

Chapter 12

Multiagent Knowledge-Based System Accessing Distributed Resources on Knowledge Grid

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ABSTRACT

Knowledge is considered as a strategic weapon to get success in any business. Span of modern business applications have increased from a specific geographical area to the global world. The necessary resources of the business are available in distributed fashion using platform / technology like world wide web and grid of computational facilities. The prime intention of the grid architecture is to utilize scarce resources in objective to efficiently mine information from distributed resources. With simple data grid and semantic web technologies, it is difficult to offer higher level knowledge-based services on grid environment. Hence, development of a framework that helps mining and utilizing the required information from large, unstructured, and distributed resources in intelligent fashion becomes necessary. This chapter describes and differentiates World Wide Web (WWW), Semantic Web, Data Grid, and Knowledge Grid with the literature survey. Considering the limitations of the existing approaches, a generic multilayer architecture is designed and described with detailed methodology for each layer. The chapter also presents fuzzy XML technique to represent domain and meta knowledge into the knowledge repositories. To experiment the proposed generic architecture, an application of e-Learning is selected and a multiagent system mining knowledge grid is discussed with detailed methodology and role of agents in the system. The chapter concludes with advantages and application areas.

INTRODUCTION

The rapid development of Information and Communication Technology has strongly influenced

the way in which people carry out their business. Success in any business depends on how better the scarce resources, information, and knowledge have been utilized for competitive advantages. To get such competitive advantages, demand of timely and reliable information is increasing

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exponentially. This leads to the concepts of data and knowledge grid. Resource on such grid can intelligently assist people to accomplish complex tasks and solve problems.

Grid applications often involve large amount of data and/or computing, and are not easily handled by today's Internet and Web infrastructures. Grid evolution had started since early 1990. The first generation grids, also called Computational Grids allowed interconnecting large supercomputing centers. Second-generation grids are characterized by their capability to link more than just few regional or nation-wide supercomputing centers, and by the adoption of standards (such as HTTP, LDAP, PKI, etc.) that enable the deployment of global-scale computing infrastructure (Cannataro & Talia, 2003). The motivation for third generation or next-generation grids is to simplify and structure the systematic building of grid applications through the composition and reuse of software components and the development on knowledge-based services and tools. Open Grid Services Architecture, Semantic Grid, and Knowledge Grids are the most promising approaches towards next-generation grids.

The prime intention of the latest generation of grid architecture is to utilize scarce resources in objective to efficiently mine information from distributed resources. This leads to an intelligent framework which helps mining and utilizing the required information. For this purpose, a knowledge-based system accessing distributed databases through a knowledge grid is designed and will be elaborated in the proposed chapter. The proposed architecture is a generic multi-tier architecture having Higher K-grid Layer, Core K-grid Layer and Data Grid Layer. To experiment the proposed design, academic domain has been selected and multiple activities in the domain were identified. As these activities were required to be loosely coupled and can be used independently, they have been conceived as autonomous agents.

The example multiagent system for the academic domain works on the top of the proposed architecture.

Besides presenting a multiagent application mining knowledge grid with detailed design and results, this chapter also elaborates other candidate applications and presents concluding remarks.

The chapter is organized as follows. First section describes and differentiates World Wide Web (WWW), Semantic Web, Data Grid, and Knowledge Grid. General structure of the data grid is also defined in this section. The parameters like computing efficiency, semantic ability, and capacity to hold knowledge is also compared in these technologies with interactive diagram.

In second section, concept of knowledge grid is elaborated with its characteristics, principles, and parameters affecting the power and role of knowledge grid. To meet described parameters and principles, a generic architecture of a knowledge grid is presented. The proposed structure encompasses three different layers namely Higher K-grid Layer, Core K-grid Layer and Data Grid Layer. This section also describes knowledge representation using fuzzy XML (with example membership functions in XML and DTD model) and for storing knowledge into the metadata repository and knowledge base. Third section presents typical applications and work done so far by elaborating different projects and applications developed in the area.

Fourth section presents a multiagent system application mining knowledge grid. The application is designed as to work on top of the proposed generic architecture of knowledge grid. This section briefly introduces agents and multiagent system fundamentals with characteristics and architecture. This section also describes the role of the multiagent knowledge grid in the area of e-Learning. The chapter concludes with advantages and application areas.

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