

SECGrid: Science and Engineering Computing Based Collaborative Problem Solving Environment

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Abstract. With the gradually extending of problem application scale, science and engineering computing becomes more and more complicated. Designing a collaborative problem solving environment aiming at specific fields is becoming more and more important. In order to integrate various heterogeneous resources and provide a flexible problem solving environment, we proposed a novel grid approach: SECGrid (Science and Engineering Computing Grid). SECGrid provides a dynamic grid application deploy environment. A grid portal is also adopted to present grid application from diverse sources in a unified way. We proposed a new scheduling algorithm (Application Demand Aware Algorithm) to make job scheduling more feasible. Moreover, SECGrid provides a lot of useful facilities, such as grid accounting, grid monitoring, etc. In the practical application, SECGrid encapsulates lots of computing modules from science and engineering, and provides an easy way for collaborative problem solving.

Keywords: PSE, grid computing, grid accounting, grid monitoring, scheduling.

1 Introduction

In recent years, the concept of grid computing has been investigated and developed to enlarge the concept of distributed computing environment. The grid infrastructure provides integrated services for resource scheduling, information sharing, data delivery, authentication, delegation and other related issues [1]. Due to the heterogeneity of resources, the complexity of computational applications increases. As continuous changes of applications as well as resources states, large amount of resources are involved. For the reasons above, the importance of problem solving environments has been more emphasized [2]. However, problem solving environment (PSE) using open source software and widely available devices to support collaboration [3] has not been investigated extensively.

Based on forecited reasons, it makes sense to combine traditional problem solving environment with grid to build a collaborative PSE in Science and Engineering. SECGrid has the following characteristics: based on specific domains of grid; supporting sharing and cooperation; easily usable high performance PSE, which makes fully use of grid possibility in resource sharing and cooperation.

There are some related projects already, such as the China National Grid (CNGrid) [4], which is a key project in the National High-Tech R&D Program (the 863 program); the European DataGrid (EDG)[5], commissioned by the European Union, with goals to develop the software to provide basic grid functionality and associated management tools for a large scale test-bed for demonstration projects in three specific areas of science; the Scientific Computing Grid (ScGrid)[6], and so on. Compared to these projects, this project focuses mainly on Science and Engineering aspects, with emphasis on providing a collaborative problem solving environment.

The rest of this paper is organized as follows. Section 2 introduces design issues and the system architecture which consists of four layers. Section 3 details the key technologies for building system as well as a job scheduling algorithm (Application Demand Aware Scheduling Algorithm). Section 4 presents an application case of SECGrid. Section 5 summarizes the SECGrid project and points out future directions.

2 Architecture

This system contains multi-layers and multi-management domains. From the job schedulers in the bottom layer to the specific application system in the top layer, there are various software and hardware, such as grid middleware, grid portal developing infrastructure, grid monitoring and grid accounting etc. They altogether emphasize the importance of system architecture design.

This system integrates and organizes different computation and storage resources in a heterogeneous environment. It shields bottom resource heterogeneity and multi-management domains via functions like application service access, data access and management services provided by system. It can exhibit users with incorporate file view and convenient, unified operating interfaces. The system is divided into four layers from bottom to top, namely Resources Layer, Core Layer, Portal Layer and Application Layer, as shown in Fig. 1.

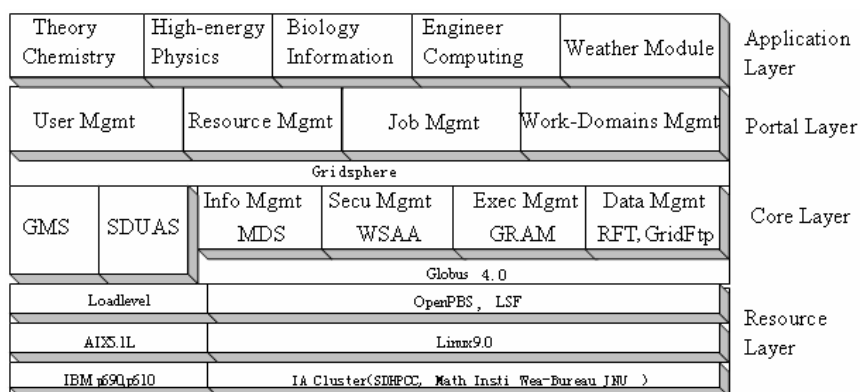


Fig. 1. SECGrid Layer Architecture