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Autore	Liyanage Madhusanka
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Environments, and Cities; 2.3 Authentication and Authorization; 2.3.1 Authentication; 2.3.2 Authorization; 2.3.3 Authentication at IoT Layers; 2.3.3.1 Perception Layer; 2.3.3.2 Network Layer; 2.3.3.3 Application Layer; 2.4 Other Security Features and Related Issues; 2.4.1 The Simplified Layer Structure; 2.4.2 The Idea of Middleware; 2.4.3 Cross-Layer Security Problem; 2.4.4 Privacy; 2.4.5 Risk Mitigation; 2.5 Discussion; 2.6 Future Research Directions; 2.6.1 Blockchain; 2.6.2 5G; 2.6.3 Fog and Edge Computing; 2.6.4 Quantum Security, AI, and Predictive Data Analytics; 2.6.5 Network Slicing; 2.7 Conclusions; References; Part II IoT Network and Communication Authentication; Chapter 3 Symmetric Key-Based Authentication with an Application to Wireless Sensor Networks; 3.1 Introduction; 3.2 Related Work; 3.3 System Model and Assumptions; 3.3.1 Design Goals; 3.3.2 Setting; 3.3.3 Notations; 3.3.4 Attack Model; 3.4 Scheme in Normal Mode; 3.4.1 Installation Phase; 3.4.1.1 Installation of CH; 3.4.1.2 Installation of CN; 3.4.2 Group Node Key; 3.4.3 Individual Cluster Key; 3.4.3.1 CN to CH; 3.4.3.2 CH to CN; 3.4.4 Pairwise Key Derivation; 3.4.5 Multicast Key; 3.4.5.1 Initiation by CH; 3.4.5.2 Derivation by CNs; 3.4.6 Group Cluster Key; 3.5 Authentication; 3.5.1 Authentication by CN; 3.5.2 Authenticated Broadcast by the CH; 3.5.3 Authenticated Broadcast by the BS; 3.6 Scheme in Change Mode; 3.6.1 Capture of CN; 3.6.2 Capture of CH; 3.6.3 Changes for Honest Nodes; 3.6.3.1 Key Update for Honest Node Replacement; 3.6.3.2 Node Removal and Addition; 3.7 Security Analysis; 3.7.1 Resistance Against Impersonation Attack; 3.7.2 Resistance Against Node Capture; 3.7.3 Resistance Against Replay Attacks; 3.8 Efficiency; 3.8.1 Number of Communication Phases; 3.8.2 Storage Requirements; 3.8.3 Packet Fragmentation; 3.9 Conclusions; Acknowledgement; References; Chapter 4 Public Key Based Protocols -- EC Crypto

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## Sommario/riassunto

"The Internet of things (IoT) is the network of physical devices such as vehicles, home appliances sensors, actuators and other electronic devices. The development of internet offers the possibility for these objects to connect and exchange data. Since IoT will play a major role in our lives, it is important to secure the IoT ecosystem for its value to be realized. Among the various security requirements, authentication to the IoT is important since it is the first step to prevent the impact of attackers. The book offers an insight into the development of various authentication mechanisms to provide IoT authentication in various levels such as user level, device level and network level. The user-level authentication identifies whether the IoT user is a legitimate user to access the smart object services and what kind of authentication mechanisms can be used. Network level authentication is needed to check the identity of connected IoT devices. This book, therefore, offers reference material which will be important for all relative stakeholders of mobile networks such as network operators, cloud operators, IoT device manufacturers, IoT device users, wireless users, IoT standardization organizations and security solution developers"--

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