

Radio Network Planning And Optimisation For Umts

A highly practical guide rooted in theory to include the necessary background for taking the reader through the planning, implementation and management stages for each type of cellular network. Present day cellular networks are a mixture of the technologies like GSM, EGPRS and WCDMA. They even contain features of the technologies that will lead us to the fourth generation networks. Designing and optimising these complex networks requires much deeper understanding. Advanced Cellular Network Planning and Optimisation presents radio, transmission and core network planning and optimisation aspects for GSM, EGPRS and WCDMA networks with focus on practical aspects of the field. Experts from each of the domains have brought their experiences under one book making it an essential read for design practitioners, experts, scientists and students working in the cellular industry. Key Highlights Focus on radio, transmission and core network planning and optimisation Covers GSM, EGPRS, WCDMA network planning & optimisation Gives an introduction to the networks/technologies beyond WCDMA, and explores its current status and future potential Examines the full range of potential scenarios and problems faced by those who design cellular networks and provides advice and solutions

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all backed up with real-world examples This text will serve as a handbook to anyone engaged in the design, deployment, performance and business of Cellular Networks. "Efficient planning and optimization of mobile networks are key to guarantee superior quality of service and user experience. They also form the essential foundation for the success of future technology development, making this book a valuable read on the road towards 4G." —Tero Ojanperä, Chief Technology Officer, Nokia Networks

This book covers the latest theories, applications and techniques in Biologically-Inspired Optimisation Methods. Many chapters derive from studies presented at workshops and international conferences on e-Science, Grid Computing and Evolutionary computation.

LTE-Advanced is the new Global standard which is expected to create a foundation for the future wireless broadband services. The standard incorporates all the latest technologies recently developed in the field of wireless communications. Presented in a modular style, the book provides an introductory description for beginners as well as practical guidelines for telecom specialists. It contains an introductory module that is suitable for the initial studies of the technology based on the 3GPP Release 10, 11 and beyond of LTE and SAE. The latter part of the book is suitable for experienced professionals who will benefit

from the practical descriptions of the physical core and radio network planning, end-to-end performance measurements, physical network construction and optimization of the system. The focus of the book is in the functioning, planning, construction, measurements and optimization of the radio and core networks of the Release 10 and beyond of the 3GPP LTE and SAE standards. It looks at the practical description of the Advanced version of the LTE/SAE, how to de-mystify the LTE-Advanced functionality and planning, and how to carry out practical measurements of the system. In general, the book describes "how-to-do-it" for the 4G system which is compliant with the ITU-R requirements.

This comprehensive volume provides state-of-the art guidance on Quality of Service (QoS) and Quality of end-user Experience (QoE) management in UMTS cellular systems, tackling planning, provisioning, monitoring and optimisation issues in a single accessible resource. In addition, a detailed discussion is provided on service applications, QoS concept, architecture and functions in access, packet & circuit switched core and backbone networks. Defines and explains the differences between QoS and QoE, and end-to-end concept, based on the premise that it is the end-user who is the ultimate beneficiary of QoS. Covers QoS and QoE issues related to present and forthcoming service applications, including multimedia messaging service (MMS), Video Sharing

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(VS), content download, business connectivity, Push to talk over Cellular (PoC), Voice over IP (VoIP), presence, instant messaging, gaming, streaming and browsing. Presents QoS concepts and architecture as defined in 3GPP Releases 97/98, 99, 5, 6, and 7, and provides a comprehensive description of protocols and packet data transfer across WCDMA evolved and (E)GPRS networks. Discusses service driven radio network planning aspects for (E)GPRS and WCDMA. Includes three detailed chapters covering concepts, means and methods for QoS provisioning, QoS & QoE performance monitoring and optimisation. This book is aimed at operators, vendors, deployers, consultants and managers specialising in the research, development, implementation, marketing and sales of products and tools for QoS and QoE management in UMTS networks. It will also be of interest to postgraduate students and researchers in the field of telecommunications and specialising in UMTS QoS and QoE principles and practices.

In June 2000, GTEL (Wireless Telecommunications Research Group) at the Federal University of Ceara was founded by Professor Rodrigo Cavalcanti and his colleagues with the mission of developing wireless communications technology and impact the development of the Brazilian telecommunications sector. From the start, this research effort has been supported by Ericsson Research providing

a dynamic environment where academia and industry together can address timely and relevant research challenges. This book summarized much of the research output that has resulted from GTEL's efforts. It provides a comprehensive treatment of the physical and multiple access layers in mobile communication systems describing different generations of systems but with a focus on 3G systems. The team of Professor C- alcanti has contributed scienti- cally to the development of this eld and built up an impressive expertise. In the chapters that follow, they share their views and kno- edge on the underlying principles and technical trade-offs when designing the air interface of 3G systems. The complexity of 3G systems and the interaction between the physical and m- tiple access layers present a tremendous challenge when modeling, designing, and analyzing the mobile communication system. Herein, the authors tackle this pr- lem in an impressive manner. Their work is very much in line with the developments in 3GPP providing a deeper understanding of the evolution of 3G and also future enhancements.

Why is high performance indoor wireless service needed, and how is it best implemented? As the challenge of providing better service and higher data speeds and quality for mobile applications intensifies, ensuring adequate in- building and tunnel coverage and capacity is increasingly important. A unique,

single-source reference on the theoretical and practical knowledge behind indoor and tunnel radio planning, this book provides a detailed overview of mobile networks systems, coverage and capacity solutions with 2G, 3G and 4G cellular system technologies as a backdrop.

Covering the key functional areas of LTE Self-Organising Networks (SON), this book introduces the topic at an advanced level before examining the state-of-the-art concepts. The required background on LTE network scenarios, technologies and general SON concepts is first given to allow readers with basic knowledge of mobile networks to understand the detailed discussion of key SON functional areas (self-configuration, -optimisation, -healing). Later, the book provides details and references for advanced readers familiar with LTE and SON, including the latest status of 3GPP standardisation. Based on the defined next generation mobile networks (NGMN) and 3GPP SON use cases, the book elaborates to give the full picture of a SON-enabled system including its enabling technologies, architecture and operation. "Heterogeneous networks" including different cell hierarchy levels and multiple radio access technologies as a new driver for SON are also discussed. Introduces the functional areas of LTE SON (self-optimisation, -configuration and -healing) and its standardisation, also giving NGMN and 3GPP use cases Explains the drivers, requirements, challenges,

enabling technologies and architectures for a SON-enabled system Covers multi-technology (2G/3G) aspects as well as core network and end-to-end operational aspects Written by experts who have been contributing to the development and standardisation of the LTE self-organising networks concept since its inception Examines the impact of new network architectures (“Heterogeneous Networks”) to network operation, for example multiple cell layers and radio access technologies

Radio Network Planning and Optimisation for UMTS, Second Edition, is a comprehensive and fully updated introduction to WCDMA radio access technology used in UMTS, featuring new content on key developments. Written by leading experts at Nokia, the first edition quickly established itself as a best-selling and highly respected book on how to dimension, plan and optimise UMTS networks. This valuable text examines current and future radio network management issues and their impact on network performance as well as the relevant capacity and coverage enhancement methods. In addition to coverage of WCDMA radio access technology used in UMTS, and the planning and optimisation of such a system, the service control and management concept in WCDMA and GPRS networks are also introduced. This is an excellent source of information for those considering future cellular networks where Quality of Service (QoS) is of paramount importance. Key features of the Second Edition include: High-Speed Downlink Packet Access (HSDPA) – physical layer, dimensioning and radio resource management Quality of Service (QoS) mechanisms in network for service differentiation Multiple Input – Multiple Output (MIMO) technology Practical network optimisation examples

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Service optimisation for UMTS and GPRS/EDGE capacity optimisation The 'hot topic' of service control and management in WCDMA and GPRS networks, that has evolved since the first edition Companion website includes: Figures Static radio network simulator implemented in MATLAB® This text will have instant appeal to wireless operators and network and terminal manufacturers. It will also be essential reading for undergraduate and postgraduate students, frequency regulation bodies and all those interested in radio network planning and optimisation, particularly RF network systems engineering professionals.

This broadly applicable book introduces radio system planning, emphasizing theoretical and practical details for the planning of GSM, GPRS and UMTS mobile networks. It explains the key planning parameters for these systems and describes the common tasks in radio system planning.

This book presents the evolutionary and visionary developments of WiMAX! WiMAX Evolution: Emerging Technologies and Applications focuses on the future developments of WiMAX technology. The book discusses the evolutionary aspects of WiMAX, from the physical to the application layer, including visions from industry, standardization and research communities. Several chapters of the book will present very new and unique information as editors and their respective organizations are involved in ongoing international projects on WiMAX, developing advanced WiMAX techniques. The Editors' in-house WiMAX test-beds enhance the book with privileged and seldom published information on practical issues. Key features: Presents evolutionary and visionary developments of WiMAX, motivating and inspiring readers to join and continue the developing work Contains chapters with previously unpublished material, including measurements on real WiMAX equipment and their validation, and introduction of

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robust header compression in WiMAX, and more Unique results on real WiMAX test-beds Covers WiMAX validation, novel scenarios, applications and business, advanced WiMAX architectures, WiMAX extensions, and WiMAX evolution and future developments Expert authorship with a balanced mix of contributions from highly regarded professionals from top research institutes, industry and academia This book is an invaluable resource for product developers, research and standardization engineers in industry, professors, research scientists and advanced students in academia. Technology managers and CTOs will also find this book insightful.

The current book provides a final report of activity performed by the COST 290 Action, “Traffic and QoS Management in Wireless Multimedia Networks,” which ran from March 10, 2004, until June 3, 2008. After an introduction to the COST framework and the Action’s survey time-frame and activities, the main part of the book addresses a number of technical issues, which are structured into several chapters. All those issues have been carefully investigated by the COST 290 community during the course of the project – the information presented in this book can be regarded as ultimate for each particular topic; every open research issue addressed in the book is described carefully, corresponding existing studies are analyzed and results achieved by the COST 290 community are presented and compared, and further research directions are defined and analyzed. Because the book covers a wide area of research addressing issues of modern wired and wireless networking at different layers, starting from the physical layer up to the application layer, it can be recommended to be used by researchers and students to obtain a comprehensive analysis on particular research topics including related areas, to obtain broad and ultimate referencing, and to be advised on current

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open issues. COST 290 is one of the Actions of the European COST Program. Founded in 1971, COST is an intergovernmental framework for European Cooperation in the field of Scientific and Technical Research, allowing the coordination of nationally funded research on a European level.

Written from an operator's viewpoint, HSPA Performance and Evolution explores the lessons learned and techniques developed for optimally deploying HSPA (High Speed Packet Access). The essential distinctions between rolling out HSPA compared to earlier UMTS and GSM technologies are explained covering the many issues that must be specifically handled. Areas in standards which have been left open for interpretation, causing significant differences between vendor implementations, are identified and solutions explored. This book is invaluable in enabling wireless operators to extract maximum performance offered by 3GPP's HSPA radio technology, consisting of both downlink (HSDPA) and uplink (HSUPA) elements. It focuses on real-world performance, sharing practical implementation methods and tradeoffs for deploying, optimizing and maintaining networks using the HSPA air interface. Examines algorithms, equipment and performance perspectives to identify and explain HSPA Measures performance and sets network parameters for optimal tradeoffs Presents results from practical and real-world network performances Explores the evolution of HSPA technology into HSPA+ and eventually next generation LTE technologies

The aim of this book is to enable network planners to realize and maintain cost efficient LTE backhaul networks, which meet the necessary performance requirements. Through an introduction to the technology background, the economical modelling, the dimensioning theory, planning and optimization processes and relevant network management aspects, the reader

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shall obtain all relevant information to achieve good backhaul results in their own network environment. It is aimed at network planners and other experts with responsibilities for LTE IP network dimensioning, LTE network planning, providing and managing leased lines, business management, LTE IP network operation and optimization.

This book sets out to provide the theoretical foundations that will enable radio network planners to plan model and optimize radio networks using state-of-the-art findings from around the globe. It adopts a logical approach, beginning with the background to the present status of UMTS radio network technology, before devoting equal coverage to planning, modelling and optimization issues. All key planning areas are covered, including the technical and legal implications of network infrastructure sharing, hierarchical cell structure (HCS) deployment, ultra-high-site deployment and the benefits and limitations of using computer-aided design (CAD) software. Theoretical models for UMTS technology are explained as generic system models, stand-alone services and mixed services. Business modelling theory and methods are put forward, taking in propagation calculations, link-level, UMTS static and UMTS dynamic simulations. The challenges and goals of the automated optimization process are explored in depth using cutting-edge cost function and optimization algorithms. This theory-based resource containing prolific illustrative case studies explains the reasons for UMTS radio networks performance issues and how to use this foundational knowledge to model, plan and optimize present and future systems.

An overwhelming development has taken place in voice and data communication over the last twenty years as the industry evolved from fixed to mobile and wireless communication. This development is supported with new technologies and evolving

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networks from the first generation (1G), 2G, 3G and the fourth generation (4G) mobile wireless communications. During this evolution and revolution in telecommunications, the industry also changed from circuit switched networks to packet switched networks in 3G and 3G. Hence the planning of telecommunication networks has equally changed significantly. By providing the necessary background and technical content to understand and stay abreast of how to plan the new network types, Planning and Optimisation of 3G and 4G Wireless Networks explores the idiosyncrasies of how to plan the various types of wireless networks. Packed with details of the technologies that support each network type, this cutting-edge reference leads the reader step by step on how to plan and optimize various types of wireless networks. It examines current and emerging network planning and enhancement techniques through examples in HSPA, B3G, WiMAX, mesh networks, personal area networks and wireless sensor networks. It clearly provides the different architectures of these networks along with their support design methods. It includes coverage of the latest wireless network types, planning and optimization methods in the form of: 3G HSPA and Beyond 3G WiMAX (fixed and mobile) and LTE OFDM Wireless mesh networks Personal area networks Propagation models and link budgets Cognitive radio and spectrum sensing Planning of wireless sensor networks Synchronisation of CDMA systems Interference suppression Cross-layer optimisation Topology control Resource management The illustrative planning and optimization methods provide the reader with a clear foot path into future networks.

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This book provides educators, industry practitioners, regulators, researchers and subscribers with the ideal foundation for developing the understanding required to design, deploy, train, and use wireless networks of various types.

A guide to implementing the DVB-H system for the carriage of MobileTV services, The DVB-H Handbook provides an overview of all aspects of the specification. Placing particular emphasis on the technical elements, it includes important information on the signalling and service discovery. The background, functioning, planning and optimisation of DVB-H are systematically explained for use in network planning and optimization. Subjects such as coding, different modes for channel delivery and protection in core and radio system are detailed. Giving examples on the practical interpretation of the DVB-H specifications, this book also describes the process behind the realization of the end-to-end system. • Outlines the functioning, planning and optimization of the complete DVB-H system • Spans topics from physical network planning and link layer specifications, to application ingredients such as EPGs and audiovisual streaming technologies • Uses illustrations and selected case examples reflecting real-life practice to give greater understanding • Functions as an overview of the topic, as well as a tutorial for implementing the system • A must-read for beginners as well as established experts within the field of Mobile broadcasting

Telecommunications Network Design And Management represents the state-of-the-art of applying operations research techniques and solutions across a broad spectrum of

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telecommunications problems and implementation issues. -The first three chapters of the book deal with the design of wireless networks, including UMTS and Ad-Hoc networks. -Chapters 4-6 deal with the optimal design of telecommunications networks. Techniques used for network design range from genetic algorithms to combinatorial optimization heuristics. -Chapters 7-10 analyze traffic flow in telecommunications networks, focusing on optimizing traffic load distribution and the scheduling of switches under multi-media streams and heavy traffic. -Chapters 11-14 deal with telecommunications network management, examining bandwidth provisioning, admission control, queue management, dynamic routing, and feedback regulation in order to ensure that the network performance is optimized. -Chapters 15-16 deal with the construction of topologies and allocation of bandwidth to ensure quality-of-service. Mobile Broadband Multimedia Networks: Techniques, Models and Tools for 4G provides the main results of the prestigious and well known European COST 273 research project on the development of next generation mobile and wireless communication systems. Based on the applied research of over 350 participants in academia and industry, this book focuses on the radio aspects of mobile and wireless broadband multimedia communications, by exploring and developing new methods, models, techniques, strategies and tools towards the implementation of 4th generation mobile and wireless communication systems. This complete reference includes topics ranging from transmission and signal processing techniques to antennas and diversity,

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ultra wide band, MIMO and reference scenarios for radio network simulation and evaluation. This book will be an ideal source of the latest developments in mobile multimedia broadband technologies for researchers, R&D engineers, graduates and engineers in industry implementing simulation models and conducting measurements. Based on the well known and respected research of the COST 273 project 'Towards Mobile Broadband Multimedia Networks', whose previous models have been adopted by standardisation bodies such as ITU, ETSI and 3GPP Gives methods, techniques, models and tools for developing 4th generation mobile and wireless communication systems Includes the latest development of key technologies and methods such as MIMO systems, ultra wide-band and OFDM

This book constitutes the refereed proceedings of the 7th European Conference on Evolutionary Computation in Combinatorial Optimization, EvoCOP 2007, held in Valencia, Spain in April 2007. The 21 revised full papers cover evolutionary algorithms as well as various other metaheuristics, like scatter search, tabu search, memetic algorithms, variable neighborhood search, ant colony optimization, and particle swarm optimization algorithms.

Radio Network Planning and Optimisation for UMTS John Wiley & Sons

“By 2008, some 2 billion people will be using mobile phones and devices, in many cases to access advanced data services. Against this backdrop, the need for efficient and effective network design will be critical to the success of increasingly complex

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mobile networks.” Simon Beresford-Wyllie (SVP, Nokia Networks) With the complexity of the cellular networks increasing day by day, a deeper understanding of the design and performance of end-to-end cellular networks is required. Moreover, all the types of networks from 2G-2.5G-3G seem to co-exist. Fundamentals of Cellular Network Planning and Optimisation covers end-to-end network planning and optimisation aspects from second generation GSM to third generation WCDMA networks including GPRS and EDGE networks. All the sub-systems of the network i.e. radio network, transmission network and core network have been covered with focus on both practical and theoretical issues. By bringing all these concepts under one cover, this book becomes essential reading for the network design engineers working either with cellular service vendors or operators, experts/scientists working on end-to-end issues and undergraduate/post-graduate students. Key Highlights: Distinctly divided into four parts: 2G (GSM), 2.5G (GPRS & EDGE), 3G (WCDMA) and introduction to 4G (OFDM, ALL-IP, WLAN Overview) respectively Each part focuses on the radio, transmission and core networks. Concentrates on cellular network planning process and explains the underlying principles behind the planning and optimizing of the cellular networks. The text will serve as a handbook for anyone engaged in the study, design, deployment and business of cellular networks.

Most books on network planning and optimization provide limited coverage of either GSM or WCDMA techniques. Few scrape the surface of HSPA, and even fewer deal

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with TD-SCDMA. Filling this void, Evolved Cellular Network Planning and Optimization for UMTS and LTE presents an accessible introduction to all stages of planning and optimizing UMTS, HSPA,

Ulrich Türke introduces innovative models and algorithms for the evaluation of WCDMA/UMTS network performance. He establishes an advanced snapshot analysis method which allows the efficient and accurate analysis of large radio networks. The author develops two statistical evaluation methods which furnish quick approximations of relevant results from snapshot simulations. Finally, he discusses the application of these methods to automatic network optimization. The majority of the developed strategies are successfully applied in a commercial radio network planning and optimization tool.

Updated new edition covering all aspects of network planning and optimization This welcome new edition provides comprehensive coverage of all aspects of network planning in all the technologies, from 2G to 5G, in radio, transmission and core aspects. Written by leading experts in the field, it serves as a handbook for anyone engaged in the study, design, deployment and business of cellular networks. It increases basic understanding of the currently deployed, and emerging, technologies, and helps to make evolution plans for future networks. The book also provides an overview of the forthcoming technologies that are expected to make an impact in the future, such as 5G. Fundamentals of Cellular Network Planning and Optimization, Second Edition

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encompasses all the technologies as well as the planning and implementation details that go with them. It covers 2G (GSM, EGPRS), 3G (WCDMA) and 4G (LTE) networks and introduces 5G. The book also looks at all the sub-systems of the network, focusing on both the practical and theoretical issues. Provides comprehensive coverage of the planning aspects of the full range of today's mobile network systems, covering radio access network, circuit and packet switching, signaling, control, and backhaul/Core transmission networks New elements in book include HSPA, Ethernet, 4G/LTE and 5G Covers areas such as Virtualization, IoT, Artificial Intelligence, Spectrum Management and Cloud By bringing all these concepts under one cover, Fundamentals of Cellular Network Planning and Optimization becomes essential reading for network design engineers working with cellular service vendors or operators, experts/scientists working on end-to-end issues, and undergraduate/post-graduate students.

Terrestrial Trunked Radio (TETRA) has become the tool to design any type of public security systems, in particular due to the strongly increased security demands for mobile systems. In this book, the authors show how TETRA can be strongly improved and these improvements will most probably be part of future TETRA standards. The areas examined include channel assignment and multiple access techniques, video transmission, wireless LAN integration, and the establishment of multiple wireless mesh networks. Since the requirements for these networks is security, the authors show that innovative techniques such as those based on chaotic signals can be used in order to

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maximize security. The book is a vital reference point for researchers with ambition to find the general solution for modern problems of public safety.

UMTS Network Planning, Optimization, and Inter-Operation with GSM is an accessible, one-stop reference to help engineers effectively reduce the time and costs involved in UMTS deployment and optimization. Rahnema includes detailed coverage from both a theoretical and practical perspective on the planning and optimization aspects of UMTS, and a number of other new techniques to help operators get the most out of their networks. Provides an end-to-end perspective, from network design to optimization Incorporates the hands-on experiences of numerous researchers Single authorship allows for strong coherency and accessibility Details the complete iteration cycle of radio link budgeting for coverage planning and dimensioning Rahnema demonstrates detailed formulation of radio capacity and coverage in UMTS, and discusses the tradeoffs involved. He presents complete link budgeting and iterative simulations for capacity and coverage planning, along with practical guidelines. UMTS Network Planning contains seventeen cohesive and well-organized chapters which cover numerous topics, including: Radio channel structures, radio channel models, parameters, model tuning Techniques for capacity and coverage enhancements Complete treatment of power control, handoffs and radio resource practical management processes and parameters Detailed coverage of TCP protocol enhancement for operation over wireless links, particularly UMTS Application of GSM

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measurements to plan and re-engineer for UMTS radio sites Guidelines for site co-location with GSM, the QOS classes, parameters and inter-workings in UMTS AMR voice codecs and tradeoffs, core and access network design, architectural evolution, and protocols Comprehensive discussion and presentation of practical techniques for radio performance analysis, trending, and troubleshooting Perfect for professionals in the field and researchers specializing in network enhancement. Engineers working on other air interfaces and next generation technologies will find many of the techniques introduced helpful in designing and deploying future wireless networks as well. Students and professionals new to the wireless field will also find this book to be a good foundation in network planning, performance analysis, and optimization.

High Speed Packet Access (HSPA) is a collection of two mobile telephony protocols, High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA). Allowing networks based on the Universal Mobile Telecommunications System to achieve data rates of several megabits per second, these powerful protocols are ideal for applications

The author establishes a concise system model for UMTS radio networks, which describes interference coupling and its impact on the network. This model is the basis for efficient radio network performance analysis as well as new optimization methods for automatic planning.

In cellular networks, a new generation of CDMA or WCDMA-based networks will

start operations in most countries in the near future. The standardized WCDMA technology generates new challenges in radio network planning, optimization and QoS management because of the dynamic nature of its radio interface and various new services and different network operating modes. Moreover, new and modified radio planning phases as well as new field measurements and emphasized QoS management are needed when UMTS networks are designed and optimized. Hence, a practical UMTS planning process must be defined in detail, from dimensioning to optimization tasks. This book follows the UMTS planning process. It is organized in three parts: Part I - UMTS configuration planning; Part II - UMTS topology planning; and Part III - UMTS network functionality. The first chapter in Part I introduces the UMTS and UTRAN systems and radio network planning strategy, and defines a planning process for UMTS. In Chapter 2, the UMTS planning process is covered, and a detailed description of the UMTS power budget is given, with planning threshold examples provided.

This book constitutes the refereed joint proceedings of seven workshops on evolutionary computing, EvoWorkshops 2007, held in Valencia, Spain in April 2007. It examines evolutionary computation in communications, networks, and connected systems; finance and economics; image analysis and signal

processing; and transportation and logistics. Coverage also details evolutionary algorithms in stochastic and dynamic environments.

With the current explosion in network traffic, and mounting pressure on operators' business case, Self-Organizing Networks (SON) play a crucial role. They are conceived to minimize human intervention in engineering processes and at the same time improve system performance to maximize Return-on-Investment (ROI) and secure customer loyalty. Written by leading experts in the planning and optimization of Multi-Technology and Multi-Vendor wireless networks, this book describes the architecture of Multi-Technology SON for GSM, UMTS and LTE, along with the enabling technologies for SON planning, optimization and healing. This is presented mainly from a technology point of view, but also covers some critical business aspects, such as the ROI of the proposed SON functionalities and Use Cases. Key features: Follows a truly Multi-Technology approach: covering not only LTE, but also GSM and UMTS, including architectural considerations of deploying SON in today's GSM and UMTS networks Features detailed discussions about the relevant trade-offs in each Use Case Includes field results of today's GSM and UMTS SON implementations in live networks Addresses the calculation of ROI for Multi-Technology SON, contributing to a more complete and strategic view of the SON paradigm This

book will appeal to network planners, optimization engineers, technical/strategy managers with operators and R&D/system engineers at infrastructure and software vendors. It will also be a useful resource for postgraduate students and researchers in automated wireless network planning and optimization.

This volume contains a selection of papers referring to lectures presented at the symposium "Operations Research 2003" (OR03) held at the Ruprecht Karls-Universitiit Heidelberg, September 3 - 5, 2003. This international conference took place under the auspices of the German Operations Research Society (GOR) and of Dr. Erwin Teufel, prime minister of Baden-Wurttemberg. The symposium had about 500 participants from countries all over the world. It attracted academicians and practitioners working in various field of Operations Research and provided them with the most recent advances in Operations Research and related areas in Economics, Mathematics, and Computer Science. The program consisted of 4 plenary and 13 semi-plenary talks and more than 300 contributed papers selected by the program committee to be presented in 17 sections. Due to a limited number of pages available for the proceedings volume, the length of each article as well as the total number of accepted contributions had to be restricted. Submitted manuscripts have therefore been reviewed and 62 of them have been selected for publication. This refereeing procedure has

been strongly supported by the section chairmen and we would like to express our gratitude to them. Finally, we also would like to thank Dr. Werner Muller from Springer-Verlag for his support in publishing this proceedings volume.

This book provides an in-depth guide to femtocell technologies. In this book, the authors provide a comprehensive and organized explanation of the femtocell concepts, architecture, air interface technologies, and challenging issues arising from the deployment of femtocells, such as interference, mobility management and self-organization. The book details a system level simulation based methodology addressing the key concerns of femtocell deployment such as interference between femto and macrocells, and the performance of both femto and macrocell layers. In addition, key research topics in interference modeling and mitigation, mobility management and Self-Organizing Network (SON) are highlighted. The authors also introduce HNB/HeNB standardization in 3GPP.. Furthermore, access methods (closed, open and hybrid), applications, timing synchronization, health issues, business models and security are discussed. The authors also provide a comparison between femtocells and other indoor coverage techniques such as picocells, repeaters, distributed antenna systems and radio over fiber. Lastly, both CDMA and OFDMA based femtocells are covered. Key Features: Provides a comprehensive reference on femtocells and

related topics Offers the latest research results on femtocells based on simulation and measurements Gives an overview of indoor coverage techniques such as picocells, repeaters, distributed antenna systems, radio over fiber and femtocells Includes chapters on femtocell access network architecture, air interface technologies (GSM, UMTS, HSPA, WiMAX and LTE), femtocell simulation, interference analysis and mitigation in femto/macrocell networks, mobility management in femto/macrocell networks, femtocell self-organization and other key challenges such as timing synchronization and security faced by femtocell deployment Points to over 240 references from 3GPP, The Femto Forum, journals and conference proceedings This book will be an invaluable guide for RF engineers from operators, R&D engineers from femtocells hardware manufacturers, employees from regulatory bodies, radio network planners, academics and researchers from universities and research organizations. Students undertaking wireless communications courses will also find this book insightful.

This book offers a comprehensive explanation on how to dimension, plan, and optimize WiMAX networks. The first part of the text introduces WiMAX networks architecture, physical layer, standard, protocols, security mechanisms, and highly related radio access technologies. It covers system framework, topology,

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capacity, mobility management, handoff management, congestion control, medium access control (MAC), scheduling, Quality of Service (QoS), and WiMAX mesh networks and security. Enabling easy understanding of key concepts and technologies, the second part presents practical examples and illustrative figures to explain planning techniques and optimization algorithms. The author provides both theoretical and practical information to ensure in-depth, realistic results.

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