

# Topic 1: Architecture of Peer-to-Peer Systems

## 1 Guidelines

Peer-to-peer (P2P) computing has been hailed as a promising technology that will reconstruct the architecture of distributed computing (e.g., the Internet). This is because it can harness various resources (including computation, storage and bandwidth) at the edge of the Internet with lower cost of ownership, and at the same time enjoy many potential desirable features (e.g., scalability, autonomy, etc.). Since the middle of 2000, P2P computing technology has spurred increasing interests in both industrial and academic communities. As such, there are increasingly more applications being developed based on this paradigm, for example, digital content sharing (e.g., Napster, Gnutella and Shareaza), scientific computation (e.g., SETI@home and Folding@home), collaborative groupware (e.g., Groove), instant messages (e.g., ICQ) and so on. Furthermore, many research topics related to P2P computing have also been studied extensively - overlay network, routing strategies, resource (al)location, query processing, replication and caching. However, there has not been much effort to study the architecture of P2P systems. As the architecture of a system is the cornerstone of high-level applications that are implemented upon it, an understanding of P2P architecture is crucial to realizing its full potential. Such a study is important because: (a) It helps researchers, developers and users to better appreciate the relationships and differences between P2P and other distributed computing paradigms (e.g., client-server and grid computing). (b) It allows us to be conscious of the potential merits of P2P computing for newly emerging application demands, and to determine the most suitable architecture for them. (c) It enables us to determine the architectural factors that are critical to a P2P systems performance, scalability, reliability, and other features.

In this topic, you should summarize and examine the architecture of P2P systems and some related issues. You should first present a taxonomy of P2P architectures based on existing systems that have been developed. On one extreme, some P2P systems are supported by centralized servers. On the other extreme, pure P2P systems are completely decentralized. Between these two extremes are hybrid systems where nodes are organized into two layers: the upper tier servers and the lower tier common nodes. Second, you should conduct an extensive comparison among these three types of architectures. Third, you should check how peers in different architectures define their neighbors (those that are directly connected) statically or dynamically, and figure out the supporting techniques for dynamic reorganization of peers that allow communities to be formed based on some common interests among the nodes. You should also examine how nodes that are relatively powerful can be exploited to shoulder more responsibilities.