

Chapter 3.23

Grid Technology for Smart Organizations

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ABSTRACT

This chapter summarizes the most relevant results that grid research achieved in the last decade, it presents the actual issues of the topic, and it outlines how current and future results from this area can contribute to smart organizations. At the first place the basic goal of the Grid is presented and its state-of-the-art, service-based realization is discussed. This global infrastructure will one day connect together diverse types of hardware and software elements, abstracting them out as intelligent autonomous agents that can discover and collaborate with each other on demand. The middle part of the chapter introduces two potential middleware technologies that service grids can be built on. They are the Web services-based open grid services architecture (OGSA) and Jini. The final part of the chapter presents the future of

service grids and the important role these flexible infrastructures will probably have in the life of smart organizations.

INTRODUCTION

Since the late 1990s—more or less since the idea of “The Grid” first came up—virtual organizations were always “the dream to realize” for the grid research community. In the grid computing sense, a virtual organization connects geographically and architecturally dispersed resources together in order to make them accessible for a well-defined group of people in some convenient way (Foster, Kesselman, & Tuecke, 2001). These people are usually referred to as “e-scientists,” because they require virtual organizations to solve computationally intensive (sometimes grand

challenge) problems they identified in theoretical or practical science (Foster & Kesselman, 1999). Grid-based virtual organizations are the tools for them to demolish the walls built by limited capacities of computational power, storage space, and network bandwidth. If grid research manages to create virtual organizations on the top of existing computer networks—primarily on the top of the Internet—then these e-scientists will be able to access remote resources whenever and wherever they would like to.

In the next section the motivations of grid computing and the necessity of a global Grid infrastructure are presented. The chapter introduces the service-oriented architecture, the approach that is believed would one day realize this vision of the global infrastructure. The chapter reviews the general structure of service-oriented grids and the building blocks they are consisting of: the grid services. The aim is to demonstrate that service-oriented grids can act as underlying layers for highly intelligent giant distributed systems.

Because the “service-oriented architecture” is a system design principle and not an implementation, service grids have to choose a technology that brings the idea into practice. The chapter presents the two most potential candidates, the technologies that were more or less involved in almost every grid project in the last few years. These technologies are the Web services extended with the open grid services architecture (OGSA) and Jini. The chapter presents how OGSA—with the additional support of the open grid services infrastructure (OGSI) and the Web services resources framework (WSRF)—can turn the Web services technology into a “grid middleware.” The chapter points out why Jini—the middleware always criticized for its Java dependency—can result in more intelligent and more convenient grid services than OGSA.

Finally, the last part of the chapter demonstrates how smart organizations could use grid-based virtual organizations as flexible infrastructures to understand and influence the environment they

are operating in, to adapt themselves to changing situations, and to efficiently overcome their all-time problems.

INTRODUCTION TO THE GRID

Each day more and more complex equations and mathematical models are formulized within different fields of science. Although computers and computer networks are said to be the most dynamically developing tools of our age, they are always few steps behind theorems: They never have enough capacity to solve any kind of computational task within the preferred periods. While in the last few decades larger and larger supercomputers and computer clusters tried to cope with the computationally intensive jobs, in the future the global Grid will provide a better solution. The “grid-approach” is based on the aggregation of resources that may be situated far away from each other. In contrast with supercomputers and clusters, virtual computers of the Grid will consist of hundreds, thousands, or even more relatively small-capacity machines and network components in order to generate the required capacities. Connecting more and more elements into these virtual computers, sooner or later the size of any supercomputer or cluster can be overgrown. If grid computing succeeds in forming “virtual supercomputers” from individual machines, then the grid approach will definitely win over supercomputing in the long run.

There are millions and millions of machines—PCs, clusters, mainframes, or supercomputers—connected to the Internet, to the global computer network. Quite usually these machines, although they are turned on, do not perform any computation. Typically this is the situation at companies where the employees use the IT infrastructure during the day but the machines are not turned off for the nights. The wasted computational power gave the inspiration for the pioneers of grid computing to develop high-level infrastructures that can

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