PVM-G: Parallel Graphics Design Environment *†

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Abstract

This paper describes the design and implementation of PVM-G, a toolkit for visual simulation, virtual reality, and other real-time 3D graphics applications based on PVM (Parallel Virtual Machine). PVM is a generic message-passing system composed of a programming library and manager processes developed by Oak Ridge National Lab. It ties together seperate physical machines (possibly of different types) to be used as a single large parallel computer.

The principal design goal is to allow application developers to more easily obtain maximal performance from a network of workstations, which feature multiple CPUs and support an immediate-mode rendering library. For this purpose, the toolkit combines a low-level library for high-performance rendering with a high-level library that implements pipelined, parallel traversals of a hierarchical scene graph. While discussing the toolkit architecture, the paper illuminates performance issues fundamental to immediate-mode graphics and coarse-grained, pipelined multiprocessing. Optimizations of PVM focus on load balancing, efficient data transfer, reduction of mode settings, and restricting state inheritance. Furthermore, We improved PVM to solve the problems of how to partition work among multiple processes, how to synchronize these processes, and how to manage data in a pipelined, multiprocessing environment.

Keywords: PVM-G, PVM (Parallel Virtual Machine), message, real-time graphics, multiprocessing, visual simulation, virtual reality, interactive 3D graphics

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