Preface

The OPEN LOOK GUI is a popular user interface style (also called a "graphical user interface," or GUI) for programs running on window systems like The X Window System. X11 itself is a network-based graphics windowing system developed at MIT and widely adopted as an industry standard. But X11 only provides the foundation and skeleton of a window system, just as concrete and wood provide the foundation and framework for a house. The material that you put on the outside will significantly affect both how the final edifice looks and how comfortable it will be to live and work in, be that edifice a house or a window system. One exterior, or Graphical User Interface, that became popular in the late 1980's and early 1990's is OPEN LOOK. The OPEN LOOK GUI was designed by Sun and AT&T with help from Xerox, and is based in part—like other X11 GUIs such as OSF/Motif, and other window systems such as the Apple Macintosh—on pioneering work done in the late 1960's and 1970's at Xerox Palo Alto Research Center (PARC) and other research sites. OPEN LOOK has also been influenced by a family resemblance to SunView, Sun's earlier, very successful, and long-popular workstation window system.

If you are new to X, you may be wondering why you should consider the OPEN LOOK GUI. First of all, OPEN LOOK has many features that make it more intuitive and easier to use than other X-based user interfaces. For example, frequently-accessed menus can be "pinned up" for as long as you need them. As well, the graphical elements each have a distinctive shape—a button is always oval, a pull-down menu is always shown by a small triangle, etc.—which makes it easier to spot buttons, pull-down menus, etc., than when using a GUI that uses rectangular shapes for everything. And of course if you have previously used SunView, you will find much that is familiar in the OPEN LOOK GUI.

In addition, the OPEN LOOK GUI specifies the behavior of certain key applications such as the File Manager (other GUIs do not specify this, and thus several different and incompatible "desktop managers" are available at extra cost). Comprehensive implementations such as Sun's OpenWindows include a suite of useful "deskset" applications that make the interface much more than a bare-bones "look and feel." OpenWindows includes (in addition to the File Manager) a set of useful tools called the DeskSet, which includes a calendar manager for scheduling appointments among people in your workgroup, a multi-media mail tool that can include audio files and graphical images in mail messages, tools for controlling printers, etc. All of these are either not available or cost a significant amount of extra money when using other GUIs.

Because the OPEN LOOK GUI is a specification, there are several implemtnations of it. Some of the complexity of this volume derives from listing the differences amont them The *X Window System User's Guide, OPEN LOOK Edition* covers the most popular implementation of the OPEN LOOK GUI, Sun's OpenWindows Version 3.* Much of the information is also applicable to AT&T's OPEN LOOK 4 software, and indeed much of it is applicable to any version of The X Window System.

We describe the basic concepts of window systems and terminology, the application programs (clients) commonly included with these packages as well as some free-software clients that you may wish to obtain on your own, and how client programs behave under OPEN LOOK. The OPEN LOOK edition is intended for those using X with the OPEN LOOK interface. There are also Motif and "generic (MIT) X11" versions of this book available from O'Reilly & Associates.

Historical Update

The OPEN LOOK Graphical User Interface has been abandoned by its two sponsors, Sun and AT&T, as part of the Common Open Systems Environment process' Common Desktop Environment (CDE). As a result, there is no new commercial development of OPEN LOOK applications. Most commercial software for X is now being deveoped for Motif, since that is the basic GUI specified by CDE. However, the availability of the XView toolkit as free software and its popularity in the Linux field, as well as the large market share of Sun Microsystems workstations, all of which still (March 1995) ship with OPEN LOOK as their default windowing environment, ensures that OPEN LOOK will remain popular for some years to come.

Assumptions

This book assumes that the OpenWindows package or another OPEN LOOK package is already installed on your UNIX system in the standard locations, and that all standard OPEN LOOK clients are available (if not, consult the appropriate vendor's documentation, or refer to Volume Eight, *X Window System Administrator's Guide*). If you are on Linux, then most of the Sun Deskset tools will not be available, though you may be able to run them remotely across the network. This book also assumes that you have basic familiarity with The UNIX Operating System. It is probable that the OPEN LOOK GUI will be "ported" or made available on operating systems other than UNIX; the XView toolkit, for example, has been ported to every major version of UNIX and is commercially available for Digital

* Version 3 is standard on Solaris 1.0 (SunOS 4.1.2) on SPARC, and Solaris 2 (SunOS SVR4) on both SPARC and Intel. Much of the information also applies to OpenWindows Version 2, though the DeskSet clients and the operation of drag-and-drop are different. We do not mention all the differences, but do provide some coverage of OpenWindowsV2 because it's the last version that Sun is making available for the Sun-3 product family line.

Equipment's VMS operating system. And Quantum Software's QNX operating system uses the OPEN LOOK GUI as the interface to QNX Windows. If you are using the OPEN LOOK GUI on an operating system other than UNIX you will still find this book useful—UNIX dependencies are not that widespread—but you may occasionally need to translate a command example into its equivalent on your system. This book also assumes that you are using a three-button mouse, and that the configuration files provided by your vendor for *olwm* and the clients have not been extensively modified locally. (If this is not the case, the book provides information that will allow you to understand how these programs can be configured on your system.)

In a few places we refer to "contributed" software. Most of the OPEN LOOK-specific free software is included with the CD-ROM accompanying this book. If this is not available on your system, you can either ignore the information—none of these programs is critical, though we have included some that are useful—or you can obtain them in source form by *ftp* or *uucp* from UUNET or elsewhere, then use *imake* to compile them. See *Xshowfonts and Other Free Programs* below for details.

This book is written for both first-time and experienced users of the OPEN LOOK GUI on the X Window System. First-time users should read the book in order, starting with Chapter 1, *An Introduction to OPEN LOOK and the X Window System*.

Experienced users of other X11 variants can use this book either to learn the specifics of OPEN LOOK—start with Chapter 2, *Working in the OPEN LOOK Environment*—or as a reference for the client programs detailed here. Since there is great flexibility with X, even frequent users need to check the syntax and availability of options. Reference pages for common client programs list command-line options, customization database (resource database) variables, and other details.

Organization

The book contains these parts:

Part One: Using X and OPEN LOOK

The *Preface* describes the book's assumptions, audience, organization, and conventions.

Chapter 1, *An Introduction to OPEN LOOK and the X Window System*, describes the basic terminology associated with OPEN LOOK and the X Window System: server, client, window, etc. The most important client programs are described.

Chapter 2, *Working in the OPEN LOOK Environment*, shows how to start the programs necessary to begin using X: the server, the first terminal window, and the window manager. It teaches the skills necessary to begin working productively. This chapter also shows you how to add additional windows; exit from a window; use the tools of the display; do some basic window manager operations using the olwm window manager, and set up the display.

Chapter 3, *Opening Additional Windows*, describes how to start additional client windows. You are introduced to two methods of customizing X client programs: command-line options and resource variables. In addition, Chapter 3 shows you how to identify OPEN LOOK clients, X Toolkit clients, and Motif clients.

At this point you will want to start *using* the system. If you prefer a visual, icon-oriented method of using computers, you should learn to use the File Manager. If you are familiar with the UNIX command-line interface, you should learn to use the *cmdtool* terminal emulator.

Chapter 4, *Using the OPEN LOOK File Manager*, discusses the OPEN LOOK File Manager, a comprehensive user-interface program. It shows the small differences between the Sun and AT&T versions.

Chapter 5, *The cmdtool/shelltool Terminal Emulator*, tells you how to use Sun's terminal emulator. Certain aspects of its operation apply to other OPEN LOOK clients as well, particularly *textedit* (1) and to all OPEN LOOK clients that have "text fields." For this reason, *textedit*(1) is described in this chapter. The other commonly-used terminal emulator, *xterm*, is described in Appendix A, *The xterm/olterm Terminal Emulator*.

Chapter 6, *Using the OPEN LOOK Window Manager*, describes additional window manager operations, such as resizing windows and changing the order of windows in the stack on your screen. It also describes the minor differences between the Sun and AT&T versions.

Chapter 7, *The OpenWindows DeskSet Clients*, describes the DeskSet clients that Sun's OpenWindows package includes: Multimedia Mail Tool and Audio Tool that let you record, play back, and send and receive verbal or other sound data; the Calendar Manager for scheduling individual or group appointments, *print tool, tape tool, perfmeter, clock, calculator, iconedit, binder*, and two online documentation facilities, Answerbook and the Help Viewer.

The following programs, though strictly speaking part of the DeskSet, are described elsewhere: *File Manager* (described in Chapter 4, *Using the OPEN LOOK File Manager*), *cmdtool/shelltool* and *textedit* (described in Chapter 5, *The cmdtool/shelltool Terminal Emulator*), and *snapshot* (described in Chapter 9, *Graphics Clients)*.

Chapter 8, *Other Standard Clients*, gives an overview of other clients available with standard distributions of The X Window System, including window and display information clients, the *xkill* program, and several "desk accessories." In describing various MIT standard clients, this chapter highlights some features of the Athena widget set.

Chapter 9, *Graphics Clients*, explains how to use the major graphics clients included with The X Window System and OPEN LOOK and OpenWindows. The OPEN LOOK programs include the *snapshot* and *olprintscreen* screen capture programs, and the *olpixmap* and *iconedit* icon editors. The standard clients include *xwd, xpr*, and *bitmap*. The chapter ends with sections on PostScript previewing and font editing.

Part Two: Customizing X

Chapter 10, *X11, OPEN LOOK and OpenWindows Font Specification*, describes the somewhat complicated font naming conventions and ways to simplify font specification, including wildcarding and aliasing, for both regular and scaleable fonts. It describes how to use the *xlsfonts*, *xfd*, and *xfontsel* clients and the OpenWindows *text* demo to list, display, and select available display fonts.

Chapter 11, *Command-line Options*, discusses some of the standard command line options accepted by most X11 clients, be they MIT clients or OpenWindows clients.

Chapter 12, *Setting Resources*, shows you how to create an *.Xdefaults* file to set default characteristics for client applications. Also discusses the tool (called *Properties...* on OpenWindows and "Workspace Manager" on AT&T-OL) that maintains your *.Xdefaults* file for you. This chapter also describes how to use *xrdb*, which saves you from having to maintain multiple *.Xdefaults* files if you run clients on multiple machines.

Chapter 13, *Customizing olwm*, describes the process of customizing *olwm* by showing the default configuration files shipped by Sun and AT&T, and examines the purpose and syntax of entries. It explains techniques for revising the files to modify existing menus and create new ones. Chapter 13 also reviews the X resources that can be used to control *olwm*.

Chapter 14, *Customization Clients*, describes how to set display and keyboard preferences using *xset* and how to set root window preferences using *xsetroot*. Chapter 14 also demonstrates how to use *xmodmap* to redefine the logical key names and pointer commands recognized by X. In addition, we describe some general customizing utilities, such as binder, which updates the file manager's list of icons and programs.

Part Three: Client Reference Pages

Presents extended reference pages for three versions of the server (MIT, AT&T and Sun) as well as all clients mentioned in this manual. These are in the standard UNIX "manual page" format and should be familiar to users of The UNIX Operating System or UNIX-like systems; for others, the format is described briefly at the beginning of this Part.

Historical Note

The Client Reference Pages are not included in the body of this book, but most of them are included in the *man* subdirectory of the CD-ROM accompanying this book.

Part Four: Appendices

Appendix A, *The xterm/olterm Terminal Emulator*, describes how to use the *xterm* terminal emulator. Certain aspects of *xterm* operation described in this chapter, such as scrolling and "copy and paste," are common to other X Toolkit applications as well.

Appendix B, *OpenWindows and X11 Fonts*, discusses the fonts included with OpenWindows and standard X11 releases, and shows how to add your own fonts.

Appendix C, *Standard Bitmaps - X11, OPEN LOOK and OpenWindows*, describes the standard bitmap images that you can use for showing as icons, in your root window, etc.

Appendix D, *Standard Cursors - X11 and OPEN LOOK*, shows the standard cursors, and describes what some of them mean.

Appendix E, *Control Sequences for xterm and cmdtool*, describes the "escape sequences" used to control the *cmdtool* and *xterm* terminal emulators.

Appendix F, *X Toolkit Translation Table Syntax*, deescribes the translation tables used by Xt libraries—OLIT and Motif.

Appendix G, *Introduction to Xt Widget Resources*, gives an introduction to the ways that Xt toolkits such as OLIT fit "Widgets" together.

Appendix H, *OPEN LOOK Intrinsics Toolkit Widget Resources*, is not included in this book for reasons of copyright. But most of the programs we discuss are based on XView, so the material in Appendix J will be more relevant anyway. If you are using OLIT, you have the manual pages with your toolkit that describe the X Resources they use..

Appendix I, *Athena Widget Resources*, describes the Resources used by the standard MIT clients.

Appendix J, *OPEN LOOK XView Toolkit Resources*, describes the resources used by the OPEN LOOK XView toolkit.

Appendix K, *OPEN LOOK Mouseless Operations*, summarizes the editing keys that can be used to perform window operations from the keyboard.

Appendix L, *Running SunView Applications on OpenWindows*, discusses how SunView applications differ from X applications under OpenWindows

Appendix M, *OPEN LOOK and Motif*, describes how to use Motif applications in relative harmony with OPEN LOOK applications. Discusses both Motif applications under the OPEN LOOK Window Manager and OPEN LOOK applications under the Motif Window Manager, *mwm.*

Appendix N, *OPEN LOOK Software Availability*, describes the availability of software that implements and uses the OPEN LOOK GUI.

The *Glossary* provides a list of the important technical terms and their meanings.

The *Documentation Roadmap and Bibliography* will describe the vendor documentation and some additional reading.

Index

On the Complexity of X

One complaint you'll hear over and over about the X Window System is that it's too complicated. One reason for this attitude is that X is widely available, and as a result many programmers have turned their hand to extending it. As a result of that, there are many different ways to do even the simplest thing. We make no apology for here documenting several ways to do most everything, as it is as yet too early in the evolution of X to tell which will survive and become widely used. Yes, X appears complex because it has many variations. But you seldom need to know more than one way of doing something, so we offer this advice to the X-struck:

Try out a few ways of doing something. Remember the one that works best for you; forget all the rest.

xshowfonts.c and Other Free Programs

There is a lot of free or contributed software to accompany The X Window System. Indeed, Sun Microsystems has contributed the source for their XView toolkit and several accompanying clients. The two most important sources of this software in North America are UUNET—a non-profit networking site established by the USENIX Association—and *export.lcs.mit.edu*, an anonymous-*ftp* site set up by The X Consortium.

The source to *xshowfonts.c*, which is printed in Appendix C, *Standard Bitmaps – X11, OPEN LOOK and OpenWindows*, is included in the CD-ROM that accompanies this book. If you have received only a printed copy of the book, this program is also available free from Uunet (although there is a small connect-time charge if you use their dial-up service). If you have access to UUNET, you can retrieve the source code using *uucp* or *ftp*. For *uucp*, find a machine with direct access to UUNET, and type the following command:

```
uucp uunet!~uucp/published/nutshell/Xuser/xshowfonts.c.Z \
          yourhost!~/yourname
```

The exclamation marks (!) wil need to be escaped with a backslah if you use the C-shell (csh) instead of the Korn or Bourne shell. The file should appear some time later (up to a day or more) in the directory */usr/spool/uucppublic/**yourname***.

You don't need to subscribe to Uunet to be able to use their archives via *uucp,* within the U.S.A. By calling 1-900-468-7727 and using the login "uucp" with no password, anyone may *uucp* any of UUNET's on-line source collection. Start by copying *uunet!~/ls-lR.Z*, which is a compressed index of every file in the archives. Peruse this file to get an idea of the programs available. The file *uunet!~/published/nutshell/ls-lR.Z* contains a listing of the files in the *published/nutshell* subdirectory (example programs for our books). As of this writing, the cost is 40 cents per minute. The charges will appear on your next telephone bill.

It is more common today to access UUNET vit the Internet. To use *ftp*, you will need to find a machine with direct access to the Internet. The following example is a sample session, with commands in boldface.

```
% ftp ftp.uu.net
Connected to ftp.uu.net.
220 uunet FTP server (Version 5.99 Wed May 23 14:40:19 EDT 1990)
ready.
Name (ftp.uu.net:ambar): anonymous
331 Guest login ok, send ident as password.
Password: vol3ol@ora.com     (use your user name and host here)
30 Guest login ok, access restrictions apply.
ftp> cd published/nutshell/Xuser
250 CWD command successful.
ftp> binary  (you must use binary transfer for compressed files)
200 Type set to I.
ftp> get xshowfonts.c.Z
200 PORT command successful.
```

```
150 Opening ASCII mode data connection for xshowfonts.c.Z (5587
bytes).
226 Transfer complete.
ftp> quit
221 Goodbye.
%
```

The file is a compressed C program. To uncompress the program, type:

```
% uncompress xshowfonts.c
```

The *compress* (and *uncompress*) programs are now shipped with most vendors' versions of UNIX and are included in System V Release 4. If you do not have them, you can get the source code (in uncompressed form, of course) from Uunet.

Finally, if you are on the Internet, the machine *export.lcs.mit.edu* is the X Consortium's public *ftp* machine; it includes the official (latest release) distribution, as well as a terrific amount of contributed software. There are other X archive sites around the Internet; consult the Frequently Asked Questions article in the mailing list *xpert@expo.lcs.mit.edu* or the USENET group *comp.windows.x* for an up-to-date list of archive sites.

These programs normally come in compressed form (as the example above) or in "compressed tar" form. The general assumption is that a C programmer will unpack, compile and install them. But it's not that hard to do this if you are not a programmer. A simple recipe is include in the book *X Window System Administrator's Guide* described below.

X Window System Administrator's Guide, with CD-ROM

X11 sources are also available bundled with a copy of Volume Eight, *X Window System Administrator's Guide* (O'Reilly & Associates, 1992). CD-ROM drives are now available for just about every workstation. Many UNIX vendors now distribute their operating systems only on CD, requiring you to buy a player. SunOS, DEC Ultrix, and SGI IRIX are currently shipping on CD-ROM, as are (optionally) MicroSoft Windows and hundreds of commercial applications, with more vendors expected to follow.

In fact, CD-ROM drives are now cheap enough that it's worth getting a CD-ROM drive and this disk even if you already have the full source of X11, because the magnetic disk space you free up can be put to other, more productive purposes.

The CD includes:

- "Rock Ridge" CDROM drivers from Young Minds, so you can install the CD as a UNIX filesystem on several UNIX platforms (current releases of SunOS already include Rock Ridge format CD's).
- Complete "core" source for MIT X11 Release 4 and 5. This includes the new R5 features, such as the font server and XCMS, the color management system.
- Complete "contrib" source for MIT X11 Release 5. This includes the complete source for the XView OPEN LOOK toolkit and several sample clients, as well as some programs not in the MIT distribution, such as *xtici*, the Tektronics Color Editor.
- Complete examples and source code from all the books in the X Window System Series.

- Programs and files that are discussed in Volume Eight. These were previously available only to administrators with Internet access.
- Pre-compiled X11 Release 5 binaries for Sun3 and Sun4 platforms running SunOS 4.1.1.

The *X Window System Adminstrator's Guide* includes directions for building and installing the MIT sources, so even if you don't currently have X up and running, you can do so with this book/CD package. Contact O'Reilly & Associates or your local bookseller.

Other Books in this series

The O'Reilly X Guides provide a comprehensive set of documents for The X Window System. Other books in the series which may be of interest to end-users include:

X Window System Administror's Guide (Volume 8). As mentioned above, this volume discusses many aspects of setting up and running the X Window System, particularly in a multi-vendor environment.

X Window System in a Nutshell. (Nutshell series) Contains reference pages for many of the standard clients, along with programmer documentation on the system.

Most of the remaining books in the series are of interest to programmers developing and maintaining X Window System applications:

Volume Zero, *X Protocol Reference Manual*, discusses the network protocol used between the X server and its clients. Of interest mainly to advanced programmers.

Volumes and Two, *XLib Programmer's Manual* and *Xlib Reference Manual* discuss the use of XLib, the lower level of access.

Volumes Four and Five, X Toolkit Intrinsics Programmer's Manual. and *X Toolkit Intrinsics Reference Manual*, discuss the details of the "Xt" toolkit library.

Volume Seven, *XView Programming Manual*, discusses Sun's XView toolkit for building OPEN LOOK applications.

Volume Six, *Motif Programming Manual*, discusses in full detail the Motif toolkit.

PHIGS Programmer's Manual. (X series, no volume number) discusses in considerable detail the use of PHIGS graphics and PEX, the Phigs Extension to X, a graphics layer that can be used on top of X.

Power Programming with RPC. (Nutshell Handbook series) discusses developing networked applications using Sun's Remote Procedure Call library, including significant discussion of developing RPC applications that work within the constraints of X toolkits such as Sun's OPEN LOOK toolkit XView and Xt (including OLIT and Motif).

Bulk Sales Information

This series of guides is routinely resold by many Workstation and X Terminal manufacturers as their official X Window System documentation. For information on volume discounts for bulk purchases, call O'Reilly & Associates, Inc., at 800-338-6887 (other numbers below), or send e-mail to *linda@ora.com* (*uunet!ora!linda*).

We will do selected customization for you. For companies requiring extensive customization of the guide, source-licensing terms are also available.

Request for Comments

Please write to tell us about any flaws you find in this manual or how you think it could be improved. This will help us to provide you with the best documentation possible.

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Font and Character Conventions

These typographic conventions are used in this book:

Italics are used for:

- new terms where they are defined.
- file and directory names, and command and client names when they appear in the body of a paragraph.

`Courier` is used within the body of the text to show:

- command lines or options that should be typed verbatim on the screen.

and is used within examples to show:

- computer-generated output.
- the contents of files.

`Courier bold` is used within examples to show command lines and options that should be typed verbatim on the screen.

`Courier italics` are used within examples or explanations of command syntax to show a parameter to a command that requires context-dependent substitution (such as a variable). For example, ***`filename`*** means to use some appropriate filename; ***`option(s)`*** means to use some appropriate option(s) to the command.

These symbols are used within the *X Window System User's Guide*:

[ ] surround an optional field in a command line or file entry.

name(1) is a reference to a command called *name* in Section 1 of the *UNIX Reference Manual* (this book may have a different name depending on the version of UNIX that you use). The OPEN LOOK-specific commands are reprinted in Part Three of this Guide.

$ is the standard prompt from the Bourne shell, *sh*(1).

% is the standard prompt from the C shell, *csh*(1).

Since there are some variations in the commands available with the various implementations of OPEN LOOK, we use the following tags:

AT&T-OL refers to a feature of the AT&T OPEN LOOK client package

OpenWindows refers to a feature of Sun's OpenWindows client/server package.

Acknowledgments

The first edition of this guide was based in part on three previous X Window System user's guides: one from Masscomp, written by Jeff Graber, one from Sequent Computer Systems, Inc., and one from Graphic Software Systems, Inc.; both were written by Candis Condo (supported by GSS' UNIX development group). Some of Jeff's and Candis's material in turn was based on material developed under the auspices of Project Athena at MIT. The first version of this guide was adapted from these works by Tim O'Reilly, and the subsequent Motif edition was prepared by Valerie Quercia.

The OPEN LOOK version of this *User's Guide* was written by Ian Darwin, but the overall design, as well as some parts (even a few whole chapters) of the text, were either adapted or borrowed intact from the "Generic X11" and Motif editions. The OPEN LOOK version was developed using Sun's OpenWindows 2., 3.0 and 3.1on Sun-3 Workstations and SPARCstations and on an AT&T 6386 WGS with AT&T's XWIN and OPEN LOOK product. Earlier versions of this guide were developed on a Sony NEWS workstation running Sony's X implementation, a Visual 640 X Display Station, and an NCD16 Network Display Station.

Mr. Darwin wishes to express his gratitudel to Sun Microsystems for ongoing provision of software, documentation, and technical support, and to AT&T and Quantum Systems for providing copies of their OPEN LOOK software and QNX-Windows systems respectively. We appreciate the support of these manufacturers in helping us develop complete and accurate X Window System documentation. Thanks are particularly due to Brad Keates of Sun Canada, Roger Nolan and Andrew Barker of Sun Microsystems, and Joanne Newbauer of AT&T. We'd also like to thank Sun for distributing the XView toolkit with an accompanying Copyright that grants permission to reprint the reference manual pages elsewhere in the CD-ROM, and to excerpt parts of the material (in particular, Appendix J, *OPEN LOOK XView Toolkit Resources*). Most of the remaining reference manual pages, those for standard MIT X clients, have been adapted from reference pages copyright © 1990-1994 the Massachusetts Institute of Technology, the X Consortium, and others. Refer to the "Authors" section at the end of each reference page for details. Other copyrights are listed on the relevant reference pages.

Mr. Darwin would like to thank the previous authors for providing the framework of this book. He also thanks the entire staff of O'Reilly and Associates for helping to produce the draft version of this book, with special thanks to Tim O'Reilly for patience above the call: this book took much longer to complete than he and I *combined* ever thought it would. "No man who is in a hurry is quite civilized." —Will Durant. The initial book design was done (initially for the *PHIGS Programming Manual* in this series) by Bill Prindle and Edie Freedman and implemented by Mike Sierra. Mike also provided invaluable assistance in learning the hidden craft of using FrameMaker. Dale Dougherty provide the initial version of the *troff*-to-Frame converter, and offered ongoing support while it was extended. Donna Woonteiler read a draft of the whole book with a careful eye to editorial regularity. Linda Walsh and Tim O'Reilly cooperated in getting clearance to reprint this work in CD-ROM form in 1995. Mr. Darwin thanks these and everyone else at O'Reilly for their unflagging assistance in bettering this book

Valerie Quercia of O'Reilly and Associates and Chuck Musciano of Harris Corporation made constructive comments on the Alpha Draft of the OPEN LOOK version of this work; their help is gratefully acknowledged.

And thanks to the staff of SoftQuad, Inc., for lending their support and for careful proofreading of many parts of the book. Liam Quin (who wrote and maintains the "Frequently Asked Questions" list on the USENET group *comp.windows.open-look*) was especially helpful.

Mr. Darwin also thanks Ken Thompson, Dennis Ritchie *et al* of the AT&T Bell Laboratories Computer Science Research department for inventing, promulgating, and extending the UNIX system; all the folks at MIT Project Athena (where X originated), the X Consortium, and elsewhere who have contributed to the design, implementation and spread of The X Window System. Special thanks to the AT&T and Sun team that originated the OPEN LOOK GUI specification.

For significant help and favors along the way, Mr. Darwin thanks Geoff Collyer, Erik Fair, Brian Kernighan, and Al Lambert. John Gilmore and Laura Creighton first got me interested in SunView, the predecessor in the Sun UNIXverse of The X Window System.

Finally, thanks to my wife Betty and children Benjamin, Andy, and Margaret for sparing me the time to write all this. Behind every parent who writes, there must be (or ought to be) a spouse as supportive as Betty. In addition, her proofreading skills salvaged scores of sick sentences.

Despite the efforts of these people, the standard authors' disclaimer applies: any errors that remain are our own.