

Shared Physical Layer and Scalability of the SoftUE

Introduction

This application note describes the concept of the shared physical layer of the SoftUE and how it relates to system configuration.

To achieve the densities required for load testing, it is not practical to implement all layers of the CDMA protocol and simply duplicate it for tens or hundreds of mobiles. Instead, functionality that requires large amounts of processing power and is common to pools of mobile terminals can be implemented in such a way that multiple phones share certain processing elements. In addition to eliminating the redundancies resulting from repeated instantiations of common functionality, the SoftUE architecture has been designed to provide the modularity and scalability necessary to cover a wide range of test requirements.

Elements & Hardware Modules

A basic SoftUE element supports 4 sector antenna ports, one CDMA carrier and a pool of 128 virtual mobile terminals (VMTs). Each VMT within this pool is completely free to *move* around the simulated coverage area of the 4 sectors, and perform soft and softer handoffs between those sectors. A hardware module consists of two compact PCI (cPCI) boards supporting one or more elements. Multiple hardware modules can be arranged in a cPCI chassis, requiring a minimum amount of IF-level reconfiguration, thereby allowing for system expansion and (re)configuration in very flexible ways.

One of the benefits of this modular concept is that a single module represents a complete, self-contained multi-sector/multi-carrier configuration. Systems of higher complexity and capacity can be built by simply adding and reconfiguring additional modules.

Multi-dimensional Scaling

SoftUE allows systems under test to be expanded along 3 dimensions: number of carrier frequencies, number of base station sectors, and number of simulated mobiles.

1. By adding modules and programming their IF frontends to operate on different CDMA carriers, a multi-sector, multiple carrier environment can be created, effectively expanding the system along the "carrier axis". In particular, this adds the capability for hard handoff of VMTs between carriers. Note that at any one time, the number of VMTs operating on a carrier is restricted by the VMT pool size of the module(s) assigned to that carrier. This however should be of no practical concern, since the VMT pool size will be as large or larger than the sector pole capacity.

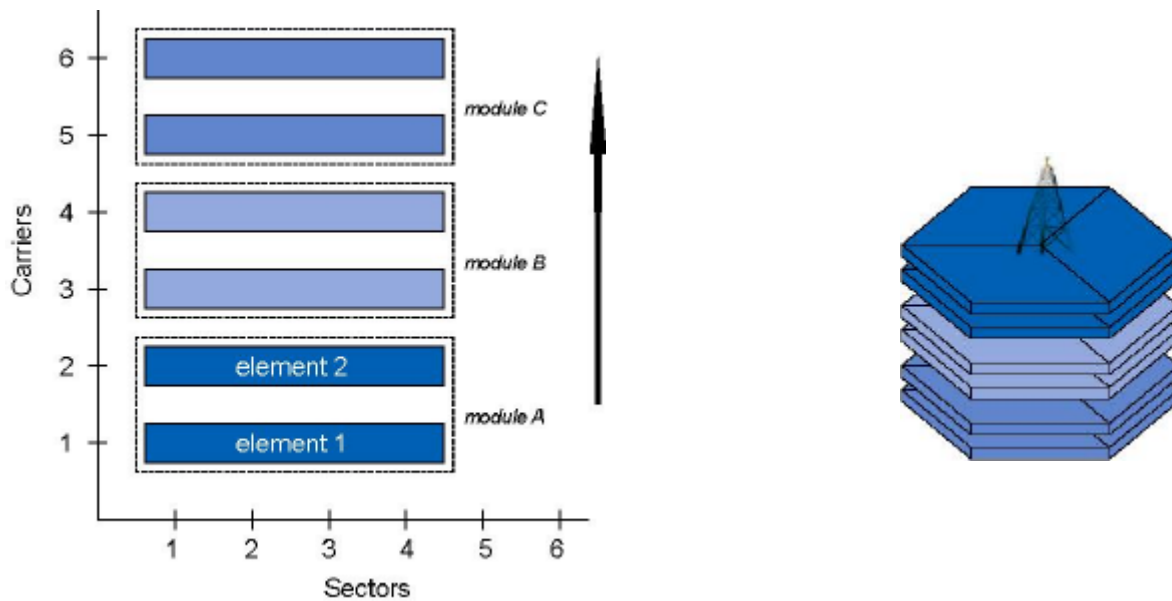


Figure 1: Adding Carrier Frequencies

2. Adding modules and reconfiguring the IF distribution so that a (small) number of sectors are shared between those modules operating on the same carrier, amounts to expansion along the "sector axis". These shared sectors effectively create overlap zones for the otherwise disjoint sets of VMTs.

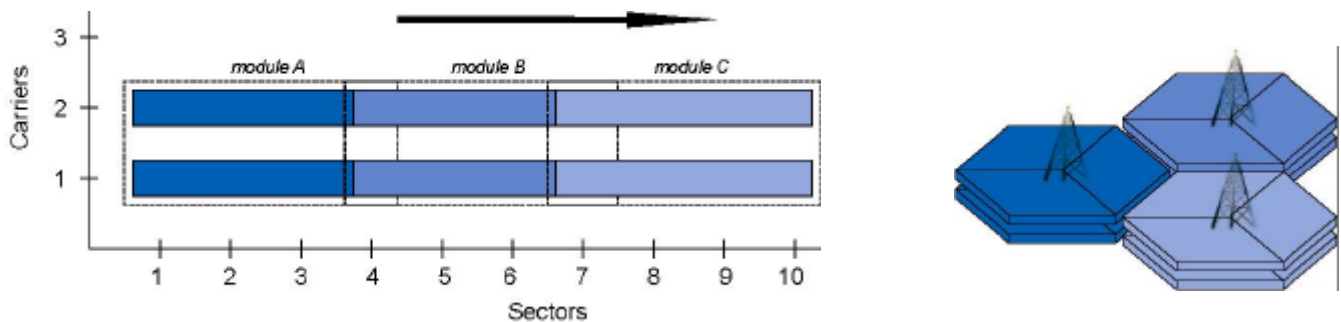


Figure 2: Adding Sectors (base stations)

3. By adding and operating modules on the same CDMA carrier, the VMT density per sector and carrier can be increased in increments of the VMT pool size ("density axis"). Even though it is expected that the VMT pool size per module is sufficient for most typical test scenarios, a need for higher VMT density per sector/carrier might arise, for example testing new algorithms that increase pole capacity.

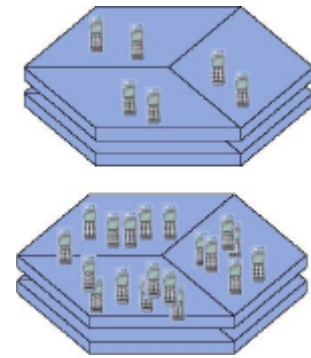
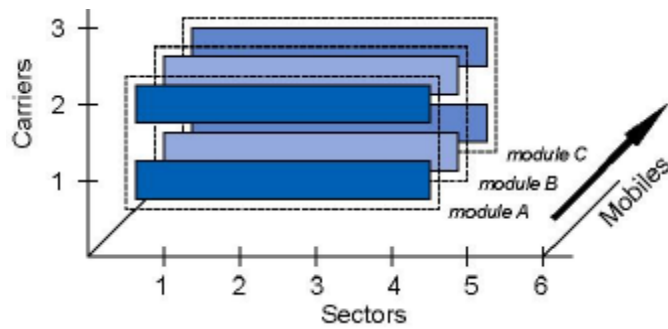


Figure 3: Adding mobile terminals

Any combination of the 3 cases above leads to mixed configurations. For example, it might be desirable to simulate a high concentration area (requiring a base station equipped with a larger number of channel elements) amidst lower density traffic.