Special issue on fog and cloud computing for cooperative information system management

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Special Issue on Fog and Cloud Computing for Cooperative Information System Management: Challenges and Opportunities

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1. Introduction

The adoption of Cloud Computing in Cooperative Information Systems (CIS) is on a rise. Cloud Computing provides a uniform and scalable solution, and offers a novel paradigm that allows computational resources from multiple organisations and providers to cooperate as component services. In domains like smart city and smart transportation, CIS benefit nowadays from smart things, which generate lots of heterogeneous data in a real-time fashion. To do so, CIS require the interconnection and interoperation of various neighboring smart things in a collective fashion. With the increasing hardware capabilities, smart things can collect and process data, and execute services on the edge of the network in a timely manner. Therefore, CIS need to be implemented at the network edge to facilitate an increasing demand for effective collaborating neighboring smart things. Fog computing is emerging as a complement to cloud computing, which attempts to deploy CIS closer to users with low-latency and high-rate services at the network edge. There is a critical need of investigating Cloud and Fog computing from different aspects for addressing CIS to meet the requirement like interconnection, interoperability, optimisation, and deployment

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of computational resources and smart things.

This special issue dedicates to the research challenges and opportunities in terms of concepts, states of the art, standards, designs, implementations, and running experiments or applications relevant to the convergence of fog computing/edge computing/cloud computing in CIS. We invited research works that provide new solutions, novel methods, or newfound knowledge and results for addressing the above challenges. After a rigorous review process, we accepted 10 submissions, distributed mainly in following groups: i) cloud resource management [1, 2, 3], ii) heterogeneous data management [4, 5], iii) container framework and system [6, 7], iv) service and business process techniques [8, 9], and v) cloud solution [10].

2. A brief of accepted articles in this special issue

The article (J. Simão et al.), entitled "GC-Wise: A Self-Adaptive Approach for Memory-Performance Efficiency in Java VMs" [1], presents a self-adaptive approach to determine the best values for critical heap management parameters of the Java VMs at run-time to maximize memory-performance efficiency, and thus to support and facilitate efficient cloud resource management. Experimental results demonstrate significant memory savings with low-impact on the throughput of applications.

The article (Faiez Zalila et al.), entitled "Model-Driven Cloud Resource Management with OCCIware" [2], proposes an OCCIware approach to design, validate, generate, implement, deploy, execute, and supervise everything as a service with Open Cloud Computing Interface (OCCI), where the static semantics for the OCCI standard are defined and different cloud service models are verified. To evaluate the performance of the OCCIware, the authors have applied it in various cloud domains and use-cases which proved to be applicable in practice.

The article (Mohammed AlShaer et al.), entitled "IBRIDIA: A Hybrid Solution for Processing Big Logistics Data" [4], proposes a hybrid framework for collecting and processing massive volume of data from heterogeneous sources

in batch style and performing analysis in real-time, to provide opportunities to predict next possible events and prevent unexpected delivery delay at run-time. IBRIDIA is implemented by adopting both real-time and batch style computational models, and evaluation results show that IBRIDIA produces better representative results.

The article (Mohamed Mohamed et al.), entitled "Extensible Persistence as a Service for Containers" [6], introduces an Ubiquity framework to provide seamless access to different types of persistent storage across heterogeneous container orchestrators. Ubiquity is designed to be extensible to other container frameworks and different types of file and block storage systems. Evaluations show that Ubiquity achieves a good performance in supporting stateful services in various container environments efficiently.

The article (Khouloud Boukadi et al.), entitled "Business process outsourcing to cloud containers: How to find the optimal deployment" [7], proposes a system architecture for optimal containers-based deployment of business processes based on the extension of Container-CloudSim simulator. A business process deployment optimizer is designed to identify the optimal resource allocation. Simulation results show the advantage of this technique in finding out the optimal deployment of a business process on cloud containers.

The article (A.S.M. Kayes et al.), entitled "Context-Aware Access Control with Imprecise Context Characterization for Cloud-Based Data Resources" [5], proposes a novel approach to Context-Aware Access Control using Fuzzy logic (FCAAC) for cloud-based data resources, where a formal context model is devised to represent the fuzzy and contextual conditions. A unified data ontology and the corresponding mapping ontology in terms of facilitating access control to cloud-based data resources is implemented. Prototype implementation, different healthcare case studies as well as experimental evaluation demonstrate that FCAAC is feasible in various environments and can provide a satisfactory option for context-sensitive access control.

The article (Aicha Ben Jrad et al.), entitled "STRATFram: A framework for describing and evaluating Elasticity Strategies for Service-based business

processes in the Cloud" [8], presents a framework (called STRATFram) for describing and evaluating elasticity strategies for Service-based Business Processes (SBP). SBP holders are allowed to define the elasticity capabilities and the corresponding strategies. Evaluations in terms of the analysis and the comparison of strategies are implemented, the results demonstrate that STRATFram can meet the requirements of cloud tenants and provide them with facilities to choose elasticity strategies that fit to their business processes and usage behaviors.

The article (Xiao Xue et al.), entitled "Evaluating of Dynamic Service Matching Strategy for Social Manufacturing in Cloud Environment" [9], proposes a computational experiment-based evaluation framework of service matching strategy in social manufacturing, where i) design of supply and demand matching strategy, ii) construction of computational experiment system, and iii) performance evaluation of different service strategies are implemented. The comparison of different adaptive service matching strategies in different experiment environments are simulated and evaluated as case studies to demonstrate the application of the proposed method.

The article (Sindyana Jlassi et al.), entitled "Towards Correct Cloud Resource Allocation in FOSS Applications" [3], proposes a Cloud Resources Allocation Model for FOSS applications (CRAM4FOSS) to formally validate the consistency and correctness of cloud resource allocation at design time according to the user's requirements and the resource's capabilities. Experiments are conducted by discharging proof obligations and animating the specification using the ProB model-checker, and the results show that CRAM4FOSS achieves promising results towards ensuring correct and consistent cloud resource allocations for FOSS applications in different environments.

The article (Aly Megahed et al.), entitled "Optimizing Cloud Solutioning Design" [10], proposes a novel optimization model from the cloud provider's prospective for offering customized cloud solutions to satisfy different user requirements at low costs in short times. Experimental performance is evaluated based on realistic data against two baseline approaches, and the numerical results show that this approach is much more efficient and effective in producing

a cloud solution which meets client requirements as well as cloud offering constraints.

3. Acknowledgement

Finally, we would like to thank all the authors who have submitted their high quality manuscripts to this special issue. We greatly appreciate the contribution of the reviewers who have participated in the review process, and provided helpful comments and suggestions to the authors on improving their manuscripts. We specially thank Professor Peter Sloot, the Editor-in-Chief of the Journal of Future Generation Computer Systems (FGCS), for giving us the opportunity to run this special issue, and the whole FGCS editorial board for their useful advice and strong support during the process of putting together this special issue. We also hope that the readers will enjoy reading the articles included in this special issue.

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