Chapter 6.4

Grid Workflows with Encompassed Business Relationships:
An Approach Establishing Quality of Service Guarantees

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ABSTRACT

This chapter focuses on presenting and describing an approach that allows the mapping of workflow processes to Grid provided services by not only taking into account the quality of service (QoS) parameters of the Grid services but also the potential business relationships of the service providers that may affect the aforementioned QoS parameters. This approach is an integral part of the QoS provisioning, since this is the only way to estimate, calculate, and conclude to the mapping of workflows and the selection of the available service types and instances in order to deliver an overall quality of service across a federation of providers. The added value of this approach lays on the fact that business relationships of the service providers are also taken into account during the mapping process.

INTRODUCTION

Although initially designed to cover the computational needs of high performance applications (I. Foster, 2001; W. Leinberger, 1999), Grid technology of nowadays aims at providing the infrastructure for the general business domain. Advanced infrastructure requirements combined with innate business goal for lower costs have driven key business sectors such as multimedia, engineering, gaming, environmental science, among others towards adopting Grid solutions into their business. Furthermore, complex application workflows are emerging along with specification languages used to enable the workflow description and execution on Grid environments. The final success of this business orientation of Grid technology however will primarily depend on its real adopters; the end users whose main demand refers to the offered level of quality.

This shift from science Grids to business Grids in parallel with the replacement of simple job executions to complex workflow management (Workflow Management Coalition, 1999) and enactment in Grids resulted in advanced requirements in the field of workflow mapping with regard to QoS metrics / resources' special attributes (e.g. performance profile). Based on the fact that each workflow contains processes that can be executed from a set of service providers / instances (candidates), which are annotated with QoS information, workflow mapping refers to the mapping of the aforementioned workflow processes to Grid provided services taking into account the QoS metrics in order to provide a selection of candidates guarantying end-to-end QoS for the submitted workflow. In bibliography, it is referred as Workflow QoS Constraints and remains one of the key factors in a Grid Workflow Management System and more specific in the Workflow Design element (J. Yu, 2005).

As presented in the Background section of this chapter, there are many approaches that address the QoS issue in Grid environments while in one of our previous works (D. Kyriazis, 2007) we have presented in detail a QoS-aware workflow mapping mechanism. However, the business relationships between the service providers are not taken into consideration during the selection process. In greater detail, the service providers may have business relationships that can be Co-operating, non-Cooperating or even Antagonistic, Cheating, or Malicious. These relationships affect the workflow mapping since the QoS metrics of a service provider may change based on a selection of another provider. In many occasions, a service provider may alter his offered services' QoS values based on the selection of another service provider depending on their business relationships.

What we discuss and present later on is a modeling of the business relationships within Grid workflows and an approach that provides a metric for defining a service providers "friendliness" bases on the relationships that service provider has with other ones. Furthermore, we discuss how this metric can be reflected into the Service Level Agreements (SLAs). The aforementioned metric can be used by QoS-based selection mechanisms to take into account business relationships during the selection process and meet the user's QoS requirements.

The remainder of the chapter is structured as follows: the Background section introduces the terminology that will be used in this chapter and presents related work in the field of QoS-based workflows management in Grids. The next section, entitled "QoS-based Workflow Mapping addressing Business Relationships" introduces the concept of Business Relationships in workflows and provides a modeling approach for them while a proposal for defining a metric to characterize a service provider's friendliness, is also included. The chapter proceeds by describing the architecture of the proposed model. Finally, it concludes with a discussion on future research and potentials for the current study (in the Future Trends section) and the conclusions of the work presented in this chapter.

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