Graphics Applications for Grid Computing

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The following quote from Sid Karen (the former director of the San Diego Supercomputing Center) aptly describes the state of distributed computing over a grid:

> As we enter the 21st century, the traditional model of stand-alone, centralized computer systems is rapidly evolving toward grid-based computing across a ubiquitous, continuous, and pervasive national computational infrastructure.

While many application scenarios are not yet possible, grid computing will provide access to distributed resources with the same ease we now access electrical power. Consider the following scenarios described by Dan Reed, director of the National Center for Supercomputing Applications and professor of computer science at the University of Illinois at Urbana-Champaign, in his recent *Computer* article:[1]

> Imagine correlating petabytes of imagery and data from multiple optical, radio, infrared, and x-ray telescopes and their associated data archives to study the initial formation of large-scale structures of matter in the early universe. Imagine combining real-time Doppler radar data from multiple sites with high-resolution weather models to predict storm formation and movement through individual neighborhoods. Imagine developing custom drugs tailored to specific genotypes based on statistical analysis of single nucleotide polymorphisms across individuals and their correlation with gene functions.

Clearly, the ability to analyze data within this distributed environment is critical to the success of the grid. To successfully analyze data, we need visualization tools. This special issue provides a glimpse at the future of grid visualization by exploring working prototypes that exploit distributed resources.

About the articles

The first article, "Enabling View-Dependent Progressive Volume Visualization on the Grid" by Alan Norton and Alyn Rockwood describes and evaluates the communication in a progressive, visibility-driven compression scheme for distributing volumetric data from grid resources to volume-rendering clients.

In "Visualization Systems on the Information-Technology-Based Laboratory," Yoshio Suzuki et al. explore a local grid called the Information-Technology-Based Laboratory and two visualization systems developed for that environment. Using their system, they explored real-time collaborative visualization of a coupled multiphysics numerical simulation, executed on their local grid, which possibly has simulation steering applications.

In the next article, "Deploying Web-Based Visual Exploration Tools on the Grid," T.J. Jankun-Kelly et al. discuss a Web portal, VisPortal, tailored to the exploration, encapsulation, and dissemination of visualization results over the grid. Their approach uses standard Web technologies tied together into a functional system. This let them develop a visualization application called AMRWebSheet used to analyze a grid-enabled adaptive mesh refinement simulation.

In "Grid-Distributed Visualizations Using Connectionless Protocols," E. Wes Bethel and John Shalf explore using the user datagram protocol for remote visualization (with the Visapult system) for the analysis of a grid-enabled, high-performance physics simulation for studying gravitational waveforms of colliding black holes (the Cactus code).

Finally, "Treemaps for Workload Visualization" by Steve Heisig describes an information visualization of grid resources. By using an information visualization technique called treemaps applied to resource utilization data, more effective analysis of grid services management is possible.

These articles provide an insight into how visualization can effectively use, analyze, and explore grid-based data and applications. ■

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Acknowledgments

We thank the authors who submitted 15 high-quality articles for this special issue. The submission quality made the selection of the included articles difficult. An international set of reviewers—renowned in the field of graphics, visualization, and grid computing—reviewed the submissions. We thank these reviewers for giving us careful and thoughtful comments. We also thank the *IEEE CG&A* staff for helping with the editorial aspects of this special issue. We hope you enjoy the articles.

Reference

1. D.A. Reed, "Grids, the TeraGrid, and Beyond," *Computer*, vol, 30, no. 1, Jan. 2003, pp. 62-68.

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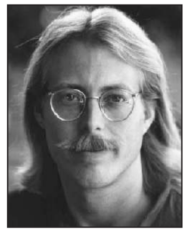

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