Editorial Preface

Special Issue on Advances in Distributed and Cloud Applications

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As the society advances, the computing world is continually challenged to provide solutions to the modern problems that were hitherto complex and unsolvable. For instance, scientific computations to unravel the mysteries of weather patterns, astronomy, genomics and so forth, are being tackled despite the computational complexities. The computational environment itself has increasingly grown complex with a mixture of competing services and platforms that create other problems for heterogeneous and distributed computing. Although the nature of these problems tend to be amenable to heterogeneous and distributed computing, there is the demand to satisfy computational efficiency and resilience. These prevailing conditions still challenge researchers to think outside the box and proffer solutions to the meet the burgeoning needs for distributed computing. This Special Issue (SI) features eight papers that discuss research findings, gaps, and challenges that exist in distributed and cloud computing. The papers cover works in meta-computing infrastructure, network coding, scientific simulations, performance analysis, cloud migration, green computing and security as a service.

In the paper Architectural Pattern by Ezugwu, Frincu and Junaidu, the authors described the challenges of scheduling design pattern for several classes of multi-component applications in a heterogeneous computing environment. To help resolve the problems of such heterogeneity, the authors proposed a component-based reference architectural model, which describes the design of a general purpose scheduling system targeted at the scheduling of multi-component applications. The objective is to identify and map out the necessary parts required to effectively perform the scheduling of multi-component applications. In another study that deals with the heterogeneity of the packet transmission within a network, Tran, Udoh and Nguyen investigated the problem of reliable unicast transmissions in wireless ad hoc and WLAN/WiMAX networks. According to the authors, currently, approaches using network coding show several-fold gain in terms of bandwidth efficiency over the traditional technique, but these new approaches assume that all the information flows have the same packet size, while the others consider transmission flows with different size packets. To improve network bandwidth efficiency, the authors exploited the size differences of packets on different flows, to introduce a new technique at the relay node/access point/base station.

In a subsequent paper, Gentzsch and Yenier described the importance of Linux Containers in the cloud environment, as this technique simplifies the adoption of cloud computing for engineering and scientific applications. This paper takes cognizance of the fact that scientists and engineers have been slow to adopt cloud computing despite its obvious advantages due to the problems of complex access to clouds, inflexible software licensing, time-consuming big data transfer, loss of control over their assets, service provider lock-in, and so forth. To ease the adoption process, the researchers introduced the UberCloud's high-performance container technology that removed many of the adoption roadblocks. The UberCloud provides an online solution platform and container technology which offer every engineer and scientist additional compute power on demand, in an easily accessible way. In another complementary cloud paper that helps managers to monitor the performance of an adopted cloud infrastructure, Udoh, Patterson and Cordle introduced a more holistic approach using

the technique of balanced scorecard that analyses cloud computing with respect to finance, customer, internal processes, and learning and growth perspectives. In the literature, most of the evaluations and simulations tend to be one-dimensional that focus on easily measurable criteria such as load balancing and response time. The new holistic approach introduced by the researchers shows that cost reduction is not enough to cause a customer to embrace cloud computing. Other factors such as value proposition, internal and growth perspectives also play a role.

Rodriguez-Pascual and others, in a paper Adapting Reproducible Research Capabilities to Resilient Distributed Calculations, present a set of tools to overcome the problem of creating and executing fault tolerant distributed applications on dynamic environments. The researchers were out to tackle computing calculations in a huge pool of available resources that may compromise heterogeneous and distributed platforms. The authors worked on the problem of researchers reusing or recalculating the data generated by other researchers, especially in experimentation works. To ensure the reproducibility of the performed experiments, the researchers provided a portable and resilient framework that can be used in Open Access Data repositories. As such, users can seamlessly search and access datasets that can be automatically retrieved as input data into a code already integrated in the proposed workflow.

In another paper - Migrating to the Cloud, the researchers Udoh, Khan, Grosse and Arnette, described the Sullivan University experience in migrating their legacy platforms to the cloud-based one. This paper describes a current and topical issue that may interest many organizations as they ponder to relocate their computing resources to the cloud environment. The cloud platforms have helped to lower the initial and operating IT costs for both small and large organizations, however the success of the migration process requires the support of the executive management and a tight alignment between IT and business goals. Scope needs to be vigorously managed, conversion pathways well defined, users engaged, and training and best practices adopted. The cloud based solution offers a compelling value proposition, but the return on investment is tightly coupled with the implementation approach and business goals. In another paper by Ofoegbu and Udoh which deals with energy conservation that may be applicable to the management of cloud data center, the researchers present an energy meter reader implemented with a microcontroller based logic methodology fused with a building automation system to implement remote load control by owners using SMS from a GSM phone. The system when deployed can enable users query and set energy consumption rates remotely so as to reduce the cost on final consumers as well as conserve energy. This is could be a useful system in the green-based design of cloud data centers.

In the final paper in this SI, that deals with the security challenges in the cloud through the web services gateway, Aniyikaiye and Udoh proposed Security as a Service (SECaaS) solutions as a new approach to security management in the cloud. Cloud security is a topical issue that affects the current adoption of cloud technology by organizations. Resolving the security concerns is major preoccupation of cloud service providers. Furthermore, software applications are being developed in the cloud and there are demands for the interoperability of these applications. A common way to meet this demand is the development of Web services (applications), which take advantage of Service-oriented architecture principles. These loosely coupled Web base components pose some security challenges. The proposed solution – SECaaS, is a work in progress that may eventually provide the solutions to cloud security concerns.

In conclusion, this SI presents some current developments in computing especially in distributed systems. It presents advances that educators, students, professionals and researchers could use as a bedrock for further investigations. There are also practical uses for government, industry, institutions, and individuals in furthering the global economy.

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