Chapter 4.5
Trust Modeling in a Virtual Organization Using Social Network Metrics

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ABSTRACT

One of the most important factors in human interaction and communication is trust. Each organization performing its quotidian tasks use intentionally or involuntary established trust relations to estimate the probability of achieving the expected results or the level of confidentiality. As in societies that evolved from real world relationship (e.g. school, office, sport activity, etc.) also in virtual communities (e.g. chat rooms, Web boards, mailing lists, etc.) trust is one of the most fundamental type of binding among the group members. In this article the trust relation establishment and evolution in virtual communities has been investigated. The presented model uses some typical parameters like node degree and centrality coefficient related to social network description and analysis.

INTRODUCTION

Trust and reputation of subjects has been typically assessed as a function of the quality of their response to requests coming from other members in the community. This approach is used in some organizational learning systems as, for example, *Answer Garden* (Golbeck,2005) or knowledge communities (Golbeck& Hendler, 2005; Schillo, 1999). Discussion about the different ratings that can be obtained by analyzing response quality is to be found for example in (Grzonkowski, 2005). These systems rely on ratings provided as a feedback from the subject receiving the response to a previous demand. Subsequently these ratings are combined and finally each subject calculates its own trust value. Trust and reputation measure gives an idea of the confidence one can have on the quality of a subject's responses. The disadvantage of this type of mechanism is that it needs

the explicit and frequent involvement of users that issue ratings. This implies that a good reputation calculation and maintenance depends on the involvement of users and continued contribution of ratings. Less intrusive and less demanding in terms of users involvement methods are more interesting. The problem is how reputation and trust level can be measured in the absence of any user feedback for subject's responses.

The main idea presented in this work is that some information about the dynamics and formation of the virtual community network can be used to evaluate the trust and reputation values. The Internet, the electrical power grid, the transportation network as well as the social networks can be viewed and analysed as the examples of complex networks. Two important properties displayed by many of these networks are the small world and scale-free properties (Ehrlich, 2006). Small-world networks can be characterized by the clustering coefficient and the average network distance. The clustering coefficient is the probability that any two nodes are connected to each other, given that they are both connected to a common node. The average network distance measures the average minimal number of links connecting any two nodes in the network. Many regular networks have high clustering coefficients and large network distances. Random networks, on the other hand, have small network distances and low clustering coefficients (Watts, 1999). Small-world networks fall somewhere in between these two extremes as they have large clustering coefficients and small average network distances (Garton 1997). The scale-free property is defined by an algebraic behaviour in the probability distribution $P(k)$ of the number k of links at a node. When we consider virtual community all these parameters describing small-world or scale-free networks can be used to analyze the position and relations among community members.

In the article a novel concept of a trust modelling and management that addresses above mentioned problems by using the some universal measures for complex networks is presented.

In the next section the main ideas dealing with how trust can be modeled within online communities have been presented. Next, some background describing social networks analysis has been described. After that, methods for constructing community-aware trust levels assessment that enables automation of the trust level calculation process and to establish trust relations between users of a social network. This methods use a novel trust model that takes advantage of complex networks. Finally, in the last section a discussion about the presented model and directions of future work has been presented.

TRUST MODELS

Trust is a very important aspect of our life because trust is the fundamental for all bilateral and multilateral activities in human society, especially when results of our own actions are highly dependent on the actions of others. The most frequently quoted definition of the trust seems to stress the following aspect related to this notion (Gambetta, 1990; Marsh, 1994):

- Trust is subjective. Trust is the social knowledge that is derived from personal observation and serves for future personal decision-making.
- Trust is affected by some actions that cannot be monitored
- Trust is context dependant. Trust can have different meaning dependently from the context. For example, one can trust TV news when it has been prepared by X but not when it has been prepared by Y.
- Trust level strictly depends on how our actions are affected by the others.
- Trust is directed.Trust relation is always composed by two entities: trustor and trustee, so