses identified can be found in our previous work (Abdullahi, 2008, 2009) where some of the research questions are specified, an in-depth analysis of our User-Centered Identity Management (UCIM) framework is presented (Abdullahi, 2009; Abdullahi 2009).

The work done in the Ponder/Ponder2 toolkits (Damianou, 2001, 2002; Russello, 2007) provides a model for policies and management domains. In this model, entities are statically associated with domains which are then associated with different types of policies. The work presented in Context-aware Management Domains (CAMDs) by Neisse et al. (2008) builds upon the model, but makes the association between entities and domains dynamic based on context. In addition, Neisse applies a generic policy management toolkit in the area of context-aware services and makes use of a system administrator to support the definition of policies and rules.

One of the most essential aims of context-aware applications is to deliver contextual resources efficiently and effectively (Brown, 2001). In today’s real world, context-awareness
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