

Editorial to Special Issue

Advanced Services in Heterogeneous Distributed Systems

Nowadays, when we face increasing demand for various services across heterogeneous networks, when data cannot be easily classified into regular relational databases and new solutions are constantly required, when data are generated and processed rapidly, we need powerful advanced services and suitable infrastructure as support for Heterogeneous Distributed Systems. Moreover, all data sources are heterogeneous (various sensors, users with different profiles, etc.) and we have different situations and contexts. Cloud-Edge Computing, which concerns large-scale interconnected systems with the main purpose of aggregating and capitalizing on the power of widely distributed resources, represents one viable solution. Smart and powerful resource management plays an essential role in heterogeneous distributed systems, mainly concerned with optimizing the use of resources. Therefore, more often than not Cloud-Edge Computing infrastructures run reliably and permanently to provide the context as a “public utility” to different services.

The goal of this special issue is to explore new directions and approaches for reasoning about advanced services in heterogeneous distributed systems, platforms and applications. The collection of papers assembled in this issue sets forth important theoretical and practical results, as well as position papers and case studies of existing verification projects with a view to highlighting the state of the art in this domain.

The special issue hosts a total of 12 papers, covering various aspects related to the central theme. The first paper addresses a solution behind the efficient Service Level Agreement (SLA) design and implementation related to a Monitoring Wireless Sensor Networks (MSN) and applies the SLA in the context of water resources management.

The next two papers deal with network services. One of the papers explores the possibility of implementing reliable security measures using machine learning algorithms to perform traffic classification and sets out to present the detection of anomalous behaviour in network traffic through k-means clustering and shallow packet inspection, while the other one proposes a ranking method for network nodes which involves the application of the theoretical framework of the Estrada communicability index to real complex networks.

The 4th paper continues the presentation of advanced services and focuses on comparing different application-layer protocols – which play an important role in orchestrating an IoT network – by carrying out experiments and prototyping a real-world interaction among IoT network actors.

The next two approaches are focused on datacenters performance. In this sense, the 5th paper details a procedure for optimizing resource allocation in mobile cloud computing (MCC) in an energy-efficient manner and sets forth an advanced load balancing of distributing tasks across numerous computing resources and an energy/cost aware technique for a demand-based network resource allocation. The proposed load balancing of tasks utilizes a Krill load balancer (Krill LB) which is expected to achieve a well-balanced load over virtual machines. The 6th paper sets forth an optimized energy-efficient resource management technique for (mobile) cloud computing which reduces the knapsack issue, energy and cost and implies two stages: the enthalpy calculation and the enthalpy-related Cuckoo Search Optimization (CSO). Both approaches present mathematical models and experimental evaluation methodologies.

The following four papers focus on solutions for collaborative platforms, high performance and real applications. Thus, the 7th paper brings forth a comparative analysis of collaborative platforms for social media use cases and presents an innovative platform that integrates Digital Interaction Intelligence (DII) for data processing based on intelligent techniques and Digital Interaction Data (DID) for data aggregation, persistence and user interaction. Further on, the 8th paper presents a benchmarking solution for routing protocols (AODV, DSDV, OLSR and GPSR) with network function virtualization (NFV) in the context of MANETs (Mobile Ad Hoc Networks), considering the performance evaluation criteria to be minimum communication time and minimum resources usage. The next paper proposes a new

zero-forcing beam-forming algorithm based on joint user grouping and antenna selection for M-MIMO (Massive Multiple-Input Multiple-Output) systems, which may greatly reduce the hardware complexity by lowering the cost and power consumption of radio-frequency chains with only a small performance loss. The 10th paper presents a novel integrated wireless sensor network architecture for elephant tracking by making use of the unmanned boundary sensing technique based on the most advanced sensors including vibration, acoustic and camera sensors.

The 11th paper focuses on map annotation methodologies whose objectives are to produce a low-cost platform for regional railway operators, to visualize the track's geometry and to generate a track representation, which can be then recalled across multiple journeys. Therefore, this paper aims to develop a flexible solution for signal alignment based on Genetic Algorithms, which makes localization algorithms possible by using the nonlinear state estimation.

This special issue ends with several Cloud Computing insights from a major successfully implemented project, reckoned to be the first initiative on Cloud Computing for Romanian public administration and whose main aim was to ensure the right Cloud Computing solutions and services for Romanian public sector entities.

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SPECIAL ISSUE GUEST EDITORS,

Florin Pop, Professor

University Politehnica of Bucharest, Romania

Gabriel Neagu, PhD, Senior Researcher, 1st degree

National Institute for R&D in Informatics (ICI), Bucharest, Romania

SPECIAL ISSUE CO-EDITOR,

Andrei Niculescu, PhD