Design for scalability in 3D computer graphics architectures

This thesis describes useful methods and techniques for designing scalable hybrid parallel rendering architectures for 3D computer graphics. Various techniques for utilizing parallelism in a pipelines system are analyzed. During the Ph.D study a prototype 3D graphics architecture named Hybris has been developed. Hybris is a prototype rendering architecture which can be tailored to many specific 3D graphics applications and implemented in various ways. Parallel software implementations for both single and multi-processor Windows 2000 system have been demonstrated. Working hardware/software codesign implementations of Hybris for standard-cell based ASIC (simulated) and FPGA technologies have been demonstrated, using manual co-synthesis for translation of a Virtual Prototyping architecture specification written in C into both optimized C source for software and into to a synthesizable VHDL specification for hardware implementation. A flexible VRML 97 3D scene graph engine with a Java interface and C++ interface has been implemented to allow flexible integration of the rendering technology into Java and C++ applications. A 3D medical visualization workstation prototype (3D-Med) is examined as a case study and an application of the Hybris graphics architecture.

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