

Preface

Course Schedule

1:30 PM	Introduction
1:35 PM	General Performance Overview
2:05 PM	Software and System Performance
2:40 PM	Break
2:55 PM	Profiling and Tuning Code
3:25 PM	Compiler and Language Considerations
3:55 PM	Graphics Techniques and Algorithms
4:40 PM	Tips and Tricks

Contents

Abstract	iii
Preface	v
Course Schedule	v
About the Speakers	vi
Acknowledgments	vii
Course Resources On the Web	vii
1 Course Introduction	1
2 General Performance Overview	3
2.1 Computer System Hardware	3
2.1.1 Overview	3
2.1.2 Hardware Overview	4
2.1.3 Computer System	4
2.1.4 CPU	5
2.1.5 Data Access Rates	6
2.1.6 Memory	7
2.1.7 Graphics Hardware	11
2.1.8 Graphics Hardware Taxonomy	13
2.1.9 Bandwidth Limitations	14
2.2 Graphics Hardware Specifications	14
2.2.1 Graphics Performance Overview	14
2.2.2 Graphics Performance Terms	14
2.2.3 Graphics Performance Techniques	16
2.3 Hardware Conclusion	17
3 Software and System Performance	19
3.1 Introduction	19
3.2 Quantify: Characterize and Compare	19
3.2.1 Characterize Application	20
3.2.2 Compare Results	21
3.3 Examine the System Configuration	22
3.3.1 Memory	22
3.3.2 Display Configuration	23
3.3.3 Disk	24

3.3.4	Network	24
3.4	CPU-Bound or Graphics-Bound?	24
3.4.1	Graphics Architecture	25
3.4.2	Simple Techniques for Determining CPU-Bound or Graphics-Bound	27
3.5	Code Considerations	28
3.5.1	Falling Off the Fast Path	28
3.5.2	Identifying Graphics Bottlenecks	28
3.6	Use System Tools to Look Deeper	31
3.6.1	Graphics API Level	31
3.6.2	Application Level	32
3.6.3	System Level	32
3.7	Conclusion	35
4	Profiling and Tuning Code	37
4.1	Why Profile Software?	37
4.2	System and Software Interaction	37
4.3	Software Profiling	38
4.3.1	Basic Block Profiling	38
4.3.2	PC Sample Profiling	41
5	Compiler and Language Issues	43
5.1	Compilers and Optimization	43
5.2	32-bit and 64-bit Code	44
5.3	User Memory Management	45
5.4	C Language Considerations	46
5.4.1	Data Structures	46
5.4.2	Data Packing and Memory Alignment	46
5.4.3	Source Code Organization	47
5.4.4	Unrolling Loop Structures	49
5.4.5	Arrays	50
5.4.6	Inlining and Macros	50
5.4.7	Temporary Variables	50
5.4.8	Pointer Aliasing	51
5.5	C++ Language Considerations	52
5.5.1	General C++ Issues	52
5.5.2	Virtual Function Tables	53
5.5.3	Exception Handling	53
5.5.4	Templates	54
6	Graphics Techniques and Algorithms	55
6.1	Introduction	55
6.2	Idioms	55
6.2.1	Culling	56
6.2.2	Level of Detail	59
6.3	Application Architectures	63
6.3.1	Multithreading	63

6.3.2	Frame-Rate Quantization	65
6.3.3	Memory vs. Time vs. Quality Trade-Offs	65
6.3.4	Scene Graphs	66
7	Tips and Tricks	69
7.1	General Hints	69
7.2	Geometry Hints	70
7.3	Lighting	71
7.4	Visuals	72
7.5	Buffers	73
7.6	Textures	73
	Glossary	75
	Bibliography	79