Rendering and Visualization in Parallel Environments

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The continuing commoditization of the computer market has precipitated a qualitative change. Increasingly powerful processors, large memories, big harddisk, high-speed networks, and fast 3D rendering hardware are now affordable without a large capital outlay. A new class of computers, dubbed Personal Workstations, has joined the traditional technical workstation as a platform for 3D modeling and rendering. In this course, attendees will learn how to understand and leverage both technical and personal workstations as components of parallel rendering systems.

The goal of the course is twofold: Attendees will thoroughly understand the important characteristics workstations architectures. We will present an overview of different workstation architectures, with special emphasis on current technical and personal workstations, addressing both single-processors as well as SMP architectures. We will also introduce important methods of programming in parallel environment with special attention how such techniques apply to developing parallel renderers.

Attendees will learn about different approaches to implement parallel renderers. The course will cover parallel polygon rendering and parallel volume rendering. We will explain the underlying concepts of workload characterization, workload partitioning, and static, dynamic, and adaptive load balancing. We will then apply these concepts to characterize various parallelization strategies reported in the literature for polygon and volume rendering. We abstract from the actual implementation of these strategies and instead focus on a comparison of their benefits and drawbacks. Case studies will provide additional material to explain the use of these techniques.

The course will be structured into two main sections: We will first discuss the fundamentals of parallel programming and parallel machine architectures. Topics include message passing vs. shared memory, thread programming, a review of different SMP architectures, clustering techniques, PC architectures for personal workstations, and graphics hardware architectures. The second section builds on this foundation to describe key concepts and particular algorithms for parallel polygon rendering and parallel volume rendering.

For updates and additional information, see
http://www.gris.uni-tuebingen.de/~bartz/sig99course

Preliminary Course Schedule

5 min	Introduction	Bartz
	Part One: Foundations	Bartz/Schneider
30 min	Personal Workstations	Schneider
30 min	Technical Workstations	Bartz
50 min	Parallel Programming	Bartz
	Part Two: Rendering	Schneider/Silva
45 min	Parallel Polygonal Rendering	Schneider
45 min	Parallel Volume Rendering	Silva
5 min	Questions and Anwers	Bartz/Schneider/Silva

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Course Speakers

Dirk Bartz is currently member of the research staff of the Computer Graphics Laboratory (GRIS) at the Computer Science department of the University of Tübingen. His recent works covers interactive virtual medicine and thread-based visualization of large regular datasets. In 1998, he was co-chair of the "9th Eurographics Workshop on Visualization in Scientific Computing 1998", and he is editor of the respective Springer book. Dirk Bartz studied computer science and medicine at the University of Erlangen-Nuremberg and the SUNY at Stony Brook. He received a Diploma (M.S.) in computer science from the University of Erlangen-Nuremberg. His main research interests are in visualization of large datasets, occlusion culling, scientific visualization, parallel computing, virtual reality, and virtual medicine.

Bengt-Olaf Schneider holds a degree in electrical and computer engineering from the Technical University in Darmstadt (Germany) and a doctorate from the University of Tübingen. After completion of his Ph.D. work he joined the IBM T.J. Watson Research Center in Yorktown Heights, first as a Postdoc and later as a Research Staff Member and Manager. He is currently a manager for 3D graphics architecture and 3D graphics software. He has also taught as an adjunct assistant professor at Columbia University in New York. Bengt has been the organizing cochair of the 10th and 11th Eurographics Workshops on Graphics Hardware, program co-chair for the Siggraph/Eurographics Workshop on Graphics Hardware and is a member of the editorial board of Computer Graphics Forum. He has published technical papers on computer architecture and computer graphics algorithms. He also holds several patents in those areas. His research interests include computer architectures for multimedia, parallel graphics algorithms and rendering algorithms for high-performance graphics.

Claudio Silva is a Research Staff Member in the Visual and Geometry Computing Department at IBM T. J. Watson Research Center. He has been working with large-scale visualization and parallel rendering for a number of years. His work includes the development of PVR, an interactive parallel volume rendering system; algorithms for volume rendering irregular grids; simplification methods for geometric models; and out-of-core visualization techniques. He received his Ph.D. in Computer Science from the State University of New York at Stony Brook.

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