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## Chapter I

# Core Concepts in Peer-to-Peer Networking

Detlef Schoder

University of Cologne, Germany

Kai Fischbach

University of Cologne, Germany

Christian Schmitt

University of Cologne, Germany

## Abstract

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*This chapter reviews core concepts of peer-to-peer (P2P) networking. It highlights the management of resources, such as bandwidth, storage, information, files, and processor cycles based on P2P networks. A model differentiating P2P infrastructures, P2P applications, and P2P communities is introduced. This model provides a better understanding of the different perspectives of P2P. Key technical and social challenges that still limit the potential of information systems based on P2P architectures are discussed.*

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## Introduction

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Peer-to-peer (P2P) has become one of the most widely discussed terms in information technology (Schoder, Fischbach, & Teichmann, 2002; Shirky, True-love, Dornfest, Gonze, & Dougherty, 2001). The term *peer-to-peer* refers to the concept that in a network of equals (peers) using appropriate information and communication systems, two or more individuals are able to spontaneously collaborate without necessarily needing central coordination (Schoder & Fischbach, 2003). In contrast to client/server networks, P2P networks promise improved scalability, lower cost of ownership, self-organized and decentralized coordination of previously underused or limited resources, greater fault tolerance, and better support for building ad hoc networks. In addition, P2P networks provide opportunities for new user scenarios that could scarcely be implemented using customary approaches.

This chapter is structured as follows: The first paragraph presents an overview of the basic principles of P2P networks. Further on, a framework is introduced which serves to clarify the various perspectives from which P2P networks can be observed: P2P infrastructures, P2P applications, P2P communities. The following paragraphs provide a detailed description of each of the three corresponding levels. First, the main challenges—namely, interoperability and security—of P2P infrastructures, which act as a foundation for the above levels, are discussed. In addition, the most promising projects in that area are highlighted. Second, the fundamental design approaches for implementing P2P applications for the management of resources, such as bandwidth, storage, information, files, and processor cycles, are explained. Finally, socioeconomic phenomena, such as free-riding and trust, which are of importance to P2P communities, are discussed. The chapter concludes with a summary and outlook.

## P2P Networks: Characteristics and a Three-Level Model

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The shared provision of distributed resources and services, decentralization and autonomy are characteristic of P2P networks (M. Miller, 2001; Barkai, 2001; Aberer & Hauswirth, 2002, Schoder & Fischbach, 2002; Schoder et al., 2002; Schollmeier, 2002):

1. Sharing of distributed resources and services: In a P2P network each node can provide both client and server functionality, that is, it can act as both a

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