Fixed-Mobile Wireless Networks Convergence

Technologies, Solutions, Services

Do you need to understand the technical solutions and associated services that allow multimedia communications between established mobile cellular networks and any form of fixed wireless communications? If so, this practical book, presenting the fundamentals of individual fixed and mobile wireless technologies in terms of architectures, standards, management capabilities, and quality of service issues, is essential reading.

Adopting the term Fixed-Mobile Convergence (FMC), an analysis of the interworking between cellular networks and a variety of wireless technologies such as WLAN, WiMAX, RFID and UWB is provided. An in-depth study of the convergent solutions offered by UMA and IMS is also given, in addition to the commercial realities of implementing convergent solutions. Up-to-date information about technical solutions, products, vendors, and current service offerings is included. You'll also find criteria for analyzing and evaluating fixed-mobile convergent products and services, and numerous diagrams and feature/component tables. This practical text is ideal for engineers and practitioners in the field of telecommunications and wireless communications, as well as for graduate students of electrical and computer engineering.

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CAMBRIDGE
UNIVERSITY PRESS

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Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment,
a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of
education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9780521513562

First published 2008

A catalogue record for this publication is available from the British Library

Library of Congress Cataloging-in-Publication data
Ghetie, Iosif G.
Fixed-mobile wireless networks convergence : technologies, solutions, services / Joseph Ghetie.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-521-51356-2 (hardback)
1. Internet telephony. 2. Mobile communication systems. 3. Cellular telephone systems. 4. Telephone.
5. Convergence (Telecommunication) 6. Bluetooth technology. 7. Radio frequency identification systems.
I. Title.
TK5105.8865.G52 2008
004.6´2 – dc22 2008015446

ISBN 978-0-521-51356-2 Hardback

I dedicate this book to my granddaughters,
Nadia and Talia,
with the wish they discover that science is the key to understanding our universe and that art is the key to understanding human beings and the human spirit.

Contents

Part III Fixed Wireless Technologies: Networking and Management

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How the Book is Organized

The book consists of six major parts organized into 20 chapters. The first part describes the fundamental concepts of wireless communication and networking along with the concepts of network and service management. The second part is focused on one of the entities of convergence, cellular mobile radio networks with their network and service management capabilities. The third part presents the other side of the convergence equation, the fixed wireless technologies that span from local area networks, to personal area networks, to near-field sensor networks, and metropolitan access networks. The fourth part introduces all the elements of fixed-mobile convergence analyzing the particular architectural solutions, products, and services that result from the integration between each form of fixed wireless network and mobile cellular network. Several convergent implementations case studies are analyzed. The fifth part is dedicated to an in-depth analysis of two major standardized sets of solutions and specifications that provide a total approach to convergence, namely, the Unlicensed Mobile Access (UMA) and IP-based Multimedia Subsystem (IMS) with particular references to signaling using the Session Initiation Protocol (SIP). The sixth part provides an overall analysis of convergent services, quality of service, service providers, industry trends, economics of convergence, and evaluation criteria for fixed-mobile solutions/products as well as issues regarding design, development, and implementation of fixed-mobile convergence.

The organization of this book is simple. First, we introduce the palette of individual wireless technologies with a magnifying glass to show what is important and relevant to convergence, i.e., architectures, standards, management capabilities, and quality of services. Then we look at the individual approaches taken for converging pairs of fixed wireless and cellular mobile networks. Next, we provide a more in-depth look at the global convergent solutions offered by UMA and IMS. Finally, we analyze the marketing projection of convergent solutions, keeping an eye on the real issues when implementing these solutions.

Part I. Wireless Communications: Networking and Management

Chapter 1 is an overview of the world of wireless communications as supported through various architectures with a diverse set of components and spectrum allocations.

Chapter 2 presents the overall concept of open network management systems, management platforms, layered communication architectures, management protocols, and

specific management requirements for wireless communications along with network management products.

Chapter 3 presents the service management concept and its components, classes of services, quality of service, and service level agreements/specifications along with specific service management products.

Part II. Cellular Mobile Radio Networking and Management

Chapter 4 provides an overview of cellular mobile radio networking architectures, and radio link access methods. Identification of spectrum allocation for specific technologies, standards organizations, and overall generational evolution steps are all intended to provide a common view of the primary entity of the fixed-mobile convergence equation.

Chapter 5 investigates specific aspects of cellular mobile networks and service management with focus on GSM/GPRS classes of services and GPRS service profiles.

Part III. Fixed Wireless Technologies: Networking and Management

Chapter 6 analyzes the wireless local area network environment from architecture to specific standards implementation with a special focus on challenges raised by transmitting voice over wireless LANs, a key requirement for convergence.

Chapter 7 analyzes the wireless personal area network environment from architectures to major standards implementations (Bluetooth and ZigBee) including analysis of QOS in wireless PAN environment.

Chapter 8 analyzes the evolution of wireless metropolitan access solutions with focus on WiMAX architecture, solutions, standards, and products.

Chapter 9 is dedicated to the analysis of near-field sensor networks from architectures to major standard implementations (RF Identification, Near Field Communications and Ultra Wide Band) along with network and service management capabilities.

Part IV. Fixed Wireless Cellular Mobile Networks Convergence and Integration

Chapter 10 provides an overview of the fixed-mobile concept that includes terminology, architectural components, interfaces, and protocols, including the overall requirements, solutions, and technical forums created to advance fixed-mobile convergent concepts.

Chapter 11 presents the specific architectural solutions, applications, products, and services created as part of the technical effort to provide convergence between wireless LANs (IEEE 802.11 a/b/g/n and WLAN Mesh) and cellular mobile networks. Several convergent implementations case studies are analyzed.

Chapter 12 presents the specific architectural solutions, applications, products, and services born out of the convergence between wireless PANs (Bluetooth and ZigBee)

and cellular mobile networks. Several convergent implementations case studies are analyzed.

Chapter 13 presents the specific architectural solutions, applications, products, and services aimed at incorporating wireless metropolitan access, represented by WiMAX technology, into wide area cellular mobile networks. Several convergent implementations case studies are analyzed.

Chapter 14 presents the specific architectural solutions, applications, products, and services created as part of the technical effort to extend fixed-mobile convergence to incorporate the convergence between wireless near-field sensor networks (RFID, NFC, UWB) and cellular mobile networks. Several convergent implementations case studies are analyzed.

Part V. Fixed Wireless Cellular Mobile Convergence: Standardized Networking Solutions

Chapter 15 is a comprehensive presentation of the Unlicensed Mobile Access (UMA) set of standard specifications. It includes an overview of UMA evolution, driving forces, and specific architectures to incorporate the convergence aspects in a unique approach that spans wireless LANs, PANs, WiMAX, and sensor networks. Details about UMA network design, the UMA Network Controller, signaling protocols for voice and data communications, and interoperability parameters in UMA operations are supplemented by UMA-based fixed-mobile convergence solutions and products.

Chapter 16 is a comprehensive analysis of the signaling protocol of choice for IMS-based networks, namely, the Session Initiation Protocol (SIP). Details about SIP development, acceptance, applicability and actual standards include SIP message formats, fields, optional parameters and specific implementation of this protocol in voice over IP operations and IMS-based network design and operations.

Chapter 17 is a comprehensive presentation of the IP-based Multimedia Subsystem (IMS) set of standard specifications. It includes an overview of IMS evolution, driving forces, high-level conceptual architecture, specific architectural components, sub modules, functions, and the all-important stepping-stones for convergence not only within the wireless world but also between wired and wireless networks. Details about standards, proposed amendments, signaling specifications, and interoperability parameters in IMS operations are supplemented by analysis of partial implementations of IMS-based fixed-mobile convergence products and services.

Part VI. Fixed-Mobile Convergence Services, Industry Trends, and Implementation Issues

Chapter 18 looks into Quality of Service (QOS) aspects of fixed wireless cellular mobile networking solutions from the perspective of both voice and data parameters, and associated QOS metrics. Integrated/Differentiated Services, Multi-Protocol Label Switching,

and Policy-based Management are also analyzed. Specific services and service providers of convergent solutions in both UMA-based and IMS-based networks are identified and analyzed.

Chapter 19 provides the economic perspective of fixed-mobile convergence starting with the driving forces and opponents of convergence, This is followed by diagrams depicting projected growth of various convergent applications in the domain of wireless LANs, PANs, WiMAX, and sensor networks along with the growth of the telecommunications industry in general, and the mobile communications sector in particular. A comprehensive set of evaluation criteria was developed to analyze and qualify fixed-mobile convergent solutions and products.

Chapter 20 is a summary of benefits of fixed-mobile convergence followed by an analysis of the state of implementations and trends in fixed-mobile convergence. A detailed list of issues confronting fixed-mobile convergence implementation in both UMA-based and IMS-based versions concludes this chapter.

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