Chapter 16

ContextRank: Begetting Order to Usage of Context Information and 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. The need of displaying only relevant contextual information (CI) with explicit user control arises in energy constraint devices and in dynamic situations. We propose an approach that allows users to define policies dynamically and a ContextRank Algorithm which will detect the usability of CI. The proposed approach is not only efficient in computation but also gives users total control and makes policy specification more expressive. In this Chapter, the authors address the issue of dynamic policy specification, usage of contextual information to facilitate IM and present a User-centered and Context-aware Identity Management (UCIM) framework for MANets.

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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.

With the proliferation and development of wireless networks, the notion of “Ubiquitous Computing” coined by Weiser (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. However, although this notion of CI is widely researched, to the best of our knowledge there has been no work done with regards to filtering such information to meet users’ needs in any environment, especially in resource-aware environments and devices. The main focus of this Chapter is on the area of context-awareness, dynamic policy specification 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. We also presented a novel algorithm, named contextRank, for filtering CI based on dynamic policy specification and putting a user in control of such policy creation. This helps to determine which CI should be displayed for the user or those that are allowed to view the presence of the user within an environment. The proposed contextRank algorithm is motivated by the concept of Google pageRank (Page 1999), with the addition of dynamic policy specification that makes policies more expressive and dynamic in the sense that users can modify policies dynamically and reflect the filtering algorithm of CI dynamically. The contribution of this Chapter 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 Chapter 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.

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