# Chapter 3.3
# Mathematics Education Over the Internet Based on Vega Grid Technology

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## ABSTRACT

This chapter presents research work conducted at the Chinese Academy of Sciences, on the Vega Grid technology and dynamic geometry technology, and how the two can integrate to provide a dynamic geometry education system based on grid technology. Such an approach could help solve the interconnect problem, the performance problem and the intellectual property problem for Internet-based education systems.

## INTRODUCTION

This chapter presents research work conducted at the Chinese Academy of Sciences, on the Vega Grid technology and dynamic geometry technology, and how these two technologies can integrate to provide a Vega Education Grid, a grid-based education system for mathematics.

*Vega Grid* is a research project at the Institute of Computing Technology, Chinese Academy of Sciences. *MXP* (Math Experience) is a dynamic geometric education system developed at the

Automated Reasoning Laboratory, Chinese Academy of Sciences. Currently, these two teams are collaborating to develop a high-performance intelligent education software deployable on a wide-area grid platform. The initial focus is mathematics education, with strong emphasis on dynamic geometry.

In the second section, we discuss the Vega Grid research project. We then describe the MXP system, identify challenges of the MXP system, and present the architecture of the Vega Education Grid, a grid-based mathematics education system under development.

## THE VEGA GRID PROJECT

The Vega Grid project aims to promote learning of fundamental properties of grid computing, and developing key techniques that are essential for building grid systems and applications. The Vega team currently consists of more than 100 people, and is conducting research work in the following areas:

- **Dawning Superservers**: Terascale grid-enabling clusters on Linux/Intel and AIX/PowerPC platforms.
- **Vega Grid Software Platform**: This work includes research on grid system software, grid application development tools, and grid user interface. The objectives are to enable resource sharing, collaboration, service composition, and dynamic deployment, utilizing open standards such as OGSA and Web services standards.
- **Vega Information Grid**: Enabling information sharing, information management, and information services in a wide-area enterprise environment or an ASP environment.
- **Vega Knowledge Grid**: Research on knowledge sharing, knowledge management, and knowledge services in a wide area Web environment.

The Vega Grid research is both a basic research and an applied research project. As such, it is driven by technology trends and application trends. We have closely followed development in computing grid (e.g., Globus), data grid, information grid and knowledge grid, and business grid (e.g., OGSA and Web services). More importantly, we constantly talk to users in China to identify applications requirements. We covered more than 20 applications fields in China, ranging from scientific research, e-government, biology and medicine, space industry, manufacturing industry, resource and environment protection, education, transportation, and social security. The research results of the Vega Grid project are currently being used in several application fields, such as Digital Olympics, bioinformatics grid, education grid, and integrated information sharing systems in the railway industry.

In this section, we outline some research progresses from the Vega Grid project, including the VEGA Service Grid principle, a grid computer model, and the Vega Grid architecture.

### The VEGA Service Grid Principle

After carefully analyzing applications requirements, we identified the VEGA Service Grid Principle to guide our development. The service grid concept abstracts three aspects of applications requirements: (1) The Vega Grid should enable user-visible services, not just an infrastructure. For instance, we need to not only develop low-level, user-invisible grid kernel technology, but also provide utilities, developing tools, and user environment technology to help users develop, deploy, and utilize grid technology. (2) Service is the main mechanism for users to interact with grid. (3) The criteria used to evaluate grid functionality and performance should evolve from traditional criteria (e.g., speed and throughput) to service-