Lecture Notes in Networks and Systems 449

Leonard Barolli
Farookh Hussain
Tomoya Enokido *Editors*

Advanced Information Networking and Applications

Proceedings of the 36th International Conference on Advanced Information Networking and Applications (AINA-2022), Volume 1

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Volume 449

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Editors

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Welcome Message from AINA-2022 Organizers

Welcome to the 36th International Conference on Advanced Information Networking and Applications (AINA-2022). On behalf of AINA-2022 Organizing Committee, we would like to express to all participants our cordial welcome and high respect.

AINA is an international forum, where scientists and researchers from academia and industry working in various scientific and technical areas of networking and distributed computing systems can demonstrate new ideas and solutions in distributed computing systems. AINA was born in Asia, but it is now an international conference with high quality thanks to the great help and cooperation of many international friendly volunteers. AINA is a very open society and is always welcoming international volunteers from any country and any area in the world.

AINA International Conference is a forum for sharing ideas and research work in the emerging areas of information networking and their applications. The area of advanced networking has grown very rapidly, and the applications have experienced an explosive growth especially in the area of pervasive and mobile applications, wireless sensor networks, wireless ad-hoc networks, vehicular networks, multimedia computing and social networking, semantic collaborative systems, as well as grid, P2P, IoT, big data, and cloud computing. This advanced networking revolution is transforming the way people live, work, and interact with each other and is impacting the way business, education, entertainment, and health care are operating. The papers included in the proceedings cover theory, design, and application of computer networks, distributed computing, and information systems.

Each year AINA receives a lot of paper submissions from all around the world. It has maintained high-quality accepted papers and is aspiring to be one of the main international conferences on the information networking in the world.

We are very proud and honored to have two distinguished keynote talks by Prof. Mario A. R. Dantas, University of Juiz de Fora, Minas Gerais, Brazil, and Prof. Isaac Woungang, Ryerson University, Toronto, Ontario, Canada, who will present their recent work and will give new insights and ideas to the conference participants.

An international conference of this size requires the support and help of many people. A lot of people have helped and worked hard to produce a successful AINA-2022 technical program and conference proceedings. First, we would like to thank all authors for submitting their papers, the session chairs, and distinguished keynote speakers. We are indebted to program track co-chairs, program committee members and reviewers, who carried out the most difficult work of carefully evaluating the submitted papers.

We would like to thank AINA-2022 General Co-chairs, PC Co-chairs, and Workshops Co-chairs for their great efforts to make AINA-2022 a very successful event. We have special thanks to Finance Chair and Web Administrator Co-chairs.

We do hope that you will enjoy the conference proceedings and readings.

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AINA-2022 Keynote Talks

Data Intensive Scalable Computing in Edge/Fog/Cloud Environments

Mario A. R. Dantas

University of Juiz de Fora, Minas Gerais, Brazil

Abstract. In this talk are presented and discussed some aspects related to the adoption of data intensive scalable computing (DISC) paradigm considering the new adoption trend of edge/fog/cloud environments. These contemporaneous scenarios are very relevant for all organizations in a world where billion of IoT and IIoT devices are being connected, and an unprecedent amount of digital data is generated. Therefore, they require special processing and storage.

Resource Management in 5G Cloudified Infrastructure: Design Issues and Challenges

Isaac Woungang

Ryerson University, Toronto, Canada

Abstract. 5G and Beyond (B5G) networks will be featured by a closer collaboration between mobile network operators (MNOs) and cloud service providers (CSPs) to meet the communication and computational requirements of modern mobile applications and services in a mobile cloud computing (MCC) environment. In this talk, we enlighten the marriage between the heterogeneous wireless networks (HetNets) and the multiple clouds (termed as InterCloud) for a better resource management in B5G networks. First, we start with an overview of the building blocks of HetNet and InterCloud, and then we describe the resource managers in both domains. Second, the key design criteria and challenges related to interoperation between the InterCloud and HetNet are described. Third, the state-of the-art security-aware resource allocation mechanisms for a multi-cloud orchestration over a B5G networks are enlighten.

Contents

An Approach for Mitigating Disruptions on Resources' Consumption Cycles

Zakaria Maamar[1(✉)], Fatma Masmoudi[2], and Ejub Kajan[3]

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Abstract. This paper examines the impact of disruptions on consumption cycles of resources. Such a cycle consists of states and transitions that depict how a resource is prepared, consumed, locked, unlocked, and withdrawn. It happens that events like last-minute upgrades and urgent fixes arise disrupting the resource's ongoing consumption. Disruption leads to suspending an ongoing consumption to accommodate these events according to 3 scenarios referred to, in this paper, as co-existence, taking turns, and co-existence/taking turns. To verify the correctness of the resources' consumption cycles with respect to each scenario, Petri Nets (PN) are developed linking this verification to properties like liveness and deadlock freeness.

1 Introduction

The democratization of the Internet, through an explosive penetration rate, compounded with an increasing number of on-the-move users are putting a lot of pressure on available computation, storage, and communication *resources* despite multiple technical advances like virtualization and load balancing. This pressure becomes severe when events like urgent upgrades to counter attacks and unexpected demands to execute last-minute requests *disrupt* the ongoing consumption plans of resources.

Simply put, disruption means suspending ongoing operations, initiating operations linked to the disruption, and, finally, resuming the suspended operations with the "hope" of not being subject to penalties by regulatory authorities nor raising concerns among users, for example. How to handle sudden changes with minimal impact on committed resources, and, how to make resources ready for such changes are 2 questions that we addressed in the past from a *consumption* and *transactional* perspectives [8]. On the one hand, the *consumption* perspective uses 3 properties (*limited*, *limited-but-renewable*, and *non-shareable*, [7]) to capture resources' characteristics. For instance, some resources are limited like storage while others are (temporarily) *non-shareable* like bandwidth. On the other hand, the *transactional* perspective uses 3 properties (*pivot*, *retriable*, and *compensatable*, [6]) to ensure that consumption demands of resources would remain compliant with these resources' consumption properties, should disruptions arise.

Although disruptions are sometimes beyond the control of organizations even when they are beneficial like upgrading security measures [11], suspending and resuming

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