

Chapter XXIV

Mobility Support Resource Management for Mobile Networks

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ABSTRACT

Limitation of wireless resources is the main obstacle for meeting the widespread demands in the cellular network technology. The crisis of resources is further augmented when reservation is made for supporting the migrating users from the neighbouring cells. Many mobility support advanced technologies and mobile communications protocols have been developed to optimally utilize wireless resources. Some policies support the heterogeneous access technologies for multimedia services in mobile networks. Some other policies exploit the mobility information from the current and neighbouring cells to dynamically adjust the key components of resource management such as resource reservation, resource allocation, and call admission control policy to adapt quickly with network traffic changes. This chapter provides a comprehensive overview of various methods to explain the mechanisms for managing these key components of resource management for cellular networks.

INTRODUCTION

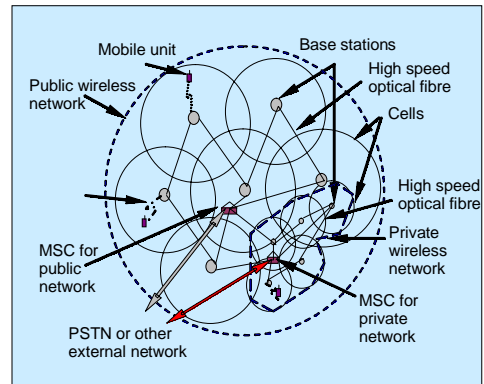
Next-generation mobile networks will support real-time interactive multimedia applications such as interactive video-on-demand, videoconferencing, teleconferencing, remote diagnosis, tele-operations, and so forth, besides its existing applications of voice conversation,

virtual office management, file downloading, e-mail, and Internet browsing. Mobile users are likely to demand the same *quality of service* (QoS) guarantees for multimedia data transmission as is available for wired networks. Currently, this expectation cannot be achieved, as the transmission capacity in wireless networks is much less than that in the wired

networks. Unlike wired networks, where it is possible to de-route the data or use more than one physical link to get higher capacity, wireless communication does not lend itself to such de-routing. Furthermore, mobility of hosts and channel imperfection make the QoS provision a far more challenging task in mobile networks. For example, a mobile unit admitted into the networks in a cell with satisfactory resources may face difficulty in continuing with required QoS soon after handing it off into a cell having little or no resources to offer. The problem becomes even more challenging with next-generation wireless networks where smaller-size cells will be implemented to allow higher transmission rates required for the multimedia applications. Smaller-size cells increase the handoff rate and result in rapid changes in the network traffic conditions, making the QoS guarantees more difficult (Oliviera, Kim, & Suda, 1998). So, resource management is the key area of research for getting effective implementation of mobile networks.

The bandwidth limitation problem in mobile networks can be partially compensated through transmitting data via wired medium, if possible. Therefore, a B3G/4G mobile network comprises both a wired network and a cellular wireless network. The *mobile unit* (MU), the base station, and the *mobile switching centre* (MSC) are the three constituent elements of a cellular network. An MU may be any handheld device, such as a mobile phone, portable computer, personal digital assistant (PDA), car communication systems, notebook, or any other device capable of communicating via omnidirectional radio waves using a prescribed communication protocol. The geographical area covered by a mobile communication network is divided into several regions known as cells, as shown in Figure 1 (Islam & Murshed, 2004). The communications between all the MUs inside a cell is controlled by a control centre

Figure 1. Typical heterogenous wireless network architecture



known as the base station through using one or more antennae connected with it. To facilitate the communications beyond the coverage of a single cell, all the base stations within a large geographical area are controlled by an MSC. The MSC stores the relevant information associated with all the MUs under its control and acts as a gateway to the external networks such as the Internet, the public-switched telephone network (PSTN), or any other MSC. The base stations are connected to an MSC by the high-speed wired network. As the high-speed optic fibre is assumed to be used in the wired part of mobile networks, the resource crisis is concentrated in the cellular part. The resources in this chapter refer to the bandwidth of omnidirectional radio waves used in cellular networks for performing all sorts of wireless communications required for mobile business.

In the next-generation B3G/4G heterogeneous cellular network configurations, the cell size may vary from a few meters to few kilometres. The smaller cells may reside entirely or partially within a larger cell to meet the higher capacity demand in “hotspots” (congested areas). Besides using the cellular networks in public domain, smaller cellular net-

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