

5g core network diagram

5G Core Network Diagram: A Deep Dive into the Architecture of Next-Generation Connectivity

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Summary: This report provides a comprehensive overview of the 5G core network diagram, detailing its architecture, key components, functionalities, and benefits compared to previous generations. We examine the evolution from 4G EPC (Evolved Packet Core) to the 5G Core, emphasizing the network slicing capabilities, improved security features, and support for diverse use cases. The report analyzes the role of key network functions, including the User Plane Function (UPF), Session Management Function (SMF), Access and Mobility Management Function (AMF), and the impact of network virtualization and cloud-native technologies on the 5G core network diagram's efficiency and scalability. We also delve into the challenges and future trends shaping the 5G core network's evolution.

Keywords: 5G core network diagram, 5G core network architecture, 5G network functions, network slicing, 5G security, cloud-native 5G core, network virtualization, UPF, SMF, AMF, 5G evolution.

1. Introduction to the 5G Core Network Diagram

The 5G core network is a significant departure from its predecessors. Unlike the 4G EPC, which was primarily a circuit-switched network, the 5G core is a service-based architecture, designed for flexibility, scalability, and adaptability to diverse use cases. Understanding the 5G core network diagram is crucial for grasping the technological advancements that underpin 5G's capabilities. The diagram illustrates a service-based architecture where network functions are decoupled and interconnected via standardized interfaces. This allows for flexibility in deploying and managing network resources.

2. Key Components of the 5G Core Network Diagram

A comprehensive 5G core network diagram showcases several key network functions (NFs):

User Plane Function (UPF): Handles the actual user data, performing functions like Quality of Service (QoS) management and packet forwarding. Its location is crucial for latency optimization.

Session Management Function (SMF): Responsible for managing user sessions, including session establishment, modification, and termination. It plays a crucial role in network slicing and policy control.

Access and Mobility Management Function (AMF): Manages user registration, authentication, and mobility management. This function is critical for seamless handover between different cells and network access technologies.

Network Repository Function (NRF): A central registry that stores information about the availability and location of different network functions. This is vital for dynamic service orchestration.

Authentication Server Function (AUSF): Handles user authentication and security procedures, ensuring secure access to the network.

Policy Control Function (PCF): Defines and enforces policies related to user access, QoS, and security. This is crucial for controlling network resources and ensuring compliance with regulations.

UDM (Unified Data Management): Stores subscriber data and user profiles, essential for personalized services and network security.

These functions, depicted in the 5G core network diagram, work in conjunction to provide seamless connectivity and support a wide range of applications. The relationships between these NFs, as shown in the 5G core network diagram, are crucial for understanding the overall functionality.

3. Network Slicing and its Representation in the 5G Core Network Diagram

One of the most significant advantages of the 5G core network is its ability to support network slicing. A 5G core network diagram illustrating network slicing would show multiple virtualized instances of the core network functions, each tailored to a specific application or service. For instance, a slice optimized for autonomous vehicles would prioritize low latency and high reliability, while a slice for IoT devices might prioritize massive connectivity and low power consumption. The 5G core network diagram, therefore, becomes more complex but also more illustrative of its flexibility and efficiency.

Research by Ericsson (2022) indicates that network slicing can improve network efficiency by up to 40% and reduce latency by up to 50% depending on the specific application. This

efficiency is clearly illustrated in a detailed 5G core network diagram showing the separation of slices.

4. Security in the 5G Core Network Diagram

Security is a paramount concern in 5G, and this is reflected in the architecture depicted by the 5G core network diagram. Several key functions, such as the AUSF and PCF, contribute to a robust security posture. End-to-end encryption, robust authentication protocols, and advanced threat detection mechanisms are incorporated to protect user data and network integrity. Studies by GSMA Intelligence (2023) highlight the importance of integrated security across the entire 5G architecture, which is visually emphasized in a comprehensive 5G core network diagram.

5. Cloud-Native Architecture and its Impact on the 5G Core Network Diagram

The 5G core is increasingly adopting a cloud-native architecture, which simplifies deployment, improves scalability, and enhances operational efficiency. The 5G core network diagram for a cloud-native deployment would highlight the virtualization of NFs and their deployment across cloud infrastructure. This approach enables dynamic resource allocation, optimized cost management, and improved resilience. Research by the Open Networking Foundation (ONF, 2023) demonstrates that cloud-native architectures can significantly reduce operational expenses and improve service agility.

6. Evolution and Future Trends

The 5G core network is a constantly evolving technology. Future developments will likely focus on further virtualization, automation, and integration with other technologies like edge computing and AI. The 5G core network diagram will continue to evolve, reflecting these advancements and new network functions. A future 5G core network diagram might include functions related to AI-driven network optimization and advanced analytics.

Conclusion

The 5G core network diagram is a critical tool for understanding the architecture and functionality of the next-generation cellular network. Its service-based architecture, supported by advanced network functions and virtualization, enables a level of flexibility and scalability unmatched by previous generations. While challenges remain, particularly around security and interoperability, the continuous evolution of the 5G core network promises to deliver unprecedented connectivity capabilities and transform various industries. The 5G core network diagram, therefore, serves not only as a visual representation but also as a roadmap for future advancements in telecommunications.

FAQs

1. What is the difference between the 4G EPC and the 5G Core? The 4G EPC is a circuit-switched architecture, while the 5G core is a service-based architecture, offering greater flexibility and scalability.

1. What is network slicing, and how does it impact the 5G core network diagram? Network slicing allows for the creation of multiple virtualized networks within a single physical infrastructure, each tailored to specific applications. A 5G core network diagram illustrating network slicing shows multiple instances of network functions.

1. What are the key security features of the 5G core network? The 5G core incorporates end-to-end encryption, robust authentication protocols, and advanced threat detection mechanisms.

1. What is the role of the UPF in the 5G core network? The UPF handles user data, performing QoS management and packet forwarding.

1. How does cloud-native architecture impact the 5G core network diagram? Cloud-native architecture virtualizes network functions and deploys them across cloud infrastructure, enabling dynamic resource allocation and improved efficiency.

1. What are the future trends in 5G core network evolution? Future trends include further virtualization, automation, integration with edge computing and AI, and advancements in network slicing techniques.

1. What are the benefits of using a 5G core network diagram? A 5G core network diagram provides a visual understanding of the network architecture, facilitating planning, troubleshooting, and optimization.

1. How does the 5G core network diagram differ from a 4G EPC diagram? The 5G core network diagram showcases a service-based architecture with decoupled network functions, unlike the monolithic structure of the 4G EPC diagram.

1. Where can I find more information on 5G core network diagrams and related topics? You can find additional information from industry publications, research papers, vendor documentation, and online resources like the 3GPP website.

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5g core network diagram: 5G Core Networks Stefan Rommer, Peter Hedman, Magnus Olsson, Lars Frid, Shabnam Sultana, Catherine Mulligan, 2019-11-14 5G Core Networks: Powering Digitalization provides an overview of the 5G Core network architecture, as well as giving descriptions of cloud technologies and the key concepts in the 3GPP rel-15/16 specifications. Written by the authors who are heavily involved in development of the 5G standards and who wrote the successful book on EPC and 4G Packet Networks, this book provides an authoritative reference on the technologies and standards of the 3GPP 5G Core network. Content includes: - An overview of the

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5g core network diagram: *An Introduction to 5G* Christopher Cox, 2020-12-14 A comprehensive and approachable introduction to 5G Written by a noted expert on the subject, An Introduction to 5G: The New Radio, 5G Network and Beyond offers an introductory system-level guide to 5G. The material covered includes: The use cases and requirements of the 5G system The architecture of the next generation radio access network and the 5G core The principles of radio transmission, millimetre waves and MIMO antennas The architecture and detailed design of the 5G new radio The implementation of HTTP/2 on the service-based interfaces of the 5G core The signalling procedures that govern the end-to-end-operation of the system The new features that are introduced in Releases 16 and 17 An Introduction to 5G is written for engineering professionals in mobile telecommunications, for those in non-technical roles such as management, marketing and intellectual property, and for students. It requires no more than a basic understanding of mobile

communications, and includes detailed references to the underlying 3GPP specifications for 5G. The book's approach provides a comprehensive, end-to-end overview of the 5G standard, which enables readers to move on with confidence to the more specialized texts and to the specifications themselves.

5g core network diagram: *Fundamentals of 5G Communications: Connectivity for Enhanced Mobile Broadband and Beyond* Wanshi Chen, Peter Gaal, Juan Montojo, Haris Zisimopoulos, 2021-07-23 Explore the foundations and applications of 5G technology This comprehensive guide contains practical information from telecommunications experts working at the forefront of 5G innovation. The authors discuss the foundations of 5G technology—not just the new standards, but the reasons and stories behind them. Fundamentals of 5G Communications features coverage of all major vertical domains with a focus on practical, commercial applications. This book serves both as an essential reference for telecom professionals and as a textbook for students learning about 5G. Coverage includes: 5G versus 4G: What's new? Deployment scenarios and architecture options The evolution of 5G architecture Numerology and slot structure Initial access and mobility Downlink control and data operation Uplink control and data operation Coexistence of 4G and 5G 5G in unlicensed and shared spectra Vertical expansion: URLLC, MTC, V2X Vertical expansion: broadcast and multicast Typical 5G commercial deployments A look toward the future of 5G

5g core network diagram: *Moving Broadband Mobile Communications Forward* Abdelfatteh Haidine, 2021-08-18 The deployment of 4G/LTE (Long-Term Evolution) mobile networks has solved the major challenge of high capacities to build a real broadband mobile internet. This was possible mainly through a very strong physical layer and flexible network architecture. However, bandwidth-hungry services such as virtual reality (VR) and augmented reality (AR), have been developed in an unprecedented way. Furthermore, mobile networks are facing other new services with extreme demand for greater reliability and almost zero-latency performance, like vehicle communications and the Internet of Vehicles (IoV). Therefore, industries and researchers are investigating new physical layers and softwarization techniques and including more intelligence in 5G and beyond 5G (B5G/6G). This book discusses some of these softwarization techniques, such as fog computing, cloud computing, and artificial intelligence (AI) and machine learning (ML). It also presents use cases showing practical aspects from 5G deployment scenarios, where other communications technologies will co-habit to build the landscape of next-generation mobile networks (NGMNs).

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5g core network diagram: *5G Explained* Jyrki T. J. Penttinen, 2019-04-29 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.

5g core network diagram: System Engineering for IMS Networks Arun Handa, 2009-03-12 The IMS is the foundation architecture for the next generation of mobile phones, wireless-enabled PDAs, PCs, and the like. IMS delivers multimedia content (audio, video, text, etc.) over all types of networks. For network engineers/administrators and telecommunications engineers it will be essential to not only understand IMS architecture, but to also be able to apply it at every stage of the network design process. This book will contain pragmatic information on how to engineer IMS networks as well as an applications-oriented approach for the engineering and networking professionals responsible for making IMS function in the real world. - Describes the convergence of wireless IMS (IP Multimedia Subsystem) with other networks, including wireline and cable - Discusses building interfaces for end users and IMS applications servers - Explores network management issues with IMS

5g core network diagram: 5G for the Connected World Devaki Chandramouli, Rainer Liebhart, Juho Pirskanen, 2019-04-29 Comprehensive Handbook Demystifies 5G for Technical and Business Professionals in Mobile Telecommunication Fields Much is being said regarding the possibilities and capabilities of the emerging 5G technology, as the evolution towards 5G promises to transform entire industries and many aspects of our society. 5G for the Connected World offers a comprehensive technical overview that telecommunication professionals need to understand and take advantage of these developments. The book offers a wide-ranging coverage of the technical aspects of 5G (with special consideration of the 3GPP Release 15 content), how it enables new services and how it differs from LTE. This includes information on potential use cases, aspects of radio and core networks, spectrum considerations and the services primarily driving 5G development and deployment. The text also looks at 5G in relation to the Internet of Things, machine to machine communication and technical enablers such as LTE-M, NB-IoT and EC-GSM. Additional chapters discuss new business models for telecommunication service providers and vertical industries as a result of introducing 5G and strategies for staying ahead of the curve. Other topics include: Key features of the new 5G radio such as descriptions of new waveforms, massive MIMO and beamforming technologies as well as spectrum considerations for 5G radio regarding all possible bands Drivers, motivations and overview of the new 5G system - especially RAN architecture and technology enablers (e.g. service-based architecture, compute-storage split and network exposure) for native cloud deployments Mobile edge computing, Non-3GPP access, Fixed-Mobile Convergence Detailed overview of mobility management, session management and Quality of Service frameworks 5G security vision and architecture Ultra-low latency and high reliability use cases and enablers, challenges and requirements (e.g. remote control, industrial automation, public safety and V2X communication) An outline of the requirements and challenges imposed by massive numbers of devices connected to cellular networks While some familiarity with the basics of 3GPP networks is helpful, 5G for the Connected World is intended for a variety of readers. It will prove a useful guide for telecommunication professionals, standardization experts,

network operators, application developers and business analysts (or students working in these fields) as well as infrastructure and device vendors looking to develop and integrate 5G into their products, and to deploy 5G radio and core networks.

5g core network diagram: 5G System Design Patrick Marsch, Ömer Bulakci, Olav Queseth, Mauro Boldi, 2018-03-28 This book provides a comprehensive overview of the latest research and standardization progress towards the 5th generation (5G) of mobile communications technology and beyond. It covers a wide range of topics from 5G use cases and their requirements, to spectrum, 5G end-to-end (E2E) system architecture including core network (CN), transport network (TN) and radio access network (RAN) architecture, network slicing, security and network management. It further dives into the detailed functional design and the evaluation of different 5G concepts, and provides details on planned trials and pre-commercial deployments across the globe. While the book naturally captures the latest agreements in 3rd Generation Partnership Project (3GPP) New Radio (NR) Release 15, it goes significantly beyond this by describing the likely developments towards the final 5G system that will ultimately utilize a wide range of spectrum bands, address all envisioned 5G use cases, and meet or exceed the International Mobile Telecommunications (IMT) requirements for the year 2020 and beyond (IMT-2020). 5G System Design: Architectural and Functional Considerations and Long Term Research is based on the knowledge and consensus from 158 leading researchers and standardization experts from 54 companies or institutes around the globe, representing key mobile network operators, network vendors, academic institutions and regional bodies for 5G. Different from earlier books on 5G, it does not focus on single 5G technology components, but describes the full 5G system design from E2E architecture to detailed functional design, including details on 5G performance, implementation and roll-out.

5g core network diagram: 5G: 2020 and Beyond Ramjee Prasad, 2022-09-01 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

5g core network diagram: 5G and Beyond Xingqin Lin, Namyoon Lee, 2021-03-25 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.

5g core network diagram: 5GtoB From Theory to Practice Liang Song,

5g core network diagram: 5G Mobile Communications Saad Asif, 2018-07-20 This book will help readers comprehend technical and policy elements of telecommunication particularly in the context of 5G. It first presents an overview of the current research and standardization practices and lays down the global frequency spectrum allocation process. It further lists solutions to

accommodate 5G spectrum requirements. The readers will find a considerable amount of information on 4G (LTE-Advanced), LTE-Advance Pro, 5G NR (New Radio); transport network technologies, 5G NGC (Next Generation Core), OSS (Operations Support Systems), network deployment and end-to-end 5G network architecture. Some details on multiple network elements (end products) such as 5G base station/small cells and the role of semiconductors in telecommunication are also provided. Keeping trends in mind, service delivery mechanisms along with state-of-the-art services such as MFS (mobile financial services), mHealth (mobile health) and IoT (Internet-of-Things) are covered at length. At the end, telecom sector's burning challenges and best practices are explained which may be looked into for today's and tomorrow's networks. The book concludes with certain high level suggestions for the growth of telecommunication, particularly on the importance of basic research, departure from ten-year evolution cycle and having a 20-30 year plan. Explains the conceivable six phases of mobile telecommunication's ecosystem that includes R&D, standardization, product/network/device & application development, and burning challenges and best practices Provides an overview of research and standardization on 5G Discusses solutions to address 5G spectrum requirements while describing the global frequency spectrum allocation process Presents various case studies and policies Provides details on multiple network elements and the role of semiconductors in telecommunication Presents service delivery mechanisms with special focus on IoT

5g core network diagram: 5G Physical Layer Ali Zaidi, Fredrik Athley, Jonas Medbo, Ulf Gustavsson, Giuseppe Durisi, Xiaoming Chen, 2018-09-22 5G Physical Layer: Principles, Models and Technology Components explains fundamental physical layer design principles, models and components for the 5G new radio access technology - 5G New Radio (NR). The physical layer models include radio wave propagation and hardware impairments for the full range of frequencies considered for the 5G NR (up to 100 GHz). The physical layer technologies include flexible multi-carrier waveforms, advanced multi-antenna solutions, and channel coding schemes for a wide range of services, deployments, and frequencies envisioned for 5G and beyond. A MATLAB-based link level simulator is included to explore various design options. 5G Physical Layer is very suitable for wireless system designers and researchers: basic understanding of communication theory and signal processing is assumed, but familiarity with 4G and 5G standards is not required. With this book the reader will learn: - The fundamentals of the 5G NR physical layer (waveform, modulation, numerology, channel codes, and multi-antenna schemes). - Why certain PHY technologies have been adopted for the 5G NR. - The fundamental physical limitations imposed by radio wave propagation and hardware impairments. - How the fundamental 5G NR physical layer functionalities (e.g., parameters/methods/schemes) should be realized. The content includes: - A global view of 5G development - concept, standardization, spectrum allocation, use cases and requirements, trials, and future commercial deployments. - The fundamentals behind the 5G NR physical layer specification in 3GPP. - Radio wave propagation and channel modeling for 5G and beyond. - Modeling of hardware impairments for future base stations and devices. - Flexible multi-carrier waveforms, multi-antenna solutions, and channel coding schemes for 5G and beyond. - A simulator including hardware impairments, radio propagation, and various waveforms. Ali Zaidi is a strategic product manager at Ericsson, Sweden. Fredrik Athley is a senior researcher at Ericsson, Sweden. Jonas Medbo and Ulf Gustavsson are senior specialists at Ericsson, Sweden. Xiaoming Chen is a professor at Xi'an Jiaotong University, China. Giuseppe Durisi is a professor at Chalmers University of Technology, Sweden, and a guest researcher at Ericsson, Sweden.

5g core network diagram: The Wiley 5G REF , 2021-07-26 THE WILEY 5G REF Explore cutting-edge subjects in 5G privacy and security In The Wiley 5G REF: Security, a team of distinguished researchers delivers an insightful collection of articles selected from the online-only The Wiley 5G Reference. The editors introduce the security landscape of 5G, including the significant security and privacy risks associated with 5G networks. They also discuss different security solutions for various segments of the 5G network, like the radio, edge, access, and core networks. The book explores the security threats associated with key network softwarization

technologies, like SDN, NFV, NS, and MEC, as well as those that come with new 5G and IoT services. There is also a detailed discussion on the privacy of 5G networks. The included articles are written by leading international experts in security and privacy for telecommunication networks. They offer learning opportunities for everyone from graduate-level students to seasoned engineering professionals. The book also offers: A thorough introduction to the 5G mobile network security landscape and the major risks associated with it Comprehensive explorations of SDMN security, the complex challenges associated with 5G security, and physical-layer security for 5G and future networks Practical discussions of security for Handover and D2D communication in 5G HetNets, authentication and access control for 5G, and G5-Core network security In-depth examinations of MEC and cloud security, as well as VNF placement and sharing in NFV-based cellular networks Perfect for researchers and practitioners in the fields of 5G security and privacy, *The Wiley 5G REF: Security* is an indispensable resource for anyone seeking a solid educational foundation in the latest 5G developments.

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5g core network diagram: Multiple Access Techniques for 5G Wireless Networks and Beyond Mojtaba Vaezi, Zhiguo Ding, H. Vincent Poor, 2018-08-23 This book presents comprehensive coverage of current and emerging multiple access, random access, and waveform design techniques for 5G wireless networks and beyond. A definitive reference for researchers in these fields, the book describes recent research from academia, industry, and standardization bodies. The book is an all-encompassing treatment of these areas addressing orthogonal multiple access and waveform design, non-orthogonal multiple access (NOMA) via power, code, and other domains, and orthogonal, non-orthogonal, and grant-free random access. The book builds its foundations on state of the art research papers, measurements, and experimental results from a variety of sources.

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arranged in three parts. This book is recommended for researchers and professionals in the field and may be used as a reference book on broadband communication networks as well as on practical uses of wired/wireless broadband communications. It is also a concise guide for students and readers interested in studying Internet connectivity, mobile/optical broadband networks and concepts/applications of telecommunications engineering.

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developments and practical possibilities for implementing AI technologies in wireless communication systems. Above all, this book is a testament to the power of collaboration and innovation in wireless communication. The authors' dedication and expertise have produced a valuable resource for anyone interested in the latest AI and wireless communication developments. This book will inspire and inform readers, and we highly recommend it to scholars interested in the future of AI in wireless communication.

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5g core network diagram: Cellular Vehicle-to-Everything (C-V2X) Shanzhi Chen, Jinling Hu, Li Zhao, Rui Zhao, Jiayi Fang, Yan Shi, Hui Xu, 2023-01-01 This book focuses on cellular Vehicle-to-Everything (C-V2X), currently the most promising wireless communication technology for Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), Vehicle-to-Pedestrian (V2P), Vehicle-to-Network (V2N) and Vehicle-to-Cloud (V2C) communications. Because of its low latency and high reliability, C-V2X has become an essential enabling technology for Intelligent Transportation Systems (ITSs) and autonomous driving. This book begins by introducing readers to the research background and status quo of global development. Then, after analyzing the performance requirements of various V2X applications, the system architecture and technical

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