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Chapter XI

Support for Dynamic Trading and Runtime Adaptability in Mobile Environments

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In this chapter we describe MAGNET, a tuplespace-based framework for dynamic trading of services addressing the needs of application in frequently-changing mobile environments. In addition to user-customized trading, MAGNET enables adaptation to a changed environment by supporting constant monitoring of selected information, mobile adaptability and scalability. In addition to presenting the MAGNET architecture and demonstrating its key features, this chapter brings an overview of dynamic trading in mobile systems and presents a theoretical framework for reconfigurability and adaptability.

Firstly, we argue that a key characteristic of mobile applications is the need for up-to-date location-dependent information, and adaptability to local configurations while the physical location of users changes frequently. Then, we discuss MAGNET – a model for dynamic trading and its implementation using a tuplespace paradigm. Further, we provide an extensive description

of the support for information monitoring, dynamic adaptability and scalability. Presented features are illustrated on a typical real-world scenario – adaptable resource allocation.

In the business climate an increasing number of people are expected to perform complex work-related tasks while on the move. In some of these systems, the movement of the mobile user to different physical locations results in the volatility of location-dependent information. For example, the answer to the question, "Where is the nearest train station?" changes as a mobile user roams around its environment. Therefore, a key requirement of weakly connected mobile users (that is, those dialling in over a mobile network) is the availability of dynamically updated location-dependent information and the support for runtime adaptability to reflect the frequent changes in the physical environment.

Therefore, the need for dedicated support for mobile applications has become important since working while travelling is becoming more commonplace. In order to meet the needs of this type of dynamic mobile application, a software component enabling dynamic runtime matching of services to requests is needed. That is, when a request is made for data or a service, a third-party software component must match the request to the services. This software component is known as a trader. The unique thing about a mobile system's trader is that it must monitor the environment to detect changes so that it can adapt the system accordingly.

Only recently have improvements in hardware support for wireless computing enabled mobile application requirements to be fulfilled. Key advances in hardware technologies allowing the current boom in mobile computing include: improvements in reliability, speed and coverage of wireless communication, decreasing hardware size/weight, the invention of the colour LCD display, the trackball and touch pads, combined with rapid improvements in mobile telephony. The timely combination of these achievements has enabled the widespread use of PDAs—small, lightweight transportable computers, designed for specific mobile applications running dedicated software.

In this chapter, we focus on the problem of availability of dynamically updated location-aware information, rather than "classical" mobile problems dealing with the fluctuation in quality of a wireless communication network or changing degree of connectivity. Therefore, we define a "mobile application" as a distributed application run by mobile users (e.g., users with portables working while in transit, tourists while sightseeing, taxi drivers, etc.) processing location-dependent information (e.g., a local resource, local "data," or location-based request) in a changing environment.