About This Guide

OpenGL on Silicon Graphics Systems explains how to use the OpenGL® graphics library on Silicon Graphics® systems. The guide expands on the *OpenGL Programming Guide*, which describes implementation-independent aspects of OpenGL. It discusses these major topics:

- Integrating OpenGL programs with the X Window System™
- Using OpenGL extensions
- Debugging OpenGL programs
- Achieving maximum performance

What This Guide Contains

This guide consists of 14 chapters and 3 appendixes:

- Chapter 1, "OpenGL on Silicon Graphics Systems," introduces the major issues involved in using OpenGL on Silicon Graphics systems.
- Chapter 2, "OpenGL and X: Getting Started," first provides background information for working with OpenGL and the X Window System. You then learn how to display some OpenGL code in an X window with the help of a simple example program.
- Chapter 3, "OpenGL and X: Examples," first presents two example programs that illustrate how to create a window using IRIS IM or Xlib. It then explains how to integrate text with your OpenGL program.
- Chapter 4, "OpenGL and X: Advanced Topics," helps you refine your programs. It discusses how to use overlays and popups. It also provides information about pixmaps, visuals and colormaps, and animation.
- Chapter 5, "Introduction to OpenGL Extensions," explains what OpenGL extensions are and how to check for OpenGL and GLX extension availability.
- Chapter 6, "Texturing Extensions," explains how to use the texturing extensions, providing example code as appropriate.

- Chapter 7, "Imaging and Blending Extensions," explains how to use extensions for color conversion (abgr, color table, color matrix), the convolution extension, the histogram/minmax extension, the packed pixel extension, and four color blending extensions.
- Chapter 8, "Miscellaneous OpenGL Extensions," explains how to use the polygon offset extension, the vertex array extension, and the multisampling extension.
- Chapter 9, "Extensions to GLX," explains how to use extensions to GLX, the OpenGL extension to the X Window System.
- Chapter 10, "Debugging OpenGL Programs," explains how to use the OpenGL debugger (ogldebug) and provides some debugging hints.
- Chapter 11, "Tuning Graphics Applications: Fundamentals," discusses basic principles of tuning graphics applications: pipeline tuning, tuning animations, optimizing cache and memory use, and benchmarking. You need this information as a background for the chapters that follow.
- Chapter 12, "Tuning the Pipeline," explains how to tune the different parts of the graphics pipeline for an OpenGL program. Example code fragments illustrate how to write your program for optimum performance.
- Chapter 13, "Tuning Graphics Applications: Examples," provides a detailed discussion of the tuning process for a small example program. It also provides a code fragment that's helpful for drawing pixels fast.
- Chapter 14, "System-Specific Tuning," provides information on tuning some specific Silicon Graphics systems: low-end systems, Indigo2 IMPACT™ systems, and RealityEngine™ systems.
- Appendix A, "OpenGL and IRIS GL," helps you port your IRIS GL™ program to OpenGL by providing a table that contrasts IRIS GL functions and equivalent OpenGL functionality (including extensions).
- Appendix B, "Benchmarks," lists a sample benchmarking program.
- Appendix C, "Benchmarking Libraries: libpdb and libisfast," discusses two libraries you can use for benchmarking drawing operations and maintaining a database of the results.

Note that although this guide contains information useful to developers porting from IRIS GL to OpenGL, the primary source of information for porting is the *OpenGL Porting Guide*, available from Silicon Graphics (or via the IRIS Insight™ viewer online).

What You Should Know Before Reading This Guide

To work successfully with this guide, you should be comfortable programming in ANSI C or C++. You should have a fairly good grasp of graphics programming concepts (terms such as “texture map” and “homogeneous coordinates” aren’t explained in this guide), and you should be familiar with the OpenGL graphics library. Some familiarity with the X Window System, and with programming for Silicon Graphics platforms in general, is also helpful. If you’re a newcomer to any of these topics, see the references listed under “Background Reading.”

Background Reading

The following books provide background and complementary information for this guide. Bibliographical information or the Silicon Graphics document number is provided. Books available in hardcopy and by using the IRIS InSight online viewer are marked with **(I)**:

OpenGL and Associated Tools and Libraries

- Neider, Jackie, Tom Davis, and Mason Woo. *OpenGL Programming Guide*. Menlo Park, CA: Addison-Wesley Publishing Company, 1993. **(I)**
- *OpenGL Porting Guide* (007-1797-020) **(I)**
- *IRIS IM Programming Guide* (007-1472-020)
- *IRIS ViewKit Programmer’s Guide* 007-2124-002. **(I)**
- *Developer Magic: RapidApp User’s Guide* (007-2590-002) **(I)**
- Wernecke, Josie and the Open Inventor Architecture Group. *The Inventor Mentor: Programming Object-Oriented 3D Graphics with Open Inventor*, Release 2. Menlo Park, CA: Addison-Wesley Publishing Company, 1994. **(I)**

X Window System: Xlib, X Toolkit, and OSF/Motif

- O’Reilly X Window System Series, Volumes 1, 2, 4, 5, and 6 (referred to in the text as “O’Reilly” with a volume number):
  - Nye, Adrian. *Volume One: Xlib Programming Manual*. Sebastopol, CA: O’Reilly & Associates, 1991.**(I)**

- *Volume Two. Xlib Reference Manual*. Sebastopol, CA: O'Reilly & Associates.
- Nye, Adrian, and Tim O'Reilly. *Volume Four. X Toolkit Intrinsics Programming Manual*. Sebastopol, CA: O'Reilly & Associates, 1992. **(I)**
- Flanagan, David (ed). *Volume Five. X Toolkit Intrinsics Reference Manual*. Sebastopol, CA: O'Reilly & Associates, 1990.
- Heller, Dan. *Volume Six. Motif Programming Manual*. Sebastopol, CA: O'Reilly & Associates.

- Young, Doug. *Application Programming with Xt: Motif Version*
- Kimball, Paul E. *The X Toolkit Cookbook*. Englewood Cliffs, NJ: Prentice Hall, 1995.
- Open Software Foundation. *OSF/Motif Programmer's Guide, Revision 1.2*. Englewood Cliffs, NJ: Prentice Hall, 1993. **(I)**
- Open Software Foundation. *OSF/Motif Programmer's Reference, Revision 1.2*. Englewood Cliffs, NJ: Prentice Hall, 1993.**(I)**
- Open Software Foundation. *OSF/Motif User's Guide, Revision 1.2*. Englewood Cliffs, NJ: Prentice Hall, 1993.
- Open Software Foundation. *OSF/Motif Style Guide*. Englewood Cliffs, NJ: Prentice Hall. **(I)**

Other Sources

- Kane, Gerry. *MIPS RISC Architecture*. Englewood Cliffs, NJ: Prentice Hall. 1989.
- *MIPS Compiling and Performance Tuning Guide.* 008-2479-001. **(I)**.

Conventions Used in This Guide

This section explains the typographical and function-naming conventions used in this guide.

Typographical Conventions

This guide uses the following typographical conventions:

Italics Filenames, IRIX command names, function parameters, and book titles.

`Fixed-width` Code examples and system output.

`Fixed-width bold`
User input.

Bold Function names, with parentheses following the name—for example **glPolygonMode()**, arguments to command line options.

Note: In the "New Functions" sections in the extensions chapters, regular font is used for function names. This avoids large blocks of boldface text, which would be difficult to read.

Function Naming Conventions

This guide refers to a group of similarly named OpenGL functions by a single name, using an asterisk to indicate all the functions whose names start the same way. For instance, **glVertex*()** refers to all functions whose names begin with "glVertex": **glVertex2s()**, **glVertex3dv()**, **glVertex4fv()**, and so on.

Naming conventions for X-related functions can be confusing, as they depend largely on capitalization to differentiate between groups of functions. For systems on which both OpenGL and IRIS GL are available, the issue is further complicated by the similarity in function names. Here's a quick guide to old and new function names:

GLX*()	IRIS GL mixed-model support
Glx*()	IRIS GL support for IRIS IM
glX*()	OpenGL support for X
GLw*()	OpenGL support for IRIS IM

Note that the (OpenGL) **glX*()** routines are collectively referred to as "GLX"; that term was previously used to refer to the (IRIS GL) **GLX*()** routines. Note, too, that **GLXgetconfig()** (an IRIS GL mixed-model routine) is not the same function as **glXGetConfig()** (a GLX routine). On systems with both IRIS GL and OpenGL, the command

```
IRIS% man glxgetconfig
```

displays both reference pages, one following the other.