COMPUTER AND NETWORK SECURITY

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Security in Distributed and Networking Systems

Yang Xiao

Yi Pan

Editors

World Scientific

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Security in Distributed and Networking Systems

SERIES IN COMPUTER AND NETWORK SECURITY

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Preface

Security issues in distributed systems and network systems become extremely important. This edited book provides a comprehensive treatment for security issues in these systems ranging from attacks to all kinds of solutions from prevention approaches to detection approaches. The books will include security studies in a large range of systems including distributed systems, Internet, pervasive computing, sensor networks, ad hoc networks, wireless networks, etc. Security issues in these systems include (but not limited to), attacks, malicious node detection, access control, authentication, intrusion detection, privacy and anonymity, security architectures and protocols, security theory and tools, secrecy and integrity, trust models. The goals of this edited book Is to provide an excellent reference for students, faculty, researchers, and people in the industry related to these fields.

This edited book contains articles written by experts on a wide range of topics that are associated with novel methods, techniques and applications of security in distributed and networking systems. It can serve as a useful reference for researchers, educators, graduate students, and practitioners in the fields of security in distributed systems, Internet, pervasive computing, sensor networks, ad hoc networks, wireless networks, etc.

The book contains 18 chapters from prominent researchers working in these areas around the world. It is organized along six themes (parts) in security issues for distributed systems, Internet, pervasive computing, sensor networks, ad hoc networks, wireless networks.

Part I: Security in Internet

Chapter 1 by Mateti introduces security issues in TCP/IP suite from a practical perspective. Chapter 2, by Wu et al. discusses two trends of potentially unwanted technologies in Internet (spam e-mails and spyware), and practical solutions. Chapter 3 by Oehler presents an overview of Secure Real-time Transport Protocol.

Part II: Security in Distributed Systems

Chapter 4 by Ling et al. surveys some mathematical results on cover-free families and present several interesting applications to topics in secure networks and distributed systems. Chapter 5 by Wang et al. proposes an ID-based Hierarchical Key Graph Scheme to manage multi-privileged group communications. Chapter 6, by Huai et al. introduces an access control policy negotiation solution on remote hot-deployment for grid services.

Part III: Security in Pervasive Computing

Chapter 7 by Xiao et al. discusses security issues in RFID systems and solution and enhancements. Chapter 8 by Misic analyzes performance of the 802.15.4 cluster in beacon enabled mode under the presence of key exchange protocol. Chapter 9 by Corbett et al. presents statistical and spectral analysis techniques to identify the type of wireless network interface cards being used on a network.

Part IV: Security in Sensor Networks

Chapter 10 by Hu et al. analyzes the time synchronization protocols in wireless sensor networks as well as potential network attacks and some efficient countermeasures. Chapter 11 by Kwok provides a detailed survey of sensor key management techniques. Chapter 12 by Dimitriou et al. shows how one can secure these protocols by adding source authentication to ensure that the program image originates from the base station.

Part V: Security in Ad Hoc Networks

Chapter 13 by Hoeper et al. introduces two full functional identity-based authentication and key exchange schemes for mobile ad hoc networks. Chapter 14 by Jiang et al. proposes a key distribution scheme with time-limited node revocation for secure group communications in wireless sensor networks. Chapter 15 by Xu et al. introduces an efficient ID-based online/offline scheme for authentication in AODV and then provides a formal transformation to convert the scheme to an ID-based online/offline multi-signature scheme.

Part VI: Security in Wireless Networks

Chapter 16 by Pervaiz et al. surveys wireless LANs security attacks and alternative security mechanisms. Chapter 17 by Shidhani et al. surveys authentication, authorization and accounting protocols and highlights their importance in securing heterogeneous wireless networks. Chapter 18 by Li et al. provides a survey of authentication mechanisms for wireless cellular networks.

Although the covered topics may not be an exhaustive representation of all the security issues in distributed systems, Internet, pervasive computing, sensor networks, ad hoc networks, and wireless networks, they do represent a rich and useful sample of the strategies and contents.

This book has been made possible by the great efforts and contributions of many people. First of all, we would like to thank all the contributors for putting together excellent chapters that are very comprehensive and informative. Second, we would like to thank the staff members, especially Dr Chunguang Sun, from World Scientific Publishing Co., for putting this book together. Finally, we would like to dedicate this book to our families.

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Editors

Yang Xiao is currently with Department of Computer Science at The University of Alabama. He worked at Micro Linear as an MAC (Medium Access Control) architect involving the IEEE 802.11 standard enhancement work before he joined Department of Computer Science at The University of Memphis in 2002. Dr. Xiao is the director of W^4-Net Lab, and was with CEIA (Center for Information Assurance) at The University of Memphis. He is an IEEE Senior member. He was a voting member of IEEE 802.11 Working Group from 2001 to 2004. He currently serves as Editor-in-Chief for *International Journal of Security and Networks (IJSN)* and for *International Journal of Sensor Networks (IJSNet)*. He serves as an associate editor or on editorial boards for the following refereed journals: *(Wiley) International Journal of Communication Systems*, *(Wiley) Wireless Communications and Mobile Computing (WCMC)*, *EURASIP Journal on Wireless Communications and Networking*, *International Journal of Wireless and Mobile Computing*, and *Recent Patents on Engineering*. Dr. Xiao serves as a (lead) guest editor for *EURASIP Journal on Wireless Communications and Networking*, special issue on “Wireless Telemedicine and Applications” in 2007, a guest editor for *IEEE Network*, special issue on “Advances on Broadband Access Networks” in 2007, a guest editor for *IEEE Wireless Communications*, special issue on “Radio Resource Management and Protocol Engineering in Future Broadband and Wireless Networks” in 2006, a (lead) guest editor for *International Journal of Security in Networks (IJSN)*, special issue on “Security Issues in Sensor Networks” in 2005, a (lead) guest editor for *EURASIP Journal on Wireless Communications and Networking*, special issue on “Wireless Network Security” in 2005, a (sole) guest editor for *(Elsevier) Computer*

Communications journal, special issue on "Energy-Efficient Scheduling and MAC for Sensor Networks, WPANs, WLANs, and WMANs" in 2005, a (lead) guest editor for *(Wiley) Journal of Wireless Communications and Mobile Computing*, special issue on "Mobility, Paging and Quality of Service Management for Future Wireless Networks" in 2004, a (lead) guest editor for *International Journal of Wireless and Mobile Computing*, special issue on "Medium Access Control for WLANs, WPANs, Ad Hoc Networks, and Sensor Networks" in 2004, and an associate guest editor for *International Journal of High Performance Computing and Networking*, special issue on "Parallel and Distributed Computing, Applications and Technologies" in 2003. He serves as editor/co-editor for ten edited books: *WiMAX/MobileFi: Advanced Research and Technology*, *Security in Distributed and Networking Systems*, *Security in Distributed, Grid, and Pervasive Computing*, *Security in Sensor Networks*, *Wireless Network Security*, *Adaptation Techniques in Wireless Multimedia Networks*, *Wireless LANs and Bluetooth*, *Security and Routing in Wireless Networks*, *Ad Hoc and Sensor Networks*, and *Design and Analysis of Wireless Networks*. He serves as a referee/reviewer for many funding agencies, as well as a panelist for US NSF and a member of Canada Foundation for Innovation (CFI)'s Telecommunications expert committee. He serves as TPC for more than 80 conferences such as INFOCOM, ICDCS, ICC, GLOBECOM, WCNC, etc. His research areas are wireless networks, mobile computing, and network security. He has published more than 180 papers in major journals and refereed conference proceedings related to these research areas. E-mail: yangxiao@ieee.org.

Yi Pan was born in Jiangsu, China. He entered Tsinghua University in March 1978 with the highest college entrance examination score among all 1977 high school graduates in Jiangsu Province. Currently, he is the chair and a professor in the Department of Computer Science and a professor in the Department of Computer Information Systems at Georgia State University. Dr. Pan received his B.Eng. and M.Eng. degrees in computer engineering from Tsinghua University, China, in 1982 and 1984, respectively, and his Ph.D. degree in computer science from the University of Pittsburgh, USA, in 1991. Dr. Pan's research interests include parallel and distributed computing, optical networks, wireless networks, and bioinformatics. Dr. Pan has published more than 100 journal papers with 30 papers published in various IEEE journals. In addition, he has published over 100 papers in refereed conferences (including IPDPS, ICPP, ICDCS, INFOCOM, and GLOBECOM). He has also co-authored/co-edited 30 books (including proceedings) and contributed several book chapters. His pioneer work on computing using reconfigurable optical buses has inspired extensive subsequent work by many researchers, and his research results have been cited by more than 100 researchers worldwide in books, theses, journal and conference papers. He is a co-inventor of three U.S. patents (pending) and 5 provisional patents, and has received many awards from agencies such as NSF, AFOSR, JSPS, IISF and Mellon Foundation. His recent research has been supported by NSF, NIH, NSFC, AFOSR, AFRL, JSPS, IISF and the states of Georgia and Ohio. He has served as a reviewer/panelist for many research foundations/agencies such as the U.S. National Science Foundation, the Natural Sciences and Engineering Research Council of Canada, the Australian Research Council, and the Hong Kong Research Grants Council. Dr. Pan has served as an editor-in-chief or editorial board member for 15 journals including 5 IEEE Transactions and a guest editor for 7 special issues. He has organized several international conferences and workshops and has also served as a program committee member for several major international conferences

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such as INFOCOM, GLOBECOM, ICC, IPDPS, and ICPP. Dr. Pan has delivered over 10 keynote speeches at many international conferences. Dr. Pan is an IEEE Distinguished Speaker (2000-2002), a Yamacraw Distinguished Speaker (2002), a Shell Oil Colloquium Speaker (2002), and a senior member of IEEE. He is listed in Men of Achievement, Who's Who in Midwest, Who's Who in America, Who's Who in American Education, Who's Who in Computational Science and Engineering, and Who's Who of Asian Americans.

Contents

PART 1 SECURITY IN INTERNET

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