Preface

By convention, a preface describes the book itself, while the introduction describes the subject matter. You should read through the preface to get an idea of how the book is organized, the conventions it follows, and so on.

This book describes how to write applications using the Motif toolkit from the Open Software Foundation (OSF). The Motif toolkit is based on the X Toolkit Intrinsics (Xt), which is the standard mechanism on which many of the toolkits written for the X Window System are based. Xt provides a library of user-interface objects called *widgets* and gadgets, which provide a convenient interface for creating and manipulating X windows, colormaps, events, and other cosmetic attributes of the display. In short, widgets can be thought of as building blocks that the programmer uses to construct a complete application.

However, the widgets that Xt provides are generic in nature and impose no user-interface policy whatsoever. That is the job of a user-interface toolkit such as Motif. Motif provides a complete set of widgets designed to implement the application look and feel specified in the *Motif Style Guide* and the *Motif Application Environment Specification.*

The book provides a complete programmer's guide to the Motif toolkit. While the OSF/ Motif toolkit is based on Xt, the focus of the book is on Motif itself, not on the Intrinsics. Detailed information about Xt is provided by Volume 4, and references are made to that volume throughout the course of this book. You are not required to have Volume 4 in order to use this book effectively, as the books are not companion volumes, but complementary ones. However, truly robust applications require a depth of knowledge about Xt and Xlib, the layer on which Xt itself is based, that is not addressed in this book alone. We never leave you completely in the dark about Xt or Xlib functions that we use or reference, but you won't learn everything there is to know about them through this particular volume.

This book covers Motif 2.1, which is the latest major release of the Motif toolkit. Motif 2. 1 is based on Release 6 of the Xlib and Xt specifications (X11R6). This release of Motif provides many new features, as well as a number of enhancements to existing functionality. All of the changes in Motif 2.1 are summarized in Section 3.5, which provides references to other sections that describe the changes in more detail.

The Plot

There are several plots and subplots in this book and the stories told are intertwined. Our primary goal is to help you learn about the Motif environment from both the programmer's and the user's perspectives. However, we are talking to you as a programmer, not as a user. We treat the user as a third party who is not with us now. In order to create an application for the user, you sometimes have to assume her role, so at times we may ask you to play such a role to help you think about things from the user's perspective rather than the programmer's.

Each chapter begins by discussing the goals that Motif is trying to achieve using a particular widget or gadget. For example, before we describe how to create a FileSelectionDialog, we introduce the object visually and conceptually, discuss its features and drawbacks, and put you in the role of the user. Once you understand what the user is working with, you should have a better perspective on the task of presenting it to her.

The next subplot is that of application design. Many design concepts transcend the graphical user interface (GUI) and are common to all programs that interact with users. You could even interpret this book as a programmer's guide that happens to use Motif as an example. As you read the material, you should stop and think about how you might approach a particular interface method if you were using another toolkit instead of Motif. A wild concept, perhaps, but this approach is the key to better application design and to toolkit independence. If Motif changes in a later release, or if you decide to port your application to another toolkit or even another windowing system, the more generalized your code is, the easier it will be to bring it into a new realm successfully.

The last story we are telling is that of general programming technique. By providing you with examples of good programming habits, styles, and usages, we hope to propagate a programming methodology that has proven to be successful over the years. These techniques have been applied to applications that have been ported to multiple architectures and operating systems. As an added bonus, we have thrown in a number of interesting programming tricks. No, these are not hacks, but conveniences that are particular to C, to UNIX, or even to the X Window System. We don't focus on these things, but they are made available to you in passing, so you should have no problem identifying them when they come up.

This book is intended to be used as a programmer's manual, not a reference manual. Volume 6B, contains reference material for all of the Motif library functions and widget classes. We have tried to identify those features of the toolkit that are most important for general discussion, so we do not discuss every aspect of the Motif toolkit in the body of this book.

Any major software development effort, especially in its early stages, has bugs that prevent certain features from being used and the Motif toolkit is no exception. There are some bugs

in the Motif toolkit that have not yet been worked out, but this does not imply that the toolkit is poorly written or riddled with errors. Throughout the book, we try to alert you to any potential problems you may encounter due to bugs. In some cases, there are things that work in Motif, but they are poorly designed, and we don't recommend that you use them. Again, we provide an explanation of what's going on and sometimes describe an alternative solution. There are also some features, resources, and functions available in the toolkit that are not supported by OSF. OSF reserves the right to change anything not publicly documented, so rather than discuss undocumented features, we simply ignore them.

We should also point out that this book is not intended to solve all your problems or answer all your questions concerning Motif or its toolkit. It is not going to spoon feed you by giving you step-by-step instructions on how to achieve a particular task. You are encouraged, and even expected, to experiment on your own with the example applications or, better yet, with your own programs. We want to provide you with discussion and examples that provoke you into asking questions like, "What would happen if I changed this program to do this?" It would be unrealistic to believe that we could address every problem that might come up. Rather than approaching situations using overly specific examples, we discuss them in a generalized way that should be applicable to many different scenarios.

Assumptions

The basic method for creating simple applications in Motif is conceptually simple and straightforward. Even if you only dabble in C, you can probably understand the concepts well enough to do most things. However, unless you have a strong handle on the C programming language, there is an upper limit to what you will be able to do when you try to create a full-featured, functioning application. After all, the user-interface portion of most applications should make up no more than 30-40% of the total code. The functionality of an application is up to you and is not discussed here. Without a strong background with C, or some other structured programming language, you might have a problem keeping up with the material presented here.

This book also assumes that you are familiar with the concepts and architecture of the X Toolkit Intrinsics, which are presented in Volume 4M, and Volume 5. A basic understanding of the X Window System is also useful. For some advanced topics, the reader may need to consult Volume 1, and Volume 2.

How This Book Is Organized

While this book attempts to serve the widest possible audience, that does not imply that the material is so simple that it is only useful to novice programmers. In fact, this book can be considered an advanced programmer's handbook, since in many places, it assumes a fairly sophisticated knowledge of many features of the X Window System.

Each chapter is organized so that it gets more demanding as you read through it. Each chapter begins with a short introduction to the particular Motif element that is the subject of the chapter. The basic mechanics involved in creating and manipulating the object are addressed next, followed by the resources and other configurable aspects of the object. If there is any advanced material about the object, it is presented at the end of the chapter. Many chapters also include exercises that suggest how the material can be adapted for uses not discussed explicitly in the text.

While the chapters may be read sequentially, it is certainly not required or expected that you do so. As you will soon discover, there are many circular dependencies that justify skipping around between chapters. Since there is no organization that would eliminate this problem, the material is not organized so that you "learn as you go." Instead, we organized the material in a top-down manner, starting with several chapters that provide an introduction to the Motif look and feel, followed by chapters organized on a widget-by-widget basis. The higher-level manager widgets are discussed first, followed by the primitive widgets and gadgets. Advanced material is positioned at the end of the book, since the details are not of paramount importance to the earlier material.

In short, everything is used everywhere. Starting at the beginning, however, means that we won't necessarily assume you know about the material that is referenced in later chapters. On the other hand, the later chapters may make the assumption that you are aware of material in earlier chapters.

The book is broken down into twenty seven chapters and one appendix as follows:

Chapter 1

Introduction to Motif answers the question "Why Motif?" and suggests some of the complexities that the programmer has to master in order to make an application easy to use.

Chapter 2

The Motif Programming Model teaches the fundamentals of Motif by example. It presents a simple "Hello, World" program that shows the structure and style common to all Motif programs. Much of this material is already covered in detail in Volume 4M,so the chapter can be read as a refresher, or a light introduction for those who haven't read the earlier book. The chapter references Volume 4 and Volume 1, to point out areas that the programmer needs to understand before progressing with Motif.

Chapter 3

Overview of the Motif Toolkit explains what is involved in creating a real application. The chapter discusses the arrangement of primitive widgets in an interface, the use of dialog boxes and menus, and the relationship between an application and the window manager. The chapter also describes all of the changes in Release 2.1 of the Motif toolkit. After reading this chapter, the programmer should have a solid overview of

Motif application programming and be able to read the remaining chapters in any order.

Chapter 4

The Main Window describes the Motif MainWindow widget, which can be used to frame many types of applications. The MainWindow is a manager widget that provides a MenuBar, a scrollable work area, and various other optional display and control areas.

Chapter 5

Introduction to Dialogs describes the fundamental concepts that underly all Motif dialogs. It provides a foundation for the more advanced material in the following chapters. In the course of the introduction, this chapter also provides details on Motif's predefined MessageDialog classes.

Chapter 6

Selection Dialogs presents the more complex Motif-supplied dialogs for displaying selectable items, such as lists of files or commands, to the user.

Chapter 7

Custom Dialogs describes how to create new dialog types, either by customizing Motif dialogs or by creating entirely new dialogs.

Chapter 8

Manager Widgets provides detailed descriptions of the various classes of Motif manager widgets. Useful examples explore the various methods of positioning components in Form and RowColumn widgets.

Chapter 9

The Container and Icon Gadget describes two components which are new to Motif 2. These were designed to work together in order to provide a more graphical presentation of the front end of the application than the older Main Window. The IconGadget pictorially represents application objects; the Container lays them out in a variety of styles, including Tablular, Grid, and Tree formats. The layout can be changed dynamically: the Container and IconGadget combination approximates to a Model-View-Controller (MVC) system for the Motif widget set.

Chapter 10

ScrolledWindows and ScrollBars describes the ins and outs of scrolling, with particular attention to application-defined scrolling, which is often required when the simple scrolling provided by the ScrolledWindow widget is insufficient.

Chapter 11

The DrawingArea Widget describes the Motif DrawingArea widget, which provides a canvas for interactive drawing. The chapter simply highlights, with numerous code examples, the difficulties that may be encountered when working with this widget, rather

than trying to teach Xlib drawing techniques. Some knowledge of Xlib is assumed; we direct the reader to Volume 1, for additional information.

Chapter 12

Labels and Buttons provides an in-depth look at labels and buttons, the most commonly-used primitive widgets. The chapter discusses the Label, PushButton, ToggleButton, ArrowButton, and DrawnButton widget classes.

Chapter 13

The List Widget describes yet another method for the user to exert control over an application. A List widget displays a group of items from which the user can make a selection.

Chapter 14

The ComboBox Widget describes another component which is new in Motif 2. The ComboBox combines List display with Text input, although the List can be hidden until required. The widget therefore maximizes user convenience using the minimal of screen space.

Chapter 15

The SpinBox and SimpleSpinBox Widgets are also new in Motif 2. Similar in concept to the ComboBox, the widgets allow the user to choose from a set of values, and the current choice is presented through a TextField. The difference is that the user changes the current choice not by selecting from a List, but by rotating through the set of available values using ArrowButtons provided for the purpose.

Chapter 16

The Scale Widget describes how to use the Scale to display a range of values.

Chapter 17

The Notebook Widget describes a component which provides page or tab manager functionality to the Motif 2 toolkit. The programmer adds children to the Notebook, only one of which is visible at any given time. The user can select between pages using Tabs (PushButtons) aligned along the edges of the Notebook, or by selecting the required page number from a SpinBox which the Notebook creates automatically.

Chapter 18

Text Widgets explains how the Text and TextField widgets can be used to provide text entry in an application, from a single data-entry field to a full-fledged text editor. Special attention is paid to problems such as how to mask or convert data input by the user so as to control its format. The chapter also discusses the internationalization features of the widgets provided in Motif 1.2.

Chapter 19

Menus describes the menus provided by the Motif toolkit.The chapter examines how menus are created and presents some generalized menu creation routines.

Chapter 20

Interacting With the Window Manager provides additional information on the relation-
ship between an application and the Motif Window Manager (*mwm*). It discusses the
shell widget resources and window manager protocols that can be used to communi-
cate with the window manager. It also discusses various CDE desktop aspects of the
window manager interaction.

Chapter 21

The Clipboard describes a way for the application to interact with other applications.
Data is placed on the clipboard, where it can be accessed by other windows on the
desktop, regardless of the applications with which they are associated.

Chapter 22

Drag and Drop presents the drag and drop mechanism for transferring data that is pro-
vided in Motif 1.2. The chapter describes the built-in drag and drop features of the Mo-
tif toolkit and provides examples of adding drag and drop functionality to an
application.

Chapter 23

The Uniform Transfer Model describes the scheme introduced in Motif 2 which allows
the programmer to handle the various data transfer operations supported by Motif (Pri-
mary and Secondary Selections, the Clipboard, Drag-and-Drop) using a single pro-
gramming interface.

Chapter 24

Render Tables describes the Motif 2 mechanisms which control the way in which com-
pound strings are displayed by the toolkit. In Motif 2, strings which appear in widgets
can be multi-colored, multi-font, and laid out in a multi-column arrangement. The col-
oration, font, and tabular information is held separately from the string which is to be
drawn in the form of a render table.

Chapter 25

Compound Strings describes Motif's technology for encoding font and directional in-
formation in the strings that are used by almost all Motif widgets. It discusses how to
use compound strings in an internationalized application.

Chapter 26

Signal Handling presents the problems that can be encountered when mixing UNIX
signals with X applications. It explains how signals work and why they can wreak such
havoc with X. It presents the new features of X11R6 which are expressly designed to
handle this problem.

Chapter 27

Advanced Dialog Programming describes the issues involved in creating multi-stage
help systems, using WorkingDialogs that allow the user to interrupt long-running
tasks, and dynamically changing the pixmaps displayed in a dialog.