WebViz:A Web-based Collaborative Interactive visualization system for large-scale Data sets

McArthur, B.[1], Weiss, R. M.[2], Yuen, D. A.[3,4] and Zhou, J.[1,3]

(1) Department of Computer Science, University of Minnesota, Minneapolis, MN 55455, USA

(2) Department of Computer Science, Macalester College, Saint Paul, MN 55105, USA

(3) Minnesota Supercomputing Institute, University of Minnesota, Minneapolis, MN 55455, USA

(4) Department of Geology and Geophysics, University of Minnesota, Minneapolis, MN 55455, USA

WebViz is a web-based application designed to conduct collaborative, interactive visualizations of large data sets for multiple users, allowing researchers situated all over the world to utilize the visualization services offered by the University of Minnesota's Laboratory for Computational Sciences and Engineering (LCSE). This ongoing project has been built upon over the last 2 years by many students under the direction of Dr. Dave Yuen.

The motivation behind WebViz lies primarily with the need to parse through an increasing amount of data produced by the scientific community as a result of larger and faster multicore and massively parallel computers coming to the market, including the use of general purpose GPU computing. WebViz allows these large data sets to be visualized online by anyone with an account. The application allows users to save time and resources by visualizing data 'on the fly', wherever he or she may be located.

By leveraging AJAX via the Google Web Toolkit (http://code.google.com/webtoolkit/), we are able to provide users with a remote, web portal to LCSE's (http://www.lcse.umn.edu) large-scale interactive visualization system already in place at the University of Minnesota. LCSE's custom hierarchical volume rendering software provides high resolution visualizations on the order of 15 million pixels and has been employed for visualizing data primarily from simulations in astrophysics to geophysical fluid dynamics [1] [2] [3] [4].

In the current version of WebViz, we have implemented a highly extensible backend framework built around HTTP "server push" technology. The web application is accessible via a variety of devices including netbooks, iPhones, and other web and javascript-enabled cell phones. Features in the current version include the ability for users to (1) securely login (2) launch multiple visualizations (3) conduct collaborative visualization sessions (4) delegate control aspects of a visualization to others and (5) engage in collaborative chats with other users within the user interface of the web application. These features are all in addition to a full range of essential visualization functions including 3-D camera and object orientation, position manipulation, time-stepping control, and custom color/alpha mapping.

Future developments of WebViz include 1) creating a mobile-specific version 2) upload files via the user interface 3) record, save, and resume sessions at a later time and 4) implement the functionality of overlaying a map, such as GoogleMaps.

As any piece of software, WebViz has its share of bugs. Primary limitations are 1) lag time between the user's visualization request and the subsequent image update 2) scalability: WebViz has limited reliability and cannot be run virtually by many users and 3) distributability: software design needs to be able to accommodate multiple visualization rendering interfaces over various networks.
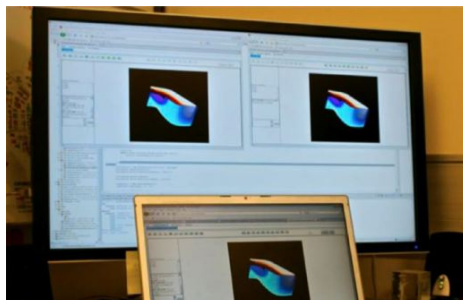

Figure 1: Three users engaged in a collaborative visualization session of the volume rendering of a 3-D Cartesian convection using a finite-volume method.
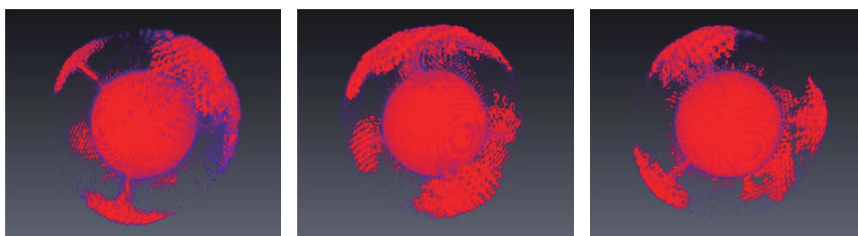

Figure 2: Volume rendering of 3-D mantle convection taken from a RBF-based method.

References
1. Damon M.R., Kameyama M.C., Knox M.R., Porter D.H., Yuen D.A., Sevre E. Interactive visualization of 3D mantle convection. Visual Geosciences. January 2008. 49-57. DOI:10.1007/s10069-007-0008-1.
2. Greensky J, B.S.G., Czech W.W., Yuen D.A., Knox M, Damon M.R., Chen S.S., Kameyama, M.C.. Ubiquitous interactive visualization of 3-D mantle convection using a web portal with java and AJAX framework. Visual Geosciences. June 2008. 105-115. DOI: 10.1007/s10069-008-0013-z.
3. McLane J, Czech W.W., Yuen D.A., Knox M.R., Greensky J, Kameyama M.C., Wheeler V, Panday R, Senshu H. Ubiquitous interactive visualization of 3-D mantle convection through web applications using java. in press, Proceedings of the International Symposium on Visual Computing 2008 (Lecture Notes in Computer Science), 2009.
4. Porter D.H. (2002) Volume visualization of high-resolution data using PC Clusters. http://www.lcse.umn.edu/hvr/pc_vol/rend_Lpdf/.