

A Service-Oriented, Scalable Approach to Grid-Enabling of Manufacturing Resources

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Abstract. To meet the challenges of geographically and logically distributed development processes. Manufacturing resources have to be encapsulated into services. The paper presents an extensible resource encapsulation framework and provides an approach to grid-enable manufacturing resources following Web Service Resource Framework (WSRF) specification which can make them offer their services and functionality in grid environment. The framework includes a Resource Container Factory Service and many Resource Container Instance Services. The same kinds of resources are deployed in one resource container instance. The encapsulation framework has many advantages such as extensible, plug-and-play deployment, automatic encapsulating and manageable. The paper presents the design principle of the resource encapsulation framework. One kind of resource container-resource container for legacy binary codes is introduced as an example in this paper, which can cast legacy binary codes into web services. At last, we give a use case to validate our method and put forward the future work.

Keywords: grid, service-oriented, manufacturing resource, Web Service Resource Framework (WSRF), encapsulation.

1 Introduction

Development of industrial and large-scale products and services poses complex problems. The processes used to develop these products and services typically involve a large number of independent organizational entities at different locations grouped in partnerships and supply chains. They need cooperate with each other, and all engineers want to work on the same set of data, share the same processes and can drive the whole development process in an integrated environment. To meet the challenges of geographically and logically distributed development processes, many resources, such as industrial simulation codes, data resources and equipment resources have to be integrated into the uniform problem solving environment. We want to share these resources based on union and open standards. Grid technologies are the viable alternative to fulfill these requirements. The major challenge is to develop strategies how to cast various manufacturing resources into services for use in service-oriented problem solving environments.

We want to encapsulate manufacturing resources into services based on union and open standards and provide an extensible encapsulation framework, which can encapsulation various resources and manage these resources deployed in it. Encapsulated resources can be deployed without restart service container and users have not to know much knowledge on grid and web service. The paper focuses on solving these problems.

The rest of the paper is organized as follows: Section 2 introduces some related works and the different characteristic of our approach. Section 3 presents the extensible encapsulation framework of manufacturing resources and introduces the Resource Container Factory Service and Resource Container Instance Services in detail. Section 4 introduces an example of resource container: resource container for legacy binary codes. The prototype is presented in section 5. At last, the conclusion and further work are presented.

2 Related Work

Many efforts have been made towards the integration of manufacturing resources. There are also some methods to transform legacy application into services. [1] puts forward tactics of CAD (Computer Aided Design) encapsulation and realize the encapsulation and invocation using Web Service technologies. It mainly solved the problem of the data exchange between CAD, PDM (Product Data Management) and CAM (Computer Aided Manufacturing) systems. [2] presents an approach to virtualize an AGV(Automated Guided Vehicle) following WSRF. The process of virtualization is very complex and user have to program for different resources. It's difficult to use for enterprise users. SIMDAT project team [3] develops strategies how to cast industrial simulation codes into grid enabled analysis services. The project put the focus on the analysis services. In-VIGO [4] presents two solutions to virtual legacy command-lined application: Generic Application Service (GAP) [5] and Virtual Application Service (VAS). The two solutions are fit for virtualizing command-oriented scientific applications.

The solutions mentioned above have some limitation and poor expansibility. They can only solve certain kind of resource encapsulation problem. The paper presents an extensible resource encapsulation framework. We can extend the resource encapsulation framework by developing new resource container instance service, which can be seen as component and added to the framework easily.

3 Framework of Resource Encapsulation

The paper presents an extensible framework of resource encapsulation [Shown in Fig.1]. Manufacturing resources are encapsulated into WS-Resource. The framework includes a Resource Container Factory Service and some Resource Container Instance Services. They are web services following Web Service Resource Framework (WSRF) [6] specification. A Resource Container Instance Service can cast one kind of resource into web services. The Resource Container Instance Service can be generated according to the profile by Factory Service, which make the framework can be extended easily to support various manufacturing resources. The Resource