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Chapter VI

A Security Solution for Web-Services Based Grid Application

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Abstract

This chapter introduces a Web services-based virtual organization solution, which is designed to enhance the security performance of WSGrid. WSGrid is a "Web services" based application for composing computational grids. A WSGrid environment involves WSGrid-enabled nodes as servers. The virtual organizations are formed by the joint of users and nodes. There is no central component in the system, so every node is individual and has equal position. WSGrid releases full access right to the users, so they can manage their resources. In order to prevent the misuse of flexibility, GateService is proposed. Firstly, a user should be able to access his resources if he can prove his identity. Secondly, he is able to access another's resources under owner's permission. Thirdly, long-running processes or crossing-nodes processes should be allowed and executed with only being authenticated at initiation. Finally, Shibboleth no matter cross-domain long-running processes or dynamic delegation should not affect the user's privacy, the host's security, and the system's flexibility. This chapter proposes a security solution for a Web services-based grid application.

Introduction

WSGrid (Henderson, 2004) is a set of Web services for composing simple computational grids (Foster & Kesselman, 2002). It is based on Apache Tomcat as a Web container and Axis as a services container. A machine (also called a server or a host), which has WSGrid installed on it, is called a "node". In the theory of network, a "node" is usually referred to "a processing location, which can be a computer or some other device, such as a printer. Every node has a unique network address" (Webopedia, a). However, this term is used as another similar definition. However, in this article, a node refers to an "individual executable environment", which holds resource(s) and is able to offer services and is also capable to serve one or more clients. The term "clients" (meaning consumers of nodes) might be users, nodes, or services. More specifically, the term "user" might mean groups of users if the members share similar properties, such as same organizations or institutes. Since a node can serve many users and vice versa, a user or a group can register on many nodes. Thus, the relations between users and nodes are many to many. This relationship can form various virtual organizations.

The nodes in the whole WSGrid system have equal privileges and positions. There is no central administrative component in the system. The structure of WSGrid systems is similar to the "Mesh Topology" (Network Dictionary, n.d.). "Mesh topology", which is one of the network Topologies, includes full mesh topology or partial mesh topology (Whatis.com, n.d.). In a full mesh topology system, a node must connect all other nodes in the system. However, in a partial mesh topology environment, a node may or may not connect to all other nodes. It depends on if it can reach the maximum data exchange via limited connection. Since a node can communicate with other nodes, a user is able to access all possible services. This architecture is also similar to peer-to-peer computing (P2P computing), whose detail will be briefed in a later section.

In order to use a WSGrid system to perform a Grid-based task, a user can request a job execution through services invocations within nodes. The services provided by WSGrid are basically File movement and Job submission services. Thus, a job execution may include files (such as job packets, and job descriptions, usually called workflows) transmission from one node to another, and job activation, such as activating other sub-workflows or sub-tasks on different locations. To extend the services, the users are conditionally allowed to deploy self-customized services through WSGrid. Therefore, WSGrid is flexible and scalable.

The aim of this research is to build a secure and suitable security solution for WSGrid. Therefore, this chapter is organized as follows. The second section provides relevant information about distributed computing, including grid computing, and security requirements that a network system should satisfy. Several current security frameworks are also discussed, especially focusing on the point of view of authentication and authorization. WSGrid, the architecture and general information, are provided in the third section. The special security issues from the point of view of WSGrid are also stated in this section. Afterward, in order to form dynamic virtual organizations and enhance the user friendliness, another component, GateService, must be enabled to enhance security and functionality for virtual organizations establishment. Components and functions of GateService are described in the fourth section, followed by a discussion of security fulfillment in the fifth section. In conclusion, future work will be addressed.