

Internet Of Things Architecture

Damilare D. Fagbemi,David Wheeler,JC Wheeler

Internet of Things for Architects Perry Lea,2018-01-22 Learn to design, implement and secure your IoT infrastructure
Key Features Build a complete IoT system that is the best fit for your organization Learn about different concepts, technologies, and tradeoffs in the IoT architectural stack Understand the theory, concepts, and implementation of each element that comprises IoT design?from sensors to the cloud Implement best practices to ensure the reliability, scalability, robust communication systems, security, and data analysis in your IoT infrastructure Book DescriptionThe Internet of Things (IoT) is the fastest growing technology market. Industries are embracing IoT technologies to improve operational expenses, product life, and people's well-being. An architectural guide is necessary if you want to traverse the spectrum of technologies needed to build a successful IoT system, whether that's a single device or millions of devices. This book encompasses the entire spectrum of IoT solutions, from sensors to the cloud. We start by examining modern sensor systems and focus on their power and functionality. After that, we dive deep into communication theory, paying close attention to near-range PAN, including the new Bluetooth® 5.0 specification and mesh networks. Then, we explore IP-based communication in LAN and WAN, including 802.11ah, 5G LTE cellular, Sigfox, and LoRaWAN. Next, we cover edge routing and gateways and their role in fog computing, as well as the messaging protocols of MQTT and CoAP. With the data now in internet form, you'll get an understanding of cloud and fog architectures, including the OpenFog standards. We wrap up the analytics portion of the book with the application of statistical analysis, complex event processing, and deep learning models. Finally, we conclude by providing a holistic view of the IoT security stack and the anatomical details of IoT exploits while countering them with software defined perimeters and blockchains.What you will learn Understand the role and scope of architecting a successful IoT deployment, from sensors to the cloud Scan the landscape of IoT technologies that span everything from sensors to the cloud and everything in between See the trade-offs in choices of protocols and communications in IoT deployments Build a repertoire of skills and the vernacular necessary to work in the IoT space Broaden your skills in multiple engineering domains necessary for the IoT architect Who this book is for This book is for architects, system designers, technologists, and technology managers who want to understand the IoT ecosphere, various technologies, and tradeoffs and develop a 50,000-foot view of IoT architecture.

Internet of Things Simone Cirani,Gianluigi Ferrari,Marco Picone,Luca Veltri,2018-08-30 This book addresses

researchers and graduate students at the forefront of study/research on the Internet of Things (IoT) by presenting state-of-the-art research together with the current and future challenges in building new smart applications (e.g., Smart Cities, Smart Buildings, and Industrial IoT) in an efficient, scalable, and sustainable way. It covers the main pillars of the IoT world (Connectivity, Interoperability, Discoverability, and Security/Privacy), providing a comprehensive look at the current technologies, procedures, and architectures.

Internet of Things- Architecture, Implementation, and Security Mayur Ramgir, 2019 Today we live in an era of internet where there are more connected devices than humans. The ecosystem of these interrelated computing devices, over the internet, for data sharing, communication and automation is called Internet of Things (IoT). Internet of Things not only exposes the learners to the world of IoT but also takes them deep into implementation, security and testing. The text is supplemented with case studies and real-world examples to enable the learners efficiently to implement the concepts discussed. Table of Contents: Chapter 1. Internet of Things—An Answer to the Next Generation Automated World Chapter 2. IoT Frameworks Chapter 3. Design Patterns for IoT Chapter 4. IoT Architecture Choices Chapter 5. IoT Core Modules Chapter 6. Essential Elements for Designing IoT Architecture Chapter 7. IoT Implementation Strategies Chapter 8. Types of Testing in IoT Chapter 9. Artificial Intelligence for IoT Chapter 10. Data Analytics and Machine Learning for IoT Chapter 11. Security Challenges for IoT Chapter 12. Holistic View on IoT Security Chapter 13. Hands-On Examples of IoT Experiments Chapter 14. IoT Project Ideas

Internet of Things From Hype to Reality Ammar Rayes, Samer Salam, 2016-10-22 This book comprehensively describes an end-to-end Internet of Things (IoT) architecture that is comprised of devices, network, compute, storage, platform, applications along with management and security components. It is organized into five main parts, comprising of a total of 11 chapters. Part I presents a generic IoT reference model to establish a common vocabulary for IoT solutions. This includes a detailed description of the Internet protocol layers and the Things (sensors and actuators) as well as the key business drivers to realize the IoT vision. Part II focuses on the IoT requirements that impact networking protocols and provides a layer-by-layer walkthrough of the protocol stack with emphasis on industry progress and key gaps. Part III introduces the concept of Fog computing and describes the drivers for the technology, its constituent elements, and how it relates and differs from Cloud computing. Part IV discusses the IoT services platform, the cornerstone of the solution followed by the Security functions and requirements. Finally, Part V provides a treatment of the topic of connected ecosystems in IoT along with practical applications. It then surveys the latest IoT standards and discusses the pivotal role of open source in IoT. “Faculty will find well-crafted questions and answers at the end of each chapter, suitable for review and in classroom discussion topics. In addition, the material in the book can be used by engineers and technical leaders looking to gain a deep technical understanding of IoT, as well as by managers and business leaders looking to gain a competitive

edge and understand innovation opportunities for the future.” Dr. Jim Spohrer, IBM “This text provides a very compelling study of the IoT space and achieves a very good balance between engineering/technology focus and business context. As such, it is highly-recommended for anyone interested in this rapidly-expanding field and will have broad appeal to a wide cross-section of readers, i.e., including engineering professionals, business analysts, university students, and professors.” Professor Nasir Ghani, University of South Florida

Towards the Internet of Things Mohammad Ali Jabraeil Jamali, Bahareh Bahrami, Arash Heidari, Parisa Allahverdizadeh, Farhad Norouzi, 2019-06-12 This book presents a comprehensive framework for IoT, including its architectures, security, privacy, network communications, and protocols. The book starts by providing an overview of the aforementioned research topics, future directions and open challenges that face the IoT development. The authors then discuss the main architectures in the field, which include Three- and Five-Layer Architectures, Cloud and Fog Based Architectures, a Social IoT Application Architecture. In the security chapter, the authors outline threats and attacks, privacy preservation, trust and authentication, IoT data security, and social awareness. The final chapter presents case studies including smart home, wearables, connected cars, industrial Internet, smart cities, IoT in agriculture, smart retail, energy engagement, IoT in healthcare, and IoT in poultry and farming. Discusses ongoing research into the connection of the physical and virtual worlds; Includes the architecture, security, privacy, communications, and protocols of IoT; Presents a variety of case studies in IoT including wearables, smart cities, and energy management.

Rethinking the Internet of Things Francis daCosta, Byron Henderson, 2014-01-23 Apress is proud to announce that *Rethinking the Internet of Things* was a 2014 Jolt Award Finalist, the highest honor for a programming book. And the amazing part is that there is no code in the book. Over the next decade, most devices connected to the Internet will not be used by people in the familiar way that personal computers, tablets and smart phones are. Billions of interconnected devices will be monitoring the environment, transportation systems, factories, farms, forests, utilities, soil and weather conditions, oceans and resources. Many of these sensors and actuators will be networked into autonomous sets, with much of the information being exchanged machine-to-machine directly and without human involvement. Machine-to-machine communications are typically terse. Most sensors and actuators will report or act upon small pieces of information - chirps. Burdening these devices with current network protocol stacks is inefficient, unnecessary and unduly increases their cost of ownership. This must change. The architecture of the Internet of Things must evolve now by incorporating simpler protocols toward at the edges of the network, or remain forever inefficient. *Rethinking the Internet of Things* describes reasons why we must rethink current approaches to the Internet of Things. Appropriate architectures that will coexist with existing networking protocols are described in detail. An architecture comprised of integrator functions, propagator nodes, and end devices, along with their interactions, is explored.

Internet-of-Things (IoT) Systems Dimitrios Serpanos, Marilyn Wolf, 2017-11-24 This book covers essential topics in the architecture and design of Internet of Things (IoT) systems. The authors provide state-of-the-art information that enables readers to design systems that balance functionality, bandwidth, and power consumption, while providing secure and safe operation in the face of a wide range of threat and fault models. Coverage includes essential topics in system modeling, edge/cloud architectures, and security and safety, including cyberphysical systems and industrial control systems.

The IoT Architect's Guide to Attainable Security and Privacy Damilare D. Fagbemi, David Wheeler, JC Wheeler, 2019-10-08 This book describes how to architect and design Internet of Things (IoT) solutions that provide end-to-end security and privacy at scale. It is unique in its detailed coverage of threat analysis, protocol analysis, secure design principles, intelligent IoT's impact on privacy, and the effect of usability on security. The book also unveils the impact of digital currency and the dark web on the IoT-security economy. It's both informative and entertaining. Filled with practical and relevant examples based on years of experience ... with lively discussions and storytelling related to IoT security design flaws and architectural issues.— Dr. James F. Ransome, Senior Director of Security Development Lifecycle (SOL) Engineering, Intel 'There is an absolute treasure trove of information within this book that will benefit anyone, not just the engineering community. This book has earned a permanent spot on my office bookshelf.— Erv Comer, Fellow of Engineering, Office of Chief Architect Zebra Technologies 'The importance of this work goes well beyond the engineer and architect. The IoT Architect's Guide to Attainable Security & Privacy is a crucial resource for every executive who delivers connected products to the market or uses connected products to run their business.— Kurt Lee, VP Sales and Strategic Alliances at PWNIE Express If we collectively fail to follow the advice described here regarding IoT security and Privacy, we will continue to add to our mounting pile of exploitable computing devices. The attackers are having a field day. Read this book, now.— Brook S.E. Schoenfield, Director of Advisory Services at IOActive, previously Master Security Architect at McAfee, and author of *Securing Systems*

Enabling Things to Talk Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, 2013-10-28 The Internet of Things (IoT) is an emerging network superstructure that will connect physical resources and actual users. It will support an ecosystem of smart applications and services bringing hyper-connectivity to our society by using augmented and rich interfaces. Whereas in the beginning IoT referred to the advent of barcodes and Radio Frequency Identification (RFID), which helped to automate inventory, tracking and basic identification, today IoT is characterized by a dynamic trend toward connecting smart sensors, objects, devices, data and applications. The next step will be “cognitive IoT,” facilitating object and data re-use across application domains and leveraging hyper-connectivity, interoperability solutions and semantically enriched information distribution. The Architectural Reference

Model (ARM), presented in this book by the members of the IoT-A project team driving this harmonization effort, makes it possible to connect vertically closed systems, architectures and application areas so as to create open interoperable systems and integrated environments and platforms. It constitutes a foundation from which software companies can capitalize on the benefits of developing consumer-oriented platforms including hardware, software and services. The material is structured in two parts. Part A introduces the general concepts developed for and applied in the ARM. It is aimed at end users who want to use IoT technologies, managers interested in understanding the opportunities generated by these novel technologies, and system architects who are interested in an overview of the underlying basic models. It also includes several case studies to illustrate how the ARM has been used in real-life scenarios. Part B then addresses the topic at a more detailed technical level and is targeted at readers with a more scientific or technical background. It provides in-depth guidance on the ARM, including a detailed description of a process for generating concrete architectures, as well as reference manuals with guidelines on how to use the various models and perspectives presented to create a concrete architecture. Furthermore, best practices and tips on how system engineers can use the ARM to develop specific IoT architectures for dedicated IoT solutions are illustrated and exemplified in reverse mapping exercises of existing standards and platforms.

Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm Sheng-Lung Peng, Souvik Pal, Lianfen Huang, 2019-11-13 This book discusses the evolution of future-generation technologies through the Internet of things, bringing together all the related technologies on a single platform to offer valuable insights for undergraduate and postgraduate students, researchers, academics and industry practitioners. The book uses data, network engineering and intelligent decision- support system-by-design principles to design a reliable IoT-enabled ecosystem and to implement cyber-physical pervasive infrastructure solutions. It takes readers on a journey that begins with understanding the insight paradigm of IoT-enabled technologies and how it can be applied. It walks readers through engaging with real-time challenges and building a safe infrastructure for IoT-based, future-generation technologies. The book helps researchers and practitioners to understand the design architecture through IoT and the state of the art in IoT countermeasures. It also highlights the differences between heterogeneous platforms in IoT-enabled infrastructure and traditional ad hoc or infrastructural networks, and provides a comprehensive discussion on functional frameworks for IoT, object identification, IoT domain model, RFID technology, wearable sensors, WBAN, IoT semantics, knowledge extraction, and security and privacy issues in IoT-based ecosystems. Written by leading international experts, it explores IoT-enabled insight paradigms, which are utilized for the future benefit of humans. It also includes references to numerous works. Divided into stand-alone chapters, this highly readable book is intended for specialists, researchers, graduate students, designers, experts, and engineers involved in research on healthcare-related issues.

Internet of Things Fatima Hussain, 2017-03-27 This book describes the building blocks and introductory business models

for Internet of Things (IoT). The author provide an overview of the entire IoT architecture and constituent layers, followed by detail description of each block . Various inter-connecting technologies and sensors are discussed in context of IoT networks. In addition to this, concepts of Big Data and Fog Computing are presented and characterized as per data generated by versatile IoT applications . Smart parking system and context aware services are presented as an hybrid model of cloud and Fog Afterwards, various IoT applications and respective business models are discussed. Finally, author summarizes the IoT building blocks and identify research issues in each, and suggest potential research projects worthy of pursuing.

Internet of Things Kolla Bhanu Prakash,2020-10-26 This book explains the fundamentals of the Internet of Things - from different architectures for managing IoT platforms to the insights on trust, security, and privacy in IoT environments, including consumer electronic devices or home applications. This opens the doors to new innovations that will build novel interactions among things and humans, and enables the realization of smart cities, infrastructures, and services. The book presents a complete overview on the research and the technology of this rapidly emerging topic.

Security and Privacy in the Internet of Things Ali Ismail Awad,Jemal Abawajy,2021-12-03 SECURITY AND PRIVACY IN THE INTERNET OF THINGS Provides the authoritative and up-to-date information required for securing IoT architecture and applications The vast amount of data generated by the Internet of Things (IoT) has made information and cyber security vital for not only personal privacy, but also for the sustainability of the IoT itself. Security and Privacy in the Internet of Things brings together high-quality research on IoT security models, architectures, techniques, and application domains. This concise yet comprehensive volume explores state-of-the-art mitigations in IoT security while addressing important security and privacy challenges across different IoT layers. The book provides timely coverage of IoT architecture, security technologies and mechanisms, and applications. The authors outline emerging trends in IoT security and privacy with a focus on areas such as smart environments and e-health. Topics include authentication and access control, attack detection and prevention, securing IoT through traffic modeling, human aspects in IoT security, and IoT hardware security. Presenting the current body of knowledge in a single volume, Security and Privacy in the Internet of Things: Discusses a broad range of IoT attacks and defense mechanisms Examines IoT security and privacy protocols and approaches Covers both the logical and physical security of IoT devices Addresses IoT security through network traffic modeling Describes privacy preserving techniques in smart cities Explores current threat and vulnerability analyses Security and Privacy in the Internet of Things: Architectures, Techniques, and Applications is essential reading for researchers, industry practitioners, and students involved in IoT security development and IoT systems deployment.

Enabling the Internet of Things Muhammad Azhar Iqbal,Sajjad Hussain,Huanlai Xing,Muhammad Ali Imran,2020-12-21 LEARN MORE ABOUT FOUNDATIONAL AND ADVANCED TOPICS IN INTERNET OF THINGS TECHNOLOGY WITH THIS ALL-IN-ONE GUIDE Enabling the Internet of Things: Fundamentals, Design, and Applications

delivers a comprehensive starting point for anyone hoping to understand the fundamentals and design of Internet of Things (IoT) systems. The book's distinguished academics and authors offer readers an opportunity to understand IoT concepts via programming in an abstract way. Readers will learn about IoT fundamentals, hardware and software components, IoT protocol stacks, security, IoT applications and implementations, as well as the challenges, and potential solutions, that lie ahead. Readers will learn about the social aspects of IoT systems, as well as receive an introduction to the Blockly Programming Language, IoT Microcontrollers, IoT Microprocessors, systems on a chip and IoT Gateway Architecture. The book also provides implementation of simple code examples in Packet Tracer, increasing the usefulness and practicality of the book. Enabling the Internet of Things examines a wide variety of other essential topics, including: The fundamentals of IoT, including its evolution, distinctions, definitions, vision, enabling technologies, and building blocks An elaboration of the sensing principles of IoT and the essentials of wireless sensor networks A detailed examination of the IoT protocol stack for communications An analysis of the security challenges and threats faced by users of IoT devices, as well as the countermeasures that can be used to fight them, from the perception layer to the application layer Perfect as a supplementary text for undergraduate students taking computer science or electrical engineering courses, Enabling the Internet of Things also belongs on the bookshelves of industry professionals and researchers who regularly work with and on the Internet of Things and who seek a better understanding of its foundational and advanced topics.

The Convergence of Internet of Things and Cloud for Smart Computing Parikshit N. Mahalle, Nancy Ambritta P., Gitanjali Rahul Shinde, Arvind Vinayak Deshpande, 2021-08-03 This book presents the know-how of the real-time IoT application development activity including a basic understanding of the IoT architecture, use cases, smart computing, and the associated challenges in design and development of the IoT system. All the technical details related to protocol stack, technologies, and platforms used for the implementation are explained. It further includes techniques and case studies that include smart computing on the IoT-Cloud models along with test beds for experimentation purposes. The book aims at setting up the groundwork for the creation of applications that can help make day-to-day tasks simpler by meeting the needs of varied sectors like education, health care, agriculture, and so forth. Features: • Covers IoT cloud convergence with a focus on complex industrial IoT case studies. • Discusses the broad background of IoT-Cloud convergence architectures and its fundamentals along with resource provisioning mechanisms. • Emphasizes the use of context in developing context-aware IoT solutions. • Presents a novel C-model that explains the IoT application development phases. • Discusses a simplified convergence model that depicts the role of Cloud in an IoT application. This book aims at graduate students, researchers, and professionals getting started in the IoT field.

Internet of Things Security Shishir K. Shandilya, Soon Ae Chun, Smita Shandilya, 2022-09-01 Internet of Things (IoT) security deals with safeguarding the devices and communications of IoT systems, by implementing protective measures and

avoiding procedures which can lead to intrusions and attacks. However, security was never the prime focus during the development of the IoT, hence vendors have sold IoT solutions without thorough preventive measures. The idea of incorporating networking appliances in IoT systems is relatively new, and hence IoT security has not always been considered in the product design. To improve security, an IoT device that needs to be directly accessible over the Internet should be segmented into its own network, and have general network access restricted. The network segment should be monitored to identify potential anomalous traffic, and action should be taken if a problem arises. This has generated an altogether new area of research, which seeks possible solutions for securing the devices, and communication amongst them.

Internet of Things (IoT) Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko, Kamal Kant Hiran, 2020-03-03 A Systematic Approach to Learn the Principles, Paradigms and Applications of Internet of Things
DESCRIPTION In this book, Principles, Paradigm frameworks, and Applications of IoT (Internet of Things) in the modern era are presented. It also provides a sound understanding of the IoT concepts, architecture, and applications, and improves the awareness of readers about IoT technologies and application areas. A key objective of this book is to provide a systematic source of reference for all aspects of IoT. This book comprises nine chapters with close co-operation and contributions from four different authors, spanning across four countries and providing a global, broad perspective on major topics on the Internet of Things. **KEY FEATURES** - IoT applications in various sectors like Education, Smart City, Politics, Healthcare, Agriculture, etc. - Adoption of the IoT technology and strategies for various sectors - To present case studies and innovative applications of the IoT - To analyze and present the state of the art of the IoT and related technologies and methodologies - To propose new models, practical solutions and technological advances of the IoT **WHAT WILL YOU LEARN** - Become aware of the IoT components, their connectivity to form the IoT altogether, and future possibilities with IoT. - Understand how the various components of cloud computing work together to form the basic architecture of cloud computing. - Examine the relationship between the various layers in the IoT architecture. - Understand the programming framework for the Internet of Things (IoT) and various programming paradigms. **WHO THIS BOOK IS FOR** This book is intended for professionals, researchers, instructors, and designers of a smart system, who will benefit from reading this book. **TABLE OF CONTENTS**
 1. IoT Introduction 2. IoT Architectures and Protocols 3. Programming Framework for IoT 4. Virtualization and IoT 5. Security, Privacy and Challenges in IoT 6. IoT Applications Areas 7. IoT and Cloud 8. Smart City Using IoT integration 9. Case Studies 10. Important Key Terms 11. References

Azure Internet of Things Revealed Robert Stackowiak, 2019-11-09 Design, build, and justify an optimal Microsoft IoT footprint to meet your project needs. This book describes common Internet of Things components and architecture and then focuses on Microsoft's Azure components relevant in deploying these solutions. Microsoft-specific topics addressed include: deploying edge devices and pushing intelligence to the edge; connecting IoT devices to Azure and landing data there,

applying Azure Machine Learning, analytics, and Cognitive Services; roles for Microsoft solution accelerators and managed solutions; and integration of the Azure footprint with legacy infrastructure. The book concludes with a discussion of best practices in defining and developing solutions and creating a plan for success. What You Will Learn Design the right IoT architecture to deliver solutions for a variety of project needs Connect IoT devices to Azure for data collection and delivery of services Use Azure Machine Learning and Cognitive Services to deliver intelligence in cloud-based solutions and at the edge Understand the benefits and tradeoffs of Microsoft's solution accelerators and managed solutions Investigate new use cases that are described and apply best practices in deployment strategies Integrate cutting-edge Azure deployments with existing legacy data sources Who This Book Is For Developers and architects new to IoT projects or new to Microsoft Azure IoT components as well as readers interested in best practices used in architecting IoT solutions that utilize the Azure platform

Design of Secure IoT Systems: A Practical Approach Across Industries Sumeet Arora,Ramachandra Gambheer,Meenakshi Vohra,2021-07-16 Build secure IoT devices and networks for a wide range of industries This practical guide fully explains the technology behind the Internet of Things, machine-to-machine communication, and automation. Written by a team of experts from leading firms, Design of Secure IoT Systems: A Practical Approach Across Industries covers all aspects of system architecture, protocols, requirements, and design. You will discover how to design and engineer IoT devices and networks with trust and security. The book features industrial automation case studies and simulation examples from a wide range of fields. Coverage includes: IoT architecture and technology fundamentals Connected machines and M2M communication Network protocols and architecture IoT hardware design fundamentals WAN, IP, and MAC configuration IoT data systems design Designing with trust and security Data security policies and regulations Cybersecurity threats and risks Automation Use cases across industries Industry compliance and standards

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