Guest Editorial: Services Composition and Virtualization Technologies

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SERVICES and Cloud Computing (SCC) is emerging rapidly as an exciting new paradigm that includes grid computing, utility computing, web computing, service-centric computing, ubiquitous computing, and ambient intelligence to provide computing and communication services any time and anywhere. Among which, services composition and virtualization are two of the most important technologies. The goal of services computing is to enable IT services and computing technology to perform business services more efficiently and effectively, while virtualization technology is a decoupling technique that separates system software from hardware platforms, making applications run pervasively.

SCC usually refers to the creation and deployment of computing technology in such a way that it becomes an invisible part of the fabric of everyday life and commerce. As pervasive computing presents a new trend of information and communication technologies for connecting cyber and physical domains, computers in the traditional sense gradually fade from view. Namely, information and communication mediated by computers is available anywhere and any time through devices that are embedded in our environment, completely interconnected, intuitive, effortlessly portable, and constantly available.

This special issue includes four extended versions of selected papers originally presented at the IEEE Asia Pacific Services Computing Conference held in Yilan, Taiwan. The papers selected for this issue not only contribute valuable insights and results, but also have particular relevance to services composition, services management, services query, and scheduling for cloud, grid, and pervasive systems. They all present high quality results for tackling problems arising from the ever-growing fields of services and cloud computing.

The paper by Chun-Feng Liao, Ya-Wen Jong, and Li-Chen Fu, entitled "Toward Reliable Service Management in Message-Oriented Pervasive Systems," proposes a reliable service management framework by formally defining a message-oriented service application model and protocols that facilitate autonomous composition, failure detection, and recovery of services. The proposed approaches are realized by constructing a developer's toolkit that enables rapid-prototyping of services. The proposed approach was evaluated by proving the reliability property as well as conducting experiments on recovery rate and performance. In addition, services developed by the proposed approach are capable of integrating heterogeneous software/hardware and can be deployed in dissimilar sites with little effort.

Dang Minh Quan and Laurence T. Yang, in the paper entitled "Parallel Mapping with Time Optimization for SLA-Aware Compositional Services in the Business Grid," present a parallel mapping algorithm to optimize the execution time of the workflow, which can reduce the runtime of the mapping algorithm without reducing the quality of the mapping solutions. As Service Level Agreements (SLAs) are currently one of the major research topics in Grid computing. The SLA mapping module holds an important position and the capability of the mapping module depends on the runtime performance of the mapping algorithm. The performance measurements show the quality of the method. The speedup of the algorithms and the quality of the solutions are significantly improved.

The paper by Blaise Omer Yenke, Jean-François Mehaut, and Maurice Tchuente, entitled "Scheduling of Computing Services on Intranet Networks" treats the scheduling problem of computing services as a sequence of knapsack problems with nonlinear constraints. Based on such an approach, enterprises can provide computing services through their intranet networks by letting their available resources be used as virtual clusters for scientific computation during idle periods such as nights, weekends, and holidays. Generally, idle periods do not permit carrying out the computations completely. It is therefore necessary to save the context of uncompleted applications for possible restart. Such a check-pointing mechanism is subject to resource constraints: the network bandwidth, the disk bandwidth, and the delay T imposed for releasing the workstations.

The paper by Kaijun Ren, Nong Xiao, and Jinjun Chen, entitled "Building Quick Service Query List Using WordNet and Multiple Heterogeneous Ontologies toward More Realistic Service Composition," presents an innovative composition technique by building an Extended Quick Service Query List (EQSQL) for supporting more efficient and more realistic service composition. In EQSQL, data structures are specially designed to record service information and their associated semantic concepts by processing semantic-related computing during the service publication period in advance. WordNet and semantic similarities among multiple heterogeneous ontologies can be exploited in the developed algorithms for forming EQSQL. Such

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approaches can be scalable to the large service repositories and can also significantly alleviate users or developers from the burden of using complicated semantic service composition; thus, service composition can be easier and more realistic.

All of the above papers address either services composition issues in pervasive or Grid computing systems or propose novel application models in the various SCC fields. They also trigger further related research and technology improvements in the application of SCC. Honorably, this special section serves as a landmark source for education, information, and references for professors, researchers, and graduate students interested in updating their knowledge about or activity in services composition, management, scheduling, and novel application models for services and cloud computing systems.

As the guest editor of this special section, I would like to express sincere gratitude to Dr. Liang-Jie Zhang (the Editor-in-Chief of the *IEEE Transactions on Services Computing*) for giving me the opportunity to prepare this special section. In addition, I am deeply indebted to the numerous reviewers for the professional effort, insight, and hard work they put into commenting on the selected articles which reflect the essence of this special section. Last but not least, I am grateful to all the authors for their contributions and for undertaking the two-cycle revision of their manuscripts, without which this special section could not have been produced.

Ching-Hsien Hsu is currently a professor in the Department of Computer Science and Information Engineering at Chung Hua University, Taiwan. His research interests are primarily in parallel and distributed computing, cloud and Grid computing, P2P computing, RFID, services computing, and smart homes. He has published more than 150 academic papers in journals, books, and conference proceedings. He was awarded the annual outstanding research award in 2005, 2006, 2007, and 2010, and a distinguished award in 2008 for excellence in research from Chung Hua University. Dr. Hsu serves on a number of journal editorial boards. He has edited more than 20 international journal special issues as a guest editor and has served many international conferences as a chair or committee member. He serves on the executive committee of the IEEE Technical Committee on Scalable Computing (TCSC) and is a senior member of the IEEE.

Hai Jin received the PhD degree in computer engineering from the Huazhong University of Science and Technology (HUST) in 1994. He is now a Cheung Kung Scholars Chair Professor of computer science and engineering and the dean of the School of Computer Science and Technology at HUST. In 1996, he was awarded a German Academic Exchange Service fellowship to visit the Technical University of Chemnitz in Germany. Dr. Jin worked at The University of Hong Kong between 1998 and 2000, and as a visiting scholar at the University of Southern California between 1999 and 2000. He was awarded the Excellent Youth Award from the National Science Foundation of China in 2001. He is the chief scientist of ChinaGrid, the largest grid computing project in China, and the chief scientist of the National 973 Basic Research Program Project of Virtualization Technology of Computing Systems. Dr. Jin is a member of the Grid Forum Steering Group (GFSG). He has coauthored 15 books and published over 400 research papers. His research interests include computer architecture, virtualization technology, cluster computing and grid computing, peer-to-peer computing, network storage, and network security. He is the steering committee chair of the International Conference on Grid and Pervasive Computing (GPC), the Asia-Pacific Services Computing Conference (APSCC), the International Conference on Frontier of Computer Science and Technology (FCST), and the Annual ChinaGrid Conference. Dr. Jin is a member of the steering committees of the IEEE/ACM International Symposium on Cluster Computing and the Grid (CCGrid), the IFIP International Conference on Network and Parallel Computing (NPC), the International Conference on Grid and Cooperative Computing (GCC), the International Conference on Autonomic and Trusted Computing (ATC), and the International Conference on Ubiquitous Intelligence and Computing (UIC). He is a senior member of the IEEE and a member of the ACM.