Editorial: Special issue on Dependable Peer-to-Peer Systems

Lu Liu[1,2], Jie Xu[2]

[1]Department of Computer Communications, School of Engineering and Information Sciences, Middlesex University, London, NW4 4BT, United Kingdom
[2]School of Computing, Faculty of Engineering, University of Leeds, Leeds, LS2 9JT, United Kingdom

As an emerging technology, peer-to-peer (P2P) systems attract attention worldwide, ranging from casual Internet users to venture capitalists. At the same time, innovations of P2P systems also offer many interesting avenues of research for scientific communities. As a major design pattern for future systems opposite to the traditional client-server paradigm, research on P2P networks is extremely important and could significantly change the way of use of computer networks.

However, P2P is sometimes regarded as a destructive technology rather than a constructive technology by Internet Service Providers (ISPs). "How to harness the power of P2P?" and "how to design dependable P2P systems for sustainable provision of services and integration of services?" remain fundamental problems. There are strong needs for improving the dependability of P2P systems to make them more secure and robust for service sharing and delivery. However, developing dependable systems is difficult because various types of properties can influence the dependability of system. Achieving dependability in a P2P environment is even more complicated due to the lack of centralized servers to monitor and control systems.

The purpose of this special issue is to collate efforts and main achievements that contribute to scalability, availability, reliability, security and maintainability of P2P systems. This special issue focuses on fundamental issues in modelling, simulation and design of *dependable P2P systems*. This special issue contains six high quality papers which were selected from 17 submissions after a peer review process.

Load balancing is a well-known crucial problem in P2P systems. *Vinod* et al. present a mechanism to optimise server-node ratio for load balancing in a P2P networks. This mechanism builds upon a load-balancing scheme, called Enhanced-Reconfigurable-Gnutella-Overlay (ERGO). In this paper, the influence of various parameters such as network load, node capacity, server capacity and the corresponding effects of server-node ratio on metrics such as success of queries, balanced nodes and the cost of achieving the balance have been systematically investigated and discussed. An optimum server-node ratio is ascertained, optimum implying the maximum balance at minimum cost and high success of queries.

Previous measurement studies have shown that some nodes observed in existing P2P networks tend to download a large number of files, but share few files or none at all. *Sasabe* et al. investigate how these selfish nodes' behaviours affect the performance of P2P systems. The authors propose a bargaining approach which has been evaluated

through simulations and discuss relationship between selfish node behaviour and system dynamics by using evolutionary game theory. The evaluation results show that the storage capacity model makes a file-sharing system robust to file disappearance independently of the network structures even if nodes behave selfishly. Addressing the similar issues of free-riding and fairness in BitTorrent networks, *W. Liu* et al. present a Tit-for-Tat model based on game theory. The existing problems of incentive mechanisms in BitTorrent networks have been analysed and an improved method based on Tit-for-Tat strategy has been proposed in this paper. The authors verify the effectiveness of the enhanced Tit-for-Tat strategy in P2P environments through simulations.

Security is essential, but particularly challenging in P2P systems. *Sun* et al. investigate the possibilities of creating the DDoS attacks using the different membership management algorithms in P2P systems. The authors evaluate the potential of mitigation schemes in enhancing the resilience of P2P systems through experiments on the Planetlab and also reveal the weakness in the schemes and regimes where they may not be sufficient.

Redundancy is a fundamental technique to improve reliability of P2P systems. *Duminuco & Biersack* present an erasure coding scheme called Hierarchical Codes which provide a flexible method of adding redundancy in distributed P2P storage systems. Hierarchical Codes achieve reduced repair traffic offered by replication and higher resilience against failures offered by coding. The simulation results show that Hierarchical Codes require a higher number of repairs but result in a lower amount of repair traffic to be transferred.

Self-organisation could be a good way to solve the control issues in the decentralised P2P architecture. *Doulkeridis* et al. propose a data-centric self-organizing P2P algorithm which is capable to dynamically identify data clusters on different peer nodes and allocate peer nodes sharing similar shared content to the same super-peer. This improves the overall search performance and increases the dependability of the P2P system.