Chapter LVIII
Combining Small and Large Scale Roaming Parameters to Optimize the Design of PCS

Mohamed Zaki
Azhar University, Egypt

Salah Ramadan
Azhar University, Egypt

ABSTRACT

The cellular principle is an effective way to guarantee efficient utilization of the offered radio band. Although PCS networks use the cellular principle, the next generation of PCS networks needs more improvements in location management to face the increased number of users. Both an Enhanced Profile-Based Strategy (EPBS) for small-scale roaming and a Caching Two-Level Forwarding Pointer (C2LFP) strategy for large-scale roaming have been proposed. This chapter introduces a model that unites the above two strategies. The idea behind this model is based on applying those two location management strategies and specifying the physical parameters of PCS networks from mobility management's point of view so that the underlying solutions can be more cost effective for location management. An evolutionary method using a constraint Genetic Algorithm (GA) has been used to achieve network parameters optimization. For convenience, we selected the planning problem with an appropriate set of parameters to be treated both genetically and analytically. Thus one can easily verify accuracy and efficiency of the evolutionary solution that would be obtained from the genetic algorithm. For more realistic environments, GA could be used reliably to solve sophisticated problems that combine the small-scale and large-scale roaming parameters of PCS networks. A case study is presented to provide a deep explanation of the proposed integration approach.

1 INTRODUCTION

The limited bandwidth for Personal Communication Systems (PCS's) can restrain the growth of the population of mobile customers. In addition, the next-generation of PCS networks should meet the increased requirements in both bandwidth and performance to offer the new demanded services. The bottleneck here is the number of location registrations which leads to a higher demand for switching capacity and signaling links. Definitely, the mobile users must be able to move from one location to another while maintaining access capacity to services regardless of their locations. Therefore, the role of location management in the network is to keep track of Mobile Terminals' (MT's) location information so that calls can be correctly delivered **(Lin, 2003; Lin,2000)**.

Location management is the process of allowing the network to know the attachment point of the mobile user for a successful call delivery. Current location management techniques involve certain database architecture and signaling messages transmission over the PCS network **(Tabbane, 1997; Wong, 2000).** The location management process in a PCS network may use a two-tier system of Home Location Register (HLR) and Visitor Location Register (VLR) databases **(Akyildiz, 1999).** According to these databases, the existing location management scheme allow the mobile user to perform location update at HLR level whenever that user crosses the boundary of an VLR area and deregisters at the previous VLR. Thus, the registrations will generate high signaling traffic as a result of many location updates to the HLR. Since many users are far away from their HLRs, heavy signaling traffic over the network can occur. This problem has been solved in the caching two-level forwarding pointer scheme.

In the case of roaming inside the VLR area, every time the user crosses the boundary of a location area, the existing location management scheme allows the mobile user to perform location update at the VLR level. Thus, the VLR location updates result in high traffic when many users update their locations to the VLR. This problem has been solved in the enhanced profile-based scheme; Figure 1 shows PCS network architecture illustrating two types of roaming. We developed those two roaming solutions where one is for small-scale roaming **(Ramadan S. M., 2004)** and the other is for large-scale roaming **(Ramadan S. M., 2003).** However, the PCS planner can face a problem in developing the locator program using such both solutions in one framework.

Moreover, an evolutionary approach is used to construct this framework, by making use of a GA chromosome, to integrate the small-scale and

Figure 1. PCS Network Architecture