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A guide to the 3GPP-specified 5G physical layer with a focus on the new beam-based dimension in the radio system 5G New Radio: A Beam-based Air Interface is an authoritative guide to the newly 3GPP-specified 5G physical layer. The contributors—noted experts on the topic and creators of the actual standard—focus on the beam-based operation which is a new dimension in the radio system due to the millimeter wave deployments of 5G. The book contains information that complements the 3GPP specification and helps to connect the dots regarding key features. The book assumes a basic knowledge of multi-antenna technologies and covers the physical layer aspects related to beam operation, such as initial access, details of reference signal design, beam management, and DL and UL data channel transmission. The contributors also provide a brief overview of standardization efforts, IMT-2020 submission, 5G spectrum, and performance analysis of 5G components. This important text: Contains information on the 3GPP-specified 5G physical layer Highlights the beam-based operation Covers the physical layer aspects related to beam operation Includes contributions from experts who created the standard Written for students and development engineers working with 5G NR, 5G New Radio: A Beam-based Air Interface offers an expert analysis of the 3GPP-specified 5G physical layer. "This book has collected the latest research within the

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field of real-time systems engineering, and will serve as a vital reference compendium for practitioners and academics"--Provided by publisher.

This book is intended to describe how to leverage emerging technologies big data analytics and SDN, to address challenges specific to LTE and IP network performance and fault management data in order to more efficiently manage and operate an LTE wireless networks. The proposed integrated solutions permit the LTE network service provider to operate entire integrated network, from RAN to Core , from UE to application service, as one unified system and correspondingly collect and align disparate key metrics and data, using an integrated and holistic approach to network analysis. The LTE wireless network performance and fault involves the network performance and management of network elements in EUTRAN, EPC and IP transport components, not only as individual components, but also as nuances of inter-working of these components. The key metrics for EUTRAN include radio access network accessibility, retainability, integrity, availability and mobility. The key metrics for EPC include MME accessibility, mobility and capacity, SGW, PGW capacity and connectivity. In the first parts of the book, the authors describe fundamental analytics techniques, and various key network partitions - RAN, Backhaul, Metro and Core of a typical LTE Wireless Service Provider Network. The second part of the book develops more advanced analytic techniques that can be used to solve complex wireless network problems. The second part of this book also describes practical and novel solutions for

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LTE service network performance and fault management systems using big data engineering. Self-organizing network (SON) architecture is presented as a way to utilize network performance and fault analytics to enable network automation. SON can significantly improve operational efficiencies and speed up network deployment. This book provides various ways to leverage data science to more intelligently and reliably to automate and manage a wireless network. The contents of the book should be useful to professional engineers and networking experts involved in LTE network operations and management. The content will also be of interest to researchers, academic and corporate, interested in the developments in fault analytics in LTE networks.

This revised edition of Communication Systems from GSM to LTE: An Introduction to Mobile Networks and Mobile Broadband Second Edition (Wiley 2010) contains not only a technical description of the different wireless systems available today, but also explains the rationale behind the different mechanisms and implementations; not only the 'how' but also the 'why'. In this way, the advantages and also limitations of each technology become apparent. Offering a solid introduction to major global wireless standards and comparisons of the different wireless technologies and their applications, this edition has been updated to provide the latest directions and activities in 3GPP standardization up to Release 12, and importantly includes a new chapter on Voice over LTE (VoLTE). There are new sections on Building Blocks of a Voice Centric Device, Building Blocks of a Smart

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Phone, Fast Dormancy, IMS and High-Speed Downlink Packet Access, and Wi-Fi-Protected Setup. Other sections have been considerably updated in places reflecting the current state of the technology. • Describes the different systems based on the standards, their practical implementation and design assumptions, and the performance and capacity of each system in practice is analyzed and explained • Questions at the end of each chapter and answers on the accompanying website make this book ideal for self-study or as course material

5G NR: The Next Generation Wireless Access

Technology follows the authors' highly celebrated books on 3G and 4G by providing a new level of insight into 5G NR. After an initial discussion of the background to 5G, including requirements, spectrum aspects and the standardization timeline, all technology features of the first phase of NR are described in detail. Included is a detailed description of the NR physical-layer structure and higher-layer protocols, RF and spectrum aspects and co-existence and interworking with LTE. The book provides a good understanding of NR and the different NR technology components, giving insight into why a certain solution was selected. Content includes: Key radio-related requirements of NR, design principles, technical features Details of basic NR transmission structure, showing where it has been inherited from LTE and where it deviates from it, and the reasons why NR Multi-antenna transmission functionality Detailed description of the signals and functionality of the initial NR access, including signals for synchronization and system information, random access and paging LTE/NR

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co-existence in the same spectrum, the benefits of their interworking as one system The different aspects of mobility in NR RF requirements for NR will be described both for BS and UE, both for the legacy bands and for the new mm-wave bands Gives a concise and accessible explanation of the underlying technology and standards for 5G NR radio-access technology Provides detailed description of the NR physical-layer structure and higher-layer protocols, RF and spectrum aspects and co-existence and interworking with LTE Gives insight not only into the details of the NR specification but also an understanding of why certain solutions look like they do

This book provides readers with a description of the UMTS radio access network, describing the key subjects in detail and covering all fundamental subjects. Starting with the high-level network architecture, the book describes the flow of data through the network. Content can be divided into three distinct sections: Section 1 provides readers with a detailed understanding of the UMTS radio access network from the perspective of application data and control plane signalling. Section 2 focuses on complete signalling procedures. Section 3 addresses the more practical issues of system dimensioning and system planning.

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

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book focuses on the end-to-end aspects of the LTE network architecture and 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 across the protocol layers. It describes the details of 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 calls with LTE, and MIMO techniques. 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 a comparative manner with reference to 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 (RoHC), and VoLTE

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Vocoders and De-Jitter buffer. The book describes several LTE and LTE-A advanced features in the evolution from Release 8 to 10 including SON, eICIC, 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. Conveys the theoretical background of 4G-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+. References the best practices in LTE networks 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 consulting firms, measurement/performance 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 hands-on, practical new resource provides optical network designers with basic but necessary information about radio systems air interface and radio access network architecture, protocols, and interfaces, using 5G

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use cases as relevant example. The book introduces mobile network designers to the transmission modeling techniques for the design of a radio access optical network. The main linear and non-linear propagation effects in optical fiber are covered. The book introduces mobile network designers to the optical technologies used in digital and analog radio access networks, such as optical amplifiers and transmitters, and describes different deployment scenarios, including point-to-point fiber systems, wavelength-division multiplexing systems, and passive optical networks. New integrated photonic technologies for optical switching are also discussed. The book illustrates the principles of optical beamforming and explains how optical technologies can be used to provide accurate phase and frequency control of antenna elements. The new architecture of the optical transport network, driven by the new, challenging requirements that 5G poses in terms of high capacity, high energy efficiency, low latency and low cost is discussed. The use of photonic devices to perform tasks as radio-frequency generation and beamforming, with improved accuracy and cost compared to traditional electronic systems, especially when moving to mm-waves is also explored. Readers also learn the replacement of electric interconnect systems with higher speed and more energy efficient optical lines to perform more effectively computationally demanding baseband processing in 5G. All presented propagation models can be implemented in a spreadsheet, in order to provide the designer with simple rules of thumbs for network planning.

This handbook is an authoritative, comprehensive

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reference on optical networks, the backbone of today's communication and information society. The book reviews the many underlying technologies that enable the global optical communications infrastructure, but also explains current research trends targeted towards continued capacity scaling and enhanced networking flexibility in support of an unabated traffic growth fueled by ever-emerging new applications. The book is divided into four parts: Optical Subsystems for Transmission and Switching, Core Networks, Datacenter and Super-Computer Networking, and Optical Access and Wireless Networks. Each chapter is written by world-renown experts that represent academia, industry, and international government and regulatory agencies. Every chapter provides a complete picture of its field, from entry-level information to a snapshot of the respective state-of-the-art technologies to emerging research trends, providing something useful for the novice who wants to get familiar with the field to the expert who wants to get a concise view of future trends.

5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards is an in-depth, systematic, technical reference on 3GPP's New Radio standards (Release 15 and beyond), covering the underlying theory, functional descriptions, practical considerations and implementation of the 5G new radio access

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technology. The book describes the design and operation of individual components and shows how they are integrated into the overall system and operate from a systems perspective. Uniquely, this book gives detailed information on RAN protocol layers, transport, network architecture and services, as well as practical implementation and deployment issues, making it suitable for researchers and engineers who are designing and developing 5G systems. Reflecting on the author's 30 plus years of experience in signal processing, microelectronics and wireless communication system design, this book is ideal for professional engineers, researchers and graduate students working and researching in cellular communication systems and protocols as well as mobile broadband wireless standards. Strong focus on practical considerations, implementation and deployment issues Takes a top-down approach to explain system operation and functional interconnection Covers all functional components, features, and interfaces based on clear protocol structure and block diagrams Describes RF and transceiver design considerations in sub-6 GHz and mmWave bands Covers network slicing, SDN/NFV/MEC networks and cloud and virtualized RAN architectures Comprehensive coverage of NR multi-antenna techniques and beamformed operation A consistent and integrated coverage reflecting the author's decades of experience in developing 3G,

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4G and 5G technologies and writing two successful books in these areas

Essential reference providing best practice of LTE-A, VoLTE, and IoT Design/deployment/Performance and evolution towards 5G This book is a practical guide to the design, deployment, and performance of LTE-A, VoLTE/IMS and IoT. A comprehensive practical performance analysis for VoLTE is conducted based on field measurement results from live LTE networks. Also, it provides a comprehensive introduction to IoT and 5G evolutions. Practical aspects and best practice of LTE-A/IMS/VoLTE/IoT are presented. Practical aspects of LTE-Advanced features are presented. In addition, LTE/LTE-A network capacity dimensioning and analysis are demonstrated based on live LTE/LTE-A networks KPIs. A comprehensive foundation for 5G technologies is provided including massive MIMO, eMBB, URLLC, mMTC, NGCN and network slicing, cloudification, virtualization and SDN. Practical Guide to LTE-A, VoLTE and IoT: Paving the Way Towards 5G can be used as a practical comprehensive guide for best practices in LTE/LTE-A/VoLTE/IoT design, deployment, performance analysis and network architecture and dimensioning. It offers tutorial introduction on LTE-A/IoT/5G networks, enabling the reader to use this advanced book without the need to refer to more introductory texts. Offers a complete overview of LTE and LTE-A,

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IMS, VoLTE and IoT and 5G Introduces readers to IP Multimedia Subsystems (IMS) Performs a comprehensive evaluation of VoLTE/CSFB Provides LTE/LTE-A network capacity and dimensioning Examines IoT and 5G evolutions towards a super connected world Introduce 3GPP NB-IoT evolution for low power wide area (LPWA) network Provide a comprehensive introduction for 5G evolution including eMBB, URLLC, mMTC, network slicing, cloudification, virtualization, SDN and orchestration Practical Guide to LTE-A, VoLTE and IoT will appeal to all deployment and service engineers, network designers, and planning and optimization engineers working in mobile communications. Also, it is a practical guide for R&D and standardization experts to evolve the LTE/LTE-A, VoLTE and IoT towards 5G evolution.

Understand the new technologies of the LTE standard and their impact on system performance improvements with this practical guide.

This book constitutes the post proceedings of the 28th International Symposium on Modelling, Analysis, and Simulation of Computer and Telecommunication Systems, MASCOTS 2020, held online -due to COVID -19- in Nice, France, in November 2020. The 17 full papers presented were carefully reviewed and selected from 124 submissions. The symposium collected the most relevant papers describing state-of-the-art research

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in the areas of the performance evaluation of computer systems and networks as well as in related areas.

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 (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

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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.

This book constitutes the thoroughly refereed proceedings of the fourth International Conference on Mobile Networks and Management, MONAMI 2012, held in Hamburg, Germany, in September 2012. The 15 revised full papers presented were carefully selected and reviewed from numerous submissions. In addition two well-received workshops are presented: the second MONAMI Workshop on Smart Objects and the first Open Connectivity Services Workshop, organized in cooperation with the EU FP7 SAIL project. All in all, 25 papers were orally presented at the conference. The papers are organized in five topical sections: mobile networks, heterogeneous networks, wireless communications, smart objects and IoT applications, and future networks.

Provides a unique focus on radio protocols for LTE and LTE-Advanced (LTE-A) Giving readers a

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valuable understanding of LTE radio protocols, this book covers LTE (Long-Term Evolution) Layer 2/3 radio protocols as well as new features including LTE-Advanced. It is divided into two sections to differentiate between the two technologies' characteristics. The authors systematically explain the design principles and functions of LTE radio protocols during the development of mobile handsets. The book also provides essential knowledge on the interaction between mobile networks and mobile handsets. Among the first publications based on the 3GPP R10 specifications, which introduces LTE-A Beginning with an overview of LTE, topics covered include: Idle Mode Procedure; Packet Data Convergence Protocol and Public Warning Systems Presents the LTE radio interface protocol layers in a readable manner, to enhance the material in the standards publications From an expert author team who have been directly working on the 3GPP standards It is targeted at professionals working or intending to work in the area and can also serve as supplementary reading material for students who need to know how theory on the most extensively used mobile radio interface today is put into practice

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

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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 knowledge 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.

"Where this book is exceptional is that the reader will not just learn how LTE works but why it works"

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Adrian Scrase, ETSI Vice-President, International Partnership Projects Following on the success of the first edition, this book is fully updated, covering the latest additions to LTE and the key features of LTE-Advanced. This book builds on the success of its predecessor, offering the same comprehensive system-level understanding built on explanations of the underlying theory, now expanded to include complete coverage of Release 9 and the developing specifications for LTE-Advanced. The book is a collaborative effort of more than 40 key experts representing over 20 companies actively participating in the development of LTE, as well as academia. The book highlights practical implications, illustrates the expected performance, and draws comparisons with the well-known WCDMA/HSPA standards. The authors not only pay special attention to the physical layer, giving an insight into the fundamental concepts of OFDMA-FDMA and MIMO, but also cover the higher protocol layers and system architecture to enable the reader to gain an overall understanding of the system. Key New Features: Comprehensively updated with the latest changes of the LTE Release 8 specifications, including improved coverage of Radio Resource Management RF aspects and performance requirements Provides detailed coverage of the new LTE Release 9 features, including: eMBMS, dual-layer beamforming, user equipment positioning, home

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eNodeBs / femtocells and pico cells and self-optimizing networks Evaluates the LTE system performance Introduces LTE-Advanced, explaining its context and motivation, as well as the key new features including: carrier aggregation, relaying, high-order MIMO, and Cooperative Multi-Point transmission (CoMP). Includes an accompanying website containing a complete list of acronyms related to LTE and LTE-Advanced, with a brief description of each

(http://www.wiley.com/go/sesia_theumts) This book is an invaluable reference for all research and development engineers involved in implementation of LTE or LTE-Advanced, as well as graduate and PhD students in wireless communications. Network operators, service providers and R&D managers will also find this book insightful.

Written by an industry insider with state of the art research at their fingertips, this book describes the Radio Access Network (RAN) architecture, starting with currently deployed 4G, followed by the description of 5G requirements and why re-thinking of the RAN architecture is needed to support these. Based on these considerations, it explains how 5G network architecture, which is currently being defined, is likely to evolve. The aim is not merely to cover relevant standards and technologies as a purely academic exercise (although a significant part of the book will be dedicated to these), but to

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augment these by practical deployment, to illustrate why the RAN architecture is changing and where it is going. With 5G deployments on the horizon, there is a desire within companies to both re-think the RAN architecture and to change the proprietary nature of the RAN. Correspondingly, there is increased interest in academia, standards bodies and commercial entities involved in the area.

From the editors of the highly successful WCDMA for UMTS, this new book gives a complete and up-to-date overview of Long Term Evolution (LTE) in a systematic and clear manner. It starts with an in-depth explanation of the background and standardization process before moving on to examine the system architecture evolution (SAE). The basics of air interface modulation choices are introduced and key subjects such as 3GPP LTE physical layer and protocol solutions are described. Mobility aspects and radio resource management together with radio and end-to-end performance are assessed. The voice solution and voice capacity in LTE are also illustrated. Finally, the main differences between LTE TDD and FDD modes are examined and HSPA evolution in 3GPP Releases 7 and 8 is described. LTE for UMTS is one of the first books to provide a comprehensive guide to the standards and technologies of LTE. Key features of the book include: Covers all the key aspects of LTE in a systematic manner Presents full description of 3GPP

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Release 8 LTE Examines the expected performance of LTE Written by experts actively involved in the 3GPP standards and product development.

This book constitutes the refereed proceedings of the 17th International GI/ITG Conference on Measurement, Modeling and Evaluation of Computing Systems and Dependability and Fault-Tolerance, MMB & DFT 2014, held in Bamberg, Germany, in March 2014. The 21 papers presented (2 invited papers, 3 tool papers and 16 full papers) were carefully reviewed and selected from numerous submissions. MMB & DFT 2014 cover all aspects of performance and dependability evaluation of systems including networks, computer architectures, distributed systems, workflow systems, software, fault-tolerant and secure systems. The conference also featured 3 satellite workshops namely the International Workshop on Demand Modeling and Quantitative Analysis of Future Generation Energy Networks and Energy-Efficient Systems, FGENET 2014; the International Workshop on Modeling, Analysis and Management of Social Networks and their Applications, SOcNET 2014 and the 2nd Workshop on Network Calculus, WoNeCa 2014. From Smart Grid to Internet of Energy covers novel and emerging metering and monitoring technologies, communication systems, and technologies in smart grid areas to present a valuable reference for readers from various engineering backgrounds.

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Considering relevant topics on the essentials of smart grids and emerging wireless communication systems, such as IEEE 802.15.4 based novel technologies, cognitive radio networks and Internet of Energy, this book offers a discussion on the emerging trends and research direction for communication technologies. The book includes research concepts and visualization of smart grids and related communication technologies, making it a useful book for practicing network engineers. Includes global case studies and examples of communications systems integrated with smart grids Presents literature surveys for a wide variety of smart grids, wired and wireless communication technologies, big data, privacy and security Covers all aspects of IoE systems and discusses the differences between IoE and Smart Grids Rapid advances in networking technology have promoted a fully revised second edition of this successful introduction to communication networks. This book focuses on key simulation and evaluation technologies for 5G systems. Based on the most recent research results from academia and industry, it describes the evaluation methodologies in depth for network and physical layer technologies. The evaluation methods are discussed in depth. It also covers the analysis of the 5G candidate technologies and the testing challenges, the evolution of the testing technologies, fading channel measurement

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and modeling, software simulations, software hardware cosimulation, field testing and other novel evaluation methods. The fifth-generation (5G) mobile communications system targets highly improved network performances in terms of the network capacity and the number of connections. Testing and evaluation technologies is widely recognized and plays important roles in the wireless technology developments, along with the research on basic theory and key technologies. The investigation and developments on the multi-level and comprehensive evaluations for 5G new technologies, provides important performance references for the 5G technology filtering and future standardizations. Students focused on telecommunications, electronic engineering, computer science or other related disciplines will find this book useful as a secondary text. Researchers and professionals working within these related fields will also find this book useful as a reference.

As the cellular world and the Internet converge, mobile networks are transitioning from circuit to packet and the Internet Protocol (IP) is now recognized as the fundamental building block for all next-generation communication networks. The all-IP vision provides the flexibility to deliver cost-effective services and applications that meet the evolving needs of mobile users. RF engineers, mobile network designers, and system architects will be expected to have an understanding of IP fundamentals and how their role in delivering the end-to-end system is crucial for delivering the

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all-IP vision that makes the Internet accessible anytime, anywhere. IP Design for Mobile Networks discusses proper IP design theory to effectively plan and implement your next-generation mobile network so that IP integrates all aspects of the network. The book outlines, from both a standards and a design theory perspective, both the current and target state of mobile networks, and the technology enablers that will assist the migration. This IP transition begins with function-specific migrations of specific network domains and ends with an end-to-end IP network for radio, transport, and service delivery. The book introduces many concepts to give you exposure to the key technology trends and decision points affecting today's mobile operators. The book is divided into three parts: Part I provides an overview of how IP is being integrated into mobile systems, including radio systems and cellular networks. Part II provides an overview of IP, the technologies used for transport and connectivity of today's cellular networks, and how the mobile core is evolving to encompass IP technologies. Part III provides an overview of the end-to-end services network based on IP, including context awareness and services. Presents an overview of what mobile networks look like today—including protocols used, transport technologies, and how IP is being used for specific functions in mobile networks Provides an all-inclusive reference manual for IP design theory as related to the broader application of IP for mobile networks Imparts a view of upcoming trends in mobility standards to better prepare a network evolution plan for IP-based mobile networks This book is part of the Networking Technology Series from Cisco Press®, which offers networking professionals valuable information for constructing efficient networks, understanding new technologies, and building successful careers.

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This book contains a selection of papers presented at a

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symposium organized under the aegis of COST Telecommunications Action 285. COST (European Cooperation in the field of Scientific and Technical Research) is a framework for scientific and technical cooperation, allowing the coordination of national research on a European level. Action 285 sought to enhance existing tools and develop new modeling and simulation tools.

From the editors of the highly successful WCDMA for UMTS, this new book provides a comprehensive and up-to-date reference to High Speed Packet Access (HSPA) technologies for WCDMA. The editors cover both HSDPA and HSUPA, including an in-depth description and explanation of 3GPP standards, and expected performance based on simulations and first measurements. The text also discusses the impact of HSDPA and HSUPA on network dimensioning, covers applications and end-to-end performance in detail, and includes a section on radio frequency requirements and terminal design considerations. The most comprehensive and advanced guide to the HSDPA (High Speed Downlink Packet Access) and HSUPA (High Speed Uplink Packet Access) technologies and standardisation, HSDPA/HSUPA for UMTS: Analyses the impact of HSDPA/HSUPA on network dimensioning, discussing co-existence with R99 (Release 99) and GPRS/EDGE (General Packet Radio Services/Enhanced Data GSM Environment) Contains a section on applications and end-to-end (e2e) performance Includes a chapter on radio frequency (RF) requirements and terminal design considerations, covering different RF bands, multi-band HSDPA and multi-mode HSDPA+EDGE challenges, power consumption Provides numerous illustrations of 3GPP (Third Generation Partnership Project) standards and performance This title provides excellent coverage of the area for system, element and chip designers, network planners, technical managers with vendors, operators and application

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developers. It is also ideal for postgraduates and researchers in related areas.

This extensively updated second edition of LTE Signaling, Troubleshooting and Performance Measurement describes the LTE signaling protocols and procedures for the third generation of mobile communications and beyond. It is one of the few books available that explain the LTE signaling messages, procedures and measurements down to the bit & byte level, and all trace examples are taken for a real lab and field trial traces. This book covers the crucial key performance indicators (KPI) to be measured during field trials and deployment phase of new LTE networks. It describes how statistic values can be aggregated and evaluated, and how the network can be optimized during the first stages of deployment, using dedicated examples to enhance understanding. Written by experts in the field of mobile communications, this book systematically describes the most recent LTE signaling procedures, explaining how to identify and troubleshoot abnormal network behavior and common failure causes, as well as describing the normal signaling procedures. This is a unique feature of the book, allowing readers to understand the root cause analysis of problems related to signaling procedures. This book will be especially useful for network operators and equipment manufacturers; engineers; technicians; network planners; developers; researchers; designers; testing personnel and project managers; consulting and training companies; standardization bodies.

This book is an in-depth, systematic and structured technical reference on 3GPP's LTE-Advanced (Releases 10 and 11), covering theory, technology and implementation, written by an author who has been involved in the inception and development of these technologies for over 20 years. The book not only describes the operation of individual

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components, but also shows how they fit into the overall system and operate from a systems perspective. Uniquely, this book gives in-depth information on upper protocol layers, implementation and deployment issues, and services, making it suitable for engineers who are implementing the technology into future products and services. Reflecting the author's 25 plus years of experience in signal processing and communication system design, this book is ideal for professional engineers, researchers, and graduate students working in cellular communication systems, radio air-interface technologies, cellular communications protocols, advanced radio access technologies for beyond 4G systems, and broadband cellular standards. An end-to-end description of LTE/LTE-Advanced technologies using a top-down systems approach, providing an in-depth understanding of how the overall system works Detailed algorithmic descriptions of the individual components' operation and inter-connection Strong emphasis on implementation and deployment scenarios, making this a very practical book An in-depth coverage of theoretical and practical aspects of LTE Releases 10 and 11 Clear and concise descriptions of the underlying principles and theoretical concepts to provide a better understanding of the operation of the system's components Covers all essential system functionalities, features, and their inter-connections based on a clear protocol structure, including detailed signal flow graphs and block diagrams Includes methodologies and results related to link-level and system-level evaluations of LTE-Advanced Provides understanding and insight into the advanced underlying technologies in LTE-Advanced up to and including Release 11: multi-antenna signal processing, OFDM, carrier aggregation, coordinated multi-point transmission and reception, eICIC, multi-radio coexistence, E-MBMS, positioning methods, real-time and non-real-time wireless

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multimedia applications

Radio Network Planning and Optimisation for UMTS comprehensively explains how to dimension, plan and optimise UMTS (Universal Mobile Telecommunications System) networks. It introduces the properties of the spread spectrum system and provides a general overview of the physical layer of UTRA FDD. The radio network planning process for WCDMA is clearly presented and detailed information on how to dimension, plan and rollout a 3G network, both theoretically and practically is provided. 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. * Includes automation examples of radio resource management * Focuses on UTRA FDD and introduces UTRA TDD, GPRS and EDGE and examines their interaction and synergy * Provides an excellent source of information for those considering future cellular networks where Quality of Service (QoS) is of paramount importance * Analyses the radio network planning challenges and opportunities for both greenfield and existing operators * Includes an accompanying CD-ROM featuring a static radio network simulator implemented in MATLAB(r) Authoritative and instructive, this text will have instant appeal to wireless operators and network and terminal manufacturers. It will also be essential reading for university students, frequency regulation bodies and everyone interested in radio network planning and optimisation, especially RF network systems engineering professionals.

This book focuses on LTE with full updates including LTE-Advanced (Release-11) to provide a complete picture of the LTE system. Detailed explanations are given for the latest LTE standards for radio interface architecture, the physical layer, access procedures, broadcast, relaying, spectrum and

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RF characteristics, and system performance. Key technologies presented include multi-carrier transmission, advanced single-carrier transmission, advanced receivers, OFDM, MIMO and adaptive antenna solutions, radio resource management and protocols, and different radio network architectures. Their role and use in the context of mobile broadband access in general is explained, giving both a high-level overview and more detailed step-by-step explanations. This book is a must-have resource for engineers and other professionals in the telecommunications industry, working with cellular or wireless broadband technologies, giving an understanding of how to utilize the new technology in order to stay ahead of the competition. New to this edition: In-depth description of CoMP and enhanced multi-antenna transmission including new reference-signal structures and feedback mechanisms Detailed description of the support for heterogeneous deployments provided by the latest 3GPP release Detailed description of new enhanced downlink control-channel structure (EPDDCH) New RF configurations including operation in non-contiguous spectrum, multi-bands base stations and new frequency bands Overview of 5G as a set of well-integrated radio-access technologies, including support for higher frequency bands and flexible spectrum management, massive antenna configurations, and ultra-dense deployments Covers a complete update to the latest 3GPP Release-11 Two new chapters on HetNet, covering small cells/heterogeneous deployments, and CoMP, including Inter-site coordination Overview of current status of LTE release 12 including further enhancements of local-area, CoMP and multi-antenna transmission, Machine-type-communication, Device-to-device communication This book is unique in presenting channels, techniques and standards for the next generation of MIMO wireless networks. Through a unified framework, it emphasizes how propagation

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mechanisms impact the system performance under realistic power constraints. Combining a solid mathematical analysis with a physical and intuitive approach to space-time signal processing, the book progressively derives innovative designs for space-time coding and precoding as well as multi-user and multi-cell techniques, taking into consideration that MIMO channels are often far from ideal. Reflecting developments since the first edition was published, this book has been thoroughly revised, and now includes new sections and five new chapters, respectively dealing with receiver design, multi-user MIMO, multi-cell MIMO, MIMO implementation in standards, and MIMO system-level evaluation. Extended introduction to multi-dimensional propagation, including polarization aspects Detailed and comparative description of physical models and analytical representations of single- and multi-link MIMO channels, covering the latest standardized models Thorough overview of space-time coding techniques, covering both classical and more recent schemes under information theory and error probability perspectives Intuitive illustration of how real-world propagation affects the capacity and the error performance of MIMO transmission schemes Detailed information theoretic analysis of multiple access, broadcast and interference channels In-depth presentation of multi-user diversity, resource allocation and (non-)linear MU-MIMO precoding techniques with perfect and imperfect channel knowledge Extensive coverage of cooperative multi-cell MIMO-OFDMA networks, including network resource allocation optimization, coordinated scheduling, beamforming and power control, interference alignment, joint processing, massive and network MIMO Applications of MIMO and Coordinated Multi-Point (CoMP) in LTE, LTE-A and WiMAX Theoretical derivations and results contrasted with practical system level evaluations highlighting the performance of single- and multi-cell MIMO techniques in realistic

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deployments

A comprehensive resource containing the operating principles and key insights of LTE networks performance optimization LTE Optimization Engineering Handbook is a comprehensive reference that describes the most current technologies and optimization principles for LTE networks. The text offers an introduction to the basics of LTE architecture, services and technologies and includes details on the key principles and methods of LTE optimization and its parameters. In addition, the author clarifies different optimization aspects such as wireless channel optimization, data optimization, CSFB, VoLTE, and video optimization. With the ubiquitous usage and increased development of mobile networks and smart devices, LTE is the 4G network that will be the only mainstream technology in the current mobile communication system and in the near future. Designed for use by researchers, engineers and operators working in the field of mobile communications and written by a noted engineer and experienced researcher, the LTE Optimization Engineering Handbook provides an essential guide that: Discusses the latest optimization engineering technologies of LTE networks and explores their implementation Features the latest and most industrially relevant applications, such as VoLTE and HetNets Includes a wealth of detailed scenarios and optimization real-world case studies Professionals in the field will find the LTE Optimization Engineering Handbook to be their go-to reference that includes a thorough and complete examination of LTE networks, their operating principles, and the most current

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information to performance optimization.

"This book addresses the advantages and the limitations of modern multicarrier technologies and how to meet the challenges they pose using non-contiguous multicarrier technologies and novel algorithms that enhance spectral efficiency, interference robustness, and reception performance. It explores techniques using non-contiguous subcarriers which allow for flexible spectrum aggregation while achieving high spectral efficiency and flexible transmission and reception at lower OSI layers. These include non-contiguous orthogonal frequency division multiplexing (NC-OFDM), its enhanced version, non-contiguous filter-bank-based multicarrier (NC-FBMC), and generalized multicarrier. Following an overview of current multicarrier technologies for radio communication, the authors examine particular properties of these technologies that allow for more efficient usage within key directions of 5G. They examine the principles of NC-OFDM and discuss efficient transmitter and receiver design. They present the principles of FBMC modulation and discuss key challenges for FBMC communications while comparing performance results with traditional OFDM. They move on from there to a fascinating discussion of GMC modulation within which they clearly demonstrate how that technology encompasses all of the advantages of previously discussed techniques, as well as all imaginable multi- and single-carrier waveforms. [...]" (source : 4ème de couverture.

Following on from the successful first edition (March 2012), this book gives a clear explanation of what LTE

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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

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with confidence.

GSM, GPRS and EDGE Performance - Second Edition provides a complete overview of the entire GSM system. GSM (Global System for Mobile Communications) is the digital transmission technique widely adopted in Europe and supported in North America. It features comprehensive descriptions of GSM's main evolutionary milestones - GPRS, (General Packet Radio Services) is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps and continuous connection to the Internet for mobile phone and computer users. AMR and EDGE (Enhanced Data GSM Environment), and such developments have now positioned GERAN (GSM/EDGE Radio Access Network) as a full 3G radio standard. The radio network performance and capabilities of GSM, GPRS, AMR and EDGE solutions are studied in-depth by using revealing simulations and field trials. Cellular operators must now roll out new 3G technologies capable of delivering wireless Internet based multimedia services in a competitive and cost-effective way and this volume, divided into three parts, helps to explain how: 1. Provides an introduction to the complete evolution of GSM towards a radio access network that efficiently supports UMTS services (GERAN). 2. Features a comprehensive study of system performance with simulations and field trials. Covers all the major features such as basic GSM, GPRS, EDGE and AMR and the full capability of the GERAN radio interface for 3G service support is envisaged. 3. Discusses different 3G radio technologies and the position of GERAN within such technologies.

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Featuring fully revised and updated chapters throughout, the second edition contains 90 pages of new material and features the following new sections, enabling this reference to remain as a leading text in the area:

Expanded material on GPRS Includes IMS architecture (Rel'5) and GERAN (Rel'6) features Presents field trial results for AMR and narrowband Provides EGPRS deployment guidelines Features a new chapter on Service Performance An invaluable reference for Engineering Professionals, Research and Development Engineers, Business Development Managers, Technical Managers and Technical Specialists working for cellular operators

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

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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 comprehensive resource contains a detailed methodology for assessing, analyzing and optimizing End-to-End Service Performance under different cellular technologies (GPRS, EDGE, WCDMA and CDMA2000). It includes guidelines for analyzing numerous different services, including FTP, WEB streaming and POC, including examples of analysis and troubleshooting from a user point-of-view. Focuses on the end-user perspective, with a detailed analysis of the main sources of service performance degradation and a comprehensive description of mobile data services Includes a detailed presentation of generic key performance indicators (KPIs) which can be re-defined to comply with each particular network Provides service performance benchmarking for different technologies from real networks Explores a new approach to service

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management known as customer experience management, including the reasons why it is overcoming traditional service management and its impact on revenues and customer satisfaction. Illustrates all points throughout using real world examples gleaned from cutting-edge research. This book draws together findings from authoritative sources that will appeal to cellular network operators and vendors. The theory-based, practical approach will be of interest to postgraduate students and telecommunication and consulting companies working in the field of cellular technologies.

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