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## Chapter IV

# Peer-to-Peer Information Storage and Discovery Systems

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## Abstract

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*This chapter investigates the current landscape of peer-to-peer (P2P) storage and discovery systems. A classification of existing P2P discovery systems, outlining the advantages and disadvantages of each category, and surveying existing systems in each class, is presented. The design, operation and applications of Squid, a P2P information discovery system that supports flexible queries with search guarantees, are described.*

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## Introduction

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Recent years have seen an increasing interest in the peer-to-peer (P2P) computing paradigm, where entities at the edges of the network can directly interact as equals (or peers) and share information, services, and resources without centralized servers. While the P2P architecture is not new (the original Internet was conceived as a P2P system), the proliferation of the World Wide Web and advances in computation and communication technologies have enabled the development and deployment of a large number of P2P applications. These applications take advantage of resources (for example, storage, computing cycles and content) available at user machines at the edges of the Internet. Properties such as decentralization, self-organization, dynamism, and fault tolerance make them naturally scalable and attractive solutions for applications in all areas of distributed computing and communication. Usenet and DNS represent an earlier generation of successful applications with P2P characteristics. More recent P2P applications include content sharing and distribution systems such as Napster (Napster Webpage) and Gnutella (Gnutella Webpage), communication and collaboration systems such as Jabber (Jabber Webpage), Groove (Groove Webpage) and ICQ (ICQ Webpage), systems for anonymity such as Freenet (Clarke, Sandberg, Wiley, & Hong, 2000), censorship-resistant systems such as Publius (Waldman, Rubin, & Cranor, 2000) and embarrassingly parallel computing such as SETI@home (SETI@home Webpage). Furthermore, P2P systems have been recently proposed for resource discovery in computational grids (Andrzejak & Xu, 2002; Foster & Iamnitchi, 2003; Iamnitchi, Foster, & Nurmi, 2002; Li, Xu, Dong, & Zhang, 2002; Schmidt & Parashar, 2003a) and for Web Service Discovery (Schlosser, Sintek, Decker, & Nejdil, 2002; Schmidt & Parashar, 2003b).

This chapter investigates the current landscape of P2P information storage and discovery systems. In this chapter, we first present an overview of P2P storage and discovery systems. We then present a classification of existing systems based on their design and target applications, and survey existing systems in each class. Specifically, we present and compare P2P data lookup and search systems. Finally, we presents Squid (Schmidt & Parashar, 2003a), an information discovery system that supports flexible queries, while providing search guarantees.

## P2P Information Storage and Discovery Systems

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An important area where P2P technologies continue to be successfully applied is information storage, discovery, and retrieval. Key strengths of the P2P

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