Chapter 5
Context Dissemination in Peer-to-Peer Networks

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ABSTRACT

In recent years, peer-to-peer overlay networks have become a popular communication paradigm with
the potential to further change communication fundamentally in the future. Overlays allow commu-
nication abstraction but suffer from one inherent problem: The overlay is unaware of the context of
a service or the context of a service consumer. The concept of context-awareness emerged out of the
research done within the area of ubiquitous computing. Context-aware computing is one key technology
to enable services and applications in the communication environment to adapt their behaviour based
on the knowledge of environmental (contextual) information, thereby enhancing the system’s ability to
become ever more responsive to the needs of the end-user or application domain. In this chapter we

DOI: 10.4018/978-1-61520-973-6.ch005
INTRODUCTION

The concept of context-awareness emerged out of the research done within the area of ubiquitous computing. Context-aware computing is one key technology to enable services and applications in the communication environment to adapt their behavior based on the knowledge of environmental (contextual) information thereby enhancing the system’s ability to become ever more responsive to the needs of the end-user or application domain. Prior research on context-awareness has lead to a number of context-aware applications and middleware implementations. This chapter first gives a brief introduction to context and context-awareness. It explains typical architectures of context frameworks that are suitable for the use in peer-to-peer overlay networks. Next it presents different strategies for the distribution of context applications and the retrieval of context information.

The distribution of context services and context information calls for efficient deployment and communication patterns to ensure that available context information can be located and retrieved across the overlay network in an efficient manner. The scalability of context architectures is an important requirement for supporting implementations in large-scale networks that perfectly reflect the characteristic of overlay networks. In many cases such overlay networks have an expansion across several countries or even continents. A prominent example therefore is Skype, the popular peer-to-peer voice over IP (VoIP) system, providing global communication and built upon an unstructured overlay. The peering of context services is not only a matter of connecting distributed context information but also imposes specific characteristics that must be investigated regarding the impact of failures and the search performance. Hence a careful decision must be made according to which topology should be used for peering context services.

The results from a comparative performance study show the tradeoffs between different possible peering approaches. In the following, different concepts of peering distributed context services will be investigated and search patterns are evaluated regarding overlay-related as well as underlay-related metrics.

CONTEXT

This section will introduce the fundamentals and basic concepts of context and context-aware computing by giving definitions and by briefly outlining the history of this computing paradigm. Afterwards, the main concepts of context modeling, context sensing and context monitoring will be explained. In recent history, much attention has been devoted to the terms context and context-awareness in the area of ubiquitous computing, leading to a great variety of definitions and interpretations depending on the respective application scenario.

What is Context?

An early definition of the term context in scientific work emerged in (Schilit, Adams and Want (1994)). The authors refer to context as „locat-