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KAILEY LAMBERT

Air Interface Technologies and

Performance
John Wiley &
Sons

The Definitive
Guide to LTE
Technology
Long-Term
Evolution
(LTE) is the
next step in
the GSM
evolutionary
path beyond
3G
technology,
and it is
strongly
positioned to
be the
dominant
global
standard for
4G cellular

networks. LTE
also
represents the
first
generation of
cellular
networks to
be based on a
flat IP
architecture
and is
designed to
seamlessly
support a
variety of
different
services, such
as broadband
data, voice,
and multicast
video. Its
design
incorporates
many of the
key
innovations of
digital
communication, such as
MIMO
(multiple input
multiple
output) and
OFDMA
(orthogonal
frequency
division
multiple
access), that
mandate new
skills to plan,
build, and
deploy an LTE
network. In
Fundamentals
of LTE , four
leading
experts from
academia and
industry
explain the
technical
foundations of
LTE in a
tutorial
style—providi
ng a
comprehensiv
e overview of
the standards.
Following the
same
approach that
made their

<p>recent Fundamentals of WiMAX successful, the authors offer a complete framework for understanding and evaluating LTE. Topics include Cellular wireless history and evolution: Technical advances, market drivers, and foundational networking and communicatio ns technologies Multicarrier modulation theory and practice: OFDM system</p>	<p>design, peak- to-average power ratios, and SC-FDE solutions Frequency Domain Multiple Access: OFDMA downlinks, SC- FDMA uplinks, resource allocation, and LTE-specific implementatio n Multiple antenna techniques and tradeoffs: spatial diversity, interference cancellation, spatial multiplexing, and multiuser/net worked MIMO LTE standard overview: air interface</p>	<p>protocol, channel structure, and physical layers Downlink and uplink transport channel processing: channel encoding, modulation mapping, Hybrid ARQ, multi-antenna processing, and more Physical/MAC layer procedures and scheduling: channel-aware scheduling, closed/open- loop multi- antenna processing, and more Packet flow, radio resource, and</p>
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<p>mobility management: RLC, PDCP, RRM, and LTE radio access network mobility/hand off procedures</p> <p><i>Broadband Wireless Access Networks for 4G: Theory, Application, and Experimentati</i> on Pearson Education</p> <p>GET A SOLID GROUNDING IN CUTTING-EDGE CELLULAR TECHNOLOGY</p> <p>Gain an overall understanding of the constantly evolving spectrum of wireless</p>	<p>technologies, devices, and standards. Completely revised throughout, Wireless Crash Course, Third Edition offers straightforward explanations of all aspects of cellular networks and provides clear information on cellular design and operational concepts. Learn the fundamentals of cell base stations, radio frequency (RF) technologies, microwave radio systems, and 3G and 4G / LTE technologies, and discover</p>	<p>practical new applications and mobile data technologies. Examples, photos, and illustrations from the field are included in this practical guide.</p> <p>COVERAGE INCLUDES:</p> <p>Cellular radio history and development The cell base station Basic cellular network design and operation Radio frequency (RF) operation and technologies Antennas, RF power, and sectorization Distributed antenna</p>
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systems (DAS) Base station elements and RF signal flow 2G and 3G digital wireless technologies Cellular generations overview 4G and Long Term Evolution (LTE) Microwave radio systems Cell site to MTSO network connections The MTSO, core network, and network operations center (NOC) Personal communicatio n services (PCS) and current marketplace Towers	Capacity management, propagation models, and drive testing Interconnectio n to the landline public switched telephone network (PSTN) Roaming and intercarrier networking Mobile data technologies The business side of wireless Mobile applications <u>Guide to Computer Network Security</u> McGraw Hill Professional With the increased functionality demand for	mobile speed and access in our everyday lives, broadband wireless networks have emerged as the solution in providing high data rate communicatio ns systems to meet these growing needs. Broadband Wireless Access Networks for 4G: Theory, Application, and Experimentati on presents the latest trends and research on mobile ad hoc networks, vehicular ad hoc networks,
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and routing algorithms which occur within various mobile networks. This publication smartly combines knowledge and experience from enthusiastic scholars and expert researchers in the area of wideband and broadband wireless networks. Students, professors, researchers, and other professionals in the field will benefit from this book's practical applications

and relevant studies. *From Massive Deployments to Critical 5G Applications* "O'Reilly Media, Inc." GET A SOLID GROUNDING IN CUTTING-EDGE CELLULAR TECHNOLOGY Gain an overall understanding of the constantly evolving spectrum of wireless technologies, devices, and standards. Completely revised throughout, *Wireless Crash Course, Third Edition* offers straightforward

d explanations of all aspects of cellular networks and provides clear information on cellular design and operational concepts. Learn the fundamentals of cell base stations, radio frequency (RF) technologies, microwave radio systems, and 3G and 4G / LTE technologies, and discover practical new applications and mobile data technologies. Examples, photos, and illustrations from the field are included in

<p>this practical guide. COVERAGE INCLUDES: Cellular radio history and development The cell base station Basic cellular network design and operation Radio frequency (RF) operation and technologies Antennas, RF power, and sectorization Distributed antenna systems (DAS) Base station elements and RF signal flow 2G and 3G digital wireless technologies Cellular generations</p>	<p>overview 4G and Long Term Evolution (LTE) Microwave radio systems Cell site to MTSO network connections The MTSO, core network, and network operations center (NOC) Personal communication services (PCS) and current marketplace Towers Capacity management, propagation models, and drive testing Interconnection to the landline public switched telephone</p>	<p>network (PSTN) Roaming and intercarrier networking Mobile data technologies The business side of wireless Mobile applications <i>2G/2.5G/3G...Evolution to 4G</i> Cambridge University Press The aim of this book is to provide comprehensive coverage of current state of the art theoretical and technological aspects of broadband mobile and wireless networks</p>
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focusing on Long Term Evolution Network. The presentation starts from basic principles, and proceeds to the most advanced topics. Provided schemes are developed and oriented in the context of actual closed standards of the IEEE working groups and the 3 GPPP LTE. Also this book will focus on the understanding of the LTE technology as well as the study of its performance

in terms of mobility, quality of service, security, resource allocation.

4G: LTE/LTE-Advanced for Mobile Broadband

Academic Press

This fully revised and updated new edition of the definitive text/reference on computer network and information security presents a comprehensive guide to the repertoire of security tools, algorithms and best practices mandated by

the technology we depend on. Topics and features: highlights the magnitude of the vulnerabilities, weaknesses and loopholes inherent in computer networks; discusses how to develop effective security solutions, protocols, and best practices for the modern computing environment; examines the role of legislation, regulation, and enforcement in securing

computing and mobile systems; describes the burning security issues brought about by the advent of the Internet of Things and the eroding boundaries between enterprise and home networks (NEW); provides both quickly workable and more thought-provoking exercises at the end of each chapter, with one chapter devoted entirely to hands-on exercises; supplies

additional support materials for instructors at an associated website. Cellular Communications Springer 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 Public Safety Networks from LTE to 5G Academic Press 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 *HSPA and LTE for Mobile Broadband*. Artech House. In the ever-evolving telecommunic

ation industry, technological improvements alone are not able to keep up with the significant growth of mobile broadband traffic. As such, new research on communications networks is necessary to keep up with rising demand.

Convergence of Broadband, Broadcast, and Cellular Network Technologies addresses the problems of broadband, broadcast, and cellular coexistence, including the

increasing number of advanced mobile users and their bandwidth demands. This book will serve as a link between academia and industry, serving students, researchers, and industry professionals.

Powering Digitalization

n Springer
Science & Business Media

This timely book provides an overview of technologies for Public Safety Networks (PSNs). Including real-

life examples of network application and services, it introduces readers to the many public safety network technologies and covers the historical developments as well as emerging trends in PSNs such as today's 4G and tomorrow's 5G cellular network related solutions. em style="mso-bidi-font-style: normal;"Public Safety Networks from LTE to 5G explores the gradual

changes and transformation in the PSNs from the traditional approaches in communications, and examines the new technologies that have permeated this realm, as well as their advantages. It gives readers a look at the challenges public safety networks face by developing solutions for data rates such as introducing broadband data services into safer communication. Topics covered

include: TETRA and TETRAPOL; Digital Mobile Radio (DMR), Next-Generation Digital Narrowband (NXDN), Digital Private Mobile Radio (dPMR); and Professional Digital Trunking (PDT). The book also presents information on FirstNet, ESN, and Safenet; Satellite Communications in EMS (Emergency Management) and Public Protection and Disaster Relief (PPDR); Wi-Fi in

Ambulances; Technology in Patrol Communications; and more. Fundamentals and Standards John Wiley & Sons 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.

LTE for 4G Mobile Broadband
John Wiley & Sons
4G: LTE/LTE-Advanced for Mobile Broadband
Academic Press
5G Mobile Communications
John Wiley & Sons

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. *LTE and the Evolution to 4G Wireless* IGI Global

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

<p>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</p>	<p>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</p>	<p>technologies. An <i>Introduction to Mobile Networks and Mobile Broadband</i> Springer Science & Business Media. 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,</p>
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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 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

**A
Comprehensive and
Practical
Guide**

McGraw Hill Professional
A practical guide to LTE design, test and measurement, this new edition has been updated to include the latest developments
This book presents the latest details on LTE from a practical and technical perspective. Written by Agilent's measurement experts, it offers a valuable insight into

LTE technology and its design and test challenges. Chapters cover the upper layer signaling and system architecture evolution (SAE). Basic concepts such as MIMO and SC-FDMA, the new uplink modulation scheme, are introduced and explained, and the authors look into the challenges of verifying the designs of the receivers, transmitters and protocols of LTE systems. The

latest information on RF and signaling conformance testing is delivered by authors participating in the LTE 3GPP standards committees. This second edition has been considerably revised to reflect the most recent developments of the technologies and standards. Particularly important updates include an increased focus on LTE-Advanced as

well as the latest testing specifications. Fully updated to include the latest information on LTE 3GPP standards Chapters on conformance testing have been majorly revised and there is an increased focus on LTE-Advanced Includes new sections on testing challenges as well as over the air MIMO testing, protocol testing and the most up-to-date test capabilities of instruments Written from

both a technical and practical point of view by leading experts in the field *3G Evolution* Springer Nature Wireless Networking Complete is a compilation of critical content from key Morgan Kaufmann titles published in recent years on wireless networking and communications. Individual chapters are organized into one complete reference giving a 360-degree view

from our bestselling authors. From wireless application protocols, to Mesh Networks and Ad Hoc Sensor Networks, to security and survivability of wireless systems – all of the elements of wireless networking are united in a single volume. The book covers both methods of analysis and problem-solving techniques, enhancing the reader's grasp of the material and ability to implement

practical solutions. This book is essential for anyone interested in new and developing aspects of wireless network technology. Chapters contributed by recognized experts in the field cover theory and practice of wireless network technology, allowing the reader to develop a new level of knowledge and technical expertise Up-to-date coverage of wireless

networking issues facilitates learning and lets the reader remain current and fully informed from multiple viewpoints Presents methods of analysis and problem-solving techniques, enhancing the reader's grasp of the material and ability to implement practical solutions *Demonstration of an Effective 4G LTE Network Simulator to Analyze Performance and Ensure Reliable*

Communication Morgan Kaufmann 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 measurement s 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

<p>scheduling (SPS), TTI bundling, Quality of Service (QoS), VoIP with C-DRX, Robust Header Compression (RoHC), and VoLTE</p> <p>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</p>	<p>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</p>	<p>deploying commercial LTE networks. Analyzes LTE coverage and link budgets, including a detailed comparative analysis with HSPA+.</p> <p>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</p>
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Theory,
Application,
and
Experimenta
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Wiley & Sons
With the
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well as the
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Though the
3GPP's Long
Term
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(LTE) has
been
successful to
mitigate most
of the
challenges,
there arises a
need to
foresee the
cellular
network
evolution
considering
various factors
like increase
in number of
users in a
particular

area, urbanization etc., and accordingly use the features of LTE to overcome the effects of them before actually deploying the network in the real world. This thesis outlines the requirement for an effective 4G LTE simulator that can model the real world cellular network by considering the various effects on a wireless network like fading, pathloss, number of

users and resource allocation. It can then explore various aspects of 4G LTE that contributes towards design and analysis of the network performance for various scenarios supporting deployment of the new network for futuristic operation or optimizing the existing network. In this study we closely look through a System level LTE Simulator developed by the Institute of

Telecommunications of The Vienna University of Technology, Austria. Using this simulator we study different scheduling schemes to evaluate performance and demonstrate how important the role of scheduling scheme is to overcome network congestion. We study various features of LTE that help in increasing throughput for various traffic models over a network and demonstrate

the role of small cells in increasing the overall throughput of the network by comparing with the existing macro cell network. Various parameters are varied and results are obtained for various scenarios using the Vienna LTE simulator. These results are then used to demonstrate how Quality of Service (QoS), capacity planning, and resource management are achieved through LTE

technology. This study helps the service provider to offer reliable service at lower implementation cost and deploy a network that has ability to sustain the evolution. 3G, 4G and Beyond IGI Global This book provides an accessible and comprehensive tutorial on the key enabling technologies for 5G and beyond, covering both the fundamentals and the state-

of-the-art 5G standards. The book begins with a historical overview of the evolution of cellular technologies and addresses the questions on why 5G and what is 5G. Following this, six tutorial chapters describe the fundamental technology components for 5G and beyond. These include modern advancements in channel coding, multiple access, massive multiple-input

and multiple-output (MIMO), network densification, unmanned aerial vehicle enabled cellular networks, and 6G wireless systems. The second part of this book consists of five chapters that introduce the basics of 5G New Radio

(NR) standards developed by 3GPP. These include 5G architecture, protocols, and physical layer aspects. The third part of this book provides an overview of the key 5G NR evolution directions. These directions include ultra-reliable low-

latency communication (URLLC) enhancements, operation in unlicensed spectrum, positioning, integrated access and backhaul, air-to-ground communication, and non-terrestrial networks with satellite communication.