Contents

Preface xi

Daniel CÂMARA and Navid NIKAEIN

Chapter 1. Public Warning Applications: Requirements and Examples 1

Javier MULERO CHAVES and Tomaso DE COLA

1.1. Introduction 1
1.2. Emergency management communications. 2
1.3. Public warning systems 5
1.4. Public warning applications. 8
1.5. Exemplary case: the Alert4All approach 11
1.5.1. HbbTV-enabled receivers 12
1.5.2. Portable receivers 14
1.6. Conclusions 16
1.7. Bibliography 17

Chapter 2. An Innovative and Economic Management of Earthquakes: Early Warnings and Situational Awareness in Real Time 19

Oscar Marcelo ZAMBRANO, Ana Maria ZAMBRANO, Manuel ESTEVE and Carlos PALAU

2.1. Introduction 19
2.2. Motivation and previous works. 22
2.3. Architecture 23
2.3.1. Smartphone application and acceleration processing 27
2.3.2. Server intermediate application 29
2.3.3. Control center 33

2.4. Results 34
2.5. Conclusions 35
2.6. Bibliography 36

Chapter 3. Community Early Warning Systems 39

Ana Maria ZAMBRANO, Xavier CALDERÓN, Sebastian JARAMILLO, Oscar Marcelo ZAMBRANO, Manuel ESTEVE and Carlos PALAU

3.1. Core early warning system components 40
3.1.1. Risk knowledge 40
3.1.2. Monitoring 42
3.1.3. Response capability 43
3.1.4. Warning communication 44
3.2. Time scenarios for EWS 46
3.2.1. Real-time systems 46
3.2.2. Management of the time in the distributed real-time systems 47
3.3. Core early warning system components using smartphones 49
3.3.1. Technology progress 49
3.3.2. Efficiency to warn the population 50
3.3.3. Data collection 50
3.4. A smart city using smartphones into CEWS 51
3.4.1. Natural disasters 52
3.4.2. Safe 55
3.4.3. Roads and transportation 58
3.5. Conclusions 62
3.6. Bibliography 63

Chapter 4. Generating Crisis Maps for Large-scale Disasters: Issues and Challenges 67

Partha Sarathi PAUL, Krishnandu HAZRA, Sujay SAHA, Subrata NANDI, Sandip CHAKRABORTY and Sajal DAS

4.1. Crisis mapping: “global” versus “local” 68
4.1.1. Why crisis mapping? 68
4.1.2. Crisis mapping: working principle 69
4.2. Post-disaster communication revisited 72
4.2.1. Post-disaster communication: state-of-the-art 72
4.2.2. Post-disaster communication: possible alternatives 75
4.2.3. Large-scale DTN systems for challenged scenarios 78

4.3. Proposed solution in a nutshell 79
4.3.1. Multi-tier hybrid architecture for post-disaster communication 79
4.3.2. Implementation & testbed 83
4.3.3. Software suite 84
4.3.4. Working principle of the proposed system 86
4.4. Localized crisis mapping 89
4.4.1. A system for offline crisis mapping 89
4.5. Concluding remarks 93
4.6. Bibliography 95

Chapter 5. Context-Aware Public Safety in a Pervasive Environment 99

Shivsubramani KRISHNAMOORTHY, Prabaharan POORNACHANDRAN and Sujadevi VIJAYA GANGADHARAN

5.1. Introduction 100
5.2. Context awareness 101
5.2.1. Context 103
5.3. Context-aware middleware 104
5.4. Practical experience – implementation of AmritaMitra personal safety framework 105
5.4.1. Sensing and alerting 105
5.4.2. Cloud services and contextual analysis 107
5.4.3. Social media as an emergency communication system 108
5.4.4. Indoor and outdoor location identification 109
5.4.5. Real-time user and context tracking 109
5.5. Conclusion and future directions 110
5.6. Bibliography 111

Chapter 6. Supporting New Application and Services over LTE Public Safety Networks 113

César Agusto GARCÍA-PÉREZ, Almudena DÍAZ-ZAYAS, Álvaro RÍOS, Pedro MERINO, Kostas KATSALIS and Donal MORRIS

6.1. Introduction 114
6.2. Motivation and background information 115
6.2.1. Motivation 115
6.2.2. Related work 116
6.3. Services for public safety networks 117
6.3.1. Common challenges for current technologies in emergencies 118
6.3.2. Specialized scenarios in public emergencies 119

6.4. Wearable devices in public safety 122
6.4.1. The BlueEye use case 122
6.4.2. BlueEye for first responders 123
6.4.3. VELOX API for public safety applications 124
6.5. Conclusions and future work 130
6.6. Acknowledgments 131
6.7. Bibliography 131

Chapter 7. Aerial Platforms for Public Safety Networks and Performance Optimization 133

Akram AL-HOURANI, Sathyanarayanan CHANDRASEKHARAN, Sithamparanathan KANDEEPAN and Abbas JAMALIPOUR

7.1. Aerial supported public safety networks 134
7.2. Air-to-ground radio channel 137
7.2.1. The nature of the air-to-ground radio channel 138
7.2.2. ABSOLUTE radio propagation model 139
7.2.3. ABSOLUTE model implementation 145
7.3. Optimizing the altitude of aerial platforms 147
7.3.1. Modeling the probability of line-of-sight 148
7.3.2. Modeling and optimizing system performance 149
7.4. Bibliography 152

Chapter 8. Topology Control for Drone Networks 155

Daniel CÂMARA

8.1. Introduction 155
8.2. Scenario 158
8.3. Related work 159
8.4. Examples of drone applications 160
8.5. Drone architecture 166
8.6. Fleet architecture 167
8.7. Topology control requirements for network reliability 171
8.8. Mission-based topology description 172
8.9. Bases of the proposed method 173
8.10. Experiments 175
8.11. Conclusion 179
8.12. Bibliography 181

Chapter 9. Safe and Secure Support for Public Safety Networks 185

Ludovic APVRILLE and Letitia W. LI

9.1. Introduction 186
9.2. Context 187
9.2.1. UAVs 187
9.2.2. Autonomous cars 188
9.3. Case study 188
9.4. Our approach: SysML-Sec 189
9.4.1. Methodology 189
9.4.2. Analysis stage 190
9.4.3. Hardware/software partitioning 192
9.4.4. Software/system design 195
9.4.5. Assumptions 196
9.4.6. Tooling 196
9.4.7. Safety 196
9.4.8. Security 197
9.4.9. Security modeling 198
9.5. Mission planning 199
9.5.1. Mission description 201
9.5.2. Integration of mission planning and autonomous vehicles 202
9.6. Related work 203
9.6.1. Embedded system design 203
9.6.2. Safety 205
9.6.3. Security 206
9.7. Conclusion and perspectives 207
9.8. Acknowledgment 208
9.9. Bibliography 208

Chapter 10. Disaster Resilient Telematics based on Device-to-Device Communication 211

Panayiotis KOLIOS, Christos PANAYIOTOU and Georgios ELLINAS

10.1. Introduction 212
10.2. Public safety ad-hoc networking 214
10.3. Beaconing-based proximate communication 216
10.4. Beaconing-based networking 218
10.4.1. Intelligent alert messaging 219
10.4.2. Device localization 221

10.4.3. Situation awareness 223
10.4.4. Evacuation navigation. 225
10.5. Concluding remarks 226
10.6. Bibliography 227

Chapter 11. ICN/DTN for Public Safety in Mobile Networks 231

Eryk SCHILLER, Eirini KALOGEITON, Torsten BRAUN,
André GOMES, and Navid NIKAEIN

11.1. Introduction 231
11.2. Related work 233
11.3. System architecture 237
11.4. Example implementation 241
11.4.1. Juju VNF Manager 241
11.4.2. OVS virtual switch 243
11.4.3. PS bundle at the network edge 244
11.5. Conclusion 246
11.6. Bibliography 246

List of Authors 249

Index 253