Chapter VIII

Metadata-Based Information Management Framework for Grids

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Abstract

Information service is a key component of a Grid environment and crucial to the operation of Grids. This chapter presents an information management framework for a Grid virtual organization (VO). This information management framework is a hierarchical structure which consists of VO layer, site layer and resource layer. We propose different models of information data organization for information
management in Grids and simulation experiments were conducted to evaluate the performance of these models. Based on the experimental results, we further introduce the data organization model for our information management framework. A performance evaluation conducted on a cross-domain Grid testbed indicates that our information management framework presents good scalability with large number of concurrent users and large amount of information aggregated. In this chapter some application experiences of using the information management framework are also presented.

Introduction

A Grid (Foster, 1999) is concerned with coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations (VO) (Foster, 2001). The information service (Plale, 2002) is a key component in such a Grid environment. It provides fundamental mechanisms for information discovering and monitoring, and serves as an underlying service for other Grid services such as meta-scheduler, execution management service, and performance diagnosis. However, information management in a Grid environment is a challenging issue because the information belonging to different organizations is characterized as diverse, dynamic, heterogeneous, and geographically distributed. The autonomy of resource owners needs to be honored along with their local resource management and usage policies.

The open Grid services architecture (OGSA) (Foster, 2002) was presented to address the challenges in a dynamic, heterogeneous, and geographical Grid environment and it provides a universal resolution for the Grid information service. The Globus toolkit (Globus, 2004) provides the MDS (MDS, 2004), which is an OGSA based framework for information management for a Grid. The MDS provides interfaces for information operations like accessing, aggregating, generating, and querying of service data. The MDS also provides a standard mechanism for registration, polling, and notification/subscription of service data. However, the MDS lacks efficient mechanisms to organize and manage information that suits the hierarchical nature of the Grid VO structure. In addition, very few results have been published that quantitatively study the performance of the OGSA-based information services. Other typical works on Grid information service include GMA (Tierney, 2002), Hawkeye (2004) and MCS (Singh, 2003). Grid monitoring architecture (GMA) is a producer-consumer model for monitoring resource information in a Grid. Hawkeye uses the monitoring agents for automatic resource monitoring and problem detection within a distributed system. Metadata catalog service (MCS) introduces the metadata mechanism for information and data management in a data Grid environment.

In this chapter, we present a metadata-based information management framework within the OGSA framework for Grids. Firstly, the architecture of this information
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