Chapter IX

UbiSrvInt:
A Context–Aware Fault–Tolerant Approach
for WP2P Service Provision

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ABSTRACT

Peer-to-Peer applications harness sharing between free resources (storage, contents, services, human presence, etc.). Most existing wireless P2P applications concern merely the sharing of a variety of contents. For magnifying the sharing extent for wireless service provision in the vicinity (i.e., the wireless P2P environments), this chapter presents a novel approach (briefly named UbiSrvInt) that is an attempt to enable a pure P2P solution that is context aware and fault tolerant for ad-hoc wireless service provision. This approach empowers an autonomous peer to propel distributed problem solving (e.g., in the travel domain) through service sharing and execution in an intelligent P2P way. This approach of ad-hoc wireless service provision is not only highly robust to failure (based on a specific clustering analysis of failure correlation among peers) but also capable of inferring a user’s service needs (through a BDI reasoning mechanism utilizing the surrounding context) in ad-hoc wireless environments. The authors have implemented UbiSrvInt into a system platform with P-JXTA that shows good performance results on fault tolerance and context awareness.
INTRODUCTION

In recent years, new services have mushroomed all over the web world, and people can easily attain a great number of services from the Internet. A service usually performs in the role of computation facility or information provider. Popular examples include search services, agent services, entertainment services, transaction services, etc. Service composition then refers to the technique of creating complex services with the help of smaller, simpler and easily executable lightweight services or components (Chakraborty, 2001). That is, we can handily create novel, interesting and customized services by bundling existing services together to meet the demands of our customers.

On the other hand, mobile devices are in widespread use now, and myriad mobile ad hoc networking technologies (e.g., Bluetooth, IEEE 802.11) unfold dramatically. Clever design of mobile devices includes dramatically reduced size, enlarged storage, economic power consumption and accelerated CPU speed. This design not only improved the performance but also advanced the functionality of the mobile devices. The overwhelming majority of mobile devices launched recently are all capable of supporting wireless Internet access as one of their key features. The next era of network enables the integration of various heterogeneous networks and makes it possible for people to surf between them through different kinds of wireless device anytime, anywhere and anyway. People are striding forward to a completely new Wireless Age.

Accordingly, it can be envisioned that in the forthcoming future everyone (who is walking on the street, dining in the restaurant or working in the office) outfits with hand-held or wearable mobile devices as the standard equipments to access any nearby available network for wanted services. As you move around, a software agent residing in your wireless devices autonomously searches and collects information about what is available from your current location. You may carry with you some useful lightweight services downloaded from the Internet or any wayside provisioning server. You may provide services on hand for nearby people who need them and equally attain desired services from nearby people who possess them. You may, moreover, compose those available wireless services to form an aggregated service tailoring to your contextualized needs, exhibiting moment of values of the services. In other words, the demand to create novel functionalities out of composing wireless services in the vicinity is extremely indispensable.

The aforementioned envisions manifest the significance of the problem of wireless service provision that aims for providing contextualized customized services to meet the concrete needs or requirements of a given client who is equipped with wireless mobile devices by utilizing resources available in its vicinity.

Wireless service provision in the vicinity requires a certain service platform installed at the side of mobile devices. Most existing service platforms (Casati et. Al., 2002) (Mao et. al., 2001) (Mennie et. Al., 2000) (Schuster et. al., 2000) (Gribble et. al., 1999) have been designed on a wired environment that is of high stability and bandwidth, performing against the nature of ad hoc networks. Furthermore, their centralized approaches exerted for service provision have their innate drawback while transplanting them to the wireless environment. The drawback is three-fold:

- **Fault-tolerance:** In centralized architectures, if the server shuts down, everything else does as the server is the central point of failure.
- **Scalability:** The scalability is limited to the capacity of the central server. Should a large amount of requests be addressed to the server, the server easily becomes the bottleneck of traffic.
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