1. Record Nr. UNINA9910676530103321

Autore	Yarali Abdulrahman
Titolo	Public safety networks from LTE to 5G / / Abdulrahman Yarali, Murray State University, Murray, KY, USA
Pubbl/distr/stampa	Hoboken, New Jersey : , : John Wiley & Sons, , 2020 [Piscataqay, New Jersey] : , : IEEE Xplore, , [2019]
ISBN	1-119-58013-7 1-119-57990-2 1-119-58015-3
Edizione	[1st edition]
Descrizione fisica	1 online resource (269 pages)
Disciplina	384.64
Soggetti	Emergency communication systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Preface xvii -- Acknowledgment xix -- 1 Public Safety Networks from TETRA to Commercial Cellular Networks 1 -- 1.1 Introduction 1 -- 1.2 Evaluation of TETRA and TETRAPOL 3 -- 1.3 Understanding TETRA Modes of Operation 4 -- 1.3.1 TETRA Security 4 -- 1.3.2 Evaluating the Challenge of Data Transmission and Possible Solutions on TETRA Networks 5 -- 1.3.3 Comparing Public Safety Networks to the Commercial Cellular Networks 6 -- 1.3.3.1 Services 6 -- 1.3.3.2 Networks 6 -- 1.3.4 How to Overcome These Differences 7 -- 1.3.4.1 Limitations of TETRA 7 -- 1.3.4.2 Need for Broadband 8 -- 1.4 Unifying the Two Worlds of Public Safety Networks and Commercial Networks 8 -- 1.4.1 User Requirements 8 -- 1.4.2 Public Safety Network Migration 9 -- 1.4.3 Deployment Models 9 -- 1.5 The Transition from TETRA to LTE and the Current Initiatives 10 -- 1.5.1 Network Softwarization 10 -- 1.5.2 LTE Technology for Public Safety Communications 10 -- 1.5.3 LTE as a Public Safety Mobile Broadband Standard 11 -- 1.5.4 Security Enhancements for Public Safety LTE Features 11 -- 1.6 Conclusion 12 -- References 12 -- 2 Public Safety Networks Evolution Toward Broadband and Interoperability 15 -- 2.1 Introduction 15 -- 2.1.1 Communication Technology 15 -- 2.1.2 Wireless Communication Systems 16 -- 2.1.3 Government Involvement 17 -- 2.2 Evolution to Broadband Systems 18 -- 2.2.1 Determining

Factors 19 -- 2.2.2 Evolution Process 21 -- 2.2.3 Broadband System Architecture 22 -- 2.2.4 Advantages of Broadband Systems 25 -- 2.3 Interoperability 28 -- 2.3.1 Developing an Interoperability Public Safety System 28 -- 2.3.2 Platform and Technology 29 -- 2.3.3 Benefits of Evolution 32 -- 2.4 Conclusion 33 -- 2.5 Recommendations 34 -- References 35 -- 3 Public Safety Communication Evolution 37 -- 3.1 Introduction 37 -- 3.1.1 Public Safety Network and Emergency Communication Networks 37 -- 3.2 Public Safety Standardization 39 -- 3.3 Evolution of Public Safety Communication 39 -- 3.3.1 Mission-Critical Voice 40 -- 3.3.2 Mission-Critical Data 41.
3.3.3 Requirements for Evolution in Communications 42 -- 3.4 Public Safety Networks 43 -- 3.4.1 Land Mobile Radio Systems (LMRS) 44 -- 3.4.1.1 SAFECOM Interoperability Continuum 46 -- 3.4.1.2 Wireless Broadband 46 -- 3.4.1.3 Wi-Fi in Ambulances 47 -- 3.4.1.4 Satellite Communications in EMS and Public Protection and Disaster Relief PPDR 47 -- 3.4.1.5 Technology in Patrol Communications 48 -- 3.4.1.6 Video Cameras 48 -- 3.4.2 Drivers of the Broadband Evolution 49 -- 3.5 4G and 4G LTE 50 -- 3.5.1 Benefits of 4G LTE in Public Safety Communication 51 -- 3.6 Fifth Generation (5G) 52 -- 3.6.1 Performance Targets and Benefits of 5G 55 -- 3.6.1.1 Security and Reliability 55 -- 3.6.1.2 Traffic Prioritization and Network Slicing 55 -- 3.6.1.3 Facial Recognition and License Plate Scanning in 5G 55 -- 3.6.1.4 Support for Sensor Proliferation and IoT 56 -- 3.6.1.5 Reduction of Trips Back to the Station 56 -- 3.7 Applying 4G and 5G Networks in Public Safety 57 -- 3.7.1 The Right Time to Implement 3GPP in Public Safety 59 -- 3.7.1.1 3GPP 59 -- 3.7.2 4G LTE as a Basis for Public Safety Communication Implementation 61 -- 3.7.3 Implementation of 5G in Public Safety 61 -- 3.8 Conclusion 61 -- References 62 -- 4 Keys to Building a Reliable Public Safety Communications Network 67 -- 4.1 Introduction 67 -- 4.2 Supporting the Law Enforcement Elements of Communication 67 -- 4.3 Components of Efficient Public Safety Communication Networks 68 -- 4.4 Networks Go Commercial 68 -- 4.5 Viable Business Prospects 69 -- 4.5.1 The Core Network 69 -- 4.5.2 The Radio Network 69 -- 4.6 The Industry Supports the Involvement of the Mobile Network Operators 70 -- 4.7 Policies for Public Safety Use of Commercial Wireless Networks 71 -- 4.8 Public Safety Networks Coverage: Availability and Reliability Even During Outages 72 -- 4.9 FirstNet Interoperability 72 -- 4.10 Solutions for Enhancing Availability and Reliability Even During Outages 73 -- 4.11 National Public Safety Broadband Network (NPSBN) 73 -- 4.12 Important Objectives of NPSBN 74.
4.13 The Future of FirstNet: Connecting Networks Together 75 -- 4.14 High Capacity Information Delivery 76 -- 4.15 Qualities that Facilitate Efficient High Capacity Information Handling 77 -- 4.15.1 FirstNet Has a Trustworthy Security System 77 -- 4.15.2 Concentrated Network Performance 77 -- 4.15.3 Simple and Scalable 77 -- 4.15.4 High Level of Vulnerability Safeguards 77 -- 4.16 FirstNet User Equipment 77 -- 4.17 Core Network 78 -- 4.18 Illustration: Layers of the LTE Network 78 -- 4.18.1 Transport Backhaul 79 -- 4.18.2 The Radio Access Networks 79 -- 4.18.3 Public Safety Devices 79 -- References 80 -- 5 Higher Generation of Mobile Communications and Public Safety 81 -- 5.1 Introduction 81 -- 5.2 Review of Existing Public Safety Networks 81 -- 5.2.1 What are LMR Systems? 82 -- 5.2.2 Services Offered by LMR Systems 83 -- 5.2.3 Adoption of Advanced Technologies to Supplement LMR 83 -- 5.2.4 Trunked Digital Network 84 -- 5.2.4.1 TETRAPOL Communication System 84 -- 5.2.4.2 The TETRA Communication System 85 -- 5.3 Is 4G LTE Forming a Good Enough Basis for Public Safety Implementations? 85 -- 5.3.1 Multi-Path

Approach and the Convergence of Mission-Critical Communication 85 -- 5.3.2 Technical Aspects of LTE 86 -- 5.4 Is It Better to Wait for 5G Before Starting Public Safety Implementations? 87 -- 5.5 Will 5G Offer a Better Service than 4G for Public Safety? 88 -- 5.5.1 The Internet of Things and 5G 88 -- 5.5.2 5G Technical Aspects 89 -- 5.5.3 5G Network Costs 90 -- 5.5.4 Key Corner Cases for 5G 90 -- 5.5.5 Localization in 5G Networks 91 -- 5.6 What is the Linkage Between 4Go5G Evolution and the Spectrum for Public Safety? 91 -- 5.6.1 The Linkage Between 4G-5G Evolutions 91 -- 5.6.2 Spectrum for Public Safety 92 -- 5.7 Conclusion 94 -- References 95 -- 6 Roadmap Toward a Network Infrastructure for Public Safety and Security 97 -- 6.1 Introduction 97 -- 6.2 Evolution Toward Broadband 97 -- 6.2.1 Existing Situation 98 -- 6.3 Requirements for Public Safety Networks 99 -- 6.3.1 Network Requirements 100.
6.3.2 Priority Control 100 -- 6.4 Public Safety Standardization 100 -- 6.5 Flawless Mobile Broadband for Public Safety and Security 101 -- 6.6 Applications in Different Scenarios 102 -- 6.7 Public Safety Systems and Architectures 103 -- 6.7.1 Airwave 103 -- 6.7.2 LMR 104 -- 6.7.3 TETRA Security Analysis 105 -- 6.7.4 TETRA Services System 106 -- 6.7.5 The Architecture of TETRA 106 -- 6.7.5.1 The Interfaces of TETRA Network 106 -- 6.7.6 TETRA Network Components 106 -- 6.7.6.1 The Mobile Station 108 -- 6.7.6.2 TETRA Line Station 108 -- 6.7.6.3 The Switching Management Infrastructure 108 -- 6.7.6.4 Network Management Unit 108 -- 6.7.6.5 The Gateways 108 -- 6.7.6.6 How the TETRA System Operates 108 -- 6.7.7 TETRA Mobility Management 109 -- 6.7.8 The Security of TETRA Networks 109 -- 6.7.8.1 Confidentiality 109 -- 6.7.8.2 Integrity 109 -- 6.7.8.3 Reliability 109 -- 6.7.8.4 Non-repudiation 109 -- 6.7.8.5 Authentication 110 -- 6.7.9 The Process of Authentication in TETRA 110 -- 6.7.10 The Authentication Key 110 -- 6.7.11 Symmetric Key Algorithms 110 -- 6.7.12 The Process of Authentication Key Generation 111 -- 6.7.12.1 ESN (In United Kingdom) 111 -- 6.8 Emergency Services Network (ESN) in the United Kingdom 112 -- 6.8.1 Overview of the ESN 112 -- 6.8.2 The Deliverables of ESN 112 -- 6.8.3 The Main Deliverables of ESN 112 -- 6.9 SafeNet in South Korea 113 -- 6.10 FirstNet (in USA) 115 -- 6.10.1 The Benefits of FirstNet 117 -- 6.10.2 Public Safety Core of SafetyNet 117 -- 6.10.2.1 End-to-End Encryption 117 -- 6.10.3 Round the Clock Security Surveillance 118 -- 6.10.4 User Authentication 118 -- 6.10.5 Mission Critical Functionalities 118 -- 6.10.5.1 Tactical LTE Coverage 118 -- 6.11 Canadian Interoperability Technology Interest Group (CITIG) 118 -- 6.12 Centre for Disaster Management and Public Safety (CDMPS) at the University of Melbourne 119 -- 6.13 European Emergency Number Association (EENA) 120 -- 6.13.1 European Standardization Organization (ESO) 121 -- 6.13.2 Public Safety Communications o Europe (PSCE) 121.
6.13.3 The Critical Communications Association (TCCA) 121 -- 6.14 Public Safety Network from LTE to 5G 122 -- 6.15 Convergence Solution for LTE and TETRA for AngolaOs National Communications Network 124 -- 6.15.1 The Objectives of the Project 124 -- 6.15.2 Advantages of the LTE-TETRA Solutions 124 -- 6.15.3 Illustration: Before Integration and After Integration 125 -- 6.15.4 Overview of LTE Technology 125 -- 6.16 5GWireless Network and Public Safety Perspective 126 -- 6.16.1 Waiting for 5G for Public Safety Implementation 127 -- 6.17 The Linkage Between 4G and 5G Evolution 128 -- 6.17.1 Connecting 4G and 5G Solutions for Public Safety 128 -- 6.17.2 Deploying LTE Public Safety Networks 129 -- 6.18 Conclusion 129 -- References 130 -- 7 Bringing Public Safety Communications

into the 21st Century 133 -- 7.1 Emerging Technologies with Life-Saving Potential 133 -- 7.1.1 Artificial Intelligence 134 -- 7.1.2 The Internet of Things (IoT) 136 -- 7.1.3 Blockchain 138 -- References 139 -- 8 4G LTE: The Future of Mobile Wireless Telecommunication Systems for Public Safety Networks 141 -- 8.1 Introduction 141 -- 8.2 Network Architecture 145 -- 8.3 User Equipment 145 -- 8.4 eNodeB 145 -- 8.5 Radio Access Network 146 -- 8.5.1 Gateways and Mobility Management Entities 146 -- 8.6 Evolved Packet Core (EPC) 147 -- 8.7 The Innovative Technologies 148 -- 8.8 PS-LTE and Public Safety 151 -- 8.9 PS-LTE 152 -- 8.10 Nationwide Public Safety Communication Systems 152 -- 8.11 Advantages of LTE Technology 152 -- 8.12 Driving Trends in Public Safety Communications 153 -- 8.13 Benefits of PS-LTE 155 -- 8.14 Benefits of Converged Networking in Public Safety 157 -- 8.15 Mobilizing Law Enforcement 157 -- References 159 -- 9 4G and 5G for PS: Technology Options, Issues, and Challenges 161 -- 9.1 Introduction 161 -- 9.2 4G LTE and Public Safety Implementation 162 -- 9.2.1 Reliability 162 -- 9.2.2 Cost Effectiveness 163 -- 9.2.3 Real-Time Communication 164 -- 9.2.4 Remote Deployment and Configuration 164.
9.2.5 Flexibility 164 -- 9.3 Starting Public Safety Implementation Versus Waiting for 5G 165 -- 9.4 5GVersus 4G Public Safety Services 166 -- 9.4.1 Video Surveillance 167 -- 9.4.2 Computer-Driven Augmented Reality (AR) Helmet 167 -- 9.5 How 5GWill Shape Emergency Services 167 -- 9.6 4G LTE Defined Public Safety Content in 5G 168 -- 9.7 The Linkage Between 4Go5G Evolution and the Spectrum for Public Safety 168 -- 9.8 Conclusion 168 -- References 168 -- 10 Fifth Generation (5G) Cellular Technology 171 -- 10.1 Introduction 171 -- 10.2 Background Information on Cellular Network Generations 172 -- 10.2.1 Evolution of Mobile Technologies 172 -- 10.2.1.1 First Generation (1G) 172 -- 10.2.1.2 Second Generation (2G) Mobile Network 172 -- 10.2.1.3 Third Generation (3G) Mobile Network 172 -- 10.2.1.4 Fourth Generation (4G) Mobile Network 173 -- 10.2.1.5 Fifth Generation (5G) 173 -- 10.3 Fifth Generation (5G) and the Network of Tomorrow 174 -- 10.3.1 5G Network Architecture 176 -- 10.3.2 Wireless Communication Technologies for 5G 177 -- 10.3.2.1 Massive MIMO 177 -- 10.3.2.2 Spatial Modulation 179 -- 10.3.2.3 Machine to Machine Communication (M2M) 179 -- 10.3.2.4 Visible Light Communication (VLC) 180 -- 10.3.2.5 Green Communications 180 -- 10.3.3 5G System Environment 180 -- 10.3.4 Devices Used in 5G Technology 181 -- 10.3.5 Market Standardization and Adoption of 5G Technology 181 -- 10.3.6 Security Standardization of Cloud Applications 183 -- 10.3.7 The Global ICT Standardization Forum for India (GISFI) 184 -- 10.3.8 Energy Efficiency Enhancements 184 -- 10.3.9 Virtualization in the 5G Cellular Network 185 -- 10.3.10 Key Issues in the Development Process 185 -- 10.3.10.1 Challenges of Heterogeneous Networks 186 -- 10.3.10.2 Challenges Caused by Massive MIMO Technology 186 -- 10.3.10.3 Big Data Problem 186 -- 10.3.10.4 Shared Spectrum 186 -- 10.4 Conclusion 187 -- References 187 -- 11 Issues and Challenges of 4G and 5G for PS 189 -- 11.1 Introduction 189 -- 11.2 4G and 5GWireless Connections 190.
11.3 Public Safety for 5G and 4G Networks 191 -- 11.4 Issues and Challenges Regarding 5G and 4G Cellular Connections 192 -- 11.5 Threats Against Privacy 192 -- 11.6 Threats Against Integrity 192 -- 11.7 Threats Against Availability 193 -- 11.8 Attacks Against Authentication 193 -- 11.9 Various Countermeasures to 4G and 5G Public Safety Threats 194 -- References 194 -- 12 Wireless Mesh Networking: A Key Solution for Rural and Public Safety Applications 195 -- 12.1 Introduction 195 -- 12.2 Wireless Mesh Networks 196 -- 12.3

WMN Challenges 197 -- 12.4 WMNs for Disaster Recovery and Emergency Services 198 -- 12.5 Reliability of Wireless Mesh Networks 199 -- 12.5.1 Self-configuration of Wireless Mesh Networks 199 -- 12.5.2 Fast Deployment and Low Installation Costs of Wireless Mesh Networks 199 -- 12.5.3 Voice Support of Wireless Mesh Networks 200 -- 12.6 Video/Image Support of Wireless Mesh Networks for Emergency Situations and Public Safety 200 -- 12.6.1 Video/Image Support of WMNs for Large Disasters 200 -- 12.6.2 WMNs Supporting Video Monitoring for Public Safety 201 -- 12.6.3 WMNs for Mobile Video Applications of Public Safety and Law Enforcement 202 -- 12.7 Interoperability of WMNs for Emergency Response and Public Safety Applications 202 -- 12.8 Security in Wireless Mesh Networks 203 -- 12.9 Conclusion 204 -- References 204 -- 13 Satellite for Public Safety and Emergency Communications 207 -- 13.1 Introduction 207 -- 13.2 Contextualizing Public Safety 208 -- 13.3 Public Safety Communications Today 208 -- 13.4 Satellite Communications in Public Safety 209 -- 13.4.1 Topology and Frequency Allocation 210 -- 13.4.2 Satellite Communications 210 -- 13.4.3 Applications of LEO and GEO Satellites in Public Safety Communication 211 -- 13.4.4 Mobile Satellite Systems 213 -- 13.4.4.1 Vehicle-Mounted Mobile Satellite Communications Systems 213 -- 13.4.4.2 Emergency Communications Trailers 216 -- 13.4.4.3 Flyaway Satellite Internet Systems 217 -- 13.4.5 VoIP Phone Service Over Satellite 218.
13.4.6 Fixed Satellite 219 -- 13.4.7 Frequency Allocations in FSS and MSS Systems 221 -- 13.5 Limitations of Satellite for Public Safety 222 -- 13.6 Conclusion 223 -- References 224 -- 14 Public Safety Communications Evolution: The Long Term Transition Toward a Desired Converged Future 227 -- 14.1 Introduction 227 -- 14.1.1 Toward Moving Public Safety Networks 227 -- 14.1.2 The Communication Needs of Public Safety Authorities 227 -- 14.1.3 The Nationwide Public Safety Broadband Networks 228 -- 14.1.4 Global Public Safety Community Aligning Behind LTE 230 -- 14.1.5 Understanding the Concept of E-Comm in Relation to Public Safety 231 -- 14.2 Transmission Trunking and Message Trunking 232 -- 14.2.1 Push-to-Talk Mechanisms 233 -- 14.2.2 Talk Groups and Group Calls 233 -- 14.2.3 Mobility of Radio Devices and Call Handover 233 -- 14.2.4 WarnSim: Learning About a Simulator for PSWN 233 -- 14.2.5 The Use Cases and Topologies of Public Safety Networks 235 -- 14.2.6 Standard Developments in Public Safety Networks 238 -- 14.2.7 The Future Challenges in Public Safety 240 -- 14.2.7.1 Moving Cells and Network Mobility 240 -- 14.2.7.2 Device-to-Device (D2D) Discovery and Communications 240 -- 14.2.7.3 Programmability and Flexibility 240 -- 14.2.7.4 Traffic Steering and Scheduling 241 -- 14.2.7.5 Optimization of Performance Metrics to Support Sufficient QoS 241 -- 14.2.8 Toward a Convergence Future of Public Safety Networks 241 -- 14.3 Conclusion 242 -- References 243 -- Index 245.

Sommario/riassunto

"The public safety community has undergone significant strides towards strengthening its abilities, capacity and improving the communications of emergencies. Public safety depends on fast and efficient levels of communication in order to properly relay time-sensitive and critical pieces of information The first responders, however, are still limited due to the presence of the fragmented networks and use of decade-old technologies in public safety agencies. They are using LMR for a majority of their communications and as an outcome, public security has struggled to speak across jurisdictional and company lines This book will discuss the evolution of the public safety system requirements by providing a technical analysis of the existing public safety network, 4G LTE and its applications in public

safety and security, a comprehensive analysis of 5G-network technology, the link between the most recent application of 4G and 5G, efficient utilization and the spectrum sharing for public safety communications systems"--