

Side-Channel Attacks

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graph TD; SCA[Side-Channel Attacks] --> Invasive; SCA --> SemiInvasive[Semi-Invasive]; SCA --> NonInvasive[Non-Invasive]; Invasive --> RE[Reverse Engineering]; SemiInvasive --> Microprobing; SemiInvasive --> DC[Direct contact with the data bus]; NonInvasive --> Active; NonInvasive --> Passive; Active --> FIA[Fault Injection Analysis]; FIA --> VCG[Voltage Clock Glitching]; FIA --> LPA[Laser Pulse Attack]; FIA --> CICI[Circumvent Code Integrity Checks]; Passive --> TA[Temporal Analysis]; Passive --> TrA[Traffic Analysis]; Passive --> PA[Power Analysis SPA, DPA]; Passive --> EMA[Electromagnetic Analysis]; Passive --> AA[Acoustic Analysis];
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Invasive

- Reverse Engineering

Semi-Invasive

- Microprobing
- Direct contact with the data bus

Non-Invasive

Active

Fault Injection Analysis:

- Voltage Clock Glitching
- Laser Pulse Attack
- Circumvent Code Integrity Checks

Passive

- Temporal Analysis
- Traffic Analysis
- Power Analysis (SPA, DPA)
- Electromagnetic Analysis
- Acoustic Analysis

Side Channel Attacks And Countermeasures For Embedded Systems

Nigel Smart



Side Channel Attacks And Countermeasures For Embedded Systems:

Side Channel Attacks Seokhie Hong,2019-06-12 This Special Issue provides an opportunity for researchers in the area of side channel attacks SCAs to highlight the most recent exciting technologies The research papers published in this Special Issue represent recent progress in the field including research on power analysis attacks cache based timing attacks system level countermeasures and so on

Side-Channel Analysis of Embedded Systems Maamar Ouladj,Sylvain Guilley,2021-07-28 It has been more than 20 years since the seminal publications on side channel attacks They aim at extracting secrets from embedded systems while they execute cryptographic algorithms and they consist of two steps measurement and analysis This book tackles the analysis part especially under situations where the targeted device is protected by random masking The authors explain advances in the field and provide the reader with mathematical formalizations They present all known analyses within the same notation framework which allows the reader to rapidly understand and learn contrasting approaches It will be useful as a graduate level introduction also for self study by researchers and professionals and the examples are taken from real world datasets

ECCWS2014-Proceedings of the 13th European Conference on Cyberwarefare and Security Andrew Liaropoulos,George Tsihrintzis,2014-03-07

Real-Time Embedded Systems Christos Koulamas,Mihai T. Lazarescu,2019-01-10 This book is a printed edition of the Special Issue Real Time Embedded Systems that was published in Electronics

Embedded Computing Systems: Applications, Optimization, and Advanced Design Khalgui, Mohamed,Mosbahi, Olfa,Valentini, Antonio,2013-04-30 Embedded computing systems play an important and complex role in the functionality of electronic devices With our daily routines becoming more reliant on electronics for personal and professional use the understanding of these computing systems is crucial Embedded Computing Systems Applications Optimization and Advanced Design brings together theoretical and technical concepts of intelligent embedded control systems and their use in hardware and software architectures By highlighting formal modeling execution models and optimal implementations this reference source is essential for experts researchers and technical supporters in the industry and academia

Side-channel Analysis Carlos Moreno,2013 Side Channel Analysis plays an important role in cryptology as it represents an important class of attacks against cryptographic implementations especially in the context of embedded systems such as hand held mobile devices smart cards RFID tags etc These types of attacks bypass any intrinsic mathematical security of the cryptographic algorithm or protocol by exploiting observable side effects of the execution of the cryptographic operation that may exhibit some relationship with the internal secret parameters in the device Two of the main types of side channel attacks are timing attacks or timing analysis where the relationship between the execution time and secret parameters is exploited and power analysis which exploits the relationship between power consumption and the operations being executed by a processor as well as the data that these operations work with For power analysis two main types have been proposed simple power analysis SPA which relies on direct observation on a single measurement and

differential power analysis DPA which uses multiple measurements combined with statistical processing to extract information from the small variations in power consumption correlated to the data In this thesis we propose several countermeasures to these types of attacks with the main themes being timing analysis and SPA In addition to these themes one of our contributions expands upon the ideas behind SPA to present a constructive use of these techniques in the context of embedded systems debugging In our first contribution we present a countermeasure against timing attacks where an optimized form of idle wait is proposed with the goal of making the observable decryption time constant for most operations while maintaining the overhead to a minimum We show that not only we reduce the overhead in terms of execution speed but also the computational cost of the countermeasure which represents a considerable advantage in the context of devices relying on battery power where reduced computations translates into lower power consumption and thus increased battery life This is indeed one of the important themes for all of the contributions related to countermeasures to side channel attacks Our second and third contributions focus on power analysis specifically SPA We address the issue of straightforward implementations of binary exponentiation algorithms or scalar multiplication in the context of elliptic curve cryptography making a cryptographic system vulnerable to SPA Solutions previously proposed introduce a considerable performance penalty We propose a new method namely Square and Buffered Multiplications SABM that implements an SPA resistant binary exponentiation exhibiting optimal execution time at the cost of a small amount of storage $O(\sqrt{\ell})$ where ℓ is the bit length of the exponent The technique is optimal in the sense that it adds SPA resistance to an underlying binary exponentiation algorithm while introducing zero computational overhead We then present several new SPA resistant algorithms that result from a novel way of combining the SABM method with an alternative binary exponentiation algorithm where the exponent is split in two halves for simultaneous processing showing that by combining the two techniques we can make use of signed digit representations of the exponent to further improve performance while maintaining SPA resistance We also discuss the possibility of our method being implemented in a way that a certain level of resistance against DPA may be obtained In a related contribution we extend these ideas used in SPA and propose a technique to non intrusively monitor a device and trace program execution with the intended application of assisting in the difficult task of debugging embedded systems at deployment or production stage when standard debugging tools or auxiliary components to facilitate debugging are no longer enabled in the device One of the important highlights of this contribution is the fact that the system works on a standard PC capturing the power traces through the recording input of the sound card

Information Security Practice and Experience Kefei Chen, Robert Deng, Xuejia Lai, Jianying Zhou, 2006-02-26 This book constitutes the refereed proceedings of the Second International Information Security Practice and Experience Conference ISPEC 2006 held in Hangzhou China in April 2006 The 35 revised full papers presented were carefully reviewed and selected from 307 submissions The papers are organized in topical sections

Introduction to Hardware Security and Trust Mohammad

Tehranipoor,Cliff Wang,2011-09-22 This book provides the foundations for understanding hardware security and trust which have become major concerns for national security over the past decade Coverage includes security and trust issues in all types of electronic devices and systems such as ASICs COTS FPGAs microprocessors DSPs and embedded systems This serves as an invaluable reference to the state of the art research that is of critical significance to the security of and trust in modern society s microelectronic supported infrastructures

Cryptographic Hardware and Embedded Systems -

CHES 2017 Wieland Fischer,Naofumi Homma,2017-09-18 This book constitutes the proceedings of the 19th International Conference on Cryptographic Hardware and Embedded Systems CHES 2017 held in Taipei Taiwan in September 2017 The 33 full papers presented in this volume were carefully reviewed and selected from 130 submissions The annual CHES conference highlights new results in the design and analysis of cryptographic hardware and soft ware implementations The workshop builds a valuable bridge between the research and cryptographic engineering communities and attracts participants from industry academia and government organizations

Constructive Side-Channel Analysis and Secure Design Romain Wacquez,2024-04-02 This book constitutes the refereed proceedings of the 15th International Workshop on Constructive Side Channel Analysis and Secure Design COSADE 2024 held in Gardanne France during April 9 10 2024 The 14 full papers included in this book were carefully reviewed and selected from 42 submissions They were organized in topical sections as follows Analyses and Tools Attack Methods Deep Learning Based Side Channel Attacks PUF RNG and Cryptographic Implementations

Embedded Cryptography 2 Emmanuel Prouff,Guenaël Renault,Mattieu Rivain,Colin

O'Flynn,2025-02-26 Embedded Cryptography provides a comprehensive exploration of cryptographic techniques tailored for embedded systems addressing the growing importance of security in devices such as mobile systems and IoT The books explore the evolution of embedded cryptography since its inception in the mid 90s and cover both theoretical and practical aspects as well as discussing the implementation of cryptographic algorithms such as AES RSA ECC and post quantum algorithms The work is structured into three volumes spanning forty chapters and nine parts and is enriched with pedagogical materials and real world case studies designed for researchers professionals and students alike offering insights into both foundational and advanced topics in the field Embedded Cryptography 2 is dedicated to masking and cryptographic implementations as well as hardware security

Software Defined Chips Leibo Liu,Shaojun Wei,Jianfeng Zhu,Chenchen Deng,2022-11-14 This book is the second volume of a two volume book set which introduces software defined chips In this book the programming model of the software defined chips is analyzed by tracing the coevolution of modern general purpose processors and programming models The enhancement in hardware security and reliability of the software defined chips are described from the perspective of dynamic and partial reconfiguration The challenges and prospective trends of software defined chips are also discussed Current applications in the fields of artificial intelligence cryptography 5G communications etc are presented in detail Potential applications in the future including post quantum cryptography evolutionary computing

etc are also discussed This book is suitable for scientists and researchers in the areas of electrical and electronic engineering and computer science Postgraduate students practitioners and professionals in related areas are also potentially interested in the topic of this book A Synergistic Framework for Hardware IP Privacy and Integrity Protection Meng Li,David Z.

Pan,2020-04-11 This book proposes a synergistic framework to help IP vendors to protect hardware IP privacy and integrity from design optimization and evaluation perspectives The proposed framework consists of five interacting components that directly target at the primary IP violations All the five algorithms are developed based on rigorous mathematical modeling for primary IP violations and focus on different stages of IC design which can be combined to provide a formal security

guarantee **Software Design and Development: Concepts, Methodologies, Tools, and Applications** Management Association, Information Resources,2013-07-31 Innovative tools and techniques for the development and design of software systems are essential to the problem solving and planning of software solutions Software Design and Development Concepts Methodologies Tools and Applications brings together the best practices of theory and implementation in the development of software systems This reference source is essential for researchers engineers practitioners and scholars seeking the latest knowledge on the techniques applications and methodologies for the design and development of software systems

Embedded Cryptography 1 Emmanuel Prouff,Guenael Renault,Mattieu Rivain,Colin O'Flynn,2025-01-13 Embedded Cryptography provides a comprehensive exploration of cryptographic techniques tailored for embedded systems addressing the growing importance of security in devices such as mobile systems and IoT The books explore the evolution of embedded cryptography since its inception in the mid 90s and cover both theoretical and practical aspects as well as discussing the implementation of cryptographic algorithms such as AES RSA ECC and post quantum algorithms The work is structured into three volumes spanning forty chapters and nine parts and is enriched with pedagogical materials and real world case studies designed for researchers professionals and students alike offering insights into both foundational and advanced topics in the field Embedded Cryptography 1 is dedicated to software side channel attacks hardware side channel attacks and fault injection attacks

Securing Cyber-Physical Systems Al-Sakib Khan Pathan,2015-10-06 Think about someone taking control of your car while you re driving Or someone hacking into a drone and taking control Both of these things have been done and both are attacks against cyber physical systems CPS Securing Cyber Physical Systems explores the cybersecurity needed for CPS with a focus on results of research and real world deploy

Embedded Cryptography 3 Emmanuel Prouff,Guenael Renault,Mattieu Rivain,Colin O'Flynn,2025-01-22 Embedded Cryptography provides a comprehensive exploration of cryptographic techniques tailored for embedded systems addressing the growing importance of security in devices such as mobile systems and IoT The books explore the evolution of embedded cryptography since its inception in the mid 90s and cover both theoretical and practical aspects as well as discussing the implementation of cryptographic algorithms such as AES RSA ECC and post quantum algorithms The work is structured into three volumes spanning forty

chapters and nine parts and is enriched with pedagogical materials and real world case studies designed for researchers professionals and students alike offering insights into both foundational and advanced topics in the field Embedded Cryptography 3 is dedicated to white box cryptography randomness and key generation as well as real world applications and attacks in the wild

Cryptography and Coding Nigel Smart, 2005-12-09 This book constitutes the refereed proceedings of the 10th IMA International Conference on Cryptography and Coding held in Cirencester UK in December 2005 The 26 revised full papers presented together with 4 invited contributions were carefully reviewed and selected from 94 submissions The papers are organized in topical sections on coding theory signatures and signcryption symmetric cryptography side channels algebraic cryptanalysis information theoretic applications number theoretic foundations and public key and ID based encryption schemes

Information and Communications Security Cristina Alcaraz, Liqun Chen, Shujun Li, Pierangela Samarati, 2022-08-23 This LNCS 13407 constitutes the refereed proceedings of the 24th International Conference on Information and Communications Security ICICS 2022 held in Canterbury UK in September 2022 The 34 revised full papers presented in the book were carefully selected from 150 submissions The papers are organized around the following topics Cryptography Authentication Privacy and Anonymity Attacks and Vulnerability Analysis Artificial Intelligence for Detection and Network Security and Forensics

Cyber-Physical Systems Security Çetin Kaya Koç, 2018-12-06 The chapters in this book present the work of researchers scientists engineers and teachers engaged with developing unified foundations principles and technologies for cyber physical security They adopt a multidisciplinary approach to solving related problems in next generation systems representing views from academia government bodies and industrial partners and their contributions discuss current work on modeling analyzing and understanding cyber physical systems

Unveiling the Power of Verbal Beauty: An Mental Sojourn through **Side Channel Attacks And Countermeasures For Embedded Systems**

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