

Radio Network Planning And Optimization Engineer

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 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, UMTS is the wireless network technology behind the rollout of Third Generation (3G) mobile telecoms networks which will bring video, music and internet services to the cellphone and a range of electronic products. Chris Braithwaite and Mike Scott use their extensive experience of training engineers across Europe, and their backgrounds in working with Nokia, Ericsson and Orange to deliver a uniquely practical guide written from the perspective of the engineer and network planner. This guide is a valuable addition to the literature on UMTS which to date has been dominated by theoretical and reference works. The authors consider each of the key topics of UMTS/WCDMA and 3G rollout in terms of Coverage, Capacity and Quality of Service- the key considerations for all engineers and managers working in 3G telecoms. *A real-world design guide with cookbook-style instructions and rules of thumb, not another R&D-level book or crib to the standards. *Covers the hot engineering issues in UMTS planning, design and implementation. *UMTS is the natural evolutionary choice for operations of GSM networks, currently representing a customer base of more than 747 million end users in over 180 countries and representing over 70% of today's digital wireless market[source: GSM Association]

The first book on Cloud Radio Access Networks (C-RANs), covering fundamental theory, current techniques, and potential applications.

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 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.

Fundamentals of Network Planning and Optimisation 2G/3G/4G

For Practical Engineering Tasks

Wireless Network Design

LTE Backhaul

OFDM-Based Broadband Wireless Networks

Indoor Radio Planning

Design, Deployment and Performance of 4G-LTE Networks

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.

Mobile wireless applications are a good way to increase productivity, improve customer service and streamline business processes. 3G mobile applications, however, bring a unique challenge: ensuring adequate in-building coverage.Â Indoor Radio Planning provides an overview of mobile networks systems and coverage solutions for cellular networks in buildings. The background of GSM, UMTS and HSPA cellular systems technology are presented and form the backdrop of the main discussion as to why indoor coverage is needed and how it is best implemented. Basic passive distributed antenna systems (DAS) through to advanced fiber optic systems are discussed in detail, giving the reader a good understanding of all the available solutions. In addition, there is a section covering multi-operator systems, as this is becoming a more and more utilized approach. Other sections cover aspects such as how to upgrade passive DAS from 2G to 3G, noise analysis, link budgets, traffic calculations and software tools that can be used to provide help with creating in-building designs. These topics are examined at length from the basic considerations to advanced indoor radio planning. One of the first texts dedicated solely to indoor radio planning, it will be of essential reading to engineering and planning personnel working for mobile operators, with the book being written with radio planners in mind throughout. Indoor Radio Planning will also be of interest to companies who service and manufacture equipment for operators such as suppliers of indoor coverage systems and vendors of base stations for mobile coverage. A unique, single-source reference for both the theoretical and practical knowledge behind indoor radio planningÂ Written by a leading practitioner in the field with more than 15 years of experienceÂ Based on real life examples and implemented systems and results Analyzes co-existence of mobile services and inter modulation analysis Outlines the key parameters and metrics for designing DAS for GSM, DCS, UMTS and HSPA

A technological overview of LTE and WiMAX LTE, WiMAX and WLAN Network Design, Optimization and Performance Analysis provides a practical guide to LTE and WiMAX technologies introducing various tools and concepts used within. In addition, topics such as traffic modelling of IP-centric networks, RF propagation, fading, mobility, and indoor coverage are explored; new techniques which increase throughput such as MIMO and AAS technology are highlighted; and simulation, network design and performance analysis are also examined. Finally, in the latter part of the book Korowajczuk gives a step-by-step guide to network design, providing readers with the capability to build reliable and robust data networks. By focusing on LTE and WiMAX this book extends current network planning approaches to next generation wireless systems based on OFDMA, providing an essential resource for engineers and operators of fixed and wireless broadband data access networks. With information presented in a sequential format, LTE, WiMAX and WLAN Network Design, Optimization and Performance Analysis aids a progressive development of knowledge, complementing latter graduate and postgraduate courses while also providing a valuable resource to network designers, equipment vendors, reference material, operators, consultants, and regulators. Key Features: One of the first books to comprehensively explain and evaluate LTE Provides an unique explanation of the basic concepts involved in wireless broadband technologies and their applications in LTE, WiMAX, and WLAN before progressing to the network design Demonstrates the application of network planning for LTE and WiMAX with theoretical and practical approaches Includes all aspects of system design and optimization, such as dynamic traffic simulations, multi-layered traffic analysis, statistical interference analysis, and performance estimations 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 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.

Fundamentals of LTE

Optimization Models and Solution Procedures

Design and Implementation of the 3G CDMA Infrastructure

Radio Network Planning and Optimisation for UMTS

A Practical Guide for 2G, 3G and 4G

2G/2.5G/3G... Evolution to 4G

A complete and practical guide to WCDMA/UMTS cellular network deployment. After introducing the network architecture of such a system, the WCDMA (UMTS) Deployment Handbook defines the coverage and capacity concepts associated with the dimensioning and design phases. Progressing to a discussion of the main system parameter optimization techniques for the main services supported by UMTS, and includes the specifics of indoor deployment and HSDPA networks evolution. Covers all stages from planning to optimization with sufficient details as required on a day-to-day basis, and thorough reference information for the reader who wants to understand the concept taken in this book is similar to the work flow of network planner and optimization engineers, allowing such personnel to easily find the relevant information Written by the company which made CDMA a household name: QUALCOMM was the first company to use CDMA technology for cellular application and is a technical leader in this domain to this book have been working in direct interaction with WCDMA operators, throughout the world, since the early days of WCDMA commercial deployment Looking to the future: This book addresses the next level of challenge that WCDMA operators will face - deployment of indoor systems and HSDPA Providing a complete introduction and cycle of a WCDMA/UMTS cellular network, from initial dimensioning through to the successful deployment of indoor solutions, or migration to HSDPA, this book is a must-have for network planners and optimization engineers as well as Telecommunication Engineering students.

This book provides an insight into the key practical aspects and best practice of 4G-LTE network design, performance, and deployment Design, Deployment and Performance of 4G-LTE Networks addresses the key practical aspects and best practice of 4G networks design, performance, and deployment. In addition, the book focuses on the most different deployment scenarios of commercial LTE networks. It describes the air interface of LTE focusing on the access stratum protocol layers: PDCP, RLC, MAC, and Physical Layer. The air interface described in this book covers the concepts of LTE frame structure, downlink and uplink scheduling, and detailed illustrations of the data flow in the optimization process including performance measurements and troubleshooting mechanisms in addition to demonstrating common issues and case studies based on actual field results. The book provides detailed performance analysis of key features/enhancements such as C-DRX for Smartphones battery saving, CSFB solution to support voice over LTE, and De-Jitter buffer. The book presents analysis of LTE coverage and link budgets alongside a detailed comparative analysis with HSPA+. Practical link budget examples are provided for data and VoLTE scenarios. Furthermore, the reader is provided with a detailed explanation of capacity dimensioning of the LTE systems. The LTE capacity analysis in this book is presented in the context of the HSPA+ network to benchmark the LTE network capacity. The book describes the voice options for LTE including VoIP protocol stack, IMS Single Radio Voice Call Continuity (SRVCC). In addition, key VoLTE features are presented: Semi-persistent scheduling (SPS), TTI bundling, Quality of Service (QoS), VoIP with C-DRX, Robust Header Compression (RHC), and De-Jitter buffer. The book describes several LTE and LTE-A advanced features in the evolution from Release 8 to 10 including SON, eCIC, CA, CoMP, HetNet, Enhanced MIMO, Relays, and LBS. This book can be used as a reference for best practices in LTE networks design and deployment, performance analysis, and evolution strategy. Commercial LTE networks Presents key aspects and best practice of 4G-LTE networks design and deployment Includes a realistic roadmap for evolution of deployed 3G/4G networks Addresses the practical aspects for designing and deploying commercial LTE networks. Analyzes LTE coverage and link budgets, including a detailed comparative analysis with HSPA+ design and deployment, performance analysis, and evolution strategy Covers infrastructure-sharing scenarios for CAPEX and OPEX saving. Provides key practical aspects for supporting voice services over LTE, Written for all 4G engineers/designers working in networks design for operators, network deployment engineers, R&D engineers, telecom equipment vendors, tools firms, deployment subcontractors, senior undergraduate students and graduate students interested in understanding the practical aspects of 4G-LTE networks as part of their classes, research, or projects.

This book surveys state-of-the-art optimization modeling for design, analysis, and management of wireless networks, such as cellular and wireless local area networks (LANS), and the services they deliver. The past two decades have seen a tremendous growth in the deployment and use of wireless networks. The current-generation wireless networks provide services at rates substantially higher than those of the previous generation. As a result, the demand for mobile information services with high reliability, fast response times, and ubiquitous connectivity continues to increase rapidly. The optimization of system performance has become critically important both in terms of practical utility and in terms of research. In the editors' previous work on traditional wired networks, we have observed that designing low cost, survivable telecommunication networks involves extremely complicated processes. Commercial products available to help with this task typically have been based on simulation and/or proprietary heuristics. As demonstrated in this book, the prominent place in the designer's toolkit. Convenient modeling languages and powerful optimization solvers have greatly facilitated the implementation of mathematical programming theory into the practice of commercial network design. These points are equally relevant and applicable in today's world of wireless network technology and design. The book provides a comprehensive overview of the current state of the art in network design decisions, such as routing and facility/element location, must be dealt with in innovative ways that are unique and distinct from wired (fiber optic) networks. The book specifically treats the recent research and the use of modeling languages and network optimization techniques that are playing particularly important and diverse roles in network design. Practical Guide Provides Students and Industry Professionals with Latest Information on 5G Mobile Networks Continuing the tradition established in his previous publications, Jyrki Penttinen offers 5G Explained as a thorough yet concise introduction to recent advancements and growing trends in mobile telecommunications. In this case, Penttinen discusses the design of 5G mobile networks and, more specifically, the challenges inherent in adjusting to new global standardization requirements and in maintaining a high level of security even as mobile technology expands to new horizons. The text discusses, for example, the Internet of Things (IoT) and how to keep networks reliable and secure when they are used in environments with varying levels of user involvement and competence. 5G Explained is primarily designed for specialists who need rapid acclimation to the possibilities and concerns presented by 5G adoption. Therefore, it assumes some prior knowledge of mobile communications. However, earlier chapters are structured so that even relative newcomers will be able to follow along. Three modules each consisting of three chapters: Introduction, Technical Network Description and Planning of Security and Deployment Comprehensive coverage of topics such as technical requirements for 5G, network architecture, radio and core networks and services/applications Discussion of specific security techniques in addition to network design and deployment Managing and optimizing 5G networks 5G Explained offers crucial updates for anyone involved in designing, deploying or working with 5G networks. It should prove a valuable guide for operators, equipment manufacturers and other professionals in mobile equipment engineering and security, network planning and optimization, and mobile applications development into these fields.

Theory and Practice

Green Radio Communication Networks

LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications

5G Second Phase Explained

High Performance Browser Networking

Design and Optimization

Security and Deployment of Advanced Mobile Communications

Sets out to provide the theoretical foundations that enables radio network planners to plan model and optimize radio networks using state-of-the-art findings from around the globe. This book includes illustrative case studies, and explains the reasons for UMTS radio networks performance issues.

Presents state-of-the-art research on green radio communications and networking technology to researchers and professionals working in wireless communication.

THE TELECOMMUNICATIONS HANDBOOK THE TELECOMMUNICATIONS HANDBOOK ENGINEERING GUIDELINES FOR FIXED, MOBILE AND SATELLITE SYSTEMS Taking a practical approach, The Telecommunications Handbook examines the principles and details of all the major and modern telecommunications systems currently available to industry and to end-users. It gives essential information about usage, architectures, how they are functioning, planning, construction, measurements and optimization. The structure of the book is modular, giving both overall descriptions of the architectures and functionality of typical use cases, as well as deeper and practical guidelines for telecom professionals. The focus of the book is on current and future networks, and the most up-to-date functionalities of each network are described in sufficient detail for deployment purposes. The contents include an introduction to each technology, its evolution path, feasibility and utilization, solution and network architecture, and technical functioning of the systems (signaling, coding, different modes for channel delivery and security of core and radio system). The planning of the core and radio networks (system-specific field test measurement guidelines, hands-on network planning advices and suggestions for parameter adjustments) and future systems are also described. With contributions from specialists in both industry and academia, the book bridges the gap between communications in the academic context and the practical knowledge and skills needed to work in the telecommunications industry.

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.

WCDMA (UMTS) Deployment Handbook

Evolved Cellular Network Planning and Optimization for UMTS and LTE

The Planning Guidelines for the Fourth Generation Networks

Cloud Radio Access Networks

Planning and Optimization Aspects

5G Networks

The Telecommunications Handbook

Following on from the successful first edition (March 2012), this book gives a clear explanation of what LTE does and how it works. The content is expressed at a systems level, offering readers the opportunity to grasp the key factors that make LTE the hot topic amongst vendors and operators across the globe. The book assumes no more than a basic knowledge of mobile telecommunication systems, and the reader is not expected to have any previous knowledge of the complex mathematical operations that underpin LTE. This second edition introduces new material for the current state of the industry, such as the new features of LTE in Releases 11 and 12, notably coordinated multipoint transmission and proximity services; the main short- and long-term solutions for LTE voice calls, namely circuit switched fallback and the IP multimedia subsystem; and the evolution and current state of the LTE market. It also extends some of the material from the first edition, such as inter-operation with other technologies such as GSM, UMTS, wireless local area networks and cdma2000; additional features of LTE Advanced, notably heterogeneous networks and traffic offloading; data transport in the evolved packet core; coverage and capacity estimation for LTE; and a more rigorous treatment of modulation, demodulation and OFDMA. The author breaks down the system into logical blocks, by initially introducing the architecture of LTE, explaining the techniques used for radio

transmission and reception and the overall operation of the system, and concluding with more specialized topics such as LTE voice calls and the later releases of the specifications. This methodical approach enables readers to move on to tackle the specifications and the more advanced texts with confidence.

How prepared are you to build fast and efficient web applications? This eloquent book provides what every web developer should know about the network, from fundamental limitations that affect performance to major innovations for building even more powerful browser applications—including HTTP 2.0 and XHR improvements, Server-Sent Events (SSE), WebSocket, and WebRTC. Author Ilya Grigorik, a web performance engineer at Google, demonstrates performance optimization best practices for TCP, UDP, and TLS protocols, and explains unique wireless and mobile network optimization requirements. You'll then dive into performance characteristics of technologies such as HTTP 2.0, client-side network scripting with XHR, real-time streaming with SSE and WebSocket, and P2P communication with WebRTC. Deliver superlative TCP, UDP, and TLS performance Speed up network performance over 3G/4G mobile networks Develop fast and energy-efficient mobile applications Address bottlenecks in HTTP 1.x and other browser protocols Plan for and deliver the best HTTP 2.0 performance Enable efficient real-time streaming in the browser Create efficient peer-to-peer videoconferencing and low-latency applications with real-time WebRTC transports

This practical new resource gives you a comprehensive understanding of the design and deployment of transmission networks for wireless applications. From principles and design, to equipment procurement, project management, testing, and operation, it's a practical, hands-on engineering guide with numerous real-life examples of turn-key operations in the wireless networking industry. This book, written for both technical and non-technical professionals, helps you deal with the costs and difficulties involved in setting up the local access with technologies that are still in the evolutionary stage. Issues involved in the deployment of various transmission technologies, and their impact on the overall wireless network topology are discussed. Strategy and approach to transmission network planning, design and deployment are explored. The book offers practical guidelines and advice derived from the author's own experience on projects worldwide. You gain a solid grounding in third generation wireless networks with increased capacity requirements, while learning all about packet data architecture, and how it will impact future transmission network design and deployment.

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 So ciety (GOR) and of Dr. Erwin Teufel, prime minister of Baden-Wurtemberg. The symposium had about 500 participants from countries all over the world. It attracted academians 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.

Advanced Cellular Network Planning and Optimisation

GSM and UMTS Radio Network Planning and Design

The LTE-Advanced Deployment Handbook

What every web developer should know about networking and web performance

Planning and Optimisation of 3g and 4g Wireless Networks

5G Explained

Planning, Design and Optimization

5G SECOND PHASE EXPLAINED A one-stop reference that offers an accessible guide to an understanding of the enhanced core technologies of 5G **5G Second Phase Explained – The 3GPP Release 16 Enhancements** offers an authoritative and essential guide to the new functionalities of the Release 16 that complement the first phase of the 5G. From the author of **5G Explained** comes the next step resource that includes detailed descriptions that provide a clear understanding to the full version of the 5G technologies and their impacts on the Phase 1 networks. The author—an industry expert—not only reviews the most up-to-date functionalities of the Release 16 but includes information on the forthcoming Release 17 as well as material on future developments. The book explores the highly unique aspects of the Release 16, which can help technical personnel's efforts to deliver essential information in a practical way. The two books, **5G Explained** and **5G Second Phase Explained**, offer a comprehensive understanding of 5G. This important guide: Offers a summary of the newest and key features of 5G Presents a one-stop reference for an understanding of the core technologies of 5G Contains a new book that expands on the author's **5G Explained** Puts the focus on security and deployment aspects of 5G enhancements Written for technical personnel of network operators, network element and user device manufacturers, **5G Second Phase Explained** offers a guide to an understanding of network deployment and device designing of 5G technologies.

UMTS Radio Network Planning, Optimization and QOS Management describes practical planning process and gives solutions for detailed planning actions by following the planning process. The role of radio planning tool environment is emphasized by specifying the requirements of the digital map production, design tool, field measurement tool, and QOS measurement tool and by giving several examples of the results of these topics. By following the content of the book, a reader is able to build up an efficient UMTS planning and optimization tool environment and to carry out a practical UMTS planning and optimization project from configuration planning to field and QOS measurements.

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** 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.

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.

Evolution to 5G

UMTS Radio Network Planning, Optimization and QOS Management

An Introduction to LTE

UMTS Radio Network Planning: Mastering Cell Coupling for Capacity Optimization

Planning and Optimization

Inclusive Radio Communications for 5G and Beyond

Modeling and Dimensioning of Mobile Wireless Networks

Radio Network Planning and Optimisation for UMTSJohn Wiley & Sons

OFDM-based Broadband Wireless Networks covers the latest technological advances in digital broadcasting, wireless LAN, and mobile networks to achieve high spectral efficiency, and to meet peak requirements for multimedia traffic. The book emphasizes the OFDM modem, air-interface, medium access-control (MAC), radio link protocols, and radio network planning. An Instructor Support FTP site is available from the Wiley editorial department.

5G Networks: Planning, Design and Optimization presents practical methods and algorithms for the design of 5G Networks, covering issues ranging from network resilience to how Big Data analytics can be used in network design optimization. The book addresses 5G optimization issues that are data driven, high dimensional and clustered. The reader will learn: 5G concepts, how they are linked and their effect on the architecture of a 5G network Models of 5G at a network level, including economic aspects of operating a network The economic implications of scale and service diversity, and the incentive for optimal design and operational strategies Network topologies from a transport to a cloud perspective Theoretic foundations for network design and network optimization Algorithms for practical design and optimization of 5G subsystems based on live network projects Efficient Bayesian methods for network analytics The trade-off and multi-objective character of QoS management and cost saving Practical traffic and resilience measurement and QoS supervision Frameworks for performance analytics and network control This book will be an invaluable resource for telecom operators and service providers, university researchers, graduate students and network planners interested in practical methods for optimizing networks for large performance improvements and cost savings. Christofer Larsson works as an independent researcher and consultant in network design traffic engineering, network performance evaluation and optimization. 5G concepts, how they are linked and their effect on the architecture of a 5G network Models of 5G at a network level, including economic aspects of operating a network The economic implications of scale and service diversity, and the incentive for optimal design and operational strategies Network topologies from a transport to a cloud perspective Theoretic foundations for network design and network optimization Algorithms for practical design and optimization of 5G subsystems based on live network projects Efficient Bayesian methods for network analytics The trade-off and multi-objective character of QoS management and cost saving Practical traffic and resilience measurement and QoS supervision Frameworks for performance analytics and network control

Highly regarded as the book on the air interface of 3G cellular systems WCDMA for UMTS has again been fully revised and updated. The third edition now covers the key features of 3GPP Release 6 ensuring it remains the leading principal resource in this constantly progressing area. By providing a deep understanding of the WCDMA air interface, the practical approach of this third edition will continue to appeal to operators, network and terminal manufacturers, service providers, university students and frequency regulators. Explains the key parts of the 3GPP/WCDMA standard Presents network dimensioning, coverage and capacity of WCDMA Introduces TDD and discusses its differences from FDD Key third edition updates include: Covers the main 3GPP Release 6 updates Further enhances High Speed Downlink Packet Access (HSDPA) chapter with a number of new simulation results Explains High Speed Uplink Packet Access (HSUPA) study item Introduces the new services including their performance analysis : Push-to-Talk over Cellular (PoC), streaming, See What I See (SWIS) and multiplayer games Presents a number of new WCDMA field measurement results: capacity, end-to-end performance and handovers Includes completely updated antenna beamforming and multilater detection sections featuring new simulation results Introduces TD-SCDMA and compares it to Release TDD

Operations Research Proceedings 2003

Engineering Guidelines for Fixed, Mobile and Satellite Systems

LTE, WIMAX and WLAN Network Design, Optimization and Performance Analysis

Transmission Systems Design Handbook for Wireless Networks

Principles, Technologies, and Applications

2G/2.5G/3G...Evolution to 4G

WCDMA for UMTS

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 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.* *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.*

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.

“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 mobile networks.” Simon Beresford-Wylie (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.

A Practical Approach

From GSM to LTE

A Practical Guide for GSM, DCS, UMTS and HSPA

The 3GPP Release 16 Enhancements

Understanding UMTS Radio Network Modelling, Planning and Automated Optimisation

UMTS Network Planning and Development

UMTS Network Planning, Optimization, and Inter-Operation with GSM

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.

This book is a must-read for all network planners and other professionals wishing to improve the quality and cost efficiency of 3G and LTE networks In this book, the authors address the architecture of the 2/3G network and the Long Term Evolution (LTE) network. The book proposes analytical models that make the analysis and dimensioning of the most important interfaces, i.e. WCDMA or Iub, possible. Furthermore, the authors include descriptions of fundamental technological issues in 2/3 G networks, basic traffic engineering models and frequent examples of the application of analytical models in the analysis and dimensioning

of the interface of cellular networks. The specific knowledge included in the content will enable the reader to understand and then to prepare appropriate programming softwares that will allow them to evaluate quality parameters of cellular networks, i.e. blocking probabilities or call losses. Additionally, the book presents models for the analysis and dimensioning of the Wideband Code Division Multiple Access (WCDMA) radio interface and the Iub interface, both carrying a mixture of Release 99 traffic (R99) and High-Speed Packet Access (HSPA) traffic streams. Finally, the analytical models presented in the book can be also used in the process of modeling and optimization of LTE networks. Key Features: Describes the architecture and the modes of operation of the cellular 2/3/4G systems and the LTE network Covers the traffic theory and engineering within the context of mobile networks Presents original analytical methods that enable their users to dimension selected interfaces of cellular networks Discusses models for the analysis and dimensioning of the Wideband Code Division Multiple Access (WCDMA) radio interface and the Iub interface, both carrying a mixture of Release 99 traffic (R99) and High-Speed Packet Access (HSPA) traffic streams Includes problems as well as an accompanying website containing solutions, software tools and interactive flash animations (<http://wiley.teletraffic.pl>) This book will be an invaluable guide for professional engineers (radio planning engineers, optimization engineers, transmission engineers, core network engineers, Service Management engineers) working in the areas of mobile wireless networks technology, not only in optimization process, but also in profitability assessment of newly implemented services (i.e. in NPV – Net Present Value analysis), and researchers and scientists. Advanced students in the fields of mobile communications networks and systems will also find this book insightful.

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.

Describing the essential aspects that need to be considered during the deployment and operational phases of 3GPP LTE/SAE networks, this book gives a complete picture of LTE systems, as well as providing many examples from operational networks. It demystifies the structure, functioning, planning and measurements of both the radio and core aspects of the evolved 3G system. The content includes an overview of the LTE/SAE environment, architectural and functional descriptions of the radio and core network, functionality of the LTE applications, international roaming principles, security solutions and network measurement methods. In addition, this book gives essential guidelines and recommendations about the transition from earlier mobile communications systems towards the LTE/SAE era and the next generation of LTE, LTE-Advanced. The book is especially suitable for the operators that face new challenges in the planning and deployment phases of LTE/SAE, and is also useful for network vendors, service providers, telecommunications consultancy companies and technical institutes as it provides practical information about the realities of the system. Presents the complete end-to-end planning and measurement guidelines for the realistic deployment of networks Explains the essential and realistic aspects of commercial LTE systems as well as the future possibilities An essential tool during the development of transition strategies from other network solutions towards LTE/SAE Contains real-world case studies and examples to help readers understand the practical side of the system

Radio Access for Third Generation Mobile Communications

Fundamentals of Cellular Network Planning and Optimisation

Efficient Methods for WCDMA Radio Network Planning and Optimization

Selected Papers of the International Conference on Operations Research (OR 2003) Heidelberg, September 3–5, 2003

The LTE / SAE Deployment Handbook

The Definitive Guide to LTE Technology Long-Term Evolution (LTE) is the next step in the GSM evolutionary path beyond 3G technology, and it is strongly positioned to be the dominant global standard for 4G cellular networks. LTE also represents the first generation of cellular networks to be based on a flat IP architecture and is designed to seamlessly support a variety of different services, such as broadband data, voice, and multicast video. Its design incorporates many of the key innovations of digital communication, such as MIMO (multiple input multiple output) and OFDMA (orthogonal frequency division multiple access), that mandate new skills to plan, build, and deploy an LTE network. In Fundamentals of LTE , four leading experts from academia and industry explain the technical foundations of LTE in a tutorial style—providing a comprehensive overview of the standards. Following the same approach that made their recent Fundamentals of WiMAX successful, the authors offer a complete framework for understanding and evaluating LTE. Topics include Cellular wireless history and evolution: Technical advances, market drivers, and foundational networking and communications technologies Multicarrier modulation theory and practice: OFDM system design, peak-to-average power ratios, and SC-FDE solutions Frequency Domain Multiple Access: OFDMA downlinks, SC-FDMA uplinks, resource allocation, and LTE-specific implementation Multiple antenna techniques and tradeoffs: spatial diversity, interference cancellation, spatial multiplexing, and multiuser/networked MIMO LTE standard overview: air interface protocol, channel structure, and physical layers Downlink and uplink transport channel processing: channel encoding, modulation mapping, Hybrid ARQ, multi-antenna processing, and more Physical/MAC layer procedures and scheduling: channel-aware scheduling, closed/open-loop multi-antenna processing, and more Packet flow, radio resource, and mobility management: RLC, PDCP, RRM, and LTE radio access network mobility/handoff procedures

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 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

Inclusive Radio Communication Networks for 5G and Beyond is based on the COST IRACON project that consists of 500 researchers from academia and industry, with 120 institutions from Europe, US and the Far East involved. The book presents state-of-the-art design and analysis methods for 5G (and beyond) radio communication networks along with key challenges and issues related to the development of 5G networks. Covers the latest research on 5G networks – including propagation, localization, IoT and radio channels Based on the International COST research project, IRACON, with 120 institutions and 500 researchers from Europe, US and the Far East involved Provides coverage of IoT protocols, architectures and applications, along with IoT applications in healthcare Contains a concluding chapter on future trends in mobile communications and networking