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A number of selected papers presented at ICEIS 2008 will be published by Springer-Verlag in a LNBIP Series book. This selection will be done by the Conference Chair and Program Chair, among the papers actually presented at the conference, based on a rigorous review by the ICEIS 2008 program committee members.

FOREWORD

This volume contains the proceedings of the Tenth International Conference on Enterprise Information Systems (ICEIS 2008), organized by the Institute for Systems and Technologies of Information Control and Communication (INSTICC) in cooperation with the Association for Advancement of Artificial Intelligence (AAAI) and co-sponsored by the Workflow Management Coalition (WfMC).

ICEIS 2008, held in Barcelona, Spain, culminates a series of ten successful ICEIS editions, clearly showing that this is a world class event which has become a major point of contact between research scientists, engineers and practitioners in the area of business applications of information systems. This year, five simultaneous tracks were held, covering different aspects related to enterprise computing, including: "Databases and Information Systems Integration", "Artificial Intelligence and Decision Support Systems", "Information Systems Analysis and Specification", "Software Agents and Internet Computing" and "Human-Computer Interaction". All tracks describe research work that is often oriented towards real world applications and highlight the benefits of Information Systems and Technology for industry and services, thus making a bridge between the Academia and the Enterprise worlds.

Following the trend of previous editions, ICEIS 2008 also had a number of satellite workshops, related to the field of the conference. This year we collaborated in the organization of the following ten international workshops: 8th International Workshop on Pattern Recognition in Information Systems; 6th International Workshop on Modelling, Simulation, Verification and Validation of Enterprise Information Systems; 6th International Workshop on Security In Information Systems; 5th International Workshop on Natural Language Processing and Cognitive Science; 2nd International Workshop on RFID Technology - Concepts, Applications, Challenges; 2nd International Workshop on Human Resource Information Systems; and .the joint workshops: 5th International Workshop on Ubiquitous Computing; 4th International Workshop on Model-Driven Enterprise Information Systems; and 3rd International Workshop on Technologies for Context-Aware Business Process Management.

ICEIS 2008 received 665 paper submissions from more than 40 countries in all continents. 62 papers were published and presented as full papers, i.e. completed work (8 pages/30' oral presentation), 183 papers reflecting work-in-progress or position papers were accepted for short presentation, and another 161 contributions were scheduled for poster presentation.

These numbers, leading to a "full-paper" acceptance ratio below 10%, and a total acceptance ratio below 61%, show the intention of preserving a high quality forum for the next editions of this conference. Additionally, as usual in the ICEIS conference series, a number of invited talks, presented by internationally recognized specialists in different areas, have positively contributed to reinforce the overall quality of the Conference and to provide a deeper understanding of the Enterprise Information Systems field.

A book of Selected Papers will be published, following the conference, by Springer-Verlag in the newly created series "Lecture Notes in Business Information Processing" (LNBIP). This series brings the successful LNCS approach to areas such as business information systems, e-business, B2B integration, Enterprise applications and industrial software development.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. Thirdly, we thank the invited speakers for their invaluable contribution and for taking the time to synthesise and prepare their talks. Fourthly, we thank the workshop chairs and the special session chairs whose collaboration with ICEIS was much appreciated. Finally, special thanks to all the members of the local organising committee, especially Jorge Cardoso, whose collaboration was fundamental for the success of this conference.

This year, the organization will distribute two awards to papers presented at the conference: the best paper award and the best student paper award, mainly based on the classifications provided by the Program Committee members.

We wish you all an exciting conference and an unforgettable stay in Barcelona. We hope to meet you again next year for the 11th ICEIS, to be held in Milan - Italy, details of which are available at http://www.iceis.org.

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I.P.Setúbal/ INSTICC, Portugal

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A MODEL TO RATE TRUST IN COMMUNITIES OF PRACTICE

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Keywords: Communities of Practice, Knowledge Management, Trust, Reputation.

Abstract: Communities of Practice are an important centre of knowledge exchange in which feelings such as membership or trust play a significant role since both is the basis for a suitable sharing of knowledge. However, current Communities of Practice are often "virtual" as their members may be geographically distributed. This makes it more difficult for a feeling of trust to take place. In this paper we describe a trust model designed to help software agents, which represent communities of practice members, to rate how trustworthy a knowledge source is. It is important to clarify that we also consider members as knowledge sources since, in fact, they are the most important knowledge providers.

1 INTRODUCTION

In recent years Knowledge Management (KM) has become an important success factor for companies. The purpose of knowledge management is to help companies to create, share and use knowledge more effectively (Davenport, 1997). Information technologies play a key role in achieving these goals but are only a small component in an overall system that must integrate the supporting technology with people-based business processes. Nowadays, organizations must operate in a climate of rapid market change and high information volume, and this increases the necessity to create knowledge management systems which support the knowledge process. KM is not a technological solution but is rather, primarily, a people oriented process which takes into account such factors as leadership, culture, expertise and learning, with technology playing a supporting role. Using this idea as a base, we have studied how people obtain and increase their knowledge in their daily work. This study led us to the conclusion that employees frequently exchange knowledge with people who work on similar topics, and consequently communities are either formally or informally created. These communities can be called "communities of practice", by which we mean groups of people with a common interest where each member contributes knowledge about a common domain (Wenger, 1998).

Communities of practice (CoPs) enable their members to benefit from each other's knowledge. This knowledge resides not only in people's minds but also in the interaction between people and documents. CoPs share values, beliefs, languages, and ways of doing things. Many companies report that such communities help reduce problems caused by a lack of communication, and save time by "working smarter" (Wenger, 2002). An interesting fact is that members of a community are frequently more likely to use knowledge built by their community team members than those created by members outside their group (Desouza, 2006). This factor occurs because people trust more in the information offered by a member of their community than in that supplied by a person who does not belongs to that community. Of course, the fact of belonging to the same community of practice already implies that these people have similar interests and perhaps the same level of knowledge about a topic. Consequently, the level of trust within a community is often higher than that which exists outside the community. As a result of this, as is claimed in (Desouza, 2006), knowledge reuse tends to be restricted within groups. Therefore, people, in real life in general and in companies in particular,

prefer to exchange knowledge with "trustworthy people" by which we mean people they trust. For these reasons we consider the implementation of a mechanism in charge of measuring and controlling the confidence level in a community in which the members share information to be of great importance.

Bearing in mind that people exchange information with "trustworthy knowledge sources" we have designed a trust model to help CoPs members to decide whether a knowledge source (for instance a person) is trustworthy or not. In the following section we describe various definitions of two related concepts: trust and reputation. In Section 3 we then explain a trust model which can be used in CoPs. Section 4 describes how the trust model can be used and how it works. In Section 5 we compare our proposal with other related works and finally, in Section 6, we present some conclusions and future work.

2 TRUST AND REPUTATION

Trust is a complex notion whose study is usually narrowly scoped. This has given rise to an evident lack of coherence among researchers in the definition of trust. For instance in (Barber, 2004) the authors define trust as confidence in the ability and intention of an information source to deliver correct information. In (Wang, 2003), Wang and Vassileva define trust as a peer's belief in another peer's capabilities, honesty and reliability based on his/her own direct experiences. In (Mui, 2001) trust is defined as a subjective expectation that one agent has about another's future behavior based on the history of their encounters.

Social scientists have collectively identified three types of trust, which are:

- *Interpersonal trust* which is the trust one agent directly has in another agent (McKnight, 1996).
- *System trust* or *impersonal trust* refers to trust that is not based on any property or state of trustee but rather on the perceived properties or reliance on the system or institution within which that trust exists. For instance, inherited experiences of an organization.
- *Dispositional trust*, or *Basic trust*, describes the general trusting attitude of the truster. This is "a sense of basic trust, which is a pervasive attitude toward oneself and the world" (McKnight, 1996).

Experiences and knowledge form the basis for trust in future familiar situations (Luhmann, 1979). For this reason, the frequency and intensity of interactions between people provide an increased level of habituation which reinforces trust between the parties.

Another important concept related to trust is reputation. Several definitions of reputation can be found in literature, such as that of Mui et al in (Mui, 2001) who define reputation as a perception that one agent has of another's intentions and norms. Barber and Kim define this concept as the amount of trust that an agent has in an information source, created through interactions with information sources (Barber, 2004) and Wang and Vassileva in (Wang, 2003) define reputation as a peer's belief in another peer's capabilities, honesty and realibility based on recommendations received from other peers.

In our work we intend to follow the definition given by Wang and Vassileva which considers that the difference between both concepts depends on who has the previous experience, so if a person has direct experiences of, for instance, a knowledge source we can say that this person has a trust value in this knowledge. However if another person has had the previous experience and recommends a knowledge source to us, then we can say that this source has a reputation value.

3 TRUST MODEL IN CoPs

Our aim is to provide a trust model based on real world social properties of trust in Communities of Practice (CoPs) by which we mean groups of people with a common interest where each member contributes knowledge about a common domain (Wenger, 1998). An interesting fact is that members of a community are frequently more likely to use knowledge built by their community team members than those created by members outside their group (Desouza, 2006). This factor occurs because people trust more in the information offered by a member of their community than in that supplied by a person who does not belong to that community. Of course, the fact of belonging to the same community of practice already implies that these people have similar interests and perhaps the same level of knowledge about a topic. Consequently, the level of trust within a community is often higher than that which exists outside the community. As a result of this, as is claimed in (Desouza, 2006), knowledge reuse tends to be restricted within groups. Therefore, people, in real life in general and in companies in

particular, prefer to exchange knowledge with "trustworthy people" by which we mean people they trust. For these reasons we consider the implementation of a mechanism in charge of measuring and controlling the confidence level in a community in which the members share information to be of great importance.

Most previous trust models calculate trust by using the users' previous experience with other users but when there is no previous experience, for instance, when a new user arrives, these models cannot calculate a reliable trust value. We propose calculating trust by using four factors that can be stressed depending on the circumstances. These factors are:

- **Position:** employees often consider information that comes from a boss as being more reliable than that which comes from another employee in the same (or a lower) position as him/her (Wasserman, 1994). However, this is not a universal truth and depends on the situation. For instance in a collaborative learning setting collaboration is more likely to occur between people of a similar status than between a boss and his/her employee or between a teacher and pupils (Dillenbourg, 1999). Such different positions inevitably influence the way in which knowledge is acquired, diffused and eventually transformed within the local area. Because of this, as will later be explained, this factor will be calculated in our research by taking into account a weight that can strengthen this factor to a greater or to a lesser degree.
- **Expertise:** This term can be briefly defined as the skill or knowledge that a person who knows a great deal about a specific thing has. This is an important factor since people often trust experts more than novice employees. In addition, "individual" level knowledge is embedded in the skills and competencies of the researchers, experts, and professionals working in the organization (Nonaka, 1995). The level of expertise that a person has in a company or in a CoP could be calculated from his/her CV or by considering the amount of time that a person has been working on a topic. This is data that most companies are presumed to have.
- **Previous experience:** This is a critical factor in rating a trust value since, as was mentioned in the definitions of trust and reputation, previous experience is the key value through which to obtain a precise trust value. However, when previous experience is scarce or it does not exist humans use other factors to decide whether or not to trust in a person or a knowledge source. One of these factors is intuition.
- **Intuition:** This is a subjective factor which, according to our study of the state of the art, has not been considered in previous trust models. However, this concept is very important because when people do not have any previous experience they often use their "intuition" to decide whether or not they are going to trust something. Other authors have called this issue "indirect reputation or prior-derived reputation" (Mui, 2002). In human societies, each of us probably has different prior beliefs about the trustworthiness of strangers we meet. Sexual or racial discrimination might be a consequence of such prior belief (Mui, 2002). We have tried to model intuition according to the similarity between personal profiles: the greater the similarity between one person and another, the greater the level of trust in this person as a result of intuition.

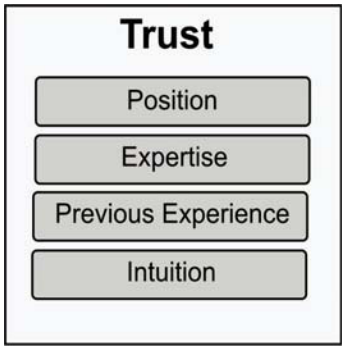

Figure 1: Trust Model.

By taking all these factors into account, we have defined our own model with which to rate trust in CoPs, and this is summarized in Figure 1.

4 USING OUR TRUST MODEL

The main goal of this model is to rate the level of confidence in an information source or in a provider of knowledge in a CoP.

As the model will be used in virtual communities where people are usually distributed in different locations we have implemented a multi-agent architecture in which each software agent acts on behalf of a person and each agent uses this trust

model to analyze which person or piece of knowledge is more trustworthy.

We have chosen the agent paradigm because it constitutes a natural metaphor for systems with purposeful interacting agents, and this abstraction is close to the human way of thinking about their own activities (Wooldridge, 2001). This foundation has led to an increasing interest in social aspects such as motivation, leadership, culture or trust (Fuentes, 2004).

In our case, the model is going to be used in CoPs and this fact implies several considerations.

The number of interactions that an agent will have with other agents in the community will be low in comparison with other scenarios such as auctions. This is very important because we cannot use trust models which need a lot of interactions to obtain a reliable trust value; it is more important to obtain a reliable initial trust value and it is for this reason that we use position, expertise and intuition.

As we observed in the previous section in Figure 1, we use four factors to obtain a trust value, but how do we use these factors? We have classified these four factors into two groups: objective factors (position and expertise) and subjective factors (intuition and previous experience). The former is given by the company or community and the latter depends on the agent itself and the agent's experience in time. There are four different ways of using these factors, which depend upon the agent's situation (see Figure 2):

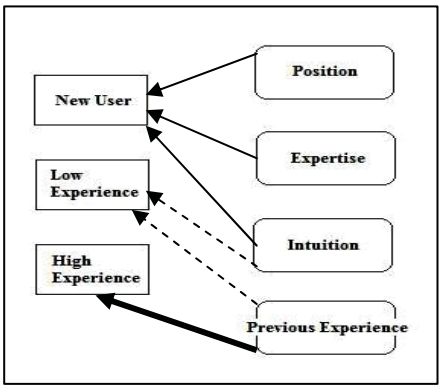

Figure 2: Using the Trust Model.

- If the agent has no previous experience, for instance because it is a new user in the community, then the agent uses position, expertise and intuition to obtain an initial trust value and this value is used to discover which other agents it can trust.
- When the agent has previous experience obtained through interactions with other agents but this previous experience is low (low number of interactions), the agent calculates the trust value by considering the intuition value and the experience value. For instance, if an agent A has a high experience value for agent B but agent A has a low intuition value for agent B (profiles are not very similar), then agent A reduces the value obtained through experience. In this case the agent does not use position and expertise factors (objective factors) because the agent has its own experience and this experience is adjusted with its intuition which is subjective and more personalized.
- When the agent has enough previous experience to consider that the trust value it has obtained is reliable, then the agent only considers this value.

In order to test our model we have developed a prototype system into which CoPs members can introduce documents and where these documents can also be consulted by other people. The goal of this prototype is to allow software agents to help users to discover the information that may be useful to them, thus decreasing the overload of information that employees often have and strengthening the use of knowledge bases in enterprises. In addition, we try to avoid the situation of employees storing valueless information in a knowledge base.

The main feature of this system is that when a person searches for knowledge in a community his/her software agent has to evaluate that knowledge in order to indicate whether:

- The knowledge obtained was useful.
- How it was related to the topic of the search (for instance a lot, not too much, not at all).

With this information, and by using our trust model, the agent calculates the most trustworthy knowledge sources and sorts these documents by using the trust model and considering the most reliable documents according to his/her user profile and preferences (Soto et al., 2007).

5 RELATED WORKS

This research can be compared with other trust models. In models such as eBay(ebay, 2007) and Amazon (Amazon.com, 2007), which were

proposed to resolve specific situations in online commerce, the ratings are stored centrally and the reputation value is computed as the sum of those ratings over six months. Thus, reputation in these models is a global single value. However, these models are too simple (in terms of their trust values and the way they are aggregated) to be applied in open multi-agent systems. For instance, in (Zacharia, 1999) the authors present the Sporas model, a reputation mechanism for loosely connected online communities where, among other features, new users start with a minimum reputation value, the reputation value of a user never falls below the reputation of a new user and users with very high reputation values experience much smaller rating changes after each update. The problem in this approach is that when somebody has a high reputation value it is difficult to change this reputation or the system needs a high amount of interactions. A further approach of the Sporas authors is Histos which is a more personalized system than Sporas and is orientated towards highly connected online communities. In (Sabater, 2002) the authors present another reputation model called REGRET in which the reputation values depend on time: the most recent rates are more important than previous rates. (Carbó, 2003) presents the AFRAS model, which is based on Sporas but uses fuzzy logic. The authors presents a complex computing reputation mechanism that handles reputation as a fuzzy set while decision making is inspired in a cognitive human-like approach. In (Abdul-Rahman, 2000) the authors propose a model which allows agents to decide which agents' opinions they trust more and to propose a protocol based on recommendations. This model is based on a reputation or word-of-mouth mechanism. The main problem with this approach is that every agent must keep rather complex data structures which represent a kind of global knowledge about the whole network.

Barber and Kim present a multi-agent belief revision algorithm based on belief networks (Barber, 2004). In their model the agent is able to evaluate incoming information, to generate a consistent knowledge base, and to avoid fraudulent information from unreliable or deceptive information sources or agents. This work has a similar goal to ours. However, the means of attaining it are different. In Barber and Kim's case they define reputation as a probability measure, since the information source is assigned a reputation value of between 0 and 1. Moreover, every time a source sends knowledge that source should indicate the certainty factor that the source has of that knowledge. In our case, the focus is very different since it is the receiver who evaluates the relevance of a piece of knowledge rather than the provider as in Barber and Kim's proposal.

In (Huynh, 2004) the authors present a trust and reputation model which integrates a number of information sources in order to produce a comprehensive assessment of an agent's likely performance. In this case the model uses four parameters to calculate trust values: interaction trust, role-based trust, witness reputation and certified reputation. We use a certified reputation when an agent wants to join a new community and uses a trust value obtained in other communities but in our case this certified reputation is composed of the four previously explained factors and is not only a single factor.

The main differences between these reputation models and our approach are that these models need an initial number of interactions to obtain a good reputation value and it is not possible to use them discover whether or not a new user can be trusted. A further difference is that our approach is orientated towards collaboration between users in CoPs. Other approaches are more orientated towards competition, and most of them are tested in auctions.

6 CONCLUSIONS AND FUTURE WORK

This paper describes a trust model which can be used in CoPs. The goal of this model is to help members to estimate how trustworthy a person or a knowledge source is since when a community is spread geographically, the advantages of face-to-face communication often disappear and therefore other techniques, such as our trust model, should be used to obtain information about other members.

One contribution of our model is that it takes into account objective and subjective parameters since the degree of trust that one person has in another is frequently influenced by both types of parameters. We therefore try to emulate social behaviour in CoPs.

We are testing our model in a prototype into which CoPs members can introduce documents, and software agents should decide how trustworthy these documents are for the user that they represent.

As future work, we are planning to add new functions to the prototype such as for instance, expert detection and recognition of fraudulent

members who contribute with no useful knowledge. We would like to stress that we are working on depurating our trust model in order for it to be used in knowledge management systems with the goal of fostering the usage of this kind of tools since employees who frequently complain about them claim that these systems often store a lot of knowledge but it is difficult to know how trustworthy it is and which is more relevant for each user.

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