Lecture Notes in Networks and Systems 1029

Valentina E. Balas
Kolla Bhanu Prakash
G. P. Saradhi Varma *Editors*

Proceedings of the International Conference on Internet of Everything and Quantum Information Processing

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Lecture Notes in Networks and Systems 1029

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Preface

This volume constitutes the Proceedings of the International Conference on Internet of Everything and Quantum Information Processing (IEQIP-2023), held on 24–25 November 2023 in Andhra Pradesh, India. This edition was organized in hybrid mode by the Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, and sponsored by the Department of Science and Technology, India.

The Internet of Things (IoT) and Quantum Computing are technological phenomena that are shaping businesses and industries. Moreover, integrating IoT and Quantum Computing solutions evolves ecosystems to offer optimum commercial practices. The emergence of these two phenomena offers revolutionary advancements. Further, Quantum Computing introduces avant-garde encryption algorithms for resilient security solutions in IoT systems. Papers presented at this conference showed how the Internet of Everything (IoE) combines sensing, computation, information extraction, and communication functionalities together in a device. IoE allows different electronic devices with different capabilities to sense the environment and to communicate for data exchange. Further, the challenge now is to identify, monitor, and ensure quality in IoT security. Moreover, there is a significant rise in data and information transfer due to a rise in the number of devices. Hence, there is a requirement for responsive, scalable, analytical, and efficient solutions.

This conference provided a premier venue for showcasing top-notch, original research, game-changing inventions, and captivating insights into artificial intelligence, quantum engineering, machine learning, deep learning, data science, and the Internet of Everything.

The conference papers included in this volume contain topics in the following areas of research:

- Artificial Intelligence
- Quantum Computing
- Internet of Things, Cloud Computing, and Data Science
- Machine learning
- Deep learning
- Image, text, and signal processing
- Disruptive technologies

In IEQIP 2023, we had many eminent Keynote Speakers: Dr. Kathleen Kramer (USA), Dr. Rajkumar Buyya (Australia), Dr. Edwin Chong (USA), Dr. Tran Duc-Tan (Vietnam), Dr. Deepak Garg (India), Rut Lineswala (India), Jash Kumar (India).

We are thankful to all the authors from different countries who have submitted papers to keep the quality of the IEQIP 2023 conference at high levels. The editors of this book would like to acknowledge all the authors, session chairs, and reviewers for their contributions. We have received invaluable help from the members of the International Program Committee and the Chairs responsible for different aspects of the event.

For their help with the IEQIP 2023 edition, we thank all the University Administration, Faculty, Scholars, and Students for customizing the registration of conference participants and all other required arrangements.

Our special thanks go to Dr. Janus Kacprzyk (Editor-in-Chief, Springer, Lecture Notes in Networks and Systems) for the opportunity to organize this guest-edited volume.

We are grateful to Springer, especially to Dr. Thomas Ditzinger (Senior Editor, Applied Sciences & Engineering Springer-Verlag), for the excellent collaboration, patience, and help during the evolution of this volume.

We hope this volume will provide helpful information to professors, researchers, and graduate students in the area of quantum computing and IoT, and all will find this collection of papers inspiring, informative, and valuable. We also hope to see you at a future IEQIP event.

Valentina E. Balas
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To my husband, Marius, For your unwavering support and belief in me.

Valentina

Acknowledgment

I would like to say thank you to the Almighty and my parents for the endless support, guidance, and love through all stages. I dedicate this book to my parents, family members, and my wife.

I would like to specially thank Sri. Koneru Satyanarayana, President, K. L. University, India, for his continuous support and encouragement throughout the preparation of this book.

I would like to express my gratitude towards all who supported, shared, talked things over, read, wrote, offered comments, allowed us to quote remarks and assisted in editing, proofreading and design, through this book journey. We pay our sincere thanks to the open data set providers.

I am grateful to Springer Publishing team, who showed us the ropes to creating this book. Without that knowledge I would not have ventured into starting this conference and preparing the proceedings book, which ultimately led to this. Their trusting in us, their guidance and providing the necessary time and resources, gave us the freedom to manage this book.

Last, but definitely not least, I'd like to thank my readers, who gave us their trust and hope this work inspires and guides them.

Valentina E. Balas
Kolla Bhanu Prakash
G. P. Saradhi Varma

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Dr. Balas is member in the specialized committee "Computers, Information Technology, and Systems Engineering" of the National Council for Attestation of University Titles, Diplomas, and Certificates (CNATDCU) for the 2024-2028 term.

She served as General Chair of the International Workshop Soft Computing and Applications (SOFA) in ten editions organized in the interval 2005-2022 and held in Romania and Hungary.

Dr. Balas participated in many international conferences as Organizer, Honorary Chair, Session Chair, member in Steering, Advisory or International Program Committees and Keynote Speaker. Recently she was working on a national project with EU funding support: BioCell-NanoART = Novel Bio-inspired Cellular Nano-Architectures - For Digital Integrated Circuits, 3M Euro from National Authority for Scientific Research and Innovation.

She is a member of European Society for Fuzzy Logic and Technology (EUSFLAT), member of Society for Industrial and Applied Mathematics (SIAM) and a Senior Member IEEE, member in Technical Committee – Fuzzy Systems (IEEE Computational Intelligence Society), chair of the Task Force 14 in Technical Committee – Emergent Technologies (IEEE CIS), member in Technical Committee – Soft Computing (IEEE SMCS). She is member in the Committee of IEEE Romania Section as Volunteers Training Coordinator and vice chair of IEEE Computational Intelligence Society Chapter – CIS 11. During the interval 2021-2022 she was a member of IEEE European Public Policy Committee Working Group on ICT. From May 2023 Dr. Balas is associate member of Romanian Academy of Scientists.

Dr. Balas was past Vice President (awards) of IFSA - International Fuzzy Systems Association Council (2013-2015), is a Joint Secretary of the Governing Council of Forum for Interdisciplinary Mathematics (FIM), - A Multidisciplinary Academic Body, India.

She is the recipient of the "Tudor Tanasescu" Prize from the Romanian Academy for contributions in the field of soft computing methods (2019) and "Stefan Odobleja" Prize from Romanian Academy of Scientists (2023 and 2024) and Diploma – Section Information Technology from The General Association of the Engineers in Romania (AGIR) 2023.

Dr. Kolla Bhanu Prakash is working as Professor, Associate Dean [R&D], and Research Group Head for A.I & Data Science Research Group at KLEF. He is Adjunct Professor at Taylors University, Malaysia. He has published 150+ research papers in international and national journals and conferences. He published Scopus and SCI publications 89 with an H-Index of 16 and a total citations of 1085. He is Reviewer for several international journals, including IEEE, Elsevier, Springer, Wiley, Taylor, and Francis, and served as Reviewer, Keynote Speaker, and TPC Member for several International conferences. His research interests include deep learning, data science, and quantum computing. He received the Best Researcher Award 4 times. He authored 2 books and edited 12 books with internationally reputed publishers like IEEE, Elsevier, Springer, River, CRC, Degryuter, and Wiley. He also published 15 patents, 2

patent grants, and 1 Copyright. He is guiding 4 Ph.D. scholars. Under his guidance, 3 Ph.D. students were awarded doctoral degrees. He is IEEE Senior Member, Fellow-ISRD, and Treasurer—ACM Amaravathi Chapter, India, LMISTE, MIAENG, SMIRED. He is Series Editor of "Next Generation Computing & Communication Engineering" for Wiley Publishers. He is Series Editor of "Industry 5.0: Artificial Intelligence, Cyber-Physical Systems, Mechatronics, and Smart Grids" for CRC publishers. He is NAAC Accessor. He is listed in the world's top 2% of researchers cited by Stanford University and Elsevier for 2021. He received a grant of 27 lakhs from Meity for establishing a Quantum Computing Research lab [QCAL] at KLEF and a grant from DST SERB worth 3 lakhs for organizing a workshop and conference in Quantum Computing. He delivered many Keynote speeches and expert talks worldwide in quantum computing, machine learning, and deep learning.

Prof. G. P. S. Varma Vice-Chancellor, KLEF, is one of the most widely experienced leaders in Indian higher education, known for his commitment to expanding student opportunity, catalyzing academic innovation, and encouraging the university's civic engagement and service to society. He adorned the position of Chairman, ISTE (Indian Society for Technical Education)—AP State, TSEMCET Test Committee Member-2021 nominated By Telangana State Govt, APEAMCET Admission Committee Member in 2016 by Andhra Pradesh State Council of Higher Education, Govt. of Andhra Pradesh. He has been a very farsighted Peer Team Visit Member for the National Assessment and Accreditation Council (NAAC) and an expert Committee Member for University Grants Commission (UGC) Autonomous Visits.

In the capacity of Board Member of IUCEE (Indo US Collaboration for Engineering Education), Board Member of GEDC (Global Engineering Deans Council), Membership Chair of ASEE (American Society for Engineering Education) Indian Chapter, Executive Body Member for Andhra Pradesh Private Engineering Colleges Managements Association (APPECMA) and Former Board Member for Storage Area Networks Industrial Association, the visionary professor advanced the unrelenting commitment to excellence in teaching, research, and public service and fostered significant collaborations across the globe.

He has received the Top 100 Educators 2015 award by the International Biographical Centre, Cambridge, England.

He has been honored with the 2000 Outstanding Intellectuals of the 21st Century medal by the International Biographical Centre, Cambridge, England. He has received the Vice Chancellor Excellence Award-2022 by AICTE—EduSkills. He has received the Lifetime Achievement Award 2021–2022 from the Bharat Education Excellence Awards, the All India Level most significant award ceremony for education and research.

During his pristine career, he held visiting delegations at universities in Israel, USA, Germany, Switzerland, Norway, Poland, Austria, Dubai, and China to submit a report on how to enhance the quality of education as per the Indian scenario.

Under his guidance, 22 doctoral students were awarded. He published 6 books, 9 patents, 38 National, and 153 International research papers in various reputed International and National Journals. While guiding KLEF through successful leaps, he brought to fruition the most ambitious projects funded by AICTE, UGC, DST, and NITI Aayog in the university's history.

He, the audacious leader, guided the university's efforts in undergraduate and graduate education, research initiatives, international and industrial partnerships, and strategic planning while playing an integral role in soaring the prestige of KLEF exponentially in the global arena of world-class education leaders.

Enhancing Cloud Security and Resource Management: A Comprehensive Review

B. Subramanya Anil Kumar(✉) and Basant Sah

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Abstract. The rapid proliferation of cloud computing has ushered in a new era of convenience and scalability for organizations and individuals alike. However, this convenience also comes with a host of security and resource management challenges that demand innovative solutions. This review paper embarks on a comprehensive exploration of three pivotal objectives aimed at fortifying the cloud ecosystem. This paper also offers a thorough perspective on the changing environment of cloud security and resource management by synthesising and analysing the most recent developments in these fields. Researchers, practitioners, and other interested parties may all benefit from it since it provides insights that can spur further innovation and growth in the rapidly developing area of cloud computing.

Keywords: Cloud Security · Data Integrity · User Authentication · Resource Optimization · Encryption · Virtual Machine (VM) Management

1 Introduction

Cloud computing has enabled businesses to streamline operations, reduce infrastructure costs, and adapt to ever-changing market demands [1]. However, this transformational shift towards the cloud also brings forth a new set of challenges, notably in the realms of security and resource management.

Strong security measures become crucial in this circumstance to ensure the availability, confidentiality, and integrity of data. Organizations must not only safeguard their data but also demonstrate compliance with regulations like GDPR, HIPAA, or industry-specific standards, which often come with strict security requirements [2]. These commitments requires the ability to allocate resources dynamically based on application needs, user demands, and performance objectives. These mechanisms enable cloud providers to match available resources with application workloads effectively, optimizing resource utilization while maintaining acceptable levels of performance and security [3].

This review paper embarks on a comprehensive exploration of these critical facets of cloud computing – security and resource management. It develops into the development and evaluation of cutting-edge models for multi-level user authentication, data integrity verification, and VM failure detection. By synthesizing and analyzing the latest advancements in these domains, this paper aims to provide a holistic perspective on the evolving landscape of cloud security and resource management.

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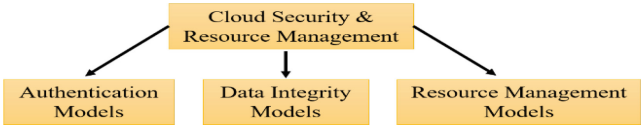

Fig. 1. Cloud Security & Resource Management

The Fig. 1 acts as a visual guide to our comprehensive review, providing a clear and structured overview of the intricate relationship between cloud security and resource management. This figure serves as the central reference point that unifies our exploration of these critical facets of cloud computing, emphasizing their deeply interwoven nature. At its core, the figure places cloud security as the central pillar, representing the bedrock upon which our entire study is founded. Cloud security is the linchpin that ensures the confidentiality, integrity, and availability of data and services in the cloud environment. Radiating outwards from the central core, we encounter three distinct segments, each encapsulating a vital domain of investigation: Authentication Models (Fig. 2), Data Integrity Models (Fig. 3), and Resource Management Models (Fig. 4).

Cloud User Authentication: User authentication is a key component of security in the world of cloud computing. It is crucial to strengthen this component against changing threats since it acts as the entry point to cloud resources [4].

Traditional Authentication Challenges: Despite their widespread usage, traditional authentication systems are rife with flaws [5]. In the ever-evolving landscape of cybersecurity, the trustworthiness of password-based security measures has come under scrutiny due to a plethora of critical vulnerabilities. In light of the previously discussed work in the domain of cloud computing and security, it is imperative to delve deeper into the pressing challenges associated with password-based authentication.

Comparative study with current ways: The Aytaj Badirova et al. paper explores multi-level user authentication, data integrity verification, and VM failure detection models, all with the goal of boosting cloud security and resource management, build on this by laying the groundwork [6].

In their study, P. Hari Kumar et al. focus on the significance of cloud data storage within the context of cloud providers like Amazon Web Services, Google Cloud Platform, and Microsoft Azure. The proposed system leverages multi-copy storage across multiple cloud servers, enhancing data security and reducing dependency on a single provider.

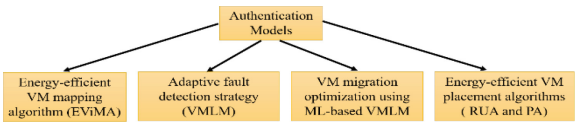

Fig. 2. Authentication Models

Authentication Models is crucial for understanding this work core concepts (see Fig. 2). It provides a structured overview of authentication models, including details about each model's purpose and benefits. Energy-efficient VM mapping algorithm

(EViMA), is highlighted, showcasing its proposal and achievement of better scheduling performance, improved energy consumption, and a reduced makespan. Adaptive fault detection strategy (VMLM), is presented with clarity, offering insights into its purpose and benefits within the realm of cloud security. VM migration optimization using machine learning-based VMLM, is depicted, shedding light on its role in reducing VM migrations, lowering energy consumption, and achieving a significant reduction in fault ratio. Energy-efficient VM placement algorithms (RUA and PA), are showcased, emphasizing their introduction and demonstration of trade-offs, particularly RUA's role in reducing SLA violations and preventing overloading.

2 Data Integrity Verification in the Cloud

This section explores the several facets of data integrity verification and how it contributes to cloud security.

Issues with Maintaining Data Integrity: The cloud environment presents a number of issues with keeping data integrity [7]. Threats to data include insider threats, unauthorised access, data corruption during transit or storage, and others. Data may be dispersed across several servers and locations, making its tracking and validation difficult [8].

Strong Encryption and Decryption methods: Data integrity verification spans the whole lifespan of data in the cloud thanks to lifecycle management [9]. Monitoring and verifying data integrity at each of these stages are critical to preventing tampering, unauthorized changes, or data loss [10].

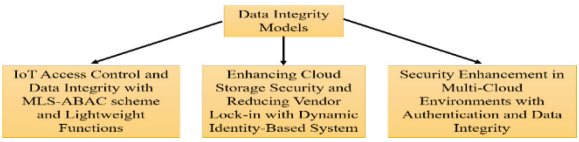

Fig. 3. Data Integrity Models

Data Integrity Models is pivotal for comprehending the core concepts of this work (see Fig. 3). The figure offers insights into various data integrity models, including details about each model's purpose and benefits. For instance, 'IoT Access Control and Data Integrity with MLS-ABAC scheme and Lightweight Functions' is highlighted,. 'Enhancing Cloud Storage Security and Reducing Vendor Lock-in with Dynamic Identity-Based System' is presented, shedding light on its role in providing a multi-copy storage system for flexibility and security.

Case Studies and Use Cases: To illustrate the practical application of data integrity verification in the cloud, this section provides real-world case studies and use cases. Data integrity issues are addressed by Mani Deep Karumanchi et al. in cloud-based Internet of Things (IoT) applications, especially in the dynamic IoT data environment. Experimental findings show that their improved supply chain data integrity model outperforms conventional methods in terms of integrity bit change, runtime, and encoding average runtime [11].