

Preface

We have witnessed the necessity of collaboration and resource sharing in many distributed applications, e.g., grid computing platform for e-Science, the PlanetLab experimental platform for distributed systems and overlay networks, P2P file sharing for fast information dissemination, cooperative caching for Web content delivery, enterprise collaboration in E-commerce, location-based services, and so on. In such a loosely-coupled open computing system, trust and reputation management becomes essential for building a healthy collaboration among participants that do not have prior knowledge about one another.

Reputation-based trust management is widely recognized as an effective way for an open system to identify and avoid malicious nodes and protect the system from possible misuses and abuses in a decentralized networked computing environment. In reputation-based trust systems, trust describes the ability to infer expectations on the susceptibility of other nodes to behave cooperatively. Trust-based reputation of a node in an open system is typically built based on the history of its behavior in terms of communication and transaction with other nodes. Reputation and trust management is highly interdisciplinary, involving researchers from communication and information systems, artificial intelligence, game theory, as well as social sciences and evolutionary biology. With the increasing importance of reputation-based trust management in large-scale data-intensive systems, two most important research issues are confronted to the data and knowledge management community: how to deal with massive amounts of historical data in reputation management and how to exploit reputation-based trust inference for building more reliable distributed information systems. Furthermore, trust management also includes the construction and management of trust hierarchies in operating systems and distributed applications, trust assignments for downloaded programs and for updating software from vendors and applications with or without signatures.

This special section selects eight peer-reviewed papers that represent recent progress in trust and reputation management of future computing systems and applications, including P2P systems, E-commerce, desktop grid, online ratings and Web services.

Reputation mechanisms are one of the key techniques for trust assessment in large-scale decentralized systems. The effectiveness of reputation-based trust management fundamentally relies on the assumption that an entity's future behavior may be predicted based on its current and past behavior. However, a key challenge in designing a good reputation mechanism is the capability of handling dishonest behaviors. In the paper "On the Modeling of Honest Players in Reputation Systems", Zhang, Wei and Yu investigate the modeling of honest entities in decentralized systems by building a statistical model for the transaction histories of honest players. This statistical model serves as a profiling tool to identify suspicious entities. By combining it with existing trust schemes, the authors show that their approach can be applied to the entities whose transaction records are consistent with the statistical model. This approach limits the manipulation capability of adversaries, and thus can significantly improve the quality of reputation-based trust assessment.

The continued advance of the Internet, in particular the wide deployment of Internet-enabled business-to-consumers (B2C) E-business solutions, has enabled many Small and Medium Enterprises (SMEs) to respond to the globalization challenge and opportunity by extending the geographic reach of their operations. Although many existing technologies are available for making the transactions more secure, there remain the risks that the unknown provider will not comply with the protocol used. Thus, the decision of who to trust and with whom to engage in a transaction becomes more difficult and usually falls on the shoulders of the individual nodes. In such an environment, reputation systems is one effective way to assist consumers in decision making. The paper titled "On Desideratum for B2C E-Commerce Reputation Systems" by Gutowska, Sloane and Buckley proposes a novel reputation model dedicated to the distributed reputation system for B2C E-commerce applications. This model can overcome the drawbacks of existing approaches by considering a number of issues that have some bearing on trust and reputation. such as age of ratings, transaction value, credibility of referees, number of malicious incidents, collusions, and unfair ratings.

Peer-to-Peer Desktop Grid (P2PDG) has emerged as a pervasive cyber-infrastructure, tackling large-scale applications with high impacts. To handle trustworthiness issues of these services, trust and reputation schemes are proposed to establish trust among peers in P2PDG. In the paper titled "H-Trust: A Group Trust Management System for Peer-to-Peer Desktop Grid", Zhao and Li propose a group trust management system, called H-Trust, inspired by the h-index aggregation technique. Leveraging the robustness of the h-index algorithm under incomplete and uncertain circumstances, H-Trust offers a robust personalized reputation evaluation mechanism for both

individual and group trusts with minimal communication and computation overheads. The H-Trust scheme consists of five phases: trust recording, local trust evaluation, trust query phase, spatial-temporal update phase, and group reputation evaluation phase. Simulation based experimental results demonstrate that H-Trust is robust and can identify and isolate malicious peers in large scale systems even when a large portion of peers are malicious.

Considering the reputation systems in the context of decentralized distributed hash table based systems, Bonnaire and Rosas propose a new metric for reputation systems on top of a Distributed Hash Table in the paper, titled "WTR: A Reputation Metric for Distributed Hash Tables Based on A Risk and Credibility Factor". WTR uses a notion of risk to make the applications aware of certain behaviors of malicious nodes. Simulation results show that the proposed metric can significantly reduce the number of malicious transactions, and that it also provides very strong resistance to several traditional attacks of reputations systems. Furthermore, the proposed solution can easily scale, and be adapted to various types of Distributed Hash Table based systems.

With the evolutionary development of E-commerce, online feedback-based rating systems are gaining increased popularity. A major challenge in building a trustworthy online rating system is to deal with unfair ratings from dishonest raters. In E-commerce systems, it is observed that collaborative dishonest raters can provide unfair ratings intentionally to boost or down-grade the rating scores of certain products or reputation of other users. In the paper titled "Dishonest Behaviors in Online Rating Systems: Cyber Competition, Attack Models, and Attack Generator", Yang and his colleagues argue that the lack of unfair rating data from real human users and realistic attack behavior models has become an obstacle towards developing reliable rating systems. To address this problem, the authors design and launch a rating challenge to collect unfair rating data from real human users. In order to broaden the scope of the data collection, a comprehensive signal-based unfair rating detection system is developed. Based on the analysis of real attack data, the paper discovers important features in unfair ratings, builds attack models, and develops an unfair rating generator. The models and the generator developed in this paper can be directly used to test current rating aggregation systems, as well as to assist the design of future rating systems.

The decentralized nature of P2P systems demands for enhanced trust between peers in order to enable reliable communication and exchange of services between peers. In the paper titled "A Comprehensive and Adaptive Trust Model for Large-Scale P2P Networks", Li and Gui propose an adaptive trusted decision-making method, which can reduce the risk and improve system efficiency considerably. The novelty of this paper is their approach to determining the weight used in the general trust model. Two new parameters, confidence factor and feedback factor, are introduced to adaptively assign the weights to direct trust and feedback trust. This approach overcomes the weakness of traditional methods in which the weights are assigned by subjective manners. Simulation-based experimental results show that the proposed model has good enhancements in the accuracy of trust decision-making and better dynamic adaptation capability in handling various types of dynamic behaviors of peers.

In the paper "RCCtrust: A Combined Trust Model for Electronic Community", Zhang and his colleagues propose RCCtrust for deriving reputation in the E-communities. RCCtrust combines Reputation-based, Content-based, and Context-based mechanisms to provide more accurate, fine-grained and efficient trust management for the electronic community. Concretely, RCCtrust extracts trust-related information from user-generated content and community context from Web to extend the reputation-based trust models. Following the study in sociology, RCCtrust exploits similarities between pairs of users to depict differentiated trust scales. The experimental results show that RCCtrust outperforms pure user similarity based method and linear decay trust-aware technique in both accuracy and coverage for a Recommender System.

Web services continue to gain its popularity as a new distributed computing paradigm. Most of the Web services are built with XML documents via loosely coupled, self-description software. In the paper titled "A Review-Based Reputation Evaluation Approach for Web Services", Li, Du and Tian argue that reputation evaluation is an efficient way to mitigate the threats in Web service environments. They note that the current feedback-based approach is inaccurate and ineffective because of its inherent limitations (e.g., the feedback quality problem). Such limitations greatly degrade their importance on service reputation evaluation. To tackle this problem, the authors present a novel trust evaluation approach, which reviews the quality in terms of multiple metrics, followed by some improvement in service reputation evaluation based on those filtered reviews. Experimental results show the effectiveness and efficiency of this proposed approach through a comparison with the naive feedback-based approaches.

In summary, we are pleased to present this selection of eight articles in this special section on trust and reputation management in future computing systems and applications. We believe that this collection represents the state-of-

the-art progress in the field of reputation and trust management. We trust that you will enjoy reading this special section.

Guest Editors:

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Ling Liu is a professor in the College of Computing at Georgia Institute of Technology. There she directs the research programs in Distributed Data Intensive Systems Lab (DiSL), examining performance, security, privacy, and data management issues in building large scale distributed computing systems. She has published over 200 international journal and conference articles in the areas of Internet Computing systems, Internet data management, distributed systems, and information security. Dr. Liu is the recipient of the best paper award of ICDCS 2003 and the best paper award of WWW 2004, and a recipient of 2005 Pat Goldberg Memorial Best Paper Award. Dr. Ling Liu is an internationally recognized expert in the areas of database systems, distributed computing, Internet systems, and service oriented computing. She has chaired a number of conferences as a PC chair, vice PC chair, or a general chair, including IEEE International Conference on Data Engineering (ICDE 2004, ICDE 2006, ICDE 2007), IEEE International Conference on Distributed Computing (ICDCS 2006), IEEE International Conference on Web Services (ICWS 2004), CreateNet-ICST Collaborative Computing Conference (CollaborateCom 2005, 2006), ACM International Conference on Knowledge and Information Management (CIKM 2000). Dr. Liu is currently on the editorial board of several international journals, including IEEE Transactions on Knowledge and Data Engineering, International Journal of Peer-to-Peer Networking and Applications (Springer), International Journal of Very Large Database Systems (Springer), International Journal of Web Services Research, Wireless Network Journal (WINET). Dr. Liu's research is primarily sponsored by NSF, DoE, DARPA, IBM, and HP. Dr. Liu is a recipient of IBM Faculty Award (2003, 2006, 2007).



Wei-Song Shi is an associate professor of Computer Science at Wayne State University. He received his B.S. degree from Xidian University in 1995, and Ph.D. degree from the Chinese Academy of Sciences in 2000, both in computer engineering. His current research focuses on mobile computing, distributed systems and high performance computing. Dr. Shi has published more than 80 peer-reviewed journal and conference papers in these areas. He is the author of the book "Performance Optimization of Software Distributed Shared Memory Systems" (High Education Press, 2004). He has also served on technical program committees of several international conferences, including WWW, ICPP, MASS. He is a recipient of Microsoft Fellowship in 1999, the President Outstanding Award of the Chinese Academy of Sciences in 2000, one of 100 outstanding Ph.D. dissertations (China) in 2002, "Faculty Research Award" of Wayne State University in 2004 and 2005, the "Best Paper Award" of ICWE'04 and IPDPS'05. He is a recipient of the NSF CAREER award and Wayne State University Career Development Chair award.