

Project Introduction

High-Performance Scientific Visualization System Supporting High-Resolution Display

- Scientific and engineering data generated by high-performance computing facilities such as supercomputers and computational grids become huge.
- High-performance display systems supporting high-resolution are essential in order to effectively display visual information extracted from high-resolution data through volume visualization techniques.

Contents

To develop fundamental technologies and implement relevant software for effectively visualizing scientific information that is extracted from very large volume data, generated by high-performance computing equipments such as computational grids, onto high-performance display systems supporting high-resolution images.

- Development of real-time rendering techniques based on programmable GPUs
- Development of distributed rendering techniques for PC clusters
- Development of high-resolution display techniques

Project Overview

Institution
Sogang University

Project Period
2004. 4. 1 – 2004. 11. 30

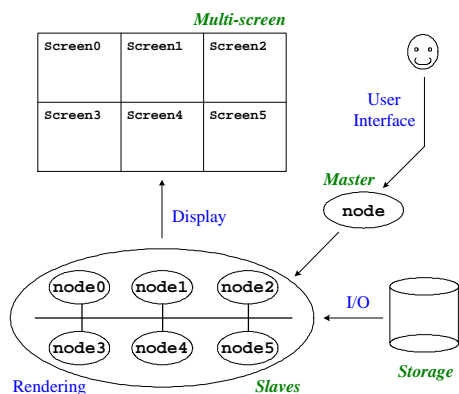
Project Objectives
Development of distributed rendering techniques for the visualization of very large data exploiting the computing resources of high-performance PC cluster systems

Research Results

- Development of visualization techniques exploiting the programmability of modern GPUs
- Effective pre-processing of huge aero-dynamics simulation data provided by KISTI Supercomputing Center
- Development of distributed visualization techniques for (currently 6-node) PC cluster

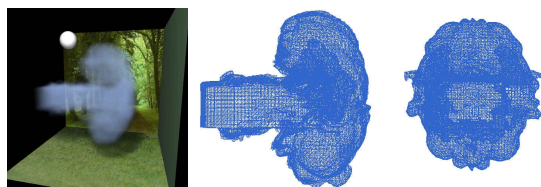
Main Goal

To develop PC cluster-based distributed visualization system supporting six-tile display

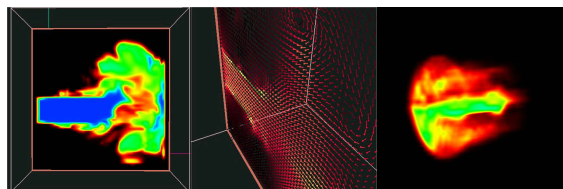


Real-Time Rendering on Programmable GPU

Utilization of both vertex and pixel shaders



Vertex shader-based iso-surface extraction

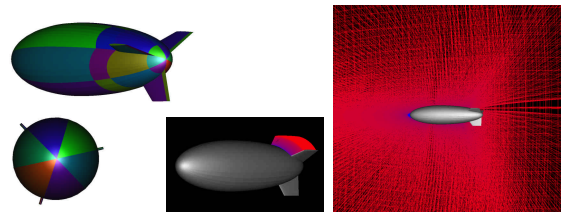


Pixel shader-based scalar, vector and volume rendering

Processing of Huge KISTI-Provided Simulation Data

Fluid simulation data around aircraft

- Density, temp., pressure, and velocity on curvilinear grid
- 146 time frames(25.9GB per time frame)→211.5GB in total

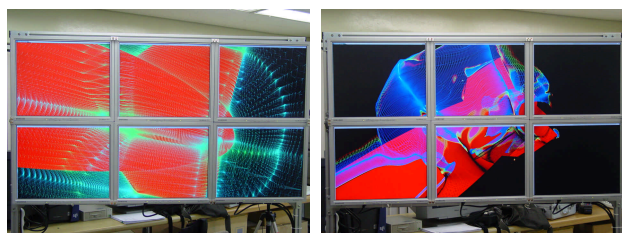


Huge curvilinear volume data from KISTI

Distributed Visualization of Very Large Fluid Data

GPU-controlled distributed processing

- Interactive distributed rendering on six PCs, offering 3,840 x 2,048 resolutions
- Use the frame-lock feature of NVIDIA Quadro 3000G for display synchronization
- Streaming of time-varying fluid data sets
- GPU-based view volume clipping of volume blocks
- Point display, cross-section display, iso-surface extraction, volume rendering, etc.



Visualization of temperature field(left), and iso-surface extraction of pressure field colored with temperature(right)