Chapter XV
Peer-to-Peer SIP for Mobile Computing: Challenges and Solutions

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Due to the increasing popularity of Peer-to-Peer (P2P) computing, the information technology industry and standardization organizations have started to direct their efforts on standardizing P2P algorithms and protocols. The Internet Engineering Task Force (IETF) has recently formed the Peer-to-Peer SIP (P2PSIP) working group for enabling serverless operation of Session Initiation Protocol (SIP). This chapter introduces the P2PSIP by presenting its background and purpose, operational principles, current status, and application areas. The focus is on the challenges and problem areas from the viewpoint of standardization and related research. The mobile- and heterogeneous environments are considered with special care. The authors provide a glance to the existing and emerging solutions that may be used in tackling the mentioned challenges and thus paving the way for successful deployment of P2PSIP in mobile environments.

INTRODUCTION

Peer-to-Peer (P2P) networks have reached an important role in the communications between end users in Internet. Since the first file sharing applications, the P2P technology has gone through several evolutionary steps. The academic community has primarily focused on the development
and optimization of the network algorithms, whereas the open-source community has been active in developing applications. Only recently, the information technology industry has become aware of the significance and business potential of P2P.

On the other hand, recent technological advances in mobile networking and mobile device capabilities have made it feasible to use mobile devices as fully functional Internet nodes. Due to this, the possibilities of using P2P networks have extended to the mobile domain as well. Extending IP-based communications to the mobile domain has highlighted the need for common standards for the purpose of interoperability. In the mobile domain, Session Initiation Protocol (SIP) plays an important role since it is the de-facto signaling protocol for session management, instant messaging, and presence information exchange in Third Generation (3G) mobile networks. SIP provides the potential of connecting a mobile device with any SIP-enabled node in Internet, removing the barriers between the mobile and fixed networking.

Due to the growing interest of the information technology industry and academia, the Internet Engineering Task Force (IETF) has established the Peer-to-Peer SIP (P2PSIP) working group (P2PSIP, 2008) for developing the standards for serverless use of SIP. P2PSIP aims to provide a decentralized, effortlessly administrated, scalable, and failure-tolerant platform for SIP communications in heterogeneous network environments, based on global standards. A principal aspect in the development of P2PSIP is that it is not meant to replace the traditional client/server SIP, but instead extend it to work in new environments. Fundamentally, P2PSIP builds upon a structured overlay, which is managed by the collaborative effort of participating P2PSIP nodes. This removes the need for extensive use of centralized server components and allows true P2P networking between the SIP nodes.

In this chapter, we provide an overview of the P2PSIP technology and standardization status, and present its fundamental operating principle and structure. The potential of P2PSIP is illustrated by presenting different applications in different environments. Then we point out the challenges regarding performance, restricted and heterogeneous networks, mobility, interoperability, security, as well as incentives. We elaborate from the viewpoint of mobile environments, and focus on the infrastructure-type mobile networking, such as wireless local area network (LAN) and mobile telephone networks. Solving the presented challenges is essential for enabling the secure, reliable, and efficient use of the protocol in mobile and other restricted network environments. The chapter strives to give the reader a glance to P2PSIP technology as an example of a lightweight peer-to-peer based protocol for communication, session management, and service provisioning purposes in mobile environment.

**BACKGROUND: PEER-TO-PEER SIP**

The scientific background of P2PSIP is built on the University of Columbia’s P2PSIP (Singh & Schulzrinne, 2004) and the College of William&Mary’s SOSIMPLE (Bryan et al., 2005) projects. Based on the results of these early projects and multiple ad-hoc meeting sessions between the interested parties during 2005-2007, IETF formed the P2PSIP working group in 2007 for developing standards for serverless use of SIP. The goal has later extended towards a more general P2P architecture, where the applications can also utilize P2PSIP overlay directly, instead of limiting the usage to only SIP-based communication. The focus of P2PSIP is in the general functions providing decentralized node- and resource location and communication, and the essential supportive functions that ensure the secure and unrestricted access to the mentioned services. As the focus is tightly in building a general-purpose enabling technology, the supplementary services are outside the scope of P2PSIP.