



Common Desktop Environment: ToolTalk Messaging Overview

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Preface

This book describes the Common Desktop Environment (CDE) components, commands, and error messages of the ToolTalk™ service.

Note - In-depth information about the functionality of the ToolTalk service in general is beyond the scope of this book. That is, *CDE ToolTalk Messaging Overview* does not describe ToolTalk APIs or commands, or other ToolTalk functionality not specifically related to this release of the ToolTalk service for the Common Desktop Environment.

Who Should Use This Book

This manual is for developers who create or maintain applications that use the ToolTalk service to inter-operate with other applications in Common Desktop Environment. This manual assumes familiarity with the ToolTalk service and its functionality, UNIX™ operating system commands, system administrator commands, and system terminology.

How This Book Is Organized

This book is organized as follows:

Chapter 1, describes how the ToolTalk service works and how it uses information that your application supplies to deliver messages; how applications use the ToolTalk service; and application and ToolTalk components.

Chapter 2, contains the information you need to write an application using the ToolTalk service in the Common Desktop Environment, including the kinds of ToolTalk toolkit messages that need to be included in your application in order for it to inter-operate with other ToolTalk-aware Common Desktop Environment-compliant applications.

Chapter 3, describes how to create and send custom-constructed ToolTalk messages, and also how to selectively monitor any or all ToolTalk messages.

Chapter 4, describes how a ToolTalk pattern matches and delivers every message tsession sees.

Appendix A, describes some of the application program interface (API functions) that are a part of the messaging toolkit.

Appendix B, gives the ToolTalk-related portions of the ptype, header, and .c files of the ToolTalk demo program CoEd.

Appendix C, describes the ToolTalk functions that map filenames between local and canonical paths.

Related Books and Other Documentation

CDE ToolTalk Messaging Overview does *not* provide in-depth information about ToolTalk and its functionality. In addition to the ToolTalk product base documentation (that is, *ToolTalk User's Guide* and the *ToolTalk Reference Manual*), the following related ToolTalk documentation provide in-depth information about the ToolTalk functionality that is beyond the scope of this book:

- *The ToolTalk Service - An Inter-Operability Solution* (Published by SunSoft Press/PTR Prentice Hall, ISBN 013-088717-X)

This book describes ToolTalk and its functionality in depth, and is appropriate for all platforms to which ToolTalk has been ported.

- *ToolTalk and Open Protocols* (Published by SunSoft Press/PTR Prentice Hall, ISBN 013-031055-7)

This book describes how to create and develop open protocols for applications that use a messaging service to communicate with other applications. The general principles described in this book provide an application with the flexibility required for users to easily interchange tools.

- ToolTalk Message Sets
 - ToolTalk Desktop Services Message Set

These conventions apply to any tools in a POSIX or X11 environment. In addition to standard messages for these environments, the Desktop conventions define data types and error codes that apply to all of the ToolTalk inter-client conventions.

- ToolTalk Document and Media Exchange Message Set

Allows a tool to be a container for arbitrary media, or to be a media player/editor that can be driven from such a container.

- CASE Inter-Operability Message Set

An *open* specification defining abstract, framework-neutral message interfaces for CASE set-up by Sunsoft, DEC, and SGI. This work has been merged with HP's CASE Communique work, which defined message interfaces for HP's SoftBench Broadcast Message Server framework, and was submitted as a joint draft to ANSI X3H6. More information on the draft X3H6 standard can be retrieved from <ftp.netcom.com>, in `/pub/X3H6`; or you can contact:

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Introducing the ToolTalk Service

As computer users increasingly demand that independently developed applications work together, inter-operability is becoming an important theme for software developers. By cooperatively using each other's facilities, inter-operating applications offer users capabilities that would be difficult to provide in a single application. The ToolTalk service is designed to facilitate the development of inter-operating applications that serve individuals and work groups.

The ToolTalk service enables independent applications to communicate with each other without having direct knowledge of each other. Applications create and send ToolTalk messages to communicate with each other. The ToolTalk service receives these messages, determines the recipients, and then delivers the messages to the appropriate applications, as shown in Figure 1-1.

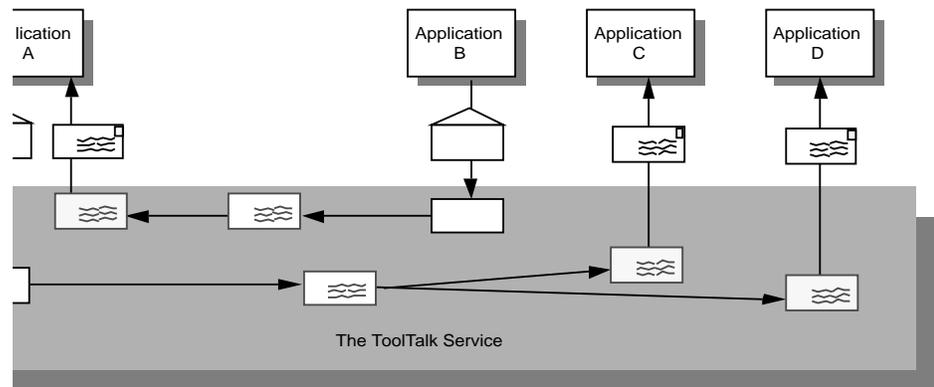


Figure 1-1 Applications Using the ToolTalk Service

What Kind of Work Problems Can the ToolTalk Service Solve?

This section describes some of the inter-operability problems the ToolTalk service is designed to solve. The ToolTalk service is the appropriate technology to use if your application needs:

- Tool inter-changeability
- Control integration
- Network-transparent events that are not owned by any well-known server (for example, an X server) and that do not have any predictable set of listeners
- Automatic tool invocation
- A widely-available distributed object system
- Persistent objects

Of course, there are some inter-operability problems for which the ToolTalk service may not be the appropriate technology to use. However, when your application needs to solve both sorts of problems (that is, a combination of those inter-operability problems for which the ToolTalk service is designed to solve and those problems for which it is not designed), you can use the ToolTalk service in combination with other technologies.

Tool Inter-changeability

Use the ToolTalk service when you want plug-and-play capability. The term *plug-and-play* means that any tool can be replaced by any other tool that follows the same protocol. That is, any tool that follows a given ToolTalk protocol can be placed (plugged) into your computing environment and perform (play) those functions indicated by the protocol. Tools can be mixed and matched, without modification and without having any specific built-in knowledge of each other.

Control Integration

Use the ToolTalk service when your application requires control integration. The term *control integration* indicates a group of tools working together toward a common end without direct user intervention. The ToolTalk service enables control integration through its easy and flexible facilities for issuing arbitrary requests, either to specific tool instances or to anonymous service providers.

Network-Transparent Events

Use the ToolTalk service when your application needs to generate or receive network-transparent events. To be useful, traditional event mechanisms (such as signals and window-system events) require special circumstances; for example, you must know a process or window ID. The ToolTalk service allows events to be expressed naturally: in terms of the file to which the event refers, or the group of processes on the network to which the event is applicable. The ToolTalk service delivers events (called *notices*) to any interested process anywhere on the network. ToolTalk notices are a flexible and easy way to provide extensibility for your system.

Automatic Tool Invocation

Use the ToolTalk service when your application needs network-transparent automatic invocation. The ToolTalk service lets you describe the messages that, when sent from any location on the network, should cause your tool to be invoked. The ToolTalk auto-start facility is easier to use and less host-specific than the conventional inetd(1) facility.

Distributed-Object System

Use ToolTalk when you need to build your application on a distributed-object system that is available across a wide variety of platforms. ToolTalk's object system can be used by any application on all the popular UNIX platforms, regardless of whether the application

- Is single- or multi-threaded
- Has a command-line or graphical user interface
- Uses its own event loop, or that of a window-system toolkit

Note - Programs coded to the ToolTalk object-oriented messaging interface are *not* portable to CORBA-compliant systems without source changes.

Persistent Objects

Use the ToolTalk service when your application needs to place objects unobtrusively in the UNIX file system.

Scenarios Illustrating How the ToolTalk Service Helps Solve Work Problems

The scenarios in this section illustrate how the ToolTalk service helps users solve their work problems. The message protocols used in these scenarios are hypothetical.

Using the ToolTalk Desktop Services Message Set

The ToolTalk Desktop Services Message Set allows an application to integrate and control other applications without user intervention. This section presents two scenarios (“The Smart Desktop” on page 4 and “Integrated Toolsets” on page 5) that show how the Desktop Services Message Set might be implemented.

The Smart Desktop

Note - The scenario in this section is intended to illustrate how the ToolTalk service can be used in an application-level program that interprets user requests; it is *not* intended to illustrate how the Common Desktop Environment product implements the ToolTalk service to interpret user requests.

A common user requirement for a graphic user interface (GUI) front-end is the ability to have data files be aware (or “know”) of their applications. To do this, an application-level program is needed to interpret the user’s requests. Examples of application-level programs, (known as *smart desktops*) are the Apple Macintosh® finder, Microsoft Windows™ File Manager, and the Common Desktop Desktop File Manager. The key common requirements for smart desktops are:

1. Takes a file
2. Determines its application
3. Invokes the application

The ToolTalk Service provides additional flexibility by allowing classes of tools to edit a specific data type. The following scenario illustrates how the Desktop Services Message Set might be implemented as a smart desktop transparent to the end-user.

1. Diane double-clicks on the File Manager icon.

- The File Manager opens and displays the files in Diane’s current directory.

2. Diane double-clicks on an icon for a data file.

- a. The File Manager requests that the file represented by the icon be displayed. The File Manager encodes the file type in the *display* message.

- b. The ToolTalk session manager matches the pattern in the *display* message to a registered application (in this case, the Icon Editor), and finds an instance of the application running on Diane's desktop.

Note - If the ToolTalk session manager does not find a running instance of the application, it checks the statically-defined process types (ptypes) and starts an application that best matches the pattern in the message. If none of the ptypes matches, the session manager returns failure to the File Manager application.

- c. The Icon Editor accepts the *display* message, de-iconifies itself, and raises itself to the top of the display.

3. Diane manually edits the file.

Integrated Toolsets

Another significant application for which the Desktop Services Message Set can be implemented is *integrated toolsets*. These environments can be applied in vertical applications (such as a CASE developer toolset) or in horizontal environments (such as compound documents). Common to both of these applications is the premise that the overall solution is built from specialized applications designed to perform one particular task well. Examples of integrated toolset applications are text editors, drawing packages, video or audio display tools, compiler front-ends, and debuggers. The integrated toolset environment requires applications to interact by calling on each other to handle user requests. For example, to display video, an editor calls a video display program; or to check a block of completed code, an editor calls a compiler.

The following scenario shows how the Desktop Services Message Set might be implemented as an integrated toolset:

1. Bruce is working on a compound document using his favorite editor.

He decides to change the some of the source code text.

2. Bruce double-clicks on the source code text.

- a. The Document Editor first determines the text represents source code and then determines which file contains the source code.

- b. The Document Editor sends an *edit* message request, using the file name as a parameter for the message.
- c. The ToolTalk session manager matches the pattern in the *edit* message to a registered application (in this case, the Source Code Editor), and finds an instance of the application running on Bruce's desktop.
-
- Note** - If the ToolTalk session manager does not find a running instance of the application, it checks the statically-defined ptypes and starts an application that best matches the pattern in the message. If none of the ptypes matches, the session manager returns failure to the Document Editor application.
-
- d. The Source Code Editor accepts the *edit* message request.
- e. The Source Code Editor determines that the source code file is under configuration control, and sends a message to check out the file.
- f. The Source Code Control application accepts the message and creates a read-write copy of the requested file. It then passes the name of the file back to the Source Code Editor.
- g. The Source Code Editor opens a window that contains the source file.

3. Bruce edits the source code text.

Using the ToolTalk Document and Media Exchange Message Set

The ToolTalk Document and Media Exchange Message Set is very flexible and robust. This section illustrates three uses of the ToolTalk Document and Media Exchange Message Set:

- Integrating multimedia into an authoring application
- Adding multimedia extensions to an existing application
- Extending the *cut-and-paste* facility of X with a media-translation facility

Integrating Multimedia Functionality

Integrating multimedia functionality into an application allows end-users of the application to embed various media types in their documents.

Typically, an icon that represents the media object is embedded in the document. Upon selection of an embedded object, the ToolTalk service automatically invokes an appropriate external media application and the object is played as illustrated in the following scenario.

- 1. Daniel opens a document that contains multimedia objects.**
- 2. The window shows the document with several icons representing various media types (such as sound, video, and graphics).**
- 3. Daniel double-clicks on the sound icon.**

A sound application (called a *player*) is launched and the embedded recording is played.
- 4. To edit the recording, Daniel clicks once on the icon to select it and uses the third mouse button to display an Edit menu.**

An editing application is launched, and Daniel edits the media object.

Adding Multimedia Extensions to Existing Applications

The ToolTalk Document and Media Exchange Message Set also allows an application to use other multimedia applications to extend its features or capabilities. For example, a Calendar Manager can be extended to use the Audio Tool to play a sound file as a reminder of an appointment, as illustrated in the following scenario:

- 1. Shelby opens her Calendar Manager and sets an appointment.**
- 2. Shelby clicks on an Audio Response button, which causes the Audio Tool to start.**
- 3. Shelby records her message; for example, “Bring the report.”**

When Shelby’s appointment reminder is executed, the Calendar Manager will start the Audio Tool and play Shelby’s recorded reminder.

Extending the X Cut-and-Paste Facility

The ToolTalk Document and Media Exchange Message Set can support an extensible, open-ended translation facility. The following scenario illustrates how an extensible multimedia *cut and paste* facility could work:

1. **Maria opens two documents that are different media types.**
2. **Maria selects a portion of Document A and cuts the portion using the standard X-windowing *cut* facility.**
3. **Maria then pastes the cut portion into Document B.**
 - a. Document B negotiates the transfer of the cut data with Document A.
 - b. If Document B does not understand any of the types offered by Document A, it requests that Document A sends it a *tagged media type*. Document B uses the tagged media type to broadcast a ToolTalk message requesting a translation of the media type to a media type it understands.
 - c. A registered translation utility accepts the request and returns the translated version of the media type to Document B.
 - d. The paste of the translated data into Document B is performed.

How Applications Use ToolTalk Messages

Applications create, send, and receive ToolTalk messages to communicate with other applications. Senders create, fill in, and send a message; the ToolTalk service determines the recipients and delivers the message to the recipients. Recipients retrieve messages, examine the information in the message, and then either discard the message or perform an operation and reply with the results.

Sending ToolTalk Messages

ToolTalk messages are simple structures that contain fields for address, subject, and delivery information. To send a ToolTalk message, an application obtains an empty message, fills in the message attributes, and sends the message. The sending application needs to provide the following information:

- Is the message a notice or a request (that is, should the recipient respond to the message)?
- What interest does the recipient share with the sender? (For example, is the recipient running in a specific user session or interested in a specific file?)

To narrow the focus of the message delivery, the sending application can provide more information in the message.

Message Patterns

An important ToolTalk feature is that senders need to know little about the recipients because applications that want to receive messages explicitly state what message they want to receive. This information is registered with the ToolTalk service in the form of *message patterns*.

Applications can provide message patterns to the ToolTalk service at installation time and while the application is running. Message patterns are created similarly to the way a message is created; both use the same type of information. For each type of message an application wants to receive, it obtains an empty message pattern, fills in the attributes, and registers the pattern with the ToolTalk service. These message patterns usually match the message protocols that applications have agreed to use. Applications can add more patterns for individual use.

When the ToolTalk service receives a message from a sending application, it compares the information in the message to the register patterns. Once matches have been found, the ToolTalk service delivers copies of the message to all recipients.

For each pattern that describes a message an application wants to receive, the application declares whether it can *handle* or *observe* the message. Although many applications can observe a message, only one application can handle the message to ensure that a requested operation is performed only once. If the ToolTalk service cannot find a handler for a request, it returns the message to the sending application indicating that delivery failed.

Receiving ToolTalk Messages

When the ToolTalk service determines that a message needs to be delivered to a specific process, it creates a copy of the message and notifies the process that a message is waiting. If a receiving application is not running, the ToolTalk service looks for instructions (provided by the application at installation time) on how to start the application.

The process retrieves the message and examines its contents.

- If the message contains a notice that an operation has been performed, the process reads the information and then discards the message.

- If the message contains a request to perform an operation, the process performs the operation and returns the result of the operation in a reply to the original message. Once the reply has been sent, the process discards the original message.

ToolTalk Message Distribution

The ToolTalk service provides two methods of addressing messages: *process-oriented* messages and *object-oriented* messages.

Process-Oriented Messages

Process-oriented messages are addressed to processes. Applications that create a process-oriented message address the message to either a specific process or to a particular type of process. Process-oriented messages are a good way for existing applications to begin communication with other applications. Modifications to support process-oriented messages are straightforward and usually take a short time to implement.

Object-Oriented Messages

Object-oriented messages are addressed to objects managed by applications. Applications that create an object-oriented message address the message to either a specific object or to a particular type of object. Object-oriented messages are particularly useful for applications that currently use objects or that are to be designed around objects. If an existing application is not object-oriented, the ToolTalk service allows applications to identify portions of application data as objects so that applications can begin to communicate about these objects.

Note - Programs coded to the ToolTalk object-oriented messaging interface are *not* portable to CORBA-compliant systems without source changes.

Determining Message Delivery

To determine which groups receive messages, you *scope* your messages. Scoping limits the delivery of messages to a particular session or file.

Sessions

A *session* is a group of processes that have an instance of the ToolTalk message server in common. When a process opens communication with the ToolTalk service, a default session is located (or created, if a session does not already exist) and a *process identifier* (*procid*) is assigned to the process. Default sessions are located either through an environment variable (called “process tree sessions”) or through the X display (called “X sessions”).

The concept of a session is important in the delivery of messages. Senders can scope a message to a session and the ToolTalk service will deliver it to all processes that have message patterns that reference the current session. To update message patterns with the current *session identifier* (*sessid*), applications join the session.

Files

A container for data that is of interest to applications is called a *file* in this book.

The concept of a file is important in the delivery of messages. Senders can scope a message to a file and the ToolTalk service will deliver it to all processes that have message patterns that reference the file without regard to the process’s default session. To update message patterns with the current file path name, applications join the file.

You can also scope a message to a file within a session. The ToolTalk service will deliver the message to all processes that reference both the file and session in their message patterns.

Note - The file scoping feature is restricted to NFS[®] and UFS file systems.

Modifying Applications to Use the ToolTalk Service

Before you modify your application to use the ToolTalk service, you must define (or locate) a ToolTalk *message protocol*: a set of ToolTalk messages that describe operations applications agree to perform. The message protocol specification includes the set of messages and how applications should behave when they receive the messages.

To use the ToolTalk service, an application calls ToolTalk functions from the ToolTalk API. The ToolTalk API provides functions to register with the ToolTalk service, to create message patterns, to send messages, to receive messages, to examine message information, and so on. To modify your application to use the ToolTalk service, you must first include the ToolTalk API header file in your program. You also need to modify your application to:

- Initialize the ToolTalk service and join a session
- Register message patterns with the ToolTalk service
- Send and receive messages
- Unregister message patterns and leave your ToolTalk session

How to Use ToolTalk Messaging

Note - The code examples shown in this chapter are taken from a ToolTalk demo program called CoEd. See Appendix B for a listing of the source code showing how ToolTalk-related code is included in the header and `.c` files for this program.

Telling Your Application about ToolTalk Functionality

Before your application can utilize the inter-operability functionality provided by the ToolTalk service and the Messaging Toolkit, it needs to know where the ToolTalk libraries and toolkit reside.

Using the Messaging Toolkit and Including ToolTalk Commands

To use the ToolTalk service, an application calls ToolTalk functions from the ToolTalk API. The Messaging Toolkit provides functions such as functions to register with the ToolTalk service, to create message patterns, to send messages, to receive messages, and to examine message information. To modify your application to use the ToolTalk service and toolkit, you must include the appropriate header files in your application's `.h` file.

```
#include <Tt/tt_c.h>           // ToolTalk Header File
#include <Tt/tttk.h>          // Messaging Toolkit Header file
```

Your application also needs to know about the new ToolTalk commands that are in its `.c` file. Place this information in your application's `.h` file, too.

Code Example 2-1 shows how the header file information is included in the `CoEditor.h` file.

CODE EXAMPLE 2-1 Including Messaging Information

```
#ifndef CoEditor_h
#define CoEditor_h

#include <X11/Intrinsic.h>
#include <Tt/tt_c.h>           // ToolTalk Header
#include <Tt/tttk.h>         // Messaging Toolkit Header
```

Using the ToolTalk Libraries

You need to change the makefile of your application so that it uses the ToolTalk libraries. To do this, add the `-ltt` option as follows:

```
LOCAL_LIBRARIES = -ltt $(XAWLIB) $(XMULIB) $(XTOOLLIB) $(XLIB)
```

Before You Start Coding

Before you can incorporate the Messaging Toolkit functionality into your application, you need to determine the way that your tool will work with other tools. There are several basic questions you need to ask:

1. How will these tools work together?
2. What kinds of operations can these tools perform?
3. What kinds of operations can these tools ask other tools to perform?
4. What events will these tools generate which may interest other tools? (What types of messages will these tools want to send?)
5. What events generated by other tools will be of interest to these tools? (What types of messages will these tools want to receive?)

To best answer these questions, you need to understand the difference between events and operations, and how the ToolTalk service handles messages regarding each of these.

What Is the Difference Between an Event and an Operation?

An *event* is an announcement that something has happened. An event is simply a news bulletin. The sending process has no formal expectations as to whether any other process will hear about the event, or whether an action is taken as a consequence of the event. When a process uses the ToolTalk service to inform interested processes that an event has occurred, it sends a *notice*. Since the sending process does not expect a reply, an event cannot fail.

An *operation* is an inquiry or an action. The requesting process makes an inquiry or requests that an operation be performed. The requesting process expects a result to be returned and needs to be informed of the status of the inquiry or action. When a process uses the ToolTalk service to ask another tool to perform an operation, it sends a *request*. The ToolTalk service delivers the request to interested processes and informs the sending process of the status of the request.

Sending Notices

When your application sends a ToolTalk notice, it will not receive a reply or be informed about whether or not any tool pays attention to the notice. It is important to make the notice an impartial report of the event as it happens.

For example, if your tool sends the Desktop Services message *Modified*, it may expect any listening tools to react in a given way. However, your tool should not care, and does not need to be informed, about whether any or no other tool reacts to the message; it only wants to report the event:

```
THE_USER_HAS_MADE_CHANGES_TO_THIS.
```

Sending Requests

When your application sends a ToolTalk request, it expects one tool to perform the indicated operation, or to answer the inquiry, and return a reply message. For example, if your tool sends the Desktop Services message *Get_Modified*, it should expect notification that the message was delivered and the action performed. The ToolTalk service guarantees that either a reply will be returned by the receiving process or the sender will be informed of the request's failure.

You can identify requests in three ways:

1. By identifying the operations requested by your tool that can fail.
2. By identifying the operations your tool can perform for other tools.
3. By identifying the operations your tool will want other tools to perform.

A good method to use to identify these operations is to develop a scenario that outlines the order of events and operations that you expect your tool to perform and have performed.

Developing a Scenario

A scenario outlines the order of the events and operations that a tool will expect to perform and have performed. For example, the following scenario outlines the events that the ToolTalk demo program CoEd expects to perform and have performed:

1. User double-clicks on a document icon in the File Manager.

The file opens in the editor, which is started by the system if one is not already running.

If another tool has modifications to the text pending for the document, User is asked whether the other tool should save the text changes or revert to the last saved version of the document.

2. User inserts text.
3. User saves the document.

If another tool has modifications pending for the document, User is asked whether to modify the document.

4. User exits the editor.

If text has unsaved changes, User is asked whether to save or discard the changes before quitting the file.

Once the scenario is done, you can answer your basic questions.

How Will the Tools Work Together?

- The File Manager will request that CoEd open a document for editing.
- Each instance of CoEd will notify other interested instances of changes it makes to the state of the document.

What Kinds of Operations Do the Tools Perform?

- Each instance of CoEd can answer questions about itself and its state, such as “What is your status?”
- Each instance of CoEd has the capability of performing operations such as:
 - Iconifying and de-iconifying
 - Raising to front and lowering to back
 - Editing a document
 - Displaying a document
 - Quitting

What Kinds of Operations Can the Tools Ask Other Tools to Perform?

- The File Manager must request that CoEd open a document for editing.
- An instance of CoEd can ask another instance of CoEd to save changes to the open document.
- An instance of CoEd can ask another instance of CoEd to revert to the last saved version of the open document.

What Events Will the Tools Generate that May Interest Other Tools?

- The document has been opened.
- The document has been modified.
- The document has been reverted to last saved version.
- The document has been saved.
- An instance of CoEd has been exited.

What Events Generated by Other Tools Will Be of Interest to This Tool?

- The document has been opened.
- The document has been modified.
- The document has been reverted to last saved version.
- The document has been saved.
- An instance of CoEd has been exited.

Preparing Your Application for Communication

The ToolTalk service provides you with a complete set of functions for application integration. Using the functionality provided with the ToolTalk Messaging Toolkit, your applications can be made to “speak” to other applications that are ToolTalk-compliant. This section describes how to add the kinds of ToolTalk functions you need to include in your application so that it can communicate with other ToolTalk-aware applications that follow the same protocols.

Creating a Ptype File

The ToolTalk types mechanism is designed to help the ToolTalk service route messages. When your tool declares a ptype, the message patterns listed in it are automatically registered; the ToolTalk service then matches messages it receives to these registered patterns. These static message patterns remain in effect until the tool closes communication with the ToolTalk service.

The ToolTalk Types Database already has installed ptypes for tools bundled with this release. You can extract a list of the installed ptypes from the ToolTalk Types Database, as follows:

```
% tt_type_comp -d user/system/network -P
```

The names of the ptypes will be printed out in source format.

For all other tools (that is, tools that are not included in this release), you need to first create a ptype file to define the ptype for your application, and then compile the ptype with the ToolTalk type compiler, `tt_type_comp`. To define a ptype, you need to include the following information in a file:

- A process-type identifier (*ptid*).
- An optional start string – The ToolTalk service will execute this command, if necessary, to start a process running the program.
- Signatures – Describes the `TT_PROCEDURE`-addressed messages that the program wants to receive. Messages to be observed are described separately from messages to be handled.

To create a ptype file, you can use any text editor (such as `vi`, `emacs`, or `dtpad`). Code Example 2-2 shows a snippet from the ptype file for the CoEd application.

CODE EXAMPLE 2-2 CoEd Ptype File

```
ptype DT_CoEd {
    start "CoEd";
    handle:
    /*
     * Display ISO_Latin_1
     */
    session Display( in ISO_Latin_1 contents) => start opnum = 1; /* Signature */
    /* NOTE: A signature is divided
     * into two parts by the => as follows:
     * Part 1 specifies how the message is to be matched;
     * Part 2 specifies what is to be taken when
     * a match occurs.
     */
}
}
```

After you have created the ptype file, you need to install the ptype. To do this, run the ToolTalk type compiler. On the command line, type the following:

```
% tt_type_comp CoEd.ptype
```

where *CoEd.ptype* is the name of the CoED ptype file.

Testing for Existing Ptypes in Current Session

The ToolTalk service provides a simple function to test if a given ptype is already registered in the current session.

```
// Test for existing ptype registered in current session
tt_ptype_exists(const char *ptid)
```

where *ptid* is the identifier of the session to test for registration.

Merging a Compiled Ptype File into a Currently Running ttsession

The ToolTalk service provides a function to merge a compiled ToolTalk type file into the currently running *ttsession*:

```
// Merge new compiled ptypes into currently running
ttsession tt_session_types_load(current_session, compiled_types_file)
```

where *current_session* is the current default ToolTalk session and *compiled_types_file* is the name of the compiled ToolTalk types file. This function adds new types and replaces existing types of the same name; other existing types remain unchanged.

Tasks Every ToolTalk-aware Application Needs to Perform

There are a number of tasks every ToolTalk-aware application needs to perform, including:

- Initializing the toolkit
- Joining a ToolTalk session and registering patterns
- Adding the ToolTalk service to its event loop

This section provides examples of the ToolTalk code you need to include in your application so that it can perform these tasks.

Note - The code snippets used in this section are taken from the `CoEd.C` file. This file contains the general commands any application needs to perform that are not specific to any particular application. See Appendix B for the detailed source code.

Initializing the Toolkit

Your application needs to initialize and register with the initial ToolTalk session. To do so, it first needs to obtain a process identifier (procid). The following code snippet shows how to obtain a procid and how to initialize the toolkit.

```
// Obtain process identifier
int myTtFd; //
Initialize toolkit and create a ToolTalk communication endpoint
char *myProcID = ttdt_open( &myTtFd, ToolName, ``SunSoft``, ``%I``, 1 );
```



Caution - Your application *must* call `ttdt_open` before any other calls are made; otherwise, errors may occur.

Joining the ToolTalk Session and Registering Message Patterns

Before your application can receive messages, it must join a ToolTalk session and register the message patterns that are to be matched.

```
// Join a ToolTalk session and register patterns and default callbacks
sessPats = ttdt_session_join( 0, 0, session_shell, this, 1 );
}
```

Adding the ToolTalk Service to Event Loop

Your application also needs to add the ToolTalk service to its event loop.

```
// Process ToolTalk events for Xt Clients
XtAppAddInput( myContext, myTtFd, (XtPointer)XtInputReadMask, tk_Xt_input_handler,
myProcID );
```

Tasks ToolTalk-aware Editor Applications Need to Perform

In addition to the duties described in the section “Tasks Every ToolTalk-aware Application Needs to Perform” on page 19, ToolTalk-aware editor applications also need to perform other tasks, including:

- Declaring a ptype
- Processing the start string message
- Passing a media callback
 - Failing a message
- Replying when a request has been completed

This section provides examples of the ToolTalk code you need to include in your editor application so that it can perform these additional tasks.

Note - The code snippets used in this section are taken from the `CoEditor.C` file. This file contains specific commands for editor applications. See Appendix B, " for the detailed source code.

Writing a Media Load Pattern Callback

There is one step you need to perform before you code your editor application to include any ToolTalk functions: you need to write a media load pattern callback routine. For example,

```
Tt_message CoEditor::loadISOLatin1_(      Tt_message      msg,      void      *pWidget,
Ttttk_op      op,      Tt_status      diagnosis,      unsigned char      *contents,
int      len,      char      *file,      char      *docname      )
```

This callback is passed to the media load function at runtime.

Declaring a Ptype

Since type information is specified only once (when your application is installed), your application needs to only declare its ptype each time it starts.

Passing Media Load Pattern Callbacks

The media load pattern callback routine you wrote previously is passed in at runtime. The callbacks are registered when your application joins the session. When your tool agrees to handle a request, a callback message is sent. A callback message is also sent if a file is joined or if a message is failed.

```
// Join the session and register patterns and callbacks
sessPats = ttdt_session_join( 0, 0, session_shell, this, 1 );

// Accept responsibility to handle a request
_contractPats = ttdt_message_accept(msg, CoEditor::_contractCB_, shell, this, 1, 1 );

// Optional task: Join a file (Can be called recursively)
if (_filePats == 0) {_filePats = ttdt_file_join( _file, TT_SCOPE_NONE, 1,
      CoEditor::_fileCB_, this );
}

// Fail a message
ttdt_message_fail( msg, TT_DESKTOP_ENODATA, 0, 1 );
```

Replying When Request Is Completed

After your application has completed the operation request, it must reply to the sending application. The following message returns the edited contents of text to the sender.

```
// Reply to media load pattern callback
// with edited contents of text
ttmedia_load_reply( _contract, (unsigned char *)contents,
                  len, 1 );
```

Optional Tasks ToolTalk-aware Editor Applications Can Perform

In addition to the tasks described in the section “Tasks ToolTalk-aware Editor Applications Need to Perform” on page 20 editor applications can also perform other optional tasks such as tasks that use desktop file interfaces to coordinate with other editors. This section provides examples of some of the ToolTalk code you need to include in your editor application so that it can perform these optional tasks.

Note - The code snippets used in this section are taken from the `CoEditor.C` file. This file contains specific commands for editor applications. See Appendix B for the detailed source code.

Requesting Modify, Revert, or Save Operations

The following code snippet asks a file whether it has any changes pending:

```
// Does the file have any changes pending?
_modifiedByOther = ttdt_Get_Modified( _contract, _file, TT_BOTH,
                                     10 * timeOutFactor );
```

The following code snippet reverts a file to its last version:

```
// Revert file to last version
status = ttdt_Revert(_contract, _file, TT_BOTH,
                   10 * timeOutFactor );
```

The following code snippet saves pending changes to a file:

```
// Save pending changes
status = ttdt_Save( _contract, _file, TT_BOTH,
                  10 * timeOutFactor );
```

Notifying When a File Is Modified, Reverted, or Saved

The following code snippet announces to interested tools that your application has changes pending for the file:

```
// File has been modified
ttdt_file_event( _contract, TTDt_MODIFIED, _filePats, 1 );
```

The following code snippet announces to interested tools that your application has reverted the file to its last saved version:

```
// File has been reverted to last version
ttdt_file_event( _contract, TTDT_REVERTED, _filePats, 1 );
```

The following code snippet announces to interested tools that your application has saved its pending changes for the file.

```
// File has been saved
ttdt_file_event( _contract, TTDT_SAVED, _filePats, 1 );
```

Quitting a File

The following code snippet unregisters interest in ToolTalk events about a file and destroys the patterns.

```
// Unregister interest in ToolTalk events and destroy patterns
status = ttdt_file_quit( _filePats, 1 );
_filePats = 0;
```


Using TTSnoop to Debug Messages and Patterns

TTSnoop is a tool provided to create and send custom-constructed ToolTalk messages. You can also use TTSnoop as a tool to selectively monitor any or all ToolTalk messages.

About TTSnoop

TTSnoop is a useful interactive tool that you can use to become familiar with ToolTalk concepts and API calls as well as to perform demonstrations. In addition, TTSnoop is a valuable debugging tool when you are developing applications.

You can use TTSnoop to monitor for messages that match more than one pattern. When a matched message is displayed, the name of the pattern that matched the entry can also be displayed.

You can add, edit, or delete messages and patterns to scrollable lists. TTSnoop allows the definitions of multiple patterns and messages to be saved and loaded from files. You can also define, save, and reload patterns and messages particular to a category of applications (for example, DeskSet™ tools) as well as associate messages and patterns with a user-defined name.

Where to Find TTSnoop

The TTSnoop program resides in the directory `/usr/dt/bin/ttsnoop`.

Starting TTSnoop

To start the program, enter the following command on the command line:

```
ttsnoop [ -t ]
```

The `-t` option displays the ToolTalk API calls that are being used to construct a particular pattern or message. Table 3-1 describes the buttons that are displayed when TTSnoop starts.

TABLE 3-1 TTSnoop Buttons

Button	Description
Start	Click this button to activate message reception. TTSnoop will display any incoming messages that match the patterns you register.
Stop	Click this button to stop receiving messages.
Clear	Click this button to clear the window.
About TTSnoop	Click this button to obtain general help for TTSnoop.
Display	Click this button to display a panel of checkboxes to highlight specific ToolTalk message components on the TTSnoop display subwindow.
Messages	Click this button to display a panel that enables you to create, store, and send ToolTalk messages.
Patterns	Click this button to display a panel that enables you to compose and register ToolTalk patterns.
Send Messages	Click this button to send messages that were stored using the Messages display.

Note - To obtain help for individual buttons and settings, place the mouse over the button or setting and click the F1 key or Help key on your keyboard.

Composing and Sending Messages

When you click the Messages button on the main display window, a display panel containing the choices shown in Table 3-2 is displayed.

TABLE 3-2 Message Button Display Window Options

Button	Description
Add Message	Click this button to store the current message settings. Once the messages are stored, you can recall and send these messages using the Send Message button on the main display window.
Edit Contexts	Click this button to add, change, and delete send message contexts. The display window displayed allows you to edit contexts to be sent with your messages.
Send Message	Click this button to send the newly created message.

Composing and Registering Patterns

When you click the Patterns button on the main display window, a display panel is displayed.

Click the Apply button to register your pattern. Once a pattern is registered, you can use TTSnoop as a debugging tool to observe what messages are being sent by other applications.

Click the Edit Receive Contexts button to add, change, and delete receive message contexts in patterns. The window displayed enables you to edit contexts to be registered with your patterns.

Displaying Message Components

When you click the Display button on the main display window, a display panel of checkboxes is displayed.

When you select a checkbox and click the Apply button, the specified ToolTalk message component is displayed until you make another selection and apply the change.

Sending Pre-Created Messages

When you click the Send Message button on the main display window, you can send one of the messages you created and stored using the Messages display.

Receiving Messages

When you click the Start button on the main display window, TTSnoop will display any incoming messages that match the patterns you registered.

Stop Receiving Messages

When you click the Stop button on the main display window, TTSnoop will stop receiving messages.

Using ToolTalk Tracing

The ToolTalk `ttsession` trace shows how ToolTalk pattern matches and delivers every message `ttsession` sees. ToolTalk tracing for this release also

- Displays a single client's interactions with ToolTalk. This feature allows implementors to focus on only one client.
- Filters the `ttsession` trace by, for example, message type, sender, or receiver.

Accessing ToolTalk Tracing

A command new for this release, `ttrace`, is the primary way to access ToolTalk tracing. This command is similar in purpose and command-line interface to the `truss` command. It enables you to control the three kinds of ToolTalk tracing. The `ttrace` command has two fundamental modes: *server* mode and *client* mode.

- In server mode, `ttrace` directs the indicated session to trace by sending it a `Session_Trace` request.
- In client mode, `ttrace` sets an environment variable and executes the ToolTalk client command given on the command line. The environment variable in the executed client instructs `libtt` whether, and how, to trace client messaging and client API calls.

Note - `ttrace` is not downward compatible with older servers or with clients using older versions of `libtt`. While `ttrace` will detect and diagnose older servers, it fails silently on clients using older versions of `libtt`.

Controlling Tracing

Controlling libtt Tracing

One way to control libtt's tracing behavior is to set the environment variable `STT_TRACE_SCRIPT`.

Note - libtt's tracing fails gracefully if the variable's value is corrupt or inconsistent.

Controlling Client-Side Tracing

The `tt_trace_control` call sets or clears an internal flag to control all client-side tracing. You can use this call to trace suspect areas in your code. The format of this call is:

```
int tt_trace_control(int option)
```

where *option* 0 to turn tracing off; 1 to turn tracing on; and -1 to toggle tracing on and off. When tracing is on, the extent of tracing is controlled by the `TT_TRACE_SCRIPT` variable or tracefile. This call returns the previous setting of the trace flag.

Tracing Message Traffic in a ToolTalk Session

The `Session_Trace` request is a ToolTalk request that `ttsession` registers to handle itself; that is, `ttsession` is the handler for the `Session_Trace` request. This request can be sent by any ToolTalk client, and, although not recommended, other ToolTalk clients can register to handle this request. (Note: This method will cause tracing to *not* work.) The syntax for this request is:

```
[file] Session_Trace(
    in boolean      on,
    in boolean      follow
    [in attribute   toPrint
    |in state       toTrace
    |in op          toTrace
    |in handler_ptype toTrace
    |in sender_ptype toTrace][...] );
```

The `Session_Trace` request turns message tracing in the scoped-to session on or off.

- If tracing is on and the file attribute of the request is set, subsequent trace output is appended to the file named by the attribute.
- If tracing is on and the file attribute is *not* set, tracing continues to the current trace.

By default, daemon mode causes the output to go to the console of the host on which `ttsession` is running; job-control mode causes the output to go to `ttsession`'s standard error. Table 4-1 describes the required and optional arguments for this request.

TABLE 4-1 `Session_Trace` Arguments

Argument	Description
<code>boolean on</code>	Required Turn tracing on or off. If no <code>toTrace</code> arguments are included and <code>on</code> is true, the previous trace settings are restored.
<code>boolean follow</code>	Required Turn on client-side tracing for Invoked clients.
attribute <code>toPrint</code>	Optional Print attribute(s) for each message traced. Valid attributes are: <ul style="list-style-type: none"> ■ <i>none</i>—print only a one-line description of traced messages (default) ■ <i>all</i>—print all attributes of traced messages
state <code>toTrace</code>	Optional State(s) through which to trace messages. In addition to the <code>Tt_states</code> defined in <code>tt_c.h</code> , valid states are: <ul style="list-style-type: none"> ■ <i>edge</i>—messages entering initial (<code>TT_SENT</code>) and final (<code>TT_HANDLED</code>, <code>TT_FAILED</code>) states. ■ <i>deliver</i>—all state changes and all client deliveries. ■ <i>dispatch</i>—<i>deliver</i> + all patterns considered for matching. (default)
<code>op toTrace</code>	Optional Trace messages that have <code>toTrace</code> as a value for the indicated message attribute.
<code>sender_ptype toTrace</code>	Optional
<code>handler_ptype toTrace</code>	Optional <ul style="list-style-type: none"> ■ Any number of <code>toTrace</code> arguments may be included in the request. ■ <code>toTrace</code> may include <code>sh</code> wildcard characters. ■ If no <code>toTrace</code> argument is included for a given message attribute, no value of that attribute excludes a message from tracing.

The current session tracing behavior changes only if this request is not failed. On failure, the `tt_message_status` of the reply is set to one of the errors described in Table 4-2 .

TABLE 4-2 Error Messages Returned by `Session_Trace` Request

Error	Description
<code>TT_ERR_NO_MATCH</code>	No handler could be found for the request.
<code>TT_ERR_APPFIRST + EACCES</code>	<code>ttsession</code> does not have permission to open or create the trace file.
<code>TT_ERR_APPFIRST + EISDIR</code>	The trace file is a directory.
<code>TT_ERR_APPFIRST + ENOSPC</code>	There is not enough space in the target file system to create the trace file.
<code>TT_ERR_APPFIRST + EEXIST</code>	Tracing is already occurring on another file. <code>ttsession</code> resets the file attribute of the reply to name the existing trace file. To trace to a different file, first turn off tracing to the current trace file.

Tracing ToolTalk Calls and Messages through the Server

The `ttrace` function traces message traffic through the server for the indicated ToolTalk session, or runs a command with ToolTalk client tracing turned on. If neither the session nor the command is given, the default session is traced. By default, tracing terminates when `ttrace` exits. The syntax for this function is:

```
ttrace [-OFCa] [-o outfile ] -S session | command
ttrace [-e script | -f scriptfile ] [-S session | command]
```

Table 4-3 describes the `ttrace` options.

TABLE 4-3 ttrace Options

Option	Description
-0	Turns off message tracing in session, or runs the specified command without message tracing (that is, with only call tracing).
-F	Follows all children forked by the indicated command, or subsequently started in session by tsession. Normally, only the indicated command or a tsession instance is traced. When the -F option is specified, the process ID is included with each line of trace output to indicate which process generated it.
-C	Do not trace client calls into the ToolTalk API. The default is to trace the calls.
-a	Prints all attributes, arguments, and context slots of traced messages. The default is to use only a single line when printing a message on the trace output.
-o <i>outfile</i>	The file to be used for the trace output. For session tracing, output goes to standard output of ttrace.
-s <i>session</i>	The session to trace. Defaults to the default session; that is, the session that tt_open would contact.
<i>command</i>	The ToolTalk client command to invoke and trace.
-e <i>script</i>	The script to be used as a ttrace setting.
-f <i>scriptfile</i>	The file from which to read the ttrace settings.

ttrace is implemented purely as a ToolTalk client, using the message interface to tsession and the TT_TRACE_SCRIPT environment variable. If this variable is set, it tells libtt to turn on client-side tracing as specified in the trace script. If the first character of the value is '.' or '/', the value is taken to be the path name of file containing the trace script to use; otherwise, the value is taken to be an inline trace script.

Formats of Traced Functions

The following is an example of how a traced ToolTalk function looks.

```
[pid] function_name(params) = return_value (Tt_status)
```

Message Summary Format

The `-a` option prints message attributes after a one-line summary of the message, as follows:

```
Tt_state Tt_paradigm Tt_class (Tt_disposition in Tt_scope): status == Tt_status
```

State Change Format

State changes are indicated by the following format:

```
old_state => new_state.
```

Message Delivery Format

Deliveries are indicated by the following indicated:

```
Tt_message => procid recipient_procid
```

Table 4-4 explains the messages you may receive during a dispatch trace.

TABLE 4-4 Reasons for Dispatch Trace

Message	Explanation
<code>tt_message_send</code>	The message to send.
<code>tt_message_reject</code>	The message was rejected.
<code>tt_message_fail</code>	The message failed.
<code>tt_message_reply</code>	The reply to a message.
<code>tt_session_join</code>	The session to join.
<code>tt_file_join</code>	The file to join.
<code>tt_message_reply</code>	A client called the indicated function.
<code>tt_message_send_on_exit</code>	ttsession is dispatching <code>on_exit</code> messages for a client that disconnected before calling <code>tt_close</code> .

TABLE 4-4 Reasons for Dispatch Trace *(continued)*

Message	Explanation
<code>tt_message_accept</code>	ttsession is dispatching messages that had been blocked while a ptype was being started. The started client has now called either <code>tt_message_accept</code> or <code>tt_message_reply</code> to indicate that the ptype should be unblocked.
<code>TT_ERR_PTYPE_START</code>	A ptype instance was started to receive the message, but the start command exited before it connected to ttsession.
<code>TT_ERR_PROCID</code>	ttsession lost its connection to the client that was working on this request.
<code>ttsession -> ttsession</code>	Another session wants this session to find recipients for the message.
<code>ttsession <- ttsession</code>	Another session wants to update (for example, fail) a message originating in this session.

Matching Format

When dispatching is being traced, matching is indicated by one of the following formats:

```
Tt_message & Tt_pattern { Tt_message & ptype ptid { Tt_message & otype otid {
```

The pattern or signature is printed, followed by:

```
} == match_score; [/* mismatch_reason */]
```

Examples

This sections contains examples of how to use the `ttrace` function.

Registering a Pattern and Sending a Matching Notice

To register a pattern and send a notice that matches the pattern, type:

```
% ttrace -a myclientprogram
```

Code Example 4-1 shows the results.

CODE EXAMPLE 4-1 Registering a Pattern and Sending a Notice

```
tt_open() = 0x51708=="7.jOHMM X 129.144.153.55 0" (TT_OK)
tt_fd() = 11 (TT_OK) tt_pattern_create() = 0x50318 (TT_OK)
tt_pattern_category_set(0x50318, TT_OBSERVE) = 0 (TT_OK)
tt_pattern_scope_add(0x50318, TT_SESSION) = 0 (TT_OK)
tt_pattern_op_add(0x50318, 0x2f308=="Hello World") = 0 (TT_OK)
tt_default_session() = 0x519e0=="X 129.144.153.55 0" (TT_OK)
tt_pattern_session_add(0x50318, 0x519e0=="X 129.144.153.55 0") = 0 (TT_OK)
tt_pattern_register(0x50318) = 0 (TT_OK) tt_message_create() = 0x51af0 (TT_OK)
tt_message_class_set(0x51af0, TT_NOTICE) = 0 (TT_OK)
tt_message_address_set(0x51af0, TT_PROCEDURE) = 0 (TT_OK)
tt_message_scope_set(0x51af0, TT_SESSION) = 0 (TT_OK)
tt_message_op_set(0x51af0, 0x2f308=="Hello World") = 0 (TT_OK)
tt_message_send(0x51af0) ...
TT_CREATED => TT_SENT:
TT_SENT TT_PROCEDURE TT_NOTICE (TT_DISCARD in TT_SESSION): 0 == TT_OK
id: 0 7.jOHMM X 129.144.153.55 0
op: Hello World
session: X 129.144.153.55 0
sender: 7.jOHMM X 129.144.153.55 0
= 0 (TT_OK)
tt_message_receive() ...
Tt_message => procid <7.jOHMM X 129.144.153.55 0>
TT_SENT TT_PROCEDURE TT_NOTICE (TT_DISCARD in TT_SESSION): 0 == TT_OK
id: 0 7.jOHMM X 129.144.153.55 0
op: Hello World
session: X 129.144.153.55 0
sender: 7.jOHMM X 129.144.153.55 0
pattern: 0:7.jOHMM X 129.144.153.55 0
= 0x51af0 (TT_OK)
```

To see `ttsession`'s view of the message flow, type:

```
% tttrace -a
```

`ttsession`'s view of *mylientprogram*'s message flow is shown in Code Example 4-2.

CODE EXAMPLE 4-2 `ttsession`'s View of Trace

```
tt_message_reply:
TT_SENT => TT_HANDLED:
TT_HANDLED TT_PROCEDURE TT_REQUEST (TT_DISCARD in TT_SESSION): 0 == TT_OK
id: 0 2.jOHMM X 129.144.153.55 0
op: Session_Trace
args: TT_IN string: "> /tmp/traceAAAA002oL; version 1; states"[...]
session: X 129.144.153.55 0
sender: 2.jOHMM X 129.144.153.55 0
pattern: 0:X 129.144.153.55 0
handler: 0.jOHMM X 129.144.153.55 0
Tt_message => procid <2.jOHMM X 129.144.153.55 0>
tt_message_send:
TT_CREATED TT_PROCEDURE TT_NOTICE (TT_DISCARD in TT_SESSION): 0 == TT_OK
id: 0 7.jOHMM X 129.144.153.55 0
op: Hello World
session: X 129.144.153.55 0
sender: 7.jOHMM X 129.144.153.55 0 TT_CREATED => TT_SENT:
TT_SENT TT_PROCEDURE TT_NOTICE (TT_DISCARD in TT_SESSION): 0 == TT_OK
```

```

id: 0 7.jOHMM X 129.144.153.55 0
op: Hello World
session: X 129.144.153.55 0
sender: 7.j HHM X 129.144.153.55 0
  Tt_message & Tt_pattern {
id: 0:7.jOHMM X 129.144.153.55 0
category: TT_OBSERVE
scopes: TT_SESSION
  sessions: X 129.144.153.55 0
ops: Hello World
  } == 3;
Tt_message => procid <7.jOHMM X 129.144.153.55 0>

```

Note - The first message traced will almost always be ttsession's reply to the request sent to it by ttrace.

Tracing a Message Flow

To trace the message flow in a specific, non-default session, type:

```
% ttrace -S "01 15303 1342177284 1 0 13691 129.144.153.55 2"
```

where *"01 15303 1342177284 1 0 13691 129.144.153.55 2"* is the specific, non-default session to be traced.

"01 15303 1342177284 1 0 13691 129.144.153.55 2" is the

Settings for ToolTalk Tracing

A ttrace script contains settings that control ToolTalk calls and messages. A ttrace script consists of commands separated by semicolons or newlines. If conflicting values are given for a setting, the last value is the one used. Table 4-5 describes these commands.

TABLE 4-5 ttrace Script Commands

Command	Description
version n	The version of the ttracefile command syntax used. The current version is 1.
follow [off on]	Sets whether to follow all children forked by the traced client or subsequently started in the traced session. Default is off.

TABLE 4-5 tttrace Script Commands (continued)

Command	Description
[> >>] outfile	File to be used for the trace output. By default, trace output goes to standard error. Normal shell interpretation of > and >> applies.
functions [all none func...]	ToolTalk API functions to trace. <i>func</i> may include shell wildcard characters. Default is all.
attributes [all none]	none (default) means use only a single line when printing a message on the trace output; all means print all attributes, arguments, and context slots of traced messages.
states [none edge deliver dispatch Tt_state]...	State(s) through which to trace messages. In addition to the Tt_states defined in tt_c.h, valid states are: <ul style="list-style-type: none"> ■ none - disable all message tracing ■ edge - messages entering initial (TT_SENT) and final (TT_HANDLED, TT_FAILED) states. ■ deliver - all state changes and all client deliveries. ■ dispatch - deliver plus all patterns considered for matching (default).
ops toTrace...	Trace messages that have <i>toTrace</i> as a value for the indicated message attribute. <i>toTrace</i> may include shell wildcard characters. If no <i>toTrace</i> argument is included for a given message attribute, then no value of that attribute excludes a message from tracing.
sender_ptypes toTrace...	
handler_ptypes toTrace...	

The Messaging Toolkit

The ToolTalk Messaging Toolkit is a higher-level interface of the ToolTalk API. It provides common definitions and conventions to easily integrate basic ToolTalk messages and functionality into an application for optimum inter-operability with other applications that follow the same message protocols.

Although most of the messages in the ToolTalk Messaging Toolkit are the messages in the standard ToolTalk message sets, the functions of the Messaging Toolkit transparently take care of several tasks that would otherwise need to be coded separately. For example, the `ttdt_file_join()` function will register a pattern to observe Deleted, Reverted, Moved, and Saved notices for the specified file in the specified scope; it also invokes a callback message.

General Description of the ToolTalk Messaging Toolkit

Inter-operability is an important theme if independently developed applications are to work together. The messages in the toolkit have been agreed upon by developers of inter-operating applications; the protocols form a small, well-defined interface that maximizes application autonomy.

The ToolTalk Messaging Toolkit plays a key role in application inter-operability and offers complete support for messaging. The message protocol specification includes the set of messages and how applications should behave when they receive the messages. These messages can be retrofitted to any existing application to leverage the functionality of the application. You can easily add these messages to existing applications to send, receive, and use shared information.

Tools that follow the ToolTalk messaging conventions will not use the same ToolTalk syntax for different semantics, nor will tools fail to talk to each other because they use different ToolTalk syntax for identical semantics. If these protocols are observed, cooperating applications can be modified, even replaced, without affecting one another.

Most of the messages in the Messaging Toolkit are the messages in the standard ToolTalk message sets. For detailed descriptions of the standard ToolTalk message sets, see the *ToolTalk Reference Manual*. Table A-1 lists the functions described in this chapter that partly comprise the ToolTalk Messaging Toolkit.

TABLE A-1 ToolTalk Messaging Toolkit Functions

Function	Description
<code>ttDt_close ()</code>	Destroys a ToolTalk communication endpoint
<code>ttDt_file_event()</code>	Announces an event about a file
<code>ttDt_file_join()</code>	Registers to observe ToolTalk events about a file
<code>ttDt_file_notice()</code>	Creates and sends a standard ToolTalk notice about a file
<code>ttDt_file_quit()</code>	Unregisters interest in ToolTalk events about a file
<code>ttDt_file_request()</code>	Creates and sends a standard ToolTalk request about a file
<code>ttDt_Get_Modified()</code>	Asks if any ToolTalk client has changes pending on a file
<code>ttDt_message_accept()</code>	Accepts the responsibility for handling a ToolTalk request
<code>ttDt_open()</code>	Creates a ToolTalk communication endpoint
<code>ttDt_Revert ()</code>	Requests that a ToolTalk client revert to the last saved version of a file
<code>ttDt_Save()</code>	Requests that a ToolTalk client save a file
<code>ttDt_sender_imprint_on()</code>	Causes a tool to emulate the behavior and characteristics of the specified ToolTalk tool

TABLE A-1 ToolTalk Messaging Toolkit Functions *(continued)*

Function	Description
<code>ttdt_session_join()</code>	Joins a ToolTalk session and registers patterns and default callbacks for many standard desktop messages
<code>ttdt_session_quit()</code>	Unregisters any patterns and default callbacks registered when session joined, and quits the ToolTalk session
<code>ttdt_subcontract_manage()</code>	Manages outstanding requests
<code>ttmedia_Deposit()</code>	Sends a Deposit request to checkpoint a document
<code>ttmedia_load()</code>	Creates and sends a Media Exchange request to display, edit, or compose a document
<code>ttmedia_load_reply()</code>	Replies to a Display, Edit, or Compose request
<code>ttmedia_ptype_declare()</code>	Declares the ptype of a Media Exchange media editor
<code>tttpk_block_while()</code>	Blocks the program while awaiting a condition such as a reply
<code>tttpk_message_abandon()</code>	Fails or rejects a message, then destroys it
<code>tttpk_message_create()</code>	Creates a message that conforms to messaging conventions
<code>tttpk_message_fail()</code>	Fails a message
<code>tttpk_message_receive()</code>	Retrieves next ToolTalk message
<code>tttpk_message_reject()</code>	Rejects a message
<code>tttpk_op_string()</code>	Returns a string for the operation

TABLE A-1 ToolTalk Messaging Toolkit Functions *(continued)*

Function	Description
<code>tttk_string_op()</code>	Returns the operation for the string
<code>tttk_xt_input_handler()</code>	Processes ToolTalk events for Xt clients

Toolkit Conventions

Most of the messaging conventions for the toolkit consist of descriptions of the standard ToolTalk message sets. This section describes conventions not related to any particular standard message set.

TABLE A-2 Messaging Toolkit Conventions

Field	Description
<code>fileAttrib</code>	Indicates whether the file attribute of the message can or needs to be set. The ToolTalk service allows each message to refer to a file, and has a mechanism (called “file-scoping”) for delivering messages to clients that are “interested in” the named file.
<code>opName</code>	The name of the operation or event (also called “op”). It is important that different tools use the same <code>opName</code> to mean the same thing. Unless a message is a standard one, its <code>opName</code> must be unique; for example, prefix the <code>opName</code> with <code>Company_Product</code> (such as <code>Acme_HoarkTool_Hoark_My_Frammistat</code>).
<code>requiredArgs</code>	Arguments that must always be included in the message.
<code>optionalArgs</code>	Extra arguments that may be included in a message. Any optional arguments in a message must be in the specified order and must follow the required arguments.
<code>vtype argumentName</code>	A description of a particular argument. A <code>vtype</code> is a programmer-defined string that describes what kind of data a message argument contains. The ToolTalk service uses <code>vtypes</code> only for matching sent message instances with registered message patterns. Every <code>vtype</code> should by convention map to a single, well-known data type.

Using the Messaging Toolkit When Writing Applications

To use the toolkit, include the ToolTalk Messaging Toolkit header file:

```
#include <Tt/tttk.h>
```

The ToolTalk Messaging Toolkit

This section contains a description of functions that are part of the ToolTalk Messaging Toolkit.

ttdt_close

```
Tt_status      ttdt_close(  const char *  procid,  
                           const char *  new_procid,  
                           int            sendStopped );
```

The `ttdt_close()` function destroys a ToolTalk communication endpoint. This function calls the ToolTalk function `tt_close()`.

- If the value of `procid` is `!= 0`, this function calls

```
tt_default_procid_set(  procid  )
```

- If the value of `new_procid` is `!= 0`, this function calls

```
tt_default_procid_set(  new_procid  )
```

- If the `sendStopped` parameter is set, this function sends a Stopped notice.

The `ttdt_close()` function can return any error returned by the ToolTalk functions `tt_default_procid_set()` and `tt_close()`. If the Sending notice fails, no errors are propagated.

ttdt_file_event

```
Tt_status  ttdt_file_event( Tt_message  context,
                          Ttk_op      event,
                          Tt_pattern *  patterns,
                          int          send );
```

The `ttdt_file_event()` function uses the ToolTalk service to announce an event about a file. This function creates and, optionally, sends a ToolTalk notice that announces an event pertaining to a specified file. This file is indicated in the path name that was passed to the `ttdt_file_join()` function when the `patterns` were created.

- Table A-3 describes the effect of the value of the *event* parameter on the announcement made.

TABLE A-3 Effect of event Parameter

Event Announced	Announcement
TTDT_MODIFIED	Registers in the scope passed to the <code>ttdt_file_join()</code> function to announce the event to interested tools that handle <code>Get_Modified</code> , <code>Save</code> , and <code>Revert</code> requests.
TTDT_SAVED, TTDT_REVERTED	Unregisters handler patterns for <code>Get_Modified</code> , <code>Save</code> , and <code>Revert</code> requests. If the <code>send</code> parameter is set, this function sends a <code>Saved</code> or <code>Reverted</code> notice, respectively, in the scope.

- If the `send` parameter is set, this function sends the `Modified` notice in the scope.
- If the `context` parameter is a value other than zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_`.

Table A-4 lists the possible errors that can be returned by this function.

TABLE A-4 Possible Errors Returned by `ttdt_file_event`

Error Returned	Description
<code>TT_DESKTOP_EINVAL</code>	The event notice was invalid. Valid event notices are <code>TTDT_MODIFIED</code> , <code>TTD_TSAVED</code> , and <code>TTDT_REVERTED</code> .
<code>TT_ERR_POINTER</code>	The <code>patterns</code> parameter was null.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.

`ttdt_file_join`

```
Tt_message ( *Ttdt_file_cb) ( Tt_message      msg,
                             Ttk_op          op,
                             char *         pathname,
                             void *         clientdata,
                             int            same_euid_egid,
                             int            same_procid );
Tt_pattern * ttdt_file_join( const char *   pathname,
                             Tt_scope       the_scope,
                             int            join,
                             Ttdt_file_cb   cb,
                             void *         clientdata );
```

The `ttdt_file_join()` function registers to observe ToolTalk events on the specified file. It registers in the scope to observe Deleted, Modified, Reverted, Moved, and Saved notices.

- The callback message argument `Ttdt_file_cb` takes the parameters listed in Table A-5.

TABLE A-5 Parameters taken by `Ttdt_file_cb`

Parameter	Description
<code>message</code>	The message being sent.
<code>op</code>	The operation being requested.
<code>pathname</code>	The path name of the file to which the message pertains. This copy can be freed with the ToolTalk function <code>tt_free()</code> .
<code>clientdata</code>	The client data contained in the message.
<code>same_euid_egid</code>	A flag that identifies the sender; if this value is true, the sender can be trusted.
<code>same_procid</code>	A flag that identifies the sender; if this value is true, the sender is the same <code>procid</code> as the receiver.

- If the value of the `the_scope` parameter is zero (that is, `TT_SCOPE_NONE`), the file scope is set to the default (`TT_BOTH`); however, if, for example, the ToolTalk database server `rpc.ttdbserver` is not installed on the file server that owns `pathname`, the file scope is set to `TT_FILE_IN_SESSION`.

The `ttdt_file_join()` function associates the value of `the_scope` and a copy of `pathname` with the `Tt_patterns` returned to allow the `ttdt_file_quit()` function to access the patterns. The caller can modify or free `pathname` after the `ttdt_file_join()` call returns.

- If the value of the `join` parameter is true, this function calls

```
tt_file_join( pathname )
```

This function returns a null-terminated array of `Tt_pattern`. Use the `ttdt_file_quit()` function to destroy the array. If an error is returned, the returned array is an error pointer that can be decoded with `tt_ptr_error`. Table A-6 is a list of the possible errors returned by the `ttdt_file_join()` function.

TABLE A-6 Possible Errors Returned by `ttdt_file_join`

Error Returned	Description
TT_ERR_NOMP	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
TT_ERR_DBAVAIL	The ToolTalk service could not access the ToolTalk database needed for this operation.
TT_ERR_DBEXIST	The ToolTalk service did not find the specified ToolTalk database in the expected place.
TT_ERR_PATH	The ToolTalk service was not able to read a directory in the specified file path name.
TT_ERR_NOMEM	There is not enough memory available to perform the operation.

ttdt_file_notice

```
Tt_message ttdt_file_notice(
    Tt_message context,
    Ttk_op op,
    T_scope scope,
    const char * pathname,
    int send_and_destroy );
```

The `ttdt_file_notice()` function creates and, optionally, sends a standard ToolTalk notice about a file. Use this function to create the following standard file notices: Created, Deleted, Moved, Reverted, Saved, and Modified.

Note - The `ttdt_file_event()` function is a higher-level interface than the `ttdt_file_notice()` function and is the preferred method to send all notices except the Moved notice.

- If the `context` parameter is a value other than zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_.`
- This function creates a notice with the specified `op` and `scope` parameters, and sets its file attribute to `pathname` parameter.
- If the `send_and_destroy` parameter is set, this function sends the message and then destroys it.

If the value of the `send_and_destroy` parameter is false, the created message is returned; if the value of the `send_and_destroy` parameter is true, zero is returned.

If an error occurs, an error pointer is returned. Use `tt_ptr_error` to find out the `Tt_status`. Table A-7 describes possible errors returned by this function.

TABLE A-7 Possible Errors Returned by `ttdt_file_notice`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_DBAVAIL</code>	The ToolTalk service could not access the ToolTalk database needed for this operation.
<code>TT_ERR_DBEXIST</code>	The ToolTalk service did not find the specified ToolTalk database in the expected place.
<code>TT_DESKTOP_EINVAL</code>	The operation was moved, and the value of the <code>send_and_destroy</code> parameter was true.
<code>TT_ERR_POINTER</code>	The path name was null, or was a ToolTalk error pointer.

`ttdt_file_quit`

```
Tt_status  ttdt_file_quit( Tt_pattern * patterns,  
                          int          quit );
```

The `ttdt_file_quit()` function unregisters interest in ToolTalk events about a file. This function destroys patterns. If the `quit` parameter is set, this function calls

```
ttdt_file_quit( pathname )
```

Use this function to unregister interest in the path name that was passed to the `ttdt_file_join()` function when patterns was created. Table A-8 lists the possible errors returned by this function.

TABLE A-8 Possible Errors Returned by `ttdt_file_quit`

Error Returned	Description
TT_ERR_NOMP	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
TT_ERR_PROCID	The process identifier specified is out of date or invalid.
TT_ERR_DBAVAIL	The ToolTalk service could not access the ToolTalk database needed for this operation.
TT_ERR_DBEXIST	The ToolTalk service did not find the specified ToolTalk database in the expected place.
TT_ERR_POINTER	The patterns were null or otherwise invalid.

ttdt_file_request

```
Tt_message ttdt_file_request(
    Tt_message context,
    Tttk_op op,
    Tt_scope scope,
    const char pathname,
    Ttdt_file_cb cb,
    void client_data,
    int send_and_destroy
);
```

The `ttdt_file_request()` function creates, and optionally sends, any standard Desktop file-scoped request (such as `Get_Modified`, `Save`, and `Revert`).

Note - This function is a lower-level interface than the `ttdt_Get_Modified()`, `ttdt_Save()`, and `ttdt_Revert()` functions, which create and send the request and then block on its reply.

The `ttdt_file_request()` function creates a request with the specified `op` and `scope`, and sets its file attribute to `pathname`. Per Desktop messaging conventions, an unset `Tt_mode` argument of `TT_IN` and the `vtype` `File` is added to the request; and if the specified operation is `ttdt_Get_Modified()`, an unset `Tt_mode` argument of `TT_OUT` and the `vtype` `Boolean` is also added to the request.

If `context` is not zero, the request created by this routine inherits from `context` all contexts whose slotname are prefixed with `ENV_`.

This function installs `cb` as a message callback for the created request, and ensures that client data will be passed into the callback. If `send` is true, this function sends the request before returning the handle to it.

This function returns the created `Tt_message` when successful. If an error occurs, an error pointer is returned. Use `tt_ptr_error` to find out the `Tt_status`. Table A-9 lists the possible errors returned by this function.

TABLE A-9 Possible Errors Returned by `ttdt_file_request`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough available memory to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_DBAVAIL</code>	The ToolTalk service could not access the ToolTalk database needed for this operation.
<code>TT_ERR_DBEXIST</code>	The ToolTalk service did not find the specified ToolTalk database in the expected place.
<code>TT_ERR_POINTER</code>	The path name was null or otherwise invalid.

ttdt_Get_Modified

```
int          ttdt_Get_Modified( Tt_message      context,
                               const char *    pathname,
                               Tt_scope        the_scope,
                               XtAppContext    app2run,
                               int            ms_timeout );
```

The `ttdt_Get_Modified()` function asks if any ToolTalk client has changes pending on a file. This function sends a `Get_Modified` request and waits for a reply.

- If the `context` parameter is a value other than zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_`.
- The `Get_Modified` request asks if any ToolTalk client has changes pending on `pathname` that it intends to make persistent.
- The `the_scope` parameter indicates the scope in which the `Get_Modified` request is sent. If the value of this parameter is zero (that is, `TT_SCOPE_NONE`), the file scope is set to the default (`TT_BOTH`); however, if, for example, the ToolTalk database server `rpc.ttdbserver` is not installed on the file server that owns `pathname`, the file scope is set to `TT_FILE_IN_SESSION`.
- The `app2run` and `ms_timeout` parameters are passed to the `tttk_block_while()` function to block on the reply to the `Get_Modified` request sent by this function.

If the `Get_Modified` request receives an affirmative reply within the specified time out, the `ttdt_Get_Modified()` function returns non-zero; otherwise, it returns zero. This call does not return any errors.

ttdt_message_accept

```
Tt_pattern *    ttdt_message_accept(
    Tt_message   contract,
    Ttdt_contract_cb cb,
    void *       clientdata,
    Widget       shell,
    int          accept,
    int          sendStatus
);
```

The `ttdt_message_accept()` function accepts a contract to handle a ToolTalk request. A tool calls this function when it wants to accept responsibility for handling (that is, failing or rejecting) a request.

A `Ttdt_contract_cb` argument takes the parameters listed in Table A-10.

TABLE A-10 Parameters Taken by the `Ttdt_contract_cb` Argument

Parameter	Description
<code>Tt_message msg</code>	The request in the sent state. The client program must either fail, reject, or reply to the message.
<code>Tttk_op op</code>	The operation of the incoming request.
<code>Widget shell</code>	The shell passed to the <code>ttdt_message_accept()</code> function.
<code>void *clientdata</code>	The client data passed to the <code>ttdt_message_accept()</code> function.
<code>Tt_message contract</code>	The contract passed to the <code>ttdt_message_accept()</code> function.

If the callback processes the message `msg` successfully, it returns zero; otherwise, it returns a `tt_error_pointer` cast to `Tt_message`.

If the callback does not consume the message `msg`, it returns the message and passes the `TT_CALLBACK_CONTINUE` routine down the call stack to offer the message to other callbacks, or to return it to the `tt_message_receive()` call.

The `ttdt_message_accept()` function registers in the default session for the handler-addressed requests described in Table A-11.

TABLE A-11 Requests for which `ttdt_message_accept` Registers

Request	How Request Is Handled
<code>Get_Geometry</code> , <code>Set_Geometry</code>	If the <code>shell</code> parameter is not null, these requests are handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
<code>Get_Iconified</code> , <code>Set_Iconified</code>	If the <code>shell</code> parameter is not null, these requests are handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
<code>Get_Mapped</code> , <code>Set_Mapped</code>	If the <code>shell</code> parameter is not null, these requests are handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .

TABLE A-11 Requests for which `ttdt_message_accept` Registers *(continued)*

Request	How Request Is Handled
Raise	If the <code>shell</code> parameter is not null, this request is handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
Lower	If the <code>shell</code> parameter is not null, this request is handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_XInfo, Set_XInfo	If the <code>shell</code> parameter is not null, these requests are handled transparently; if the <code>shell</code> parameter is null and the <code>cb</code> parameter is not null, these requests are passed to the callback routine; otherwise, these requests fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
Pause	If the <code>cb</code> parameter is not null, this request is passed to the callback routine; otherwise, it fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Resume	If the <code>cb</code> parameter is not null, this request is passed to the callback routine; otherwise, it fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Quit	If the <code>cb</code> parameter is not null, this request is passed to the callback routine; otherwise, it fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_Status	If the <code>cb</code> parameter is not null, this request is passed to the callback routine; otherwise, it fails with the error <code>TT_DESKTOP_ENOTSUP</code> .

If the `contract` argument has a `TT_WRN_START_MESSAGE` message status, the message caused the tool to be started.

Note - The started tool should join any scopes it wants to serve before accepting the contract so that it will receive any other messages already dispatched to its `ptype`; otherwise, the tool should undeclare its `ptype` while it is busy. If the tool does not join any scopes, the dispatched messages will cause other instances of the `ptype` to be started.

If the `accept` argument is true, the `ttdt_message_accept()` function calls

```
ttdt_message_accept( contract
)
```

If the `sendStatus` argument is true, the `ttdt_message_accept()` function sends a status notice to the requestor, using the parameters (if any) passed to the `ttdt_open()` function.

This function returns a null-terminated array of `Tt_pattern`. Use the `ttk_patterns_destroy()` function to destroy the array. If an error is returned, the returned array is an error pointer that can be decoded with `tt_ptr_error`. Table A-12 is a list of the possible errors returned by the `ttdt_message_accept()` function.

TABLE A-12 Possible Errors Returned by `ttdt_message_accept`

Returned Error	Description
<code>TT_ERR_NOMP</code>	The <code>tt</code> session process is not available. The ToolTalk service tries to restart <code>tt</code> session if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_POINTER</code>	The pointer passed does not point at an object of the correct type for this operation. For example, the pointer may point to an integer when a character string is needed.
<code>TT_ERR_UNIMP</code>	The <code>tt</code> session for the default session is a version (1.0 or 1.0.1) that does not support the <code>tt_message_accept()</code> function. Note: If the contract argument has a <code>TT_WRN_START_MESSAGE</code> message status, messages to the tool's ptype will remain blocked until the contract is rejected, replied to, or failed.

ttdt_open

```
char *      ttdt_open(    int *      ttfid,
                        const char * toolname,
                        const char * vendor,
                        const char * version,
                        int      sendStarted
);
```

The `ttdt_open()` function creates a ToolTalk communication endpoint. This function calls `tt_open()` and `tt_fd()` functions. The `ttdt_open()` function associates `toolname`, `vendor`, and `version` with the created `procid`. It initializes the new `procid`'s default contexts from `environ(5)`. If the `sendStarted` argument is set, this function sends a Started notice.

The `ttdt_open()` function returns the created `procid` in a string that can be freed with the `tt_free()` function.

This function can return any error returned by the `tt_open()` and `tt_fd()` functions. If the Started notice fails, errors are not propagated.

ttdt_Revert

```
Tt_status ttdt_Revert( Tt_message context,
                      const char *  pathname,
                      Tt_scope      the_scope,
                      XtAppContext  app2run,
                      int            ms_timeout
);
```

The `ttdt_Revert()` function requests a ToolTalk client to revert a file. It sends a Revert request in `the_scope` and waits for a reply. The Revert request asks the handling ToolTalk client to discard any changes pending on `pathname`.

- If the `context` parameter is a value other than zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_`.
- If the value of the `the_scope` parameter is zero (that is, `TT_SCOPE_NONE`), the file scope is set to the default (`TT_BOTH`); however, if, for example, the ToolTalk database server `rpc.ttdbserver` is not installed on the file server that owns `pathname`, the file scope is set to `TT_FILE_IN_SESSION`.
- The `app2run` and `ms_timeout` parameters are passed to the `ttdk_block_while()` function to block on the reply to the Revert request sent by this function.

If the request receives an affirmative reply within the indicated timeout, the `ttdt_Revert()` function returns `TT_OK`; otherwise, it returns either the `ttdt_message_status` of the failure reply, or one of the errors listed in Table A-13.

TABLE A-13 Possible Errors Returned by `ttdt_Revert`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_DBAVAIL</code>	The ToolTalk service could not access the ToolTalk database needed for this operation.

TABLE A-13 Possible Errors Returned by `ttdt_Revert` (continued)

Error Returned	Description
<code>TT_ERR_DBEXIST</code>	The ToolTalk service did not find the specified ToolTalk database in the expected place.
<code>TT_DESKTOP_ETIMEOUT</code>	No reply was received before the allotted timeout.
<code>TT_DESKTOP_EPROTO</code>	The request was failed; however, the handler set the <code>tt_message_status</code> of the failure reply to <code>TT_OK</code> instead of a specific error status.
<code>TT_ERR_POINTER</code>	Path name was null, or was a ToolTalk error pointer.

`ttdt_Save`

```
Tt_status  ttdt_Save( Tt_message  context,
                    const char *  pathname,
                    Tt_scope      the_scope,
                    XtAppContext   app2run,
                    int            ms_timeout );
```

The `ttdt_Save()` function requests a ToolTalk client to save a file. It sends a Save request in `the_scope` and waits for a reply. The Save request asks the handling ToolTalk client to discard any changes pending on `pathname`.

- If the `context` parameter is a value other than zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_`.
- If the value of the `the_scope` parameter is zero (that is, `TT_SCOPE_NONE`), the file scope is set to the default (`TT_BOTH`); however, if, for example, the ToolTalk database server `rpc.ttdbserver` is not installed on the file server that owns `pathname`, the file scope is set to `TT_FILE_IN_SESSION`.
- The `app2run` and `ms_timeout` parameters are passed to the `ttk_block_while()` function to block on the reply to the Save request sent by this function.

If the request receives an affirmative reply within the indicated timeout, the `ttdt_Save()` function returns `TT_OK`; otherwise, it returns either the `tt_message_status` of the failure reply, or one of the errors listed in Table A-14.

TABLE A-14 Possible Returns of the `ttdt_Save` function

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_DBAVAIL</code>	The ToolTalk service could not access the ToolTalk database needed for this operation.
<code>TT_ERR_DBEXIST</code>	The ToolTalk service did not find the specified ToolTalk database in the expected place.
<code>TT_DESKTOP_ETIMEOUT</code>	No reply was received before the allotted timeout.
<code>TT_DESKTOP_EPROTO</code>	The request was failed; however, the handler set the <code>tt_message_status</code> of the failure reply to <code>TT_OK</code> instead of a specific error status.
<code>TT_ERR_POINTER</code>	Path name was null, or was a ToolTalk error pointer.

`ttdt_sender_imprint_on`

```

Tt_status  ttdt_sender_imprint_on( const char *  handler,
                                Tt_message  contract,
                                char **     display,
                                int *       width,
                                int *       height,
                                int *       xoffset,
                                int *       yoffset,
                                XtAppContext app2run,
                                int         ms_timeout
                                );

```

The `ttdt_sender_imprint_on()` function causes the calling tool (“ToolB”) to adopt the behavior and certain characteristics of another tool (“ToolA”). ToolB adopts ToolA’s X11 display, locale, and current working directory; it also learns ToolA’s X11 geometry so that it can position itself appropriately.

If the `display` parameter is null, the environment variable `$DISPLAY` is set to ToolA’s display; otherwise, ToolA’s display is returned in this parameter. The returned value is a string that can be freed with the ToolTalk `tt_free()` function.

This function sends a `Get_Geometry` request to ToolA. If ToolA does not return a value for any or all of the geometry parameters:

- If a value for the `width` parameter is not returned, it is set to `-1`.
- If a value for the `height` parameter is not returned, it is set to `-1`.
- If a value for the `xoffset` parameter is not returned, it is set to `INT_MAX`.
- If a value for the `yoffset` parameter is not returned, it is set to `INT_MAX`.

If the `width`, `height`, `xoffset`, and `yoffset` parameters in the `ttdt_sender_imprint_on()` function are all set to null, a `Get_Geometry` request is not sent to ToolA.

The `app2run` and `ms_timeout` parameters are passed to the `tttk_block_while()` function to block on the replies to the `Get_Geometry` request sent by this function.

Table A-15 lists the possible errors that can be returned by this function.

TABLE A-15 Possible Errors Returned by the `ttdt_sender_imprint_on`

Error Returned	Description
<code>TT_DESKTOP_ETIMEDOUT</code>	One or more of the sent requests did not complete before the allotted timeout.
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.

ttdt_session_join

```

Tt_message ( *Ttdt_contract_cb) ( Tt_message msg,
    void * clientdata
    Tt_message contract );
Tt_pattern * ttdt_session_join( const char * sessid,
    Ttdt_session_cb cb,
    Widget shell,
    void * clientdata,
    int join
);

```

The `ttdt_session_join()` function joins a ToolTalk session as a “good desktop citizen”; that is, it registers patterns and default callbacks for many standard desktop message interfaces when it joins the session `sessid`. Table A-16 lists the message interfaces for which this function currently registers.

TABLE A-16 Standard Messages for which the `ttdt_session_join` Registers

Request	How Message Is Handled
Get_Environment Set_Environment	These messages are handled transparently.
Get_Locale, Set_Locale	These messages are handled transparently.
Get_Situation, Set_Situation	These messages are handled transparently.
Signal	This message is handled transparently.
Get_Sysinfo	This message is handled transparently.
Get_Geometry, Set_Geometry	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , these messages are handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , these messages fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_Iconified, Set_Iconified	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , these messages are handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , these messages fail with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_Mapped, Set_Mapped	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , these messages are handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , these messages fail with the error <code>TT_DESKTOP_ENOTSUP</code> .

TABLE A-16 Standard Messages for which the `ttdt_session_join` Registers *(continued)*

Request	How Message Is Handled
Raise	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , this message is handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Lower	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , this message is handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_XInfo	If the value of the <code>shell</code> parameter is not null, this message is handled transparently; otherwise, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Set_XInfo	If the value of the <code>shell</code> parameter is not null and the shell is a realized <i>mappedWhenManaged applicationShellWidget</i> , this message is handled transparently; if the shell is not a <i>mappedWhenManaged applicationShellWidget</i> , this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Pause	If the <code>cb</code> parameter is not null, this message is passed to the callback; the <code>cb</code> parameter is null, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Resume	If the <code>cb</code> parameter is not null, this message is passed to the callback; the <code>cb</code> parameter is null, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Quit	If the <code>cb</code> parameter is not null, this message is passed to the callback; the <code>cb</code> parameter is null, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Get_Status	If the <code>cb</code> parameter is not null, this message is passed to the callback; the <code>cb</code> parameter is null, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .
Do_Command	If the <code>cb</code> parameter is not null, this message is passed to the callback; the <code>cb</code> parameter is null, this message fails with the error <code>TT_DESKTOP_ENOTSUP</code> .

If the `sessid` parameter is null, the default session is joined.

If the `join` parameter is set, the specified session is joined.

A `Ttdt_contract_cb` message takes the parameters described in Table A-17. If the callback does not consume the message, it returns the message; if it consumes the message, it returns either zero or a error pointer cast to `Tt_message`.

TABLE A-17 Parameters taken by `Ttdt_session_cb`

Parameter	Description
<code>Tt_message msg</code>	The request in the sent state. The client program must either fail, reject, or reply to the message. Note: Destroy the message <i>msg</i> after it is processed.
<code>void *clientdata</code>	The <i>clientdata</i> passed to either the <code>ttdt_session_join()</code> or <code>ttdt_message_accept()</code> function.
<code>Tt_messagecontract</code>	The contract passed to the <code>ttdt_message_accept()</code> function. If the callback is installed by the <code>ttdt_session_join()</code> function, the value for the <i>contract</i> parameter is always zero.

The `ttdt_session_join()` function returns a null-terminated array of `Tt_pattern`, which can be passed to the `ttdt_session_quit()` function to be destroyed. If an error occurs, the returned array that is an error pointer. Use `tt_ptr_error` to find the `Tt_status`. Table A-18 lists the possible errors returned.

TABLE A-18 Possible Errors Returned by the `ttdt_session_join`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_SESSION</code>	An out-of-date or invalid ToolTalk session was specified.
<code>TT_ERR_POINTER</code>	The pointer passed does not point at an object of the correct type for this operation. For example, the pointer may point to an integer when a character string is needed.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.

ttdt_session_quit

```
Tt_status  ttdt_session_quit( const char *   sessid,  
                          Tt_pattern *    sess_pats,  
                          int              quit );
```

The `ttdt_session_quit()` function quits a ToolTalk session as a “good desktop citizen”; that is, it unregisters all the patterns and default callback it registered when it joined the session.

This function destroys all patterns in `sess_pats`. If the `quit` parameter is set, it quits the session `sessid`; if the `sessid` parameter is null, it quits the default session.

Table A-19 lists the errors that can be returned by this function.

TABLE A-19 Possible Errors Returned by the `ttdt_session_quit`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_SESSION</code>	An out-of-date or invalid ToolTalk session was specified.
<code>TT_ERR_POINTER</code>	The pointer passed does not point at an object of the correct type for this operation. For example, the pointer may point to an integer when a character string is needed.

ttdt_subcontract_manage

```
Tt_pattern * ttdt_subcontract_manage( Tt_message contract,  
                                     Ttdt_contract_cb cb,  
                                     Widget      shell,  
                                     void *      clientdata  
);
```

The `ttdt_subcontract_manage()` function manages an outstanding request. It allows the requesting tool to manage the standard Desktop interactions with the tool

that is handling the request. This function registers in the default session for TT_HANDLER-addressed Get_Geometry and Get_XInfo requests, and Status notices.

If the `shell` parameter is null, the request or notice is passed to the `cb` parameter; otherwise, the request is handled transparently.

The `ttdt_subcontract_manage()` function returns a null-terminated array of `Tt_pattern`, which can be passed to the `ttdt_session_quit()` function to be destroyed. If an error occurs, the returned array that is an error pointer. Use `tt_ptr_error` to find the `Tt_status`. Table A-20 lists the possible errors returned.

TABLE A-20 Possible Errors Returned by the `ttdt_subcontract_manage`

Error Returned	Description
TT_ERR_NOMEM	There is not enough memory available to perform the operation.
TT_ERR_NOMP	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
TT_ERR_PROCID	The process identifier specified is out of date or invalid.
TT_ERR_POINTER	The <code>subcontract</code> parameter was not a valid <code>Tt_message</code> .
TT_ERR_EINVAL	Both the <code>shell</code> and <code>cb</code> parameters were null.

ttmedia_Deposit

```
Tt_status ttmedia_Deposit( Tt_message load_contract,
                           const char *   buffer_id,
                           const char *   media_type,
                           const unsigned char * new_contents,
                           int            new_len,
                           const char *   pathname,
                           XtAppContext  app2run,
                           int            ms_timeout );
```

The `ttmedia_Deposit` function sends a Deposit request to checkpoint a document that was the subject of a Media Exchange `load_contract` request such as Edit, Compose, or Open.

This function creates and sends a Deposit request and returns the success or failure of that request.

- `load_contract` is the request that caused this editor to load the document
- `buffer_id` is the id of the buffer this editor created if the document was loaded by an Open request
- `media_type` is the vtype of the `contents` argument of the sent request
- `new_contents` and `new_len` are the values for the `contents` argument

After the request is sent, `app2run` and `ms_timeout` are passed to the `tttk_block_while()` function to wait for the reply.

TABLE A-21 Possible Errors Returned by the `ttmedia_Deposit`

<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough available memory to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.
<code>TT_ERR_DBAVAIL</code>	The ToolTalk service could not access the ToolTalk database needed for this operation.
<code>TT_ERR_DBEXIST</code>	The ToolTalk service did not find the specified ToolTalk database in the expected place.
<code>TT_DESKTOP_ETIMEOUT</code>	No reply was received before the allotted timeout.
<code>TT_ERR_POINTER</code>	Path name was null, or was a ToolTalk error pointer.

ttmedia_load

```
Tt_message (*Ttmedia_load_msg_cb) (Tt_message msg,  
void * clientdata,
```

```

        Tttk_op          op,
        unsigned char * contents,
        int             len,
        char *         file );
Tt_message  ttmedia_load( Tt_message  context,
        Ttmedia_load_msg_cb cb,
        void *        clientdata,
        Tttk_op       op,
        const char *   media_type,
        const unsigned char* contents,
        int           len,
        const char *   file,
        const char *   docname,
        int           send );

```

The `ttmedia_load` function creates and, optionally, sends a Media Exchange request to display, edit, or compose a document. This function creates and sends Display, Edit, or Compose requests.

Note - Use the `tttdt_subcontract_manage()` function immediately after sending the request created by this message to manage the standard interactions with the handler of the request.

If value of the `context` argument is not zero, messages created by this routine inherit all contexts whose slotname begins with `ENV_`.

The `clientdata` argument is passed to the `cb` argument when the reply is received, or when intermediate versions of the document are checkpointed through Deposit requests.

The `op` argument must be either `TTME_DISPLAY`, `TTME_EDIT`, or `TTME_COMPOSE`.

The `media_type` argument names the data format of the document. This argument usually determines which application is chosen to handle the request.

The `contents` and `len` arguments specify the document. If the value of both of these arguments is zero and the value of the `file` argument is not zero, the document is assumed to be contained in the specified file.

If the `docname` argument is not null, it is used as the title of the document.

If the `send` argument is true, the message is sent before it is returned.

Table A-22 lists the parameters taken by a `Ttmedia_load_msg_cb` message.

TABLE A-22 Parameters Taken by the `Ttmedia_load_msg_cb`

Parameter	Description
<code>Tt_message msg</code>	The reply to the request, or a Deposit request with a <code>messageID</code> argument that names the <code>tt_message_id</code> of the load request. If the value of this parameter is a Deposit request, the client program must either fail or reply to the request. Note: Destroy the message <code>msg</code> after it is processed.
<code>Tttk_op op</code>	The operation of the message (either <code>TTME_DEPOSIT</code> or the operation passed to the <code>ttmedia_load()</code> message).
<code>unsigned char * contents int len char *file</code>	The contents of the arriving document. If the <code>len</code> argument is zero, the document is contained in the specified file. If the <code>contents</code> or <code>file</code> arguments are non-null, use the ToolTalk function <code>tt_free()</code> to free them.
<code>void *clientdata</code>	The client data passed to the <code>ttmedia_load()</code> message.

If the message is processed successfully, the callback returns zero; if the processing results in an error, the callback returns an error pointer cast to `Tt_message`.

If the callback does not consume the message `msg`, it returns the message and the toolkit passes the `TT_CALLBACK_CONTINUE` routine down the call stack to offer the message to other callbacks, or to return it to the `tt_message_receive()` call.

Upon completion, the `ttmedia_load()` function returns the request it was asked to build. If an error occurs, this function returns an error pointer. Use `tt_ptr_error` to find the `Tt_status`. Table A-23 lists the possible errors returned.

TABLE A-23 Possible Errors Returned by the `ttmedia_load`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.

TABLE A-23 Possible Errors Returned by the `ttmedia_load` (continued)

Error Returned	Description
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.
<code>TT_ERR_OVERFLOW</code>	The ToolTalk service has received the maximum amount of active messages (2000) it can properly handle.

ttmedia_load_reply

```
Tt_message ttmedia_load_reply ( Tt_message contract,  
                               const unsigned char * new_contents,  
                               int new_len,  
                               int reply_and_destroy  
);
```

Use the `ttmedia_load_reply()` function to reply to a Media Exchange request to display, edit, or compose a document.

If both the `new_contents` and `new_len` arguments are non-zero, their value is used to set the new contents of the document in the appropriate output argument of the `contract` argument. If the `reply_and_destroy` argument is true, a reply is made to the `contract` argument and then the message is destroyed.

Table A-24 lists the possible errors returned.

TABLE A-24 Possible Errors Returned by the `ttmedia_load_reply`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NUM</code>	
<code>TT_ERR_NOTHANDLER</code>	

TABLE A-24 Possible Errors Returned by the `ttmedia_load_reply` (continued)

`ttmedia_ptype_declare`

```
Tt_message (*Ttmedia_load_pat_cb) ( Tt_message msg,
void * clientdata,
Tttoolkit_op op,
Tt_status diagnosis,
unsigned char * contents,
int len,
char * file,
char * docname );

Tt_status ttmedia_ptype_declare( const char * ptype,
int base_opnum,
Ttmedia_load_pat_cb cb,
void * clientdata,
int declare );
```

The `ttmedia_ptype_declare()` function declares the `ptype` of a Media Exchange media editor. This function initializes an editor that implements the Media Exchange message interface for a particular media type.

- It calls the `cb` argument when the editor is asked to edit a document of the kind supported by `ptype`.
- It installs a toolkit-internal operation number (`opnum`) callback on a series of signatures that the `ptype` is assumed to contain. The toolkit-internal `opnum` callback passes `clientdata` to the `cb` argument when a request is received that matches one of these signatures. The `opnums` start at `base_opnum`, which must be zero or a multiple of 1000.

- If the `declare` argument is true, it calls

```
tt_ptype_declare( ptype )
```

If the `ptype` implements several different media types, the `ttmedia_ptype_declare()` function can be called multiple times. Each call must have a different `base_opnum` value.

Note - The `ttmedia_ptype_declare()` function can be called multiple times; however, the `declare` argument can “true” only once.

Table A-25 lists the parameters taken by a `Ttmedia_load_pat_cb` message.

TABLE A-25 Parameters Taken by `Ttmedia_load_pat_cb`

Parameter	Description
<code>Tt_message msg</code>	The request sent. The client program must either fail, reject, or reply to the request.
<code>Tttk_op op</code>	The operation of the incoming request (either <code>TTME_COMPOSE</code> , <code>TTME_EDIT</code> , or <code>TTME_DISPLAY</code>).
<code>Tt_status diagnosis</code>	The error code with which the toolkit recommends the request should be failed (for example, <code>TT_DESKTOP_ENODATA</code>). If the diagnosis is not <code>TT_OK</code> and the callback routine returns the message <code>msg</code> , the toolkit fails the message <code>msg</code> and destroys it.
<code>unsigned char * contents int len char *file</code>	The contents of the arriving document. If the <code>len</code> argument is zero, the document is contained in specified file. If value of the <code>contents</code> or <code>file</code> arguments is non-null, use the ToolTalk function <code>tt_free</code> to free them.
<code>char * docname</code>	The name of the document, if any.
<code>void * clientdata</code>	The client data passed to the <code>ttmedia_ptype_declare()</code> message.

If the message is processed successfully, the callback returns zero; if the processing results in an error, the callback returns an error pointer cast to `Tt_message`.

If the callback does not consume the message `msg` and the value of the `diagnosis` argument is not `TT_OK`, it returns the message and the toolkit passes the `TT_CALLBACK_CONTINUE` routine down the call stack to offer the message to other callbacks, or to return it to the `tt_message_receive()` call.

If an error occurs, this function returns one of the errors listed in Table A-26.

TABLE A-26 Possible Errors Returned by the `ttmedia_ptype_declare`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.

TABLE A-26 Possible Errors Returned by the `ttmedia_ptype_declare` (continued)

Error Returned	Description
<code>TT_ERR_PTYPE</code>	The ToolTalk service could not locate the specified ptype.
<code>TT_ERR_POINTER</code>	The pointer passed does not point at an object of the correct type for this operation. For example, the pointer may point to an integer when a character string is needed.

`tttk_block_while`

```
Tt_status   tttk_block_while(  
            const int *blocked,  
            int       ms_timeout  
);
```

The `tttk_block_while` function blocks the program while it awaits a reply for the `ms_timeout` time.

`tttk_message_abandon`

```
Tt_status   tttk_message_abandon ( Tt_message   msg );
```

The `tttk_message_abandon()` function abandons the request, and then destroys it.

Note - A program should abandon a message when it does not understand the message and wants to dispose of it.

If an error occurs, this function returns one of the errors listed in Table A-27.

TABLE A-27 Possible Errors Returned by the `ttk_message_abandon`

Error Returned	Description
TT_ERR_NOMP	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
TT_ERR_POINTER	The pointer passed does not point at an object of the correct type for this operation. For example, the pointer may point to an integer when a character string is needed.
TT_ERR_NOTHANDLER	

`ttk_message_create`

```
Tt_message_ttk_message_create( Tt_message      context,
                               Tt_class        the_class,
                               Tt_scope        the_scope,
                               const char *    handler,
                               const char *    op,
                               Tt_message_callback callback
);
```

The `ttk_message_create()` function creates a message that conforms to the conventions. This function provides a simple way to create a message that propagates inherited contexts from one message to another.

The `ttk_message_create()` function creates a message and copies onto it all the context slots from `context` whose slotname begins with `ENV_`. The created message is given a `Tt_class` value of `the_class` and a `Tt_scope` value of `the_scope`.

If the `handler` parameter is null, the message is given a `Tt_address` of `TT_PROCEDURE`; otherwise, the message is `TT_HANDLER`-addressed to that `procid`.

If the `op` argument is not null, the message's `op` argument is set to that value.

If the `callback` argument is not null, it is added to the message as a message callback.

If successful, the `ttk_message_create()` function returns the created `Tt_message`, which can be modified, sent, and destroyed in the same way as any other `Tt_message`.

If an error occurs, an error pointer is returned. Use `tt_ptr_error` to find the `Tt_status`. Table A-28 lists the possible errors returned.

TABLE A-28 Possible Errors Returned by the `ttk_message_create`

Error Returned	Description
<code>TT_ERR_NOMP</code>	The <code>ttsession</code> process is not available. The ToolTalk service tries to restart <code>ttsession</code> if it is not running. This error indicates that the ToolTalk service is either not installed or not installed correctly.
<code>TT_ERR_PROCID</code>	The process identifier specified is out of date or invalid.
<code>TT_ERR_NOMEM</code>	There is not enough memory available to perform the operation.

`ttk_message_destroy`

```
Tt_status ttk_message_destroy ( Tt_message  msg );
```

The `ttk_message_destroy()` function destroys any message that conforms to the conventions.

Note - This message can be used in place of the `tt_message_destroy()` message.

The `ttk_message_destroy()` function destroys any patterns that may have been stored on the message by the `tt_message_accept()` or `tt_message_subcontract_manage()` functions and then passes the message `msg` to the `tt_message_destroy()` function.

This function returns the value returned by the `tt_message_destroy()` function.

`ttk_message_fail`

```
Tt_status  ttk_message_fail( Tt_message  msg,
                             Tt_status   status,
                             const char  *status_string,
                             int         destroy
                             );
```

The `ttk_message_fail()` function fails the message `msg` and then destroys it.

Note - A program should abandon a message when it does not understand the message and wants to dispose of it.

A message whose state is `TT_SENT` can be failed. If the message is a handler-addressed message, or if it has a `tt_message_status` of `TT_WRN_START_MESSAGE`, it can be failed.

This function returns `TT_DESKTOP_ENOTSUP`.

tttk_message_receive

```
Tt_status    tttk_message_receive( const char* procid );
```

The `tttk_message_receive()` function calls the `tt_message_receive()` function to retrieve the next ToolTalk message.

If `procid != 0`, this function calls

```
tt_default_procid_set( procid )
```

tttk_message_reject

```
Tt_status    tttk_message_reject(
    Tt_message    msg,
    Tt_status     status,
    const char*   status_string,
    int           destroy);
```

The `tttk_message_reject()` function rejects the message `msg` and then destroys it.

Note - A program should abandon a message when it does not understand the message and wants to dispose of it.

A message whose state is `TT_SENT` can be rejected. If the message is not a handler-addressed message, or if it has a `tt_message_status` other than `TT_WRN_START_MESSAGE`, it can be rejected.

This function returns `TT_DESKTOP_ENOTSUP`.

tttk_op_string

```
char *tttk_op_string( Tttk_op op);
```

The `tttk_op_string()` function returns string for the operation `op` if successful; otherwise, this function returns zero.

Note - Use the `tt_free()` function to free the string returned.

```
Tttk_op tttk_string_op( const char * opstring );
```

The `tttk_string_op()` function returns a string containing the operation for the specified string. On error, this function returns `TTDT_OP_NONE`.

tttk_Xt_input_handler

```
void tttk_Xt_input_handler( XtPointer procid,  
int * source,  
XtInputId * id );
```

The `tttk_Xt_input_handler()` function processes ToolTalk events for Xt clients. Use this function as your Xt input handler unless you expect some messages not to be consumed by callbacks.

This function passes the `procid` argument to the `tttk_message_receive()` function and passes any returned message (that is, messages that are not consumed by callbacks) to the `tttk_message_abandon()` function.

If this function returns the error `TT_ERR_NOMP`, the `tttk_Xt_input_handler()` function will pass the `id` parameter to the `XtRemoveInput()` function.

The CoEd Demonstration Program

This appendix contains the files and source code listing showing the ToolTalk related code for a ToolTalk demonstration program called CoEd. The CoEd demo program uses the ToolTalk Desktop Services message set. It illustrates how an editor can use the ToolTalk service to keep all changes made by the user in sync if multiple instances of the editor are editing the same file at the same time.

The CoEd Ptype File

The CoEd ptype file, shown in Code Example B-1 .

CODE EXAMPLE B-1 CoEd Ptype File

```
ptype DT_CoEd {
    start "CoEd;
    handle:
    /*
    * Display ISO_Latin_1
    */
    session Display( in ISO_Latin_1 contents) => start opnum = 1; /* Signature */
    session Display( in ISO_Latin_1 contents,
    in messageID counterfoil ) => start opnum = 2;
    session Display( in ISO_Latin_1 contents,
    in title docName ) => start opnum = 3;
    session Display( in ISO_Latin_1 contents,
    in messageID counterfoil,
    in title docName ) => start opnum = 4;

    /*
    * Edit ISO_Latin_1
    */
    session Edit( inout ISO_Latin_1 contents) => start opnum = 101;
    session Edit( inout ISO_Latin_1 contents,
    in messageID counterfoil) => start opnum = 102;
```

```

session      Edit(   inout ISO_Latin_1 contents,
                    in      title          docName) => start opnum = 103;
session      Edit(   inout ISO_Latin_1 contents,
                    in      messageID      counterfoil,
                    in      title          docName) => start opnum = 104;

/*
 * Compose ISO_Latin_1
 */
session      Edit(   out   ISO_Latin_1 contents) => start opnum = 201;
session      Edit(   out   ISO_Latin_1 contents,
                    in   messageID counterfoil) => start opnum = 202;
session      Edit(   out   ISO_Latin_1 contents,
                    in   title          docName) => start opnum = 203;
session      Edit(   out   ISO_Latin_1 contents,
                    in   messageID      counterfoil,
                    in   title          docName) => start opnum = 204;

/*
 * Open an ISO_Latin_1 buffer
 */
session      Open(   in   ISO_Latin_1 contents,
                    out  bufferID      docBuf,
                    in   boolean       readOnly      ) => start opnum = 400;
session      Open(   in   ISO_Latin_1 contents,
                    out  bufferID      docBuf,
                    in   boolean       readOnly,
                    in   boolean       mapped        ) => start opnum = 401;
session      Open(   in   ISO_Latin_1 contents,
                    out  bufferID      docBuf,
                    in   boolean       readOnly,
                    in   boolean       mapped,
                    in   integer       shareLevel    ) => start opnum = 402;
session      Open(   in   ISO_Latin_1 contents,
                    out  bufferID      docBuf,
                    in   boolean       readOnly,
                    in   boolean       mapped,
                    in   integer       shareLevel,
                    in   locator       initialPos    ) => start opnum = 403;
};

```

The CoEd.C File

The CoEd.C file, shown in Code Example B-2 , shows the ToolTalk code that needs to be included in every application to initialize the toolkit, join a ToolTalk session and registering patterns, and add the ToolTalk service to its event loop.

Note - This file also contains ToolTalk code that is specific to CoEd in its role as an editor application. This code includes declaring a ptype and processing the start message.

CODE EXAMPLE B-2 The CoEd.C File

```
/*
 * CoEd.cc
 *
 * Copyright (c) 1991,1993 by Sun Microsystems.
 */

#include <stdlib.h>
#include <desktop/tttk.h>           // Include the ToolTalk messaging toolkit
#include <CoEd.h>
#include ``CoEditor.h``
#include ``CoEdTextBuffer.h``

XtAppContext      myContext;
Widget            myTopWidget     = 0;
Display          *myDpy;
int               abortCode = 0;
Tt_pattern       *sessPats = 0;   // Patterns returned when session joined
int              timeOutFactor   = 1000;
int              maxBuffers     = 1000;
int              *pArgc;
char             **globalArgv;

const char       *ToolName = ``CoEd``;
const char       *usage =
``Usage: CoEd [-p01] [-w n] [-t n] [file]\n``
`` -p      print ToolTalk procid\n``
`` -0      do not open an initial composition window\n``
`` -1      be a single-buffer editor\n``
`` -w      sleep for n seconds before coming up\n``
`` -t      use n as timeout factor, in milliseconds (default: 1000)\n``
;

void main(
    int   argc,
    char **argv
)
{
    static const char *here = ``main()``;
    int   delay = 0;   int   printid = 0;
    int   compose = 1; char *file = 0;
    OlToolkitInitialize( 0 );
    XtToolkitInitialize();
    myContext = XtCreateApplicationContext();
    //
    // This display may get closed, and another opened, inside
    // CoEditor::_init(), if e.g. our parent is on a different screen
    //
    pArgc = &argc;
    globalArgv = argv;
    myDpy = XtOpenDisplay( myContext, 0, 0, ``CoEd``, 0, 0, &argc, argv );
    int c;
    while ((c = getopt( argc, argv, ``p01w:t:`` )) != -1) {
        switch (c) {
            case 'p':
                printid = 1;
                break;
            case '0':
                compose = 0;
        }
    }
}
```

```

        break;
        case 'l':
            maxBuffers = 1;
            break;
        case 'w':
            delay = atoi( optarg );
            break;
        case 't':
            timeOutFactor = atoi( optarg );
            break;
        default:
            fputs( usage, stderr );
            exit( 1 );
    }
}
if (optind < argc) {
    file = argv[ optind ];
}
while (delay > 0) {
    sleep( 1 );
    delay--;
}
int myTtFd; // Obtain process identifier
// Initialize toolkit and create a ToolTalk communication endpoint
char *myProcID = ttdt_open( &myTtFd, ToolName, ``SunSoft``, ``%I``, 1 );

// Declare ptype ttmedia_ptype_declare( ``DT_CoEd``, 0, CoEditor::loadISOLatin1_,
    (void *)&myTopWidget, 1 );

// Process the message that started us, if any
ttdt Xt_input_handler( 0, 0, 0 );
if (abortCode != 0) {
    // Error in message that caused us to start.
    exit( abortCode );
}

if (CoEditor::numEditors == 0) {
    // started by hand, not by ToolTalk
    if (file == 0) {
        if (compose) {
            new CoEditor( &myTopWidget );
        }
        else {
            new CoEditor( &myTopWidget, file );
        }
    }
}
//
// If sessPats is unset, then we have not joined the desktop
// session yet. So join it.
//
if (sessPats == 0) {
    Widget session_shell = CoEditor::editors[0]->shell;
    if (maxBuffers > 1) {
        //
        // In multi-window mode, no single window is the
        // distinguished window.
        //
        session_shell = myTopWidget;
    }
    sessPats = ttdt_session_join( 0, 0, session_shell, 0, 1 );
}

```

```

        XtAppAddInput( myContext, myTtFd, (XtPointer)XtInputReadMask,
                    tttk_Xt_input_handler, myProcID );
    XtAppMainLoop( myContext );
}

```

The Coeditor.C File

The Coeditor.C file, shown in Code Example B-3, shows the ToolTalk code that needs to be included in every editor application to pass a media callback and reply when a request has been completed. It also shows other optional ToolTalk functions that can be included in an editor application.

Note - Ellipses (...) indicates code that has been omitted.

CODE EXAMPLE B-3 The CoEditor.C File

```

...

CoEditor::CoEditor(
    Widget *parent
)
{
    _init();
    _init( parent );
}

CoEditor::CoEditor(
    Widget *parent,
    const char *file
)
{
    _init();
    _init( parent );
    _load( file );
}

CoEditor::CoEditor(
    Widget *parent,
    Tt_messagemsg,
    const char * /*docname*/,
    Tt_status &status
)
{
    _init();
    status = _init( msg );
    if (status != TT_OK) {
        return;
    }
    _init( parent );
    status = _acceptContract( msg );
}

```

```

}

CoEditor::CoEditor(
    Widget      *parent,
    Tt_message  msg,
    int         /*readOnly*/,
    const char  *file,
    const char  * /*docname*/,
    Tt_status  &status
)
{
    _init();
    status = _init( msg );
    if (status != TT_OK) {
        return;
    }
    _init( parent );
    status = _load( file );
    if (status != TT_OK) {
        return;
    }
    status = _acceptContract( msg );
}

CoEditor::CoEditor(
    Widget      *parent,
    Tt_message  msg,
    int         /*readOnly*/,
    unsigned char *contents,
    int         /*len*/,
    const char  * /*docname*/,
    Tt_status  &status
)
{
    _init();
    status = _init( msg );
    if (status != TT_OK) {
        return;
    }
    _init( parent );
    XtVaSetValues( (Widget)_text,
                  XtNsourceType,      (XtArgVal)OL_STRING_SOURCE,
                  XtNsource,          (XtArgVal)contents,
                  NULL );
    _textBuf = OlTextEditTextBuffer( _text );
    RegisterTextBufferUpdate( _textBuf, CoEditor::_textUpdateCB_,
                              (caddr_t)this );
    status = _acceptContract( msg );
}

CoEditor::~CoEditor()
{
    //
    // No need for a separate save if we are sending the document
    // back in a reply.
    //
    if ( _contract == 0 ) {
        if ( _modifiedByMe ) {
            // we revert before quitting if we don't want to save
            _save();
        }
    }
}

```

```

    }
} else {
    int len;
    char *contents = _contents( &len );
    // Reply to media load callback with edited contents of text
    ttmedia_load_reply( _contract, (unsigned char *)contents,
        len, 1 );
    if (contents != 0) {
        XtFree( contents );
    }
    _contract = 0;
}
numEditors--; // XXX assumes user destroys windows LIFO!
}

Tt_message
CoEditor::loadISOLatin1_(
    Tt_message msg,
    Ttk_op op,
    Tt_status diagnosis,
    unsigned char *contents,
    int len,
    char *file,
    char *docname,
    void *pWidget
)
{
    static const char *here = ``CoEditor::loadISOLatin1_()``;

    Tt_status status = TT_OK;
    CoEditor *coEditor = 0;
    if (diagnosis != TT_OK) {
        // toolkit detected an error
        if (tt_message_status( msg ) == TT_WRN_START_MESSAGE) {
            //
            // Error is in start message! We now have no
            // reason to live, so tell main() to exit().
            //
            abortCode = 2;
        }
        // let toolkit handle the error
        return msg;
    }
    if ((op == TTME_COMPOSE) & (file == 0)) {
        coEditor = new CoEditor( (Widget *)pWidget, msg, docname,
            status );
    } else if (len > 0) {
        coEditor = new CoEditor( (Widget *)pWidget, msg,
            (op == TTME_DISPLAY),
            contents, len, docname, status );
    } else if (file != 0) {
        coEditor = new CoEditor( (Widget *)pWidget, msg,
            (op == TTME_DISPLAY),
            file, docname, status );
    } else {
        // Fail a message
        ttk_message_fail( msg, TT_DESKTOP_ENODATA, 0, 1 );
        tt_free( (caddr_t)contents );
        tt_free( file );
        tt_free( docname );
        return 0;
    }
}

```

```

void
CoEditor::_init()
{
    _baseFrame      = 0;
    _controls       = 0;
    _fileBut        = 0;
    _editBut        = 0;
    _scrolledWin    = 0;
    _text           = 0;
    _textBuf        = 0;
    _modifiedByMe   = FALSE;
    _modifiedByOther = 0;
    _contract       = 0;
    _contractPats   = 0;
    _filePats       = 0;
    _file           = 0;
    _x              = INT_MAX;
    _y              = INT_MAX;
    _w              = INT_MAX;
    _h              = INT_MAX;
}

Tt_status
CoEditor::_init(
    Tt_message msg
)
{
    int width, height, xOffset, yOffset;
    width = height = xOffset = yOffset = INT_MAX;
    _contract = msg;
    ttdt_sender_imprint_on( 0, msg, 0, &_w, &_h, &_x, &_y,
        10 * timeOutFactor );
    return TT_OK;
}

typedef enum {
    Open,
    Save,
    SaveAs,
    Revert
} FileOp;

static const char *fileButs[] = {
    ``Open...``,
    ``Save``,
    ``Save as...``,
    ``Revert``
};

const int numFileButs = sizeof( fileButs ) / sizeof( const char * );

typedef enum {
    Undo,
    Cut,
    Copy,
    Paste,
    Delete,
    SelText,
    SelAppt
}

```

```

} EditOp;

static const char *editButs[] = {
    ``Undo``,
    ``Cut``,
    ``Copy``,
    ``Paste``,
    ``Delete``,
    ``Text as ISO_Latin_1``,
    ``Text as Appointment``
};

const int numEditButs = sizeof( editButs ) / sizeof( const char * );

void
CoEditor::_init(
    Widget *parent
)
{
    if (*parent == 0) {
        if (_contract != 0) {
            //
            // Re-open display, since $DISPLAY may have changed by
            // ttdt_sender_imprint_on().
            //
            XtCloseDisplay( myDpy );
            myDpy = XtOpenDisplay( myContext, 0, 0, ``CoEd``, 0, 0,
                pArgc, globalArgv );
        }
        *parent = XtAppCreateShell( 0, ``CoEd``,
            applicationShellWidgetClass, myDpy, 0, 0 );
        XtVaSetValues( *parent,
            XtNmappedWhenManaged, False,
            XtNheight, 1,
            XtNwidth, 1,
            0 );
        XtRealizeWidget( *parent );
    }
    shell = XtCreatePopupShell( ``CoEd``,
        applicationShellWidgetClass, *parent, 0, 0 );
    XtVaSetValues( shell, XtNuserData, this, 0 );
    // Pop up next to our parent
    if ((_x != INT_MAX) && (_y != INT_MAX) && (_w != INT_MAX)) {
        // XXX Be smarter about picking a geometry
        Dimension x      = _x + _w;
        Dimension y      = _y;
        XtVaSetValues( shell, XtNx, x, XtNy, y, 0 );
    }
    XtAddCallback( shell, XtNdestroyCallback, CoEditor::_destroyCB_,
        this );
    OlAddCallback( shell, XtNwmProtocol, CoEditor::_wmProtocolCB_, this );
    _baseFrame = XtVaCreateManagedWidget(
        ``baseFrame``, rubberTileWidgetClass, shell, 0 );
    _controls = XtVaCreateManagedWidget( ``controls``,
        controlAreaWidgetClass, _baseFrame,
        XtNweight, (XtArgVal)0,
        0 );
    _fileBut = XtVaCreateManagedWidget( ``File``,
        menuButtonWidgetClass, _controls, 0 );
    Widget menuPane;

```

```

XtVaGetValues( _fileBut, XtNmenuPane, &menuPane, 0 );
for (int i = 0; i < numFileButs; i++) {
    Widget but = XtVaCreateManagedWidget( fileButs[i],
        oblongButtonWidgetClass, menuPane,
        XtNuserData, i, 0 );
    XtAddCallback( but, XtNselect, CoEditor::_fileButsCB_, this );
}
_editBut = XtVaCreateManagedWidget( `Edit`,
    menuButtonWidgetClass, _controls, 0 );
XtVaGetValues( _editBut, XtNmenuPane, &menuPane, 0 );
for (i = 0; i < numEditButs; i++) {
    Widget but = XtVaCreateManagedWidget( editButs[i],
        oblongButtonWidgetClass, menuPane,
        XtNuserData, i, 0 );
    XtAddCallback( but, XtNselect, CoEditor::_editButsCB_, this );
}
_scrolledWin = XtVaCreateManagedWidget(
    `scrolledWin`, scrolledWindowWidgetClass,
    _baseFrame,
    XtNforceVerticalSB, (XtArgVal)True,
    0 );
_text = (TextEditWidget)XtVaCreateManagedWidget(
    `text`, textEditWidgetClass, _scrolledWin,
    0 );
XtVaSetValues( (Widget)_text, XtNuserData, this, 0 );
XtRealizeWidget( shell );
XtPopup( shell, XtGrabNone );
if (numEditors < MaxEditors) {
    editors[ numEditors ] = this;
    numEditors++;
}
if (numEditors >= maxBuffers) {
    tt_ptype_undeclare( `DT_CoEd` );
}
}
Tt_status
CoEditor::_unload()
{
    Tt_status status = TT_OK;
    if ( _filePats != 0 ) {
        // Unregister interest in ToolTalk events and destroy patterns
        status = ttdt_file_quit( _filePats, 1 );
        _filePats = 0;
    }
    if ( _file != 0 ) {
        free( _file );
        _file = 0;
    }
    return status;
}

Tt_status
CoEditor::_load(
    const char *file
)
{
    int reloading = 1;
    if (file != 0) {
        if (( _file != 0 ) && (strcmp( file, _file ) != 0)) {
            reloading = 0;
            _unload();
        } else {

```

```

        _file = strdup( file );
    }
}
// Join a file Can be called recursively, below
if ( _filePats == 0 ) {
    _filePats = ttdt_file_join( _file, TT_SCOPE_NONE, 1,
        CoEditor::_fileCB_, this );
}
XtVaSetValues( (Widget)_text,
    XtNsourceType,          (XtArgVal)OL_DISK_SOURCE,
    XtNsource,              (XtArgVal)_file,
    NULL );
_textBuf = OlTextEditTextBuffer( _text );
RegisterTextBufferUpdate( _textBuf, CoEditor::_textUpdateCB_,
    (caddr_t)this );
if ( _modifiedByMe && reloading ) {
    ttdt_file_event( _contract, TTDT_REVERTED, _filePats, 1 );
}
_modifiedByMe = 0;
// Does the file have any changes pending?
_modifiedByOther = ttdt_Get_Modified( _contract, _file, TT_BOTH,
    10 * timeOutFactor );
if ( _modifiedByOther ) {
    int choice = userChoice( myContext, _baseFrame,
        ``Another tool has modifications pending for ``
        ``this file.\nDo you want to ask it to save ``
        ``or revert the file?``, 3, ``Save``, ``Revert``,
        ``Ignore`` );
    Tt_status status = TT_OK;
    switch ( choice ) {
        case 0:
            // Save pending changes
            status = ttdt_Save( _contract, _file, TT_BOTH,
                10 * timeOutFactor );
            break;
        case 1:
            // Revert file to last version
            status = ttdt_Revert( _contract, _file, TT_BOTH,
                10 * timeOutFactor );
            break;
    }
    if ( status != TT_OK ) {
        char *s = tt_status_message( status );
        userChoice( myContext, _baseFrame, s, 1, ``Okay`` );
        tt_free( s );
    } else if ( choice == 0 ) {
        // file was saved, so reload
        return _load( 0 );
    } else if ( choice == 1 ) {
        // file was reverted
        _modifiedByOther = 0;
    }
}
return TT_OK;
}

Tt_status
CoEditor::_load(
    unsigned char *contents,
    int //len
)
{

```

```

        _unload();
        XtVaSetValues( (Widget)_text,
            XtNsourceType,          (XtArgVal)OL_DISK_SOURCE,
            XtNsource,              (XtArgVal)contents,
            NULL );
        _textBuf = OlTextEditTextBuffer( _text );
        RegisterTextBufferUpdate( _textBuf, CoEditor::_textUpdateCB_,
            (caddr_t)this ); _modifiedByMe = 0;
        _modifiedByOther = 0; return TT_OK;
    }

    //
    // Caller responsible for reporting any errors to user
    //
    Tt_status
    CoEditor::_save()
    {
        Tt_status status;
        if (_file != 0) {
            if (SaveTextBuffer( _textBuf, _file ) != SAVE_SUCCESS) {
                return TT_DESKTOP_EIO;
            }
            _modifiedByMe = 0;
            _modifiedByOther = 0;
            // File has been saved
            ttdt_file_event( _contract, TTDT_SAVED, _filePats, 1 );
        }
        if (_contract != 0) {
            int len = 0;
            char *contents = 0;
            if (_file == 0) {
                // If you worry that the buffer might be big,
                // you could instead try a a temp file to
                // transfer the data ``out of band``.
                contents = _contents( &len );
            }
            status = ttmedia_Deposit( _contract, 0, ``ISO_Latin_1``,
                (unsigned char *)contents,
                len, _file, 10 * timeOutFactor );
            if (status != TT_OK) {
                return status;
            }
            _modifiedByMe = 0;
            _modifiedByOther = 0;
            if (contents != 0) {
                XtFree( contents );
            }
        }
        return status;
    }

    Tt_status
    CoEditor::_revert() // XXX how about we always just send Revert? :-)
    {
        if (! _modifiedByMe) {
            return TT_OK;
        }
        return _load( 0 ); // XXX what if it's not a file? keep last deposit
    }

    void

```

```

CoEditor::_destroyCB_(
    Widget w,
    XtPointer coEditor,
    XtPointer call_data
)
{
    ((CoEditor *)coEditor)->_destroyCB( w, call_data );
}

void
CoEditor::_destroyCB(
    Widget w,
    XtPointer //call_data
)
{
    delete this;
}

void
CoEditor::_wmProtocolCB_(
    Widget w,
    XtPointer coEditor,
    XtPointer wmMsg
)
{
    ((CoEditor *)coEditor)->_wmProtocolCB( w, (OlWmProtocolVerify*)wmMsg );
}

void
CoEditor::_wmProtocolCB(
    Widget w,
    OlWmProtocolVerify *wmMsg
)
{
    switch (wmMsg->msgtype) {
        case OL_WM_DELETE_WINDOW:
            if (_modifiedByMe) {
                int choice =
                    userChoice( myContext, _baseFrame,
                                ``The text has unsaved changes.'`,
                                3, ``Save, then Quit'',
                                ``Discard, then Quit'',
                                ``Cancel'' );
                switch (choice) {
                    case 0:
                        break;
                    case 1:
                        _revert();
                        break;
                    case 2:
                        return;
                }
            }
            if (umEditors > 1) {
                XtDestroyWidget( shell );
            } else {
                // XXX OlWmProtocolAction() doesn't call destructor?!
                delete this;
                OlWmProtocolAction( w, wmMsg, OL_DEFAULTACTION );
            }
    }
}

```

```

        break;
    default:
        OLWMPProtocolAction( w, wmMsg, OL_DEFAULTACTION );
        break;
    }
}

void
CoEditor::_fileButsCB_(
    Widget    button,
    XtPointer coEditor,
    XtPointer call_data
)
{
    ((CoEditor *)coEditor)->_fileButsCB( button, call_data );
}

void
CoEditor::_fileButsCB(
    Widget    button,
    XtPointer //call_data
)
{
    FileOp op;    XtVaGetValues( button, XtNuserData, &op, 0 );
    Tt_status status = TT_OK;
    switch (op) {
        case Open:
            break;
        case Revert:
            status = _revert();
            break;
        case Save:
            status = _save();
            break;
        case SaveAs:
            break;
    }
    if (status != TT_OK) {
        _adviseUser( status );
    }
}

void
CoEditor::_editButsCB_(
    Widget    button,
    XtPointer coEditor,
    XtPointer call_data
)
{
    ((CoEditor *)coEditor)->_editButsCB( button, call_data );
}

void
CoEditor::_editButsCB(
    Widget    button,
    XtPointer //call_data
)
{
    EditOp op;
    XtVaGetValues( button, XtNuserData, &op, 0 );
}

```

```

Tt_status status = TT_OK;
switch (op) {
    int len;
    char *contents;
    const char *mediaType;
    Tt_messagemsg;
    Tt_pattern *pats;
case SelText:
case SelAppt:
    if (op == SelText) {
        mediaType = ``ISO_Latin_1``;
    } else {
        mediaType = ``DT_CM_Appointment``;
    }
    //contents = _selection( &len );
    contents = _contents( &len );
    if (len <= 0) {
        return;
    }
    // Media load callback
    msg = ttmedia_load( _contract, CoEditor::_mediaLoadMsgCB_,
        this, TTME_EDIT, mediaType,
        (unsigned char *)contents, len, 0, 0, 1 );
        if (contents != 0) {
            XtFree( contents );
        }
        status = tt_ptr_error( msg );
        if (status != TT_OK) {
            break;
        }
        pats = ttdt_subcontract_manage( msg, 0, shell, this );
        status = tt_ptr_error( pats );
        if (status != TT_OK) {
            break;
        }
        break;
    }
    if (status != TT_OK) {
        char *s = tt_status_message( status );
        char buf[ 1024 ];
        sprintf( buf, ``%d: %s``, status, s );
        tt_free( s );
        userChoice( myContext, _baseFrame, buf, 1, ``Okay`` );
    }
}

char *
CoEditor::_contents(
    int *len ) {
    _textBuf = OlTextEditTextBuffer( _text );
    TextLocation start = { 0, 0, 0 };
    TextLocation end = LastTextBufferLocation( _textBuf );
    char *contents = GetTextBufferBlock( _textBuf, start, end );
    *len = 0;
    if (contents != 0) {
        *len = strlen( contents );
    }
    return contents;
}

```

```

Tt_status
CoEditor::_acceptContract(
    Tt_message msg ) {
    static const char *here = ``CoEditor::_acceptContract()``;
    _contract = msg;
    if (tt_message_status( msg ) == TT_WRN_START_MESSAGE) {
        //
        // Join session before accepting start message,
        // to prevent unnecessary starts of our ptype
        //
        Widget session_shell = shell;
        if (maxBuffers > 1) {
            //
            // If we are in multi-window mode, just use
            // our unmapped toplevel shell as our session
            // shell, since we do not know if any particular
            // window will exist the whole time we are in
            // the session.
            //
            session_shell = XtParent(shell );
        }
        // Join the session and register patterns and callbacks
        sessPats = ttdt_session_join( 0, 0, session_shell, this, 1 );
    }
    // Accept responsibility to handle a request
    _contractPats = ttdt_message_accept(
        msg, CoEditor::_contractCB_, shell, this,
        1, 1 );
    Tt_status status = tt_ptr_error( _contractPats );
    if (status != TT_OK) {
        return status;
    }
    return status;
}

Tt_message
CoEditor::_contractCB_(
    Tt_message, //msg,
    TtTk_op, //op,
    Widget, //shell,
    void*, //coEditor,
    Tt_message //Contract
)
{
    return 0; }

void
CoEditor::_editButCB_(
    Widget w,
    XtPointer coEditor,
    XtPointer call_data
)
{
    ((CoEditor *)coEditor)->_editButCB( w, call_data );
}

void
CoEditor::_editButCB(
    Widget ,
    XtPointer //call_data
)

```

```

{
    int        len;
    char      *contents = _contents( &len );
        // Media Load Callback
    Tt_message msg = ttmedia_load( _contract, CoEditor::_mediaLoadMsgCB_,
                                  this, TTME_EDIT, ``ISO_Latin_1'',
                                  (unsigned char *)contents,
                                  len, 0, 0, 1 );

    if (contents != 0) {
        XtFree( contents );
    }
    Tt_pattern *pats = ttdt_subcontract_manage( msg, 0, shell, this );
}

Tt_message
CoEditor::_mediaLoadMsgCB_(
    Tt_message      msg,
    Tttk_op         op,
    unsigned char   *contents,
    int             len,
    char            *file,
    void            *clientData
)
{
    return ((CoEditor *)clientData)->_mediaLoadMsgCB( msg, op,
                                                       contents, len, file ); }

Tt_message
CoEditor::_mediaLoadMsgCB(
    Tt_message      msg,
    Tttk_op,
    unsigned char   *contents,
    int             len,
    char            *file
)
{
    if (len > 0) {
        XtVaSetValues( (Widget)_text,
                       XtNsourceType,      (XtArgVal)OL_STRING_SOURCE,
                       XtNsource,          (XtArgVal)contents,
                       NULL );
        _textBuf = OlTextEditTextBuffer( _text );
        RegisterTextBufferUpdate( _textBuf, CoEditor::_textUpdateCB_,
                                  (caddr_t)this );
        // ReplaceBlockInTextBuffer
    } else if (file != 0) {
    }
    tt_message_destroy( msg );
    return 0;
}

void
CoEditor::_textUpdateCB_(
    XtPointer      coEditor,
    XtPointer      pTextBuffer,
    EditResult     status ) {
    if (coEditor == 0) {
        return;
    }
    ((CoEditor *)coEditor)->_textUpdateCB( (TextBuffer *)pTextBuffer,

```

```

        status );
    }

void
CoEditor::_textUpdateCB(
    TextBuffer *textBuf,
    EditResult //editStatus ) {
    //Tt_status status;
    if (_textBuf != textBuf) {
        fprintf( stderr, ``_textBuf != textBuf`` );
    }
    if ((! _modifiedByMe) && TextBufferModified( _textBuf )) {
        _modifiedByMe = TRUE;
        // File has changes pending
        ttdt_file_event( _contract, TTDT_MODIFIED, _filePats, 1 );
    }
}

Tt_message
CoEditor::_fileCB_(
    Tt_message msg,
    Tt_op op,
    char *pathname,
    void *coEditor,
    int trust,
    int me
)
{
    tt_free( pathname );
    if (coEditor == 0) {
        return msg;
    }
    return ((CoEditor *)coEditor)->_fileCB( msg, op, pathname,
        trust, me );
}

Tt_message
CoEditor::_fileCB(
    Tt_message msg,
    Tt_op op,
    char *pathname,
    int, //trust
    int //me
)
{
    tt_free( pathname );
    Tt_status status = TT_OK;
    switch (op) {
        case TTDT_MODIFIED:
            if (_modifiedByMe) {
                // Hmm, the other editor either doesn't know or
                // doesn't care that we are already modifying the
                // file, so the last saver will win.
                // XXX Or: a race condition has arisen!
            } else {
                // Interrogate user if she ever modifies the buffer
                _modifiedByOther = 1;
                XtAddCallback( (Widget)_text, XtNmodifyVerification,
                    (XtCallbackProc)CoEditor::_textModifyCB_, 0 );
            }
    }
}

```

```

        break;
    case TTDT_GET_MODIFIED:
        tt_message_arg_ival_set( msg, 1, _modifiedByMe );
        tt_message_reply( msg );
        break;
    case TTDT_SAVE:
        status = _save();
        if (status == TT_OK) {
            tt_message_reply( msg );
        } else {
            // Fail message
            tttk_message_fail( msg, status, 0, 0 );
        }
        break;
    case TTDT_REVERT:
        status = _revert();
        if (status == TT_OK) {
            tt_message_reply( msg );
        } else {
            // Fail message
            tttk_message_fail( msg, status, 0, 0 );
        }
        break;
    case TTDT_REVERTED:
    case TTDT_SAVED:
    case TTDT_MOVED:
    case TTDT_DELETED:
        printf( ``CoEditor::_fileCB(): %s\n``, tttk_op_string( op ) );
        break;
    }
    tt_message_destroy( msg );
    return 0;
}

void CoEditor::_textModifyCB(
    TextEditWidget      text,
    XtPointer            ,
    OlTextModifyCallData *mod
)
{
    CoEditor *coEditor = 0;
    XtVaGetValues( (Widget)text, XtNuserData, &coEditor, 0 );
    if (coEditor == 0) {
        return;
    }
    coEditor->_textModifyCB( mod );
}

void
CoEditor::_textModifyCB(
    OlTextModifyCallData *mod
)
{
    if ( _modifiedByOther != 1 ) {
        return;
    }
    int cancel = userChoice( myContext, _baseFrame,
        ``Another tool has modifications pending for this file.\n``
        ``Are you sure you want to start modifying the file?``,
        2, ``Modify``, ``Cancel`` );
}

```

```
        if (cancel) {
            mod->ok = FALSE;
        }
        _modifiedByOther = 2;
    }

void
CoEditor::_adviseUser(
    Tt_status status
)
{
    char *s = tt_status_message( status );
    char buf[ 1024 ];
    sprintf( buf, ``%d: %s``, status, s );
    tt_free( s );
    userChoice( myContext, _baseFrame, buf, 1, ``Okay`` );
}
```

New ToolTalk Functions

This chapter describes ToolTalk functions that are new for this release. To use these functions, you need to include the ToolTalk header file: `#include <Tt/tt_c.h>`.

tt_error

```
void tt_error(const char *funcname, Tt_status
status)
```

The `tt_error()` function is a publicly-known null function. This function is called by the ToolTalk library just before it returns from any ToolTalk API call that has a status other than `TT_OK`. The name of the function that is about to return and the status code is passed. You can use this call to set a dbx breakpoint in `tt_error()` to quickly catch and trace back any ToolTalk errors. You can also interpose this function, for example, to log ToolTalk errors to `stderr`. The following code example shows how an application might do this.

```
void
tt_error(const char *funcname, Tt_status status)
{
    fprintf(stderr, ``ToolTalk function %s returned %s.\n``,
            funcname, tt_status_message(status));
}
```

tt_file_netfile

```
char *      tt_file_netfile(  
    const char * filename );
```

The `tt_file_netfile()` function maps between local and canonical path names. It converts the file specified in `filename` to a `netfilename` that can be passed to other hosts on the network. The `filename` is an absolute or relative path name that is valid on the local host. The last component of `filename` is not required; however, every other component of `filename` must exist.

Note - You do not need to call the `tt_open` function before you use this function.

This function returns either an error pointer or, if successful, a newly-allocated null-terminated string of an unspecified format, which may be passed to the `tt_netfile_file` function.

Use `tt_ptr_error` to extract a status from an error pointer. Possible errors are described in Table C-1.

TABLE C-1 Possible Errors Returned by `tt_file_netfile`

Error	Description
TT_ERR_PATH	<code>filename</code> is a path that is not valid on this host
TT_ERR_DBAVAIL	<code>rpc.ttdbserverd</code> could not be reached on host
TT_ERR_DBEXIST	<code>rpc.ttdbserverd</code> does not appear to be properly installed on host

To free allocated strings, use either the `tt_free` or `tt_release` call.

To convert the file back to a local file name for the same file, use the `tt_netfile_file` function.

tt_host_file_netfile

```
char * tt_host_file_netfile(  
    const char * host,  
    const char * filename
```

```
);
```

The `tt_host_file_netfile()` function maps between local and canonical path names on a remote host. It converts the file specified in `host` to a `netfilename` that can be passed to other hosts on the network. The `filename` is an absolute or relative path name that is valid on the remote host. The last component of `filename` is not required; however, every other component of `filename` must exist.

Note - You do not need to call the `tt_open` function before you use this function.

This function returns either an error pointer or, if successful, a newly-allocated null-terminated string of an unspecified format, which may be passed to the `tt_netfile_file` function.

Use `tt_ptr_error` to extract a status from an error pointer. Possible errors are described in Table C-2.

TABLE C-2 Possible Errors Returned by `tt_host_file_netfile`

Error	Description
TT_ERR_PATH	<code>filename</code> is a path that is not valid on the remote host
TT_ERR_DBAVAIL	<code>rpc.ttdbserverd</code> could not be reached on host
TT_ERR_DBEXIST	<code>rpc.ttdbserverd</code> does not appear to be properly installed on host
TT_ERR_UNIMP	<code>rpc.ttdbserverd</code> version does not support the <code>tt_host_file_netfile()</code> function

- To free allocated strings, use either the `tt_free` or `tt_release` call.

To convert the file back to a local file name for the same file, use the `tt_host_netfile_file()` function.

tt_host_netfile_file

```
char * tt_host_netfile_file(  
    const char * host,  
    const char * netfilename  
);
```

The `tt_host_file_netfile()` function maps between local and canonical path names on the remote host. It converts the file specified `netfilename` to a path name that is valid on the remote host. The `netfilename` is a copy of a null-terminated string returned by the `tt_netfile_file` function.

Note - You do not need to call the `tt_open` function before you use this function.

If the specified file is not currently mounted on the local host, a path name in the form of

/DTMOUNTPOINT/host/filepath

is constructed, where:

`DTMOUNTPOINT` is the intended mount point for the automounter's host map.

You can also specify this mount point with the environment variable

`DTMOUNTPOINT`.

`host` is the host that contains the file.

`filepath` is the path to the file contained on the host.

This function returns either an error pointer or, if successful, a newly-allocated null-terminated local file name.

Use `tt_ptr_error` to extract a status from an error pointer. Possible errors are described in Table C-3.

TABLE C-3 Possible Errors Returned by `tt_host_netfile_file`

Errors	Description
<code>TT_ERR_PATH</code>	<code>netfilename</code> is not a valid <code>netfilename</code>
<code>TT_ERR_DBAVAIL</code>	<code>rpc.ttdbserverd</code> could not be reached on host
<code>TT_ERR_DBEXIST</code>	<code>rpc.ttdbserverd</code> does not appear to be properly installed on host
<code>TT_ERR_UNIMP</code>	<code>rpc.ttdbserverd</code> version does not support the <code>tt_host_netfile_file()</code> function

To free allocated strings, use either the `tt_free` or `tt_release` call.

To convert the file back to a local file name for the same file, use the `tt_host_file_netfile()` function.

tt_message_print

```
char * tt_message_print(Tt_message m);
```

The `tt_message_print` function allows you to print out messages that are received by not understood.

To free allocated strings, use either the `tt_free` or `tt_release` call.

This function returns either the error `TT_ERR_POINTER` or, if successful, the message `m` in a buffer allocated by ToolTalk (in the same manner as is done in other ToolTalk API calls such as `tt_x_session`).

tt_netfile_file

```
char *  
tt_netfile_file(  
    const char * netfilename );
```

The `tt_netfile_file` function maps between canonical and local path names. It converts the file specified `netfilename` to a path name that is valid on the local host. The `netfilename` is a copy of a null-terminated string returned by `tt_netfile_file`.

Note - You do not need to call the `tt_open` function before you use this function.

If the specified file is not currently mounted on the local host, a path name in the form of

/DTMOUNTPOINT/host/filepath

is constructed, where:

`DTMOUNTPOINT` is the intended mount point for the automounter's host map. You can also specify this mount point with the environment variable `DTMOUNTPOINT`.

`host` is the host that contains the file.

`filepath` is the path to the file contained on the host.

This function returns either an error pointer or, if successful, a newly-allocated null-terminated local file name.

Use `tt_ptr_error` to extract a status from an error pointer. Possible errors are described in Table C-4.

TABLE C-4 Possible Errors Returned by `tt_netfile_file`

Error	Description
<code>TT_ERR_PATH</code>	<code>netfilename</code> is not a valid netfilename
<code>TT_ERR_DBAVAIL</code>	<code>rpc.ttdbserverd</code> could not be reached on host
<code>TT_ERR_DBEXIST</code>	<code>rpc.ttdbserverd</code> does not appear to be properly installed on host

To free allocated strings, use either the `tt_free` or `tt_release` call.

To convert the file back to a net file name for the same file, use the `tt_file_netfile()` function.

`tt_pattern_print`

```
char *  
tt_message_print(Tt_pattern p);
```

The `tt_pattern_print()` function allows you to print out patterns.

To free allocated strings, use either the `tt_free` or `tt_release` call.

This function returns either the error `TT_ERR_POINTER` or, if successful, the pattern `p` in a buffer allocated by ToolTalk (in the same manner as is done in other ToolTalk API calls such as `tt_X_session`).

Examples

Example Ttdt_contract_cb

Code Example D-1 is an example of a typical algorithm of a `Ttdt_contract_cb` callback for an application that handles its own Pause/Resume/Quit requests but allows the toolkit to handle the X11-related requests.

Note - This example callback deals with the case when the *contract* parameter has a value other than zero and can, therefore, also be used as the `Ttdt_contract_cb` callback passed to `ttdt_message_accept`.

CODE EXAMPLE D-1 Typical Algorithm of `Ttdt_contract_cb`

```
Tt_message myContractCB(
    Tt_message      msg,
    void            *clientdata,
    Tt_message      contract
)
{
    char *opString = tt_message_op( msg );
    Ttk_op op = ttk_string_op( opString );
    tt_free( opString );
    int silent = 0;
    int force = 0;
    Boolean cancel = False;
    Boolean sensitive = True;
    char *status, command;
    switch (op) {
        case TTDI_QUIT:
            tt_message_arg_ival( msg, 0, &silent );
            tt_message_arg_ival( msg, 1, &force );
            if (contract == 0) {
                /* Quit entire application */
            }
    }
}
```

```

        cancel = ! myQuitWholeApp( silent, force );
    } else {
        /* Quit just the specified request being worked on */
        cancel = ! myCancelThisRequest(contract, silent, force);
    }
    if (cancel) {
        /* User canceled Quit; fail the Quit request */
        tttk_message_fail( msg, TT_DESKTOP_ECANCELED, 0, 1 );
    } else {
        tt_message_reply( msg );
        tttk_message_destroy( msg );
    }
    return 0;
case TTDT_PAUSE:
    sensitive = False;
case TTDT_RESUME:
    if (contract == 0) {
        int already = 1;
        if (XtIsSensitive( myTopShell ) != sensitive) {
            already = 0;
            XtSetSensitive( myTopShell, sensitive );
        }
        if (already) {
            tt_message_status_set(msg,TT_DESKTOP_EALREADY);
        }
    } else {
        if (XtIsSensitive( thisShell ) == sensitive) {
            tt_message_status_set(msg,TT_DESKTOP_EALREADY);
        } else {
            XtSetSensitive( thisShell, sensitive );
        }
    }
    tt_message_reply( msg );
    tttk_message_destroy( msg );
    return 0;
case TTDT_GET_STATUS:
    if (contract == 0) {
        status = "Message about status of entire app";
    } else {
        status = "Message about status of this request";
    }
    tt_message_arg_val_set( msg, 0, status );
    tt_message_reply( msg );
    tttk_message_destroy( msg );
    return 0;
case TTDT_DO_COMMAND:
    if (! haveExtensionLanguage) {
        tttk_message_fail( msg, TT_DESKTOP_ENOTSUP, 0, 1 );
        return 0;
    }
    command = tt_message_arg_val( msg, 0 );
    result = myEval( command );
    tt_free( command );
    tt_message_status_set( msg, result );
    if (tt_is_err( result )) {
        tttk_message_fail( msg, result, 0, 1 );
    } else {
        tt_message_reply( msg );
        tttk_message_destroy( msg );
    }
}

```

```

        return 0;
    }
    /* Unrecognized message; do not consume it */
    return msg;
}

```

Example Ttdt_file_cb

Code Example D-2 is an example of a typical algorithm of this callback.

CODE EXAMPLE D-2 Typical Algorithm of Ttdt_file_cb

```

Tt_message myFileCB(
    Tt_message    msg,
    Tttk_op       op,
    char          *pathname,
    int           trust,
    int           isMe
)
{
    tt_free( pathname );
    Tt_status status = TT_OK;
    switch (op) {
        case TTDI_MODIFIED:
            if ((_modifiedByMe) && (! isMe)) {
                // Hmm, the other editor either does not know or
                // does not care that we are already modifying the
                // file, so the last saver will win.
            } else {
                // Interrogate user if she ever modifies the buffer
                _modifiedByOther = 1;
                XtAddCallback( myTextWidget, XmNmodifyVerifyCallback,
                               myTextModifyCB, 0 );
            }
            break;
        case TTDI_GET_MODIFIED:
            tt_message_arg_ival_set( msg, 1, _modifiedByMe );
            tt_message_reply( msg );
            break;
        case TTDI_SAVE:
            status = mySave( trust );
            if (status == TT_OK) {
                tt_message_reply( msg );
            } else {
                tttk_message_fail( msg, status, 0, 0 );
                break;
            }
        case TTDI_REVERT:
            status = myRevert( trust );
            if (status == TT_OK) {
                tt_message_reply( msg );
            } else {
                tttk_message_fail( msg, status, 0, 0 );
            }
    }
}

```

```

        break;
    case TTDT_REVERTED:
        if (! isMe) {
            _modifiedByOther = 0;
        }
        break;
    case TTDT_SAVED:
        if (! isMe) {
            _modifiedByOther = 0;
            int choice = myUserChoice( myContext, myBaseFrame,
                "Another tool has saved "
                "this file.", 2, "Ignore",
                "Revert" );

            switch (choice) {
                case 1:
                    myRevert( 1 );
                    break;
            }
        }
        break;
    case TTDT_MOVED:
    case TTDT_DELETED:
        // Do something appropriate
        break;
    }
    tttk_message_destroy( msg );
    return 0;
}

```

Example Ttmedia_load_msg_cb

Code Example D-3 is an example of a typical algorithm of this callback.

CODE EXAMPLE D-3 Typical Algorithm of Ttmedia_load_msg_cb

```

Tt_message
myLoadMsgCB(
    Tt_message msg,
    void *clientData,
    Ttk_op op,
    unsigned char *contents,
    int len,
    char *file
)
{
    if (len > 0) {
        // Replace data with len bytes in contents
    } else if (file != 0) {
        // Replace data with data read from file
    }
    if (op == TTME_DEPOSIT) {
        tt_message_reply( msg );
    }
}

```

```

        tttk_message_destroy( msg );
        return 0;
    }

```

Example Ttmedia_load_pat_cb

Code Example D-4 is an example of a typical algorithm of this callback.

CODE EXAMPLE D-4 Typical Algorithm of Ttmedia_load_pat_cb

```

Tt_message myAcmeSheetLoadCB(
    Tt_message      msg,
    void            *client_data,
    Tttk_op         op,
    Tt_status       diagnosis,
    unsigned char   *contents,
    int             len,
    char            *file,
    char            *docname
)
{
    Tt_status status = TT_OK;
    if (diagnosis != TT_OK) {
        // toolkit detected an error
        if (tt_message_status( msg ) == TT_WRN_START_MESSAGE) {
            //
            // Error is in start message! We now have no
            // reason to live, so tell main() to exit().
            //
            myAbortCode = 2;
        }
        // let toolkit handle the error
        return msg;
    }
    if ((op == TTME_COMPOSE) && (file == 0)) {
        // open empty new buffer
    } else if (len > 0) {
        // load contents into new buffer
    } else if (file != 0) {
        if (ttdt_Get_Modified( msg, file, TT_BOTH, myCntxt, 5000 )) {
            switch (myUserChoice( "Save, Revert, Ignore?" )) {
                case 0:
                    ttdt_Save( msg, file, TT_BOTH, myCntxt, 5000 );
                    break;
                case 1:
                    ttdt_Revert( msg, file, TT_BOTH, myCntxt, 5000);
                    break;
            }
        }
        // load file into new buffer
    } else {
        tttk_message_fail( msg, TT_DESKTOP_ENODATA, 0, 1 );
        tt_free( contents ); tt_free( file ); tt_free( docname );
        return 0;
    }
}

```

```

}
int w, h, x, y = INT_MAX;
ttdt_sender_imprint_on( 0, msg, 0, &w, &h, &x, &y, myCntxt, 5000 );
positionMyWindowRelativeTo( w, h, x, y );
if (maxBuffersAreNowOpen) {
    // Un-volunteer to handle future requests until less busy
    tt_ptype_undeclare( "Acme_Calc" );
}
if (tt_message_status( msg ) == TT_WRN_START_MESSAGE) {
    //
    // Join session before accepting start message,
    // to prevent unnecessary starts of our ptype
    //
    ttdt_session_join( 0, myContractCB, myShell, 0, 1 );
}
ttdt_message_accept( msg, myContractCB, myShell, 0, 1, 1 );
tt_free( contents ); tt_free( file ); tt_free( docname );
return 0;
}

```

Example Ptype Signature for Ttmedia_ptype_declare Function

Code Example D-5 is an example of the signature layout of a media ptype.

CODE EXAMPLE D-5 Example of Media Ptype Signature Layout

```

ptype Acme_Calc {
    start "acalc";
    handle:
        /*
         * Display Acme_Sheet
         * Include in tool's ptype if tool can display a document.
         */
        session Display( in    Acme_Sheet  contents      ) => start opnum = 1;
        session Display( in    Acme_Sheet  contents,
                             in    messageID counterfoil  ) => start opnum = 2;
        session Display( in    Acme_Sheet  contents,
                             in    title    docName       ) => start opnum = 3;
        session Display( in    Acme_Sheet  contents,
                             in    messageID counterfoil,
                             in    title    docName       ) => start opnum = 4;
        /*
         * Edit Acme_Sheet
         * Include in tool's ptype if tool can edit a document.
         */
        session Edit(   inout Acme_Sheet  contents      ) => start opnum = 101;
        session Edit(   inout Acme_Sheet  contents,
                             in    messageID counterfoil  ) => start opnum = 102;
        session Edit(   inout Acme_Sheet  contents,
                             in    title    docName       ) => start opnum = 103;
}

```

```

session Edit(      inout Acme_Sheet contents,
                  in    messageID  counterfoil,
                  in    title      docName      ) => start opnum = 104;
/*
 * Compose Acme_Sheet
 * Include in tool's ptype if tool can compose a document from scratch.
 */
session Edit(      out  Acme_Sheet contents      ) => start opnum = 201;
session Edit(      out  Acme_Sheet contents,
                  in    messageID  counterfoil   ) => start opnum = 202;
session Edit(      out  Acme_Sheet contents,
                  in    title      docName      ) => start opnum = 203;
session Edit(      out  Acme_Sheet contents,
                  in    messageID  counterfoil,
                  in    title      docName      ) => start opnum = 204;
/*
 * Mail Acme_Sheet
 * Include in tool's ptype if tool can mail a document.
 */
session Mail(      in    Acme_Sheet contents      ) => start opnum = 301;
session Mail(      inout Acme_Sheet contents      ) => start opnum = 311;
session Mail(      inout Acme_Sheet contents,
                  in    title      docName      ) => start opnum = 313;
session Mail(      out  Acme_Sheet contents      ) => start opnum = 321;
session Mail(      out  Acme_Sheet contents,
                  in    messageID  counterfoil   ) => start opnum = 323;
};

```

Example for Xt Input Handler Function

Code Example D-6 is an example for the Xt input handler function.

CODE EXAMPLE D-6 Xt Input Handler Function Example

```

int myTtFd;
char *myProcID;
myProcID = ttdt_open( &myTtFd, "WhizzyCalc", "Acme", "1.0", 1 );
/* ... */
/* Process the message that started us, if any */
ttk_Xt_input_handler( myProcID, 0, 0 );
/* ... */
XtAppAddInput( myContext, myTtFd, (XtPointer)XtInputReadMask,
               ttk_Xt_input_handler, myProcID );

```


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