Special Issue: Grid and Pervasive Computing 2009

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Abstract

This special issue of Future Generation Computer Systems contains selected high–quality papers from the 4th International Conference on Grid and Pervasive Computing (GPC 2009), which was held in May 2009 in Geneva, Switzerland, and its related workshops. Research problems in these papers have been analyzed systematically, and for specific approaches or models a detailed evaluation was performed to demonstrate their feasibility and advantages. The papers were selected on this basis and also peer reviewed thoroughly.

Key words:

1. Introduction

This special issue of *Future Generation Computer Systems* contains selected high–quality papers from the 4th International Conference on Grid and Pervasive Computing (GPC 2009), which was held in May 2009 in Geneva, Switzerland. In the past years the conference has established itself as an international forum for providers, practitioners and researchers in the field of grid and pervasive computing. The conference's main topics illustrate current work in the theory and practice of the design, development and maintenance of grid and pervasive systems for a variety of application domains.

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The Program Committees selected 42 papers among 112 for the main conference and 21 among 48 received submissions for the three associated workshops: the International Workshop on Workflow management (IWWM 2009), the International Workshop on Grids, Clouds and Virtualization (IWGCV 2009) and the Symposium on Services, Security and Data Management Technologies (SSDU 2009).

This special issue contains extended versions of seven of the best papers presented at GPC 2009 [1] and its related workshops [2]. Research problems in these papers have been analyzed systematically, and for specific approaches or models a detailed evaluation was performed to demonstrate their feasibility and advantages. The papers were selected on this basis and also peer reviewed thoroughly. All papers are summarized in Section 2.

2. This Special Issue

Jha et al [3] deal with Application-Level Interoperability (ALI), i.e., the ability of an application to utilize multiple distributed heterogeneous resources. The main reasons motivating ALI are the increasing volumes of data, multiple sources of data as well as resource types that current and future applications are expected to handle. The paper presents a thorough analysis of how ALI can be provided across distributed infrastructures, using an example application based on the Map-Reduce paradigm. The application chosen is the canonical Word-Count, implemented using the SAGA APIs; the authors investigate its scale–out across clusters, clouds and HPC resources, and establish the execution using MR and other programming models such as Sphere concurrently.

Vazquez et al. [4] discuss the use of clouds for grid resource provisioning, presenting an architecture for building arbitrarily complex grid infrastructures able to sustain the demand required by any given service, taking advantage of the pay-per-use model and the seemingly unlimited capacity of the cloud computing paradigm. Therefore, a key feature of the architecture is the ability to satisfy peak demands a service may have and to provide support for dynamic changes in quality of service constraints. The authors also analyze the overheads associated to dynamic provisioning mechanisms in an experiment showing the elastic growth of a grid infrastructure making use of cloud providers.

Song et al. [5] explore service composition through a workflow framework. They note that service composition and its evaluation are based on

participant web services functional and non–functional attributes, and that this process often includes the following steps: functional property–based service location, non–functional property–based quality evaluation, and a final executive plan. Usually, this scheduling process is unfolded in a workflow framework. However, manual selection and composition of qualified services are time–consuming and error–prone activities. To overcome this challenge, a workflow framework is presented in their paper for intelligently navigating service composition.

The workflow framework is based on two primary processing modules, a planning module and a CSP (constraint satisfaction problems) solving module. The former, taking into account the services functional attributes, aims at producing referred composite plans that play as general patterns. The latter selects qualified services in order to implement composite plans, based on the evaluation of non–functional attributes. The authors also present a case study demonstrating the validity of the framework.

Charr et al. [6] present a distributed, fault tolerant environment suitable for execution of parallel iterative asynchronous applications on volatile distributed architectures. JACEP2P–V2 is a Java environment allowing the design of parallel iterative asynchronous algorithms (with direct communications between nodes) and execution on global computing architectures or distributed clusters composed of a large number of volatile heterogeneous computing nodes that can be geographically spread. The platform can benefit from fault tolerance, multi–threaded and completely decentralized execution.

The authors begin describing the different components of JACEP2P–V2 and then proceed to discuss the various mechanisms used to provide scalability and for fault tolerance. The performance of the proposed environment is evaluated in many experiments solving, over a volatile distributed architecture, a 3D advection–diffusion equations system. Finally, the authors test how scalable JACEP2P–V2 is as well as its compatibility with several types of problems by solving a large instance of the 3D advection–diffusion problem using more than 1000 cores and by solving the NAS parallel benchmark (GC).

Ghaeb et al. [7] deal with data integrity assurance. Data integrity is an important, fundamental aspect of storage and network security, and indeed, no security strategy can be achieved without assuring data integrity. Therefore, data assurance is a prerequisite for most computer systems and network applications.

The authors propose a novel technique improving the detection of data integrity violations. The technique proposed in their paper is based on the check determinant factor (CDF) in measuring the data integrity assurance, and requires appending a Determinant Factor (DF) for each data matrix before storing or transmitting the data. This DF is then recomputed at the retrieved stage to insure data integrity. Results of a computer simulation show that the new method outperforms traditional methods such as, for instance, Hamming code and RAID methods.

Yoon et al. [8] propose a novel broadcasting cryptosystem for grid computing environments. A key requirement related to security is indeed the use of efficient and secure authenticated broadcasting technologies; these should be applied to both users and computational resources, in order to guarantee that both resources are data are actually not provided by a malicious attacker.

A broadcasting cryptosystem is able to establish a secure communication channel from a sender to a group of authorized, legal receivers. While many different broadcasting cryptosystems have already been proposed, researchers have shown that these are flawed by several security weaknesses. In their papers, the authors present a new secure broadcasting cryptosystem that fits grid computing environment and can withstand various security attacks.

Ton de Vrieze et al [9] discuss how to extend existing data-oriented functionality for enterprise use, in order to support business processes. In particular they explore the use of mashups, data aggregation applications exploiting web 2.0 and web services technology, as an example of lightweight data integration. The authors propose a design of a process-oriented enterprise mashup system, combining data from different sources to create valuable information.

3. Conclusions

We have selected for this Special Issue high–quality, revised papers from the 4th International Conference on Grid and Pervasive Computing (GPC 2009), which was held in May 2009 in Geneva, Switzerland, and its related workshops. Our desire and hope is that interested readers will find them useful and that this Special Issue will contribute to new advances in the field.

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