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DU74PV - CABRERA SELAH

Whether you are an executive or sales manager in a networking company, a data communications engineer, or a telecommunications professional, you must have a thorough working knowledge of the ever growing and interrelated array of telecom and data communications technologies. From protocols and operation of the Internet (IP, TCP, HTTP, ...) and its access systems such as ADSL, and GSM... to the basics of transmission and switching, this newly revised resource delivers an up-to-date introduction to a broad range of networking technologies, clearly explaining the networking essentials you need to know to be a successful networking professional. Moreover, the book explores the future developments in optical, wireless and digital broadcast communications.

Cable and Wireless Networks: Theory and Practice presents a comprehensive approach to networking, cable and wireless communications, and networking security. It describes the most important state-of-the-art fundamentals and system details in the field, as well as many key aspects concerning the development and understanding of current and emergent services. In this book, the author gathers in a single volume current and emergent cable and wireless network services and technologies. Unlike other books, which cover each one of these topics independently without establishing their natural relationships, this book allows students to quickly learn and improve their mastering of the covered topics with a deeper understanding of their interconnection. It also collects in a single source the latest developments in the area, typically only within reach of an active researcher. Each chapter illustrates the theory of cable and wireless communications with relevant examples, hands-on exercises, and review questions suitable for readers with a BSc degree or an MSc degree in computer science or electrical engineering. This approach makes the book well suited for higher education students in courses such as networking, telecommunications, mobile communications, and network security. This is an excellent reference book for academic, institutional, and industrial professionals with technical responsibilities in planning, design and development of networks, telecommunications and security systems, and mobile communications, as well as for Cisco CCNA and CCNP exam preparation.

In this book, the author addresses technologies that are being used in emerging cellular markets. These include GSM/EGPRS and CDMA which are being deployed at a rapid pace, while technologies such as UMTS (3G)/ HSPA (3.5G) which have started to find a place in these high growth markets, are also considered. The book examines other technologies including LTE (3.9G) which have already moved out of research labs into the commercial world. 2G-CDMA is widely used, while further developments, e.g. CDMA2000 are also finding acceptance in the commercial arena. IMS/Convergence is increasingly popular all over the world; UMA, which is deployed mostly in North America; and DVB which is gaining worldwide popularity, especially in South Asia, are all reviewed. Each chapter discusses a different technology and is structured into three parts. The technology is examined at an overview level, first explaining what the technology is and then considering the technical features of the technology. The chapter concludes by looking at the planning/implementation aspects of the technology. Key Features: Useful for all cellular industry professionals as provides an overview of the currently deployed technologies in mass scale, and the forthcoming technologies that are expected to make an impact in the future, such as 4th Generation Cellular Networks. One of the first books on the market to encompass all the major cellular technologies, as well as considering the design and implementation perspective. Wireless Technology will play a key role in uplifting the economies of the Emerging countries globally. Ashok Chandra, Wireless Advisor to Govt. of India 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,

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 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 Het-Net, 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 introduces the technical foundations and tools for estimating the power consumption of internet networks and services, including a detailed description of how these models are constructed and applied. Modeling the Power Consumption and Energy Efficiency of Telecommunications Networks can be used to gain insight into the construction of mathematical models that provide realistic estimates of the power consumption of internet networks and services. This knowledge enables forecasting the energy footprint of future networks and services to integrate sustainability and environmental considerations into network planning and design. FEATURES Provides the motivation for developing mathematical models for telecommunications network and service power consumption and energy efficiency modeling Presents factors impacting overall network and service power consumption Discusses the types of network equipment and their power consumption profiles Reviews the basics of power modeling, including network segmentation, traffic forecasting, top-down and bottom-up models, wired and wireless networks, data centers and servers Explores the application of energy efficiency metrics for equipment, networks, and services This book is aimed at students and technologists as well as technology managers and policy makers. This book will be of value to any organization that wishes to estimate the energy footprint of the use of information and communications technologies. This book can also be integrated into a course on the sustainability of information and communications technologies.

The huge and growing demand for wireless communication systems has spurred a massive effort on the parts of the computer science and electrical engineering communities to formulate ever-more efficient protocols and algorithms. Written by a respected figure in the field, Handbook of Wireless Networks and Mobile Computing is the first book to cover the subject from a computer scientist's perspective. It provides detailed practical coverage of an array of key topics, including cellular networks, channel assignment, queuing, routing, power optimization, and much more. Cellular networks of today generate a massive amount of signalling data. A large part of this signalling is generated to handle the mobility of subscribers and contains location information that can be used to fundamentally change our understanding of mobility patterns. However, the location data available from standard interfaces in cellular networks is very sparse and an important research question is how this data can be processed in order to efficiently use it for traffic state estimation and traffic planning. In this thesis, the potentials and limitations of using this signalling data in the context of estimating the road network traffic state and understanding mobility patterns is analyzed. The thesis describes in detail the location data that is available from signalling messages in GSM, GPRS and UMTS networks, both when terminals are in idle mode and when engaged in a telephone call or a data session. The potential is evaluated empirically using signalling data and measurements generated by standard cellular phones. The data used for analysis of location estimation and route classification accuracy (Paper I-IV in the thesis) is collected using dedicated hardware and software for cellular network analysis as well as tailor-made Android applications. For evaluation of more ad-

vanced methods for travel time estimation, data from GPS devices located in Taxis is used in combination with data from fixed radar sensors observing point speed and flow on the road network (Paper V). To evaluate the potential in using cellular network signalling data for analysis of mobility patterns and transport planning, real data provided by a cellular network operator is used (Paper VI). The signalling data available in all three types of networks is useful to estimate several types of traffic data that can be used for traffic state estimation as well as traffic planning. However, the resolution in time and space largely depends on which type of data that is extracted from the network, which type of network that is used and how it is processed. The thesis proposes new methods based on integrated filtering and classification as well as data assimilation and fusion that allows measurement reports from the cellular network to be used for efficient route classification and estimation of travel times. The thesis also shows that participatory sensing based on GPS equipped smartphones is useful in estimating radio maps for fingerprint-based positioning as well as estimating mobility models for use in filtering of course trajectory data from cellular networks. For travel time estimation, it is shown that the CEP-67 location accuracy based on the proposed methods can be improved from 111 meters to 38 meters compared to standard fingerprinting methods. For route classification, it is shown that the problem can be solved efficiently for highway environments using basic classification methods. For urban environments the link precision and recall is improved from 0.5 and 0.7 for standard fingerprinting to 0.83 and 0.92 for the proposed method based on particle filtering with integrity monitoring and Hidden Markov Models. Furthermore, a processing pipeline for data driven network assignment is proposed for billing data to be used when inferring mobility patterns used for traffic planning in terms of OD matrices, route choice and coarse travel times. The results of the large-scale data set highlight the importance of the underlying processing pipeline for this type of analysis. However, they also show very good potential in using large data sets for identifying needs of infrastructure investment by filtering out relevant data over large time periods.

Advanced Antenna Systems for 5G Network Deployments: Bridging the Gap between Theory and Practice provides a comprehensive understanding of the field of advanced antenna systems (AAS) and how they can be deployed in 5G networks. The book gives a thorough understanding of the basic technology components, the state-of-the-art multi-antenna solutions, what support 3GPP has standardized together with the reasoning, AAS performance in real networks, and how AAS can be used to enhance network deployments. Explains how AAS features impact network performance and how AAS can be effectively used in a 5G network, based on either NR and/or LTE Shows what AAS configurations and features to use in different network deployment scenarios, focusing on mobile broadband, but also including fixed wireless access Presents the latest developments in multi-antenna technologies, including Beamforming, MIMO and cell shaping, along with the potential of different technologies in a commercial network context Provides a deep understanding of the differences between mid-band and mm-Wave solutions

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 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

Fundamentals of 5G Mobile Networks provides an overview of the key features of the 5th Generation (5G) mobile networks, discuss-

ing the motivation for 5G and the main challenges in developing this new technology. This book provides an insight into the key areas of research that will define this new system technology paving the path towards future research and development. The book is multi-disciplinary in nature, and aims to cover a whole host of intertwined subjects that will predominantly influence the 5G landscape, including the future Internet, cloud computing, small cells and self-organizing networks (SONs), cooperative communications, dynamic spectrum management and cognitive radio, Broadcast-Broadband convergence, 5G security challenge, and green RF. This book aims to be the first of its kind towards painting a holistic perspective on 5G Mobile, allowing 5G stakeholders to capture key technology trends on different layering domains and to identify potential inter-disciplinary design aspects that need to be solved in order to deliver a 5G Mobile system that operates seamlessly.

Do you need to design efficient wireless communications systems? This unique text provides detailed coverage of radio resource allocation problems in wireless networks and the techniques that can be used to solve them. Covering basic principles and mathematical algorithms, and with a particular focus on power control and channel allocation, you will learn how to model, analyze, and optimize the allocation of resources in both physical and data link layers, and for a range of different network types. Both established and emerging networks are considered, including CDMA and OFDMA wireless networks, relay-based wireless networks, and cognitive radio networks. Numerous exercises help you put knowledge into practice, and provide the tools needed to address some of the current research problems in the field. This is an essential reference whether you are a graduate student, researcher or industry professional working in the field of wireless communication networks.

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. 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 planning. Written by a leading practitioner in the field with more than 15 years of experience. 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.

The future society would be ushered in a new communication era with the emergence of 5G. 5G would be significantly different, especially, in terms of architecture and operation in comparison with the previous communication generations (4G, 3G...). This book discusses the various aspects of the architecture, operation, possible challenges, and mechanisms to overcome them. Further, it supports users' interaction through communication devices relying on Human Bond Communication and COmmunication-NAvigation- SENSing- SERVICES (CONASENSE). Topics broadly covered in this book are: • Wireless Innovative System for Dynamically Operating Mega Communications (WISDOM) • Millimeter Waves and Spectrum Management • Cyber Security • Device to Device Communication Content: Introduction WISDOM Concept and Challenges SMNAT and Enabler of Device-to-Device Communication Dynamic Spectrum Management and mm-WAVES Cyber Security and Threats Beyond 2020

This textbook takes a unified view of the fundamentals of wireless communication and explains cutting-edge concepts in a simple and intuitive way. An abundant supply of exercises make it ideal for graduate courses in electrical and computer engineering and it will also be of great interest to practising engineers.

Low power wide area network (LPWAN) is a promising solution for long range and low power Internet of Things (IoT) and machine to machine (M2M) communication applications. The LPWANs are resource-constrained networks and have critical requirements for long battery life, extended coverage, high scalability, and low device and deployment costs. There are several design and deployment challenges such as media access control, spectrum manage-

ment, link optimization and adaptability, energy harvesting, duty cycle restrictions, coexistence and interference, interoperability and heterogeneity, security and privacy, and others. LPWAN Technologies for IoT and M2M Applications is intended to provide a one-stop solution for study of LPWAN technologies as it covers a broad range of topics and multidisciplinary aspects of LPWAN and IoT. Primarily, the book focuses on design requirements and constraints, channel access, spectrum management, coexistence and interference issues, energy efficiency, technology candidates, use cases of different applications in smart city, healthcare, and transportation systems, security issues, hardware/software platforms, challenges, and future directions. One stop guide to the technical details of various low power long range technologies such as LoRaWAN, Sigfox, NB-IoT, LTE-M and others. Describes the design aspects, network architectures, security issues and challenges. Discusses the performance, interference, coexistence issues and energy optimization techniques. Includes LPWAN based intelligent applications in diverse areas such as smart city, traffic management, health and others. Presents the different hardware and software platforms for LPWANs. Provides guidance on selecting the right technology for an application.

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

This practical hands-on new resource presents LTE technologies from end-to-end, including network planning and the optimization tradeoff process. This book examines the features of LTE-Advanced and LTE-Advanced Pro and how they integrate into existing LTE networks. Professionals find in-depth coverage of how the air interface is structured at the physical layer and how the related link level protocols are designed and work. This resource highlights potential 5G solutions as considered in releases 14 and beyond, the migration paths, and the challenges involved with the latest updates and standardization process. Moreover, the book covers performance analysis and results, as well as SON specifications and realization. Readers learn about OFDMA, and how DFT is used to implement it. Link budgeting, parameter estimations, and network planning and sizing is explained. Insight into core network architecture is provided, including the protocols and signaling used for both data and voice services. The book also presents a detailed chapter on the end-to-end data transfer optimization mechanisms based on the TCP protocol. This book provides the tools needed for network planning and optimization while addressing the challenges of LTE and LTE-advanced networks.

This book is a detailed compendium of these major advancements focusing exclusively on the emerging broadband wireless communication technologies which support broadband wireless data rate transmissions.

5G Outlook - Innovations and Applications is a collection of the recent research and development in the area of the Fifth Generation Mobile Technology (5G), the future of wireless communications. Plenty of novel ideas and knowledge of the 5G are presented in this book as well as divers applications from health science to business modeling. The authors of different chapters contributed from various countries and organizations. The chapters have also been presented at the 5th IEEE 5G Summit held in Aalborg on July 1, 2016. The book starts with a comprehensive introduction on 5G and its need and requirement. Then millimeter waves as a promising spectrum to 5G technology is discussed. The book continues with the novel and inspiring ideas for the future wireless communication usage and network. Further, some technical issues in signal processing and network design for 5G are presented. Finally, the book ends up with different applications of 5G in distinct areas. Topics widely covered in this book are: 5G technology from past to present to the future. Millimeter-waves and their characteristics. Signal processing and network design issues for 5G. Applications, business modeling and several novel ideas for the

future of 5G

Mobile devices outnumber desktop and laptop computers three to one worldwide, yet little information is available for designing and developing mobile applications. Mobile Design and Development fills that void with practical guidelines, standards, techniques, and best practices for building mobile products from start to finish. With this book, you'll learn basic design and development principles for all mobile devices and platforms. You'll also explore the more advanced capabilities of the mobile web, including markup, advanced styling techniques, and mobile Ajax. If you're a web designer, web developer, information architect, product manager, usability professional, content publisher, or an entrepreneur new to the mobile web, Mobile Design and Development provides you with the knowledge you need to work with this rapidly developing technology. Mobile Design and Development will help you: Understand how the mobile ecosystem works, how it differs from other mediums, and how to design products for the mobile context. Learn the pros and cons of building native applications sold through operators or app stores versus mobile websites or web apps. Work with flows, prototypes, usability practices, and screen-size-independent visual designs. Use and test cross-platform mobile web standards for older devices, as well as devices that may be available in the future. Learn how to justify a mobile product by building it on a budget.

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.

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 covers issues related to 5G network security. The authors start by providing details on network architecture and key requirements. They then outline the issues concerning security policies and various solutions that can handle these policies. Use of SDN-NFV technologies for security enhancement is also covered. The book includes intelligent solutions by utilizing the features of artificial intelligence and machine learning to improve the performance of the 5G security protocols and models. Optimization of security models is covered as a separate section with a detailed information on the security of 5G-based edge, fog, and osmotic computing. This book provides detailed guidance and reference material for academicians, professionals, and researchers. Presents extensive information and data on research and challenges in 5G networks; Covers basic architectures, models, security frameworks, and software-defined solutions for security issues in 5G networks; Provides solutions that can help in the growth of new startups as well as research directions concerning the future of 5G networks.

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 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 fea-

tures/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 Vo-coders 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.

Wireless technology is a truly revolutionary paradigm shift, enabling multimedia communications between people and devices from any location. It also underpins exciting applications such as sensor networks, smart homes, telemedicine, and automated highways. This book provides a comprehensive introduction to the underlying theory, design techniques and analytical tools of wireless communications, focusing primarily on the core principles of wireless system design. The book begins with an overview of wireless systems and standards. The characteristics of the wireless channel are then described, including their fundamental capacity limits. Various modulation, coding, and signal processing schemes are then discussed in detail, including state-of-the-art adaptive modulation, multicarrier, spread spectrum, and multiple antenna techniques. The concluding chapters deal with multiuser communications, cellular system design, and ad-hoc network design. Design insights and tradeoffs are emphasized throughout the book. It contains many worked examples, over 200 figures, almost 300 homework exercises, over 700 references, and is an ideal textbook for students.

Over the recent years, few books have been published covering all the subjects needed to understand the very fundamental concepts of cell planning. Most books which deal with this topic are destined to very specific audiences, and the vast majority introduce the subject at a very basic, or technical, level, or are destined to an academic audience. Cellular Network Planning begins with an introduction to the subject, covering conventional and contemporary wireless systems. Spectral allocation and the frequency plan are discussed, along with the essential characteristics of wireless systems. The design of mobile cellular systems includes cell planning, traffic and channel problems. The book presents a review of existing models, considering both green field dimensioning and network expansion strategies, and discusses multi-objective optimization and base station deployment based on artificial immune systems. It also discusses a cost-effective base station deployment approach based on artificial immune systems, and introduces the modified MO-AIS algorithm.

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work Expansion Cost-effective Planning Strategies

In response to a request from the Defense Advanced Research Projects Agency, the committee studied a range of issues to help identify what strategies the Department of Defense might follow to meet its need for flexible, rapidly deployable communications systems. Taking into account the military's particular requirements for security, interoperability, and other capabilities as well as the extent to which commercial technology development can be expected to support these and related needs, the book recommends systems and component research as well as organizational changes to help the DOD field state-of-the-art, cost-effective untethered communications systems. In addition to advising DARPA on where its investment in information technology for mobile wireless communications systems can have the greatest impact, the book explores the evolution of wireless technology, the often fruitful synergy between commercial and military research and development efforts, and the technical challenges still to be overcome in making the dream of "anytime, anywhere" communications a reality.

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

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

Enables engineers and researchers to understand the fundamentals and applications of device-to-device communications and its optimization in wireless networking.

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 focuses on the development and employment 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 constantly accessed by many different devices 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 gain useful information. Other notable features include: 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 common-sense guidelines for planning, deploying, 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 application development, or anyone looking to break into these fields.

This book presents a detailed pedagogical description of the 5G commercial wireless communication system design, from an end to end perspective. It compares and contrasts NR with LTE, and gives a concise and highly accessible description of the key technologies in the 5G physical layer, radio access network layer protocols and procedures. This book also illustrates how the 5G core and EPC is integrated into the radio access network, how virtualization and edge computer fundamentally change the way users interact with the network, as well as 5G spectrum issues. This book is structured into six chapters. The first chapter reviews the use cases, requirements, and standardization organization and activities for 5G. These are 5G requirements and not NR specifically, as technology that meets the requirements, may be submitted to the ITU as 5G technology. This includes a set of Radio Access Technologies (RATs), consisting of NR and LTE; with each RAT

meeting different aspects of the requirements. The second chapter describes the air interface of NR and LTE side by side. The basic aspects of LTE that NR builds upon are first described, followed by sections on the NR specific technologies, such as carrier/channel, spectrum/duplexing (including SUL), LTE/NR co-existence and new physical layer technologies (including waveform, Polar/LDPC codes, MIMO, and URLLC/mMTC). In all cases the enhancements made relative to LTE are made apparent. The third chapter contains descriptions of NR procedures (IAM/Beam Management/Power control/HARQ), protocols (CP/UP/mobility, including grant-free), and RAN architecture. The fourth chapter includes a detailed discussion related to end-to-end system architecture, and the 5G Core (5GC), network slicing, service continuity, relation to EPC, network virtualization, and edge computing. The fifth and major chapter describes the ITU submission and how NR and LTE meet the 5G requirements in significant detail, from the rapporteur responsible for leading the preparation and evaluation, as well as some field trial results. Engineers, computer scientists and professionals with a passing knowledge of 4G LTE and a comprehensive understanding of the end to end 5G commercial wireless system will find this book to be a valuable asset. Advanced-level students and researchers studying and working in communication engineering, who want to gain an understanding of the 5G system (as well as methodologies to evaluate features and technologies intended to supplement 5G) will also find this book to be a valuable resource.

This book gathers papers presented at the 13th International Conference on Genetic and Evolutionary Computing (ICGEC 2019), which was held in Qingdao, China, from 1st to 3rd, November 2019. Since it was established, in 2006, the ICGEC conference series has been devoted to new approaches with a focus on evolutionary computing. Today, it is a forum for the researchers and professionals in all areas of computational intelligence including evolutionary computing, machine learning, soft computing, data mining, multimedia and signal processing, swarm intelligence and security. The book appeals to policymakers, academics, educators, researchers in pedagogy and learning theory, school teachers, and other professionals in the learning industry, and further and continuing education.

A comparative introduction to major global wireless standards, technologies and their applications From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband, 3rd Edition provides technical descriptions of the various wireless technologies currently in use. It explains the rationales behind their differing mechanisms and implementations while exploring the advantages and limitations of each technology. This edition has been fully updated and substantially expanded to reflect the significant evolution in mobile network technology occurring over the past several years. The chapter on LTE has been extensively enhanced with new coverage of current implementations of LTE carrier aggregation, mobility management, cell reselection and handover procedures, as well as the latest developments in 5G radio and core networks in 3GPP. It now features additional information on the TD-LTE air interface, IPv6 in mobile networks, Network Function Virtualization (NFV) and Narrowband Internet of Things (NB-IOT). Voice-over-LTE (VoLTE) is now treated extensively in a separate chapter featuring coverage of the VoLTE call establishment process, dedicated bearer setup, header compression, speech codec and bandwidth negotiation, supplementary service configuration and VoLTE emergency calls. In addition, extensive coverage of Voice-over-Wifi and mission critical communication for public safety organizations over LTE has been added. The WLAN chapter now provides coverage of WPA2-Professional with certificates for authentication in large deployments, such as the global Eduroam network and the new WLAN 60 GHz air interface. Bluetooth evolution has been addressed by including a detailed description of Bluetooth Low Energy (BLE) in the chapter devoted to Bluetooth. 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.

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, and LTE cellular networks. Supplying a comprehensive explanation of the fundamental aspects of current and future cellular networks, the text starts with an overview of each type of network, including basic techniques and channel models. Next, it examines the challenges operators and vendors are likely to face—explaining the critical role network planning and optimization play in addressing these challenges. The book details effective system-level simulation methods, it also provides: A complete overview of UMTS, HSPA, and LTE networks Techniques for planning and optimizing cellular networks An examination of inter-operation issues with existing cellular networks Coverage of the challenges in deploying LTE and relay networks In addition to exploring the procedures for planning and optimizing each type of network, the text covers techniques for ma-

for mechanisms, trending, troubleshooting, and conducting radio performance analysis. Paying special attention to compatibility issues among these networks, this book provides the understanding required to deploy and optimize networks that meet the growing demands for mobile data solutions.

Summarizes and surveys current LTE technical specifications and implementation options for engineers and newly qualified support staff Concentrating on three mobile communication technologies, GSM, 3G-WCDMA, and LTE—while majorly focusing on Radio Access Network (RAN) technology—this book describes principles of mobile radio technologies that are used in mobile phones and service providers' infrastructure supporting their operation. It introduces some basic concepts of mobile network engineering used in design and rollout of the mobile network. It then follows up with principles, design constraints, and more advanced insights into radio interface protocol stack, operation, and dimensioning for three major mobile network technologies: Global System Mobile (GSM) and third (3G) and fourth generation (4G) mobile technologies. The concluding sections of the book are concerned with further developments toward next generation of mobile network (5G). Those include some of the major features of 5G such as a New Radio, NG-RAN distributed architecture, and network slicing. The last section describes some key concepts that may bring significant enhancements in future technology and services experienced by customers. Introduction to Mobile Network Engineering: GSM, 3G-WCDMA, LTE and the Road to 5G covers the types of Mobile Network by Multiple Access Scheme; the cellular system; radio propagation; mobile radio channel; radio network planning; EGPRS - GPRS/EDGE; Third Generation Network (3G), UMTS; High Speed Packet data access (HSPA); 4G-Long Term Evolution (LTE) system; LTE-A; and Release 15 for 5G. Focuses on Radio Access Network technologies which empower communications in current and emerging mobile network systems Presents a mix of introductory and advanced reading, with a generalist view on current mobile

network technologies Written at a level that enables readers to understand principles of radio network deployment and operation Based on the author's post-graduate lecture course on Wireless Engineering Fully illustrated with tables, figures, photographs, working examples with problems and solutions, and section summaries highlighting the key features of each technology described Written as a modified and expanded set of lectures on wireless engineering taught by the author, Introduction to Mobile Network Engineering: GSM, 3G-WCDMA, LTE and the Road to 5G is an ideal text for post-graduate and graduate students studying wireless engineering, and industry professionals requiring an introduction or refresher to existing technologies.

"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 plann-

ing 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.

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.