Introduction

Digital mobile wireless communication and the Internet have undergone a fantastic growth in the last few years and, despite originating from two different worlds, they are converging. This convergence corresponds to the evolution of mobile systems towards the highest broadband data transmissions (GSM, EDGE/GPRS, UMTS then HSDPA), while the computing world gets equipped with wireless technologies such as Wi-Fi or Wi-Max.

Due to progress and the integration of digital technologies, communication systems (either network systems or user terminals) have become multimode, i.e. able to operate in multiple standards within various frequency bands. Applications, protocol stacks or transceivers are adaptive, optimizing processing based on environmental conditions, users' preferences and provisioned services. Soon, all equipment and systems will be entirely reconfigurable, meeting the vision of software radio developed initially in the military field.

Obviously, this increase of flexibility within the equipment in return requires a more complex management: how should this reconfiguration capability be managed? Why, when and how should reconfiguration be used? Is it possible to design a radio system with a flexible spectrum allocation? What would be the roles of service providers, operators, regulators and users? Who controls what? Which are the technological limits of the reconfiguration? Will the services and users know how to make adjustments?

In this book, our objective is to put forward answers to these questions, by gathering around the theme of reconfigurable radiomobile systems a panel of experts, coming from various horizons: universities, manufacturers and operators, all of them being time users.

Chapter 1, written by Guillaume Dorbes, addresses the new models of services and the applications induced by the technological evolutions associated with the convergence of the fixed and mobile communication systems, showing increasing reconfigurability capability, and bearing in mind that more and more people use them.

The implementation of reconfigurable mobile radio systems requires more and more software. Chapter 2, written by Antoine Delautre and Yann Denef introduces the concept of object modeling in the software context and presents its interest in the reconfigurable systems. A review of the most relevant developments and standards, especially in the military field, is then proposed.

Chapter 3, written by a team of France Telecom R&D engineers, looks into the design of a software radio terminal. The interests of such an approach as well as its underlying constraints are described through concrete examples, at the level of the hardware, of the software and also at the terminal overall architecture.

An example of concrete design of a reconfigurable terminal and a base station is then described in Chapter 4. The mobile communications team group in the Eurecom institute presents a UMTS-TDD software-defined radio platform whose protocol stacks are entirely implemented in C under Linux and thus are totally reconfigurable on request.

This full software approach is then completed by Chapter 5, which discusses hardware reconfiguration. Iannis Krikidis, Lirida Naviner and Jean-Luc Danger propose improvement axes of a *Rake* receiver, by automatic reconfiguration. Various reconfiguration strategies as well as the associated performances are also presented.

Sébastien Roy and Jean-Yves Chouinard extend the topic of hardware reconfiguration by covering in Chapter 6 the specific problem of the multiantenna transmissions (MIMO). Indeed, MIMO is considered by all the recent mobile radio systems. After a presentation of the MIMO systems and their performances, this chapter discusses their practical implementation in reconfigurable architectures.

Chapter 7 focuses on a key element of the software-defined radio: analog-to-digital converters. Firstly, Patrick Loumeau, Lirida Naviner and Jean-François Naviner describe the role of the converters in typical receivers as well as the current performances. They then present various converter structures, especially the most promising ones to be used in reconfigurable mobile radio systems.

Finally, to conclude this book, David Grandblaise extends the flexible spectrum management concept to the most general cognitive radio topic. In fact, the final stage of the reconfigurable mobile radio systems would be to be able to use any standard in any band. Chapter 8 thus presents the (r)evolutions of thought around the spectrum and its management at the regulatory level as well as on concrete techniques which enable to share it efficiently.

This book thus provides an extended overview of the most relevant subjects related to reconfigurable mobile radio systems. A reader involved in this field can stop to the most technical chapters and go into more detail by means of the numerous references given at the end of each chapter, while a reader in a hurry may satisfy himself picking up the sufficient information by simply going through the chapters, in order to understand the problems related to the reconfigurability of a wireless communication system.