

# Trust Model for Mobile Devices in Ubiquitous Environment

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**Abstract.** In ubiquitous computing environment, people carrying their mobile devices (eg., mobile phone, PDA, embedded devices) expect to access locally hosted services or resources anytime, anywhere. These mobile devices have restricted capabilities and security supports. Traditional security management systems used definite access control policies for each role or user in each domain server or agent. But in ubiquitous environment, it is hard to specify authorization policies for mobile users and it is inflexible and unavailable for security management of users or mobile devices. To solve these problems, we need trust-based management mechanism as a reference to security management systems. Trust model contains trust relationship and calculation of trust value. Experiences and recommendations are the factors to calculate trust value. In this paper, we design a trust model to calculate trust value and a trust management architecture which can be running in various domain servers and mobile devices.

## 1 Introduction

In ubiquitous computing environment, people carrying their mobile devices (eg., mobile phone, PDA, embedded devices) expect to access services or resources anytime, anywhere. But they don't know these services are trustworthy or not. At the same time, service domains don't know how to trust mobile users. Traditional security management systems used definite access control policies for each mobile user or device. But in ubiquitous environment, it is hard to specify authorization policies and it is inflexible and unavailable for security management. Trust-based security management defines a trust model to allow entities to compare the trustworthiness of other entities for security decisions[12]. It captures the dynamic aspects and human intuitions about trust for using in security management. It enhances the existed security management and makes more easier to do collaboration works.

In this paper, we propose a trust model for mobile users. This model is used experience and recommendation as factors to compute trust value. We present new computation method to compute trust value according to transaction history and enhance the recommendation protocol to propagate recommendation requests. We also designed a trust-based management system which can be used in mobile devices or domain servers.

The remainder of this paper is structured as follows. In section 2, we describe some related work. Section 3 shows our trust model which includes the trust relationship and calculation algorithms of trust value. We present our trust management architecture in section 4. Finally, we draw some conclusions and outlines directions for future work.

## 2 Related Work

In this section, we briefly highlight several existing trust management systems. The basic part in trust management system is the trust model which defines trust relationships and the computation mechanisms for trust value.

The main trust factors calculating trust value are experiences and recommendations. For instance, in [2,3] mainly used experience between a trust and a trustee. [4,5,7,9] used both experience and recommendation to calculate trust value. VTrust used both experience and recommendation as trust factors, it calculated experience value which given weight for each action[6]. These researches considered that each negative or positive action gave the same effect to evaluate trust value. [8] designed a trust evolution model, they used mathematical and probabilistic model to calculate trust value. In [11], they set more weight to negative actions when they calculated experience value. In [13], the authors distinguished transaction amounts and computes different impact factors when computing trust values. In [13], the authors distinguished transaction amounts and computes different impact factors when computing trust values. These works considered different impact factors to compute trust value with different views and implemented their trust management systems.

In this paper, we propose a dynamic trust model for mobile devices. We consider security level of a target service and give more weight to continuous negative actions to calculate experience value. And we enhanced our recommendation protocol to propagate recommendation re-quests. We also consider security capabilities of mobile devices to reduce risks.

## 3 Proposed Trust Model

A Trust model defines trust relationship and the computational mechanism for trust value.

### 3.1 Trust Relationship

Truster(Tr) trusts Trustee(Te) to perform actions to the specific Services(Se) when Contexts(Cs) are satisfied during a TimePeriod(TP). Tr and Te can be users or intelligent devices. As are performed actions to the Tr's resources. TV is a trust value. Trust value is the number in the range [-1, 1]. The value in the positive region is used to express trust and in the negative region is used to express distrust. 1 means complete trust and -1 means complete distrust. 0 indicates trust neutral value.

$$\{ \text{Tr}, \quad \text{Te}, \quad \text{TV}, \quad \text{Se}, \quad \text{Cs}, \quad \text{TP} \}$$