

The Role of Reputation in Ubiquitous Healthcare System

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Abstract

In this work, we analyze the role of reputation in ubiquitous healthcare system as well as the relationship of security, trust and reputation in this environment in details. In addition, an example is given to show how to use reputation system in ubiquitous healthcare and how to use reputation system on decision making.

1. Introduction

In this paper, we contribute to analyze the importance of using reputation system in ubiquitous healthcare. We analyze the relationship of security, trust and reputation in ubiquitous healthcare in details. We also give an example of scenarios using reputation system in ubiquitous healthcare and how to use reputation system on decision making. The requirements and challenges of reputation system are addressed based on the analyse of the example scenario.

2. Security, Trust and Reputation in Ubiquitous Healthcare

The difference between traditional security mechanism (e.g. authentication) and trust was first described in [1] as hard security and soft security separately (as shown in Fig.1). Soft security is based on so called social control mechanisms since it is accomplished through the interactions of participants themselves rather than through some central authority when trying to know something about the participants. Hard security on the other hand provides a safe environment and secure communications for ubiquitous healthcare system. As one of the soft security mechanism, trust system helps build not only patients' confidence but also a stable environment for patients and healthcare providers to carry out transactions with a reduction of risk in ubiquitous healthcare system.

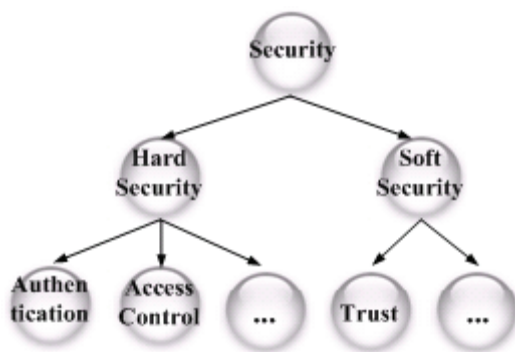


Fig.1. The Relationship between Security and Trust

Reputation is what is generally said or believed about a person's or thing's character or standing [2]. Reputation is closely related to trust, but there are also distinct differences. Trust system gives a score that reflects the truster's

subjective view on the trustee's trustworthiness, whereas reputation system gives the trustee's reputation score as seen by the whole community. An individual's subjective trust can be derived from a combination of (1) his Personal Interaction Experience on the transactions with the trustee, (2) and Reputation of the trustee.

3. Reputation System in Ubiquitous Healthcare

Fig.2 gives an example of the scenarios using reputation system in ubiquitous healthcare system. The user, Bob, is trying to find a physician to cure the pain in his shoulder. He does not have any knowledge about the local physicians since he is a visitor to the city. He uses his cell phone to get in touch with the local ubiquitous healthcare system. In his requests, Bob gives the keyword "shoulder". The ubiquitous healthcare system detects Bob's location according to his cell phone and lists the physicians who are related to the given keyword around Bob's location. Along with the list, the system also gives the reputation of each listed physician. The reputation of each physician is calculated by the ratings given by the physician's previous patients. After the transaction with the physician, the patient is requested to give his rating on the physician. The ubiquitous healthcare system collects the ratings given by all the previous patients and calculates the reputation of each physician. When giving the rating, the patients are also encouraged to give text description about the physician and the transactions. Later on, the following users, e.g. Bob, can have further understandings about the physician by reading the text descriptions. With the help of the reputation, it is relatively easy for Bob to find a reliable physician. Bob can then make an appointment by his cell phone and the ubiquitous healthcare system will give information on how to contact the chosen physician in details.

A desirable reputation system in ubiquitous healthcare system should meet the following requirements:

- (1) Ratings given by previous patients should be captured, distributed and visible in the future.
- (2) Ratings about the previous transactions must have influence to the current and future transactions. At the same time, adding any single rating should not influence the reputation significantly.
- (3) The reputation system should be capable of distinguishing between a new healthcare provider of unknown quality and a healthcare provider with poor long-term performance.

(4) It should be impossible or difficult for the healthcare provider to change his identity or pseudonym for the purpose of erasing his past behavior.

(5) The reputation system should realize and reflect recent trends in healthcare provider's performance.

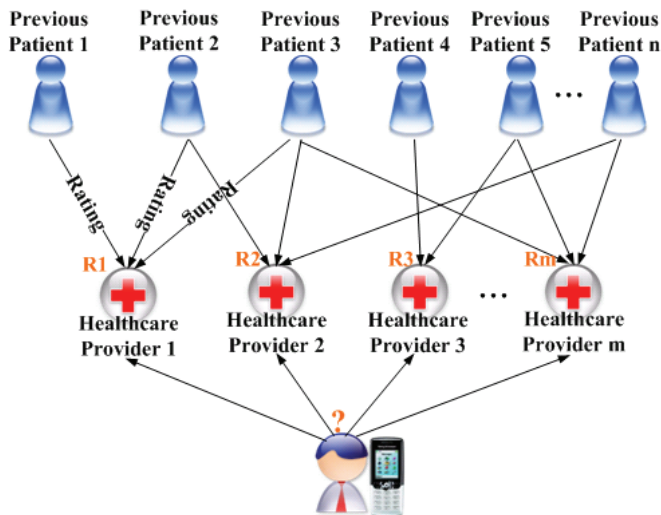


Fig.2. A scenario using reputation system in ubiquitous healthcare

The reputation system faces several challenges in ubiquitous healthcare as mentioned in the following aspects.

(1) Unfair Ratings

In the dynamic ubiquitous healthcare environments, there may possibly exist numerous self-interested raters who give unfair ratings to maximize their own gains (perhaps at the cost of others). Therefore, finding ways to avoid or reduce the influence of unfair ratings is a fundamental problem in reputation systems.

(2) Free Riders

It is essential for the reputation system to overcome the free riding behavior. Users who attempt to benefit from the resources of others without offering their own resources in exchange are termed "free-riders"[3]. For reputation system in ubiquitous healthcare, "free-riders" refer to those who do not give ratings after the transactions with the healthcare providers.

(3) Lack of Negative Ratings

The researches on reputation system in e-business showed that it was hardly to observe any negative ratings, around 1 percent. The proportion of negative ratings may even be much less in ubiquitous healthcare system because of the speciality of the services provided by ratees.

(4) Changing Behaviors

The problem of changing behaviors may appear both sides. On one hand, the healthcare providers may for example provide good service to all except some small number of patients. Or healthcare providers provide high quality of services on some trivial aspects in order to get high reputation, but provide low quality of services on crucial aspects. On the other hand, the raters may also give fair ratings to all except some small number of healthcare providers because of their personal interests.

(5) Changing Identity

As mentioned in previous section, it is requested that the identity or pseudonym of the healthcare provider should be impossible or difficult to change.

4. Conclusions and Future Work

The concept of reputation differs from trust that reputation reflects the view of the whole environments on the trustee's trustworthiness and trust reflects the truster's own view on trustee's trustworthiness[4][5][6]. We introduce in this paper the importance of reputation system in ubiquitous healthcare. By collecting, distributing and aggregating feedback about the healthcare providers' past behaviors, reputation system helps the patient choose reliable healthcare providers as well as helps the healthcare provider build up the trustworthiness and attract more patients in unfamiliar environments. We plan to focus on more details on the reputation system used in ubiquitous healthcare in the future, such as to solve the problem of Lack of Negative Ratings. Though the research on reputation system in ubiquitous healthcare is still in the beginning stage, we do believe that the usage of reputation system in ubiquitous healthcare presents a promising path for the future research.

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