Guest Editorial: Special Section on Advances of Utility and Cloud Computing Technologies and Services

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COMPUTING is rapidly moving towards a model where it is provided as services that are delivered in a manner similar to traditional utilities such as water, electricity, gas, and telephony. In such a model, users access services according to their requirements, without regard to where the services are hosted or how they are delivered. Several computing architectures have evolved to realize this utility computing vision, including Grid computing, Service-Oriented Architecture (SOA) and Cloud computing, which has recently shifted into the center of attention in the ICT industry. Increasing numbers of IT vendors are promising to offer applications, storage and computation hosting services with conforming Service-Level Agreements (SLA) to ensure Quality of Services (QoS) and performance. Considering many of these services are hosted in traditional data centers, there is significant complexity involved in ensuring the scalability, availability, manageability and accessibility of applications, services and data, as the scale of the systems as well as the users grows. As a result, it is becoming important to investigate the use of cloud computing techniques and its interoperability with utility computing. This special section focuses on principles, paradigms and applications of "Utility computing" and its practical realization especially in the context of Cloud Computing.

This Special Section aims at presenting the current state-ofthe-art research and future trends on various aspects of Advances of Utility and Cloud Computing Technologies and Services. The major subjects of this Special Section cover methodologies, modeling, analysis, and newly introduced cloud computing technologies and applications. More specifically, main topics are multi-cloud storage services, elasticity in cloud computing, Service-Oriented Architecture, cloud data access control system, cloud pricing model, resource scheduling, service migration and composition, federated clouds, and trustworthy issues.

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The paper by Zhuang, Hao; Rahman, Rameez; Hui, Pan; and Aberer, Karl, entitled "Optimizing Information Leakage in Multicloud Storage Services" introduced StoreSim, an information leakage aware storage system in multicloud, aims to store syntactically similar data on the same cloud, thus minimizing the user's information leakage across multiple clouds. Performance results show that the proposed techniques can reduce the information leakage by up to 60 percent compared to unplanned placement.

The paper by Tseng, Fan-Hsun; Jheng, Yong-Ming; Chou, Li-Der; Chao, Han-Chieh; and Leung, Victor C.M., entitled "Link-Aware Virtual Machine Placement for Cloud Services Based on Service-Oriented Architecture" introduced network-aware virtual machine placement based on integer linear programming, aiming to provide high scalability and ensure service availability, and also to improve average utility rate of physical machines with lower power consumption.

The paper by Gao, Lijun; Yan, Zheng; and Yang, Laurence T., entitled "Game Theoretical Analysis on Acceptance of a Cloud Data Access Control System Based on Reputation" investigates the acceptance of a cloud data access control system based on reputation using Game Theory. Theoretical analysis and simulation results show the effectiveness of the compensation and punishment mechanisms to increase cloud storage rate and restrain dishonest system entities.

The paper by Zhu, Chunsheng; Li, Xiuhua; Leung, Victor C.M. Yang, Laurence T.; Ngai, Edith C.-H.; and Shu, Lei, entitled "Towards Pricing for Sensor-Cloud" introduces Pricing Models for Sensor-Cloud. This paper also conducts a review on user behavior and presents a number of case studies on sensor-cloud applications. This research could serve as a very favorable guidance for future research about pricing in Sensor-Cloud.

The paper by Cui, Delong; Peng, Zhiping; Jianbin, Xiong; Xu, Bo; and Lin, Weiwei, entitled "A Reinforcement Learning-Based Mixed Job Scheduler Scheme for Grid or IaaS Cloud" introduced a novel job scheduling scheme based on reinforcement learning to minimize the makespan and Average Waiting Time under resource and deadline constraints, and employ parallel multi-age technologies to balance the exploration and exploitation in learning process to accelerate the convergence of the Q-learning algorithm.

The paper by Sukhpal, Singh; Chana, Inderveer; and Buyya, Rajkumar, entitled "STAR: SLA-Aware Autonomic Management of Cloud Resources" presented SLA-aware autonomic resource management technique called STAR which mainly focuses on reducing SLA violation rate for the efficient delivery of cloud services. The experimental results demonstrate that STAR is efficient in reducing SLA violation rate and in optimizing other QoS parameters which effect efficient cloud service delivery.

The paper by Tziritas, Nikos; Khan, Samee U.; Loukopoulos, Thanasis; Lalis, Spyros; Xu, Cheng-Zhong; Li, Keqin; and Zomaya, Albert Y., entitled "Online Inter-Datacenter Service Migrations" propose an online algorithm that minimizes the inter-datacenter network, taking into account the network load of migrating a service between two datacenters. The authors present a rigorous mathematical proof showing that the algorithm is competitive for a cloud network structured as a tree of multiple datacenters.

The paper by Tao, Ming; Ota, Kaoru; and Dong, Mianxiong, entitled "DSARP: Dependable Scheduling with Active Replica Placement for Workflow Applications in Cloud Computing" proposed a dependable scheduling strategy with active replica placement for managing workflows in decentralized architecture. Five well-known workflow applications were simulated with CloudSim. The analytical results are shown to demonstrate the performance of the proposed architecture.

The paper by Lučanin, Dražen; Pietri, Ilia; Holmbacka, Simon; Brandic, Ivona; Lilius, Johan; and Sakellariou, Rizos, entitled "Performance-Based Pricing in Multi-Core Geo-Distributed Cloud Computing" proposed a non-linear power model that estimates power dissipation of a multi-core physical machine and a pricing model that adjusts the pricing based on the virtual machine's CPU-boundedness characteristics. A cloud controller that uses these models to allocate virtual resources to achieve energy cost savings is also presented.

The paper by Wen, Zhenyu; Qasha, Rawaa; Li, Zequn; Ranjan, Rajiv; Watson, Paul; and Romanovsky, Alexander, entitled "Dynamically Partitioning Workflow over Federated Clouds for Optimising the Monetary Cost and Handling Run-Time Failures" proposes a novel workflow management framework call DoFCF (Deploy on Federated Cloud Framework) that can dynamically partition scientific workflows across federated cloud (public/private) data-centres for minimising the financial cost, adhering to security requirements, while gracefully handling run-time failures.

The paper by He, Hui; Zhang, Weizhe; Liu, Chuanyi; and Sun, Honglei, entitled "Trustworthy Enhancement for Cloud Proxy based on Autonomic Computing" proposed a trustworthy autonomous enhancement framework for virtual machines, and a method to extract linear relationship of monitoring items. According to the mapping relation between monitoring items and system modules, an abnormal module positioning technology based on Naive Bayes classifier was developed to realize self-sensing of abnormal system conditions.

The paper by Wang, Shangguang; Zhou, Ao; Yang, Fangchun; and Chang, Rong N., entitled "Towards Network-Aware Service Composition in the Cloud" proposes a network-aware cloud service composition approach. By formalizing the service composition goal as a multi-objective constraint optimization problem, the authors have validated the proposed approach can be used to effectively reduce network resource consumption and deliver QoS optimality while satisfying the end-to-end QoS constraints for the candidate composite services in the cloud.

All of the papers not only provide novel ideas and state-of-the-art techniques in the field, but also stimulate future research in the cloud computing environments. Honorably, this Special Section serves as a landmark source for education, information, and reference to professors, researchers, and graduate students interested in updating their knowledge about or active in cloud computing technologies, services and novel application models. This Special Section covers different aspects of the problem, both from the theoretical to practical side. After a large open call for papers, an international editorial committee selected 12 top ranked research papers out of 68 submissions. Each paper was reviewed by at least three reviewers.

The guest editors would like to express sincere gratitude to the EiC of *IEEE Transactions on Cloud Computing (TCC)* for giving the opportunity to prepare this Special Section. In addition, we are deeply indebted to numerous reviewers for their professional effort, insight, and hard-work put into commenting on the selected papers that reflect the essence of this Special Section. Last, but not least, we are grateful to all the authors for their contributions and for undertaking two-cycle revisions of their manuscripts, without which this Special Section could not have been produced.

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Manish Parashar (Fellow, IEEE) is Distinguished Professor of Computer Science at Rutgers University. He is also the founding Director of the Rutgers Discovery Informatics Institute (RDI2). His research interests are in the broad areas of Parallel and Distributed Computing and Computational and Data-Enabled Science and Engineering. Manish is the founding chair of the IEEE Technical Consortium on High Performance Computing (TCHPC), Editor-in-Chief of the IEEE Transactions on Parallel and Distributed Systems. He is Fellow of AAAS, Fellow of IEEE/IEEE Computer Society and ACM Distinguished Scientist. For more information please visit http://parashar.rutgers.edu/.

Omer Rana is professor of Performance Engineering and previously led the Complex Systems research group. His research interests lie in the overlap between intelligent systems and high performance distributed computing. He is particularly interested in understanding how intelligent techniques could be used to support resource management in distributed systems, and the use of these techniques in various application areas.