Chapter 7.41
A Bio-Inspired Approach for the Next Generation of Cellular Systems

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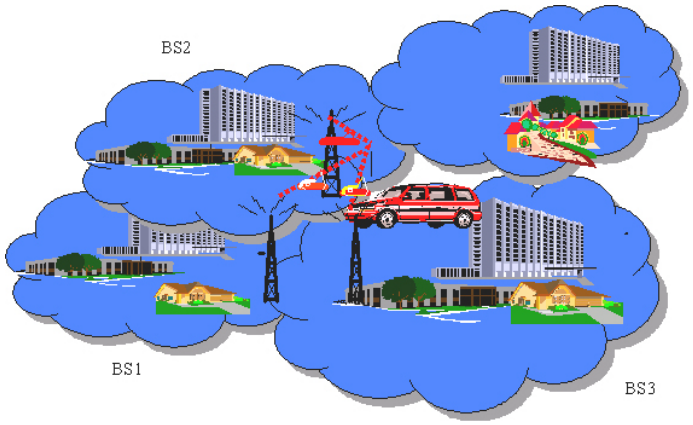
INTRODUCTION

In the current 3G systems and the upcoming 4G wireless systems, *missing neighbor pilot* refers to the condition of receiving a high-level pilot signal from a Base Station (BS) that is not listed in the mobile receiver's neighbor list (LCC International, 2004; Agilent Technologies, 2005). This pilot signal interferes with the existing ongoing call, causing the call to be possibly dropped and

Figure 1. Missing pilot scenario



increasing the handoff call dropping probability. Figure 1 describes the missing pilot scenario where BS1 provides the highest pilot signal compared to BS1 and BS2's signals. Unfortunately, this pilot is not listed in the mobile user's active list.

The horizontal and vertical handoff algorithms are based on continuous measurements made by the user equipment (UE) on the Primary Scrambling Code of the Common Pilot Channel (CPICH). In *3G systems,* UE attempts to measure the quality of all received CPICH pilots using the Ec/Io and picks a dominant one from a cellular system (Chiung & Wu, 2001; El-Said, Kumar, & Elmaghraby, 2003). The UE interacts with any of the available radio access networks based on its memorization to the neighboring BSs. As the UE moves throughout the network, the serving BS must constantly update it with neighbor lists, which tell the UE which CPICH pilots it should be measuring for handoff purposes. In *4G systems*, CPICH pilots would be generated from any wireless system including the 3G systems (Bhashyam, Sayeed, & Aazhang, 2000). Due to the complex heterogeneity of the 4G radio access network environment, the UE is expected to suffer from various carrier interoperability problems. Among these problems, the missing neighbor pilot is considered to be the most dangerous one that faces the 4G industry.

The wireless industry responded to this problem by using an inefficient traditional solution relying on using antenna downtilt such as given in Figure 2. This solution requires shifting the antenna's radiation pattern using a mechanical adjustment, which is very expensive for the cellular carrier. In addition, this solution is permanent and is not adaptive to the cellular network status (Agilent Technologies, 2005; Metawave, 2005).

Therefore, a self-managing solution approach is necessary to solve this critical problem. Whisnant, Kalbarczyk, and Iyer (2003) introduced a system model for dynamically reconfiguring application software. Their model relies on considering the application's static structure and run-time behaviors to construct a workable version of reconfiguration software application. Self-managing applications are hard to test and validate because they increase systems complexity (Clancy, 2002). The ability to reconfigure a software application requires the ability to deploy

Figure 2. Missing pilot solution: Antenna downtilt