



## A practical reputation system for pervasive social chatting

Zheng Yan<sup>a,b,\*</sup>, Yu Chen<sup>c</sup>, Yue Shen<sup>b</sup>

<sup>a</sup> The State Key Laboratory of ISN, Xidian University, PO Box 119, No. 2 South Taibai Road, 710071 Xi'an, China

<sup>b</sup> Department of ComNet, Aalto University, Otakaari 5, 02150 Espoo, Finland

<sup>c</sup> Human-Computer Interaction Group, EPFL – I&C GR-PU, BC 145, Station 14, CH-1015, Lausanne, Switzerland

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### ABSTRACT

A Mobile Ad Hoc Network (MANET) is becoming a practical platform for pervasive social networking. For example, people chat with each other via MANET for instant social activities. How to help mobile users build up trust in pervasive social chatting is becoming an important and interesting issue. By applying a method for usable trust management, we designed PerChatRep, a reputation system for pervasive social chatting based on the result of a need assessment survey. We evaluated the effectiveness and robustness of PerChatRep through simulations. Furthermore, we implemented the system by applying Nokia N900 smart phones as MANET nodes based on a distributed energy-efficient social networking platform. We further conducted a two-session controlled user experiment to investigate the impacts of PerChatRep on mobile users. Results show the usefulness and user acceptance of PerChatRep.

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\* Corresponding author at: The State Key Laboratory of ISN, Xidian University, PO Box 119, No. 2 South Taibai Road, 710071 Xi'an, China.

E-mail addresses: zhengyan.pz@gmail.com, zyan@xidian.edu.cn, zheng.yan@aalto.fi (Z. Yan).

## 1. Introduction

A Mobile Ad Hoc Network (MANET) has a good prospect of becoming a practical platform for instant social activities [1]. MANET is a collection of autonomous nodes that communicate with each other by forming a multi-hop radio network and maintaining connectivity in a decentralized manner. A social group could be instantly formed based on MANET not only by people socially connected, but also those physically in proximity, such as groups for purchase, resource sharing and social events. For example, Groupon (<http://www.groupon.com>) provides daily digests of group purchase activities to users; eRideShare (<http://www.erideshare.com/>) helps people with similar driving routes to share car riding; Last.fm Festival (<http://www.last.fm/festivals>) suggests a list of music festivals to users near the event locations. A user could chat with strangers nearby for instant social needs. This kind of pervasive social chatting is an essential complement for Internet social networking, thus very valuable for mobile users, especially when Internet or mobile networks are temporarily unavailable or costly to access.

Trust plays an important role in the pervasive social chatting for reciprocal activities among nearby strangers. During the instant social activities, users are not necessarily acquaintances but more likely strangers. Therefore the users need to balance between the benefits received in such reciprocal activities and the risk of communications with strangers. In this context, it is important to figure out how much users should trust with each other in order to make a decision. This introduces a demand to provide a practical reputation system for MANET-based pervasive social chatting that could intelligently assist mobile users and encourage benevolent behaviors. On the other hand, the physical proximity among MANET nodes introduces an additional concern on privacy. How to provide identity/trust management with privacy enhancements is another practical issue needed to solve.

In this paper, we develop PerChatRep, a reputation system for pervasive social chatting by applying a methodology for usable trust management in order to provide good usage experience and make the designed system easily accepted by users [6]. We design a reputation scheme for PerChatRep to address the concern of users on trust during pervasive social chatting and their preferences on reputation visualization. We implement the system using Nokia N900 as MANET nodes based on a distributed energy-efficient MANET platform [1]. PerChatRep apply a centralized Trusted Server (TS) to provide accurate reputation when the system adopts pseudonyms for each node to enhance its privacy; solve inconsistent reputation problem in MANET, and protect the system from potential attacks [8,36]. Particularly, the local and general reputations are respectively evaluated by each individual node and the TS based on ephemeral and historical experiences. We validate the effectiveness of PerChatRep through both simulations and a two-session controlled user experiment with regard to its correctness, robustness, usefulness and user acceptance.

The rest of the paper is organized as follows. Section 2 reviews related work. We introduce the method applied in our research in Section 3. Following the steps of usable trust management development, a need assessment survey was conducted to investigate how users consider and expect to cope with a reputation system for pervasive social chatting in Section 4. Next, we describe the design and implementation of PerChatRep in Section 5. Section 6 reports simulation results that show the correctness and robustness of PerChatRep reputation generation, and conducts a user experiment to test the impact of introducing PerChatRep into pervasive social chatting. We further analyze the data collected from the user experiment to ascertain research results and implications. Finally, we conclude by discussing the contributions of this paper and suggesting future work in the last section.

## 2. Background and related work

Several research groups have focused on social activities based on mobile ad hoc networks. Stanford MobiSocial Group has developed Junction, a mobile ad hoc and multiparty platform for MANET applications [27]. Micro-blog [3], developed by SyNRG in Duke University, helps users to post micro-blogs tagged by locations. AdSocial [4], introduced by ETHz Systems Group, provides a pervasive social communication platform. However, trust and reputation aspects in pervasive social networking are not considered in these projects. Traditional centralized social networking systems (e.g., facebook) have not taken user privacy into concern. They cannot satisfy instant social networking demands, especially when users do not have Internet connection, but with location proximity with each other.

In industry, quite a number of companies, such as Microsoft, Nokia and Intel have conducted research in the area of pervasive social networking (PSN). For example, Microsoft Research Asia has developed EZSetup system in order to let a mobile user find services provided by his/her neighbors [43]. The Nokia Instant Community developed by the Nokia Research Center provides an instant social networking platform to allow people in vicinity to communicate, get to know, and share information with each other [1,44]. Similarly, Intel Berkeley Lab runs a project named Familiar Stranger based on mobile devices to extend our feelings and relationships with strangers that we regularly observe but do not interact with in public places [7]. However, issues on trust management for security assurance and privacy enhancement need serious research in order to deploy a practical pervasive social networking system that can be easily accepted by mobile users.

Trust and reputation mechanisms have been widely studied in various fields of distributed systems, such as ad hoc networks, peer-to-peer (P2P) systems, grid computing, pervasive computing and e-commerce [2]. Trust is the belief of the reliability, integrity, ability, or character of an entity. Reputation is a measure derived from direct or indirect knowledge/experience on earlier interactions of entities and is used to assess the level of trust put into an entity [11]. Many

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