

CAVE Rendering Framework

Virtual Reality and Parallel Rendering / Prof. Urs Künzler, Michael Luggen

Expert: Han van der Kleij

A common approach to increase the rendering performance in virtual reality (VR) systems is to combine multiple workstations to a cluster. Previously applied software technologies that made use of such clusters in the CAVE of the CPVR research group were either very network intense (Chromium) or limited the application programmer to the usage of VRML/X3D.

The CAVE Rendering Framework defines an interface that combines the existing opensource parallel rendering API *Equalizer* with the opensource scene graph engine *OpenSceneGraph* (OSG). This allows almost any OSG-based C++-application to be run parallelized in virtual reality environments with only a few changes to the application code.

VR installations are often limited in either rendering performance or flexibility. The usage of a cluster can solve the first problem. There are several existing software solutions that can be used for parallel rendering. The technologies used at the BFH-TI are Chromium, which is very network intense and a VRML/X3D based solution, which only shows statistic content. Therefore, current solutions are not entirely satisfactory.

The goal of the project was to find a solution that allows both, the flexible parallel rendering of an application and the flexibility of high-level OpenGL development. The first requirement can be satisfied by the usage of Equalizer. A technology based on the scene graph concept would meet the requirements for the second part of the problem. Our approach was to take the fast Equalizer API and to combine it with the flexible OSG.

Technology

Equalizer is an opensource, cross-platform parallel rendering API which allows the development of parallel OpenGL based applications. An application written with Equalizer can be rendered on any combination of rendering resources and content unmodified on any visualization system. The topologies to be used can be defined within a single configuration file.

OSG is an opensource, cross-platform graphics toolkit based on the concept of a scene graph and written in Standard C++. It provides an object-oriented framework on top of OpenGL and allows a rapid development of graphics applications.

Framework

The resulting CAVE Rendering Framework (CRF) provides all functionality needed to render OSG applications with Equalizer without further knowledge about parallel rendering or Equalizer. It is compatible with most Equalizer configurations and supports most of the OSG features.

As shown in figure 1, the CRF catches the OSG output and passes it to Equalizer for parallelization. It handles highly dynamic scenes with user input by passing caught events from Equalizer to OSG for further processing.

Conclusion

We were able to test our framework in the CAVE of the BFH-TI. It is a VR installation consisting of 4 screens arranged in a cube as shown in figure 2. An immersive experience is produced by the usage of passive stereoscopy.

The framework proved to be successful. The tested OSG applications ran perfectly with high performance, 3D immersion and total functionality.

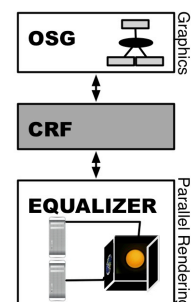


Figure 1: Architecture

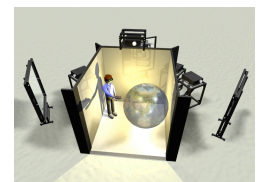


Figure 2: CAVE