

Introduction

The *Graphics Library Programming Guide* introduces the Silicon Graphics® IRIS® Graphics Library™ (GL) to graphics programmers and application developers. The IRIS GL is a library of subroutines for creating 2-D and 3-D color graphics and animation.

This guide covers the IRIS GL as it is implemented on Silicon Graphics workstations. Where it is necessary to differentiate among the various workstation models, the applicable product is identified by its model name.

This guide is written for C programmers. It assumes:

- You are comfortable writing programs in the C programming language.

Programmers who use one of the other languages supported by the GL (C++, Ada®, Fortran, Pascal, or BASIC) can follow the context of the information presented in this guide and look at the on-line GL manual (man) pages to obtain the proper syntax for that language.
- You are familiar with the Silicon Graphics IRIX™ operating system and can create and edit files.

This guide does not assume that you have a knowledge of computer graphics. However, if you are already familiar with the basic concepts of computer graphics, you will find it easy to learn this particular implementation. For an introduction to computer graphics concepts, see the “Suggestions for Further Reading” at the end of this introduction.

How to Use This Guide

This guide is organized so that programmers new to the GL can read through it, skipping over the more complex topics until later. All sections dealing with advanced topics begin with a paragraph that first alerts you to the specialized nature of the material, and then guides you to the next appropriate section where you can continue reading.

Sample programs are provided throughout this guide, and as C language source code in the `/usr/people/4Dgifts` directory on your workstation, to demonstrate GL programming concepts.

Once you understand the sample programs, you can experiment with the GL functions to get the effects you want to use in your own programs. The sample programs are general enough that you should be able to adapt them for your own needs. In many cases, you may be able to change parameter values to achieve the effects you want. In other cases, you need to work the GL functions into the structure of your own programs.

All the sample programs in *4Dgifts* are complete programs, but much of the sample code in the text is only fragments of complete programs. In these cases, you need to construct the remaining framework to have the program compile and execute.

How to Use the Sample Programs

All the sample programs in this guide are available on-line in the directory:

`/usr/people/4Dgifts/examples/glpg`

Follow the instructions in the *README* file to set up your environment so you can compile and run these programs.

Sample programs are in the directory under `/usr/people/4Dgifts/examples/glpg` that corresponds to the chapter number that contains the program. All the directories begin with the letters *ch*, followed by a two digit number:

`ch<nn>`

where *nn* represents the chapter number. Sample programs for advanced topics and certain workstation models are located separately.

Typographical Conventions

In this guide, special typefaces designate:

- *New words, ideas, or important information*
- References to “Section Titles” in this guide and in other *documents*.
- *Directory, file, and program names*
- IRIX *commands* and *system()* calls
- *Subroutine arguments*
- **Information that you enter from the keyboard**
- **<key>** that you press on the keyboard
- GL subroutines()
- GL **TOKENS**, also called **SYMBOLS**
- `Sample code`

What this Guide Contains

In Volume I of the *Graphics Library Programming Guide*:

- Chapter 1, “Graphics Development Environment,” describes the tools and the facilities available for developing graphics applications.
- Chapter 2, “Drawing,” introduces graphics fundamentals that you use throughout the graphics development process.
- Chapter 3, “Characters and Fonts,” describes how to create fonts and work with character strings.
- Chapter 4, “Display and Color Modes,” explains the operation of the color monitor and tells you how to use different methods for describing and working with color.
- Chapter 5, “User Input,” describes the GL facilities for programming a user interface for your application.
- Chapter 6, “Animation,” describes how to set graphics scenes in motion.
- Chapter 7, “Coordinate Systems,” describes the coordinate systems used in creating and displaying geometry.

- Chapter 8, “Hidden-Surface Removal,” describes techniques you can use to reduce drawing time by drawing only the items that are visible.
- Chapter 9, “Lighting,” tells you how to use lights and lighting effects.
- Chapter 10, “Frame Buffers and Drawing Modes,” explains the different “layers” of graphics memory and of the display screen.
- Chapter 11, “Pixels,” describes the methods used to access screen pixels.
- Chapter 12, “Picking and Selecting,” describes how to program your applications to let users select items on the screen.

In Volume II of the *Graphics Library Programming Guide*:

- Chapter 13, “Depth-Cueing and Atmospheric Effects,” describes how you can add realism to your scene by adding depth perception cues.
- Chapter 14, “Curves and Surfaces,” tells you how to use NURBS to draw curves and surfaces.
- Chapter 15, “Antialiasing,” describes how to compensate for the inherent limitations in the way graphics are displayed on a monitor.
- Chapter 16, “Graphical Objects,” tells you how to work with hierarchies and use display lists.
- Chapter 17, “Feedback,” tells you how to access hardware operational information during the drawing process.
- Chapter 18, “Textures,” tells you how to use texture to promote realism.
- Chapter 19, “Using the GL in a Networked Environment,” describes how to run GL programs over the network on a remote host and describes how non-graphics servers can access graphics tools.
- Appendix A, “Scope of GL Subroutines,” describes the operational modes of the subroutines and the resources they act upon.
- Appendix B, “Global State Attributes,” describes attributes of the graphics development environment and the GL subroutines.
- Appendix C, “Transformation Matrices,” lists the matrices used to calculate graphics operations.
- Appendix D, “Error Messages,” lists the GL error messages and suggests debugging procedures.
- Appendix E, “Using Graphics and Share Groups,” tells you how to use shared processes with graphics.

How to Use the On-line Manual Pages

GL man pages are located in Section 3G of the on-line manual pages. Read the on-line GL man pages for detailed information about syntax, machine capabilities and special features. In most cases, the man pages provide more in-depth descriptions of the individual subroutines than is presented in this guide.

Using Man Pages from the Toolchest

An easy way to access man pages is to select “Manual Pages” from the Tools section of the Toolchest on your workstation. This launches the X Window System™ utility *xman*, a browsing tool for locating and reading man pages. To learn how to use *xman*, use the left mouse button to pull down the Options menu, select “Help”, and read the on-line instructions.

You can leave *xman* running while you use other workstation utilities and windows. Click on the small square in the upper right-hand corner to iconify the browser when you aren’t using it. See the *IRIS Utilities Guide* for more information about the Toolchest, system utilities, and other workstation basics.

Using Man Pages from an IRIX Shell

To read a man page from an IRIX shell, use the *man* command followed by the name of the command you are interested in. For example, to read the man page on *man* itself, enter:

```
% man man
```

To get a keyword list of man pages, enter *apropos* or *man -k* followed by the topic name. For example, to get a list of man pages that have the word “printer” in them, enter:

```
% man -k printer
```

or enter:

```
% apropos printer
```

This returns a list of man pages that contain the keyword, along with the subject line of each man page. Look at the subjects to decide which man page to view.

Note: If you have never used *apropos* or *man -k* before, you (or your system administrator) may have to make the *what*is database on your system. See the *makewhatis* man page for information on how to use that command.

Suggestions for Further Reading

For a general introduction to computer graphics, see:

Foley, J.D., A. van Dam, S. Feiner, and J.D. Hughes, *Computer Graphics Principles and Practice*, Second Edition, Addison Wesley Publishing Company Inc., Menlo Park, 1990.

Newman, W., and R. Sproull, *Principles of Interactive Computer Graphics*, 2nd ed., McGraw-Hill, New York, 1979.

In the manual set shipped with your system, see:

Graphics Library Programming Tools and Techniques, Silicon Graphics P/N 007-1489-010, for information about tools and techniques that can assist you in developing and debugging your IRIS GL applications.