
Advance in web/grid information and services discovery and management

B. Di Martino and S. Venticinque*

Department of Information Engineering
Faculty of Engineering
Second University of Naples
Via Roma 29, 81031 Aversa (CE), Italy
Fax: +39-0815037042
E-mail: beniamino.dimartino@unina.it
E-mail: salvatore.venticinque@unina2.it
*Corresponding author

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Biographical notes: Beniamino Di Martino is a Full Professor at the Second University of Naples (Italy). He is the author of five international books and more than 100 publications in international journals and conferences. He served as General and Program Chairman, and a member in programme committees, of several international conferences, and as Guest Editor for several journals' special issues. He is an Editorial Board Member and Chair of international journals. He is Vice Chair of the Executive Board of the IEEE CS Technical Committee on Scalable Computing. His research interests include programming and compiler techniques for high-performance and grid computing, mobile and intelligent agents, automated program analysis and transformation, reverse engineering, semantic-based information retrieval, the semantic web and semantic web services.

Salvatore Venticinque has been an Assistant Professor at the Second University of Naples (Italy) since 2006. He received his Laurea degree in Electronic Engineering in 2000 and his PhD in 2003. He teaches 'Computer Programming' and 'Computer Architecture' in regular courses. He is involved in research activities dealing with parallel and grid computing, mobile agents programming for distributed systems and service-oriented architectures. He currently collaborates with national organisations and foreign academic institutions, also through public research projects. The results of his activities have been published in international journals, books and conferences. He has served as a reviewer for international journals and as Co-Chairman and programme committee member of many international conferences.

This special issue, Web/Grid Information and Services Discovery and Management, addresses all aspects (theory, applications and tools) of intelligent methods applied to web-based systems.

Intelligent-based services discovery and management are relevant for supporting automatic and web services composition, granting the semantic compliance of composed services. Services composition can be defined as a process of discovering, integrating and

executing a set of related services in the proper order to form a meaningful and composite service. It can be used to find new equivalent workflows, to improve services availability or to build new services categories.

Grid technologies have emerged as standardised middleware aimed at enabling the shared and coordinated usage of a variety of resources scattered around the world within dynamic, heterogeneous and distributed computing systems (Foster *et al.*, 2001).

Important components of resource sharing are resource description, discovery and interoperability. Web services are rapidly being imposed, over equivalent technologies such as CORBA, DCOM and RMI, as a *de facto* standard for describing software components and methods for discovering and accessing them, based on standardised ASCII-based protocols and languages such as XML, HTTP, SOAP, WSDL and Ws-Inspection. They are able to support interoperability and independence from transport protocols, programming languages and models, and system software. The alignment – and augmentation – of grid and web services technologies is the aim of the Open Grid Services Architecture (OGSA) effort (Foster and Kesselman, 2002). This architecture uses the Web Services Description Language (WSDL) to achieve self-describing, discoverable services and interoperable protocols, with extensions for supporting multiple interfaces. It represents a standards-based distributed system that supports the creation of sophisticated distributed services, which are required in modern enterprises and interorganisational computing environments. Recently, new ideas have been proposed to extend the functionality of the UDDI registry by introducing additional features (Chen *et al.*, 2006; Ali *et al.*, 2003). The discovery of different service implementations, but providing the same functionalities, has been investigated using standard or *ad hoc* taxonomies (Aversa *et al.*, 2004).

Ontologies can improve the quality of information about grid software, hardware and data. They enable the sharing of a common understanding about domain concepts, the reuse of domain knowledge, explicit definitions of domain assumptions, interoperability enhancement and other important features in the context of grid environments. Ontologies are the fundamental building blocks of the semantic grid and were defined by an extension of the current grid, in which information and services are given a well-defined meaning, better enabling computers and people to work in cooperation (de Roure, 2005). Semantic discovery of web services allows effective brokering (Eberhart, 2004; Di Martino, 2006) and intelligent services composition (Aversa *et al.*, 2006).

These themes and additional related ones have been addressed by the papers published in this special issue. The papers describe practical challenges and present the adopted solutions.

We selected the best contributions from the *Web/Grid Information and Services Discovery and Management Workshop (WGISD 2008)* and from the main track of the *2nd International Conference on Complex, Intelligent and Software Intensive Systems (CISIS 2008)*. Original contributions were extended and reviewed before being accepted for publication.

In ‘Optimising decentralised grid markets through group selection’, Chao *et al.* propose automatic coordination mechanisms for the grid. They are required due to the increasing complexity exhibited in large-scale distributed systems. Decentralised economic models are being considered as scalable coordination mechanisms for the management of service allocations to clients. However, decentralisation incorporates further dynamicity and unpredictability into the system. Introducing higher levels of

adaptation and learning in the coordination protocols helps the system cope with complexity. A solution is provided here based on a self-organised, emergent mechanism involving grid market participants through a group selection process. Dynamic congregations organise agents into optimised market segments, maximising utility and thereby improving system-wide performance.

'Towards automatic service generation and scheduling in the OpenCF project', by Santos *et al.*, describes the Open Computational Framework (OpenCF). It is intended to ease the access to high-performance computing resources for those willing to use them. The main objective is to diminish the significant barrier (with regard to technology and learning) users face when trying to access High-Performance Computing Systems (HPCS). The OpenCF can be grouped with those projects which provide generic solutions using web services-based technologies. In this paper some new facilities provided in OpenCF are presented.

'An ontology-based approach for modelling grid services in the context of e-learning', by Brut and Buraga, presents a technique for developing e-learning grid services by using the OntoGrid infrastructure, which adds to the current OGSA architecture the facilities for ontology access. Services are considered for developing a user competence profile by referring to domain ontologies for expressing competences, and also services for learning objects' ontology-based annotation. This approach enables the improvement of personalisation services.

In 'The performance evaluation of a grid using Windows PCs', Tanaka *et al.* deal with the performance analysis of Windows-based grid architectures. They experiment with different configurations of grids, made with Windows-native PCs and Linux Virtual Machines (executing on dual core grid PCs). They use parallel applications for image rendering to study the performance results of execution on different architectures. A grid service for Virtual Machine (VM) monitoring and management is also presented.

Traditional service management techniques and frameworks are inadequate for handling new-generation integrated applications and cross-enterprise business processes and services. In 'Managing an increased service heterogeneity in a converged enterprise infrastructure with SOA', by Kryvinska *et al.* address the Service Delivery Platform (SDP) for service management. They identify both the current boundaries of SDP and the concept's importance. They classify and analyse the components and the relations between the elements of this management framework, and visualise the results of their analysis through the reference architecture.

In 'The Grid4All ontology for the retrieval of traded resources in a market-oriented grid' Kotis *et al.* propose the Grid4All ontology. One of the most challenging problems in grid environments concerns the matchmaking between resource requests and offers. As it happens in the physical economy, the grid economy must be supported by services that locate resources based not only on their characteristics, but also on market-related properties, the properties and constraints of offers and requests, as well as on declarative specifications of the features of peers (providers and consumers). Resource retrieval in the context of a grid economy extends the notion of resource matchmaking to the process of discovering those markets that trade resources through market orders. This paper describes an ontology that represents resource orders (offers and requests) in a market-oriented resource retrieval process, showing the preliminary results of its utilisation for the retrieval of traded resources.

'A centralised control mechanism for network resource allocation in grid applications', by Reinhard and Tomasik, focuses on application-network interactions in a high-speed network, which are of paramount importance for service responsiveness. High-speed networking features are needed to support distributed applications in an operator network. An architectural solution is presented in this paper. Using simulations, system performance has been studied, for applications demanding the quality of service in terms of latency and data loss. Results show that a centralised control of application-network applications is efficient for small and fast networks.

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