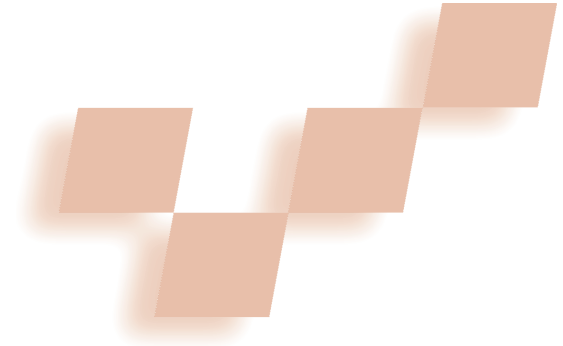


Graphics Applications for Grid Computing



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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.

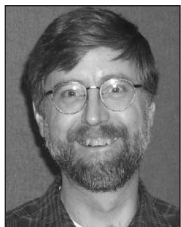
These articles provide an insight into how visualization can effectively use, analyze, and explore grid-based data and applications. ■

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.

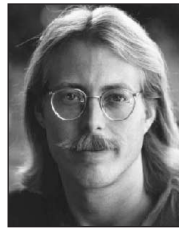
Reference

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



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Chris Johnson directs the Scientific Computing and Imaging Institute at the University of Utah where he is a professor of computer science and holds faculty appointments in the departments of physics and bio-engineering. His research interests are in the area of scientific computing and include inverse and imaging problems, adaptive methods, problem-solving environments, large-scale computational problems in medicine, and scientific visualization. He received a PhD in biophysics from the University of Utah. In 1996, he received a Department of Energy Computational Science Award and in 1997 the Par Excellence Award from the University of Utah Alumni Association and the Presidential Teaching Scholar Award. In 1999, he was awarded the Governor's Medal for Science and Technology. He is a member of the *IEEE Computer Society*, *ACM*, and *SIAM*.

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IEEE Computer Graphics AND APPLICATIONS

2003 Editorial Calendar

January/February Web Graphics

With the popularity of the Internet, we're seeing a migration of traditional applications to run on the Web environment and a growing demand for more powerful Web-based applications. Fused by the increasing availability and dramatic reduction in the cost of 3D graphics accelerators, a new direction of research, called Web Graphics, is emerging. This includes developing graphics applications as well as tools to support these applications in the Web environment.

March/April Graphics Applications for Grid Computing

Grid computing allows access to distributed computing resources with the same ease as electrical power. In recent years, graphics application tools that take advantage of distributed computing, or grid environments, have emerged. New methodologies and techniques that harness resources for graphics applications are critical for the success of grid environments.

May/June Advances in Computer Graphics

This issue covers an array of advances in computer graphics such as organic textures, lighting, and approximation of surfaces. Also, you'll find out about new developments in virtual reality, novel approaches in visualization, and innovative CG applications. The range of topics highlights the usefulness of computer graphics for everyone.

<http://computer.org/cga>

July/August Nonphotorealistic Rendering

Nonphotorealistic rendering (NPR) investigates alternatives that leverage techniques developed over centuries by artists and illustrators to depict the world. One goal of this research is to broaden the achievable range of image styles and thereby embrace new applications. Additionally, NPR has the potential to open a new line of attack on one of the central problems of 3D computer graphics today: content creation.

September/October Perceptual Multimodal Interfaces

This issue focuses on recent advances in methods, techniques, applications, and evaluations of multimodal interaction. Learn how researchers' cross-disciplinary approaches helped develop multimodal interfaces from interaction-centered prototypes to user-oriented and application-tailored solutions. This issue also explores the notion of moving toward transparent user interfaces.

November/December 3D Reconstruction and Visualization

Models based on 3D data will ultimately include everything associated with the environment, such as trees, shrubs, lampposts, sidewalks, streets, and so on. The main mode of exploration for this massive collection will be through interactive visualization. Ultimately, you should be able to fly continuously from overviews of a large city to centimeter-size details on the side of any building. Smoothly joining these different scales may require integrating rendering techniques in new ways.