

Peer-to-Peer Paradigm

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What, in fact, is peer-to-peer (P2P)? Is it a set of protocols, an IT architecture, a design philosophy stressing decentralization, a business model? In its current form it encompasses all of these attributes. Reduced to a common denominator the term P2P refers to technology which enables two or more peers to collaborate spontaneously in a network of equals (peers) by using appropriate information and communication systems without the necessity for central coordination.

The most frequently discussed applications include popular file-sharing systems, such as early Napster or BearShare and its numerous successors. In addition to file-sharing collaborative P2P spaces, grid computing and instant messaging are key applications of P2P.

Scientists and practitioners are confronted with the question whether, and if so, to what extent, P2P offers advantages in contrast to other architectural concepts, such as the client/server model. While comparisons on the basis of technical and economic criteria, such as persistence, performance or costs, can be made, they miss the point. Operating largely independent of central coordination, P2P opens up new dimensions of information management. It has the potential for accelerating communication processes, exploiting idle resources, and facilitating the exchange of the most recently created and highly distributed information. It can reduce collaboration costs through lean and ad hoc administration of working groups, even if groups extend beyond the boundaries of a company. They permit a greater degree of freedom and independence on the part of users by making resources available in a more customized manner. These benefits are strengthened by the increasing availability of powerful communication networks, a growing number of agreed technical standards for interfaces and protocols, as well as more user-friendly clients which make P2P architectures transparent for the user.

It appears profitable to build information systems based on P2P architectures. However, the extent to which companies can take advantage of P2P is under debate. Will decentralized control be able to cope with challenges regarding network control, security, interoperability, meta data, and cost sharing?

This minitrack features five papers that address the wide range of P2P research topics.

Paul Silvey and **Laurie Hurwitz** (The MITRE Corporation) open the minitrack introducing network simulations, that help explain the ubiquitous natural occurrence of scale-free networks, and demonstrate how P2P networks can improve in both performance and robustness.

Jan U. Becker and **Michel Clement** (University of Kiel, Germany) offer a theoretical base to explain sharing behavior and prove that the users' utility considerations depend on the network's life cycle. In addition, the authors develop strategies for file-sharing networks to enhance the user's willingness to share.

Ramayya Krishnan, **Michael D. Smith**, **Zhulei Tang**, and **Rahul Telang** (Carnegie Mellon University, USA) propose an analytic model to analyze the behavior of P2P networks in the presence of free-riding. In contrast to previous predictions, they find that P2P networks can operate effectively in the presence of significant free-riding.

Michael Reinicke and **Moritz Strasser** (University of Freiburg, Germany) introduce an economic approach that balances the scarce quantity of bandwidth in a market system with the help of an internal payment system. They show, that for the dispersion of bandwidth and the choice of the access point, market mechanisms can be mapped to radio networks and efficient allocations can be reached in comparison to previous techniques and central coordination.

Makoto Iguchi, **Masayuki Terada**, and **Ko Fujimura** (NTT Information Sharing Platform Laboratories and NTT DoCoMo Multimedia Laboratories) conclude the minitrack by presenting a novel approach to solve the problem of trust by introducing a new reputation management model.