BEA TUXEDO

Administering the BEA TUXEDO System

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Administering the BEA TUXEDO System

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6.5	February 1999	BEA TUXEDO Release 6.5

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Preface

Purpose of This Document

This document describes how to administer the BEA TUXEDO system.

Who Should Read This Document

This document is intended for administrators who configure operational parameters that support mission-critical BEA TUXEDO systems.

How This Document Is Organized

Administering the BEA TUXEDO System is organized as follows:

- Chapter 1 introduces the administration tasks.
- Chapter 2 identifies the administration tools that are part of the BEA TUXEDO system.
- Chapter 3 details the application, machine, group, server, services, interfaces, routing, and network parameters in an application's `UBBCONFIG` configuration file.
- Chapter 4 explains how to start and shut down applications.
- Chapter 5 explains how to distribute applications.
- Chapter 6 explains how to build networked applications.

- Chapter 7 explains how to configure transactions.
- Chapter 8 explains how to manage multiple domains.
- Chapter 9 explains how to manage workstation clients.
- Chapter 10 explains how to manage queued messages.
- Chapter 11 explains how to implement application security.
- Chapter 12 explains how to monitor a running system.
- Chapter 13 explains how to monitor log files.
- Chapter 14 explains how to tune applications.
- Chapter 15 explains how to migrate applications.
- Chapter 16 explains how to modify systems dynamically.
- Chapter 17 explains how to reconfigure applications dynamically.
- Chapter 18 explains how to use the Event Broker.
- Chapter 19 explains how to troubleshoot problems.

How to Use This Document

This document, *Administering the BEA TUXEDO System*, is designed primarily as an online, hypertext document. If you are reading this as a paper publication, note that to get full use from this document you should access it as an online document via the BEA TUXEDO Online Documentation CD.

The following sections explain how to view this document online, and how to print a copy of this document.

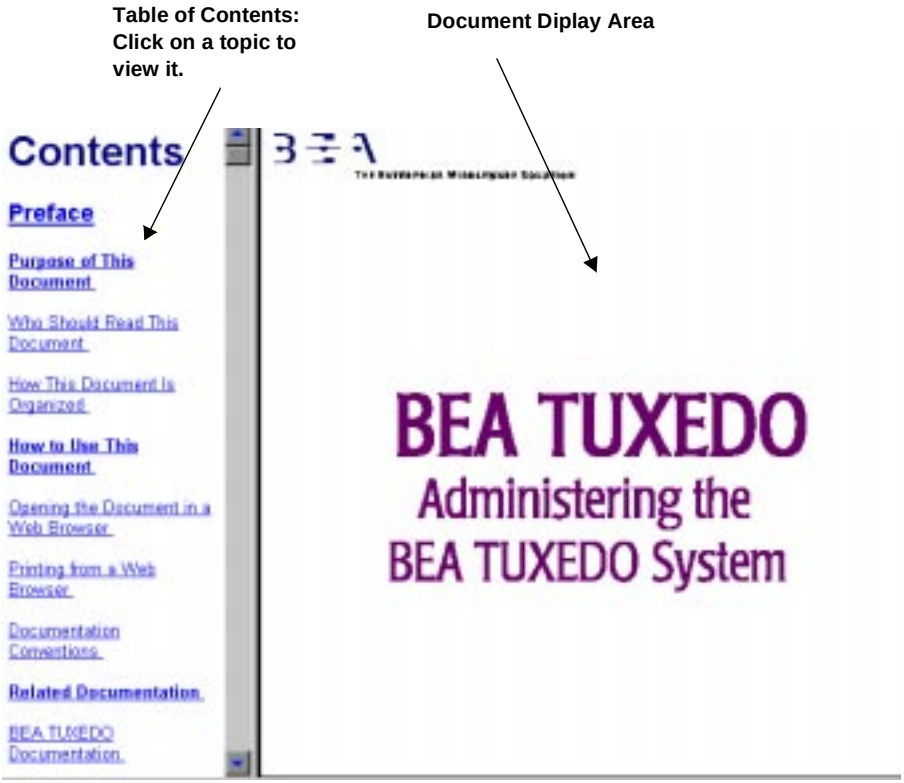
Opening the Document in a Web Browser

To access the online version of this document, open the `index.htm` file in the top-level directory of the BEA TUXEDO Online Documentation CD. On the main menu, click the Bookshelf button. On the Bookshelf, scroll to the entry for *Administering the BEA TUXEDO System* and click the HTML option. The CD provides other options to open this document. The preceding example describes one option.

Note: The online documentation requires a Web browser that supports HTML version 3.0. Netscape Navigator version 3.0 or Microsoft Internet Explorer version 3.0 or later is recommended.

Figure 1 shows the online document with the clickable navigation bar and table of contents.

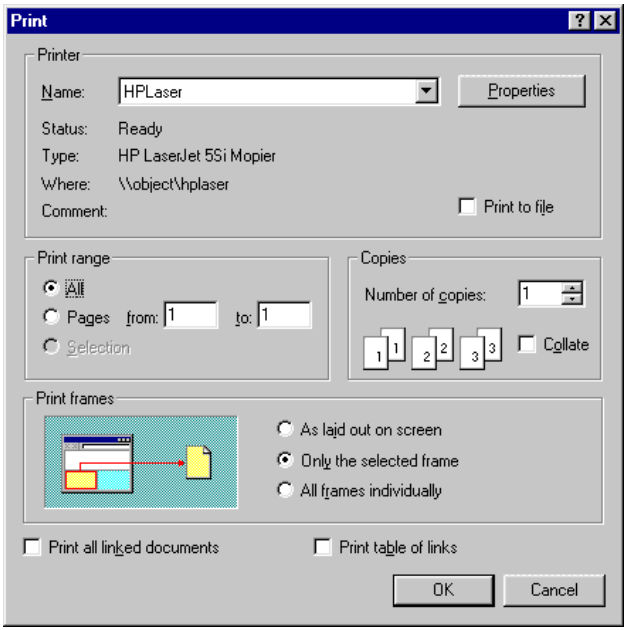
Figure 1 Online Document Displayed in a Netscape Web Browser



Printing from a Web Browser

You can print a copy of this document, one file at a time, from the Web browser. Before you print, make sure that the chapter or appendix you want is displayed and *selected* in your browser.

To select a chapter or appendix, click anywhere inside the chapter or appendix you want to print. If your browser offers a Print Preview feature, you can use the feature to verify which chapter or appendix you are about to print. If your browser offers a Print Frames feature, you can use the feature to select the frame containing the chapter or appendix you want to print. For example:



The BEA TUXEDO Online Documentation CD also includes Adobe Acrobat PDF files of all of the online documents. You can use the Adobe Acrobat Reader to print all or a portion of each document. On the CD's main menu, click the Bookshelf button. On the Bookshelf, scroll to the entry for the BEA TUXEDO document you want to print and click the PDF option.

Documentation Conventions

The following documentation conventions are used throughout this document.

Convention	Item
boldface text	Indicates terms defined in the glossary.
Ctrl+Tab	Indicates that you must press two or more keys simultaneously.
italics	Indicates emphasis or book titles.

`monospace text`	Indicates code samples, commands and their options, data structures and their members, data types, directories, and file names and their extensions. Monospace text also indicates text that you must enter from the keyboard.
	Examples:
	`#include <iostream.h> void main ( ) the pointer psz`
	`chmod u+w *`
	`.doc`
	`BITMAP`
	`float`

`monospace boldface text`	Identifies significant words in code. *Example*: `void` **`commit`** `( )`
`monospace italic text`	Identifies variables in code. *Example*: `String` *`expr`*
UPPERCASE TEXT	Indicates device names, environment variables, and logical operators. *Examples*: LPT1 SIGNON OR
`{ }`	Indicates a set of choices in a syntax line. The braces themselves should never be typed.

Convention	Item
[ ]	Indicates optional items in a syntax line. The brackets themselves should never be typed. *Example*: `buildobjclient [-v] [-o name ] [-f file-list]... [-l file-list]...`
|	Separates mutually exclusive choices in a syntax line. The symbol itself should never be typed.
. . .	Indicates one of the following in a command line: ♦ That an argument can be repeated several times in a command line ♦ That the statement omits additional optional arguments ♦ That you can enter additional parameters, values, or other information The ellipsis itself should never be typed. *Example*: `buildobjclient [-v] [-o name ] [-f file-list]... [-l file-list]...`
. . .	Indicates the omission of items from a code example or from a syntax line. The vertical ellipsis itself should never be typed.

Related Documentation

The following sections list the documentation provided with the BEA TUXEDO software, related BEA publications, and other publications related to the technology.

BEA TUXEDO Documentation

The BEA TUXEDO information set consists of the following documents:

BEA TUXEDO Release Notes

Administering the BEA TUXEDO System (this document)

Application Developer' s Guide

COBOL Guide

Domains User Guide

FML Programmer's Guide

Glossary

Installation Guide

Product Overview

Programmer's Guide

/Q Guide

TxRPC Guide

Windows NT User's Guide

/Workstation Guide

Note: The BEA TUXEDO Online Documentation CD also includes Adobe Acrobat PDF files of all of the online documents. You can use the Adobe Acrobat Reader to print all or a portion of each document.

BEA Publications

Selected BEA TUXEDO Release 6.4 documents are available on the Online Documentation CD.

To access these documents:

1. Click the Reference button on the main menu.
2. Click the BEA TUXEDO Manuals option.

Other Publications

For more information about the BEA TUXEDO system and related technologies, refer to the following books:

Edwards, J. with DeVoe, D. 1997. *3-Tier Client/Server At Work*. Wiley Computer Publishing.

Edwards, J., Harkey, D., and Orfali, R. 1996. *The Essential Client/Server Survival Guide*. Wiley Computer Publishing.

Contact Information

The following sections provide information about how to obtain support for the documentation and software.

Documentation Support

If you have questions or comments on the documentation, you can contact the BEA Information Engineering Group by e-mail at **docsupport@beasys.com**.

Customer Support

If you have any questions about this version of the BEA TUXEDO system, or if you have problems installing and running the BEA TUXEDO system, contact BEA Customer Support through BEA WebSupport at `www.beasys.com`. You can also contact Customer Support by using the contact information provided on the Customer Support Card, which is included in the product package.

When contacting Customer Support, be prepared to provide the following information:

- Your name, e-mail address, phone number, and fax number
- Your company name and company address

- Your machine type and authorization codes
- The name and version of the product you are using
- A description of the problem and the content of pertinent error messages

CHAPTER

1 Introduction to Administration

As the administrator of your organization's computing applications, you are responsible for setting up and running a system that is critical to your corporate mission. You must plan how to maximize the performance and reliability of your new BEA TUXEDO system, and then make it happen.

This chapter discusses the following topics:

- The Administrator's Job
- Roadmap for Your Responsibilities
- Planning Your Configuration

The Administrator's Job

You are the person responsible for configuring and booting an application and then keeping it running smoothly. Your job can be viewed in two phases:

- During the "groundwork phase," you establish the foundation of your application by planning, designing, installing, and configuring your application with the BEA TUXEDO system. You also select a security scheme for your application.

  Most of the work you do during this phase is necessary only once. The exception to this rule is the configuration work: the BEA TUXEDO system allows you to reconfigure your application whenever necessary to maximize performance and reliability.

- During the "operational phase," you run the application, monitoring it and reconfiguring it when necessary. You also diagnose and correct runtime problems.

The remainder of this chapter lists the specific tasks you need to do during each phase.

The Groundwork Phase

During this phase, you must do the following tasks.

Plan		Collect information from the application designers, the programmers, and the business that will use the application. Use this information to configure your system.
Install		Set up your environment (including hardware and software), and install the BEA TUXEDO system and the application.
Configure	Your system	Set the parameters provided by the BEA TUXEDO system that govern how the components of your application will be used.
	Transactions	Add transactions functionality to your definitions of domains, machines, groups, interfaces, services, and any other required components of your application.
Implement	Security	Select and implement one or more methods provided by the BEA TUXEDO system for protecting your application and data.

Depending on your application, you may also need to set up the following:

Distributed applications	Create distributed applications with the routing tools: data-dependent routing in BEA TUXEDO applications.
Networked applications	Set up any networked applications.
Domains	Configure local and remote domains that will interact, and a routing table for each.

Workstation clients	To support BEA TUXEDO workstation clients, set required environment variables, configure a workstation listener, and modify the machine configuration.
Queued messages	Create an application queue space and modify the configuration file to support queued messages.

Note: This guide provides instructions for all the tasks shown in this table, except installation. For installation instructions, see *BEA TUXEDO Installation Guide*.

The Operational Phase

During this phase, you must do the following tasks.

Start up	Boot your application.
Monitor	Log the activities, problems, and performance of your application and analyze the results regularly.
Troubleshoot	Identify and resolve problems as they occur.

Depending on your application, you may also have to do the following:

Tune	Use techniques such as load balancing and prioritizing to maximize the performance of your application.
Migrate	Reassign primary responsibility for your application from your original MASTER machine to an alternate (BACKUP) machine when problems occur on the MASTER.
Dynamically modify	Change system parameters and the menu of services offered, when necessary, to meet the evolving needs of your customers.
Dynamically reconfigure	Redefine your application to reflect the addition of a component, such as a new machine or server.

Roadmap for Your Responsibilities

At the beginning of this chapter, we summarized your job responsibilities in two phases. For software descriptions and procedures that help you perform your work, refer to the appropriate documentation, as follows:

- During the groundwork phase, see the *BEA TUXEDO Installation Guide* and Chapters 3 through 11 of this document.
- During the operational phase, see Chapter 4 and Chapters 12 through 19 of this document.

If you are administering a BEA TUXEDO system, the following chapters are very important:

- Chapter 9, “Working with Multiple Domains”
- Chapter 10, “Managing Workstation Clients”
- Chapter 12, “Managing Queued Messages”

Planning Your Configuration

As an administrator, you need to work with your system designers and application designers to understand how the administrative configuration of your application can support the requirements for it. In addition, you need to know the requirements of your customer: the business unit using the new software.

Before you can start configuring your system, you need answers to questions about the design of your application and about the server applications developed from that design, as defined in the following section.

Questions About the Design

The following questions may help you start the planning process:

- How many machines will be used?
- Will client applications reside on machines that are remote from the server applications?
- Which services will your BEA TUXEDO application offer?
- What resource managers will the application use and where will they be located?
- What "open" strings will the resource managers need?
- What setup information will be needed for an RDBMS?
- Will transactions be distributed?
- What buffer types will be used?
- Will data be distributed across machines?
- To which external domains will the application export services? From which external domains will the application import services?
- Will data-dependent routing be used?
- In what order of priority should services be available?
- What are the reliability requirements? Will redundant listener and handler ports be needed? Will replicated server applications be needed?

Questions About Server Applications

The following questions may help you focus on the issues related to your server application that need to be resolved in your plan:

- What are the names of the BEA TUXEDO services?
- Are there any conversational services?
- What resource managers do they access?
- What buffer types do they use?

As you start putting together a configuration plan, you will discover more questions to which you need answers.

2 Administration Tools

Your BEA TUXEDO system gives you a choice of several methods for performing the same set of administrative tasks. Whether you are more comfortable using a graphical user interface or entering commands at a shell prompt, you will be able to find a comfortable method of doing your job as the administrator of a BEA TUXEDO domain.

This chapter discusses the following topics:

- Configuration and Run-time Administration
- BEA TUXEDO Web-based GUI
- Command-line Interface
- AdminAPI

Configuration and Run-time Administration

At the highest level, the job of an administrator can be viewed as two broadly defined tasks:

- Configuration—the most important (and complicated) part of setting up your system before booting your online transaction processing (OLTP) application
- Run-time administration—the set of tasks that are performed on an application that has been booted

This chapter describes how these tools can be used to configure an application and how to administer a running system.

Tools for Configuration

Because the BEA TUXEDO system offer great flexibility and many options to application designers and programmers, no two applications are alike. An application, for example, may be small and simple (a single client and server running on one machine) or complex enough to handle transactions among thousands of clients and servers. For this reason, for every BEA TUXEDO application being managed, an administrator must provide a file that defines and governs the components of that application.

The components:

domain
: The collection of servers, services, interfaces, machines, and associated resource managers defined by a single `UBBCONFIG` (ASCII) or `TUXCONFIG` (binary) configuration file; a collection of programs that perform a function. A domain represents an administrative set of functionality.

server
: A software program (or the hardware on which it runs) in which BEA TUXEDO services offered to your users are stored.

client
: A software program that requests services from servers (and sometimes resides on nonserver hardware).

queue
: A set of requests that are submitted to servers in a particular order (which may be determined by the administrator).

service
: A program that takes client requests as input and performs a particular function in response.

server group
: A set of interfaces or a logical grouping of servers.

These components (and others, when appropriate) are defined, or configured, in an ASCII file that is referred to, in the BEA TUXEDO documentation, as `UBBCONFIG`. The `UBBCONFIG` file may, in fact, be given any file name. When compiled into a binary

file, the file is referred to as TUXCONFIG. During the groundwork (or setup) phase of administration, the administrator's goal is to create a TUXCONFIG file. You have a choice of the following three tools.

If You Use the . . .	You Must . . .
BEA TUXEDO Web-based GUI	Use a graphical user interface (GUI) to create and edit the TUXCONFIG file. Full descriptions of the GUI are available by accessing the Help directly from the GUI.
Command-line interface	1. Edit the UBBCONFIG file (an ASCII version of TUXCONFIG) with a text editor. 2. Run tmloadcf to convert the UBBCONFIG file into a TUXCONFIG (binary) file. For details about using the command-line interface to perform administrative tasks, see the applicable chapters in this document. For information about the tmloadcf command, see the section "Create TUXCONFIG" in Chapter 4, "Starting and Shutting Down Applications." For specific details about the tmloadcf command options, see tmloadcf(1) in the *BEA TUXEDO Reference Manual*.
AdminAPI	Write a program that modifies the TUXCONFIG file for you. For details, see Chapter 18, "Event Broker/Monitor."

Tools for Run-time Administration

With your BEA TUXEDO system installed and your TUXCONFIG file loaded, you are ready to boot your application. As soon as your application is launched, you must start monitoring its activities and watching for problems—both actual and potential.

When problems occur, you must identify and solve them. If performance is degraded, you may want to do load balancing or prioritize your interfaces or services. If trouble develops on a MASTER machine, you may want to replace it with a designated BACKUP machine.

As the processing and resource usage requirements of your application evolve, you may need to add machines, servers, clients, interfaces, services, and so on, to your existing system.

The job of run-time administration encompasses many tasks, from starting and stopping the application, to monitoring activity, troubleshooting problems, and dynamically reconfiguring the application. Again, you have a choice of three tools for performing these tasks: the Web-based GUI, the command-line interface, and the AdminAPI.

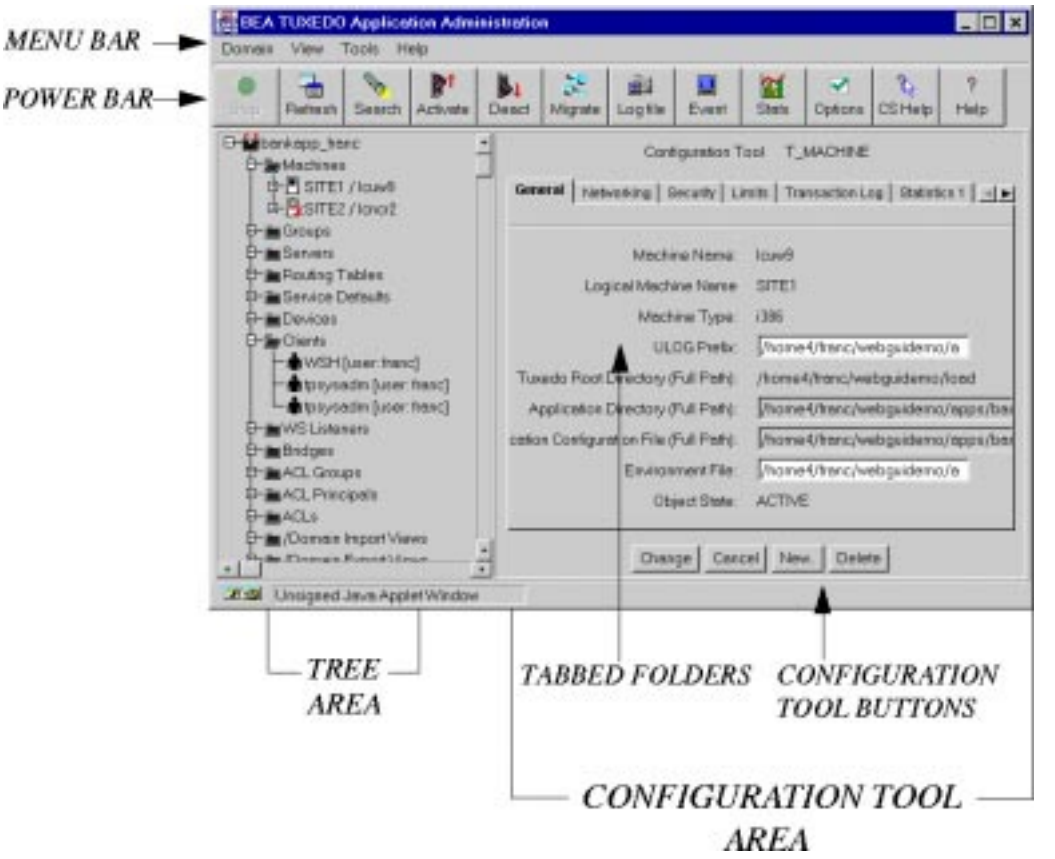
BEA TUXEDO Web-based GUI

The BEA TUXEDO Web-based GUI is a graphical user interface that enables you to perform most administrative tasks for a BEA TUXEDO application. Figure 2-1 shows the Main Window that is displayed when you bring up the Web-based GUI for the first time. The four major sections of the main window are:

- MENU BAR—A row of frequently used menus
- POWER BAR— A row of buttons that allow you to use tools, such as Help
- TREE—A hierarchical representation of the administrative class objects (such as servers and clients) in a BEA TUXEDO domain
- CONFIGURATION TOOL—A set of tabbed folders on which you can display, define, and modify the attributes of objects, such as the name of a machine

After you have set up and activated a domain, the Tree will be populated with labeled icons, representing the administrative class objects in your domains. In addition, as soon as you start using the Configuration Tool, the right-hand column dedicated to that tool will be populated with tabbed folders in which you enter information needed for configuration.

Figure 2-1 The Main Window of the Web-Based GUI



Command-line Interface

You can use the following commands to administer the BEA TUXEDO system. This document provides procedures for administrative tasks that are based on the command-line interface. For details about individual commands, see the *BEA TUXEDO Reference Manual*.

- tmboot—Activates the BEA TUXEDO application that is referenced in the specified configuration file. Depending on the options used, the entire application or parts of the application are started.
- tmloadcf—Parses the UBBCONFIG file and loads the binary TUXCONFIG configuration file.
- tmunloadcf—Unloads the TUXCONFIG configuration file.
- tmconfig—Dynamically updates and retrieves information about the BEA TUXEDO configuration for a running system.
- dmadmin—Updates the compiled BDMCONFIG (binary domain configuration file) while the system is running.
- tmadmin—The BEA TUXEDO Bulletin Board interpreter. This command is used primarily to produce information about configuration parameters. Once invoked, you can enter many administrative commands that duplicate the functions of other commands. For example, the tmadmin shutdown command is identical to the tmshutdown command.
- tmshutdown—Shuts down a set of specified BEA TUXEDO servers, or removes a set of BEA TUXEDO services listed in a configuration file.

AdminAPI

The AdminAPI is an application programming interface (API) for directly accessing and manipulating system settings in the BEA TUXEDO Management Information Bases (MIBs). The advantage of the AdminAPI is that it can be used to automate administrative tasks, such as monitoring log files and dynamically reconfiguring an application, thus eliminating the need for human intervention. This advantage can be crucially important in mission-critical, real-time applications.

For an example of a program written with the AdminAPI, see Chapter 18, “Event Broker/Monitor.”

For details about the MIBs, see ACL_MIB(5), APPQ_MIB(5), EVENT_MIB(5), MIB(5), TM_MIB(5), and WS_MIB(5) in the *BEA TUXEDO Reference Manual*.

Note: An online version of the *BEA TUXEDO Reference Manual* is available on the *BEA TUXEDO Online Documentation CD*. From the BEA TUXEDO home page, click *Reference Manual Pages-->Reference Manual: Section 5*.

3 Creating a Configuration File

Configuring each BEA TUXEDO application is a central task of the administrator. By configuring a file, you are describing your application using a set of parameters that the software interprets to create a runnable application.

This chapter discusses the following topics:

- What Is the Configuration File?
- Setting Domain-wide Parameters
- Configuring Machines
- Configuring Groups
- Configuring Servers
- Configuring Services
- Configuring Routing
- Configuring Network Information

Note: For related information about the `DMCONFIG` domain configuration file, see Chapter 8, "Working with Multiple Domains."

What Is the Configuration File?

An application consists of four basic parts:

- A configuration file that describes the application
- The server that performs the service request
- The client that issues the request
- The commands that build and run the application

This section discusses the configuration file.

Two Forms of the Configuration File

- The UBBCONFIG file is an ASCII version of the configuration file, created and edited with any editor. Except for sample configuration files distributed with the BEA TUXEDO sample applications, no UBBCONFIG file is provided. You must create a UBBCONFIG file for each new application. The syntax used for entries in the file is described in the ubbconfig(5) reference page in Section 5 of the *BEA TUXEDO Reference Manual*.

  Note: The BEA TUXEDO software provides the ubbshm, ubbmp, and ubbsimple sample UBBCONFIG files, as part of the bankapp and simpapp applications. Portions of these UBBCONFIG sample files are also shown in this document.

- The TUXCONFIG file is a binary version of the configuration file, created from the ASCII version by the tmloadcf(1) command. When tmloadcf is executed, the environment variable TUXCONFIG must be set to the full path name of the device or system file where TUXCONFIG is to be loaded. Many parameters in TUXCONFIG can be changed while the application is running by using tmconfig(1).

Contents of the Configuration File

At its maximum, a configuration file can consist of eight sections. At its minimum, it must contain three required sections:

- RESOURCES, in which all system parameters are defined
- MACHINES, in which all the machines in your application are specified
- GROUPS, in which all groups, names, and IDs are defined for your application.

The file must also contain a minimum of nine parameters. There are 80 different parameters, and in all sections but the first, there can be multiple entries, each with its own selection of parameters. In all sections other than RESOURCES, the first section, you can use a DEFAULT parameter to specify parameters that repeat from one entry to the next.

Setting Domain-wide Parameters

This section explains how to set RESOURCES parameters that control the application as a whole. Some of these parameters serve as system-wide defaults and can be overridden on a per-machine basis in the MACHINES section.

Identifying Information in the RESOURCES Section

The RESOURCES section is a required section and must appear as the first section in the configuration file. Information in this section includes the following:

- The address of shared memory (IPCKEY)
- Administration site (MASTER) for boot and shutdown
- Control of user access to the application (UID, GID, and PERM)
- Level of security for this application (SECURITY, AUTHSVC)

- IPC limits for the number of processes associated with the application, the number of server processes, and the number of services offered (MAXACCESSERS, MAXSERVERS, and MAXSERVICES)
- Application architecture (MODEL), which indicates a single machine or multiple machines application
- Server load balancing enabled (LDBAL)
- Maximum number of buffer types and subtypes (MAXBUFTYPE and MAXBUFSTYPE)
- Time intervals for sanity scans of the Bulletin Board (SCANUNIT, SANITYSCAN)
- Timeout value for service requests (BLOCKTIME)
- Maximum number of simultaneous conversations (MAXCONV)
- Unsolicited notification method (NOTIFY, USIGNAL)

Some of these parameters serve as system-wide defaults (UID, GID, PERM, MAXACCESSERS, and MAXCONV) and can be overridden on a per-machine basis. For more information about the ubbconfig(5) reference page, see Section 5 of the *BEA TUXEDO Reference Manual*.

Description of Parameters in a Sample RESOURCES Section

The following table provides sample parameters and values in the RESOURCES section of a configuration file for a BEA TUXEDO application.

Parameter	Value	Meaning
IPCKEY	39211	A number greater than 32769 unique to this application on this system.
UID	0	The user ID of the BEA TUXEDO administrator. **Note:** On Windows NT, this must be set to 0.
GID	1	The group ID of other. **Note:** On Windows NT, this must be set to 0.

Parameter	Value	Meaning
PERM	0660	Allows read/write access to those in the group of the administrator.
MAXACCESSERS	15	Allows up to 15 processes to be run at this site.
MAXSERVICES	25	Allows up to 25 services to be advertised at all sites.
MASTER	SITE1, SITE2	Specifying LMID SITE1 means the machine is the master. If LMID SITE2 is specified, the machine is the backup.
MODEL	MP	This application has more than one machine in the configuration.
OPTIONS	LAN, MIGRATE	This is a networked application; servers can be migrated to alternate processors.
SECURITY	APP_PW	This is a secure application; clients are required to supply a password to join.
AUTHSVC	"AUTHSVC"	In addition to the password, clients must pass authentication from a service called "AUTHSVC".
NOTIFY	DIPIN	Clients receive unsolicited messages by dip-in.
SYSTEM_ACCESS	PROTECTED, NO _OVERRIDE	The application code does not attach to shared memory. (This cannot be changed.)
LDBAL	Y	Indicates that load balancing is on.

Sample RESOURCES Section

```
RESOURCES
IPCKEY          39211
UID             0
GID             1
PERM            0660
MAXACCESSERS    75
MAXSERVERS      40
MAXSERVICES     55
MASTER          SITE1, SITE2
MODEL           MP
OPTIONS         LAN, MIGRATE
SECURITY        APP_PW
AUTHSVC         "AUTHSVC"
```

```
NOTIFY          DIPIN
SYSTEM_ACCESS   PROTECTED, NO_OVERRIDE
LDBAL           Y
```

Setting the Address of Shared Memory

You set the address of shared memory using the IPCKEY parameter. This parameter is used by the BEA TUXEDO system to allocate application IPC resources such that they may be located easily by new processes joining the application. This key and its variations are used internally to allocate the Bulletin Board, message queues, and semaphores that must be available to new application processes. In a single processor mode, this key names the Bulletin Board; in a multiprocessor mode, this key names the message queue of the DBBL.

Characteristics of the IPCKEY Parameter

The IPCKEY parameter has the following characteristics:

- It is required and must appear in the configuration file.
- It is used to access the Bulletin Board and other IPC resources.
- Its value must be an integer in the range 32,769 to 262,143.
- No other application on the system may use this specific value for its IPCKEY.
- In the sample RESOURCES section, the IPCKEY is 39211 for the sample BEA TUXEDO application.

Identifying the Master Machine

You must specify a master machine for all configurations (MASTER). The master machine controls the booting and administration of the entire application. This machine is specified as a Logical Machine Identifier (LMID). This is an alphanumeric name chosen by the administrator. (LMIDs are discussed further in the section "Configuring Machines" in this chapter.)

Two LMIDs are specified if migration of the master site is to be allowed. If it is necessary to bring down the master site without shutting down the application, it is necessary to specify the backup master site.

Characteristics of the MASTER Parameter

The MASTER parameter has the following characteristics:

- It is required and it controls booting and administration.
- Two LMIDs are required for migration to back up the master machine.
- In the sample RESOURCES section, the master site is SITE1; the backup site is SITE2.

Setting the Application Type

Among the architectural decisions needed for a BEA TUXEDO application are the following:

- Should this application run on a single processor with global shared memory?
- Will the application be networked?
- Will server migration be supported?

The MODEL parameter specifies whether an application runs on a single processor. It is set to SHM for uniprocessors and also for multiprocessors with global shared memory. A MODEL value of MP is used for multiprocessors that do not have global shared memory, as well as for networked applications. This is a required parameter.

The OPTIONS parameter is a comma-separated list of application configuration options. Two available options are LAN (indicating a networked configuration) and MIGRATE (indicating that application server migration is allowed).

Characteristics of the MODEL and OPTIONS Parameters

The MODEL and OPTIONS parameters have the following characteristics.

Parameter	Characteristics
MODEL	It is a required parameter. A value of SHM indicates a single machine with global shared memory. A value of MP indicates multiple machines or a nonglobal shared memory multiprocessor.
OPTIONS	It is a comma-separated list of application configuration options. A value of LAN indicates a local area network. A value of MIGRATE enables server migration. In the sample RESOURCES section, model is MP; options is set to LAN and MIGRATE.

Note: No OPTIONS are specified for the SHM model.

Defining Access Control

You can provide basic access to a BEA TUXEDO application using three parameters: UID, GID, and PERM:

- UID— the user ID of the administrator. The value is a numeric value corresponding to the UNIX system user ID of the person who boots and shuts down the system.
- GID— the numeric Group ID of the administrator.
- PERM — an octal number that specifies the permissions to assign to the IPC resources created when the application is booted. This provides the first level of security to protect the BEA TUXEDO system IPC structures against unauthorized access. The default is 0666, which gives read/write access to all. These values should be specified for production applications.

Note: If the UID and GID are not specified, they default to the IDs of the person who runs the tmloadcf(1) command on the configuration, unless they are overridden in the MACHINES section.

Characteristics of the UID, GID, and PERM Parameters

The UID, GID, and PERM parameters have the following characteristics.

Parameter	Characteristics
UID	The user ID of the administrator. The default is the ID of the person who runs tmloadcf(1). Example: UID=3002 On Windows NT, this value is always 0.
GID	The group ID of the administrator. The default is the ID of the person who runs tmloadcf(1). Example: GID=100
PERM	The permissions for access to IPC structures. The default is 0666. Example: PERM=0660 On Windows NT, this value is always 0.

Note: You can overwrite values on remote machines.

Defining IPC Limits

Because most IPC and Shared Memory Bulletin Board tables are statically allocated for speedy processing, it is important to tune them correctly. If they are sized too generously, memory and IPC resources are consumed to excess; if they are set too small, the process fails when the limits are eclipsed.

The following tunable parameters related to IPC sizing are currently available in the RESOURCES section:

- MAXACCESSERS—the maximum number of overall processes allowed to be attached to the BEA TUXEDO system at one site. It is not the sum of all processes, but is equal to the number at the site that has the most processes. The default is 50. (You can overwrite MAXACCESSERS on a per-machine basis in the MACHINES section.)

- MAXSERVERS—the maximum number of server processes in the application, including all the administrative servers (for example, BBL and TMS). It is the sum of the server processes at all sites. The default is 50.
- MAXSERVICES—the maximum number of different services that can be advertised in the application. It is the sum of all services in the system. The default is 100. (When setting this value, consider the defaults to be a quantity reserved for system resources.)

The cost incurred by increasing MAXACCESSERS is one additional semaphore per site per accesser. There is a small fixed semaphore overhead for system processes in addition to that added by the MAXACCESSERS value. The cost of increasing MAXSERVERS and MAXSERVICES is a small amount of shared memory that is kept for each server, service, and client entry, respectively. The general idea for these parameters is to allow for future growth of the application. It is more important to scrutinize MAXACCESSERS.

Note: Two additional parameters, MAXGTT and MAXCONV, affect shared memory.

Characteristics of MAXACCESSERS, MAXSERVERS, and MAXSERVICES Parameters

The MAXACCESSERS, MAXSERVERS, and MAXSERVICES parameters have the following characteristics.

Parameter	Characteristics
MAXACCESSERS	Number of processes on the site that is running the most processes. You can overwrite the value on a per-machine basis in the MACHINES section. The cost is one additional semaphore per accesser.
MAXSERVERS	Maximum number of server processes in an application (sum of all sites). The cost is a small amount of shared memory.

Parameter	Characteristics
MAXSERVICES	Maximum number of BEA TUXEDO services advertised in the application (sum of all sites). The cost is a small amount of shared memory. Default is 100.

Enabling Load Balancing

You can control whether a load balancing algorithm is used on the BEA TUXEDO system as a whole. Using load balancing, a load factor is applied to each service within the system, and you can track the total load on every server. Every service request is sent to the qualified server that is least loaded.

This algorithm, although effective, is expensive and should be used only if it is needed. It is needed only when a service is offered by servers that use more than one queue. Services offered by only one server, or by servers in an MSSQ (multiple server single queue) set do not need load balancing. Their LDBAL parameter should be set to N. In other cases, you may want to set LDBAL to Y.

If LDBAL is set to N and multiple queues offer the same service, the first available queue is selected.

If LDBAL is set to Y and the application is networked, the TMNETLOAD environment variable can be used to give preference to local sites.

Characteristics of the LDBAL Parameter

The LDBAL parameter has the following characteristics:

- If LDBAL is set to Y, the server assigned will be load balanced.
- If LDBAL is set to Y, you can use TMNETLOAD for local preference.
- If LDBAL is set to N, the server assigned will be the first available server.
- The default is N.
- Because LDBAL incurs overhead, use it only when necessary.

- Do not use load balancing if every BEA TUXEDO service is offered by only one server.
- Do not use load balancing if every BEA TUXEDO service is offered by one MSSQ server set.

Setting Buffer Type and Subtype Limits

You can control the number of buffer types and subtypes allowed in the application with the MAXBUFTYPE and MAXBUFSTYPE parameters, respectively. The current default for MAXBUFTYPE is 16. Unless you are creating many user-defined buffer types, you can omit MAXBUFTYPE. However, if you intend to use many different VIEW subtypes, you may want to set MAXBUFSTYPE to exceed its current default of 32.

Characteristics of the MAXBUFTYPE and MAXBUFSTYPES Parameters

The MAXBUFTYPE and MAXBUFSTYPES parameters have the following characteristics.

Parameter	Characteristics
MAXBUFTYPE	Maximum number of buffer types allowed in the system. Use only if you create 8 or more user-defined buffer types. Default is 16. Example: `MAXBUFTYPE 20`
MAXBUFSTYPE	Maximum number of buffer subtypes allowed in the system. Default is 32. Example: `MAXBUFSTYPE 40`

Setting the Number of Sanity Checks and Blocking Timeouts

You can set the number of times the administrative server (BBL) will periodically check the sanity of servers local to its machine. In addition, you can set the number of timeout periods for blocking messages, transactions, and other system activities.

You use the SCANUNIT parameter to control the granularity of such checks and timeouts. Its value (in seconds) can be a positive multiple of 5. Its default is 10.

You use the SANITYSCAN parameter to specify how many SCANUNITs elapse between sanity checks of the servers. It must not be set so that SANITYSCAN * SCANUNIT exceeds 300; its current default is set so that SANITYSCAN * SCANUNIT is approximately 120 seconds.

Example: Setting Sanity Checks and Timeouts

A SCANUNIT of 10 and a BLOCKTIME of 3 allows 30 seconds before the client application times out. The BLOCKTIME default is set so that BLOCKTIME * SCANUNIT is approximately 60 seconds. The value of BLOCKTIME is the total of the following times:

- Time waiting to get on the queue
- Time waiting on the queue
- Time for service processing
- Time on the network

Characteristics of the SCANUNIT, SANITYSCAN, and BLOCKTIME Parameters

The SCANUNIT, SANITYSCAN, and BLOCKTIME parameters have the following characteristics.

Parameter	Characteristics
SCANUNIT	Establishes granularity of check intervals and timeouts. Value must be multiples of 5 seconds. Example: SCANUNIT 10 If not set, the default is 10.
SANITYSCAN	Frequency that the BBL checks the server (in SCANUNIT intervals). SCANUNIT * SANITYSCAN must not exceed 300. If not set, the default is such that SCANUNIT * SANITYSCAN is approximately 120 seconds.
BLOCKTIME	Timeout for blocking messages. SCANUNIT * BLOCKTIME must not exceed 32767. If not set, the default is such that SCANUNIT * BLOCKTIME is approximately 60 seconds.

Setting Conversation Limits

You can specify the maximum number of conversations on a machine with the MAXCONV parameter.

Characteristics of the MAXCONV Parameter

The MAXCONV parameter has the following characteristics:

- It is the maximum number of simultaneous conversations per machine.
- Its value must be greater than or equal to 0 and less than 32,766.
- The default for an application that has conversational servers listed in the SERVERS section is 10; otherwise, the default is 1.
- You can overwrite this value in the MACHINES section.

Setting the Security Level

You can set the following three levels of security:

- PERM parameter—sets the first or lowest-level permission to write to the application queues.
- SECURITY parameter—sets the second-level permission. This requires that the client supplies a password when joining the application. This password is checked against the password supplied by the administrator when the TUXCONFIG file is generated from the UBBCONFIG file.
- AUTHSVC parameter—sets the third-level permission. This sends the client's request to join the application to an authentication service. This level requires the second level of SECURITY to be present. The authentication service may be the default supplied by the BEA TUXEDO system or it may be a service, such as a Kerberos service, supplied by another vendor.

Characteristics of the SECURITY and AUTHSVC Parameters

The SECURITY and AUTHSVC parameters have the following characteristics.

Parameter	Characteristics
Security	Accepted values are: NONE (default), APP_PW, USER_AUTH, ACL, and MANDATORY_ACL. Default is NONE. Example: SECURITY APP_PW
AUTHSVC	The name of the authentication service. SECURITY APP_PW must be specified. Default is no authentication service. Client authentication with Kerberos is possible. Example: AUTHSVC ''AUTHSVC''

Setting Parameters of Unsolicited Notification

You can set the default method for clients to receive unsolicited messages using the NOTIFY parameter. The client, however, can override this choice in the TPINIT structure when tpinit() is called.

Following are three possible methods:

- IGNORE—clients should ignore unsolicited messages.
- DIPIN—clients should receive unsolicited messages only when they call tpchkunsol() or when they make an ATMI call.
- SIGNAL—clients should receive unsolicited messages by having the system generate a signal that has the signal handler call the function, that is, set with tpsetunsol().

Two types of signals can be generated: SIGUSR1 and SIGUSR2. The USIGNAL parameter allows the administrator to choose the type of signal. The default is SIGUSR2. In applications that choose notification by signals, any MS-DOS client workstations are switched automatically to DIPIN.

Characteristics of the NOTIFY and USIGNAL Parameters

The NOTIFY and USIGNAL parameters have the following characteristics.

Parameter	Characteristics
NOTIFY	Value of IGNORE means clients should ignore unsolicited messages. Value of DIPIN means clients should receive unsolicited messages by dip-In. Value of SIGNAL means clients should receive unsolicited messages by signals. Default is DIPIN. Example: NOTIFY SIGNAL

Parameter	Characteristics
USIGNAL	Value of SIGUSR1 means notify clients with this type of signal. Value of SIGUSR2 means notify clients with this type of signal. Default is SIGUSR2. Example: USIGNAL SIGUSR1

Protecting Shared Memory

You can shield system tables kept in shared memory from application clients and/or servers using the SYSTEM_ACCESS parameter. This option is useful when applications are being developed because faulty application code can inadvertently corrupt shared memory with a bad pointer. When the application is fully debugged and tested, this option could then be changed to allow for faster responses. Following are the options for this parameter:

- PROTECTED—BEA TUXEDO libraries compiled with application code will not attach to shared memory while executing system code.
- FASTPATH—BEA TUXEDO libraries will attach to shared memory at all times.
- NO_OVERRIDE—the selected option cannot be changed either by the client in the TPINIT structure of the tpinit() call or in the SERVERS section for servers.

Characteristics of the PROTECTED, FASTPATH, and NO_OVERRIDE Parameters

The PROTECTED, FASTPATH, and NO_OVERRIDE parameters have the following characteristics.

Parameter	Characteristics
PROTECTED	Internal structures in shared memory will not be corrupted inadvertently by application processes.
FASTPATH (default)	Application processes will join with access to shared memory at all times.

Parameter	Characteristics
NO_OVERRIDE	The specified option cannot be changed.

Note: An example: SYSTEM_ACCESS PROTECTED, NO_OVERRIDE

Configuring Machines

This section explains how to define parameters for each processor, or *machine*, on which your application runs.

Identifying Machines in the MACHINES Section

Every machine in an application must have a MACHINES section entry in the configuration file and it must be the second section in the file. The MACHINES section contains the following information specific to each machine in the application:

- The mapping of the machine *address* to a logical identifier (LMID)
- The location of the configuration file (TUXCONFIG)
- The location of the installed BEA TUXEDO software (TUXDIR)
- The location of the application servers (APPDIR)
- The location of the application log file (ULOGPFX)
- The location of the environment file (ENVFILE)

The only required parameters for the MACHINES section are LMID, TUXCONFIG, TUXDIR, and APPDIR.

Note: For a particular machine, you can override the UID, GID, PERM, MAXACCESSERS, and MAXCONV values that were specified in the RESOURCES section.

Description of Parameters in a Sample MACHINES Section

The following table provides a sample of parameters and their values in the MACHINES section of the configuration file.

Parameter	Meaning
gumby	The machine name obtained with the command uname -n on UNIX systems. On Windows NT systems, see the Computer Name value in the Network Control Panel.
LMID=SITE1	The logical machine identifier of the machine *gumby*.
TUXDIR	The double quoted string of the full path to the installed BEA TUXEDO software.
APPDIR	The double quoted string of the full path to the application directory.
TUXCONFIG	The double quoted string of the full path name of the configuration file.
ENVFILE	The double quoted string of the full path name of a file containing environment information.
ULOGPFX	The double quoted string of the full path name prefix of the log file.
MAXACCESSERS	Override the system-wide value with 100 for this machine.
MAXCONV	Override the system-wide value with 15 for this machine.

Example: MACHINES Section

The following example provides a sample MACHINES section of a configuration file:

```
MACHINES
gumby         LMID=SITE1
              TUXDIR="/tuxdir"
              APPDIR="/home/apps/mortgage"
              TUXCONFIG="/home/apps/mortgage/tuxconfig"
              ENVFILE="/home/apps/mortgage/ENVFILE"
              ULOGPFX="/home/apps/mortgage/logs/ULOG"
              MAXACCESSERS=100
               MAXCONV=15
```

How to Customize the MACHINES Section

You can customize the MACHINES section by performing the following steps:

- Substitute your machine name for *gumby*.
- Substitute your BEA TUXEDO software directory for TUXDIR.
- Substitute your application directory for APPDIR.
- Substitute the full path names for ENVFILE, TUXCONFIG, and ULOGPFX.

Reserving the Physical Address and Machine ID

You initially define the address in the address portion, which is the basis for a MACHINES section entry. All other parameters in the entry describe the machine specified by the address. You must set the address to the value printed by calling uname -n on UNIX systems. On Windows NT systems, see the Computer Name value in the Network Control Panel.

The LMID parameter is mandatory and specifies a logical name used to designate the computer whose address has just been provided. It may be any alphanumeric value, and must be unique among other machines in the application.

Characteristics of the Address and Machine ID, and the LMID Parameter

The address and machine ID and the LMID parameter have the following characteristics:

- The address and machine ID are specified in the following way:

  <address> LMID=*<logical_machine_name>*
- The address identifies the physical processor name.
- The format of the LMID parameter is LMID=*<logical_machine_name>*.
- The LMID is the logical machine name for a physical processor.
- LMID is alphanumeric and must be unique within the MACHINES section.

Identifying the Location of the Configuration File

You identify the configuration file location and file name of a machine with TUXCONFIG, a required parameter. The TUXCONFIG parameter is enclosed in double quotes and represents the full path name up to 64 characters. The path specified must be the same as the environment variable, TUXCONFIG; otherwise, the tmloadcf(1) will not compile the binary file.

Characteristics of the TUXCONFIG Parameter

The TUXCONFIG parameter has the following characteristics:

- The syntax of the TUXCONFIG parameter is TUXCONFIG="<*tuxconfig*>".
- This parameter identifies the location of the configuration file and file name (though it should remain TUXCONFIG for convention purposes) for the machine.
- The full path name for TUXCONFIG can be up to 64 characters.
- The value of TUXCONFIG must match the TUXCONFIG environment variable.

Identifying the Locations of the System Software and Application Server Machines

Each machine in an application must have a copy of the BEA TUXEDO system software and application software. You identify the location of system software with the TUXDIR parameter. You identify the location of the application servers with the APPDIR parameter. Both parameters are mandatory. The APPDIR parameter becomes the current working directory of all server processes. The BEA TUXEDO software looks in the TUXDIR/bin and APPDIR for executables.

Characteristics of the TUXDIR and APPDIR Parameters

The TUXDIR and APPDIR parameters have the following characteristics.

Parameter	Characteristics
TUXDIR	The syntax requires the full path name enclosed in double quotes: TUXDIR="<*TUXDIR*>". TUXDIR identifies the location of the BEA TUXEDO software. TUXDIR is a required parameter.
APPDIR	The syntax requires the full path name enclosed in double quotes: APPDIR="<*APPDIR*>". APPDIR identifies the location of application servers. APPDIR is a required parameter. APPDIR becomes the current working directory of server processes.

Identifying the Location of the Log File

The application log file contains warning and informational messages, as well as error messages that describe the nature of any ATMI error with a return code of TPESYSTEM or TPEOS (that is, underlying system errors). The user can use this log to track application-related errors. By default, the file is named ULOG.*mmddyy* where *mmddyy* is the month, date, and 2-digit year. By default, the file is written into the APPDIR.

You can override the default directory and prefix by specifying the ULOGPFX parameter that is the absolute path name of the application log file, without the date. For example, it may be set to APPDIR/logs/ULOG so that logs collect in a particular directory. In a networked application, a central log can be maintained by specifying a remote directory that is mounted on all machines.

Characteristics of the ULOGPFX Parameter

The ULOGPFX parameter has the following characteristics:

- The syntax of the ULOGPFX parameter is a string enclosed in double quotes: ULOGPFX="<*ULOGPFX*>".
- The application log contains all explanations of TPESYSTEM and TPEOS errors.
- You can use the application to log application errors.

- The ULOGPFX defaults to <*APPDIR*>/ULOG.
- Examples: ULOGPFX="/usr/appdir/logs/ULOG"
  ULOGPFX="/mnt/usr/appdir/logs/BANKLOG"

Specifying Environment Variable Settings for Processes

With the ENVFILE parameter, you can specify a file that contains environment variable settings for all processes to be booted by the BEA TUXEDO system. The system sets TUXDIR and APPDIR for each process, so they should not be specified in this file. You can specify settings for the following because they affect an application's operation:

- FIELDTBLS, FLDTBLDIR
- VIEWFILES, VIEWDIR
- TMCMPLIMIT
- TMNETLOAD

Characteristics of the ENVFILE Parameter

The ENVFILE parameter has the following characteristics:

- The syntax of the ENVFILE parameter is a string enclosed in double quotes: ENVFILE="<envfile>".
- ENVFILE is the file containing environment variable settings for all processes booted by the BEA TUXEDO system. (The UBBCONFIG file issues warnings in a similar way, that is, using fully qualified path names.)
- Set FIELDTBLS, FLDTBLDIR, and so on, but do not set TUXDIR and APPDIR.
- The ENVFILE parameter is optional and all settings must be hard coded. No evaluations such as FLDTBLDIR=$APPDIR are allowed.
- The format is *VARIABLE=string*.

Overriding System-wide Parameters

You can override the following system-wide parameters for a specific machine:

- UID
- GID
- PERM
- MAXACCESSERS
- MAXCONV
- MAXGTT

Note: Each parameter, except MAXGTT, is described in the RESOURCES section.

Configuring Groups

You can use GROUPS to designate logically grouped sets of servers, which can later be used to access resource managers, and facilitate server group migration. The GROUPS section of the configuration file contains the definition of server groups. You must define at least one server group for a machine to have application servers running on it. If no group is defined for a machine, the group can still be part of the application and you can run the administrative command tmadmin(1) from that site.

For nontransactional, nondistributed systems, groups are relatively simple. You only need to define the basic mapping of group name to group number and logical machine of each group. Additional flexibility is available to support distributed transactional systems.

Specifying a Group Name, Number, and LMID

The group name is the basis for a GROUPS section entry and is an alphanumeric name by which the group is identified. It is given a mandatory, unique group number (GRPNO). Each group must reside wholly on one logical machine (LMID). The LMID is also mandatory.

Configuring Servers

This section explains the SERVERS section parameters that you need to define to configure server processes.

Identifying Server Information in the SERVERS Section

The SERVERS section of the configuration file contains information specific to a server process. While this section is not required, an application without this section has no application servers and little functionality. Each entry in this section represents a server process to be booted in the application. Server-specific information includes the following:

- A server name, group, and numeric identifier (SRVGRP, SRVID)
- Command-line options (CLOPT)
- Parameters to determine the booting order and number of servers to boot (SEQUENCE, MIN, MAX)
- A server-specific environment file (ENVFILE)
- Server queue-related information (RQADDR, RQPERM, REPLYQ, RPPERM)
- Restart information (RESTART, RCMD, MAXGEN, GRACE)
- Server designation as a conversational server (CONV)
- Overriding of system-wide shared memory access (SYSTEM_ACCESS)

Command-line options supported by the BEA TUXEDO system are described on the servopts(5) reference page in the *BEA TUXEDO Reference Manual*.

Description of Parameters in a Sample SERVERS Section

The following table provides a sample of parameters and their values in the SERVERS section of the configuration file.

Parameter	Meaning
RESTART=Y (default)	Restart the servers.
MAXGEN=5 (default)	The MAXGEN parameter specifies a number greater than 0 and less than 256 that controls the number of times the server can be started within the period specified in the GRACE parameter. The default is 1. If the server is to be restartable, MAXGEN must be >= 2. The number of restarts is at most *number - 1* times. RESTART must be Y or MAXGEN is ignored.
GRACE=3600 (default)	If RESTART is Y, the GRACE parameter specifies the time period (in seconds) during which this server can be restarted as MAXGEN - 1 times. The number assigned must be equal to or greater than 0. The maximum is 2,147,483,648 seconds (or a little more than 68 years). If GRACE is not specified, the default is 86,400 seconds (24 hours). As soon as one GRACE period is over, the next grace period begins. Setting the grace period to 0 removes all limitations; the server can be restarted an unlimited number of times.
REPLYQ=N (default)	There is no reply queue.
CLOPT="-A" (default)	Specify -A on the command line of each server.
ENVFILE="/usr/home/envfile" (default)	Read environment settings from the file ENVFILE.
SYSTEM_ACCESS=PROTECTED (default)	Deny access to internal tables outside of system code.
RINGUP1	Sample name of the first server to be booted.
SRVGRP=GROUP1 SRVID=1 MIN=3 RQADDR="ring1"	Three instances of the sample server will be booted in group GROUP1 with server IDs of 1, 2, and 3, respectively. All three servers will form an MSSQ set and will read requests from queue *ring1*. **Note:** RQADDR assigns a symbolic name to the request queue of this server. MSSQ sets are established by using the same symbolic queue name for more than one server (and by specifying MIN greater than 1).
RINGUP2	Name of the second sample server to be booted.

Example: SERVERS Section

The following example provides a sample SERVERS section of a configuration file.

```
SERVERS
DEFAULT:          RESTART=Y MAXGEN=5 GRACE=3600
                  REPLYQ=N CLOPT="-A"
                  ENVFILE="/usr/home/envfile"
                  SYSTEM_ACCESS=PROTECTED

RINGUP1           SRVGRP=GROUP1 SRVID=1 MIN=3
                  RQADDR="ring1"
RINGUP2           SRVGRP=GROUP1 SRVID=4 MIN =3
                   RQADDR="ring2"
```

Note: Omitted from this sample are SEQUENCE (the order of booting is 1 to 6), REPLYQ and RPPERM (the server does not receive replies), RCMD (no special commands are desired on restart), and CONV (servers are not conversational). Defaults are applied to all servers unless a different setting is specified for a specific server.

Defining Server Name, Group, and ID

You initially define the server name entry in the SERVERS section entry, which is the name of an executable file built with buildserver(1). You must provide each server with a group identifier (SRVGRP). This is set to the name specified in the beginning of a GROUPS section entry. You must also provide each server process in a given group with a unique numeric identifier (SRVID). Every server must specify a SRVGRP and SRVID. Because the entries describe machines to be booted and not just applications, it is possible that in some cases the same server name will be displayed in many entries.

Characteristics of the Server Name, SRVGRP, and SRVID Parameters

The Server Name, SRVGRP, and SRVID parameters have the following characteristics.

Parameter	Characteristics
Server name	It identifies the executable to be booted. It is built with buildserver(1). It is required, but may not be unique.
SRVGRP (Server Group)	It identifies the group affiliation. The group name begins with a GROUPS section entry. It is required.
SRVID (Server ID)	It is numeric. It is required and unique within a server group.

Using Server Command-Line Options

The server may need to obtain information from the command line. The CLOPT parameter allows you to specify command-line options that can change some defaults in the server, or pass user-defined options to the tpsvrinit() function.

The standard main() of a server parses one set of options ending with the argument --, and passes the remaining options to tpsvrinit(). The default for CLOPT is -A, which tells the server to advertise all the services built into it with buildserver(1). The following table provides a partial list of the available options.

Option	Purpose
-o *filename*	Redirects standard output to file *filename.*
-e *filename*	Redirects standard error to file *filename.*
-s *services*	Advertises services.
-s x,y,z	An example that advertises services x, y, and z.
-s x,y,z:*funcname*	An example that advertises services x, y, and z, but processes requests for those services with function *funcname*. This is called aliasing a function name.

Option	Purpose
-r	An example that specifies that the server should log the services performed.

Note: You can find other standard main() options in the servopts(5) reference page in the *BEA TUXEDO Reference Manual*.

Server Command-Line Options

- The syntax is CLOPT="*servopts -- application_opts*".
- This is an optional parameter with a default of -A.
- Both main() and tpsvrinit() use server command-line options.
- The servopts(5) options are passed to main().
- The application options are passed to tpsvrinit().
- A BANKAPP example is CLOPT="-A -- -T 10".

Note: In the BANKAPP example, the server is given the option to advertise all services (-A) and tellerID of 10 so it can update a specific teller record with each operation. The use of this option, especially the options passed to tpsvrinit(), require communication between the system administrator and the application programmer.

Setting the Order in Which Servers Are Booted

You can specify the sequence of servers to be booted with the SEQUENCE parameter, which specifies a number in the range of 1 to 10,000. A server given a smaller SEQUENCE value is booted before a server with a larger value. If no servers specify SEQUENCE, servers are booted in the order of their appearance within the SERVERS section. If there is a mixture of sequenced and unsequenced servers, the sequenced servers are booted first. Servers are shut down in reverse order of the way they were booted.

The SEQUENCE parameter is optional. It may be helpful in a large application in which control over the order is important.

You can boot multiple servers using the MIN parameter, which is a shorthand method of booting. The servers all share the same server options. If you specify RQADDR, the servers will form an MSSQ set. The default for MIN is 1.

You specify the maximum number of servers that can be booted with the MAX parameter. The tmboot(1) command boots up to MIN servers at run time. Additional servers can be booted up to MAX. The default is MIN.

The MIN and MAX parameters are helpful in large applications to keep the size of the configuration file manageable. Allowances for MAX values must be made in the IPC resources.

Characteristics of the SEQUENCE, MIN, and MAX Parameters

The SEQUENCE, MIN, and MAX parameters have the following characteristics.

Parameter	Characteristics
SEQUENCE	It is an optional parameter with a numeric range of 1 - 10,000. Smaller values are booted before larger values. Omitted values are booted in the order that they appear in the SERVERS section. All sequenced servers are booted before any unsequenced servers.
MIN	It represents the minimum number of servers to boot during run time. If RQADDR is specified and MIN>1, an MSSQ set is created. All instances have the same server options. The range of values is 0 to 1000. The default is 1.
MAX	It represents the maximum number of servers to boot. The range of values for MAX is 0 to 1000. If MAX is not specified, the default is the value of MIN.

Identifying the Location of the Server Environment File

You use the ENVFILE parameter in the MACHINES section to specify environment settings. You can also specify the same parameter for a specific server process; the semantics are the same. If both the MACHINES section ENVFILE and the SERVERS section ENVFILE are specified, both go into effect. For any overlapping variable defined in both the MACHINES and SERVERS sections, the setting in the SERVERS section prevails.

Characteristics of the Server Environment File

The parameter that defines the server environment file has the following characteristics:

- It is an optional parameter that contains the same semantics as the ENVFILE parameter in the MACHINES section, but for one server only.
- For overlapping variables, the setting in the SERVERS section ENVFILE overrides the setting in the MACHINES section ENVFILE.

Identifying Server Queue Information

Server Queue information controls the creation and access of server message queues. On a BEA TUXEDO system, you can create multiple server single queue (MSSQ) sets using the RQADDR parameter. For any given server, you can set this parameter to an alphanumeric value. Those servers that offer the same set of services can consolidate their services under one message queue, providing automatic load balancing. You can do this by specifying the same value for all members of the MSSQ set.

MSSQ Example

The MSSQ set is similar to a situation at a bank. If you have four tellers, one line may be formed and everyone is assured of the most equitable wait in line. Understandably, the loan teller is not included because some people do not want loans on a given day. Similarly, MSSQ sets are not allowed if the participant servers offer different services from one another.

The RQPERM parameter allows you to specify the permissions of server request queues, along the lines of the UNIX system convention (for example, 0666). This allows services to control access to the request queue.

If the service routines within an MSSQ server perform service requests, they must receive replies to their requests on a reply queue. This is done by specifying REPLYQ=Y. By default, REPLYQ is set to N. If REPLYQ is set to Y, you can also assign permissions to it with the RPPERM parameter.

Characteristics of the RQADDR, RQPERM, REPLYQ, and RPPERM Parameters

The RQADDR, RQPERM, REPLYQ, and RPPERM parameters have the following characteristics.

Parameter	Characteristics
RQADDR	It is an alphanumeric value that allows MSSQ sets to be created. The value is the same for all members of an MSSQ set. All members of an MSSQ set must offer the same set of services.
RQPERM	Represents the permissions on a request queue. If no parameter is specified, the permissions of the Bulletin Board, as specified by PERM in the RESOURCES section, is used. If no value is specified there, the default of 0666 is used. This opens your application to possible use by any login on the system.
REPLYQ	Specifies whether a reply queue, separate from the request queue, is to be set up for this server. If only one server is using the request queue, replies can be picked up from the request queue without causing problems. On a BEA TUXEDO system, if the server is a member of an MSSQ set and contains services programmed to receive reply messages, REPLYQ should be set to Y so that an individual reply queue is created for this server. If not, the reply is sent to the request queue shared by all servers of the MSSQ set, and there is no way of assuring that it will be picked up by the server that is waiting for it.
RPPERM	Assigns permissions to the reply queue. This parameter is useful only when REPLYQ=Y. If requests and replies are read from the same queue, only RQPERM is needed; RPPERM is ignored.

Defining Server Restart Information

A properly debugged server should not terminate on its own. By default, servers that do terminate while the application is booted will not be restarted by the BEA TUXEDO system. You can set the RESTART parameter to Y if you want the server to restart. The RCMD, MAXGEN, and GRACE parameters are relevant to a server if RESTART=Y.

The RCMD parameter specifies a command to be performed in parallel with restarting a server. This command must be an executable file. The option allows you to take some action when a server is being restarted. For example, mail could be sent to the developer of the server or to someone who is auditing such activity.

The MAXGEN parameter represents the total number of *lives* to which a server is entitled within the period specified by GRACE. The server can then be restarted MAXGEN-1 times during GRACE seconds. If GRACE is set to zero, there is no limit on server restarts. MAXGEN defaults to 1 and may not exceed 256. GRACE must be greater than or equal to zero and must not exceed 2,147,483,647 (2^{31} - 1).

Note: A fully debugged server should not need to be restarted. The RESTART and associated parameters should have different settings during the testing phase than they do during production.

Characteristics of the RESTART, RCMD, MAXGEN, and GRACE Parameters

The RESTART, RCMD, MAXGEN, and GRACE parameters have the following characteristics.

Parameter	Characteristics
RESTART	A setting of Y enables a server to restart. The default is N.
RCMD	Determines if the executable file is executed at restart time. Allows you to take an action when a server is restarted.
MAXGEN	Represents the maximum number of server lives in a specific interval. It defaults to 1; the maximum is 256.

Parameter	Characteristics
GRACE	Represents the interval used by MAXGEN. Zero represents unlimited restart. It must be between 0 and 2147,483,647 (2^{31} - 1). The default is 24 hours.

Specifying a Server as Conversational

If a server is a conversational server (that is, it establishes a connection with a client), the CONV parameter is required and must be set to Y. The default is N, indicating that the server will not be part of a conversation.

Characteristics of the CONV Parameter

The CONV parameter has the following characteristics:

- A Y value indicates a server is conversational; an N value indicates a server is not conversational.
- A Y value is required if the server is to receive conversational requests.
- The default is N.

Defining Server Access to Shared Memory

The SYSTEM_ACCESS parameter determines if the server process may attach to shared memory and thus have access to internal tables outside of system code. During application development, we recommend that such access be denied (PROTECTED). When the application is fully tested, you can change it to FASTPATH to yield better performance.

This parameter overrides the value specified in the RESOURCES section unless the NO_OVERRIDE value was specified. In this case, the parameter is ignored. The NO_OVERRIDE value may not be used in this section.

Characteristics of the SYSTEM_ACCESS Parameter

The SYSTEM_ACCESS parameter has the following characteristics:

- A value of PROTECTED indicates that the server may not attach to shared memory outside of the system code.
- A value of FASTPATH indicates that the server will attach to shared memory at all times.
- If NO_OVERRIDE is specified in the RESOURCES section, this parameter is ignored.
- The default is the RESOURCES value.

Configuring Services

Identifying BEA TUXEDO Services in the SERVICES Section

You indicate specific information about BEA TUXEDO services in your application in the SERVICES section of the configuration file. Such information, for nontransactional, nondistributed applications, is relatively simple. The SERVICES section includes the following types of information:

- Load balancing information (SRVGRP)
- Assignment of priorities to services
- Different service parameters for different server groups
- Buffer type checking information (BUFTYPE)

Sample SERVICES Section

The following example provides a sample SERVICES section of a configuration file.

```
SERVICES
#
DEFAULT:  LOAD=50 PRIO=50
RINGUP    BUFTYPE="VIEW:ringup"
```

In this example, the default load and priority of a service are 50; the one service declared is a RINGUP service that accepts a ringup VIEW as its required buffer type.

Enabling Load Balancing

If you set the RESOURCES section parameter LDBAL to Y, server load balancing occurs. A LOAD factor is assigned to each service performed, which keeps track of the total load of services that each server has performed. Each service request is routed to the server with the smallest total load. The routing of that request causes the server's total to be increased by the LOAD factor of the service requested.

Load information is stored only on the site originating the service request. It would be inefficient for the BEA TUXEDO system to attempt to constantly propagate load information to all sites in a distributed application. When performing load balancing in such an environment, each site knows only about the load it originated and performs load balancing accordingly. This means that each site has different load statistics for a given server (or queue). The server perceived as being the least busy differs across sites.

When load balancing is not activated, and multiple servers offer the same service, the first available queue receives the request.

Characteristics of the LDBAL Parameter

The LDBAL parameter has the following characteristics:

- Load balancing is used if the RESOURCES LDBAL parameter is set to Y.
- The load factor is added to a server's total load.
- The load is relative to other services.

Controlling the Flow of Data by Service Priority

You can exert significant control over the flow of data in an application by assigning service priorities using the PRIO parameter. For instance, Server 1 offers Services A, B, and C. Services A and B have a priority of 50 and Service C has a priority of 70. A service requested for C will always be dequeued before a request for A or B. Requests for A and B are dequeued equally with respect to one another. The system dequeues every tenth request in FIFO order to prevent a message from waiting indefinitely on the queue.

Note: A priority can also be changed dynamically with the tpsprio()call.

Characteristics of the PRIO Parameter

The PRIO parameter has the following characteristics:

- It determines the priority of a service on the server's queue.
- The highest assigned priority gets first preference.
- Every tenth request is dequeued FIFO.

Specifying Different Service Parameters for Different Server Groups

You can specify different load, priority, or other service-specific parameters for different server groups. To do this, you should repeat the service's entry for each group with different values for the SRVGRP parameter.

Sample SERVICES Section

The following example provides a sample SERVICES section of a configuration file.

```
SERVICES
A  SRVGRP=GRP1 PRIO=50 LOAD=60
A  SRVGRP=GRP2  PRIO=70 LOAD=30
```

This example assigns different service-specific parameters to two different server groups. Service A assigns a priority of 50, and a load of 60 in server group GRP1; and a priority of 70, and a load of 30 in server group GRP2.

Specifying a List of Allowable Buffer Types for a Service

With the BUFTYPE parameter, you can tune a service to check buffer types independently of the actual service code. If you set this parameter, it specifies a list of allowable buffer types for a service. Its syntax is a semicolon-separated list of types in the format type[:subtype[,subtype]]. The subtype may be set to * to allow all subtypes.

A service can have BUFTYPE set to ALL, which means that this service accepts all buffer types. If this parameter is not specified, the default is ALL.

Examples of the BUFTYPE Parameter

The BUFTYPE parameter has the following characteristics.

BUFTYPE Example	Meaning
BUFTYPE="FML;VIEW:aud,aud2"	FML and VIEW with subtypes aud and aud2 buffer types are allowed.
BUFTYPE="FML;VIEW:*"	All FML and VIEW buffer types are allowed.
BUFTYPE=ALL	All buffer types are allowed (the default).

Service Timeout Errors

Sometimes an unexpected system error occurs that freezes a service or causes it to run out of control while it is processing a request. Though desirable to remove these processes, it is difficult to detect them or their origin. A BEA TUXEDO mechanism terminates these processes based on the time it takes for a service to process a request.

You can configure the time limit by defining the SVCTIMEOUT parameter in the UBBCONFIG file or by dynamically changing the TA_SVCTIMEOUT attribute in TM_MIB. By default, the BEA TUXEDO system does not terminate any service process, so you must set the SVCTIMEOUT value (in seconds) to activate this feature. We recommend that you set the value of SVCTIMEOUT or TA_SVCTIMEOUT to at least two to three times the number of seconds it takes for your longest running service to process a request. Setting the service timeout this way guarantees that the BEA TUXEDO system removes only frozen processes. In essence, the service timeout acts like a scavenger for frozen or out of control application servers.

This section describes the causes and results of Service Timeout errors, along with an explanation of how the BEA TUXEDO system reports such errors. Advice about how to handle errors is also provided.

Situations that Cause a Service Timeout

Service timeouts occur in the following situations:

- A service timeout occurs due to SVCTIMEOUT generally when an unknown or unexpected system error freezes the server process, or when an application coding error causes an infinite loop or recursion.
- The server process exits abnormally and dumps core, generally because of an application coding error.
- Bad parameters are passed to tpreturn, tpforward, TPRETURN, or TPFORWARD (application coding error).
- There are outstanding replies when tpreturn, tpforward, TPRETURN, or TPFORWARD is called (application coding error).
- There are open subordinate connections when tpreturn, tpforward, TPRETURN, or TPFORWARD is called (application coding error).
- The caller's transaction has been marked “abort-only.”

What Happens When a Timeout Occurs

When a timeout occurs, the BEA TUXEDO system terminates the server process running the frozen service (but not its child processes, if any). It then returns a TPESVCERR error, indicating that an unknown problem occurred during processing. In a conversational service, the conversation event TPEV_SVCERR is returned.

How a Service Timeout Is Reported

Before Release 6.4 of the BEA TUXEDO system, only the error code TPESVCERR was returned when a service timeout occurred. In Release 6.4, however, three new features of Service Timeout reporting were introduced:

- TPED_SVCTIMEOUT—timeout error detail that provides more information than tpstrerror(3c)
- .SysServiceTimeout—a system event
- ULOG information about .SysServiceTimeout

Because the SVCTIMEOUT value is configurable, it is important for clients to be able to easily distinguish a TPESVCERR that may be caused by exceeding the value set for SVCTIMEOUT, from those caused by other situations. Although the ULOG contains this information, it is difficult for client programs to extract it. To differentiate the service timeout TPESVCERR from others, a call to tperrordetail(3c) routine (after a TPESVCERR has been detected) yields TPED_SVCTIMEOUT when a service timeout occurs.

In addition, a system event, .SysServiceTimeout, is generated when a service timeout occurs. When the .SysServiceTimeout event occurrs, it is reflected in the ULOG in the following way:

```
ERROR: .SysServiceTimeout: %TA_SERVERNAME, group %TA_SRVGRP, id
%TA_SRVID server killed due to a service timeout
```

How to Control a Service Timeout

- Application administrators may control the service timeout by changing the SVCTIMEOUT parameter in the SERVICES section of the UBBCONFIG file, or by modifying the TA_SVCTIMEOUT attribute of the T_SERVER or T_SERVICE class of TM_MIB. They may also monitor the ULOG file for service timeout activity.
- In addition to monitoring the ULOG file for service timeout activity, application operators can subscribe to the .SysServiceTimeout event, which alerts them when a service timeout occurs.
- Application programmers can use the tperrordetail(3c) and tpstrerrordetail(3c) APIs, and the TPED_SVCTIMEOUT error detail code. They may want to add one or more subscriptions to the .SysServiceTimeout system event, which is generated when a service timeout occurs.

Configuring Routing

The ROUTING section of UBBCONFIG allows the full definition of the routing criteria named in the SERVICES section (for BEA TUXEDO data-dependent routing).

For more information about using these parameters to implement factory-based routing or data-dependent routing, see Chapter 5, "Distributing Applications."

Defining Routing Criteria in the ROUTING Section

The following table identifies the information required for an entry in the ROUTING section.

Parameter	Characteristics
criterion_name	This is a string value with a maximum length of 15 characters. For BEA TUXEDO data-dependent routing, it is the routing criteria name that you specified as the ROUTING parameter in the SERVICES section.
FIELD	The name of the buffer field on which the routing is to be done. In BEA TUXEDO data-dependent routing, this value is the name of an FML field (for FML buffers) or VIEW structure element name (for VIEW buffers). This is the actual field that is used to route the message. It may be of any data type.
FIELDTYPE	Specifies the type of the routing field. Field types supported are: SHORT $-2^{15} \ldots 2^{15} - 1$ (16 bit) LONG $-2^{31} \ldots 2^{31} - 1$ (32 bit) FLOAT IEEE single-precision floating point numbers DOUBLE IEEE double-precision numbers CHAR A single character; an 8-bit quantity STRING A null-terminated character array

Parameter	Characteristics
RANGES	The limits assigned to each criteria. The syntax is RANGES="[*val1*[-*val2*]:*group1*] [,*val3*[-*val4*]:*group2*]...[,*:*groupn*]" *val1* is a value; *val1*-*val2* is a range; *groupn* is either a group name or the wildcard character (*) denoting all group names. *val* can be a number, a quote-enclosed (') string, or MIN or MAX. A wildcard in place of a range means *Catch-All*, that is, *No Limit* to the number of ranges.
BUFTYPE	For BEA TUXEDO data-dependent routing, the buffer type allowed. This parameter is similar to its SERVICES section counterpart in that it restricts the routing criteria to a specific set of buffer types and subtypes. Only FML and VIEW types can be used for routing. The syntax is the same as the syntax in the SERVICES section, a semicolon-separated list of *type*:*subtype*[,*subtype*]. You can specify only one type for routing criteria. This restriction limits the number of buffer types allowed in routing services.

Specifying Range Criteria in the ROUTING Section

The RANGES parameter provides the actual mapping between field value and group name. Its syntax is as follows.

RANGES="[*val1*[-*val2*]:*group1*] [,*val3*[-*val4*]:*group2*]...[,*:*groupn*]"

where *val1*, *val2*, and so on, are values of that field and *groupn* may be either a group name or the wildcard character (*) denoting that any group may be selected. The * character occupying the place of *val* at the end is a *Catch-All* choice, that is, it specifies what to do if the data does not fall into any range that has been specified. *val1* is a number when it appears in numeric fields, and is enclosed in single quotes (') when it appears in STRING or CARRAY fields. The field values MIN and MAX (not enclosed in quotes) are provided to allow *machine minimum and maximum* data values to be expressed. There is no limit to the number of ranges that may be specified, but all routing information is stored in shared memory and incurs a cost there.

Note: Overlapping ranges are allowed, but values that belong to both ranges map to the first group. For example, if RANGES is specified as RANGES="0-5:Group1,3-5:Group2", then a range value of 4 routes to Group1.

Configuring Network Information

You can configure network groups in the NETGROUPS and NETWORK sections of an application's UBBCONFIG file.

Note: For specific information about the tasks involved, see Chapter 6, "Building Networked Applications."

Specifying Information in the NETGROUPS Section

The NETGROUPS section of the UBBCONFIG file describes the network groups available to an application in a LAN environment. There is no limit to the number of network groups to which a pair of machines may be assigned. The method of communication to be used by members of different networks in a network group is determined by the priority mechanism (NETPRIO).

Every LMID must be a member of the default network group (DEFAULTNET). The network group number for this group (that is, the value of NETGRPNO) must be zero. However, you can modify the default priority of DEFAULTNET. Networks defined in releases of the BEA TUXEDO system prior to Release 6.4 are assigned to the DEFAULTNET network group.

Specifying the NETGRPNO, NETPRIO, NETGROUP, MAXNETGROUPS, and MAXPENDINGBYTES Parameters

The NETGRPNO, NETPRIO, NETGROUP, MAXNETGROUPS, and MAXPENDINGBYTES parameters have the following characteristics.

Parameter	Required/Optional	Description
NETGRPNO = *numeric_value*	Required	A unique network group number that you must assign to use in failover and failback situations. If this entry describes DEFAULTNET, the numeric value must be zero. Communication with pre-v6.4 releases of the BEA TUXEDO system use only DEFAULTNET.

Parameter	Required/Optional	Description
NETPRIO = *numeric_value*	Optional	The priority of this network group. A pair of machines in multiple network groups of the same priority communicates simultaneously over the circuits with the highest priority. If all network circuits of a certain priority are torn down by the administrator or by network conditions, the next lowest priority circuit is used. Retries of the higher priority circuits are attempted. This value must be greater than zero and less than 8,192. If not specified, the default is 100. **Note:** In v6.4 of the BEA TUXEDO system, parallel data circuits are prioritized by the network group number (NETGRPNO) parameter within the priority group number. In future releases, a different algorithm/mechanism may be used to prioritize parallel data circuits.
NETGROUP = *string_value*	Required	The network group associated with this network entry. All network entries with a NETGROUP parameter of DEFAULTNET are represented in the T_MACHINE class, while NETWORK entries associated with any other NETGROUP are represented in the T_NETMAP class to interoperate with previous releases.
MAXNETGROUPS	Optional	Allows more netgroups to be defined than the default (8).
MAXPENDINGBYTES	Optional	MAXPENDINGBYTES enables you to configure the maximum size of data waiting for the network to become available. There are two situations when MAXPENDINGBYTES is significant: ♦ When the BRIDGE requests an asynchronous connection ♦ When all circuits are busy You can configure larger computers that have more memory and disk space, with larger MAXPENDINGBYTES, and smaller computers with smaller MAXPENDINGBYTES. Because connections were always synchronous in v6.3 of the BEA TUXEDO system, situation (1) above did not apply.

Sample Network Groups Configuration

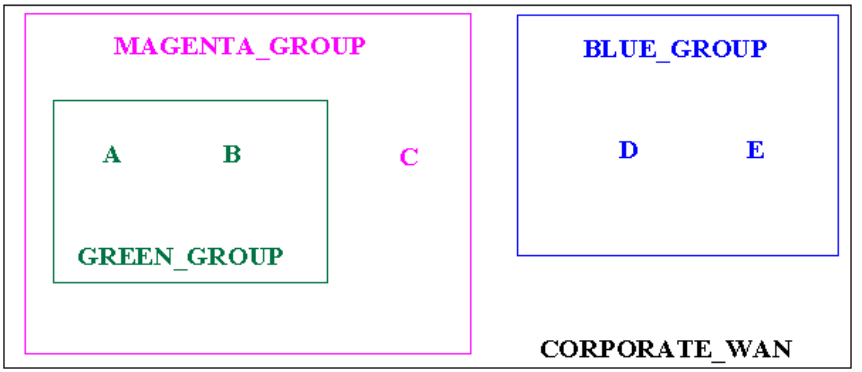
You can associate network addresses with a network group. The following example illustrates how this capability may be useful.

First State Bank has a network of five machines (A-E). Each machine belongs to two or three of four netgroups that you have defined in the following way:

- DEFAULTNET (the default network, which is the corporate WAN)
- MAGENTA_GROUP (a LAN)
- BLUE_GROUP (a LAN)
- GREEN_GROUP (a private LAN that provides high-speed, fiber, point-to-point links between member machines)

Every machine belongs to DEFAULTNET (the corporate WAN). In addition, each machine is associated with either the MAGENTA_GROUP or the BLUE_GROUP. Finally, some machines in the MAGENTA_GROUP LAN also belong to the private GREEN_GROUP. Figure 3-1 shows machines A through E in the networks for which they have network addresses.

Figure 3-1 Example of a Network Grouping



The following table shows you which machines have addresses for which groups.

Machine	Has Addresses for These Groups
A and B	DEFAULTNET (the corporate WAN) MAGENTA_GROUP (LAN) GREEN_GROUP (LAN)
C	DEFAULTNET (the corporate WAN) MAGENTA_GROUP (LAN)

Machine	Has Addresses for These Groups
D and E	DEFAULTNET (the corporate WAN) BLUE_GROUP (LAN)

Note: Because the local area networks are not routed among the locations, machine D (in the BLUE_GROUP LAN) may contact machine A (in the GREEN_GROUP LAN) only by using the single address they have in common: the corporate WAN network address.

Configuring the UBBCONFIG File with Netgroups

To set up the configuration just described, the First State Bank system administrator defines each group in the NETGROUPS section of the UBBCONFIG file, as shown in Listing 3-1.

Listing 3-1 Sample NETGROUPS and NETWORK Sections

```
NETGROUPS

DEFAULTNET    NETGRPNO = 0          NETPRIO = 100 #default
BLUE_GROUP    NETGRPNO = 9          NETPRIO = 100
MAGENTA_GROUP NETGRPNO = 125        NETPRIO = 200
GREEN_GROUP   NETGRPNO = 13         NETPRIO = 200

NETWORK

A       NETGROUP=DEFAULTNET         NADDR="//A_CORPORATE:5723”
A       NETGROUP=MAGENTA_GROUP      NADDR="//A_MAGENTA:5724"
A       NETGROUP=GREEN_GROUP        NADDR="//A_GREEN:5725"

B       NETGROUP=DEFAULTNET         NADDR="//B_CORPORATE:5723"
B       NETGROUP=MAGENTA_GROUP      NADDR="//B_MAGENTA:5724"
B       NETGROUP=GREEN_GROUP        NADDR="//B_GREEN:5725"

C       NETGROUP=DEFAULTNET         NADDR="//C_CORPORATE:5723"
C       NETGROUP=MAGENTA_GROUP      NADDR="//C_MAGENTA:5724"

D       NETGROUP=DEFAULTNET         NADDR="//D_CORPORATE:5723"
D       NETGROUP=BLUE_GROUP         NADDR="//D_BLUE:5726"
E       NETGROUP=DEFAULTNET         NADDR="//E_CORPORATE:5723"
E       NETGROUP=BLUE_GROUP         NADDR="//E_BLUE:5726"
```

4 Starting and Shutting Down Applications

This chapter describes how to ensure that your application is ready to be booted, how to boot it, and how to shut it down. There are also procedures that help you resolve some problems you may run into when you first begin to start and shut down your BEA TUXEDO system application.

Topics covered in this chapter are:

- Starting Applications
- Shutting Down Applications
- Using tmshutdown
- Clearing Common Problems

Starting Applications

Before you issue the command to start an application, make sure you have completed all of the tasks in the prerequisite checklist, described in the following section.

Prerequisite Checklist

Complete the following tasks before booting your application.

Table 4-1 Preliminary Tasks

Task	Procedure
1	Set Environment Variables
2	Create TUXCONFIG
3	Propagate the BEA TUXEDO Software
4	Create a TLOG Device
5	Start tlisten at All Sites (MP environments)

Set Environment Variables

Set and export variables TUXDIR, TUXCONFIG, PATH, and LD_LIBRARY_PATH so that they are in your environment as the system is booted. For example:

```
$TUXDIR=<path_name_of_TUX_home_directory>
$TUXCONFIG=<path_name_of_TUXCONFIG>
$PATH=$PATH:$TUXDIR/bin
$LD_LIBRARY_PATH=<path_name_of_shared_libraries>
export TUXDIR TUXCONFIG PATH LD_LIBRARY_PATH
```

Replace the substitutable strings (shown in *italic*) with the path names appropriate for your installation. Other environment variables can be specified in an ENVFILE. (See ubbconfig(5).)

On AIX, LIBPATH must be set instead of LD_LIBRARY_PATH. On HPUX, SHLIB_PATH must be set instead of LD_LIBRARY_PATH. On NT, no variable for shared libraries is required.

Create TUXCONFIG

TUXCONFIG is a binary version of the text configuration file. The tmloadcf(1) command converts the configuration file to binary form and writes it to the location given in the TUXCONFIG variable.

Enter the command as follows:

```
$ tmloadcf [-n] [-y] [-c] [-b blocks] {ubbconfig_file | - }
```

Note: You must be logged in on the MASTER machine and have the effective user ID of the owner of the configuration file.

You may want to consider the following options before you create TUXCONFIG:

- -c Calculate minimum IPC resources of the configuration.
- -n Do a syntax check only; report errors.

The -c and -n options do not load the TUXCONFIG file.

UNIX IPC resources are platform specific. If you use the -c option, check the platform data sheet for your platform in Appendix A of the *BEA TUXEDO Installation Guide* to judge whether you need to make some changes. If you do want to change IPC resources, check the administration guide for your platform.

If the -n option indicates syntax errors in the configuration file, correct the errors before you proceed.

For *ubbconfig_file*, substitute the fully qualified name of your configuration file.

When you are ready to create the TUXCONFIG file, you may want to consider the following options:

- -b Limit the size of the TUXCONFIG file.
- -y Overwrite the existing TUXCONFIG file without asking.

The -b option takes an argument that limits the number of blocks used to store the TUXCONFIG file. Use it if you are installing TUXCONFIG on a raw disk device that has not been initialized. The option is not recommended if TUXCONFIG will be stored in a regular UNIX system file.

Propagate the BEA TUXEDO Software

TUXCONFIG is automatically propagated to all machines in your configuration by the BEA TUXEDO system software when you run tmboot(1), but there are other files that need to be present on all machines. Table 4-2 is a list of files and directories needed for a networked application.

Table 4-2 Propagating Directories or Files

Directory or File	Comments
APPDIR	The directory named in the APPDIR variable must be created on each node. It is helpful if this directory has the same path name on all nodes.
Executables	Application servers must be built once for each platform type, and must be manually propagated to other machines of that platform (that is, BEA TUXEDO does not do this automatically). Store the executables in APPDIR, or in a directory pointed to in a PATH variable in ENVFILES in the MACHINES section.
Field tables VIEW files	Depending on the requirements of application services (that is, if FML or VIEWS buffer types are used), field tables and VIEW description files must be manually propagated to machines where they are used, then recompiled. Use mkfldhdr(1) to make a header file out of a field table file; use viewc(1) to compile a VIEW file. The FML field tables and VIEW description files should be available through the environment variables FLDTBLDIR, FIELDTBLS, VIEWDIR, and VIEWFILES, or their 32-bit equivalents.
tlisten	The tlisten process must be started on each machine of a networked BEA TUXEDO application. See tlisten(1). The tlisten process must be started before the application is booted. **Note:** You must define TUXDIR, TUXCONFIG, APPDIR, and other relevant environment variables before starting tlisten.

Create a TLOG Device

To create distributed transaction processing, you must have a global transaction log (TLOG) on each participating machine. To define a TLOG, you must set several parameters in the MACHINES section of the configuration file. You must create the device list entry for the TLOGDEVICE on each machine where a TLOG is needed. It can be done before or after TUXCONFIG has been loaded, but must be done before the system is booted.

To create an entry in the UDL for the TLOG device:

1. On the master node with the application inactive, invoke `tmadmin -c`. The `-c` option brings `tmadmin` up in configuration mode.

2. Enter the command:

   `crdl -z config -b blocks`

   where `-z config` specifies the full path name for the device where the UDL should be created (that is, where the `TLOG` will reside), and `-b blocks` specifies the number of blocks to be allocated on the device. The value of *config* should match the value of the `TLOGDEVICE` parameter in the `MACHINES` section. If *config* is not specified, it defaults to the value of the variable `FSCONFIG` (which points to the application's databases).

3. Repeat Steps 1 and 2 on each node of your application that is expected to be involved with global transactions.

If the `TLOGDEVICE` is mirrored between two machines, Step 3 is not required on the paired machine. To be recoverable, the `TLOG` should preferably be on a device that can be mirrored. Because the `TLOG` is too small (typically,100 pages) to warrant having a whole disk partition to itself, the expectation is that the `TLOG` will be stored on the same raw disk slice as the application's databases. `FSCONFIG` is the environment variable used by the system. Therefore, the `tmadmin crdl` command defaults to `FSCONFIG`.

Start tlisten at All Sites

To have a networked application, a listener process must be running on each machine.

This step is required if you are running the application on more than one machine, as established by the `MODEL MP` parameter in the `RESOURCES` section of the application's `UBBCONFIG` file.

Note: You must define `TUXDIR`, `TUXCONFIG`, `APPDIR`, and other relevant environment variables before starting `tlisten`.

The port on which the process is listening must be the same as the port specified for `NLSADDR` in the `NETWORK` section of the configuration file. On each machine, use the `tlisten`(1) command, as follows:

```
tlisten [ -d device ] -l nlsaddr [-u {uid-# | uid-name}] [ -z bits\
] [ -Z bits ]
```

The options to this command are as follows.

`-d` *`device`*

The full path name of the network device. For the BEA TUXEDO system version 6.4 or above, this option is not required. For earlier versions of the BEA TUXEDO system (v6.3 and lower), some network providers (TCP/IP, for example) require this information.

`-l` *`nlsaddr`*

The network address as specified for this machine (*`LMID`*) in the `NETWORK` section of the configuration file. *`nlsaddr`* can be specified in any of the formats that can be specified for the `NADDR` parameter in the same section. If the address has the form `0x`*`hex-digits`* or `\\x`*`hex-digits`*, it must contain an even number of valid hexadecimal digits.

TCP/IP addresses may be in the //#.#.#.#:*`port`* format or the *`//machine-name`*`:`*`port`* format.

`tmloadcf`(1) prints an error if *`nlsaddr`* is missing from any entry but the entry for the `MASTER LMID`, for which it prints a warning. However, if *`nlsaddr`* is missing from the `MASTER LMID` entry, `tmadmin`(1) is not able to run in administrator mode on remote machines; it will be limited to read-only operations. This also means that the backup site is unable to reboot the master site after failure.

`-u` *`uid-#`* or *`uid-name`*

Can be used to have the `tlisten` process run as the indicated user. This option is required if the `tlisten`(1) command is run by `root` on a remote machine.

`-z` [*`bits`*]

When establishing a network link between a BEA TUXEDO administrative process and `tlisten`, require at least this minimum level of encryption. Zero (0) means no encryption, while 40 and 128 specify the length (in bits) of the encryption key. If this minimum level of encryption cannot be met, link establishment fails. The default is zero.

`-Z` [*`bits`*]

When establishing a network link between a BEA TUXEDO administrative process and `tlisten`, allow encryption up to this level. Zero (0) means no encryption, while 40 and 128 specify the length (in bits) of the encryption key. The default is 128. The `-z` and `-Z` options are available only if either the

International or Domestic BEA TUXEDO Security Add-on Package is installed.

Booting the Application

Once the preliminaries have been successfully completed, you are ready to bring up the application, as described in the following section.

Using tmboot

The user who created the TUXCONFIG file is considered the administrator of the application. Only this user can execute tmboot(1).

The application is normally booted from the machine designated as the MASTER in the RESOURCES section of the configuration file or the BACKUP MASTER acting as the MASTER. The -b option allows some deviation from this rule.

For tmboot(1) to find executables, the BEA TUXEDO system processes, such as the BBL, must be located in $TUXDIR/bin. Application servers should be in APPDIR as specified in the configuration file.

When booting application servers, tmboot(1) uses the CLOPT, SEQUENCE, SRVGRP, SRVID, and MIN parameters from the configuration file.

Application servers are booted in the order specified by their SEQUENCE parameter, if SEQUENCE is used. If SEQUENCE is not specified, servers are booted in the order in which they appear in the configuration file.

The command line should look something like the following (this is a greatly simplified example):

```
$ tmboot  [-g grpname] [-o sequence] [-S] [-A] [-y]
```

The options shown have the meanings listed in Table 4-3.

Table 4-3 tmboot Options

Option	Meaning
-g *grpname*	Boot all TMS and application servers in groups using this *grpname* parameter.

Table 4-3 tmboot Options

Option	Meaning
`-o sequence`	Boot all servers in the order shown in their SEQUENCE parameter.
`-s server-name`	Boot individual servers.
`-S`	Boot all servers listed in the SERVERS section.
`-A`	Boot all administrative servers for machines listed in the MACHINES section. This ensures that the DBBL, BBL, and BRIDGE processes are started in the proper order.
`-y`	Provides an automatic "yes" response to the prompt that asks if all administrative and application servers should be booted. This prompt appears only if no options that limit the scope of the command (`-g grpname`, for example) are specified.

There are many more options than are shown in the example. For a complete listing of the tmboot options, see the tmboot(1) reference page in the *BEA TUXEDO Reference Manual*.

Default Boot Sequence for a Small Application

The following scenario shows the order of processing when booting a two-machine configuration. This is not a procedure that you have to initiate; it is what the software does if you enter the following command.

```
prompt> tmboot -y
```

1. tmboot comes up on the MASTER site and processes the TUXCONFIG file, creating a "to do" list for itself.
2. tmboot boots the DBBL on the MASTER machine.
3. tmboot boots the BBL on the MASTER machine, which creates the shared memory Bulletin Board.
4. tmboot boots the BRIDGE on the MASTER machine, which establishes its listening address.

5. tmboot establishes a connection with the remote site tlisten process and propagates the TUXCONFIG file to the remote site if it is not already there.
6. tmboot boots a BSBRIDGE. The BSBRIDGE establishes a connection back to the BRIDGE process on the MASTER machine.
7. tmboot boots a BBL. The BBL creates the local Bulletin Board and sends a request to the DBBL via the BSBRIDGE, to register it as a server. The reply from the DBBL contains a complete copy of the MASTER Bulletin Board and the BBL updates its Bulletin Board with the information.
8. tmboot boots a BRIDGE. The BRIDGE establishes a connection back to the BRIDGE on the MASTER site, at which point it tells the BSBRIDGE to go away since it is no longer needed.
9. tmboot can then boot the application servers.
10. tmboot boots the local application servers first, then boots the remote application servers.
11. tmboot is now finished processing and leaves gracefully.

Optimized Boot Sequence for Large Applications

The boot sequence recommended for larger applications is shown here. This sequence boots entire machines in a single step rather than taking all the steps used to boot two machines in the default sequence. The optimized sequence can be explained as follows.

1. Boot the entire MASTER machine first. This is done by using the -M -l combination.
2. Boot the entire remote machine. This is done by using the -B -l combination.

This method is faster because the number of system messages is far smaller. In large applications (more than 50 machines), this method generally reduces boot time by 50%.

In a configuration with a slow network, boot time can be improved by first booting the machines that have higher speed connections to the MASTER machine.

Shutting Down Applications

The tmshutdown(1) command is provided for shutting down an application.

The rules for use of this command are very similar to those of tmboot(1).

Administrators face several problems when shutting down an application. The two most common situations are discussed in the last section of this chapter.

The tmshutdown(1) command is the inverse of the tmboot(1) command. It shuts down part or all of the BEA TUXEDO system application.

When the entire application is shut down, tmshutdown(1) removes the IPC resources associated with the BEA TUXEDO system.

The options used by tmboot(1) for partial booting (-A, -g, -I, -S, -s, -l, -M, -B) are supported in tmshutdown(1). Note that the -b option, which allows tmboot to be used from a non-MASTER machine, is not supported for tmshutdown; the tmshutdown command must be entered from the MASTER (or BACKUP MASTER) machine.

If servers are to be migrated, the -R option must be used. This shuts the servers down without removing the Bulletin Board entries.

If a node is partitioned, tmshutdown(1) with the -P *lmid* option can be run on the partitioned machine to shut down the servers on that machine.

tmshutdown(1) will not shut down the administrative server BBL on a machine that has clients attached. The -c option can be used to override this feature. This option is needed when a machine must be brought down immediately and the administrator has been unable to contact the clients.

The -w *delay* option can be used to force a hard shutdown after *delay* seconds. This option suspends all servers immediately so that additional work cannot be queued. The value of *delay* should allow time for requests already queued to be serviced. After *delay* seconds, a SIGKILL signal is sent to the servers. This option enables the administrator to shut down servers that are looping or blocked in application code.

Always check the details of a command such as tmshutdown(1) in the *BEA TUXEDO Reference Manual* to make sure you have the most recent information on available options.

Using tmshutdown

The user creating the TUXCONFIG file is considered to be the administrator of the application. Only this user can execute tmshutdown(1).

The application can be shut down only from the machine designated as MASTER in the configuration file. When the BACKUP MASTER is acting as the MASTER, it is considered to be the MASTER for shutdown purposes.

The only exception to this rule is a partitioned machine. By using the -p option, the administrator can run the command from the partitioned machine to shut down the application at that site.

Application servers are shut down in the reverse order specified by their SEQUENCE parameter, or by reverse order of their appearance in the configuration file. If some servers have SEQUENCE numbers and others do not, the unnumbered servers are the first to be shut down, followed by the application servers with SEQUENCE numbers (in reverse order). Finally, administrative servers are shut down.

When an application is shut down, all the IPC resources allocated by the BEA TUXEDO system are removed. Note that tmshutdown does not remove IPC resources allocated by the DBMS.

Clearing Common Problems

There are several problems that you may encounter when first working with the BEA TUXEDO system. This section lists and discusses some of the common startup and shutdown problems.

Common Startup Problems

This section describes a few problems you may encounter when starting your first BEA TUXEDO system application. Evidence that a problem exists comes in the form of a message to ULOG, a message to your screen, or both, as follows:

- TLOG Not Created
- Server Not Built Correctly
- Incorrect OPENINFO String
- Unable to Propagate the BEA TUXEDO System

TLOG Not Created

If the transaction log (TLOG) fails to get created, a message is sent to the user log (ULOG).

The message includes the message catalog name, the unique message number within the catalog, and the reason for the failure. For example, one such message is:

```
CMDTUX 142 ERROR: Identifier for TLOGNAME must be <= len characters in length
```

TLOGNAME cannot be more than 30 characters long.

Problems of this kind can be avoided if you check the syntax of the TLOG parameters in the MACHINES section of the UBBCONFIG file (see ubbconfig(5)).

Following are other reasons why the TLOG might not get created:

- The person entering the command may lack the authority to do so.
- File permissions may not allow you to write to the device.
- There is not enough space to create the file.

Server Not Built Correctly

Following are two reasons a server may not start correctly:

- buildserver(1) fails
- buildserver(1) succeeds but the server comes up with the wrong services

buildserver(1) failure

An error in this area should be noticed before you attempt to boot a BEA TUXEDO system application. buildserver(1) is used to compile application code, combining the services to be offered by a server into the executable module. If the code fails to

compile, the causes can be that an incorrect compiler was specified, the needed libraries were not found, needed service modules were not found, there is a problem in the code, and so forth. Pay close attention to the error messages and consult the *BEA TUXEDO Reference Manual*.

server comes up with wrong services

Problems in this area can often be attributed to an incorrect `CLOPT` parameter for the server (`CLOPT` is an abbreviation for "command-line options"). The `CLOPT` parameter is assigned in the `SERVERS` section of the `UBBCONFIG` file. It carries command-line options that apply to a server when the server is booted. The options are defined on the `servopts`(5) reference page. Refer to this page and the `ubbconfig`(5) reference page for help on debugging the problem.

Another cause for a server coming up with the wrong services could be an incorrect specification of services when the server is built. While services are usually in a module of code that has a mnemonic name, there is no requirement that this be the case. Service *a*, for example, may actually be performed by function *x*, which could lead to an error.

Incorrect OPENINFO String

The `OPENINFO` string is specified in the `GROUPS` section of the `UBBCONFIG` file. It carries information needed by servers in the group when they try to open an application database. There is a very specific form for the information that is agreed to by vendors of XA-compliant DBMS; the information is stored in the BEA TUXEDO system file `$TUXDIR/udataobj/RM`.

Note: After changing the `OPENINFO` string, BEA recommends that you reboot the servers that use this resource manager (RM).

To clear a problem:

1. Check the *BEA TUXEDO System Message Manual* for an explanation of the error message.

   If this does not resolve the problem, go to Step 2.

2. Check the syntax of the `OPENINFO` parameter as specified in the `GROUPS` section of `ubbconfig`(5).

   If the problem persists, go to Step 3.

3. Look in $TUXDIR/udataobj/RM to see how the information for your DBMS needs to be specified.

Unable to Propagate the BEA TUXEDO System

In a networked application, there are several reasons why the system may not be able to propagate the TUXCONFIG file. The generic message is as follows:

```
cannot propagate TUXCONFIG file
```

Following are possible reasons for the failure:

- No listener on the remote machine
- Mismatched address specifications for the listener on the remote machine
- Group ID and/or the user ID are not the same on both machines
- Access (permissions) problems

Table 4-4 shows a possible solution for each propagation problem.

Table 4-4 Possible Solutions to Propagation Failure

Problem	Solution
Application fails to boot	If tlisten password security is enabled, check that the tlisten passwords match on both machines. The match is required.
Listener process not started on remote machine	Check that the TUXDIR, TUXCONFIG, APPDIR, and other relevant environment variables are set on the remote machine, before starting the listener. Then use the tlisten(1) command to start the listener.
Listener started at address different from the NLSADDR in the configuration file	Correct the listener address and rerun the tlisten(1) command.
Group ID and/or the User ID are not the same on both machines	Change the IDs to be the same or specify the correct IDs in the MACHINES section for that machine.

Table 4-4 Possible Solutions to Propagation Failure

Problem	Solution
Wrong permissions on files/directories on remote machine	Change the permissions to the appropriate values.

Common Shutdown Problems

The two most common problems encountered when shutting down applications are shown with solutions in Table 4-5.

Table 4-5 Two Common Shutdown Problems and Their Solutions

Problem	Solution
Shutting down administrative servers before application servers	The BEA TUXEDO system does not allow this action because the administrative servers are needed even after all application servers are shut down. If you want to shut down a machine, the application servers must be shut down ahead of the administrative servers. Use the `tmshutdown -l`, `-S`, `-s`, `-g`, and `-I` options before `-A`, `-M`, and `-B`.
Unable to shut down a machine with clients attached	As a rule, the BEA TUXEDO system does not allow this. However, if the client cannot be contacted, the `-c` option can be used to shut down the `BBL` while it still has clients attached. There are consequences to client applications that must be considered before taking this action. Try running `tmshutdown` with the `-w` *`delay`* option to shut down servers forcibly after *`delay`* seconds, or run `tmshutdown` with the `-c` option to shut down the `BBL`, even though it has clients attached.

CHAPTER

5 Distributing Applications

This chapter discusses the following topics:

- Why Distribute an Application?
- Using Data-dependent Routing
- Modifying and Creating the UBBCONFIG Sections for a Distributed Application
- Example of UBBCONFIG Sections in a Distributed Application
- Modifying the Domain Gateway Configuration File to Support Routing

Why Distribute an Application?

Distributing an application enables you to select which parts of an application should be grouped together logically and where these groups should run. You distribute an application by creating more than one entry in the `GROUPS` section of the `UBBCONFIG` file, and by dividing application resources or tasks among the groups. Creating groups of servers enables you to partition a very large application into its component business applications and, in turn, to partition each of these applications into logical components of manageable size and optimal location.

Benefits of a Distributed Application

- Scalability—The load an application can sustain can be increased by placing extra server processes in a group; adding machines to the application and redistributing the groups across the machines; replicating a group onto other machines within the application and using load balancing; segmenting a database and using data-dependent routing to reach the groups dealing with these separate database segments.
- Ease of development/maintainability—The separation of the business application logic into services or components that communicate through well-defined messages or interfaces allows both development and maintenance to be similarly separated and so simplified.
- Resilience—When multiple machines are in use and one fails, the remainder can continue operation. Similarly, when multiple server processes are within a group and one fails, the others are present to perform work. Finally, if a machine should break, but there are multiple machines within the application, these other machines can be used to perform the work of the application.
- Coordination of autonomous actions—If you have separate applications, you can coordinate autonomous actions among the applications. You can coordinate *autonomous actions* as a single logical *unit of work*. *Autonomous actions* are actions that involve multiple server groups and/or multiple resource manager interfaces.

Characteristics of Distributing an Application

A distributed application has the following characteristics:

- Enlarges the client and/or server model
- Establishes multiple server groups
- Enables transparent access to BEA TUXEDO services
- Allows data-dependent partitioning of data
- Enables management of multiple resources
- Supports a networked model

Using Data-dependent Routing

Data-dependent routing is a mechanism whereby a service request is routed by a client (or a server acting as a client) to a server within a specific group based on a data value contained within the buffer that is sent. Within the internal code of a service call, the BEA TUXEDO system chooses a destination server by comparing a data field with the routing criteria it finds in the Bulletin Board shared memory.

For any given service, a routing criteria identifier can be specified in the `SERVICES` section of the `UBBCONFIG` file. The routing criteria identifier, in particular, the mapping of data ranges to server groups, is specified in the `ROUTING` section.

Characteristics of Data-dependent Routing

Data-dependent routing has the following characteristics:

- The service request assigned to a server in the group is based on a data value.
- Routing uses the Bulletin Board criteria and occurs in a server call.
- The routing criteria identifier for a service is specified in the `SERVICES` section of the `UBBCONFIG` file.
- The routing criteria identifier is defined in the `ROUTING` section of the `UBBCONFIG` file.

Example: A Distributed Application

The following table illustrates how client requests are routed to servers. In this example, a banking application called `bankapp` uses data-dependent routing. For `bankapp`, there are three groups (`BANKB1`, `BANKB2`, and `BANKB3`), and two routing criteria (`Account ID` and `Branch ID`). The services `WITHDRAW`, `DEPOSIT`, and `INQUIRY` are routed using the `Account_ID` field; the services `OPEN` and `CLOSE` are routed using the `Branch_ID` field.

Server Group	Routing Criteria Used	For These Services
BANKB1	Account_ID: 10000 - 49999	WITHDRAW, DEPOSIT, and INQUIRY
	Branch_ID: 1 - 4	OPEN and CLOSE
BANKB2	Account_ID: 50000 - 79999	WITHDRAW, DEPOSIT, and INQUIRY
	Branch_ID: 5 - 7	OPEN and CLOSE
BANKB3	Account_ID: 80000 - 109999	WITHDRAW, DEPOSIT, and INQUIRY
	Branch_ID: 8 - 10	OPEN and CLOSE

Modifying and Creating the UBBCONFIG Sections for a Distributed Application

Data-dependent routing is described in the UBBCONFIG file, as follows:

- The GROUPS section is populated with as many server groups as are required for distributing the system. This allows the system to route a request to a server in a specific group. These groups can all reside on the same site (SHM mode) or, if there is networking, the groups can reside on different sites (MP mode).
- For data-dependent routing in the BEA TUXEDO system, the SERVICES section must list the routing criteria for each service that uses the ROUTING parameter.

  Note: If a service has multiple entries, each with a different SRVGRP parameter, all such entries must set ROUTING the same way. Otherwise, routing cannot be done consistently for that service. A service can route only on one field, which must be the same for all the same services.

- You must add a ROUTING section to the configuration file to show mappings between data ranges and groups. This allows the system to send the request to a

server in a specific group. Each ROUTING section item contains an identifier that is used in the SERVICES section.

Modifying the GROUPS Section

Parameters in the GROUPS section implement two important aspects of distributed transaction processing. They associate a group of servers with a particular LMID and a particular instance of a resource manager. In addition, by allowing a second LMID to be associated with the server group, they name an alternate machine to which a group of servers can be migrated if the MIGRATE option is specified. Table 5-1 describes the parameters in the GROUPS section.

Table 5-1 Description of the GROUPS Section Parameters

Parameter	Meaning
LMID	LMID must be assigned in the MACHINES section. It indicates that this server group runs on this particular machine. A second LMID value can be specified (separated from the first by a comma) to name an alternate machine to which this server group can be migrated if the MIGRATE option has been specified. Servers in the group must specify RESTART=Y to migrate.
GRPNO	GRPNO is a required parameter that associates a numeric group number with this server group. The number must be greater than 0 and less than 30000. It must be unique among entries in the GROUPS section in this configuration file.
TMSNAME	Specifies which transaction management server (TMS) should be associated with this server group.
TMSCOUNT	An optional parameter that can be used to specify how many copies of TMSNAME should be started for this server group. The minimum value is 2. If not specified, the default is 3. All TMSNAME servers started for a server group are automatically set up in an MSSQ set.

Parameter	Meaning
OPENINFO	Specifies information needed to open a particular instance of a particular resource manager, or it indicates that such information is not required for this server group. When a resource manager is named in the OPENINFO parameter, information such as the name of the database and the access mode is included. The entire value string must be enclosed in double quotes and must not be more than 256 characters. The format of the OPENINFO string is dependent on the requirements of the vendor providing the underlying resource manager. The string required by the vendor must be prefixed with rm_name:, which is the published name of the vendor's transaction (XA) interface followed immediately by a colon (:). The OPENINFO parameter is ignored if TMSNAME is not set or is set to TMS. If TMSNAME is set but the OPENINFO string is set to the null string ("") or if this parameter does not appear on the entry, it means that a resource manager exists for the group but does not require any information for executing an open operation.
CLOSEINFO	Specifies information the resource manager needs when closing a database. The parameter can be omitted or the null string can be specified. The default is the null string.

Modifying the SERVICES Section

The SERVICES section contains parameters that control the way application services are handled. An entry line in this section is associated with a service by its identifier name. Because the same service can be link edited with more than one server, the SRVGRP parameter is provided to tie the parameters for an instance of a service to a particular group of servers. Three parameters in the SERVICES section are particularly related to DTP: ROUTING, AUTOTRAN, and TRANTIME. Table 5-2 describes the parameters in the SERVICES section.

Table 5-2 Description of the SERVICES Section Parameters

Parameter	Meaning
ROUTING	The ROUTING parameter in the SERVICES section points to an entry in the ROUTING section where data-dependent routing is specified for transactions that request this service.
AUTOTRAN	Setting the AUTOTRAN parameter to Y or N determines whether a transaction should be started automatically if a message received by this service is not already in transaction mode.The default is N. Use of the parameter should be coordinated with the programmers coding the services for your application.
TRANTIME	The TRANTIME parameter sets a timeout value in seconds for transactions automatically started in this service. The default is 30 seconds. The TRANTIME parameter is needed only if AUTOTRAN =Y, and not even then if the default is acceptable.

Sample SERVICES Section

The following listing shows a sample SERVICES section.

```
SERVICES

WITHDRAW  ROUTING=ACCOUNT_ID
DEPOSIT   ROUTING=ACCOUNT_ID
OPEN_ACCT ROUTING=BRANCH_ID
```

Creating the ROUTING Section

For information about ROUTING parameters that support the BEA TUXEDO system data-dependent routing, see Chapter 3, “Creating a Configuration File.”

Example of UBBCONFIG Sections in a Distributed Application

The following `UBBCONFIG` file contains the `GROUPS`, `SERVICES`, and `ROUTING` sections of a configuration file to accomplish data-dependent routing in the BEA TUXEDO system.

```
GROUPS
BANKB1            GRPNO=1
BANKB2            GRPNO=2
BANKB3            GRPNO=3
#
SERVICES
WITHDRAW          ROUTING=ACCOUNT_ID
DEPOSIT           ROUTING=ACCOUNT_ID
INQUIRY           ROUTING=ACCOUNT_ID
OPEN_ACCT         ROUTING=BRANCH_ID
CLOSE_ACCT        ROUTING=BRANCH_ID
#
ROUTING
ACCOUNT_ID        FIELD=ACCOUNT_ID BUFTYPE="FML"
                   RANGES="MIN - 9999:*,
                      10000-49999:BANKB1,
                      50000-79999:BANKB2,
                      80000-109999:BANKB3,
                      *:*"
BRANCH_ID         FIELD=BRANCH_ID BUFTYPE="FML"
                   RANGES="MIN - 0:*,
                      1-4:BANKB1,
                      5-7:BANKB2,
                      8-10:BANKB3,
                        *:*"
```

Modifying the Domain Gateway Configuration File to Support Routing

This section explains how and why you need to modify the domain gateway configuration to support routing. For more information about the domain gateway configuration file, see Chapter 8, ‘‘Working with Multiple Domains.’’

What Is the Domains Gateway Configuration File?

All Domains gateway configuration information is stored in a binary file, the BDMCONFIG file. The DMCONFIG file (ASCII) is created and edited with any text editor. The compiled BDMCONFIG file can be updated while the system is running by using the dmadmin(1) command.

You must have one BDMCONFIG file for each BEA TUXEDO application to which you want to add Domains functionality. System access to the BDMCONFIG file is provided through the Domains administrative server, DMADM(5). When a gateway group is booted, the gateway administrative server, GWADM(5), requests from the DMADM server a copy of the configuration required by that group. The GWADM server and the DMADM server also ensure that run-time changes to the configuration are reflected in the corresponding Domains gateway groups.

Note: For more information about the DMCONFIG file, refer to the dmconfig(5) reference page in the *BEA TUXEDO Reference Manual*.

Description of Parameters in the ROUTING Section of the DMCONFIG File

The DM_ROUTING section provides information for data-dependent routing of service requests using FML, VIEW, X_C_TYPE, and X_COMMON typed buffers. Lines within the DM_ROUTING section have the form CRITERION_NAME, where CRITERION_NAME is the

(identifier) name of the routing entry specified in the SERVICES section. The CRITERION_NAME entry may contain no more than 15 characters. The following table describes the parameters in the DM_ROUTING section.

Parameter	Meaning
FIELD = identifier	Specifies the name of the routing field. It must contain 30 characters or fewer. This field is assumed to be a field name identified in an FML field table (for FML buffers) or an FML VIEW table (for VIEW, X_C_TYPE, or X_COMMON buffers). The FLDTBLDIR and FIELDTBLS environment variables are used to locate FML field tables; the VIEWDIR and VIEWFILES environment variables are used to locate FML VIEW tables. If a field in an FML32 buffer is used for routing, it must have a field number less than or equal to 8191.
RANGES ="range1:rdom1[,range2:rdom2 ...]"	Specifies the ranges and associated remote domain names (RDOM) for the routing field. The string must be enclosed in double quotes, with the format of a comma-separated ordered list of range/RDOM pairs. A range is either a single value (signed numeric value or character string in single quotes), or a range of the form *lower-upper* (where *lower* and *upper* are both signed numeric values or character strings in single quotes). The value of *lower* must be less than or equal to *upper*. A single quote embedded in a character string value (as in "O'Brien," for example), must be preceded by two backslashes ("O\\'Brien"). Use MIN to indicate the minimum value for the data type of the associated FIELD. For strings and carrays, it is the null string; for character fields, it is 0; for numeric values, it is the minimum numeric value that can be stored in the field. Use MAX to indicate the maximum value for the data type of the associated FIELD. For strings and carrays, it is effectively an unlimited string of octal-255 characters; for a character field, it is a single octal-255 character; for numeric values, it is the maximum numeric value that can be stored in the field. Thus, MIN - -5 is all numbers less than or equal to -5, and 6 - MAX is all numbers greater than or equal to 6. The metacharacter * (wildcard) in the position of a range indicates any values not covered by the other ranges previously seen in the entry. Only one wildcard range is allowed per entry and it should be last (ranges following it are ignored).

Parameter	Meaning
BUFTYPE = "*type1*[:*subtype1*[,*subtype2* . . .]][;*type2*[:*subtype3*[, . . .]]] . . ."	A list of types and subtypes of data buffers for which this routing entry is valid. The types are restricted to FML, VIEW, X_C_TYPE, and X_COMMON. No subtype can be specified for type FML, and subtypes are required for the other types (* is not allowed). Duplicate type/subtype pairs cannot be specified for the same routing criteria name; more than one routing entry can have the same criteria name as long as the type/subtype pairs are unique. This parameter is required. If multiple buffer types are specified for a single routing entry, the data types of the routing field for each buffer type must be the same. (If the field value is not set (for FML buffers), or does not match any specific range, and a wildcard range has not been specified, an error is returned to the application process that requested the execution of the remote service.)

Routing Field Description

The routing field can be of any data type supported in FML or VIEW. A numeric routing field must have numeric range values, and a string routing field must have string range values.

String range values for string, carray, and character field types must be placed inside a pair of single quotes and cannot be preceded by a sign. Short and long integer values are a string of digits, optionally preceded by a plus or minus sign. Floating point numbers are of the form accepted by the C compiler or atof(): an optional sign, then a string of digits (optionally containing a decimal point), then an optional e or E followed by an optional sign or space, followed by an integer.
When a field value matches a range, the associated RDOM value specifies the remote domain to which the request should be routed. An RDOM value of * indicates that the request can go to any remote domain known by the gateway group. Within a range/RDOM pair, the range is separated from the RDOM by a : (colon).

Example of a Five-Site Domain Configuration Using Routing

The following configuration file defines a 5-site domain configuration. Listing 5-1 shows four bank branch domains communicating with a Central Bank Branch. Three of the bank branches run within other BEA TUXEDO system domains. The fourth branch runs under the control of another TP domain, and OSI-TP is used in the

communication with that domain. The example shows the BEA TUXEDO system Domains gateway configuration file from the Central Bank point of view. In the `DM_TDOMAIN` section, this example shows a mirrored gateway for `b01`.

Listing 5-1 A 5-Site Domains Configuration

```
# TUXEDO DOMAIN CONFIGURATION FILE FOR THE CENTRAL BANK
#
#
DM_LOCAL_DOMAINS
# <local domain name> <Gateway Group name> <domain type> <domain id> <log device>
#                     [<audit log>] [<blocktime>]
#                     [<log name>] [<log offset>] [<log size>]
#                     [<maxrdom>] [<maxrdtran>] [<maxtran>]
#                     [<maxdatalen>] [<security>]
#                     [<tuxconfig>] [<tuxoffset>]

#
#
DEFAULT: SECURITY = NONE
c01     GWGRP = bankg1
        TYPE = TDOMAIN
        DOMAINID = "BA.CENTRAL01"
        DMTLOGDEV = "/usr/apps/bank/DMTLOG"
        DMTLOGNAME = "DMTLG_C01"
c02     GWGRP = bankg2
        TYPE = OSITP
        DOMAINID = "BA.CENTRAL01"
        DMTLOGDEV = "/usr/apps/bank/DMTLOG"
        DMTLOGNAME = "DMTLG_C02"
        NWDEVICE = "OSITP"
        URCH = "ABCD"
#
DM_REMOTE_DOMAINS
#<remote domain name>  <domain type> <domain id>
#
b01     TYPE = TDOMAIN
        DOMAINID = "BA.BANK01"
b02     TYPE = TDOMAIN
        DOMAINID = "BA.BANK02"
b03     TYPE = TDOMAIN
        DOMAINID = "BA.BANK03"
b04     TYPE = OSITP
        DOMAINID = "BA.BANK04"
        URCH = "ABCD"
#
```

```
DM_TDOMAIN
#
#     <local or remote domainname> <network address> [nwdevice]
#
# Local network addresses
c01     NWADDR = "//newyork.acme.com:65432"     NWDEVICE ="/dev/tcp"
c02     NWADDR = "//192.76.7.47:65433"     NWDEVICE ="/dev/tcp"
# Remote network addresses: second b01 specifies a mirrored gateway
b01     NWADDR = "//192.11.109.5:1025" NWDEVICE = "/dev/tcp"
b01     NWADDR = "//194.12.110.5:1025" NWDEVICE = "/dev/tcp"
b02     NWADDR = "//dallas.acme.com:65432"  NWDEVICE = "/dev/tcp"
b03     NWADDR = "//192.11.109.156:4244" NWDEVICE = "/dev/tcp"
#
DM_OSITP
#
#<local or remote domain name> <apt> <aeq>
#                               [<aet>] [<acn>] [<apid>] [<aeid>]
#                               [<profile>]
#
c02     APT = "BA.CENTRAL01"
        AEQ = "TUXEDO.R.4.2.1"
        AET = "{1.3.15.0.3},{1}"
        ACN = "XATMI"
b04     APT = "BA.BANK04"
        AEQ = "TUXEDO.R.4.2.1"
        AET = "{1.3.15.0.4},{1}"
        ACN = "XATMI"
DM_LOCAL_SERVICES
#<service_name>  [<Local Domain name>] [<access control>] [<exported svcname>]
#                [<inbuftype>] [<outbuftype>]
#
open_act        ACL = branch
close_act       ACL = branch
credit
debit
balance
loan            LDOM = c02      ACL = loans
DM_REMOTE_SERVICES
#<service_name>   [<Remote domain name>] [<local domain name>]
#                 [<remote svcname>] [<routing>] [<conv>]
#                 [<trantime>] [<inbuftype>] [<outbuftype>]
#
tlr_add   LDOM = c01  ROUTING = ACCOUNT
tlr_bal   LDOM = c01  ROUTING = ACCOUNT
tlr_add   RDOM = b04  LDOM = c02 RNAME ="TPSU002"
tlr_bal   RDOM = b04  LDOM = c02 RNAME ="TPSU003"
DM_ROUTING
# <routing criteria>    <field> <typed buffer> <ranges>
#
```

```
ACCOUNT FIELD = branchid  BUFTYPE ="VIEW:account"
        RANGES ="MIN - 1000:b01, 1001-3000:b02, *:b03"
DM_ACCESS_CONTROL
#<acl name>   <Remote domain list>
#
branch  ACLIST = b01, b02, b03
loans   ACLIST = b04
```

6 Building Networked Applications

This chapter covers the following topics:

- Terms and Definitions
- Configuring Networked Applications
- Example: A Network Configuration
- Example: A Network Configuration with Multiple Netgroups
- Running a Networked Application

Terms and Definitions

asynchronous connections
: Virtual circuits set up to execute independently of each other or asynchronously. An asynchronous connection does not block the processing of working circuits while attempts are being made to reconnect failed circuits. The BEA TUXEDO system v6.4 `BRIDGE` allows the use of nonfailing network paths by listening and transferring data using multiple network address endpoints.

failover and failback
: Network failover occurs when a redundant unit seamlessly takes over the network load for the primary unit. Some operating system and hardware bundles transparently detect a problem on one network card and have a spare

automatically replace it. When done quickly enough, application-level TCP virtual circuits have no indication a fault happened.

In the BEA TUXEDO system, data flows over the highest available priority circuit. If network groups have the same priority, data travels over all networks simultaneously. If all circuits at the current priority fail, data is sent over the next lower priority circuit. This is called failover.

When a higher priority circuit becomes available, the data flow is shifted to flow over the higher priority circuit. This is called failback.

When a failover condition is detected, all higher priority circuits are retried periodically. After connections to all network addresses have been tried and failed, connections are tried again the next time data needs to be sent between machines.

multiple listening addresses
: Having addresses available on separate networks means that even if one virtual circuit is disrupted, the other circuit can continue undisturbed. Only a failure on all configured networks makes reconnection of the `BRIDGES` impossible. For example, when a high priority network fails, its load can be switched to an alternate network that has a lower priority. When the higher priority network returns to service, the network load returns to it.

parallel data circuits
: Parallel data circuits enable data to flow simultaneously on more than one circuit. When you configure parallel data circuits, network traffic is scheduled over the circuit with the largest network group number (`NETGRPNO`). When this circuit is busy, the traffic is scheduled automatically over the circuit with the next lower network group number. When all circuits are busy, data is queued until a circuit is available.

Note: Alternate scheduling algorithms may be introduced in future releases.

Configuring Networked Applications

To configure a networked application, make these changes in the configuration file.

1. Check the following settings in the RESOURCES section:

   - Make sure MODEL is set to MP.

     MP stands for multiprocessor and enables the other networking parameters.

   - Make sure OPTIONS is set to LAN.

     LAN specifies that communication between machines is via a Local Area Network (as opposed to being between two or more processors in a single machine).

   - Use the MAXNETGROUPS parameter to set a limit on the number of NETGROUPS that can be defined.

     The default is 8; the upper limit 8192.

2. Check the following settings in the MACHINES section:

   - TYPE=*string*. Specifying *string* for the machines in your network allows the system to bypass encode/decode processing when messages are transmitted between machines of the same TYPE.

     When you identify machines as being of the same TYPE, encode/decode processing is not needed. If you have, say, nine SPARC machines and one HP machine, specify TYPE= *string* only for the HP; for the SPARC machines, the default null string identifies them as being of the same type.

   - CMPLIMIT=*remote,local*. The CMPLIMIT setting specifies thresholds for the point at which message compression should begin. A threshold is a number from 0 to MAXLONG. It sets the minimum byte size for a message to be compressed before being sent over the network. For example:

     ```
     CMPLIMIT=1024
     ```

     This parameter specifies that any message greater than 1024 bytes bound for a remote location should be compressed. The absence of a second number means that local messages are never compressed. Compression thresholds can also be specified with the variable TMCMPLIMIT. See also the discussion in tuxenv(5) of the variable TMCMPPRFM. It sets the degree of compression in a range of 1 to 9.

   - NETLOAD=*number*. Assigns an application-specific number to be added to a remote service's LOAD number. The result is used by the system to evaluate whether the request should be processed locally or sent to a remote machine.

3. Check the following settings in the NETGROUPS section:

- NETGROUP. The name assigned by the application to the particular group. The name can be up to 30 characters long. One group (that includes all machines on the network) must be named DEFAULTNET.
- NETGRPNO=*number*. If this is DEFAULTNET, NETGRPNO must be zero; for any other group the number can be from 1 to 8192. This parameter is required.
- NETPRIO=*number*. Assigning a priority to a NETGROUP helps the software determine which network connection to use. The number must be between 0 and 8192. Assign higher priority to your faster circuits; give your lowest priority to DEFAULTNET.

4. Check the following settings in the NETWORK section:
   - LMID. This Logical Machine Identifier must match one of the entries in the MACHINES section. It associates this particular NETWORK section entry with one of the application's machines.
   - NADDR=*string*. This network address is the listening address for the BRIDGE process on this LMID. There are four valid formats for specifying this address. See the NETWORK section of ubbconfig(5).
   - NLSADDR=*string*. This parameter is the network address for the tlisten process on this LMID. Valid formats are the same as the valid formats for NADDR.
   - NETGROUP=*string*. This must be a NETWORK group name previously specified in the NETGROUPS section. If not specified, it defaults to DEFAULTNET.

Example: A Network Configuration

The following example illustrates the configuration of a simple network.

```
# The following configuration file excerpt shows a NETWORK
# section for a 2-site configuration.

NETWORK
   SITE1   NADDR="//mach1:80952”
           NLSADDR="//mach1:serve"
#
   SITE2   NADDR="//mach386:80952"
           NLSADDR="//mach386:serve"
```

Example: A Network Configuration with Multiple Netgroups

The hypothetical First State Bank has a network of five machines (A-E). It serves the bank’s business best to have four network groups and to have each machine belong to two or three of the four groups.

Note: Configuration of multiple `NETGROUPS` has both hardware and system software prerequisites that are beyond the scope of this document. For example, `NETGROUPS` commonly requires machines with more than one directly attached network. Each TCP/IP symbolic address must be identified in the `/etc/hosts` file or in the DNS (Domain Name Services). In the example that follows, addresses in the form “`//A_CORPORATE:5345`” assume that the string “`A_CORPORATE`” is in the `/etc/hosts` file or in DNS.

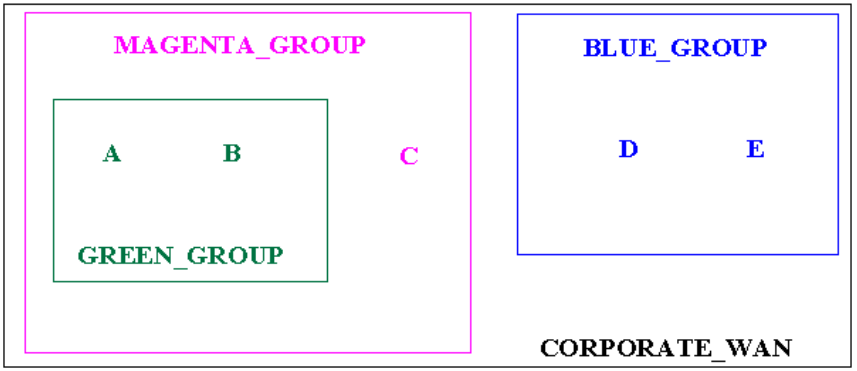
The four groups in the First State Bank example are as follows:

- `DEFAULTNET` (the default network, which is the corporate WAN)
- `MAGENTA_GROUP` (a LAN)

- BLUE_GROUP (a LAN)
- GREEN_GROUP (a private LAN that provides high-speed, fiber, point-to-point links between member machines)

All machines belong to DEFAULTNET (the corporate WAN). In addition, each machine is associated with either the MAGENTA_GROUP or the BLUE_GROUP. Finally, some machines in the MAGENTA_GROUP also belong to the GREEN_GROUP. Figure 6-1 illustrates group assignments for the network.

Figure 6-1 Example of a Network Grouping



In this example, machines A and B have addresses for the following:

- DEFAULTNET (the corporate WAN)
- MAGENTA_GROUP (LAN)
- GREEN_GROUP (LAN)

Machine C has addresses for the following:

- DEFAULTNET (the corporate WAN)
- MAGENTA_GROUP (LAN)

Machines D and E have addresses for the following:

- DEFAULTNET (the corporate WAN)
- BLUE_GROUP (LAN)

Because the local area networks are not routed among the locations, machine D (in the BLUE_GROUP LAN) may contact machine A (in the GREEN_GROUP LAN) only by using the single address they have in common: the corporate WAN network address.

The UBBCONFIG File for the Network Example

To set up the configuration described in the preceding section, the First State Bank administrator defined each group in the NETGROUPS and NETWORK sections of the UBBCONFIG file as follows:

```
NETGROUPS

DEFAULTNET    NETGRPNO = 0          NETPRIO = 100 #default
BLUE_GROUP    NETGRPNO = 9          NETPRIO = 100
MAGENTA_GROUP NETGRPNO = 125        NETPRIO = 200
GREEN_GROUP   NETGRPNO = 13         NETPRIO = 200

NETWORK

A       NETGROUP=DEFAULTNET         NADDR="//A_CORPORATE:5723”
A       NETGROUP=MAGENTA_GROUP      NADDR="//A_MAGENTA:5724"
A       NETGROUP=GREEN_GROUP        NADDR="//A_GREEN:5725"

B       NETGROUP=DEFAULTNET         NADDR="//B_CORPORATE:5723"
B       NETGROUP=MAGENTA_GROUP      NADDR="//B_MAGENTA:5724"
B       NETGROUP=GREEN_GROUP        NADDR="//B_GREEN:5725"

C       NETGROUP=DEFAULTNET         NADDR="//C_CORPORATE:5723"
C       NETGROUP=MAGENTA_GROUP      NADDR="//C_MAGENTA:5724"

D       NETGROUP=DEFAULTNET         NADDR="//D_CORPORATE:5723"
D       NETGROUP=BLUE_GROUP         NADDR="//D_BLUE:5726"

E       NETGROUP=DEFAULTNET         NADDR="//E_CORPORATE:5723"
E       NETGROUP=BLUE_GROUP         NADDR="//E_BLUE:5726"
```

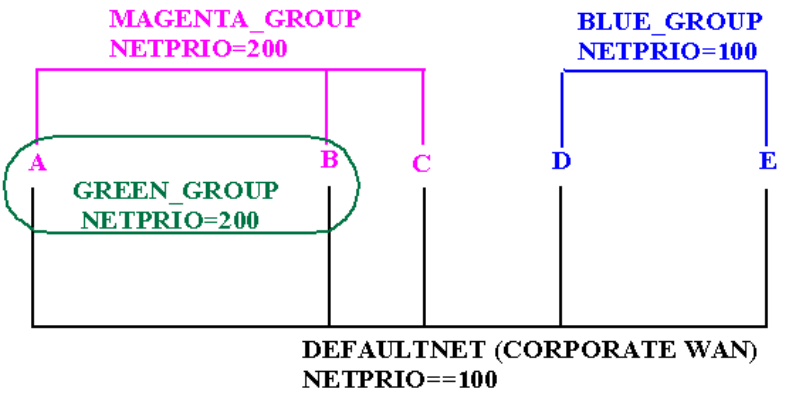
Assigning Priorities for Each Network Group

Appropriately assigning priorities for each NETGROUP enables you to maximize the capability of network BRIDGE processes. When determining your NETGROUP priorities, keep in mind the following considerations:

- Data flows over the highest available priority circuit.
- If network groups have the same priority, data travels over all circuits simultaneously.
- If all circuits at the current priority fail, data is sent over the next lower priority circuit.
- When a higher priority circuit becomes available, data flows over this higher priority circuit.
- All unavailable higher priority circuits are retried periodically.
- After connections to all network addresses have been tried and have failed, connections are tried again the next time data needs to be sent between machines.

Figure 6-2 illustrates how the First State Bank administrator can assign priorities to the network groups.

Figure 6-2 Assigning Priorities to Network Groups



The UBBCONFIG Example Considerations

You can specify the value of NETPRIO for DEFAULTNET just as you do for any other netgroup. If you do not specify a NETPRIO for DEFAULTNET, a default of 100 is used, as in the following example.

```
NETGROUP
DEFAULTNET  NETGRPNO = 0   NETPRIO = 100
```

For DEFAULTNET, the value of the network group number must be zero; any other number is invalid. If the BLUE_GROUP's network priority is commented out, the priority defaults to 100. Network group number entries are unique. Some of the network priority values are equal, as in the case of MAGENTA_GROUP and GREEN_GROUP (200).

Each network address is associated by default with the network group, DEFAULTNET. It may be specified explicitly for uniformity or to associate the network address with another netgroup.

```
NETWORK
D       NETGROUP=BLUE_GROUP NADDR="//D_BLUE:5726"
```

In this case, MAGENTA_GROUP and GREEN_GROUP have the same network priority of 200. Note that a lower priority network, such as DEFAULTNET, could be a charge-per-minute satellite link.

Running a Networked Application

For the most part, the work of running a BEA TUXEDO networked application takes place in the configuration phase. Once you have defined the network for an application and you have booted the system, the software automatically takes care of running the network for you.

In this section we discuss some aspects of running a networked application to give you a better understanding of how the software works. Knowledge of how the software works can often make configuration decisions easier.

Scheduling Network Data over Parallel Data Circuits

If you have configured a networked application that uses parallel data circuits, scheduling network data proceeds as follows:

- The `BRIDGE` listens on more than one address and may send data simultaneously on parallel data circuits, thus making the `BRIDGE` more frequently available and making error recovery faster.
- When you configure parallel data circuits, the software attempts to schedule traffic over the circuit with the highest network group number (`NETGRPNO`). If this circuit is busy, the traffic is automatically scheduled over the circuit with the next lower network group number. When all circuits are busy, data is queued until a circuit is available.
- The software guarantees that conversational messages are kept in the correct sequence by binding the conversation connection to one particular data circuit.
- If your application requires that all messages be kept in sequence, the application must be programmed to keep track of the sequence for nonconversational messages. If this is your design, you might elect not to configure parallel data circuits.
- The `BRIDGE` sends a message to destination machine X by writing the message to a virtual circuit and delegating to the operating system the responsibility for sending it. The operating system retains a copy of pending messages. If a network error occurs, however, pending messages are lost.

Figure 6-3 is a flow diagram that illustates how the BRIDGE processes data by priority.

Figure 6-3 Flow of Data over the BRIDGE

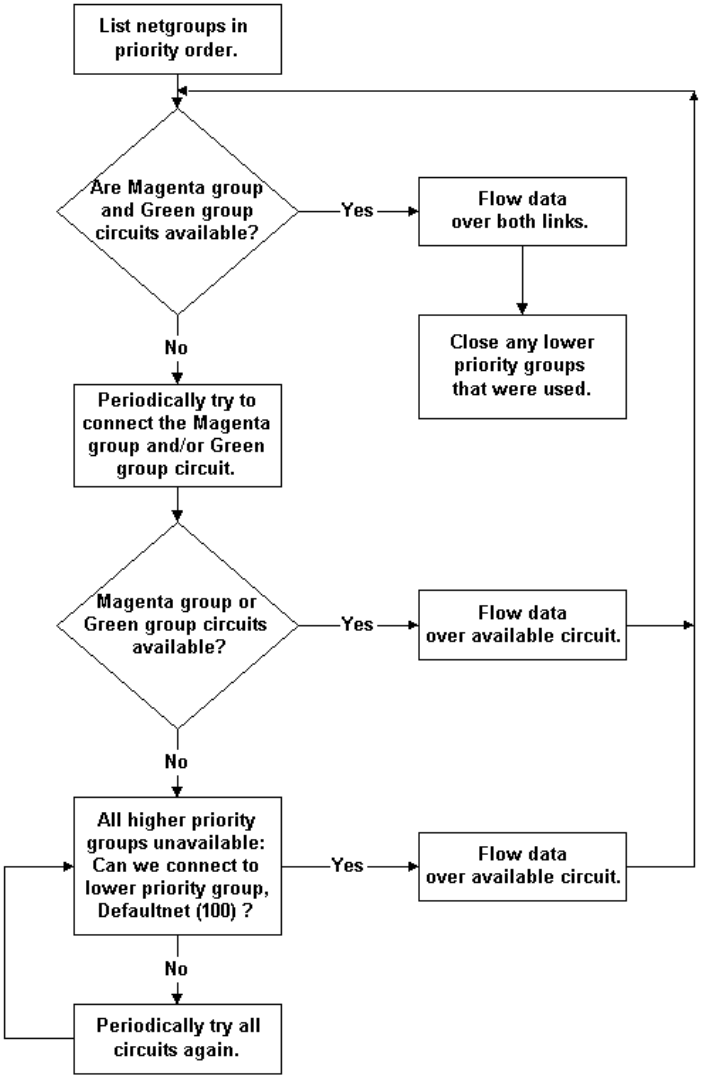


Figure 6-3 illustrates the flow of data when machine A attempts to contact machine B. First, the BRIDGE determines which network groups are common to both machine A and machine B. They are the MAGENTA_GROUP, the GREEN_GROUP, and the DEFAULTNET.

The highest priority network addresses originate from the network groups with the highest network priority. Network groups with the same NETPRIO value flow network data in parallel. All network groups with a higher priority than that of the network groups that are flowing data are retried periodically.

Once network connections have been established with different NETPRIO values, no further data is scheduled for the lower priority connection. The lower priority connection is disconnected in an orderly fashion.

Network Data in Failover and Failback

Data flows over the highest available priority circuit. If network groups have the same priority, data travels over all networks simultaneously. If all circuits at the current priority fail, data is sent over the next lower priority circuit. This is called failover.

When a higher priority circuit becomes available, data flow is restored to the higher priority circuit. This is called failback.

All unavailable higher priority circuits are retried periodically. After connections to all network addresses have been tried and have failed, connections are tried again the next time data needs to be sent between machines.

Using Data Compression for Network Data

When data is sent between processes of an application, you can elect to have it compressed. Several aspects of data compression are described in the sections that follow.

Taking Advantage of Data Compression

Data compression is useful in most applications and is in fact vital to supporting large configurations. Following is a list of recommendations for when to use data compression and for how the limits should be set.

When should I set remote data compression and what setting should be used?

You should always use remote data compression as long as all of your sites are running BEA TUXEDO Release 4.2.1 or later. The setting used depends on the speed of your network. In general, you can separate the decision into high-speed (for example, Ethernet) and low-speed (for example, X.25) networks.

High-speed network. Set remote data compression to the lowest limit for BEA TUXEDO generated file transfers (see note below on file transfers). That is, compress only the messages that are large enough to be candidates for file transfer either on the sending site or on the receiving site. Note that each machine in an application may have a different limit and the lowest limit should be chosen.

Low-speed network. Set remote data compression to zero on all machines; that is, compress all application and system messages.

When should I set local data compression and what setting should be used?

You should always set local data compression for sites running BEA TUXEDO Release 4.2.1 or later, even if they are interoperating with pre-4.2.1 sites. The setting should be the local limit for BEA TUXEDO-generated file transfers (see note below). This setting enables you to avoid file transfers in many cases that might otherwise have required a transfer, and greatly reduces the size of files used if file transfers are still necessary.

Note: For high traffic applications that involve a large volume of timeouts and discarding of messages due to queue blocking, you may want to set local compression to always occur, thus lowering the demand of the application on the queuing subsystem.

Setting the Compression Level

An environment variable, `TMCMPPRFM`, can be used to set the level of compression. This variable adds further control to data compression by allowing you to go beyond the simple choice of "compress or do not compress" that is provided by `CMPLIMIT`. You can specify any of nine levels of compression. The `TMCMPPRFM` environment variable takes as its value a single digit in the range of 1 through 9. A value of 1 specifies the lowest level of compression; 9 is the highest. When a low number is specified, the compression routine does its work more quickly. (See `tuxenv`(5) in the *BEA Tuxedo Reference Manual* for details.)

Balancing Network Request Loads

If load balancing is on (LDBAL set to Y in the RESOURCES section of the configuration file), the BEA TUXEDO system attempts to balance requests across the network. Because load information is not updated globally, each site will have its own view of the load at remote sites. This means the local site views will not all be the same.

The TMNETLOAD environment variable (or the NETLOAD parameter in the MACHINES section) can be used to force more requests to be sent to local queues. The value expressed by this variable is added to the remote values to make them appear to have more work. This means that load balancing can be on, but that local requests will be sent to local queues more often.

NETLOAD

The NETLOAD parameter affects the load balancing behavior of a system when a service is available on both local and remote machines. NETLOAD is a numeric value (of arbitrary units) that is added to the load factor of services remote from the invoking client. This provides a bias for choosing a local server over a remote server.

As an example, assume servers A and B offer a service with load factor 50. Server A is running on the same machine as the calling client (local), and server B is running on a different machine (remote). If NETLOAD is set to 100, approximately three requests will be sent to A for every one sent to B.

Another enhancement to load balancing is local idle server preference. Requests are preferentially sent to a server on the same machine as the client, assuming it offers the desired service and is idle. This decision overrides any load balancing considerations, since the local server is known to be immediately available.

SPINCOUNT

SPINCOUNT determines the number of times a process tries to get the shared memory latch before the process stops trying. Setting SPINCOUNT to a value greater than 1 gives the process that is holding the latch enough time to finish.

Using Link-Level Encryption

Link-level encryption (LLE) is the encryption of messages going across network links. This functionality is provided in the BEA TUXEDO system Security Package, which is offered in two versions: US/Canada and International. The difference between the two versions consists solely in the number of bits of the 128-bit encryption key that remain private. The US/Canada version has a key length of 128 bits; the International version now has an effective key length of 56 bits.

The Security Package allows encryption of data that flows over BEA TUXEDO system network links. The objective is to ensure data privacy, so a network-based eavesdropper cannot learn the content of BEA TUXEDO system messages or application-generated messages.

Link-level encryption applies to the following types of BEA TUXEDO links:

- Workstation client to `WSH`
- `BRIDGE` to `BRIDGE`
- Administrative utilities (`tmboot`, `tmshutdown`, `tmadmin`, and so forth) to `tlisten`
- Domains gateway to Domains gateway

How LLE Works

Link-level encryption control parameters and underlying communication protocols are different for various link types, but there are some common themes, as follows:

- A Connecting process begins the communication session.
- An Accepting process receives the initial connection.
- Both processes are aware of the link-level encryption feature, and both have two configuration parameters. (This statement is not true if the processes are interoperating between releases, in which case the older release's lack of encryption capability is implicitly assumed.)
- The first configuration parameter is the minimum encryption level a process will accept. The value is a number representing the key length: 0, 40, or 128 bits.

- The second configuration parameter is the maximum encryption level a process is willing to support. The value of this parameter is expressed as 0, 40, or 128 bits.
- For convenience, we denote the two parameters as (`MIN`, `MAX`). So (40,128) means that a process will accept at least a 40-bit encryption key but would prefer a 128-bit key, if possible.
- LLE is point-to-point, which means that your data may be encrypted/decrypted many times as it flows over network links.

Encryption Key Size Negotiation

The first step in negotiating the key size is for the two processes to agree on the largest common key size supported by both. This negotiation need not be encrypted or hidden.

Once encryption is negotiated, it remains in effect for the lifetime of the network connection.

A preprocessing step temporarily reduces the maximum key size parameter configured to agree with the installed software's capabilities. This must be done at link negotiation time, because at configuration time it may not be possible to verify a particular machine's installed encryption package. For example, the administrator may configure (0, 128) encryption for an unbooted machine that has only a 40-bit encryption package installed. When the machine actually negotiates a key size, it should represent itself as (0, 40). In some cases this may cause a run-time error; for example (128, 128) is not possible with a 40-bit encryption package.

In some cases, international link level is upgraded automatically from 40 bits to 56 bits. The encryption strength upgrade requires that both sides of a network connection are running BEA TUXEDO Release 6.5 software, with the optional US/Canada or International Encryption Security Add-on Package installed. You can verify a server machine's encryption package by running the `tmadmin -v` command. Both machines must also be configured to accept 40-bit encryption. When these conditions are met, the encryption strength is upgraded automatically to 56 bits.

Table 6-1 shows the outcome for all possible combinations of `min/max` parameters.

Table 6-1 Encryption Key Matrix

Inter-Process Negotiation Results	(0,0)	(0,40)	(0, 128)	(40, 40)	(40,128)	(128,128)
(0,0)	0	0	0	ERROR	ERROR	ERROR
(0,40)	0	56	56	56	56	ERROR
(0,128)	0	56	128	56	128	128
(40,40)	ERROR	56	56	56	56	ERROR
(40,128)	ERROR	56	128	56	128	128
(128,128)	ERROR	ERROR	128	ERROR	128	128

Note: Shaded cells show the result of an automatic upgrade from 40-bit to 56-bit encryption when both machines are running BEA TUXEDO Release 6.5. When communicating with an older release, encryption remains at 40-bit strength in the shaded cells.

MINENCRYPTBITS/MAXENCRYPTBITS

When a network link is established to the machine identified by the `LMID` for the current entry, the `MIN` and `MAX` parameters are used to specify the number of significant bits of the encryption key. `MINENCRYPTBITS` says, in effect, “at least this number of bits are meaningful.” `MAXENCRYPTBITS`, on the other hand, says, “encryption should be negotiated up to this level.” The possible values are 0, 40, and 128. A value of zero means no encryption is used, while 40 and 128 specify the number of significant bits in the encryption key.

The BEA TUXEDO system US/Canada security package permits use of up to 128 bits; the International package allow specification of no more than 56 bits.

How to Change Network Configuration Parameters

Use `tmconfig`(1) to change configuration parameters while the application is running. In effect, `tmconfig` is a shell-level interface to the BEA TUXEDO system Management Information Base (MIB). See the `tmconfig`(1), `MIB`(5), and `TM_MIB`(5) reference pages in the *BEA TUXEDO Reference Manual.*

7 Configuring Transactions

This chapter discusses the following topics:

- Understanding Transactions
- Modifying the UBBCONFIG File to Accommodate Transactions
- Modifying the Domain Configuration File to Support Transactions
- Example: A Distributed Application Using Transactions

Understanding Transactions

Transactions greatly simplify the writing of distributed applications. They allow your application to cope more easily with a large set of problems that occur in a distributed environment, such as machine, program, or network failures. One of the greatest strengths of the BEA TUXEDO system is that the transaction semantic was built into the software and into the TUXEDO ATMI. Global transactions were woven into the fabric of the system and into its communication APIs and protocols.

The ability to define a global transaction around communication calls makes it an indispensable tool for writing distributed applications. A global transaction allows not only the effects of your communications to be committed as a single unit, but it also gives you a simple, programmatic way to undo work if errors occur.

To illustrate the power of global transactions, consider the following example. A Place Order service performs two operations: it updates the Order database and enqueues the order to the shipping department. The business intends that both these actions occur together as a unit or that neither action should occur if one action fails.

To accomplish this, the client application invoking the Place Order service associates the call with a global transaction. You do this by using the ATMI begin-transaction function before issuing the service request, and issuing the commit-transaction function after it. Because the service is invoked as part of a global transaction, its work is done on its behalf. The server is propagated with the client's transaction when the Place Order service is invoked. Both the database access and the enqueue operation to the shipping application queue become part of the client's transaction.

Should either operation fail because of an application or system error, the work done in the transaction is rolled back to its state at the outset of the transaction. If both succeed, however, the client's call to commit the transaction causes the effects of the database update and the enqueued message to become permanent records of this transaction.

Modifying the UBBCONFIG File to Accommodate Transactions

You must modify the `RESOURCES`, `MACHINES`, `GROUPS`, and the `SERVICES` sections of the application's `UBBCONFIG` file in the following way to accommodate transactions:

- In the `RESOURCES` section, specify the application-wide number of allowed transactions, and the value of the commit control flag.
- In the `MACHINES` section, create the `TLOG` information for each machine.
- In the `GROUPS` section, indicate information about each resource manager, and about the transaction manager server.
- In the `SERVICES` section, enable the automatic transaction option.

Specifying Application-Wide Transactions in the RESOURCES Section

The following table provides a description of transaction-related parameters in the RESOURCES section of the configuration file.

Parameter	Meaning
MAXGTT	Limits the total number of global transaction identifiers (GTRIDs) allowed on one machine at one time. The maximum value allowed is 2048, minimum 0, and default 100. You can override this value on a per-machine basis in the MACHINES section. Entries remain in the table only while the global transaction is active, so this parameter has the effect of setting a limit on the number of simultaneous transactions.
CMTRET	Specifies the initial setting of the TP_COMMIT_CONTROL characteristic. The default is COMPLETE. Following are its two settings: ♦ LOGGED—The TP_COMMIT_CONTROL characteristic is set to TP_CMT_LOGGED, which means that tpcommit() returns when all the participants have successfully precommitted. ♦ COMPLETE—The TP_COMMIT_CONTROL characteristic is set to TP_CMT_COMPLETE, which means that tpcommit() will not return until all the participants have successfully committed. **Note:** You should consult with the RM vendors to determine the appropriate setting. If any RM in the application uses the *late commit* implementation of the XA standard, the setting should be COMPLETE. If all the resource managers use the *early commit* implementation, the setting should be LOGGED for performance reasons. (You can override this setting with tpscmt().)

Creating a Transaction Log (TLOG)

This section discusses creating a TLOG.

Creating the UDL

The Universal Device List (UDL) is like a map of the BEA TUXEDO file system. The UDL gets loaded into shared memory when an application is booted. The TLOG refers to a log in which information on transactions is kept until the transaction is completed.To create an entry in the UDL for the TLOG device, create the UDL on each machine using global transactions. If the TLOGDEVICE is mirrored between two machines, it is unnecessary to do this on the paired machine. The Bulletin Board Liaison (BBL) then initializes and opens the TLOG during the boot process.

To create the UDL, enter a command using the following format, before the application has been booted:

```
tmadmin -c crdl -z config -b blocks
```

In the preceding format statement, specify in the `-z config` argument the full path name for the device where you should create the UDL. Specify in the `-b blocks` argument the number of blocks to be allocated on the device. *config* should match the value of the TLOGDEVICE parameter in the MACHINES section of the UBBCONFIG file.

Note: In general, the value that you supply for blocks should not be less than the value for TLOGSIZE. For example, if TLOGSIZE is specified as 200 blocks, specifying `-b 500` would not cause a degradation.

For more information about storing the TLOG, see the *BEA TUXEDO Installation Guide*.

Defining Transaction-related Parameters in the MACHINES Section

You can define a global transaction log (TLOG) using several parameters in the MACHINES section of the UBBCONFIG file. You must manually create the device list entry for the TLOGDEVICE on each machine where a TLOG is needed. You can do this either before or after TUXCONFIG has been loaded, but it must be done before the system is booted.

The following table provides a description of transaction-related parameters in the MACHINES section of the configuration file.

Parameter	Meaning
TLOGNAME	The name of the DTP transaction log for this machine.

Parameter	Meaning
TLOGDEVICE	Specifies the BEA TUXEDO file system that contains the DTP transaction log (TLOG) for this machine. If this parameter is not specified, the machine is assumed not to have a TLOG. The maximum string value length is 64 characters.
TLOGSIZE	The size of the TLOG file in physical pages. Its value must be between 1 and 2048, and its default is 100. The value should be large enough to hold the number of outstanding transactions on the machine at a given time. One transaction is logged per page. The default should be enough for most applications.
TLOGOFFSET	Specifies the offset in pages from the beginning of TLOGDEVICE to the start of the VTOC that contains the transaction log for this machine.The number must be greater than or equal to 0 and less than the number of pages on the device. The default is 0. TLOGOFFSET is rarely necessary. However, if two VTOCs share the same device or if a VTOC is stored on a device (such as a file system) that is shared with another application, you can use TLOGOFFSET to indicate a starting address relative to the address of the device.

Creating the Domains Transaction Log

You can create the Domains transaction log before starting the Domains gateway group by using dmadmin(1) `crdmlog (crdlog) -d` *`local_domain_name`*. Create the Domains transaction log for the named local domain on the current machine (that is, the machine where dmadmin is running). The command uses the parameters specified in the DMCONFIG file. This command fails if the named local domain is active on the current machine or if the log already exists. If the transaction log has not been created, the Domains gateway group creates the log when the Domains gateway group starts.

Defining Each Resource Manager (RM) and the Transaction Manager Server in the GROUPS Section

Additions to the GROUPS section fall into two categories:

- Defining the transaction manager servers that perform most of the work that controls global transactions. The TMSNAME parameter is the name of the server executable; TMSCOUNT is the number of such servers to boot (minimum 2, maximum 10, default 3).
  A null transactional manager server does not communicate with any resource manager. It is used to exercise an application's use of the transactional primitives before actually testing the application in a recoverable, *real* environment. This server is named TMS and it simply begins, commits, or terminates without talking to any RM.
- Defining opening and closing information for each resource manager. OPENINFO is a string with information used to open a resource manager, and CLOSEINFO is used to close a resource manager.

Sample of the GROUPS Section

The following is an example from the GROUPS section in the banking application, called bankapp.

```
BANKB1 GRPNO=1 TMSNAME=TMS_SQL TMSCOUNT=2
OPENINFO="TUXEDO/SQL:<APPDIR>/bankdl1:bankdb:readwrite"
```

Description of Transaction Values in the Sample GROUPS Section

The following table describes the transaction values shown in the sample GROUPS section.

Transaction Value	Meaning
BANKB1 GRPNO=1 TMSNAME=TMS_SQL\ TMSCOUNT=2	Contains the name of the transaction manager server (TMS_SQL), and the number (2) of these servers to be booted in the group BANKB1
TUXEDO/SQL	Published name of the resource manager
<APPDIR>/bankdl1	Includes a device name
bankdb	Database name
readwrite	Access mode

Characteristics of the TMSNAME, TMSCOUNT, OPENINFO, and CLOSEINFO Parameters

The following table lists the characteristics of the TMSNAME, TMSCOUNT, OPENINFO, and CLOSEINFO parameters.

Parameter	Characteristics
TMSNAME	Name of the transaction manager server executable. Required parameter for transactional configurations. TMS is a null transactional manager server.
TMSCOUNT	Number of transaction manager servers (must be between 2 and 10). Default is 3.
OPENINFO, CLOSEINFO	Represents information to open or close a resource manager. Content depends on the specific resource manager. Starts with the name of the resource manager. Omission means the RM needs no information to open.

Characteristics of the AUTOTRAN, TRANTIME, and FACTORYROUTING Parameters

The following table lists the characteristics of the AUTOTRAN, TRANTIME, and FACTORYROUTING parameters.

Parameter	Characteristics
AUTOTRAN	Makes an interface the initiator of a transaction. To work properly, may be dependent on personal communication between the system designer and the system administrator. If the administrator sets this value to Y without prior knowledge of the ICF parameters set by the developer, the actual run-time effort of the parameter might be unknown. If a transaction already exists, a new one is not started. Default is N.

Parameter	Characteristics
TRANTIME	Represents the timeout for the AUTOTRAN transactions. Valid values are between 0 and 2^{31} - 1, inclusive. 0 represents no timeout. Default is 30 seconds.
FACTORYROUTING	Points to an entry in the ROUTING section where data-dependent routing is specified for transactions that request this service.

Enabling a Service to Begin a Transaction in the SERVICES Section

The following are three transaction-related additions in the SERVICES section:

- If you want a service, instead of a client, to begin a transaction, you must set the AUTOTRAN flag to Y. This is useful if the service is not needed as part of any larger transaction, and if the application wants to relieve the client of making transaction decisions. If the service is called when there is already an existing transaction, this call becomes part of it. (The default is N.)

  Note: Generally, clients are the best initiators of transactions because a service has the potential of participating in a larger transaction.

- If AUTOTRAN is set to Y, you must set the TRANTIME parameter, which is the transaction timeout in seconds for the transactions to be created. The value must be greater than or equal to 0 and must not exceed 2,147,483,647 (2^{31} - 1, or about 70 years). A value of zero implies there is no timeout for the transaction. (The default is 30 seconds.)

- You must specify a ROUTING parameter for transactions that request data-dependent routing.

Characteristics of the AUTOTRAN, TRANTIME, and ROUTING Parameters

The following table lists the characteristics of the AUTOTRAN, TRANTIME, and ROUTING parameters.

Parameter	Characteristics
AUTOTRAN	Makes a service the initiator of a transaction. Relieves the client of the transactional burden. If a transaction already exists, a new one is not started. Default is N.
TRANTIME	Represents the timeout for the AUTOTRAN transactions. Valid values are between 0 and 2^{31} - 1, inclusive. 0 represents no timeout. Default is 30 seconds.
ROUTING	Points to an entry in the ROUTING section where data-dependent routing is specified for transactions that request this service.

Modifying the Domain Configuration File to Support Transactions

To enable transactions across domains, you need to set parameters in both the DM_LOCAL_DOMAINS and the DM_REMOTE_SERVICES sections of the Domains configuration file (DMCONFIG). Entries in the DM_LOCAL_DOMAINS section define local domain characteristics. Entries in the DM_REMOTE_SERVICES section define information on services that are *imported* and that are available on remote domains.

Characteristics of the DMTLOGDEV, DMTLOGNAME, DMTLOGSIZE, MAXRDTRAN, and MAXTRAN Parameters

The DM_LOCAL_DOMAINS section of the Domains configuration file identifies local domains and their associated gateway groups. This section must have an entry for each gateway group (Local Domain). Each entry specifies the parameters required for the Domains gateway processes running in that group.

The following table provides a description of the five transaction-related parameters in this section: DMTLOGDEV, DMTLOGNAME, DMTLOGSIZE, MAXRDTRAN, and MAXTRAN.

Parameter	Characteristics
DMTLOGDEV	Specifies the BEA TUXEDO file system that contains the Domains transaction log (DMTLOG) for this machine. The DMTLOG is stored as a BEA TUXEDO VTOC table on the device. If this parameter is not specified, the Domains gateway group is not allowed to process requests in transaction mode. Local domains running on the same machine can share the same DMTLOGDEV file system, but each local domain must have its own log (a table in the DMTLOGDEV) named as specified by the DMTLOGNAME keyword.
DMTLOGNAME	Specifies the name of the Domains transaction log for this domain. This name must be unique when the same DMTLOGDEV is used for several local domains. If a value is not specified, the value defaults to the string DMTLOG. The name must contain 30 characters or less.
DMTLOGSIZE	Specifies the numeric size of the Domains transaction log for this machine (in pages). It must be greater than zero and less than the amount of available space on the BEA TUXEDO file system. If a value is not specified, the value defaults to 100 pages. **Note:** The number of domains in a transaction determine the number of pages you must specify in the DMTLOGSIZE parameter. One transaction does not necessarily equal one log page.
MAXRDTRAN	Specifies the maximum number of domains that can be involved in a transaction. It must be greater than zero and less than 32,768. If a value is not specified, the value defaults to 16.

Parameter	Characteristics
MAXTRAN	Specifies the maximum number of simultaneous global transactions allowed on this local domain. It must be greater than or equal to zero, and less than or equal to the MAXGTT parameter specified in the TUXCONFIG file. If not specified, the default is the value of MAXGTT.

Characteristics of the AUTOTRAN and TRANTIME Parameters

The DM_REMOTE_SERVICES section of the Domains configuration file identifies information on services *imported* and available on remote domains. Remote services are associated with a particular remote domain.

The following table describes the two transaction-related parameters in this section: AUTOTRAN and TRANTIME.

Parameter	Characteristics
AUTOTRAN	Used by gateways to automatically start/terminate transactions for remote services. This capability is required if you want to enforce reliable network communication with remote services. You specify this capability by setting the AUTOTRAN parameter to Y in the corresponding remote service definition.
TRANTIME	Specifies the default timeout value in seconds for a transaction automatically started for the associated service. The value must be greater than or equal to zero, and less than 2147483648. The default is 30 seconds. A value of zero implies the maximum timeout value for the machine.

Example: A Distributed Application Using Transactions

The following configuration file shows bankapp as an application that is distributed over three sites and that uses transactions. The application includes the following:

- Data-dependent routing on ACCOUNT_ID
- Data distributed over three databases
- BRIDGE processes communicating with the system via the ATMI interface
- System administration from one site

The file includes seven sections: RESOURCES, MACHINES, GROUPS, NETWORK, SERVERS, SERVICES, and ROUTING.

The RESOURCES Section

The RESOURCES section shown in Listing 7-1 specifies the following parameters:

- MAXSERVERS, MAXSERVICES, and MAXGTT are less than the defaults. This makes the Bulletin Board smaller.
- MASTER is SITE3 and the backup master is SITE1.
- MODEL is set to MP and OPTIONS is set to LAN, MIGRATE. This allows a networked configuration with migration.
- BBLQUERY is set to 180 and SCANUNIT is set to 10. This means that DBBL checks of the remote BBLs are done every 1800 seconds (one half hour).

Listing 7-1 Sample RESOURCES Section

```
RESOURCES
#
IPCKEY       99999
```

```
UID          1
GID          0
PERM         0660
MAXACCESSERS 25
MAXSERVERS   25
MAXSERVICES  40
MAXGTT       20
MASTER       SITE3, SITE1
SCANUNIT     10
SANITYSCAN   12
BBLQUERY     180
BLOCKTIME    30
DBBLWAIT     6
OPTIONS      LAN, MIGRATE
MODEL        MP
LDBAL         Y
```

The MACHINES Section

The MACHINES section shown in Listing 7-2 specifies the following parameters:

- TLOGDEVICE and TLOGNAME are specified, which indicate that transactions will be done.
- The TYPE parameters are all different, which indicates that encode/decode will be done on all messages sent between machines.

Listing 7-2 Sample MACHINES Section

```
MACHINES
Gisela       LMID=SITE1
             TUXDIR="/usr/tuxedo"
             APPDIR="/usr/home"
             ENVFILE="/usr/home/ENVFILE"
             TLOGDEVICE="/usr/home/TLOG"
             TLOGNAME=TLOG
             TUXCONFIG="/usr/home/tuxconfig"
             TYPE="3B600"

romeo        LMID=SITE2
             TUXDIR="/usr/tuxedo"
             APPDIR="/usr/home"
```

```
                ENVFILE="/usr/home/ENVFILE"
                TLOGDEVICE="/usr/home/TLOG"
                TLOGNAME=TLOG
                TUXCONFIG="/usr/home/tuxconfig"
                TYPE="SEQUENT"

juliet          LMID=SITE3
                TUXDIR="/usr/tuxedo"
                APPDIR='/usr/home"
                ENVFILE="/usr/home/ENVFILE"
                TLOGDEVICE="/usr/home/TLOG"
                TLOGNAME=TLOG
                TUXCONFIG="/usr/home/tuxconfig"
                TYPE="AMDAHL"
```

The GROUPS and NETWORK Sections

The GROUPS and NETWORK sections shown in Listing 7-3 specify the following parameters:

- The TMSCOUNT is set to 2, which means that only two TMS_SQL transaction manager servers will be booted per group.
- The OPENINFO string indicates that the application will perform database access.

Listing 7-3 Sample GROUPS and NETWORK Sections

```
GROUPS
DEFAULT:         TMSNAME=TMS_SQL        TMSCOUNT=2
BANKB1           LMID=SITE1             GRPNO=1
 OPENINFO="TUXEDO/SQL:/usr/home/bankdl1:bankdb:readwrite"
BANKB2           LMID=SITE2             GRPNO=2
 OPENINFO="TUXEDO/SQL:/usr/home/bankdl2:bankdb:readwrite"
BANKB3            LMID=SITE3             GRPNO=3
 OPENINFO="TUXEDO/SQL:/usr/home/bankdl3:bankdb:readwrite"

NETWORK
SITE1             NADDR="0X0002ab117B2D4359"
                  BRIDGE="/dev/tcp"
                  NLSADDR="0X0002ab127B2D4359"
```

```
SITE2           NADDR="0X0002ab117B2D4360"
                BRIDGE="/dev/tcp"
                NLSADDR="0X0002ab127B2D4360"

SITE3           NADDR="0X0002ab117B2D4361"
                BRIDGE="/dev/tcp"
                NLSADDR="0X0002ab127B2D4361"
```

The SERVERS, SERVICES, and ROUTING Sections

The SERVERS, SERVICES, and ROUTING sections shown in Listing 7-4 specify the following parameters:

- The TLR servers have a -T *number* passed to their tpsrvrinit() functions.
- All requests for the services are routed on the ACCOUNT_ID field.
- None of the services will be performed in AUTOTRAN mode.

Listing 7-4 Sample SERVERS, SERVICES, and ROUTING Sections

```
SERVERS
DEFAULT: RESTART=Y MAXGEN=5 REPLYQ=N CLOPT="-A"
TLR      SRVGRP=BANKB1    SRVID=1    CLOPT="-A -- -T 100"
TLR      SRVGRP=BANKB2    SRVID=3    CLOPT="-A -- -T 400"
TLR      SRVGRP=BANKB3    SRVID=4    CLOPT="-A -- -T 700"
XFER     SRVGRP=BANKB1    SRVID=5    REPLYQ=Y
XFER     SRVGRP=BANKB2    SRVID=6    REPLYQ=Y
XFER     SRVGRP=BANKB3    SRVID=7    REPLYQ=Y

SERVICES
DEFAULT:    AUTOTRAN=N
WITHDRAW        ROUTING=ACCOUNT_ID
DEPOSIT         ROUTING=ACCOUNT_ID
TRANSFER        ROUTING=ACCOUNT_ID
INQUIRY         ROUTING=ACCOUNT_ID

ROUTING
ACCOUNT_ID      FIELD=ACCOUNT_ID     BUFTYPE="FML"
                     RANGES="MON - 9999:*,
                     10000 - 39999:BANKB1
```

```
40000 - 69999:BANKB2
70000 - 100000:BANKB3
   ""
```

8 Working with Multiple Domains

This chapter describes the task of administering services across multiple Domains by using the BEA TUXEDO Domains feature. This chapter discusses the following topics:

- Benefits of Using BEA TUXEDO System Domains
- What Is the Domains Gateway Configuration File?
- Configuring Local and Remote Domains
- Example of a Domains-based Configuration
- Ensuring Security in Domains
- Routing Service Requests to Remote Domains

Benefits of Using BEA TUXEDO System Domains

Using Domains provides the following benefits:

- Scalability and modular growth—Programmers can structure their application for modularity, isolation of failures, and independent growth. Interoperation with other transaction processing applications is achieved easily by adding to the

Domains configuration the description of the interfaces (that is, services) used by a remote application.

- Transparency and independence—Applications are totally unaware of service distribution. A service may be available on the same machine, on another machine in the local domain, or on a remote domain. Client application programmers do not need to know the implementation changes made to a service, the location of a service, network addresses, and so on.
- Aliasing capability—This allows you to define a mapping between the service names used by a remote application and the service names used by the local application, allowing for easy integration of applications that use different naming schemes.
- Transaction management and reliability—The Domains feature us integrated with the BEA TUXEDO system transaction management capabilities.
- Availability—You can specify alternate destinations to handle failure conditions.
- Security—An access control list (ACL) facility is provided to restrict access to local services from a particular set of remote domains. Domains also provides encryption and password verification.

What Is the Domains Gateway Configuration File?

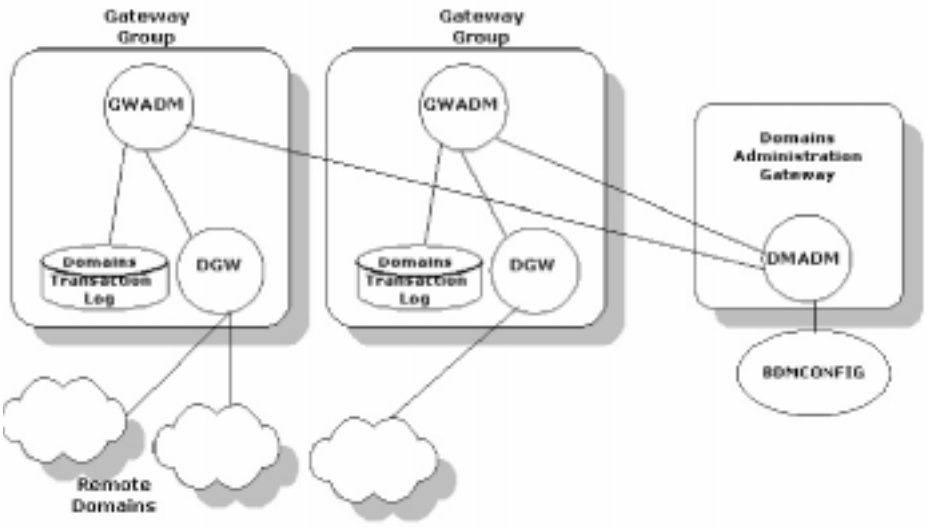
All domain configuration information is stored in a binary file, called the `BDMCONFIG` file. You can create and edit the domain gateway configuration file (`DMCONFIG` file), with any UNIX text editor. You can update the compiled `BDMCONFIG` file while the system is running by using the `dmadmin`(1) command when using Domains. There must be one `BDMCONFIG` file per BEA TUXEDO application.

A BEA TUXEDO system domain gateway is a server supplied by the BEA TUXEDO system that enables access to and from remote domains. Domains provides a gateway administrative server (`GWADM`) that enables run-time administration of the Domains gateway group, and a Domains administrative server (`DMADM`) that enables run-time administration of the Domains configuration information (`BDMCONFIG`). You enable

remote domain access by specifying a gateway group and a domain administration group in the `GROUPS` section of the `TUXCONFIG` file, and by adding entries for the gateway and the two administrative servers in the `SERVERS` section.

In Figure 8-1, `DGW` is the domain gateway; `GWADM` is the gateway administrative server; `DMADM` is the Domains administrative server; and `BDMCONFIG` is the Domains gateway configuration file.

Figure 8-1 BEA TUXEDO Domains Gateway



Components of the DMCONFIG File

The following table describes the sections of the `DMCONFIG` file.

Section of the DMCONFIG File	Purpose
`DM_LOCAL_DOMAINS`	Describes the environment for a particular domain gateway group. You can use multiple entries in this section to define multiple gateway groups within a single BEA TUXEDO application.
`DM_REMOTE_DOMAINS`	Identifies the remote domains that clients and servers of this Domains application can access.
`DM_LOCAL_SERVICES`	Describes the set of services in this domain which remote domains can access.
`DM_REMOTE_SERVICES`	Describes the set of services provided by remote domains that are accessible from this domain.

Section of the DMCONFIG File	Purpose
DM_ROUTING	Specifies criteria for data-dependent routing used by gateways to route service requests to specific remote domains.
DM_ACCESS_CONTROL	Specifies a named list (the Access Control List) of remote domains permitted to access a particular service.
DM_<*dmtype*>	Defines the specific parameters required for a particular Domains instance. Currently, the value of *dmtype* can be OSITP, SNA, or TDOMAIN. (This chapter focuses only on TDOMAIN.) You must specify each domain type in a section of its own.

Configuring Local and Remote Domains

To configure a local domain and a remote domain, perform the following tasks:

- Set environment variables
- Build a local application configuration file and a local domain gateway configuration file
- Build a remote application configuration file and a remote domain gateway configuration file

Setting Environment Variables

You need to set the following environment variables for the application to be configured successfully:

- TUXDIR—The BEA TUXEDO system root directory (for example, /opt/tuxedo)
- TUXCONFIG—The application configuration file (for example, lapp.tux or rapp.tux)

- BDMCONFIG—The Domains gateway configuration file (for example, lapp.bdm or rapp.bdm)
- PATH—Must include $TUXDIR/bin
- LD_LIBRARY_PATH—Must include $TUXDIR/lib

Example

```
$ TUXDIR=/opt/tuxedo
$ PATH=$TUXDIR/bin:$PATH
$ LD_LIBRARY_PATH=$TUXDIR/lib:$LD_LIBRARY_PATH
$ export TUXDIR PATH LD_LIBRARY_PATH
```

Building a Local Application Configuration File and a Local Domains Gateway Configuration File

Build a local application configuration file using tmloadcf(1), and a local domain gateway configuration file using dmloadcf(1). The local application configuration file (lapp.ubb) contains the information necessary to boot the local application. This file is compiled into a binary data file (lapp.tux), using tmloadcf(1).

The local domain gateway configuration file (lapp.dom) contains the information used by domain gateways for communications with other domains. This file is compiled into a binary data file (lapp.bdm), using dmloadcf(1).

```
$ cd /home/lapp
$ TUXCONFIG=/home/lapp/lapp.tux; export TUXCONFIG
$ tmloadcf -y lapp.ubb
$ BDMCONFIG=/home/lapp/lapp.dom; export BDMCONFIG
$ dmloadcf -y lapp.dom
$ tmboot -y
```

Building a Remote Application Configuration File and a Remote Domains Gateway Configuration File

Build a remote application configuration file and a remote domain gateway configuration file. The remote application configuration file (`rapp.ubb`) contains the information used by domain gateways for communication with other domains. This file is compiled into a binary data file (`rapp.tux`).

The remote domain gateway configuration file (`rapp.dom`) contains the information used by domain gateways to initialize the context required for communications with other domains. This configuration file is similar to the local domain gateway configuration file. The difference is in which services are exported and imported. This file is compiled into a binary data file (`rapp.bdm`).

```
$ cd /home/rapp

$ TUXCONFIG=/home/rapp/rapp.tux; export TUXCONFIG

$ tmloadcf -y rapp.ubb

$ BDMCONFIG=/home/rapp/rapp.dom; export BDMCONFIG

$ dmloadcf -y rapp.dom

$ tmboot -y
```

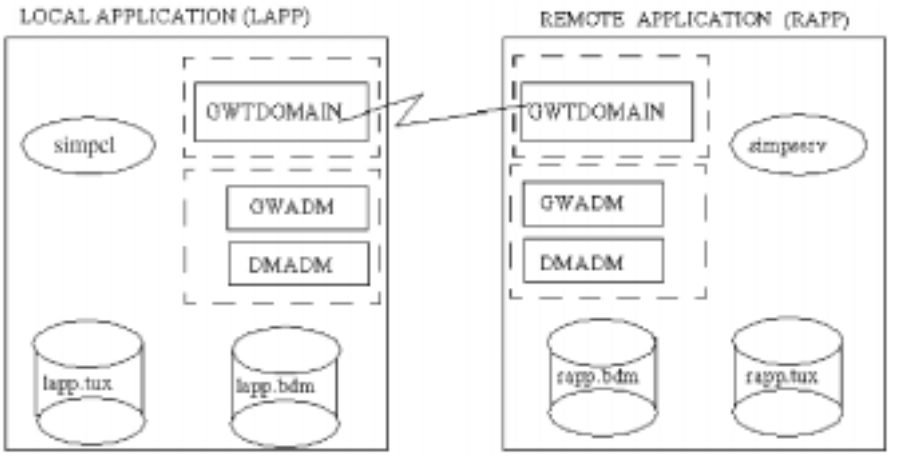
Once you create both the local and remote domains, you can then boot the application using `tmboot`(1). The order in which the two domains are booted does not matter. Monitor the applications with `dmadmin`(1).

Once both applications are booted, a client in the local application can call the `TOUPPER` service residing in the remote application.

Example of a Domains-based Configuration

The Domains example illustrated in Figure 8-2 and throughout this chapter consists of two applications, both of which are based on the `simpapp` example provided with the BEA TUXEDO system. The first application is called `lapp` for "local application"; the second, `rapp` for "remote application." lapp is configured to allow its clients to access a service called `TOUPPER`, which is advertised in `rapp`.

Figure 8-2 A Local and a Remote Application (simpapp)



Defining the Local Domains Environment

For the sample local application configuration file (`lapp.ubb`) shown in Listing 8-1, only the required parameters are defined. Default settings are used for the other parameters.

The following two server groups are defined:

- The first contains the domain administrative server (`DMADM`).
- The second contains the gateway administrative server (`GWADM`) and the domain gateway (`GWTDOMAIN`).

The following three servers are defined:

- `DMADM`—The domain administrative server enables run-time administration of the configuration information required by domain gateway groups. This server provides run-time administration of the binary domain configuration file and supports a list of registered gateway groups. (There must be only one instance of `DMADM` per Domains application.)

- GWADM—The gateway administrative server enables run-time administration of a particular Domains gateway group. This server gets domain configuration information from the DMADM server. It also provides administrative functionality and transaction logging for the gateway group.
- GWTDOMAIN—The domain gateway server enables access to and from remote Domains. It allows for interoperability of two or more BEA TUXEDO domains. Information about the local and remote services it needs to export and import is included in the domain configuration file. The domain gateway server should always be configured with REPLYQ=N.

Listing 8-1 Example of a Local Application Configuration File

```
# lapp.ubb
#
*RESOURCES
IPCKEY          111111

MASTER          LAPP
MODEL           SHM

*MACHINES
giselle

                LMID=LAPP
                TUXDIR="/opt/tuxedo"
                APPDIR="/home/lapp"
                 TUXCONFIG="/home/lapp/lapp.tux"

*GROUPS

LDMGRP          GRPNO=1 LMID=LAPP
LGWGRP          GRPNO=2 LMID=LAPP

*SERVERS

DMADM           SRVGRP=LDMGRP SRVID=1
GWADM           SRVGRP=LGWGRP SRVID=1
GWTDOMAIN       SRVGRP=LGWGRP SRVID=2 REPLYQ=N

*SERVICES
```

Defining the Local and Remote Domains, Addressing, and Imported and Exported Services

For the sample local domain gateway configuration file (`lapp.dom`), shown in Listing 8-2, only the required parameters are defined. Default settings are used for the other parameters.

The `DM_LOCAL_DOMAIN` section identifies the local domains and their associated gateway groups. This section has one entry (`LAPP`) and specifies the parameters required for the domain gateway processes in that group, as follows:

- `GWGRP` specifies the name of the gateway server group as specified in the application.
- `TYPE` of `TDOMAIN` indicates that the local domain will be communicating with another BEA TUXEDO domain. Other options are SNA and OSI.
- `DOMAINID` identifies the name of the Domains gateway and must be unique across all Domains.

The `DM_REMOTE_DOMAINS` section identifies the known set of remote Domains and their characteristics. This section has one entry (`RAPP`). `TYPE` is used to classify the type of Domains. `DomainsID` is a unique domain identifier.

The `DM_TDOMAIN` section defines the addressing information required by the BEA TUXEDO Domains feature. Following are entries in the section for each local and remote domain specified in this configuration file:

- `NWADDR` specifies either the network address to accept connections from other BEA TUXEDO Domains (local Domains entry), or the network address to connect to other BEA TUXEDO Domains (remote Domains entry).

The `DM_LOCAL_SERVICES` section provides information about the services that are exported. This section has no entries because no services are being exported.

The `DM_REMOTE_SERVICES` section provides information about the services that are imported. The `TOUPPER` service is imported so that it can be accessed by clients in the local domains.

Listing 8-2 Example of a Local Domains Gateway Configuration File

```
#
# lapp.dom
#
*DM_LOCAL_DOMAINS

LAPP          GWGRP=LGWGRP
              TYPE=TDOMAIN
               DOMAINID="111111"

*DM_REMOTE_DOMAINS

RAPP          TYPE=TDOMAIN
               DOMAINID="222222"

*DM_TDOMAIN

LAPP           NWADDR="//mach1:5000"

RAPP           NWADDR="//mach2:5000"

*DM_LOCAL_SERVICES

*DM_REMOTE_SERVICES

TOUPPER
```

Defining the Remote Domains Environment

For the sample remote application configuration file (`rapp.ubb`), shown in Listing 8-3, only the required parameters are defined. Default settings are used for the other parameters.

The following three server groups are defined:

- The first server group (`SRVGP=RDMGRP`) contains the Domains administrative server (`DMADM`).
- The second server group (`SRVGP=RGWGRP`) contains the gateway administrative server, `GWADM`, and the Domains gateway, `GWTDOMAIN`.
- The third server group (`SRVGP=APPGRP`) contains the application server `simpserv`.

The following four servers are defined:

- DMADM—The Domains administrative server
- GWADM—The gateway administrative server
- GWTDOMAIN—The Domains gateway server
- simpserv—The simple application server that advertises the TOUPPER service, which converts strings from lowercase to uppercase characters

Listing 8-3 Example of a Remote Application Configuration File

```
# rapp.ubb
#
*RESOURCES
IPCKEY        222222

MASTER        RAPP

MODEL        SHM

*MACHINES

juliet

             LMID=RAPP
             TUXDIR="/opt/tuxedo"
              APPDIR="/home/rapp"
               TUXCONFIG="/home/rapp/rapp.tux"

*GROUPS

RDMGRP        GRPNO=1 LMID=RAPP
RGWGRP        GRPNO=2 LMID=RAPP
APPGRP         GRPNO=3 LMID=RAPP

*SERVERS

DMADM         SRVGRP=RDMGRP SRVID=1
GWADM         SRVGRP=RGWGRP SRVID=1
GWTDOMAIN     SRVGRP=RGWGRP SRVID=2 REPLYQ=N
simpserv       SRVGRP=APPGRP SRVID=1

*SERVICES
TOUPPER
```

Defining the Exported Services

For the sample remote domain gateway configuration file (`rapp.dom`), shown in Listing 8-4, only the required parameters are defined. Default settings are used for the other parameters.

This configuration file is similar to the local domain gateway configuration file. The difference is in which services are exported and imported.

The `DM_LOCAL_SERVICES` section provides information about the services exported by each local domain. In this example, the `TOUPPER` service is exported and included in the `DM_LOCAL_SERVICES` section. No service is imported so there are no entries in the `DM_REMOTE_SERVICES` section.

Listing 8-4 Example of a Remote Domains Gateway Configuration File

```
# rapp.dom
#

*DM_LOCAL_DOMAINS

RAPP        GWGRP=RGWGRP
            TYPE=TDOMAIN
             DOMAINID=”222222"

*DM_REMOTE_DOMAINS

LAPP        TYPE=TDOMAIN
             DOMAINID=”111111"

*DM_TDOMAIN

RAPP         NWADDR=”//mach2:5000"

LAPP         NWADDR=”//mach1:5000"

*DM_LOCAL_SERVICES
TOUPPER
*DM_REMOTE_SERVICES
```

Using Data Compression Between Domains

Data compression is useful in most applications and vital to supporting large configurations. When data is sent between Domains, you can elect to compress it for faster performance. This is configured by setting the `CMPLIMIT` parameter in the `dmconfig`(5). See Chapter 6, "Building Networked Applications," for more information on data compression.

Ensuring Security in Domains

Because Domains can exist under diverse ownership, multiple ways are offered to enable you to provide sufficient security:

- Local Domains—Provides a first level of security. A partial view of the application (that is, a subset of services) can be made available to remote domains. This partial view is defined by including the corresponding services in the `DM_LOCAL_SERVICES` section of the `DMCONFIG` file.
- Domains Passwords—Authentication techniques are required to ensure the proper *identity* of each remote domain. Domains provides a facility for the definition of passwords on a per-remote-domain basis. This is configured by setting `SECURITY=DM_PW` in `dmconfig`(5).
- Access Control—Access control provides another level of security in which you can restrict access to services within a local domain such that only selected remote domains can execute these services. This is configured in the `DM_ACCESS_CONTROL` section of the `dmconfig`(5).
- Link-Level Encryption— Encryption can be used across domains to ensure data privacy, so a network-based eavesdropper cannot learn the content of BEA TUXEDO messages or application-generated messages from domain gateway to domain gateway. This is configured by setting `MINENCRYPTBITS` and `MAXENCRYPTBITS` in the `dmconfig`(5). (See Chapter 6, "Building Networked Applications," for more information.)

Creating a Domain Access Control List (ACL)

To create a domain ACL, you must specify the name of the domain ACL and a list of the remote domains that are part of the list (the Domain Import List) in the DM_ACCESS_CONTROL section of the DMCONFIG file. The following chart describes these two fields.

Domain ACL Field	Description
Domain ACL name	The name of this ACL. A valid name consists of a string of 1-30 characters, inclusive. It must be printable and it may not include a colon, a pound sign, or a new line character. An example is: ACLGRP1
Domain import VIEW list	The list of remote domains that are granted access for this access control list. A valid value in this field is a set of one or more comma-separated strings. An example is: REMDOM1,REMDOM2,REMDOM3

Routing Service Requests to Remote Domains

Information for data-dependent routing used by gateways to route service requests (to specific remote domains) is provided in the DM_ROUTING section of the DMCONFIG file. The FML32, VIEW32, FML, VIEW, X_C_TYPE, and X_COMMON typed buffers are supported. To create a routing table for a domain, you must specify the buffer type for which the routing entry is valid, the name of the routing entry and field, and the ranges and associated remote domain names of the routing field. The following table describes these fields.

Routing Table Fields	Description
Buffer type	A list of types and subtypes of data buffers for which this routing entry is valid. The types may include FML32, VIEW32, FML, VIEW, X_C_TYPE, or X_COMMON. No subtype can be specified for type FML; subtypes are required for the other types. The * (or *wildcard*) value is not allowed. Duplicate *type*/*subtype* pairs cannot be specified for the same routing criteria name; more than one routing entry can have the same criteria name as long as the *type*/*subtype* pairs are unique. If multiple buffer types are specified for a single routing entry, the data types of the routing field for each buffer type must be the same. Valid values for *type* are: [:*subtype1*[,*subtype2* . . .]][;*type2*[:*subtype3*[,*subtype4* . . .]]] . . . where the maximum length is 256 characters over 32 *type*/*subtype* combinations. Valid values for *subtype* are names may not include semicolons, colons, commas, or asterisks. An example is FML.
Domain routing criteria	The name (identifier) of the routing entry. A valid value is any string of 1-15 characters, inclusive. An example is ROUTTAB1.
Routing field name	The name of the routing field. This field is assumed to be a field name that is identified in an FML field table (for FML buffers) or an FML VIEW table (for VIEW, X_C_TYPE, or X_COMMON buffers). A valid value is an identifier string that is 1-30 characters, inclusive. An example is FIELD1.

Routing Table Fields	Description
Ranges	The ranges and associated remote domain names (RDOM) for the routing field. The routing field can be of any data type supported in FML. A numeric routing field must have numeric range values, and a string routing field must have string range values. String range values for string, carray, and character field types must be placed inside a pair of single quotes and cannot be preceded by a sign. Short and long integer values are a string of digits, optionally preceded by a plus or minus sign. Floating point numbers are of the form accepted by the C compiler or atof() as follows: an optional sign, then a string of digits optionally containing a decimal point, then an optional e or E followed by an optional sign or space, followed by an integer. When a field value matches a range, the associated RDOM value specifies the remote domains to which the request should be routed. An RDOM value of * indicates that the request can go to any remote domain known by the gateway group. Valid values are a comma-separated ordered list of range/RDOM pairs where a *range* is one of two types: (a) a single value (signed numeric value or character string in single quotes); or (b) a range of the form *lower-upper* (where *lower* and *upper* are both signed numeric values or character strings in single quotes). Note that *lower* must be less than or equal to *upper*. Within a range/RDOM pair, the range is separated from the RDOM by a colon (:). MIN can be used to indicate the minimum value for the data type of the associated FIELD; for strings and carrays, it is the null string; for character fields, it is 0; for numeric values, it is the minimum numeric value that can be stored in the field. MAX can be used to indicate the maximum value for the data type of the associated FIELD; for strings and carrays, it is effectively an unlimited string of octal-255 characters; for a character field, it is a single octal-255 character; for numeric values, it is the maximum numeric value that can be stored in the field. Thus, MIN - -5 is all numbers less than or equal to -5 and - MAX is the set of all numbers greater than or equal to 6. The meta-character * (*wildcard*) in the position of a range indicates any values not covered by the other ranges previously seen in the entry; only one wildcard range is allowed per entry and it should be last (ranges following it are ignored). An example is 1-100:REMDOM3.

9 Managing Workstation Clients

This chapter discusses the following topics:

- Workstation Terms
- What Is a Workstation Client?
- Setting Environment Variables
- Setting the Maximum Number of Workstation Clients
- Configuring a Workstation Listener (WSL)
- Modifying the MACHINES Section to Support Workstation Clients

Workstation Terms

Workstation
: Workstation Extension—The workstation product that is an extension of the base BEA TUXEDO system.

DLL
: Dynamic Link Libraries—A collection of functions grouped into a load module that is dynamically linked with an executable program at run time for a Microsoft Windows or an OS/2 application.

WSC
: Workstation Client—A client process running on a remote site.

WSH
: Workstation Handler—A client process running on an application site that acts as a surrogate on behalf of the WSC.

WSL
: Workstation Listener—A server process running on an application site that listens for WSCs to connect.

What Is a Workstation Client?

The Workstation Extension of the BEA TUXEDO system allows application clients to reside on a machine that does not have a full server-side installation, that is, a machine that does not support any administration or application servers, or a Bulletin Board. All communication between the client and the application takes place over the network.

The client process can be running UNIX, MS-DOS, Windows, or OS/2. The client has access to the ATMI interface for clients. The networking behind the calls is transparent to the user. The client process registers with the system and has the same status as a native client. The client can do the following:

- Send and receive messages
- Begin, end, or commit transactions
- Send and receive unsolicited messages
- Pass application security (on a mandatory basis)
- Communicate information about remote clients through the `tmadmin`(1) command

Note: A client process communicates with the native domain through the WSH rather than through a `BRIDGE` process.

Illustration of an Application with Two Workstation Clients

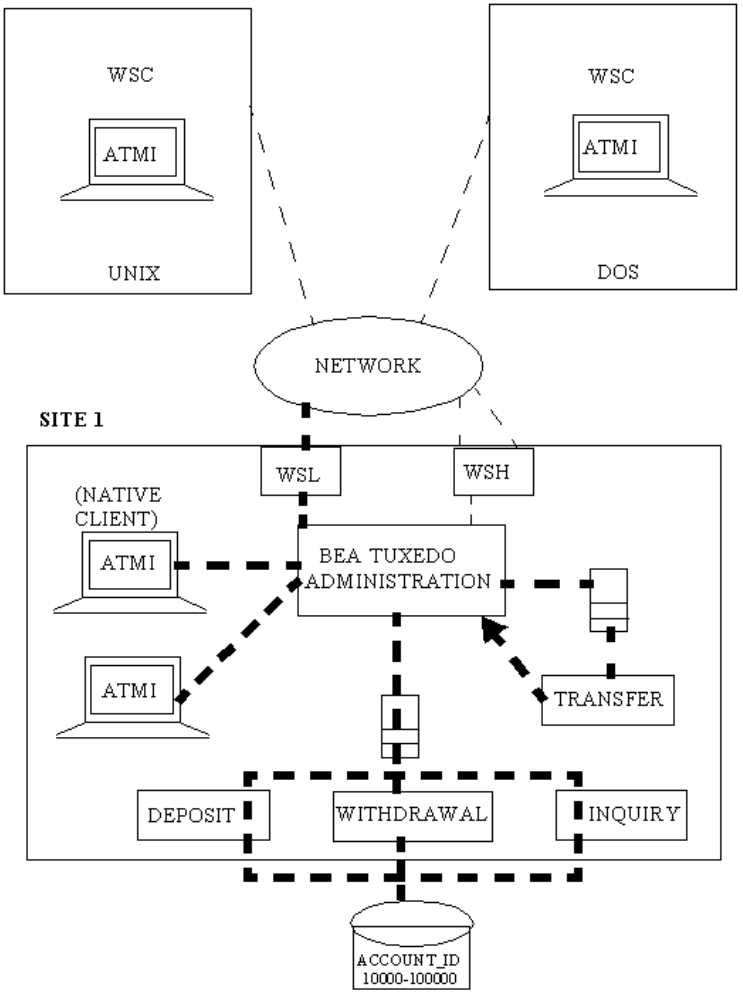
Figure 9-1 shows an example of an application with two WSCs connected. The client on the left is running on a UNIX system workstation, while the client on the right is running on an MS-DOS workstation. Both WSCs are communicating with the application through the WSH process. Initially, both joined by communicating with the WSL (indicated by the heavily dashed line).

The administrative servers and the application servers are located entirely on `SITE1`. Any request by a WSC to access the resource manager (RM) is sent over the network to the WSH. This process sends the request to the appropriate server and sends the reply back to the WSC.

The application is running in SHM mode. If the application was distributed over several nodes, the procedure would be very similar. The WSC would communicate with one WSH, and the request would be sent to a `BRIDGE` process, which would forward it to the correct node.

Note: As used in this book, the term “resource manager” refers to an entity that interacts with the BEA TUXEDO system and implements the XA standard interfaces. The most common example of a resource manager is a database. Resource managers provide transaction capabilities and permanence of actions; they are the entities accessed and controlled within a global transaction.

Figure 9-1 A Bank Application with Two Workstation Clients



How the Workstation Client Connects to an Application

A workstation client connects to an application in the following manner.

1. The client connects to the WSL process using a known network address. This is initiated when the client calls either `tpchkauth()` or `tpinit()`. The WSL returns the address of a WSH to the client.
2. The WSL process sends a message to the WSH process informing it of the connection request.
3. The WSC connects to the WSH. (All further communication between the WSC and the application takes place through the WSH.)

Setting Environment Variables

Eight environment variables can be used to pass information to the system. All are optional except `TUXDIR` and `WSNADDR`. Defaults are available for all except `WSENVFILE`:

- `TUXDIR`—This contains the location of the BEA TUXEDO software on this workstation. It must be set for the client to connect.
- `WSNADDR`— This contains the network address of the WSL that the client wants to contact. This must match the address of a WSL process, as specified in the application configuration file.
- `WSDEVICE`—This contains the network device to be used. The default is an empty string. `WSDEVICE` must be set if TLI is being used.
- `WSENVFILE`—This contains the name of a file in which all environment variables may be set. There is no default for this variable.
- `WSTYPE`—This contains the machine type. If the value of `WSTYPE` matches the value of `TYPE` in the configuration file for the WSL machine, no encoding/decoding is performed. The default is the empty string. Keep in mind, when deciding whether to use the default, that a value of “empty string” will match any other “empty string” value. Be sure to specify the value of `WSTYPE` whenever that value does not match the value of `TYPE` on the WSL machine.
- `WSRPLYMAX`—This contains the amount of core memory to be used for buffering application replies. The default is 32,000 bytes.

- TMPDIR—This contains the directory in which to store replies when the WSRPLYMAX limit has been reached. The default is the working directory.
- APP_PW—This contains the password in a secure application. Clients that run from scripts can get the application password from this variable.

Setting the Maximum Number of Workstation Clients

To join workstation clients to an application, you must specify the MAXWSCLIENTS parameter in the MACHINES section of the UBBCONFIG file.

MAXWSCLIENTS is the only parameter that has special significance for the Workstation feature. MAXWSCLIENTS tells the BEA TUXEDO system at boot time how many *accesser slots* to reserve exclusively for workstation clients. For native clients, each accesser slot requires one semaphore. However, the Workstation handler process (executing on the native platform on behalf of workstation clients) multiplexes Workstation client accessers through a single accesser slot and, therefore, requires only one semaphore. This points out an additional benefit of the Workstation extension. By putting more clients out on workstations and off the native platform, an application reduces its IPC resource requirements.

MAXWSCLIENTS takes its specified number of accesser slots from the total set in MAXACCESSERS. This is important to remember when specifying MAXWSCLIENTS; enough slots must be left to accommodate native clients as well as servers. If you specify a value for MAXWSCLIENTS greater than MAXACCESSERS, native clients and servers fail at tpinit() time. The following table describes the MAXWSCLIENTS parameter.

Parameter	Description
MAXWSCLIENTS	Specifies the maximum number of WSCs that may connect to a node. The default is 0. If not specified, WSCs may not connect to the machine being described. The syntax is MAXWSCLIENTS=*number*.

Configuring a Workstation Listener (WSL)

Workstation clients access your application through the services of a WSL process and one or more WSH processes. The WSL and WSH are specified in one entry as a server supplied by the BEA TUXEDO system, although they are separate processes. The WSL can support multiple workstation clients and acts as the single point of contact for all the workstation clients connected to your application at the network address specified on the WSL command line. The listener schedules work for one or more workstation handler processes. A WSH process acts as a surrogate within the administrative domain of your application for workstation clients on remote workstations. The WSH uses a multiplexing scheme to support multiple Workstation clients concurrently.

To join Workstation clients to an application, you must list the Workstation Listener (WSL) processes in the `SERVERS` section of the `UBBCONFIG` file. Use the same syntax you use when listing a server.

Format of the CLOPT Parameter

Use the command-line option string (`CLOPT`) to pass information to a WSL process. The format of the `CLOPT` parameter is as follows.

```
CLOPT="[ -A ] [servopts-options] -- -n netaddr [-d device] ]\
       [-w WSHname] [-t timeout-factor][-T Client-timeout]\
       [-m minh][-M maxh][-x mpx-factor ]\
       [-p minwshport][-P maxwshport]\
       [-I init-timeout][-c compression-threshold][-k\
compression-threshold]\
       [-z bits][-Z bits][-H external-netaddr]"
```

The `-A` value indicates that the WSL is to be booted to offer all its services. This is a default, but it is shown to emphasize the distinction between system-supplied servers and application servers. The latter can be booted to offer only a subset of their available services. The `--` syntax marks the beginning of a list of parameters that are passed to the WSL after the latter has been booted.

Command-line Options of the CLOPT Parameter

You can specify the following command-line options in the CLOPT string after the -- (double minus signs):

- -n *netaddr* is the network address that WSCs use to contact the listener. The WSC must set the environment variable (WSNADDR) to this value. This is a required parameter.
- [-d *device*] is the network device name. This is an optional parameter because some transport interfaces (sockets) do not require it. However, it is required if the provider is TLI.
- [-t *timeout*] allows more time for a client to join when there is a large number of clients attempting to join simultaneously. The value is multiplied by the SCANUNIT parameter. The default is 3 in a nonsecure application and 6 in an application with security on it.
- [-w *name*] is the name of the WSH process that should be booted for this listener. The default is WSH, which is the name of the handler provided. If another handler process is built with the buildwsh(1) command, that name is specified here.
- [-m *number*] specifies the minimum number of handlers that should be booted and always available. The default is 0.
- [-M *number*] specifies the maximum number of handlers that can be booted. The default is the value of MAXWSCLIENTS for that node divided by the multiplexing value.
- [-x *number*] specifies the maximum number of clients that a WSH can multiplex at a time. The default is 10 and the value must be greater than 0.
- [-T *client-timeout*] specifies the inactive client timeout option. The inactive client timeout is the time (in minutes) allowed for a client to stay idle. If a client does not make any requests within this time period, the WSH disconnects the client. If this argument is not given or is set to 0, the timeout is infinite.
- [-p *minwshport*] [-P *maxwshport*] specifies the range for port numbers available for use by WSHs associated with this listener server. Port numbers must fall in the range between 0 and 65535. The default is 2048 for *minwshport* and 65535 for *maxwshport*.

Modifying the MACHINES Section to Support Workstation Clients

Listing 9-1 shows an example of how you can add the Workstation feature to the bankapp application.

Listing 9-1 UBBCONFIG Configuration

```
MACHINES
SITE1
                ...
                MAXWSCLIENTS=150

                ...
SITE2

                ...
                MAXWSCLIENTS=0
                ...

SERVERS
                ...
WSL SRVGRP="BANKB1" SRVID=500 RESTART=Y
           CLOPT="-A -- -N 0x0002ffffaaaaaaaa \
           -d /dev/tcp -m 5 -M 30 -x 5"

           ...
```

Notice the following specifications in the MACHINES and SERVERS sections:

- The MACHINES section shows the default MAXWSCLIENTS as being overridden for two sites. For SITE1, the default is raised to 150, while it is lowered to 0 for SITE2, which will not have WSCs connected to it.
- The SERVERS section shows a WSL process listed for group BANKB1. The WSL has a server ID of 500 and it is marked as restartable.
- The command-line options show the following:

- The WSL will advertise all of its services (`-A`).
- The WSL will listen at network address 0x0002ffffaaaaaaaa (`-N`).
- The network provider will be `/dev/tcp` (`-d`).
- A minimum of 5 WSHs will be booted (`-m`).
- A maximum of 30 WSHs will be booted (`-M`).
- Each handler will be allowed a maximum of 5 clients connected at any one time (`-x`).

10 Managing Queued Messages

This chapter describes how to configure the BEA TUXEDO Queued Message Facility for your application, and how to manage the facility when the application goes into production.

The following topics are presented:

- Terms and Definitions
- Overview of the BEA TUXEDO Queued Message Facility
- Administrative Tasks
- Setting the QMCONFIG Environment Variable
- Using qmadmin, the /Q Administrative Interface
- Creating an Application Queue Space and Queues
- Modifying the Configuration File

Terms and Definitions

The following terms are used in this chapter.

/Q
: A short name for the BEA TUXEDO Queued Message Facility

`QMCONFIG`
: An environment variable that holds the name of the device (file) where /Q queue space is located.

Queue
: A named stable storage area where service requests from client processes or responses from application servers are stored.

Queue Space
: A collection of queues that can be administered as a unit.

Request Queue
: A space associated with an application server where service requests are placed for processing by the server.

`TMQUEUE`
: A BEA TUXEDO system server that accepts messages from a `tpenqueue()` call and places them on a /Q queue.

`TMQFORWARD`
: A BEA TUXEDO system server that dequeues a message from a /Q queue and forwards the message to an application server.

`TMS_QM`
: A BEA TUXEDO system server that manages transactions for /Q.

Overview of the BEA TUXEDO Queued Message Facility

The BEA TUXEDO Queued Message Facility allows messages to be queued to stable storage for later processing. Primitives are added to the BEA TUXEDO system application-transaction manager interface, (ATMI), that provides for messages to be added to or read from stable-storage queues. Reply messages and error messages can be queued for later return to client programs. An administrative command interpreter is provided for creating, listing, and modifying the queues. Prewritten servers are included to accept requests to enqueue and dequeue messages, to forward messages from the queue for processing, and to manage the transactions that involve the queues.

Administrative Tasks

The BEA TUXEDO system administrator is responsible for defining servers and creating queue space and queues like those shown between the vertical dashed lines in Figure 10-1.

The administrator must define at least one queue server group with `TMS_QM` as the transaction manager server for the group.

Two additional system-provided servers need to be defined in the configuration file. These servers perform the following functions:

- The message queue server, `TMQUEUE`(5), is used to enqueue and dequeue messages. This provides a surrogate server for doing message operations for clients and servers, whether or not they are local to the queue.
- The message forwarding server, `TMQFORWARD`(5), is used to dequeue and forward messages to application servers. The BEA TUXEDO system provides routines for servers that handle server initialization and termination, allocate buffers to receive and dispatch incoming requests to service routines, and route replies to the correct destination. All of this processing is transparent to the application.
- Existing servers do not dequeue their own messages or enqueue replies. One goal of /Q is to be able to use existing servers to service queued messages without change. The `TMQFORWARD` server, for example:
  - Dequeues a message from one or more queues in the queue space
  - Forwards the message to a server that has a service with the same name as the queue
  - Waits for the reply
  - Queues the success reply or failure reply on the associated reply or failure queues (assuming the originator specified a reply or failure queue)

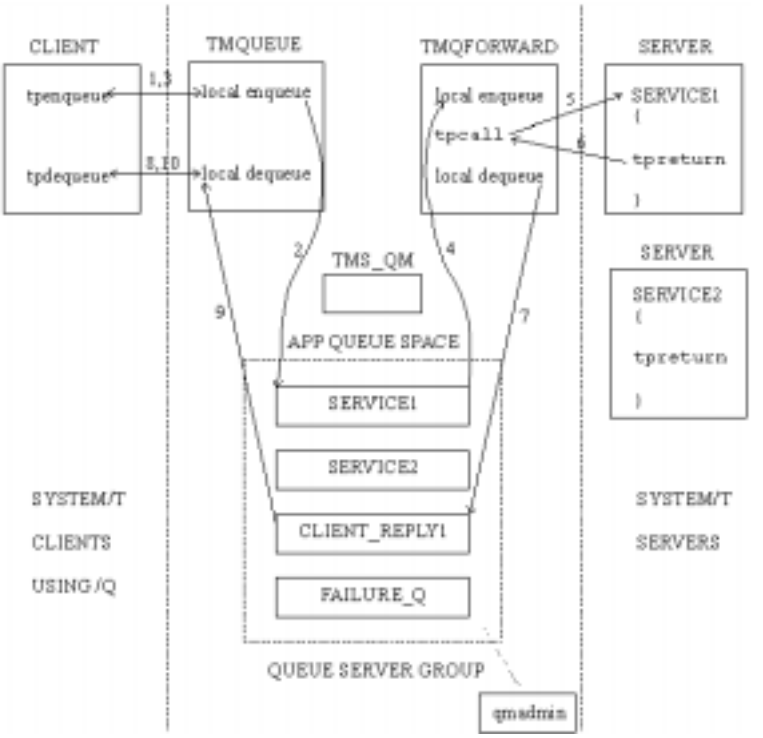
Also, the administrator must create a queue space using the queue administration program, `qmadmin`(1). The queue space contains a collection of queues. In Figure 10-1, for example, four queues are present within the queue space named `APP`. There is a one-to-one mapping of queue space to queue server group since each queue space is a resource manager (RM) instance and only a single RM can exist in a group.

The notion of queue space allows for reducing the administrative overhead associated with a queue by sharing the overhead among a collection of queues in the following ways:

- The queues in a queue space share the stable storage area for messages.
- A single message queue server, such as `TMQUEUE` in Figure 10-1, can be used to enqueue and dequeue messages for multiple queues within a single queue space.
- A single message forwarding server, such as `TMQFORWARD` in Figure 10-1, can be used to dequeue and forward messages for multiple queues within a single queue space.
- A single transaction manager server, such as `TMS_QM` in Figure 10-1, can be used to complete transactions for multiple queues within a single queue space.
- The administrator can define a single server group in the application configuration for the queue space by specifying the group in `UBBCONFIG` or by using `tmconfig`(1) to add the group dynamically.
- Finally, when the administrator moves messages between queues within a queue space, the overhead is less than if the messages were in different stable storage areas, because a one-phase commit can be done.

Figure 10-1 shows how the BEA TUXEDO Queued Message Facility works. The queue spaces and queues shown between the vertical dashed lines must be defined by the system administrator.

Figure 10-1 Overview of the Queued Message Facility



In Figure 10-1 (Steps 1, 2, and 3), a client enqueues a message to the `SERVICE1` queue in the APP queue space using `tpenqueue()`. Optionally, the names of a reply queue and a failure queue can be included in the call to `tpenqueue()`. In Figure 10-1 they are the queues `CLIENT_REPLY1` and `FAILURE_Q`. The client can specify a "correlation identifier" value to accompany the message. This value is persistent across queues so that any reply or failure message associated with the queued message can be identified when it is read from the reply or the failure queue.

The client can use the default queue ordering (for example, a time after which the message should be dequeued), or can specify an override of the default queue ordering (asking, for example, that this message be put at the top of the queue or ahead of another message on the queue). The call to `tpenqueue()` sends the message to the `TMQUEUE` server, the message is queued to stable storage, and an acknowledgment (step 3) is sent to the client. The acknowledgment is not seen directly by the client, but can be assumed when the client gets a successful return. (A failure return includes information about the nature of the failure.)

A message identifier assigned by the queue manager is returned to the application. The identifier can be used to dequeue a specific message. It can also be used in another `tpenqueue()` to identify a message already on the queue that the subsequent message should be enqueued ahead of.

Before an enqueued message is made available for dequeuing, the transaction in which the message is enqueued must be committed successfully.

When the message reaches the top of the queue, the `TMQFORWARD` server dequeues the message and forwards it, via `tpcall()`, to a service with the same name as the queue name. In Figure 10-1 the queue and the service are both named `SERVICE1`; steps 4, 5, and 6 show the transfer and return of the message. The client identifier and the application authentication key are set to the client that caused the message to be enqueued; they accompany the dequeued message as it is sent to the service.

When the service returns a reply, `TMQFORWARD` enqueues the reply (with an optional user-return code) to the reply queue (step 7 in Figure 10-1). Sometime later, the client uses `tpdequeue()` to read from the reply queue (`CLIENT_REPLY1`), and to get the reply message (steps 8, 9, and 10 in Figure 10-1). Messages on the reply queue are not automatically cleaned up; they must be dequeued, either by an application client or server, or by a `TMQFORWARD` server.

Part of the task of defining a queue is specifying the order for messages on the queue. Queue ordering can be time-based, priority based, `FIFO` or `LIFO`, or a combination of these sort criteria. The administrator specifies one or more of these criteria for the queue, listing the most significant criteria first. `FIFO` or `LIFO` can be specified only as the least significant sort criteria. Messages are put on the queue according to the specified sort criteria, and dequeued from the top of the queue.

The administrator can configure as many message queuing servers as are needed to keep up with the requests generated by clients for the stable queues.

Data-dependent routing can be used to route between multiple server groups with servers offering the same service.

For housekeeping purposes, the administrator can set up a command to be executed when a threshold is reached for a queue that does not routinely get drained. The threshold can be based on the bytes, blocks, or percentage of the queue space used by the queue, or the number of messages on the queue. The command set up by the administrator might boot a `TMQFORWARD` server to drain the queue or send mail to the administrator for manual handling.

Setting the QMCONFIG Environment Variable

The environment variable `QMCONFIG` must be set and exported before work can be done to create a queue space. A BEA TUXEDO system application uses a Universal Device List (UDL). The `QMCONFIG` variable must contain the full path name of the device list, such as the path shown in the following example.

```
$ QMCONFIG = /dev/rawfs; export QMCONFIG
```

The commands provided by `qmadmin`, (the /Q administrative interface), will not work unless this location is defined. The information can be furnished on the command line as well as in the environment variable. If it is specified in both places, the information on the command line takes precedence.

Using qmadmin, the /Q Administrative Interface

/Q has an administrative program, `qmadmin`(1), that is used to create and administer queues. The following sections include a sampling of the available commands. For a complete list of `qmadmin` commands, refer to the `qmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.

Creating an Application Queue Space and Queues

Complete the following four steps to create an application queue space and queues.

1. Create an entry in the UDL with the `qmadmin` `crdl` command. The device may be created on a raw slice or in a UNIX file. For example:

   ```
   qmadmin        # to start the qmadmin command
   crdl device offset size
   ```

   where *`device`* is the same device named in the `QMCONFIG` variable; *`offset`* is the block number within the UDL where space may begin to be allocated (the first entry must have an offset of 0), and *`size`* is the number of blocks to allocate. To make the example more realistic, it might be like the following:

   ```
   crdl /dev/rawfs 500 500
   ```

   which says create an entry on the device `/dev/rawfs` 500 blocks from the start of the UDL and allocate 500 blocks. Implicit in this request is the presence of an existing entry, since the offset 0 is not specified. If you enter `crdl` without arguments, the software prompts you for information. You can create up to 25 entries on a device list.

2. Create a queue space on the device. This will be a space on the device that will contain a collection of queues. Space is created with the `qmadmin` `qspacecreate` command.

   ```
   qspacecreate queue_space_name ipckey pages queues trans procs\
   messages errorq inityn
   ```

   If you enter `qspacecreate` without arguments, the software prompts you for information. This is probably the better choice for this command because the prompts explain the information you need to provide. The following is an example from the `qmadmin`(1) reference page.

   ```
   > qspacecreate
   Queue space name: myqueuespace
   IPC Key for queue space: 42000
   Size of queue space in disk pages: 50000
   Number of queues in queue space: 30
   Number of concurrent transactions in queue space: 20
   ```

```
Number of concurrent processes in queue space: 30
Number of messages in queue space: 20000
Error queue name: ERRORQ
Initialize extents (y, n [default=n]): y
Blocking factor [default=16]: 16
```

The IPC Key value must be unique and different from the value specified in the RESOURCES section. The number of disk pages specified as the size of the queue space varies from application to application and depends on the number of queues, the number of messages to be handled and the size of the messages. The specification for the number of concurrent processes in the queue space must be large enough to include four or five possible BEA TUXEDO system processes.

3. Open the queue space.

   qopen *queue_space_name*

   The queue space has to be open for you to proceed.

4. Create individual queues within the queue space. Queues are created with the qmadmin qcreate command, as follows.

   qcreate *queue_name qorder out-of-order retries delay high low*

   This is another command where it is better to allow the software to prompt you for information. The following is an example from qmadmin(1) (using mostly default values where available).

   ```
   >qcreate Queue name: service1 queue order (priority, time, fifo,
   lifo): fifo out-of-ordering enqueuing (top, msgid,
   [default=none]):none retries [default=0]: 0 retry delay in
   seconds [default=0]: 0 High limit for queue capacity warning (b
   for bytes used, B for blocks used, % for percent used, m for
   messages [default=100%]): 100% Reset (low) limit for queue
   capacity warning [default=0%]: 50% queue capacity command:
   /usr/app/bin/mailadmin myqueuespace service1
   ```

   Retries specifies the number of times the system attempts to enqueue the message.

   We recommend that you read the qmadmin(1) reference page in the *BEA Tuxedo Reference Manual* carefully and that you also read the "Administration" chapter of the *BEA TUXEDO System /Q Guide.* The parameters that you enter for the qcreate command control the way the queue operates for your application. Of particular importance is the choice for the order in which messages are placed on the queue (they are always removed from the top).

Modifying the Configuration File

In addition to creating a queue space and queues, the system administrator needs to associate these resources with the BEA TUXEDO Queued Message Facility application by editing the configuration file as described in the remaining sections of this chapter.

The configuration changes involve making an entry in the GROUPS section for the group that owns the queue and the transaction server (TMS_QM), and listing (in the SERVERS section) the two servers (TMQUEUE and TMQFORWARD).

Note: The chronological order of these specifications is not critical. The configuration file can be created either before or after the queue space is defined. The important thing is that the configuration must be defined and queue space and queues must be created before the facility can be used.

Associating a Queue with a Group

A server group must be defined for each queue space the application expects to use. In addition to the standard requirements of a group name tag and a value for GRPNO, the TMSNAME and OPENINFO parameters need to be set, as shown in the following example.

```
TMSNAME=TMS_QM
```

and

```
OPENINFO="TUXEDO/QM:device_name:queue_space_name"
```

(See the ubbconfig(5) reference page in the *BEA Tuxedo Reference Manual* for details.)

TMS_QM is the name for the transaction manager server for the BEA TUXEDO Queued Message Facility . In the OPENINFO parameter, TUXEDO/QM is the literal name for the resource manager as it appears in $TUXDIR/udataobj/RM. The values for *device_name* and *queue_space_name* are instance-specific and must be set to the path name for the universal device list and the name associated with the queue space, respectively.

The following example includes some of the detail.

```
*GROUPS
QUE1
LMID = SITE1 GRPNO = 2
TMSNAME = TMS_QM TMSCOUNT = 2
OPENINFO = “TUXEDO/QM:/dev/rawfs:myqueuespace”
```

Note the use of quotation marks around the information for `OPENINFO`. We recommend using quotation marks in this way to protect your entries in the configuration file.

Listing the /Q Servers in the SERVERS Section

Three servers are provided with the BEA TUXEDO Queued Message Facility. One is the TMS server, `TMS_QM`, that is the transaction manager server for the /Q resource manager. `TMS_QM` is defined in the `GROUPS` section of the configuration file.

The other two, `TMQUEUE`(5) and `TMQFORWARD`(5), provide services to users. They must be defined in the `SERVERS` section of the configuration file, as follows.

```
*SERVERS
TMQUEUE SRVGRP=QUE1 SRVID=1 CLOPT="-s QSPACENAME:TMQUEUE - - "
TMQFORWARD SRVGRP=QUE1 SRVID=5 CLOPT="- - -I 2 -q STRING"
```

The application can also create its own queue servers. If the functionality of `TMQFORWARD`, for example, does not fully meet the needs of the application, you might want to have a special server written. You might, for example, create a server that dequeues messages moved to the error queue, which `TMQFORWARD` does not do.

CHAPTER

11 Securing Applications

This chapter discusses the levels of security that are available to BEA TUXEDO system applications, and describes how to implement the level of security your designers decide best serves the requirements of your application.

The following topics are presented:

- Security Strategy
- Configuring the RESOURCES SECURITY Parameter
- Implementing Operating System Security
- Implementing Application Password-level Security
- Implementing Security via an Authentication Server
- Implementing Security via Access Control Lists

Security Strategy

This section covers the levels of security provided by the BEA TUXEDO system. Application designers need to decide the appropriate level for their applications.

Operating System

For platforms that have underlying security mechanisms, this is the first line of defense. The security level is configured to "`NONE`" (configuration is discussed below). This implies that there are no additional mechanisms (for example, a BEA TUXEDO system password) beyond what the platform provides.

Most BEA TUXEDO applications are managed by a system administrator who configures the application, starts up the application (servers run with the permissions of this administrator), and monitors the running application, making dynamic changes as necessary. This arrangement implies that server programs are "trusted," since they run with the administrator's permissions. This working method is supported by the login mechanism and read/write permissions on files, directories, and system resources provided by the underlying operating system.

Client programs are run directly by users with their own permissions. Normally, however, users have access to the administrative configuration file and interprocess communication mechanisms, such as the Bulletin Board (in shared memory), as part of normal processing. This is true regardless of whether additional BEA TUXEDO system security is configured.

For some applications running on platforms that support greater security, a more secure approach is to limit access to the files and IPC mechanisms to the application administrator and to have "trusted" client programs run with the permissions of the administrator (using a `setuid` mechanism). Combining these practices with BEA TUXEDO system security allows the application to "know" who is making the request.

For the most secure environment, only workstation clients should be allowed to access the application; client programs should not be allowed to run on the same machines on which application server and administrative programs run.

BEA TUXEDO system security mechanisms can be used in addition to operating system security to prevent unauthorized access. The additional security can be used to avoid simple violations, such as someone accessing an unattended terminal. In addition, it can protect the boundaries of the administrative domain from interdomain or workstation client access over the network by unauthorized users.

Application Password

This security level requires that every client provide an application password as one step in the process of joining the application. The security level is configured to `APP_PW`. The administrator must provide an application password when this level is configured. (The password can be changed by the administrator.) It is the responsibility of the administrator to inform authorized users of the application about the password.

If this level of security is used, BEA TUXEDO system-supplied client programs, `ud`(1) for example, prompt for the application password.

Application-written client programs must include code to obtain the password from a user. The password should not be echoed to the user's screen. The password is placed in clear text in the `TPINIT` buffer and is evaluated when the client calls `tpinit()` to join the application.

See "Writing Client Programs" in the *BEA TUXEDO Programmer's Guide* for examples of code for handling a password.

User Authentication

The third level of BEA TUXEDO system security is based on authenticating each individual user in addition to providing the application password. The security level is configured to `USER_AUTH`.

This level involves passing user-specific data to an authentication service. Often, the data is a per-user password. This data is automatically encrypted when it is sent over the network from workstation clients. The default authentication service, `AUTHSVC`, is provided by a BEA TUXEDO system-supplied server, `AUTHSVR`. The operation of an authentication service is described in "Writing Service Routines" in the *BEA TUXEDO Programmer's Guide*. This server can be replaced with an application authentication server that has logic specific to the application. (For example, it might access the widely used Kerberos mechanism for authentication.)

With this level of security, authentication is provided, but access control is not provided. That is, the user is checked when joining the application, but then is free to execute any services, to post events, and to access application queues. It is possible for servers to do application-specific authorization within the logic of the service routines, but there are no hooks for authorization that check for access to events or application queues. The alternative is to use the built-in access control checking.

Access Control

With the use of access control lists (ACLs), not only is a user authenticated when joining the application, but in addition, permissions are checked automatically when attempts are made to access application entities (such as services). ACL security also includes the user-authentication security equivalent to `USER_AUTH`.

Optional Access Control Lists

There are two levels of ACL checking. The first ACL security level is simply called `ACL`. If `ACL` is configured, the access control lists are checked whenever a user attempts to access a service name, queue name, or event name within the application. If there is no ACL associated with the user's name, the

assumption is that permission is granted. For this reason, this level is considered "optional." It allows the administrator to configure access for only those resources that need more security; ACLs need not be configured for services, queues, or events that are open to everyone.

For some applications, it may be necessary to use both system-level and application authorization. An ACL can be used to control who can request a service, and application logic can control data-dependent access (for example, who can handle transactions for more than one million dollars).

Note that ACL checking is not done for administrative services, queues, and events with names that begin with a dot (.). For example, anyone can subscribe to administrative events such as, `.SysMachineBroadcast`, `.SysNetworkConfig`, `.SysServerCleaning`.

Mandatory Access Control Lists

The second ACL security level is `MANDATORY_ACL`. This level is similar to `ACL`, but an access control list must be configured for every entity (such as a service, queue, or event) that users can access. If `MANDATORY_ACL` is specified and there is no ACL for a particular entity, permission for that entity is denied.

Link-Level Encryption

Users of the BEA TUXEDO Security Add-On Package (US/Canada or International) can establish data privacy for messages moving over the network links that connect the machines in a BEA TUXEDO application. For a detailed description of this feature, see Chapter 6, "Building Networked Applications."

Configuring the RESOURCES SECURITY Parameter

You can designate a security scheme by setting the value of one parameter in the `RESOURCES` section of the configuration file: `SECURITY`. (The parameter `AUTHSVC` also comes into play if `SECURITY` is set to `USER_AUTH`, `ACL` or `MANDATORY_ACL`.)

To set the `SECURITY` parameter, perform the following steps.

1. Open the UBBCONFIG file in a text editor.
2. Set the SECURITY parameter as follows.

   SECURITY=*METHOD* where the value of *METHOD* is one of the following:

   - NONE
   - APP_PW
   - USER_AUTH
   - ACL
   - MANDATORY_ACL

   The default is NONE.

The value APP_PW indicates that application password security will be enforced (that is, clients will be required to provide the application password during initialization). Setting APP_PW causes tmloadcf to prompt for an application password.

The value USER_AUTH is similar to APP_PW but, in addition, indicates that per-user authentication will be done during client initialization.

The value ACL is similar to USER_AUTH but, in addition, indicates that access control checks will be done on service names, queue names, and event names. If an associated ACL is not found for a name, it is assumed that permission is granted.

The value MANDATORY_ACL is similar to ACL, but permission is denied if an associated ACL is not found for the name.

Implementing Operating System Security

Implementing operating system security is one of the easier tasks you will have as an administrator. It consists entirely of not implementing any higher level of security.

In the RESOURCES section, set SECURITY to NONE. If you leave SECURITY blank, NONE is the default.

Operating system security depends on the underlying password and the read/write permission structure of the operating system. You need to make sure that your users are able to connect to the application and have access to application files and programs. Consult the administrator's guide for your operating system to learn how to do this.

Implementing Application Password-level Security

Application password-level security requires all users to enter the same password to be allowed access to the application.

It is implemented as follows:

- The application programmer writes code that prompts the user for the password. The password must be put into the `passwd` field of the `TPINIT` buffer before `tpinit`(3c) is called to join the application.
- The administrator sets the `SECURITY` parameter (in the `RESOURCES` section of the `UBBCONFIG` file) to `APP_PW`.
- When the configuration is loaded via `tmloadcf`(1), the administrator is prompted for a password. The password entered at that time becomes the password for the application and remains in effect until it is changed by the administrator via the `passwd` command of `tmadmin`(1).

At runtime, all clients need to provide this password to access the application.

Implementing Security via an Authentication Server

User authentication-level security requires a server that can authenticate users by checking individual passwords against a file of legal users.

The authentication server shipped with the BEA TUXEDO system, `AUTHSVR`, provides two levels of security checks:

- User level security—determines whether or not a particular user can log on to the system. When the `tpinit`(3c) function is called to join the application, the user's ID, client name, and user name are verified with a password.

- Group level security—determines which application programs users can use once they have logged on. Once users have logged on, the application knows which users belong to which groups.

The Authentication Server

BEA TUXEDO system user authentication is provided by AUTHSVR(5).

AUTHSVR provides per-user authentication. When a client process calls tpinit(3c) to join the application, AUTHSVR validates the user name, client name, and password. If tpinit fails for security reasons, a security violation is logged both in the userlog, and as a system event. On success, AUTHSVR provides the client with an application key that cannot be forged. The client presents the application key in the appkey field of the TPSVCINFO structure on each service invocation.(See "Writing Client Programs" in the *BEA TUXEDO Programmer's Guide*.)

Currently, authentication is not provided by a standard authentication mechanism, such as Kerberos, DCE, or public key encryption. When enhancements are provided to use such mechanisms, authentication is based on the user name. The client name is used for application logic only (for example, filtering of broadcast messages). If you are planning to use an alternate authentication scheme, we recommend that you do not associate client names with users. In this case, administrators should use only wildcard values for the *client* name in the user file; they should not use wildcard values for the *user* name.

Configuring the Authentication Server

To add AUTHSVR to an application, you must define AUTHSVR as a server in the TUXCONFIG file. To do so, add the following lines to the UBBCONFIG file.

```
RESOURCES
SECURITY   "USER_AUTH"
AUTHSVC    "AUTHSVC"

SERVERS
AUTHSVR SRVGRP="groupname" SRVID=1 RESTART=Y GRACE=0 MAXGEN=2
CLOPT="-A"
```

Adding, Modifying, and Deleting User Accounts

The shell-level commands tpusradd(1) and tpgrpadd(1) allow you to create files containing lists of authorized users and groups. The tpusrdel(1), tpusrmod(1), tpgrpdel(1), and tpgrpmod(1) commands enable you to maintain your user and group files. The following parameters are used in one or more of these six commands:

- *usrname*—a character string that represents the name of a user.
- *client_name* or *cltname*—a character string that represents the name of a client.
- *UID*—an integer between 0 and 128K used internally by the application to refer to a particular user. This is not the same as the UID parameter in the RESOURCES section of the configuration file, which designates the owner of the application.
- *group_name* or *grpname*—a character string that represents the name of a group.
- *GID*—an integer between 0 and 16K used internally by the application to refer to an application group. This is not the same as the GID parameter in the RESOURCES section of the configuration file, which designates the group of the owner of the application.

Two files are used for user and group administration:

- $APPDIR/tpusr
- $APPDIR/tpgrp

The files are colon-delimited, flat ASCII files, readable only by the application's administrator.

The files are kept in the application directory, specified by the environment variable $APPDIR. The format of the files is irrelevant, since they are fully administered with shell-level commands.

The commands tpusradd(1), tpusrdel(1), and tpusrmod(1) are available for modifying the files tpusr and tpgrp. For all of these commands, the environment variable $APPDIR must be set to the path name of the BEA TUXEDO system application that will be modified. In addition, only the application owner, as specified in $TUXCONFIG, is allowed to use these commands.

Following is the syntax of the commands.

```
tpusradd [-u UID] [-g GID] [-c client_name] usrname

tpusrdel [-c client_name] usrname

tpusrmod [-u UID] [-g GID] [-c client_name] [-l new_login] [-n\
new_client_name] [-p] usrname
```

Section (1) of the *BEA TUXEDO Reference Manual* also includes the commands `tpaddusr`(1), `tpdelusr`(1), and `tpmodusr`(1), which are functionally similar to the three commands described here. `tpaddusr`(1), `tpdelusr`(1), and `tpmodusr`(1) are provided for compatibility with releases prior to Release 6.0; if you are running Release 6.0 or later, we recommend you use the commands described in this section.

Adding, Modifying, and Deleting Groups

The commands `tpgrpadd`(1), `tpgrpdel`(1), and `tpgrpmod`(1) enable you to modify the files `tpusr` and `tpgrp`. For all of these commands, the environment variable `$APPDIR` must be set to the path name of the BEA TUXEDO system application that will be modified. In addition, only the application owner, as specified in `$TUXCONFIG`, is allowed to use these commands.

Following is the syntax of the commands.

```
tpgrpadd [-g GID] grpname
tpgrpdel grpname
tpgrpmod [-g GID] [-n new_grpname] grpname
```

Implementing Security via Access Control Lists

Access control lists (ACLs) enhance the security features of the BEA TUXEDO system. ACLs provide group-based access control to application entities (services, events, and /Q queues). By looking at the client's application key, these entities can identify the group to which the user belongs; by looking at the ACL, the entity can determine whether the client's group has access permission.

Access control is done at the group level for the following reasons:

- System administration is simplified. It is easier to give a group of people access to a new service than it is to give each individual user access to the service.
- Performance is improved. Because access permission needs to be checked for each invocation of an entity, permission should be resolved quickly. Because there are fewer groups than users, it is quicker to search through the list of privileged groups than it is to search through a list of privileged users.

If user-level ACLs are needed, they may be implemented by creating a group for each user, and then setting up the group to have the desired permissions for its single member.

Limitations of ACLs

Access control lists have the following limitations:

- A user can be associated with only one group at a time. To be a member of more than one group, a user must have multiple entries in the file `$APPDIR/tpusr`.
- ACLs are name based. They do not distinguish between services, events, or queues; they look only at the name. Because of this, all entities must be named uniquely. It is not valid to have a queue and a service with the same name, unless access to both entities is always either granted or denied.
- User identification aging is not supported. If a user is removed from the system, it is up to the administrator to decide when it is appropriate to add another user with the same ID to the application.

Administering ACLs

ACLs are stored in the file `$APPDIR/tpacl`, an ASCII file that is readable and writable only by the application administrator. The file is administered with the following commands:

- `tpacladd`

  `tpacladd [-g` *`GID`* `|` *`group_name`*`] [,`*`GID`* `|` *`group_name...`*`]` *`entity_name`*

  `entity_name` is the name of the service, event, or /Q queue for which to create an ACL.

- `tpacldel`

  `tpacldel` *`entity_name`*

  `entity_name` is the name of the ACL entry that is to be deleted.

- `tpaclmod`

  `tpaclmod [-g` *`GID | group_name`*`][,`*`GID | group_name...`*`]` *`entity_name`*

  The `-g` option allows the specification of a group or list of groups that can access the feature provided by *`entity_name`*.

CHAPTER

12 Monitoring a Running System

As an administrator, you must ensure that once your application is up and running, it meets (and continues to meet) the performance, availability, and security requirements your company has set for it. To perform this task, you need to monitor the resources (such as shared memory), activities (such as transactions), and potential problems (such as security breaches) in your configuration, and take any corrective actions that are necessary.

To help you meet this responsibility, the BEA TUXEDO system provides tools that enable you to oversee both system events and application events. This chapter explains how to use these tools to keep your application performing fast, well, and securely.

Specifically, this chapter discusses the following topics:

- Overview of System and Application Data
- Monitoring Methods
- Using the tmadmin Command Interpreter
- Running tmadmin Commands
- Monitoring a Running System with tmadmin
- Example: Output from tmadmin Commands
- Case Study: Monitoring Run-time bankapp

Overview of System and Application Data

This section describes the types of data available for monitoring a running system and explains how to use that data.

Components and Activities for Which Data Is Available

Your BEA TUXEDO system maintains parameter settings and generates statistics for the following system components:

- Clients
- Conversations
- Groups
- Message queues
- Networks
- Servers
- Services
- Transactions

Where the Data Resides

To ensure that you have the information necessary for monitoring your system, the BEA TUXEDO system provides the following three data repositories:

- `UBBCONFIG`—an ASCII file in which you define the *parameters* of your system and application
- Bulletin Board—a segment of shared memory (on each machine in your network) to which your system writes *statistics* about the components and activities of your configuration

- Log files—files to which your system writes *messages*

This chapter describes the data stored in the `UBBCONFIG` file and in the Bulletin Board, and provides instructions for monitoring that data. For a description of the log files, see Chapter 13, "Monitoring Log Files."

How You Can Use the Data

The administrative data provided by your BEA TUXEDO system allows you to monitor a multitude of potential trouble areas on your system. For example, this data allows you to:

- Tune the running system based on actual loads
- Detect security breaches

Moreover, you can set up your system so that it is able to use the statistics in the Bulletin Board to make decisions and to modify system components dynamically, without your help. With proper configuration, your system may be able to do tasks such as the following (when indicated by Bulletin Board statistics):

- Turn on load balancing
- Start a new copy of a server
- Shut down servers that are not being used

Thus, by monitoring the administrative data for your system, you can prevent and resolve problems that threaten the performance, availability, and security of your application.

Types of Data

Two types of administrative data are available on every running BEA TUXEDO system: static and dynamic.

Static Data

Static data about your configuration consists of configuration settings that you assign when you first configure your system and application. These settings are never changed without intervention (either in real-time or through a program you have provided). Examples include system-wide parameters (such as the number of machines being used) and the amount of IPC resources (such as shared memory) allocated to your system on your local machine. Static data is kept in the `UBBCONFIG` file and in the Bulletin Board.

At times you will need to check the static data about your configuration. For example:

- Suppose you want to add a large number of machines and you are concerned that by doing so you may exceed the maximum number of machines allowed in your configuration (or, to be precise, allowed in the machine tables of the Bulletin Board). You can look up the maximum number of machines allowed by checking the current values of the system-wide parameters for your configuration (one of which is `MAXMACHINES`).
- Suppose you think you may be able to improve the performance of your application by tuning your system. To determine whether tuning is required, you need to check on the amount of local IPC resources currently available.

Dynamic Data

Dynamic data about your configuration consists of information that changes in real time, that is, while an application is running. For example, the load (the number of requests sent to a server) and the state of various configuration components (such as servers) change frequently. Dynamic data is kept in the Bulletin Board.

You will need to check the dynamic data about your configuration frequently. For example:

- Suppose throughput is suffering and you want to know whether you have enough servers running to accommodate the number of clients currently connected.
  - Check the numbers of running servers and connected clients
  - Check the load on one or more servers

  These numbers will help you determine whether adding more servers is likely to improve performance.

- Suppose you receive complaints from multiple users about slow response when making particular requests of your application. Checking load statistics may help you determine whether it is appropriate to increase the value of `BLOCKTIME`.

Monitoring Methods

To monitor a running application, you need to keep track of the dynamic aspects of your configuration and sometimes check the static data. Thus, you need to be able to watch the Bulletin Board on an ongoing basis and consult the `UBBCONFIG` file when necessary. The BEA TUXEDO system provides the following methods of doing both tasks, as shown in this table.

You Can Use the . . .	By . . .	For Instructions, See . . .
`tmadmin` command	Entering commands after a prompt	This chapter
AdminAPI	Using the MIB (and the commands described in this chapter) to write programs that monitor your run-time application	Chapter 18, "Event Broker/Monitor."
BEA TUXEDO Web-based GUI	Using a graphical interface	The Help accessed directly from the GUI

Which method is best for you? The answer depends on your answers to several questions.

- How much experience do you have as a BEA TUXEDO system administrator?

  If you have a lot of experience as an administrator (and shell programming expertise), you may prefer to write programs that automate your most frequently run commands.

- Are you an experienced UNIX system user?

  If not, you may be most comfortable using the Web-based GUI.

- What information do you want to view?

If you examine the RESOURCES section of the UBBCONFIG file through the tmadmin command, you see only the current values; the defaults are not displayed.

If you decide to monitor your system at run time through the tmadmin command interpreter, continue reading; this chapter describes tmadmin and explains how to use it.

Using the tmadmin Command Interpreter

This section provides the following information:

- A step-by-step description of what happens during a typical tmadmin session, including:
  - Descriptions of the operating modes for tmadmin sessions and instructions for invoking them
  - A table showing the system requirements for access to various tmadmin commands
  - Descriptions of the tmadmin meta-commands: commands that help you make the best—and most efficient—use of the tmadmin commands
- A step-by-step procedure that you can follow to run tmadmin for most tasks

  Instructions for individual tasks are provided in later sections of this chapter.

What Is tmadmin?

The tmadmin command is an interpreter for 50 commands that let you view and modify a Bulletin Board and its associated entities.

Note: tmadmin is supported on UNIX and Windows NT platforms.

How might you want to use tmadmin to modify your system while it is running? Consider the following sample scenario. Suppose you want to check the current values for all the parameters listed in the Bulletin Board, such as maximum number of servers and services. You can do this by running the tmadmin command, bbparms.

How a tmadmin Session Works

1. A tmadmin session starts when you (the administrator) enter the tmadmin command at a shell prompt. The shell prompt($) is replaced by the tmadmin prompt (>) which is used until you quit tmadmin.

   ```
   $ tmadmin [operating_mode_option]
   >
   ```

   You can request one of three operating modes on the command line: the default mode (which allows you to view and change the Bulletin Board and associated entities), read-only mode (-r), or configuration mode (-c).

2. tmadmin verifies that the configuration is running. If the configuration is not running the following message is displayed:

   ```
   No bulletin board exists. Entering boot mode
   >
   ```

3. tmadmin checks the TUXCONFIG and TUXOFFSET environment variables to get the location and offset at which the configuration file has been loaded. (Be sure you have defined these variables before beginning a tmadmin session.)

4. tmadmin enters the Bulletin Board in one of the following three states, depending on which operating mode you have requested.

   - If you have requested the default operating mode (tmadmin with no options), tmadmin enters the Bulletin Board as an administrative process, allowing you to view and make changes to configuration components and/or activities listed in the Bulletin Board.
   - If you have requested read-only mode (tmadmin -r), tmadmin enters the Bulletin Board as a client instead of as an administrator. This mode is useful if you want to leave the administrator slot unoccupied. (Only one tmadmin process can be the administrator at one time.) If the -r option is specified by a user other than the BEA TUXEDO administrator and security is turned on, the user is prompted for a password.

- If you have requested configuration mode (`tmadmin -c`), `tmadmin` enters the Bulletin Board as an administrative process, allowing you to make changes to the configuration components and/or activities listed in the Bulletin Board. You can request configuration mode on any machine, whether the machine is active or inactive. (A machine is considered active if `tmadmin` can join the application as an administrative process or as a client, via a running BBL.)

5. The > prompt is displayed on your screen and you enter a `tmadmin` command.

   Not all `tmadmin` commands are available on every machine at all times. Which commands are available depends on several factors:

   - The mode (read-only or configuration) of the current `tmadmin` session
   - The current state of the configuration
   - The type of machine on which you are working

   For details, see the `tmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.

Summary of tmadmin Options

Whenever you start a `tmadmin` session, you have a choice of operating modes for that session: read-only mode, configuration mode, or the default operating mode. In addition, you can generate a report of the BEA TUXEDO version and license numbers.

Read-only Mode

In this mode, you can view the data in the Bulletin Board, but you cannot make any changes. The advantage of working in read-only mode is that your administrator process is not tied up by `tmadmin`; the `tmadmin` process attaches to the Bulletin Board as a client, leaving your administrator slot available for other work.

To start a `tmadmin` session in read-only mode, specify the `-r` option on the command line:

```
$ tmadmin -r
```

Configuration Mode

In this mode, you can view the data in the Bulletin Board and, if you are the BEA TUXEDO application administrator, you can make changes. You can start a `tmadmin` session in configuration mode on any machine, including an inactive machine. On most inactive machines, configuration mode is required. (The only inactive machine on which you can start a `tmadmin` session without requesting configuration mode is the `MASTER` machine.)

To start a `tmadmin` session in configuration mode, specify the `-c` option on the command line:

```
$ tmadmin -c
```

Default Operating Mode

If you want to view and change Bulletin Board data during a `tmadmin` session, you must:

1. Have administrator privileges (that is, your effective `UID` and `GID` must be those of the administrator).
2. Invoke the command interpreter without any options:

```
$ tmadmin
```

Version number and license number report

To find out which version of the BEA TUXEDO system you are running and to get the license number for it, specify the `-v` option on the command line:

```
$ tmadmin -v
```

After displaying the version and license numbers, `tmadmin` exits, even if you have specified `-c` or `-r` in addition to `-v`. When `-v` is requested, all other options are ignored.

tmadmin Meta-commands

The `tmadmin` command interpreter is equipped with a set of meta-commands, commands that help you use `tmadmin`. Table 12-1 lists the `tmadmin` meta-commands.

Note: The tables and examples in this chapter include the abbreviated forms of the `tmadmin` command names.

Table 12-1 tmadmin Meta-commands

Use This Command	Or its Abbreviation	To
`default`	`d`	Set defaults for arguments of other commands
`dump`	`du`	Download the current Bulletin Board into a file
`echo`	`e`	Display input command lines
`help`	`h`	Display command list or command syntax
`paginate`	`page`	Pipe output of commands to a pager
`quit`	`q`	Terminate the session
`verbose`	`v`	Show output in verbose mode (a toggle key)
`!`*`shlcmd`*	(n/a)	Escape to the shell and run the specified shell command
`!!`	(n/a)	Repeat the previous shell command
<RETURN>	(n/a)	Repeat the last `tmadmin` command

Default

The `default` meta-command (`d`) lets you set and unset defaults for the following frequently used parameters for most `tmadmin` commands: group name, server ID, machine, user name, client name, queue address, service name, device blocks, device offset, and UDL configuration device path. (For details, see the `tmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.)

Note: You cannot assign defaults to any parameters for the `boot` and `shutdown` commands.

Once defaults are set, they remain in effect until the session ends or until the parameters are reset to different values. The remainder of this section provides a list of instructions for checking, setting, and unsetting defaults:

- To check your current default settings, run the `default` meta-command without any options. Listing 12-1 shows an example of the report that is displayed when no parameters are set.

Listing 12-1 Default Output

```
> d
Default Settings:
     Group Name: (not set)
      Server ID: (not set)
     Machine ID: (not set)
     Queue Name: (not set)
    Client Name: (not set)
   Service Name: (not set)
      User Name: (not set)
         Blocks: 1000
         Offset: 0
           Path: /home/apps/bank/bankdll # Path defaults to value of FSCONFIG
>
```

- To assign a new value as the default for a parameter, enter the `default` command, specifying the parameter, as follows:

  `default -`*`parameter new_value`*

  For example, to change the default of the service name to "teller," enter the following command:

  ```
  default -s teller
  ```

- To unset a default setting, run the `default` command with the appropriate option for the parameter in question, followed by the `*` wildcard argument.

  `default -`*`parameter`* `*`

  For example, to unset the default for the service name (specified with the `-s` argument), enter the following command:

  ```
  default -s *
  ```

For most parameters, when you unset the default setting without specifying a new one, the result is that you have no default for that parameter. This generalization does not apply to the machine ID parameter, however.

In a multiprocessor environment, the value of the machine ID can be a specific processor, the DBBL, or `all`. If the value of the machine ID is a specific processor, information is retrieved only from that processor. To remind you of this fact, the logical machine ID is added to the `tmadmin` session prompt (*`LMID`* >), as shown in Listing 12-2.

Listing 12-2 Prompt When Machine ID Is Set to a Specific Processor

```
                        # 1. default mid not previously set
> d -m SITE1            # 2. set SITE1 as default mid
SITE1 >                 # 3. prompt now shows default mid
```

If you unset the current default of the machine ID without specifying a new default, the DBBL is used, automatically, as the new default. In other words, if you enter

```
default -m *
```

DBBL becomes the machine ID. You can also simply specify DBBL as the new machine by entering the following:

```
default -m DBBL
```

Optional versus Required Arguments

Most `tmadmin` commands require explicit information about the resource on which the command is to act. Required arguments can always be specified on the command line, and can often be set via the `default` command, as well. `tmadmin` reports an error if the required information is not available from either source.

Some `tmadmin` statistical commands interpret unspecified default parameters as `all`.

Running tmadmin Commands

This section provides the basic procedure for running `tmadmin` commands. Commands for doing specific monitoring tasks through `tmadmin` are provided in the section "Monitoring a Running System with tmadmin" in this chapter.

Note: For complete details about `tmadmin`, see the `tmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.

Perform the following steps to run the `tmadmin` commands.

1. Make sure the `TUXCONFIG` and `TUXOFFSET` environment variables have been set.
2. Enter `tmadmin` in the appropriate operating mode.
   - For default mode (which allows you to view and change information listed in the Bulletin Board), do not specify any options.
   - For configuration mode, enter the `-c` option on the `tmadmin` command line.
   - For read-only mode, enter the `-r` option on the `tmadmin` command line.
3. When the `tmadmin` session prompt (>) is displayed, enter your first `tmadmin` command. Specify, on the command line, how much information from the Bulletin Board you want to have displayed.
   - For complete, detailed output, request verbose mode:

     `tmadmin_command` `-v`

     For example: `bbparms -v`
   - For abbreviated (sometimes truncated) output, request terse mode:

     `tmadmin_command` `-t`

     For example: `bbparms -t`
4. After viewing the output of your first `tmadmin` command, continue entering `tmadmin` commands until you are ready to end the session.
5. End the `tmadmin` session by entering:

   ```
   quit
   ```

Monitoring a Running System with tmadmin

Table 12-2 provides a list of potential problems that you might want to check while monitoring your run-time system, along with a list of the `tmadmin` commands that enable you to perform such a check. The table also suggests follow-up actions you might take if the `tmadmin` command you run generates a particular type of output.

Note: For a comprehensive list of the `tmadmin` commands, see the `tmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.

Table 12-2 Commands for Monitoring Tasks

To Determine Whether . . .	Run this Command . . .	If . . .	Then . . .
Any servers are stalled in a service	`$ tmadmin -r` `> printserver`	The Current Service and Request fields do not change	The server is spending excessive time on the current service. In a development environment, the server might be stalled in an infinite loop; you may want to stop it.
The load distribution is appropriate	`$ tmadmin -r` `> printserver`	The values in the Load Done field are not reasonably similar	Check the layout of the MSSQs and the data-dependent routing. If the current servers have too heavy a load, you may want to boot more servers.
A particular service is doing any work	`$ tmadmin -r` `> printservice`	The value in the Requests Completed field is 0	Data-dependent routing may be preventing requests from being sent to that server for that service. You can: ♦ Change the routing criteria or ♦ Move the service to another server.

Table 12-2 Commands for Monitoring Tasks

To Determine Whether . . .	Run this Command . . .	If . . .	Then . . .
Any clients are inactive	`$ tmadmin -r` `> printclient`	♦ There has been no activity for a long time for a client, and ♦ Resources are needed	Tell the client—via a broadcast message—to exit
The work is distributed in such a way that it is flowing smoothly through the system	`$ tmadmin -r` `> printqueue`	Some queues are always heavy and others are not	Check the arrangement of services within servers, data-dependent routing, and/or queue organization.
A client is tying up a connection and preventing a server from doing any work for another client	`$ tmadmin -r` `> printconn`	A client is maintaining control of a connection and is not issuing any requests	1. Suspend the client by using the client MIB. (We recommend using the BEA TUXEDO Web-based GUI for this task.) 2. Terminate the client.
The network is stable	`$ tmadmin -r` `> printnet`	A machine is no longer connected	You may want to: 1. Partition the machine (that is, take it off the network). 2. Resolve the problem. 3. Reconnect the machine.
You must manually commit or abort a transaction	`$ tmadmin -r` `> printtrans`	For example, the status is `TMGDECIDED`	The first phase of the two-phase commit has completed successfully. This means you must find out why the second phase cannot be completed. For example, you may find that the coordinating TMS cannot complete the transaction because a participating site has gone down.

Table 12-2 Commands for Monitoring Tasks

To Determine Whether . . .	Run this Command . . .	If . . .	Then . . .
Your operating system resources (such as shared memory and semaphores) on a local machine are sufficient	`$tmadmin -r > bbsread`	You do not have sufficient resources in the operating system	Increase the IPC resources (semaphores, shared memory segments, and so on) in the operating system.
You want to keep the current values for system-wide parameters (in the `RESOURCES` section of your `UBBCONFIG` file)	`$ tmadmin -r > bbparms`	You do not have sufficient resources for your application	1. Stop the application. 2. Configure additional IPC resources (assuming you have enough available) by increasing the values of relevant parameters (such as `MAXSERVERS` and `MAXCLIENTS`) in the `RESOURCES` section of the configuration file. 3. Re-boot the application.

Example: Output from tmadmin Commands

This section provides examples of output from the following `tmadmin` monitoring commands:

- `printqueue`
- `printconn`
- `printnet`
- `printtrans`

Note: For a list of all 50 `tmadmin` commands, see the `tmadmin`(1) reference page in the *BEA TUXEDO Reference Manual*.

printqueue Output

The following output from the `printqueue` command lets you check the distribution of work in the `bankapp` application.

```
printqueue [qaddress]

tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.  All rights reserved.

>pq
```

a.out Name	Queue Nam	# Svrs	Wk Q'd	# Queued	Ave. Len	Machine
TLR	28706	1	0	0	0.0	SITE1
TMS_SQL	BANKB1_T	2	0	0	0.0	SITE1
TLR	24946	1	0	0	0.1	SITE1
BAL	8533	1	0	0	0.0	SITE1
BAL	24915	1	0	0	0.0	SITE1
BTADD	28897	1	0	0	0.0	SITE1
XFER	4380	1	0	0	0.0	SITE1
XFER	28840	1	100	0	1.0	SITE1
TLR	12519	1	100	2	0.0	SITE1
BBL	24846	1	0	2	0.0	SITE1
ACCT	71	1	0	0	0.0	SITE1
TMS_SQL	BANKB3_T	2	0	0	0.0	SITE1
BAL	28958	1	0	0	0.0	SITE1
ACCT	254	1	0	0	0.0	SITE1
BTADD	12310	1	0	0	0.0	SITE1
XFER	16494	1	0	0	0.0	SITE1
TMS_SQL	BANKB2_T	2	0	0	0.0	SITE1
BTADD	8430	1	0	0	0.0	SITE1
ACCT	24641	1	0	0	0.0	SITE1

Note: By default, information is supplied for all queues. If you want your output to be limited to information about only one queue, specify the address for the desired queue.

The output of this command includes the following information.

In the Column Labeled . . .	You See . . .
`a.out Name`	The name of the executable to which the queue is connected
`Queue Name`	The symbolic queue name (set to either the `RQADDR` parameter of `UBBCONFIG` or a randomly chosen value)
`# Svrs`	The number of servers connected to the queue
`Wk Q'd`	The load factor of all requests currently queued
`# Queued`	The actual number of requests queued
`Ave. Len`	The average queue length **Note:** Not available in MP mode.
`Machine`	The LMID of the machine on which the queue is located

printconn Data

The following (verbose) output from the `printconn` command shows that the client process has:

- Begun two conversations
- Maintained control of both lines
- Not yet sent any requests

```
printconn [-m machine]

tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL. All rights reserved.

> echo
Echo now on.
```

```
> v
Verbose now on.

> pc

Originator
         Group/pid:    Client/29704
              LMID:    SITE1
             Sends:    0
Subordinate
   Group/server id:    Group1/2
              LMID:    SITE1
             Sends:    -
           Service:   TOUPPER1
Originator
         Group/pid:    Client/29704
              LMID:    SITE1
             Sends:    0
Subordinate
 Group/server id:    Group1/2
            LMID:    SITE1
           Sends:    -
         Service:    TOUPPER2
```

printnet Command Output

This section shows the output from the following procedure.

1. The `printnet` command was run. (The output shows the number of messages sent and received by both sites.)
2. The `BRIDGE` process at `SITE2` was stopped.
3. The `printnet` command was re-entered. (The output shows that `SITE2` is no longer connected to the master machine, `SITE1`.)

```
printnet [-m machine_list]

tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL. All rights reserved.

> echo
Echo now on.

> pnw
```

```
SITE1     Connected To:   msgs sent   msgs received
SITE2     100103

SITE2     Connected To:   msgs sent   msgs received
SITE1     104             101

> pnw
SITE1     Connected To:   msgs sent   msgs received

           Could not retrieve status from SITE2

>
```

printtrans Command Output

The `printtrans` command reports statistics only for transactions that are currently in progress, specifically, statistics on the number of rollbacks, commits, and aborts that have been executed on your machine, group, or server.

This section shows the output produced by running the `printtrans` command in terse and verbose modes:

- In terse mode, the `GTRID` (a unique string that identifies a transaction across an application) and the transaction state are shown.
- In verbose mode, information about timeouts and participants is added.

Note: The index shown in the example is used by the administrator to commit or abort the transaction.

printtrans [-m *machine*] [-g *groupname*]

```
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL. All rights reserved.

> pt
>> index=0>gtrid=x0 x2bb8f464 x1
:   Machine id: SITE1, Transaction status: TMGACTIVE
    Group count: 1

> v
Verbose now on.

> pt
>> index=0>gtrid=x0 x2bb8d464 x1
```

```
:   Machine id: SITE1, Transaction status: TMGACTIVE
    Group count: 1, timeout: 300, time left: 299
    Known participants:
       group: GROUP1, status: TMGACTIVE, local, coord

>
```

Case Study: Monitoring Run-time bankapp

This section presents a sample configuration for a multiprocessor (MP) version of the `bankapp` application. This section also shows the output that was returned when the local IPC resources and system-wide parameters were checked by running the appropriate `tmadmin` commands.

Configuration File for bankapp

For this case study, we will use the configuration defined in the `UBBCONFIG` file shown in Listing 12-3.

Listing 12-3 UBBCONFIG File for bankapp (MP Version)

```
#Copyright (c) 1997, 1998 BEA Systems, Inc.
#All rights reserved

RESOURCES
IPCKEY            80952
UID               4196
GID               601
PERM              0660
MAXACCESSERS      40
MAXSERVERS        35
MAXSERVICES       75
MAXCONV           10
MAXGTT            20
MASTER            SITE1,SITE2
SCANUNIT          10
SANITYSCAN        12
BBLQUERY          180
```

```
BLOCKTIME         30
DBBLWAIT          6
OPTIONS           LAN,MIGRATE
MODEL             MP
LDBAL             Y
#
MACHINES
mchn1             LMID=SITE1
                  TUXDIR="/home/tuxroot"
                  APPDIR="/home/apps/bank"
                  ENVFILE="/home/apps/bank/ENVFILE"
                  TLOGDEVICE="/home/apps/bank/TLOG"
                  TLOGNAME=TLOG
                  TUXCONFIG="/home/apps/bank/tuxconfig"
                  TYPE="3B2"
                  ULOGPFX="/home/apps/bank/ULOG"
wgs386            LMID=SITE2
                  TUXDIR="/home2/tuxroot"
                  APPDIR="/home2/apps/bank"
                  ENVFILE="/home2/apps/bank/ENVFILE"
                  TLOGDEVICE="/home2/apps/bank/TLOG"
                  TLOGNAME=TLOG
                  TUXCONFIG="/home2/apps/bank/tuxconfig"
                  TYPE="386"
                  ULOGPFX="/home2/apps/bank/ULOG"
#
GROUPS
DEFAULT:  TMSNAME=TMS_SQL   TMSCOUNT=2
# For NT/Netware,  :bankdb: becomes ;bankdb;
BANKB1              LMID=SITE1         GRPNO=1

OPENINFO="TUXEDO/SQL:/home/apps/bank/bankdl1:bankdb:readwrite"
BANKB2              LMID=SITE2         GRPNO=2

OPENINFO="TUXEDO/SQL:/home2/apps/bank/bankdl2:bankdb:readwrite"

NETWORK
SITE1     NADDR="//mach1.beasys.com:1900"
          BRIDGE="/dev/tcp"
          NLSADDR="//mach1.beasys.com:1900"
SITE2     NADDR="//mach386.beasys.com:1900"
          BRIDGE="/dev/tcp"
          NLSADDR="//mach386.beasys.com:1900"
SERVERS
#
DEFAULT:  RESTART=Y MAXGEN=5 REPLYQ=Y CLOPT="-A"

TLR       SRVGRP=BANKB1    SRVID=1    RQADDR=tlr1    CLOPT="-A --
-T 100"
```

```
TLR       SRVGRP=BANKB1    SRVID=2    RQADDR=tlr1    CLOPT="-A --
-T 200"
TLR       SRVGRP=BANKB2    SRVID=3    RQADDR=tlr2    CLOPT="-A --
-T 600"
TLR       SRVGRP=BANKB2    SRVID=4    RQADDR=tlr2    CLOPT="-A --
-T 700"
XFER      SRVGRP=BANKB1    SRVID=5
XFER      SRVGRP=BANKB2    SRVID=6
ACCT      SRVGRP=BANKB1    SRVID=7
ACCT      SRVGRP=BANKB2    SRVID=8
BAL       SRVGRP=BANKB1    SRVID=9
BAL       SRVGRP=BANKB2    SRVID=10
BTADD     SRVGRP=BANKB1
BTADD     SRVGRP=BANKB2    SRVID=12
AUDITC    SRVGRP=BANKB1    SRVID=13 CONV=Y MIN=1 MAX=10
BALC      SRVGRP=BANKB1    SRVID=24
BALC      SRVGRP=BANKB2    SRVID=25
#

SERVICES
DEFAULT:  LOAD=50          AUTOTRAN=N
WITHDRAWAL          PRIO=50          ROUTING=ACCOUNT_ID
DEPOSIT             PRIO=50          ROUTING=ACCOUNT_ID
TRANSFER            PRIO=50          ROUTING=ACCOUNT_ID
INQUIRY             PRIO=50          ROUTING=ACCOUNT_ID
CLOSE_ACCT          PRIO=40          ROUTING=ACCOUNT_ID
OPEN_ACCT           PRIO=40          ROUTING=BRANCH_ID
BR_ADD              PRIO=20          ROUTING=BRANCH_ID
TLR_ADD             PRIO=20          ROUTING=BRANCH_ID
ABAL                PRIO=30          ROUTING=b_id
TBAL                PRIO=30          ROUTING=b_id
ABAL_BID            PRIO=30          ROUTING=b_id
TBAL_BID            PRIO=30          ROUTING=b_id
ABALC_BID           PRIO=30          ROUTING=b_id
TBALC_BID           PRIO=30          ROUTING=b_id

ROUTING
ACCOUNT_ID          FIELD=ACCOUNT_ID
                    BUFTYPE="FML"
                    RANGES="10000-59999:BANKB1,
                            60000-109999:BANKB2,
                            *:*"
BRANCH_ID FIELD=BRANCH_ID
                    BUFTYPE="FML"
                    RANGES="1-5:BANKB1,
                            6-10:BANKB2,
                            *:*"
b_id                FIELD=b_id
                    BUFTYPE="VIEW:aud"
```

```
                    RANGES="1-5:BANKB1,
                            6-10:BANKB2,
                            *:*"
```

Output from Checking the Local IPC Resources

To check the local IPC resources for this configuration, a `tmadmin` session was started, and the `bbsread` command was run. The output of `bbsread` is shown in Listing 12-4.

Listing 12-4 bbsread Output

```
SITE1> bbsread

IPC resources for the bulletin board on machine SITE1:
SHARED MEMORY:          Key: 0x1013c38
SEGMENT 0:
                         ID: 15730
                       Size: 36924
         Attached processes: 12
      Last attach/detach by: 4181

This semaphore is the system semaphore
SEMAPHORE:              Key: 0x1013c38
                         Id: 15666
       |  semaphore |  current |   last   | # waiting |
       |   number   |  status  | accesser | processes |
       |-------------------------------------------|
       |     0      |   free   |   4181   |     0     |
       |------------|----------|----------|-----------|
This semaphore set is part of the user-level semaphore
SEMAPHORE:              Key: IPC_PRIVATE
                         Id: 11572
       |  semaphore |  current |   last   | # waiting |
       |   number   |  status  | accesser | processes |
       |-------------------------------------------|
       |      0     |  locked  |   4181   |     0     |
       |      1     |  locked  |   4181   |     0     |
       |      2     |  locked  |   4181   |     0     |
       |      3     |  locked  |   4181   |     0     |
       |      4     |  locked  |   4181   |     0     |
       |      5     |  locked  |   4181   |     0     |
       |      6     |  locked  |   4181   |     0     |
```

```
|      7     |  locked  |   4181   |     0     |
|      8     |  locked  |   4181   |     0     |
|      9     |  locked  |   4181   |     0     |
|     10     |  locked  |   4181   |     0     |
|     11     |  locked  |   4181   |     0     |
|     12     |  locked  |   4181   |     0     |
|     13     |  locked  |   4181   |     0     |
|------------|----------|----------|-----------|
```

Note: The display is the same with verbose mode on or off.

Output from Checking System-wide Parameter Settings

To check the current values of the system-wide parameters for this configuration, we started a `tmadmin` session and ran the `bbparms` command. The output of `bbparms` is shown in Listing 12-5.

Listing 12-5 Sample bbparms Output

```
> bbparms
Bulletin Board Parameters:
        MAXSERVERS: 35
       MAXSERVICES: 75
      MAXACCESSERS: 40
            MAXGTT: 20
           MAXCONV: 10
        MAXBUFTYPE: 16
       MAXBUFSTYPE: 32
            IPCKEY: 35384
            MASTER: SITE1,SITE2
             MODEL: MP
             LDBAL: Y
           OPTIONS: LAN,MIGRATE
         SCANUNIT: 10
        SANITYSCAN: 12
          DBBLWAIT: 6
          BBLQUERY: 180
         BLOCKTIME: 30
```

Note: The display is the same with verbose mode on or off.

CHAPTER

13 Monitoring Log Files

To help you identify error conditions quickly and accurately, the BEA TUXEDO system provides you with two log files:

- User log (ULOG)—a log of messages generated by the BEA TUXEDO system while your application is running.
- Transaction log (TLOG)—a binary file that is not normally read by you (the administrator), but that is used by the Transaction Manager Server (TMS). A TLOG is created only on machines involved in BEA TUXEDO global transactions.

These two logs are maintained and updated constantly while your application is running.

This chapter discusses the following topics:

- What Is the ULOG?
- What Is tlisten?
- What Is the Transaction Log (TLOG)?
- Creating and Maintaining Logs
- Using Logs to Detect Failures

What Is the ULOG?

The user log (ULOG) is a central event logger. All messages generated by the BEA TUXEDO system—error messages, warning messages, information messages, and debugging messages—are written to this log. Application clients and servers can also write to the user log.

A new log is created every day and there can be a different log on each machine. However, a ULOG can be shared across machines when a remote file system is being used.

Purpose

The purpose of the ULOG is to give you, the administrator, a record of the events on your system from which you can determine the cause of most BEA TUXEDO system and application failures.

How Is the ULOG Created?

The ULOG is created by the BEA TUXEDO system whenever one of the following events occurs:

- A new configuration file is loaded
- An application is booted

How Is the ULOG Used?

You can view the ULOG, an ASCII file, with any text editor.

When a message is written to the ULOG through the tperrno global variable, application clients and servers are notified, as follows:

- If tperrno is set to TPESYSTEM after returning from an ATMI call, you can conclude that:
  - A BEA TUXEDO system error has occurred.
  - An error message has been placed in the user log.
- If tperrno is set to TPEOS after returning from an ATMI call, you can conclude that:
  - An operating system error has occurred.
  - An error message has been placed in the user log.

Message Format

A ULOG message consists of two parts: a tag and text. Each part consists of three strings, as shown in the following table.

This Part . . .	Consists of . . .
tag	A 6-digit string (*hhmmss*) representing the time of day (in terms of hour, minute, and second)
	Name of the machine (as returned, on UNIX systems, by the `uname -n` command)
	Name and identifier of the process that is logging the message
text	Message catalog name
	Message number
	BEA TUXEDO system message

Consider the following example of a user log message.

```
121449.gumby!simpserv.27190: LIBTUX_CAT:262: std main starting
```

From the message tag we learn:

- The message was written into the log at around 12:15 P.M.

- The machine on which the error occurred was `gumby`.
- The message was logged by the `simpserv` process (which has an ID of 27190).

From the message text we learn:

- The message came from the `LIBTUX` catalog.
- The number of the message is 262.
- The message itself reads as follows: `std main starting.`

For more information about a message, note its catalog name and catalog number. With this information you can look up the message in the *BEA TUXEDO System Message Manual*, which provides complete descriptions of all system messages.

Location

By default, the user log is called `ULOG.`*`mmddyy`* (where *`mmddyy`* represents the date in terms of month, day, and year) and it is created in the `$APPDIR` directory.

You can place this file in any location, however, by setting the `ULOGPFX` parameter in the `MACHINES` section.

What Is tlisten?

`tlisten` is the section of the `ULOG` in which error messages for the `tlisten` process are recorded. (The `tlisten` process provides remote service connections for other machines.) As part of the `ULOG` file, a `tlisten` log can be viewed with any text editor.

Each machine, including the master machine, should have a `tlisten` process running on it. Separate `tlisten` logs are maintained in the `ULOG` on each machine. However, they can be shared across remote file systems.

Purpose

The tlisten log is a record of tlisten process failures. It is used, during the boot process, by tmboot and, while an application is running, by tmadmin.

How Is the tlisten Log Created?

The tlisten log is created by the tlisten process as soon as that process is started. Whenever a tlisten process failure occurs, an appropriate message is recorded in the tlisten log.

Message Format

Each tlisten log message includes the date and time at which the message was added to the log.

Location

By default, the tlisten log resides in $TUXDIR/udataobj. You can store it in another location, however, by entering the following command.

```
tlisten -L new_pathname
```

For example, if you want your TLOG file to be named TLLOG and to reside in the /home/apps/logs directory, enter the following command.

```
tlisten -L /home/apps/logs/TLOG
```

What Is the Transaction Log (TLOG)?

The transaction log (TLOG) keeps track of global transactions during the commit phase. A global transaction is recorded in the TLOG only when it is in the process of being committed. The TLOG is used to record the reply from the global transaction participants at the end of the first phase of a two-phase-commit protocol. The TLOG records the decision about whether a global transaction should be committed or rolled back.

We recommend that you create a TLOG on each machine that participates in global transactions.

How Is the TLOG Created?

For instructions on creating a TLOG, see the section "Creating a Transaction Log (TLOG)" in this chapter.

How Is the TLOG Used?

The TLOG file is used only by the Transaction Manager Server (TMS) that coordinates global transactions. It is not read by the administrator.

Location

The location and size of the TLOG are specified by four parameters that you set in the MACHINES section of the UBBCONFIG file: TLOGDEVICE, LOGOFFSET, TLOGNAME, and TLOGSIZE. (For descriptions of these parameters and instructions for assigning values to them, see "Creating a Transaction Log (TLOG)" in this chapter.)

Creating and Maintaining Logs

The ULOG is generated by various BEA TUXEDO system processes; you do not need to create it. The TLOG, however, is not produced automatically; you must create it.

This section provides the following instructions:

- How to maintain the ULOG
- How to create TLOGs

How to Assign a Location for the ULOG

To override the default location for your ULOG file, specify the desired location as the value of the ULOGPFX parameter in the MACHINES section of the UBBCONFIG file. (By default, the value of ULOGPFX is $APPDIR/ULOG.) The value you assign becomes the first part of the ULOG file name.

Listing 13-1 shows how you can override the default setting.

Listing 13-1 Overriding Default Settings in the MACHINES Section of Your UBBCONFIG File

```
MACHINES
gumby LMID=SITE1
TUXDIR="/usr/tuxedo"
APPDIR="/home/apps"
TUXCONFIG="/home/apps/tuxconfig"
ULOGPFX="/home/apps/logs/ULOG"
...
```

The following ULOG was created for SITE1 on 04/13/98.

```
/home/apps/logs/ULOG.041398
```

Creating a Transaction Log (TLOG)

To create a TLOG, you must complete the following procedure:

- Step 1: Assign Values to MACHINES Parameters
- Step 2: Create a UDL Entry
- Step 3 (optional): Allocate Space for a New Device on an Existing System
- Step 4: Create the Log

This section provides instructions for each step.

Step 1: Assign Values to MACHINES Parameters

Your first step is to assign values to four parameters in the MACHINES section of the UBBCONFIG file: TLOGDEVICE, TLOGNAME, TLOGOFFSET, and TLOGSIZE.

TLOGDEVICE

TLOGDEVICE specifies the device in the BEA TUXEDO file system that contains the transaction log. This can be the same device used by TUXCONFIG.

Note: Technically, there is no reason that TLOGDEVICE cannot be a separate VTOC file, but there are two reasons why it is not recommended: the TLOG is generally too small to justify devoting a raw disk segment to it, and creating TLOGDEVICE as a UNIX file leads to expensive delays when synchronous writes to the TLOG are required.

The TLOG is stored as a BEA TUXEDO system VTOC table on the device named in this parameter. If the TLOGDEVICE parameter is not specified, there is no default; the BEA TUXEDO system assumes that no TLOG exists for the machine. If no TLOG exists for a given machine, the associated LMID cannot be used by server groups that participate in distributed transactions.

After TUXCONFIG has been created via tmloadcf, you must create a device list entry for the TLOG on each machine for which TLOGDEVICE is specified. This is done using the tmadmin crdl command. The BBL creates the log automatically the first time the system is booted.

TLOGNAME

TLOGNAME specifies the name of the Distributed Transaction Processing (DTP) transaction log for this machine. The default name is TLOG. If more

than one transaction log exists on the same TLOGDEVICE, each transaction log must have a unique name. If a name is specified, it must not conflict with any other table specified on the configuration.

TLOGOFFSET

TLOGOFFSET specifies the offset in pages from the beginning of TLOGDEVICE to the start of the VTOC that contains the transaction log for this machine. The number must be greater than or equal to 0 and less than the number of pages on the device. The default value is 0.

TLOGOFFSET is rarely necessary. However, if two VTOCs share the same device or if a VTOC is stored on a device (such as a file system) that is shared with another application, TLOGOFFSET can be used to indicate a starting address relative to the address of the device.

TLOGSIZE

TLOGSIZE specifies the number of pages for the TLOG. The default is 100 pages. Once a global transaction is complete, TLOG records are no longer needed and are thrown away. The maximum number of pages that can be specified, subject to the amount of available space on TLOGDEVICE, is 2048 pages. Choosing a value is entirely application-dependent.

Listing 13-2 shows an example of the use of transaction log parameters.

Listing 13-2 Sample Transaction Log Parameters for a Specified Machine

```
MACHINES
gumby LMID=SITE1
...
TLOGDEVICE="/home/apps/logs/TLOG"
TLOGNAME=TLOG
TLOGOFFSET=0
TLOGSIZE=100
...
```

Step 2: Create a UDL Entry

Next, create an entry in the Universal Device List (UDL) for the TLOGDEVICE on each machine that requires a TLOG. You can perform this step either before or after TUXCONFIG has been loaded, but you must do it before the system is booted.

To create an entry in the UDL for the TLOG device, complete the following procedure.

1. On the master machine (with the application inactive), enter the following.

   ```
   tmadmin -c
   ```

   You do not have to create TLOGs on any machine other than the master machine. The BEA TUXEDO system creates TLOGs on nonmaster machines (as long as a UDL exists on those machines) when the application is booted.

2. Enter the following command.

   ```
   crdl -z config -b blocks
   ```

   - -z *config* specifies the full path name for the device on which the UDL should be created (and where the TLOG will reside).
   - -b specifies the number of blocks to be allocated on the device.
   - *config* should match the value of the TLOGDEVICE parameter in the MACHINES section. If *config* is not specified, it defaults to the value of FSCONFIG (a BEA TUXEDO system environment variable).

3. Repeat Steps 1 and 2 on each machine of your application that will participate in global transactions.

   Note: If the TLOGDEVICE is mirrored between two machines, Step 3 is not required on the paired machine.

During the boot process, the Bulletin Board Listener (BBL) initializes and opens the TLOG.

Step 3 (optional): Allocate Space for a New Device on an Existing System

In Step 2, you created a new BEA TUXEDO file system that can be used to hold the TLOG. Sometimes, however, it is necessary to add new devices or space to an existing configuration or to check space usage. You can perform these tasks by running the command.

```
tmadmin -c
```

(You can run this command whether or not the system is booted.)

It is possible that the UDL exists on *config* but does not have sufficient space for the log. To allocate space on a new device to an existing BEA TUXEDO file system, enter the following.

```
crdl -z config -b blocks new_device
```

where *new_device* specifies the full path name for the new device on which space is to be allocated. This command creates a new entry on the UDL and makes the space available for any tables that are created on *config.* (For example, this procedure can be used for the TUXCONFIG file when there is not enough space for a modified configuration, for allocating a new TLOG, or for increasing the size of the TLOG by deleting an old log and then creating a larger one.) If you are running several commands using the current configuration, it is possible to set the default configuration by entering the default command (d), as follows:

```
d -z config
```

If you run this command, you will not need to enter the -z option after each command.

Under rare circumstances, a device does not start at offset 0. This might happen if space has been allocated on a device (less than the entire device) to a BEA TUXEDO file system, and more space on the same device is available to be allocated. In this case, you can allocate the second entry by entering the following command.

```
crdl -z config -b blocks -o new_device_offset new_device
```

Here, *new_device_offset* specifies the offset of the new space being allocated on the device. (Note that the option is a lowercase o.) In this case, since the first entry on the UDL is allocated at offset 0, TLOGOFFSET and/or TUXOFFSET are set to 0, instead of to the offset of the new device. (The BEA TUXEDO system needs to find the UDL, from which it can determine the offset of other available space.)

A second (and rarer) reason that a device does not start at offset 0 is that a single raw device is shared. This happens, for example, if a UNIX file system is followed by a BEA TUXEDO file system on the same device. (This situation is risky because the raw device must be writable by the BEA TUXEDO system administrator and it is possible to overwrite the UNIX file system.) If the first entry on the UDL does not start at offset 0 (as in this example), the device offset must be specified everywhere that the device is referenced. To allocate the entry, enter the following command.

```
crdl -z config -b blocks -o offset -O offset new_device
```

Here, *offset* is the offset of the space to be allocated for the BEA TUXEDO file system (UDL and tables). Note that the -o (lowercase o) specifies the offset of the UDL and -O (uppercase O) specifies the offset of the new device space being allocated. Any devices that are created subsequently on this configuration must use both the -o option with the offset of the first entry, and the -O option with the offset of the new entry. (The offset may be 0 if a new device is being specified.) If the first entry on the

UDL is not allocated at offset 0, TLOGOFFSET and/or TUXOFFSET must be set to the offset of the first entry. This is the only case in which TLOGOFFSET and TUXOFFSET must be set in the UBBCONFIG file, and the TUXOFFSET environment variable must be set when all BEA TUXEDO application and administrative processes are being run.

To list the current UDL, enter the following command.

```
lidl -z config
```

where *config* was created using the above procedures. If the first entry was created with an offset other than 0, -o *offset* must be specified in addition to the configuration device. In verbose mode, this command lists not only the space initially allocated for each device entry, but also the amount of free space.

It is also possible to generate a list of the tables on the configuration by entering the following command.

```
livtoc -z config
```

Here *config* was creating using the above procedures. If the first entry was created with an offset other than 0, -o *offset* must be specified in addition to the configuration device. This command lists the table name, device number, offset within the device, and number of pages for each table. The first two tables are always VTOC and UDL. TUXCONFIG table names are of the form *_secname*_SECT, where *secname* is the name of a section in the UBBCONFIG file. The TLOG table name is based on the TLOG parameter in the UBBCONFIG file, and defaults to TLOG. In the rare case in which two applications share a single BEA TUXEDO file system for the TLOGDEVICE, the TLOG parameter must be different for each application.

Note: A BEA TUXEDO system file system is a file that is managed by BEA TUXEDO, which may be located on a raw disk or in an operating system file system. A BEA TUXEDO system file system contains one TUXCONFIG file and one or more TLOG files.

Because the table names for the TUXCONFIG file are fixed, it is not possible for two applications to share the same BEA TUXEDO file system for the TUXCONFIG file.

Step 4: Create the Log

Perform the following steps to create the log.

1. Make sure you have a TUXCONFIG file. (If you do not, the commands for creating the TLOG will fail.)

2. Start a tmadmin session by entering the following command.

   ```
   tmadmin -c
   ```

3. At the tmadmin command prompt (>), enter the following.

   ```
   crlog [-m machine]
   ```

   where the value of *machine* is the LMID of a machine, as specified in TUXCONFIG.

Note: The -m option is shown as optional because it can be specified with the default (d) command of tmadmin. If you have not specified a machine with the d command, however, the -m option is required on the crlog command line.

Maintaining a TLOG

TLOGs require little maintenance. This section provides instructions for two common maintenance tasks: reinititalizing a TLOG and removing a TLOG:

- To reinitialize a TLOG, enter the following.

  ```
  inlog [-yes] [-m machine]
  ```

  The value of *machine* is the LMID of a machine, as specified in TUXCONFIG.

  Be careful when using this command: it will reinitialize the log even if there are outstanding transactions. The result could be inconsistent TLOGs, possibly causing transactions to abort.

- To delete a TLOG, enter the following.

  ```
  dslog [-yes] [-m machine]
  ```

  The value of *machine* is the LMID of a machine, as specified in TUXCONFIG.

  If the application is not active or if there are transactions still outstanding in the log, an error will be returned.

Note: The -yes and -m options are shown as optional because they can be specified with the default (d) command. If you have not specified a machine with the d command, however, the -m option is required on the inlog and dslog command lines.

Using Logs to Detect Failures

The BEA TUXEDO log files can help you detect failures in both your application and your system. This section provides instructions for analyzing the data in the logs.

Analyzing the User Log (ULOG)

Note: Although application administrators are responsible for analyzing user logs, application programmers may also consult the logs.

It is not unusual for multiple messages to be placed in the user log for a given problem. In general, the earlier messages will better reflect the exact nature of the problem.

Consider the example shown in Listing 13-3. Notice how `LIBTUX_CAT` message 358 identifies the exact nature of the problem causing problems reported in subsequent messages, namely, that there are not enough UNIX system semaphores to boot the application.

Listing 13-3 Sample ULOG Messages

```
151550.gumby!BBL.28041: LIBTUX_CAT:262: std main starting
151550.gumby!BBL.28041: LIBTUX_CAT:358: reached UNIX limit on semaphore ids
151550.gumby!BBL.28041: LIBTUX_CAT:248: fatal: system init function ...
151550.gumby!BBL.28040: CMDTUX_CAT:825: Process BBL at SITE1 failed ...
151550.gumby!BBL.28040: WARNING: No BBL available on site SITE1.
        Will not attempt to boot server processes on that site.
```

See the *BEA TUXEDO System Message Manual* for complete descriptions of user log messages and recommendations for any actions that should be taken to resolve the problems indicated.

Analyzing the tlisten Log

Keep the following guidelines in mind as you check the `tlisten` messages in your `ULOG`:

- A message is placed in the `tlisten` log every time the log is contacted.
- A sequence number is given to every accepted request.
- If you cannot boot your application and subsequently cannot find any `tlisten` messages in your `ULOG` file, one of the following problems may have occurred:
  - The `tlisten` process may not have been started.
  - The `tlisten` process may be listening on the wrong network address.

  To find out whether one of these errors has occurred, check the `ULOG` file.

Note: Application administrators are responsible for analyzing the `tlisten` messages in the `ULOG`, but programmers may also find it useful to check these messages.

The `CMDTUX` catalog in the *BEA TUXEDO System Message Manual* contains the following information about `tlisten` messages:

- Descriptions of all messages
- Recommended actions that you (or a programmer) can take to resolve error conditions reported in these messages

Example

Consider the following example of a message in a `tlisten` log.

```
042398; 27909;CMDTUX_CAT: 615 INFO: Terminating tlisten process
```

This message was recorded on April 23, 1998. Its purpose is simply to provide information: the `tlisten` process is being terminated. No action is required.

Note: This message can be found in the `CMDTUX` catalog of the *BEA TUXEDO System Message Manual.*

Analyzing a Transaction Log (TLOG)

The TLOG is a binary file that contains only messages about global transactions that are in the process of being committed. You should never need to examine this file.

If you do need to view the TLOG, you must first convert it to ASCII format so that it is readable. The BEA TUXEDO system provides two tmadmin operations for this purpose:

- dumptlog (dl) downloads (or dumps) the TLOG (a binary file) to an ASCII file.
- loadtlog uploads (or loads) an ASCII version of the TLOG into an existing TLOG (a binary file).

The dumptlog and loadtlog commands are also useful when you need to move the TLOG between machines as part of a server group migration or machine migration.

CHAPTER

14 Tuning Applications

This chapter discusses the following topics:

- Maximizing Your Application Resources
- When to Use MSSQ Sets
- Enabling Load Balancing
- Assigning Priorities to Interfaces or Services
- Bundling Services into Servers
- Enhancing Efficiency with Application Parameters
- Setting Application Parameters
- Determining IPC Requirements
- Measuring System Traffic

Maximizing Your Application Resources

Making correct decisions in response to the following questions can improve the functioning of your BEA TUXEDO application:

- When should I use MSSQ sets?
- How should I assign load factors?
- How should I package interfaces and/or services into servers?
- How should I set my application parameters?

- How should I tune my operating system IPC parameters?
- How should I hunt for and eliminate bottlenecks?

When to Use MSSQ Sets

When is it beneficial to use MSSQ sets?

When to Use MSSQ Sets	When Not to Use MSSQ Sets
There are several, but not too many servers.	There are a large number of servers. (A compromise is to use many MSSQ sets.)
Buffer sizes are not too large.	Buffer sizes are large enough to exhaust one queue.
The servers offer identical sets of services.	Services are different for each server.
The messages involved are reasonably sized.	Long messages are being passed to the services causing the queue to be exhausted. This causes nonblocking sends to fail, or blocking sends to block.
Optimization and consistency of service turnaround time is paramount.	

Two analogies from everyday life may help to show why using MSSQ sets is sometimes, but not always, beneficial:

- An application in which MSSQ sets are used appropriately is similar to a bank, where all the tellers offer the same services and customers wait in line for the first available teller. This efficient arrangement ensures the best use of available services.
- An application in which it is better to avoid using MSSQ sets is similar to a supermarket, where each cashier offers a different set of services: some accept cash only; some accept credit cards; and still others serve only customers buying fewer than ten items.

Enabling Load Balancing

You can control whether a load balancing algorithm is used on the system as a whole. With load balancing, a load factor is applied to each service within the system, and you can track the total load on every server. Every service request is sent to the qualified server that is least loaded.

This algorithm, although effective, is expensive and should be used only when necessary, that is, only when a service is offered by servers that use more than one queue. Services offered by only one server, or by multiple servers all in an MSSQ (multiple server single queue) do not need load balancing. The `LDBAL` parameter for these services should be set to `N`. In other cases, you may want to set `LDBAL` to `Y`.

To figure out how to assign load factors (located in the `SERVICES` section), run an application for a long period of time. Note the average time it has taken for each service to be performed. Assign a `LOAD` value of 50 (`LOAD=50`) to any service that takes roughly the average amount of time. Any service taking longer than the average amount of time to execute should have a `LOAD>50`; any service taking less than the average amount of "code" time to execute should have a `LOAD<50`.

Two Ways to Measure Service Performance Time

You can measure service performance time in one of the following ways:

- Enter `servopts -r` in the configuration file. The `-r` option causes a log of services performed to be written to standard error. You can then use the `txrpt`(1) command to analyze this information. (For details about `servopts`(5) and `txrpt`(1), see the *BEA TUXEDO Reference Manual*.)
- Insert calls to `time`(2) at the beginning and end of a service routine. Services that take the longest time receive the highest load; those that take the shortest time receive the lowest load. (For details about `time`(2), see a UNIX System Reference Manual.)

Assigning Priorities to Interfaces or Services

You can exert significant control over the flow of data in an application by assigning priorities to BEA TUXEDO services using the PRIO parameter.

For an application running on a BEA TUXEDO system, you can specify the PRIO parameter for each service named in the SERVICES section of the application's UBBCONFIG file.

For example, Server 1 offers Interfaces A, B, and C. Interfaces A and B have a priority of 50 and Interface C has a priority of 70. An interface requested for C is always dequeued before a request for A or B. Requests for A and B are dequeued equally with respect to one another. The system dequeues every tenth request in first-in, first-out (FIFO) order to prevent a message from waiting indefinitely on the queue.

You can also dynamically change a priority with the tpsprio() call. Only preferred clients should be able to increase the service priority. In a system on which servers perform service requests, the server can call tpsprio()to increase the priority of its interface or service calls so the user does not wait in line for every interface or service request that is required.

Characteristics of the PRIO Parameter

The PRIO parameter should be used cautiously. Depending on the order of messages on the queue (for example, A, B, and C), some (such as A and B) will be dequeued only one in ten times. This means reduced performance and potential slow turnaround time on the service.

The characteristics of the PRIO parameter are as follows:

- It determines the priority of an interface or a service on the server's queue.
- The highest assigned priority gets first preference. This interface or service should occur less frequently.
- A lower priority message does not remain forever enqueued, because every tenth message is retrieved on a FIFO basis. Response time should not be a concern of the lower priority interface or service.

Assigning priorities enables you to provide faster service to the most important requests and slower service to the less important requests. You can also give priority to specific users or in specific circumstances.

Bundling Services into Servers

The easiest way to package services into server executables is to not package them at all. Unfortunately, if you do not package services, the number of server executables, and also message queues and semaphores, rises beyond an acceptable level. There is a trade-off between no bundling and too much bundling.

When to Bundle Services

You should bundle services for the following reasons:

- Functional similarity—If some services are similar in their role in the application, you can bundle them in the same server. The application can offer all or none of them at a given time. An example is the `bankapp` application, in which the `WITHDRAW`, `DEPOSIT`, and `INQUIRY` services are all teller operations. Administration of services becomes simpler.
- Similar libraries—For example, if you have three services that use the same 100K library and three services that use different 100K libraries, bundling the first three services saves 200K. Often, functionally equivalent services have similar libraries.
- Filling the queue—Bundle only as many services into a server as the queue can handle. Each service added to an unfilled MSSQ set may add relatively little to the size of an executable, and nothing to the number of queues in the system. Once the queue is filled, however, the system performance degrades and you must create more executables to compensate.
- Placement of call-dependent services—Avoid placing in the same server two (or more) services that call each other. If you do so, the server will issue a call to itself, causing a deadlock.

Enhancing Efficiency with Application Parameters

You can set the following application parameters to enhance the efficiency of your system:

- MAXACCESSERS, MAXSERVERS, MAXINTERFACES, and MAXSERVICES
- MAXGTT, MAXBUFTYPE, and MAXBUFSTYPE
- SANITYSCAN, BLOCKTIME, and individual transaction timeouts
- BBLQUERY and DBBLWAIT

Setting the MAXACCESSERS, MAXSERVERS, MAXINTERFACES, and MAXSERVICES Parameters

The MAXACCESSERS, MAXSERVERS, MAXINTERFACES, and MAXSERVICES parameters increase semaphore and shared memory costs, so you should choose the minimum value that satisfies the needs of the system. You should also allow for the variation in the number of clients accessing the system at the same time. Defaults may be appropriate for a generous allocation of IPC resources; however, it is prudent to set these parameters to the lowest appropriate values for the application.

Setting the MAXGTT, MAXBUFTYPE, and MAXBUFSTYPE Parameters

You should increase the value of the MAXGTT parameter if the product of multiplying the number of clients in the system times the percentage of time they are committing a transaction is close to 100. This may require a great number of clients, depending on

the speed of commit. If you increase MAXGTT, you should also increase TLOGSIZE accordingly for every machine. You should set MAXGTT to 0 for applications that do not use distributed transactions.

You can limit the number of buffer types and subtypes allowed in the application with the MAXBUFTYPE and MAXBUFSTYPE parameters, respectively. The current default for MAXBUFTYPE is 16. Unless you are creating many user-defined buffer types, you can omit MAXBUFTYPE. However, if you intend to use many different VIEW subtypes, you may want to set MAXBUFSTYPE to exceed its current default of 32.

Setting the SANITYSCAN, BLOCKTIME, BBLQUERY, and DBBLWAIT Parameters

If a system is running on slow processors (for example, due to heavy usage), you can increase the timing parameters: SANITYCAN, BLOCKTIME, and individual transaction timeouts. If networking is slow, you can increase the value of the BLOCKTIME, BBLQUERY, and DBBLWAIT parameters.

Setting Application Parameters

The following table describes the system parameters available for tuning an application.

Parameters	Action
MAXACCESSERS, MAXSERVERS, MAXINTERFACES, and MAXSERVICES	Set the smallest satisfactory value because of IPC cost. Allow for extra clients.

Parameters	Action
MAXGTT, MAXBUFTYPE, and MAXBUFSTYPE	Increase MAXGTT for many clients; set MAXGTT to 0 for nontransactional applications. Use MAXBUFTYPE only if you create eight or more user-defined buffer types. If you use many different VIEW subtypes, increase the value of MAXBUFSTYPE.
BLOCKTIME, TRANTIME, and SANITYSCAN	Increase the value for a slow system.
BLOCKTIME, TRANTIME, BBLQUERY, and DBBLWAIT	Increase values for slow networking.

Determining IPC Requirements

The values of different system parameters determine IPC requirements. You can use the tmboot -c command to test a configuration's IPC needs. The values of the following parameters affect the IPC needs of an application:

- MAXACCESSERS
- REPLYQ
- RQADDR (that allows MSSQ sets to be formed)
- MAXSERVERS
- MAXSERVICES
- MAXGTT

Table 14-1 describes the system parameters that affect the IPC needs of an application.

Table 14-1 Tuning IPC Parameters

Parameter(s)	Action
MAXACCESSSERS	Equals the number of semaphores. Number of message queues is almost equal to MAXACCESSERS + number of servers with reply queues (number of servers in MSSQ set + number of MSSQ sets).
MAXSERVERS, MAXSERVICES, and MAXGTT	While MAXSERVERS, MAXSERVICES, MAXGTT, and the overall size of the ROUTING, GROUP, and NETWORK sections affect the size of shared memory, an attempt to devise formulas that correlate these parameters can become complex. Instead, simply run tmboot -c or tmloadcf -c to calculate the minimum IPC resource requirements for your application.
Queue-related kernel parameters	Need to be tuned to manage the flow of buffer traffic between clients and servers. The maximum total size of a queue in bytes must be large enough to handle the largest message in the application, and to typically be 75 to 85 percent full. A smaller percentage is wasteful; a larger percentage causes message sends to block too frequently. Set the maximum size for a message to handle the largest buffer that the application sends. Maximum queue length (the largest number of messages that are allowed to sit on a queue at once) must be adequate for the application's operations. Simulate or run the application to measure the average fullness of a queue or its average length. This may be a trial and error process in which tunables are estimated before the application is run and are adjusted after running under performance analysis. For a large system, analyze the effect of parameter settings on the size of the operating system kernel. If unacceptable, reduce the number of application processes or distribute the application to more machines to reduce MAXACCESSERS.

Measuring System Traffic

As on any road in which traffic exists and runs at finite speed, bottlenecks can occur in your system. On a highway, cars can be counted with a cable strung across the road, that causes a counter to be incremented each time a car drives over it. Similarly, you can measure service traffic. For example, at boot time (that is, when `tpsvrinit()` is invoked), you can initialize a global counter and record a starting time. Subsequently, each time a particular service is called, the counter is incremented. When the server is shut down (by invoking the `tpsvrdone`() function, the final count and the ending time are recorded. This mechanism allows you to determine how busy a particular service is over a specified period of time.

In the BEA TUXEDO system, bottlenecks can originate from data flow patterns. The quickest way to detect bottlenecks is to begin with the client and measure the amount of time required by relevant services.

Example: Detecting a System Bottleneck

Client 1 requires 4 seconds to print to the screen. Calls to `time`(2) determine that the `tpcall` to service A is the culprit with a 3.7 second delay. Service A is monitored at the top and bottom and takes 0.5 seconds. This implies that a queue may be clogged, which was determined by using the `pq` command.

On the other hand, suppose service A takes 3.2 seconds. The individual parts of service A can be bracketed and measured. Perhaps service A issues a `tpcall` to service B, which requires 2.8 seconds. It should be possible then to isolate queue time or message send blocking time. Once the relevant amount of time has been identified, the application can be retuned to handle the traffic.

Using `time`(2), you can measure the duration of the following:

- The entire client program
- A client service request only
- The entire service function
- The service function making a service request (if any)

Detecting Bottlenecks on UNIX Platforms

The UNIX system sar(1) command provides valuable performance information that can be used to find system bottlenecks. You can use sar(1) to do the following:

- Sample cumulative activity counters in the operating system at predetermined intervals
- Extract data from a system file

The following table describes the sar(1) command options.

Use This Option	To
-u	Gather CPU utilization numbers, including the portion of the time running in user mode, running in system mode, idle with some process waiting for block I/O, and otherwise idle.
-b	Report buffer activity, including transfers per second of data between system buffers and disk, or other block devices.
-c	Report system call activity. This includes system calls of all types, as well as specific system calls such as fork(2) and exec(2).
-w	Monitor system swapping switching activity. This includes the number of transfers for swapins and swapouts.
-q	Report average queue lengths while occupied and the percent of time occupied.
-m	Report message and system semaphore activities, including the number of primitives per second.
-p	Report paging activity, including the address translation page faults, page faults and protection errors, and the valid pages reclaimed for free lists.

Use This Option	To
`-r`	Report unused memory pages and disk blocks, including the average number of pages available to user processes and the disk blocks available for process swapping.

Note: Some flavors of the UNIX system do not provide the `sar`(1) command, but offer equivalent commands instead. BSD, for example, offers the `iostat`(1) command; Sun offers `perfmeter`(1).

Detecting Bottlenecks on Windows NT Platforms

On Windows NT platforms, use the Performance Monitor to collect system information and detect bottlenecks. Select the following options from the Start menu.

```
Start —> Programs —> Administration Tools —> NT Performance Monitor
```

CHAPTER

15 Migrating Applications

This chapter discusses the following topics:

- About Migration
- Migration Options
- Switching Master and Backup Machines
- Migrating a Server Group
- Migrating Machines
- Canceling a Migration
- Migrating Transaction Logs to a Backup Machine

Note: A migration requirement is that both the master and backup machines must be running the same release of the BEA TUXEDO software.

About Migration

Whether you need to migrate all or portions of an application, the changes to the application setup must be made with minimal service disruption. Machines, networks, databases, the BEA TUXEDO system, and the application all need to be maintained. The BEA TUXEDO system provides a way to migrate the applications so that they can be serviced.

The BEA TUXEDO system offers migration tools that can also be used to recover from a machine crash, network partitions, database corruptions, BEA TUXEDO system problems, and application faults.

Migration Options

The following is a list of migration options:

- Switch master and backup machines.
- Migrate a server group from its primary machine to its alternate machine.
- Migrate all server groups from their primary machine to their alternate machine.
- Cancel a migration.
- Migrate a transaction log.

By using a combination of these options and partitioned network recovery utilities, you can migrate entire machines.

Switching Master and Backup Machines

Server migration is the process of moving one or more servers from one machine to another. One special instance of this process is the ability to switch master and backup machines. This type of switching is done by migrating the DBBL from the master machine to the backup machine. While this procedure is most frequently used when a network is partitioned, it is also useful in situations that require you to shut down the master machine.

Use the `master` command to switch the master machine.

Command	Description
`master(m)`	Switches the master machine to the backup machine or the reverse

Use the `tmadmin`(1) `master` (`m`) command to switch master and backup machines when the master machine must be shut down for maintenance, or when the master machine is no longer accessible. Switching master and backup machines, however, is

only a first step. In most cases, application servers need to be migrated to alternate sites, or the master machine needs to be restored. (These tasks are described in this chapter.)

How to Switch the Master and Backup Machines

To switch the master and backup machines, call the `tmadmin`(1) command interpreter with the `master` (`m`) command from the backup machine.

Examples: Switching Master and Backup Machines

Listing 15-1 and Listing 15-2 illustrate how you can switch master and backup machines. In the first example, the master machine is accessible from the backup machine, and the `DBBL` process is migrated from the master machine to the backup machine.

In the second example, because the master machine is not accessible from the backup machine, the `DBBL` process is created on the backup machine.

Listing 15-1 When the Master Machine Is Accessible from the Backup Machine

```
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.  All rights reserved.
> master
are you sure? [y,n] y
Migrating active DBBL from SITE1 to SITE2, please wait...
DBBL has been migrated from SITE1 to SITE2
> q
```

Listing 15-2 When the Master Machine Is Not Accessible from the Backup Machine

```
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.  All rights reserved.
TMADMIN_CATT:199: Cannot become administrator.  Limited set of commands available.
```

```
> master
are you sure? [y,n]  y
Creating new DBBL on SITE2, please wait... New DBBL created on SITE2
> q
```

Migrating a Server Group

Use the following two `tmadmin` commands to migrate servers.

Use This Command	To
`migrategroup(migg)`	Migrate servers in a group to their alternate location
`migratemach(migm)`	Migrate servers by using `LMID`s

The `tmadmin`(1) `migrategroup` (`migg`) command takes the name of a single server group as an argument. You must first shut down the servers to be migrated with the `-R` option (for example, `tmshutdown -R -g GROUP1`).

You must specify an alternate location in the `LMID` parameter (for the server group being migrated) in the `GROUPS` section of the `UBBCONFIG` file. Servers in the group must specify `RESTART=Y` and the `MIGRATE` option must be specified in the `RESOURCES` section of the `UBBCONFIG` file.

If transactions are being logged for the server involved in a group migration, you may need to move the `TLOG` to the backup machine, load it, and perform a warm start.

Migrating a Server Group When the Alternate Machine Is Accessible from the Primary Machine

To migrate a server group when the alternate machine is accessible from the primary machine, complete the following steps.

1. Call tmshutdown(1) from the master machine with the -R and -g (group_name) options.
2. Run tmadmin(1) from the master machine.
3. Call the migrategroup (migg) command with *group_name* as the argument.
4. Migrate the transaction log, if necessary.
5. Migrate the application data, if necessary.

Migrating a Server Group When the Alternate Machine Is Not Accessible from the Primary Machine

To migrate a server group when the alternate machine is not accessible from the primary machine, complete the following steps.

1. Switch the master and backup machines, if necessary.
2. Run tmadmin(1) from the alternate machine.
3. Call the pclean (pcl) command with the primary machine as the argument.
4. Call the migrategroup (migg) command with *group_name* as the argument.
5. Call the tmboot(1) command to boot the server group.

Examples: Migrating a Server Group

Listing 15-3 and Listing 15-4 show how you can migrate a server group. In the first example, the alternate machine is accessible from the primary machine. In the second example, the alternate machine is not accessible from the primary machine.

Listing 15-3 When the Alternate Machine Is Accessible from the Primary Machine

```
$ tmshutdown -R -g GROUP1
Shutting down server processes...
```

```
Server ID = 1 Group ID = GROUP1 machine = SITE1: shutdown succeeded
1 process stopped.
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.
> migg GROUP1
migg successfully completed
> q
```

Listing 15-4 When the Alternate Machine Is Not Accessible from the Primary Machine

```
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.
> pclean SITE1
Cleaning the DBBL.
Pausing 10 seconds waiting for system to stabilize.
3 SITE1 servers removed from bulletin board
> migg GROUP1
migg successfully completed.
> boot -g GROUP1
Booting server processes ...
exec simpserv -A :
on SITE2 -> process id=22699 ... Started.
1 process started.
> q
```

Migrating Machines

Use the `tmadmin`(1) `migratemach` (`migm`) command to migrate all server groups from one machine to another when the primary machine must be shut down for maintenance or when the primary machine is no longer accessible.

The command takes one logical machine identifier as an argument. The `LMID` names the processor on which the server group(s) have been running. The alternate location must be the same for all server groups on the `LMID`. Servers on the `LMID` must specify

RESTART=Y and the MIGRATE options must be specified in the RESOURCES section of the UBBCONFIG file. You must first shut down the server groups with the tmshutdown(1) -R option, and servers in the groups must be marked as restartable.

Migrating Machines When the Alternate Machine Is Accessible from the Primary Machine

To migrate a machine when the alternate machine is accessible from the primary machine, complete the following steps.

1. Call tmshutdown(1) from the master machine with the -R and -l (primary_machine) options.
2. Run tmadmin(1) from the master machine.
3. Call the migratemach (migm) command with *primary_machine* as the argument.
4. Migrate the transaction log, if necessary.
5. Migrate the application data, if necessary.

Migrating Machines When the Alternate Machine Is Not Accessible from the Primary Machine

To migrate a machine when the alternate machine is not accessible from the primary machine, complete the following steps.

1. Switch the master and backup machines if necessary.
2. Run tmadmin(1) from the alternate machine.
3. Call the pclean (pcl) command with *primary_machine* as the argument.
4. Call the migratemach (migm) command with *primary_machine* as the argument.
5. Call the boot (b) command to boot the server groups.

Examples: Migrating a Machine

Listing 15-5 and Listing 15-6 illustrate how you can migrate server groups. In the first example, the alternate machine is accessible from the primary machine. In the second example, the alternate machine is not accessible from the primary machine.

Listing 15-5 When the Alternate Machine Is Accessible from the Primary Machine

```
$ tmshutdown -R -l SITE1
Shutting down server processes...
Server ID = 1 Group ID = GROUP1 machine = SITE1: shutdown
succeeded 1 process stopped.
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.
> migm SITE1
migm successfully completed
> q
```

Listing 15-6 When the Alternate Machine Is Not Accessible from the Primary Machine

```
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.
>pclean SITE1
Cleaning the DBBL.
Pausing 10 seconds waiting for system to stabilize.
3 SITE1 servers removed from bulletin board
> migm SITE1
migm successfully completed.
> boot -l SITE1
Booting server processes ...
exec simpserv -A :
on SITE2 -- process id=22782 ... Started.
1 process started.
>q
```

Canceling a Migration

You can cancel a migration after a shutdown occurs, but before using the `migrate` command, by using the `-cancel` option with the `migrate` command.

You can cancel a migration in the following ways:

- By using the `tmadmin`(1) `migrategroup` (`migg`) `-cancel` command to cancel a server migration. Server entries are deleted from the Bulletin Board. You must reboot the servers once the migration procedure is canceled.
- By using the `tmadmin`(1) `migratemach` (`migm`) `-cancel` command to cancel a machine migration.

Example: A Migration Cancellation

Listing 15-7 illustrates how a server group and a machine can be migrated between their respective primary and alternate machines.

Listing 15-7 Canceling a Server Group Migration for Server Group GROUP1

```
$tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL.
> psr -g GROUP1

a.out Name  Queue Name    Grp Name   ID RqDone Ld Done Current Service
----------  ----------    --------   -- ------ ------- ---------------
simpserv     00001.00001   GROUP1     1    -    -       (DEAD MIGRATING)
> psr -g GROUP1
TMADMIN_CAT:121: No such server
migg -cancel GROUP1
>boot -g GROUP1
Booting server processes...
exec simpserv -A:
on SITE1 ->process id_27636 ... Started. 1 process started.
> psr -g GROUP1

a.out Name  Queue Name    Grp Name   ID RqDone Ld Done Current Service
----------  ----------    --------   -- ------ ------- ---------------
```

```
simpserv    00001.00001    GROUP1     1    -    -          ( - )
> q
```

Migrating Transaction Logs to a Backup Machine

To migrate transactions logs to a backup machine, complete the following steps.

1. Shut down the servers in all the groups that write to the log to stop additional writes to the log.
2. Dump the TLOG into an ASCII file by running the following command.
   `dumptlog [-z config] [-o offset] [-n name] [-g groupname]`

   Note: The TLOG is specified by the *config* and *offset* arguments. *Offset* defaults to 0 and *name* defaults to TLOG. If the -g option is chosen, only those records for which the TMS from *groupname* is the coordinator are dumped.
3. Copy *filename* to the backup machine.
4. Use `loadtlog -m machine ASCII_file` to read the name of the ASCII file into the existing TLOG for the specified machine.
5. Use `logstart machine` to force a warm start of the TLOG.
   (The information is read from the TLOG to create an entry in the transaction table in shared memory.)
6. Migrate the servers to the backup machine.

16 Dynamically Modifying Systems

The BEA TUXEDO system allows you to make changes to your configuration without shutting it down. Without inconveniencing your users, you can suspend or resume interfaces or services, advertise or unadvertise services, and change interface or service parameters (such as `LOAD` and `PRIORITY`). If your configuration specifies interfaces or services as `AUTOTRAN`, it is also possible to change the timeout value associated with such transactions. Thus, you can adjust your system to reflect either current or expected conditions.

This chapter discusses the following topics:

- Dynamic Modification Methods
- Procedures for Dynamically Modifying Your System

Dynamic Modification Methods

You have a choice of two methods for making changes to your system while the system is running:

- The Web-based GUI—a graphical user interface to the commands that perform administrative tasks, including dynamic system modification
- The `tmadmin` command interpreter—a shell-level command with 50 subcommands for performing various administrative tasks, including dynamic system modification

Because it is a graphical user interface, the Web-based GUI is simpler to use than the `tmadmin` command interpreter. If you prefer using a GUI, bring it up on your screen as soon as you are ready to begin an administrative task. The graphics and detailed procedures will guide you through any task you need to perform.

For instructions on using the `tmadmin` command interpreter, see Chapter 8, "Monitoring a Running System."

Instructions for dynamically modifying your system through `tmadmin` are provided in this chapter.

Procedures for Dynamically Modifying Your System

This section provides procedures for making the following types of changes, through `tmadmin`, while your system is running:

- Suspending and resuming services
- Advertising and unadvertising services
- Changing service parameters
- Changing the `AUTOTRAN` timeout value

Suspending and Resuming Services

This section provides instructions for suspending and resuming services and servers, and describes the results of these operations.

Note: The two commands described in this section have minimal impact on the BEA TUXEDO system.

Suspending Services

To suspend a server or a service, enter the `suspend` (or `susp`) command, as follows.

```
prompt> tmadmin
> susp
```

The `suspend` command marks as inactive one of the following:

- One service
- All services of a particular queue
- All services of a particular group ID/server ID combination

After you have suspended a service or a server, any requests remaining on the queue are handled, but no new service requests are routed to the suspended server. If a group ID/server ID combination is specified and it is part of an MSSQ set, all servers in that MSSQ set become inactive for the services specified.

Resuming Services

To resume a server or a service, enter the `resume` (or `res`) command, as follows.

```
prompt> tmadmin
> res
```

The `resume` command undoes the effect of the `suspend` command: it marks as active for the queue one of the following:

- One service
- All services of a particular queue
- All services of a particular group ID/server ID combination

If, in this state, the group ID or the server ID is part of an MSSQ set, all servers in that MSSQ set become active for the services specified.

Advertising and Unadvertising Services

This section provides instructions for advertising and unadvertising services and servers, and describes the results of these operations.

Advertising Services

To advertise a service, enter the following command.

```
adv [{[-q queue_name] | [-g grpid] [-i srvid]}] service
```

Note: Although a service must be suspended before it may be unadvertised, you do not need to "unsuspend" a service before re-advertising it. If you simply advertise a service that has been suspended and unadvertised previously, the service will be unsuspended.

Unadvertising Services

To unadvertise a service, complete the following procedure.

1. Suspend the service.
2. Enter the following command.

   ```
   unadv [{[-q queue_name] | [-g grpid] [-i srvid]}] service
   ```

   Note: Unadvertising has more drastic results than suspending because when you unadvertise a service, the service table entry for that service is deallocated and the cleared space in the service table becomes available to other services.

Changing Service Parameters (BEA TUXEDO System)

You can change the service parameter values for the following:

- A specific group ID/server ID combination
- A specific queue

The following table lists the names of the parameters for which you can change values dynamically, along with the commands for changing them.

To Change . . .	Enter the Following Command . . .
Load value (LOAD)	`chl -s service_name`

To Change . . .	Enter the Following Command . . .
Dequeueing priority (PRIO)	`chp -s service_name`
Transaction timeout value	`chtt -s service_name`

You must specify a service name (after the `-s` option) for all three commands.

You can specify this option on either the command line (for the `chl`, `chp`, or `chtt` command) or on a default subcommand line.

Note: The `-s` option is listed as optional because the required value may be specified on the default subcommand line.

Changing the AUTOTRAN Timeout Value

To change the transaction timeout (`TRANTIME`) of an interface or service with the `AUTOTRAN` flag set, run the `changetrantime` (`chtt`) command, as follows.

```
chtt [-m machine] {-q qaddress [-g groupname] [-i srvid] |-g\
groupname -i srvid} -s service newtlim
```

Note: Transaction timeouts begun by application clients using `tpbegin()` or `tx_set_transaction_timeout()` cannot be changed.

CHAPTER

17 Dynamically Reconfiguring Applications

This chapter presents the following topics:

- Introduction to Dynamic Reconfiguration
- Overview of the tmconfig Command Interpreter
- General Instructions for Running tmconfig
- Procedures
- Final Advice About Dynamic Reconfiguration

Introduction to Dynamic Reconfiguration

At times you will want to modify an application's configuration without having to shut it down. The BEA TUXEDO system allows you to perform two types of dynamic reconfiguration of your application. You can do the following:

- Modify existing entries in your configuration file (`TUXCONFIG`)
- Add components by adding entries for them to your configuration file

Both types of change are implemented by editing TUXCONFIG. Because TUXCONFIG is a binary file, however, it cannot be edited through a simple text editor. For this reason, the BEA TUXEDO system provides the following tools for configuration file editing:

- The Web-based GUI is a graphical user interface (GUI) to the commands that perform administrative tasks, including dynamic system modification.
- The tmconfig command interpreter is a shell-level command with 50 subcommands for performing various administrative tasks, including dynamic system modification.

The BEA TUXEDO Web-based GUI is a graphical user interface to administrative tasks. You always have the choice between doing application administration tasks through this graphical interface or through a command-line interface. You can choose the working style most familiar and comfortable to you. When it comes to dynamic reconfiguration, however, we recommend using the BEA TUXEDO Web-based GUI. You will find the dynamic reconfiguration is easier when you use the Web-based GUI instead of the tmconfig command interpreter.

The BEA TUXEDO Web-based GUI is not described in this document. Full descriptions of the GUI are available by accessing the Help directly from the GUI.

If you prefer to work on the command line, run the tmconfig command interpreter.

Note: We recommend that you keep a copy of the tmconfig(1) and ubbconfig(5) reference pages handy as you read this chapter. The input and output field names that correspond to UBBCONFIG parameters and reconfiguration restrictions are listed in tmconfig(1) and TM_MIB(5) in the *BEA TUXEDO Reference Manual*. These reference pages are the final authority on the semantics, range values, and validations of configuration parameters.

Overview of the tmconfig Command Interpreter

This section describes the following:

- What tmconfig does

- How tmconfig works

What tmconfig Does

The tmconfig command enables you to browse and modify the TUXCONFIG file and its associated entities, and to add new components (such as machines and servers) while your application is running.

When you modify your configuration file (TUXCONFIG on the MASTER machine), tmconfig performs the following tasks:

- Updates the TUXCONFIG file on all nodes in the application that are currently booted
- Propagates the TUXCONFIG file automatically to new machines as they are booted.

The tmconfig command runs as a BEA TUXEDO system client.

Implications of Running as a Client

Keep in mind the following implications of the fact that tmconfig runs as a BEA TUXEDO system client:

- tmconfig fails if it cannot allocate a TPINIT typed buffer.
- The *username* associated with the client is the login name of the user. (tmconfig fails if the user's login name cannot be determined.)
- For a secure application (that is, an application for which the SECURITY parameter has been set in the UBBCONFIG file), tmconfig prompts for the application password. If the application password is not provided, tmconfig fails.
- If tmconfig cannot register as a client, an error message containing *tperrno* is displayed and tmconfig exits. If this happens, check the user log to determine the cause. The most likely causes for this type of failure are:
  - The TUXCONFIG environment variable was not set correctly.
  - The system was not booted on the machine on which tmconfig is being run.

- `tmconfig` ignores all unsolicited messages.
- The client name for the `tmconfig` process that is displayed in the output from `printclient` (a `tmadmin` command) will be `tpsysadm`.

How tmconfig Works

When you type `tmconfig` on a command line, you are launching the display of a series of menus and prompts through which you can request an operation (such as the display or modification of a configuration file entry). `tmconfig` collects your menu choices, performs the requested operation, and prompts you to request another operation (by making another set of menu choices). It repeatedly offers to perform operations (by repeatedly displaying the menus) until you exit the `tmconfig` session by selecting `QUIT` from a menu.

Listing 17-1 shows the menus and prompts that are displayed once you enter the `tmconfig` command, thus launching the session.

Note: The lines in the listing have been numbered in this example for your convenience; during an actual `tmconfig` session, these numbers are not displayed.

Listing 17-1 Menus and Prompts Displayed in a tmconfig Session

```
1   $ tmconfig
2   Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
3    5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
4    10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
5
6   Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
7    6) CLEAR BUFFER 7) QUIT [1]:
8   Enter editor to add/modify fields [n]?
9   Perform operation [y]?
```

As shown here, you are asked to answer four questions:

- In which section of the configuration file do you want to view or modify an entry?

- For the section of the configuration file you have just specified, which operation do you want `tmconfig` to perform?
- Do you want to enter a text editor now?
- Do you want `tmconfig` to perform the requested operation now?

This section discusses these four questions and defines possible answers to each.

Sections of the Configuration File

When you start a `tmconfig` session, the following menu of sections (of `TUXCONFIG`, the configuration file) is displayed.

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
```

Note: For details about these sections (including a list of configurable parameters for each section), see the `ubbconfig`(5) reference page in the *BEA TUXEDO Reference Manual*.

To select a section, enter the appropriate number after the menu prompt. For example, to select the `MACHINES` section, enter 2, as follows.

```
10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]: 2
```

The default selection is the `RESOURCES` section, in which parameters that apply to your entire application are defined. To accept the default selection, simply press `ENTER` after the menu and colon (`:`) prompt.

```
10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
```

tmconfig Operations

Next, a menu of operations that `tmconfig` can perform is displayed.

```
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
  6) CLEAR BUFFER 7) QUIT [1]:
```

To select an operation, enter the appropriate number after the menu prompt. For example, to select the `UPDATE` section, enter 5, as follows.

```
6) CLEAR BUFFER 7) QUIT [1]: 5
```

Table 17-1 defines each operation.

Table 17-1 tmconfig Operations

Operation Number . . .	Called . . .	Performs the Following . . .
1	FIRST	Displays the first record from the specified section. No key fields are needed (they are ignored if they are in the input buffer). Using the FIRST operation can reduce the amount of typing that is needed. When adding a new entry to a section, instead of typing in all of the parameter names and values, use the FIRST operation to retrieve an existing entry for the UBBCONFIG section. Then, select the ADD operation and use the text editor to modify the parameter values.
2	NEXT	Displays the next record from the specified section, based on the key fields in the input buffer.
3	RETRIEVE	Displays the record (requested with the appropriate key field(s)) from the specified section.
4	ADD	Adds the indicated record in the specified section. Any fields not specified (unless required) take the default values specified in ubbconfig(5). (All default values and validations used by tmloadcf(1) are enforced.) The current value for all fields is returned in the output buffer. This operation can be done only by the BEA TUXEDO system administrator.
5	UPDATE	Updates the record specified in the input buffer in the selected section. Any fields not specified in the input buffer remain unchanged. (All default values and validations used by tmloadcf(1) are enforced.) The current values for all fields are returned in the input buffer. This operation can be done only by the BEA TUXEDO system administrator.
6	CLEAR BUFFER	Clears the input buffer (all fields are deleted). After this operation, tmconfig immediately prompts for the section again.
7	QUIT	Exits tmconfig gracefully (that is, the client is terminated). A value of q for any prompt allows you to exit tmconfig.

Output from tmconfig Operations

After tmconfig has executed an operation, the results (a return value and the contents of the output buffer) are displayed on the screen.

- If the operation was successful but no update was done, the following message is displayed.

  ```
  Return value TAOK
  ```

  Following is the message in the TA_STATUS field.

  ```
  Operation completed successfully.
  ```

- If the operation was successful and an update was done, the following message is displayed.

  ```
  Return value TAUPDATED
  ```

  Following is the message in the TA_STATUS field.

  ```
  Update completed successfully.
  ```

- If the operation failed, an error message is displayed:

  - If there is a problem with permissions or a BEA TUXEDO system communications error (rather than with the configuration parameters), one of the following return values is displayed: TAEPERM, TAEOS, TAESYSTEM, or TAETIME.
  - If there is a problem with a configuration parameter of the running application, the name of that parameter is displayed as the value of the TA_BADFLDNAME file, and the problem is indicated in the value of the TA_STATUS field in the output buffer. If this type of problem occurs, one of the following return values is displayed: TAERANGE, TAEINCONSIS, TAECONFIG, TAEDUPLICATE, TAENOTFOUND, TAEREQUIRED, TAESIZE, TAEUPDATE, or TAENOSPACE.

  The following list describes the conditions indicated by both sets of error messages.

TAEPERM
: The UPDATE or ADD operation was selected but tmconfig is not being run by the BEA TUXEDO system administrator.

TAESYSTEM
: A BEA TUXEDO system error has occurred. The exact nature of the error is recorded in `userlog`(3c).

TAEOS
: An operating system error has occurred. The exact nature of the error is written to `userlog`(3c).

TAETIME
: A blocking timeout has occurred. The input buffer is not updated so no information is returned for retrieval operations. The status of update operations can be checked by doing a retrieval on the record that was being updated.

TAERANGE
: A field value is either out of range or invalid.

TAEINCONSIS
: A field value (or set of field values) is inconsistently specified. For example, an existing `RQADDR` value may be specified for a different `SRVGRP` and `SERVERNAME`.

TAECONFIG
: An error occurred while the `TUXCONFIG` file was being read.

TAEDUPLICATE
: The operation attempted to add a duplicate record.

TAENOTFOUND
: The record specified for the operation was not found.

TAEREQUIRED
: A field value is required but is not present.

TAESIZE
: A field value for a string field is too long.

TAEUPDATE
: The operation attempted to do an update that is not allowed.

TAENOSPACE
: The operation attempted to do an update but there was not enough space in the `TUXCONFIG` file and/or the Bulletin Board.

General Instructions for Running tmconfig

This section explains how to do the following:

- Set up your environment properly before starting a `tmconfig` session
- Walk through a `tmconfig` session

Preparing to Run tmconfig

Before you can start a `tmconfig` session, you must have the required permissions and set the required environment variables. For your convenience, you may also want to select a text editor other than the default. Complete the following procedure to ensure you have set up your working environment properly before running `tmconfig`.

1. Log in as the BEA TUXEDO application administrator if you want to add entries to `TUXCONFIG`, or to modify existing entries. (If you want to view existing configuration file entries without changing or adding to them, this step is not necessary.)
2. Assign values to two mandatory environment variables: `TUXCONFIG` and `TUXDIR`.
   a. The value of `TUXCONFIG` must be the path name and binary configuration file name on the machine on which `tmconfig` is being run.
   b. The value of `TUXDIR` must be the root directory for the BEA TUXEDO system binary files. (`tmconfig` must be able to extract field names and identifiers from `$TUXDIR/udataobj/tpadmin`.)
3. You may also set the `EDITOR` environment variable; doing so is optional. The value of `EDITOR` must be the name of the text editor you want to use when changing parameter values; the default value is `ed` (a command-line editor).

Note: Many full-screen editors do not function properly unless the `TERM` environment variable has also been set.

Running tmconfig: A High-level Walk-through

This section provides a walk-through of a generic `tmconfig` session in which you modify entries in your configuration file.

1. Enter `tmconfig` after a shell prompt.

   ```
   $ tmconfig
   ```

   Note: You can end a session at any time by entering `q` (short for quit) after the Section menu prompt.

   A menu of sections in the `TMCONFIG` file is displayed.

   ```
   Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
    5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
    10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
   ```

2. Select the section that you want to change by entering the appropriate menu number, such as `2` for the `MACHINES` section. The default choice is the `RESOURCES` section, represented by `[1]` at the end of the list of sections shown in Step 1. If you specify a section (instead of accepting the default), that section becomes the new default choice and remains so until you specify another section.

   A menu of possible operations is displayed.

   ```
   Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
    6) CLEAR BUFFER 7) QUIT [1]: 1
   ```

   Note: Each operation listed here is available to be performed on one entry at a time of one section of the configuration file. The names of most operations (`FIRST` and `NEXT`) are self-explanatory. When you select `FIRST`, you are asking to have the first entry (in the specified section of the configuration file) displayed on the screen. When you select `NEXT`, you are asking to have the contents of the buffer replaced by the second entry in the specified section, and to have the new buffer contents displayed on the screen. By repeatedly choosing `NEXT`, you can view all the entries in a given section of the configuration file in the order in which they are listed.

3. Select the operation that you want to have performed.

   The default choice is the `UPDATE` operation, represented by `[1]` at the end of the list of operations shown in Step 2.

   A prompt is displayed, asking whether you want to enter a text editor to start making changes to the `TMCONFIG` section you specified in Step 2.

```
Enter editor to add/modify fields [n]?
```

4. Select y or n (for yes or no, respectively). The default choice (shown at the end of the prompt) is [n].

   If you select yes (y), the specified editor is invoked and you can start adding or changing fields. The format of each field is

   field_name<*tabs*>*field_value*

   where the name and value of the field are separated by one or more tabs.

   In most cases, the field name is the same as the KEYWORD in the UBBCONFIG file, prefixed with TA_.

Note: For details about valid input, see the following section ("Input Buffer Considerations"). For descriptions of the field names associated with each section of UBBCONFIG, see the TM_MIB(5) reference page in the *BEA TUXEDO Reference Manual*.

When you finish editing the input buffer, tmconfig reads it. If any errors occur, a syntax error is displayed and tmconfig prompts you to decide whether to correct the problem.

```
Enter editor to correct?
```

5. Select n or y.

   If you decide not to correct the problem (by selecting n), the input buffer contains no fields. Otherwise, the editor is executed again.

   Once you have finished editing the input buffer, a prompt is displayed, asking whether you want to have the operation you specified (in Step 3) performed now.

   ```
   Perform operation [y]?
   ```

6. Select n or y. The default choice (shown at the end of the prompt) is [y].

   - If you select no, the menu of sections is displayed again. (Return to Step 2.)
   - If you select yes, tmconfig executes the requested operation and displays the following confirmation message.

     ```
     Return value TAOK
     ```

   The results of the operation are displayed on the screen.

You have completed an operation on one section of TMCONFIG; you may now start another operation on the same section or on another section. To allow you to start a new operation, tmconfig displays, again, the menu of TMCONFIG sections (as shown in Step 1).

Note: All output buffer fields are available in the input buffer unless the buffer is cleared.

7. Continue your tmconfig session (by requesting more operations) or quit the session.

   - To continue requesting operations, return to Step 2.
   - To end your tmconfig session, select QUIT from the menu of operations (shown in Step 3).

8. After you end your tmconfig session, you are given a chance to make an ASCII-format backup copy of your newly modified TUXCONFIG file. In the following example, the administrator chooses the default response to the offer of a backup (yes) and overrides the default name of the backup file (UBBCONFIG) by specifying another name (backup).

```
Unload TUXCONFIG file into ASCII backup [y]?
Backup filename [UBBCONFIG]? backup
Configuration backed up in backup
```

Input Buffer Considerations

The following considerations apply to the input buffer used with tmconfig:

- If the value of a field you are typing extends beyond one line, you may continue it on the next line if you insert one or more tabs at the beginning of the second line. (The tab characters are dropped when your input is read into tmconfig.)
- An empty line consisting of a single newline character is ignored.
- If more than one line is provided for a particular field name, the first occurrence is used and other occurrences are ignored.
- To enter an unprintable character as part of the value of a field, or to start a field value with a tab, use a backslash followed by the two-character hexadecimal representation of the desired character (see the ASCII(5) reference page in a UNIX system reference manual). Here are a few examples:

- To insert a blank space, type “\20”.
- To insert a backslash, type “\\”.

Procedures

This section provides procedures for dynamically reconfiguring your application by making the following changes:

- Adding a new machine
- Adding a server to a running application
- Activating a newly configured server
- Adding a new group
- Changing the factory-based routing for an interface
- Changing the data-dependent routing (DDR) for the application
- Changing application-wide parameters
- Changing the application password

Adding a New Machine

Complete the following steps to add a new machine.

1. Start a `tmconfig` session.
2. Specify the `MACHINE` section of the configuration file (choice #2 in the list).
3. Request the `FIRST` operation; that is, request a display of the first entry in the `MACHINE` section. (This operation is the default choice; press `ENTER` to select it.)
4. Request the `ADD` operation (choice #4 in the list).
5. Specify new values for four key fields:

- TLOG
- TA_LMID
- TA_TYPE
- TA_PMID

Listing 17-2 illustrates a `tmconfig` session in which a machine is being added.

Listing 17-2 Adding a Machine

```
$ tmconfig
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]: 2
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
 6) CLEAR BUFFER 7) QUIT [1]:
Enter editor to add/modify fields [n]?
Perform operation [y]?
Return value TAOK
Buffer contents:
TA_OPERATION            4
TA_SECTION              1
TA_OCCURS               1
TA_PERM                 432
TA_MAXACCESSERS         40
TA_MAXGTT               20
TA_MAXCONV              10
TA_MAXWSCLIENTS         0
TA_TLOGSIZE             100
TA_UID                  4196
TA_GID                  601
TA_TLOGOFFSET           0
TA_TUXOFFSET            0
TA_STATUS               LIBTUX_CAT:1137: Operation completed successfully
TA_PMID                 mchn1
TA_LMID                 SITE1
TA_TUXCONFIG            /home/apps/bank/tuxconfig
TA_TUXDIR               /home/tuxroot
TA_STATE                ACTIVE
TA_APPDIR               /home/apps/bank
TA_TYPE                 3B2
TA_TLOGDEVICE           /home/apps/bank/TLOG
TA_TLOGNAME             TLOG
TA_ULOGPFX              /home/apps/bank/ULOG
TA_ENVFILE              /home/apps/bank/ENVFILE
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
```

```
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [2]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
 6) CLEAR BUFFER 7) QUIT [1]: 4
Enter editor to add/modify fields [n]? y
491
g/home/s//usr/p
TA_TUXCONFIG             /usr/apps/bank/tuxconfig
TA_TUXDIR                /usr/tuxroot
TA_APPDIR                /usr/apps/bank
TA_TLOGDEVICE            /usr/apps/bank/TLOG
TA_ULOGPFX               /usr/apps/bank/ULOG
TA_ENVFILE               /usr/apps/bank/ENVFILE
g/TLOG/d
/SITE1/s//SITE3/p
TA_LMID SITE3
/3B2/s//SPARC/p
TA_TYPE SPARC
/mchn1/s//mchn2/p
TA_PMID mchn2
w
412
q
Perform operation [y]?
Return value TAUPDATED
Buffer contents:
TA_OPERATION             2
TA_SECTION               1
TA_OCCURS                1
TA_PERM                  432
TA_MAXACCESSERS          40
TA_MAXGTT                20
TA_MAXCONV               10
TA_MAXWSCLIENTS          0
TA_TLOGSIZE              100
TA_UID                   4196
TA_GID                   601
TA_TLOGOFFSET            0
TA_TUXOFFSET             0
TA_STATUS                LIBTUX_CAT:1136: Update completed successfully
TA_PMID                  mchn2
TA_LMID                  SITE3
TA_TUXCONFIG             /usr/apps/bank/tuxconfig
TA_TUXDIR                /usr/tuxroot
TA_STATE                 NEW
TA_APPDIR                /usr/apps/bank
TA_TYPE                  SPARC
TA_TLOGDEVICE
TA_TLOGNAME              TLOG
```

```
TA_ULOGPFX                /usr/apps/bank/ULOG
TA_ENVFILE                  /usr/apps/bank/ENVFILE
```

Adding a Server

Complete the following steps to add a server.

1. Start a `tmconfig` session.
2. Specify the `SERVERS` section of the configuration file (choice #4 in the list).
3. Request the `CLEAR BUFFER` operation (choice #6 in the list).
4. Request the `ADD` operation (choice #4 in the list).
5. Enter the text editor.
6. Specify new values for three key fields:
   - `TA_SERVERNAME`
   - `TA_SRVGRP`
   - `TA_SRVID`

Listing 17-3 illustrates a `tmconfig` session in which a server is added.

Listing 17-3 Adding a Server

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]: 4
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
 6) CLEAR BUFFER 7) QUIT [4]: 6
Buffer cleared
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [4]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
   6) CLEAR BUFFER 7) QUIT [6]: 4
Enter editor to add/modify fields [n]? y
1
c
```

```
TA_SERVERNAME             XFER
TA_SRVGRP                 BANKB1
TA_SRVID                  5
.
w
28
q
Perform operation [y]?
Return value TAOK
Buffer contents:
TA_OPERATION              3
TA_SECTION                3
TA_OCCURS                 1
TA_SRVID                  5
TA_SEQUENCE               0
TA_MIN                    1
TA_MAX                    1
TA_RQPERM                 432
TA_RPPERM                 432
TA_MAXGEN                 5
TA_GRACE                  86400
TA_STATUS                 LIBTUX_CAT:1137: Operation completed successfully
TA_SYSTEM_ACCESS          FASTPATH
TA_ENVFILE
TA_SRVGRP                 BANKB1
TA_SERVERNAME             XFER
TA_CLOPT                  -A
TA_CONV                   N
TA_RQADDR
TA_REPLYQ                 Y
TA_RCMD
TA_RESTART                  Y
```

Activating a Newly Configured Server

Complete the following steps to add a newly configured server.

1. Start a `tmconfig` session.
2. Select the `MACHINES` section.
3. Using the `FIRST` and `NEXT` operations, select the entry for which you want to change the state from `NEW` to `ACTIVE`.

4. Select the UPDATE operation (choice #5 in the list).
5. Enter y (for ''yes'') when prompted to say whether you want to start editing.
6. Change the value of the TA_STATE field from NEW to ACTIVE.
7. tmconfig displays the revised entry for the specified machine so you can review your change (and, if necessary, edit it).
8. If the revised entry is acceptable, select QUIT (choice #6 in the list) to end the tmconfig session.

Adding a New Group

Complete the following steps to add a group.

1. Start a tmconfig session.
2. Select the GROUPS section of the configuration file (choice #3 in the list).
3. Request the CLEAR BUFFER operation (choice #6 in the list).
4. Request the ADD operation (choice #4 in the list).
5. Enter y (for ''yes'') when prompted to say whether you want to start editing.
6. Specify new values for three key fields:
   - TA_LMID
   - TA_SRVGRP
   - TA_GRPNO

Listing 17-4 illustrates a tmconfig session in which a group is added.

Listing 17-4 Adding a Group

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]: 3
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
   6) CLEAR BUFFER 7) QUIT [4]: 6
Buffer cleared
```

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [3]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
   6) CLEAR BUFFER 7) QUIT [6]: 4
Enter editor to add/modify fields [n]? y
1
c
TA_LMID                 SITE3
TA_SRVGRP               GROUP3
TA_GRPNO                3
.
w
42
q
Perform operation [y]?
Return value TAUPDATED
Buffer contents:
TA_OPERATION            2
TA_SECTION              2
TA_OCCURS               1
TA_GRPNO                3
TA_TMSCOUNT             0
TA_STATUS               LIBTUX_CAT:1136: Update completed successfully
TA_LMID                 SITE3
TA_SRVGRP               GROUP3
TA_TMSNAME
TA_OPENINFO
TA_CLOSEINFO
```

Changing the Data-dependent Routing (DDR) for the Application

Complete the following steps to change the data-dependent routing for an application.

1. Start a `tmconfig` session.
2. Select the `ROUTING` section of the configuration file (choice #7 in the list).
3. Using the `FIRST` and `NEXT` operations, select the entry for which you want to change the DDR.
4. Select the `UPDATE` operation.
5. Enter `y` (for ''yes'') when prompted to say whether you want to start editing.

   ```
   Do you want to edit(n)? y
   ```

6. Change the relevant fields to values such as those shown in the middle column of the following table.

Field	Sample Value	Meaning
`TA_ROUTINGNAME`	`account_routing`	Name of the routing section
`TA_BUFTYPE`	`FML`	Buffer type
`TA_FIELD`	`account_ID`	The value of this field is subject to the criterion (specified in the `TA_RANGES` field); that is, the value of this field determines the routing result.
`TA_RANGES`	`1-10:group1,*:*`	The routing criterion being used.

The value of the `TA_RANGES` field is the routing criterion. If the value of `account_ID` is between 1 and 10 (inclusive), requests are sent to the servers in group 1. Otherwise, requests are sent to any other server in the configuration.

Note: For details, see the `tmconfig`(1) reference page in the *BEA TUXEDO Reference Manual*.

Changing Application-wide Parameters

Some run-time parameters are relevant to all the components (machines, servers, and so on) of your configuration. These parameters are listed in the RESOURCES section of the configuration file.

An easy way to familiarize yourself with the parameters in the RESOURCES section is to display the first entry in that section. To do so, complete the following procedure.

1. Start a tmconfig session.
2. Select the RESOURCES section of the configuration file. (The RESOURCES section, choice #1 on the menu of configuration file sections, is the default selection.)
3. Using the FIRST and NEXT operations, select the entry that you want to display. (Because the first entry is the default selection, in this case you can simply accept the default.)
4. Select the FIRST operation (the default selection).
5. Respond "no" (by accepting the default) when asked whether you want to edit.

   ```
   Do you want to edit(n)?
   ```

6. Respond "yes" (by accepting the default) when asked whether you want the specified operation (FIRST) to be performed.

   ```
   Perform operation [y]?
   ```

Listing 17-5 illustrates a tmconfig session in which the first entry in the RESOURCES section is displayed.

Listing 17-5 Displaying the First Entry in the RESOURCES Section

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
 6) CLEAR BUFFER 7) QUIT [1]: 1
Enter editor to add/modify fields [n]?
Perform operation [y]?
Return value TAOK
Buffer contents:
TA_OPERATION       1
```

```
TA_SECTION          0
TA_STATUS           Operation completed successfully
TA_OCCURS           1
TA_PERM             432
TA_BBLQUERY         30
TA_BLOCKTIME        6
TA_DBBLWAIT         2
TA_GID              10
TA_IPCKEY           80997
TA_LICMAXUSERS      1000000
TA_MAXACCESSERS     100
TA_MAXBUFSTYPE      32
TA_MAXBUFTYPE       16
TA_MAXCONV          10
TA_MAXDRT           0
TA_MAXGROUPS        100
TA_MAXGTT           25
TA_MAXMACHINES      256
TA_MAXQUEUES        36
TA_MAXRFT           0
TA_MAXRTDATA        8
TA_MAXSERVERS       36
TA_MAXSERVICES      100
TA_MIBMASK          0
TA_SANITYSCAN       12
TA_SCANUNIT         10
TA_UID              5469
TA_MAXACLGROUPS     16384
TA_MAXNETGROUPS     8
TA_MAXINTERFACES    150
TA_MAXOBJECTS       1000
TA_STATE            ACTIVE
TA_AUTHSVC
TA_CMTRET           COMPLETE
TA_DOMAINID
TA_LDBAL            Y
TA_LICEXPIRE        1998-09-15
TA_LICSERIAL        1234567890
TA_MASTER           SITE1
TA_MODEL            SHM
TA_NOTIFY           DIPIN
TA_OPTIONS
TA_SECURITY         NONE
TA_SYSTEM_ACCESS    FASTPATH
TA_USIGNAL          SIGUSR2
TA_PREFERENCES
TA_COMPONENTS       TRANSACTIONS,QUEUE,TDOMAINS,TxRPC,
EVENTS,WEBGUI,WSCOMPRESSION,TDOMCOMPRESSION
```

Changing an Application Password

Complete the following steps to change an application password.

1. Start a `tmconfig` session.
2. Select the `RESOURCES` section (#1, the default choice on the menu of sections).
3. Clear the buffer.
4. Enter (in the buffer):

   `TA_PASSWORD` *`new_password`*

   `wq!`

Listing 17-6 illustrates a `tmconfig` session in which an application password is changed.

Listing 17-6 Changing an Application Password

```
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES  6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
   6) CLEAR BUFFER 7) QUIT [4]: 6
Buffer cleared
Section: 1) RESOURCES, 2) MACHINES, 3) GROUPS 4) SERVERS
 5)SERVICES 6) NETWORK 7) ROUTING q) QUIT 9) WSL
 10) NETGROUPS 11) NETMAPS 12) INTERFACES [1]:
Operation: 1) FIRST 2) NEXT 3) RETRIEVE 4) ADD 5) UPDATE
   6) CLEAR BUFFER 7) QUIT [6]: 5
Enter editor to add/modify fields [n]? y
1
c
TA_PASSWORD         neptune
.
w
49
q
Perform operation [y]?
Return value TAUPDATED
Buffer contents:
TA_OPERATION       1
TA_SECTION         0
TA_STATUS          Operation completed successfully
```

```
TA_OCCURS          1
TA_PERM            432
TA_BBLQUERY        30
TA_BLOCKTIME       6
TA_DBBLWAIT        2
TA_GID             10
TA_IPCKEY          80997
TA_LICMAXUSERS     1000000
TA_MAXACCESSERS    100
TA_MAXBUFSTYPE     32
TA_MAXBUFTYPE      16
TA_MAXCONV         10
TA_MAXDRT          0
TA_MAXGROUPS       100
TA_MAXGTT          25
TA_MAXMACHINES     256
TA_MAXQUEUES       36
TA_MAXRFT          0
TA_MAXRTDATA       8
TA_MAXSERVERS      36
TA_MAXSERVICES     100
TA_MIBMASK         0
TA_SANITYSCAN      12
TA_SCANUNIT        10
TA_UID             5469
TA_MAXACLGROUPS    16384
TA_MAXNETGROUPS    8
TA_MAXINTERFACES   150
TA_MAXOBJECTS      1000
TA_PASSWORD        neptune
TA_STATE           ACTIVE
TA_AUTHSVC
TA_CMTRET          COMPLETE
TA_DOMAINID
TA_LDBAL           Y
TA_LICEXPIRE       1998-09-15
TA_LICSERIAL       1234567890
TA_MASTER          SITE1
TA_MODEL           SHM
TA_NOTIFY          DIPIN
TA_OPTIONS
TA_SECURITY        NONE
TA_SYSTEM_ACCESS   FASTPATH
TA_USIGNAL         SIGUSR2
TA_PREFERENCES
TA_COMPONENTS      TRANSACTIONS,QUEUE,TDOMAINS,TxRPC,EVENTS,WEBGUI,
                     WSCOMPRESSION,TDOMCOMPRESSION
```

Final Advice About Dynamic Reconfiguration

Keep in mind the following restrictions. Be careful about setting parameters that cannot be changed easily.

- Associated with each section is a set of key fields that are used to identify the record upon which to operate. (For details see the `tmconfig`(1) reference page in the *BEA TUXEDO Reference Manual*.) Key field values cannot be changed while an application is running. Normally, it is sufficient to add a new entry (with a new key field value) and use it instead of the old entry. In this case, the old entry in the configuration is not booted by the administrator; the new entry is used, instead.
- Generally speaking, you cannot update a parameter while the configuration component associated with it is booted. (For example, you cannot change an entry in the `MACHINES` or `NETWORK` section while the machine associated with that entry is booted.) Specifically:
  - If any server in a group is booted, you cannot change the entry for that group.
  - If a server is booted, you cannot change its name, type (conversational or not), or parameters related to its message queue. (You can change other server parameters at any time but your changes will not take effect until the next time the server is booted.)
  - You can change a `SERVICES` entry at any time but your changes will not take effect until the next time the service is advertised.
  - Updates to the `RESOURCES` section are restricted by the following conditions. The `UID`, `GID`, `PERM`, `MAXACCESSERS`, `MAXGTT`, and `MAXCONV` parameters cannot be updated in the `RESOURCES` section but can be updated on a per-machine basis. The `IPCKEY`, `MASTER`, `MODEL`, `OPTIONS`, `USIGNAL`, `MAXSERVERS`, `MAXSERVICES`, `MAXBUFTYPE`, and `MAXBUFSTYPE` parameters cannot be changed.

Note: Before shutting down the `MASTER` machine, make sure to migrate it to the `acting backup` machine.

- Be sure to keep track of the section of the configuration file in which you are working; `tmconfig` does not warn you if you try to perform an operation that is wrong for the section currently available in the buffer. For example, if you try to update the `ENVFILE` parameter (in the `MACHINES` section) while you are working in the `RESOURCES` section, the operation will appear to succeed (that is, `tmconfig` will return `TAOK`), but the change will not appear in your unloaded `UBBCONFIG` file. The only way you can be sure that an update has been done is by seeing the `TAUPDATED` status message displayed.
- With regard to interoperability, updates and additions are not allowed to any site in an application if a Release 4.1 (R4.1) site is booted. You must shut down the R4.1 site before updates can be done. When the updates are complete, you can reboot the R4.1 site; the updated `TUXCONFIG` will be propagated to the R4.1 node automatically.

In a multimachine configuration, always do the following:

- Specify a backup for the `MASTER` machine, along with the `MIGRATE` option (even if application server migration is not anticipated).
- Set `MAXSERVERS`, `MAXSERVICES`, and other "`MAX`" parameters high enough to allow for sufficient growth. If your application is, initially, a single-machine configuration but is expected to grow to a multimachine configuration, use the MP model, specifying the `LAN` option and a network entry for the initial machine.
- Set the parameters in the `MACHINES` section carefully since updating them requires shutting down the machine (and switching the `MASTER` to the backup in the case of the `MASTER` machine).

18 Event Broker/Monitor

The BEA TUXEDO Event Broker/Monitor is a tool that enhances the tracking of events in a running application. It extends the usefulness of the `USERLOG` (in which the BEA TUXEDO system records system events) by providing the following:

- A system-wide summary of events
- A tool that lets you set up various types of automatic notification when certain events occur

The BEA TUXEDO Event Broker/Monitor is built on the AdminAPI, the administrative programming interface to the BEA TUXEDO system. It is an example of administration through programming.

The chapter discusses the following topics:

- Events
- Setting Up Event Detection
- Subscribing to Events
- Application-specific Event Broker/Monitors
- How an Event Broker/Monitor Might Be Deployed
- How the Event Broker/Monitor Works

Note: This chapter demonstrates how you can use the BEA TUXEDO AdminAPI to enhance your application. For an actual example that you can run as a demo and copy from, see the `bankapp` application (distributed with the BEA TUXEDO system) and the *BEA TUXEDO Application Development Guide*.

Events

An event is a change in a component of a running application. This change may be harmless or it may cause a problem that requires work by the operator or administrator (and, in some cases, particular software) to be resolved.

Event Classifications

The BEA TUXEDO Event Monitor keeps track of events in a running application and classifies them on the basis of severity. The Event Monitor uses the same three severity classifications used by the BEA TUXEDO system to sort system messages sent to the `USERLOG`: information (`INFO`), warnings (`WARN`), and errors (`ERROR`).

- An `INFO` event is one of the following:
  - A state change of a process
  - The detection of a configuration change
- A `WARN` event is a configuration change that threatens the performance of the application.
- An `ERROR` event is an abnormal occurrence, such as:
  - A server dying
  - A network connection being dropped

List of Events

Events affecting objects in the classes defined in `TM_MIB`(5) are tracked. The list is published in `EVENTS`(5).

The designers of an Event Broker/Monitor need to decide which events to track. Users of the system need to know the list of events being tracked.

Setting Up Event Detection

You can set the BEA TUXEDO system event detection logic to do two things:

- Post messages to a UNIX error message log (`syslogd`)
- Post events to the BEA TUXEDO event server

To activate event detection logic, set and export `TMSYSLOGD_FACILITY` to a numeric value from 0 to 7.

For details, see `syslogd`(3c) in a UNIX system reference manual.

Subscribing to Events

Clients subscribe to events by calls to `tpsubscribe`(3c). A call to `tpsubscribe` has a required argument, *`eventexpr`*, that points to a wildcard string. This string, in turn, identifies the events about which the user wants to know. The wildcard string makes use of the syntax described in `recomp`(3c) to apply the subscription to more than one type of event. The wildcard string is used to match the message distributed when the event is detected.

In the BEA TUXEDO System Monitor the message includes the severity level, so a user can subscribe accordingly. Here are two examples:

- A user who wants to be notified of all events related to BEA TUXEDO networking sets the value of *`eventexpr`* to the following.

  ```
  \.SysNetwork.*
  ```

- A user who wants to subscribe to all events with a severity level of `ERROR` sets the value of *`eventexpr`* to the following.

  ```
  \.*(ERR|err)\.*
  ```

When a client leaves an application (by calling `tpterm`) all of its subscriptions are "canceled." If the client later rejoins the application and wants those subscriptions, it must subscribe again. A well-behaved client unsubscribes before calling `tpterm`. A client that accepts notification via unsolicited messages should issue a `tpunsubscribe`(3c) call before leaving the application.

Another argument of the `tpsubscribe` call (in addition to *`eventexpr`*) is a pointer to a structure of type `TPEVCTL` (defined in `atmi.h`). Through the use of the `TPEVCTL` structure (or non-use, if the argument is NULL), the user can select the notification method to be used for sending information about subscribed events. If the argument is NULL, the event broker sends an unsolicited message to the subscriber. The subscriber can alternatively elect to have the notification sent to a service or to a queue in stable storage. If a client wants to enter such a subscription, it must invoke a service routine to subscribe on its behalf.

As a BEA TUXEDO system administrator, you can enter subscription requests on behalf of a client or server process through calls to the `EVENT_MIB`(5). You may also use two notification methods that are specified in entries in the `EVENT_MIB` (besides the three available in `tpsubscribe`):

- A command can be invoked via the UNIX `system`(2) command.
- A message can be sent to the `userlog`.

Application-specific Event Broker/Monitors

By "application-specific Event Broker/Monitor" we mean a monitor customized to recognize events generated by application code. For example, a stock brokerage system could be programmed to post an event when a stock trades at or above a certain price. A banking application might be programmed to post an event when a withdrawal or deposit above a specified amount is detected.

The function of an application-specific Event Broker/Monitor is similar to that of the BEA TUXEDO System Event Broker/Monitor: when an event is posted, subscribers are notified (or an action specified by the subscriber is initiated). This section describes the same three areas that were described above, pointing out how the customized monitor resembles and differs from the BEA TUXEDO system monitor.

Events

The real distinction between a System Event Broker/Monitor and an Event Broker/Monitor for a specific application is the way events are defined. System events are defined in advance by the BEA TUXEDO system code. For an application, designers must select application events to monitor. Application programs must be written to a) detect when an event of interest has occurred, and b) post the event to the Event Monitor via `tppost`.

Event List

There is no difference between the Event Lists generated and used on an application-specific Event Broker/Monitor and a BEA TUXEDO system Event Broker/Monitor. The BEA TUXEDO System Event Broker/Monitor makes a list of monitored events available to interested users. (For details, see `EVENTS`(5) in the *BEA TUXEDO Reference Manual*.) In the same way, when an application-specific Event Broker/Monitor is being used, interested users should have access to a list of monitored events. The names of system events begin with a dot (.); application-specific event names may not begin with a dot (.).

Subscriptions

The process of subscribing to an event in an application-specific Event Monitor is the same as that of subscribing with the BEA TUXEDO system Event Monitor. Subscriptions are made by calls to `tpsubscribe` using the published list of events, so the application can identify the events to which you are subscribing.

Note: For the BEA TUXEDO System Event Monitor, `EVENTS`(5) lists the notification message generated by an event, as well as the event name. The event name is used as an argument when `tppost` is called. Subscribers, on the other hand, can take advantage of the wildcard capability of regular expressions to make a single call to `tpsubscribe` to cover a whole category of events. We strongly recommend using the same format for the published event list for an application-specific Event Monitor/Broker.

How an Event Broker/Monitor Might Be Deployed

The client interfaces with the Event Broker/Monitor through either of two servers provided by the BEA TUXEDO system:

- `TMSYSEVT`(5)
- `TMUSREVT`(5)

These servers introduce the concept of a principal server and zero or more secondary servers. Both types (principal and secondary) process events and trigger notification actions.

To install the BEA TUXEDO system Event Broker/Monitor, configure:

- The principal server on the `MASTER` site
- Whatever secondary servers your installation might need on other machines on your network

With an application-specific Event Broker/Monitor, the primary server may be on any machine other than the `MASTER`; secondary servers may be located around your network.

The reason for locating secondary servers on other nodes of your network is to reduce the amount of network traffic caused by posting events and by distributing event notifications to subscribers. The secondary server periodically polls the primary server to get the latest version of the subscription list, which stores filtering and notification rules.

You can configure the polling interval as needed. There may be a perception that event messages are lost during this period between the time at which subscriptions are initially added and the time at which all secondary servers are updated. If the application cannot “lose” messages, the programs must wait, at least until the end of the polling period, before `tppost` is called for the new event.

How the Event Broker/Monitor Works

The BEA TUXEDO Event Broker/Monitor is built with the following AdminAPI components:

- ATMI Extensions—The Event Monitor uses three function calls in the ATMI library:
  - `tppost`
  - `tpsubscribe`
  - `tpunsubscribe`

  These three functions appear in both the C library and the COBOL library. (See Sections (3c) and (3cbl) in the *BEA TUXEDO Reference Manual* for details.)
- MIB component—The `EVENT_MIB` management information base is the control file in which you can store subscription information and filtering rules. In your own application, you cannot define new events for the BEA TUXEDO system Event Broker/Monitor, but you can customize the Event Broker/Monitor to do the following:
  - Track events
  - Distribute notifications of special interest to the application

CHAPTER

19 Troubleshooting Applications

Other chapters of this document discuss many diagnostic tools provided by your BEA TUXEDO system: commands and log files that help you monitor a running system, identify potential problems while there is still time to prevent them, and detect error conditions once they have occurred. This chapter provides additional information to help you identify and recover from various system errors.

This chapter discusses the following topics:

- Distinguishing Between Types of Failures
- Broadcasting Unsolicited Messages
- Performing System File Maintenance
- Repairing Partitioned Networks
- Restoring Failed Machines
- Replacing System Components
- Replacing Application Components
- Cleaning Up and Restarting Servers Manually
- Aborting or Committing Transactions
- Recovering from Failures When Transactions Are Used

Distinguishing Between Types of Failures

The first step in troubleshooting is to determine the area in which the problem has occurred. In most applications, you must consider six possible sources of trouble:

- Application
- BEA TUXEDO system
- Database management software
- Network
- Operating system
- Hardware

To resolve the trouble in most of these areas, you must work with the appropriate administrator. If, for example, you determine that the trouble is being caused by a networking problem, you must work with the network administrator.

Determining the Cause of an Application Failure

To detect the source of an application failure, complete the following steps.

1. Check any BEA TUXEDO system warnings and error messages in the user log (`ULOG`).
2. Select the messages you think are most likely to reflect the current problem. Note the catalog name and the message number of each of those messages and look them up in the *BEA TUXEDO System Message Manual*. The document entry provides:
   - Details about the error condition flagged by the message
   - Recommendations for actions you can take to recover
3. Check any application warnings and error messages in the `ULOG`.

4. Check any warnings and errors generated by application servers and clients. Such messages are usually sent to the standard output and standard error files (named, by default `stdout` and `stderr`, respectively).
   - The `stdout` and `stderr` files are located in `$APPDIR`.
   - The `stdout` and `stderr` files for your clients and servers may have been renamed. (You can rename the `stdout` and `stderr` files by specifying `-e` and `-o` in the appropriate client and server definitions in your configuration file. For details, see the `servopts`(5) reference page in the *BEA TUXEDO Reference Manual*.)
5. Look for any core dumps in `$APPDIR`. Use a debugger such as `sdb` to get a stack trace. If you find core dumps, notify the application developer.
6. Check your system activity reports (by running the `sar`(1) command) to determine why your system is not functioning properly. Consider the following possible reasons:
   - The system may be running out of memory.
   - The kernel might not be tuned correctly.

Determining the Cause of a BEA TUXEDO System Failure

To detect the source of a system failure, complete the following steps:

1. Check any BEA TUXEDO system warnings and error messages in the user log (`ULOG`):
   - `TPEOS` messages indicate errors in the operating system.
   - `TPESYSTEM` messages indicate errors in the BEA TUXEDO system.
2. Select the messages you think are most likely to reflect the current problem. Note the catalog name and message number of each of those messages and look them up in the *BEA TUXEDO System Message Manual*. The reference manual entry provides the following:
   - Details about the error condition flagged by the message
   - Recommendations for actions you can take to recover
3. Prepare for debugging by completing the following steps:

- Set the following BEA TUXEDO system environment variables: TMDEBUG, BRDBG, NWDBG, and WSDBG.
- Compile the BEA TUXEDO system.

Broadcasting Unsolicited Messages

To send an unsolicited message, enter the following command.

```
broadcast (bcst) [-m machine] [-u usrname] [-c cltname] [text]
```

By default, the message is sent to all clients. You have the choice, however, of limiting distribution to one of the following recipients:

- One machine (-m *machine*)
- One client group (-c *client_group*)
- One user (-u *user*)

The text may not include more than 80 characters. The system sends the message in a buffer of type STRING. This means that the client's unsolicited message handling function (specified by tpsetunsol(0)) must be able to handle a message of this type. The tptypes() function may be useful in this case.

Performing System File Maintenance

This section provides instructions for the following tasks that you may need to perform in the course of maintaining your file system:

- Creating a device list
- Destroying a device list
- Reinitializing a device
- Printing the Universal Device List

- Printing VTOC information

Creating a Device List

Complete the following steps to create a device list.

1. Start a `tmadmin` session.
2. Enter the following command.

   `crdl [-z` *`devicename`*`] [-b` *`blocks`*`]`

   - The value of *`devicename`* [*`devindx`*] is the desired device name. (Another way to assign a name to a new device is by setting the `FSCONFIG` environment variable to the desired device name.)
   - The value of *`blocks`* is the number of blocks needed. The default value is 1000 pages.

Note: Because 35 blocks are needed for the administrative overhead associated with a TLOG, be sure to assign a value higher than 35 when you create a TLOG.

Destroying a Device List

To destroy a device list with index *`devindx`*, enter the following command.

`dsdl [-z` *`devicename`*`] [yes] [`*`devindx`*`]`

- You can specify the device by:
  - Entering its name after the `-z` option (as shown here), or
  - Setting the environment variable `FSCONFIG` to the device name
- If you include the `yes` option on the command line, you will not be prompted to confirm your intention to destroy the file before the file is actually destroyed.
- The value of *`devindx`* is the index to the file to be destroyed.

Reinitializing a Device

To reinitialize a device on a device list, enter the following command.

```
initdl [-z devicename] [-yes] devindx
```

- You can specify the device by:
  - Entering its name after the `-z` option (as shown here), or
  - Setting the environment variable `FSCONFIG` to the device name
- If you include the `-yes` option on the command line, you will not be prompted to confirm your intention to destroy the file before the file is actually destroyed.
- The value of *`devindx`* is the index to the file to be destroyed.

Printing the Universal Device List (UDL)

To print a UDL, enter the following command.

```
lidl
```

To specify the device from which you want to obtain the UDL, you have a choice of two methods:

- Specify the following on the `lidl` command line.

  `-z device name [devindx]`

- Set the environment variable `FSCONFIG` to the name of the desired device.

Printing VTOC Information

To get information about all VTOC table entries, enter the following command.

```
livtoc
```

To specify the device from which you want to obtain the VTOC, you have a choice of two methods:

- Specify the following on the `lidl` command line.

  `-z` *`device name`* [*`devindx`*]

- Set the environment variable `FSCONFIG` to the name of the desired device.

Repairing Partitioned Networks

A network partition exists if one or more machines cannot access the master machine. As the application administrator, you are responsible for detecting partitions and recovering from them. This section provides instructions for troubleshooting a partition, identifying its cause, and taking action to recover from it.

A network partition may be caused by the following:

- A network failure—one of two types:
  - Transient failure, which corrects itself in minutes
  - Severe failure, which requires you to take the partitioned machine out of the network
- A machine failure on either:
  - The master machine
  - The nonmaster machine
- A `BRIDGE` failure

The procedure you follow to recover from a partitioned network depends on the cause of the partition. Recovery procedures for these situations are provided in this section.

Detecting Partitioned Networks

There are several ways to detect a network partition:

- You can check the user log (`ULOG`) for messages that may shed light on the origin of the problem.

- You can gather information about the network, server, and service by running the `tmadmin` commands provided for this purpose.

Checking the ULOG

When things go wrong with the network, BEA TUXEDO system administrative servers start sending messages to the `ULOG`. If the `ULOG` is set up over a remote file system, all messages are written to the same log. In such a case you can run the `tail`(1) command on one file and check the failure messages displayed on the screen.

If, however, the remote file system is using the same network, the remote file system may no longer be available.

Example

```
151804.gumby!DBBL.28446: ... : ERROR: BBL partitioned, machine=SITE2
```

Gathering Information about the Network, Server, and Service

Listing 19-1 provides an example of a `tmadmin` session in which information is being collected about a partitioned network, and a server and a service on that network. Three `tmadmin` commands are run:

- `pnw` (the `printnetwork` command)
- `psr` (the `printserver` command)
- `psc` (the `printservice` command)

Listing 19-1 Example of a tmadmin Session

```
$ tmadmin
> pnw SITE2
Could not retrieve status from SITE2

> psr -m SITE1
a.out Name   Queue Name   Grp Name   ID   Rq Done   Load Done   Current Service
BBL          30002.00000  SITE1       0      -         -            ( - )
DBBL         123456       SITE1       0     121       6050          MASTERBB
simpserv     00001.00001  GROUP1      1      -         -            ( - )
BRIDGE       16900672     SITE1       0      -         -            ( DEAD )
>psc -m SITE1
```

```
Service Name Routine Name a.out    Grp Name ID Machine # Done Status
------------ ------------ -------- -------- -- ------- ------------
ADJUNCTADMIN ADJUNCTADMIN BBL      SITE1     0   SITE1      - PART
ADJUNCTBB    ADJUNCTBB    BBL      SITE1     0   SITE1      - PART
TOUPPER      TOUPPER      simpserv GROUP1    1   SITE1      - PART
BRIDGESVCNM  BRIDGESVCNM  BRIDGE   SITE1     1   SITE1      - PART
```

Restoring a Network Connection

This section provides instructions for recovering from transient and severe network failures.

Recovering from Transient Network Failures

Because the `BRIDGE` tries, automatically, to recover from any transient network failures and reconnects, transient network failures are usually not noticed. If, however, you do need to perform a manual recovery from a transient network failure, complete the following procedure.

1. On the master machine, start a `tmadmin`(1) session.
2. Run the `reconnect` command (`rco`), specifying the names of nonpartitioned and partitioned machines.

   `rco` *`non-partioned_node1 partioned_node2`*

Recovering from Severe Network Failures

Perform the following steps to recover from severe network failure.

1. On the master machine, start a `tmadmin` session.
2. Run the `pclean` command, specifying the name of the partitioned machine.

   `pcl` *`partioned_machine`*

3. Migrate the application servers or, once the problem has been corrected, reboot the machine.

Restoring Failed Machines

The procedure you follow to restore a failed machine depends on whether that machine was the master machine.

Restoring a Failed Master Machine

To restore a failed master machine, complete the following procedure.

1. Make sure that all IPC resources are removed for the BEA TUXEDO processes that died.
2. Start a `tmadmin` session on the `ACTING MASTER` (`SITE2`):

   ```
   tmadmin
   ```

3. Boot the BBL on the `MASTER` (`SITE1`) by entering the following command:

   ```
   boot -B SITE1
   ```

   The BBL will not boot if you have not executed `pclean` on `SITE1`.

4. Still in `tmadmin`, start a DBBL running again on the master site (`SITE1`) by entering the following:

   ```
   MASTER
   ```

5. If you have migrated application servers and data off the failed machine, boot them or migrate them back.

Restoring a Failed Nonmaster Machine

To restore a failed nonmaster machine, complete the following procedure.

1. On the master machine, start a `tmadmin` session.
2. Run `pclean`, specifying the partitioned machine on the command line.
3. Fix the machine problem.

4. Restore the failed machine by booting the Bulletin Board Listener (BBL) for it from the master machine.
5. If you have migrated application servers and data off the failed machine, boot them or migrate them back.

In Listing 19-2, `SITE2`, a nonmaster machine, is restored.

Listing 19-2 Example of Restoring a Failed Nonmaster Machine

```
$ tmadmin
tmadmin - Copyright © 1987-1990 AT&T; 1991-1993 USL. All rights reserved

> pclean SITE2
Cleaning the DBBL.

Pausing 10 seconds waiting for system to stabilize.
3 SITE2 servers removed from bulletin board

> boot -B SITE2
Booting admin processes ...

Exec BBL -A :

on SITE2 -> process id=22923 ... Started.
1 process started.
> q
```

Replacing System Components

To replace BEA TUXEDO system components, complete the following procedure.

1. Install the BEA TUXEDO system software that is being replaced.
2. Shut down those parts of the application that will be affected by the changes:
   - The BEA TUXEDO system servers may need to be shut down if libraries are being updated.

- Application clients and servers must be shut down and rebuilt if relevant BEA TUXEDO system header files or static libraries are being replaced. (Application clients and servers do not need to be rebuilt if the BEA TUXEDO system message catalogs, system commands, administrative servers, or shared objects are being replaced.)

3. If relevant BEA TUXEDO system header files and static libraries have been replaced, rebuild your application clients and servers.
4. Reboot the parts of the application that you shut down.

Replacing Application Components

To replace components of your application, complete the following procedure.

1. Install the application software. This software may consist of application clients, application servers, and various administrative files, such as the FML field tables.
2. Shut down the application servers being replaced.
3. If necessary, build the new application servers.
4. Boot the new application servers.

Cleaning Up and Restarting Servers Manually

By default, the BEA TUXEDO system cleans up resources associated with dead processes (such as queues) and restarts restartable dead servers from the Bulletin Board (BB) at regular intervals during BBL scans. You may, however, request cleaning at other times.

Cleaning Up Resources Associated with Dead Processes

To request an immediate cleanup of resources associated with dead processes, complete the following procedure.

1. Start a `tmadmin` session.
2. Enter `bbclean` *machine*.

The `bbclean` command takes one optional argument: the name of the machine to be cleaned.

If You Specify . . .	Then . . .
No machine	The resources on the default machine are cleaned.
A machine	The resources on that machine are cleaned.
DBBL	The resources on the Distinguished Bulletin Board Listener (DBBL) and the Bulletin Boards at all sites are cleaned.

Cleaning Up Resources

To clean up other resources, complete the following procedure.

1. Start a `tmadmin` session.
2. Enter `pclean` *machine*.

Note: You must specify a value for *machine*; it is a required argument.

If the Specified Machine Is . . .	Then . . .
Not partitioned	`pclean` will invoke `bbclean`.
Partitioned	`pclean` will remove all entries for servers and services from all nonpartitioned Bulletin Boards.

This command is useful for restoring order to a system after partitioning has occurred unexpectedly.

Aborting or Committing Transactions

This section provides instructions for aborting and committing transactions.

Aborting a Transaction

To abort a transaction, enter the following command.

```
aborttrans (abort) [-yes] [-g groupname] tranindex
```

- To determine the value of *tranindex*, run the `printtrans` command (a `tmadmin` command).
- If *groupname* is specified, a message is sent to the TMS of that group to mark as "aborted" the transaction for that group. If a group is not specified, a message is sent, instead, to the coordinating TMS, requesting an abort of the transaction. You must send abort messages to all groups in the transaction to control the abort.

This command is useful when the coordinating site is partitioned or when the client terminates before calling a commit or an abort. If the timeout is large, the transaction remains in the transaction table unless it is aborted.

Committing a Transaction

To commit a transaction, enter the following command.

```
committrans (commit) [-yes] [-g groupname] tranindex
```

- Both *groupname* and *tranindex* are required arguments.
- The operation fails if the transaction is not precommitted or has been marked aborted.

- This message should be sent to all groups to fully commit the transaction.

Cautions

Be careful about using this command. The only time you should need to run it is when both of the following conditions apply:

- The coordinating TMS has gone down before all groups got the commit message.
- The coordinating TMS will not be able to recover the transaction for some time.

Also, a client may be blocked on `tpcommit()`, which will be timed out. If you are going to perform an administrative commit, be sure to inform this client.

Recovering from Failures When Transactions Are Used

When the application you are administering includes database transactions, you may need to apply an after-image journal (AIJ) to a restored database following a disk corruption failure. Or you may need to coordinate the timing of this recovery activity with your site's database administrator (DBA). Typically, the database management software automatically performs transaction rollback when an error occurs. When the disk containing database files has become permanently corrupt, however, you or the DBA may need to step in and perform the rollforward operation.

Assume that a disk containing portions of a database is corrupted at 3:00 P.M. on a Wednesday. For this example, assume that a shadow volume does not exist.

1. Shut down the BEA TUXEDO application. For instructions, see Chapter 4, "Starting and Shutting Down Applications."
2. Get the last full backup of the database and restore the file. For example, restore the full backup version of the database from last Sunday at 12:01 A.M.

3. Apply the incremental backup files, such as the incrementals from Monday and Tuesday. For example, assume that this step restores the database up until 11:00 P.M. on Tuesday.
4. Apply the AIJ, or transaction journal file, that contains the transactions from 11:15 P.M. on Tuesday up to 2:50 P.M. on Wednesday.
5. Open the database again.
6. Restart the BEA TUXEDO applications.

Refer to the documentation for the resource manager (database product) for specific instructions on the database rollforward process.

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