TriTeal Enterprise Desktop (TED™) 4.0

Programmer's Guide

TriTeal™

Printed in USA

Part No. TED008004000

Printing History
August 1995 ... First Edition
Printed in the U.S.A

Sales Information and Technical Support

TriTeal Corporation
2011 Palomar Airport Road, Suite 200
Carlsbad, CA 92009
USA

Tel: (619) 930-2077
Fax: (619) 930-2081
Support E-Mail: support@triteal.com
Sales E-Mail: info@triteal.com
World Wide Web: http://www.triteal.com/

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Preface

Who Should Use This Book

Use this book if you are a programmer interested in integrating an existing application into the TriTeal Enterprise Desktop (TED), or in developing a new application that uses the features and functionality of TED. This book describes the TED development environment, and assumes that you are familiar with Motif®, X, UNIX®, or C programming.

Before You Read This Book

The TriTeal Enterprise Desktop: *Programmer's Guide* is a collection of programming information. The manuals listed in the section "Related Books" should be read before you begin integration of any applications to TED.

The *TriTeal Enterprise Desktop: Programmer's Overview* provides a description of TED and introduces the programming environment.

How This Book Is Organized

The *TriTeal Enterprise Desktop: Programmer's Guide* has two parts. Each part provides a detailed description of each element of the TriTeal Enterprise Desktop, a conceptual diagram, and a task-oriented description of how to use each element, complete with code examples.

Part 1 — "Basic Integration" introduces how to register your application and printing levels.

Chapter 1, "Basic Application Integration" describes the steps involved with the basic integration of an existing application into TED.

Part 2 — "Recommended Integration" introduces how to integrate existing applications into the TriTeal Enterprise Desktop.

Chapter 2, "Integrating Fonts" describes how to use generic standard font descriptions to ensure that you get the closest matching font for your application on any TED-compliant system.

Chapter 3, "Displaying Errors from Your Application" describes a common model for presenting information and error messages.

Chapter 4, "Integrating with Session Manager" describes the ICCM session management protocol and provides examples of how to integrate your application with Session Manager.

Chapter 5, "Integrating with Drag and Drop" describes the drag-and-drop user model, the new drag-and-drop application program interface (API), and how to use drag and drop.

Part 3 — "Optional Integration" describes how to integrate new applications with the Session Manager and with drag and drop. It also explains how locales affect the Login Manager, Window Manager, and the terminal emulator.

Chapter 6, "Integrating with the Workspace Manager" describes how to integrate your application with the Workspace Manager in specialized ways.

Chapter 7, "TriTeal Enterprise Desktop Motif Widgets" describes how to use the custom widgets that are provided as part of TED.

Chapter 8, "Invoking Actions from Applications" describes how to create actions within your application.

Chapter 9, "Accessing the Data-Typing Database" describes the data-typing functions and how to use the data-typing database.

Chapter 10, "Integrating with Calendar" introduces the Calendar API, including functions, data structures, calendar attributes, and entry attributes. It also describes how to use the Calendar API.

Glossary is a list of words and phrases found in this book and their definitions.

Related Books

Before beginning integration of your application into TED, you should become familiar with the other books in the documentation set. See "Development Environment Documentation" for a list of the companion books.

The run-time environment documentation set consists of:

- *TriTeal Enterprise Desktop: User's Guide*
- *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide*
- Online help volumes

Note – The *Advanced User's and System Administrator's Guide* contains information to help you integrate an application into the desktop.

For more information about the Calendaring and Scheduling API, contact the X.400 API Association for the latest copy of the *XAPIA Specification*. The address is X.400 API Association, 800 El Camino Real, Mountain View, California, 94043.

Development Environment Documentation

This section provides an overview of each manual—except for the *Programmer's Guide*—in the developer documentation set. In addition to the *Programmer's Guide*, the development environment documentation set consists of:

- *TriTeal Enterprise Desktop: Style Guide and Certification Checklist*
- *TriTeal Enterprise Desktop: Application Builder User's Guide*
- *TriTeal Enterprise Desktop: Programmer's Overview*
- *TriTeal Enterprise Desktop: Help System Author's and Programmer's Guide*
- *TriTeal Enterprise Desktop: ToolTalk Messaging Overview*
- *TriTeal Enterprise Desktop: Internationalization Programmer's Guide*
- *TriTeal Enterprise Desktop: Desktop Korn Shell User's Guide*
- Online man pages

TriTeal Enterprise Desktop: Programmer's Overview

The *TriTeal Enterprise Desktop: Programmer's Overview* has two parts. Part 1 contains an architectural overview of the TriTeal Enterprise Desktop, including high-level information on both the run-time and development environments. Part 2 contains information useful to know before developing an application, and describes the development environment components.

The *TriTeal Enterprise Desktop: Programmer's Overview* provides a high-level view of the TriTeal Enterprise Desktop development environment and the developer documentation set. Read this book first before starting application design and development.

TriTeal Enterprise Desktop: Style Guide and Certification Checklist

The *TriTeal Enterprise Desktop: Style Guide and Certification Checklist* provides application design style guidelines and the list of requirements for TriTeal Enterprise Desktop application-level certification. These requirements consist of the Motif Version 1.2 requirements with TriTeal Enterprise Desktop-specific additions.

The checklist describes keys using a model keyboard mechanism. It assumes that your application is being designed for a left-to-right language environment in an English-language locale. Wherever keyboard input is specified, the keys are indicated by the engravings on the Motif model keyboard. Mouse buttons are represented using a virtual button mechanism to specify behavior independent of the number of buttons on the mouse.

This book provides information to assist the application designer in developing consistent applications and behaviors within the applications.

TriTeal Enterprise Desktop: Application Builder User's Guide

The TriTeal Enterprise Desktop Application Builder (also called *App Builder*) is an interactive tool for developing TriTeal Enterprise Desktop applications. AppBuilder provides features that facilitate both the construction of an application graphical user interface (GUI) and the incorporation of the desktop's many useful desktop services (such as Help, ToolTalk, and Drag and Drop). The *TriTeal Enterprise Desktop: Application Builder User's Guide* explains how to create an interface by dragging and dropping "objects" from a palette. The guide also explains how to make connections between objects in the interface, use the application framework editor to easily integrate desktop services, generate C code, and add application code to the App Builder output to produce a finished application.

TriTeal Enterprise Desktop: Help System Author's and Programmer's Guide

The *TriTeal Enterprise Desktop: Help System Author's and Programmer's Guide* describes how to develop online help for application software. It covers how to create help topics and integrate online help into a Motif application.

The audience for this book includes:

- Authors who design, create, and view online help information
- Developers who want to create software applications that provide a fully integrated help facility

This book has four parts. Part1 describes the collaborative role that authors and developers undertake to design application help. Part 2 provides information for authors organizing and writing online help. Part 3 describes the Help System application programmer's toolkit. Part 4 contains information for both authors and programmers about preparing online help for different language environments.

TriTeal Enterprise Desktop: ToolTalk Messaging Overview

The *TriTeal Enterprise DesktopTriTeal Enterprise Desktop: ToolTalk Messaging Overview* describes the ToolTalk components, commands, and error messages offered as convenience routines to enable your application to conform to Media Exchange and Desktop Services message set conventions. This manual is for developers who create or maintain applications that use the ToolTalk® service to interoperate with other applications.

The *ToolTalk Messaging Overview* does *not* describe general ToolTalk functionality. For detailed information about the ToolTalk service, refer to *The ToolTalk Service: An Inter-Operability Solution*. For tips and techniques to help make using ToolTalk easier, read *ToolTalk and Open Protocols: Inter-Application Communication*.

TriTeal Enterprise Desktop: Internationalization Programmer's Guide

The *TriTeal Enterprise Desktop: Internationalization Programmer's Guide* provides information for internationalizing an application so that it can be easily localized to support various languages and cultural conventions in a consistent user interface.

Specifically, this guide:

- Provides guidelines and hints for developers on how to write applications for worldwide distribution.
- Provides an overall view of internationalization topics that span different layers within the desktop.
- Provides pointers to references and more detailed documentation. In some cases, standard documentation is referenced.

This guide is not intended to duplicate the existing reference or conceptual documentation, but rather to provide guidelines and conventions on specific internationalization topics. It focuses on internationalization topics and not on any specific component or layer in an open software environment.

TriTeal Enterprise Desktop: Desktop Korn Shell User's Guide

The *TriTeal Enterprise Desktop: Desktop Korn Shell User's Guide* describes how to create Motif applications with Desktop Korn Shell (`dtksh`) scripts. It contains several example scripts of increasing complexity, in addition to the basic information a developer needs to get started.

This guide is intended for developers who find a shell-style scripting environment suitable for a particular task. It assumes a knowledge of Korn Shell programming, Motif, the Xt Intrinsics, and, to a lesser extent, Xlib.

What Typographic Changes and Symbols Mean

The following table describes the type changes and symbols used in this book.

Table P-1 Typographic Conventions

Typeface or Symbol	Meaning	Example
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. system% You have mail.
AaBbCc123	Command-line placeholder: replace with a real name or value	To delete a file, type `rm` *filename*.
AaBbCc123	Book titles, new words or terms, or words to be emphasized	Read Chapter 6 in *User's Guide*. These are called *class* options. You *must* be root to do this.
Code samples are included in boxes and may display the following:		
`%`	UNIX C shell prompt	`system%`
`$`	UNIX Bourne and Korn shell prompt	`system$`
`#`	Superuser prompt, all shells	`system#`

Part 1 — Basic Integration

Chapter 1 describes some basic integration and printing features.

Basic Application Integration 1

Basic application integration is a set of highly recommended tasks you should perform.

Basic integration does not involve extensive use of the desktop application programmer's interface (API). Therefore, it does not provide other interaction with the desktop, such as drag and drop, session management, ToolTalk® messaging, and programmatic access to the actions and data typing database.

A few of the integration tasks covered in this chapter require source code modification. They are optional, and are discussed here because they are closely related to basic integration tasks.

Basic Integration Features

Basic application integration provides these features for end users:

- A graphical way to locate and start your application on the desktop

Your application will provide a desktop *registration package*, and your installation script will automatically register your application.

Registration creates an application group at the top level of Application Manager. The application group contains an icon the user double-clicks to start the application.

- The ability to recognize and manipulate your application's data files

  Your application will provide data types for its data files.

  Data typing configures data files to use a unique icon to help users identify them. The data files also have meaningful desktop behavior. For example, the user can start your application by double-clicking a data file; dropping a data file on a desktop printer drop zone prints the file using the appropriate print command.

- Easy font and color selection using Style Manager

  Your application will change interface fonts and background, foreground, and shadow colors dynamically.

  The desktop defines general interface font and color resources that are used if no corresponding application-specific resources exist.

Basic integration provides these advantages to system administrators:

- Easy installation and registration

  Upon installation, the application is automatically registered. The system administrator has little or no additional work to do.

- Easy ongoing administration

  All the desktop's configuration files are gathered in one location. Furthermore, the application can easily be unregistered if, for example, the administrator wants to update it or to move it to a different application server.

Organization of Basic Integration Information

Most of the tasks involved in basic integration are also performed by system administrators who are integrating an existing application into the desktop. Therefore, most basic integration documentation is located in the chapter “Registering an Application” in the *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide*.

This chapter guides you to that information and contains additional information specific to application programmers.

Basic Integration Tasks

These are the general tasks involved in basic integration:

- Modify any application resources that set fonts and colors. This allows users to change the application's interface fonts and colors using Style Manager.

  See the section on modifying font and color resources in the chapter “Registering an Application” in the *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide*.

- Create the registration package for your application.

  See the text, “Creating a Registration Package for Your Application and “Registering an Application” in the *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide.*

- Modify your application's installation script to install the registration package files and perform the registration procedure.

  See the section on registering the application using `dtappintegrate` in the chapter “Registering an Application” in the *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide*

- Print application data files on networked and local printers. The desktop printer model provides a graphical way for users to print and is built on top of the native networking capabilities of the UNIX `lp` service.

Levels of Printing Integration

The printing functionality available to the user depends on the level of integration you use. There are three levels of integration:

- Complete integration. See “Complete Print Integration” on page 6.

  You should do complete integration if you have the ability to modify the application’s source code.

  When you do complete print integration, users can print data files on various printers by dropping them on printer drop zones (the Front Panel Printer control and printer icons in Print Manager). Certain other desktop behaviors are also implemented (see “Desktop Printing Environment Variables” on page 6).

- Partial integration. See “Partial Print Integration” on page 10.

  You should do partial integration if you do not have the ability to modify the application’s source code, but you do have the ability to invoke printing via an action.

  When you do partial integration, your application provides a subset of full-integration functionality. For example, by using the `LPDEST` environment variable, your application’s printing mechanism will obtain the print destination from the drop zone.

- No integration. See “Nonintegrated Printing” on page 13.

  If an application can not supply a print action for its data files, you should configure the data files to display an error dialog box when users drop the files on printer drop zones.

Complete Print Integration

To do complete print integration, your application must:

- Provide a Print action.
- Use (dereference) the four desktop printing environment variables.

Desktop Printing Environment Variables

To have fully integrated printing, your application must dereference the following four environment variables. The `LPDEST` variable is particularly important. It provides the ability for the user to choose the print destination by using a particular printer drop zone.

Printing Variable	Description

`LPDEST`	Uses the specified value as the printer destination for the file. If the variable is not set, the default printing device for your application should be used.
`DTPRINTUSERFILENAME`	Specifies the name of the file as it should appear in the Print dialog or print output. If the variable is not set, the actual file name should be used.
`DTPRINTSILENT`	Specifies whether to display a Print dialog box. When the variable is set to True, the Print dialog should not be displayed. If the variable is not set, the dialog box should be displayed.
`DTPRINTFILEREMOVE`	When the variable is set to True, the file should be removed after it is printed. This functionality is intended for temporary files that don't need to be retained after printing is complete. If the variable is not set, the file should not be removed.

A Fully Integrated Print Action

The Print action is part of the registration package, provided in a configuration file, *app_root*`/dt/appconfig/types/language/`*name*`.dt`.

If your print action executes a program that dereferences the four environment variables indicated in "Desktop Printing Environment Variables," then your data type is fully integrated. The Print action must be written to be specific for the application's data type and should accept only a single file.

For example, the following print action is specific for a data type named `ThisAppData`:

```
Print

{
ARG_TYPEThisAppData
EXEC_STRINGprint_command -file %(file)Arg_1%
}
```

If your application handles the Print ToolTalk request, then your print action could send a variant of it with the following actions. (If any of the four environment variables are not set, the corresponding message argument will be null. When the message argument is null, refer to "Desktop Printing Environment Variables" for the default interpretation.)

```
ACTION Print
{
    ARG_TYPEThisAppData
    ARG_CLASSFILE
    ARG_COUNT1
    TYPE    TT_MSG
    TT_CLASSTT_REQUEST
    TT_SCOPETT_SESSION
    TT_OPERATIONPrint
    TT_FILE %Arg_1%
    TT_ARG0_MODETT_IN
    TT_ARG0_VTYPE%Arg_1%
    TT_ARG1_MODETT_IN
    TT_ARG1_VTYPELPDEST
    TT_ARG1_VALUE$LPDEST
    TT_ARG2_MODETT_IN
    TT_ARG2_VTYPEDTPRINTUSERFILENAME
    TT_ARG2_VALUE$DTPRINTUSERFILENAME
    TT_ARG3_MODETT_IN
    TT_ARG3_VTYPEDTPRINTSILENT
    TT_ARG3_VALUE$DTPRINTSILENT
    TT_ARG4_MODETT_IN
    TT_ARG4_VTYPEDTPRINTFILEREMOVE
    TT_ARG4_VALUE$DTPRINTFILEREMOVE
}

ACTION Print
{
    ARG_TYPEThisAppData
```

```
    ARG_CLASSBUFFER
    ARG_COUNT1
    TYPE    TT_MSG
    TT_CLASSTT_REQUEST
    TT_SCOPETT_SESSION
    TT_OPERATIONPrint
    TT_ARG0_MODETT_IN
    TT_ARG0_VTYPE%Arg_1%
    TT_ARG0_VALUE%Arg_1%
    TT_ARG1_MODETT_IN
    TT_ARG1_VTYPELPDEST
    TT_ARG1_VALUE$LPDEST
    TT_ARG2_MODETT_IN
    TT_ARG2_VTYPEDTPRINTUSERFILENAME
    TT_ARG2_VALUE$DTPRINTUSERFILENAME
    TT_ARG3_MODETT_IN
    TT_ARG3_VTYPEDTPRINTSILENT
    TT_ARG3_VALUE$DTPRINTSILENT
    TT_ARG4_MODETT_IN
    TT_ARG4_VTYPEDTPRINTFILEREMOVE
    TT_ARG4_VALUEfalse
}
```

Creating Print Actions for Filtered Data or Data Ready to Print

The desktop print utility `/usr/dt/dtlp` provides functionality on top of the `lp` subsystem. It gathers `lp` print options and prints the specified file.

Your application can use `dtlp` if either of the following conditions are true:

- The data files do not need to be processed before they are sent to a printer.
- *Or*, your application provides a filter for converting its data files to a ready-to-print form.

For more information about `dtlp`, see the `dtlp(1)` man page.

If the file is ready to print, the Print action runs `dtlp` in the `EXEC_STRING.` For example:

```
Print
{
    ARG_TYPE       ThisAppData
    EXEC_STRING    dtlp %Arg_1%
}
```

If the application provides a conversion filter, the filter must be run before running `dtlp.` For example:

```
Print
{
    ARG_TYPE       MyAppData
    EXEC_STRING    /bin/sh `cat %Arg_1%| filter_name | dtlp`
}
```

where *filter_name* is the name of the print filter.

Partial Print Integration

To do partial print integration, your application must provide:

- A Print action
- The extent to which printing is integrated depends on which, if any, of the printing environment variables are handled by the action.

Providing the Print Command for Partial Integration

To provide partial print integration, your application must provide a print command line of the form:

print_command `[`*options*`]-file` *filename*

where *options* provides a mechanism for dereferencing none, some, or all of the printing environment variables (see "Desktop Printing Environment Variables" on page 6).

The simplest form of this print command line omits *options*.

print_command `-file` *filename*

This command line lets users print your application's data files using the desktop printer drop zones. However, printing destination is not set by the drop zone. In addition, other print behaviors set by the environment variables are not implemented. For example, the desktop may not be able to direct silent printing or remove temporary files.

If your print command line provides additional command-line *options* that correspond to the desktop printing environment variables, you can provide additional integration.

For example, the following command line provides the ability to dereference `LPDEST`:

print_command `[-d` *destination*`] [-file` *filename*`]`

where:

destination is the destination printer.

The next print command line provides options for dereferencing all four variables:

print_command `[-d` *destination*`] [-u` *user_file_name*`] [-s] [-e] -file` *filename*

where:

user_file_name	The file name as seen by the user.
`-s`	Printing is silent (no Print dialog box is displayed).
`-e`	The file is removed after it is printed.

The dereferencing occurs in the action definition. See the section, "Desktop Printing Environment Variables" on page 6 for more information.

Turning Environment Variables into Command Line Switches

If your action is not capable of dereferencing the four environment variables, but it is capable of taking corresponding command line options, this subsection explains how to turn the environment variable values into command line options.

For example, this is a simple Print action that deferences `LPDEST`:

```
Print
{
    ARG_TYPE        data_type
    EXEC_STRING     print_command -d $LPDEST -file %(file)Arg_1%
}
```

However, this Print action may create unpredictable behavior if `LPDEST` is not set.

One way to create a Print action that provides proper behavior when variables are not set is to create a shell script that is used by the Print action.

For example, the following action and the script it uses properly handle all four environment variables:

```
Print
    ARG_TYPE        data_type
    EXEC_STRING     app_root/bin/envprint %(File)Arg_1%
}
```

The contents of the `envprint` script follows:

```
#!/bin/sh
# envprint - sample print script
DEST=""
USERFILENAME=""
REMOVE=""
SILENT=""

if [ $LPDEST ] ; then
    DEST="-d $LPDEST"
fi

if [ $DTPRINTUSERFILENAME ] ; then
    USERFILENAME="-u $DTPRINTUSERFILENAME"
fi

DTPRINTFILEREMOVE=echo $DTPRINTFILEREMOVE | tr "[:upper:]"
"[:lower:]"`
if [ "$DTPRINTFILEREMOVE" = "true" ] ; then
    REMOVE="-e"
fi

DTPRINTSILENT=`echo $DTPRINTSILENT | tr "[:upper:]" "[:lower:]"`
if [ "$DTPRINTSILENT" = "true" ] ; then
    SILENT="-s"
```

```
fi

print_command $DEST $USERFILENAME $REMOVE $SILENT -file $1
```

Nonintegrated Printing

If your application does not integrate printing with the desktop, users must open your application to properly print data files.

Nevertheless, you should provide a Print action that runs when users drop your application's data files on a printer drop zone. Otherwise, the desktop may assume that the file contains text data, and the print output will be garbled.

The desktop provides a print action for this purpose named NoPrint. The NoPrint action displays a dialog box telling users that the data files cannot be printed using the printer drop zones.

The NoPrint action displays the Unable to Print dialog box shown in Figure 1-1.

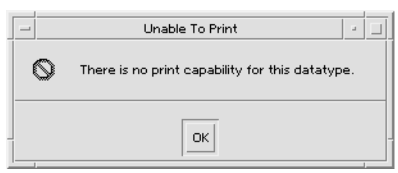


Figure 1-1 Dialog box displayed by the built-in NoPrint action

To use the Unable to Print dialog box, create a print action specific to your data type that maps to the NoPrint action. For example, suppose the data type for your application is:

```
DATA_ATTRIBUTES MySpreadSheet_Data1
{
    ACTIONS         Open, Print
    ICON            DtSpread
    NAME_TEMPLATE   %s.ss
}
```

The following Print action maps to the NoPrint for this data type:

```
ACTION Print
{
    ARG_TYPE        MySpreadSheet_Data1
```

```
    TYPE           MAP
    MAP_ACTION     NoPrint
}
```

Creating a Registration Package for Your Application

The desktop registration package you create for an application should become part of the application's installation package. The procedures for creating a registration package are also performed by system administrators integrating existing applications into the desktop. These procedures are documented in the chapter "Registering an Application" in the *TriTeal Enterprise Desktop: Advanced User's and System Administrator's Guide*.

Part 2 — Recommended Integration

Chapters 2 through 5 describe how to perform the following recommended integration tasks:

- Use standard font aliases so that your application uses the closest matching font on any desktop-compliant system.
- Display error messages from your application.
- Integrate with the Session Manager to preserve the state of the application at logout.
- Implement drag and drop in your application as a direct-manipulation accelerator *for existing functionality.*

Integrating Fonts 2

Your application may be used by someone sitting at an X terminal, or by someone at a remote workstation across a network. In these situations, the fonts available to the user's X display from the X window server might be different from your application's defaults, and some fonts may not be available.

The standard interface font names defined by TED are guaranteed to be available on all CDE-compliant systems. These names do not specify actual fonts. Instead, they are aliases that each system vendor maps to its best available fonts. If you use only these font names in your application, you can be sure of getting the closest matching font on any CDE-compliant system.

These standard interface font names are guaranteed to be available for all locales, whereas the standard application font names are only guaranteed for ISO Latin locales. See the man pages, `DtStdInterfaceFontNames` and `DtStdAppFontNames` for more information.

Standard Interface Fonts

Default Font Names

The set of standard interface font names is defined by the XLFD field name values described in Table 2-2.

Table 2-1 Field Name Values for Standard Interface Font Names

Field	Value	Description
FOUNDRY	dt	TED name
FAMILY_NAME	interface system or interface user	TED standard interface font name
WEIGHT_NAME	medium or bold	Weight of the font
SLANT	r	Roman
SET_WIDTH	normal	Normal set width
SPACING	p or m	
ADD_STYLE	size hint sans or serif	Proportional or Monospace values from xxs to xxl Sans for sans serif font or serif for serif
PIXEL_SIZE	Platform dependent	
POINT_SIZE	Platform dependent	
RESOLUTION_X	Platform dependent	
RESOLUTION_Y	Platform dependent	
AVERAGE_WIDTH	m p	Monospace for user font Proportional for system font
NUMERIC FIELD	Platform dependent	
CHAR_SET_REGISTRY	Locale Dependent	
ENCODING	Locale Dependent	

Point Sizes for Standard Interface Fonts

The seven named point sizes for each of the three styles are prepend in the `ADD_STYLE_NAME` field. The font XLFD patterns matching these names can match a named size, not a numeric size. These named sizes are used because the exact size of an interface font is less important than its nominal size, and implementation differences for the hand-tuned interface fonts do not allow common numeric point sizes to be assured across systems.

The seven nominal sizes are as follows:

```
xxs  extra extra small
xs   extra small
s    small
m    medium
l    large
xl   extra large
xxl  extra extra large
```

The goal of these named sizes is to provide enough fonts to display a variety monitor sizes and resolutions that TED will run on, and the range of user preferences for comfortably reading button labels, window titles and so forth, can be accommodated in the GUI. Both the smallest size, xxs, and the largest size, xxl, are meant to be reasonable sizes for displaying and viewing the TED desktop on common displays and X terminals; they are not meant to imply either hard-to-read fine print or headline-sized display type.

Patterns for the Standard Interface Font Names

Using these values, the XLFD pattern

```
-dt-interface*-*
```

logically matches the full set of XTED Standard Interface Font Names. (Note that no specific X server behavior is implied).

For example, in Western locales, the full set of 21 TED Standard Interface Font Names can be represented:

```
-dt-interface system-medium-r-normal-*-*-*-*-*-*-*-iso8859-1
-dt-interface user-medium-r-normal-*-*-*-*-*-m-*-iso8859-1
-dt-interface user-bold-r-normal-*-*-*-*-*-m-*-iso8859-1
```

The full set of patterns in the `app-defaults` files for all seven system font sizes is:

```
-dt-interface system-medium-r-normal-xxs*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-xs*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-s*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-m*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-l*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-xl*-*-*-*-*-*-*-iso8859-1
-dt-interface system-medium-r-normal-xxl*-*-*-*-*-*-*-iso8859-1
```

These patterns could be used in a resource file and will match the full TED Standard Interface Names for the iso Latin-1 locales on all CDE-compliant systems. For more information, see the `DtStdInterfaceFontNames(5)` man page.

Using Fonts in TED Configuration Files

TED specifies a set of generic standard application font names, in several sizes, that can be used by applications running under TED on all platforms. Each TED vendor maps the standard set of font names to its available fonts. The mapping of font names to existing fonts may vary from vendor to vendor.

When you use the standard application font names in your `app-defaults` files, you can use a single `app-defaults` file across all TED platforms. If you don't use the standard font names, you must supply different `app-defaults` files for each application on each TED platform.

All TED systems provide a set of 13 standard application font names, in at least 6 sizes, that represent 12 generic design and style variations (serif and sans serif), as well as a symbol font. These standard names are provided in addition to the names of the fonts that the standard names are mapped to for a particular TED platform. An additional four standard font names—to allow both serif and sans serif designs in a monospaced font—may also be provided by TED platform vendors.

These 13 font names are provided in TED platforms for the locales using the ISO 8859-1 character set. See the *TriTeal Enterprise Desktop: Internationalization Programmer's Guide* for information on using standard font names in other locales.

Standard Application Fonts

Default Font Names

The set of standard application default font names is defined by the XLFD field name values described in Table 2-2.

Table 2-2 Field Name Values for Standard Application Font Names

Field	Value	Description
FOUNDRY	dt	TED name
FAMILY_NAME	application	TED standard application font name
WEIGHT_NAME	medium or bold	Weight of the font
SLANT	r i	Roman Italic
SET_WIDTH	normal	Normal set width
ADD_STYLE	sans serif	Sans serif font Serif font
PIXEL_SIZE	*	Platform dependent
POINT_SIZE	*pointsize*	Point size of the desired font
RESOLUTION_X	*	Platform dependent
RESOLUTION_Y	*	Platform dependent
AVERAGE_WIDTH	p m	Proportional Monospace
NUMERIC FIELD	*	Platform dependent
CHAR_SET_REGISTRY	iso8859-1	Defining standards authority
ENCODING	1	Character set number

The standard names are available using the regular X Windows XLFD font-naming scheme. When properly specified with appropriate wildcards for the platform-dependent fields, a TED font name is guaranteed to open a valid, corresponding platform-dependent font. The `XLFD` name returned from a call to the Xlib `XListFont` function, however, is not guaranteed to be the same on all TED platforms.

Using these values, the XLFD pattern

```
-dt-application-*
```

matches the full set of TED standard application font names on a given platform. The pattern

```
-dt-application-bold-*-*-*-*-*-*-*-p-*-*-*-
```

matches the bold, proportionally spaced TED fonts, both serif and sans serif. And the pattern

```
-dt-application-*-*-*-*-*-*-*-*-m-*-*-*-
```

matches the monospaced fonts (whether serif or sans serif, or both).

The full set of TED Standard Application Font Names can be represented as follows:

```
-dt-application-bold-i-normal-serif-*-*-*-*-p-*-iso8859-1
-dt-application-bold-r-normal-serif-*-*-*-*-p-*-iso8859-1
-dt-application-medium-i-normal-serif-*-*-*-*-p-*-iso8859-1
-dt-application-medium-r-normal-serif-*-*-*-*-p-*-iso8859-1
-dt-application-bold-i-normal-sans-*-*-*-*-p-*-iso8859-1
-dt-application-bold-r-normal-sans-*-*-*-*-p-*-iso8859-1
-dt-application-medium-i-normal-sans-*-*-*-*-p-*-iso8859-1
-dt-application-medium-r-normal-sans-*-*-*-*-p-*-iso8859-1
-dt-application-bold-i-normal-*-*-*-*-*-m-*-iso8859-1
-dt-application-bold-r-normal-*-*-*-*-*-m-*-iso8859-1
-dt-application-medium-i-normal-*-*-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-*-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-*-*-*-*-p-*-dtsymbol-1
```

Point Sizes for Standard Application Fonts

The complete set of point sizes available for each of the standard application font names is determined by the set of fonts shipped with a vendor's TED platform, whether bitmapped only or both bitmapped and scalable outline.

The minimum set of sizes required and available on all TED platforms corresponds to the standard sizes of bitmapped fonts that make up the default mapping for X11R5: 8, 10, 12, 14, 18, and 24.

For example, the entire set of six sizes of the plain monospaced font can be represented by the patterns:

```
-dt-application-medium-r-normal-*-80-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-100-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-120-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-140-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-180-*-*-*-m-*-iso8859-1
-dt-application-medium-r-normal-*-240-*-*-*-m-*-iso8859-1
```

These patterns match the corresponding standard font name on any TED platform, even though the numeric fields other than `POINTSIZE` may be different on various platforms, and the matched fonts may be either serif or sans serif, depending on how the vendor implemented the set of standard names.

Standard Application Font Names in app-defaults files

You can code a single `app-defaults` file to specify font resources for your application and use it across all TED platforms. Because the parts of the standard names that are defined are the same across different vendors' platforms, you can specify these values in the resource specification in the `app-defaults` file. However, you must use wildcards for the other fields (`PIXEL_SIZE`, `RESOLUTION_X`, `RESOLUTION_Y`, and `AVERAGE_WIDTH`) because they may vary across platforms. For example, to specify some of the default resource needs for an application named `appOne`, you might use:

```
appOne*headFont: -dt-application-bold-r-normal-sans-*-140-*-*-p-*-iso8859-1
appOne*linkFont: -dt-application-bold-i-normal-sans-*-100-*-*-p-*-iso8859-1
```

As another example, suppose that `appTwo` running on a vendor's platform defines two font resources for headings and hypertext links. `appTwo` uses a 14 point bold, serif font (Lucidabright bold) and a 12-point bold, italic sans serif font (Lucida bold-italic). You would then change the font definition from:

```
apptwo *headingFont: -b&h-lucidabright-bold-r-normal--20-140-100-100-p-127-iso8859-1
apptwo *linkFont:    -b&h-lucida-bold-i-normal-sans-17-120-100-100-p-96-iso8859-1
```

to:

```
apptwo *headingFont: -dt-application-bold-r-normal-serif-*-140-*-*-p-*-iso8859-1
apptwo *linkFont:    -dt-application-bold-i-normal-sans-*-120-*-*-p-*-iso8859-1
```

in your app-defaults file. Even though you may not know the names of the fonts on other TED platforms, these platform-independent patterns specified with the TED standard application font names match appropriate fonts on each platform.

You encode them exactly as shown, complete with the * wildcards, in your resource definitions. By applying the wildcards to the numeric fields other than point size, you ensure that the resources match TED fonts on all platforms, even if the exact pixel size or average width of the fonts is slightly different.

Displaying Errors from Your Application 3

Users running your application expect messages to be displayed in message footers, error dialogs, or warning dialogs, with further explanations available in online help when appropriate. Applications in the TriTeal Enterprise Desktop (TED) follow a common model for presenting error messages and warnings.

How to Present Error Messages

Because of the way message text is handled, users may not see messages from your application unless you display them in a dialog, footer, or elsewhere in the user interface.

In TED, such messages are directed to log files that a casual user may not routinely examine. Use the following rules when deciding where to tell users about warnings, messages, and error conditions:

- *If the message is informational,* display the text in the message footer of the application; for example, "MyDoc file copied."

- *If the message is about an error or serious warning*—a problem where an operation important to the user has failed—display an error dialog or warning dialog.

Information to Present in Error Dialogs

A good error dialog or warning dialog gives the user the following information:

- What happened (from the user's point of view)
- Why it happened, in simple language that the user can relate to the current task and environment
- How to fix the problem

If the information cannot be presented in four or five lines of the error dialog, consider adding a help button to the dialog and link it to a topic in the help volume for your application.

For more information on writing messages, see the *TriTeal Enterprise Desktop: Internationalization Programmer's Guide*.

Linking Message Dialogs to Online Help

In cases where additional background information is required, or where it takes more than four or five lines of a dialog to explain an error fully, you should add a button that links the user to online help.

Adding online help for a dialog is a straightforward task. Once you have decided that a particular dialog is a candidate for online help, do the following:

1. Choose a unique ID for the error help.

   This ID provides the link to the online help text. IDs should be 64 characters or less; for example, `DiskSpaceError`.

2. Create the dialog and add a help callback.

   Use the `XmCreateErrorDialog` convenience function for error messages and `XmCreateWarningDialog` for warnings, adding the help callback as follows:

```
XtAddCallback(dialog, XmNhelpCallback, helpfn, "ID");
```

In this example, *helpfn* is a help function you have created to manage the help dialog, and the string "*ID*" is the ID you chose for the error message (for example, `DiskSpaceError`). In your help function, set the `XmNlocationId` resource to the value of *ID*. The `/usr/dt/examples/dthelp` directory contains examples of how to set up such a help function.

For detailed information about creating and managing help dialog widgets, see the *TriTeal Enterprise Desktop: Help System Author's and Programmer's Guide*.

3. Write a corresponding help section for the error message.

   Document the message in the "messages" chapter of your help volume. In the help source document, you should have a separate section for each message, and the ID= attribute at the beginning of the section should match the ID you chose in your code for the error.

   For example, in the `s1` section heading, the ID is `DiskSpaceError`.

   When the user's system has insufficient disk space, the error message the user sees from the following heading is "Could Not Save File."

   ```
   <s1 ID=DiskSpaceError>Could Not Save File <\s1>
   ```

   Note that by convention, the text of the section heading should correspond closely to the text in the error dialog.

4. Rebuild the help file.

   The new help section for the error message becomes active as soon as you rebuild the help file (using the `dthelptag` program) and recompile your application.

For information about writing and building online help, see the *TriTeal Enterprise Desktop: Help System Author's and Programmer's Guide.*

Recovery Routines

If a recovery routine exists for an error condition, consider adding a Retry button to the dialog. For example, if a file could not be copied because the system had insufficient disk space, you might offer a Recopy option in the dialog that users could choose once they have corrected a disk space or permissions problem.

Integrating with Session Manager 4

Session Manager saves information about the Desktop environment and the applications running when the user logs out (of the current session) or when the user saves the environment (in a home session). For an application to be saved as part of the current session or the home session and then restarted as part of the next session, it must participate in the X Inter-Client Communication Conventions Manual (ICCCM) 1.1 Session Management Protocol. This chapter outlines how Session Manager saves and restores sessions and details the steps necessary for an application to participate in session management.

How Session Manager Saves Sessions and Applications

When you exit a session or when you save a Home session, Session Manager:

1. Saves the selected resource settings and X server settings.
2. Allows each application to save its state and waits for the save to be completed.
3. Obtains the command line required to restart the application.

How to Program the Application for Session Management

Setting the Program Environment

This section describes the programming steps necessary for an application to be saved as part of the integration process.

Follow these steps to set the program environment:

1. Include the following header files:
   - `Xm/Xm.h`
   - `Xm/Protocols.h`
   - `Dt/Session.h`

2. Link with `libXm` and `libDtSvc`.

3. Initialize the toolkit and create a top-level widget.

Setting the WM_SAVE_YOURSELF Atom

Use the Motif `XmAddWMProtocol()` function to set the `WM_SAVE_YOURSELF` atom on the `WM_PROTOCOLS` property for the top-level window of your application, as shown in the following example.

```
Atom XaWmSaveYourself;
Display *dsp;

dsp = XtDisplay(toplevel);
XaWmSaveYourself =
XmInternAtom(dsp, "WM_SAVE_YOURSELF", False);
XmAddWMProtocols(toplevel, &XaWmSaveYourself, 1);
```

Note – Do not set the `WM_SAVE_YOURSELF` atom for more than one window.

Prepare to Receive the WM_SAVE_YOURSELF Message

Use the Motif `XmAddWMProtocolCallback()` function to establish a callback procedure to be called when the application receives a `WM_SAVE_YOURSELF` client message:

```
XmAddWMProtocolCallback(toplevel, XaWmSaveYourself,
SaveYourselfProc,
   toplevel);
```

Processing the WM_SAVE_YOURSELF Message

When Session Manager sends a `WM_SAVE_YOURSELF` client message to this sample application's top-level window, the `SaveYourselfProc()` callback procedure is called. Use the callback to save the application's state. The application can save its state by any means you want, but cannot interact with the user during the save.

Session Manager provides the `DtSessionSavePath()` function as a way to return a full path name and a base file name to use for saving the application's state.

Setting the WM_COMMAND Property

After the application has finished processing the `WM_SAVE_YOURSELF` message, either by saving its state or ignoring the message, the application must set the `WM_COMMAND` property on its top-level window to tell Session Manager that the save operation is complete.

Use the Xlib `XsetCommand()` function to set the `WM_COMMAND` property on the application's top-level window. Setting this property lets Session Manager know that the application has finished processing the `WM_SAVE_YOURSELF` message and gives Session Manager the command line it needs to restart the application.

`XsetCommand()` accepts an array of command-line arguments. If the application uses the `DtSessionSavePath()` function as part of the save process, `XsetCommand()` needs an additional command-line argument: `-session` *basename*, where *basename* is the base file name returned by `DtSessionSavePath()`.

How Session Manager Restores a Session

Session Manager restores a session by:

1. Restoring the resource database and server settings.
2. Restarting applications using the saved command lines.

If the application used `DtSessionSavePath()` to find a path for its saved state, the application can pass the base file name from the `-session` argument to the `DtSessionRestorePath()` function to find the full path name of its saved-state file.

Integrating with Drag and Drop 5

This chapter describes the drag-and-drop user model and the TriTeal Enterprise Desktop drag-and-drop convenience application program interface (API), and describes how to use drag and drop.

Summary

The TriTeal Enterprise Desktop contains an application program interface (API) for drag and drop that is layered on top of Motif to provide convenient, consistent, and interoperable drag and drop across the desktop. The TriTeal Enterprise Desktop drag-and-drop API makes it easier for developers to implement drag and drop. With drag and drop, users can manipulate objects on the screen directly by grabbing them, dragging them around the display, and dropping them on other objects to perform a transfer of data.

Text, files, and buffers are the three categories of data that are used with the TriTeal Enterprise Desktop drag-and-drop API. *Text* is defined, in this context, as any user-visible text such as text in type-in fields. A *file* is a container of data that resides in the file system. Each file also has a format that describes its contents. *Buffers* are data contained in memory. Typically, each buffer also has a format that describes its contents.

Library and Header Files

To use drag and drop, you need to link to the `DtSvc` library. The header file is `Dt/Dnd.h`.

Demo Program

A demo program containing an example of drag and drop is in `/usr/dt/examples/dtdnd`.

Using Drag and Drop

▼ *To Integrate with Drag and Drop*

To integrate your application with drag and drop, follow these steps:

1. Include `Dt/Dnd.h`.
2. Link to `libDtsvc`.
3. As recipient:
    a. Register as a drop zone using `DtDndDropRegister`.
    b. Optionally, write a drop animate callback.
    c. Write a transfer callback.
4. As source:
    a. Recognize user action (possibly requiring a modification of translation tables) and call `DtDndDragStart`.

b. Write a convert callback.

c. Write a drag finish callback.

Drag-and-Drop User Model

This section describes the user model behind drag and drop to help you design an application that is consistent with the rest of the desktop and users' expectations.

See the *TriTeal Enterprise Desktop: Style Guide and Certification Checklist* for more information about the drag-and-drop user model and for guidelines for the visual appearance of drag-and-drop elements.

When drag and drop is available for all applications on the desktop, the system is more predictable to the user and is, therefore, easier to use and to learn. Users leverage their learning across more applications by using skills that they already know. In addition, many users prefer drag and drop to using menus.

In this chapter, the term *drop zone* is used to describe places where users can drop something. Drop zones are usually represented by a control or icon graphic; for example, a trash icon or a type-in field graphic. The term *drop target* is used to describe the rectangular area that represents the drop zone.

Drag and Drop Capability

With the Drag and Drop capability, users can select and manipulate objects represented as icons.

Note – Drag and drop is an accelerator to functionality that is accessible through other user interface controls supported within your application. However, not all users are able to take advantage of drag and drop. Do not support any basic operations solely through drag and drop. Any basic function that your application supports through drag and drop should also be supported by menus, buttons, or dialog boxes.

Drag Icons

When users select and manipulate icons using drag and drop, they expect the graphic icon that represents the item being dragged to remain consistent from the selection through the drag and drop. If the user selects a message icon in the File Manager and starts to drag it, the source portion of the drag icon is represented by that message icon. Providing this kind of consistency makes drag and drop more predictable to the user. Where the destination application uses icons, the icon shown should, in most cases, be the same one that was selected and then dragged and dropped. This behavior is not, however, always appropriate for all applications. Dragging text is an exception. A text drag icon is used instead of dragging the selected text.

Both the source and destination applications specify the visual appearance of drag icons. You are responsible for ensuring that an application has a consistent and appropriate icon to drag. Although the drag-and-drop library provides default icons, it is a good idea for you to specify your own for each application. Most often, you should use the data-typing database to obtain the icon associated with the type data represented by the icon. See Chapter 9, "Accessing the Data-Typing Database."

When users start a drag without selecting an icon, it is appropriate for you to provide a relevant drag icon. For example, in an appointment editor, the user can select an appointment out of a scrolling list—which may or may not show icons. You should use an appointment icon as the source indicator. The destination application (for example, a File Manager) should display the same appointment icon.

Parts of the Drag Icon

The drag icon changes appearance to provide *drag-over* feedback when the user moves it over potential drop zones.

The drag icon has three parts that combine to provide the drag-over feedback:

- A state indicator.
- An operation indicator.
- A source indicator.

The *state indicator* is a pointer used for positioning combined with a valid or invalid drop zone indicator. The valid state indicator is an arrow pointer. The pointer has a hot spot so users can position it in a predictable manner. The invalid state indicator—a circle with a diagonal line—is displayed when users have positioned the cursor over an invalid drop zone.

The *operation indicator* gives users feedback on what operation is occurring during the drag; either move, copy, or link. Because most drags are moves, users are given additional feedback when they perform the less-frequent copy or link operations.

Note – The operation feedback is drawn on top of the state and source feedback. This behavior is consistent with Motif drag-and-drop behavior.

The user can choose the drag operation move, copy, or link by pressing and holding certain keys during a drag, as shown in Table 5-1.

Table 5-1 Keys Used to Modify a Drag Operation

Modifier Key	**Operation**
Shift	Move
Control	Copy
Control and Shift	Link

The source application can force a copy, as in the case of the read-only File Manager window. When the user chooses an operation, the drop zone must match that operation for the drop to succeed; otherwise, the drop zone is invalid. In other words, if the user chooses a copy by holding down the Control key, and then drags the drag icon over the trash icon, the drag icon should show the trash icon as an invalid drop zone and any drop should fail, because copying to the trash is not allowed.

The *source indicator* represents the selection (or the item being dragged). The source indicator varies depending on whether the selection represents single or multiple items and what kind of item the selection represents. Table 5-2 shows the default source indicators in the TriTeal Enterprise Desktop. These source indicators are generated automatically when you use the TriTeal Enterprise Desktop drag-and-drop convenience API. The icons are approximations, not exact screen representations.

Table 5-2 Types of Drag Icons

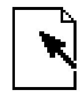
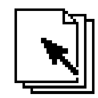
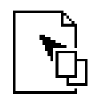
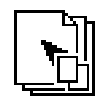
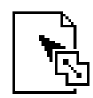
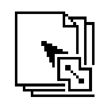
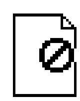
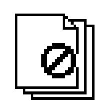
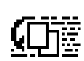
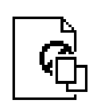
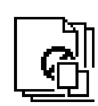
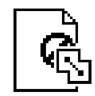
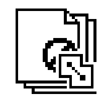
Drag Icons	**Text Selection**	**Single Selection**	**Multiple Selection**
Valid Move			
Valid Copy			
Valid Link			
Invalid Move None			
Invalid Copy			

Table 5-2 Types of Drag Icons *(Continued)*

Drag Icons	**Text Selection**	**Single Selection**	**Multiple Selection**
Invalid Link			

Drags from Inside Windows

Sometimes an application needs to enable a drag from within a dialog box or window. The Appointment Editor in Calendar has a scrolling list of appointments and an entry area for editing an appointment. Users can drag from the scrolling list to get an appointment, but users also need to be able to drag from the appointment entry area. Enabling users to drag from the entry area covers those times when the appointment is not yet inserted in the calendar (for example, when a proposed meeting time is entered but not inserted into the calendar).

The item that can be dragged needs to have an icon graphic associated with it. Place the icon graphic in the dialog box in an appropriate area adjacent to the information to be dragged. The upper-right corner of the dialog box or window is the recommended default position. The icon lets the user know that something can be dragged and the graphic used is the *same* graphic used in the drag icon to provide consistency. The icon should be 32x32 pixels and have a label so that it resembles a File Manager icon. See the *TriTeal Enterprise Desktop: Style Guide and Certification Checklist* chapter on drag and drop for more information.

Note – Drags are only enabled from human interface elements that have components or items that can be selected. Drags cannot be enabled from static labels such as those on buttons or menus.

Visual Feedback

The following sections describe the drop zone feedback and transition effects of drag and drop.

Drop Zone Feedback

The default drop zone feedback, called *drag under*, can be a solid line drawn around the site, a raised or lowered surface with a beveled edge around the drop zone, or a pixmap drawing over the drop zone.

Transition Effects

Transition effects show the user that the drop has either succeeded or failed. The two transition effects are *melt* and *snap back*.

Melting occurs when the user drops a drag icon on a valid drop zone. When the user drops a drag icon on a valid drop zone, the drag icon melts into the drop zone. The drag icon is replaced by the icon appropriate to the destination application. A printer on the Front Panel may show nothing other than the melting effect. An open File Manager window may display an appropriate icon.

When an icon is dropped, sometimes the melting effect does not take place immediately. The icon is displayed where it is placed until the transfer is done. It is a good idea for the destination to set its cursor to a busy state while the transfer is occurring. The user cannot move or select the icon until the transfer is complete; the busy cursor lets the user know the transfer is in process.

Snap back occurs when a drop fails. Drops can fail in two ways. If the user drops a drag icon over an invalid drop zone, then the drag icon snaps back to the source application. Once a drop occurs, the source and destination applications have to transfer the data. If the data transfer fails, the drag icon snaps back and the destination application is responsible for indicating failure to the user and providing information on why the drop failed.

Drag-and-Drop Sources

To help you understand the behavior of drag-and-drop sources, Table 5-3 describes the key desktop components that can be a source of drags of text selections, files, and buffers.

Table 5-3 Desktop Components That Can Be Drag Sources

Drag Source	Text Selections	Files	Buffers
Text fields (Motif)*	Selected text	N/A	N/A
Text Editor: Main Window	Selected Text	N/A	N/A
Terminal: Main Window	Selected Text	N/A	N/A
File Manager: Folder Window	N/A	Files	N/A
File Manager: Trash Window	N/A	Files	N/A
Mail: Message List	N/A	N/A	Message in mail-message format
Mail: Attachment List	N/A	N/A	Attachment in format of the attachment
Calendar: Appointment Editor	N/A	N/A	Appointment in appointment format

*Any application that has Motif text field sources selected drags text.

Drag-and-Drop Destinations

The following components on the desktop provide drop destinations:

- Editors
- File Manager
- Front Panel

Each component accepts drops of text selections, files, and buffers. Most of the text drop destinations are provided automatically by the Motif library. File or buffer data drop destinations require additional code.

When a user drops data from a file, and that file is modified in some way, the modifications can be written back to the original holder of the file. This behavior is described as *saveback*. However, when data is dropped from a buffer, the data does not have information about an originating file. As a result, changes to data from buffers cannot be written back, because there is no original holder of the data. This behavior is described as *no saveback*.

For example, the Mailer can export mail attachments to editors using drag and drop. If the attachment is exported as a buffer (that has no saveback), the editor has no way to change the original attachment in the mailer. So, the editor can only save its modified version of the attachment to a new file.

Because mail attachments are not already separate files (they are embedded into a mail folder file), they are only exported as buffers and cannot be saved back by other editors.

If the attachment is exported as a file (that has saveback) the editor saves its modified version to that same file.

Table 5-4 describes the drops of text selections, files, and buffers on editor-type components such as Text Editor, Icon Editor, Calendar, Mailer, and Application Builder.

Table 5-4 Editor Drop Destinations

Drop Destination	**Text Selections**	**Files**	**Buffers**
Text Editor: Main Window	Insert	Insert	Insert
Terminal: Main Window	Insert	N/A	N/A
Icon Editor: Main Window	N/A	Load (if file in icon format) saveback	Load into read-only (if data in icon format) no saveback
Mailer: Message List	N/A	Append (if file in mail format)	Append (if data in mail format)
Mailer: Compose	Insert	Insert	Insert
Mailer: Attachment List	Attach	Attach	Attach

Table 5-4 Editor Drop Destinations *(Continued)*

Drop Destination	Text Selections	Files	Buffers
Calendar: Main Window	N/A	Schedule Appointment (if file in appointment format)	Schedule appointment (if data in appointment format)
Calendar: Appointment Editor	Insert into text field	Fill in appointment fields (if file in appointment format)	Fill in appointment fields (if data in appointment format)
AppBuilder	N/A	Load (if file in BIX or BIL format) saveback	Load into read-only (if data in BIP format) no saveback

Table 5-4 describes the drops of text selections, files, and buffers on file and folder icons in the File Manager.

Table 5-5 File Manager Drop Destinations

Drop Destination	Text Selections	Files	Buffers
File Icon	Invoke drop action on target file and dropped text (if file accepts text drops and dropped text in appropriate format) no saveback/copy	Invoke drop action on target file and dropped file (if file accepts file drop and dropped file in appropriate format) saveback	Invoke drop action on target file and dropped data (if file accepts data drop and dropped data in appropriate format) no saveback/copy

Table 5-5 File Manager Drop Destinations *(Continued)*

Drop Destination	Text Selections	Files	Buffers
Folder Icon	Insert text into new file using "Untitled" name in folder	Copy/move file to folder	Insert data into new file using supplied name (if available) in folder else using "Untitled"
Action Icon	Invoke action on text (if appropriate format and accepts text drop) no saveback	Invoke action on files (if appropriate format and accepts file drop) saveback	Invoke action on data (if appropriate format and accepts data drop) no saveback
Mail Container Icon	Append to mailbox (if text in mail format)	Append to mailbox (if file in mail format)	Append to mailbox (if data in mail format)

Table 5-4 describes the drops of text selections, files, and buffers on action icons in the Front Panel.

Table 5-6 Front Panel Drop Destinations

Drop Destination	Text Selections	Files	Buffers
Text Editor	Load into read-only no saveback	Load saveback	Load into read-only no saveback
Calendar	Schedule appointment (if text in appointment format)	Schedule appointment (if file in appointment format)	Schedule appointment (if data in appointment format)
Mail	Compose message attach text	Compose message attach file	Compose message attach data
Printer	Print text (if print method available for text)	Print file contents (if print method available for file format)	Print data (if print method available for data format)
Trash Can	N/A	Move file to Trash Can	N/A

Table 5-6 Front Panel Drop Destinations *(Continued)*

Drop Destination	Text Selections	Files	Buffers
Subpanel: Install Icon	N/A	Install icon	N/A
Subpanel: Action	Same as File Manager	Same as File Manager	Same as File Manager
Subpanel: Executable	Same as File Manager	Same as File Manager	Same as File Manager

See the *TriTeal Enterprise Desktop: Style Guide and Certification Checklist* for more information and guidelines on how the drag and drop should appear to the user.

Drag-and-Drop Convenience API

The TriTeal Enterprise Desktop provides a drag-and-drop convenience API to promote consistency and interoperability across the desktop, and to make it easier for developers to implement drag and drop.

The existing Motif API for drag and drop provides reasonable functionality to achieve a rendezvous between the source and destination applications in the transaction. It provides a framework for data transfer but leaves the actual data transfer details up to the application. For true consistency and interoperability between applications across the desktop, all applications must use the same data transfer protocols. The TriTeal Enterprise Desktop drag-and-drop convenience API provides common data transfer routines.

Simplify Use for Developers

The existing Motif API for drag and drop is very flexible and, therefore, is somewhat difficult for nonexpert developers to use. The TriTeal Enterprise Desktop drag-and-drop convenience API provides some convenience functions, described in the following paragraphs, that result in an API that is simpler and easier to use by providing the following services:

- Manages configuration and appearance of drag icons. Graphics are provided for the default source, state, and operation icons that make up the drag icon in Motif. The compositing of these icons checks the type of data being dragged.
- Enables animation for a drop. You can define an animation procedure that is called when the drop has completed.
- Provides data transfer using standard X selection targets for text, file, and buffer transfers. This data transfer allows interoperability with other applications that use the standard targets directly.
- Provides dual registration. You can register a text widget as a drop zone for data other than text and preserve the ability to accept text drops.

Establish Policy

The drag-and-drop API establishes policy in three areas:

- Common targets. Where available, existing selection targets defined by the *Inter-Client Communication Conventions Manual* (ICCCM) are used.
- Data transfer protocols. The API hides some of the details of data transfer and presents the data to the application in the form of some simple data structures.
- Default drag icons. Default drag icons are provided for applications that can accept them.

Provide Common Functionality

The drag-and-drop API provides common functionality in these areas:

- Supports the transfer of data as text, file names, and buffers
- Supports, through the data transfer framework, the addition of new, built-in protocols

Leverage Existing Motif API

The API for drag and drop does not invent a new drag-and-drop subsystem; rather, it uses the existing Motif API. In addition, since common data transfer protocols were chosen, where available, applications can interoperate at the selection protocol level without requiring global use of the new API.

The transfer of text and files use existing protocols. Buffer transfer uses new protocols.

Drag-and-Drop Transaction

Figure 5-1 illustrates how the basic drag-and-drop transaction is performed. The dotted-line boxes show the basic transaction. The solid boxes show the optional transitions and operations.

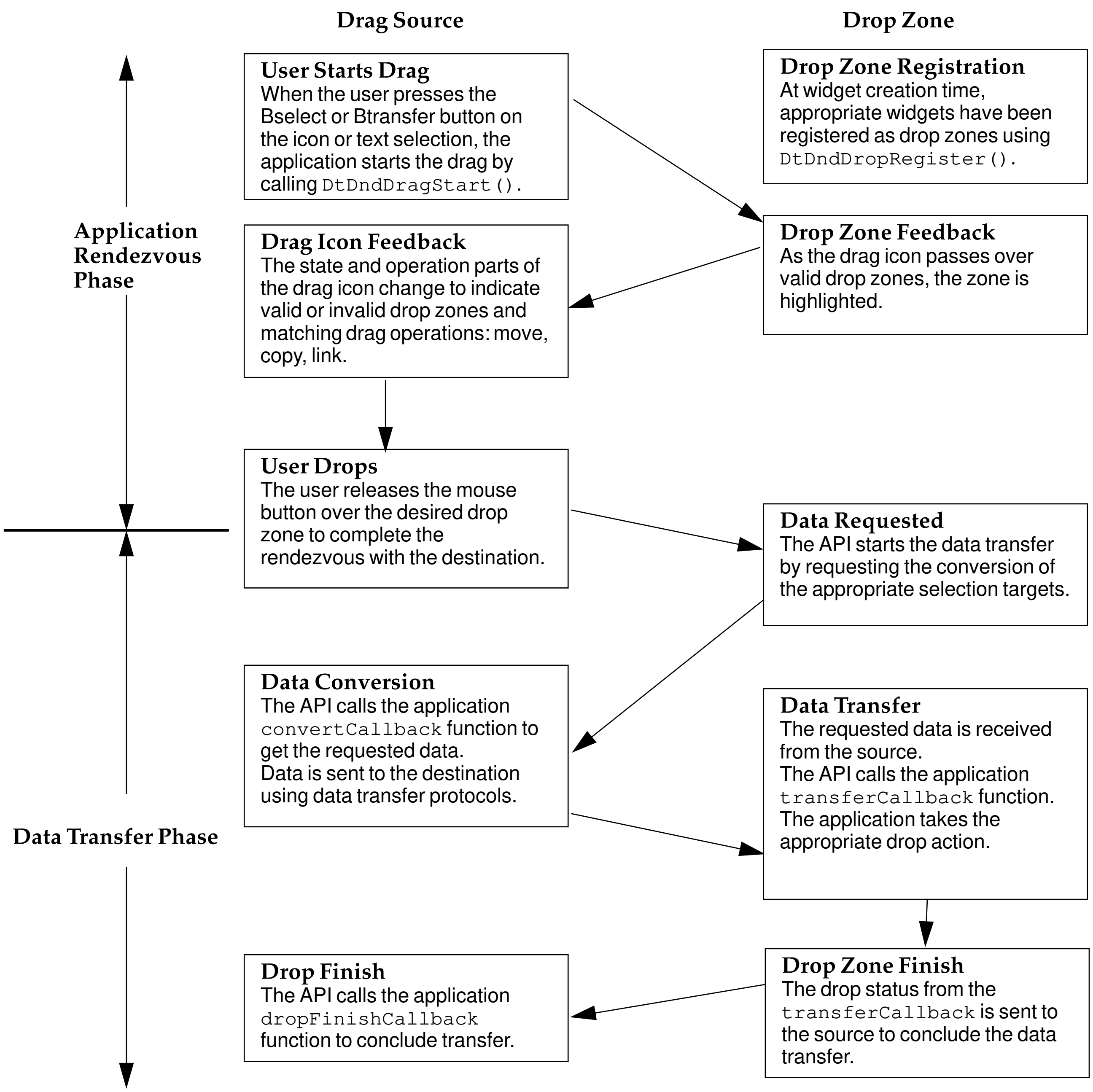


Figure 5-1 The basic drag-and-drop transaction

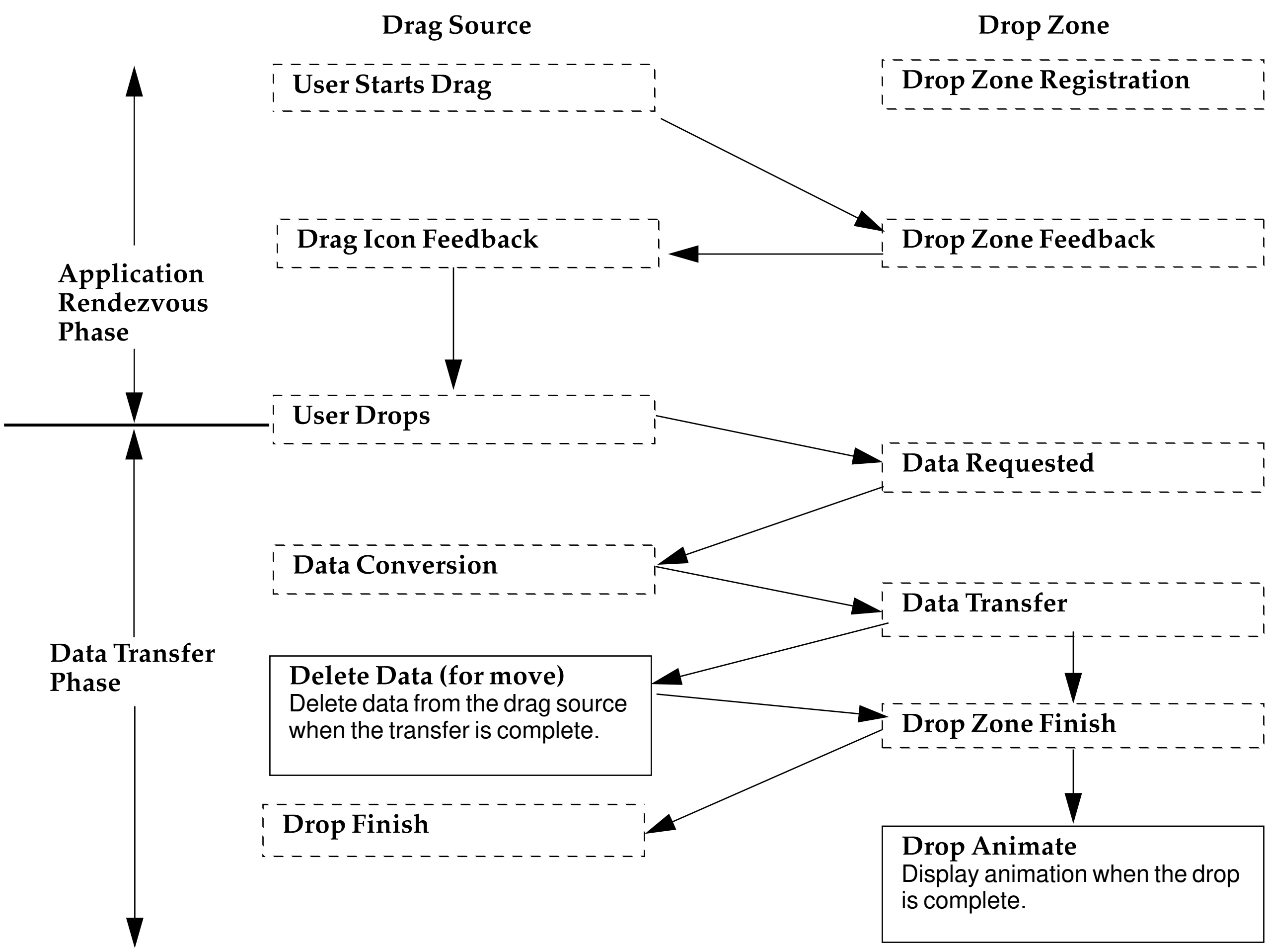


Figure 5-2 Optional transitions and operations for drag and drop

Figure 5-2 illustrates the optional transitions and operations for the drag-and-drop transaction.

Integration Action Plan

This section suggests a plan of action for integrating your application with drag and drop in TriTeal Enterprise Desktop 4.0.

Review Drag-and-Drop API and Sample Code

Use the information provided in this chapter to familiarize yourself with the drag-and-drop API. Once you have a basic understanding of the API, review the source code for the drag-and-drop demo program, `/usr/dt/examples/dtdnd`. This code provides examples of how to use the API in various ways. The examples should give you an understanding of the character and amount of code you need to write to support drag and drop in your application. Understanding the actions and the data-typing API is useful as well.

Review Your Application for Possible Drop Zones

Identify the types of data your application might accept through a drag-and-drop transaction. If, for example, you are writing a bitmap editor, you want to support the drop of files. Once you have identified the data types you will allow to be dropped on your application, determine the widget or widgets that should be drop zones. For the bitmap editor example, you may decide the only place a file should be dropped on the application is the bitmap editing area. In this case, register the widget representing this area using `DtDndDropRegister()` and provide the appropriate callbacks.

Because it is easiest to handle the drop of file names, start by implementing them. Once you have mastered this technique, you will find it easier to move on to implementing the drop of text and buffers.

Review Your Application for Possible Drag Sources

Identify the types of data your application might permit as sources for a drag-and-drop transaction. In the example of the bitmap editor, you may want bitmap data containing the current bitmap selection to be a drag source as an accelerator for cut and paste. Once you have identified the data types you will allow to be dragged from your application, determine the widget or widgets that should be drag sources. In the bitmap editor example, you may decide the bitmap editing area containing the highlighted bitmap selection should serve as the drag source. In this case, enable the widget representing this area for sourcing drags.

Start by implementing the drag of buffers that are most appropriate or specific to your application. You will also want to add the ability to drop buffers on your application to enable easy data transfer between multiple invocations of your application.

API Overview

This section provides an overview of the drag-and-drop application program interface (API).

DtSvc Library and Header File

The drag-and-drop functionality is implemented in the Desktop Services library, `DtSvc`. To access the drag-and-drop API, include the header file `<Dt/Dnd.h>` and link with `-lDtSvc`.

Functions

The API includes four function calls, which are declared in the header file `Dnd.h` and outlined in the following paragraphs. These functions are described in greater detail in later sections.

- `DtDndDragStart()` starts a drag in response to a user action.
- `DtDndCreateSourceIcon()` creates a source icon to use with `DtDndDragStart()`.
- `DtDndDropRegister()` registers a widget as a drop zone. Drop zone registration usually occurs immediately after the widget is created, but may be performed at any time.
- `DtDndDropUnregister()` unregisters a previously registered widget. A drop zone is usually unregistered immediately before being destroyed, but may be unregistered any time after being registered.

The DtDndContext Structure

You handle transfers of data using the `DtDndContext` data structure. This structure contains fields for the transfer protocol, the number of items being transferred, and an array of the data items being transferred. See the `DtDndDragStart(3)` and `DtDndDropRegister(3)` man pages for details about the syntax of this structure.

Protocols

Protocols are used to tell the API the type of data being transferred. The predefined protocols are shown in Table 5-7.

Table 5-7 Predefined Protocols

Protocol	Description
`DtDND_TEXT_TRANSFER`	Text transfer. Compound text. (Motif uses a compound text target for text transfers.)
`DtDND_FILENAME_TRANSFER`	File name transfer.
`DtDND_BUFFER_TRANSFER`	Memory buffer.

Operations

The drag source and the drop zone can transfer the data in one of three ways, as described in Table 5-8.

Table 5-8 Data Transfer Operations

Operation	Description
`XmDROP_MOVE`	Moves the data (Copy followed by Delete).
`XmDROP_COPY`	Copies the data.
`XmDROP_LINK`	Contains a link to the data.

How Drag Sources Are Used

This section describes how drag sources are used.

Starting a Drag

A drag is started in one of two ways. First, the user may start a drag by pressing down `Btransfer`, the middle mouse button. As soon as the button is pressed down, the drag begins. Second, the user may start a drag by pressing and holding down `Bselect`, the left mouse button, and moving the cursor across the screen. The drag begins when the user moves the mouse a certain distance. This distance is called the drag threshold and it is measured in pixels. The default drag threshold is 10 pixels for `Bselect`. For `Btransfer`, the drag threshold is 0; because there is no drag threshold, the drag begins as soon as the pointer is moved. Motif scrolled text lists and text widgets are automatically registered as drag sources for text drags using `Btransfer` and `Bselect`.

Dragging from Lists or Icons

There are two common interface objects that can be used to source a drag: lists and icons. The Motif List widget automatically sources text drags. If other types of drags are desired, this is accomplished by overriding the default widget translations with new `Bntl` and `Btn2` translations. There is no icon widget in Motif but often a drawing area is used as container of icons. In this case, an event handler for `Btn1Motion` would be used to start the drag. Refer to the sample code in `/usr/dt/examples/dtdnd` for more detailed code examples.

Drag Threshold

When starting a drag using `Bselect` the widget event handler or translation procedures must apply the drag threshold of 10 pixels before starting the drag. For `Btransfer`, there is no threshold and the drag starts immediately.

Btransfer or Badjust

Style Manager has a setting in the Mouse category that controls whether `Btn2`, the middle mouse button, acts as `Btransfer` or `Badjust`. This setting is stored as a resource name: `enableBtn1Transfer`. A setting of 1 indicates that `Btn2` is `Badjust` and should adjust the selection while a setting of any other value means that `Btn2` is `Btransfer` and should start a drag. `Btn1`, the left mouse button, always starts a drag.

The following example shows how to determine whether `Btn2` should be `Btransfer` or `Badjust`.

```
Display* display;
int adjust;

XtVaGetValues ((Widget)XmGetXmDisplay(display,
    "enableBtn1Transfer", &adjust,
    NULL);

if (adjust == 1)
       /* Btn2 is adjust */
else
      /* Btn2 is transfer */
```

Initiating a Drag

TriTeal Enterprise Desktop 4.0 applications start a drag by calling `DtDndDragStart()`. This function performs some desktop-specific setup and calls `XmDragStart()` to initiate a drag. The `DtDndDragStart()` function synopsis and parameter usage are described as follows:

```
Widget
DtDndDragStart(
    Widget         dragSource,
    XEvent         *event,
    DtDndProtocol  protocol,
    Cardinal       numItems,
    unsigned char  operations,
    XtCallbackList convertCallback,
    XtCallbackList dragFinishCallback
    ArgList        argList,
    Cardinal       argCount)
```

`Widget dragSource`

The widget that received the event that triggered the drag.

`XEvent *event`

The button press or button motion event that triggered the drag.

`DtDndProtocol protocol`

The protocol used for the data transfer. The protocol may be one of the following:

```
DtDND_TEXT_TRANSFER
DtDND_FILENAME_TRANSFER
DtDND_BUFFER_TRANSFER
```

`Cardinal numItems`

Specifies the number of items being dragged.

`unsigned char operations`

Specifies options supported by `dragSource`. The options are `XmDROP_MOVE`, `XmDROP_COPY`, and `XmDROP_LINK`. A drag source may support any combination of these operations. You specify a combination of operations by using or. For example, to support the move and copy operations, specify `XmDROP_MOVE | XmDROP_COPY`.

`XtCallbackList convertCallback`

This callback is invoked when a drop has started and the drop zone has requested data from the drag source. The `convertCallback` is explained in more detail in the next section.

`XtCallbackList dragFinishCallback`

This callback is invoked when the drag-and-drop transaction is complete. The `dragFinishCallback` should reset the `dragMotionHandler()` and free any memory allocated by the drag source during the drag-and-drop transaction.

Using Convert Callbacks

The convert callback provides data to the drop zone when a drop occurs. The first action in the convert callback is a verification of the reason field in the `callData`. If the reason is not `DtCR_CONVERT_DATA` or `DtCR_CONVERT_DELETE`, you should return immediately; otherwise, proceed to convert the data. For example, if you are handling the conversion of a file name, retrieve the appropriate file name from your internal data structures and copy it into the file data object. If your drag source supports the move operation, you need to support conversion of the `DELETE` target. That is, when `convertCallback` is called with a reason of `DtCR_CONVERT_DELETE`, perform the appropriate deletion action for the data that was moved. In the case of the file transfer, delete the file. Here is a simple `convertCallback` that handles the conversion and deletion of file names.

```
void
convertFileCallback(
    Widget dragContext,
    XtPointer clientData,
    XtPointer callData)
{
    DtDndConvertCallbackStruct *convertInfo =
    (DtDndConvertCallbackStruct*) callData;
    char *fileName = (char *) clientData;

    if (convertInfo->reason == DtCR_DND_CONVERT_DATA) {
        convertInfo->dragData->data.files[0]=
                XtNewString(fileName);
    } else if (convertInfo->reason == DtCR_DND_CONVERT_DELETE) {
        deleteFile(fileName);
    } else {
        convertInfo->status = DtDND_FAILURE;
    }
}
```

How Drop Zones Are Used

This section describes how drop zones are used.

Registering a Drop Zone

You generally register drop zones just after the widget that is going to be the drop zone is created. If you want a *modal* drop zone, you may register the widget as a drop zone when you want users to be able to drop on it and unregister it when you do not want users to drop on it.

Motif text widgets are automatically registered as drop zones for text when they are created. Dual registration is allowed. If you want a text widget to accept drops of other data, such as file names, in addition to text, you may register the text widget as a drop zone for file names as well. The text drop functionality provided by Motif is preserved. The functionality for file-name (or other data-type) drops is layered on top.

Use the function `DtDndDropRegister()` to register a widget as a drop zone. This function handles dual registration, if necessary, performs desktop-specific setup, and calls `XmDropSiteRegister()`. The `DtDndDropRegister()` function synopsis and parameter use are as follows.

```
void DtDndDropRegister(
    WidgetdropSite,
    DtDndProtocolprotocols;
    unsigned charoperations;
    XtCallbackListtransferCallback;
    ArgListargList;
    CardinalargCount)
```

`Widget dropSite`

The widget that is being registered as a drop zone.

`DtDndProtocol protocols`

Specifies the list of data transfer protocols that the drop zone can use. To specify the use of more than one protocol, use OR with the protocol values.

`unsigned char operations`

The operations supported by the drop zone. The drop zone may support any combination of `XmDROP_MOVE`, `XmDROP_COPY`, and `XmDROP_LINK` by using OR for the desired combination of operations.

`XtCallbackList transferCallback`

This function accepts the data that is dropped on the drop zone. The transfer callback is explained in greater detail in the next section.

`ArgList argList`

Specifies an optional argument list.

`Cardinal argCount`

Specifies the number of arguments in *argList*.

Using the Transfer Callback

The transfer callback accepts data from the drag source when a drop occurs. The first action in the transfer callback is a verification of the reason field in the `callData`. If the reason is not `DtCR_DND_TRANSFER_DATA`, you should return immediately; otherwise, proceed with data transfer based on its type and the operation specified in the reason. For example, if you are handling the copy of a file, retrieve the file name from the data structure, open the file, and copy its contents. If your drop zone supports more than one data type, you need to support the transfer of each data type appropriately.

Here is a simple transfer callback for a drawing area drop zone that supports the copying of text and file-name data types.

```
void
    TransferCallback(
    Widget widget,
    XtPointer clientData,
    XtPointer callData)
{
    DtDndTransferCallbackStruct *transferInfo =
        (DtDndTransferCallbackStruct*) callData;
    int ii;
    DtDndcontext * dropData = transferInfo->dropData;
        return;
    switch dropData->protocol {
    case DtDND_FILENAME_TRANSFER:
        for (ii=0; ii < dropData->numItems; ii++) {
            drawTheString(dropData->data, strings[ii]);
        }
        break;
    case DtDND_TEXT_TRANSFER:
        for (ii=0; ii<dropData->numItems; ii++){
        drawTheFile(dropData->data.files[ii]);
        }
        break;
    default:
```

```
        transferInfo->status = DtDND_FAILURE;
    }
}
```

Using Data Typing

In an application that accepts drops of buffers, you may want to handle the dropped data in a different way depending on its type. To accomplish data typing, use the data-typing API. Data-typing function calls of interest are `DtDtsBufferToDataType()` and `DtDtsBufferToAttributeValue()`. The former returns the data attribute name for the data, the latter returns the value of a specified attribute of the data. Attributes you may find useful for drag and drop are shown in Table 5-9.

Table 5-9 Data-Typing Attributes

Attributes	Description
`ICON`	Path of icon to use for this data.
`MEDIA`	The Message Alliance media name for this data.

See Chapter 9, “Accessing the Data-Typing Database” for more information.

Part 3 — Optional Integration

Chapters 6 through 10 describe how to perform the following optional integration tasks:

- Integrate with the Workspace Manager to enable your application to determine the workspace location of each session at session start time
- Use the TEDcde custom widgets
- Invoke actions from within an application
- Access the data-typing database
- Access the Calendar API

Integrating with the Workspace Manager 6

The Workspace Manager provides the means for an application to manage its windows within the desktop's multiple workspace environment. An application can perform four major tasks by communicating with the Workspace Manager:

- Place the application's windows in one or more workspaces
- Identify the workspaces in which the application's windows are located
- Prevent the application's windows from moving to another workspace
- Monitor changes to the workspaces, such as when a user switches from one workspace to another

Normally, Session Manager will get your application main window into the right workspace without your intervention. However, if your application has multiple top-level windows, you should use the Workspace Manager API to figure out where your windows are and save this data as part of your session state.

See Chapter 4, "Integrating with Session Manager" for details on saving application-related information between sessions.

Communicating with the Workspace Manager

An application communicates with the Workspace Manager by using functions provided by the desktop. These functions allow you to quickly and easily perform a variety of tasks associated with workspace management. The following is a list of these functions:

- `DtWsmAddCurrentWorkspaceCallback`
- `DtWsmAddWorkspaceFunctions`
- `DtWsmAddWorkspaceModifiedCallback`
- `DtWsmFreeWorkspaceInfo`
- `DtWsmGetCurrentBackdropWindows`
- `DtWsmGetCurrentWorkspace`
- `DtWsmGetWorkspaceInfo`
- `DtWsmGetWorkspaceList`
- `DtWsmGetWorkspacesOccupied`
- `DtWsmOccupyAllWorkspaces`
- `DtWsmRemoveWorkspaceCallback`
- `DtWsmRemoveWorkspaceFunctions`
- `DtWsmSetCurrentWorkspace`
- `DtWsmSetWorkspacesOccupied`

Segments of code from two demo programs (`occupy.c` and `wsinfo.c`) illustrate the use of these functions. Listings for `occupy.c`, `wsinfo.c`, and makefiles for several brands of workstations are in the directory `/usr/dt/examples/dtwsm`. See the applicable man page for more information on each function.

Placing an Application Window in Workspaces

An application can place its windows in any or all of the existing workspaces. `DtWsmOccupyAllWorkspaces` places the windows in all currently defined workspaces, while `DtWsmSetWorkspacesOccupied` places the windows in all workspaces named in a list that is passed to the function.

▼ To Place an Application Window in All Workspaces

♦ Use `DtWsmOccupyAllWorkspaces`.
In `occupy.c`, the callback `allWsCB` for the Occupy All Workspaces push button calls this function.

```
DtWsmOccupyAllWorkspaces (XtDisplay(toplevel),
                          XtWindow(toplevel));
```

where:

- `XtDisplay(toplevel)` is the X display.
- `XtWindow(toplevel)` is the window to be placed in all workspaces.

See the `DtWsmOccupyAllWorkspaces` man page for more information on this function.

▼ To Place an Application Window in Specified Workspaces

♦ Use `DtWsmSetWorkspacesOccupied`.
In `occupy.c`, the callback `setCB` for the Set Occupancy push button calls this function.

```
DtWsmSetWorkSpacesOccupied (XtDisplay(toplevel),
                            XtWindow(toplevel), paWsSet, numSet);
```

where:

- `XtDisplay(toplevel)` is the X display.
- `XtWindow(toplevel)` is the window to be placed in the workspaces.
- `paWsSet` is a pointer to a list of workspace names that have been converted to X atoms.
- `numSet` is the number of workspaces in the list.

See the `DtWsmSetWorkspacesOccupied` man page for more information on this function.

Identifying Workspaces Containing the Application Windows

The function `DtWsmGetWorkspacesOccupied` returns a list of the workspaces in which a specified application window resides. In `occupy.c`, the procedure `ShowWorkspaceOccupancy` calls this function. Based on the results of this call, ShowWorkspaceOccupancy changes the appearance of the toggle buttons that represent the workspaces. A check mark appears on every toggle button in whose workspace the application window resides.

▼ To Identify Workspaces That Contain the Application Window

♦ Use DtWsmGetWorkspacesOccupied.

```
rval = DtWsmGetWorkspacesOccupied(XtDisplay(toplevel)
            XtWindow(toplevel), &paWsIn, &numWsIn);
```

where:

- XtDisplay(toplevel) is the X display.
- XtWindow(toplevel) is the window to be searched for in the workspaces.
- paWsIn is the address of a pointer to a list of workspace names that have been converted to X atoms.
- numWsIn is the address of an integer into which the number of workspaces in the list is placed.

After this call, loops are set up to compare the list of workspaces (found in the procedure SetUpWorkspaceButtons by DtWsmGetWorkspaceList) with the list of workspaces in which the application window was found to reside. The toggle button resource XmNset is set to True for each toggle button that represents a workspace in which the application window resides.

Preventing Application Movement Among Workspaces

The function DtWsmRemoveWorkspaceFunctions prevents an application from:

- Switching from one workspace to another
- Occupying all workspaces
- Being removed from the current workspace

DtWsmRemoveWorkspaceFunctions does this by making that portion of the desktop Workspace Manager (dtwm) window menu inactive. The application should call DtWsmRemoveWorkspaceFunctions before its top-level window is mapped because dtwm only checks workspace information at the time it manages the application's top-level window. If you need to call DtWsmRemoveWorkspaceFunctions after the application's top-level window is managed, then you must first call the Xlib function `XWithdrawWindow`, call `DtWsmRemoveWorkspaceFunctions`, and then call `XMapWindow` to remap the top-level window.

▼ To Prevent Movement to Another Workspace

♦ Use `DtWsmRemoveWorkspaceFunctions`.

```
DtWsmRemoveWorkspaceFunctions(XtDisplay(toplevel),
                              XtWindow(toplevel));
```

where:

- `XtDisplay(toplevel)` is the X display.
- `XtWindow(toplevel)` is the window for which workspace movement is to be prevented.

Monitoring Workspace Changes

You can monitor workspace changes by using either or both of the following functions:

- `DtWsmAddCurrentWorkspaceCallback`
- `DtWsmWorkspaceModifiedCallback`

`DtWsmAddCurrentWorkspaceCallback` registers an application callback to be called whenever the Workspace Manager is switched to a new workspace. See the `DtWsmAddCurrentWorkspaceCallback(3)` man page for more information.

`DtWsmWorkspaceModifiedCallback` registers an application callback to be called whenever a workspace is added, deleted, or changed. See the `DtWsmWorkspaceModifiedCallback(3)` man page for more information.

▼ To Monitor Workspace Switching

♦ Use `DtWsmAddCurrentWorkspaceCallback`.

In the demo program `wsinfo.c`, this function is called after the top-level widget is realized.

```
DtWsmAddCurrentWorkspaceCallback (toplevel, wschangecb, NULL);
```

where

- `toplevel` is the application's top level widget.
- `wschangecb` is the name of the function to be called.
- `NULL` is the parameter for client data to be passed to the callback. In this case, no data is passed.

▼ To Monitor Other Workspace Changes

♦ Use `DtWsmWorkspaceModifiedCallback`.

```
DtWsmWorkspaceModifiedCallback (toplevel, wschangecb, NULL);
```

where:

- `toplevel` is the application's top-level widget.
- `wschangecb` is the name of the function to be called.
- `NULL` is the parameter for client data to be passed to the callback. In this case, no data is passed.

TriTeal Enterprise Desktop Motif Widgets 7

The TriTeal Enterprise Desktop provides Motif (based on Motif 1.2) OSF patch-level 1.2.3 libraries (with bug fixes) and enhancements. In addition, the TriTeal Enterprise Desktop provides four custom widgets you can use to provide certain OPEN LOOK™ and Microsoft® Windows functionality. This chapter describes these Motif custom widgets.

The widget library, `libDtWidget`, contains four widgets that combine or enhance functionality of existing Motif 1.2 widgets:

- `DtSpinBox` combines a text field and arrow buttons in a control that can increment or decrement numeric or text values.
- `DtComboBox` combines a text field and a list box in a control that displays one of the many valid choices for the text field.
- `DtMenuButton` provides menu-cascading functionality outside of the menu bar.

- DtEditor incorporates such single text editor functions as cut and paste.

These widgets provide common functionality across all TriTeal Enterprise Desktop applications. None of these widgets support subclassing.

The Custom Widgets library depends directly on the following libraries:

- Xm library for the Motif superclass support.
- Xt library for creation and manipulation of widgets.
- X11 Library for the base X Window System.
- DtSvc for desktop support utilized by DtEditor.

Using TriTeal Enterprise Desktop Motif

The TriTeal Enterprise Desktop Motif toolkit consists of the Motif 1.2 widget library with enhancements to existing functionality, bug fixes, and two new features.

TriTeal Enterprise Desktop Motif adds functionality to the Motif 1.2.3 release while maintaining source compatibility. TriTeal Enterprise Desktop Motif is source and binary compatible with Motif 1.2 applications. Existing Motif 1.2 applications will compile using TriTeal Enterprise Desktop Motif. Existing Motif 1.2 binaries will run without modification using TriTeal Enterprise Desktop Motif.

TriTeal Enterprise Desktop Motif also provides four custom widgets not found in Motif 1.2. The custom widgets are described in detail in this chapter.

Motif Libraries

Use the TriTeal Enterprise Desktop Motif and X11R5 libraries to develop a TriTeal Enterprise Desktop Motif-compliant application for the X Window System. The TriTeal Enterprise Desktop Motif libraries are the Motif 1.2.3 libraries (with bug fixes) and enhancements.

Motif Library (libXm)

TriTeal Enterprise Desktop provides all the Motif 1.2 header files.

Motif UIL Library (libUil)

The Motif User Interface Language (UIL) is a specification language for describing the initial state of a Motif application's user interface.

Include the `uil/UilDef.h` header file to access UIL.

Motif Resource Manager Library (libMrm)

The Motif Resource Manager (MRM) creates widgets based on definitions contained in User Interface Definition (UID) files created by the UIL compiler. MRM interprets the output of the UIL compiler and generates the appropriate argument lists for widget creation functions. Use `libMrm` to access the Motif Resource Manager.

Include the `Mrm/MrmPublic.h` header files to access `libMrm` in your application.

Features Added to Motif

The following features have been added to Motif 1.2.3 to support desktop applications:

- Complete internationalization of toolkit error messages.
- `XmGetPixmap()` and `XmGetPixmapByDepth()` use the environment variable `XMICONSEARCHPATH` or `XMICONBMSEARCHPATH` as the icon search path. If neither of these variables is set, `XBMLANGPATH` is used, which governs the Motif 1.2 behavior.See the TriTeal Enterprise Desktop Motif man pages for more information.

Enhancements to Existing Motif Functionality

The TriTeal Enterprise Desktop `Xm` library contains minor enhancements to Motif to enable better usability by OPEN LOOK and Microsoft Windows users. The usability enhancements include:

- Enabling button two on a three-button mouse to be used to extend the current selection. This functionality is equivalent to the OPEN LOOK ADJUST mouse button.

- Enabling Tab to be used to move through a group of `PushButton` widgets and gadgets, `ArrowButton` widgets and gadgets, and `DrawnButton` widgets.
- Enabling button 3 to activate a `CascadeButton` menu.
- Providing three new resources (`pathMode`, `fileFilterStyle`, and `dirTextLabelString`) for the `XmFileSelectionBox` widget, which gives it a new look and feel. See the *TriTeal Enterprise Desktop: Programmer's Overview* for details about the new `XmFileSelectionBox` resources.
- Enabling interoperability with Microsoft Windows and OPEN LOOK by providing multiple key bindings for Motif virtual keys.

Each of the preceding enhancements can be controlled by a resource: either a widget resource (for `XmFileSelectionBox`) or an application-wide resource (all other cases). The default values for this resource provide behavior and an API that is identical to that of Motif 1.2. For information on these enhancements and resources, see the `XmDisplay(3x)` and `XmFileSelectionBox(3x)` man pages.

Visual Enhancements

TriTeal Enterprise Desktop changes the Motif 1.2 look in the following ways:

- `RadioBox` fill color is changed to show state more clearly.
- `RadioBox` shape is changed from diamond to circular.
- A check glyph is added to the `CheckBox` to show state more clearly.
- `CascadeButtons` and menu items are changed to have an etched-in border when active.
- Thumb is removed from the read-only Scale to distinguish it from the Scale.
- Default shadow thickness is changed to 1 pixel.
- Default highlight thickness is changed to 1 pixel.
- Default `PushButton` visual draws the highlight inside the button's default shadow.

An application-wide resource can control each of these enhancements. The default values for these resources provide behavior and an API that is identical to that of Motif 1.2.

For information on these enhancements, see the `XmDisplay(3)`, `XmPushButton(3)`, `XmPushButtonGadget(3)`, `XmToggleButton(3)`, `XmToggleButtonGadget(3)`, and `XmScale(3)` man pages.

Text Field and Arrow Button Widget (DtSpinBox)

Use the `DtSpinBox` for cycling through a list of text items or incrementing and decrementing a numeric entry. `DtSpinBox` is a subclass of the `XmManager` class and is used to display a text field and two arrows.

The `DtSpinBox` widget is a user interface control used to increment and decrement an arbitrary text or numeric field. You can use it, for example, to cycle through the months of the year or days of the month. Figure 7-1 shows examples of the `DtSpinBox` widget.

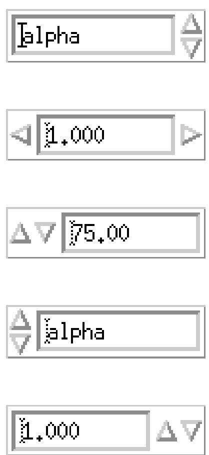


Figure 7-1 Examples of the DtSpinBox widget

Library and Header Files

The `DtSpinBox` widget is in the `libDtWidget` library. The header file is `Dt/SpinBox.h`.

Demo Program

A demo containing an example of the `DtSpinBox` widget is in `/usr/dt/examples/dtwidget/controls.c`.

Compatibility with Motif 2.0

To use the Motif 2.0 widgets, change the `Dt` names for the class, types, and creation routines to `Xm`. For example, change all occurrences of `DtSpinBox` to `XmSpinBox` in your code. This information is supplied in case you choose to port your application to Motif 2.0, but it is not a recommendation that you do so.

Note – TriTeal Enterprise Desktop does not guarantee strict API or binary compatibility between the TriTeal Enterprise Desktop widgets and the Motif 2.0 widgets.

Convenience Functions

Table 7-1 lists the convenience functions for the `DtSpinBox` widget. See the `DtSpinBox(3)` man page for more information.

Table 7-1 DtSpinBox Convenience Functions

Function	Description
`DtCreateSpinBox()`	Creates a SpinBox widget.
`DtSpinBoxAddItem()`	Adds an item into a `DtSpinBox` widget at a specified location.
`DtSpinBoxDeletePos()`	Deletes a specified item from a `DtSpinBox` widget.
`DtSpinBoxSetItem()`	Sets the current item in a `DtSpinBox` widget.

Classes

`DtSpinBoxWidget` inherits behavior and resources from the `Core`, `Composite`, `Constraint`, and `XmManager` classes.

The class pointer is `dtSpinBoxWidgetClass`.

The class name is `DtSpinBoxWidget`.

`DtSpinBoxWidget` does not support subclassing.

Resources

The DtSpinBox widget defines the following set of widget resources. Table 7-2 lists the class, type, default, and access for each resource.

- DtNarrowLayout specifies the style and position of the DtSpinBox arrows.
- DtNarrowSensitivity specifies the sensitivity of the arrows in the DtSpinBox.
- DtNspinBoxChildType specifies the style of the DtSpinBox.
- DtNdecimalPoints specifies the position of the decimal point within the integer value when the child type is numeric.
- DtNincrementValue specifies the amount to increment or decrement the position when the child type is numeric.
- DtNinitialDelay specifies the amount of time in milliseconds before the arrow buttons begin to spin continuously.
- DtNnumValues specifies the number of items in the DtNvalues list when the child type is a string.
- DtNvalues supplies the list of strings to cycle through when the child type resource is a string.
- DtNmaximumValue specifies the upper bound on the DtSpinBox range when the child type is numeric.
- DtNminimumValue specifies the lower bound on the DtSpinBox range when the child type is numeric.
- DtNmodifyVerifyCallback is called just before the DtSpinBox position changes. The application can use this callback to implement new application-related logic, including setting a new position, spinning to, or canceling the impending action.
- DtNposition has a different value based on the child type resource. When the child type is a string, DtNposition is the index into the DtNvalues list for the current item. When the child type is numeric, DtNposition is the integer value of the DtSpinBox that falls within the maximum and minimum value range.

- DtNrepeatDelay is the number of milliseconds between repeated calls to the DtNvalueChangedCallback while the user is spinning the DtSpinBox.
- DtNvalueChangedCallback is called whenever the value of the DtNposition resource is changed through the use of the spinner arrows.

See the DtSpinBox(3) man page for more information.

Table 7-2 DtSpinBoxWidget Resources

Name	Class	Type	Default	Access
DtNarrowLayout	DtCArrowLayout	unsigned char	DtARROWS_END	CSG
DtNarrowSensitivity	DtCArrowSensitivity	unsigned char	DtARROWS_SENSITIVE	CSG
DtNspinBoxChildType	DtCSpinBoxChildType	unsigned char	DtSTRING	CG
DtNdecimalPoints	DtCDecimalPoints	short	0	CSG
DtNincrementValue	DtCIncrementValue	int	1	CSG
DtNinitialDelay	DtCInitialDelay	unsigned int	250 ms	CSG
DtNnumValues	DtCNumValues	int	0	CSG
DtNvalues	DtCValues	XmStringTable	NULL	CSG
DtNmaximumValue	DtCMaximumValue	int	10	CSG
DtNminimumValue	DtCMinimumValue	int	0	CSG
DtNmodifyVerifyCallback	DtCCallback	XtCallbackList	NULL	C
DtNposition	DtCPosition	int	0	CSG
DtNrepeatDelay	DtCRepeatDelay	unsigned int	200 ms	CSG
DtNvalueChangedCallback	DtCCallback	XtCallbackList	NULL	C

Callback Structures

The callback structure follows and is described in Table 7-3.

```
typedef struct {
    int         reason;
    XEvent      *event;
    Widget      widget;
    Boolean     doit;
    int         position;
    XmString    value;
    Boolean     crossed_boundary;
} DtSpinBoxCallbackStruct;
```

Table 7-3 DtSpinBox Callbacks

Callback	Description
reason	Use this callback for three possible reasons. For the first call to the callback at the beginning of a spin, or for a single activation of the spin arrows, `DtCR_OK` is the reason. If the `DtSpinBox` is being continuously spun, the reason is `DtCR_SPIN_NEXT` or `DtCR_SPIN_PRIOR`, depending on the arrow that is spinning.
event	A pointer to the event that caused this callback to be invoked. It can be `NULL` when the `DtSpinBox` is continuously spinning.
widget	The widget identifier for the text widget that is affected by the spin.
doit	Sets this value only when the `call_data` comes from the `DtNmodifyVerifyCallback`. For a modifyVerify callback, the setting of this field by an application determines whether the action that initiated the callback should be performed. When this field is set to `False`, the action is not performed.

Table 7-3 DtSpinBox Callbacks *(Continued)*

Callback	Description
position	The new value of the `DtNposition` resource that results from the spin.
value	The new `XmString` value displayed in the Text widget that results from the spin. This string must be copied if it is used beyond the scope of the `call_data` structure.
crossed_boundary	This Boolean is True when the spinbox cycles, and/or `DtNspinBoxChildType` of `XmSTRING` wraps from the first item to the last or the last item to the first. When the `DtNspinBoxChildType` is `XmNUMERIC`, the boundary is crossed when the `DtSpinBox` cycles from the maximum value to the minimum value or vice versa.

Example of DtSpinBox Widget

The following example shows how to create and use a `DtSpinBox` widget. You can find this code as part of the `controls.c` demo in the `/usr/dt/examples/dtwidget` directory.

```
/*
 * Example code for SpinBox
 */

#include <Dt/SpinBox.h>

static char *spinValueStrings[] = {
    "alpha", "beta", "gamma", "delta",
    "epsilon", "zeta", "eta", "theta",
    "iota", "kappa", "lambda", "mu",
    "nu", "xi", "omicron", "pi",
    "rho", "sigma", "tau", "upsilon",
    "phi", "chi", "psi", "omega"
};

static void ModifyVerifyCb(Widget, XtPointer, XtPointer);

static void CreateSpinBoxes(Widget parent)
{
    Widget titleLabel, spinBox;
    XmString *valueXmstrings;
    int numValueStrings;
```

```
XmString labelString;
Arg args[20];
int i, n;

/* Create value compound strings */

numValueStrings = XtNumber(spinValueStrings);
valueXmstrings = (XmString *)XtMalloc(numValueStrings
sizeof(XmString*));
for (i = 0; i < numValueStrings; i++) {
    valueXmstrings[i] =
    XmStringCreateLocalized(spinValueStrings[i]);
}

/* Create title label */

labelString = XmStringCreateLocalized("SpinBox Widget");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
titleLabel = XmCreateLabel(parent, "title", args, n);
XtManageChild(titleLabel);
XmStringFree(labelString);

/*
* Create a SpinBox containing string values.
*/

n = 0;
XtSetArg(args[n], DtNvalues, valueXmstrings); n++;
XtSetArg(args[n], DtNnumValues, numValueStrings); n++;
XtSetArg(args[n], DtNcolumns, 10); n++;
spinBox = DtCreateSpinBox(parent, "spinBox1", args, n);
XtManageChild(spinBox);

/*
* Create a SpinBox containing numeric values to 3 decimal places.
* Position the arrows on either side of the displayed value.
*/

n = 0;
XtSetArg(args[n], DtNspinBoxChildType, DtNUMERIC); n++;
XtSetArg(args[n], DtNminimumValue, 1000); n++;
XtSetArg(args[n], DtNmaximumValue, 100000); n++;
```

```
 XtSetArg(args[n], DtNincrementValue,1000); n++;
 XtSetArg(args[n], DtNdecimalPoints,3); n++;
 XtSetArg(args[n], DtNposition,1000); n++;
 XtSetArg(args[n], DtNarrowLayout,DtARROWS_SPLIT); n++;
 XtSetArg(args[n], DtNcolumns, 10); n++;
 spinBox = DtCreateSpinBox(parent, "spinBox2", args, n);
 XtManageChild(spinBox);

/*
* Create a SpinBox containing numeric values to 2 decimal places.
* Position the arrows on the left of the displayed value.
* Disallow alternate user changes by adding a modify/verify
 callback.
*/

 n = 0;
 XtSetArg(args[n], DtNspinBoxChildType, DtNUMERIC); n++;
 XtSetArg(args[n], DtNminimumValue, 1500); n++;
 XtSetArg(args[n], DtNmaximumValue, 60500); n++;
 XtSetArg(args[n], DtNincrementValue,1500); n++;
 XtSetArg(args[n], DtNdecimalPoints,2); n++;
 XtSetArg(args[n], DtNposition,7500); n++
 XtSetArg(args[n], DtNarrowLayout,DtARROWS_FLAT_BEGINNING); n++;
 XtSetArg(args[n], DtNcolumns, 10); n++;
 spinBox = DtCreateSpinBox(parent, "spinBox3", args, n);
 XtManageChild(spinBox);

 XtAddCallback(spinBox, DtNmodifyVerifyCallback, ModifyVerifyCb,
   NULL);

/*
* Create a SpinBox containing string values.
* Position the arrows on the left of the display value
*/

 n = 0;
 XtSetArg(args[n], DtNvalues, valueXmstrings); n++;
 XtSetArg(args[n], DtNnumValues, numValueStrings); n++;
 XtSetArg(args[n], DtNarrowLayout, DtARROWS_BEGINNING); n++;
 XtSetArg(args[n], DtNcolumns, 10); n++;
 spinBox = DtCreateSpinBox(parent, "spinBox4", args, n);
 XtManageChild(spinBox);
```

```
/*
* Create a SpinBox containing numeric values to 3 decimal places.
* Position the arrows on the right of the displayed value.
*/

 n = 0;
 XtSetArg(args[n], DtNspinBoxChildType, DtNUMERIC); n++;
 XtSetArg(args[n], DtNminimumValue, 1000); n++;
 XtSetArg(args[n], DtNmaximumValue, 100000); n++;
 XtSetArg(args[n], DtNincrementValue,1000); n++;
 XtSetArg(args[n], DtNdecimalPoints,3); n++;
 XtSetArg(args[n], DtNposition,1000); n++;
 XtSetArg(args[n], DtNarrowLayout, DtARROWS_FLAT_END); n++;
 XtSetArg(args[n], DtNcolumns, 10); n++;
 spinBox = DtCreateSpinBox(parent, "spinBox5", args, n);
 XtManageChild(spinBox);

 /*
 * Free value strings, SpinBox has taken a copy.
 */

 for (i = 0; i < numValueStrings; i++) {
           XmStringFree(valueXmstrings[i]);
 }
 XtFree((char*)valueXmstrings);

}

    /*
    * modify/verify callback.
    *
    * Allow/disallow alternate user changes
    */

static void ModifyVerifyCb(Widget w, XtPointer cd, XtPointer cb)
{
    DtSpinBoxCallbackStruct *scb= (DtSpinBoxCallbackStruct*)cb;
    static Boolean allowChange = True;

    scb->doit = allowChange;

    if (allowChange == False) {
    printf("DtSpinBox: DtNmodifyVerifyCallback.
     Change disallowed.\n");
```

```
    XBell(XtDisplay(w), 0);
    }

    allowChange = (allowChange == True) ? False : True;
}
```

Text Field and List Box Widget (DtComboBox)

Use the `DtComboBox` widget to display a list and the current selection from the list. You can use this widget for display only, or as a selectable control.

The `DtComboBox` widget is a combination of a text field and a list widget that provides a list of valid choices for the text field. Selecting an item from this list automatically fills in the text field with that list item. Figure 7-2 shows examples of a `DtComboBox` widget.

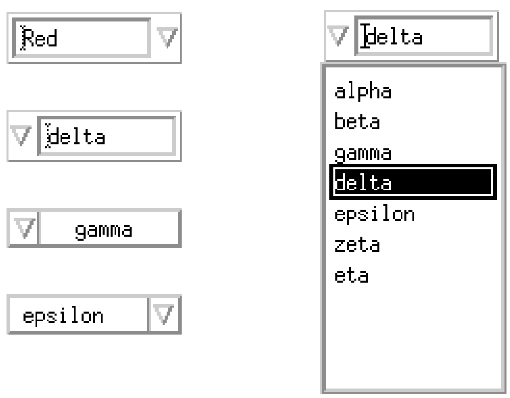


Figure 7-2 Examples of text field and list box widget (DtComboBox)

Library and Header Files

The `DtComboBox` widget is in the `libDtWidget` library. The header file is `Dt/ComboBox.h`.

Demo Program

A demo containing an example of the `DtComboBox` widget is in `/usr/dt/examples/dtwidget/controls.c`.

Compatibility with Motif 2.0

The `DtComboBox` widget is similar to the Motif 2.0 release of `XmComboBox`. The APIs are designed so that an application can easily switch to the Motif 2.0 version of these widgets. To use the Motif 2.0 widgets, change the `Dt` names for the class, type, and creation routines to `Xm`. For example, change all occurrences of `DtComboBox` to `XmComboBox` in your code. This information is supplied in case you choose to port your application to Motif 2.0, but it is not a recommendation that you do so.

Note – TriTeal Enterprise Desktop does not provide strict API or binary compatibility between the TriTeal Enterprise Desktop widgets and the Motif 2.0 widgets.

Convenience Functions

The `DtComboBox` widget provides the following convenience functions, described in more detail in Table 7-4.

See the `DtComboBox(3)` man page for more information.

Table 7-4 DtComboBox Widget Convenience Functions

Function	Description
`DtCreateComboBox()`	Creates a `DtComboBox` widget.
`DtComboBoxAddItem()`	Adds an item into a `DtComboBox` widget at a specified position.
`DtComboBoxDeletePos()`	Deletes a specified item from a `DtComboBox` widget.
`DtComboBoxSetItem()`	Selects an item in the `XmList` of a `DtComboBox` widget and makes it the first visible item in the list.
`DtComboBoxSelectItem()`	Selects an item in the `XmList` of the `DtComboBox` widget.

`DtComboBox` is a subclass of the `XmManager` class that is used to display `XmList` or `XmScrolledList`.

Classes

DtComboBox inherits behavior and resources from Core, Composite, Constraints, and XmManager classes.

The class pointer is dtComboBoxWidgetClass.

The class name is DtComboBoxWidget.

DtComboBoxWidget does not support subclassing.

Resources

DtComboBox provides the following resources. Table 7-5 shows the class, type, default, and access for these resources.

- DtNmarginHeight specifies the number of pixels added between the top and bottom of the text widget and the start of the shadow.
- DtNmarginWidth specifies the number of pixels added between the right and left sides of the text widget and the start of the shadow.
- DtNselectedItem is passed through to the XmList to set the XmNselectedItemCount and XmNselectedItems as the single item in the DtNitems that matches this specified XmString in the list.
- DtNselectedPosition is passed through to the XmList to set the XmNselectedItemCount and XmNselectedItems as the single item at this specified position in the list.
- DtNselectionCallback is issued when an item is selected from the DtComboBox widget list.
- DtNcomboBoxType determines the style type of the DtComboBox.

The list widget ID is accessible using the XtNameToWidget() function. The resources of these widgets can be set. See the DtComboBox(3) man page for more information.

The codes in the access column show if you can:

- Set the resource at creation time (C)
- Set by using XtSetValues (S)

- Retrieve by using `XtGetValues` (G)

Table 7-5 DtComboBox Widget Resources

Name	Class	Type	Default	Access
DtNmarginHeight	DtCMarginHeight	Dimension	2	CSG
DtNmarginWidth	DtCMarginWidth	Dimension	2	CSG
DtNselectedItem	DtCSelectedItem	XmString	Dimension	CSG
DtNselectedPosition	DtCSelectedPosition	int	Dimension	CSG
DtNselectionCallback	DtCCallback	XtCallbackList	XmString	C
DtNcomboBoxType	DtCComboBoxType	unsigned char	int	CG

Callback Structures

The callback structure follows and is described in Table 7-6.

```
typedef struct {
    int         reason;
    XEvent      *event;
    XmString    item_or_text;
    int         item_position;
} DtComboBoxCallbackStruct;
```

Table 7-6 DtComboBox Callback Structures

Structure	Description
reason	The only reason to issue this callback is `XmCR_SELECT`.
event	A pointer to the event that caused this callback to be invoked. It can be NULL.
item_or_text	The contents of the text widget at the time the event invoked the callback. This data is only valid within the scope of the `call_data` structure, so it must be copied when it is used outside of this scope.
item_position	The new value of the `DtNposition` resource in the `DtComboBox` list. If the value is 0, the user entered a value in the `XmTextField` widget.

Example of DtComboBox Widget

The following example shows how to create and use a `DtComboBox` widget. You can find this code as part of the `controls.c` demo in the `/usr/dt/examples/dtwidget` directory.

```
/*
 * Example code for DtComboBox
 */

#include <Dt/ComboBox.h>

static char *comboValueStrings[] = {
    "alpha", "beta", "gamma", "delta",
    "epsilon", "zeta", "eta", "theta",
    "iota", "kappa", "lambda", "mu",
    "nu", "xi", "omicron", "pi",
    "rho", "sigma", "tau", "upsilon",
    "phi", "chi", "psi", "omega"
};

static char *colorStrings[] = { "Red", "Yellow", "Green", "Brown",
"Blue" };

static void CreateComboBoxes(Widget parent)
{
    Widget titleLabel, comboBox, list;
    XmString *valueXmstrings, *colorXmstrings;
    int numValueStrings, numColorStrings;
    XmString labelString, xmString;
    Arg args[20];
    int i, n;

    /* Create value compound strings */

    numValueStrings = XtNumber(comboValueStrings);
    valueXmstrings =
    (XmString *)XtMalloc(numValueStrings * sizeof(XmString*));
    for (i = 0; i < numValueStrings; i++) {
        valueXmstrings[i] =
        XmStringCreateLocalized(comboValueStrings[i]);
    }

    /* Create color compound strings */
```

```
numColorStrings = XtNumber(colorStrings);
colorXmstrings = (XmString *)XtMalloc(numColorStrings *
sizeof(XmString*));
for (i = 0; i < numColorStrings; i++) {
    colorXmstrings[i] =
    XmStringCreateLocalized(colorStrings[i]);
}

/* Create title label */

labelString = XmStringCreateLocalized("ComboBox Widget");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
titleLabel = XmCreateLabel(parent, "title", args, n);
XtManageChild(titleLabel);
XmStringFree(labelString);


/*
 * Create an editable ComboBox containing the color strings.
 * Get the widget id of the drop down list, add some greek
 * letter names to it, and make more items visible.
 */

n = 0;
XtSetArg(args[n], DtNcomboBoxType, DtDROP_DOWN_COMBO_BOX); n++;
XtSetArg(args[n], DtNitems, colorXmstrings); n++;
XtSetArg(args[n], DtNitemCount, numColorStrings); n++;
XtSetArg(args[n], DtNvisibleItemCount, 5); n++;
XtSetArg(args[n], DtNcolumns, 10); n++;
comboBox = DtCreateComboBox(parent, "comboBox1", args, n);
XtManageChild(comboBox);

list = XtNameToWidget(comboBox, "*List");
XmListAddItems(list, valueXmstrings, 10, 0);
XtVaSetValues(list, XmNvisibleItemCount, 10, NULL);


/*
 * Create an editable ComboBox with no entries.
 * Get the widget id of the drop down list, add some greek
 * letter names to it and select the third item in the list.
 */
```

```
n = 0;
XtSetArg(args[n], DtNcomboBoxType, DtDROP_DOWN_COMBO_BOX); n++;
XtSetArg(args[n], DtNorientation, DtLEFT); n++;
XtSetArg(args[n], DtNcolumns, 10); n++;
comboBox = DtCreateComboBox(parent, "comboBox2", args, n);
XtManageChild(comboBox);

list = XtNameToWidget(comboBox, "*List");
XmListAddItems(list, valueXmstrings, 7, 0);
XtVaSetValues(list, XmNvisibleItemCount, 7, NULL);
XtVaSetValues(comboBox, DtNselectedPosition, 3, NULL);


/*
 * Create a non-editable ComboBox containing some greek letter
           names.
 * Position the arrow on the left.
 * Select the 'gamma' item in the list.
 */

n = 0;
XtSetArg(args[n], DtNorientation, DtLEFT); n++;
XtSetArg(args[n], DtNitems, valueXmstrings); n++;
XtSetArg(args[n], DtNitemCount, numValueStrings); n++;
XtSetArg(args[n], DtNvisibleItemCount, 8); n++;
comboBox = DtCreateComboBox(parent, "comboBox3", args, n);
XtManageChild(comboBox);

xmString = XmStringCreateLocalized("gamma");
XtVaSetValues(comboBox, DtNselectedItem, xmString, NULL);
XmStringFree(xmString);

/*
 * Create a non-editable ComboBox with no entries.
 * Position the arrow on the right.
 * Add the greek letter names to the list and select the fourth
    item.
 */

n = 0;
XtSetArg(args[n], DtNorientation, DtRIGHT); n++;
XtSetArg(args[n], DtNvisibleItemCount, 8); n++;
comboBox = DtCreateComboBox(parent, "comboBox4", args, n);
XtManageChild(comboBox);
```

```
    for (i = 0; i < numValueStrings; i++) {
        DtComboBoxAddItem(comboBox, valueXmstrings[i],
        0, True);
    }
    XtVaSetValues(comboBox, DtNselectedPosition, 4, NULL);

    /*
     * Free value and color strings, ComboBox has taken a copy.
     */

    for (i = 0; i < numValueStrings; i++) {
        XmStringFree(valueXmstrings[i]);
    }
    XtFree((char*)valueXmstrings);

    for (i = 0; i < numColorStrings; i++) {
        XmStringFree(colorXmstrings[i]);
    }
    XtFree((char*)colorXmstrings);
}
```

Menu Button Widget (DtMenuButton)

Use the `DtMenuButton` widget to provide menu-cascading functionality outside of a menu pane.

`DtMenuButton` widget is a command widget that complements the menu cascading functionality of an `XmCascadeButton` widget. As a complement to `XmCascadeButton` widget, it can only be instantiated outside a `MenuBar`, `Pulldown`, or `Popup` (use `XmCascadeButton` widget inside a `MenuPane`.) Figure 7-2 shows examples of a `DtMenuButton` widget.

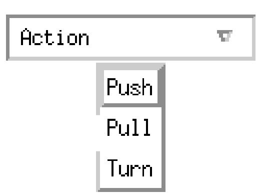


Figure 7-3 Examples of menu button widget (DtMenuButton)

Library and Header Files

The DtMenuButton widget is in the libDtWidget library. The header file is Dt/MenuButton.h.

Demo Program

A demo containing an example of the DtMenuButton widget is in /usr/dt/examples/dtwidget/controls.c.

Convenience Functions

DtCreateMenuButton() is a convenience function that creates a TriTeal Enterprise Desktop widget.

DtMenuButton widget is a subclass of XmLabel class. Visually, DtMenuButton widget has a label string and a menu glyph. The menu glyph always appears on the right end of the widget and, by default, is a downward pointing arrow.

DtMenuButton widget has an implicitly created submenu attached to it. The submenu is a pop-up menu and has this DtMenuButton widget as its parent. The name of the implicitly created submenu is obtained by prefixing submenu_ to the name of this DtMenuButton widget. You can obtain the widget ID of the submenu by setting an XtGetValues on DtNsubMenuId resource of this DtMenuButton widget. The implicitly created submenu must not be destroyed by the user of this widget.

The submenu can be popped up by pressing the menu post button (see XmNmenuPost resource of XmRowColumn) anywhere on the DtMenuButton widget or by pressing the Motif Cancel key (usually Escape).

Classes

DtMenuButtonWidget inherits behavior and resources from Core, XmPrimitive, and XmLabel classes.

The class pointer is dtMenuButtonWidgetClass.

The class name is DtMenuButtonWidget.

DtMenuButtonWidget does not support subclassing.

Resources

`DtMenuButtonWidget` provides the following resources. Table 7-7 shows the class, type, default, and access for these resources.

- `DtNcascadingCallback` specifies the list of callbacks that are called before the attached submenu is displayed.
- `DtNcascadePixmap` specifies the pixmap that is displayed as the menu glyph. If no pixmap is specified, a downward pointing arrow is displayed.
- `DtNsubMenuId` specifies the widget ID of the pop-up menu pane to be associated with this `DtMenuButton` widget. You must create the pop-up menu pane with this `DtMenuButton` as its parent. You cannot specify this resource when the widget is created because the submenu is automatically destroyed by this widget when the resource is set.

See the `DtMenuButton(3)` man page for more information.

The codes in the access column show if you can:

- Set the resource at creation time (C).
- Set by using `XtSetValues` (S).
- Retrieve by using `XtGetValues` (G).

Table 7-7 DtMenuButtonWidget Resources

Name	**Class**	**Type**	**Default**	**Access**
DtNcascadingCallback	DtCCallback	XtCallbackList	NULL	C
DtNcascadePixmap	DtCPixmap	Pixmap	XmUNSPECIFIED_PIXMAP	CSG
DtNsubMenuId	DtCMenuWidget	Widget	NULL	SG

Callback Structures

The callback structure follows and is described in Table 7-8.

```
typedef struct {
    int        reason;
    XEvent     *event;
```

```
} XmAnyCallbackStruct;
```

Table 7-8 DtMenuButtonWidget Callback Structures

Structure	Description
reason	Returns reason why the callback was invoked.
event	Points to the `XEvent` that triggered the callback or `NULL` if the callback was not triggered by an XEvent.

Example of DtMenuButton Widget

The following example shows how to create and use a `DtMenuButton` widget. You can find this code as part of the `controls.c` demo in the `/usr/dt/examples/dtwidget` directory.

```
/*
 * Example code for DtMenuButton
 */

#include Dt/DtMenuButton.h

/* MenuButton custom glyph */

#define menu_glyph_width 16
#define menu_glyph_height 16
static unsigned char menu_glyph_bits[] = {
    0xe0, 0x03, 0x98, 0x0f, 0x84, 0x1f, 0x82, 0x3f, 0x82, 0x3f, 0x81,
    0x7f,
    0x81, 0x7f, 0xff, 0x7f, 0xff, 0x40, 0xff, 0x40, 0xfe, 0x20, 0xfe,
    0x20,
    0xfc, 0x10, 0xf8, 0x0c, 0xe0, 0x03, 0x00, 0x00};

static void CreateMenuButtons(Widget parent)
{
    Widget menuButton, submenu, titleLabel, button;
    Pixmap cascadePixmap;
    Pixel fg, bg;
    Cardinal depth;
    XmString labelString;
    Arg args[20];
    int i, n;

    /* Create title label */
```

```
labelString = XmStringCreateLocalized("MenuButton Widget");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
titleLabel = XmCreateLabel(parent, "title", args, n);
XtManageChild(titleLabel);
XmStringFree(labelString);

/*
 * Create a MenuButton.
 * Add push buttons to the built-in popup menu.
 */

labelString = XmStringCreateLocalized("Action");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
menuButton = DtCreateMenuButton(parent, "menuButton1", args, n);
XtManageChild(menuButton);
XmStringFree(labelString);

XtVaGetValues(menuButton, DtNsubMenuId, &submenu, NULL);
button = XmCreatePushButton(submenu, "Push", NULL, 0);
XtManageChild(button);
button = XmCreatePushButton(submenu, "Pull", NULL, 0);
XtManageChild(button);
button = XmCreatePushButton(submenu, "Turn", NULL, 0);
XtManageChild(button);

/*
 * Create a MenuButton.
 * Replace the built-in popup menu with a tear-off menu.
 * Add a custom pixmap in the colors of the MenuButton.
 */

labelString = XmStringCreateLocalized("Movement");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
menuButton = DtCreateMenuButton(parent, "menuButton1", args, n);
XtManageChild(menuButton);
XmStringFree(labelString);

/* Create a tear-off menu */

n = 0;
XtSetArg(args[0], XmNtearOffModel, XmTEAR_OFF_ENABLED); n++;
submenu = XmCreatePopupMenu(menuButton, "submenu", args, n);
button = XmCreatePushButton(submenu, "Run", NULL, 0);
```

```
    XtManageChild(button);
    button = XmCreatePushButton(submenu, "Jump", NULL, 0);
    XtManageChild(button);
    button = XmCreatePushButton(submenu, "Stop", NULL, 0);
    XtManageChild(button);

    XtVaSetValues(menuButton, DtNsubMenuId, submenu, NULL);

    /* Create a pixmap using the menu button's colors and depth */

    XtVaGetValues(menuButton,
                  XmNforeground, &fg,
                  XmNbackground, &bg,
                  XmNdepth, &depth,
                  NULL);

    cascadePixmap = XCreatePixmapFromBitmapData(XtDisplay
               (menuButton),DefaultRootWindow(XtDisplay
               (menuButton)),
               (char*)menu_glyph_bits,
               menu_glyph_width, menu_glyph_height,
               fg, bg, depth);
    XtVaSetValues(menuButton, DtNcascadePixmap, cascadePixmap,
    NULL);
}
```

Text Editor Widget (DtEditor)

The TriTeal Enterprise Desktop text editing system consists of two components:

- The text editor client, `dtpad`, which provides editing services through graphical, action, and ToolTalk interfaces.
- The editor widget, `DtEditor(3)`, which provides a programmatic interface for the following editing services:
  - Cut and paste.
  - Search and replace.
  - Simple formatting.
  - Spell checking (for 8-bit locales).
  - Undo previous edit.
  - Enhanced I/O handling capabilities that support input and output of ASCII text, multibyte text, and buffers of data.
  - Support for reading and writing files directly.

Although the OSF/Motif text widget also provides a programmatic interface, applications that use the system-wide uniform editor should use the `DtEditor(3)` widget. The TriTeal Enterprise Desktop Text Editor and Mailer use the editor widget. Use this widget in the following circumstances:

1. You want the functionality, such as spell checking, undo, and find/change, that is provided by the `DtEditor(3)` widget.
2. You do not want to write the code so that users may read and write data to and from a file.
3. Your program does not need to examine every character typed or every cursor movement made by a user.

This section describes the text editor widget, `DtEditor(3)`.

The Editor Widget library provides support for creating and editing text files. It enables applications running in the desktop environment to have a consistent method of editing text data. The `DtEditor(3)` widget consists of a scrolled edit window for text, an optional status line, and dialogs for finding and changing text, spell checking, and specifying formatting options. The text editor widget includes a set of convenience functions for programmatically controlling the widget.

Library and Header Files

The `DtEditor` widget is in the `libDtWidget` library. The header file is `Dt/Editor.h`.

Demo Program

A demo containing an example of the `DtEditor` widget is in `/usr/dt/examples/dtwidget/editor.c`.

Classes

Widget subclassing is not supported for the `DtEditor` widget class.

`DtEditor` inherits behavior and resources from `Core`, `Composite`, `Constraints`, `XmManager`, and `XmForm` classes.

The class name for the editor widget is `DtEditorWidget`.

The class pointer is `dtEditorWidgetClass`.

Convenience Functions

The `DtEditor` convenience functions are described in the following tables.

Life Cycle Functions

The `DtEditor` life cycle functions are described in Table 7-9.

Table 7-9 DtEditor Life Cycle Functions

Function	Description
`DtCreateEditor`	Creates a new instance of a `DtEditor` widget and its children.
`DtEditorReset`	Restores a `DtEditor` widget to its initial state.

Input/Output Functions

The `DtEditor` input/output functions are described in Table 7-10.

Table 7-10 DtEditor Input/Output Functions

Function	Description
`DtEditorAppend`	Appends content data to the end of an editor widget.
`DtEditorAppendFromFile`	Appends the contents of a file to the end of an editor widget.
`DtEditorGetContents`	Retrieves the entire contents of an editor widget.
`DtEditorInsert`	Inserts content data at the current insert position.
`DtEditorInsertFromFile`	Inserts the contents of a file at the current insert position.
`DtEditorReplace`	Replaces a portion of text with the supplied data.
`DtEditorReplaceFromFile`	Replaces a portion of text with the contents of a file.

Table 7-10 DtEditor Input/Output Functions *(Continued)*

Function	Description
DtEditorSaveContentsToFile	Saves the entire contents to a file.
DtEditorSetContents	Loads content data into an editor widget, replacing the entire contents of the widget.
DtEditorSetContentsFromFile	Loads the contents of a file into an editor widget, replacing the entire contents of the widget.

Selection Functions

The DtEditor selection functions are described in Table 7-11.

Table 7-11 DtEditor Selection Functions

Function	Description
DtEditorClearSelection	Replaces the currently selected contents with blanks.
DtEditorCopyToClipboard	Copies the currently selected contents to the clipboard.
DtEditorCutToClipboard	Removes the currently selected contents, placing then on the clipboard.
DtEditorDeleteSelection	Removes the currently selected contents.
DtEditorDeselect	Deselects any selected contents.
DtEditorPasteFromClipboard	Pastes the contents of the clipboard into an editor widget, replacing any currently selected contents.
DtEditorSelectAll	Selects the entire contents of an editor widget.

Format Functions

The `DtEditor` format functions are described inTable 7-12.

Table 7-12 DtEditor Format Functions

Function	Description
`DtEditorFormat`	Formats all or part of the contents of an editor widget.
`DtEditorInvokeFormatDialog`	Displays the format dialog box that enables the user to specify format settings for margins and justification style and to perform formatting operations.

Find and Change Functions

The `DtEditor` find and change functions are described in Table 7-13.

Table 7-13 DtEditArea Find and Change Functions

Function	Description
`DtEditorChange`	Changes one or all occurrences of a string.
`DtEditorFind`	Finds the next occurrence of a string.
`DtEditorInvokeFindChangeDialog`	Displays the dialog box that enables the user to search for, and optionally change, a string.
`DtEditorInvokeSpellDialog`	Displays a dialog box with a list of misspelled words in the current contents.

Auxiliary Functions

The DtEditor auxiliary functions are described in Table 7-14.

Table 7-14 DtEditor Auxiliary Functions

Function	Description
DtEditorCheckForUnsavedChanges	Reports whether the contents of an editor widget have been altered since the last time they were retrieved or saved.
DtEditorDisableRedisplay	Prevents redisplay of an editor widget even though its visual attributes have changed.
DtEditorEnableRedisplay	Forces the visual update of an editor widget.
DtEditorGetInsertPosition	Returns the insertion cursor position of the editor widget.
DtEditorGetLastPosition	Returns the position of the last character in the edit window.
DtEditorGetMessageTextFieldID	Retrieves the widget ID of the text field widget used to display application messages.
DtEditorGetSizeHints	Retrieves sizing information from an editor widget.
DtEditorGoToLine	Moves the insertion cursor to the specified line.
DtEditorSetInsertionPosition	Sets the position of the insertion cursor.
DtEditorTraverseToEditor	Sets keyboard traversal to the edit window of an editor widget.
DtEditorUndoEdit	Undoes the last edit made by a user.

Resources

The `DtEditor` widget provides the following set of resources.

- `DtNautoShowCursorPosition` ensures that the text visible in the scrolled edit window contains the insert cursor when set to True. If the insert cursor changes, the contents of the editor may scroll to bring the insertion point into the window.
- `DtNblinkRate` specifies the blink rate of the text cursor in milliseconds. The time it takes to blink the insertion cursor on and off is twice the blink rate. When the blink rate is set to zero, the cursor does not blink. The value must not be negative.
- `DtNbuttonFontList` specifies the font list used for the buttons that are displayed in the dialog boxes of `DtEditor`.
- `DtNcolumns` specifies the initial width of the editor as an integer number of characters. The value must be greater than zero.
- `DtNcursorPosition` specifies the location of the current insert cursor in the editor where the current insert cursor is placed. Position is determined by the number of characters from the beginning of the text. The first character position is 0.
- `DtNcursorPositionVisible` marks the insert cursor position by a blinking text cursor when the Boolean value is True.
- `DtNdialogTitle` specifies the title for all dialogs displayed by DtEditor. These include the dialogs for word search and replace, misspelled words, and format settings.
- `DtNeditable` indicates that the user can edit the data when set to True. Prohibits the user from editing data when set to False.
- `DtNlabelFontList` specifies the font list used for `DtEditor` labels (the labels are displayed in the status line and `DtEditor` dialog boxes).
- `DtNoverstrike` when set to False, characters typed into the editor widget inserts at the position of the cursor (the default). When set to True, characters typed into the editor widget replace the characters that directly follow the insertion cursor. When the end of the line is reached, characters are appended to the end of the line. If the status line is visible, the `DtNoverstrikeIndicatorLabel` is displayed in the status line whenever `DtNoverstrike` is True.

- `DtNrows` specifies the initial height of the editor measured in character heights. The value must be greater than zero.
- `DtNscrollHorizontal` adds a scroll bar that enables the user to scroll horizontally through text when the Boolean value is True.
- `DtNscrollLeftSide` puts a vertical scroll bar on the left side of the scrolled edit window when the Boolean value is True.
- `DtNshowStatusLine` displays a status line below the text window when set to True. The status line contains a field that displays the current line number of the insert cursor, total number of lines in the document, and whether the editor is in overstrike mode. Users can type a line number in the line number display to go directly to that line.

The status line also includes a Motif `XmTextField(3X)` widget for displaying messages supplied by an application. This field is a convenient place for an application to display status and feedback about the document being edited. The ID of the text field is retrieved using `DtEditorGetMessageTextFieldID(3)`. A message is displayed by setting the `XmNvalue` or `XmNvalueWcs` resource of this widget. If the text field is not needed, you can unmanage it by calling `XtUnmanageChild(3X)` with its ID.

- `DtNspellFilter` specifies the filter used to identify spelling errors. The function `DtEditorInvokeSpellDialog(3)` filters the contents of an editor through the filter specified by `DtNspellFilter`. The filter specified should accept a file name and produce a list of misspelled and unrecognized words in this file on `stdout`. The default filter is `spell(1)`.
- `DtNtextBackground` specifies the background for the edit window.
- `DtNtextDeselectCallback` specifies a function called whenever no text is selected within the edit area. The reason sent by the callback is `DtEDITOR_TEXT_DESELECT`.
- `DtNtextFontList` specifies the font list used for the `DtEditor` edit window and its text fields. The text fields are displayed in the status line and `DtEditor` dialog boxes.
- `DtNtextForeground` specifies the foreground for the edit window.
- `DtNtextSelectCallback` specifies a function called whenever text is selected within the edit area. The reason sent by the callback is `DtEDITOR_TEXT_SELECT`.

- `DtNtextTranslations` specifies translations that are added to the edit window. Translations specified with this resource override any duplicate translations defined for the edit window. See the `DtEditor(3)` man page for a list of translations provided by `DtEditor`.
- `DtNtopCharacter` displays the line that contains the position of text at the top of the scrolled edit window. The line is displayed at the top of the widget without shifting the text left or right. Position is determined by the number of characters from the beginning of the text. The first character position is zero.

  `XGetValues(3X)` for `DtNtopCharacter` returns the position of the first character in the line that is displayed at the top of the widget.
- `DtNwordWrap` breaks lines at word breaks with soft carriage returns when they reach the right edge of the window. Note that word wrap affects only the visual appearance of the contents of an editor widget. The line breaks (soft carriage returns) are not physically inserted into the text. The editor does support substituting hard carriage returns when the contents of the widget are retrieved or saved to a file. See the `DtEditorGetContents(3)` and `DtEditorSaveContentsToFile(3)` man pages for more information.

Table 7-15 lists the class, type, default, and access for each resource. You can also set the resource values for the inherited classes to set attributes for this widget. To reference a resource by name or class in an `.Xdefaults` file, remove the `DtN` or `DtC` prefix and use the remaining letters. To specify one of the defined values for a resource in an `.Xdefaults` file, remove the `Dt` prefix and use the remaining letters (in either lowercase or uppercase, but include any underscores between words).

The codes in the access column show if you can:

- Set the resource at creation time (C)
- Set by using `XtSetValues` (S)
- Retrieve by using `XtGetValues` (G)

See the DtEditor(3) man page for more information.

Table 7-15 DtEditor Resources

Name	Class	Type	Default	Access
DtNautoShowCursorPosition	DtCAutoShowCursorPosition	Boolean	True	CSG
DtNblinkRate	DtCBlinkRate	int	500	CSG
DtNbuttonFontList	DtCFontList	XmFontList	Dynamic	CSG
DtNcolumns	DtCColumns	XmNcolumns	Dynamic	CSG
DtNcursorPosition	DtCCursorPosition	XmTextPosition	0	CSG
DtNcursorPositionVisible	DtCCursorPositionVisible	Boolean	True	CSG
DtNdialogTitle	DtCDialogTitle	XmString	NULL	CSG
DtNeditable	DtCEditable	Boolean	True	CSG
DtNlabelFontList	DtCFontList	XmFontList	Dynamic	CSG
DtNmaxLength	DtCMaxLength	int	Largest integer	CSG
DtNoverstrike	DtCOverstrike	Boolean	False	CSG
DtNrows	DtCRows	XmNrows	Dynamic	CSG
DtNscrollHorizontal	DtCScroll	Boolean	True	CG
DtNscrollLeftSide	DtCScrollSide	Boolean	Dynamic	CG
DtNscrollTopSide	DtCScrollSide	Boolean	False	CG
DtNscrollVertical	DtCScroll	Boolean	True	CG
DtNshowStatusLine	DtCShowStatusLine	Boolean	False	CSG
DtNspellFilter	DtCspellFilter	char *	Spell	CSG
DtNtextBackground	DtCBackground	Pixel	Dynamic	CSG
DtNtextDeselectCallback	DtCCallback	XtCallbackList	NULL	C
DtNtextFontList	DtCFontList	XmFontList	Dynamic	CSG
DtNtextForeground	DtCForeground	Pixel	Dynamic	CSG
DtNtextTranslations	DtCTranslations	XtTranslations	NULL	CS

Table 7-15 DtEditor Resources *(Continued)*

Name	Class	Type	Default	Access
DtNtextSelectCallback	DtCCallback	XtCallbackList	NULL	C
DtNtopCharacter	DtCTextPosition	XmTextPosition	0	CSG
DtNwordWrap	DtCWordWrap	Boolean	True	CSG

Inherited Resources

`DtEditor` inherits behavior and resources from the following superclasses:

- `XmForm`
- `XmManager`
- `Composite`
- `Core`

Refer to the appropriate man page for more information.

Localization Resources

The following list describes a set of widget resources that are designed for localization of the `DtEditor` widget and its dialog boxes. Default values for these resources depend on the locale.

- `DtNcenterToggleLabel` specifies the label for the center alignment toggle button in the Format Settings dialog box. The default value in the C locale is Center.
- `DtNchangeAllButtonLabel` specifies the label for the button in the Find/Change dialog box that changes all occurrences of the Find string in the document. The default value in the C locale is Change All.
- `DtNchangeButtonLabel` specifies the label for the button in the Find/Change dialog box that changes the next occurrence of the find string in the document. The default value in the C locale is Change.
- `DtNchangeFieldLabel` specifies the label for the field in the Find/Change dialog box where the user specifies the replacement string. The default value in the C locale is Change To.
- `DtNcurrentLineLabel` specifies the label for the current line number field in the status line. The default value in the C locale is Line.

- `DtNfindButtonLabel` specifies the label for the button in the Find/Change dialog box that finds the next occurrence of the find string in the document. The default value in the C locale is Find.
- `DtNfindChangeDialogTitle` specifies the title for the Find/Change dialog box. If `DtNdialogTitle` is non-null, it is added to the front of this resource to form the title. The default value in the C locale is Find/Change.
- `DtNfindFieldLabel` specifies the label for the field in the Find/Change dialog box where the user specifies the search string. The default value in the C locale is Find.
- `DtNformatAllButtonLabel` specifies the label for the button in the Format Settings dialog box that formats the complete document. The default value in the C locale is All.
- `DtNformatParagraphButtonLabel` specifies the label for the button in the Format Settings dialog box that formats the paragraph containing the insertion cursor. The default value in the C locale is Paragraph.
- `DtNformatSettingsDialogTitle` specifies the title for the Format Settings dialog box. If DtNdialogTitle is non-null, it is added to the front of this resource to form the title. The default value in the C locale is Format Settings.
- `DtNinformationDialogTitle` specifies the title for the Information dialog box that is used to present feedback and general information to the user. If `DtNdialogTitle` is non-null, it is added to the front of this resource to form the title. The default value in the C locale is Information.
- `DtNjustifyToggleLabel` specifies the label for the justify alignment toggle button in the Format Settings dialog box. The default value in the C locale is Justify.
- `DtNleftAlignToggleLabel` specifies the label for the left alignment toggle button in the Format Settings dialog box. The default value in the C locale is Left Align.
- `DtNleftMarginFieldLabel` specifies the label for the left margin value field in the Format Settings dialog box. The default value in the C locale is Left Margin.
- `DtNmisspelledListLabel` specifies the label for the list of unrecognized and misspelled words in the Spell dialog box. The default value in the C locale is Misspelled Words.

- `DtNoverstrikeLabel` specifies the label in the status line that shows that the editor is in overstrike mode. The default value in the C locale is Overstrike.
- `DtNrightAlignToggleLabel` specifies the label for the right alignment toggle button in the Format Settings dialog box. The default value in the C locale is Right Align.
- `DtNrightMarginFieldLabel` specifies the label for the right margin value field in the Format Settings dialog box. The default value in the C locale is Right Margin.
- `DtNspellDialogTitle` specifies the title for the Format Settings dialog box. If `DtNdialogTitle` is non-null, it is added to the front of this resource to form the title. The default value in the C locale is Spell.
- `DtNtotalLineCountLabel` specifies the label for the display as part of the status line that shows the total number of lines in the document. The default value in the C locale is Total.

Table 7-16 lists the class, type, default, and access for each of the localization resources. The codes in the access column show if you can:

- Set the resource at creation time (C).
- Set by using `XtSetValues` (S).
- Retrieve by using `XtGetValues` (G).

See the `DtEditor(3)` man page for more information.

Table 7-16 DtEditor Localization Resources

Name	Class	Type	Default	Access
DtNcenterToggleLabel	DtCCenterToggleLabel	XmString	Dynamic	CSG
DtNchangeAllButtonLabel	DtCChangeAllButtonLabel	XmString	Dynamic	CSG
DtNchangeButtonLabel	DtCChangeButtonLabel	XmString	Dynamic	CSG
DtNchangeFieldLabel	DtCChangeFieldLabel	XmString	Dynamic	CSG
DtNcurrentLineLabel	DtCCurrentLineLabel	XmString	Dynamic	CSG
DtNfindButtonLabel	DtCFindButtonLabel	XmString	Dynamic	CSG
DtNfindChangeDialogTitle	DtCFindChangeDialogTitle	XmString	Dynamic	CSG
DtNfindFieldLabel	DtCFindFieldLabel	XmString	Dynamic	CSG
DtNformatAllButtonLabel	DtCFormatAllButtonLabel	XmString	Dynamic	CSG

Table 7-16 DtEditor Localization Resources *(Continued)*

Name	Class	Type	Default	Access
DtNformatParagraphButtonLabel	DtCFormatParagraphButtonLabel	XmString	Dynamic	CSG
DtNformatSettingsDialogTitle	DtCFormatSettingsDialogTitle	XmString	Dynamic	CSG
DtNinformationDialogTitle	DtCInformationDialogTitle	XmString	Dynamic	CSG
DtNjustifyToggleLabel	DtCJustifyToggleLabel	XmString	Dynamic	CSG
DtNleftAlignToggleLabel	DtCLeftAlignToggleLabel	XmString	Dynamic	CSG
DtNleftMarginFieldLabel	DtCLeftMarginFieldLabel	XmString	Dynamic	CSG
DtNmisspelledListLabel	DtCMisspelledListLabel	XmString	Dynamic	CSG
DtNoverstrikeLabel	DtCOverstrikeLabel	XmString	Dynamic	CSG
DtNrightAlignToggleLabel	DtCRightAlignToggleLabel	XmString	Dynamic	CSG
DtNrightMarginFieldLabel	DtCRightMarginFieldLabel	XmString	Dynamic	CSG
DtNspellDialogTitle	DtCSpellDialogTitle	XmString	Dynamic	CSG
DtNtotalLineCountLabel	DtCTotalLineCountLabel	XmString	Dynamic	CSG

Callback Functions

The `DtEditor` widget supports three callback functions:

- `DtEditorNHelpCallback`
- `DtNtextSelectCallback`
- `DtNtextDeselectCallback`

If you want to present help information about the editor widget and its dialog boxes, set the `XmNhelpCallback` resource and use the reason field passed as part of `DtEditorHelpCallbackStruct` to set the contents of the Help dialog box. A pointer to the following structure is passed to `XmNHelpCallback`. The callback structure and is described in Table 7-17.

```
typedef struct {
    int        reason;
    XEvent     *event;
```

```
} DtEditorHelpCallbackStruct;
```

Table 7-17 DtEditorHelp Callback Structure

Structure	Description
reason	The reason why the callback was invoked. Refer to the `DtEditor(3)` man page for a list of reasons.
event	A pointer to the event that invoked this callback. The value can be NULL.

Use the `DtNtextSelectCallback` and `DtNtextDeselectCallback` resources when you want to enable and disable menu items and commands depending on whether text is selected. `DtNtextSelectCallback` specifies a function that is called whenever some text is selected in the edit window. `DtNtextDeselectCallback` specifies a function that is called whenever no text is selected within the edit window. The reasons sent by the callbacks are `DtEDITOR_TEXT_SELECT` and `DtEDITOR_TEXT_DESELECT`.

Invoking Actions from Applications 8

If your application manages an extensible collection of data types, there is a strong likelihood that it should be directly involved with action invocation. This chapter explains how you can invoke an action from an application. Included is an example program that shows you how to invoke an action.

For more information on actions and how you create them, see the chapter "Accessing the Data-Typing Database" in this manual, and the following chapters in the *Advanced User's and System Administrator's Guide*:

- "Introduction to Actions and Data Types"
- "Creating Actions and Data Types Using Create Action"
- "Creating Actions Manually"
- "Creating Data Types Manually"

Mechanisms for Invoking Actions from an Application

The action invocation API exported by the Desktop Services library is one mechanism available to your application to cause another application to be invoked or to perform an operation. Other mechanisms include:

- The `fork/exec` system calls
- ToolTalk messages

Each of these mechanisms has benefits and limitations, so you must evaluate your specific situation to determine which is most appropriate.

The advantages of using the action invocation API include:

- Actions can encapsulate both traditional command-line applications (that is, `COMMAND` actions) and ToolTalk applications (that is, `TT_MSG` actions). The application that invokes the action does not need to know whether a command is forked or a message is sent.
- Actions are polymorphic and are integrated with the desktop's data-typing mechanisms. This means that an action, such as Open or Print, may have different behavior depending on the type of argument that is supplied, but the behavior differences are transparent to the application that invokes the action.
- Actions provide a great deal of configurability for the application developer, system integrator, system administrator, and end user. Any one of these people can edit the action database to modify the definition of how an action is to be performed.
- Actions work well in distributed environments. If an application uses `fork/exec` to directly invoke another application, then both applications must be available and able to run on the same system. By contrast, the action invocation API uses information in the action database to determine on which system a `COMMAND` action should be invoked.
- Actions allow your application to behave consistently with the behavior of the desktop. This is because the desktop's components interact by using actions when manipulating the user's data files.
- The disadvantage of using g the action invocation API is that it is only an invocation mechanism that has limited return value capabilities and has no capabilities for a dialog with the invoked action handler. If these features are

required, `fork/exec/pipes` can be used. However, within TED, ToolTalk is the preferred cross process communications mechanism due to its generalized client/server paradigm.

Returning to invocation, suppose your application manages data files in several different formats (text and graphics) and needs to provide a way for the user to edit and display these files. To implement this without using actions, you would probably use one of the following mechanisms:

- Use `fork/exec` to start the appropriate editor and invent some mechanism (for example, environment variables) for the user to specify the names of the editors. The limitations of this approach include the following:
  - You must write complex code that uses system calls to invoke sub-processes and monitors the resulting signals.
  - The editors must either be available on the same system as your application or the system administrator must provide a complex configuration using facilities such as `rsh`.
  - System administrators and users must learn and manage your application's unique configuration model.
- Use ToolTalk messages to request that operations, such as Edit and Display, be performed on the data. The limitation of this approach is that ToolTalk-based editors must be available for all of your types of data.

To implement this using actions, you only have to invoke the Open action on the buffer or on the data file. The action invocation API will use the action database to determine the appropriate message to send or command to invoke, as well as handle all details, such as creating and cleaning up temporary files and catching necessary signals.

Types of Actions

The action application program interface (API) works with any type of action. Types of actions in the desktop include:

Command actions	Specifies a command line to execute.
ToolTalk actions	Specifies a ToolTalk message to send, which is then received by the appropriate application.
Map actions	Refers to another action instead of defining any specific behavior.

See “Introduction to Actions and Data Types” in the *TriTeal Enterprise Desktop: Advanced Users’ and System Administrator’s Guide* for more information.

Action Invocation API

The action invocation API is exported from the Desktop Services library and provides functions to accomplish a number of tasks, such as:

- Initialize and load the database of action and data-type definitions. The database *must* be loaded before an action can be run.
- Query the database. There are functions to determine whether a specified action or its associated icon image, label, or description exists.
- Invoke an action. The application can pass file or buffer arguments to the action.
- Register a callback to receive action status and return arguments.

Related Information

For detailed information about action commands, functions, and data formats, see the following man pages:

- `dtaction(1)`
- `dtactionfile(4)`
- `DtActionCallbackProc(3)`
- `DtActionDescription(3)`
- `DtActionExists(3)`
- `DtActionIcon(3)`
- `DtActionInvoke(3)`
- `DtActionLabel(3)`
- `dtexec(1)`

actions.c Example Program

This section describes a simple example program, `actions.c`. A complete listing of `actions.c` is at the end of this chapter.

Loading the Database of Actions and Data Types

Before your application can invoke an action, it *must* initialize the Desktop Services library (which contains the action invocation API) and load the database of action and data-type definitions.

▼ To Initialize the Desktop Services Library

♦ Use the `DtInitialize()` function to initialize the Desktop Services Library.

`DtInitialize(`**display*`,`*widget*`,`**name*`,`**tool_class*`)`

`DtInitialize()` uses the default Intrinsic `XtAppContext`. The API provides an additional function, `DtAppInitialize()` to use when your application must specify an *app_context*:

`DtAppInitialize(`*app_context*`,`**display*`,`*widget*`,`**name*`,` *tool_class*`)`

DtInitialize() Example

The following code segment shows how the example program `actions.c` uses `DtInitialize()`.

```
/* Initialize the desktop */
if (DtInitialize(XtDisplay(shell), shell, argv[0],
ApplicationClass)==False) {
        /* DtInitialize() has already logged an appropriate error
msg */
        exit(-1);
    }
```

▼ To Load the Actions and Data-Types Database

♦ Use the `DtDbLoad()` function to load the actions and data-typing databases.

```
DtDbLoad(void)
```

`DtDbLoad()` reads in the action and data-typing databases. This function determines the set of directories that are to be searched for database files (the database search path) and loads the `*.dt` files found into the database. The directory search path is based on the value of the `DTDATABASESEARCHPATH` environment variable and internal defaults.

DtDbLoad() Example

The following code segment shows how the example program `actions.c` uses `DtDbLoad()`.

```
/* Load the filetype/action databases */
    DtDbLoad();
```

▼ To Request Notification of Reload Events

If you use DtDbLoad() in a long-lived application, it must dynamically reload the database whenever it is modified.

1. Use the `DtDbReloadNotify()` function to request notification of reload events.

```
DtDbReloadNotify(DtDbReloadCallbackProc callback_proc,
                 XtPointer client_data)
```

2. Supply a callback that:
   - Destroys cached database information held by the application
   - Calls the `DtDbLoad()` function again

Callback_proc cleans up any cached database information your application is holding and then invokes `DtDbLoad()`. *Client_data* may be used to pass additional client information to the callback routine.

Checking the Actions Database

Your application accesses the database if it needs to display the icon or label for an action. Also by invoking an action, your application can check that it exists. An action is identified in the database by the action name:

```
ACTION action_name
{
  …
}
```

For example, the action definition for the Calculator looks like this:

```
ACTION Dtcalc
{
        LABEL           Calculator
        ICON            Dtcalc
        ARG_COUNT       0
        TYPE            COMMAND
        WINDOW_TYPE     NO_STDIO
        EXEC_STRING     /usr/dt/bin/dtcalc
        DESCRIPTION     The Calculator (Dtcalc) action runs the \
                        desktop Calculator application.
}
```

The action name for the Calculator action is `Dtcalc`. When an executable file has a file name that matches an action name in the database, that file is an action file — a representation for the underlying action. The information about the icon and label for that file are stored in the database.

▼ To Determine Whether a Specified Action Definition Exists

♦ Use the `DtActionExists()` function to determine whether a specified action definition exists.

`DtActionExists(*name)`

`DtActionExists()` checks whether the specified *name* corresponds to the name of an action in the database. The function returns True if *name* corresponds to an action name, or False if no action with that name is found.

▼ To Obtain the Icon Image Information for a Specified Action

♦ Use the `DtActionIcon()` function to obtain the icon image information.

`DtActionIcon(char *action_name)`

An action definition specifies the icon image used to represent the action in the definition's ICON field:

```
ACTION action_name
{
    ICON   icon_image_base_name
    ...
}
```

`DtActionIcon()` returns a character string containing the value of the icon image field. If the action definition does not contain an icon field, the function returns the value of the default action icon image, `Dtactn`.

You then need to determine the location of the icon, and the size you want to use. Icons can exist in four sizes and are available in bitmap or pixmap form. For example, you can find the base name of the icon file from the action definition for the Calculator. You then use the base name coupled with the information given in Table 8-1 and knowledge of the location of all the icons to find the specific icon file you want.

The icon name for the calculator action is `Dtcalc`, but that is not the entire file name. Icon file names are based on the size of the icon, and there are four sizes. Table 8-1 shows the sizes and file-naming conventions for the desktop icons.

Table 8-1 Icon Sizes and File Names

Icon Size	Bitmap Name	Pixmap Name
16 by 16 (tiny)	*name*`.t.bm`	*name*`.t.pm`
24 by 24 (small)	*name*`.s.bm`	*name*`.s.pm`
32 by 32 (medium)	*name*`.m.bm`	*name*`.m.pm`
48 by 48 (large)	*name*`.l.bm`	*name*`.l.pm`

Note – See "Creating Icons for the Desktop" in the *Advanced Users and System Administrator's Guide* for more information about the desktop icon files.

For bitmaps, there is an additional file that is used as a mask, and its extension ends with `_m.bm`. Thus, there can be a total of three files for each size icon. Here are the icon files for the calculator:

```
Dtcalc.t.bm
Dtcalc.t.pm
Dtcalc.t_m.bm
Dtcalc.m.bm
Dtcalc.m.pm
Dtcalc.m_m.bm
Dtcalc.l.bm
Dtcalc.l.pm
Dtcalc.l_m.bm
```

Note – There are no small icons (Dtcalc.s.bm, Dtcalc.s.pm, Dtcalc.s_m.bm) for the Calculator.

`DtActionIcon()` returns only a base name; for the Calculator it is `Dtcalc`. You must choose the type (pixmap or bitmap) and size (tiny, small, medium, or large) and append the applicable extension to the base name. In addition, you must know where the file resides.

▼ To Get the Localized Label for an Action

♦ Use the `DtActionLabel()` function to get the localized label for an action.

```
char *DtActionLabel(char *actionName)
```

An action definition may include a label. The label is defined using the *label_text* field:

```
ACTION action_name
{
   LABEL   label_text
   …
}
```

This label is used in graphical components (such as File Manager and the Application Manager) to label the action’s icon. If an action definition does not include a *label_text* field, the *action_name* is used.

The value of *label_text* string should be used by all interface components to identify the action to the end user.

The `DtActionLabel()` function returns the value of the *label_text* field in the action definition of the action named *actionName*. If the *label_text* field does not exist, the function returns the *actionName*.

```
labelString = XmStringCreateLocalized("On File:");
n = 0;
XtSetArg(args[n], XmNlabelString, labelString); n++;
w = XmCreateLabel(workArea, "fileLabel", args, n);
XtManageChild(w);
XmStringFree(labelString);
```

Invoking Actions

After your application has initialized the Desktop Services Library it can then invoke an action.

▼ To Invoke an Action

♦ Use the `DtActionInvoke()` function to invoke an action.

`DtActionInvoke(`*widget*`,` *action*`,` *args*`,` *argCount*`,` *termOpts, execHost,* *contexDir*`,` *useIndicator*`,` *statusUpdateCb*`,` *client_data*`)`

DtActionInvoke() searches the action database for an entry that matches the specified action name, and accepts arguments of the class, type and count provided. Remember that your application must initialize and load the database before invoking an action.

DtActionInvoke() Example

The following code segment is from `activateCB()` (the activate callback for the drawn button) in `actions.c`.

```
DtActionInvocationID actionId;
/* If a file was specified, build the file argument list */
printf("%s(%s)\n",action,file);
if (file != NULL && strlen(file) != 0) {
     ap = (DtActionArg*) XtCalloc(1, sizeof(DtActionArg));
   ap[0].argClass = DtACTION_FILE;
   ap[0].u.file.name = file;
   nap = 1;
 }
  /* Invoke the specified action */
```

```
actionId =
DtActionInvoke(shell,action,ap,nap,NULL,NULL,NULL,True,NULL,NULL);
}
```

Listing for actions.c

```
/* Include File Declarations */
#include <Xm/XmAll.h>
#include <Dt/Dt.h>
#include <Dt/Action.h>

#define ApplicationClass "Dtaction"

static Widget shell;
static XtAppContext appContext;
static Widget actionText;
static Widget fileText;

static void CreateWidgets(Widget);
static void InvokeActionCb(Widget, XtPointer, XtPointer);
static void InvokeAction(char*, char*);
static void DbReloadProc(XtPointer);

void main(int argc, char **argv)
{
    Arg args[20];
    int n=0;
    int numArgs = 0;

   shell = XtAppInitialize(&appContext , ApplicationClass, NULL, 0,
                                           &argc, argv, NULL, args, n);

    CreateWidgets(shell);
```

```
    if (DtInitialize(XtDisplay(shell), shell, argv[0],
ApplicationClass)==False) {
        /* DtInitialize() has already logged an appropriate error
msg */
        exit(-1);
    }

    /* Load the filetype/action databases */
    DtDbLoad();

    /* Notice changes to the database without needing to restart
application */
    DtDbReloadNotify(DbReloadProc, NULL);

    XtRealizeWidget(shell);
    XmProcessTraversal(actionText, XmTRAVERSE_CURRENT);
XmProcessTraversal(actionText, XmTRAVERSE_CURRENT);

    XtAppMainLoop(appContext);
}
static void CreateWidgets(Widget shell)
{
    Widget messageBox, workArea, w;
    Arg args[20];
    int n;
    XmString labelString;

    labelString = XmStringCreateLocalized("Invoke");

    n = 0;
    XtSetArg(args[n], XmNdialogType, XmDIALOG_TEMPLATE); n++;
    XtSetArg(args[n], XmNokLabelString, labelString); n++;
    messageBox = XmCreateMessageBox(shell, "messageBox", args, n);
```

```
    XtManageChild(messageBox);
    XmStringFree(labelString);
    XtAddCallback(messageBox, XmNokCallback, InvokeActionCb, NULL);

    n = 0;
    XtSetArg(args[n], XmNorientation, XmVERTICAL); n++;
    XtSetArg(args[n], XmNpacking, XmPACK_COLUMN); n++;
    XtSetArg(args[n], XmNnumColumns, 2); n++;
    XtSetArg(args[n], XmNentryAlignment, XmALIGNMENT_END); n++;
    workArea = XmCreateWorkArea(messageBox, "workArea", args, n);
    XtManageChild(workArea);

    labelString = XmStringCreateLocalized("Invoke Action:");
    n = 0;
    XtSetArg(args[n], XmNlabelString, labelString); n++;
    w = XmCreateLabel(workArea, "actionLabel", args, n);
    XtManageChild(w);
    XmStringFree(labelString);

    labelString = XmStringCreateLocalized("On File:");
    n = 0;
    XtSetArg(args[n], XmNlabelString, labelString); n++;
    w = XmCreateLabel(workArea, "fileLabel", args, n);
    XtManageChild(w);
    XmStringFree(labelString);

    n = 0;
    XtSetArg(args[n], XmNcolumns, 12); n++;
    actionText = XmCreateTextField(workArea, "actionText", args, n);

XmProcessTraversal(actionText, XmTRAVERSE_CURRENT);

    XtAppMainLoop(appContext);
}
```

```
static void CreateWidgets(Widget shell)
{
    Widget messageBox, workArea, w;
    Arg args[20];
    int n;
    XmString labelString;

    labelString = XmStringCreateLocalized("Invoke");

    n = 0;
    XtSetArg(args[n], XmNdialogType, XmDIALOG_TEMPLATE); n++;
    XtSetArg(args[n], XmNokLabelString, labelString); n++;
    messageBox = XmCreateMessageBox(shell, "messageBox", args, n);
    XtManageChild(messageBox);
    XmStringFree(labelString);
    XtAddCallback(messageBox, XmNokCallback, InvokeActionCb, NULL);

    n = 0;
    XtSetArg(args[n], XmNorientation, XmVERTICAL); n++;
    XtSetArg(args[n], XmNpacking, XmPACK_COLUMN); n++;
    XtSetArg(args[n], XmNnumColumns, 2); n++;
    XtSetArg(args[n], XmNentryAlignment, XmALIGNMENT_END); n++;
    workArea = XmCreateWorkArea(messageBox, "workArea", args, n);
    XtManageChild(workArea);

    labelString = XmStringCreateLocalized("Invoke Action:");
    n = 0;
    XtSetArg(args[n], XmNlabelString, labelString); n++;
    w = XmCreateLabel(workArea, "actionLabel", args, n);
    XtManageChild(w);
    XmStringFree(labelString);

    labelString = XmStringCreateLocalized("On File:");
```

```
    n = 0;
    XtSetArg(args[n], XmNlabelString, labelString); n++;
    w = XmCreateLabel(workArea, "fileLabel", args, n);
    XtManageChild(w);
    XmStringFree(labelString);

    n = 0;
    XtSetArg(args[n], XmNcolumns, 12); n++;
    actionText = XmCreateTextField(workArea, "actionText", args, n);

DtActionInvocationID actionId;

    /* If a file was specified, build the file argument list */

printf("%s(%s)\n",action,file);
    if (file != NULL && strlen(file) != 0) {
        ap = (DtActionArg*) XtCalloc(1, sizeof(DtActionArg));
        ap[0].argClass = DtACTION_FILE;
        ap[0].u.file.name = file;
        nap = 1;
    }

    /* Invoke the specified action */

    actionId =
DtActionInvoke(shell,action,ap,nap,NULL,NULL,NULL,True,NULL,NULL);
}
```

Accessing the Data-Typing Database 9

This chapter describes the data-typing functions and how to use the data-typing database.

Summary

Data typing provides an extension to the attributes of files and data beyond what is provided by the traditional UNIX file systems. These extensions consist of attributes, such as icon names, descriptions, and actions, that can be performed on files and data. This information is stored in name/value pairs in the `DATA_ATTRIBUTES` table (or database). The desktop uses a certain set of `DATA_ATTRIBUTES`, described in the following paragraphs. The `DATA_ATTRIBUTES` table is extendable for future and application-specific growth, although extending this table is not recommended because other applications may not check the additions.

Data is matched with a specific file or data entry in a DATA_CRITERIA table. The DATA_CRITERIA table entries are sorted in decreasing order from most specific to least specific. For example, /usr/lib/lib* is more specific than /usr/* and would, therefore, appear first. When a request to type a file or data is made, the table is checked in sequence to find the best match using the information provided either from the file or from the data. When an information and entry match is found, DATA_ATTRIBUTES_NAME is used to find the proper DATA_ATTRIBUTES entry.

If you want your application to present data objects (either files or data buffers) to the user in a manner consistent with the desktop, use the DtDts* API to determine how to display the data objects and how to operate on them. For example, your application can determine the icon that represents a data object by calling the DtDtsDataTypeToAttributeValue function for the ICON attribute.

Library and Header Files

To use data typing, you need to link to the libDtSvc library. Actions are usually loaded with the data-typing information. Actions require links to the libXm and libX11 libraries. The header files are Dt/Dts.h and Dt/Dt.h.

Demo Program

A demo program containing an example of how to use the data-typing database is in /usr/dt/examples/dtdts/datatyping.c.

Data Criteria and Data Attributes

Data typing consists of two parts:

- A database that stores data criteria and data attributes
- A collection of routines that query the database

The attributes of data criteria, in alphabetical order, are:

- CONTENT
- DATA_ATTRIBUTES_NAME
- LINK_NAME
- LINK_PATH
- MODE
- NAME_PATTERN

- PATH_PATTERN

Table 9-1 describes the data criteria in the order in which you are most likely to use them.

Table 9-1 Data Criteria in Order of Most Likely Use

Criteria	Description	Typical Usage
DATA_ATTRIBUTES_NAME	The name of this type of data. This value is a record_name in the data attributes table.	POSTSCRIPT
NAME_PATTERN	A shell pattern-matching expression describing the file names that could match this data. The default is an empty string, which means to ignore file patterns in matching.	*.ps
CONTENT	Three values that are interpreted as the start, type, and value fields of the magic file used by the file utility. See the file(1) man page for more information. The default is an empty field, which means to ignore contents in matching. The following types are examples of what can be matched: string, byte, short, long, and file name.	0 string !%
MODE	A string of zero to four characters that match the mode field of a stat structure. See the stat(2) man page for more information. The first character indicates: d matches a directory s matches a socket l matches a symbolic link f matches a regular file b matches a block file c matches a character special file The characters listed below can be either the first or subsequent characters: r matches any file with any of its user, group, or other read permission bits set. w matches any file with any of its user, group, or other write permission bits set. x matches any file with any of its user, group, or other execute or directory-search permission bits set.	f&!x

Table 9-1 Data Criteria in Order of Most Likely Use *(Continued)*

Criteria	Description	Typical Usage
	For example, the MODE field of frw matches any regular file that is readable or writable; x matches any file with any of its executable or search bits set. The default is an empty field, which means to ignore the mode in matching.	
PATH_PATTERN	A shell pattern-matching expression describing the absolute path names that could match this data. The default is an empty string, which means to ignore path patterns in matching.	*/*mysubdir*/*
LINK_NAME	See dtdtsfile(4) man page.	
LINK_PATH	See dtdtsfile(4) man page.	

Some of the more common attributes of data types, in alphabetical order, are:

- ACTIONS
- COPY_TO_ACTION
- DESCRIPTION
- ICON
- INSTANCE_ICON
- IS_EXECUTABLE
- IS_TEXT
- LINK_TO_ACTION
- MEDIA
- MIME_TYPE
- MOVE_TO_ACTION
- NAME_TEMPLATE
- PROPERTIES
- X400_TYPE

Table 9-1 describes the data attributes in the order in which you are most likely to use them.

Table 9-2 Data Attributes in Order of Most Likely Use

Criteria	Description	Typical Usage
DESCRIPTION	A human-readable description of this data. If this field is NULL or is not included in the data attribute record, the name of the data attribute should be used.	This is a PostScript page description.
ICON	The name of the icon to be used for this data. If this field is NULL or is not included in the data attribute record, the standard icon should be used. See dtdtsfile(4) for more details on icon naming.	Dtps
PROPERTIES	Keywords to indicate properties for this data. Valid values are invisible and visible. If this field is NULL or is not included in the data attribute record, the visible property should be assumed. Use this if you want to completely hide files from the user.	invisible
ACTIONS	A list of actions that can be performed on this data. This list refers to names in the action table for actions that are to be presented to the user for objects of this type. If this field is NULL or is not included in the data attribute record, no action is available.	Open,Print

Table 9-2 Data Attributes in Order of Most Likely Use *(Continued)*

Criteria	Description	Typical Usage
`NAME_TEMPLATE Field`	A string used to create a new file for data of this type. The string is passed to `sprintf(3)` with the file name as the single argument. The default is empty. Contrast this field with the `NAME_PATTERN` field of the data criteria table in that the template is used to create a specific file, such as `%s.c`, whereas the pattern is used to find files, such as `*.c`.	`%s.ps`
`IS_EXECUTABLE Field`	A string-Boolean value that tells users of this data type that it can be executed as an application. If `IS_EXECUTABLE` is set to `true` (see `DtDtsIsTrue()`) the data is executable. If this field is `NULL`, is not included in the data attribute record, or is not set to true, then the data is considered not executable.	`true`
`MOVE_TO_ACTION`	The name of an action to be invoked when an object is moved to the current object.	`FILESYSTEM_MOVE`
`COPY_TO_ACTION`	The name of an action to be invoked when an object is copied to the current object.	`FILESYSTEM_COPY`
`LINK_TO_ACTION`	The name of an action to be invoked when an object is linked to the current object.	`FILESYSTEM_LINK`
`IS_TEXT`	A string-Boolean value that tells users of this data type that it is suitable for manipulation (viewing or editing) in a text editor or text widget. The `IS_TEXT` field is set to `true` (see `DtDtsIsTrue()`) if the data is textual in nature and if it should be presented to the user in text form. Criteria for making this determination include whether data consists of human language, is generated and maintained manually, is usefully viewable and editable in a text editor, or contains no (or only minimal) structuring and formatting information. If the `IS_TEXT` field is `true`, the data is eligible to be displayed directly by an application. That is, the application can load the data directly into a text editing widget, such as `XmText`.	See Table 9-3 for more examples.

Table 9-2 Data Attributes in Order of Most Likely Use *(Continued)*

Criteria	Description	Typical Usage
MEDIA Field	The names in the MEDIA name space describe the form of the data itself. MEDIA names are used as ICCCM selection targets, named in the MEDIA field of the data-type records, and used in the type parameter of ToolTalk Media Exchange messages. The MEDIA name space is a subset of the name space of selection target atoms as defined by the ICCCM. All selection targets that specify a data format are valid MEDIA names, and all valid MEDIA names can be used directly as selection targets. Some selection targets specify an attribute of the selection (for example, LIST_LENGTH) or a side effect to occur (for example, DELETE), rather than a data format. These attribute selection targets are not part of the MEDIA name space.	POSTSCRIPT
MIME_TYPE	MEDIA is the desktop internal, unique name for data types. However, other external naming authorities have also established name spaces. Multipurpose Internet Message Extensions (MIME), as described in the referenced MIME RFC, is one of those external registries, and is the standard-type name space for the desktop mailer.	application/postscript

Table 9-2 Data Attributes in Order of Most Likely Use *(Continued)*

Criteria	Description	Typical Usage
X400_TYPE	X.400 types are similar in structure to the MEDIA type, but are formatted using different rules and have different naming authorities.	1 2 840 113556 3 2 850
INSTANCE_ICON Field	The name of the icon to be used for this instance of data, typically a value such as %*name*%.icon [Bug in dtdtsfile(4) man page, too.] If INSTANCE_ICON is set, the application should use it instead of ICON. If this field is NULL or is not included in the data attribute record, the ICON field should be used.	/*myicondir*/%*name*%.bm
DATA_HOST	The DATA_HOST attribute is not a field that can be added to the data attributes table in the *.dt file, but it may be returned to an application reading attributes from the table. The data-typing service adds this attribute automatically to indicate the host system from which the data type was loaded. If this field is NULL or is not included in the data attribute record, the data type was loaded from the local system.	

The IS_TEXT field differs from the text attribute of the MIME_TYPE field, which is the MIME content type, as described in the referenced MIME_ RFC. The MIME content type determines whether the data consists of textual characters or byte values. If the data consists of textual characters, and the data is labeled as text/*, the IS_TEXT field determines whether it is appropriate for the data to be presented to users in textual form.

Table 9-3 shows some examples of IS_TEXT usage with different MIME_TYPE attributes.

Table 9-3 IS_TEXT Attribute Examples

Description and MIME_TYPE Attribute	IS_TEXT Value
Human language encoded in ASCII with MIME_TYPE text/plain	IS_TEXT true
Human language encoded in E*UC, JIS, Unicode, or an ISO Latin charset with MIME_TYPE text/plain; charset=XXX	IS_TEXT true
CalendarAppointmentAttrs with a MIME_TYPE text/plain	IS_TEXT false

Table 9-3 IS_TEXT Attribute Examples *(Continued)*

Description and MIME_TYPE Attribute	IS_TEXT Value
HyperText Markup Language (HTML) with a `MIME_TYPE text/html`	`IS_TEXT true`
PostScript with `MIME_TYPE application/postscript`	`IS_TEXT false`
C program source (`C_SRC`) with `MIME_TYPE text/plain`	`IS_TEXT true`
Bitmaps and pixmaps (`XBM` and `XPM`) with `MIME_TYPE text/plain`	`IS_TEXT false`
Project or module files for the desktop application building service with `MIME_TYPE text/plain`	`IS_TEXT false`
Shell scripts with `MIME_TYPE text/plain`	`IS_TEXT false`
Encoded text produced by `uuencode(1)` with `MIME_TYPE text/plain`	`IS_TEXT false`
*`MIME_TYPE text/plain`	`IS_TEXT false`

See the `dtdtsfile(4)` man page for more information about data-type attributes.

Data-Typing Functions

To look up an attribute for a data object, you must first determine the type of the object and then ask for the appropriate attribute value for that type. The functions that you can use to query the database for data information are shown in Table 9-4. Each of these functions has a man page in section `(3)`. Refer to the appropriate man page for more information.

Table 9-4 Data-Typing Database Query Functions

Function	Description
`DtDtsBufferToAttributeList`	Finds the list of data attributes for a given buffer.
`DtDtsBufferToAttributeValue`	Finds the data attribute for a given buffer.
`DtDtsBufferToDataType`	Finds the data-type name for a given buffer.

Table 9-4 Data-Typing Database Query Functions *(Continued)*

Function	Description
`DtDtsDataToDataType`	Finds the data type for a given set of data.
`DtDtsDataTypeIsAction`	Returns the resulting saved data type for the directory.
`DtDtsDataTypeNames`	Finds a complete list of available data types.
`DtDtsDataTypeToAttributeList`	Finds the attribute list for a given data attribute name.
`DtDtsDataTypeToAttributeValue`	Finds the attribute value for a given data attribute name.
`DtDtsFileToAttributeList`	Finds the list of data attributes for a given file.
`DtDtsFileToAttributeValue`	Finds the data attribute value for a given file.
`DtDtsFileToDataType`	Finds the data type for a given file.
`DtDtsFindAttribute`	Finds the list of data types where attribute `name` matches `value`.
`DtDtsFreeAttributeList`	Frees the memory of the given attribute list.
`DtDtsFreeAttributeValue`	Frees the memory of the given attribute value.
`DtDtsFreeDataType`	Frees the application memory for the given data-type name.
`DtDtsFreeDataTypeNames`	Releases memory created with the `DtDtsDataTypeNames` or `DtDtsFindAttribute` call.
`DtDtsIsTrue`	A convenience function that converts a string to a Boolean.

Table 9-4 Data-Typing Database Query Functions *(Continued)*

Function	Description
`DtDtsRelease`	Unloads the data-typing database information, generally in preparation for a reload.
`DtDtsSetDataType`	Sets the data type for the specified directory.
`DtsLoadDataTypes`	Initializes and loads the database fields for the data-typing functions. Use instead of `DtDbLoad` when you do not need to use actions or action types and you need extra performance. Use `DtDbLoad` when you need to use actions.

You can type data and retrieve attributes in one of three ways: simple, intermediate, or advanced.

Simple Data Typing

The simplest way to type data is to use the following functions:

- `DtDtsFileToAttributeList`
- `DtDtsFileToAttributeValue`

When you use these functions, a file is typed and a single attribute, or the entire list, is retrieved. System calls are made, data is typed, and the attribute is retrieved. These functions call the intermediate data-typing functions.

- `DtDtsBufferToAttributeList`
- `DtDtsBufferToAttributeValue`

Buffers are assumed to have a mode that matches regular files that have read/write permissions. See “Advanced Data Typing” to type read-only buffers.

Intermediate Data Typing

When you type data and retrieve attributes, the data-typing part of the process is the most expensive in terms of performance. You can type data in a second way that improves performance by separating the data-typing and attribute-retrieval functions. Use the following functions for intermediate data typing:

- `DtDtsBufferToDataType`
- `DtDtsFileToDataType`
- `DtDtsDataTypeToAttributeList`
- `DtDtsDataTypeToAttributeValue`

Use these functions if your application queries for more than a single attribute value. When you use these functions, an object is typed and then that type is used to retrieve one or more attributes from the attribute list.

Using the intermediate data-typing functions is the recommended way to type data and retrieve attributes. These functions call the advanced data-typing functions and make the same assumptions about buffers as the simpler data typing.

Advanced Data Typing

Advanced data typing separates system calls, data typing, and attribute retrieval even further. Advanced data typing is more complicated to code because it uses data from existing system calls, which are initialized in advance and are not included as part of the data-typing function. Use the following function for advanced data typing:

```
DtDtsDataToDataType
```

To type a read-only buffer, a `stat` structure should be passed that has the `st_mode` field set to `S_IFREG | S_IROTH | S_IRGRP | S_IRUSR`.

Data Types That Are Actions (DtDtsDataTypeIsAction)

For every action in a database a *synthetic data type* is generated when a database is loaded that allows actions to be typed. These data types may have two additional attributes:

- `IS_ACTION` is a string-Boolean value that tells users of this data type that it is an action. If `IS_ACTION` is set to the string `true` (independent of case), the data is an action.
- `IS_SYNTHETIC` is a string-Boolean value that tells users of this data type that it was generated from an entry in the `ACTION` table. If `IS_SYNTHETIC` is set to `true`, the data type was generated.

Registering Objects as Drop Zones

If your application defines data types, follow these steps to ensure that it provides all the drag and drop behavior that you intend:

1. In your application, decide if you need to define any data types.
2. For each data type you define, decide whether you want the associated object to be a drop zone.
3. For each object that you want to register as a drop zone, decide which operations—move, copy, or link—you want to define.
4. For the drop operations that are valid for each object, define the appropriate drop actions (set the `MOVE_TO_ACTION`, `COPY_TO_ACTION`, and `LINK_TO_ACTION` attributes).

If your application displays icons for data objects, you may choose to support those icons as drop zones. If so, you need to query the `MOVE_TO_ACTION`, `COPY_TO_ACTION`, or `LINK_TO_ACTION` attributes to determine the drop behavior for those data objects. Objects should support drop operations only if the corresponding attribute value is not `NULL`. If all three attributes have `NULL` values, the object should not be registered as a drop site. Whenever you set at least one of these attributes for an object with a defined data type, your application registers that object as a drop zone.

When a user drags an object to a drop zone, your application determines which gesture (that is, which drag operation) was used to make the drop. Based on the drag operation and the drop zone's data type, the application retrieves a drop attribute from the data-typing database. It then calls `DtActionInvoke`, using the following two rules to determine its parameters:

1. If the user drops objects A and B onto object C, call `DtActionInvoke` with C, A and B as *args*. The `action` is the value of either `MOVE_TO_ACTION`, `COPY_TO_ACTION`, `LINK_TO_ACTION` of C. If object C is an action, the args list does not include C. Also, the `action` is C.

The File Manager, along with its directory and folder objects, exemplifies how the desktop uses the move, copy, and link drop attributes. A user can drag and drop objects (files) to directory folders. File Manager defines `MOVE_TO_ACTION`, `COPY_TO_ACTION`, and `LINK_TO_ACTION` actions for folder objects. These actions perform the appropriate file system move, copy, and link system functions.

See /usr/dt/appconfig/types/C/dtfile.dt for an example of how to define the MOVE_TO_ACTION, COPY_TO_ACTION, and LINK_TO_ACTION attributes. See Chapter 5, “Integrating with Drag and Drop,” for information about how to use drag and drop.

Example of Using the Data-Typing Database

This section contains example code of how to use data typing. You can find this example code in /usr/dt/examples/dtdts/datatyping.c. The example code displays the data type, icon name, and supported actions for each file passed to it. You can then use the dtaction client to run a supported action on the file. The usage for datatyping is:

datatyping *file1* [*file2* ...]

```
#include <Xm/Form.h>
#include <Xm/Text.h>
#include <Dt/Dts.h>

#define ApplicationClass "DtDatatyping"

static Widget text;

static void DisplayTypeInfo(int, char**);

int main(int argc, char **argv)
{
    XtAppContext appContext;
    Widget toplevel, form;
    Arg args[20];
    int n;

    toplevel = XtAppInitialize(&appContext, ApplicationClass,
    NULL, 0,
        argc, argv, NULL, NULL, 0);

    if (argc == 1) {
        printf("%s: No files specified.\n", argv[0]);
        exit(1);
    }

    form = XmCreateForm(toplevel, "form", NULL, 0);
    XtManageChild(form);
    n = 0;
    XtSetArg(args[n], XmNleftAttachment, XmATTACH_FORM); n++;
```

```
    XtSetArg(args[n], XmNrightAttachment, XmATTACH_FORM); n++;
    XtSetArg(args[n], XmNtopAttachment, XmATTACH_FORM); n++;
    XtSetArg(args[n], XmNbottomAttachment, XmATTACH_FORM); n++;
    XtSetArg(args[n], XmNeditable, False); n++;
    XtSetArg(args[n], XmNeditMode, XmMULTI_LINE_EDIT); n++;
    XtSetArg(args[n], XmNrows, 25); n++;
    XtSetArg(args[n], XmNcolumns, 90); n++;
    text = XmCreateScrolledText(form, "text", args, n);
    XtManageChild(text);

    XtRealizeWidget(toplevel);
    if (DtAppInitialize(appContext, XtDisplay(toplevel), toplevel,
        argv[0],
                                    ApplicationClass) == False) {
        printf("%s: Couldn't initialize Dt\n", argv[0]);
        exit(1);
    }

    DtDbLoad();

    DisplayTypeInfo(argc, argv);

    XtAppMainLoop(appContext);
}

static void DisplayTypeInfo(int argc, char **argv)
{
    char *file;
    char *datatype;
    char *icon;
    char *actions;
    char str[100];
    int i;

    sprintf(str, "%-30s\t%-10s\t%-8s\t%-20s\n",
                "File",
                "DataType",
                "Icon",
                "Actions");
    XmTextInsert(text, XmTextGetLastPosition(text), str);

    sprintf(str, "%-30s\t%-10s\t%-8s\t%-20s\n",
                "-------------------",
                "--------",
                "----",
                "-------");
```

```
XmTextInsert(text, XmTextGetLastPosition(text), str);

    for(i=1; i < argc; i++) {
    char *file = argv[i];

    /* find out the Dts data type */
    datatype = DtDtsFileToDataType(file);

    if(datatype) {
        /* find the icon attribute for the data type */
        icon = DtDtsDataTypeToAttributeValue(datatype,
    DtDTS_DA_ICON, file);
    }

 /*  Directly find the action attribute for a file */

    actions = DtDtsFileToAttributeValue(file,
       DtDTS_DA_ACTION_LIST);

    sprintf(str, "%-30s\t%-10s\t%-8s\t%s\n",
                    file,
                    datatype?datatype:"unknown",
                    icon?icon:"unknown",
                    actions?actions:"unknown");
    XmTextInsert(text, XmTextGetLastPosition(text), str);

    /* Free the space allocated by Dts */

    DtDtsFreeAttributeValue(icon);
    DtDtsFreeAttributeValue(actions);
    DtDtsFreeDataType(datatype);
}
```

Integrating with Calendar 10

The Calendar application program interface (API) provides a programmatic way to access and manage calendar data in a networked environment. The API supports inserting, deleting, and modifying of entries as well as browse and find capabilities. It also supports calendar administration functions.

The Calendar API is an implementation of the X.400 Application Programming Interface Association's (XAPIA) Calendaring and Scheduling API (CSA API). CSA API defines a set of high-level functions so that applications that are calendar enabled can access the varied features of the calendaring and scheduling service. For more information about the latest XAPIA Specification, contact the X.400 API Association, 800 El Camino Real, Mountain View, California 94043.

This chapter describes the Calendar API in these sections:

Library and Header Files

To use the Calendar API, you need to link to the `libcsa` library. The header file is `csa/csa.h`.

Demo Program

A demo program containing an example of how to use the Calendar API is in `/usr/dt/examples/dtcalendar`.

Using the Calendar API

▼ *How to Integrate with Calendar*

The Calendar API provides a way to access and manage calendar data in a networked environment.

1. Include `csa/csa.h` in your application.
2. Use the calendar API to incorporate the calendar operations you want in your application.
3. Link with `libcsa`.

Overview of the CSA API

The CSA interface enables a common interface to a calendaring and scheduling service. For each CSA implementation, the view and capabilities presented by CSA must be mapped to the view and capabilities of the underlying calendaring service. The interface is designed to be independent of the actual calendaring and scheduling implementation. The interface is also designed to be independent of the operating system and underlying hardware used by the calendaring service.

The number of function calls provided is minimal. A single set of functions manage multiple types of calendar entries.

C Naming Conventions

The identifier for an element of the C interface is derived from the generic name of the element and its associated data type, as specified in Table 10-1. The generic name is prefixed with the character string in the second column of the table; alphabetic characters are converted to the case in the third column.

Table 10-1 Derivation of C Naming Conventions

Element Type	Prefix	Case
Data type	`CSA_`	`Lower`
Data value	`CSA_`	`Upper`
Function	`csa_`	`Lower`
Function argument	`none`	`Lower`
Function result	`none`	`Lower`
Constant	`CSA_`	`Upper`
Error	`CSA_E_`	`Upper`
Macro	`CSA_`	`Upper`
Reserved for extension sets	`CSA_XS_`	`Any`
Reserved for extensions	`CSA_X_`	`Any`
Reserved for use by implementors	`CSAP`	`Any`
Reserved for vendor function extensions	`csa_x`	`Lower`
Structure Tag	`CSA_TAG_`	`Upper`

Elements with the prefix `CSAP` (any case) are reserved for internal proprietary use by implementors of the CSA service. They are not intended for direct use by programs written using the CSA interface.

The prefixes CSA_XS_, CSA_X_ (in either uppercase or lowercase), and csa_x are reserved for extensions of the interface by vendors or groups. The specification defines these interface extensions as extensions to the base set of functions.

For constant data values, an additional string is usually appended to CSA_ to indicate the data structure or function for the constant data value.

Functional Architecture

This section describes the functional architecture of services supporting the CSA API. It provides an abstract implementation model, an abstract data model, and a functional overview.

Implementation Model

The abstract implementation model is provided as a reference aid to help you understand the scope of the CSA API.

The CSA interface is defined between a calendar-enabled application and a calendaring service. All functions in this interface are designed to be independent of the calendaring service; however, the API does allow protocol-specific extensions to the common functions to be invoked through the use of extensions. See “Extensions” for more information. The relationship of the CSA interface to a calendar-enabled application and the calendar service is shown in Figure 10-1.

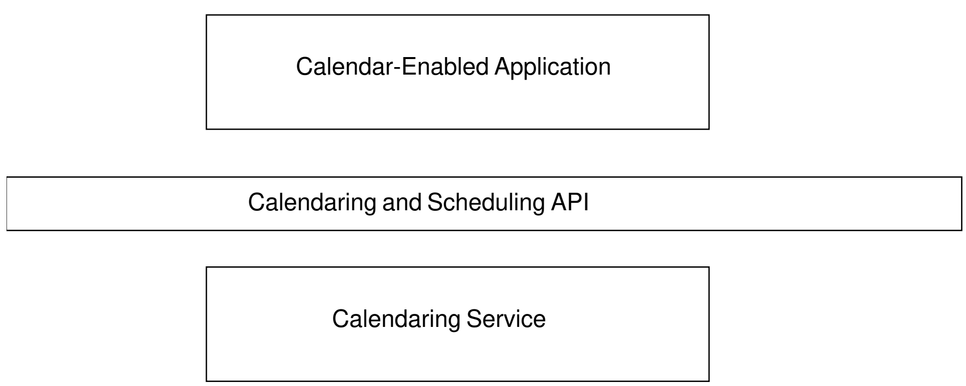


Figure 10-1 Positioning of the Calendaring and Scheduling API

The model of the CSA interface can be divided into three components: administration, calendar management, and entry management. These components are shown in Figure 10-2.

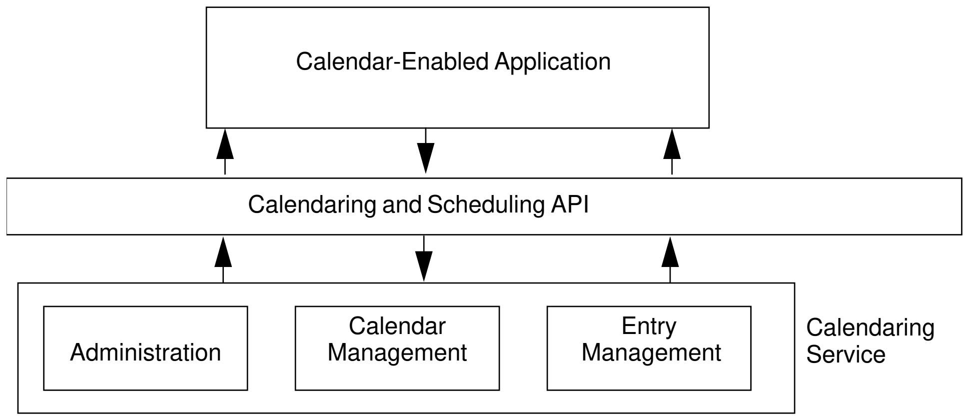


Figure 10-2 Components of the Calendaring and Scheduling API

Access to the calendaring service is established through a calendaring session. The session provides for a valid connection to the calendaring service and assists in ensuring the integrity of the calendaring information maintained by the service. A calendar-enabled application logs on to an individual calendar within the calendaring service to establish a valid session or connection. The session is terminated by the calendar-enabled application logging off from the calendar.

The calendaring service maintains one or more calendars. The calendar service provides some level of administration support for these calendars. A calendar-enabled application might access a list of the calendars maintained by a particular calendar service. In addition, the calendar service might provide support for the archive and restore of calendar information into some implementation-specific, persistent format. Where a calendar service provides support for maintaining more than one calendar, support functions are defined for creating and deleting calendars. In addition, functions are provided to support administering the characteristics of the calendar.

The majority of the functions within the CSA interface manage individual calendar entries. Calendar entries may be either events, to dos, or memos. Entries can be added, deleted, updated, and read from a particular calendar. A calendar-enabled application can also add reminders to calendar entries.

Data Model

The CSA interface is an access method to a conceptual back-end store of calendaring information that is maintained by a calendaring service. A common data model is helpful in visualizing the components of the calendaring information maintained by a calendaring service.

Calendar Entities

The data model is based on the concept of a calendar entity. The calendar is represented by a named collection of administrative calendar attributes and calendar entries. A calendar is owned by an individual user. The user could represent a person, a group of people, or a resource.

The calendar attributes are a set of named values that may represent common, implementation-specific, or application-specific administrative characteristics about the calendar. For example, time zone, name, owner, and access rights to the calendar can be specified in individual calendar attributes.

The calendar entries are the primary components of a calendar. The three classes of calendar entries follow:

- Events.
- To Dos.
- Memos.

Calendar entries are represented by a uniquely named collection of entry attributes. The entry attributes are a set of named values that represent common, implementation-specific, or application-specific characteristics of the calendar entry. For example, an event might contain a start and end date and time, a description, and a subtype. A to do might contain the date it was created, the due date, a priority, and a status. A memo might contain the date it was created and a text content or description.

The calendar attributes and entry attributes consist of a name, type, and value tuple. Common attributes defined by the specification can be extended. Implementations can define implementation-specific attributes. In addition, some implementations may provide the capability for applications to define application-specific attributes. The TED implementation supports application defined attributes.

Access Rights

The accessibility of a calendar to an individual user can be controlled by the access rights given that user. Access rights are paired with a calendar user. CSA allows users to be an individual, group, or resource. The TED implementation only supports individual users. The access rights are maintained in an access list. The access list is a particular calendar attribute. The access rights are individually controlled and can be accumulated to define a range of accessibility of a user to a calendar and its entries. The access rights can also be specified in terms of the following access roles:

- The owner of a calendar.
- The organizer of a particular entry within the calendar.
- The sponsor of a particular entry within the calendar.

The owner role enables the user to do anything to the calendar or calendar entries that the owner of the calendar can do, including deleting the calendar; viewing, inserting, and changing calendar attributes; adding and deleting calendar entries; and viewing, inserting, and changing entry attributes.

The organizer role enables the user to delete the entry or view and change entry attributes of those calendar entries for which the user is specified as the organizer. The organizer defaults to the calendar user who created the entry.

The sponsor role enables the user to delete the entry or view and change entry attributes for those calendar entries for which the user is specified as the sponsor. The sponsor is the calendar user who effectively owns the calendar entry.

In addition to these roles, an access right can be set to limit access to free time searches; view, insert, or change calendar attributes; or view, insert or change entries, depending on whether they are classified as public, confidential, or private. The entry classification acts as a secondary filter on accessibility.

Functional Overview

The CSA interface supports three principle types of tasks:

- Administration.
- Calendar management.
- Entry management.

Administration

Most of the CSA function calls occur within a calendar session. The calendar session is a logical connection between the calendar-enabled application and a particular calendar maintained by the calendaring service. A session is established with a call to the `csa_logon()` function and terminated with a call to the `csa_logoff()` function. The context of the session is represented by a session handle. This handle provides a token in each of the CSA functions to distinguish one calendar session from another. The `csa_logon()` function also authenticates the user to the calendaring service and sets session attributes. Currently, there is no support for sharing calendar sessions among applications.

The `csa_list_calendars()` function is used to list the names of the calendars managed by a particular calendar service.

The `csa_query_configuration()` function is used to list information about the current calendar service configuration. This information can include the character set, line terminator characters for text strings, default service name, default authorization user identifier for the specified calendar service, an indicator of whether a password is needed to authenticate the user identifier, an indicator of whether the common extensions for user interface dialogs is supported, and the CSA specification supported by the implementation.

The CSA implementation provides support for managing the memory for calendar objects and attributes that are returned by the service. The `csa_free()` function is used to free up this memory after it is no longer needed. It is the responsibility of the application to free up the memory allocated and managed by the calendar service.

Calendar Management

The CSA interface provides several calendar management functions. The TED implementation supports multiple calendars per calendar service; the calendar-enabled application can add or delete calendars. The `csa_delete_calendar()` function is used to delete calendars. The `csa_add_calendar()` function is used to add new calendars to the service.

The application can also list, read, and update calendar attributes using the `csa_list_calendar_attributes()`, `csa_read_calendar_attributes()`, and `csa_update_calendar_attributes()` functions. The application can register callback functions for receiving notification of a calendar logon, calendar deletion, update of calendar attributes, addition of a new calendar entry, deletion of a calendar entry, and update of a calendar entry. The callback function is only registered for the duration of the calendar session. In any case, this information may be invaluable for some calendar administration applications.

Entry Management

The CSA interface has a robust set of functions for managing calendar entries. The context of a calendar entry in a calendar session is maintained by the entry handle. This handle provides a token in the CSA functions to distinguish one calendar entry from another. The entry handle is returned by the `csa_add_entry()` and `csa_list_entries()` functions. The entry handle is valid for the duration of the calendar session or until the entry is deleted or updated. The entry handle becomes invalid when it is freed by a call to `csa_free()`.

The `csa_add_entry()` function is used to add new entries to a calendar. The `csa_delete_entry()` function is used to delete an entry in a calendar. The `csa_ list_entries()` function is used to enumerate the calendar entries that match a particular set of entry attribute criteria. The `csa_read_entry_attributes()` function is used to get either all or a set of entry attribute values associated with a particular calendar entry.

To add an entry to a calendar, a calendar-enabled application must first establish a session with the calendaring service using the `csa_logon()` function. Then the application invokes the `csa_add_entry()` function to specify the new entry. The calendar-enabled application is responsible for composing the attributes used in the `csa_add_entry()` function. The session is terminated using the `csa_logoff()` function.

The entry attributes in an individual calendar entry can be enumerated with the `csa_list_entry_attributes()` function. The values of one or more attributes can be read with the `csa_ read_entry_attributes()` function. Individual entry attributes can be modified with the `csa_update_entry_attributes()` function.

Memory allocated by the CSA implementation for retrieved calendar information is released by passing the associated memory pointers to the `csa_free()` function.

Some calendar entries are associated with a recurring activity. The `csa_list_entry_sequence()` function can be used to enumerate the other recurring calendar entries. This function returns a list of entry handles for the recurring entries.

The TED calendar server provides support for alarms or reminders to be associated with calendar entries. Reminders can take the form of audio reminders from the terminal speaker, flashing reminders presented on the terminal screen, mail reminders sent to the calendar user, or pop-up reminders presented on the terminal screen. The calendar service manages the reminders, but it is the responsibility of the calendar application to retrieve the reminder information and act on it. The `csa_read_next_reminder()` function is used to read the information about the next scheduled type of reminder.

Extensions

The major data structures and functions defined in the CSA specification can be extended methodically through extensions. Extensions are used to add additional fields to data structures and additional parameters to a function call. A standard generic data structure has been defined for these extensions. It consists of an item code, identifying the extension; an item data, holding the length of extension data or the data itself; an item reference, pointing to where the extension value is stored or `NULL` if there is no related item storage; and flags for the extension.

Extensions that are additional parameters to a function call may be input or output. That is, the extension may be passed as input parameters from the application to the CSA service or passed as output parameters from CSA service to the application. If an extension is an input parameter, the application allocates memory for the extension structure and any other structures associated with the extension. If an extension is an output parameter, the CSA service allocates the storage for the extension result, if necessary. In this case, the application must free the allocated storage with a `csa_free()` call.

If an extension that is not supported is requested, `CSA_E_UNSUPPORTED_FUNCTION_EXT` is returned.

Data Structures

Table 10-2 lists the CSA data structures. See the relevant man page for complete information.

Table 10-2 CSA Data Structures

Data Type Name	Description
Access List	List of access rights structures for calendar users
Attendee List	List of attendee structures
Attribute	Attribute structure
Attribute Reference	Attribute reference structure
Boolean	A value that indicates logical true or false
Buffer	Pointer to a data item
Calendar User	Calendar user structure
Callback Data Structures	Callback data structures
Date and Time	Date and time designation
Date and Time List	List of date and time values
Date and Time Range	Range of date and time
Entry Handle	Handle for the calendar entry
Enumerated	Data type containing a value from an enumeration
Extension	Extension structure
Flags	Container for bit masks
Free Time	Free time structure
Opaque Data	Opaque data structure
Reminder	Reminder structure
Reminder Reference	Reminder reference structure
Return Code	Return value indicating either that a function succeeded or why it failed
Service Reference	Service reference structure

Table 10-2 CSA Data Structures *(Continued)*

Data Type Name	Description
Session Handle	Handle for the calendar session
String	Character string pointer
Time Duration	Time duration

Calendar Attributes

Table 10-3 lists the calendar attributes supported in the TED implementation. See the relevant man page for more information. The list of calendar attributes is extensible through the extended naming convention.

Table 10-3 CSA Calendar Attributes

Attribute Name	Description	Read-Only
Access List	Access list attribute	No
Calendar Name	Calendar name attribute	Yes
Calendar Owner	Calendar owner attribute	Yes
Calendar Size	Calendar size attribute (computed)	Yes
Character Set	Character set attribute	No
Date Created	Calendar creation date attribute	Yes
Number Entries	Number of entries attribute (computed)	Yes
Product Identifier	Product identifier attribute	Yes
Time Zone	Time zone attribute	No
Version	Product version attribute	Yes

The following section provides additional information about the calendar attributes listed in Table 10-3.

- `Access List`

When a new calendar is added and if no access list is specified, the default access list contains a special user *world* and its corresponding access right is `CSA_VIEW_PUBLIC_ENTRIES`, which provides access right to list and read calendar entries with public classification. The special user *world* includes all users.

- `Calendar Name`

  The calendar name is specified when the calendar is created using `csa_add_calendar()`. It becomes read-only and cannot be changed after the calendar is created.

- `Calendar Owner`

  The calendar owner is set to the user who is running the application that calls `csa_add_calendar()` to create the calendar. It becomes read-only and cannot be changed after the calendar is created.

- `Character Set`

  The TED common locale name should be used to set this value.

TED Calendar Attributes

The followings are TED-defined calendar attributes:

- `Server Version`

  This read-only attribute shows the version number of the server managing the calendar. This attribute is a `CSA_VALUE_UINT32` type of attribute.

- `Data Version`

  This read-only attribute shows the data version of the calendar. This attribute is a `CSA_VALUE_UINT32` type of attribute.

Entry Attributes

Table 10-4 lists the entry attributes supported in the TED implementation. See the relevant man page for more information. The list of entry attributes is extensible through the extended naming convention.

Table 10-4 CSA Entry Attributes

Attribute Name	Description	Read-Only
Audio Reminder	Audio reminder attribute	No
Classification	Classification attribute	No
Date Completed	Date completed attribute	No
Date Created	Entry creation date attribute	Yes
Description	Description attribute	No
Due Date	Due date attribute	No
End Date	End date attribute	No
Exception Dates	Exception dates attribute	No
Flashing Reminder	Flashing reminder attribute	No
Last Update	Last update attribute	Yes
Mail Reminder	Mail reminder attribute	No
Number Recurrences	Number of recurrences attribute (computed)	Yes
Organizer	Organizer attribute	Yes
Popup Reminder	Pop-up reminder attribute	No
Priority	Priority attribute	No
Recurrence Rule	Recurrence rule attribute	No
Reference Identifier	Reference identifier attribute	Yes
Sponsor	Sponsor attribute	No
Start Date	Start date attribute	No
Status	Status attribute	No
Subtype	Subtype attribute	No

Table 10-4 CSA Entry Attributes *(Continued)*

Attribute Name	Description	Read-Only
Summary	Summary attribute	No
Transparency	Time transparency or blocking attribute	No
Type	Type attribute	Yes

The following section provides additional information about the entry attributes listed in Table 10-4.

- `Organizer`

  The organizer of an entry is set to the user who is running the application that calls `csa_add_entry()` to add the entry to the calendar. It becomes read-only and cannot be changed after the entry is added.

- `Reference Identifier`

  The reference identifier of an entry is a string that contains a unique identifier of the entry within the calendar as well as the name and location of the calendar. The format is `n:calendar@location` where `n` is a number that uniquely identifies the entry within the calendar, `calendar` is the name of the calendar, and `location` is the name of the machine where the calendar is stored.

- `Status`

  The TED implementation defines the following additional status values:

  `CSA_X_DT_STATUS_ACTIVE`

  `CSA_X_DT_STATUS_DELETE_PENDING`

  `CSA_X_DT_STATUS_ADD_PENDING`

  `CSA_X_DT_STATUS_COMMITTED`

  `CSA_X_DT_STATUS_CANCELLED`

- `Type`

  The value becomes read-only and cannot be changed after the entry is added. The TED implementation defines the following additional type value:

CSA_X_DT_TYPE_OTHER

TED Entry Attributes

The following are TED-defined entry attributes:

- Show Time

  The value of this attribute indicates whether the start and end time of the entry should be shown to the user. It can be modified using csa_update_entry_attributes(). This attribute is a CSA_VALUE_SINT32 type of attribute.

- Repeat Type

  The frequency of recurrence of the entry, which indicates how often the entry repeats. This is a read-only attribute and is derived from the entry attribute Recurrence Rule.

  This attribute is a CSA_VALUE_UINT32 type of attribute.

  The following values are defined:

  CSA_X_DT_REPEAT_ONETIME

  CSA_X_DT_REPEAT_DAILY

  CSA_X_DT_REPEAT_WEEKLY

  CSA_X_DT_REPEAT_BIWEEKLY

  CSA_X_DT_REPEAT_MONTHLY_BY_WEEKDAY

  CSA_X_DT_REPEAT_MONTHLY_BY_DATE

  CSA_X_DT_REPEAT_YEARLY

  CSA_X_DT_REPEAT_EVERY_NDAY

  CSA_X_DT_REPEAT_EVERY_NWEEK

  CSA_X_DT_REPEAT_EVERY_NMONTH

  CSA_X_DT_REPEAT_MON_TO_FRI

  CSA_X_DT_REPEAT_MONWEDFRI

  CSA_X_DT_REPEAT_TUETHUR

  CSA_X_DT_REPEAT_WEEKDAYCOMBO

CSA_X_DT_REPEAT_OTHER

CSA_X_DT_REPEAT_OTHER_WEEKLY

CSA_X_DT_REPEAT_OTHER_MONTHLY

CSA_X_DT_REPEAT_OTHER_YEARLY

- `Repeat Times`

  This attribute shows the number of times an entry repeats. This is a read-only attribute and is derived from the entry attribute `Recurrence Rule`. This attribute is a `CSA_VALUE_UINT32` type of attribute.

- `Repeat Interval`

  This attribute tells how often an entry with repeat types `CSA_X_DT_REPEAT_EVERY_NDAY`, `CSA_X_DT_REPEAT_EVERY_NWEEK`, or `CSA_X_DT_REPEAT_EVERY_NMONTH` repeats. This is a read-only attribute, and is derived from the entry attribute `Recurrence Rule`. For example, if the value of this attribute is 3 and the repeat type is `CSA_X_DT_REPEAT_EVERY_NWEEK`, the entry repeats every three weeks. This attribute is a `CSA_VALUE_UINT32` type of attribute.

- `Repeat Occurrence Number`

  If the entry's repeat type is `CSA_X_DT_REPEAT_MONTHLY_BY_WEEKDAY`, this attribute tells in which week the entry repeats. This is a read-only attribute and is derived from the entry attribute `Recurrence Rule`. This attribute is a `CSA_VALUE_SINT32` type of attribute.

- `Sequence End Date`

  This entry attribute shows the end date of the sequence. This is a read-only attribute and is derived from the entry attribute `Recurrence Rule`. This attribute is a `CSA_VALUE_DATE_TIME` type of attribute.

General Information about Functions

The following general information applies to all functions:

- Character set restriction

  The calendar attribute, `CSA_CAL_ATTR_CHARACTER_SET`, is used to store the locale information of the calendar.

Note – All data except textual description passed in the library must be in ASCII format and the library supports single-byte as well as multibyte character strings.

- Type checking for attribute values is provided for the predefined attributes only.
- When a function takes both a session handle and an entry handle, the session handle is always ignored in the TED implementation.
- Entry attributes CSA_ENTRY_ATTR_RECURRENCE_RULE and CSA_ENTRY_ATTR_EXCEPTION_DATES are used to specify recurrence information of a calendar entry. Information in the CSA_ENTRY_ATTR_RECURRENCE_RULE attribute can be queried using the following attributes: CSA_X_DT_ENTRY_ATTR_REPEAT_TYPE, CSA_X_DT_ENTRY_ATTR_REPEAT_TIMES, CSA_X_DT_ENTRY_ATTR_REPEAT_INTERVAL, CSA_X_DT_ENTRY_ATTR_REPEAT_OCCURRENCE_NUM, and CSA_X_DT_ENTRY_ATTR_SEQUENCE_END_DATE. These computed attributes are read-only.
- The CSA_calendar_user data structure specifies either a user or a calendar. In the first case, for example, when specifying a user in an access list, only the user_name field is used and all other fields are ignored. In the latter case, for example, when specifying the calendar to log onto, only the calendar_address field is used and all other fields are ignored. The format is calendar@location where calendar is the name of the calendar and location is the name of the machine where the calendar is stored.
- Attributes of value type CSA_VALUE_ATTENDEE_LIST are not supported and CSA_E_INVALID_ATTRIBUTE_VALUE will be returned if they are specified.
- Although the repeat_count and snooze_time fields in the CSA_reminder data structure are stored in the calendar, the calendar service does not interpret their values and the associated reminder will be returned only once by the server.
- The user interface extension CSA_X_UI_ID_EXT is not supported.

Administration Functions

This section contains descriptions for the administration functions supported in the TED implementation. See the relevant man page for more information.

- Free — Frees memory allocated by the calendaring service.

```
CSA_return_code
csa_free(
       CSA_buffer             memory
);
```

- List Calendars — Lists the calendars supported by a calendar server.

```
CSA_return_code
csa_list_calendars(
       CSA_service_reference   calendar_service,
       CSA_uint32              *number_names,
       CSA_calendar_user       **calendar_names,
       CSA_extension           *list_calendars_extensions
);
```

A host name where the server runs should be passed in `calendar_server`.

- Logon — Logs on to the calendar service and establishes a session with a calendar.

```
CSA_return_code
csa_logon(
       CSA_service_reference  calendar_service,
       CSA_calendar_user      *user,
       CSA_string              password,
       CSA_string              character_set,
       CSA_string              required_csa_version,
       CSA_session_handle      *session,
       CSA_extension           *logon_extensions
);
```

Arguments `calendar_service, password, character_set,` and `required_csa_version` are not used.

The `calendar_address` field of the `CSA_calendar_user` structure pointed to by `user` specifies the calendar to log onto. The format is `calendar@location` where `calendar` is the name of the calendar and `location` is the host name where the calendar is stored.

The TED-defined extension `CSA_X_DT_GET_USER_ACCESS_EXT` is supported. This extension can be used to get the access rights the calling user has with respect to the calendar. The user's access rights is returned in the `item_data` field of the extension structure.

- Logoff — Terminates a session with a calendar.

```
CSA_return_code
csa_logoff(
       CSA_session_handle session,
       CSA-extension      *logoff_extensions
);
```

- Query Configuration — Determines information about the installed CSA configuration.

```
CSA_return_code
csa_query_configuration(
        CSA_session_handle      session,
        CSA_enum                item,
        CSA_buffer              *reference,
        CSA_extension           *query_configuration_extensions
);
```

The following items are not supported by this implementation of TED:

`CSA_CONFIG_CHARACTER_SET`

`CSA_CONFIG_LINE_TERM`

`CSA_CONFIG_VER_IMPLEM`

Calendar Management Functions

This section contains descriptions for the calendar management functions supported in the TED implementation. See the relevant man page for more information.

- Add calendar — Adds a calendar to the calendar service.

```
CSA_return_code
csa_add_calendar(
        CSA_session_handle      session,
        CSA_calendar_user       *user,
        CSA_uint32              number_attributes,
```

```
        CSA_attribute            *calendar_attributes,
        CSA_extension            *add_calendar_extensions
);
```

The first argument `session` is ignored.

The `calendar_address` field of the `CSA_calendar_user` structure pointed to by `user` specifies the name and the location of the calendar to be created. The format is `calendar@location` where `calendar` is the name of the calendar and `location` is the host name where the calendar is to be stored; for example, `my_calendar@my_host`.

- Call Callbacks — Forces the invocation of the callback functions associated with the specified callback list(s).

```
CSA_return_code
csa_call_callbacks(
       CSA_session_handle    session,
       CSA_flags             reason,
       CSA_extension         *call_callbacks_extensions
);
```

- Delete Calendar — Deletes a calendar from the calendar service.

```
CSA_return_code
csa_delete_calendar
       CSA_session_handle    session,
       csa_extension         *delete_calendar_extensions
);
```

- List Calendar Attributes — Lists the names of the calendar attributes associated with a calendar.

```
CSA_return_code
csa_list_calendar_attributes(
       CSA_session_handle    session,
       CSA_uint32            *number_names,
       CSA_attribute_reference **calendar_attributes_names,
       CSA_extension         *list_calendar_attributes_extensions
);
```

- Read Calendar Attributes — Reads and returns the calendar attribute values for a calendar.

```
CSA_return_code
csa_read_calendar_attributes(
       CSA_session_handle      session,
       CSA_uint32              number_names,
```

```
        CSA_attribute_reference *attribute_names,
        CSA_uint32               *number_attributes,
        CSA_attribute            **calendar_attributes,
        CSA_extension           *read_calendar_attributes_extensions
);
```

- Register Callback Functions — Registers the callback function to be invoked with the specified type of updates in the calendar.

```
CSA_return_code
csa_register_callback(
        CSA_session_handle     session,
        CSA_flags              reason,
        CSA_callback           callback,
        CSA_buffer             client_data,
        CSA_extension          *register_callback_extensions

);
```

- Unregister Callback Functions — Unregisters the specified callback function.

```
CSA_return_code
csa_unregister_callback(
        CSA_session_handle     session,
        CSA_flags              reason,
        CSA_callback           callback,
        CSA_buffer             client_data,
        CSA_extension          *unregister_callback_extensions

);
```

- Update Calendar Attributes — Updates the calendar attribute values for a calendar.

```
CSA_return_code
csa_update_calendar_attributes(
        CSA_session_handle session,
        CSA_uint32         number_attributes,
        CSA_attribute      *calendar_attributes,
        CSA_extension      *update_calendar_attributes_extensions
);
```

Entry Management Functions

This section contains descriptions for the entry management functions supported in the TED implementation. See the relevant man page for more information.

- Add Entry — Adds an entry to the specified calendar.

```
CSA_return_code
csa_add_entry(
        CSA_session_handle      session,
        CSA_uint32              number_attributes,
        CSA_attribute           *entry_attributes,
        CSA_entry_handle        *entry,
        CSA_extension           *add_entry_extensions
);
```

- Delete Entry — Deletes an entry from the specified calendar.

```
CSA_return_code
csa_delete_entry(
        CSA_session_handle      session,
        CSA_entry_handle        entry,
        CSA_enum                delete_scope,
        CSA_extension           *delete_entry_extensions
);
```

- List Entries — Lists the calendar entries that match all the attribute search criteria.

```
CSA_return_code
csa_list_entries(
        CSA_session_handle      session,
        CSA_uint32              number_attributes,
        CSA_attribute           *entry_attributes,
        CSA_enum                *list_operators,
        CSA_uint32              *number_entries,
        CSA_entry_handle        **entries,
        CSA_extension           *list_entries_extensions
);
```

The following information details more about the operators specified in `list_operators`:

Only the operators `CSA_MATCH_ANY` and `CSA_MATCH_EQUAL_TO` are supported for the attribute value types `CSA_VALUE_REMINDER`, `CSA_VALUE_CALENDAR_USER`, and `CSA_VALUE_DATE_TIME_RANGE`.

Only the operators `CSA_MATCH_ANY`, `CSA_MATCH_EQUAL_TO`, `CSA_MATCH_NOT_EQUAL_TO`, and `CSA_MATCH_CONTAIN` are supported for the attribute value type `CSA_VALUE_STRING`. The operator `CSA_MATCH_CONTAIN` only applies to `CSA_VALUE_STRING` type of attributes.

Matching of attributes with the value types CSA_VALUE_OPAQUE_DATA, CSA_VALUE_ACCESS_LIST, CSA_VALUE_ATTENDEE_LIST, and, CSA_VALUE_DATE_TIME_LIST are not supported. The only exception is the attribute CSA_ENTRY_ATTR_REFERENCE_IDENTIFIER. The operator CSA_MATCH_EQUAL_TO is supported for this attribute.

- List Entry Attributes — Lists the names of the entry attributes associated with the specified entry.

```
CSA_return_code

csa_list_entry_attributes(
       CSA_session_handle        session,
       CSA_entry_handle          entry,
       CSA_uint32                *number_names,
       CSA_attribute_reference   **entry_attribute_names,
       CSA_extension             *list_entry_attributes_extensions
);
```

- List Entry Sequence — Lists the recurring calendar entries that are associated with a calendar entry.

```
CSA_return_code

csa_list_entry_sequence(
       CSA_session_handle    session,
       CSA_entry_handle      entry,
       CSA_date_time_range   time_range,
       CSA_uint32            *number_entries,
       CSA_entry_handle      **entry_list,
       CSA_extension         *list_entry_sequences_extensions
);
```

CSA_E_INVALID_PARAMETER is returned if the specified entry is a one-time entry.

- Read Entry Attributes — Reads and returns the calendar entry attribute values for a specified entry.

```
CSA_return_code

csa_read_entry_attributes(
      CSA_session_handle     session,
      CSA_entry_handle       entry,
      CSA_uint32             number_names,
      CSA_attribute_reference*attribute_names,
      CSA_uint32             *number_attributes,
```

```
        CSA_attribute           **entry_attributes,
        CSA_extension           *read_entry_attributes_extensions
);
```

- Read Next Reminder — Reads the next reminder of the given type in the specified calendar relative to a given time.

```
CSA_return_code
csa_read_next_reminder(
        CSA_session_handle      session,
        CSA_uint32              number_names,
        CSA_attribute_reference *reminder_names,
        CSA_date_time           given_time,
        CSA_uint32              *number_reminders,
        CSA_remainder_reference **reminder_references,
        CSA_extension           *read_next_reminder_extensions
);
```

- Update Entry Attributes — Updates the calendar entry attributes.

```
CSA_return_code
csa_update_entry_attributes(
        CSA_session_handle      session,
        CSA_entry_handle        entry,
        CSA_enum                update_scope,
        CSA_boolean             update_propagation,
        CSA_uint32              number_attributes,
        CSA_attribute           *entry_attributes,
        CSA_entry_handle        *new_entry,
        CSA_extension           *update_entry_attributes_extensions
);
```

Update propagation is not supported; the `update_propagation` argument should be set to `CSA_FALSE`.

Glossary

action

A user interface defined in a database of files that requests an application perform some operation.

action icon

An icon that represents an action in a File Manager or Application Manager window. It is displayed by creating an executable file with the same name as the action it represents.

action server

A host computer that provides access to a collection of actions.

active

A window, window element, or icon that is currently affected by keyboard and mouse input. Active windows are differentiated from other windows on the workspace by a distinctive title bar color or shade. An active window element is indicated by a highlight or selection cursor.

app-defaults file

A file for each application that programmers use to define the X resources.

application group

An Application Manager container that holds a specific software application.

Application Manager

The software application that manages the tools and other software applications available to you.

application server

A host computer that provides access to a software application.

argument

An item of information following a command.

arrow keys

The four directional keys on a keyboard. Also see *navigation keys*.

attachment

An encapsulated data object inside a document.

background

The underlying area of a window on which objects, such as buttons and lists, are displayed.

bitmap

An image stored in a raster format. Usually refers to an image limited to two colors (a foreground and a background color). Contrast with *pixmap*.

bitmapped font

A font made from a matrix of dots. See *font*.

busy pointer

The mouse pointer displayed when an application is busy and cannot accept input.

button

A generic term for a window control that initiates an action by an application, usually executing a command, displaying a window, or displaying a menu. Also used to describe the controls on a mouse.

button binding

Association of a mouse button operation with a particular behavior.

cascaded list

The list box that displays additional elements from which you choose in order to interact with other screen elements.

cascaded menu

The menu item that displays additional elements from which you choose in order to interact with other screen elements.

CDE

Common Desktop Environment, a graphical user interface running on UNIX.

check box

A nonexclusive control whose setting is indicated by the presence or absence of a check mark. A check box has two states, on and off.

choose

To use the mouse or keyboard to pick a menu command, button, or icon that begins a command or action. Contrast with *select*.

click

To press and release a mouse button without moving the mouse pointer.

client

A system or software application that requests services from a network server.

clipboard

A buffer that temporarily stores the last cut, copy, or paste data or object.

combo box

Use *text box* to refer to the text box portion of a combo box, and *list box* to refer to the list portion. Example: Type the name of the file in the File text box or select it from the list box underneath.

command line prompt

A prompt, usually `%`, `>`, or `$`, that shows the computer is ready to accept commands. In a terminal emulation window, you display the command line prompt by pressing Return.

context-sensitive help

Help information about the specific choice or object that the cursor or pointer is on.

control

A generic term for a variety of objects (such as buttons, check boxes, and scroll bars) that perform an action or indicate an option setting. Also applies to Front Panel icons.

Copy View Options

A menu command that copies the current view's properties and places the copy onto the clipboard.

current item

The currently highlighted item in a list.

current session

The session saved by Session Manager when you log off. At the next login, unless you specify otherwise, this session automatically opens, enabling work to continue where you left off. Contrast with *home session*.

current setting

The present state of a control such as a check box or radio button.

current workspace

The workspace that is presently displayed on the screen. It can be changed with the *workspace switch*.

cursor

A graphical device that indicates the current object that will be affected by mouse or keyboard input.

data host

A host computer where the data for an action is located.

DATA_HOST

An attribute added to the `DATA_ATTRIBUTES` entry that indicates the host system that the Data Type was loaded from. Note that this value should not be set in the *.dt files but is generated when the database is loaded.

database host

A host computer where an action is defined.

data-type

A mechanism that associates particular data files with the appropriate applications and actions. Data types can determine the type of a file based on file-naming conventions, such as a particular extension name, or on the contents of the file.

default

A value set automatically by an application.

dialog box

A window displayed by an application that requires user input. Do not use *dialog* as shorthand.

directory

A collection of files and other subdirectories.

display-dependent session

A session that can be restored on only a particular display.

display-independent session

A session that can be restored on any display, regardless of screen resolution or color capability.

double-click

To quickly press a mouse button twice without moving the mouse pointer. Unless otherwise specified, button 1 is assumed.

drag

To move the mouse pointer over an object, press and hold down mouse button 1, and then move the mouse pointer and the object to another location on the workspace.

drag and drop

To directly manipulate an object by using a pointing device to move and place the object somewhere else.

drag over feedback

The drag icon changes appearance when the user drags it over potential drop zones.

drag under feedback

The appearance provided by a drop zone. The feedback can be a solid line drawn around the site, a raised or lowered surface with a beveled edge around the drop zone, or a pixmap drawing over the drop zone.

drop

After grabbing an object, the act of releasing the mouse button. If the object is dropped in an appropriate area, an Action is initiated. Also see *grab*.

drop target

A rectangular graphic that represents the drop zone in an application.

drop zone

An area of the workspace, including the Trash, Printer, and CDE Mail icons, that accepts a dropped object. Objects can be dropped on the workspace for quick access.

element

A generic term for any entity that can be considered a standalone item in a broader context, such as an item in a list or a control in a window.

execution host

A host computer where an application invoked by an action runs. This may be the same computer where the action resides, or it may be another computer on the network.

field

A window element that holds data, as in the Name field or the Telephone number field. Preferred: Use a more specific noun to describe the element, as in the Name text box or the Files list box.

File Manager

The software application that manages the files and directories on your system.

file server

A host computer that stores data files used by applications.

format type

In TED document containers, the type used to store the property.

focus

Place to which keyboard input is directed.

folder

An icon that represents a directory.

font

A complete set of characters (letters, digits, and special characters) of one size and one typeface. Ten-point Helvetica bold is an example of a font.

foreground

The content of a window and the color or shading used to distinguish it from the window's background.

Front Panel

A centrally located window containing icons for accessing applications and utilities, including the *workspace switch*. The Front Panel occupies all workspaces.

grab

To move the mouse pointer over an object, and then to press and hold down mouse button 1 in preparation for moving the object. Also see *drag; drop*.

grab handles (or handles)

The small squares displayed at the corners and midpoints of a selected graphic object.

group box

A box in a window that visually associates a set of controls.

home directory

A directory where you keep personal files and additional directories. By default, File Manager and Terminal Emulator windows are set to the home directory when you first open them.

home session

A choice at logout to designate a particular session, other than the one you are currently in, as the one you will automatically return to at the next login.

hyperlink

In Help text, information that when chosen displays another Help topic.

icon

A graphic symbol displayed on the screen, which you can select to work in a particular function or software application.

insertion point

The point at which data typed on the keyboard, or pasted from the clipboard or a file, appears on the screen. In text, a synonym for *cursor*.

Install Icon

A choice on subpanels that enables you to install icons on the desktop using *drag and drop*.

IS_ACTION

An attribute added to the `DATA_ATTRIBUTES` entry that is created when an action is loaded. The `DtDtsDataTypeIsAction` uses this attribute to determine if a data type was created from the action table. It has no representation in the `*.dt` files except as an action entry. Note that this value should not be set in the `*.dt` files and is only used internally.

IS_SYNTHETIC

An attribute added to the `DATA_CRITERIA/DATA_ATTRIBUTES` entries that is created when an action is loaded. It has no representation in the `*.dt` files except as an action entry. Note: This value should not be set in the `*.dt` files and is only used internally.

ITE

Internal Terminal Emulator. ITE allows use of a bitmapped display as a terminal (through command-line mode from the Login screen).

items

Elements in a list.

key binding

Association of a keystroke with a particular behavior.

label

The text appearing next to a window element that names the element.

link

Synonym for *symbolic link*.

list

A control that contains elements from which you select. Also called *selection list*.

list box

Any of a number of graphical devices that displays a list of items from which you can select one or more items. It is usually not necessary to name the specific kind of box being used.

local host

The CPU or computer on which a software application is running; your workstation.

mapping

An action that invokes another action rather than containing its own EXEC-STRING.

menu

A list of commands from which you select to perform a particular application task.

menu bar

The part of the application window between the title bar and the work area where menu names are listed.

menu item

A choice that appears on a menu.

minimize

To turn a window into an icon. The push button that minimizes a window is located near the upper-right corner of the window frame.

modifier key

A key that when pressed and held along with another key changes the meaning of the second key. Control, Alt, and Shift are examples.

multipart document

A document that contains one or more attachments.

navigation keys

The keyboard keys used to move the current location of the cursor. These include the arrow keys (with or without the Control key); the Tab key (with or without the Control or Shift keys); the Begin and End keys (with or without the Control key); and the Page Up and Page Down keys.

networked session

A session managed across multiple systems. Using a networked session enables the same session to be seen, regardless of which system was used to log in. It also provides a single home directory across multiple systems.

newline character

An unseen character that marks the end of a line of text in a document. It tells a printer or screen to break a line and start a new one.

no saveback

The inability of drag and drop to write changes in data held in buffers back to an originating file.

On Item help

A form of help in which an application provides on-screen information about a particular command, operation, dialog box, or control.

operation indicator

The part of a drag icon that gives users feedback on the operation (move, copy, or link) that is occurring during the drag.

options

A generic term that applies to the variations available when choosing a command to run, or when selecting or filling in items in a dialog box.

page

To advance text displayed in a window by one full screen at a time, usually using a scroll bar.

palette

The range of available elements, usually colors.

pixmap

An image stored in a raster format. Usually refers to an image that may have more than two colors. Contrast with *bitmap*.

point

To move the mouse until the pointer rests on a particular screen object or area.

pointer

The arrow or other graphical marker that indicates the current mouse position, and possibly the active window. Also see *cursor.*

print server

A host computer to which one or more printers are connected, or the UNIX process that manages those printers.

Properties

A menu command that enables you to set characteristics of an object, such as its date or name, or display identifying characteristics of an object, such as typefaces.

push button

A control that immediately starts an action as soon as it is chosen. OK, Cancel, and Help are examples of push buttons commonly found in dialog boxes.

radio button

An exclusive control whose setting is indicated by the presence or absence of a graphical indicator, usually part of a radio group. A radio button has two states, on and off.

radio button group

A box containing a set of radio buttons that may have a distinct label. At most, one of the radio buttons may be activated at a time.

release

To let go of a mouse button or keyboard key.

resize handle

A control used to change the size of a window or a pane in a window.

resize pointer

The mouse pointer displayed when an object, such as a window, is being resized.

resource

A mechanism of the X Window System for specifying an attribute (appearance or behavior) of a window or application. Resources are usually named after the elements they control.

saveback

The ability of drag and drop to write modified data back to the originating file.

scalable typeface

A mathematical outline for a typeface used to create a bitmapped font for a particular size, slant, or weight.

screen lock

A function that locks the workstation screen, barring further input until the valid user password is entered.

screen saver

A choice that causes the workstation, after a specified time period, to switch off the display or to vary the images that are displayed, thereby prolonging the life of the screen.

scroll bar

A control located at the right or bottom of a window that enables you to display window content not currently visible.

select

To add highlighting or some other visual cue to an object so that it can be operated or enabled. Selection does not imply the initiation of an action but rather a change of state, such as highlighting an item in a list, or toggling a check box on.

server

A system that supplies services to a client.

session

The elapsed time between user *login* and *logout*.

session server

A system that provides networked sessions. Session files reside on the session server and are used whenever you log into a system on the network.

shortcut

General term for a mouse action that simplifies filling out a dialog box. For example: As a shortcut, double-click an item in the Filename list box to select it and choose OK in one action.

shortcut keys

A keyboard key sequence used to activate a menu command. This can be a key sequence that uses a special accelerator key, or an underlined letter (mnemonic) sequence. For example: Press Alt+F4 or Alt+F+P to choose the command File⇒Print.

slider

A control that uses a track and arm to set a value from among the available values. The position of the arm (or a separate indicator) gives the currently set value.

software application

A computer program that provides you with tools to do work. Style Manager, Text Editor, and File Manager are examples of software applications.

source indicator

The part of a drag icon that represents the item being dragged.

spin box

A window element with a text box and two arrow buttons that displays a set of related but mutually exclusive choices, such as days of the week.

state indicator

The part of a drag icon that is used as a pointer for positioning combined with feedback that shows whether a drop zone is valid or invalid.

Style Manager

The software application used to customize some of the visual elements and system device behaviors of the workspace environment, including colors and fonts, and keyboard, mouse, window, and session start-up behaviors.

subpanel

A component of the Front Panel that provides additional controls. Subpanels usually contain groups of related controls.

symbolic link

A reference to a file or directory.

synthetic data attribute

A data type added to the DATA_CRITERIA/DATA_ATTRIBUTES entries that is created when an action is loaded. It has no representation in the `*.dt` files except as an action entry. Note that this attribute should not be set in the `*.dt` files and is only used internally.

TED

TriTeal Enterpise Desktop. An implementation of the Common Desktop Environment developed by TriTeal Corporation.

terminal emulator

A window that emulates a particular type of terminal for running nonwindow programs. Terminal emulator windows are most commonly used for typing commands to interact with the computer's operating system.

text field

A rectangular area in a window where information is typed. Text fields with keyboard focus have a blinking text insertion cursor.

tile

A rectangular area used to cover a surface with a pattern or visual texture. For example: The Workspace Manager supports tiling, enabling users with limited system color availability to create new color tiles blended from existing colors.

title bar

The topmost area of a window, containing the window title.

toggle

To change the state of a two-state control, such as a radio button or check box, using either the mouse or keyboard.

window

A rectangular area on the display. Software applications typically have one main window from which secondary windows, called dialog boxes, can be opened.

window frame

The visible part of a window that surrounds a software application. A window frame can contain up to five controls: title bar, resize borders, minimize button, maximize button, and the Window menu button.

window icon

A minimized window.

Window list

An action that presents a list of all the open windows associated with the window from which the action was selected.

Window menu

The menu displayed by choosing the Window menu button. The menu provides choices that manipulate the location or size of the window, such as Move, Size, Minimize, and Maximize.

Window menu button

The control at the upper-left corner of a window, next to the title bar. Choosing it displays the Window menu.

work area

The part of a window where controls and text appear.

workspace

The current screen display, the icons and windows it contains, and the unoccupied screen area where objects can be placed.

workspace background

The portion of the display not covered by windows, icons, or objects.

Workspace Manager

The software application that controls the size, placement, and operation of windows within multiple workspaces. The Workspace Manager includes the Front Panel, the window frames that surround each application, and the Window and Workspace menus.

Workspace menu

The menu displayed by pointing at an unoccupied area of the workspace and clicking mouse button 3.

workspace object

An object that has been copied from File Manager to the workspace.

workspace switch

A control that enables you to select one workspace from among several workspaces.

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