



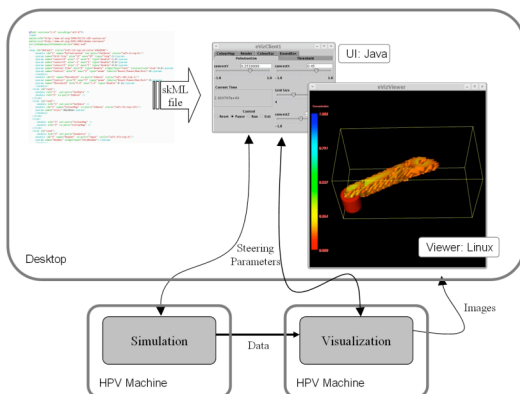
THE WHITE ROSE GRID e-Science Centre

e-Viz – An Advanced Environment for Enabling Visual Supercomputing

Introduction

The e-Viz project is studying the architecture for advanced visualization services.

Early work on developing visualization solutions for e-science focused on the evolution of existing systems to the Grid environment. For example, the gViz project allowed IRIS Explorer visualization pipelines to span a set of Grid resources, with individual modules assigned manually to different machines. In a similar way, the Grid Visualization Kernel (GVK) extended the OpenDX modular visualization system. But these approaches require the user to be expert in both Grid computing and visualization pipeline design.



The aim of e-Viz is different. We want to allow users to think at a higher level of abstraction: they should simply pose a visualization task and rely on the e-Viz software environment to determine the appropriate technique, the appropriate piece of software and the necessary set of resources. The task should be launched from the user's desktop, and the visualization image should be returned likewise to the desktop.

Components of e-Viz

In order to achieve this aim we need to build a visualization e-infrastructure with the following elements:

- A client which provides a user environment in which a visualization problem can be formulated and which hosts an e-Viz viewer that displays the resulting rendered image.
- A visualization description language which can express a visualization pipeline and its user interface in an abstract manner.
- An intelligent agent which can express the solution to a visualization problem in terms of this language, and resolve the description into a specific software solution running on a specific set of resources.
- A resource allocation process that can not only select the appropriate level of facility for a task, but allow tolerance to failure or lack of availability of the 'ideal' resource.

Contribution from partners

The e-Viz project is a collaboration between four universities: Universities of Manchester and Leeds, and the University of Wales at Bangor and Swansea. The project leader is Professor Nigel John, from Bangor.



Work at Swansea has been focussed on two areas, a simulation system, SimuVis, and an agent based volume rendering system.

SimuVis is able to model the components that make up a visualization pipeline and the network infrastructure that links the various components. Using SimuVis it is possible to estimate the best arrangements of components to give the desired levels of performance.

The agent based volume rendering system has been developed to monitor system





performance and aid optimisation. It allows the components of a distributed parallel volume renderer to be migrated to improve performance without requiring user intervention



Bangor have focussed on delivering an augmented reality demonstrator for the e-Viz system which is based around Transcranial Magnetic Stimulation (TMS). This demonstrator takes a live video feed of a patient's head and uses a robust feature point detection algorithm to extract the patients pose from the video stream. This video is then augmented with a volume rendering, from the appropriate viewpoint, of the patient's own brain. An e-Viz remote rendering service is used to generate the image of the volume rendered brain, and the automatic choice compression codec ensures reliable framerate across the local network.



Manchester have developed two components of the e-Viz system: the e-Viz Launcher application and a remote rendering library and viewing tool.

The e-Viz Launcher attempts to aid the user with selecting an appropriate visualization pipeline based on the description of the data provided by the user. It also locates suitable software and launches it onto selected compute resources.

The remote rendering tool is a library that works seamlessly with VTK to capture the output of the rendering process. This is then compressed and transmitted across the network to any connected display clients running on the users desktop machine. This allows the visualization to take place on a remote resource while still allowing the user to interact with it as if it were rendering locally.



Leeds have concentrated on developing a dynamically configurable user interface tool for the e-Viz project. This tool, the e-Viz Client, uses the e-Viz XML visualization description language to generate a user interface appropriate for the visualization pipeline created by the e-Viz Launcher. It processes the XML and generates widgets for parameters of components in the visualization pipeline.

As well as generating the user interface widgets, the e-Viz client also processes the

XML description to discover where the visualization components are running. It then provides a mechanism, using the steering library developed in the earlier gViz project, to allow widget changes to be passed to remote visualization components.

As well as being dynamically configurable, the e-Viz client is also extensible. In addition to using the gViz steering library for communications, the e-Viz client provides a framework for other communications mechanisms to be plugged in. Similarly, while the e-Viz client provides a set of basic user interface widgets, it provides a framework for user created widgets to be used.

Visualization Description Language

Another product of the gViz e-science project was skML, a language for describing visualization pipelines. This was developed by David Duce and Musbah Sagar at Oxford Brookes University. We are using skML as the basis of our e-Viz XML visualization description language but have extended it to aid automatic generation of user interfaces and allow dynamic changes to parameter representations on those interfaces. Pipelines described in skML have been successfully translated into IRIS Explorer, AVS/Express, vtk and the Real Time Ray Tracing (RTRT, or *-Ray) software from Utah.

Further Information

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The e-Viz Client provides a dynamically configurable user interface tool for Grid based visualization applications.



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