

# Fog Computing And Its Role In The Internet Of Things

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Security Issues in Fog Computing from 5G to 6G Chintan Bhatt 2022-10-10 The book provides an examination of how fog security is changing the information technology industry and will continue to in the next decade. The authors first discuss how fog enables key applications in wireless 5G, the Internet of Things, and big data. The book then presents an overview of fog/edge computing, focusing on its relationship with cloud technology, Internet of Things and the future with the use of secure 5G/6G communication. The book also presents a comprehensive overview of liabilities in fog/edge computing within multi-level architectures and the intelligent management. The last part of the book reviews applications of fog/edge computing in smart cities, including in Industrial IoT, edge-based augmented reality, data streaming, and blockchain-based.

The Cloud-to-Thing Continuum Theo Lynn 2020-01-01 The Internet of Things offers massive societal and economic opportunities while at the same time significant challenges, not least the delivery and management of the technical infrastructure underpinning it, the deluge of data generated

from it, ensuring privacy and security, and capturing value from it. This Open Access Pivot explores these challenges, presenting the state of the art and future directions for research but also frameworks for making sense of this complex area. This book provides a variety of perspectives on how technology innovations such as fog, edge and dew computing, 5G networks, and distributed intelligence are making us rethink conventional cloud computing to support the Internet of Things. Much of this book focuses on technical aspects of the Internet of Things, however, clear methodologies for mapping the business value of the Internet of Things are still missing. We provide a value mapping framework for the Internet of Things to address this gap. While there is much hype about the Internet of Things, we have yet to reach the tipping point. As such, this book provides a timely entrée for higher education educators, researchers and students, industry and policy makers on the technologies that promise to reshape how society interacts and operates. Theo Lynn is Full Professor of Digital Business at DCU Business School, Ireland and Director of the Irish Institute of Digital Business. John G. Mooney is Associate Professor of Information Systems and Technology Management at the Pepperdine Graziadio Business School, United States. Brian Lee is Director of the Software Research Institute at Athlone Institute of Technology. Patricia Takako Endo is a Postdoctoral Research Fellow at the Irish Institute of Digital Business, Dublin City University, Ireland, and a Professor at Universidade de Pernambuco, Brazil.

Fog and Edge Computing Ajit Singh 2021-03-21 In recent times, the number of Internet of Things (IoT) devices/sensors increased tremendously. To support the computational demand of real-time latency-sensitive applications of largely geo-distributed IoT devices/sensors, a new computing paradigm named 'Fog computing' has been introduced as the demerits of cloud computing lie in the velocity, bandwidth, and privacy of data. Fog computing is an extension of cloud computing, and it is one of the most important archetype in the current world. Fog computing is like cloud computing as it provides data storage, computation, processing capabilities. IoT edge computing is significantly different from non-IoT edge computing, with distinct demands and considerations. IoT devices typically have limited data processing and storage capabilities, so substantial data processing needs to occur off the device, with the edge offering an environment to undertake this processing and manage large volumes of IoT devices and data. This, in turn, can reduce device cost, as many functions can be off-loaded to the edge. The location of the edge itself has various possibilities and will differ according to the use case. For example,

the edge for IoT could reside at an operator's local or regional data centre, at a base station or at a dedicated server on the customer's premises. This book features Fog and Edge Computing with respect to Cloud, Mobile, IoT and IIoT technologies from evolution, architecture, implementation and design. All aspects have been covered with in-depth real-life and practical use cases from industry. This book covers the curriculum of the Fog/Edge Computing course at prominent global Universities / Institutions. Simply In Depth.....

Intelligent Internet of Things Farshad Firouzi 2020-01-21 This holistic book is an invaluable reference for addressing various practical challenges in architecting and engineering Intelligent IoT and eHealth solutions for industry practitioners, academic and researchers, as well as for engineers involved in product development. The first part provides a comprehensive guide to fundamentals, applications, challenges, technical and economic benefits, and promises of the Internet of Things using examples of real-world applications. It also addresses all important aspects of designing and engineering cutting-edge IoT solutions using a cross-layer approach from device to fog, and cloud covering standards, protocols, design principles, reference architectures, as well as all the underlying technologies, pillars, and components such as embedded systems, network, cloud computing, data storage, data processing, big data analytics, machine learning, distributed ledger technologies, and security. In addition, it discusses the effects of Intelligent IoT, which are reflected in new business models and digital transformation. The second part provides an insightful guide to the design and deployment of IoT solutions for smart healthcare as one of the most important applications of IoT. Therefore, the second part targets smart healthcare-wearable sensors, body area sensors, advanced pervasive healthcare systems, and big data analytics that are aimed at providing connected health interventions to individuals for healthier lifestyles.

Applying Integration Techniques and Methods in Distributed Systems and Technologies Kecskemeti, Gabor 2019-04-12 Distributed systems intertwine with our everyday lives. The benefits and current shortcomings of the underpinning technologies are experienced by a wide range of people and their smart devices. With the rise of large-scale IoT and similar distributed systems, cloud bursting technologies, and partial outsourcing solutions, private entities are encouraged to increase their efficiency and offer unparalleled availability and reliability to their users. Applying Integration Techniques and Methods in Distributed Systems is a critical scholarly publication that defines the current state of distributed systems,

determines further goals, and presents architectures and service frameworks to achieve highly integrated distributed systems and presents solutions to integration and efficient management challenges faced by current and future distributed systems. Highlighting topics such as multimedia, programming languages, and smart environments, this book is ideal for system administrators, integrators, designers, developers, researchers, and academicians.

### Fog, Edge, and Pervasive Computing in Intelligent IoT Driven Applications

Deepak Gupta 2021-01-07 A practical guide to the design, implementation, evaluation, and deployment of emerging technologies for intelligent IoT applications With the rapid development in artificially intelligent and hybrid technologies, IoT, edge, fog-driven, and pervasive computing techniques are becoming important parts of our daily lives. This book focuses on recent advances, roles, and benefits of these technologies, describing the latest intelligent systems from a practical point of view. Fog, Edge, and Pervasive Computing in Intelligent IoT Driven Applications is also valuable for engineers and professionals trying to solve practical, economic, or technical problems. With a uniquely practical approach spanning multiple fields of interest, contributors cover theory, applications, and design methodologies for intelligent systems. These technologies are rapidly transforming engineering, industry, and agriculture by enabling real-time processing of data via computational, resource-oriented metaheuristics and machine learning algorithms. As edge/fog computing and associated technologies are implemented far and wide, we are now able to solve previously intractable problems. With chapters contributed by experts in the field, this book: Describes Machine Learning frameworks and algorithms for edge, fog, and pervasive computing Considers probabilistic storage systems and proven optimization techniques for intelligent IoT Covers 5G edge network slicing and virtual network systems that utilize new networking capacity Explores resource provisioning and bandwidth allocation for edge, fog, and pervasive mobile applications Presents emerging applications of intelligent IoT, including smart farming, factory automation, marketing automation, medical diagnosis, and more Researchers, graduate students, and practitioners working in the intelligent systems domain will appreciate this book's practical orientation and comprehensive coverage. Intelligent IoT is revolutionizing every industry and field today, and Fog, Edge, and Pervasive Computing in Intelligent IoT Driven Applications provides the background, orientation, and inspiration needed to begin.

Handbook of Large-Scale Distributed Computing in Smart Healthcare

Samee U. Khan 2017-08-07 This volume offers readers various perspectives and visions for cutting-edge research in ubiquitous healthcare. The topics emphasize large-scale architectures and high performance solutions for smart healthcare, healthcare monitoring using large-scale computing techniques, Internet of Things (IoT) and big data analytics for healthcare, Fog Computing, mobile health, large-scale medical data mining, advanced machine learning methods for mining multidimensional sensor data, smart homes, and resource allocation methods for the BANs. The book contains high quality chapters contributed by leading international researchers working in domains, such as e-Health, pervasive and context-aware computing, cloud, grid, cluster, and big-data computing. We are optimistic that the topics included in this book will provide a multidisciplinary research platform to the researchers, practitioners, and students from biomedical engineering, health informatics, computer science, and computer engineering.

Predictive Analytics in Cloud, Fog, and Edge Computing Hiren Kumar Thakkar 2022-11-23 This book covers the relationship of recent technologies (such as Blockchain, IoT, and 5G) with the cloud computing as well as fog computing, and mobile edge computing. The relationship will not be limited to only architecture proposal, trends, and technical advancements. However, the book also explores the possibility of predictive analytics in cloud computing with respect to Blockchain, IoT, and 5G. The recent advancements in the internet-supported distributed computing i.e. cloud computing, has made it possible to process the bulk amount of data in a parallel and distributed. This has made it a lucrative technology to process the data generated from technologies such as Blockchain, IoT, and 5G. However, there are several issues a Cloud Service Provider (CSP) encounters, such as Blockchain security in cloud, IoT elasticity and scalability management in cloud, Service Level Agreement (SLA) compliances for 5G, Resource management, Load balancing, and Fault-tolerance. This edited book will discuss the aforementioned issues in connection with Blockchain, IoT, and 5G. Moreover, the book discusses how the cloud computing is not sufficient and one needs to use fog computing, and edge computing to efficiently process the data generated from IoT, and 5G. Moreover, the book shows how smart city, smart healthcare system, and smart communities are few of the most relevant IoT applications where fog computing plays a significant role. The book discusses the limitation of fog computing and the need for the edge computing to further reduce the network latency to process streaming data from IoT devices. The book also explores power of

predictive analytics of Blockchain, IoT, and 5G data in cloud computing with its sister technologies. Since, the amount of resources increases day-by-day, artificial intelligence (AI) tools are becoming more popular due to their capability which can be used in solving wide variety of issues, such as minimize the energy consumption of physical servers, optimize the service cost, improve the quality of experience, increase the service availability, efficiently handle the huge data flow, manages the large number of IoT devices, etc.

Fog Computing in the Internet of Things Amir M. Rahmani 2017-05-29 This book describes state-of-the-art approaches to Fog Computing, including the background of innovations achieved in recent years. Coverage includes various aspects of fog computing architectures for Internet of Things, driving reasons, variations and case studies. The authors discuss in detail key topics, such as meeting low latency and real-time requirements of applications, interoperability, federation and heterogeneous computing, energy efficiency and mobility, fog and cloud interplay, geo-distribution and location awareness, and case studies in healthcare and smart space applications.

Fog and Edge Computing Rajkumar Buyya 2019-02-06 A comprehensive guide to Fog and Edge applications, architectures, and technologies Recent years have seen the explosive growth of the Internet of Things (IoT): the internet-connected network of devices that includes everything from personal electronics and home appliances to automobiles and industrial machinery. Responding to the ever-increasing bandwidth demands of the IoT, Fog and Edge computing concepts have developed to collect, analyze, and process data more efficiently than traditional cloud architecture. Fog and Edge Computing: Principles and Paradigms provides a comprehensive overview of the state-of-the-art applications and architectures driving this dynamic field of computing while highlighting potential research directions and emerging technologies. Exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, this timely book addresses both the challenges and opportunities that Fog and Edge computing presents. Contributions from leading IoT experts discuss federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated presentation of topics helps readers gain thorough knowledge of the foundations, applications, and issues that are central to Fog and Edge computing. This valuable resource: Provides insights on transitioning from current Cloud-centric and

4G/5G wireless environments to Fog Computing Examines methods to optimize virtualized, pooled, and shared resources Identifies potential technical challenges and offers suggestions for possible solutions Discusses major components of Fog and Edge computing architectures such as middleware, interaction protocols, and autonomic management Includes access to a website portal for advanced online resources Fog and Edge Computing: Principles and Paradigms is an essential source of up-to-date information for systems architects, developers, researchers, and advanced undergraduate and graduate students in fields of computer science and engineering.

The Smart Cyber Ecosystem for Sustainable Development Pardeep Kumar 2021-09-08 The Cyber Ecosystem can be a replica of our natural ecosystem where different living and non-living things interact with each other to perform specific tasks. Similarly, the different entities of the cyber ecosystem collaborate digitally with each other to revolutionize our lifestyle by creating smart, intelligent, and automated systems/processes. The main actors of the cyber ecosystem, among others, are the Internet of Things (IoT), Artificial Intelligence (AI), and the mechanisms providing cybersecurity. This book documents how this blend of technologies is powering a digital sustainable socio-economic infrastructure which improves our life quality. It offers advanced automation methods fitted with amended business and audits models, universal authentication schemes, transparent governance, and inventive prediction analysis.

Handbook of Research on Information and Records Management in the Fourth Industrial Revolution Chigwada, Josiline Phiri 2021-06-25

Information and records management has been an important part of society for establishing procedures to effectively manage information. As technology has increased in society, this essential function has been impacted as well. With the onset of technological tools brought upon by the fourth industrial revolution, technologies such as artificial intelligence, the internet of things, big data, and more have changed the face of information and records management. These technologies and tools have paved new ways for security, efficiency in timely processes, new ways to create and process records, and other beneficial traits. Along with these advancements come new contemporary issues, leading to the need for research on how exactly information records management is functioning in modern times, the technologies brought on by the fourth industrial revolution, and both the benefits and challenges to this transition. The Handbook of Research on Information and Records Management in the Fourth Industrial Revolution showcases contemporary issues and

demonstrates the value of information and records management in the fourth industrial revolution. The book provides a summary of the key activities undertaken by information and records managers as they seek to make records and information management more visible in the modern knowledge-driven society. The chapters highlight innovation, the use of information and communication technology in information and records management, best practices, challenges encountered, and how they are overcome. The target audience of this book will be composed of professionals, librarians, archivists, lecturers, and researchers working in the field of library and information science, along with practitioners, academicians, and students interested in information and records management in the 21st century.

Fog Computing A Complete Guide - 2019 Edition Gerardus Blokdyk 2019-06-18 How can sdn help the fog network security? What are the business drivers? What are the disruptive aspects of IoT? How much edge computing power do you need? Fog computing: will it be the future of cloud computing ? Defining, designing, creating, and implementing a process to solve a challenge or meet an objective is the most valuable role... In EVERY group, company, organization and department. Unless you are talking a one-time, single-use project, there should be a process. Whether that process is managed and implemented by humans, AI, or a combination of the two, it needs to be designed by someone with a complex enough perspective to ask the right questions. Someone capable of asking the right questions and step back and say, 'What are we really trying to accomplish here? And is there a different way to look at it?' This Self-Assessment empowers people to do just that - whether their title is entrepreneur, manager, consultant, (Vice-)President, CxO etc... - they are the people who rule the future. They are the person who asks the right questions to make Fog computing investments work better. This Fog computing All-Inclusive Self-Assessment enables You to be that person. All the tools you need to an in-depth Fog computing Self-Assessment. Featuring 957 new and updated case-based questions, organized into seven core areas of process design, this Self-Assessment will help you identify areas in which Fog computing improvements can be made. In using the questions you will be better able to: - diagnose Fog computing projects, initiatives, organizations, businesses and processes using accepted diagnostic standards and practices - implement evidence-based best practice strategies aligned with overall goals - integrate recent advances in Fog computing and process design strategies into practice according to best practice guidelines Using a Self-Assessment tool known

as the Fog computing Scorecard, you will develop a clear picture of which Fog computing areas need attention. Your purchase includes access details to the Fog computing self-assessment dashboard download which gives you your dynamically prioritized projects-ready tool and shows your organization exactly what to do next. You will receive the following contents with New and Updated specific criteria: - The latest quick edition of the book in PDF - The latest complete edition of the book in PDF, which criteria correspond to the criteria in... - The Self-Assessment Excel Dashboard - Example pre-filled Self-Assessment Excel Dashboard to get familiar with results generation - In-depth and specific Fog computing Checklists - Project management checklists and templates to assist with implementation **INCLUDES LIFETIME SELF ASSESSMENT UPDATES** Every self assessment comes with Lifetime Updates and Lifetime Free Updated Books. Lifetime Updates is an industry-first feature which allows you to receive verified self assessment updates, ensuring you always have the most accurate information at your fingertips.

**Integration of Cloud Computing with Internet of Things** Monika Mangla 2021-03-08 The book aims to integrate the aspects of IoT, Cloud computing and data analytics from diversified perspectives. The book also plans to discuss the recent research trends and advanced topics in the field which will be of interest to academicians and researchers working in this area. Thus, the book intends to help its readers to understand and explore the spectrum of applications of IoT, cloud computing and data analytics. Here, it is also worth mentioning that the book is believed to draw attention on the applications of said technology in various disciplines in order to obtain enhanced understanding of the readers. Also, this book focuses on the researches and challenges in the domain of IoT, Cloud computing and Data analytics from perspectives of various stakeholders.

**Fog Computing** Assad Abbas 2020-04-21 Summarizes the current state and upcoming trends within the area of fog computing Written by some of the leading experts in the field, **Fog Computing: Theory and Practice** focuses on the technological aspects of employing fog computing in various application domains, such as smart healthcare, industrial process control and improvement, smart cities, and virtual learning environments. In addition, the Machine-to-Machine (M2M) communication methods for fog computing environments are covered in depth. Presented in two parts—**Fog Computing Systems and Architectures**, and **Fog Computing Techniques and Application**—this book covers such important topics as energy efficiency and Quality of Service (QoS) issues, reliability and fault tolerance, load balancing, and scheduling in fog computing systems. It also

devotes special attention to emerging trends and the industry needs associated with utilizing the mobile edge computing, Internet of Things (IoT), resource and pricing estimation, and virtualization in the fog environments. Includes chapters on deep learning, mobile edge computing, smart grid, and intelligent transportation systems beyond the theoretical and foundational concepts Explores real-time traffic surveillance from video streams and interoperability of fog computing architectures Presents the latest research on data quality in the IoT, privacy, security, and trust issues in fog computing Fog Computing: Theory and Practice provides a platform for researchers, practitioners, and graduate students from computer science, computer engineering, and various other disciplines to gain a deep understanding of fog computing.

Fog Computing Based IoT Applications and Their Performance Santosh Reddy Gundala Palle 2018 Today's Internet of Things (IoT) is enabling innovations much faster to enhance the quality of life using various IoT applications such as Smart City, Smart Homes, Autonomous Driving Cars, Drone Monitoring Systems and many more applications. Cloud Computing in IoT has playing a significant role in providing its maximum services such as Data Storage, Computing or Processing, Analyzing and Securing Big Data etc for IoT applications. But, researchers estimated that the users are going to deploy 1 trillion IoT devices by the year 2025 which could have an economic impact of \$11 trillion dollars per year. The unprecedented amount of data that is going to generate from those number of devices is pushing the cloud computing traditional systems to difficult situations to handle. Along with this situation there are certain applications (Self Driving, Health Monitoring, Gaming, Real-Time Big Data Analytics, Live Streaming and Controlling Applications etc.) in IoT which requires quick response to react and control the situations if necessary. The traditional Cloud Computing systems in this scenario cannot satisfy the service level agreement (SLA) made between the cloud service providers and cloud users. Balancing this scenario, cloud service providers must maintain a reasonable performance while reducing the energy consumption and cost of maintenance. In this thesis work a new computing paradigm called Fog Computing has been used for our newly proposed application models to overcome the problems or drawbacks of Cloud Computing and to enhance the performance for our application models by satisfying the quality of service level agreements (QOSLA). By using Fog Computing distributed strategy our models achieved better performance and worked more efficient than in Cloud. It also reduced the network usage, energy consumption in cloud and cost of execution. To simulate our work, we

used iFogSim simulation toolkit which is currently growing significantly for the past couple of years.

Handbook of Research on Cloud and Fog Computing Infrastructures for Data Science Raj, Pethuru 2018-05-18 Fog computing is quickly increasing its applications and uses to the next level. As it continues to grow, different types of virtualization technologies can thrust this branch of computing further into mainstream use. The Handbook of Research on Cloud and Fog Computing Infrastructures for Data Science is a key reference volume on the latest research on the role of next-generation systems and devices that are capable of self-learning and how those devices will impact society. Featuring wide-ranging coverage across a variety of relevant views and themes such as cognitive analytics, data mining algorithms, and the internet of things, this publication is ideally designed for programmers, IT professionals, students, researchers, and engineers looking for innovative research on software-defined cloud infrastructures and domain-specific analytics.

Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning Nur Zincir-Heywood 2021-10-12  
COMMUNICATION NETWORKS AND SERVICE MANAGEMENT IN THE ERA OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING  
Discover the impact that new technologies are having on communication systems with this up-to-date and one-stop resource Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning delivers a comprehensive overview of the impact of artificial intelligence (AI) and machine learning (ML) on service and network management. Beginning with a fulsome description of ML and AI, the book moves on to discuss management models, architectures, and frameworks. The authors also explore how AI and ML can be used in service management functions like the generation of workload profiles, service provisioning, and more. The book includes a handpicked selection of applications and case studies, as well as a treatment of emerging technologies the authors predict could have a significant impact on network and service management in the future. Statistical analysis and data mining are also discussed, particularly with respect to how they allow for an improvement of the management and security of IT systems and networks. Readers will also enjoy topics like: A thorough introduction to network and service management, machine learning, and artificial intelligence An exploration of artificial intelligence and machine learning for management models, including autonomic management, policy-based management, intent based -management, and network virtualization-based

management Discussions of AI and ML for architectures and frameworks, including cloud -systems, software defined networks, 5G and 6G networks, and Edge/Fog networks An examination of AI and ML for service management, including the automatic -generation of workload profiles using unsupervised learning Perfect for information and communications technology educators, Communication Networks and Service Management in the Era of Artificial Intelligence and Machine Learning will also earn a place in the libraries of engineers and professionals who seek a structured reference on how the emergence of artificial intelligence and machine learning techniques is affecting service and network management.

Fog Computing for Healthcare 4.0 Environments Sudeep Tanwar 2020-08-02 This book provides an analysis of the role of fog computing, cloud computing, and Internet of Things in providing uninterrupted context-aware services as they relate to Healthcare 4.0. The book considers a three-layer patient-driven healthcare architecture for real-time data collection, processing, and transmission. It gives insight to the readers for the applicability of fog devices and gateways in Healthcare 4.0 environments for current and future applications. It also considers aspects required to manage the complexity of fog computing for Healthcare 4.0 and also develops a comprehensive taxonomy.

The Rise of Fog Computing in the Digital Era K. G. Srinivasa 2018 "This book contains a compendium of the latest academic material on the evolving theory and practice related to fog computing. Including innovative studies on distributed fog computing environments, programming models, and access control mechanisms"--

Fog Computing Zaigham Mahmood 2018-07-12 This authoritative text/reference describes the state of the art of fog computing, presenting insights from an international selection of renowned experts. A particular focus is provided on development approaches, architectural mechanisms, and measurement metrics for building smart adaptable environments. The coverage also includes important related topics such as device connectivity, security and interoperability, and communication methods. Topics and features: introduces the core concepts and principles of fog computing, and reviews the latest research and best practice relating to fog/edge environments; discusses the vision for an Internet of Things (IoT) in terms of fog computing and other related distributed computing paradigms, such as cloud computing; presents a survey of the key issues and broader aspects of the fog paradigm, as well as the factors that affect adoption of fog computing; examines frameworks and methodologies for fog-based architecture design, improving performance, and measuring

quality of experience; proposes tools and methodologies for analyzing large amounts of sensor data from smart city initiatives; describes approaches for designing robust services, management of data-intensive applications, context-aware data analysis, and vehicular networking; identifies potential future research directions and technological innovations in relation to distributed computing environments such as the IoT. This enlightening volume offers essential perspectives for researchers of distributed computing and computer networking, as well as for advanced undergraduate and graduate students pursuing interests in this area. Professional engineers seeking to enhance security and connectivity in their IoT systems will also find this work to be a valuable reference.

#### Fog and Fogonomics Yang Yang 2020-01-14 THE ONE-STOP RESOURCE FOR ANY INDIVIDUAL OR ORGANIZATION

CONSIDERING FOG COMPUTING Fog and Fogonomics is a comprehensive and technology-centric resource that highlights the system model, architectures, building blocks, and IEEE standards for fog computing platforms and solutions. The "fog" is defined as the multiple interconnected layers of computing along the continuum from cloud to endpoints such as user devices and things including racks or microcells in server closets, residential gateways, factory control systems, and more. The authors—noted experts on the topic—review business models and metrics that allow for the economic assessment of fog-based information communication technology (ICT) resources, especially mobile resources. The book contains a wide range of templates and formulas for calculating quality-of-service values. Comprehensive in scope, it covers topics including fog computing technologies and reference architecture, fog-related standards and markets, fog-enabled applications and services, fog economics (fogonomics), and strategy. This important resource: Offers a comprehensive text on fog computing Discusses pricing, service level agreements, service delivery, and consumption of fog computing Examines how fog has the potential to change the information and communication technology industry in the next decade Describes how fog enables new business models, strategies, and competitive differentiation, as with ecosystems of connected and smart digital products and services Includes case studies featuring integration of fog computing, communication, and networking systems Written for product and systems engineers and designers, as well as for faculty and students, Fog and Fogonomics is an essential book that explores the technological and economic issues associated with fog computing.

Large-scale Data Streaming, Processing, and Blockchain Security Hemraj

Saini 2020 "This book explores the latest methodologies, modeling, and simulations for coping with the generation and management of large-scale data in both scientific and individual applications"--

Fog and Edge Computing Rajkumar Buyya 2019-01-04 A comprehensive guide to Fog and Edge applications, architectures, and technologies Recent years have seen the explosive growth of the Internet of Things (IoT): the internet-connected network of devices that includes everything from personal electronics and home appliances to automobiles and industrial machinery. Responding to the ever-increasing bandwidth demands of the IoT, Fog and Edge computing concepts have developed to collect, analyze, and process data more efficiently than traditional cloud architecture. Fog and Edge Computing: Principles and Paradigms provides a comprehensive overview of the state-of-the-art applications and architectures driving this dynamic field of computing while highlighting potential research directions and emerging technologies. Exploring topics such as developing scalable architectures, moving from closed systems to open systems, and ethical issues rising from data sensing, this timely book addresses both the challenges and opportunities that Fog and Edge computing presents. Contributions from leading IoT experts discuss federating Edge resources, middleware design issues, data management and predictive analysis, smart transportation and surveillance applications, and more. A coordinated and integrated presentation of topics helps readers gain thorough knowledge of the foundations, applications, and issues that are central to Fog and Edge computing. This valuable resource: Provides insights on transitioning from current Cloud-centric and 4G/5G wireless environments to Fog Computing Examines methods to optimize virtualized, pooled, and shared resources Identifies potential technical challenges and offers suggestions for possible solutions Discusses major components of Fog and Edge computing architectures such as middleware, interaction protocols, and autonomic management Includes access to a website portal for advanced online resources Fog and Edge Computing: Principles and Paradigms is an essential source of up-to-date information for systems architects, developers, researchers, and advanced undergraduate and graduate students in fields of computer science and engineering.

The Rise of Fog Computing in the Digital Era Srinivasa, K.G. 2018-08-31 With the immense growth of information, the prevalence of ubiquitously connected smart devices is rapidly increasing. Providing platforms that support computation, storage, and networking services between end devices is an essential aspect of an expanding digital society. The Rise of

Fog Computing in the Digital Era provides innovative insights into the present generation of computing devices, as well as new approaches to computational platforms through fog computing. The content within this publication presents concepts and theories on data analytics, management systems, networking architectures, and many more. It is a vital reference source for IT professionals, computer programmers, software developers, computer engineers, researchers, and upper-level students seeking topics centered on the challenges and benefits of fog computing in mobile environments.

Research Anthology on Architectures, Frameworks, and Integration Strategies for Distributed and Cloud Computing Management Association, Information Resources 2021-01-25 Distributed systems intertwine with our everyday lives. The benefits and current shortcomings of the underpinning technologies are experienced by a wide range of people and their smart devices. With the rise of large-scale IoT and similar distributed systems, cloud bursting technologies, and partial outsourcing solutions, private entities are encouraged to increase their efficiency and offer unparalleled availability and reliability to their users. The Research Anthology on Architectures, Frameworks, and Integration Strategies for Distributed and Cloud Computing is a vital reference source that provides valuable insight into current and emergent research occurring within the field of distributed computing. It also presents architectures and service frameworks to achieve highly integrated distributed systems and solutions to integration and efficient management challenges faced by current and future distributed systems. Highlighting a range of topics such as data sharing, wireless sensor networks, and scalability, this multi-volume book is ideally designed for system administrators, integrators, designers, developers, researchers, academicians, and students.

Innovations in the Industrial Internet of Things (IIoT) and Smart Factory Goundar, Sam 2021-01-22 Industrial internet of things (IIoT) is changing the face of industry by completely redefining the way stakeholders, enterprises, and machines connect and interact with each other in the industrial digital ecosystem. Smart and connected factories, in which all the machinery transmits real-time data, enable industrial data analytics for improving operational efficiency, productivity, and industrial processes, thus creating new business opportunities, asset utilization, and connected services. IIoT leads factories to step out of legacy environments and arcane processes towards open digital industrial ecosystems. Innovations in the Industrial Internet of Things (IIoT) and Smart Factory is a pivotal reference source that discusses the development of models and

algorithms for predictive control of industrial operations and focuses on optimization of industrial operational efficiency, rationalization, automation, and maintenance. While highlighting topics such as artificial intelligence, cyber security, and data collection, this book is ideally designed for engineers, manufacturers, industrialists, managers, IT consultants, practitioners, students, researchers, and industrial industry professionals.

Privacy-Enhancing Fog Computing and Its Applications Xiaodong Lin 2018-11-12 This SpringerBrief covers the security and privacy challenges in fog computing, and proposes a new secure and privacy-preserving mechanisms to resolve these challenges for securing fog-assisted IoT applications. Chapter 1 introduces the architecture of fog-assisted IoT applications and the security and privacy challenges in fog computing. Chapter 2 reviews several promising privacy-enhancing techniques and illustrates examples on how to leverage these techniques to enhance the privacy of users in fog computing. Specifically, the authors divide the existing privacy-enhancing techniques into three categories: identity-hidden techniques, location privacy protection and data privacy enhancing techniques. The research is of great importance since security and privacy problems faced by fog computing impede the healthy development of its enabled IoT applications. With the advanced privacy-enhancing techniques, the authors propose three secure and privacy-preserving protocols for fog computing applications, including smart parking navigation, mobile crowdsensing and smart grid. Chapter 3 introduces identity privacy leakage in smart parking navigation systems, and proposes a privacy-preserving smart parking navigation system to prevent identity privacy exposure and support efficient parking guidance retrieval through road-side units (fogs) with high retrieving probability and security guarantees. Chapter 4 presents the location privacy leakage, during task allocation in mobile crowdsensing, and propose a strong privacy-preserving task allocation scheme that enables location-based task allocation and reputation-based report selection without exposing knowledge about the location and reputation for participators in mobile crowdsensing. Chapter 5 introduces the data privacy leakage in smart grid, and proposes an efficient and privacy-preserving smart metering protocol to allow collectors (fogs) to achieve real-time measurement collection with privacy-enhanced data aggregation. Finally, conclusions and future research directions are given in Chapter 6. This brief validates the significant feature extension and efficiency improvement of IoT devices without sacrificing the security and privacy of users against dishonest fog nodes. It also provides valuable insights on the security and privacy

protection for fog-enabled IoT applications. Researchers and professionals who carry out research on security and privacy in wireless communication will want to purchase this SpringerBrief. Also, advanced level students, whose main research area is mobile network security will also be interested in this SpringerBrief.

Architecture and Security Issues in Fog Computing Applications Goundar, Sam 2019-09-20 As the progression of the internet continues, society is finding easier, quicker ways of simplifying their needs with the use of technology. With the growth of lightweight devices, such as smart phones and wearable devices, highly configured hardware is in heightened demand in order to process the large amounts of raw data that are acquired. Connecting these devices to fog computing can reduce bandwidth and latency for data transmission when associated with centralized cloud solutions and uses machine learning algorithms to handle large amounts of raw data. The risks that accompany this advancing technology, however, have yet to be explored. Architecture and Security Issues in Fog Computing Applications is a pivotal reference source that provides vital research on the architectural complications of fog processing and focuses on security and privacy issues in intelligent fog applications. While highlighting topics such as machine learning, cyber-physical systems, and security applications, this publication explores the architecture of intelligent fog applications enabled with machine learning. This book is ideally designed for IT specialists, software developers, security analysts, software engineers, academicians, students, and researchers seeking current research on network security and wireless systems.

Advanced Information Networking and Applications Leonard Barolli 2022 This book covers the theory, design and applications of computer networks, distributed computing and information systems. Networks of today are going through a rapid evolution, and there are many emerging areas of information networking and their applications. Heterogeneous networking supported by recent technological advances in low-power wireless communications along with silicon integration of various functionalities such as sensing, communications, intelligence and actuations is emerging as a critically important disruptive computer class based on a new platform, networking structure and interface that enable novel, low-cost and high-volume applications. Several of such applications have been difficult to realize because of many interconnections problems. To fulfill their large range of applications, different kinds of networks need to collaborate, and wired and next generation wireless systems should be

integrated in order to develop high-performance computing solutions to problems arising from the complexities of these networks. The aim of the book "Advanced Information Networking and Applications" is to provide the latest research findings, innovative research results, methods and development techniques from both theoretical and practical perspectives related to the emerging areas of information networking and applications.

Big Data and Internet of Things: A Roadmap for Smart Environments Nik Bessis 2014-03-11 This book presents current progress on challenges related to Big Data management by focusing on the particular challenges associated with context-aware data-intensive applications and services. The book is a state-of-the-art reference discussing progress made, as well as prompting future directions on the theories, practices, standards and strategies that are related to the emerging computational technologies and their association with supporting the Internet of Things advanced functioning for organizational settings including both business and e-science. Apart from inter-operable and inter-cooperative aspects, the book deals with a notable opportunity namely, the current trend in which a collectively shared and generated content is emerged from Internet end-users. Specifically, the book presents advances on managing and exploiting the vast size of data generated from within the smart environment (i.e. smart cities) towards an integrated, collective intelligence approach. The book also presents methods and practices to improve large storage infrastructures in response to increasing demands of the data intensive applications. The book contains 19 self-contained chapters that were very carefully selected based on peer review by at least two expert and independent reviewers and is organized into the three sections reflecting the general themes of interest to the IoT and Big Data communities: Section I: Foundations and Principles Section II: Advanced Models and Architectures Section III: Advanced Applications and Future Trends The book is intended for researchers interested in joining interdisciplinary and transdisciplinary works in the areas of Smart Environments, Internet of Things and various computational technologies for the purpose of an integrated collective computational intelligence approach into the Big Data era.

Fog/Edge Computing For Security, Privacy, and Applications Wei Chang 2021-01-04 This book provides the state-of-the-art development on security and privacy for fog/edge computing, together with their system architectural support and applications. This book is organized into five parts with a total of 15 chapters. Each area corresponds to an important snapshot. The first part of this book presents an overview of fog/edge

computing, focusing on its relationship with cloud technology and the future with the use of 5G communication. Several applications of edge computing are discussed. The second part of this book considers several security issues in fog/edge computing, including the secure storage and search services, collaborative intrusion detection method on IoT-fog computing, and the feasibility of deploying Byzantine agreement protocols in untrusted environments. The third part of this book studies the privacy issues in fog/edge computing. It first investigates the unique privacy challenges in fog/edge computing, and then discusses a privacy-preserving framework for the edge-based video analysis, a popular machine learning application on fog/edge. This book also covers the security architectural design of fog/edge computing, including a comprehensive overview of vulnerabilities in fog/edge computing within multiple architectural levels, the security and intelligent management, the implementation of network-function-virtualization-enabled multicasting in part four. It explains how to use the blockchain to realize security services. The last part of this book surveys applications of fog/edge computing, including the fog/edge computing in Industrial IoT, edge-based augmented reality, data streaming in fog/edge computing, and the blockchain-based application for edge-IoT. This book is designed for academics, researchers and government officials, working in the field of fog/edge computing and cloud computing. Practitioners, and business organizations (e.g., executives, system designers, and marketing professionals), who conduct teaching, research, decision making, and designing fog/edge technology will also benefit from this book. The content of this book will be particularly useful for advanced-level students studying computer science, computer technology, and information systems, but also applies to students in business, education, and economics, who would benefit from the information, models, and case studies therein.

Advancing Consumer-Centric Fog Computing Architectures Munir, Kashif  
2018-12-07 Due to a rapidly growing number of devices and communications, cloud computing has begun to fall behind on its ability to adequately process today's technology. Additionally, companies have begun to look for solutions that would help reduce their infrastructure costs and improve profitability. Fog computing, a paradigm that extends cloud computing and services to the edge of the network, has presented itself as a viable solution and cost-saving method. However, before businesses can implement this new method, concerns regarding its security, privacy, availability, and data protection must be addressed. Advancing Consumer-Centric Fog Computing Architectures is a collection of innovative research

on the methods and applications of fog computing in technological, business, and organizational dimensions. Thoroughly examining fog computing with respect to issues of management, trust and privacy, governance, and interoperability, this publication highlights a range of topics including access control mechanism, data confidentiality, and service-oriented architecture. This book is ideally designed for academicians, researchers, software developers, IT professionals, policymakers, technology designers, graduate-level students, managers, and business owners.

Enterprise Internet of Things Handbook Arvind Ravulavaru 2018-04-30 Get familiar with the building blocks of IoT solutions using off-the-shelf IoT platforms. Key Features Work with various trending IoT platforms such as AWS IoT, Azure IoT, Google IoT, IBM Watson IoT, and Kaa IoT Gain hands-on knowledge working with Cloud-based IoT platforms, IoT Analytics, and so on. A practical guide that will help you build IoT strategies for your organization Book Description There is a lot of work that is being done in the IoT domain and according to Forbes the global IoT market will grow from \$157B in 2016 to \$457B by 2020. This is an amazing market both in terms technology advancement as well as money. In this book, we will be covering five popular IoT platforms, namely, AWS IoT, Microsoft Azure IoT, Google IoT Core, IBM Watson IoT, and Kaa IoT middleware. You are going to build solutions that will use a Raspberry Pi 3, a DHT11 Temperature and humidity sensor, and a dashboard to visualize the sensor data in real-time. Furthermore, you will also explore various components of each of the platforms that are needed to achieve the desired solution. Besides building solutions, you will look at how Machine Learning and IoT go hand in hand and later design a simple predictive web service based on this concept. By the end of this book, you will be in a position to implement an IoT strategy best-fit for your organization What you will learn Connect a Temperature and Humidity sensor and see how these two can be managed from various platforms Explore the core components of AWS IoT such as AWS Kinesis and AWS IoT Rules Engine Build a simple analysis dashboard using Azure IoT and Power BI Understand the fundamentals of Google IoT and use Google core APIs to build your own dashboard Get started and work with the IBM Watson IoT platform Integrate Cassandra and Zeppelin with Kaa IoT dashboard Review some Machine Learning and AI and get to know more about their implementation in the IoT domain. Who this book is for This book is targeted at IoT architects and engineers, or any stakeholders working with IoT solutions in an organization. This book will also help decision makers

and professionals from small- and medium-sized enterprises build an IoT strategy for their venture.

Internet of Everything Beniamino Di Martino 2017-10-15 This book focuses on the Internet of Everything and related fields. The Internet of Everything adds connectivity and intelligence to just about every device, giving it special functions. The book provides a common platform for integrating information from heterogeneous sources. However, this can be quite reductive, as the Internet of Everything provides links not only among things, but also data, people, and business processes. The evolution of current sensor and device networks, with strong interactions between people and social environments, will have a dramatic impact on everything from city planning, first responders, the military and health. Such a shared ecosystem will allow for the interaction between data, sensor inputs and heterogeneous systems. Semantics is a fundamental component of this since semantic technologies are able to provide the necessary bridge between different data representations, and to solve terminology incongruence. Integrating data from distributed devices, sensor networks, social networks and biomedical instruments requires, first of all, the systematization of the current state of the art in such fields. Then, it is necessary to identify a common action thread to actually merge and homogenize standards and techniques applied in such a heterogeneous field. The exact requirements of an Internet of Everything environment need to be precisely identified and formally expressed, and finally, the role of modern computing paradigms, such as Cloud and Fog Computing, needs to be assessed with respect to the requirements expressed by an Internet of Everything ecosystem.

Fog Computing: Breakthroughs in Research and Practice Management Association, Information Resources 2018-06-04 Fog computing is rapidly expanding in its applications and capabilities through various parts of society. Utilizing different types of virtualization technologies can push this branch of computing to even greater heights. Fog Computing: Breakthroughs in Research and Practice contains a compendium of the latest academic material on the evolving theory and practice related to fog computing. Including innovative studies on distributed fog computing environments, programming models, and access control mechanisms, this publication is an ideal source for programmers, IT professionals, students, researchers, and engineers.

Novel Practices and Trends in Grid and Cloud Computing Raj, Pethuru 2019-06-28 Business and IT organizations are currently embracing new strategically sound concepts in order to be more customer-centric,

competitive, and cognitive in their daily operations. While useful, the various software tools, pioneering technologies, as well as their unique contributions largely go unused due to the lack of information provided on their special characteristics. *Novel Practices and Trends in Grid and Cloud Computing* is a collection of innovative research on the key concerns of cloud computing and how they are being addressed, as well as the various technologies and tools empowering cloud theory to be participative, penetrative, pervasive, and persuasive. While highlighting topics including cyber security, smart technology, and artificial intelligence, this book is ideally designed for students, researchers, and business managers on the lookout for innovative IT solutions for all the business automation software and improvisations of computational technologies.

Blockchain-enabled Fog and Edge Computing: Concepts, Architectures and Applications Muhammad Maaz Rehan 2020-07-27

This comprehensive book unveils the working relationship of blockchain and the fog/edge computing. The contents of the book have been designed in such a way that the reader will not only understand blockchain and fog/edge computing but will also understand their co-existence and their collaborative power to solve a range of versatile problems. The first part of the book covers fundamental concepts and the applications of blockchain-enabled fog and edge computing. These include: Internet of Things, Tactile Internet, Smart City; and E-challan in the Internet of Vehicles. The second part of the book covers security and privacy related issues of blockchain-enabled fog and edge computing. These include, hardware primitive based Physical Unclonable Functions; Secure Management Systems; security of Edge and Cloud in the presence of blockchain; secure storage in fog using blockchain; and using differential privacy for edge-based Smart Grid over blockchain. This book is written for students, computer scientists, researchers and developers, who wish to work in the domain of blockchain and fog/edge computing. One of the unique features of this book is highlighting the issues, challenges, and future research directions associated with Blockchain-enabled fog and edge computing paradigm. We hope the readers will consider this book a valuable addition in the domain of Blockchain and fog/edge computing.

Modeling and Simulation Design Phillip Tavel 2007-01-01

Cloud and Fog Computing Platforms for Internet of Things Pankaj Bhambri 2022 "Today, relevant data are typically delivered to cloud-based servers for storing and analysis in order to extract key features and enable enhanced applications beyond the basic transmission of raw data in order to realize the possibilities associated with the impending Internet of Things

(IoT). To allow for quicker, more efficient and much more privacy-preserving services, a new trend called fog computing has emerged: moving these responsibilities to the network's edge. Traditional centralized cloud computing paradigms confront new problems posed by IoT application growth, including high latency, limited storage and outages due to a lack of available resources. Fog computing puts the cloud and IoT devices closer together to address these issues. Instead of sending IoT data to the cloud, the fog processes and stores it locally at IoT devices. Unlike the cloud, fog-based services have a faster reaction time and better quality overall. Fog computing, Cloud Computing and their connectivity with the IoT are discussed in this book, with an emphasis on the advantages and implementation issues. It also explores the various architectures and appropriate IoT applications. Fog Computing, Cloud Computing and the Internet of Things are being suggested as potential research directions"--