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Secure and Trustworthy Transportation Cyber-Physical Systems

 Springer

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Foreword

The application of IT along with a rapid development of the Internet has dramatically changed both society and our daily lives; Critical Information Infrastructure (CII) thus plays an increasingly important role in safeguarding social stability and promoting economic development. The transportation network, including highways, airports and railroad systems, has evolved into a “social artery”—with vast amounts of goods as well as human beings moving day to day using the transportation network, making it a sensitive and significant part of the National Critical Information Infrastructure.

In modern transportation networks, the new concept of Cyber-Physical Systems (CPS) is emerging at the same time as the challenges we are facing are becoming more serious and complicated than ever before. It is now possible for vehicles (cars, trucks, airplanes, and trains) and important infrastructures (highways, airports, and railroad tracks) to connect with each other via the Internet. The applications of CPS in transportation, not only change the way people interact with transportation systems, but also change the world in which we live.

However, the greater the reliance becomes on information and communication technologies (ICT), the greater the challenges to transportation’s CPS. Cybersecurity threats really place the development of the world’s transportation systems at high risk. Therefore, securing the safety and reliability of transportation’s CPS (automotive, aerospace, and rail) is one of the most important challenges that we face.

In order to meet the basic needs of transportation’s CPS security development, that is, to overcome the increasing scientific challenges and secure sensitive information within the system, we need to further investigate optimized technologies. This is the motivation which drives the promotion of research and education in the fields of cybersecurity, privacy, CPS and transportation systems.

We believe this is the very first book researching the security and privacy of transportation’s CPS. It is a long-awaited book which specifically presents current trending technologies, the practices of security and the reliability of transportation’s CPS. In addition, this book bridges the gap between theory and practice.

This book presents techniques leveraging fundamental physical properties and laws; it aims to increase security, protect privacy, improve usability and support scalability within the extreme heterogeneity and mobility of transportation's CPS. It provides the readers with a deep understanding of the key technical, social and legal issues at stake as well as identifying a range of technical issues affecting cybersecurity and privacy in transportation's CPS. In the foreseeable future, this book will foster scientific research in transportation cybersecurity and encourage practical methods to overcome the difficulties and address the challenges that we face in transportation.

Dr. Sun is very hardworking and innovative in his research at CNITSEC . I very much appreciate his efforts and am thankful for his contributions. I hope there will be more academic research in this area to promote the harmonious development of the cyberspace society.

Beijing, China
January 2017

Shizhong Wu
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Preface

According to the definition of the US National Science Foundation, Cyber-Physical Systems (CPS), which are smart networked systems with embedded sensors, processors and actuators that are designed to sense and interact with the physical world (including the human users), and support real-time, guaranteed performance in safety-critical applications, are transforming the way people interact with engineered systems. Cyber-Physical Systems applied in transportation, i.e., transportation CPS (TCPS), are transforming the way people interact with transportation systems, including personal and commercial automotive, aerospace, and rail transport. However, TCPS are subject to various cybersecurity and privacy threats. To address these cybersecurity and privacy challenges in TCPS, novel, transformative, multidisciplinary approaches at the confluence of cybersecurity, privacy, and TCPS are needed.

This edited book, *Secure and Trustworthy Transportation Cyber-Physical Systems*, aims to summarize the scientific foundations and engineering principles needed to ensure the cybersecurity and privacy of TCPS, and the state-of-the-art research findings and practices in tackling the cybersecurity and privacy issues of TCPS. This book is organized into three parts: System Foundations; Principles; and Tools and Practices.

Part I is composed of three chapters. In addition to the opportunities and challenges facing the cybersecurity and privacy of TCPS (Chap. 1), this part also presents various scientific foundations of TCPS, including architecture and enabling technologies (Chap. 2), and properties, principles, and metrics (Chap. 3).

Part II is composed of three chapters. This part presents the various engineering principles behind the cybersecurity and privacy of TCPS, including privacy-aware computing (Chap. 4), trust management (Chap. 5), and secure data dissemination (Chap. 6).

Part III includes several tools and practices available to TCPS (Chap. 7).

This book will enable readers to update their knowledge of state-of-the-art approaches, technologies, and solutions to the issue of cyber security and privacy in TCPS. As the book includes several works from different researchers, experts, and professionals, it also provides the audience with an efficient channel for obtaining

ideas, learning various methodologies, and even building up communications in the future . For those readers with different research interests, the security and privacy issues introduced in this book may also be extended to other interdisciplinary subjects.

This book would not have been possible without the help of many people. First, we would like to thank all the contributors of each of the book's chapters as well as reviewers all over the world. Second, we would like to thank Xiaolan Yao and Celine Lanlan Chang, both at Springer , who guided us through the book-editing process. Third, we sincerely acknowledge the support of the China Information Technology Security Evaluation Center.

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Beijing, China
Daytona Beach, USA
February 2017

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