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What Is 5G?; 1.3 Background; 1.4 Research; 1.5 Challenges for Electronics; 1.6 Expected 5G in Practice; 1.7 5G and Security; 1.8 Motivations; 1.9 5G Standardization and Regulation; 1.10 Global Standardization in 5G Era; 1.11 Introduction to the Book; References; 2 Requirements; 2.1 Overview; 2.2 Background; 2.3 5G Requirements Based on ITU; 2.4 The Technical Specifications of 3GPP; 2.5 NGMN; 2.6 Mobile Network Operators; 2.7 Mobile Device Manufacturers; References

3 Positioning of 5G 3.1 Overview; 3.2 Mobile Generations; 3.3 The Role of 3GPP in LPWA and IoT; 3.4 The Role of 5G in Automotive (V2X); 3.5 The Role of 5G in the Cyber-World; References; 4 Architecture; 4.1 Overview; 4.2 Architecture; 4.3 Renewed Functionality of the 5G System; 4.4 Supporting Solutions for 5G; 4.5 Control and User Plane Separation of EPC Nodes (CUPS); References; 5 Radio Network; 5.1 Overview; 5.2 5G Performance; 5.3 5G Spectrum; 5.4 5G Radio Access Technologies; 5.5 Uplink OFDM of 5G: CP-OFDM and DFT-s-OFDM; 5.6 Downlink; 5.7 New Radio (NR) Interface of 3GPP; 5.8 User Devices 5.9 Other Aspects 5.10 CBRS; References; 6 Core Network; 6.1 Overview; 6.2 Preparing the Core for 5G; 6.3 5G Core Network Elements; 6.4 5G Functionalities Implemented in 5G Core; 6.5 Transport Network; 6.6 Protocols and Interfaces; 6.7 5G Core Network Services; References; 7 Services and Applications; 7.1 Overview; 7.2 5G Services; 7.3 Network Function-Related Cases; 7.4 Vehicle Communications; 7.5 Machine Learning and Artificial Intelligence; References; 8 Security; 8.1 Overview; 8.2 5G Security Threats and Challenges; 8.3 Development 8.4 Security Implications in 5G Environments and Use Cases 8.5 5G Security Layers; 8.6 Device Security; 8.7 Security Between Network Entities; 8.8 Security Opportunities for Stakeholders; 8.9 5G Security Architecture for 3GPP Networks; 8.10 UICC Evolution; 8.11 5G Security Development; 8.12 UICC Variants; References; 9 5G Network Planning and Optimization; 9.1 Overview; 9.2 5G Core and Transmission Network Dimensioning; 9.3 5G Radio Network Planning; References; 10 Deployment; 10.1 Overview; 10.2 Trials and Early Adopters Prior to 2020; 10.3 5G Frequency Bands 10.4 Core and Radio Network Deployment Scenarios 10.5 Standalone and Non-Standalone Deployment Scenarios; 10.6 5G Network Interfaces and Elements; 10.7 Core Deployment; 10.8 CoMP; 10.9 Measurements; References; Index; End User License Agreement

## Sommario/riassunto

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.

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