Oracle® Solaris Trusted Extensions Administrator's Procedures

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Preface

The *Oracle Solaris Trusted Extensions Administrator's Procedures* guide provides procedures for configuring Trusted Extensions on the Solaris Operating System. This guide also provides procedures for managing users, zones, devices, and hosts that are labeled with Trusted Extensions software.

Note – This Solaris release supports systems that use the SPARC and x86 families of processor architectures. The supported systems appear in the Solaris OS: Hardware Compatibility Lists (`http://www.sun.com/bigadmin/hcl`). This document cites any implementation differences between the platform types.

In this document these x86 related terms mean the following:

- "x86" refers to the larger family of 64-bit and 32-bit x86 compatible products.
- "x64" relates specifically to 64-bit x86 compatible CPUs.
- "32-bit x86" points out specific 32-bit information about x86 based systems.

For supported systems, see the *Solaris OS: Hardware Compatibility Lists*.

Who Should Use This Guide

This guide is for knowledgeable system administrators and security administrators who are configuring and administering Trusted Extensions software. The level of trust that is required by your site security policy, and your level of expertise, determines who can perform the configuration tasks.

Administrators should be familiar with Oracle Solaris administration. In addition, administrators should understand the following:

- The security features of Trusted Extensions and your site security policy
- Basic concepts and procedures for using a host that is configured with Trusted Extensions, as described in the *Oracle Solaris Trusted Extensions User's Guide*
- How administrative tasks are divided among roles at your site

How the Trusted Extensions Guides Are Organized

The following table lists the topics that are covered in the Trusted Extensions guides and the audience for each guide.

Title of Guide	Topics	Audience
Solaris Trusted Extensions Transition Guide	Obsolete. Provides an overview of the differences between Trusted Solaris 8 software, Solaris 10 software, and Trusted Extensions software. For this release, the *What's New* document for the Oracle Solaris OS provides an overview of Trusted Extensions changes.	All
Solaris Trusted Extensions Reference Manual	Obsolete. Provides Trusted Extensions man pages for the Solaris 10 11/06 and Solaris 10 8/07 releases of Trusted Extensions. For this release, Trusted Extensions man pages are included with the Solaris man pages. To locate specific man pages, see Appendix B, "List of Trusted Extensions Man Pages."	All
Oracle Solaris Trusted Extensions User's Guide	Describes the basic features of Trusted Extensions. This guide contains a glossary.	End users, administrators, developers
Solaris Trusted Extensions Installation and Configuration for Solaris 10 11/06 and Solaris 10 8/07 Releases	Obsolete. Describes how to plan for, install, and configure Trusted Extensions for the Solaris 10 11/06 and Solaris 10 8/07 releases of Trusted Extensions.	Administrators, developers
Oracle Solaris Trusted Extensions Configuration Guide	Starting with the Solaris 10 5/08 release, describes how to enable and initially configure Trusted Extensions. Replaces *Solaris Trusted Extensions Installation and Configuration*.	Administrators, developers
Oracle Solaris Trusted Extensions Administrator's Procedures	Shows how to perform specific administration tasks.	Administrators, developers
Oracle Solaris Trusted Extensions Developer's Guide	Describes how to develop applications with Trusted Extensions.	Developers, administrators
Oracle Solaris Trusted Extensions Label Administration	Provides information about how to specify label components in the label encodings file.	Administrators
Compartmented Mode Workstation Labeling: Encodings Format	Describes the syntax used in the label encodings file. The syntax enforces the various rules for well-formed labels for a system.	Administrators

Related System Administration Guides

The following guides contain information that is useful when you prepare for and run Trusted Extensions software.

Book Title	Topics
System Administration Guide: Basic Administration	User accounts and groups, server and client support, shutting down and booting a system, managing services, and managing software (packages and patches)
System Administration Guide: Advanced Administration	Terminals and modems, system resources (disk quotas, accounting, and crontabs), system processes, and troubleshooting Solaris software problems
System Administration Guide: Devices and File Systems	Removable media, disks and devices, file systems, and backing up and restoring data
System Administration Guide: IP Services	TCP/IP network administration, IPv4 and IPv6 address administration, DHCP, IPsec, IKE, Solaris IP filter, Mobile IP, IP network multipathing (IPMP), and IPQoS
System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)	DNS, NIS, and LDAP naming and directory services, including transitioning from NIS to LDAP and transitioning from NIS+ to LDAP
System Administration Guide: Network Services	Web cache servers, time-related services, network file systems (NFS and Autofs), mail, SLP, and PPP
System Administration Guide: Security Services	Auditing, device management, file security, BART, Kerberos services, PAM, Solaris Cryptographic Framework, privileges, RBAC, SASL, and Solaris Secure Shell
System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones	Resource management topics projects and tasks, extended accounting, resource controls, fair share scheduler (FSS), physical memory control using the resource capping daemon (rcapd), and resource pools; virtualization using Solaris Zones software partitioning technology and `lx` branded zones
Oracle Solaris ZFS Administration Guide	ZFS storage pool and file system creation and management, snapshots, clones, backups, using access control lists (ACLs) to protect ZFS files, using ZFS on a Solaris system with zones installed, emulated volumes, and troubleshooting and data recovery
System Administration Guide: Printing	Solaris printing topics and tasks, using services, tools, protocols, and technologies to set up and administer printing services and printers

Related References

Your site security policy document – Describes the security policy and security procedures at your site

Solaris Common Desktop Environment: Advanced User's and System Administrator's Guide – Describes the Common Desktop Environment (CDE)

The administrator guide for your currently installed operating system – Describes how to back up system files

Related Third-Party Web Site References

Third-party URLs are referenced in this document and provide additional, related information.

Note – Oracle is not responsible for the availability of third-party web sites that are mentioned in this document. Oracle does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Oracle will not be responsible or liable for any actual or alleged damage or loss caused or alleged to be caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Documentation, Support, and Training

See the following web sites for additional resources:

- Documentation (`http://docs.sun.com`)
- Support (`http://www.oracle.com/us/support/systems/index.html`)
- Training (`http://education.oracle.com`) – Click the Sun link in the left navigation bar.

Oracle Welcomes Your Comments

Oracle welcomes your comments and suggestions on the quality and usefulness of its documentation. If you find any errors or have any other suggestions for improvement, go to `http://docs.sun.com` and click Feedback. Indicate the title and part number of the documentation along with the chapter, section, and page number, if available. Please let us know if you want a reply.

Oracle Technology Network (`http://www.oracle.com/technetwork/index.html`) offers a range of resources related to Oracle software:

- Discuss technical problems and solutions on the Discussion Forums (`http://forums.oracle.com`).
- Get hands-on step-by-step tutorials with Oracle By Example (`http://www.oracle.com/technetwork/tutorials/index.html`).
- Download Sample Code (`http://www.oracle.com/technology/sample_code/index.html`).

Typographic Conventions

The following table describes the typographic conventions that are used in this book.

TABLE P–1 Typographic Conventions

Typeface	Meaning	Example
`AaBbCc123`	The names of commands, files, and directories, and onscreen computer output	Edit your `.login` file. Use `ls -a` to list all files. `machine_name% you have mail.`
`AaBbCc123`	What you type, contrasted with onscreen computer output	`machine_name%` **`su`** `Password:`
aabbcc123	Placeholder: replace with a real name or value	The command to remove a file is `rm` *filename*.
AaBbCc123	Book titles, new terms, and terms to be emphasized	Read Chapter 6 in the *User's Guide*. A *cache* is a copy that is stored locally. Do *not* save the file. **Note:** Some emphasized items appear bold online.

Shell Prompts in Command Examples

The following table shows the default UNIX system prompt and superuser prompt for shells that are included in the Oracle Solaris OS. Note that the default system prompt that is displayed in command examples varies, depending on the Oracle Solaris release.

TABLE P–2 Shell Prompts

Shell	Prompt
Bash shell, Korn shell, and Bourne shell	`$`
Bash shell, Korn shell, and Bourne shell for superuser	`#`
C shell	`machine_name%`
C shell for superuser	`machine_name#`

◆ ◆ ◆ CHAPTER 1

Trusted Extensions Administration Concepts

This chapter introduces you to administering a system that is configured with Solaris Trusted Extensions software.

Trusted Extensions Software and the Oracle Solaris OS

Trusted Extensions software adds labels to a system that is running the Solaris Operating System (Oracle Solaris OS). Labels implement *mandatory access control* (MAC). MAC, along with discretionary access control (DAC), protects system subjects (processes) and objects (data). Trusted Extensions software provides interfaces to handle label configuration, label assignment, and label policy.

Similarities Between Trusted Extensions and the Oracle Solaris OS

Trusted Extensions software uses rights profiles, roles, auditing, privileges, and other security features of the Oracle Solaris OS. You can use Oracle Solaris Secure Shell (SSH), BART, the Oracle Solaris cryptographic framework, IPsec, and IPfilter with Trusted Extensions.

- As in the Oracle Solaris OS, users can be limited to using applications that are necessary for performing their jobs. Other users can be authorized to do more.
- As in the Oracle Solaris OS, capabilities that were formerly assigned to superuser are assigned to separate, discrete "roles."
- As in the Oracle Solaris OS, privileges protect processes. Zones are also used to separate processes.
- As in the Oracle Solaris OS, events on the system can be audited.

- Trusted Extensions uses the system configuration files of the Oracle Solaris OS, such as `policy.conf` and `exec_attr`.

Differences Between Trusted Extensions and the Oracle Solaris OS

Trusted Extensions software extends the Oracle Solaris OS. The following list provides an overview. For a quick reference, see Appendix A, "Quick Reference to Trusted Extensions Administration."

- Trusted Extensions controls access to data with special security tags that are called *labels*. Labels provide *mandatory access control* (MAC). MAC protection is in addition to UNIX file permissions, or discretionary access control (DAC). Labels are directly assigned to users, zones, devices, windows, and network endpoints. Labels are implicitly assigned to processes, files, and other system objects.

  MAC cannot be overridden by regular users. Trusted Extensions requires regular users to operate in labeled zones. By default, no users or processes in labeled zones can override MAC.

  As in the Oracle Solaris OS, the ability to override security policy can be assigned to specific processes or users when MAC can be overridden. For example, users can be authorized to change the label of a file. Such an action upgrades or downgrades the sensitivity of the information in that file.
- Trusted Extensions adds to existing configuration files and commands. For example, Trusted Extensions adds audit events, authorizations, privileges, and rights profiles.
- Some features that are optional on an Oracle Solaris system are required on a Trusted Extensions system. For example, zones and roles are required on a system that is configured with Trusted Extensions.
- Some features that are optional on an Oracle Solaris system are recommended on a Trusted Extensions system. For example, in Trusted Extensions the `root` user should be turned into the `root` role.
- Trusted Extensions can change the default behavior of the Oracle Solaris OS. For example, on a system that is configured with Trusted Extensions, auditing is enabled by default. In addition, device allocation is required.
- Trusted Extensions can narrow the options that are available in the Oracle Solaris OS. For example, on a system that is configured with Trusted Extensions, the NIS+ naming service is not supported. Also, in Trusted Extensions, all zones are labeled zones. Unlike the Oracle Solaris OS, labeled zones must use the same pool of user IDs and group IDs. Additionally, in Trusted Extensions, labeled zones can share one IP address.
- Trusted Extensions provides trusted versions of two desktops. To work in a labeled environment, desktop users of Trusted Extensions must use one of these desktops:

  - **Solaris Trusted Extensions (CDE)** – Is the trusted version of Common Desktop Environment (CDE). The name can be shortened to Trusted CDE.
  - **Solaris Trusted Extensions (JDS)** – Is the trusted version of Java Desktop System, Release *number*. The name can be shortened to Trusted JDS.
- Trusted Extensions provides additional graphical user interfaces (GUIs) and command line interfaces (CLIs). For example, Trusted Extensions provides the Device Allocation Manager to administer devices. In addition, the `updatehome` command is used to place startup files in an regular user's home directory at every label.
- Trusted Extensions requires the use of particular GUIs for administration. For example, on a system that is configured with Trusted Extensions, the Solaris Management Console is used to administer users, roles, and the network. Similarly, in Trusted CDE, the Admin Editor is used to edit system files.
- Trusted Extensions limits what users can see. For example, a device that cannot be allocated by a user cannot be seen by that user.
- Trusted Extensions limits users' desktop options. For example, users are allowed a limited time of workstation inactivity before the screen locks.

Multiheaded Systems and the Trusted Extensions Desktop

When the monitors of a multiheaded Trusted Extensions system are configured horizontally, the trusted stripe stretches across the monitors. When the monitors are configured vertically, the trusted stripe appears in the lowest monitor.

When different workspaces are displayed on the monitors of a multiheaded system, Trusted CDE and Trusted JDS render the trusted stripe differently.

- On a Trusted JDS desktop, each monitor displays a trusted stripe.
- On a Trusted CDE desktop, one trusted stripe appears on the primary monitor.

Caution – If a second trusted stripe appears on a Trusted CDE multiheaded system, the stripe is not generated by the operating system. You might have an unauthorized program on your system.

Contact your security administrator immediately. To determine the correct trusted stripe, see "How to Regain Control of the Desktop's Current Focus" on page 70.

Basic Concepts of Trusted Extensions

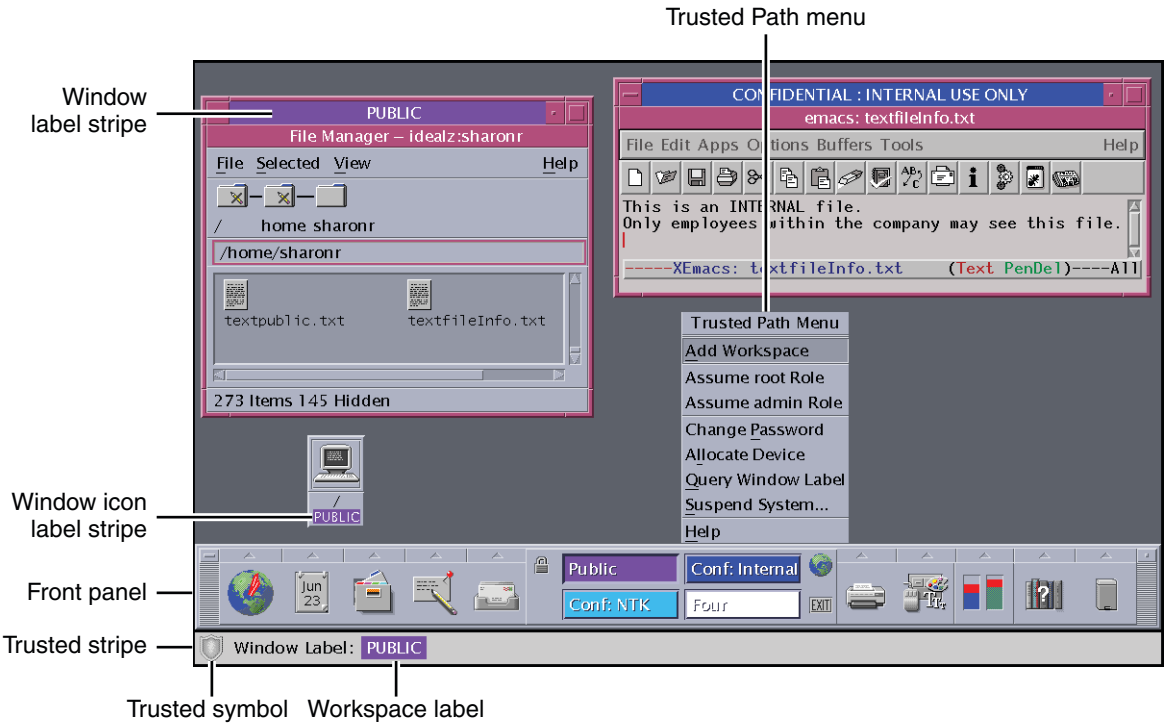
Trusted Extensions software adds labels to an Oracle Solaris system. Labeled desktops and trusted applications, such as the Label Builder and the Device Allocation Manager, are also added. The concepts in this section are necessary to understand Trusted Extensions, both for users and administrators. Users are introduced to these concepts in the *Oracle Solaris Trusted Extensions User's Guide*.

Trusted Extensions Protections

Trusted Extensions software enhances the protection of the Oracle Solaris OS. The Oracle Solaris OS protects access to the system with user accounts that require passwords. You can require that passwords be changed regularly, be of a certain length, and so on. Roles require additional passwords to perform administrative tasks. Additional authentication limits the damage that can be done by an intruder who guesses the root password, because roles cannot be used as login accounts. Trusted Extensions software goes further by restricting users and roles to an approved label range. This label range limits the information that users and roles can access.

Trusted Extensions software displays the Trusted Path symbol, an unmistakable, tamper-proof emblem that appears at the left of the trusted stripe. In Trusted CDE, the stripe is at the bottom of the screen. In Trusted JDS, the stripe is at the top of the screen. The Trusted Path symbol indicates to users when they are using security-related parts of the system. If this symbol does not appear when the user is running a trusted application, that version of the application should be checked immediately for authenticity. If the trusted stripe does not appear, the desktop is not trustworthy. For a sample desktop display, see Figure 1–1.

FIGURE 1–1 Trusted Extensions Multilevel CDE Desktop



Most security-related software, that is, the Trusted Computing Base (TCB), runs in the global zone. Regular users cannot enter the global zone or view its resources. Users are able to interact with TCB software, as in when they change passwords. The Trusted Path symbol is displayed whenever the user interacts with the TCB.

Trusted Extensions and Access Control

Trusted Extensions software protects information and other resources through both discretionary access control (DAC) and mandatory access control (MAC). DAC is the traditional UNIX permission bits and access control lists that are set at the discretion of the owner. MAC is a mechanism that the system enforces automatically. MAC controls all transactions by checking the labels of processes and data in the transaction.

A user's *label* represents the sensitivity level at which the user is permitted to operate and chooses to operate. Typical labels are `Secret`, or `Public`. The label determines the information that the user is allowed to access. Both MAC and DAC can be overridden by special permissions that are in the Oracle Solaris OS. *Privileges* are special permissions that can be granted to processes. *Authorizations* are special permissions that can be granted to users and roles by an administrator.

As an administrator, you need to train users on the proper procedures for securing their files and directories, according to your site's security policy. Furthermore, you need to instruct any users who are allowed to upgrade or downgrade labels as to when doing so is appropriate.

Roles and Trusted Extensions

On a system that is running Oracle Solaris software without Trusted Extensions, roles are optional. On a system that is configured with Trusted Extensions, roles are required. The system is administered by the System Administrator role and the Security Administrator role. In some cases, the `root` role is used.

As in the Oracle Solaris OS, rights profiles are the basis of a role's capabilities. Trusted Extensions provides two rights profiles, Information Security and User Security. These two profiles define the Security Administrator role.

The programs that are available to a role in Trusted Extensions have a special property, the *trusted path attribute*. This attribute indicates that the program is part of the TCB. The trusted path attribute is available when a program is launched from the global zone.

For information about roles, see Part III, "Roles, Rights Profiles, and Privileges," in *System Administration Guide: Security Services*.

Labels in Trusted Extensions Software

Labels and clearances are at the center of mandatory access control (MAC) in Trusted Extensions. They determine which users can access which programs, files, and directories. Labels and clearances consist of one *classification* component and zero or more *compartment* components. The classification component indicates a hierarchical level of security such as `TOP SECRET` or `CONFIDENTIAL`. The compartment component represents a group of users who might need access to a common body of information. Some typical types of compartments are projects, departments, or physical locations. Labels are readable by authorized users, but internally, labels are manipulated as numbers. The numbers and their readable versions are defined in the `label_encodings` file.

Trusted Extensions mediates all attempted security-related transactions. The software compares the labels of the accessing entity, typically a process, and the entity being accessed, usually a filesystem object. The software then permits or disallows the transaction depending on which label is *dominant*. Labels are also used to determine access to other system resources, such as allocatable devices, networks, frame buffers, and other hosts.

Dominance Relationships Between Labels

One entity's label is said to *dominate* another label if the following two conditions are met:

- The classification component of the first entity's label is equal to or higher than the second entity's classification. The security administrator assigns numbers to classifications in the `label_encodings` file. The software compares these numbers to determine dominance.
- The set of compartments in the first entity includes all of the second entity's compartments.

Two labels are said to be *equal* if they have the same classification and the same set of compartments. If the labels are equal, they dominate each other and access is permitted.

If one label has a higher classification or if it has the same classification and its compartments are a superset of the second label's compartments, or both, the first label is said to *strictly dominate* the second label.

Two labels are said to be *disjoint* or *noncomparable* if neither label dominates the other label.

The following table presents examples of label comparisons for dominance. In the example, `NEED_TO_KNOW` is a higher classification than `INTERNAL`. There are three compartments: Eng, Mkt, and Fin.

TABLE 1–1 Examples of Label Relationships

Label 1	Relationship	Label 2
`NEED_TO_KNOW Eng Mkt`	(strictly) dominates	`INTERNAL Eng Mkt`
`NEED_TO_KNOW Eng Mkt`	(strictly) dominates	`NEED_TO_KNOW Eng`
`NEED_TO_KNOW Eng Mkt`	(strictly) dominates	`INTERNAL Eng`
`NEED_TO_KNOW Eng Mkt`	dominates (equals)	`NEED_TO_KNOW Eng Mkt`
`NEED_TO_KNOW Eng Mkt`	is disjoint with	`NEED_TO_KNOW Eng Fin`
`NEED_TO_KNOW Eng Mkt`	is disjoint with	`NEED_TO_KNOW Fin`
`NEED_TO_KNOW Eng Mkt`	is disjoint with	`INTERNAL Eng Mkt Fin`

Administrative Labels

Trusted Extensions provides two special administrative labels that are used as labels or clearances: `ADMIN_HIGH` and `ADMIN_LOW`. These labels are used to protect system resources and are intended for administrators rather than regular users.

`ADMIN_HIGH` is the highest label. `ADMIN_HIGH` dominates all other labels in the system and is used to protect system data, such as administration databases or audit trails, from being read. You must be in the global zone to read data that is labeled `ADMIN_HIGH`.

ADMIN_LOW is the lowest label. ADMIN_LOW is dominated by all other labels in a system, including labels for regular users. Mandatory access control does not permit users to write data to files with labels lower than the user's label. Thus, a file at the label ADMIN_LOW can be read by regular users, but cannot be modified. ADMIN_LOW is typically used to protect public executables that are shared, such as files in /usr/bin.

Label Encodings File

All label components for a system, that is, classifications, compartments, and the associated rules, are stored in an ADMIN_HIGH file, the label_encodings file. This file is located in the /etc/security/tsol directory. The security administrator sets up the label_encodings file for the site. A label encodings file contains:

- **Component definitions** – Definitions of classifications, compartments, labels, and clearances, including rules for required combinations and constraints
- **Accreditation range definitions** – Specification of the clearances and minimum labels that define the sets of available labels for the entire system and for regular users
- **Printing specifications** – Identification and handling information for print banners, trailers, headers, footers, and other security features on printer output
- **Customizations** – Local definitions including label color codes, and other defaults

For more information, see the label_encodings(4) man page. Detailed information can also be found in *Oracle Solaris Trusted Extensions Label Administration* and *Compartmented Mode Workstation Labeling: Encodings Format*.

Label Ranges

A *label range* is the set of potentially usable labels at which users can operate. Both users and resources both have label ranges. Resources that can be protected by label ranges include such things as allocatable devices, networks, interfaces, frame buffers, and commands or actions. A label range is defined by a clearance at the top of the range and a minimum label at the bottom.

A range does not necessarily include all combinations of labels that fall between a maximum and minimum label. Rules in the label_encodings file can disqualify certain combinations. A label must be *well-formed*, that is, permitted by all applicable rules in the label encodings file, in order to be included in a range.

However, a clearance does not have to be well-formed. Suppose, for example, that a label_encodings file prohibits any combination of compartments Eng, Mkt, and Fin in a label. INTERNAL Eng Mkt Fin would be a valid clearance but not a valid label. As a clearance, this combination would let a user access files that are labeled INTERNAL Eng, INTERNAL Mkt, and INTERNAL Fin.

Account Label Range

When you assign a clearance and a minimum label to a user, you define the upper and lower boundaries of the *account label range* in which that user is permitted to operate. The following equation describes the account label range, using ≤ to indicate "dominated by or the same as":

minimum label ≤ permitted label ≤ clearance

Thus, the user is permitted to operate at any label that is dominated by the clearance as long as that label dominates the minimum label. When a user's clearance or minimum label is not expressly set, the defaults that are defined in the `label_encodings` file take effect.

Users can be assigned a clearance and a minimum label that enable them to operate at more than one label, or at a single label. When a user's clearance and minimum label are equal, the user can operate at only one label.

Session Range

The *session range* is the set of labels that is available to a user during a Trusted Extensions session. The session range must be within the user's account label range and the label range set for the system. At login, if the user selects single-label session mode, the session range is limited to that label. If the user selects multilabel session mode, then the label that the user selects becomes the session clearance. The session clearance defines the upper boundary of the session range. The user's minimum label defines the lower bound. The user begins the session in a workspace at the minimum label. During the session, the user can switch to a workspace at any label within the session range.

What Labels Protect and Where Labels Appear

Labels appear on the desktop and on output that is executed on the desktop, such as printer output.

- **Applications –** Applications start processes. These processes run at the label of the workspace where the application is started. An application in a labeled zone, as a file, is labeled at the label of the zone.
- **Devices –** Data flowing through devices is controlled through device allocation and device label ranges. To use a device, users must be within the label range of the device, and be authorized to allocate the device.
- **File system mount points –** Every mount point has a label. The label is viewable by using the `getlabel` command.
- **Network interfaces –** IP addresses (hosts) have templates that describe their label range. Unlabeled hosts also have a default label.

- **Printers and printing –** Printers have label ranges. Labels are printed on body pages. Labels, handling information, and other security information is printed on the banner and trailer pages. To configure printing in Trusted Extensions, see Chapter 15, "Managing Labeled Printing (Tasks)," and "Labels on Printed Output" in *Oracle Solaris Trusted Extensions Label Administration*.
- **Processes –** Processes are labeled. Processes run at the label of the workspace where the process originates. The label of a process is visible by using the `plabel` command.
- **Users –** Users are assigned a default label and a label range. The label of the user's workspace indicates the label of the user's processes.
- **Windows –** Labels are visible at the top of desktop windows. The label of the desktop is also indicated by color. The color appears on the desktop switch and above window title bars.

  When a window is moved to a differently labeled workspace, the window maintains its original label.
- **Zones –** Every zone has a unique label. The files and directories that are owned by a zone are at the zone's label. For more information, see the `getzonepath(1)` man page.

◆ ◆ ◆ CHAPTER 2

Trusted Extensions Administration Tools

This chapter describes the tools that are available in Trusted Extensions, the location of the tools, and the databases on which the tools operate.

Administration Tools for Trusted Extensions

Administration on a system that is configured with Trusted Extensions uses many of the same tools that are available in the Oracle Solaris OS. Trusted Extensions offers security-enhanced tools as well. Administration tools are available only to roles in a role workspace.

Within a role workspace, you can access commands, actions, applications, and scripts that are trusted. The following table summarizes these administrative tools.

TABLE 2–1 Trusted Extensions Administrative Tools

Tool	Description	For More Information
`/usr/sbin/txzonemgr`	Provides a menu-based wizard for creating, installing, initializing, and booting zones. This script replaces the Trusted CDE actions that manage zones. The script also provides menu items for networking options, name services options, and for clienting the global zone to an existing LDAP server. `txzonemgr` uses the `zenity` command.	See "Creating Labeled Zones" in *Oracle Solaris Trusted Extensions Configuration Guide* See also the `zenity`(1) man page.
In Trusted CDE, actions in the Trusted_Extensions folder in the Application Manager folder	Used to edit local files that the Solaris Management Console does not manage, such as `/etc/system`. Some actions run scripts, such as the Install Zone action.	See "Trusted CDE Actions" on page 35 and "How to Start CDE Administrative Actions in Trusted Extensions" on page 53.
In Trusted CDE, Device Allocation Manager In Solaris Trusted Extensions (JDS), Device Manager	Used to administer the label ranges of devices, and to allocate or deallocate devices.	See "Device Allocation Manager" on page 36 and "Handling Devices in Trusted Extensions (Task Map)" on page 225.
Solaris Management Console	Used to configure users, roles, rights, hosts, zones, and networks. This tool can update local files or LDAP databases. This tool can also launch the `dtappsession` legacy application.	For basic functionality, see Chapter 2, "Working With the Solaris Management Console (Tasks)," in *System Administration Guide: Basic Administration*. For information that is specific to Trusted Extensions, see "Solaris Management Console Tools" on page 38.
Solaris Management Console commands, such as `smuser` and `smtnzonecfg`	Is the command-line interface for the Solaris Management Console.	For a list, see Table 2–4.
Label Builder	Is also a user tool. Appears when a program requires you to choose a label.	For an example, see "How to Modify a User's Label Range in the Solaris Management Console" on page 91.
Trusted Extensions commands	Used to perform tasks that are not covered by Solaris Management Console tools or CDE actions.	For the list of administrative commands, see Table 2–5.

`txzonemgr` Script

Starting in the Solaris 10 5/08 release, the `txzonemgr` script is used to configure labeled zones. This `zenity`(1) script displays a dialog box with the title Labeled Zone Manager. This GUI presents a dynamically-determined menu that displays only valid choices for the current configuration status of a labeled zone. For instance, if a zone is already labeled, the Label menu item is not displayed.

Trusted CDE Actions

The following tables list the CDE actions that roles in Trusted Extensions can run. These trusted CDE actions are available from the Trusted_Extensions folder. The Trusted_Extensions folder is available from the Application Manager folder on the CDE desktop.

TABLE 2–2 Administrative Actions in Trusted CDE, Their Purpose, and Associated Rights Profiles

Action Name	Purpose of Action	Default Rights Profile
`Add Allocatable Device`	Creates devices by adding entries to device databases. See `add_allocatable`(1M).	Device Security
`Admin Editor`	Edits the specified file. See "How to Edit Administrative Files in Trusted Extensions" on page 54.	Object Access Management
`Audit Classes`	Edits the `audit_class` file. See `audit_class`(4).	Audit Control
`Audit Control`	Edits the `audit_control` file. See `audit_control`(4).	Audit Control
`Audit Events`	Edits the `audit_event` file. See `audit_event`(4).	Audit Control
`Audit Startup`	Edits the `audit_startup.sh` script. See `audit_startup`(1M).	Audit Control
`Check Encodings`	Runs the `chk_encodings` command on specified encodings file. See `chk_encodings`(1M).	Object Label Management
`Check TN Files`	Runs the `tnchkdb` command on `tnrhdb`, `tnrhtp`, and `tnzonecfg` databases. See `tnchkdb`(1M).	Network Management
`Configure Selection Confirmation`	Edits `/usr/dt/config/sel_config` file. See `sel_config`(4).	Object Label Management
`Create LDAP Client`	Makes the global zone an LDAP client of an existing LDAP directory service.	Information Security
`Edit Encodings`	Edits the specified `label_encodings` file and runs the `chk_encodings` command. See `chk_encodings`(1M).	Object Label Management
`Name Service Switch`	Edits the `nsswitch.conf` file. See `nsswitch.conf`(4).	Network Management
`Set DNS Servers`	Edits the `resolv.conf` file. See `resolv.conf`(4).	Network Management

TABLE 2–2 Administrative Actions in Trusted CDE, Their Purpose, and Associated Rights Profiles *(Continued)*

Action Name	Purpose of Action	Default Rights Profile
`Set Daily Message`	Edits the `/etc/motd` file. At login, the contents of this file display in the Last Login dialog box.	Network Management
`Set Default Routes`	Specifies default static routes.	Network Management
`Share Filesystem`	Edits the `dfstab` file. Does not run the `share` command. See `dfstab(4)`.	File System Management

The following actions are used by the initial setup team during zone creation. Some of these actions can be used for maintenance and troubleshooting.

TABLE 2–3 Installation Actions in Trusted CDE, Their Purpose, and Associated Rights Profiles

Action Name	Purpose of Action	Default Rights Profile
`Clone Zone`	Creates a labeled zone from a ZFS snapshot of an existing zone.	Zone Management
`Copy Zone`	Creates a labeled zone from an existing zone.	Zone Management
`Configure Zone`	Associates a label with a zone name.	Zone Management
`Initialize Zone for LDAP`	Initializes the zone for booting as an LDAP client.	Zone Management
`Install Zone`	Installs the system files that a labeled zone requires.	Zone Management
`Restart Zone`	Restarts a zone that has already been booted.	Zone Management
`Share Logical Interface`	Sets up one interface for the global zone and a separate interface for the labeled zones to share.	Network Management
`Share Physical Interface`	Sets up one interface that is shared by the global zone and the labeled zones.	Network Management
`Shut Down Zone`	Shuts down an installed zone.	Zone Management
`Start Zone`	Boots an installed zone and starts the services for that zone.	Zone Management
`Zone Terminal Console`	Opens a console to view processes in an installed zone.	Zone Management

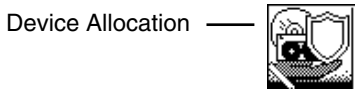
Device Allocation Manager

A *device* is either a physical peripheral that is connected to a computer or a software-simulated device called a *pseudo-device*. Because devices provide a means for the import and export of data to and from a system, devices must be controlled to properly protect the data. Trusted Extensions uses device allocation and device label ranges to control data flowing through devices.

Examples of devices that have label ranges are frame buffers, tape drives, diskette and CD-ROM drives, printers, and USB devices.

Users allocate devices through the Device Allocation Manager. The Device Allocation Manager mounts the device, runs a clean script to prepare the device, and performs the allocation. When finished, the user deallocates the device through the Device Allocation Manager, which runs another clean script, and unmounts and deallocates the device.

FIGURE 2–1 Device Allocation Manager Icon in Trusted CDE



You can manage devices by using the Device Administration tool from the Device Allocation Manager. Regular users cannot access the Device Administration tool.

Note – In Solaris Trusted Extensions (JDS), this GUI is named Device Manager, and the Device Administration button is named Administration.

FIGURE 2–2 Device Allocation Manager GUI

For more information about device protection in Trusted Extensions, see Chapter 17, "Managing Devices for Trusted Extensions (Tasks)."

Solaris Management Console Tools

The Solaris Management Console provides access to toolboxes of GUI-based administration tools. These tools enable you to edit items in various configuration databases. In Trusted Extensions, the Solaris Management Console is the administrative interface for users, roles, and the trusted network databases.

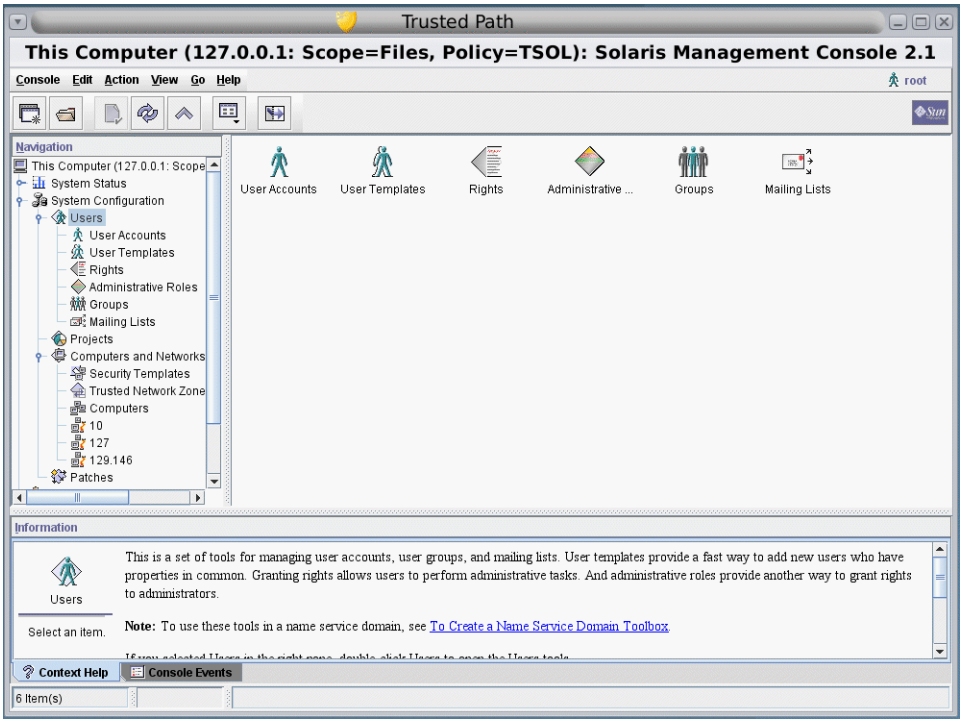
Trusted Extensions extends the Solaris Management Console:

- Trusted Extensions modifies the Solaris Management Console Users tool set. For an introduction to the tool set, see Chapter 2, "Working With the Solaris Management Console (Tasks)," in *System Administration Guide: Basic Administration*.
- Trusted Extensions adds the Security Templates tool and the Trusted Network Zones tool to the Computers and Networks tool set.

Solaris Management Console tools are collected into *toolboxes* according to scope and security policy. To administer Trusted Extensions, Trusted Extensions provides toolboxes whose `Policy=TSOL`. You can access tools according to scope, that is, according to naming service. The available scopes are local host and LDAP.

The Solaris Management Console is shown in the following figure. A `Scope=Files` Trusted Extensions toolbox is loaded, and the Users tool set is open.

FIGURE 2–3 Typical Trusted Extensions Toolbox in the Solaris Management Console



Trusted Extensions Tools in the Solaris Management Console

Trusted Extensions adds configurable security attributes to three tools:

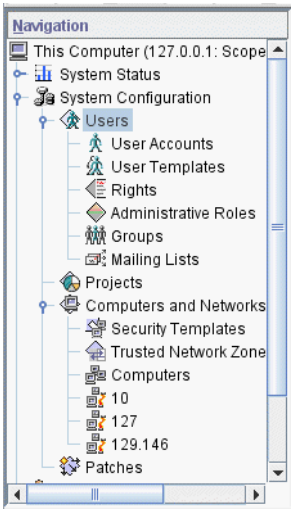
- **User Accounts tool** – Is the administrative interface to change a user's label, change a user's view of labels, and to control account usage.
- **Administrative Roles tool** – Is the administrative interface to change a role's label range and screen-locking behavior when idle.
- **Rights tool** – Includes CDE actions that can be assigned to rights profiles. Security attributes can be assigned to these actions.

Trusted Extensions adds two tools to the Computers and Networks tool set:

- **Security Templates tool** – Is the administrative interface for managing the label aspects of hosts and networks. This tool modifies the `tnrhtp` and `tnrhdb` databases, enforces syntactic accuracy, and updates the kernel with the changes.
- **Trusted Network Zones tool** – Is the administrative interface for managing the label aspects of zones. This tool modifies the `tnzonecfg` database, enforces syntactic accuracy, and updates the kernel with the changes.

Figure 2–4 shows the Files toolbox with the Users tool set highlighted. The Trusted Extensions tools appear below the Computers and Networks tool set.

FIGURE 2–4 Computers and Networks Tool Set in the Solaris Management Console



Security Templates Tool

A *security template* describes a set of security attributes that can be assigned to a group of hosts. The Security Templates tool enables you to conveniently assign a specific combination of security attributes to a group of hosts. These attributes control how data is packaged, transmitted, and interpreted. Hosts that are assigned to a template have identical security settings.

The hosts are defined in the Computers tool. The security attributes of the hosts are assigned in the Security Templates tool. The Modify Template dialog box contains two tabs:

- **General tab –** Describes the template. Includes its name, host type, default label, domain of interpretation (DOI), accreditation range, and set of discrete sensitivity labels.
- **Hosts Assigned to Template tab –** Lists all the hosts on the network that you have assigned to this template.

Trusted networking and security templates are explained in more detail in Chapter 12, "Trusted Networking (Overview)."

Trusted Network Zones Tool

The Trusted Network Zones tool identifies the zones on your system. Initially, the global zone is listed. When you add zones and their labels, the zone names display in the pane. Zone creation usually occurs during system configuration. Label assignment, multilevel port configuration, and label policy is configured in this tool. For details, see Chapter 10, "Managing Zones in Trusted Extensions (Tasks)."

Client-Server Communication With the Solaris Management Console

Typically, a Solaris Management Console client administers systems *remotely*. On a network that uses LDAP as a naming service, a Solaris Management Console client connects to the Solaris Management Console server that runs on the LDAP server. The following figure shows this configuration.

FIGURE 2–5 Solaris Management Console Client Using an LDAP Server to Administer the Network

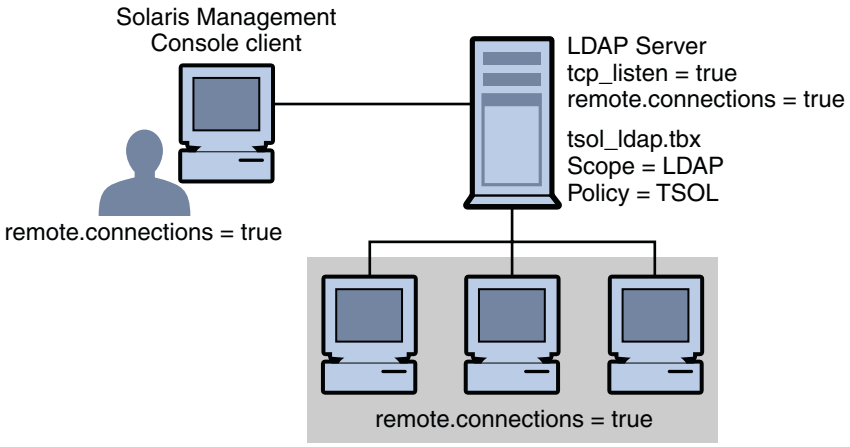
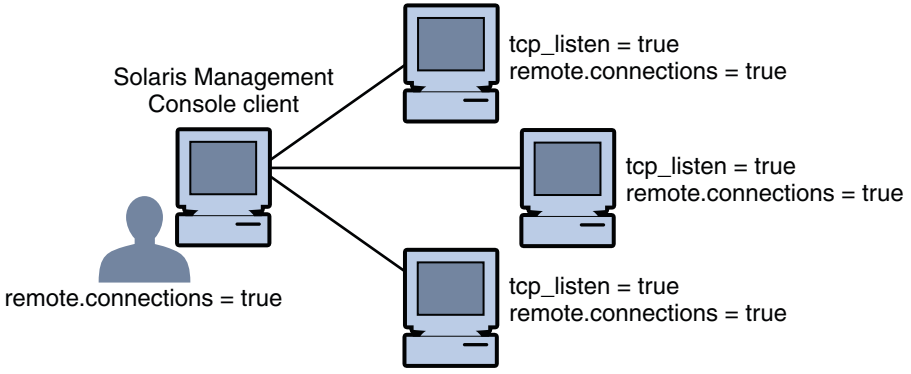


Figure 2–6 shows a network that is not configured with an LDAP server. The administrator configured each remote system with a Solaris Management Console server.

FIGURE 2–6 Solaris Management Console Client Administering Individual Remote Systems on a Network

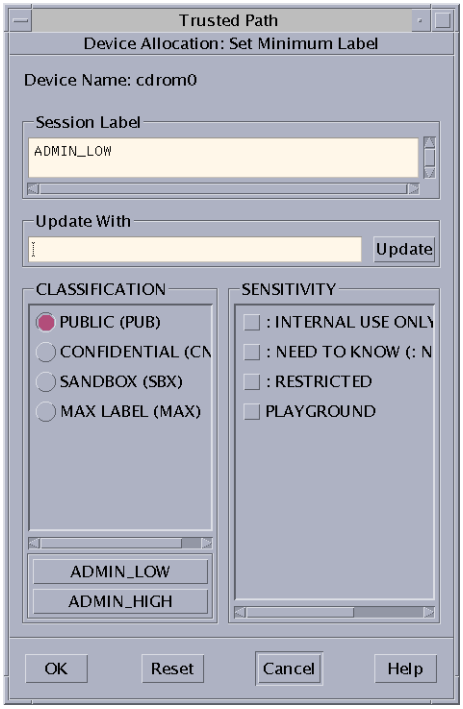


Solaris Management Console Documentation

The main source of documentation for the Solaris Management Console is its online help. Context-sensitive help is tied to the currently selected feature and is displayed in the information pane. Expanded help topics are available from the Help menu or by clicking links in the context-sensitive help. Further information is provided in Chapter 2, "Working With the Solaris Management Console (Tasks)," in *System Administration Guide: Basic Administration*. Also see "Using the Solaris Management Tools With RBAC (Task Map)" in *System Administration Guide: Basic Administration*.

Label Builder in Trusted Extensions

The label builder GUI enforces your choice of a valid label or clearance when a program requires you to assign a label. For example, a label builder appears during login (see Chapter 2, "Logging In to Trusted Extensions (Tasks)," in *Oracle Solaris Trusted Extensions User's Guide*). The label builder also appears when you change the label of a workspace, or when you assign a label to a user, zone, or network interface in the Solaris Management Console. The following label builder appears when you assign a label range to a new device.



In the label builder, component names in the Classification column correspond to the `CLASSIFICATIONS` section in the `label_encodings` file. The component names in the Sensitivity column correspond to the `WORDS` section in the `label_encodings` file.

Command Line Tools in Trusted Extensions

Commands that are unique to Trusted Extensions are contained in the *Trusted Extensions Reference Manual*. The Oracle Solaris commands that Trusted Extensions modifies are contained in the *Oracle Solaris Reference Manual*. The `man` command finds all the commands.

The following table lists commands that are unique to Trusted Extensions. The commands are listed in man page format.

TABLE 2–4 User and Administrative Trusted Extensions Commands

Man Page	Trusted Extensions Modification	For More Information
`add_allocatable(1M)`	Enables a device to be allocated by adding the device to device allocation databases. By default, removable devices are allocatable.	"How to Configure a Device in Trusted Extensions" on page 227
`atohexlabel(1M)`	Translates a label into hexadecimal format.	"How to Obtain the Hexadecimal Equivalent for a Label" on page 71
`chk_encodings(1M)`	Checks the integrity of the `label_encodings` file.	"How to Debug a label_encodings File" in *Oracle Solaris Trusted Extensions Label Administration*
`dtappsession(1)`	Opens a remote Trusted CDE session by using the Application Manager.	Chapter 8, "Remote Administration in Trusted Extensions (Tasks)"
`getlabel(1)`	Displays the label of the selected files or directories.	"How to Display the Labels of Mounted Files" on page 122
`getzonepath(1)`	Displays the full pathname of a specific zone.	"Acquiring a Sensitivity Label" in *Oracle Solaris Trusted Extensions Developer's Guide*
`hextoalabel(1M)`	Translates a hexadecimal label into its readable equivalent.	"How to Obtain a Readable Label From Its Hexadecimal Form" on page 72
`plabel(1)`	Displays the label of the current process.	See the man page.
`remove_allocatable(1M)`	Prevents allocation of a device by removing its entry from device allocation databases.	"How to Configure a Device in Trusted Extensions" on page 227
`setlabel(1)`	Relabels the selected item. Requires the `solaris.label.file.downgrade` or `solaris.label.file.upgrade` authorization. These authorizations are in the Object Label Management rights profile.	For the equivalent GUI procedure, see "How to Move Files Between Labels in Trusted CDE" in *Oracle Solaris Trusted Extensions User's Guide*.
`smtnrhdb(1M)`	Manages entries in the `tnrhdb` database locally or in a naming service database.	For equivalent procedures that use the Solaris Management Console, see "Configuring Trusted Network Databases (Task Map)" on page 166.

TABLE 2–4 User and Administrative Trusted Extensions Commands *(Continued)*

Man Page	Trusted Extensions Modification	For More Information
smtnrhtp(1M)	Manages entries in the tnrhtp database locally or in a naming service database.	See the man page.
smtnzonecfg(1M)	Manages entries in the local tnzonecfg database.	For an equivalent procedure that uses the Solaris Management Console, see "How to Create a Multilevel Port for a Zone" on page 130.
tnchkdb(1M)	Checks the integrity of the tnrhdb and tnrhtp databases.	"How to Check the Syntax of Trusted Network Databases" on page 181
tnctl(1M)	Caches network information in the kernel.	"How to Synchronize the Kernel Cache With Trusted Network Databases" on page 183
tnd(1M)	Executes the trusted network daemon.	"How to Synchronize the Kernel Cache With Trusted Network Databases" on page 183
tninfo(1M)	Displays kernel-level network information and statistics.	"How to Compare Trusted Network Database Information With the Kernel Cache" on page 182.
updatehome(1M)	Updates .copy_files and .link_files for the current label.	"How to Configure Startup Files for Users in Trusted Extensions" on page 86

The following table lists Oracle Solaris commands that are modified or extended by Trusted Extensions. The commands are listed in man page format.

TABLE 2–5 User and Administrative Commands That Trusted Extensions Modifies

Man Page	Purpose of Command	For More Information
allocate(1)	Adds options to clean the allocated device, and to allocate a device to a specific zone. In Trusted Extensions, regular users do not use this command.	"How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*
deallocate(1)	Adds options to clean the device, and to deallocate a device from a specific zone. In Trusted Extensions, regular users do not use this command.	"How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*
list_devices(1)	Adds the -a option to display device attributes, such as authorizations and labels. Adds the -d option to display the default attributes of an allocated device type. Adds the -z option to display available devices that can be allocated to a labeled zone.	See the man page.

TABLE 2–5 User and Administrative Commands That Trusted Extensions Modifies *(Continued)*

Man Page	Purpose of Command	For More Information
tar(1)	Adds the -T option to archive and extract files and directories that are labeled.	"How to Back Up Files in Trusted Extensions" on page 139 and "How to Restore Files in Trusted Extensions" on page 140
auditconfig(1M)	Adds the windata_down and windata_up audit policy options.	"How to Configure Audit Policy" in *System Administration Guide: Security Services*
auditreduce(1M)	Adds the -l option to select audit records by label.	"How to Select Audit Events From the Audit Trail" in *System Administration Guide: Security Services*
automount(1M)	Modifies the names and contents of auto_home maps to account for zone names and zone visibility from higher labels.	"Changes to the Automounter in Trusted Extensions" on page 137
ifconfig(1M)	Adds the all-zones option to make an interface available to every zone on the system.	"How to Verify That a Host's Interfaces Are Up" on page 185
netstat(1M)	Adds the -R option to display extended security attributes for sockets and routing table entries.	"How to Debug the Trusted Extensions Network" on page 186
route(1M)	Adds the -secattr option to display the security attributes of the route: cipso, doi, max_sl, and min_sl.	"How to Configure Routes With Security Attributes" on page 179

Remote Administration in Trusted Extensions

You can remotely administer a system that is configured with Trusted Extensions by using the ssh command, the dtappsession program, or the Solaris Management Console. If site security policy permits, you can configure a Trusted Extensions host to enable login from a non-Trusted Extensions host, although this configuration is less secure. For more information, see Chapter 8, "Remote Administration in Trusted Extensions (Tasks)."

◆ ◆ ◆ CHAPTER 3

Getting Started as a Trusted Extensions Administrator (Tasks)

This chapter introduces you to administering a system that is configured with Trusted Extensions.

What's New in Trusted Extensions

Solaris 10 10/08 – In this release, Trusted Extensions provides the following features:

- The Trusted Extensions shared IP stack allows default routes to isolate labeled zones from each other and from the global zone.
- The loopback interface, `lo0`, is an `all-zones` interface.
- Separation of duty can be enforced by role. The System Administrator role creates users, but cannot assign passwords. The Security Administrator role assigns passwords, but cannot create users. For details, see "Create Rights Profiles That Enforce Separation of Duty" in *Oracle Solaris Trusted Extensions Configuration Guide*.
- This guide includes a list of Trusted Extensions man pages in Appendix B, "List of Trusted Extensions Man Pages."

Solaris 10 5/08 – In this release, Trusted Extensions provides the following features:

- The service management facility (SMF) manages Trusted Extensions as the `svc:/system/labeld` service. By default, the `labeld` service is disabled. When the service is enabled, the system must still be configured and rebooted to enforce Trusted Extensions security policies.
- The CIPSO Domain of Interpretation (DOI) number that your system uses is configurable.
  - For information about the DOI, see "Network Security Attributes in Trusted Extensions" on page 154.

  - To specify a DOI that differs from the default, see "Configure the Domain of Interpretation" in *Oracle Solaris Trusted Extensions Configuration Guide*.
- Trusted Extensions recognizes CIPSO labels in NFS Version 3 (NFSv3) mounted file systems, as well as in NFS Version 4 (NFSv4). Therefore, you can mount NFSv3 file systems on a Trusted Extensions system as a labeled file system. To use udp as an underlying protocol for multilevel mounts in NFSv3, see "How to Configure a Multilevel Port for NFSv3 Over udp" on page 129.
- The name service cache daemon, `nscd`, can be configured to run in every labeled zone at the label of the zone.

Security Requirements When Administering Trusted Extensions

In Trusted Extensions, roles are the conventional way to administer the system. Typically, superuser is not used. Roles are created just as they are in the Oracle Solaris OS, and most tasks are performed by roles. In Trusted Extensions, the `root` user is not used to perform administrative tasks.

The following roles are typical of a Trusted Extensions site:

- `root` **role** – Created by the initial setup team
- **Security Administrator role** – Created during or after initial configuration by the initial setup team
- **System Administrator role** – Created by the Security Administrator role

As in the Oracle Solaris OS, you might also create a Primary Administrator role, an Operator role, and so on. With the exception of the `root` role, the roles that you create can be administered in a naming service.

As in the Oracle Solaris OS, only users who have been assigned a role can assume that role. In Solaris Trusted Extensions (CDE), you can assume a role from a desktop menu called the Trusted Path menu. In Solaris Trusted Extensions (JDS), you can assume a role when your user name is displayed in the Trusted Stripe. The role choices appear when you click your user name.

Role Creation in Trusted Extensions

To administer Trusted Extensions, you create roles that divide system and security functions. The initial setup team created the Security Administrator role during configuration. For details, see "Create the Security Administrator Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

The process of creating a role in Trusted Extensions is identical to the Oracle Solaris OS process. As described in Chapter 2, "Trusted Extensions Administration Tools," the Solaris Management Console is the GUI for managing roles in Trusted Extensions.

- For an overview of role creation, see Chapter 10, "Role-Based Access Control (Reference)," in *System Administration Guide: Security Services* and "Using RBAC (Task Map)" in *System Administration Guide: Security Services*.
- To create a powerful role that is equivalent to superuser, see "Creating the Primary Administrator Role" in *System Administration Guide: Basic Administration*. At sites that use Trusted Extensions, the Primary Administrator role might violate security policy. These sites would turn `root` into a role, and create a Security Administrator role.
- To create the `root` role, see "How to Make root User Into a Role" in *System Administration Guide: Security Services*.
- To create roles by using the Solaris Management Console, see "How to Create and Assign a Role by Using the GUI" in *System Administration Guide: Security Services*.

Role Assumption in Trusted Extensions

Unlike the Oracle Solaris OS, Trusted Extensions provides an Assume *Rolename* Role menu item from the Trusted Path menu. After confirming the role password, the software activates a role workspace with the trusted path attribute. Role workspaces are administrative workspaces. Such workspaces are in the global zone.

Getting Started as a Trusted Extensions Administrator (Task Map)

Familiarize yourself with the following procedures before administering Trusted Extensions.

Task	Description	For Instructions
Log in.	Logs you in securely.	"Logging In to Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*
Perform common user tasks on a desktop.	These tasks include: ■ Configuring your workspaces ■ Using workspaces at different labels ■ Accessing Trusted Extensions man pages ■ Accessing Trusted Extensions online help	"Working on a Labeled System" in *Oracle Solaris Trusted Extensions User's Guide*

Task	Description	For Instructions
Perform tasks that require the trusted path.	These tasks include: ■ Allocating a device ■ Changing your password ■ Changing the label of a workspace	"Performing Trusted Actions" in *Oracle Solaris Trusted Extensions User's Guide*
Create useful roles.	Creates administrative roles for your site. Creating roles in LDAP is a one-time task. The Security Administrator role is a useful role.	"Role Creation in Trusted Extensions" on page 48 "Create the Security Administrator Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
(Optional) Make `root` a role.	Prevents anonymous login by `root`. This task is done once per system.	"How to Make root User Into a Role" in *System Administration Guide: Security Services*
Assume a role.	Enters the global zone in a role. All administrative tasks are performed in the global zone.	"How to Enter the Global Zone in Trusted Extensions" on page 50
Exit a role workspace and become regular user.	Leaves the global zone.	"How to Exit the Global Zone in Trusted Extensions" on page 51
Locally administer users, roles, rights, zones, and networks.	Uses the Solaris Management Console to manage the distributed system.	"How to Administer the Local System With the Solaris Management Console" on page 52
Administer the system by using Trusted CDE actions.	Uses the administrative actions in the Trusted_Extensions folder.	"How to Start CDE Administrative Actions in Trusted Extensions" on page 53
Edit an administrative file.	Edits files in a trusted editor.	"How to Edit Administrative Files in Trusted Extensions" on page 54
Administer device allocation.	Uses the Device Allocation Manager – Device Administration GUI.	"Managing Devices in Trusted Extensions (Task Map)" on page 226

▼ How to Enter the Global Zone in Trusted Extensions

By assuming a role, you enter the global zone in Trusted Extensions. Administration of the entire system is possible only from the global zone. Only superuser or a role can enter the global zone.

After assuming a role, the role can create a workspace at a user label to edit administration files in a labeled zone.

For troubleshooting purposes, you can also enter the global zone by starting a Failsafe session. For details, see "How to Log In to a Failsafe Session in Trusted Extensions" on page 89.

Before You Begin You have created one or more roles, or you plan to enter the global zone as superuser. For pointers, see "Role Creation in Trusted Extensions" on page 48.

1 **Use a trusted mechanism.**

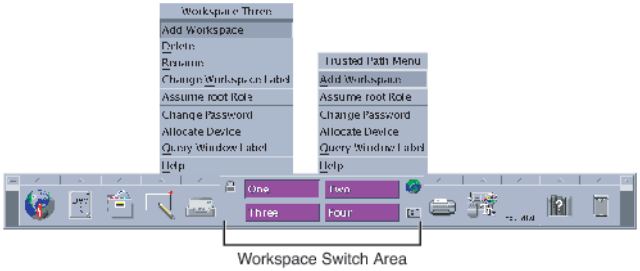
- **In Solaris Trusted Extensions (JDS), click your user name in the trusted stripe and choose a role.**

  If you have been assigned a role, the role names are displayed in a list.

  For the location and significance of Trusted Extensions desktop features, see Chapter 4, "Elements of Trusted Extensions (Reference)," in *Oracle Solaris Trusted Extensions User's Guide*.

- **In Solaris Trusted Extensions (CDE), open the Trusted Path menu.**

  a. **Click mouse button 3 over the workspace switch area.**



  b. **Choose Assume *rolename* Role from the Trusted Path menu.**

2 **At the prompt, type the role password.**

In Trusted CDE, a new role workspace is created, the workspace switch button changes to the color of the role desktop, and the title bar above each window shows `Trusted Path`. In Trusted JDS, the current workspace changes to the role workspace.

In Trusted CDE, you leave a role workspace by using the mouse to choose a regular user workspace. You can also delete the last role workspace to exit a role. In Trusted JDS, you click the role name on the trusted stripe, and from the menu, select a different role or user. This action changes the current workspace to the process of the new role or user.

▼ How to Exit the Global Zone in Trusted Extensions

The menu locations for exiting a role are different in Trusted JDS and Trusted CDE.

Before You Begin You are in the global zone.

- **On both desktops, you can click a user workspace in the Workspace Switch area.**

  You can also exit the role workspace, and therefore the global zone, by doing one of the following:

  - **In Trusted JDS, click your role name in the trusted stripe.**

    When you click the role name, your user name and a list of roles that you can assume is displayed. When you select your user name, all subsequent windows that you create in that workspace are created by the selected name. The windows that you previously created on the current desktop continue to display at the name and label of the role.

    If you choose a different role name, you remain in the global zone in a different role.

  - **In Trusted CDE, delete the role workspace.**

    Click mouse button 3 over the workspace button and select Delete. You are returned to the last workspace you occupied.

▼ How to Administer the Local System With the Solaris Management Console

The first time that you launch the Solaris Management Console on a system, a delay occurs while the tools are registered and various directories are created. This delay typically occurs during system configuration. For the procedure, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

To administer a remote system, see "Administering Trusted Extensions Remotely (Task Map)" on page 102.

Before You Begin You must have assumed a role. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

1. **Start the Solaris Management Console.**

   In Solaris Trusted Extensions (JDS), use the command line.

   ```
   $ /usr/sbin/smc &
   ```

   In Trusted CDE, you have three choices.

   - **Use the `smc` command in a terminal window.**
   - **From the Tools pull-up menu on the Front Panel, click the Solaris Management Console icon.**
   - **In the Trusted_Extensions folder, double-click the Solaris Management Console icon.**

2. **Choose Console -> Open Toolbox.**

3. **From the list, select a Trusted Extensions toolbox of the appropriate scope.**

   A Trusted Extensions toolbox has `Policy=TSOL` as part of its name. The Files scope updates local files on the current system. The LDAP scope updates LDAP directories on the Sun Java System Directory Server. The toolbox names appear similar to the following:

   ```
   This Computer (this-host: Scope=Files, Policy=TSOL)
   This Computer (ldap-server: Scope=LDAP, Policy=TSOL)
   ```

4. **Navigate to the desired Solaris Management Console tool.**

   The password prompt is displayed.

   For tools that Trusted Extensions has modified, click System Configuration.

5. **Type the password.**

   Refer to the online help for additional information about Solaris Management Console tools. For an introduction to the tools that Trusted Extensions modifies, see "Solaris Management Console Tools" on page 38.

6. **To close the GUI, choose Exit from the Console menu.**

▼ How to Start CDE Administrative Actions in Trusted Extensions

1. **Assume a role.**

   For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

2. **In Trusted CDE, bring up the Application Manager.**

   a. **Click mouse button 3 on the background to bring up the Workspace menu.**

b. **Click Applications, then click the Application Manager menu item.**

The Trusted_Extensions folder is in the Application Manager.

3 **Open the Trusted_Extensions folder.**

4 **Double-click the appropriate icon.**

For a list of administrative actions, see "Trusted CDE Actions" on page 35.

▼ How to Edit Administrative Files in Trusted Extensions

Administrative files are edited with a trusted editor that incorporates auditing. This editor also prevents the user from executing shell commands and from saving to any file name other than the name of the original file.

1 **Assume a role.**

For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

2 **Open a trusted editor.**

- **In Solaris Trusted Extensions (CDE), do the following:**

  a. **To bring up the editor, click mouse button 3 on the background to bring up the Workspace menu.**

  b. **Click Applications, then click the Application Manager menu item.**

  The Trusted_Extensions folder is in the Application Manager.

c. **Open the Trusted_Extensions folder.**

d. **Double-click the Admin Editor action.**

You are prompted to provide a file name. For the format, see Step 3 and Step 4.

- **In Solaris Trusted Extensions (JDS), do the following:**
  - **(Optional) To use `gedit` as the trusted editor, modify the `EDITOR` variable.**

    For details, see "How to Assign the Editor of Your Choice as the Trusted Editor" on page 68.
  - **Use the command line to bring up the trusted editor.**

    ```
    # /usr/dt/bin/trusted_edit filename
    ```

    You must provide a *filename* argument.

3 **To create a new file, type the full path name for the new file.**

When you save the file, the editor creates a temporary file.

4 **To edit an existing file, type the full path name for the existing file.**

Note – If your editor provides a Save As option, do not use it. Use the editor's Save option to save the file.

---

5 **To save the file to the specified path name, close the editor.**

◆ ◆ ◆ CHAPTER 4

Security Requirements on a Trusted Extensions System (Overview)

This chapter describes configurable security features on a system that is configured with Trusted Extensions.

Configurable Oracle Solaris Security Features

Trusted Extensions uses the same security features that the Oracle Solaris OS provides, and adds some features. For example, the Oracle Solaris OS provides `eeprom` protection, password requirements and strong password algorithms, system protection by locking out a user, and protection from keyboard shutdown.

Trusted Extensions differs from the Oracle Solaris OS in the actual procedures that are used to modify these security defaults. In Trusted Extensions, you typically administer systems by assuming a role. Local settings are modified by using the trusted editor. Changes that affect the network of users, roles, and hosts are made in the Solaris Management Console.

Trusted Extensions Interfaces for Configuring Security Features

Procedures are provided in this book where Trusted Extensions requires a particular interface to modify security settings, and that interface is optional in the Oracle Solaris OS. Where Trusted Extensions requires the use of the trusted editor to edit local files, no separate procedures are provided in this book. For example, the procedure "How to Prevent Account Locking for Users" on page 96 describes how to update a user's account by using the Solaris Management Console to prevent the account from being locked. However, the procedure for

setting a system-wide password lock policy is not provided in this book. You follow the Oracle Solaris instructions, except that in Trusted Extensions, you use the trusted editor to modify the system file.

Extension of Oracle Solaris Security Mechanisms by Trusted Extensions

The following Oracle Solaris security mechanisms are extensible in Trusted Extensions as they are in the Oracle Solaris OS:

- **Audit events and classes –** Adding audit events and audit classes is described in Chapter 30, "Managing Solaris Auditing (Tasks)," in *System Administration Guide: Security Services*.
- **Rights profiles –** Adding rights profiles is described in Part III, "Roles, Rights Profiles, and Privileges," in *System Administration Guide: Security Services*.
- **Roles –** Adding roles is described in Part III, "Roles, Rights Profiles, and Privileges," in *System Administration Guide: Security Services*.
- **Authorizations –** For an example of adding a new authorization, see "Customizing Device Authorizations in Trusted Extensions (Task Map)" on page 235.

As in the Oracle Solaris OS, privileges cannot be extended.

Trusted Extensions Security Features

Trusted Extensions provides the following unique security features:

- **Labels –** Subjects and objects are labeled. Processes are labeled. Zones and the network are labeled.
- **Device Allocation Manager –** By default, devices are protected by allocation requirements. The Device Allocation Manager GUI is the interface for administrators and for regular users.
- **Change Password menu item –** The Trusted Path menu enables you to change your user password, and the password of the role that you have assumed.

Security Requirements Enforcement

To ensure that the security of the system is not compromised, administrators need to protect passwords, files, and audit data. Users need to be trained to do their part. To be consistent with the requirements for an evaluated configuration, follow the guidelines in this section.

Users and Security Requirements

Each site's security administrator ensures that users are trained in security procedures. The security administrator needs to communicate the following rules to new employees and remind existing employees of these rules on a regular basis:

- Do not tell anyone your password.

  Anyone who knows your password can access the same information that you can without being identified and therefore without being accountable.
- Do not write your password down or include it in an email message.
- Choose passwords that are hard to guess.
- Do not send your password to anyone by email.
- Do not leave your computer unattended without locking the screen or logging off.
- Remember that administrators do not rely on email to send instructions to users. Do not ever follow emailed instructions from an administrator without first double-checking with the administrator.

  Be aware that sender information in email can be forged.
- Because you are responsible for the access permissions on files and directories that you create, make sure that the permissions on your files and directories are set appropriately. Do not allow unauthorized users to read a file, to change a file, to list the contents of a directory, or to add to a directory.

Your site might want to provide additional suggestions.

Email Usage

It is an unsafe practice to use email to instruct users to take an action.

Tell users not to trust email with instructions that purport to come from an administrator. Doing so prevents the possibility that spoofed email messages could be used to fool users into changing a password to a certain value or divulging the password, which could subsequently be used to log in and compromise the system.

Password Enforcement

The System Administrator role must specify a unique user name and user ID when creating a new account. When choosing the name and ID for a new account, the administrator you must ensure that both the user name and associated ID are not duplicated anywhere on the network and have not been previously used.

The Security Administrator role is responsible for specifying the original password for each account and for communicating the passwords to users of new accounts. You must consider the following information when administering passwords:

- Make sure that the accounts for users who are able to assume the Security Administrator role are configured so that the account cannot be locked. This practice ensures that at least one account can always log in and assume the Security Administrator role to reopen everyone's account if all other accounts are locked.
- Communicate the password to the user of a new account in such a way that the password cannot be eavesdropped by anyone else.
- Change an account's password if you have any suspicion that the password has been discovered by someone who should not know it.
- Never reuse user names or user IDs over the lifetime of the system.

  Ensuring that user names and user IDs are not reused prevents possible confusion about the following:

  - Which actions were performed by which user when audit records are analyzed
  - Which user owns which files when archived files are restored

Information Protection

You as an administrator are responsible for correctly setting up and maintaining discretionary access control (DAC) and mandatory access control (MAC) protections for security-critical files. Critical files include the following:

- `shadow` **file** – Contains encrypted passwords. See `shadow(4)`.
- `prof_attr` **database** – Contains definitions of rights profiles. See `prof_attr(4)`.
- `exec_attr` **database** – Contains commands and actions that are part of rights profiles. See `exec_attr(4)`.
- `user_attr` **file** – Contains the rights profiles, privileges, and authorizations that are assigned to local users. See `user_attr(4)`.
- **Audit trail** – Contains the audit records that the auditing service has collected. See `audit.log(4)`

Caution – Because the protection mechanisms for LDAP entries are not subject to the access control policy enforced by the Trusted Extensions software, the default LDAP entries must not be extended, and their access rules must not be modified.

Password Protection

In local files, passwords are protected from viewing by DAC and from modifications by both DAC and MAC. Passwords for local accounts are maintained in the `/etc/shadow` file, which is readable only by superuser. For more information, see the `shadow(4)` man page.

Group Administration

The System Administrator role needs to verify on the local system and on the network that all groups have a unique group ID (GID).

When a local group is deleted from the system, the System Administrator role must ensure the following:

- All objects with the GID of the deleted group must be deleted or assigned to another group.
- All users who have the deleted group as their primary group must be reassigned to another primary group.

User Deletion Practices

When an account is deleted from the system, the System Administrator role and the Security Administrator role must take the following actions:

- Delete the account's home directories in every zone.
- Delete any processes or jobs that are owned by the deleted account:
  - Delete any objects that are owned by the account,or assign the ownership to another user.
  - Delete any `at` or `batch` jobs that are scheduled on behalf of the user. For details, see the `at(1)` and `crontab(1)` man pages.
- Never reuse the user (account) name or user ID.

Rules When Changing the Level of Security for Data

By default, regular users can perform cut-and-paste, copy-and-paste, and drag-and-drop operations on both files and selections. The source and target must be at the same label.

To change the label of files, or the label of information within files requires authorization. When users are authorized to change the security level of data, the Selection Manager application mediates the transfer. In Trusted CDE, the `/usr/dt/config/sel_config` file controls file relabeling actions, and the cutting and copying of information to a different label. In Trusted JDS, the `/usr/share/gnome/sel_config` file controls these transfers. In Trusted CDE, the

`/usr/dt/bin/sel_mgr` application controls drag-and-drop operations between windows. As the following tables illustrate, the relabeling of a selection is more restrictive than the relabeling of a file.

The following table summarizes the rules for file relabeling. The rules cover cut-and-paste, copy-and-paste, and drag-and-drop operations.

TABLE 4–1 Conditions for Moving Files to a New Label

Transaction Description	Label Relationship	Owner Relationship	Required Authorization
Copy and paste, cut and paste, or drag and drop of files between File Managers	Same label	Same UID	None
	Downgrade	Same UID	`solaris.label.file.downgrade`
	Upgrade	Same UID	`solaris.label.file.upgrade`
	Downgrade	Different UIDs	`solaris.label.file.downgrade`
	Upgrade	Different UIDs	`solaris.label.file.upgrade`

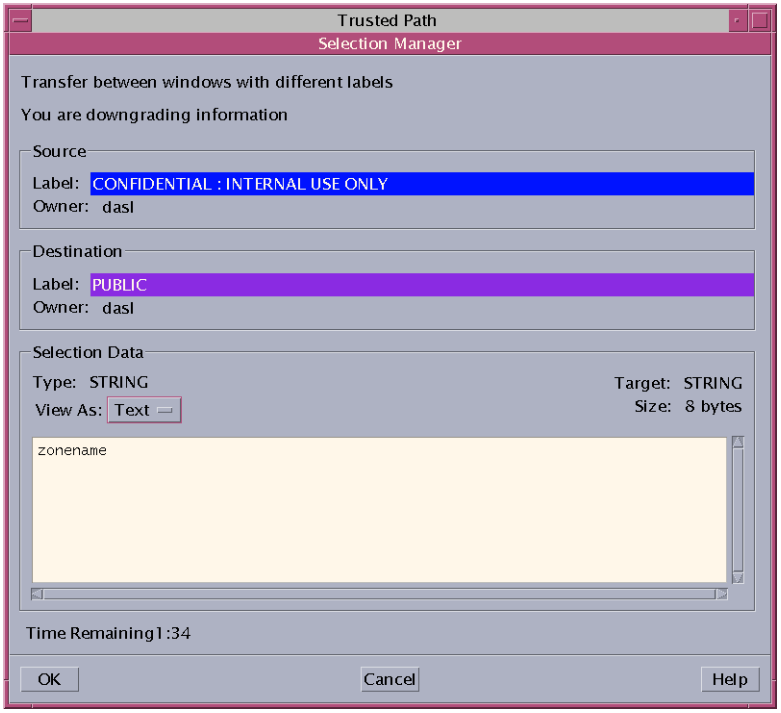
Different rules apply to selections within a window or file. Drag-and-drop of *selections* always requires equality of labels and ownership. Drag-and-drop between windows is mediated by the Selection Manager application, not by the `sel_config` file.

The rules for changing the label of selections are summarized in the following table.

TABLE 4–2 Conditions for Moving Selections to a New Label

Transaction Description	Label Relationship	Owner Relationship	Required Authorization
Copy and paste, or cut and paste of selections between windows	Same label	Same UID	None
	Downgrade	Same UID	`solaris.label.win.downgrade`
	Upgrade	Same UID	`solaris.label.win.upgrade`
	Downgrade	Different UIDs	`solaris.label.win.downgrade`
	Upgrade	Different UIDs	`solaris.label.win.upgrade`
Drag and drop of selections between windows	Same label	Same UID	None applicable

Trusted Extensions provides a selection confirmer to mediate label changes. This window appears when an authorized user attempts to change the label of a file or selection. The user has 120 seconds to confirm the operation. To change the security level of data without this window requires the `solaris.label.win.noview` authorization, in addition to the relabeling authorizations. The following illustration shows a selection, `zonename`, in the window.



By default, the selection confirmer displays whenever data is being transferred to a different label. If a selection requires several transfer decisions, the automatic reply mechanism provides a way to reply once to the several transfers. For more information, see the `sel_config(4)` man page and the following section.

`sel_config` File

The `sel_config` file is checked to determine the behavior of the selection confirmer when an operation would upgrade or downgrade a label.

The `sel_config` file defines the following:

- A list of selection types to which automatic replies are given
- Whether certain types of operations can be automatically confirmed
- Whether a selection confirmer dialog box is displayed

In Trusted CDE, the Security Administrator role can change the defaults by using the Configure Selection Confirmation action in the Trusted_Extensions folder. The new settings become effective at the next login. In Solaris Trusted Extensions (JDS), the CDE action is not available. To change the defaults, modify the `/usr/share/gnome/sel_config` file in a text editor.

Customization of Solaris Trusted Extensions (CDE)

In Solaris Trusted Extensions (CDE), users can add actions to the Front Panel and customize the Workspace menu. Trusted Extensions software limits users' ability to add programs and commands to CDE.

Front Panel Customization

Anyone can drag and drop a pre-existing action from the Application Manager to the Front Panel, as long as the account performing the modification has the action in its profile. Actions in the `/usr/dt/` or `/etc/dt/` directories can be added to the Front Panel, but applications in the `$HOME/.dt/appconfig` directory cannot. While users can use the Create Action action, they cannot write into any of the directories where the system-wide actions are stored. Therefore, regular users cannot create actions that are usable.

In Trusted Extensions, the actions' search path has been changed. Actions in any individual's home directory are processed last instead of first. Therefore, no one can customize existing actions.

The Security Administrator role is assigned the Admin Editor action, so can make any needed modifications to the `/usr/dt/appconfig/types/C/dtwm.fp` file and the other configuration files for the Front Panel subpanels.

Workspace Menu Customization

The Workspace Menu is the menu that appears when you click mouse button 3 on the background of the workspace. Regular users can customize the menu, and add items to the menu.

The following conditions apply when a user is allowed to work at multiple labels:

- The user must have a home directory in the global zone.

  To save the customizations, processes in the global zone must be able to write to the user's home directory at the correct label. The zone path to a user home directory that is writable by global zone processes is similar to the following:

  `/zone/`*zone-name*`/home/`*username*
- The user must use the Customize Menu and Add Item to Menu options in a regular user workspace. The user can create a different customization for each label.
- When the user assumes a role, changes to the Workspace Menu persist.
- Changes that are made to the Workspace Menu are stored in the user's home directory at the current label. The customized menu file is `.dt/wsmenu`.
- The user's rights profile must enable the user to run the desired action.

Any action that is added to the Workspace Menu must be handled by one of the user's rights profiles. Otherwise, the action fails when invoked and an error message is displayed.

For example, anyone with the Run action can double-click the icon for any executable and run it, even if the action or any commands that the action invokes are not in one of the account's rights profiles. By default, roles are not assigned the Run action. Therefore, any menu item that requires the Run action fails when executed by a role.

◆ ◆ ◆ CHAPTER 5

Administering Security Requirements in Trusted Extensions (Tasks)

This chapter contains tasks that are commonly performed on a system that is configured with Trusted Extensions.

Common Tasks in Trusted Extensions (Task Map)

The following task map describes procedures that set up a working environment for administrators of Trusted Extensions.

Task	Description	For Instructions
Change the editor program for the trusted editor.	Specify the editor for administrative files.	"How to Assign the Editor of Your Choice as the Trusted Editor" on page 68
Change the password for root.	Specify a new password for the `root` user, or for the `root` role.	"How to Change the Password for `root`" on page 69
Change the password for a role.	Specifies a new password for your current role.	Example 5–2
Use the Secure Attention key combination.	Gets control of the mouse or keyboard. Also, tests whether the mouse or keyboard is trusted.	"How to Regain Control of the Desktop's Current Focus" on page 70
Determine the hexadecimal number for a label.	Displays the internal representation for a text label.	"How to Obtain the Hexadecimal Equivalent for a Label" on page 71
Determine the text representation for a label.	Displays the text representation for a hexadecimal label.	"How to Obtain a Readable Label From Its Hexadecimal Form" on page 72
Edit system files.	Securely edits Oracle Solaris or Trusted Extensions system files.	"How to Change Security Defaults in System Files" on page 73
Allocate a device.	Uses a peripheral device to add information to or remove information from the system.	"How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*

Task	Description	For Instructions
Administer a host remotely.	Administers Oracle Solaris or Trusted Extensions hosts from a remote host.	Chapter 8, "Remote Administration in Trusted Extensions (Tasks)"

▼ How to Assign the Editor of Your Choice as the Trusted Editor

The trusted editor uses the value of the `$EDITOR` environment variable as its editor.

Before You Begin You must be in a role in the global zone.

1 Determine the value of the `$EDITOR` variable.

```
# echo $EDITOR
```

The following are editor possibilities. The `$EDITOR` variable might also not be set.

- `/usr/dt/bin/dtpad` – Is the editor that CDE provides.
- `/usr/bin/gedit` – Is the editor that Java Desktop System, Release *number* provides. Solaris Trusted Extensions (JDS) is the trusted version of that desktop.
- `/usr/bin/vi` – Is the visual editor.

2 Set the value of the `$EDITOR` variable.

- **To set the value permanently, modify the value in the shell initialization file for the role.**

  For example, in the role's home directory, modify the `.kshrc` file for a Korn shell, and the `.cshrc` file for a C shell.

- **To set the value for the current shell, set the value in the terminal window.**

  For example, in a Korn shell, use the following commands:

  ```
  # setenv EDITOR=pathname-of-editor
  # export $EDITOR
  ```

  In a C shell, use the following command:

  ```
  # setenv EDITOR=pathname-of-editor
  ```

  In a Bourne shell, use the following commands:

  ```
  # EDITOR=pathname-of-editor
  # export EDITOR
  ```

Example 5–1 Specifying the Editor for the Trusted Editor

The Security Administrator role wants to use `vi` when editing system files. A user who has assumed the role modifies the `.kshrc` initialization file in the role's home directory.

```
$ cd /home/secadmin
$ vi .kshrc

## Interactive shell
set -o vi
...
export EDITOR=vi
```

The next time that any user assumes the Security Administrator role, `vi` is the trusted editor.

▼ How to Change the Password for `root`

The Security Administrator role is authorized to change any account's password at any time by using the Solaris Management Console. However, the Solaris Management Console cannot change the password of a system account. A *system account* is an account whose UID is below 100. `root` is a system account because its UID is 0.

1. **Become superuser.**

   If your site has made superuser into the `root` role, assume the `root` role.

2. **Choose Change Password from the Trusted Path menu.**

   - **In Trusted JDS, click the trusted symbol in the trusted stripe.**

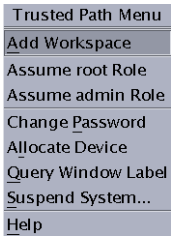
     From the trusted path menu, choose Change Password.

   - **In Solaris Trusted Extensions (CDE), open the Trusted Path menu.**

     a. **Click mouse button 3 over the workspace switch area.**

     b. **Choose Change Password from the Trusted Path menu.**



3 **Change the password, and confirm the change.**

Example 5–2 Changing the Password for a Role

Any user who can assume a role that is defined in LDAP can use the Trusted Path menu to change the password for the role. The password is then changed in LDAP for all users who attempt to assume the role.

As in the Oracle Solaris OS, the Primary Administrator role can change the password for a role by using the Solaris Management Console. In Trusted Extensions, the Security Administrator role can change another role's password by using the Solaris Management Console.

▼ How to Regain Control of the Desktop's Current Focus

The "Secure Attention" key combination can be used to break a pointer grab or a keyboard grab by an untrusted application. The key combination can also be used to verify if a pointer or a keyboard has been grabbed by a trusted application. On a multiheaded system that has been spoofed to display more than one trusted stripe, this key combination warps the pointer to the authorized trusted stripe.

1 **To regain control of a Sun keyboard, use the following key combination.**

Press the keys simultaneously to regain control of the current desktop focus. On the Sun keyboard, the diamond is the Meta key.

```
<Meta> <Stop>
```

If the grab, such as a pointer, is not trusted, the pointer moves to the stripe. A trusted pointer does not move to the trusted stripe.

2 **If you are not using a Sun keyboard, use the following key combination.**

```
<Alt> <Break>
```

Press the keys simultaneously to regain control of the current desktop focus on your laptop.

Example 5–3 Testing If the Password Prompt Can Be Trusted

On an x86 system that is using a Sun keyboard, the user has been prompted for a password. The cursor has been grabbed, and is in the password dialog box. To check that the prompt is trusted, the user presses the <Meta> <Stop> keys simultaneously. When the pointer remains in the dialog box, the user knows that the password prompt is trusted.

If the pointer had moved to the trusted stripe, the user would know that the password prompt could not be trusted, and contact the administrator.

Example 5–4 Forcing the Pointer to the Trusted Stripe

In this example, a user is not running any trusted processes but cannot see the mouse pointer. To bring the pointer to the center of the trusted stripe, the user presses the <Meta> <Stop> keys simultaneously.

▼ How to Obtain the Hexadecimal Equivalent for a Label

This procedure provides an internal hexadecimal representation of a label. This representation is safe for storing in a public directory. For more information, see the `atohexlabel(1M)` man page.

Before You Begin You must be in the Security Administrator role in the global zone. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

- **To obtain a hexadecimal value for a label, do one of the following.**
  - **To obtain the hexadecimal value for a sensitivity label, pass the label to the command.**

    ```
    $ atohexlabel "CONFIDENTIAL : NEED TO KNOW"
    0x0004-08-68
    ```

  - **To obtain the hexadecimal value for a clearance, use the `-c` option.**

    ```
    $ atohexlabel -c "CONFIDENTIAL NEED TO KNOW"
    0x0004-08-68
    ```

Note – Human readable sensitivity labels and clearance labels are formed according to rules in the `label_encodings` file. Each type of label uses rules from a separate section of this file. When a sensitivity label and a clearance label both express the same underlying level of sensitivity, the labels have identical hexadecimal forms. However, the labels can have different human readable forms. System interfaces that accept human readable labels as input expect one type of label. If the text strings for the label types differ, these text strings cannot be used interchangeably.

In the default `label_encodings` file, the text equivalent of a clearance label does not include a colon (:).

Example 5–5 Using the `atohexlabel` Command

When you pass a valid label in hexadecimal format, the command returns the argument.

```
$ atohexlabel 0x0004-08-68
0x0004-08-68
```

When you pass an administrative label, the command returns the argument.

```
$ atohexlabel admin_high
ADMIN_HIGH
atohexlabel admin_low
ADMIN_LOW
```

Troubleshooting The error message `atohexlabel parsing error found in <string> at position 0` indicates that the `<string>` argument that you passed to `atohexlabel` was not a valid label or clearance. Check your typing, and check that the label exists in your installed `label_encodings` file.

▼ How to Obtain a Readable Label From Its Hexadecimal Form

This procedure provides a way to repair labels that are stored in internal databases. For more information, see the `hextoalabel(1M)` man page.

Before You Begin You must be in the Security Administrator role in the global zone.

- **To obtain the text equivalent for an internal representation of a label, do one of the following.**
  - **To obtain the text equivalent for a sensitivity label, pass the hexadecimal form of the label.**

    ```
    $ hextoalabel 0x0004-08-68
    CONFIDENTIAL : NEED TO KNOW
    ```

- **To obtain the text equivalent for a clearance, use the -c option.**

```
$ hextoalabel -c 0x0004-08-68
CONFIDENTIAL NEED TO KNOW
```

How to Change Security Defaults in System Files

In Trusted Extensions, the security administrator changes or accesses default security settings on a system.

Files in the `/etc/security` and `/etc/default` directories contain security settings. On an Oracle Solaris system, superuser can edit these files. For Oracle Solaris security information, see Chapter 3, "Controlling Access to Systems (Tasks)," in *System Administration Guide: Security Services*.

Caution – Relax system security defaults only if site security policy allows you to.

Before You Begin You must be in the Security Administrator role in the global zone.

- **Use the trusted editor to edit the system file.**

  For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

  The following table lists the security files and what security parameters to change in the files.

File	Task	For More Information
`/etc/default/login`	Reduce the allowed number of password tries.	See the example under "How to Monitor All Failed Login Attempts" in *System Administration Guide: Security Services*. `passwd(1)` man page
`/etc/default/kbd`	Disable keyboard shutdown.	"How to Disable a System's Abort Sequence" in *System Administration Guide: Security Services* **Note –** On hosts that are used by administrators for debugging, the default setting for `KEYBOARD_ABORT` allows access to the `kadb` kernel debugger. For more information about the debugger, see the `kadb(1M)` man page.

File	Task	For More Information
`/etc/security/policy.conf`	Require a more powerful algorithm for user passwords. Remove a basic privilege from all users of this host. Restrict users of this host to Basic Solaris User authorizations.	`policy.conf(4)` man page
`/etc/default/passwd`	Require users to change passwords frequently. Require users to create maximally different passwords. Require a longer user password. Require a password that cannot be found in your dictionary.	`passwd(1)` man page

◆ ◆ ◆ CHAPTER 6

Users, Rights, and Roles in Trusted Extensions (Overview)

This chapter describes essential decisions that you must make before creating regular users, and provides additional background information for managing user accounts. The chapter assumes that the initial setup team has set up roles and a limited number of user accounts. These users can assume the roles that are used to configure and administer Trusted Extensions. For details, see "Creating Roles and Users in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

User Security Features in Trusted Extensions

Trusted Extensions software adds the following security features to users, roles, or rights profiles:

- A user has a label range within which the user can use the system.
- A role has a label range within which the role can be used to perform administrative tasks.
- A Trusted Extensions rights profile can include CDE administrative actions. Like commands, actions can have security attributes.
- Commands and actions in a Trusted Extensions rights profile have a label attribute. The command or action must be performed within a label range, or at a particular label.
- Trusted Extensions software adds privileges and authorizations to the set of privileges and authorizations that are defined by the Oracle Solaris OS.

Administrator Responsibilities for Users

The System Administrator role creates user accounts. The Security Administrator role sets up the security aspects of an account.

If you are using the Sun Java System Directory Server for the LDAP naming service, check that the initial setup team configured the `tsol_ldap.tbx` toolbox. For the procedure, see "Configuring the Solaris Management Console for LDAP (Task Map)" in *Oracle Solaris Trusted Extensions Configuration Guide*.

For details on setting up users and roles, see the following:

- "How to Create the First Role (Primary Administrator)" in *System Administration Guide: Basic Administration*
- "Setting Up User Accounts (Task Map)" in *System Administration Guide: Basic Administration*
- Part III, "Roles, Rights Profiles, and Privileges," in *System Administration Guide: Security Services*

System Administrator Responsibilities for Users

In Trusted Extensions, the System Administrator role is responsible for determining who can access the system. The system administrator is responsible for the following tasks:

- Adding and deleting users
- Adding and deleting roles
- Modifying user and role configurations, other than security attributes

Security Administrator Responsibilities for Users

In Trusted Extensions, the Security Administrator role is responsible for all security attributes of a user or role. The security administrator is responsible for the following tasks:

- Assigning and modifying the security attributes of a user, role, or rights profile
- Creating and modifying rights profiles
- Assigning rights profiles to a user or role
- Assigning privileges to a user, role, or rights profile
- Assigning authorizations to a user, a role, or rights profile
- Removing privileges from a user, role, or rights profile
- Removing authorizations from a user, role, or rights profile

Typically, the Security Administrator role creates rights profiles. However, if a profile needs capabilities that the Security Administrator role cannot grant, then superuser or the Primary Administrator role can create the profile.

Before creating a rights profile, the security administrator needs to analyze whether any of the commands or actions in the new profile need privilege or authorization to be successful. The man pages for individual commands list the privileges and authorizations that might be needed. For examples of actions that require privileges and authorizations, see the `exec_attr` database.

Decisions to Make Before Creating Users in Trusted Extensions

The following decisions affect what users are able to do in Trusted Extensions and how much effort is required. Some decisions are the same as the decisions that you would make when installing the Oracle Solaris OS. However, decisions that are specific to Trusted Extensions can affect site security and ease of use.

- Decide whether to change default user security attributes in the `policy.conf` file. User defaults in the `label_encodings` file were configured by the initial setup team. For a description of the defaults, see "Default User Security Attributes in Trusted Extensions" on page 77.
- Decide which startup files, if any, to copy or link from each user's minimum-label home directory to the user's higher-level home directories. For the procedure, see "How to Configure Startup Files for Users in Trusted Extensions" on page 86.
- Decide if users can access peripheral devices, such as the microphone, CD-ROM drive, and JAZ drive.

  If access is permitted to some users, decide if your site requires additional authorizations to satisfy site security. For the default list of device-related authorizations, see "How to Assign Device Authorizations" on page 239. For a finer-grained set of device authorizations, see "Customizing Device Authorizations in Trusted Extensions (Task Map)" on page 235.

Default User Security Attributes in Trusted Extensions

Settings in the `label_encodings` and the `policy.conf` files together define default security attributes for user accounts. The values that you explicitly set for a user override these system values. Some values that are set in these files also apply to role accounts. For security attributes that you can explicitly set, see "Configurable User Attributes in Trusted Extensions" on page 78.

`label_encodings` File Defaults

The `label_encodings` file defines a user's minimum label, clearance, and default label view. For details about the file, see the `label_encodings(4)` man page. Your site's `label_encodings` file

was installed by your initial setup team. Their decisions were based on "Devising a Label Strategy" in *Oracle Solaris Trusted Extensions Configuration Guide*, and examples from *Oracle Solaris Trusted Extensions Label Administration*.

Label values that the security administrator explicitly sets for individual users in the Solaris Management Console are derived from the `label_encodings` file. Explicitly set values override the values in the `label_encodings` file.

`policy.conf` File Defaults in Trusted Extensions

The Oracle Solaris `/etc/security/policy.conf` file contains the default security settings for the system. Trusted Extensions adds two keywords to this file. You can add these keyword=value pairs to the file if you want to change the system-wide value. These keywords are enforced by Trusted Extensions. The following table shows the possible values for these security settings and their default values.

TABLE 6–1 Trusted Extensions Security Defaults in `policy.conf` File

Keyword	Default Value	Possible Values	Notes
IDLECMD	LOCK	LOCK | LOGOUT	Does not apply to roles.
IDLETIME	30	0 to 120 minutes	Does not apply to roles.

The authorizations and rights profiles that are defined in the `policy.conf` file are *in addition* to any authorizations and profiles that are assigned to individual accounts. For the other fields, the individual user's value overrides the system value.

"Planning User Security in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide* includes a table of every `policy.conf` keyword. See also the `policy.conf(4)` man page.

Configurable User Attributes in Trusted Extensions

The Solaris Management Console 2.1 is your tool for creating and modifying user accounts. For users who can log in at more than one label, you might also want to set up `.copy_files` and `.link_files` files in each user's minimum–label home directory.

The User Accounts tool in the Solaris Management Console works as it does in the Oracle Solaris OS, with two exceptions:

- Trusted Extensions adds attributes to user accounts.
- Home directory server access requires administrative attention in Trusted Extensions.
  - You create the home directory server entry the same as you do on an Oracle Solaris system.
  - Then, you and the user perform additional steps to mount the home directory at every user label.

As described in "How to Add a User With the Solaris Management Console's Users Tool" in *System Administration Guide: Basic Administration*, a wizard enables you to create user accounts quickly. After using the wizard, you can modify the user's default Trusted Extensions attributes.

For more information about the `.copy_files` and `.link_files` files, see "`.copy_files` and `.link_files` Files" on page 81.

Security Attributes That Must Be Assigned to Users

The Security Administrator role must specify some security attributes for new users, as the following table shows. For information about the files that contain default values, see "Default User Security Attributes in Trusted Extensions" on page 77. The following table shows the security attributes that can be assigned to users and the effects of each assignment.

TABLE 6–2 Security Attributes That Are Assigned After User Creation

User Attribute	Location of Default Value	Is Action Required	Effect of Action
Password	None	Required	User has password
Roles	None	Optional	User can assume a role
Authorizations	`policy.conf` file	Optional	User has additional authorizations
Rights Profiles	`policy.conf` file	Optional	User has additional rights profiles
Labels	`label_encodings` file	Optional	User has different default label or accreditation range
Privileges	`policy.conf` file	Optional	User has different set of privileges
Account Usage	`policy.conf` file	Optional	User has different setting for computer when it is idle
Audit	`audit_control` file	Optional	User is audited differently from the system audit settings

Security Attribute Assignment to Users in Trusted Extensions

The Security Administrator role assigns security attributes to users in the Solaris Management Console after the user accounts are created. If you have set up correct defaults, your next step is to assign security attributes only for users who need exceptions to the defaults.

When assigning security attributes to users, the security administrator considers the following information:

Assigning Passwords

The Security Administrator role assigns passwords to user accounts after the accounts have been created. After this initial assignment, users can change their passwords.

As in the Oracle Solaris OS, users can be forced to change their passwords at regular intervals. The password aging options limit how long any intruder who is able to guess or steal a password could potentially access the system. Also, establishing a minimum length of time to elapse before changing a password prevents a user with a new password from reverting immediately to the old password. For details, see the `passwd(1)` man page.

Note – The passwords for users who can assume roles must not be subject to any password aging constraints.

Assigning Roles

A user is not required to have a role. A single user can be assigned more than one role if doing so is consistent with your site's security policy.

Assigning Authorizations

As in the Oracle Solaris OS, assigning authorizations directly to a user adds those authorizations to existing authorizations. In Trusted Extensions, you add the authorizations to a rights profile, then assign the profile to the user.

Assigning Rights Profiles

As in the Oracle Solaris OS, the order of profiles is important. The profile mechanism uses the first instance of the command or action in an account's profile set.

You can use the sorting order of profiles to your advantage. If you want a command to run with different security attributes from those attributes that are defined for the command in an existing profile, create a new profile with the preferred assignments for the command. Then, insert that new profile before the existing profile.

Note – Do not assign rights profiles that include administrative actions or administrative commands to a regular user. The profile would not work because a regular user cannot enter the global zone.

Changing Privilege Default
The default privilege set can be too liberal for many sites. To restrict the privilege set for any regular user on a system, change the `policy.conf` file setting. To change the privilege set for individual users, use the Solaris Management Console. For an example, see "How to Restrict a User's Set of Privileges" on page 94.

Changing Label Defaults
Changing a user's label defaults creates an exception to the user defaults in the `label_encodings` file.

Changing Audit Defaults
As in the Oracle Solaris OS, assigning audit classes to a user creates exceptions to the audit classes that are assigned in the `/etc/security/audit_control` file on the system. For more information about auditing, see Chapter 18, "Trusted Extensions Auditing (Overview)."

`.copy_files` and `.link_files` Files

In Trusted Extensions, files are automatically copied from the skeleton directory *only* into the zone that contains the account's minimum label. To ensure that zones at higher labels can use startup files, either the user or the administrator must create the files `.copy_files` and `.link_files`.

The Trusted Extensions files `.copy_files` and `.link_files` help to automate the copying or linking of startup files into every label of an account's home directory. Whenever a user creates a workspace at a new label, the `updatehome` command reads the contents of `.copy_files` and `.link_files` at the account's minimum label. The command then copies or links every listed file into the higher-labeled workspace.

The `.copy_files` file is useful when a user wants a slightly different startup file at different labels. Copying is preferred, for example, when users use different mail aliases at different labels. The `.link-files` file is useful when a startup file should be identical at any label that it is invoked. Linking is preferred, for example, when one printer is used for all labeled print jobs. For example files, see "How to Configure Startup Files for Users in Trusted Extensions" on page 86.

The following lists some startup files that you might want users to be able to link to higher labels or to copy to higher labels:

```
.acrorc
.aliases
.cshrc
.dtprofile
.emacs
.login
.mailrc
.mime_types
.newsrc
.profile
.signature
.soffice
.Xdefaults
.Xdefaults-hostname
```

◆ ◆ ◆ CHAPTER 7

Managing Users, Rights, and Roles in Trusted Extensions (Tasks)

This chapter provides the Trusted Extensions procedures for configuring and managing users, user accounts, and rights profiles.

Customizing the User Environment for Security (Task Map)

The following task map describes common tasks that you can perform when customizing a system for all users, or when customizing an individual user's account.

Task	Description	For Instructions
Change label attributes.	Modify label attributes, such as minimum label and default label view, for a user account.	"How to Modify Default User Label Attributes" on page 84
Change Trusted Extensions policy for all users of a system.	Changes the `policy.conf` file.	"How to Modify `policy.conf` Defaults" on page 84
	Turns on the screensaver after a set amount of time. Logs the user out after a set amount of time that the system is idle.	Example 7–1
	Removes unnecessary privileges from all ordinary users of a system.	Example 7–2
	Removes labels from printed output at a public kiosk.	Example 7–3

Task	Description	For Instructions
Configure initialization files for users.	Configures startup files, such as `.cshrc`, `.copy_files`, and `.soffice` for all users.	"How to Configure Startup Files for Users in Trusted Extensions" on page 86
Lengthen the timeout for file relabeling.	Configures some applications to enable authorized users to relabel files.	"How to Lengthen the Timeout When Relabeling Information" on page 88
Log in to a failsafe session.	Fixes faulty user initialization files.	"How to Log In to a Failsafe Session in Trusted Extensions" on page 89

▼ How to Modify Default User Label Attributes

You can modify the default user label attributes during the configuration of the first system. The changes must be copied to every Trusted Extensions host.

Before You Begin You must be in the Security Administrator role in the global zone. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

1 Review the default user attribute settings in the `/etc/security/tsol/label_encodings` file.

For the defaults, see "`label_encodings` File Defaults" on page 77.

2 Modify the user attribute settings in the `label_encodings` file.

Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54. In Trusted CDE, you can also use the Edit Label Encodings action. For details, see "How to Start CDE Administrative Actions in Trusted Extensions" on page 53.

The `label_encodings` file should be the same on all hosts.

3 Distribute a copy of the file to every Trusted Extensions host.

▼ How to Modify `policy.conf` Defaults

Changing the `policy.conf` defaults in Trusted Extensions is similar to changing any security-relevant system file in the Oracle Solaris OS. In Trusted Extensions, you use a trusted editor to modify system files.

Before You Begin You must be in the Security Administrator role in the global zone. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

1 Review the default settings in the `/etc/security/policy.conf` file.

For Trusted Extensions keywords, see Table 6–1.

2 **Modify the settings.**

Use the trusted editor to edit the system file. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

Example 7–1 Changing the System's Idle Settings

In this example, the security administrator wants idle systems to return to the login screen. The default locks an idle system. Therefore, the Security Administrator role adds the `IDLECMD` keyword=value pair to the `/etc/security/policy.conf` file as follows:

```
IDLECMD=LOGOUT
```

The administrator also wants systems to be idle a shorter amount of time before logout. Therefore, the Security Administrator role adds the `IDLETIME` keyword=value pair to the `policy.conf` file as follows:

```
IDLETIME=10
```

The system now logs out the user after the system is idle for 10 minutes.

Example 7–2 Modifying Every User's Basic Privilege Set

In this example, the security administrator of a Sun Ray installation does not want regular users to view the processes of other Sun Ray users. Therefore, on every system that is configured with Trusted Extensions, the administrator removes `proc_info` from the basic set of privileges. The `PRIV_DEFAULT` setting in the `/etc/policy.conf` file is modified as follows:

```
PRIV_DEFAULT=basic,!proc_info
```

Example 7–3 Assigning Printing-Related Authorizations to All Users of a System

In this example, the security administrator enables a public kiosk computer to print without labels by typing the following in the computer's `/etc/security/policy.conf` file. At the next boot, print jobs by all users of this kiosk print without page labels.

```
AUTHS_GRANTED= solaris.print.unlabeled
```

Then, the administrator decides to save paper by removing banner and trailer pages. She first ensures that the Always Print Banners checkbox in the Print Manager is not selected. She then modifies the `policy.conf` entry to read the following and reboots. Now, all print jobs are unlabeled, and have no banner or trailer pages.

```
AUTHS_GRANTED= solaris.print.unlabeled,solaris.print.nobanner
```

How to Configure Startup Files for Users in Trusted Extensions

Users can put a `.copy_files` file and `.link_files` file into their home directory at the label that corresponds to their minimum sensitivity label. Users can also modify the existing `.copy_files` and `.link_files` files at the users' minimum label. This procedure is for the administrator role to automate the setup for a site.

Before You Begin You must be in the System Administrator role in the global zone. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

1. **Create two Trusted Extensions startup files.**

   You are going to add `.copy_files` and `.link_files` to your list of startup files.

   ```
   # cd /etc/skel
   # touch .copy_files .link_files
   ```

2. **Customize the `.copy_files` file.**

   a. **Start the trusted editor.**

      For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

   b. **Type the full pathname to the `.copy_files` file.**

      ```
      /etc/skel/.copy_files
      ```

   c. **Type into `.copy_files`, one file per line, the files to be copied into the user's home directory at all labels.**

      Use "`.copy_files` and `.link_files` Files" on page 81 for ideas. For sample files, see Example 7–4.

3. **Customize the `.link_files` file.**

   a. **Type the full pathname to the `.link_files` file in the trusted editor.**

      ```
      /etc/skel/.link_files
      ```

   b. **Type into `.link_files`, one file per line, the files to be linked into the user's home directory at all labels.**

4. **Customize the other startup files for your users.**

   - For a discussion of what to include in startup files, see "Customizing a User's Work Environment" in *System Administration Guide: Basic Administration*.
   - For details, see "How to Customize User Initialization Files" in *System Administration Guide: Basic Administration*.

- For an example, see Example 7–4.

5 **(Optional) Create a `skelP` subdirectory for users whose default shell is a profile shell.**

The `P` indicates the Profile shell.

6 **Copy the customized startup files into the appropriate skeleton directory.**

7 **Use the appropriate `skel`*X* pathname when you create the user.**

The *X* indicates the letter that begins the shell's name, such as `B` for Bourne, `K` for Korn, `C` for a C shell, and `P` for Profile shell.

Example 7–4 Customizing Startup Files for Users

In this example, the security administrator configures files for every user's home directory. The files are in place before any user logs in. The files are at the user's minimum label. At this site, the users' default shell is the C shell.

The security administrator creates a `.copy_files` and a `.link_files` file in the trusted editor with the following contents:

```
## .copy_files for regular users
## Copy these files to my home directory in every zone
.mailrc
.mozilla
.soffice
:wq

## .link_files for regular users with C shells
## Link these files to my home directory in every zone
.cshrc
.login
.Xdefaults
.Xdefaults-hostname
:wq

## .link_files for regular users with Korn shells
# Link these files to my home directory in every zone
.ksh
.profile
.Xdefaults
.Xdefaults-hostname
:wq
```

In the shell initialization files, the administrator ensures that the users' print jobs go to a labeled printer.

```
## .cshrc file
setenv PRINTER conf-printer1
setenv LPDEST  conf-printer1
```

```
## .ksh file
export PRINTER conf-printer1
export LPDEST  conf-printer1
```

The administrator modifies the `.Xdefaults-`*home-directory-server* file to force the `dtterm` command to source the `.profile` file for a new terminal.

```
## Xdefaults-HDserver
Dtterm*LoginShell: true
```

The customized files are copied to the appropriate skeleton directory.

```
$ cp .copy_files .link_files .cshrc .login .profile \
.mailrc .Xdefaults .Xdefaults-home-directory-server \
/etc/skelC
$ cp .copy_files .link_files .ksh .profile \
.mailrc .Xdefaults .Xdefaults-home-directory-server \
/etc/skelK
```

Troubleshooting If you create a `.copy_files` files at your lowest label, then log in to a higher zone to run the `updatehome` command and the command fails with an access error, try the following:

- Verify that from the higher-level zone you can view the lower-level directory.

  ```
  higher-level zone# ls /zone/lower-level-zone/home/username
  ACCESS ERROR: there are no files under that directory
  ```

- If you cannot view the directory, then restart the automount service in the higher-level zone:

  ```
  higher-level zone# svcadm restart autofs
  ```

Unless you are using NFS mounts for home directories, the automounter in the higher-level zone should be loopback mounting from `/zone/`*lower-level-zone*`/export/home/`*username* to `/zone/`*lower-level-zone*`/home/`*username*.

▼ How to Lengthen the Timeout When Relabeling Information

In Trusted Extensions, the Selection Manager mediates transfers of information between labels. The Selection Manager appears for drag-and-drop operations, and for cut-and-paste operations. Some applications require that you set a suitable timeout so that the Selection Manager has time to intervene. A value of two minutes is sufficient.

Caution – Do not change the default timeout value on an unlabeled system. The operations fail with the longer timeout value.

Before You Begin You must be in the System Administrator role in the global zone. For details, see "How to Enter the Global Zone in Trusted Extensions" on page 50.

1. **For the StarOffice application, do the following:**

   a. **Navigate to the file** *office-install-directory*`/VCL.xcu`**.**

      where *office-install-directory* is the StarOffice installation directory, for example:

      office-top-dir`/share/registry/data/org/staroffice`

   b. **Change the `SelectionTimeout` property value to 120.**

      Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

      The default value is three seconds. A value of 120 sets the timeout to two minutes.

2. **For users of applications that rely on the GNOME ToolKit (GTK) library, change the selection timeout property value to two minutes.**

   Note – As an alternative, you could have each user change the selection timeout property value.

   Most Sun Java Desktop System applications use the GTK library. Web browsers such as Mozilla, Firefox, and Thunderbird use the GTK library.

   By default, the selection timeout value is 300, or five seconds. A value of 7200 sets the timeout to two minutes.

   a. **Create a GTK startup file.**

      Name the file `.gtkrc-mine`. The `.gtkrc-mine` file belongs in the user's home directory at the minimum label.

   b. **Add the selection timeout value to the file.**

      ```
      ## $HOME/.gtkrc-mine file
      *gtk-selection-timeout: 7200
      ```

      As in the Oracle Solaris OS, the `gnome-settings-daemon` reads this file on startup.

3. **(Optional) Add the `.gtkrc-mine` file to the list in each user's `.link_files` file.**

   For details, see "How to Configure Startup Files for Users in Trusted Extensions" on page 86.

▼ How to Log In to a Failsafe Session in Trusted Extensions

In Trusted Extensions, failsafe login is protected. If a regular user has customized shell initialization files and now cannot log in, you can use failsafe login to fix the user's files.

Before You Begin You must know the `root` password.

1. **As in the Oracle Solaris OS, choose Options –> Failsafe Session on the login screen.**
2. **At the prompt, have the user provide the user name and password.**
3. **At the prompt for the `root` password, provide the password for `root`.**

   You can now debug the user's initialization files.

Managing Users and Rights With the Solaris Management Console (Task Map)

In Trusted Extensions, you must use the Solaris Management Console to administer users, authorizations, rights, and roles. To manage users and their security attributes, assume the Security Administrator role. The following task map describes common tasks that you perform for users who operate in a labeled environment.

Task	Description	For Instructions
Modify a user's label range.	Modifies the labels at which a user can work. Modifications can restrict or extend the range that the `label_encodings` file permits.	"How to Modify a User's Label Range in the Solaris Management Console" on page 91
Create a rights profile for convenient authorizations.	Several authorizations exist that might be useful for regular users. Creates a profile for users who qualify to have these authorizations.	"How to Create a Rights Profile for Convenient Authorizations" on page 92
Modify a user's default privilege set.	Removes a privilege from the user's default privilege set.	"How to Restrict a User's Set of Privileges" on page 94
Prevent account locking for particular users.	Users who can assume a role must have account locking turned off.	"How to Prevent Account Locking for Users" on page 96
Enable a user to relabel data.	Authorizes a user to downgrade information or upgrade information.	"How to Enable a User to Change the Security Level of Data" on page 96
Remove a user from the system.	Completely removes a user and the user's processes..	"How to Delete a User Account From a Trusted Extensions System" on page 97
Handle other tasks.	Uses the Solaris Management Console to handle tasks that are not specific to Trusted Extensions.	"Handling Other Tasks in the Solaris Management Console (Task Map)" on page 98

How to Modify a User's Label Range in the Solaris Management Console

You might want to extend a user's label range to give the user read access to an administrative application. For example, a user who can log in to the global zone could then run the Solaris Management Console. The user could view, but not not change the contents.

Alternatively, you might want to restrict the user's label range. For example, a guest user might be limited to one label.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Open a Trusted Extensions toolbox in the Solaris Management Console.**

   Use a toolbox of the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

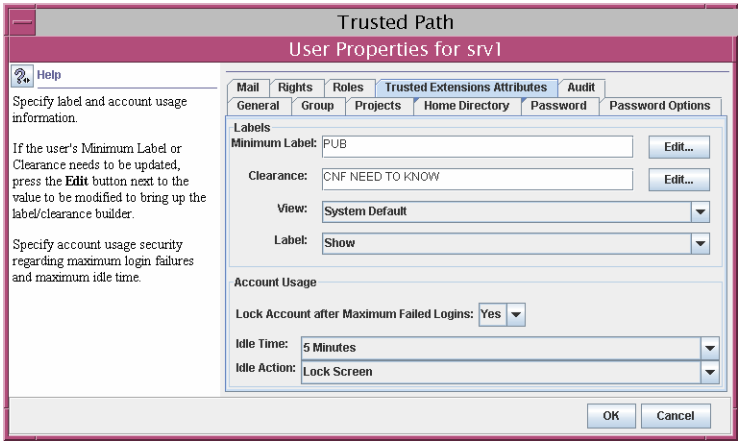
2. **Under System Configuration, navigate to User Accounts.**

   A password prompt might be displayed.

3. **Type the role password.**

4. **Select the individual user from User Accounts.**

5. **Click the Trusted Extensions Attributes tab.**



- **To extend the user's label range, choose a higher clearance.**

  You can also lower the minimum label.

- **To restrict the label range to one label, make the clearance equal to the minimum label.**

6 **To save the changes, click OK.**

▼ How to Create a Rights Profile for Convenient Authorizations

Where site security policy permits, you might want to create a rights profile that contains authorizations for users who can perform tasks that require authorization. To enable every user of a particular system to be authorized, see "How to Modify `policy.conf` Defaults" on page 84.

Before You Begin You must be in the Security Administrator role in the global zone.

1 **Open a Trusted Extensions toolbox in the Solaris Management Console.**

Use a toolbox of the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

2 **Under System Configuration, navigate to Rights.**

A password prompt might be displayed.

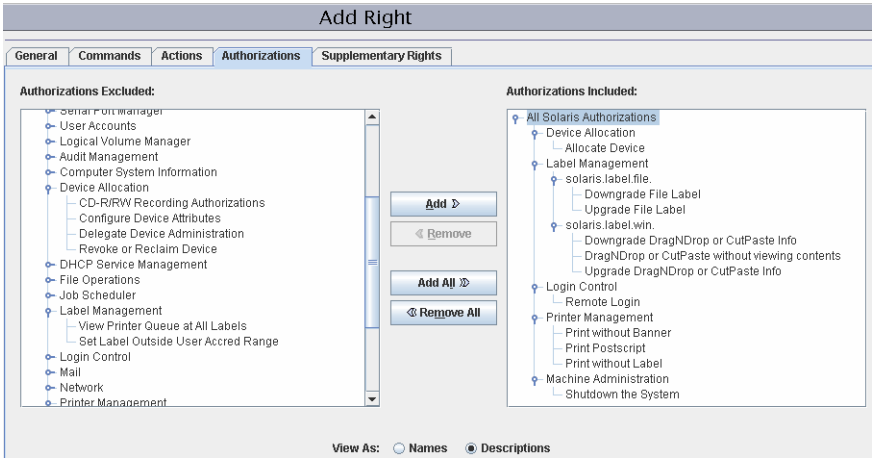
3 **Type the role password.**

4 **To add a rights profile, click Action –> Add Right.**

5 **Create a rights profile that contains one or more of the following authorizations.**

For the step-by-step procedure, see "How to Create or Change a Rights Profile" in *System Administration Guide: Security Services*.

In the following figure, the Authorizations Included window shows the authorizations that might be convenient for users.



- Allocate Device – Authorizes a user to allocate a peripheral device, such as a microphone.

  By default, Oracle Solaris users can read and write to a CD-ROM. However, in Trusted Extensions, only users who can allocate a device can access the CD-ROM drive. To allocate the drive for use requires authorization. Therefore, to read and write to a CD-ROM in Trusted Extensions, a user needs the Allocate Device authorization.
- Downgrade DragNDrop or CutPaste Info – Authorizes a user to select information from a higher-level file and place that information in a lower-level file.
- Downgrade File Label – Authorizes a user to lower the security level of a file
- DragNDrop or CutPaste without viewing contents – Authorizes a user to move information without viewing the information that is being moved.
- Print Postscript – Authorizes a user to print PostScript files.
- Print without Banner - Authorizes a user to print hard copy without a banner page.
- Print without Label – Authorizes a user to print hard copy that does not display labels.
- Remote Login – Authorizes a user to remotely log in.
- Shutdown the System – Authorizes a user to shut down the system and to shut down a zone.
- Upgrade DragNDrop or CutPaste Info – Authorizes a user to select information from a lower-level file and place that information in a higher-level file.
- Upgrade File Label – Authorizes a user to heighten the security level of a file.

6 Assign the rights profile to a user or a role.

For assistance, see the online help. For the step-by-step procedure, see "How to Change the RBAC Properties of a User" in *System Administration Guide: Security Services*.

Example 7–5 Assigning a Printing-Related Authorization to a Role

In the following example, the Security Administrator allows a role to print jobs without labels on body pages.

In the Solaris Management Console, the security administrator navigates to Administrative Roles. She views the rights profiles that are included in a particular role, then ensures that the print-related authorizations are contained in one of the role's rights profiles.

▼ How to Restrict a User's Set of Privileges

Site security might require that users be permitted fewer privileges than users are assigned by default. For example, at a site that uses Trusted Extensions on Sun Ray systems, you might want to prevent users from viewing other users' processes on the Sun Ray server.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Open a Trusted Extensions toolbox in the Solaris Management Console.**

   Use a toolbox of the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

2. **Under System Configuration, navigate to User Accounts.**

   A password prompt might be displayed.

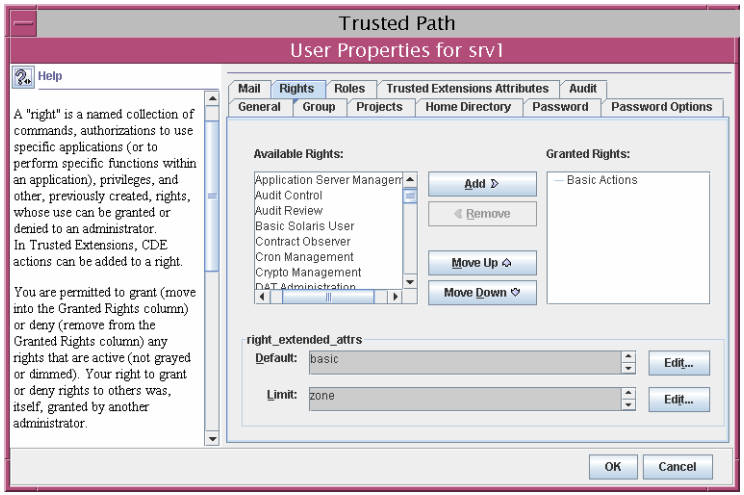
3. **Type the role password.**

4. **Double–click the icon for the user.**

5. **Remove one or more of the privileges in the `basic` set.**

   a. **Double-click the icon for the user.**

b. Click the Rights tab.

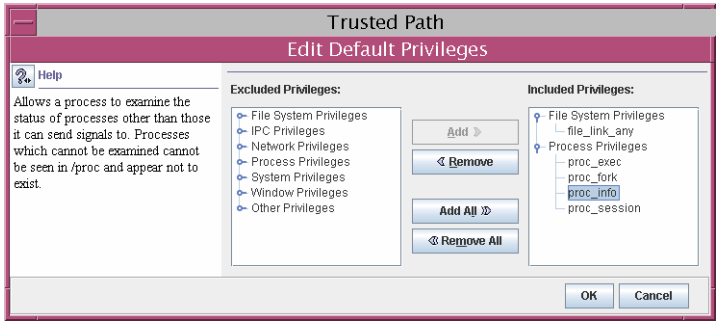


c. Click the Edit button to the right of the `basic` set in the `right_extended_attr` field.

d. Remove `proc_session` or `file_link_any`.

By removing the `proc_session` privilege, you prevent the user from examining any processes outside the user's current session. By removing the `file_link_any` privilege, you prevent the user from making hard links to files that are not owned by the user.

Caution – Do not remove the `proc_fork` or the `proc_exec` privilege. Without these privileges, the user would not be able to use the system.



6 To save the changes, click OK.

How to Prevent Account Locking for Users

Trusted Extensions extends the user security features in the Solaris Management Console to include account locking. Turn off account locking for users who can assume a role.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Start the Solaris Management Console.**

   Use a toolbox of the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

2. **Under System Configuration, navigate to User Accounts.**

   A password prompt might be displayed.

3. **Type the role password.**

4. **Double–click the icon for the user.**

5. **Click the Trusted Extensions Attributes tab.**

6. **In the Account Usage section, choose `No` from the pull-down menu next to `Lock account after maximum failed logins`.**

7. **To save the changes, click OK.**

How to Enable a User to Change the Security Level of Data

A regular user or a role can be authorized to change the security level, or labels, of files and directories. The user or role, in addition to having the authorization, must be configured to work at more than one label. And, the labeled zones must be configured to permit relabeling. For the procedure, see "How to Enable Files to be Relabeled From a Labeled Zone" on page 128.

Caution – Changing the security level of data is a privileged operation. This task is for trustworthy users only.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Follow the procedure "How to Create a Rights Profile for Convenient Authorizations" on page 92 to create a rights profile.**

The following authorizations enable a user to relabel a file:

- Downgrade File Label
- Upgrade File Label

The following authorizations enable a user to relabel information within a file:

- Downgrade DragNDrop or CutPaste Info
- DragNDrop or CutPaste Info Without Viewing
- Upgrade DragNDrop or CutPaste Info

2 **Use the Solaris Management Console to assign the profile to the appropriate users and roles.**

For assistance, use the online help. For a step-by-step procedure, see "How to Change the RBAC Properties of a User" in *System Administration Guide: Security Services*.

▼ How to Delete a User Account From a Trusted Extensions System

When a user is removed from the system, you must ensure that the user's home directory and any objects that the user owns are also deleted. As an alternative to deleting objects that are owned by the user, you might change the ownership of these objects to a valid user.

You must also ensure that all batch jobs that are associated with the user are also deleted. No objects or processes belonging to a removed user can remain on the system.

Before You Begin You must be in the System Administrator role.

1 **Archive the user's home directory at every label.**

2 **Archive the user's mail files at every label.**

3 **In the Solaris Management Console, delete the user account.**

a. **Open a Trusted Extensions toolbox in the Solaris Management Console.**

Use a toolbox of the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

b. **Under System Configuration, navigate to User Accounts.**

A password prompt might be displayed.

c. **Type the role password.**

d. Select the user account to be removed, and click the Delete button.

You are prompted to delete the user's home directory and mail files. When you accept the prompt, the user's home directory and mail files are deleted in the global zone only.

4 In every labeled zone, manually delete the user's directories and mail files.

Note – You are responsible for finding and deleting the user's temporary files at all labels, such as files in `/tmp` directories.

Handling Other Tasks in the Solaris Management Console (Task Map)

Follow Oracle Solaris procedures to handle tasks in the Solaris Management Console. You must be superuser, or in a role in the global zone. The following task map points to basic Solaris Management Console tasks.

Task	For Instructions
Perform administrative tasks by using the Solaris Management Console.	Chapter 2, "Working With the Solaris Management Console (Tasks)," in *System Administration Guide: Basic Administration*
Create users.	"Using the Solaris Management Tools With RBAC (Task Map)" in *System Administration Guide: Basic Administration*
Create roles.	"How to Create and Assign a Role by Using the GUI" in *System Administration Guide: Security Services*
Modify roles.	"How to Change the Properties of a Role" in *System Administration Guide: Security Services*
Create or modify a rights profile.	"How to Create or Change a Rights Profile" in *System Administration Guide: Security Services*
Change other security attributes of a user.	"How to Change the RBAC Properties of a User" in *System Administration Guide: Security Services*
Audit the actions of a role.	"How to Audit Roles" in *System Administration Guide: Security Services*
List the rights profiles by using `smprofile list -D`*name-service-type*`:/`*server-name*`/`*domain-name*	*Chapter 9, "Using Role-Based Access Control (Tasks)," in System Administration Guide: Security Services* or the `smprofile`(1M) man page

◆ ◆ ◆ CHAPTER 8

Remote Administration in Trusted Extensions (Tasks)

This chapter describes how to use Trusted Extensions administrative tools to administer a remote system.

Secure Remote Administration in Trusted Extensions

By default, Trusted Extensions does not allow remote administration. Remote administration would present a significant security risk if users on remote untrusted systems could administer systems that are configured with Trusted Extensions. Therefore, systems are initially installed without the option of being remotely administered.

Until the network is configured, all remote hosts are assigned the `admin_low` security template. Therefore, the CIPSO protocol is not used or accepted for any connections. While in this initial state, systems are protected from remote attacks by several mechanisms. Mechanisms include `netservices` settings, default login policy, and PAM policy.

- When the `netservices` Service Management Facility (SMF) profile is set to `limited`, no remote services except secure shell are enabled. However, the `ssh` service cannot be used for remote logins because of the login and PAM policies.
- The `root` account cannot be used for remote logins because the default policy for `CONSOLE` in the `/etc/default/login` file prevents remote logins by `root`.
- Two PAM settings also affect remote logins.

  The `pam_roles` module always rejects local logins from accounts of type `role`. By default, this module also rejects remote logins. However, the system can be configured to accept remote logins by specifying `allow_remote` in the system's `pam.conf` entry.

Additionally, the `pam_tsol_account` module rejects remote logins into the global zone unless the CIPSO protocol is used. The intent of this policy is for remote administration to be performed by another Trusted Extensions system.

To enable remote login functionality, both systems must assign their peer to a CIPSO security template. If this approach is not practical, the network protocol policy can be relaxed by specifying the `allow_unlabeled` option in the `pam.conf` file. If either policy is relaxed, the default network template must be changed so that arbitrary machines cannot access the global zone. The `admin_low` template should be used sparingly, and the `tnrhdb` database should be modified so that the wildcard address `0.0.0.0` does not default to the `ADMIN_LOW` label. For details, see "Administering Trusted Extensions Remotely (Task Map)" on page 102 and "How to Limit the Hosts That Can Be Contacted on the Trusted Network" on page 175.

Methods for Administering Remote Systems in Trusted Extensions

Typically, administrators use the `rlogin` and `ssh` commands to administer remote systems from the command line. The Solaris Management Console can also be used. In Trusted CDE, the `dtappsession` program can remotely launch Trusted CDE actions. Starting in the Solaris 10 5/09 release, a virtual networking computer (vnc) can be used to remotely display a multilevel desktop.

The following methods of remote administration are possible in Trusted Extensions:

- The root user can log in to a remote host from a terminal. See "How to Log In Remotely From the Command Line in Trusted Extensions" on page 103. This method works as it does on an Oracle Solaris system. This method is insecure.
- A role can log in to a remote host from a terminal in the role workspace. See "How to Log In Remotely From the Command Line in Trusted Extensions" on page 103.
- Administrators can start a Solaris Management Console server that is running on a remote system. See "How to Remotely Administer Systems by Using the Solaris Management Console From a Trusted Extensions System" on page 105.
- Actions in the Trusted_Extensions folder can be started remotely by using the `dtappsession` command. See "How to Remotely Administer Trusted Extensions With `dtappsession`" on page 103.
- A user can log in to a remote multilevel desktop by using a vnc client program to connect to the Xvnc server on a Trusted Extensions system. See "How to Use Xvnc to Remotely Access a Trusted Extensions System" on page 109.

Remote Login by a Role in Trusted Extensions

As in the Oracle Solaris OS, a setting in the `/etc/default/login` file on each host must be changed to allow remote logins. Additionally, the `pam.conf` file might need to be modified. In Trusted Extensions, the security administrator is responsible for the change. For the procedures, see "Enable Remote Login by root User in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide* and "Enable Remote Login by a Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

On both Trusted Extensions and Oracle Solaris hosts, remote logins might or might not require authorization. "Remote Login Management in Trusted Extensions" on page 101 describes the conditions and types of logins that require authorization. By default, roles have the Remote Login authorization.

Remote Role-Based Administration From Unlabeled Hosts

In Trusted Extensions, users assume roles through the Trusted Path menu. The roles then operate in trusted workspaces. By default, roles cannot be assumed outside of the trusted path. If site policy permits, the security administrator can change the default policy. Administrators of unlabeled hosts that are running Solaris Management Console 2.1 client software can then administer trusted hosts.

- To change the default policy, see "Enable Remote Login by a Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.
- To administer systems remotely, see "How to Log In Remotely From the Command Line in Trusted Extensions" on page 103.

This policy change only applies when the user on the remote unlabeled system has a user account on the Trusted Extensions host. The Trusted Extensions user must have the ability to assume an administrative role. The role can then use the Solaris Management Console to administer the remote system.

Caution – If remote administration from a non-Trusted Extensions host is enabled, the administrative environment is less protected than a Trusted Extensions administrative workspace. Be cautious when typing passwords and other secure data. As a precaution, shut down all untrusted applications before starting the Solaris Management Console.

Remote Login Management in Trusted Extensions

A remote login between two Trusted Extensions hosts is considered to be an extension of the current login session.

An authorization is not required when the `rlogin` command does not prompt for a password. If an `/etc/hosts.equiv` file or a `.rhosts` file in the user's home directory on the remote host lists either the username or the host from which the remote login is being attempted, no password is required. For more information, see the `rhosts(4)` and `rlogin(1)` man pages.

For all other remote logins, including logins with the `ftp` command, the Remote Login authorization is required.

To create a rights profile that includes the Remote Login authorization, see "Managing Users and Rights With the Solaris Management Console (Task Map)" on page 90.

Administering Trusted Extensions Remotely (Task Map)

The following task map describes the tasks used to administer a remote Trusted Extensions system.

Task	Description	For Instructions
Enable `root` to remotely log in to a Trusted Extensions system.	Enables the `root` user to work remotely from a labeled system.	"Enable Remote Login by root User in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
Enable a role to remotely log in to a Trusted Extensions system.	Allows any role to work remotely from a labeled system.	"Enable Remote Login by a Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
Enable remote login from an unlabeled system to a Trusted Extensions system.	Allows any user or role to work remotely from an unlabeled system.	"Enable Remote Login From an Unlabeled System" in *Oracle Solaris Trusted Extensions Configuration Guide*
Log in remotely to a Trusted Extensions system.	Logs in as a role to a Trusted Extensions system.	"How to Log In Remotely From the Command Line in Trusted Extensions" on page 103
Administer a system remotely.	Uses the `dtappsession` command to administer the remote system with Trusted_Extensions actions.	"How to Remotely Administer Trusted Extensions With `dtappsession`" on page 103
	From a Trusted Extensions system, uses the Solaris Management Console to administer the remote host.	"How to Remotely Administer Systems by Using the Solaris Management Console From a Trusted Extensions System" on page 105
	From an unlabeled system, uses the Solaris Management Console to administer remote Trusted Extensions hosts.	"How to Remotely Administer Systems by Using the Solaris Management Console From an Unlabeled System" on page 106

Task	Description	For Instructions
Administer and use a remote system	From any client, uses the Xvnc server on the remote Trusted Extensions to display a multilevel session back to the client	"How to Use Xvnc to Remotely Access a Trusted Extensions System" on page 109
Enable specific users to log in to the global zone.	Uses user and network tools in the Solaris Management Console to enable specific users to access the global zone.	"How to Enable Specific Users to Log In Remotely to the Global Zone in Trusted Extensions" on page 108

▼ How to Log In Remotely From the Command Line in Trusted Extensions

Note – The `telnet` command cannot be used for remote role assumption because this command cannot pass the primary and role identities to the `pam_roles` module.

Before You Begin The user and the role must be identically defined on the local and the remote system.

The role must have the Remote Login authorization. By default, this authorization is in the Remote Administration, and the Maintenance and Repair rights profiles.

The security administrator has completed the procedure "Enable Remote Login by a Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide* on every system that can be remotely administered. If the system can be administered from an unlabeled system, the procedure "Enable Remote Login From an Unlabeled System" in *Oracle Solaris Trusted Extensions Configuration Guide* has also been completed.

- **From the workspace of a user who can assume a role, log in to the remote host.**

  Use the `rlogin` command, the `ssh` command, or the `ftp` command.

  - If the `rlogin -l` or `ssh` command is used to log in, all commands that are in the role's rights profiles are available.
  - If the `ftp` command is used, see the `ftp(1)` man page for the commands that are available.

▼ How to Remotely Administer Trusted Extensions With `dtappsession`

The `dtappsession` program enables an administrator to administer a remote system that is running CDE.

`dtappsession` is useful when a remote system does not have a monitor. For example, `dtappsession` is often used to administer domains on large servers. For more information, see the `dtappsession(1)` man page.

Before You Begin On a labeled system, you must be in an administrative role in the global zone. On an unlabeled system, you must assume a role that is defined on the remote system. You must then run the remote login from the role's profile shell.

1 (Optional) Create a workspace that is dedicated to the remote session.

To avoid confusion between the remote CDE applications and any local applications, dedicate an administrative role workspace to this procedure. For details, see "How to Add a Workspace at a Particular Label" in *Oracle Solaris Trusted Extensions User's Guide*.

2 Log in to the remote host.

You can use the `rlogin` command or the `ssh` command.

```
$ ssh remote-host
```

3 Start remote administration.

In the terminal window, type the `dtappsession` command followed by the name of the local host.

```
$ /usr/dt/bin/dtappsession local-host
```

the Application Manager that is running on the remote host displays on the local host. Also, an Exit dialog box appears.

4 Administer the remote host.

If you invoked the remote session from Trusted CDE, you can use actions in the Trusted_Extensions folder.

5 When finished, click the Exit button.

Caution – Closing the Application Manager does not end the login session and is not recommended.

6 In the terminal window, exit the remote login session.

And use the `hostname` command to verify that you are on your local host.

```
$ exit
$ hostname
local-host
```

How to Remotely Administer Systems by Using the Solaris Management Console From a Trusted Extensions System

The Solaris Management Console provides a remote administration interface to manage users, rights, roles, and the network. You assume a role to use the Console. In this procedure, you run the Console on the local system and specify the remote system as the server.

Before You Begin You have completed the following procedures:

- On both systems – "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
- On the remote system – "Enable Remote Login by a Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide* and "Enable the Solaris Management Console to Accept Network Communications" in *Oracle Solaris Trusted Extensions Configuration Guide*
- On the remote system that is the LDAP server – "Configuring the Solaris Management Console for LDAP (Task Map)" in *Oracle Solaris Trusted Extensions Configuration Guide*

1 On the local system, log in as the user who is defined identically on the remote system.

2 Assume the role that you plan to use to administer the system.

3 In the role, start the Solaris Management Console.

For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

a. In the Server dialog box, type the name of the remote server.

- **If you are using LDAP as a naming service, type the name of the LDAP server.**

  Then, choose one of the following scopes.

  - **To administer the databases in the naming service, choose the `Scope=LDAP` toolbox.**

    `This Computer (`*ldap-server*`: Scope=LDAP, Policy=TSOL)`

- **To administer the local files on the LDAP server, choose the `Scope=Files` toolbox.**

  `This Computer (`*ldap-server*`: Scope=Files, Policy=TSOL)`

- **If you are not using LDAP as a naming service, type the name of the remote system that you want to administer.**

  Then, choose the `Scope=Files` toolbox.

  `This Computer (`*remote-system*`: Scope=Files, Policy=TSOL)`

4. **Select a tool under System Configuration.**

   When you select a tool such as User, a dialog box displays the Solaris Management Console server name, your user name, your role name, and a place to type the role's password. Make sure that the entries are correct.

5. **In the role that is defined identically on the local and the remote systems, log in to the Solaris Management Console server.**

   Type the role's password and press Login as Role. You can now use the Solaris Management Console to manage the system.

Note – Although you can use the Solaris Management Console to run `dtappsession`, the simplest way to use `dtappsession` is described in "How to Remotely Administer Trusted Extensions With `dtappsession`" on page 103.

▼ How to Remotely Administer Systems by Using the Solaris Management Console From an Unlabeled System

In this procedure, you run the Solaris Management Console client and server on the remote system, and display the Console on the local system.

Before You Begin The Trusted Extensions system must have assigned the label `ADMIN_LOW` to the local system.

Note – A system that is not running the CIPSO protocol, such as a Trusted Solaris system, is an unlabeled system from the viewpoint of a Trusted Extensions system.

The Solaris Management Console server on the remote system must be configured to accept the remote connection. For the procedure, see "Enable the Solaris Management Console to Accept Network Communications" in *Oracle Solaris Trusted Extensions Configuration Guide*.

Both systems must have the same user who is assigned the same role that can use the Solaris Management Console. The user can have the normal user's label range, but the role must have the range from `ADMIN_LOW` to `ADMIN_HIGH`.

You must be in an administrative role in the global zone.

1 Enable the local X server to display the remote Solaris Management Console.

```
# xhost + TX-SMC-Server
# echo $DISPLAY
:n.n
```

2 On the local system, become the user who can assume a role for the Solaris Management Console.

```
# su - same-username-on-both-systems
```

3 As that user, log in to the remote server as the role.

```
$ rlogin -l same-rolename-on-both-systems  TX-SMC-Server
```

4 Make sure that the environment variables that the Solaris Management Console uses have the correct values.

a. Set the value of the `DISPLAY` variable.

```
$ DISPLAY=local:n.n
$ export DISPLAY=local:n.n
```

b. Set the value of the `LOGNAME` variable to the user name.

```
$ LOGNAME=same-username-on-both-systems
$ export LOGNAME=same-username-on-both-systems
```

c. Set the value of the `USER` variable to the role name.

```
$ USER=same-rolename-on-both-systems
$ export USER=same-rolename-on-both-systems
```

5 In the role, start the Solaris Management Console from the command line.

```
$ /usr/sbin/smc &
```

6 Select a tool under System Configuration.

When you select a tool such as User, a dialog box displays the Solaris Management Console server name, your user name, your role name, and a place to type the role's password. Make sure that the entries are correct.

7 As the role, log in to the server.

Type the role's password and press Login as Role. You can now use the Solaris Management Console to manage the system.

Note – When you try to access network database information from a system that is not the LDAP server, the operation fails. The Console allows you to log in to the remote host and open the toolbox. However, when you try to access or change information, the following error message indicates that you have selected `Scope=LDAP` on a system that is not the LDAP server:

```
Management server cannot perform the operation requested.
...
Error extracting the value-from-tool.
The keys received from the client were machine, domain, Scope.
Problem with Scope.
```

How to Enable Specific Users to Log In Remotely to the Global Zone in Trusted Extensions

The user's default label range and the zone's default behavior are changed to enable remote login by a non-role. You might want to complete this procedure for a tester who is using a remote labeled system. For security reasons, the tester's system should be running a disjoint label from other users.

Before You Begin You must have a very good reason why this user can log in to the global zone.

You must be in the Security Administrator role in the global zone.

1. **To enable specific users to log in to the global zone, assign them an administrative label range.**

   Use the Solaris Management Console to assign a clearance of `ADMIN_HIGH` and a minimum label of `ADMIN_LOW` to each user. For details, see "How to Modify a User's Label Range in the Solaris Management Console" on page 91.

   The user's labeled zones must also permit login.

2. **To enable remote login from a labeled zone into the global zone, do the following.**

   a. **Add a multilevel port for remote login to the global zone.**

      Use the Solaris Management Console. Port 513 over the TCP protocol enables remote login. For an example, see "How to Create a Multilevel Port for a Zone" on page 130.

   b. **Read the `tnzonecfg` changes into the kernel.**

      ```
      # tnctl -fz /etc/security/tsol/tnzonecfg
      ```

   c. **Restart the remote login service.**

      ```
      # svcadm restart svc:/network/login:rlogin
      ```

How to Use Xvnc to Remotely Access a Trusted Extensions System

Virtual Network Computing (vnc) technology connects a client to a remote server, then displays the desktop of the remote server in a window on the client. Xvnc is the UNIX version of vnc, which is based on a standard X server. In Trusted Extensions, a client on any platform can connect to an Xvnc that is running Trusted Extensions software, log in to the Xvnc server, then display and work on a multilevel desktop.

Before You Begin You have installed and configured Trusted Extensions software on the system that is going to be used as the Xvnc server. You have created and booted the labeled zones. Your Xvnc server recognizes the vnc clients by hostname or IP address.

You are superuser in the global zone of the system that is going to be used as the Xvnc server.

1 Configure the Xvnc server.

For more information, see the `Xvnc`(1) and `vncconfig`(1) man pages.

Caution – If you are running the Solaris 10 10/08 or the Solaris 10 5/08 release, you must patch your system before configuring the server. For a SPARC system, install the latest version of patch 125719. For an x86 system, install the latest version of patch 125720.

a. Create the Xservers configuration directory.

```
# mkdir -p /etc/dt/config
```

b. Copy the `/usr/dt/config/Xservers` file to the `/etc/dt/config` directory.

```
# cp /usr/dt/config/Xservers /etc/dt/config/Xservers
```

c. Edit the `/etc/dt/config/Xservers` file to start up the Xvnc program instead of Xserver or Xorg.

In this example, the entry is configured to log in to the server without a password. To successfully log in the desktop, the local UID must be `none` instead of `console`.

The entry is split for display purposes. The entry must be on one line.

```
#   :0  Local local_uid@console root /usr/X11/bin/Xserver :0 -nobanner
  :0  Local local_uid@none root /usr/X11/bin/Xvnc :0 -nobanner
  -AlwaysShared -SecurityTypes None -geometry 1024x768x24 -depth 24
```

Note – A safer configuration is to require a password by using the `-SecurityTypes VncAuth` parameter. The `Xvnc`(1) man page describes password requirements.

d. Reboot the server or start the Xvnc server.

```
# reboot
```

After reboot, verify that the Xvnc program is running.

```
# ps -ef | grep Xvnc
  root  2145  932  0  Jan 18 ?  6:15 /usr/X11/bin/Xvnc :0 -nobanner
  -AlwaysShared -SecurityTypes None -geometry 1024
```

2 On every vnc client of the Trusted Extensions Xvnc server, install vnc client software.

For the client system, you have a choice of software. This example uses the Sun vnc software.

```
# cd SUNW-pkg-directory
# pkgadd -d . SUNWvncviewer
```

3 In a terminal window on a vnc client, connect to the server.

```
% /usr/bin/vncviewer Xvnc-server-hostname
```

4 In the window that displays, type your name and password.

Continue with the login procedure. For a description of the remaining steps, see "Logging In to Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*.

If you logged in to the server as superuser, you can administer the server immediately. If you logged in to the server as a user, you must assume a role to administer the system.

◆ ◆ ◆ CHAPTER 9

Trusted Extensions and LDAP (Overview)

This chapter describes the use of the Sun Java System Directory Server (Directory Server) for a system that is configured with Trusted Extensions.

Using a Naming Service in Trusted Extensions

To achieve uniformity of user, host, and network attributes within a security domain with multiple Trusted Extensions systems, a naming service is used for distributing most configuration information. LDAP is an example of a naming service. The `nsswitch.conf` file determines which naming service is used. LDAP is the recommended naming service for Trusted Extensions.

The Directory Server can provide the LDAP naming service for Trusted Extensions and Oracle Solaris clients. The server must include Trusted Extensions network databases, and the Trusted Extensions clients must connect to the server over a multilevel port. The security administrator specifies the multilevel port when configuring Trusted Extensions.

Trusted Extensions adds two trusted network databases to the LDAP server: `tnrhdb` and `tnrhtp`. These databases are administered by using the Security Templates tool in the Solaris Management Console. A toolbox of `Scope=LDAP, Policy=TSOL` stores configuration changes on the Directory Server.

- For information about the use of the LDAP naming service in the Oracle Solaris OS, see *System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)*.
- Setting up the Directory Server for Trusted Extensions clients is described in *Oracle Solaris Trusted Extensions Configuration Guide*. Trusted Extensions systems can be clients of an Oracle Solaris LDAP server by using an LDAP proxy server that is configured with Trusted Extensions.

Note – Systems that are configured with Trusted Extensions cannot be clients of NIS or NIS+ masters.

Non-Networked Trusted Extensions Systems

If a naming service is not used at a site, administrators must ensure that configuration information for users, hosts, and networks is identical on all hosts. A change that is made on one host must be made on all hosts.

On a non-networked Trusted Extensions system, configuration information is maintained in the `/etc`, `/etc/security`, and `/etc/security/tsol` directories. Actions in the Trusted_Extensions folder enable you to modify some configuration information. The Security Templates tool in the Solaris Management Console enables you to modify network database parameters. Users, roles, and rights are modified in the User Accounts, Administrative Roles, and Rights tools. A toolbox on This Computer with `Scope=Files, Policy=TSOL` stores configuration changes locally.

Trusted Extensions LDAP Databases

Trusted Extensions extends the Directory Server's schema to accommodate the `tnrhdb` and `tnrhtp` databases. Trusted Extensions defines two new attributes, `ipTnetNumber` and `ipTnetTemplateName`, and two new object classes, `ipTnetTemplate` and `ipTnetHost`.

The attribute definitions are as follows:

```
ipTnetNumber
   ( 1.3.6.1.1.1.1.34 NAME 'ipTnetNumber'
     DESC 'Trusted network host or subnet address'
     EQUALITY caseExactIA5Match
     SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
     SINGLE-VALUE )

ipTnetTemplateName
   ( 1.3.6.1.1.1.1.35 NAME 'ipTnetTemplateName'
     DESC 'Trusted network template name'
     EQUALITY caseExactIA5Match
     SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
     SINGLE-VALUE )
```

The object class definitions are as follows:

```
ipTnetTemplate
   ( 1.3.6.1.1.1.2.18 NAME 'ipTnetTemplate' SUP top STRUCTURAL
     DESC 'Object class for Trusted network host templates'
     MUST ( ipTnetTemplateName )
```

```
     MAY ( SolarisAttrKeyValue ) )

ipTnetHost
   ( 1.3.6.1.1.1.2.19 NAME 'ipTnetHost' SUP top AUXILIARY
     DESC 'Object class for Trusted network host/subnet address
           to template mapping'
     MUST ( ipTnetNumber $ ipTnetTemplateName ) )
```

The `cipso` template definition in LDAP is similar to the following:

```
ou=ipTnet,dc=example,dc=example1,dc=exampleco,dc=com
 objectClass=top
 objectClass=organizationalUnit
 ou=ipTnet

 ipTnetTemplateName=cipso,ou=ipTnet,dc=example,dc=example1,dc=exampleco,dc=com
 objectClass=top
 objectClass=ipTnetTemplate
 ipTnetTemplateName=cipso
 SolarisAttrKeyValue=host_type=cipso;doi=1;min_sl=ADMIN_LOW;max_sl=ADMIN_HIGH;

 ipTnetNumber=0.0.0.0,ou=ipTnet,dc=example,dc=example1,dc=exampleco,dc=com
 objectClass=top
 objectClass=ipTnetTemplate
 objectClass=ipTnetHost
 ipTnetNumber=0.0.0.0
 ipTnetTemplateName=internal
```

Using the LDAP Naming Service in Trusted Extensions

The LDAP naming service is managed in Trusted Extensions as it is managed in the Oracle Solaris OS. The following is a sample of useful commands, and contains references to more detailed information:

- For strategies to solve LDAP configuration problems, see Chapter 13, "LDAP Troubleshooting (Reference)," in *System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)*.
- To troubleshoot client-to-server LDAP connection problems that are affected by labels, see "How to Debug a Client Connection to the LDAP Server" on page 188.
- To troubleshoot other client-to-server LDAP connection problems, see Chapter 13, "LDAP Troubleshooting (Reference)," in *System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)*.
- To display LDAP entries from an LDAP client, type:

  ```
  $ ldaplist -l
  $ ldap_cachemgr -g
  ```

- To display LDAP entries from an LDAP server, type:

  ```
  $ ldap_cachemgr -g
  $ idsconfig -v
  ```

- To list the hosts that LDAP manages, type:

```
$ ldaplist -l hosts      Long listing
$ ldaplist hosts         One-line listing
```

- To list information in the Directory Information Tree (DIT) on LDAP, type:

```
$ ldaplist -l services | more
dn: cn=apocd+ipServiceProtocol=udp,ou=Services,dc=exampleco,dc=com
  objectClass: ipService
  objectClass: top
  cn: apocd
  ipServicePort: 38900
  ipServiceProtocol: udp

...
$ ldaplist services name
dn=cn=name+ipServiceProtocol=udp,ou=Services,dc=exampleco,dc=com
```

- To display the status of the LDAP service on the client, type:

```
# svcs -xv network/ldap/client
svc:/network/ldap/client:default (LDAP client)
 State: online since date
   See: man -M /usr/share/man -s 1M ldap_cachemgr
   See: /var/svc/log/network-ldap-client:default.log
Impact: None.
```

- To start and stop the LDAP client, type:

```
# svcadm enable network/ldap/client

# svcadm disable network/ldap/client
```

- To start and stop the LDAP server in version 5.2 of Sun Java System Directory Server software, type:

```
# installation-directory/slap-LDAP-server-hostname/start-slapd
# installation-directory/slap-LDAP-server-hostname/stop-slapd
```

- To start and stop the LDAP server in version 6 of Sun Java System Directory Server software, type:

```
# dsadm start /export/home/ds/instances/your-instance
# dsadm stop /export/home/ds/instances/your-instance
```

- To start and stop a proxy LDAP server in version 6 of Sun Java System Directory Server software, type:

```
# dpadm start /export/home/ds/instances/your-instance
# dpadm stop /export/home/ds/instances/your-instance
```

◆ ◆ ◆ CHAPTER 10

Managing Zones in Trusted Extensions (Tasks)

This chapter describes how non-global zones work on a system that is configured with Trusted Extensions. Also included are procedures that are unique to zones in Trusted Extensions.

Zones in Trusted Extensions

A properly configured Trusted Extensions system consists of a global zone, which is the operating system instance, and one or more labeled non-global zones. During configuration, Trusted Extensions attaches a unique label to each zone, which creates labeled zones. The labels come from the `label_encodings` file. The administrators can create a zone for each label, but are not required to. It is possible to have more labels than labeled zones on a system. It is not possible to have more labeled zones than labels.

On a Trusted Extensions system, the file systems of a zone are usually mounted as a loopback file system (lofs). All writable files and directories in a labeled zone are at the label of the zone. By default, a user can view files that are in a zone at a lower label than the user's current label. This configuration enables users to view their home directories at lower labels than the label of the current workspace. Although users can view files at a lower label, they cannot modify them. Users can only modify files from a process that has the same label as the file.

In Trusted Extensions, the global zone is an administrative zone. The labeled zones are for regular users. Users can work in a zone whose label is within the user's accreditation range.

Every zone has an associated IP address and security attributes. A zone can be configured with multilevel ports (MLPs). Also, a zone can be configured with a policy for Internet Control Message Protocol (ICMP) broadcasts, such as `ping`.

For information about sharing directories from a labeled zone and about mounting directories from labeled zones remotely, see Chapter 11, "Managing and Mounting Files in Trusted Extensions (Tasks)."

Zones in Trusted Extensions are built on the Oracle Solaris zones product. For details, see Part II, "Zones," in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*. In particular, patching and package installation issues affect Trusted Extensions. For details, see Chapter 25, "About Packages and Patches on a Solaris System With Zones Installed (Overview)," in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones* and Chapter 30, "Troubleshooting Miscellaneous Solaris Zones Problems," in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*.

Zones and IP Addresses in Trusted Extensions

Your initial setup team assigned IP addresses to the global zone and the labeled zones. Three types of configurations are documented in "Creating Labeled Zones" in *Oracle Solaris Trusted Extensions Configuration Guide*:

- The system has one IP address for the global zone and all labeled zones.

  This configuration is useful on a system that uses DHCP software to obtain its IP address. If no users are expected to log in, an LDAP server might have this configuration.
- The system has one IP address for the global zone, and one IP address that is shared by all zones, including the global zone. Any zone can have a combination of a unique address and a shared address.

  This configuration is useful on a system that regular users are going to log in to. It can also be used for a printer or an NFS server. This configuration conserves IP addresses.
- The system has one IP address for the global zone, and each labeled zone has a unique IP address.

  This configuration is useful for providing access to separate physical networks of single-level systems. Typically, each zone would have an IP address on a different physical network from the other labeled zones. Because this configuration is implemented with a single IP instance, the global zone controls the physical interfaces and manages global resources, such as the route table.

With the introduction of exclusive IP instances for a non-global zone, a fourth type of configuration is available in the Oracle Solaris OS. Starting in the Solaris 10 8/07 release, a non-global zone can be assigned its own IP instance and manage its own physical interfaces. In this configuration, each zone operates as if it is a distinct system. For a description, see "Zone Network Interfaces" in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*.

However, in such a configuration, each labeled zone operates as if it is a distinct single-labeled system. The multilevel networking features of Trusted Extensions rely on features of a shared IP stack. Administration procedures in Trusted Extensions assume that networking is controlled entirely by the global zone. Therefore, if your initial setup team has installed labeled zones with exclusive IP instances, you must provide or refer to site-specific documentation.

Zones and Multilevel Ports

By default, a zone cannot send packets to and receive packets from any other zone. Multilevel ports (MLPs) enable particular services on a port to accept requests within a range of labels or from a set of labels. These privileged services can reply at the label of the request. For example, you might want to create a privileged web browser port that can listen at all labels, but whose replies are restricted by label. By default, labeled zones have no MLPs.

The range of labels or set of labels that constrains the packets that the MLP can accept is based on the zone's IP address. The IP address is assigned a remote host template in the `tnrhdb` database. The label range or set of labels in the remote host template constrains the packets that the MLP can accept.

- The constraints on MLPs for different IP address configurations are as follows:
- On a system where the global zone has an IP address and each labeled zone has a unique IP address, an MLP for a particular service can be added to every zone. For example, the system could be configured so that the `ssh` service, over TCP port 22, is an MLP in the global zone and in every labeled zone.
- In a typical configuration, the global zone is assigned one IP address and labeled zones share a second IP address with the global zone. When an MLP is added to a shared interface, the service packet is routed to the labeled zone where the MLP is defined. The packet is accepted only if the remote host template for the labeled zone includes the label of the packet. If the range is `ADMIN_LOW` to `ADMIN_HIGH`, then all packets are accepted. A narrower range would discard packets that are not within the range.

  At most, one zone can define a particular port to be an MLP on a shared interface. In the preceding scenario, where the `ssh` port is configured as a shared MLP in a non-global zone, no other zone can receive `ssh` connections on the shared address. However, the global zone could define the `ssh` port as a private MLP for receipt of connections on its zone-specific address.
- On a system where the global zone and the labeled zones share an IP address, an MLP for the `ssh` service could be added to one zone. If the MLP for `ssh` is added to the global zone, then no labeled zone can add an MLP for the `ssh` service. Similarly, if the MLP for the `ssh` service is added to a labeled zone, then the global zone cannot be configured with an `ssh` MLP.

For an example of adding MLPs to labeled zones, see Example 13–16.

Zones and ICMP in Trusted Extensions

Networks transmit broadcast messages and send ICMP packets to systems on the network. On a multilevel system, these transmissions could flood the system at every label. By default, the network policy for labeled zones requires that ICMP packets be received only at the matching label.

Global Zone Processes and Labeled Zones

In Trusted Extensions, MAC policy applies to all processes, including processes in the global zone. Processes in the global zone run at the label `ADMIN_HIGH`. When files from a global zone are shared, they are shared at the label `ADMIN_LOW`. Therefore, because MAC prevents a higher-labeled process from modifying a lower-level object, the global zone usually cannot write to an NFS-mounted system.

However, in a limited number of cases, actions in a labeled zone can require that a global zone process modify a file in that zone.

To enable a global zone process to mount a remote file system with read/write permissions, the mount must be under the zone path of the zone whose label corresponds to that of the remote file system. But it must not be mounted under that zone's root path.

- The mounting system must have a zone at the identical label as the remote file system.
- The system must mount the remote file system under the zone path of the identically labeled zone.

  The system must *not* mount the remote file system under the *zone root path* of the identically labeled zone

Consider a zone that is named `public` at the label `PUBLIC`. The *zone path* is `/zone/public/`. All directories under the zone path are at the label `PUBLIC`, as in:

```
/zone/public/dev
/zone/public/etc
/zone/public/home/username
/zone/public/root
/zone/public/usr
```

Of the directories under the zone path, only files under `/zone/public/root` are visible from the public zone. All other directories and files at the label `PUBLIC` are accessible only from the global zone. The path `/zone/public/root` is the *zone root path*.

From the perspective of the public zone administrator, the zone root path is visible as `/`. Similarly, the public zone administrator cannot access a user's home directory in the zone path, `/zone/public/home/`*username* directory. That directory is visible only from the global zone. The public zone mounts that directory in the zone root path as `/home/`*username*. From the perspective of the global zone, that mount is visible as `/zone/public/root/home/`*username*.

The public zone administrator can modify `/home/`*username*. A global zone process, when files in a user's home directory need to be modified, does not use that path. The global zone uses the user's home directory in the zone path, `/zone/public/home/`*username*.

- Files and directories that are under the zone path, `/zone/`*zonename*`/`, but not under the zone root path, `/zone/`*zonename*`/root` directory, can be modified by a global zone process that runs at the label `ADMIN_HIGH`.
- Files and directories that are under the zone root path, `/zone/public/root`, can be modified by the labeled zone administrator.

For example, when a user allocates a device in the public zone, a global zone process that runs at the label `ADMIN_HIGH` modifies the `dev` directory in the zone path, `/zone/public/dev`. Similarly, when a user saves a desktop configuration, the desktop configuration file is modified by a global zone process in the `/zone/public/home/`*username*. Finally, to share files from a labeled zone, the global zone administrator creates the configuration file, `dfstab`, in the zone path, `/zone/public/etc/dfs/dfstab`. A labeled zone administrator cannot access that file, and cannot share files from the labeled zone. To share a labeled directory, see "How to Share Directories From a Labeled Zone" on page 140.

Zone Administration Utilities in Trusted Extensions

Some zone administration tasks can be performed from the command line. However, the simplest way to administer zones is to use the GUIs that Trusted Extensions provides:

- The configuration of zone security attributes is performed by using the Trusted Network Zones tool in the Solaris Management Console. For a description of the tool, see "Trusted Network Zones Tool" on page 41. For examples of zone configuration and creation, see Chapter 4, "Configuring Trusted Extensions (Tasks)," in *Oracle Solaris Trusted Extensions Configuration Guide* and "How to Create a Multilevel Port for a Zone" on page 130.
- The shell script, `/usr/sbin/txzonemgr`, provides a menu-based wizard for creating, installing, initializing, and booting zones. If you are administering zones from Solaris Trusted Extensions (JDS), use the `txzonemgr` script rather than Trusted CDE actions. `txzonemgr` uses the `zenity` command. For details, see the `zenity`(1) man page.
- In Trusted CDE, the configuration and creation of zones can be performed by using actions in the Trusted_Extensions folder. For a description of the actions, see "Trusted CDE Actions" on page 35. For procedures that use the actions, see "How to Start CDE Administrative Actions in Trusted Extensions" on page 53.

Managing Zones (Task Map)

The following task map describes zone management tasks that are specific to Trusted Extensions. The map also points to common procedures that are performed in Trusted Extensions just as they are performed on an Oracle Solaris system.

Task	Description	For Instructions
View all zones.	At any label, views the zones that are dominated by the current zone.	"How to Display Ready or Running Zones" on page 121
View mounted directories.	At any label, views the directories that are dominated by the current label.	"How to Display the Labels of Mounted Files" on page 122
Enable regular users to view an `/etc` file.	Loopback mounts a directory or file from the global zone that is not visible by default in a labeled zone.	"How to Loopback Mount a File That Is Usually Not Visible in a Labeled Zone" on page 123
Prevent regular users from viewing a lower-level home directory from a higher label.	By default, lower-level directories are visible from higher-level zones. When you disable the mounting of one lower-level zone, you disable all mounts of lower-level zones.	"How to Disable the Mounting of Lower-Level Files" on page 124
Configure a zone to enable the changing of the labels on files.	Labeled zones have limited privileges. By default, labeled zones do not have the privilege that enables an authorized user to relabel a file. You modify the zone configuration to add the privilege.	"How to Enable Files to be Relabeled From a Labeled Zone" on page 128
Move a file or directory into or out of a labeled zone.	Changes a file or directory's level of security by changing its label.	"How to Move Files Between Labels in Trusted CDE" in *Oracle Solaris Trusted Extensions User's Guide*
Attach a ZFS dataset to a labeled zone and share it.	Mounts a ZFS dataset with read/write permissions in a labeled zone and shares the dataset read-only with a higher zone.	"How to Share a ZFS Dataset From a Labeled Zone" on page 125.
Configure a new zone.	Creates a zone at a label that is not currently being used to label a zone on this system.	See "Name and Label the Zone" in *Oracle Solaris Trusted Extensions Configuration Guide*. Then, follow the procedure that the initial setup team used to create the other zones. For the steps, see "Creating Labeled Zones" in *Oracle Solaris Trusted Extensions Configuration Guide*.

Task	Description	For Instructions
Create a multilevel port for an application.	Multilevel ports are useful for programs that require a multilevel feed into a labeled zone.	"How to Configure a Multilevel Port for NFSv3 Over udp" on page 129 "How to Create a Multilevel Port for a Zone" on page 130
Troubleshoot NFS mount and access problems.	Debugs general access issues for mounts and possibly for zones.	"How to Troubleshoot Mount Failures in Trusted Extensions" on page 146
Remove a labeled zone.	Completely removes a labeled zone from the system.	"How to Remove a Non-Global Zone" in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*

▼ How to Display Ready or Running Zones

This procedure creates a shell script that displays the labels of the current zone and all zones that the current zone dominates.

Before You Begin You must be in the System Administrator role in the global zone.

1 Use the trusted editor to create the `getzonelabels` script.

For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

Provide the pathname to the script, such as `/usr/local/scripts/getzonelabels`.

2 Add the following content, and save the file:

```
#!/bin/sh
#
echo "NAME\t\tSTATUS\t\tLABEL"
echo "====\t\t======\t\t====="
myzone=‘zonename‘
for i in ‘/usr/sbin/zoneadm list -p‘ ; do
        zone=‘echo $i | cut -d ":" -f2‘
        status=‘echo $i | cut -d ":" -f3‘
        path=‘echo $i | cut -d ":" -f4‘
        if [ $zone != global ]; then
                if [ $myzone = global ]; then
                        path=$path/root/tmp
                else
                        path=$path/export/home
                fi
        fi
        label=‘/usr/bin/getlabel -s $path |cut -d ":" -f2-9‘
        if [ ‘echo $zone|wc -m‘ -lt 8 ]; then
                echo "$zone\t\t$status\t$label"
        else
                echo "$zone\t$status\t$label"
        fi
done
```

3 Test the script in the global zone.

```
# getzonelabels
NAME            STATUS          LABEL
====            ======          =====
global          running         ADMIN_HIGH
needtoknow      running         CONFIDENTIAL : NEED TO KNOW
restricted      ready           CONFIDENTIAL : RESTRICTED
internal        running         CONFIDENTIAL : INTERNAL
public          running         PUBLIC
```

When run from the global zone, the script displays the labels of all ready or running zones. Here is the global zone output for the zones that were created from the default `label_encodings` file:

Example 10–1 Displaying the Labels of All Ready or Running Zones

In the following example, a user runs the `getzonelabels` script in the `internal` zone.

```
# getzonelabels
NAME            STATUS          LABEL
====            ======          =====
internal        running         CONFIDENTIAL : INTERNAL
public          running         PUBLIC
```

▼ How to Display the Labels of Mounted Files

This procedure creates a shell script that displays the mounted file systems of the current zone. When run from the global zone, the script displays the labels of all mounted file systems in every zone.

Before You Begin You must be in the System Administrator role in the global zone.

1 Use the trusted editor to create the `getmounts` script.

For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

Provide the pathname to the script, such as `/usr/local/scripts/getmounts`.

2 Add the following content and save the file:

```
#!/bin/sh
#
for i in `/usr/sbin/mount -p | cut -d " " -f3` ; do
        /usr/bin/getlabel $i
done
```

3 Test the script in the global zone.

```
# /usr/local/scripts/getmounts
/:      ADMIN_LOW
/dev:   ADMIN_LOW
/kernel:        ADMIN_LOW
```

```
/lib:   ADMIN_LOW
/opt:   ADMIN_LOW
/platform:      ADMIN_LOW
/sbin:  ADMIN_LOW
/usr:   ADMIN_LOW
/var/tsol/doors:        ADMIN_LOW
/zone/needtoknow/export/home:   CONFIDENTIAL : NEED TO KNOW
/zone/internal/export/home:     CONFIDENTIAL : INTERNAL USE ONLY
/zone/restricted/export/home:   CONFIDENTIAL : RESTRICTED
/proc:  ADMIN_LOW
/system/contract:       ADMIN_LOW
/etc/svc/volatile:      ADMIN_LOW
/etc/mnttab:    ADMIN_LOW
/dev/fd:        ADMIN_LOW
/tmp:           ADMIN_LOW
/var/run:       ADMIN_LOW
/zone/public/export/home:  PUBLIC
/root:          ADMIN_LOW
```

Example 10–2 Displaying the Labels of File Systems in the `restricted` Zone

When run from a labeled zone by a regular user, the `getmounts` script displays the labels of all the mounted file systems in that zone. On a system where zones are created for every label in the default `label_encodings` file, the following is the output from the `restricted` zone:

```
# /usr/local/scripts/getmounts
/:      CONFIDENTIAL : RESTRICTED
/dev:   CONFIDENTIAL : RESTRICTED
/kernel:        ADMIN_LOW
/lib:   ADMIN_LOW
/opt:   ADMIN_LOW
/platform:      ADMIN_LOW
/sbin:  ADMIN_LOW
/usr:   ADMIN_LOW
/var/tsol/doors:        ADMIN_LOW
/zone/needtoknow/export/home:   CONFIDENTIAL : NEED TO KNOW
/zone/internal/export/home:     CONFIDENTIAL : INTERNAL USE ONLY
/proc:  CONFIDENTIAL : RESTRICTED
/system/contract:       CONFIDENTIAL : RESTRICTED
/etc/svc/volatile:      CONFIDENTIAL : RESTRICTED
/etc/mnttab:    CONFIDENTIAL : RESTRICTED
/dev/fd:        CONFIDENTIAL : RESTRICTED
/tmp:   CONFIDENTIAL : RESTRICTED
/var/run:       CONFIDENTIAL : RESTRICTED
/zone/public/export/home:       PUBLIC
/home/gfaden:   CONFIDENTIAL : RESTRICTED
```

▼ How to Loopback Mount a File That Is Usually Not Visible in a Labeled Zone

This procedure enables a user in a specified labeled zone to view files that are not exported from the global zone by default.

Before You Begin You must be in the System Administrator role in the global zone.

1 Halt the zone whose configuration you want to change.

```
# zoneadm -z zone-name halt
```

2 Loopback mount a file or directory.

For example, enable ordinary users to view a file in the `/etc` directory.

```
# zonecfg -z zone-name
 add filesystem
 set special=/etc/filename
 set directory=/etc/filename
 set type=lofs
 add options [ro,nodevices,nosetuid]
 end
 exit
```

Note – Certain files are not used by the system, so that loopback mounting them has no effect. For example, the `/etc/dfs/dfstab` file in a labeled zone is not checked by Trusted Extensions software. For more information, see "Sharing Files From a Labeled Zone" on page 135.

3 Start the zone.

```
# zoneadm -z zone-name boot
```

Example 10–3 Loopback Mounting the `/etc/passwd` file

In this example, the security administrator wants to enable testers and programmers to check that their local passwords are set. After the `sandbox` zone is halted, it is configured to loopback mount the `passwd` file. Then, the zone is restarted.

```
# zoneadm -z sandbox halt
# zonecfg -z sandbox
 add filesystem
    set special=/etc/passwd
    set directory=/etc/passwd
    set type=lofs
    add options [ro,nodevices,nosetuid]
 end
 exit
# zoneadm -z sandbox boot
```

▼ How to Disable the Mounting of Lower-Level Files

By default, users can view lower-level files. Remove the `net_mac_aware` privilege to prevent the viewing of all lower-level files from a particular zone. For a description of the `net_mac_aware` privilege, see the `privileges(5)` man page.

Before You Begin You must be in the System Administrator role in the global zone.

1. **Halt the zone whose configuration you want to change.**

   ```
   # zoneadm -z zone-name halt
   ```

2. **Configure the zone to prevent the viewing of lower-level files.**

   Remove the `net_mac_aware` privilege from the zone.

   ```
   # zonecfg -z zone-name
    set limitpriv=default,!net_mac_aware
    exit
   ```

3. **Restart the zone.**

   ```
   # zoneadm -z zone-name boot
   ```

Example 10–4 Preventing Users From Viewing Lower-Level Files

In this example, the security administrator wants to prevent users on one system from being confused. Therefore, users can only view files at the label at which the users are working. So, the security administrator prevents the viewing of all lower-level files. On this system, users cannot see publicly available files unless they are working at the `PUBLIC` label. Also, users can only NFS mount files at the label of the zones.

```
# zoneadm -z restricted halt
# zonecfg -z restricted
 set limitpriv=default,!net_mac_aware
 exit
# zoneadm -z restricted boot

# zoneadm -z needtoknow halt
# zonecfg -z needtoknow
 set limitpriv=default,!net_mac_aware
 exit
# zoneadm -z needtoknow boot

# zoneadm -z internal halt
# zonecfg -z internal
 set limitpriv=default,!net_mac_aware
 exit
# zoneadm -z internal boot
```

Because `PUBLIC` is the lowest label, the security administrator does not run the commands for the `PUBLIC` zone.

▼ How to Share a ZFS Dataset From a Labeled Zone

In this procedure, you mount a ZFS dataset with read/write permissions in a labeled zone. Because all commands are executed in the global zone, the global zone administrator controls the addition of ZFS datasets to labeled zones.

At a minimum, the labeled zone must be in the `ready` state to share a dataset. The zone can be in the `running` state.

Before You Begin To configure the zone with the dataset, you first halt the zone.

1 Create the ZFS dataset.

```
# zfs create datasetdir/subdir
```

The name of the dataset can include a directory, such as `zone/data`.

2 In the global zone, halt the labeled zone.

```
# zoneadm -z labeled-zone-name halt
```

3 Set the mount point of the dataset.

```
# zfs set mountpoint=legacy datasetdir/subdir
```

Setting the ZFS `mountpoint` property sets the label of the mount point when the mount point corresponds to a labeled zone.

4 Add the dataset to the zone as a file system.

```
# zonecfg -z labeled-zone-name
# zonecfg:labeled-zone-name> add fs
# zonecfg:labeled-zone-name:dataset> set dir=/subdir
# zonecfg:labeled-zone-name:dataset> set special=datasetdir/subdir
# zonecfg:labeled-zone-name:dataset> set type=zfs
# zonecfg:labeled-zone-name:dataset> end
# zonecfg:labeled-zone-name> exit
```

By adding the dataset as a file system, the dataset is mounted at `/data` in the zone before the `dfstab` file is interpreted. This step ensures that the dataset is not mounted before the zone is booted. Specifically, the zone boots, the dataset is mounted, then the `dfstab` file is interpreted.

5 Share the dataset.

Add an entry for the dataset file system to the `/zone/`*labeled-zone-name*`/etc/dfs/dfstab` file. This entry also uses the */subdir* pathname.

```
share -F nfs -d "dataset-comment" /subdir
```

6 Boot the labeled zone.

```
# zoneadm -z labeled-zone-name boot
```

When the zone is booted, the dataset is mounted automatically as a read/write mount point in the *labeled-zone-name* zone with the label of the *labeled-zone-name* zone.

Example 10–5 Sharing and Mounting a ZFS Dataset From Labeled Zones

In this example, the administrator adds a ZFS dataset to the `needtoknow` zone and shares the dataset. The dataset, `zone/data`, is currently assigned to the `/mnt` mount point. Users in the `restricted` zone can view the dataset.

First, the administrator halts the zone.

```
# zoneadm -z needtoknow halt
```

Because the dataset is currently assigned to a different mount point, the administrator removes the previous assignment, then sets the new mount point.

```
# zfs set zoned=off zone/data
# zfs set mountpoint=legacy zone/data
```

Next, in the `zonecfg` interactive interface, the administrator explicitly adds the dataset to the `needtoknow` zone.

```
# zonecfg -z needtoknow
# zonecfg:needtoknow> add fs
# zonecfg:needtoknow:dataset> set dir=/data
# zonecfg:needtoknow:dataset> set special=zone/data
# zonecfg:needtoknow:dataset> set type=zfs
# zonecfg:needtoknow:dataset> end
# zonecfg:needtoknow> exit
```

Next, the administrator modifies the `/zone/needtoknow/etc/dfs/dfstab` file to share the dataset, then boots the `needtoknow` zone.

```
## Global zone dfstab file for needtoknow zone
share  -F nfs  -d "App Data on ZFS"  /data

# zoneadm -z needtoknow boot
```

The dataset is now accessible.

Users in the the `restricted` zone, which dominates the `needtoknow` zone, can view the mounted dataset by changing to the `/data` directory. They use the full path to the mounted dataset from the perspective of the global zone. In this example, `machine1` is the host name of the system that includes the labeled zone. The administrator assigned this host name to a non-shared IP address.

```
# cd /net/machine1/zone/needtoknow/root/data
```

Troubleshooting If the attempt to reach the dataset from the higher label returns the error `not found` or `No such file or directory`, the administrator must restart the automounter service by running the `svcadm restart autofs` command.

How to Enable Files to be Relabeled From a Labeled Zone

This procedure is a prerequisite for a user to be able to relabel files.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Halt the zone whose configuration you want to change.**

   ```
   # zoneadm -z zone-name halt
   ```

2. **Configure the zone to enable relabeling.**

   Add the appropriate privileges to the zone. The windows privileges enable users to use drag-and-drop and cut-and-paste operations.

   - **To enable downgrades, add the `file_downgrade_sl` privilege to the zone.**

     ```
     # zonecfg -z zone-name
      set limitpriv=default,win_dac_read,win_mac_read,win_dac_write,
      win_mac_write,win_selection,file_downgrade_sl
      exit
     ```

   - **To enable upgrades, add the `sys_trans_label` and `file_upgrade_sl` privileges to the zone.**

     ```
     # zonecfg -z zone-name
      set limitpriv=default,win_dac_read,win_mac_read,win_dac_write,
      win_mac_write,win_selection,sys_trans_label,file_upgrade_sl
      exit
     ```

   - **To enable both upgrades and downgrades, add all three privileges to the zone.**

     ```
     # zonecfg -z zone-name
      set limitpriv=default,win_dac_read,win_mac_read,win_dac_write,
      win_mac_write,win_selection,sys_trans_label,file_downgrade_sl,
      file_upgrade_sl
      exit
     ```

3. **Restart the zone.**

   ```
   # zoneadm -z zone-name boot
   ```

   For the user and process requirements that permit relabeling, see the `setflabel`(3TSOL) man page. To authorize a user to relabel files, see "How to Enable a User to Change the Security Level of Data" on page 96.

Example 10–6 Enabling Upgrades From the `internal` Zone

In this example, the security administrator wants to enable authorized users on a system to upgrade files. By enabling users to upgrade information, the administrator enables them to protect the information at a higher level of security. In the global zone, the administrator runs the following zone administration commands.

```
# zoneadm -z internal halt
# zonecfg -z internal
 set limitpriv=default,sys_trans_label,file_upgrade_sl
 exit
# zoneadm -z internal boot
```

Authorized users can now upgrade `internal` information to `restricted` from the `internal` zone.

Example 10–7 Enabling Downgrades From the `restricted` Zone

In this example, the security administrator wants to enable authorized users on a system to downgrade files. Because the administrator does not add windows privileges to the zone, authorized users cannot use the File Manager to relabel files. To relabel files, users use the `setlabel` command.

By enabling users to downgrade information, the administrator permits users at a lower level of security to access the files. In the global zone, the administrator runs the following zone administration commands.

```
# zoneadm -z restricted halt
# zonecfg -z restricted
 set limitpriv=default,file_downgrade_sl
 exit
# zoneadm -z restricted boot
```

Authorized users can now downgrade `restricted` information to `internal` or `public` from the `restricted` zone by using the `setlabel` command.

▼ How to Configure a Multilevel Port for NFSv3 Over `udp`

This procedure is used to enable NFSv3 read-down mounts over `udp`. The Solaris Management Console is used to add the MLP.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Start the Solaris Management Console.**

   For details, see "How to Administer the Local System With the Solaris Management Console" on page 52.

2. **Choose the Files toolbox.**
   The title of the toolbox includes `Scope=Files, Policy=TSOL`.
3. **Configure the zone and the MLP.**
   a. **Navigate to the Trusted Network Zones tool.**
   b. **Double-click the global zone.**
   c. **Add a multilevel port for the UDP protocol:**
      i. **Click Add for the Multilevel Ports for Zone's IP Addresses.**
      ii. **Type 2049 for the port number, and click OK.**
   d. **Click OK to save the settings.**
4. **Close the Solaris Management Console.**
5. **Update the kernel.**

```
# tnctl -fz /etc/security/tsol/tnzonecfg
```

▼ How to Create a Multilevel Port for a Zone

This procedure is used when an application that runs in a labeled zone requires a multilevel port (MLP) to communicate with the zone. In this procedure, a web proxy communicates with the zone. The Solaris Management Console is used to add the MLP.

Before You Begin You must be in the Security Administrator role in the global zone. The labeled zone must exist. For details, see "Creating Labeled Zones" in *Oracle Solaris Trusted Extensions Configuration Guide*.

1. **Start the Solaris Management Console.**
   For details, see "How to Administer the Local System With the Solaris Management Console" on page 52.
2. **Choose the Files toolbox.**
   The title of the toolbox includes `Scope=Files, Policy=TSOL`.
3. **Add the proxy host and the webservices host to the list of computers.**
   a. **Under System Configuration, navigate to the Computers and Networks tool.**

b. **In the Computers tool, click the Action menu and choose Add Computer.**

c. **Add the host name and IP address for the proxy host.**

d. **Save the changes.**

e. **Add the host name and IP address for the webservice host.**

f. **Save the changes.**

4 **Configure the zone and the MLP.**

a. **Navigate to the Trusted Network Zones tool.**

b. **Select the labeled zone.**

c. **In the MLP Configuration for Local IP Addresses section, specify the appropriate port/protocol field.**

d. **Save the changes.**

5 **For the zone, customize a template by completing the following steps:**

a. **Navigate to the Security Templates tool.**
Click the Action menu and choose Add Template.

b. **Use the host name for the template name.**

c. **Specify CIPSO for the Host Type.**

d. **Use the label of the zone for the Minimum Label and for the Maximum Label.**

e. **Assign the zone label to the Security Label Set.**

f. **Select the Hosts Explicitly Assigned tab.**

g. **In the Add an Entry section, add the IP address that is associated with the zone.**

h. **Save the changes.**

6 **Close the Solaris Management Console.**

7 **Start the zones.**

```
# zoneadm -z zone-name boot
```

8 In the global zone, add routes for the new addresses.

For example, if the zones have a shared IP address, do the following:

```
# route add proxy labeled-zones-IP-address
# route add webservice labeled-zones-IP-address
```

◆ ◆ ◆ CHAPTER 11

Managing and Mounting Files in Trusted Extensions (Tasks)

This chapter describes how LOFS and NFS mounts work on a system that is configured with Trusted Extensions. This chapter also covers how to back up and restore files.

Sharing and Mounting Files in Trusted Extensions

Trusted Extensions software supports the same file systems and file system management commands as the Oracle Solaris OS. Trusted Extensions adds the ability for a non-global zone to share files. In addition, Trusted Extensions attaches a unique label to every non-global zone. All the files and directories that belong to that zone are mounted at the label of the zone. Any shared file systems that belong to other zones or to NFS servers are mounted at the label of the owner. Trusted Extensions prevents any mounts that would violate the mandatory access control (MAC) policies for labeling. For example, a zone's label must dominate all of its mounted file system labels, and only equally labeled file systems can be mounted with read/write permissions.

NFS Mounts in Trusted Extensions

NFS mounts in Trusted Extensions are similar to Oracle Solaris mounts. The differences occur in the use of zone root pathnames when mounting a labeled zone in Trusted Extensions, and in the enforcement of MAC policy.

NFS shares in Trusted Extensions are similar to Oracle Solaris shares in a global zone. However, the sharing of files from a labeled zone on a multilevel system is unique to Trusted Extensions:

- **Shares and mounts in the global zone –** Sharing and mounting files in the global zone of a Trusted Extensions system is almost identical to the procedure in the Oracle Solaris OS. For mounting files, the automounter, the `vfstab` file, and the `mount` command can be used. For sharing files, the `dfstab` file is used.
- **Mounts in labeled zones –** Mounting files in labeled zones in Trusted Extensions is almost identical to mounting files in non-global zones in the Oracle Solaris OS. For mounting files, the automounter, the `vfstab` file, and the `mount` command can be used. In Trusted Extensions, a unique `automount_home_`*label* configuration file exists for each labeled zone.
- **Shares in labeled zones –** Files in a labeled zone can be shared at the label of the zone by using a `dfstab` file that is at the label of the zone, but is visible to the global zone only. So, configuring a labeled zone to share files is performed by the global zone administrator in the global zone. This configuration file is not visible from its labeled zone. For more discussion, see "Global Zone Processes and Labeled Zones" on page 118.

Labels affect which files can be mounted. Files are shared and mounted at a particular label. For a Trusted Extensions client to write to a file that is NFS-mounted, the file must be mounted with read/write permissions *and* be at the same label as the client. If you are mounting a file between two Trusted Extensions hosts, the server and the client must have compatible remote host templates of type `cipso`. If you are mounting a file between a Trusted Extensions host and an unlabeled host, files that are at the single label that is specified for the unlabeled host in the `tnrhdb` file can be mounted. Files that are mounted with LOFS can be viewed, but cannot be modified. For details on NFS mounts, see "Access to NFS Mounted Directories in Trusted Extensions" on page 135.

Labels also affect which directories and files can be viewed. By default, lower-level objects are available in a user's environment. Therefore, in the default configuration, a regular user can view files that are in a zone at a lower level than the user's current level. For example, users can see their lower-level home directories from a higher label. For details, see "Home Directory Creation in Trusted Extensions" on page 136.

If site security forbids the viewing of lower-level objects, you can make lower-level directories invisible to the user. For details, see "How to Disable the Mounting of Lower-Level Files" on page 124.

The mount policy in Trusted Extensions has no MAC overrides. Mounted files that are visible at a lower label can never be modified by a higher-label process. This MAC policy is also in effect in the global zone. A global zone `ADMIN_HIGH` process cannot modify an NFS-mounted file at a lower label, such as a `PUBLIC` file or an `ADMIN_LOW` file. MAC policies enforce the default configuration and are invisible to regular users. Regular users cannot see objects unless they have MAC access to them.

Sharing Files From a Labeled Zone

In the Oracle Solaris OS, a non-global zone cannot share directories from its zone. However, in Trusted Extensions, a labeled zone can share directories. The specification of which directories in a labeled zone can be shared is performed in the global zone by using a directory that is outside the `root` path of the zone. For more discussion, see "Global Zone Processes and Labeled Zones" on page 118.

`/zone/`*labeled-zone*`/`*directories*	Also called the zone path. Is the path from the global zone to the labeled zone. Every directory under *labeled-zone* is labeled the same as the zone.
`/zone/`*labeled-zone*`/root/`*directories*	Also called the zone root path. Is the `root` path of a labeled zone from the perspective of the global zone. From the perspective of the labeled zone, this is the zone's root, the `/` directory. This path is not used by the global zone to administer the zone.

To share directories from a labeled zone, the global zone administrator creates and modifies the `dfstab` file in the `/etc` directory of the zone path:

`/zone/`*labeled-zone*`/etc/dfs/dfstab`

This `/etc` directory is not visible from the labeled zone. This directory is distinct from the `/etc` directory that is visible from the zone:

```
Global zone view: /zone/labeled-zone/root/etc
Labeled zone view of the same directory: /etc
```

A `dfstab` file in this path does not enable labeled directories to be shared.

When the status of the labeled zone is `ready` or `running`, the files that are listed in the `/zone/`*labeled-zone*`/etc/dfs/dfstab` file are shared at the label of the zone. For the procedure, see "How to Share Directories From a Labeled Zone" on page 140.

Access to NFS Mounted Directories in Trusted Extensions

By default, NFS-mounted file systems are visible at the label of the exported file system. If the file system is exported with read/write permissions, users at that label can write to the files. NFS mounts that are at a lower label than the user's current session are visible to the user, but cannot be written to. Even if a file system is shared with read/write permissions, the mounting system can write to it only at the label of the mount.

To make lower-level directories that are NFS-mounted visible to users in a higher-level zone, the administrator of the global zone on the NFS server must export the parent directory. The

parent directory is exported at its label. On the client side, each zone must have the `net_mac_aware` privilege. By default, labeled zones include the `net_mac_aware` privilege in their `limitpriv` set.

- **Server configuration** – On the NFS server, you export the parent directory in a `dfstab` file. If the parent directory is in a labeled zone, the `dfstab` file must be modified in the labeled zone of the parent directory. The `dfstab` file for a labeled zone is visible only from the global zone. For the procedure, see "How to Share Directories From a Labeled Zone" on page 140.
- **Client configuration** – The `net_mac_aware` privilege must be specified in the zone configuration file that is used during initial zone configuration. So, a user who is permitted to view all lower-level home directories must have the `net_mac_aware` privilege in every zone, except the lowest zone. For an example, see "How to NFS Mount Files in a Labeled Zone" on page 142.

EXAMPLE 11–1 Providing Access to Lower-Level Home Directories

On the home directory server, the administrator creates and modifies the `/zone/`*labeled-zone*`/etc/dfs/dfstab` file in every labeled zone. The `dfstab` file exports the `/export/home` directory with read/write permissions. Thus, when the directory is mounted at the same label, the home directory is writable. To export the `/export/home` directory of `PUBLIC`, the administrator creates a workspace at the `PUBLIC` label on the home directory server, and from the global zone, modifies the `/zone/public/etc/dfs/dfstab` file.

On the client, the administrator of the global zone checks that every labeled zone, except the lowest label, has the `net_mac_aware` privilege. This privilege permits the mount. This privilege can be specified by using the `zonecfg` command during zone configuration. The lower-level home directory can only be viewed. MAC protects the files in the directory from modification.

Home Directory Creation in Trusted Extensions

Home directories are a special case in Trusted Extensions. You need to make sure that the home directories are created in every zone that a user can use. Also, the home directory mount points must be created in the zones on the user's system. For NFS-mounted home directories to work correctly, the conventional location for directories, `/export/home`, must be used. In Trusted Extensions, the automounter has been modified to handle home directories in every zone, that is, at every label. For details, see "Changes to the Automounter in Trusted Extensions" on page 137.

Home directories are created when users are created. In Trusted Extensions, the Solaris Management Console (Console) is used to create users, so the Console creates the home directories. However, the Console creates the home directories in the global zone of the home directory server. On that server, the directories are mounted by LOFS. Home directories are automatically created by the automounter if they are specified as LOFS mounts.

Note – When you delete a user by using the Console, only the user's home directory in the global zone is deleted. The user's home directories in the labeled zones are not deleted. You are responsible for archiving and deleting the home directories in the labeled zones. For the procedure, see "How to Delete a User Account From a Trusted Extensions System" on page 97.

However, the automounter cannot automatically create home directories on remote NFS servers. Either the user must first log in to the NFS server or administrative intervention is required. To create home directories for users, see "Enable Users to Access Their Home Directories in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

Changes to the Automounter in Trusted Extensions

In Trusted Extensions, each label requires a separate home directory mount. The `automount` command has been modified to handle these labeled automounts. For each zone, the automounter, `autofs`, mounts an `auto_home_`*zone-name* file. For example, the following is the entry for the global zone in the `auto_home_global` file:

```
+auto_home_global
*       -fstype=lofs    :/export/home/&
```

When a zone that permits lower-level zones to be mounted is booted, the following occurs. The home directories of lower-level zones are mounted read only under `/zone/<`*zone-name*`>/export/home`. The `auto_home_<`*zone-name*`>` map specifies the `/zone` path as the source directory for an `lofs` remount onto `/zone/<`*zone-name*`>/home/<`*username*`>`.

For example, the following is an `auto_home_public` entry in an `auto_home_`*zone-at-higher-label* map that is generated from a higher-level zone:

```
+auto_home_public
*       -fstype=lofs    :/zone/public/export/home/&
```

The following is the corresponding entry in the public zone:

```
auto_home_public
*       -fstype=lofs    :/export/home/&
```

When a home directory is referenced and the name does not match any entries in the `auto_home_<`*zone-name*`>` map, the map tries to match this loopback mount specification. The software creates the home directory when the following two conditions are met:

1. The map finds the match of the loopback mount specification
2. The home directory name matches a valid user whose home directory does not yet exist in *zone-name*

For details on changes to the automounter, see the automount(1M) man page.

Trusted Extensions Software and NFS Protocol Versions

In the Solaris 10 11/06 and Solaris 10 8/07 releases, Trusted Extensions recognizes multiple labels on NFS Version 4 (NFSv4) only. Starting in the Solaris 10 5/08 release, Trusted Extensions software recognizes labels on NFS Version 3 (NFSv3) and NFSv4. You can use one of the following sets of mount options:

```
vers=4 proto=tcp
vers=3 proto=tcp
vers=3 proto=udp
```

Trusted Extensions has no restrictions on mounts over the `tcp` protocol. In NFSv3 and NFSv4, the `tcp` protocol can be used for same-label mounts and for read-down mounts. Read-down mounts require a multilevel port (MLP).

For NFSv3, Trusted Extensions behaves like the Oracle Solaris OS. The `udp` protocol is the default for NFSv3, but `udp` is used only for the initial mount operation. For subsequent NFS operations, the system uses `tcp`. Therefore, read-down mounts work for NFSv3 in the default configuration.

In the rare case that you have restricted NFSv3 mounts to use the udp protocol for initial and subsequent NFS operations, you must create an MLP for NFS operations that use the `udp` protocol. For the procedure, see "How to Configure a Multilevel Port for NFSv3 Over udp" on page 129.

A host that is configured with Trusted Extensions can also share its own file systems with unlabeled hosts. A file or directory that is exported to an unlabeled host is *writable* if its label equals the label that is associated with the remote host in its trusted networking database entries. A file or directory that is exported to an unlabeled host is *readable* only if its label is dominated by the label that is associated with the remote host.

Communications with systems that are running a release of Trusted Solaris software is possible only at a single label. The Trusted Extensions system and the Trusted Solaris system must assign to the other system a template with the unlabeled host type. The unlabeled host types must specify the same single label. As an unlabeled NFS client of a Trusted Solaris server, the label of the client cannot be `ADMIN_LOW`.

The NFS protocol that is used is independent of the local file system's type. Rather, the protocol depends on the type of the sharing computer's operating system. The file system type that is specified to the `mount` command or in the `vfstab` file for remote file systems is always NFS.

Backing Up, Sharing, and Mounting Labeled Files (Task Map)

The following task map describes common tasks that are used to back up and restore data from labeled file systems, and to share and mount directories and files that are labeled.

Task	Description	For Instructions
Back up files.	Protects your data by backing it up.	"How to Back Up Files in Trusted Extensions" on page 139
Restore data.	Restores data from a backup.	"How to Restore Files in Trusted Extensions" on page 140
Share the contents of a directory from a labeled zone.	Allows the contents of a labeled directory to be shared among users.	"How to Share Directories From a Labeled Zone" on page 140
Mount the contents of a directory that was shared by a labeled zone.	Allows the contents of a directory to be mounted in a zone at the same label for read/write. When a higher-level zone mounts the shared directory, the directory is mounted read-only.	"How to NFS Mount Files in a Labeled Zone" on page 142
Create home directory mount points.	Creates mount points for every user at every label. This task enables users to access their home directory on a system that is not the NFS home directory server.	"Enable Users to Access Their Home Directories in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
Hide lower-level information from a user who is working at a higher label.	Prevent the viewing of lower-level information from a higher-level window.	"How to Disable the Mounting of Lower-Level Files" on page 124
Troubleshoot file system mounting problems.	Resolve problems with mounting a file system.	"How to Troubleshoot Mount Failures in Trusted Extensions" on page 146

▼ How to Back Up Files in Trusted Extensions

1. **Assume the Operator role.**

   This role includes the Media Backup rights profile.

2. **Use one of the following backup methods:**

   - `/usr/lib/fs/ufs/ufsdump` for major backups
   - `/usr/sbin/tar cT` for small backups
   - A script calling either of these commands

     For example, the Budtool backup application calls the `ufsdump` command. See the `ufsdump(1M)` man page. For details on the `T` option to the `tar` command, see the `tar(1)` man page.

How to Restore Files in Trusted Extensions

1. **Assume the System Administrator role.**

   This role includes the Media Restore rights profile.

2. **Use one of the following methods:**

   - `/usr/lib/fs/ufs/ufsrestore` for major restores
   - `/usr/sbin/tar xT` for small restores
   - A script calling either of these commands

   For details on the `T` option to the `tar` command, see the `tar(1)` man page.

Caution – Only these commands preserve labels.

How to Share Directories From a Labeled Zone

As in the Oracle Solaris OS, the Mounts and Shares tool in the Solaris Management Console is used to share and mount files from the global zone. The tool cannot be used to mount or share directories that originate in labeled zones. Create a `dfstab` file at the label of the zone, and then restart the zone to share the labeled directories.

Caution – Do not use proprietary names for shared file systems. The names of shared file systems are visible to every user.

Before You Begin You must be superuser, or in the System Administrator role in the global zone on the file server.

1. **Create a workspace at the label of the directory that is going to be shared.**

   For details, see "How to Add a Workspace at a Particular Label" in *Oracle Solaris Trusted Extensions User's Guide*.

2. **Create a `dfstab` file in at the label of that zone.**

   For each zone that will share a directory, repeat the following steps:

   a. **Create the `/etc/dfs` directory in the zone.**

      ```
      # mkdir -p /zone/zone-name/etc/dfs
      ```

   b. **Open the trusted editor.**

      For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

c. Type the full pathname of the `dfstab` file into the editor.

```
# /zone/zone-name/etc/dfs/dfstab
```

d. Add an entry to share a directory from that zone.

The entry describes the directory from the perspective of the zone root path. For example, the following entry shares an application's files at the label of the containing zone:

```
share -F nfs -o ro /viewdir/viewfiles
```

3 For each zone, share the directories by starting the zone.

In the global zone, run one of the following commands for each zone. Each zone can share its directories in any of these ways. The actual sharing occurs when each zone is brought into the `ready` or `running` state.

- **If the zone is not in the running state and you do not want users to log in to the server at the label of the zone, set the zone state to `ready`.**

  ```
  # zoneadm -z zone-name ready
  ```

- **If the zone is not in the running state and users are allowed to log in to the server at the label of the zone, boot the zone.**

  ```
  # zoneadm -z zone-name boot
  ```

- **If the zone is already running, reboot the zone.**

  ```
  # zoneadm -z zone-name reboot
  ```

4 Display the directories that are shared from your system.

```
# showmount -e
```

5 To enable the client to mount the exported files, see "How to NFS Mount Files in a Labeled Zone" on page 142.

Example 11–2 Sharing the `/export/share` Directory at the `PUBLIC` Label

For applications that run at the label `PUBLIC`, the system administrator enables users to read the documentation in the `/export/share` directory of the `public` zone. The zone named `public` runs at the label `PUBLIC`.

First, the administrator creates a `public` workspace and edits the `dfstab` file.

```
# mkdir -p /zone/public/etc/dfs
# /usr/dt/bin/trusted_edit /zone/public/etc/dfs/dfstab
```

In the file, the administrator adds the following entry:

```
## Sharing PUBLIC user manuals
share -F nfs -o ro /export/appdocs
```

The administrator leaves the `public` workspace and returns to the Trusted Path workspace. Because users are not allowed to log in to this system, the administrator shares the files by putting the zone in the ready state:

```
# zoneadm -z public ready
```

Users can access the shared directories once the directories are mounted on the users' systems.

How to NFS Mount Files in a Labeled Zone

In Trusted Extensions, a labeled zone manages the mounting of files in its zone.

Files from unlabeled and labeled hosts can be mounted on a Trusted Extensions labeled host.

- To mount the files read/write from a single-label host, the assigned label of the remote host must be identical to the zone in which the file is being mounted.
- Files that are mounted by a higher-level zone are read-only.
- In Trusted Extensions, the `auto_home` configuration file is customized per zone. The file is named by zone name. For example, a system with a global zone and a public zone has two `auto_home` files, `auto_home_global` and `auto_home_public`.

Trusted Extensions uses the same mounting interfaces as the Oracle Solaris OS:

- To mount files at boot, use the `/etc/vfstab` file in the labeled zone.
- To mount files dynamically, use the `mount` command in the labeled zone.
- To automount home directories, use the `auto_home_`*zone-name* files.
- To automount other directories, use the standard automount maps. If the automount maps are in LDAP, use LDAP commands to manage them.

Before You Begin You must be on the client system, in the zone at the label of the files that you want to mount. Unless you are using the automounter, you must be superuser, or be in the System Administrator role. To mount from lower-level servers, the zone must be configured with the `net_mac_aware` privilege.

- **To NFS mount files in a labeled zone, use the following procedures.**

  Most procedures include creating a workspace at a particular label. To create a workspace, see "How to Add a Workspace at a Particular Label" in *Oracle Solaris Trusted Extensions User's Guide*.

  - **Mount files dynamically.**

    In the labeled zone, use the `mount` command. For an example of mounting files dynamically, see Example 11–3.

- **Mount files when the zone boots**

  In the labeled zone, add the mounts to the `vfstab` file.

  For examples of mounting files when a labeled zone boots, see Example 11–4 and Example 11–5.

- **Mount home directories for systems that are administered with LDAP.**

  a. **At every label, add the user specifications to the `auto_home`_*zone-name* files.**

  b. **Then, use these files to populate the `auto_home`_*zone-name* database on the LDAP server.**

  For an example, see Example 11–6.

- **Mount home directories for systems that are administered with files.**

  a. **Create and populate an `/export/home/auto_home`_*lowest-labeled-zone-name* file.**

  b. **Edit the `/etc/auto_home`_*lowest-labeled-zone-name* file to point to the newly populated file.**

  c. **Modify the `/etc/auto_home`_*lowest-labeled-zone-name* file in every higher-level zone to point to the file that you created in Step a.**

  For an example, see Example 11–7.

Example 11–3 Mounting Files in a Labeled Zone by Using the `mount` Command

In this example, the system administrator mounts a remote file system from a public zone. The public zone is on a multilevel server.

After assuming the System Administrator role, the administrator creates a workspace at the label `PUBLIC`. In that workspace, the administrator runs the `mount` command.

```
# zonename
public
# mount -F nfs remote-sys:/zone/public/root/opt/docs  /opt/docs
```

A single-label file server at the label `PUBLIC` also contains documents to be mounted:

```
# mount -F nfs public-sys:/publicdocs  /opt/publicdocs
```

When the public zone of the `remote-sys` file server is in the `ready` or `running` state, the `remote-sys` files successfully mount on this system. When the `public-sys` file server is running, the files successfully mount.

Example 11–4 Mounting Files Read/Write in a Labeled Zone by Modifying the `vfstab` File

In this example, the system administrator mounts two remote file systems at the label `PUBLIC` in the local system's public zone when the public zone boots. One file system mount is from a multilevel system, and one file system mount is from a single-label system.

After assuming the System Administrator role, the administrator creates a workspace at the label `PUBLIC`. In that workspace, the administrator modifies the `vfstab` file in that zone.

```
## Writable books directories at PUBLIC
remote-sys:/zone/public/root/opt/docs  - /opt/docs  nfs  no  yes  rw
public-sys:/publicdocs    - /opt/publicdocs  nfs no yes rw
```

To access the files in the remote labeled zone of the multilevel system, the `vfstab` entry uses the zone root path of the remote system's public zone, `/zone/public/root`, as the directory pathname to the directories to mount. The path to the single-label system is identical to the path that would be used on an Oracle Solaris system.

In a terminal window at the label `PUBLIC`, the administrator mounts the files.

```
# mountall
```

Example 11–5 Mounting Lower-Level Files in a Labeled Zone by Modifying the `vfstab` File

In this example, the system administrator mounts a remote file system from a public zone in the local system's internal zone. After assuming the System Administrator role, the administrator creates a workspace at the label `INTERNAL`, then modifies the `vfstab` file in that zone.

```
## Readable books directory at PUBLIC
## ro entry indicates that PUBLIC docs can never be mounted rw in internal zone
remote-sys:/zone/public/root/opt/docs  - /opt/docs  nfs  no  yes  ro
```

To access the files in the remote labeled zone, the `vfstab` entry uses the zone root path of the remote system's public zone, `/zone/public/root`, as the directory pathname to the directories to mount.

From the perspective of a user in the internal zone, the files can be accessed at `/opt/docs`.

In a terminal window at the label `INTERNAL`, the administrator mounts the files.

```
# mountall
```

Example 11–6 Mounting Labeled Home Directories in a Network That Is Administered by Using LDAP

In this example, the system administrator enables a new user, `ikuk`, to access her home directory at every label. This site uses two home directory servers, and is administered by using LDAP. The second server contains the home directories for the users `jdoe` and `pkai`. The new user is added to this list.

First, after assuming the System Administrator role, the administrator modifies the `auto_home_`*zone-name* files in the `/etc` directory of the global zone to include the new user on the second home directory server.

```
## auto_home_global file
jdoe   homedir2-server:/export/home/jdoe
pkai   homedir2-server:/export/home/pkai
ikuk   homedir2-server:/export/home/ikuk
*      homedir-server:/export/home/&

## auto_home_internal file
## Mount the home directory from the internal zone of the NFS server
jdoe   homedir2-server:/export/home/jdoe
pkai   homedir2-server:/export/home/pkai
ikuk   homedir2-server:/export/home/ikuk
*      homedir-server:/export/home/&

## auto_home_public
## Mount the home directory from the public zone of the NFS server
jdoe   homedir2-server:/export/home/jdoe
pkai   homedir2-server:/export/home/pkai
ikuk   homedir2-server:/export/home/ikuk
*      homedir-server:/export/home/&
```

Next, to enable the users to log in at all labels, the administrator repeats these edits for the `auto_home_`*zone-name* files at every label.

Finally, after modifying every `auto_home_`*zone-name* file on this system, the administrator uses these files to add entries to the LDAP database.

Similar to the Oracle Solaris OS, the `+auto_home_public` entry in the `/etc/auto_home_`*zone-name* files directs the automounter to the LDAP entries. The `auto_home_`*zone-name* files on other systems on the network are updated from the LDAP database.

Example 11–7 Mounting a Lower-Level Home Directory on a System That Is Administered by Using Files

In this example, the system administrator enables users to access their home directories at every label. The labels at the site are `PUBLIC`, `INTERNAL`, and `NEEDTOKNOW`. This site uses two home directory servers, and is administered by using files. The second server contains the home directories for the users `jdoe` and `pkai`.

To accomplish this task, the system administrator defines the public zone NFS home directories in the public zone, and shares this configuration with the internal and needtoknow zones.

First, after assuming the System Administrator role, the administrator creates a workspace at the label `PUBLIC`. In this workspace, the administrator creates a new file, `/export/home/auto_home_public`. This file contains all the customized per-user NFS specification entries.

```
## /export/home/auto_home_public file at PUBLIC label
jdoe   homedir2-server:/export/home/jdoe
pkai   homedir2-server:/export/home/pkai
*      homedir-server:/export/home/&
```

Second, the administrator modifies the `/etc/auto_home_public` file to point to this new file.

```
## /etc/auto_home_public file in the public zone
## Use /export/home/auto_home_public for the user entries
## +auto_home_public
+ /export/home/auto_home_public
```

This entry directs the automounter to use the contents of the local file.

Third, the administrator similarly modifies the `/etc/auto_home_public` file in the internal and needtoknow zones. The administrator uses the pathname to the public zone that is visible to the internal and needtoknow zones.

```
## /etc/auto_home_public file in the internal zone
## Use /zone/public/export/home/auto_home_public for PUBLIC user home dirs
## +auto_home_public
+ /zone/public/export/home/auto_home_public
```

```
## /etc/auto_home_public file in the needtoknow zone
## Use /zone/public/export/home/auto_home_public for PUBLIC user home dirs
## +auto_home_public
+ /zone/public/export/home/auto_home_public
```

When the administrator adds the new user `ikuk`, the addition is made to the `/export/home/auto_home_public` file at the `PUBLIC` label.

```
## /export/home/auto_home_public file at PUBLIC label
jdoe   homedir2-server:/export/home/jdoe
pkai   homedir2-server:/export/home/pkai
ikuk   homedir2-server:/export/home/ikuk
*      homedir-server:/export/home/&
```

The higher-level zones read down to obtain the per-user home directories from the lower-level public zone.

▼ How to Troubleshoot Mount Failures in Trusted Extensions

Before You Begin You must be in the zone at the label of the files that you want to mount. You must be the superuser, or in the System Administrator role.

1. **Check the security attributes of the NFS server.**

   Use the Security Templates tool in the Solaris Management Console at the appropriate scope. For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

   a. **Verify that the IP address of the NFS server is an assigned host in one of the security templates.**

      The address might be directly assigned, or indirectly assigned through a wildcard mechanism. The address can be in a labeled template, or in an unlabeled template.

   b. **Check the label that the template assigns to the NFS server.**

      The label must be consistent with the label at which you are trying to mount the files.

2. **Check the label of the current zone.**

   If the label is higher than the label of the mounted file system, then you cannot write to the mount even if the remote file system is exported with read/write permissions. You can only write to the mounted file system at the label of the mount.

3. **To mount file systems from an NFS server that is running earlier versions of Trusted Solaris software, do the following:**

   - **For a Trusted Solaris 1 NFS server, use the `vers=2` and `proto=udp` options to the `mount` command.**
   - **For a Trusted Solaris 2.5.1 NFS server, use the `vers=2` and `proto=udp` options to the `mount` command.**
   - **For a Trusted Solaris 8 NFS server, use the `vers=3` and `proto=udp` options to the `mount` command.**

   To mount file systems from any of these servers, the server must be assigned to an unlabeled template.

◆ ◆ ◆ CHAPTER 12

Trusted Networking (Overview)

This chapter describes trusted networking concepts and mechanisms in Trusted Extensions.

The Trusted Network

Trusted Extensions assigns security attributes to zones, hosts, and networks. These attributes ensure that the following security features are enforced on the network:

- Data is properly labeled in network communications.
- Mandatory access control (MAC) rules are enforced when data is sent or received across a local network and when file systems are mounted.
- MAC rules are enforced when data is routed to distant networks.
- MAC rules are enforced when data is routed to zones.

In Trusted Extensions, network packets are protected by MAC. Labels are used for MAC decisions. Data is labeled explicitly or implicitly with a sensitivity label. A label has an ID field, a classification or "level" field, and a compartment or "category" field. Data must pass an accreditation check. This check determines if the label is well formed, and if the label lies within the accreditation range of the receiving host. Well-formed packets that are within the receiving host's accreditation range are granted access.

IP packets that are exchanged between trusted systems can be labeled. Trusted Extensions supports Commercial IP Security Option (CIPSO) labels. A CIPSO label on a packet serves to classify, segregate, and route IP packets. Routing decisions compare the sensitivity label of the data with the label of the destination.

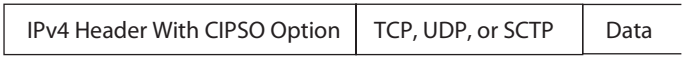
Typically on a trusted network, the label is generated by a sending host and processed by the receiving host. However, a trusted router can also add or strip labels while forwarding packets in a trusted network. A sensitivity label is mapped to a CIPSO label before transmission. The CIPSO label is embedded in the IP packet. Typically, a packet sender and the packet's receiver operate at the same label.

Trusted networking software ensures that the Trusted Extensions security policy is enforced even when the subjects (processes) and objects (data) are located on different hosts. Trusted Extensions networking preserves MAC across distributed applications.

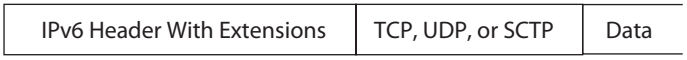
Trusted Extensions Data Packets

Trusted Extensions data packets include a CIPSO label option. The data packets can be sent over IPv4 or IPv6 networks.

In the standard IPv4 format, the IPv4 header with options is followed by a TCP, UDP, or SCTP header and then the actual data. The Trusted Extensions version of an IPv4 packet uses the CIPSO option in the IP header for the security attributes.



In the standard IPv6 format, an IPv6 header with extensions is followed by a TCP, UDP, or SCTP header and then the actual data. The Trusted Extensions IPv6 packet includes a multilevel security option in the header with extensions.



Trusted Network Communications

Trusted Extensions supports labeled and unlabeled hosts on a trusted network. LDAP is a fully supported naming service. Various commands and GUIs enable the network to be administered.

Systems that run Trusted Extensions software support network communications between Trusted Extensions hosts and any of the following types of systems:

- Other systems that are running Trusted Extensions
- Systems that are running operating systems that do not recognize security attributes, but do support TCP/IP, such as Oracle Solaris systems, other UNIX systems, Microsoft Windows, and Macintosh OS systems

- Systems that are running other trusted operating systems that recognize CIPSO labels

As in the Oracle Solaris OS, Trusted Extensions network communications and services can be managed by a naming service. Trusted Extensions adds the following interfaces to Oracle Solaris network interfaces:

- Trusted Extensions adds three network configuration databases, `tnzonecfg`, `tnrhdb`, and `tnrhtp`. For details, see "Network Configuration Databases in Trusted Extensions" on page 152.
- The Trusted Extensions version of the naming service switch file, `nsswitch.conf`, includes entries for the `tnrhtp` and `tnrhdb` databases. These entries can be modified to suit each site's configuration.

  Trusted Extensions uses the LDAP naming service to centrally manage configuration files that define hosts, networks, and users. The default `nsswitch.conf` entries for the trusted network databases for the LDAP naming service follow:

  ```
  # Trusted Extensions
  tnrhtp: files ldap
  tnrhdb: files ldap
  ```

  The LDAP naming service on a Sun Java System Directory Server is the only fully supported naming service in Trusted Extensions. For information about the use of LDAP on a system that is configured with Trusted Extensions, see Chapter 9, "Trusted Extensions and LDAP (Overview)."
- Trusted Extensions adds tools to the Solaris Management Console. The console is used to centrally manage zones, hosts, and networks. The network tools are described in "Solaris Management Console Tools" on page 38.

  The *Oracle Solaris Trusted Extensions Configuration Guide* describes how to define zones and hosts when you configure the network. For additional details, see Chapter 13, "Managing Networks in Trusted Extensions (Tasks)."
- Trusted Extensions adds commands to administer trusted networking. Trusted Extensions also adds options to the Oracle Solaris network commands. For a description of these commands, see "Network Commands in Trusted Extensions" on page 152.

Network Configuration Databases in Trusted Extensions

Trusted Extensions loads three network configuration databases into the kernel. These databases are used in accreditation checks as data is transmitted from one host to another host.

- `tnzonecfg` – This local database stores zone attributes that are security-related. The attributes for each zone specify the zone label and the zone's access to single-level and multilevel ports. Another attribute handles responses to control messages, such as `ping`. The labels for zones are defined in the `label_encodings` file. For more information, see the `label_encodings(4)` and `smtnzonecfg(1M)` man pages. For a discussion of multilevel ports, see "Zones and Multilevel Ports" on page 117.
- `tnrhtp` – This database stores templates that describe the security attributes of hosts and gateways. `tnrhtp` can be a local database or stored on the LDAP server. Hosts and gateways use the attributes of the destination host and next-hop gateway to enforce MAC when sending traffic. When receiving traffic, hosts and gateways use the attributes of the sender. For details of the security attributes, see "Trusted Network Security Attributes" on page 153. For more information, see the `smtnrhtp(1M)` man page.
- `tnrhdb` – This database holds the IP addresses and network prefixes (fallback mechanism) that correspond to all hosts that are allowed to communicate. `tnrhdb` can be a local database or stored on the LDAP server. Each host or network prefix is assigned a security template from the `tnrhtp` database. The attributes in the template define the attributes of the assigned host. For more information, see the `smtnrhdb(1M)` man page.

In Trusted Extensions, the Solaris Management Console has been extended to handle these databases. For details, see "Solaris Management Console Tools" on page 38.

Network Commands in Trusted Extensions

Trusted Extensions adds the following commands to administer trusted networking:

- `tnchkdb` – This command is used to verify the correctness of the trusted network databases. The `tnchkdb` command is used whenever you change a security template (`tnrhtp`), a security template assignment (`tnrhdb`), or the configuration of a zone (`tnzonecfg`). The Solaris Management Console tools run this command automatically when a database is modified. For details, see the `tnchkdb(1M)` man page.
- `tnctl` – This command can be used to update the trusted network information in the kernel. `tnctl` is also a system service. A restart with the command `svcadm restart /network/tnctl` refreshes the kernel cache from the trusted network databases on the local system. The Solaris Management Console tools run this command automatically when a database is modified in the Files scope. For details, see the `tnctl(1M)` man page.

- `tnd` – This daemon pulls `tnrhdb` and `tnrhtp` information from the LDAP directory and local files. The information from the naming services is loaded according to their order in the `nsswitch.conf` file. The `tnd` daemon is started at boot time by the `svc:/network/tnd` service. This service is dependent on the `svc:/network/ldap/client`.

  The `tnd` command also can be used for debugging and for changing the polling interval. For details, see the `tnd`(1M) man page.
- `tninfo` – This command displays the details of the current state of the trusted network kernel cache. The output can be filtered by host name, zone, or security template. For details, see the `tninfo`(1M) man page.

Trusted Extensions adds options to the following Oracle Solaris network commands:

- `ifconfig` – The `all-zones` interface flag for this command makes the specified interface available to every zone on the system. The appropriate zone to deliver data to is determined by the label that is associated with the data. For details, see the `ifconfig`(1M) man page.
- `netstat` – The `-R` option extends Oracle Solaris `netstat` usage to display Trusted Extensions-specific information, such as security attributes for multilevel sockets and routing table entries. The extended security attributes include the label of the peer, and whether the socket is specific to a zone, or available to several zones. For details, see the `netstat`(1M) man page.
- `route` – The `-secattr` option extends Oracle Solaris `route` usage to display the security attributes of the route. The value of the option has the following format:

  `min_sl=`*label*`,max_sl=`*label*`,doi=`*integer*`,cipso`

  The `cipso` keyword is optional and set by default. For details, see the `route`(1M) man page.
- `snoop` – As in the Oracle Solaris OS, the `-v` option to this command can be used to display the IP headers in detail. In Trusted Extensions, the headers contain label information.

Trusted Network Security Attributes

Network administration in Trusted Extensions is based on security templates. A security template describes a set of hosts that have common protocols and identical security attributes.

Security attributes are administratively assigned to systems, both hosts and routers, by means of templates. The security administrator administers templates and assigns them to systems. If a system does not have an assigned template, no communications are allowed with that system.

Every template is named, and includes the following:

- A host type of either Unlabeled or CIPSO. The protocol that is used for network communications is determined by the host type of the template.

  The host type is used to determine whether to use CIPSO options and affects MAC. See "Host Type and Template Name in Security Templates" on page 155.

- A set of security attributes that are applied to each host type.

For more detail about host types and security attributes, see "Network Security Attributes in Trusted Extensions" on page 154.

Network Security Attributes in Trusted Extensions

Trusted Extensions is installed with a default set of security templates. When a template is assigned to a host, the security values in the template are applied to the host. In Trusted Extensions, both unlabeled hosts and labeled hosts on the network are assigned security attributes by means of a template. Hosts that are not assigned a security template cannot be reached. The templates can be stored locally, or in the LDAP naming service on the Sun Java System Directory Server.

Templates can be assigned directly or indirectly to a host. Direct assignment assigns a template to a particular IP address. Indirect assignment assigns a template to a network address that includes the host. Hosts that do not have a security template cannot communicate with hosts that are configured with Trusted Extensions. For an explanation of direct assignment and indirect assignment, see "Trusted Network Fallback Mechanism" on page 157.

Templates are modified or created by using the Security Templates tool in the Solaris Management Console. The Security Templates tool enforces the completion of the required fields in the templates. Which fields are required is based on the host type.

Each host type has its own set of additional required and optional security attributes. The following security attributes are specified in security templates:

- **Host type** – Defines whether the packets are labeled with CIPSO security labels or not labeled at all.
- **Default label** – Defines the level of trust of the unlabeled host. Packets that are sent by an unlabeled host are read at this label by the receiving Trusted Extensions host or gateway.

  The Default label attribute is specific to the unlabeled host type. For details, see the `smtnrhtp(1M)` man page and the following sections.
- **DOI** – A positive, non-zero integer that identifies the domain of interpretation. The DOI is used to indicate which set of label encodings applies to a network communication or network entity. Labels with different DOIs, even if otherwise identical, are disjoint. For unlabeled hosts, the DOI applies to the default label. In Trusted Extensions, the default value is 1.
- **Minimum label** – Defines the bottom of the label accreditation range. Hosts and next-hop gateways do not receive packets that are below the minimum label that is specified in their template.
- **Maximum label** – Defines the top of the label accreditation range. Hosts and next-hop gateways do not receive packets that are higher than the maximum label that is specified in their template.

- **Security label set** – Optional. Specifies a discrete set of security labels for a security template. In addition to their accreditation range that is determined by the maximum and minimum label, hosts that are assigned to a template with a security label set can send and receive packets that match any one of the labels in the label set. The maximum number of labels that can be specified is four.

Host Type and Template Name in Security Templates

Trusted Extensions supports two host types in the trusted network databases and provides two default templates:

- **CIPSO host type –** Intended for hosts that run trusted operating systems. Trusted Extensions supplies the template named `cipso` for this host type.

  The Common IP Security Option (CIPSO) protocol is used to specify security labels that are passed in the IP options field. CIPSO labels are derived automatically from the data's label. Tag type 1 is used to pass the CIPSO security label. This label is then used to make security checks at the IP level and to label the data in the network packet.
- **Unlabeled host type** - Intended for hosts that use standard networking protocols but do not support CIPSO options. Trusted Extensions supplies the template named `admin_low` for this host type.

  This host type is assigned to hosts that run the Oracle Solaris OS or other unlabeled operating systems. This host type gives provides a default label and a default clearance to apply to communications with the unlabeled host. Also, a label range or a set of discrete labels can be specified to allow the sending of packets to an unlabeled gateway for forwarding.

Caution – The `admin_low` template provides an example for constructing unlabeled templates with site-specific labels. While the `admin_low` template is required for the installation of Trusted Extensions, the security settings might not be appropriate for normal system operations. Retain the provided templates without modification for system maintenance and support reasons.

Default Label in Security Templates

Templates for the unlabeled host type specify a default label. This label is used to control communications with hosts whose operating systems are not aware of labels, such as Oracle Solaris systems. The default label that is assigned reflects the level of trust that is appropriate for the host and its users.

Because communications with unlabeled hosts are essentially limited to the default label, these hosts are also referred to as *single-label hosts*.

Domain of Interpretation in Security Templates

Organizations that use the same Domain of Interpretation (DOI) agree among themselves to interpret label information and other security attributes in the same way. When Trusted Extensions performs a label comparison, a check is made as to whether the DOI is equal.

A Trusted Extensions system enforces label policy on one DOI value. All zones on a Trusted Extensions system must operate at the same DOI. A Trusted Extensions system does not provide exception handling on packets that are received from a system that uses a different DOI.

If your site uses a DOI value that is different from the default value, you must add this value to the `/etc/system` file, and change the value in every security template. For the initial procedure, see "Configure the Domain of Interpretation" in *Oracle Solaris Trusted Extensions Configuration Guide*. To configure the DOI in every security template, see Example 13–1.

Label Range in Security Templates

The minimum label and maximum label attributes are used to establish the label range for labeled and unlabeled hosts. These attributes are used to do the following:

- To set the range of labels that can be used when communicating with a remote CIPSO host

  In order for a packet to be sent to a destination host, the label of the packet must be within the label range assigned to the destination host in the security template for that host.
- To set a label range for packets that are being forwarded through a CIPSO gateway or an unlabeled gateway

  The label range can be specified in the template for an unlabeled host type. The label range enables the host to forward packets that are not necessarily at the label of the host, but are within a specified label range.

Security Label Set in Security Templates

The security label set defines at most four discrete labels at which packets can be accepted, forwarded, or sent by the remote host. This attribute is optional. By default, no security label set is defined.

Trusted Network Fallback Mechanism

The `tnrhdb` database can assign a security template to a particular host either directly or indirectly. Direct assignment assigns a template to a host's IP address. Indirect assignment is handled by a fallback mechanism. The trusted network software first looks for an entry that specifically assigns the host's IP address to a template. If the software does not find a specific entry for the host, it looks for the "longest prefix of matching bits". You can indirectly assign a host to a security template when the IP address of the host falls within the "longest prefix of matching bits" of an IP address with a fixed prefix length.

In IPv4, you can make an indirect assignment by subnet. When you make an indirect assignment by using 4, 3, 2, or 1 trailing zero (0) octets, the software calculates a prefix length of 0, 8, 16, or 24, respectively. Entries 3 – 6 in Table 12–1 illustrate this fallback mechanism.

You can also set a fixed prefix length by adding a slash (/) followed by the number of fixed bits. IPv4 network addresses can have a prefix length between 1 – 32. IPv6 network addresses can have a prefix length between 1 – 128.

The following table provides fallback address and host address examples. If an address within the set of fallback addresses is directly assigned, the fallback mechanism is not used for that address.

TABLE 12–1 `tnrhdb` Host Address and Fallback Mechanism Entries

IP Version	`tnrhdb` Entry	Addresses Covered
IPv4	`192.168.118.57:cipso`	`192.168.118.57`
	`192.168.118.57/32:cipso`	The `/32` sets a prefix length of 32 fixed bits.
	`192.168.118.128/26:cipso`	From `192.168.118.0` through `192.168.118.63`
	`192.168.118.0:cipso`	All addresses on `192.168.118.` network
	`192.168.118.0/24:cipso`	
	`192.168.0.0/24:cipso`	All addresses on `192.168.0.` network.
	`192.168.0.0:cipso`	All addresses on `192.168.` network
	`192.168.0.0/16:cipso`	
	`192.0.0.0:cipso`	All addresses on `192.` network
	`192.0.0.0/8:cipso`	
	`192.168.0.0/32:cipso`	Network address `192.168.0.0`. Not a wildcard address.
	`192.168.118.0/32:cipso`	Network address `192.168.118.0`. Not a wildcard address.
	`192.0.0.0/32:cipso`	Network address `192.0.0.0`. Not a wildcard address.
	`0.0.0.0/32:cipso`	Host address `0.0.0.0`. Not a wildcard address.
	`0.0.0.0:cipso`	All addresses on all networks
IPv6	`2001\:DB8\:22\:5000\:\:21f7:cipso`	`2001:DB8:22:5000::21f7`
	`2001\:DB8\:22\:5000\:\:0/52:cipso`	From `2001:DB8:22:5000::0` through `2001:DB8:22:5fff:ffff:ffff:ffff:ffff`
	`0\:\:0/0:cipso`	All addresses on all networks

Note that the `0.0.0.0/32` address matches the specific address, `0.0.0.0`. The `tnrhdb` entry `0.0.0.0/32:admin_low` is useful on a system where the literal address, `0.0.0.0`, is used as a source IP address. For example, DHCP clients contact the DHCP server as `0.0.0.0` before the server provides the clients with an IP address.

To create a `tnrhdb` entry on a Sun Ray server that serves DHCP clients, see Example 13–13. Because `0.0.0.0:admin_low` is the default wildcard entry, see "How to Limit the Hosts That Can Be Contacted on the Trusted Network" on page 175 for issues to consider before removing or changing this default.

For more information about prefix lengths in IPv4 and IPv6 addresses, see "Designing Your CIDR IPv4 Addressing Scheme" in *System Administration Guide: IP Services* and "IPv6 Addressing Overview" in *System Administration Guide: IP Services*.

Overview of Routing in Trusted Extensions

In Trusted Extensions, routes between hosts on different networks must maintain security at each step in the transmission. Trusted Extensions adds extended security attributes to the routing protocols in the Oracle Solaris OS. Unlike the Oracle Solaris OS, this Trusted Extensions release does not support dynamic routing. For details about specifying static routing, see the `-p` option in the `route(1M)` man page.

Gateways and routers route packets. In this discussion, the terms "gateway" and "router" are used interchangeably.

For communications between hosts on the same subnet, accreditation checks are performed at endpoints only because no routers are involved. Label range checks are performed at the source. If the receiving host is running Trusted Extensions software, label range checks are also performed at the destination.

When the source and destination hosts are on different subnets, the packet is sent from the source host to a gateway. The label range of the destination and the first-hop gateway is checked at the source when a route is selected. The gateway forwards the packet to the network where the destination host is connected. A packet might go through several gateways before reaching the destination.

Background on Routing

On Trusted Extensions gateways, label range checks are performed in certain cases. A Trusted Extensions system that is routing a packet between two unlabeled hosts compares the default label of the source host to the default label of the destination host. When the unlabeled hosts share a default label, the packet is routed.

Each gateway maintains a list of routes to all destinations. Standard Oracle Solaris routing makes choices to optimize the route. Trusted Extensions provides additional software to check security requirements that apply to the route choices. The Oracle Solaris choices that do not satisfy security requirements are skipped.

Routing Table Entries in Trusted Extensions

The routing table entries in Trusted Extensions can incorporate security attributes. Security attributes can include a `cipso` keyword. Security attributes must include a maximum label, a minimum label, and a DOI.

For entries that do not provide security attributes, the attributes in the gateway's security template are used.

Trusted Extensions Accreditation Checks

Trusted Extensions software determines the suitability of a route for security purposes. The software runs a series of tests called *accreditation checks* on the source host, the destination host, and the intermediate gateways.

Note – In the following discussion, an accreditation check for a label range also means a check for a security label set.

The accreditation check verifies the label range and CIPSO label information. The security attributes for a route are obtained from the routing table entry, or from the security template of the gateway if the entry has no security attributes.

For incoming communications, the Trusted Extensions software obtains labels from the packets themselves, whenever possible. Obtaining labels from packets is only possible when the messages are sent from systems that support labels. When a label is not available from the packet, a default label is assigned to the message from trusted networking database files. These labels are then used during accreditation checks. Trusted Extensions enforces several checks on outgoing messages, forwarded messages, and incoming messages.

Source Accreditation Checks

The following accreditation checks are performed on the sending process or sending zone:

- For all destinations, the label of the data must be within the label range of the next hop in the route, that is, the first hop. And, the label must be contained in the first-hop gateway's security attributes.
- For all destinations, the DOI of an outgoing packet must match the DOI of the destination host. The DOI must also match the DOI of all hops along the route, including its first-hop gateway.
- When the destination host is an unlabeled host, one of the following conditions must be satisfied:
  - The sending host's label must match the destination host's default label.
  - The sending host is privileged to perform cross-label communication, and the sender's label dominates the destination's default label.
  - The sending host is privileged to perform cross-label communication, and the sender's label is `ADMIN_LOW`. That is, the sender is sending from the global zone.

Note – A first-hop check occurs when a message is being sent through a gateway from a host on one network to a host on another network.

Gateway Accreditation Checks

On a Trusted Extensions gateway system,the following accreditation checks are performed for the next-hop gateway:

- If the incoming packet is unlabeled, the packet inherits the source host's default label from the `tnrhdb` entry. Otherwise, the packet receives the indicated CIPSO label.
- Checks for forwarding a packet proceed similar to source accreditation:
  - For all destinations, the label of the data must be within the label range of the next hop. And, the label must be contained in the security attributes of the next-hop host.
  - For all destinations, the DOI of an outgoing packet must match the DOI of the destination host. The DOI must also match the DOI of the next-hop host.
  - The label of an unlabeled packet must match the destination host's default label.
  - The label of a CIPSO packet must be within the destination host's label range.

Destination Accreditation Checks

When a Trusted Extensions host receives data, the software performs the following checks:

- If the incoming packet is unlabeled, the packet inherits the source host's default label from the `tnrhdb` entry. Otherwise, the packet receives the indicated CIPSO label.
- The label and DOI for the packet must be consistent with the destination zone or destination process's label and DOI. The exception is when a process is listening on a multilevel port. The listening process can receive a packet if the process is privileged to perform cross-label communications, and the process is either in the global zone or has a label that dominates the packet's label.

Administration of Routing in Trusted Extensions

Trusted Extensions supports several methods for routing communications between networks. In the Security Administrator role, you can set up routes that enforce the degree of security required by your site's security policy.

For example, sites can restrict communications outside the local network to a single label. This label is applied to publicly available information. Labels such as `UNCLASSIFIED` or `PUBLIC` can indicate public information. To enforce the restriction, these sites assign a single-label template to the network interface that is connected to the external network. For more details about TCP/IP and routing, see the following:

- "Planning for Routers on Your Network" in *System Administration Guide: IP Services*
- "Configuring Systems on the Local Network" in *System Administration Guide: IP Services*
- "Major TCP/IP Administrative Tasks (Task Map)" in *System Administration Guide: IP Services*
- "Preparing Your Network for the DHCP Service (Task Map)" in *System Administration Guide: IP Services*

Choosing Routers in Trusted Extensions

Trusted Extensions hosts offer the highest degree of trust as routers. Other types of routers might not recognize Trusted Extensions security attributes. Without administrative action, packets can be routed through routers that do not provide MAC security protection.

- CIPSO routers drop packets when they do not find the correct type of information in the IP options section of the packet. For example, a CIPSO router drops a packet if it does not find a CIPSO option in the IP options when the option is required, or when the DOI in the IP options is not consistent with the destination's accreditation.
- Other types of routers that are not running Trusted Extensions software can be configured to either pass the packets or drop the packets that include the CIPSO option. Only CIPSO-aware gateways such as Trusted Extensions provides can use the contents of the CIPSO IP option to enforce MAC.

To support trusted routing, the Solaris 10 routing tables are extended to include Trusted Extensions security attributes. The attributes are described in "Routing Table Entries in Trusted Extensions" on page 159. Trusted Extensions supports static routing, in which the administrator creates routing table entries manually. For details, see the `-p` option in the `route`(1M) man page.

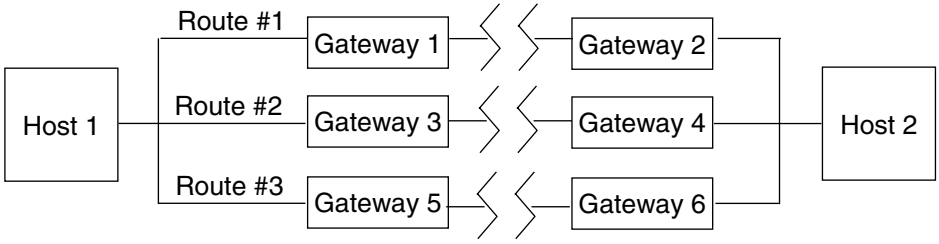
The routing software tries to find a route to the destination host in the routing tables. When the host is not explicitly named, the routing software looks for an entry for the subnetwork where the host resides. When neither the host nor the network where the host resides is defined, the host sends the packet to a default gateway, if defined. Multiple default gateways can be defined, and each is treated equally.

In this release of Trusted Extensions, the security administrator sets up routes manually, and then manually changes the routing table when conditions change. For example, many sites have a single gateway that communicates with the outside world. In these cases, the single gateway can be statically defined as the *default* on each host on the network. Dynamic routing support might be available in future releases of Trusted Extensions.

Gateways in Trusted Extensions

An example of routing in Trusted Extensions follows. The diagram and table show three potential routes between Host 1 and Host 2.

FIGURE 12–1 Typical Trusted Extensions Routes and Routing Table Entries



Route	First-Hop Gateway	Minimum Label	Maximum Label	DOI
#1	Gateway 1	`CONFIDENTIAL`	`SECRET`	1
#2	Gateway 3	`ADMIN_LOW`	`ADMIN_HIGH`	1
#3	Gateway 5			

- Route #1 can transmit packets within the label range of `CONFIDENTIAL` to `SECRET`.
- Route #2 can transmit packets from `ADMIN_LOW` to `ADMIN_HIGH`.
- Route #3 does not specify routing information. Therefore, its security attributes are derived from the template in the `tnrhtp` database for Gateway 5.

Routing Commands in Trusted Extensions

To show labels and extended security attributes for sockets, Trusted Extensions modifies the following Oracle Solaris network commands:

- The `netstat -rR` command displays the security attributes in routing table entries.
- The `netstat -aR` command displays the security attributes for sockets.
- The `route -p` command with the `add` or `delete` option changes the routing table entries.

For details, see the `netstat(1M)` and `route(1M)` man pages.

For examples, see "How to Configure Routes With Security Attributes" on page 179.

◆ ◆ ◆ CHAPTER 13

Managing Networks in Trusted Extensions (Tasks)

This chapter provides implementation details and procedures for securing a Trusted Extensions network.

Managing the Trusted Network (Task Map)

The following table points to the task maps for common trusted networking procedures.

Task	Description	For Instructions
Configure network databases.	Creates remote host templates,and assigns hosts to the templates.	"Configuring Trusted Network Databases (Task Map)" on page 166
Configure routing, and check network databases and network information in the kernel.	Configures static routes that enable labeled packets to reach their destination through labeled and unlabeled gateways. Also, displays the state of your network.	"Configuring Routes and Checking Network Information in Trusted Extensions (Task Map)" on page 179
Troubleshoot networking problems.	Steps to take when diagnosing network problems with labeled packets.	"Troubleshooting the Trusted Network (Task Map)" on page 185

Configuring Trusted Network Databases (Task Map)

Trusted Extensions software includes the `tnrhtp` and `tnrhdb` databases. These databases provide labels for remote hosts that contact the system. The Solaris Management Console provides the GUI that you use to administer these databases.

The following task map describes tasks to create security templates and apply them to hosts.

Task	Description	For Instructions
Determine if your site requires customized security templates.	Evaluates the existing templates for the security requirements of your site.	"How to Determine If You Need Site-Specific Security Templates" on page 167
Access the Security Templates tool in the Solaris Management Console.	Accesses the tool for modifying trusted network databases.	"How to Open the Trusted Networking Tools" on page 168
Modify security templates.	Modifies the definitions of security attributes in your trusted network by modifying the trusted network databases.	"How to Construct a Remote Host Template" on page 168
	Changes the DOI to a value different from `1`.	Example 13–1
	Creates a security template for labeled hosts that restrict communication between other hosts to a single label.	Example 13–2
	Creates a security template for unlabeled hosts that operate as single-label gateways.	Example 13–3
	Creates a security template for hosts with a restricted label range.	Example 13–4
	Creates a security template for a host that specifies a set of discrete labels in its label range.	Example 13–5
	Creates a security template for unlabeled systems and networks.	Example 13–6
	Creates a security template for two developer systems.	Example 13–7
Add hosts to the known network.	Adds systems and networks to the trusted network.	"How to Add Hosts to the System's Known Network" on page 173
Provide remote host access by using wildcard entries.	Allows hosts within a range of IP addresses to communicate with a system by indirectly assigning each host to the same security template.	Example 13–8 Example 13–9 Example 13–10

Task	Description	For Instructions
Change the `admin_low` wildcard entry in the `tnrhdb` file.	Increases security by replacing the wildcard entry with specific addresses for the host to contact at boot time.	"How to Limit the Hosts That Can Be Contacted on the Trusted Network" on page 175
	Increases security by replacing the wildcard entry with a network of labeled hosts as the default.	Example 13–11
Create an entry for the host address `0.0.0.0`	Configures a Sun Ray server to accept the initial contact from a remote client	Example 13–13
Assign security templates.	Associates a template with an IP address or list of contiguous IP addresses.	"How to Assign a Security Template to a Host or a Group of Hosts" on page 174

▼ How to Determine If You Need Site-Specific Security Templates

Before You Begin You must be in the Security Administrator role in the global zone.

1 Familiarize yourself with the Trusted Extensions templates.

Read the `tnrhtp` file on a local host. The comments in the file are helpful. You can also view the security attribute values in the Security Templates tool in the Solaris Management Console.

- The default templates match any installation. The label range for each template is `ADMIN_LOW` to `ADMIN_HIGH`.
- The `cipso` template defines a CIPSO host type whose DOI is `1`. The label range for the template is `ADMIN_LOW` to `ADMIN_HIGH`.
- The `admin_low` template defines an unlabeled host whose DOI is `1`. The template's default label is `ADMIN_LOW`. The label range for the template is `ADMIN_LOW` to `ADMIN_HIGH`. In the default configuration, the address `0.0.0.0` is assigned to this template. Therefore, all non-CIPSO hosts are treated as hosts that operate at the `ADMIN_LOW` security label.

2 Keep the default templates.

For support purposes, do not delete or modify the default templates. You can change the host that is assigned these default templates. For an example, see "How to Limit the Hosts That Can Be Contacted on the Trusted Network" on page 175.

3 Create new templates if you want to do any of the following:

- Limit the label range of a host or a group of hosts.
- Create a single-label host.
- Create a host that recognizes a few discrete labels.
- Use a different DOI than `1`.

- Require a default label for unlabeled hosts that is not `ADMIN_LOW`.

For details, see "How to Construct a Remote Host Template" on page 168.

▼ How to Open the Trusted Networking Tools

Before You Begin You must be in the global zone in a role that can modify network security. For example, roles that are assigned the Information Security or Network Security rights profile can modify security settings. The Security Administrator role includes these profiles.

To use the LDAP toolbox, you must have completed "Configuring the Solaris Management Console for LDAP (Task Map)" in *Oracle Solaris Trusted Extensions Configuration Guide*.

1 Start the Solaris Management Console.

For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

2 Use the appropriate tool.

- To modify a template, use the Security Templates tool.

  All currently defined templates display in the right pane. When you select or create a template, online help is available in the left pane.
- To assign a host to a template, use the Security Templates tool.
- To create a host that can be assigned to a template, use the Computers and Networks tool.
- To assign a label to a zone, use the Trusted Network Zones tool. For more information about zones in Trusted Extensions, see Chapter 10, "Managing Zones in Trusted Extensions (Tasks)."

▼ How to Construct a Remote Host Template

Before You Begin You must be in the global zone in a role that can modify network security. For example, roles that are assigned the Information Security or Network Security rights profiles can modify security settings. The Security Administrator role includes these profiles.

1 In the Solaris Management Console, navigate to the Security Templates tool.

See "How to Open the Trusted Networking Tools" on page 168 for the steps.

2 Under Computers and Networks, double-click Security Templates.

The existing templates are displayed in the View pane. These templates describe the security attributes for hosts that this system can contact. These hosts include CIPSO hosts that are running Trusted Extensions and unlabeled hosts.

3. **Examine the `cipso` template.**

   View which hosts and which networks are already assigned this template.

4. **Examine the `admin_low` template.**

   View which hosts and which networks are already assigned this template.

5. **Create a template.**

   If the provided templates do not sufficiently describe the hosts that can be in communication with this system, choose Add Template from the Action menu.

   Use the online help for assistance. Before assigning hosts to the templates, create all the templates that your site requires.

6. **(Optional) Modify an existing template that is not a default template.**

   Double-click the template, and use the online help for assistance. You can change the assigned hosts or the assigned networks.

Example 13–1 Creating a Security Template With a Different DOI Value

In this example, the security administrator's network has a DOI whose value is different from `1`. The team that initially configured the system has completed "Configure the Domain of Interpretation" in *Oracle Solaris Trusted Extensions Configuration Guide*.

First, the security administrator confirms the value of the DOI in the `/etc/system` file:

```
# grep doi /etc/system
set default_doi = 4
```

Then, in the Security Templates tool, for every template that the administrator creates, the value of `doi` is set to `4`. For the single-label system that is described in Example 13–2, the security administrator creates the following template:

```
template: CIPSO_PUBLIC
host_type: CIPSO
doi: 4
min_sl: PUBLIC
max_sl: PUBLIC
```

Example 13–2 Creating a Security Template That Has a Single Label

In this example, the security administrator wants to create a gateway that can only pass packets at a single label, `PUBLIC`. Using the Security Templates tool in the Solaris Management Console, the administrator creates a template and assigns the gateway host to the template.

First, the gateway host and IP address are added to the Computers and Networks tool.

```
gateway-1
192.168.131.75
```

Then, the template is created in the Security Templates tool. The following are the values in the template:

```
template: CIPSO_PUBLIC
host_type: CIPSO
doi: 1
min_sl: PUBLIC
max_sl: PUBLIC
```

The tool supplies the hexadecimal value for `PUBLIC`, `0X0002-08-08`.

Finally, the `gateway-1` host is assigned to the template by its name and IP address.

```
gateway-1
192.168.131.75
```

On a local host, the `tnrhtp` entry appears similar to the following:

```
cipso_public:host_type=cipso;doi=1;min_sl=0X0002-08-08;max_sl=0X0002-08-08;
```

On a local host, the `tnrhdb` entry appears similar to the following:

```
# gateway-1
192.168.131.75:cipso_public
```

Example 13–3 Creating a Security Template for an Unlabeled Router

Any IP router can forward messages with CIPSO labels even though the router does not explicitly support labels. Such an unlabeled router needs a default label to define the level at which connections to the router, perhaps for router management, need to be handled. In this example, the security administrator creates a router that can forward traffic at any label, but all direct communication with the router is handled at the default label, `PUBLIC`.

In the Solaris Management Console, the administrator creates a template and assigns the gateway host to the template.

First, the router and its IP address are added to the Computers and Networks tool.

```
router-1
192.168.131.82
```

Then, the template is created in the Security Templates tool. The following values are in the template:

```
Template Name: UNL_PUBLIC
Host Type: UNLABELED
DOI: 1
```

```
Default Label: PUBLIC
Minimum Label: ADMIN_LOW
Maximum Label: ADMIN_HIGH
```

The tool supplies the hexadecimal value for the labels.

Finally, the `router-1` router is assigned to the template by its name and IP address.

```
router-1
192.168.131.82
```

Example 13–4 Creating a Security Template That Has a Limited Label Range

In this example, the security administrator wants to create a gateway that restricts packets to a narrow label range. In the Solaris Management Console, the administrator creates a template and assigns the gateway host to the template.

First, the host and its IP address are added to the Computers and Networks tool.

```
gateway-ir
192.168.131.78
```

Then, the template is created in the Security Templates tool. The following values are in the template:

```
Template Name: CIPSO_IUO_RSTRCT
Host Type: CIPSO
DOI: 1
Minimum Label: CONFIDENTIAL : INTERNAL USE ONLY
Maximum Label: CONFIDENTIAL : RESTRICTED
```

The tool supplies the hexadecimal value for the labels.

Finally, the `gateway-ir` gateway is assigned to the template by its name and IP address.

```
gateway-ir
192.168.131.78
```

Example 13–5 Creating a Security Template That Has a Security Label Set

In this example, the security administrator wants to create a security template that recognizes two labels only. In the Solaris Management Console, the administrator creates a template and assigns the gateway host to the template.

First, each host and IP address that is going to use this template is added to the Computers and Networks tool.

```
host-slset1
192.168.132.21
```

```
host-slset2
192.168.132.22

host-slset3
192.168.132.23

host-slset4
192.168.132.24
```

Then, the template is created in the Security Templates tool. The following values are in the template:

```
Template Name: CIPSO_PUB_RSTRCT
Host Type: CIPSO
DOI: 1
Minimum Label: PUBLIC
Maximum Label: CONFIDENTIAL : RESTRICTED
SL Set: PUBLIC, CONFIDENTIAL : RESTRICTED
```

The tool supplies the hexadecimal value for the labels.

Finally, the range of IP addresses are assigned to the template by using the Wildcard button and a prefix.

```
192.168.132.0/17
```

Example 13–6 Creating an Unlabeled Template at the Label PUBLIC

In this example, the security administrator allows a subnetwork of Oracle Solaris systems to have the PUBLIC label in the trusted network. The template has the following values:

```
Template Name: public
Host Type: Unlabeled
Default Label: Public
Minimum Label: Public
Maximum Label: Public
DOI: 1

Wildcard Entry: 10.10.0.0
Prefix: 16
```

All systems on the 10.10.0.0 subnetwork are handled at the label PUBLIC.

Example 13–7 Creating a Labeled Template for Developers

In this example, the security administrator creates a SANDBOX template. This template is assigned to systems that are used by developers of trusted software. The two systems that are assigned this template create and test labeled programs. However, their tests do not affect the other labeled systems, because the label SANDBOX is disjoint from the other labels on the network.

```
Template Name: cipso_sandbox
Host Type: CIPSO
Minimum Label: SANDBOX
Maximum Label: SANDBOX
DOI: 1

Hostname: DevMachine1
IP Address: 196.168.129.129

Hostname: DevMachine2
IP Address: 196.168.129.102
```

The developers who use these systems can communicate with each other at the label `SANDBOX`.

▼ How to Add Hosts to the System's Known Network

The Computers tool in the Solaris Management Console is identical to the Computers tool in the Oracle Solaris OS. This procedure is provided here for your convenience. After the hosts are known, you then assign the hosts to a security template.

Before You Begin You must be in an administrator who can manage networks. For example, roles that include the Network Management or System Administrator rights profiles can manage networks.

1. **In the Solaris Management Console, navigate to the Computers tool.**
   For details, see "How to Open the Trusted Networking Tools" on page 168.
2. **In the Computers tool, confirm that you want to view all computers on the network.**
3. **Add a host that this system can contact.**
   You must add every host that this system might contact, including any static routers and any audit servers.
   a. **From the Action menu, choose Add Computer.**
   b. **Identify the host by name and IP address.**
   c. **(Optional) Provide additional information about the host.**
   d. **To add the host, click Apply.**
   e. **When the entries are complete, click OK.**
4. **Add a group of hosts that this system can contact.**
   Use the online help to add groups of hosts by using a network IP address.

▼ How to Assign a Security Template to a Host or a Group of Hosts

Before You Begin You must be in the Security Administrator role in the global zone.

All hosts that you want to assign to a template must exist in the Computers and Networks tool. For details, see "How to Add Hosts to the System's Known Network" on page 173.

1. **In the Solaris Management Console, navigate to the Security Templates tool.**
   For details, see "How to Open the Trusted Networking Tools" on page 168.
2. **Double-click the appropriate template name.**
3. **Click the Hosts Assigned to Template tab.**
4. **To assign the template to a single host, do the following:**
   a. **In the Hostname field, type the host's name.**
   b. **In the IP Address field, type the host's address.**
   c. **Click the Add button.**
   d. **To save your changes, click OK.**
5. **To assign a template to a group of hosts with contiguous addresses, do the following:**
   a. **Click Wildcard.**
   b. **In the IP Address field, type the IP address.**
   c. **In the Prefix field, type the prefix that describes the group of contiguous addresses.**
   d. **Click the Add button.**
   e. **To save your changes, click OK.**

Example 13–8 Adding an IPv4 Network as a Wildcard Entry

In the following example, a security administrator assigns several IPv4 subnetworks to the same security template. In the Hosts Assigned to Template tab, the administrator adds the following wildcard entries:

```
IP Address: 192.168.113.0
IP address: 192.168.75.0
```

Example 13–9 Adding a List of IPv4 Hosts as a Wildcard Entry

In the following example, a security administrator assigns contiguous IPv4 addresses that are not along octet boundaries to the same security template. In the Hosts Assigned to Template tab, the administrator adds the following wildcard entries:

```
IP Address: 192.168.113.100
Prefix Length: 25
```

This wildcard entry covers the address range of `192.168.113.0` to `192.168.113.127`. The address includes `192.168.113.100`.

Example 13–10 Adding a List of IPv6 Hosts as a Wildcard Entry

In the following example, a security administrator assigns contiguous IPv6 addresses to the same security template. In the Hosts Assigned to Template tab, the administrator adds the following wildcard entries:

```
IP Address: 2001:a08:3903:200::0
Prefix Length: 56
```

This wildcard entry covers the address range of `2001:a08:3903:200::0` to `2001:a08:3903:2ff:ffff:ffff:ffff:ffff`. The address includes `2001:a08:3903:201:20e:cff:fe08:58c`.

▼ How to Limit the Hosts That Can Be Contacted on the Trusted Network

This procedure protects labeled hosts from being contacted by arbitrary unlabeled hosts. When Trusted Extensions is installed, this default template defines every host on the network. Use this procedure to enumerate specific unlabeled hosts.

The local `tnrhdb` file on each system is used to contact the network at boot time. By default, every host that is not provided with a CIPSO template is defined by the `admin_low` template. This template assigns every system that is not otherwise defined (`0.0.0.0`) to be an unlabeled system with the default label of `admin_low`.

Caution – The default `admin_low` template can be a security risk on a Trusted Extensions network. If site security requires strong protection, the security administrator can remove the `0.0.0.0` wildcard entry after the system is installed. The entry must be replaced with entries for every host that the system contacts during boot.

For example, DNS servers, home directory servers, audit servers, broadcast and multicast addresses, and routers must be in the local `tnrhdb` file after the `0.0.0.0` wildcard entry is removed.

If an application initially recognizes clients at the host address `0.0.0.0`, then you must add the `0.0.0.0/32:admin_low` host entry to the `tnrhdb` database. For example, to receive initial connection requests from potential Sun Ray clients, Sun Ray servers must include this entry. Then, when the server recognizes the clients, the clients are provided an IP address and connected as CIPSO clients.

Before You Begin You must be in the Security Administrator role in the global zone.

All hosts that are to be contacted at boot time must exist in the Computers and Networks tool.

1 **In the Solaris Management Console, navigate to the Security Templates tool in the Files scope.**

The Files scope protects the system during boot. To access the Security Templates tool, see "How to Open the Trusted Networking Tools" on page 168.

2 **Modify the hosts that are assigned to the `admin_low` template.**

a. **Double-click the `admin_low` template.**

Every host that is added can be contacted during boot at the label `ADMIN_LOW`.

b. **Click the Hosts Assigned to Template tab.**

Every host that is added can be contacted during boot at the label `ADMIN_LOW`.

c. **Add each unlabeled host that must be contacted at boot time.**

For details, see "How to Assign a Security Template to a Host or a Group of Hosts" on page 174.

Include every on-link router that is not running Trusted Extensions, through which this host must communicate.

d. **Add the ranges of hosts that must be contacted at boot time.**

e. **Remove the `0.0.0.0` entry.**

3. **Modify the hosts that are assigned to the `cipso` template.**

   a. **Double-click the `cipso` template.**

      Every host that is added can be contacted during boot.

   b. **Click the Hosts Assigned to Template tab.**

      Every host that is added can be contacted during boot at the label `ADMIN_LOW`.

   c. **Add each labeled host that must be contacted at boot time.**

      For details, see "How to Assign a Security Template to a Host or a Group of Hosts" on page 174.

      - Include the LDAP server.
      - Include every on-link router that is running Trusted Extensions, through which this host must communicate
      - Make sure that all network interfaces are assigned to the template.
      - Include broadcast addresses.

   d. **Add the ranges of hosts that must be contacted at boot time.**

4. **Verify that the host assignments allow the system to boot.**

Example 13–11 Changing the Label of the `0.0.0.0` `tnrhdb` Entry

In this example, the security administrator creates a public gateway system. The administrator removes the `0.0.0.0` entry from the `admin_low` template and assigns the entry to an unlabeled template that is named `public`. The system then recognizes any system that is not listed in its `tnrhdb` file as an unlabeled system with the security attributes of the `public` security template.

The following describes an unlabeled template that was created specifically for public gateways.

```
Template Name: public
Host Type: Unlabeled
Default Label: Public
Minimum Label: Public
Maximum Label: Public
DOI: 1
```

Example 13–12 Enumerating Computers to Contact During Boot in the `tnrhdb` Database

The following example shows the local `tnrhdb` database with entries for an LDAP client with two network interfaces. The client communicates with another network and with routers.

```
127.0.0.1:cipso             Loopback address
192.168.112.111:cipso       Interface 1 of this host
```

```
192.168.113.111:cipso       Interface 2 of this host
10.6.6.2:cipso              LDAP server
192.168.113.6:cipso         Audit server
192.168.112.255:cipso       Subnet broadcast address
192.168.113.255:cipso       Subnet broadcast address
192.168.113.1:cipso         Router
192.168.117.0:cipso         Another Trusted Extensions network
192.168.112.12:public       Specific network router
192.168.113.12:public       Specific network router
224.0.0.2:public            Multicast address
255.255.255.255:admin_low       Broadcast address
```

Example 13–13 Making the Host Address `0.0.0.0` a Valid `tnrhdb` Entry

In this example, the security administrator configures a Sun Ray server to accept initial connection requests from potential clients. The server is using a private topology and is using the defaults:

```
# utadm -a bge0
```

First, the administrator determines the Solaris Management Console domain name:

```
SMCserver # /usr/sadm/bin/dtsetup scopes
Getting list of managable scopes...
Scope 1 file:/machine1.ExampleCo.COM/machine1.ExampleCo.COM
```

Then, the administrator adds the entry for client initial connection to the Sun Ray server's `tnrhdb` database. Because the administrator is testing, the default wildcard address is still used for all unknown addresses:

```
SunRayServer # /usr/sadm/bin/smtnrhdb \
add -D file:/machine1.ExampleCo.COM/machine1.ExampleCo.COM \
-- -w 0.0.0.0 -p 32 -n admin_low
Authenticating as user: root

Please enter a string value for: password ::
... from machine1.ExampleCo.COM was successful.
```

After this command, the `tnhrdb` database appears similar to the following. The result of the `smtnrhdb` command is highlighted:

```
## tnrhdb database
## Sun Ray server address
       192.168.128.1:cipso
## Sun Ray client addresses on 192.168.128 network
       192.168.128.0/24:admin_low
## Initial address for new clients
       0.0.0.0/32:admin_low
## Default wildcard address
0.0.0.0:admin_low
     Other addresses to be contacted at boot
```

```
# tnchkdb -h /etc/security/tsol/tnrhdb
```

After this phase of testing succeeds, the administrator makes the configuration more secure by removing the default wildcard address, checks the syntax of the `tnrhdb` database, and tests again. The final `tnhrdb` database appears similar to the following:

```
## tnrhdb database
## Sun Ray server address
       192.168.128.1:cipso
## Sun Ray client addresses on 192.168.128 network
       192.168.128.0/24:admin_low
## Initial address for new clients
       0.0.0.0/32:admin_low
## 0.0.0.0:admin_low - no other systems can enter network at admin_low
     Other addresses to be contacted at boot
```

Configuring Routes and Checking Network Information in Trusted Extensions (Task Map)

The following task map describes tasks to configure the network and to verify the configuration.

Task	Description	For Instructions
Configure static routes.	Manually describes the best route from one host to another host.	"How to Configure Routes With Security Attributes" on page 179
Check the accuracy of the local network databases.	Uses the `tnchkdb` command to check the syntactic validity of the local network databases.	"How to Check the Syntax of Trusted Network Databases" on page 181
Compare the network database entries with the entries in the kernel cache.	Uses the `tninfo` command to determine if the kernel cache has been updated with the latest database information.	"How to Compare Trusted Network Database Information With the Kernel Cache" on page 182
Synchronize the kernel cache with the network databases.	Uses the `tnctl` command to update the kernel cache with up-to-date network database information on a running system.	"How to Synchronize the Kernel Cache With Trusted Network Databases" on page 183

▼ How to Configure Routes With Security Attributes

Before You Begin You must be in the Security Administrator role in the global zone.

1 Add every destination host and gateway that you are using to route packets over the trusted network.

The addresses are added to the local `/etc/hosts` file, or to its equivalent on the LDAP server. Use the Computers and Networks tool in the Solaris Management Console. The Files scope

modifies the `/etc/hosts` file. The LDAP scope modifies the entries on the LDAP server. For details, see "How to Add Hosts to the System's Known Network" on page 173.

2 Assign each destination host, network, and gateway to a security template.

The addresses are added to the local `/etc/security/tsol/tnrhdb` file, or to its equivalent on the LDAP server. Use the Security Templates tool in the Solaris Management Console. For details, see "How to Assign a Security Template to a Host or a Group of Hosts" on page 174.

3 Set up the routes.

In a terminal window, use the `route add` command to specify routes.

The first entry sets up a default route. The entry specifies a gateway's address, `192.168.113.1`, to use when no specific route is defined for either the host or the packet's destination.

```
# route add default 192.168.113.1  -static
```

For details, see the `route(1M)` man page.

4 Set up one or more network entries.

Use the `-secattr` flag to specify security attributes.

In the following list of commands, the second line shows a network entry. The third line shows a network entry with a label range of `PUBLIC` to `CONFIDENTIAL : INTERNAL USE ONLY`.

```
# route add default 192.168.113.36
# route add -net 192.168.102.0 gateway-101
# route add -net 192.168.101.0 gateway-102 \
-secattr min_sl="PUBLIC",max_sl="CONFIDENTIAL : INTERNAL USE ONLY",doi=1
```

5 Set up one or more host entries.

The new fourth line shows a host entry for the single-label host, `gateway-pub`. `gateway-pub` has a label range of `PUBLIC` to `PUBLIC`.

```
# route add default 192.168.113.36
# route add -net 192.168.102.0 gateway-101
# route add -net 192.168.101.0 gateway-102 \
-secattr min_sl="PUBLIC",max_sl="CONFIDENTIAL : INTERNAL USE ONLY",doi=1
# route add -host 192.168.101.3 gateway-pub \
-secattr min_sl="PUBLIC",max_sl="PUBLIC",doi=1
```

Example 13–14 Adding a Route With a Label Range of `CONFIDENTIAL : INTERNAL USE ONLY` to `CONFIDENTIAL : RESTRICTED`

The following `route` command adds to the routing table the hosts at `192.168.115.0` with `192.168.118.39` as its gateway. The label range is from `CONFIDENTIAL : INTERNAL USE ONLY` to `CONFIDENTIAL : RESTRICTED`, and the DOI is `1`.

```
$ route add -net 192.168.115.0 192.168.118.39 \
-secattr min_sl="CONFIDENTIAL : INTERNAL USE ONLY",max_sl="CONFIDENTIAL : RESTRICTED",doi=1
```

The result of the added hosts is shown with the `netstat -rR` command. In the following excerpt, the other routes are replaced by ellipses (...).

```
$ netstat -rRn
...
192.168.115.0        192.168.118.39        UG       0      0
       min_sl=CNF : INTERNAL USE ONLY,max_sl=CNF : RESTRICTED,DOI=1,CIPSO
...
```

How to Check the Syntax of Trusted Network Databases

The `tnchkdb` command checks that the syntax of each network database is accurate. The Solaris Management Console runs this command automatically when you use the Security Templates tool or the Trusted Network Zones tool. Typically, you run this command to check the syntax of database files that you are configuring for future use.

Before You Begin You must be in the global zone in a role that can check network settings. The Security Administrator role and the System Administrator role can check these settings.

- **In a terminal window, run the `tnchkdb` command.**

  ```
  $ tnchkdb [-h tnrhdb-path] [-t tnrhtp-path] [-z tnzonecfg-path]
  checking /etc/security/tsol/tnrhtp ...
  checking /etc/security/tsol/tnrhdb ...
  checking /etc/security/tsol/tnzonecfg ...
  ```

Example 13–15 Testing the Syntax of a Trial Network Database

In this example, the security administrator is testing a network database file for possible use. Initially, the administrator uses the wrong option. The results of the check are printed on the line for the `tnrhdb` file:

```
$ tnchkdb -h /opt/secfiles/trial.tnrhtp
checking /etc/security/tsol/tnrhtp ...
checking /opt/secfiles/trial.tnrhtp ...
line 12: Illegal name: min_sl=ADMIN_LOW;max_sl=ADMIN_HIGH
line 14: Illegal name: min_sl=ADMIN_LOW;max_sl=ADMIN_HIGH
checking /etc/security/tsol/tnzonecfg ...
```

When the security administrator checks the file by using the `-t` option, the command confirms that the syntax of the trial `tnrhtp` database is accurate:

```
$ tnchkdb -t /opt/secfiles/trial.tnrhtp
checking /opt/secfiles/trial.tnrhtp ...
checking /etc/security/tsol/tnrhdb ...
checking /etc/security/tsol/tnzonecfg ...
```

▼ How to Compare Trusted Network Database Information With the Kernel Cache

The network databases might contain information that is not cached in the kernel. This procedure checks that the information is identical. When you use the Solaris Management Console to update the network, the kernel cache is updated with network database information. The `tninfo` command is useful during testing and for debugging.

Before You Begin You must be in the global zone in a role that can check network settings. The Security Administrator role and the System Administrator role can check these settings.

- **In a terminal window, run the `tninfo` command.**
  - `tninfo -h` *hostname* displays the IP address and template for the specified host.
  - `tninfo -t` *templatename* displays the following information:

    ```
    template: template-name
    host_type: either CIPSO or UNLABELED
    doi: 1
    min_sl: minimum-label
    hex: minimum-hex-label
    max_sl: maximum-label
    hex:maximum-hex-label
    ```

  - `tninfo -m` *zone-name* displays the multilevel port (MLP) configuration of a zone.

Example 13–16 Displaying Multilevel Ports on a Host

In this example, a system is configured with several labeled zones. All zones share the same IP address. Some zones are also configured with zone-specific addresses. In this configuration, the TCP port for web browsing, port `8080`, is an MLP on a shared interface in the public zone. The administrator has also set up `telnet`, TCP port `23`, to be an MLP in the public zone. Because these two MLPs are on a shared interface, no other zone, including the global zone, can receive packets on the shared interface on ports `8080` and `23`.

In addition, the TCP port for `ssh`, port `22`, is a per-zone MLP in the public zone. The public zone's `ssh` service can receive any packets on its zone-specific address within the address's label range.

The following command shows the MLPs for the public zone:

```
$ tninfo -m public
private: 22/tcp
shared:  23/tcp;8080/tcp
```

The following command shows the MLPs for the global zone. Note that ports `23` and `8080` cannot be MLPs in the global zone because the global zone shares the same address with the public zone:

```
$ tninfo -m global
private: 111/tcp;111/udp;514/tcp;515/tcp;631/tcp;2049/tcp;
         6000-6003/tcp;38672/tcp;60770/tcp;
shared:  6000-6003/tcp
```

How to Synchronize the Kernel Cache With Trusted Network Databases

When the kernel has not been updated with trusted network database information, you have several ways to update the kernel cache. The Solaris Management Console runs this command automatically when you use the Security Templates tool or the Trusted Network Zones tool.

Before You Begin You must be in the Security Administrator role in the global zone.

- **To synchronize the kernel cache with network databases, run one of the following commands:**

  - **Restart the `tnctl` service.**

    Caution – Do not use this method on systems that obtain their trusted network database information from an LDAP server. The local database information would overwrite the information that is obtained from the LDAP server.

    ```
    $ svcadm restart  svc:/network/tnctl
    ```

    This command reads all information from the local trusted network databases into the kernel.

  - **Update the kernel cache for your recently added entries.**

    ```
    $ tnctl -h hostname
    ```

    This command reads only the information from the chosen option into the kernel. For details about the options, see Example 13–17 and the `tnctl`(1M) man page.

  - **Modify the `tnd` service.**

    Note – The `tnd` service is running only if the `ldap` service running.

    - **Change the `tnd` polling interval.**

      This does not update the kernel cache. However, you can shorten the polling interval to update the kernel cache more frequently. For details, see the example in the `tnd`(1M) man page.

- **Refresh the `tnd`.**

  This Service Management Facility (SMF) command triggers an immediate update of the kernel with recent changes to trusted network databases.

  ```
  $ svcadm refresh svc:/network/tnd
  ```

- **Restart the `tnd` by using SMF.**

  ```
  $ svcadm restart svc:/network/tnd
  ```

Caution – Avoid running the `tnd` command to restart the `tnd`. This command can interrupt communications that are currently succeeding.

Example 13–17 Updating the Kernel With Your Latest `tnrhdb` Entries

In this example, the administrator has added three addresses to the local `tnrhdb` database. First, the administrator removed the `0.0.0.0` wildcard entry.

```
$ tnctl -d -h 0.0.0.0:admin_low
```

Then, the administrator views the format of the final three entries in the `/etc/security/tsol/tnrhdb` database:

```
$ tail /etc/security/tsol/tnrhdb
#\:\:0:admin_low
127.0.0.1:cipso
#\:\:1:cipso
192.168.103.5:admin_low
192.168.103.0:cipso
0.0.0.0/32:admin_low
```

Then, the administrator updates the kernel cache:

```
$ tnctl -h 192.168.103.5
tnctl -h 192.168.103.0
tnctl -h 0.0.0.0/32
```

Finally, the administrator verifies that the kernel cache is updated. The output for the first entry is similar to the following:

```
$ tninfo -h 192.168.103.5
IP Address: 192.168.103.5
Template: admin_low
```

Example 13–18 Updating Network Information in the Kernel

In this example, the administrator updates the trusted network with a public print server, and then checks that the kernel settings are correct.

```
$ tnctl -h public-print-server
$ tninfo -h public-print-server
IP Address: 192.168.103.55
Template: PublicOnly
$ tninfo -t PublicOnly
================================
Remote Host Template Table Entries
--------------------------------
template: PublicOnly
host_type: CIPSO
doi: 1
min_sl: PUBLIC
hex: 0x0002-08-08
max_sl: PUBLIC
hex: 0x0002-08-08
```

Troubleshooting the Trusted Network (Task Map)

The following task map describes tasks to debug your network.

Task	Description	For Instructions
Determine why two hosts cannot communicate.	Checks that the interfaces on a single system are up.	"How to Verify That a Host's Interfaces Are Up" on page 185
	Uses debugging tools when two hosts cannot communicate with each other.	"How to Debug the Trusted Extensions Network" on page 186
Determine why an LDAP client cannot reach the LDAP server.	Troubleshoots the loss of connection between an LDAP server and a client.	"How to Debug a Client Connection to the LDAP Server" on page 188

▼ How to Verify That a Host's Interfaces Are Up

Use this procedure if your system does not communicate with other hosts as expected.

Before You Begin You must be in the global zone in a role that can check network settings. The Security Administrator role and the System Administrator role can check these settings.

1 Verify that the system's network interface is up.

The following output shows that the system has two network interfaces, `hme0` and `hme0:3`. Neither interface is up.

```
# ifconfig -a
...
hme0: flags=1000843<BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500 index 2
         inet 192.168.0.11 netmask ffffff00 broadcast 192.168.0.255
hme0:3 flags=1000843<BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500 index 2
         inet 192.168.0.12 netmask ffffff00 broadcast 192.168.0.255
```

2 **If the interface is not up, bring it up and then verify that it is up.**

The following output shows that both interfaces are up.

```
# ifconfig hme0 up
# ifconfig -a
...
hme0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,...
hme0:3 flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,..
```

How to Debug the Trusted Extensions Network

To debug two hosts that should be communicating but are not, you can use Trusted Extensions and Solaris debugging tools. For example, Oracle Solaris network debugging commands such as `snoop` and `netstat` are available. For details, see the `snoop`(1M) and `netstat`(1M) man pages. For commands that are specific to Trusted Extensions, see Table 2–4.

- For problems with contacting labeled zones, see "Managing Zones (Task Map)" on page 120.
- For debugging NFS mounts, see "How to Troubleshoot Mount Failures in Trusted Extensions" on page 146.
- For debugging LDAP communications, see "How to Debug a Client Connection to the LDAP Server" on page 188.

Before You Begin You must be in the global zone in a role that can check network settings. The Security Administrator role or the System Administrator role can check these settings.

1 **To troubleshoot the `tnd` daemon, change the polling interval and collect debugging information.**

Note – The `tnd` service is running only if the `ldap` service running.

For details, see the `tnd`(1M) man page.

2 **Check that the hosts that cannot communicate are using the same naming service.**

a. **On each host, check the `nsswitch.conf` file.**

i. **Check the values for the Trusted Extensions databases in the `nsswitch.conf` file.**

For example, at a site that uses LDAP to administer the network, the entries are similar to the following:

```
# Trusted Extensions
tnrhtp: files ldap
tnrhdb: files ldap
```

ii. If the values are different, correct the `nsswitch.conf` file.

To modify these entries, the system administrator uses the Name Service Switch action. For details, see "How to Start CDE Administrative Actions in Trusted Extensions" on page 53. This action preserves the required DAC and MAC file permissions.

b. Check that the LDAP naming service is configured.

```
$ ldaplist -l
```

c. Check that both hosts are in the LDAP naming service.

```
$ ldaplist -l hosts | grep hostname
```

3 Check that each host is defined correctly.

a. Use the Solaris Management Console to verify the definitions.

- In the Security Templates tool, check that each host is assigned to a security template that is compatible with the security template of the other host.
- For an an unlabeled system, check that the default label assignment is correct.
- In the Trusted Network Zones tool, check that the multilevel ports (MLPs) are correctly configured.

b. Use the command line to check that the network information in the kernel is current.

Check that the assignment in each host's kernel cache matches the assignment on the network, and on the other host.

To get security information for the source, destination, and gateway hosts in the transmission, use the `tninfo` command.

- **Display the IP address and the assigned security template for a given host.**

```
$ tninfo -h hostname
IP Address: IP-address
Template: template-name
```

- **Display a template definition.**

```
$ tninfo -t template-name
template: template-name
host_type: one of CIPSO or UNLABELED
doi: 1
min_sl: minimum-label
hex: minimum-hex-label
max_sl: maximum-label
hex: maximum-hex-label
```

- **Display the MLPs for a zone.**

```
$ tninfo -m zone-name
private: ports-that-are-specific-to-this-zone-only
shared: ports-that-the-zone-shares-with-other-zones
```

4 **Fix any incorrect information.**

- To change or check network security information, use the Solaris Management Console tools. For details, see "How to Open the Trusted Networking Tools" on page 168
- To update the kernel cache, restart the `tnctl` service on the host whose information is out of date. Allow some time for this process to complete. Then, refresh the `tnd` service. If the refresh fails, try restarting the `tnd` service. For details, see "How to Synchronize the Kernel Cache With Trusted Network Databases" on page 183.

Note – The `tnd` service is running only if the `ldap` service running.

Rebooting clears the kernel cache. At boot time, the cache is populated with database information. The `nsswitch.conf` file determines whether local databases or LDAP databases are used to populate the kernel.

5 **Collect transmission information to help you in debugging.**

- **Verify your routing configuration.**

  Use the `get` subcommand to the `route` command.

  ```
  $ route get [ip] -secattr sl=label,doi=integer
  ```

  For details, see the `route`(1M) man page.

- **View the label information in packets.**

  Use the `snoop -v` command.

  The `-v` option displays the details of packet headers, including label information. This command provides a lot of detail, so you might want to restrict the packets that the command examines. For details, see the `snoop`(1M) man page.

- **View the routing table entries and the security attributes on sockets.**

  Use the `-R` option with the `netstat -a|-r` command.

  The `-aR` option displays extended security attributes for sockets. The `-rR` option displays routing table entries. For details, see the `netstat`(1M) man page.

▼ How to Debug a Client Connection to the LDAP Server

Misconfiguration of the client entry on the LDAP server can prevent the client from communicating with the server. Similarly, misconfiguration of files on the client can prevent communication. Check the following entries and files when attempting to debug a client-server communication problem.

Before You Begin You must be in the Security Administrator role in the global zone on the LDAP client.

1 Check that the remote host template for the LDAP server and for the gateway to the LDAP server are correct.

```
# tninfo -h LDAP-server
# route get LDAP-server
# tninfo -h gateway-to-LDAP-server
```

If a remote host template assignment is incorrect, assign the host to the correct template by using the Security Templates tool in the Solaris Management Console.

2 Check and correct the `/etc/hosts` file.

Your system, the interfaces for the labeled zones on your system, the gateway to the LDAP server, and the LDAP server must be listed in the file. You might have more entries.

Look for duplicate entries. Remove any entries that are labeled zones on other systems. For example, if `Lserver` is the name of your LDAP server, and `LServer-zones` is the shared interface for the labeled zones, remove `LServer-zones` from `/etc/hosts`.

3 If you are using DNS, check and correct the entries in the `resolv.conf` file.

```
# more resolv.conf
search list of domains
domain domain-name
nameserver IP-address

...
nameserver IP-address
```

4 Check that the `tnrhdb` and `tnrhtp` entries in the `nsswitch.conf` file are accurate.

5 Check that the client is correctly configured on the server.

```
# ldaplist -l tnrhdb client-IP-address
```

6 Check that the interfaces for your labeled zones are correctly configured on the LDAP server.

```
# ldaplist -l tnrhdb client-zone-IP-address
```

7 Verify that you can `ping` the LDAP server from all currently running zones.

```
# ldapclient list
...
NS_LDAP_SERVERS= LDAP-server-address
# zlogin zone-name1 ping LDAP-server-address
LDAP-server-address is alive
# zlogin zone-name2 ping LDAP-server-address
LDAP-server-address is alive
...
```

8 Configure LDAP and reboot.

a. For the procedure, see "Make the Global Zone an LDAP Client in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

b. In every labeled zone, re-establish the zone as a client of the LDAP server.

```
# zlogin zone-name1
# ldapclient init \
-a profileName=profileName \
-a domainName=domain \
-a proxyDN=proxyDN \
-a proxyPassword=password  LDAP-Server-IP-Address
# exit
# zlogin zone-name2 ...
```

c. Halt all zones, lock the file systems, and reboot.

If you are using Oracle Solaris ZFS, halt the zones and lock the file systems before rebooting. If you are not using ZFS, you can reboot without halting the zones and locking the file systems.

```
# zoneadm list
# zoneadm -z zone-name halt
# lockfs -fa
# reboot
```

◆ ◆ ◆ CHAPTER 14

Multilevel Mail in Trusted Extensions (Overview)

This chapter covers security and multilevel mailers on systems that are configured with Trusted Extensions.

Multilevel Mail Service

Trusted Extensions provides multilevel mail for any mail application. When regular users start their mailer, the application opens at the user's current label. If users are operating in a multilevel system, they might want to link or copy their mailer initialization files. For details, see "How to Configure Startup Files for Users in Trusted Extensions" on page 86.

Trusted Extensions Mail Features

In Trusted Extensions, the System Administrator role sets up and administers mail servers according to instructions in the Oracle Solaris *System Administration Guide: Advanced Administration* and *System Administration Guide: IP Services*. In addition, the security administrator determines how Trusted Extensions mail features need to be configured.

The following aspects of managing mail are specific to Trusted Extensions:

- The `.mailrc` file is at a user's minimum label.

  Therefore, users who work at multiple labels do not have a `.mailrc` file at the higher labels, unless they copy or link the `.mailrc` file in their minimum-label directory to each higher directory.

  The Security Administrator role or the individual user can add the `.mailrc` file to either `.copy_files` or `.link_files`. For a description of these files, see the `updatehome`(1M) man page. For configuration suggestions, see "`.copy_files` and `.link_files` Files" on page 81.

- Your mail reader can run at every label on a system. Some configuration is required to connect a mail client to the server.

  For example, to use Mozilla mail for multilevel mail requires that you configure a Mozilla mail client at each label to specify the mail server. The mail server could be the same or different for each label, but the server must be specified.

- The Mailing Lists tool in the Solaris Management Console manages mail aliases.

  Depending on the scope of the selected Solaris Management Console toolbox, you can update the local `/etc/aliases` file or the LDAP entry on the Sun Java System Directory Server.

- Trusted Extensions software checks host and user labels before sending or forwarding mail.
  - The software checks that the mail is within the accreditation range of the host. The checks are described in this list and in Chapter 13, "Managing Networks in Trusted Extensions (Tasks)."
  - The software checks that the mail is between the account's clearance and minimum label.
  - Users can read email that is received within their accreditation range. During a session, users can read mail only at their current label.

    To contact regular user by email, an administrative role must send mail from a workspace that is at a label that the user can read. The user's default label is usually a good choice.

◆ ◆ ◆ CHAPTER 15

Managing Labeled Printing (Tasks)

This chapter describes how to use Trusted Extensions software to configure labeled printing. It also describes how to configure print jobs without the labeling options.

Labels, Printers, and Printing

Trusted Extensions software uses labels to control printer access. Labels are used to control access to printers and to information about queued print jobs. The software also labels printed output. Body pages are labeled, and mandatory banner and trailer pages are labeled. Banner and trailer pages can also include handling instructions.

The system administrator handles basic printer administration. The security administrator role manages printer security, which includes labels and how the labeled output is handled. The administrators follow basic Oracle Solaris printer administration procedures, then they assign labels to the print servers and printers.

Trusted Extensions software supports both single-level and multilevel printing. Multilevel printing is implemented in the global zone only. To use the global zone's print server, a labeled zone must have a host name that is different from the global zone. One way to obtain a distinct host name is to assign an IP address to the labeled zone. The address would be distinct from the global zone's IP address.

Restricting Access to Printers and Print Job Information in Trusted Extensions

Users and roles on a system that is configured with Trusted Extensions software create print jobs at the label of their session. The print jobs can print only on printers that recognize that label. The label must be in the printer's label range.

Users and roles can view print jobs whose label is the same as the label of the session. In the global zone, a role can view jobs whose labels are dominated by the label of the zone.

Printers that are configured with Trusted Extensions software print labels on the printer output. Printers that are managed by unlabeled print servers do not print labels on the printer output. Such printers have the same label as their unlabeled server. For example, an Oracle Solaris print server can be assigned an arbitrary label in the `tnrhdb` database of the LDAP naming service. Users can then print jobs at that arbitrary label on the Oracle Solaris printer. As with Trusted Extensions printers, those Oracle Solaris printers can only accept print jobs from users who are working at the label that has been assigned to the print server.

Labeled Printer Output

Trusted Extensions prints security information on body pages and banner and trailer pages. The information comes from the `label_encodings` file and from the `tsol_separator.ps` file.

The security administrator can do the following to modify defaults that set labels and add handling instructions to printer output:

- Localize or customize the text on the banner and trailer pages
- Specify alternate labels to be printed on body pages or in the various fields of the banner and trailer pages
- Change or omit any of the text or labels

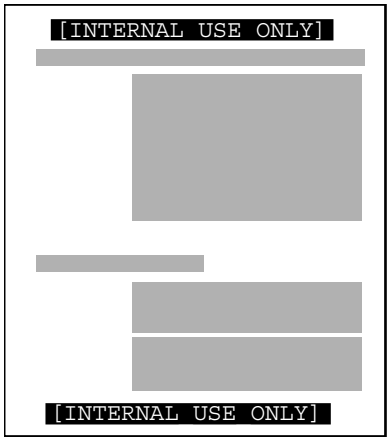
The security administrator can also configure user accounts to use printers that do not print labels on the output. Users can also be authorized to selectively not print banners or labels on printer output.

Labeled Body Pages

By default, the "Protect As" classification is printed at the top and bottom of every body page. The "Protect As" classification is the dominant classification when the classification from the job's label is compared to the `minimum protect as classification`. The `minimum protect as classification` is defined in the `label_encodings` file.

For example, if the user is logged in to an Internal Use Only session, then the user's print jobs are at that label. If the `minimum protect as classification` in the `label_encodings` file is Public, then the Internal Use Only label is printed on the body pages.

FIGURE 15–1 Job's Label Printed at the Top and Bottom of a Body Page



Labeled Banner and Trailer Pages

The following figures show a default banner page and how the default trailer page differs. Callouts identify the various sections. Note that the trailer page uses a different outer line.

The text, labels, and warnings that appear on print jobs are configurable. The text can also be replaced with text in another language for localization.

FIGURE 15–2 Typical Banner Page of a Labeled Print Job

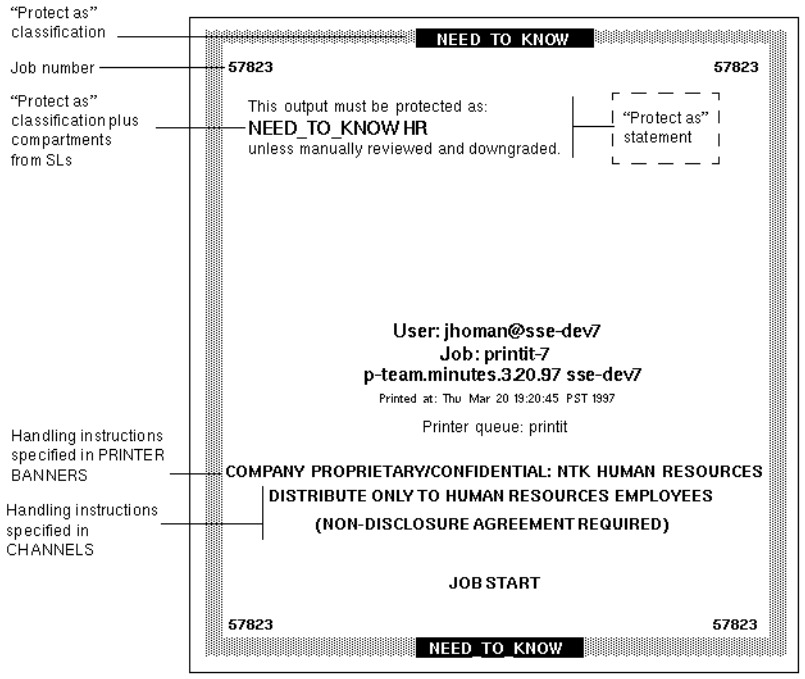
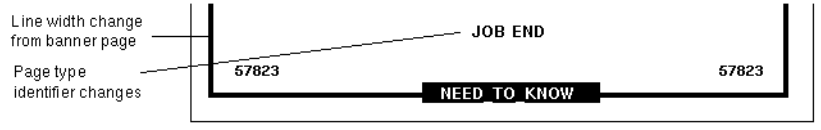


FIGURE 15–3 Differences on a Trailer Page



The following table shows aspects of trusted printing that the security administrator can change by modifying the `/usr/lib/lp/postscript/tsol_separator.ps` file.

Note – To localize or internationalize the printed output, see the comments in the `tsol_separator.ps` file.

TABLE 15–1 Configurable Values in the `tsol_separator.ps` File

Output	Default Value	How Defined	To Change
`PRINTER BANNERS`	`/Caveats Job_Caveats`	`/Caveats Job_Caveats`	See "Specifying Printer Banners" in *Oracle Solaris Trusted Extensions Label Administration*.
`CHANNELS`	`/Channels Job_Channels`	`/Channels Job_Channels`	See "Specifying Channels" in *Oracle Solaris Trusted Extensions Label Administration*.
Label at the top of banner and trailer pages	`/HeadLabel Job_Protect def`	See `/PageLabel` description.	The same as changing `/PageLabel`.. Also see "Specifying the Protect As Classification" in *Oracle Solaris Trusted Extensions Label Administration*.
Label at the top and bottom of body pages	`/PageLabel Job_Protect def`	Compares the label of the job to the `minimum protect as classification` in the `label_encodings` file. Prints the more dominant classification. Contains compartments if the print job's label has compartments.	Change the `/PageLabel` definition to specify another value. Or, type a string of your choosing. Or, print nothing at all.
Text and label in the "Protect as" classification statement	`/Protect Job_Protect def`	See `/PageLabel` description.	The same as changing `/PageLabel`.
	`/Protect_Text1 () def`	Text to appear above label.	Replace `()` in `Protect_Text1` and `Protect_Text2` with text string.
	`/Protect_Text2 () def`	Text to appear below label.	

PostScript Printing of Security Information

Labeled printing in Trusted Extensions relies on features from Solaris printing. In the Oracle Solaris OS, printer model scripts handle banner page creation. To implement labeling, a printer model script first converts the print job to a PostScript file. Then, the PostScript file is manipulated to insert labels on body pages, and to create banner and trailer pages.

Solaris printer model scripts can also translate PostScript into the native language of a printer. If a printer accepts PostScript input, then Oracle Solaris software sends the job to the printer. If a printer does not accept PostScript input, then the software converts the PostScript format to a raster image. The raster image is then converted to the appropriate printer format.

Because PostScript software is used to print label information, users cannot print PostScript files by default. This restriction prevents a knowledgeable PostScript programmer from creating a PostScript file that modifies the labels on the printer output.

The Security Administrator role can override this restriction by assigning the `Print Postscript` authorization to role accounts and to trustworthy users. The authorization is assigned only if the account can be trusted not to spoof the labels on printer output. Also, allowing a user to print PostScript files must be consistent with the site's security policy.

Printer Model Scripts

A printer model script enables a particular model of printer to provide banner and trailer pages. Trusted Extensions provides four scripts:

- `tsol_standard` - For directly attached PostScript printers, for example, printers attached by a parallel port
- `tsol_netstandard` - For network–accessible PostScript printers
- `tsol_standard_foomatic` - For directly attached printers that do not print PostScript format
- `tsol_netstandard_foomatic` - For network–accessible printers that do not print PostScript format

The `foomatic` scripts are used when a printer driver name begins with `Foomatic`. Foomatic drivers are PostScript Printer Drivers (PPD).

Note – When you add a printer to a labeled zone, "Use PPD" is specified by default in the Print Manager. A PPD is then used to translate banner and trailer pages into the language of the printer.

Additional Conversion Filters

A conversion filter converts text files to PostScript format. The filter's programs are trusted programs that are run by the printer daemon. Files that are converted to PostScript format by any installed filter program can be trusted to have authentic labels and banner and trailer page text.

Oracle Solaris software provides most conversion filters that a site needs. A site's System Administrator role can install additional filters. These filters can then be trusted to have authentic labels, and banner and trailer pages. To add conversion filters, see Chapter 7, "Customizing LP Printing Services and Printers (Tasks)," in *System Administration Guide: Printing*.

Interoperability of Trusted Extensions With Trusted Solaris 8 Printing

Trusted Solaris 8 and Trusted Extensions systems that have compatible `label_encodings` files and that identify each other as using a CIPSO template can use each other for remote printing. The following table describes how to set up the systems to enable printing. By default, users cannot list or cancel print jobs on a remote print server of the other OS. Optionally, you can authorize users to do so.

Originating System	Print Server System	Action	Results
Trusted Extensions	Trusted Solaris 8	Configure printing – In the Trusted Extensions `tnrhdb`, assign a template with the appropriate label range to the Trusted Solaris 8 print server. The label could be CIPSO or unlabeled.	Trusted Solaris 8 printer can print jobs from a Trusted Extensions system within the printer's label range.
Trusted Extensions	Trusted Solaris 8	Authorize users – On the Trusted Extensions system, create a profile that adds the needed authorizations. Assign the profile to users.	Trusted Extensions users can list or cancel print jobs that they send to a Trusted Solaris 8 printer. Users cannot view or remove jobs at a different label.
Trusted Solaris 8	Trusted Extensions	Configure printing – In the Trusted Solaris 8 `tnrhdb`, assign a template with the appropriate label range to the Trusted Extensions print server. The label could be CIPSO or unlabeled.	Trusted Extensions printer can print jobs from a Trusted Solaris 8 system within the printer's label range.
Trusted Solaris 8	Trusted Extensions	Authorize users – On the Trusted Solaris 8 system, create a profile that adds the needed authorizations. Assign the profile to users.	Trusted Solaris 8 users can list or cancel print jobs that they send to a Trusted Extensions printer. Users cannot view or remove jobs at a different label.

Trusted Extensions Print Interfaces (Reference)

The following user commands are extended to conform with Trusted Extensions security policy:

- `cancel` – The caller must be equal to the label of the print job to cancel a job. By default, regular users can cancel only their own jobs.
- `lp` – Trusted Extensions adds the `-o nolabels` option. Users must be authorized to print with no labels. Similarly, users must be authorized to use the `-o nobanner` option.
- `lpstat` – The caller must be equal to the label of the print job to obtain the status of a job. By default, regular users can view only their own print jobs.

The following administrative commands are extended to conform with Trusted Extensions security policy. As in the Oracle Solaris OS, these commands can only be run by a role that includes the Printer Management rights profile.

- `lpmove` – The caller must be equal to the label of the print job to move a job. By default, regular users can move only their own print jobs.
- `lpadmin` – In the global zone, this command works for all jobs. In a labeled zone, the caller must dominate the print job's label to view a job, and be equal to change a job.

  Trusted Extensions adds printer model scripts to the `-m` option. Trusted Extensions adds the `-o nolabels` option.
- `lpsched` – In the global zone, this command is always successful. As in the Oracle Solaris OS, use the `svcadm` command to enable, disable, start, or restart the print service. In a labeled zone, the caller must be equal to the label of the print service to change the print service. For details about the service management facility, see the `smf(5)`, `svcadm(1M)`, and `svcs(1)` man pages.

Trusted Extensions adds the `solaris.label.print` authorization to the Printer Management rights profile. The `solaris.print.unlabeled` authorization is required to print body pages without labels.

Managing Printing in Trusted Extensions (Task Map)

Trusted Extensions procedures for configuring printing are performed after completing Oracle Solaris printer setup. The following task map points to the major tasks that manage labeled printing.

Task	Description	For Instructions
Configure printers for labeled output.	Enables users to print to a Trusted Extensions printer. The print jobs are marked with labels.	"Configuring Labeled Printing (Task Map)" on page 201

Task	Description	For Instructions
Remove visible labels from printer output.	Enables users to print at a specific label to an Oracle Solaris printer. The print jobs are not marked with labels. Or, prevents labels from printing on a Trusted Extensions printer.	"Reducing Printing Restrictions in Trusted Extensions (Task Map)" on page 213

Configuring Labeled Printing (Task Map)

The following task map describes common configuration procedures that are related to labeled printing.

Note – Printer clients can only print jobs within the label range of the Trusted Extensions print server.

Task	Description	For Instructions
Configure printing from the global zone.	Creates a multilevel print server in the global zone.	"How to Configure a Multilevel Print Server and Its Printers" on page 201
Configure printing for a network of systems.	Creates a multilevel print server in the global zone and enables labeled zones to use the printer.	"How to Configure a Network Printer for Sun Ray Clients" on page 203
Configure printing for unlabeled systems in the same subnet as labeled systems.	Enable unlabeled systems to use the network printer.	"How to Configure Cascade Printing on a Labeled System" on page 206
Configure printing from a labeled zone.	Creates a single–label print server for a labeled zone.	"How to Configure a Zone for Single-Label Printing" on page 209
Configure a multilevel print client.	Connects a Trusted Extensions host to a printer.	"How to Enable a Trusted Extensions Client to Access a Printer" on page 210
Restrict the label range of a printer.	Limits a Trusted Extensions printer to a narrow label range.	"How to Configure a Restricted Label Range for a Printer" on page 212

▼ How to Configure a Multilevel Print Server and Its Printers

Printers that are managed by a Trusted Extensions print server print labels on body pages, banner pages, and trailer pages. Such printers can print jobs within the label range of the print server. Any Trusted Extensions host that can reach the print server can use the printers that are connected to that server.

Before You Begin Determine the print server for your Trusted Extensions network. You must be in the System Administrator role in the global zone on this print server.

1 Start the Solaris Management Console.

For details, see "How to Administer the Local System With the Solaris Management Console" on page 52.

2 Choose the Files toolbox.

The title of the toolbox includes `Scope=Files, Policy=TSOL`.

3 Enable multilevel printing by configuring the global zone with the print server port, 515/tcp.

Create a multilevel port (MLP) for the print server by adding the port to the global zone.

a. Navigate to the Trusted Network Zones tool.

b. In the Multilevel Ports for Zone's IP Addresses, add 515/tcp.

c. Click OK.

4 Define the characteristics of every connected printer.

Use the command line. The Print Manager GUI does not work in the global zone.

```
# lpadmin -p printer-name -v /dev/null \
-o protocol=tcp -o dest=printer-IP-address:9100 -T PS -I postscript
# accept printer-name
# enable printer-name
```

5 Assign a printer model script to each printer that is connected to the print server.

The model script activates the banner and trailer pages for the specified printer.

For a description of the scripts, see "Printer Model Scripts" on page 198. If the driver name for the printer starts with `Foomatic`, then specify one of the foomatic model scripts. On one line, use the following command:

```
$ lpadmin -p printer \
 -m { tsol_standard | tsol_netstandard |
      tsol_standard_foomatic | tsol_netstandard_foomatic }
```

If the default printer label range of `ADMIN_LOW` to `ADMIN_HIGH` is acceptable for every printer, then your label configuration is done.

6 In every labeled zone where printing is allowed, configure the printer.

Use the `all-zones` IP address for the global zone as the print server.

a. Log in as root to the zone console of the labeled zone.

```
# zlogin -C labeled-zone
```

b. Add the printer to the zone.

```
# lpadmin -p printer-name -s all-zones-IP-address
```

c. (Optional) Set the printer as the default.

```
# lpadmin -d printer-name
```

7 In every zone, test the printer.

Note – Starting in the Solaris 10 7/10 release, files with an administrative label, either `ADMIN_HIGH` or `ADMIN_LOW`, print `ADMIN_HIGH` on the body of the printout. The banner and trailer pages are labeled with the highest label and compartments in the `label_encodings` file.

As `root` and as a regular user, perform the following steps:

a. Print plain files from the command line.

b. Print files from your applications, such as StarOffice, your browser, and your editor.

c. Verify that banner pages, trailer pages, and security banners print correctly.

See Also

- **Limit printer label range –** "How to Configure a Restricted Label Range for a Printer" on page 212
- **Prevent labeled output –** "Reducing Printing Restrictions in Trusted Extensions (Task Map)" on page 213
- **Use this zone as a print server –** "How to Enable a Trusted Extensions Client to Access a Printer" on page 210

▼ How to Configure a Network Printer for Sun Ray Clients

This procedure configures a PostScript printer on a Sun Ray server that has a single `all-zones` interface. The printer is made available to all users of Sun Ray clients of this server. Initial configuration happens in the global zone. After the global zone is configured, each labeled zone is configured to use the printer.

Before You Begin You must be logged in to a multilevel session in Trusted CDE.

1 In the global zone, assign an IP address to the network printer.

For instructions, see Chapter 5, "Setting Up Printers by Using LP Print Commands (Tasks)," in *System Administration Guide: Printing*.

2 Start the Solaris Management Console.

- For instructions, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.
- Select the `Scope=Files, Policy=TSOL` toolbox and log in.

3 Assign the printer to the `admin_low` template.

a. In the Computers and Networks tool, double-click Security Templates.

b. Double-click `admin_low`.

c. In the Hosts Assigned to Template tab, add the printer's IP address.

For more information, read the online help in the left pane.

4 Add the printer port to the shared interface of the global zone.

a. In the Computers and Networks tool, double-click Trusted Network Zones.

b. Double-click `global`.

c. To the Multilevel Ports for Shared IP Addresses list, add port `515`, protocol `tcp`.

5 Verify that the Solaris Management Console assignments are in the kernel.

```
# tninfo -h printer-IP-address
   IP address= printer-IP-address
   Template = admin_low

# tninfo -m global
   private: 111/tcp;111/udp;513/tcp;515/tcp;631/tcp;2049/tcp;6000-6050/tcp;
7007/tcp;7010/tcp;7014/tcp;7015/tcp;32771/tcp;32776/ip
   shared: 515/tcp;6000-6050/tcp;7007/tcp;7010/tcp;7014/tcp;7015/tcp
```

Note – The additional private and shared multilevel ports (MLPs) such as `6055` and `7007` support Sun Ray requirements.

---

6 Ensure that printing services are enabled in the global zone.

```
# svcadm enable print/server
# svcadm enable rfc1179
```

7 If your system was installed with `netservices limited`, enable the printer to reach the network.

The `rfc1179` service must listen on addresses other than `localhost`. The LP service listens only on a named pipe.

```
# inetadm -m svc:/application/print/rfc1179:default bind_addr=''
# svcadm refresh rfc1179
```

Note – If you are running `netservices open`, the preceding command generates the following error: `Error: "inetd" property group missing`.

8 Enable all users to print PostScript.

In the Trusted Editor, create the `/etc/default/print` file and add this line:

```
PRINT_POSTSCRIPT=1
```

Applications such as StarOffice and `gedit` create PostScript output.

9 Add all LP filters to the printing service.

In the global zone, run this C-Shell script:

```
csh
    cd /etc/lp/fd/
    foreach a (*.fd)
        lpfilter -f $a:r -F $a
    end
```

10 Add a printer in the global zone.

Use the command line. The Print Manager GUI does not work in the global zone.

```
# lpadmin -p printer-name -v /dev/null -m tsol_netstandard \
-o protocol=tcp -o dest=printer-IP-address:9100 -T PS -I postscript
# accept printer-name
# enable printer-name
```

11 (Optional) Set the printer as the default.

```
# lpadmin -d printer-name
```

12 In every labeled zone, configure the printer.

Use the `all-zones` IP address for the global zone as the print server. If your `all-zones` NIC is a virtual network interface (vni), use the IP address for the vni as the argument to the `-s` option.

a. Log in as root to the zone console of the labeled zone.

```
# zlogin -C labeled-zonename
```

b. Add the printer to the zone.

```
# lpadmin -p printer-name -s global-zone-shared-IP-address
```

c. (Optional) Set the printer as the default.

```
# lpadmin -d printer-name
```

13 In every zone, test the printer.

Note – Starting in the Solaris 10 7/10 release, files with an administrative label, either `ADMIN_HIGH` or `ADMIN_LOW`, print `ADMIN_HIGH` on the body of the printout. The banner and trailer pages are labeled with the highest label and compartments in the `label_encodings` file.

As `root` and as a regular user, perform the following steps:

a. **Print plain files from the command line.**

b. **Print files from your applications, such as StarOffice, your browser, and your editor.**

c. **Verify that banner pages, trailer pages, and security banners print correctly.**

Example 15–1 Determining Printer Status for a Network Printer

In this example, the administrator verifies the network printer's status from the global zone and from a labeled zone.

```
global # lpstat -t
    scheduler is running
    system default destination: math-printer
    system for _default: trusted1 (as printer math-printer)
    device for math-printer: /dev/null
    character set
    default accepting requests since Feb 28 00:00 2008
    lex accepting requests since Feb 28 00:00 2008
    printer math-printer is idle. enabled since Feb 28 00:00 2008. available.

Solaris1# lpstat -t
   scheduler is not running
   system default destination: math-printer
   system for _default: 192.168.4.17 (as printer math-printer)
   system for math-printer: 192.168.4.17
   default accepting requests since Feb 28 00:00 2008
   math-printer accepting requests since Feb 28 00:00 2008
   printer _default is idle. enabled since Feb 28 00:00 2008. available.
   printer math-printer is idle. enabled since Feb 28 00:00 2008. available.
```

▼ How to Configure Cascade Printing on a Labeled System

Cascade printing provides the ability to print from a Windows desktop session to a Trusted Extensions labeled zone interface, where the zone IP address of the physical interface acts as the print spooler. The multilevel port (MLP) listener that is on the zone IP address of the physical interface talks to the Trusted Extensions printing subsystem and prints the file with the appropriate labeled header and trailer sheets.

This procedure enables unlabeled systems that are in the same subnet as labeled systems to use the labeled network printer. The `rfc1179` service handles cascade printing. You must perform this procedure in every labeled zone from which you permit cascade printing.

Before You Begin You have completed "How to Configure a Network Printer for Sun Ray Clients" on page 203.

1 Log in as root to the zone console of the labeled zone.

```
# zlogin -C labeled-zonename
```

2 Remove the `rfc1179` service's dependency on the print/server service.

```
labeled-zone # cat <<EOF | svccfg
      select application/print/rfc1179
      delpg lpsched
      end
   EOF

labeled-zone # svcadm refresh application/print/rfc1179
```

3 Ensure that the `rfc1179` service is enabled.

```
labeled-zone # svcadm enable rfc1179
```

4 If the labeled zone was installed with `netservices limited`, enable the printer to reach the network.

The `rfc1179` service must listen on addresses other than `localhost`. The LP service listens only on a named pipe.

```
# inetadm -m svc:/application/print/rfc1179:default bind_addr=''
# svcadm refresh rfc1179
```

Note – If you are running `netservices open`, the preceding command generates the following message: `Error: "inetd" property group missing`.

---

5 Configure cascade printing from the labeled zone.

```
labeled-zone # lpset -n system -a spooling-type=cascade printer-name
```

This command updates the zone's `/etc/printers.conf` file.

6 Test an Oracle Solaris system that is on the same subnet as this labeled zone.

For example, test the `Solaris1` system. This system is on the same subnet as the `internal` zone. The configuration parameters are the following:

- `math-printer` IP address is 192.168.4.6
- `Solaris1` IP address is 192.168.4.12

- `internal` zone IP address is 192.168.4.17

```
Solaris1# uname -a
SunOS Solaris1 Generic_120011-11 sun4u sparc SUNW,Sun-Blade-1000
Solaris1# lpadmin -p math-printer -s 192.168.4.17
Solaris1# lpadmin -d math-printer

Solaris1# lpstat -t
   scheduler is not running
   system default destination: math-printer
   system for _default: 192.168.4.17 (as printer math-printer)
   system for math-printer: 192.168.4.17
   default accepting requests since Feb 28 00:00 2008
   math-printer accepting requests since Feb 28 00:00 2008
   printer _default is idle. enabled since Feb 28 00:00 2008. available.
   printer math-printer is idle. enabled since Feb 28 00:00 2008. available.
```

- **Test the `lp` command.**

```
Solaris1# lp /etc/hosts
   request id is math-printer-1 (1 file)
```

- **Test printing from applications such as StarOffice and the browser.**

7 Test a Windows 2003 server that is on the same subnet as this labeled zone.

a. Set up the printer on the Windows server.

Use the Start Menu->Settings->Printers & Faxes GUI.

Specify the following printer configuration:

- Add A Printer
- Local Printer attached to this computer
- Create a new port – Standard TCP/IP Port
- Printer Name or IP Address – 192.168.4.17, that is, the IP address of the labeled zone
- Port Name – Accept default
- Additional Port Information Required – Accept default
  - Device Type = Custom
  - Settings – Protocol = LPR
  - LPR Settings – Queue Name = math-printer, that is, the UNIX Queue Name
  - LPR Byte Counting Enabled

Finish the printer prompts by specifying the manufacturer, model, driver and other printer parameters.

8 Test the printer by selecting the printer from an application.

For example, test the `winserver` system that is on the same subnet as the `internal` zone. The configuration parameters are the following:

- `math-printer` IP address is 192.168.4.6
- `winserver` IP address is 192.168.4.200
- `internal` zone IP address is 192.168.4.17

```
winserver C:/> ipconfig
Windows IP Configuration
   Ethernet adapter TP-NIC:
      Connection-specific DNS Suffix  . :
      IP Address. . . . . . . . . . . . : 192.168.4.200
      Subnet Mask . . . . . . . . . . . : 255.255.255.0
      Default Gateway . . . . . . . . . : 192.168.4.17
```

▼ How to Configure a Zone for Single-Label Printing

Before You Begin The zone must not be sharing an IP address with the global zone. You must be in the System Administrator role in the global zone.

1 Add a workspace.

For details, see "How to Add a Workspace at a Particular Label" in *Oracle Solaris Trusted Extensions User's Guide*.

2 Change the label of the new workspace to the label of the zone that will be the print server for that label.

For details, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User's Guide*.

3 Define the characteristics of the connected printers.

a. At the label of zone, start the Print Manager.

By default, the "Use PPD" checkbox is selected. The system finds the appropriate driver for the printer.

b. (Optional) To specify a different printer driver, do the following:

i. Remove the check from "Use PPD".

ii. Define the make and model of the printer that uses a different driver.

In the Print Manager, you supply the values for the first two fields, then the Print Manager supplies the driver name.

`Printer Make`	*manufacturer*
`Printer Model`	*manufacturer-part-number*
`Printer Driver`	*automatically filled in*

4 **Assign a printer model script to each printer that is connected to the zone.**

The model script activates the banner and trailer pages for the specified printer.

For your choices of scripts, see "Printer Model Scripts" on page 198. If the driver name for the printer starts with `Foomatic`, then specify one of the foomatic model scripts. Use the following command:

```
$ lpadmin -p printer -m model
```

The attached printers can print jobs only at the label of the zone.

5 **Test the printer.**

Note – Starting in the Solaris 10 7/10 release, files with an administrative label, either `ADMIN_HIGH` or `ADMIN_LOW`, print `ADMIN_HIGH` on the body of the printout. The banner and trailer pages are labeled with the highest label and compartments in the `label_encodings` file.

As `root` and as a regular user, perform the following steps:

a. **Print plain files from the command line.**

b. **Print files from your applications, such as StarOffice, your browser, and your editor.**

c. **Verify that banner pages, trailer pages, and security banners print correctly.**

See Also **Prevent labeled output –** "Reducing Printing Restrictions in Trusted Extensions (Task Map)" on page 213

▼ How to Enable a Trusted Extensions Client to Access a Printer

Initially, only the zone in which a print server was configured can print to the printers of that print server. The system administrator must explicitly add access to those printers for other zones and systems. The possibilities are as follows:

- For a global zone, add access to the printers that are connected to a global zone on a different system.
- For a labeled zone, add access to the printers that are connected to the global zone of its system.
- For a labeled zone, add access to a printer that a remote zone at the same label is configured for.
- For a labeled zone, add access to the printers that are connected to a global zone on a different system.

Before You Begin A print server has been configured with a label range or a single label, and the printers that are connected to it have been configured. For details, see the following:

- "How to Configure a Multilevel Print Server and Its Printers" on page 201
- "How to Configure a Zone for Single-Label Printing" on page 209
- "How to Assign a Label to an Unlabeled Print Server" on page 214

You must be in the System Administrator role in the global zone, or be able to assume the role.

1 Complete the procedures that enable your systems to access a printer.

- **Configure the global zone on a system that is not a print server to use another system's global zone for printer access.**

  a. On the system that does not have printer access, assume the System Administrator role.

  b. Add access to the printer that is connected to the Trusted Extensions print server.

  ```
  $ lpadmin -s printer
  ```

- **Configure a labeled zone to use its global zone for printer access.**

  a. Change the label of the role workspace to the label of the labeled zone.

  For details, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User's Guide*.

  b. Add access to the printer.

  ```
  $ lpadmin -s printer
  ```

- **Configure a labeled zone to use another system's labeled zone for printer access.**

  The labels of the zones must be identical.

  a. On the system that does not have printer access, assume the System Administrator role.

  b. Change the label of the role workspace to the label of the labeled zone.

  For details, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User's Guide*.

  c. Add access to the printer that is connected to the print server of the remote labeled zone.

  ```
  $ lpadmin -s printer
  ```

- **Configure a labeled zone to use an unlabeled print server for printer access.**

  The label of the zone must be identical to the label of the print server.

  a. On the system that does not have printer access, assume the System Administrator role.

b. Change the label of the role workspace to the label of the labeled zone.

For details, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User's Guide*.

c. Add access to the printer that is connected to the arbitrarily labeled print server.

```
$ lpadmin -s printer
```

2 Test the printers.

Starting in the Solaris 10 7/10 release, files with an administrative label, either `ADMIN_HIGH` or `ADMIN_LOW`, print `ADMIN_HIGH` on the body of the printout. The banner and trailer pages are labeled with the highest label and compartments in the `label_encodings` file.

On every client, test that printing works for `root` and roles in the global zone and for `root`, roles, and regular users in labeled zones.

a. Print plain files from the command line.

b. Print files from your applications, such as StarOffice, your browser, and your editor.

c. Verify that banner pages, trailer pages, and security banners print correctly.

▼ How to Configure a Restricted Label Range for a Printer

The default printer label range is `ADMIN_LOW` to `ADMIN_HIGH`. This procedure narrows the label range for a printer that is controlled by a Trusted Extensions print server.

Before You Begin You must be in the Security Administrator role in the global zone.

1 Start the Device Allocation Manager.

- **Choose the Allocate Device option from the Trusted Path menu.**
- **In Trusted CDE, launch the Device Allocation Manager action from the Tools subpanel on the Front Panel.**

2 Click the Device Administration button to display the Device Allocation: Administration dialog box.

3 Type a name for the new printer.

If the printer is attached to your system, find the name of the printer.

4. **Click the Configure button to display the Device Allocation: Configuration dialog box.**
5. **Change the printer's label range.**
   a. **Click the Min Label button to change the minimum label.**
      Choose a label from the label builder. For information about the label builder, see "Label Builder in Trusted Extensions" on page 43.
   b. **Click the Max Label button to change the maximum label.**
6. **Save the changes.**
   a. **Click OK in the Configuration dialog box.**
   b. **Click OK in the Administration dialog box.**
7. **Close the Device Allocation Manager.**

Reducing Printing Restrictions in Trusted Extensions (Task Map)

The following tasks are optional. They reduce the printing security that Trusted Extensions provides by default when the software is installed.

Task	Description	For Instructions
Configure a printer to not label output.	Prevents security information from printing on body pages, and removes banner and trailer pages.	"How to Remove Labels From Printed Output" on page 214
Configure printers at a single label without labeled output.	Enables users to print at a specific label to an Oracle Solaris printer. The print jobs are not marked with labels.	"How to Assign a Label to an Unlabeled Print Server" on page 214
Remove visible labeling of body pages.	Modifies the `tsol_separator.ps` file to prevent labeled body pages on all print jobs that are sent from a Trusted Extensions host.	"How to Remove Page Labels From All Print Jobs" on page 215
Suppress banner and trailer pages.	Authorizes specific users to print jobs without banner and trailer pages.	"How to Suppress Banner and Trailer Pages for Specific Users" on page 216
Enable trusted users to print jobs without labels.	Authorizes specific users or all users of a particular system to print jobs without labels.	"How to Enable Specific Users to Suppress Page Labels" on page 216
Enable the printing of PostScript files.	Authorizes specific users or all users of a particular system to print PostScript files.	"How to Enable Users to Print PostScript Files in Trusted Extensions" on page 217

Task	Description	For Instructions
Assign printing authorizations.	Enables users to bypass default printing restrictions.	"How to Create a Rights Profile for Convenient Authorizations" on page 92 "How to Modify `policy.conf` Defaults" on page 84

How to Remove Labels From Printed Output

Printers that do not have a Trusted Extensions printer model script do not print labeled banner or trailer pages. The body pages also do not include labels.

Before You Begin You must be in the Security Administrator role in the global zone.

- **At the appropriate label, do one of the following:**
  - **From the print server, stop banner printing altogether.**

    ```
    $ lpadmin -p printer -o nobanner=never
    ```

    Body pages are still labeled.
  - **Set the printer model script to an Oracle Solaris script.**

    ```
    $ lpadmin -p printer  \
    -m { standard | netstandard | standard_foomatic | netstandard_foomatic }
    ```

    No labels appear on printed output.

How to Assign a Label to an Unlabeled Print Server

A Oracle Solaris print server is an unlabeled print server that can be assigned a label for Trusted Extensions access to the printer at that label. Printers that are connected to an unlabeled print server can print jobs only at the label that has been assigned to the print server. Jobs print without labels or trailer pages and might print without banner pages. If a job prints with a banner page, the page does not contain any security information.

A Trusted Extensions system can be configured to submit jobs to a printer that is managed by an unlabeled print server. Users can print jobs on the unlabeled printer at the label that the security administrator assigns to the print server.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Open the Solaris Management Console in the appropriate scope.**

   For details, see "Initialize the Solaris Management Console Server in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

2. **Under System Configuration, navigate to the Computers and Networks tool.**

   Provide a password when prompted.

3. **Assign an unlabeled template to the print server.**

   For details, see "How to Assign a Security Template to a Host or a Group of Hosts" on page 174.

   Choose a label. Users who are working at that label can send print jobs to the Oracle Solaris printer at the label of the print server. Pages do not print with labels, and banner and trailer pages are also not part of the print job.

Example 15–2 Sending Public Print Jobs to an Unlabeled Printer

Files that are available to the general public are suitable for printing to an unlabeled printer. In this example, marketing writers need to produce documents that do not have labels printed on the top and bottom of the pages.

The security administrator assigns an unlabeled host type template to the Oracle Solaris print server. The template is described in Example 13–6. The arbitrary label of the template is `PUBLIC`. The printer `pr-nolabel1` is connected to this print server. Print jobs from users in a `PUBLIC` zone print on the `pr-nolabel1` printer with no labels. Depending on the settings for the printer, the jobs might or might not have banner pages. The banner pages do not contain security information.

▼ How to Remove Page Labels From All Print Jobs

This procedure prevents all print jobs on a Trusted Extensions printer from including visible labels on the body pages of the print job.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Edit the `/usr/lib/lp/postscript/tsol_separator.ps` file.**

   Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

2. **Find the definition of `/PageLabel`.**

   Find the following lines:

   ```
   %% To eliminate page labels completely, change this line to
   %% set the page label to an empty string: /PageLabel () def
   /PageLabel Job_PageLabel def
   ```

   Note – The value `Job_PageLabel` might be different at your site.

3 **Replace the value of `/PageLabel` with a set of empty parentheses.**

```
/PageLabel () def
```

▼ How to Enable Specific Users to Suppress Page Labels

This procedure enables an authorized user or role to print jobs on a Trusted Extensions printer without labels on the top and bottom of each body page. Page labels are suppressed for all labels at which the user can work.

Before You Begin You must be in the Security Administrator role in the global zone.

1 **Determine who is permitted to print jobs without page labels.**

2 **Authorize those users and roles to print jobs without page labels.**

Assign a rights profile that includes the Print without Label authorization to those users and roles. For details, see "How to Create a Rights Profile for Convenient Authorizations" on page 92.

3 **Instruct the user or role to use the `lp` command to submit print jobs:**

```
% lp -o nolabels staff.mtg.notes
```

▼ How to Suppress Banner and Trailer Pages for Specific Users

Before You Begin You must be in the Security Administrator role in the global zone.

1 **Create a rights profile that includes the Print without Banner authorization.**

Assign the profile to each user or role that is allowed to print without banner and trailer pages.

For details, see "How to Create a Rights Profile for Convenient Authorizations" on page 92.

2 **Instruct the user or role to use the `lp` command to submit print jobs:**

```
% lp -o nobanner staff.mtg.notes
```

▼ How to Enable Users to Print PostScript Files in Trusted Extensions

Before You Begin You must be in the Security Administrator role in the global zone.

- **Use one of the following three methods to enable users to print PostScript files:**

  - **To enable PostScript printing on a system, modify the `/etc/default/print` file.**

    a. **Create or modify the `/etc/default/print` file.**

       Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

    b. **Type the following entry:**

       ```
       PRINT_POSTSCRIPT=1
       ```

    c. **Save the file and close the editor.**

  - **To authorize all users to print PostScript files from a system, modify the `/etc/security/policy.conf` file.**

    a. **Modify the `policy.conf` file.**

       Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

    b. **Add the `solaris.print.ps` authorization.**

       `AUTHS_GRANTED=`*other-authorizations*`,solaris.print.ps`

    c. **Save the file and close the editor.**

  - **To enable a user or role to print PostScript files from any system, give just those users and roles the appropriate authorization.**

    Assign a profile that includes the `Print Postscript` authorization to those users and roles. For details, see "How to Create a Rights Profile for Convenient Authorizations" on page 92.

Example 15–3 Enabling PostScript Printing From a Public System

In the following example, the security administrator has constrained a public kiosk to operate at the `PUBLIC` label. The system also has a few icons that open topics of interest. These topics can be printed.

The security administrator creates an `/etc/default/print` file on the system. The file has one entry to enable the printing of PostScript files. No user needs a `Print Postscript` authorization.

```
# vi /etc/default/print

# PRINT_POSTSCRIPT=0
PRINT_POSTSCRIPT=1
```

◆ ◆ ◆ CHAPTER 16

Devices in Trusted Extensions (Overview)

This chapter describes the extensions that Trusted Extensions provides to Oracle Solaris device protection.

Device Protection With Trusted Extensions Software

On an Oracle Solaris system, devices can be protected by allocation and by authorization. By default, devices are available to regular users without an authorization. A system that is configured with Trusted Extensions software uses the device protection mechanisms of the Oracle Solaris OS.

However, by default, Trusted Extensions requires that a device be allocated for use, and that the user be authorized to use the device. In addition, devices are protected by labels. Trusted Extensions provides a graphical user interface (GUI) for administrators to manage devices. The same interface is used by users to allocate devices.

Note – In Trusted Extensions, users cannot use the `allocate` and `deallocate` commands. Users must use the Device Allocation Manager. In Solaris Trusted Extensions (JDS), the title of the GUI is Device Manager.

For information about device protection in the Oracle Solaris OS, see Chapter 4, "Controlling Access to Devices (Tasks)," in *System Administration Guide: Security Services*.

On a system that is configured with Trusted Extensions, two roles protect devices.

- The System Administrator role controls access to peripheral devices.

  The system administrator makes a device allocatable. Devices that the system administrator makes nonallocatable cannot be used by anyone. Allocatable devices can be allocated only by authorized users.
- The Security Administrator role restricts the labels at which a device can be accessed and sets device policy. The security administrator decides who is authorized to allocate a device.

The following are the main features of device control with Trusted Extensions software:

- By default, an unauthorized user on a Trusted Extensions system cannot allocate devices such as tape drives, CD-ROM drives, or diskette drives.

  A regular user with the Allocate Device authorization can import or export information at the label at which the user allocates the device.
- Users invoke the Device Allocation Manager to allocate devices when they are logged in directly. To allocate a device remotely, users must have access to the global zone. Typically, only roles have access to the global zone.
- The label range of each device can be restricted by the security administrator. Regular users are limited to accessing devices whose label range includes the labels at which the users are allowed to work. The default label range of a device is `ADMIN_LOW` to `ADMIN_HIGH`.
- Label ranges can be restricted for both allocatable and nonallocatable devices. Nonallocatable devices are devices such as frame buffers and printers.

Device Label Ranges

To prevent users from copying sensitive information, each allocatable device has a label range. To use an allocatable device, the user must be currently operating at a label within the device's label range. If the user is not, allocation is denied. The user's current label is applied to data that is imported or exported while the device is allocated to the user. The label of exported data is displayed when the device is deallocated. The user must physically label the medium that contains the exported data.

Effects of Label Range on a Device

To restrict direct login access through the console, the security administrator can set a restricted label range on the frame buffer.

For example, a restricted label range might be specified to limit access to a publicly accessible system. The label range enables users to access the system only at a label within the frame buffer's label range.

When a host has a local printer, a restricted label range on the printer limits the jobs that can be printed on the printer.

Device Access Policies

Trusted Extensions follows the same device policies as the Oracle Solaris OS. The security administrator can change default policies and define new policies. The `getdevpolicy` command retrieves information about device policy, and the `update_drv` command changes device policy. For more information, see "Configuring Device Policy (Task Map)" in *System Administration Guide: Security Services*. See also the `getdevpolicy`(1M) and `update_drv`(1M) man pages.

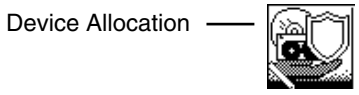
Device-Clean Scripts

A device-clean script is run when a device is allocated or deallocated. The Oracle Solaris OS provides scripts for tape drives, CD-ROM drives, and diskette drives. If your site adds allocatable device types to the system, the added devices might need scripts. To see existing scripts, go to the `/etc/security/lib` directory. For more information, see "Device-Clean Scripts" in *System Administration Guide: Security Services*.

For Trusted Extensions software, device-clean scripts must satisfy certain requirements. These requirements are described in the `device_clean`(5) man page.

Device Allocation Manager GUI

The Device Allocation Manager is used by administrators to administer allocatable and nonallocatable devices. The Device Allocation Manager is also used by regular users to allocate and deallocate devices. The users must have the Allocate Device authorization. In a Solaris Trusted Extensions (CDE) workspace, the Device Allocation Manager is opened from the Front Panel. The icon appears as follows:



In a Solaris Trusted Extensions (JDS) workspace, the GUI is called the Device Manager. This GUI is started from the Trusted Path menu by selecting Allocate Device. In Trusted CDE, you can also start the GUI from the Trusted Path menu. The following figure shows a Device Allocation Manager that was opened by a user who can allocate the `audio` device.

FIGURE 16–1 Device Allocation Manager Opened by a User

Users see an empty list when they are not authorized to allocate devices. Or, an empty list might indicate that the allocatable devices are currently allocated by another user or are in an error state. If a user cannot see a device in the Available Devices list, the user needs to contact the responsible administrator.

The Device Administration feature is available to roles that have either one or both of the authorizations that are needed to administer devices. The administration authorizations are Configure Device Attributes, and Revoke or Reclaim Device. The following figure shows a Device Allocation Administration dialog box.

In a Solaris Trusted Extensions (JDS), the Device Administration button is called Administration.

Enforcement of Device Security in Trusted Extensions

The security administrator decides who can allocate devices and makes sure that any user who is authorized to use devices is trained. The user is trusted to do the following:

- Properly label and handle any media containing exported sensitive information so that the information does not become available to anyone who should not see it.

  For example, if information at a label of `NEED TO KNOW ENGINEERING` is stored on a diskette, the person who exports the information must physically label the disk with the `NEED TO KNOW ENGINEERING` label. The diskette must be stored where it is accessible only to members of the engineering group with a need to know.
- Ensure that labels are properly maintained on any information being imported (read) from media on these devices.

  An authorized user must allocate the device at the label that matches the label of the information that is being imported. For example, if a user allocates a diskette drive at `PUBLIC`, the user must only import information labeled `PUBLIC`.

The security administrator is also responsible for enforcing proper compliance with these security requirements.

Devices in Trusted Extensions (Reference)

Trusted Extensions device protection uses Oracle Solaris interfaces and Trusted Extensions interfaces.

For Oracle Solaris command-line interfaces, see "Device Protection (Reference)" in *System Administration Guide: Security Services*.

Administrators who do not have access to the Device Allocation Manager can administer allocatable devices by using the command line. The `allocate` and `deallocate` commands have administrative options. For examples, see "Forcibly Allocating a Device" in *System Administration Guide: Security Services* and "Forcibly Deallocating a Device" in *System Administration Guide: Security Services*.

For Trusted Extensions command-line interfaces, see the `add_allocatable(1M)` and `remove_allocatable(1M)` man pages.

◆ ◆ ◆ CHAPTER 17

Managing Devices for Trusted Extensions (Tasks)

This chapter describes how to administer and use devices on a system that is configured with Trusted Extensions.

Handling Devices in Trusted Extensions (Task Map)

The following task map points to task maps for administrators and users for handling peripheral devices.

Task	Description	For Instructions
Use devices.	Uses a device as a role or as a regular user.	"Using Devices in Trusted Extensions (Task Map)" on page 226
Administer devices.	Configures devices for ordinary users.	"Managing Devices in Trusted Extensions (Task Map)" on page 226
Customize device authorizations.	The Security Administrator role creates new authorizations, adds them to the device, places them in a rights profile and assigns this profile to the user.	"Customizing Device Authorizations in Trusted Extensions (Task Map)" on page 235

Using Devices in Trusted Extensions (Task Map)

In Trusted Extensions, all roles are authorized to allocate a device. Like users, roles must use the Device Allocation Manager. The Oracle Solaris `allocate` command does not work in Trusted Extensions. The following task map points to user procedures that include using devices to perform administrative tasks.

Task	For Instructions
Allocate and deallocate a device.	"How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide* "Workspace Switch Area" in *Oracle Solaris Trusted Extensions User's Guide*
Use portable media to transfer files.	"How to Copy Files From Portable Media in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide* "How to Copy Files to Portable Media in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*

Managing Devices in Trusted Extensions (Task Map)

The following task map describes procedures to protect devices at your site.

Task	Description	For Instructions
Set or modify device policy.	Changes the privileges that are required to access a device.	"Configuring Device Policy (Task Map)" in *System Administration Guide: Security Services*
Authorize users to allocate a device.	The Security Administrator role assigns a profile with the Allocate Device authorization to the user.	"How to Authorize Users to Allocate a Device" in *System Administration Guide: Security Services*
	The Security Administrator role assigns a profile with the site-specific authorizations to the user.	"Customizing Device Authorizations in Trusted Extensions (Task Map)" on page 235
Configure a device.	Chooses security features to protect the device.	"How to Configure a Device in Trusted Extensions" on page 227
Revoke or reclaim a device.	Uses the Device Allocation Manager to make a device available for use.	"How to Revoke or Reclaim a Device in Trusted Extensions" on page 230
	Uses Oracle Solaris commands to make a device available or unavailable for use.	"Forcibly Allocating a Device" in *System Administration Guide: Security Services* "Forcibly Deallocating a Device" in *System Administration Guide: Security Services*

Task	Description	For Instructions
Prevent access to an allocatable device.	Provides fine–grained access control to a device.	Example 17–4
	Denies everyone access to an allocatable device.	Example 17–1
Protect printers and frame buffers.	Ensures that nonallocatable devices are not allocatable.	"How to Protect Nonallocatable Devices in Trusted Extensions" on page 231
Configure serial login devices.	Enables logins by serial port.	"How to Configure a Serial Line for Logins" on page 232
Enable a CD player program to be used.	Enables an audio player program to open automatically when a music CD is inserted.	"How to Configure an Audio Player Program for Use in Trusted CDE" on page 233
Prevent the File Manager from displaying.	Prevents the File Manager from displaying after a device has been allocated.	"How to Prevent the File Manager From Displaying After Device Allocation" on page 234
Use a new device-clean script.	Places a new script in the appropriate places.	"How to Add a Device_Clean Script in Trusted Extensions" on page 235

▼ How to Configure a Device in Trusted Extensions

By default, an allocatable device has a label range from `ADMIN_LOW` to `ADMIN_HIGH` and must be allocated for use. Also, users must be authorized to allocate the device. These defaults can be changed.

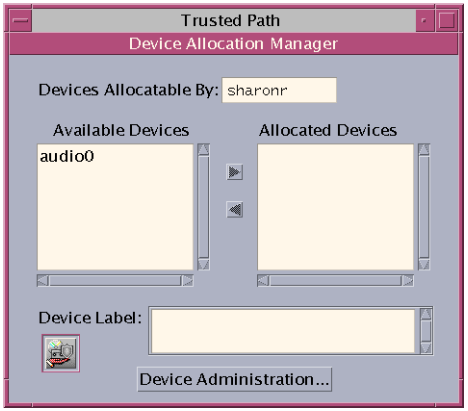
The following devices can be allocated for use:

- `audio`*n* – Indicates a microphone and speaker
- `cdrom`*n* – Indicates a CD-ROM drive
- `floppy`*n* – Indicates a diskette drive
- `mag_tape`*n* – Indicates a tape drive (streaming)
- `rmdisk`*n* – Indicates a removable disk, such as a JAZ or ZIP drive, or USB hot-pluggable media

Before You Begin You must be in the Security Administrator role in the global zone.

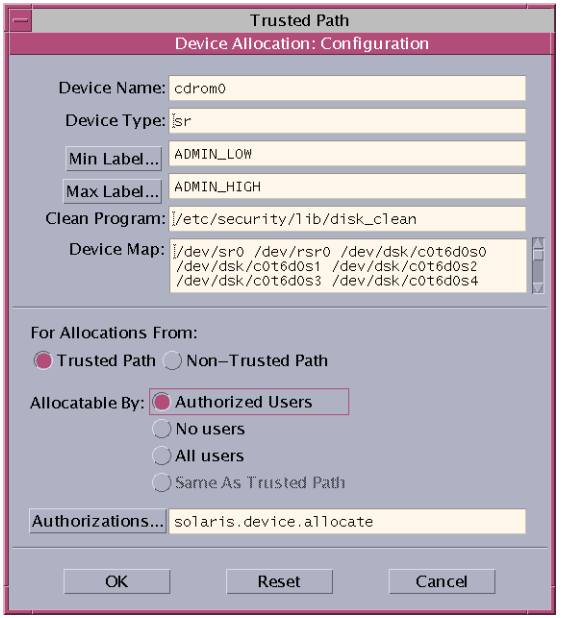
1 **From the Trusted Path menu, select Allocate Device.**

The Device Allocation Manager appears.



2 **View the default security settings.**

Click Device Administration, then highlight the device. The following figure shows a CD-ROM drive with default security settings.



3 **(Optional) Restrict the label range on the device.**

a. **Set the minimum label.**

Click the Min Label... button. Choose a minimum label from the label builder. For information about the label builder, see "Label Builder in Trusted Extensions" on page 43.

b. **Set the maximum label.**

Click the Max Label... button. Choose a maximum label from the label builder.

4 **Specify if the device can be allocated locally.**

In the Device Allocation Configuration dialog box, under For Allocations From Trusted Path, select an option from the Allocatable By list. By default, the Authorized Users option is checked. Therefore, the device is allocatable and users must be authorized.

- **To make the device nonallocatable, click No Users.**

  When configuring a printer, frame buffer, or other device that must not be allocatable, select No Users.

- **To make the device allocatable, but to not require authorization, click All Users.**

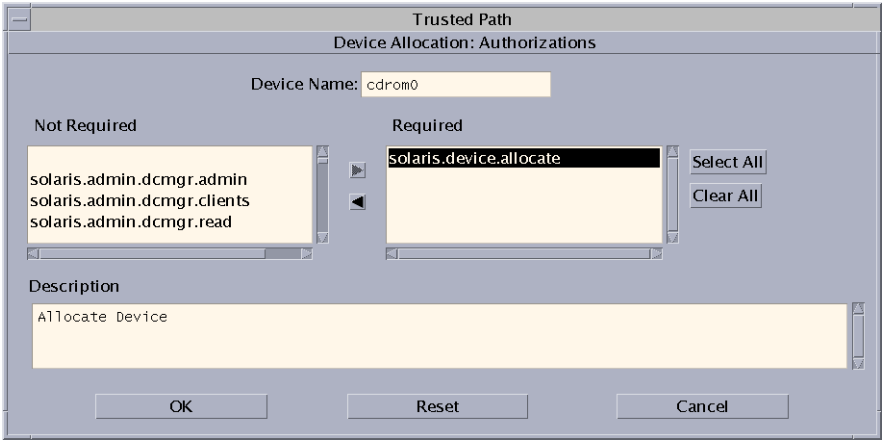
5 **Specify if the device can be allocated remotely.**

In the For Allocations From Non-Trusted Path section, select an option from the Allocatable By list. By default, the Same As Trusted Path option is checked.

- **To require user authorization, select Allocatable by Authorized Users.**
- **To make the device nonallocatable by remote users, select No Users.**
- **To make the device allocatable by anyone, select All Users.**

6 **If the device is allocatable, *and* your site has created new device authorizations, select the appropriate authorization.**

The following dialog box shows the `solaris.device.allocate` authorization is required to allocate the `cdrom0` device.



To create and use site-specific device authorizations, see "Customizing Device Authorizations in Trusted Extensions (Task Map)" on page 235.

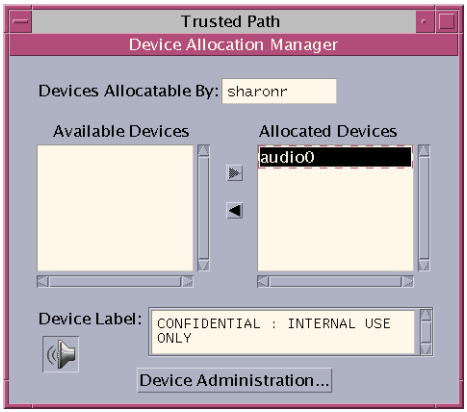
7 **To save your changes, click OK.**

▼ How to Revoke or Reclaim a Device in Trusted Extensions

If a device is not listed in the Device Allocation Manager, it might already be allocated or it might be in an allocate error state. The system administrator can recover the device for use.

Before You Begin You must be in the System Administrator role in the global zone. This role includes the `solaris.device.revoke` authorization.

1. **From the Trusted Path menu, select Allocate Device.**
   In the following figure, the audio device is already allocated to a user.



2. **Click the Device Administration button.**
3. **Check the status of a device.**
   Select the device name and check the State field.
   - **If the State field is Allocate Error State, click the Reclaim button.**
   - **If the State field is Allocated, do one of the following:**
     - **Ask the user in the Owner field to deallocate the device.**
     - **Force deallocation of the device by clicking the Revoke button.**
4. **Close the Device Allocation Manager.**

How to Protect Nonallocatable Devices in Trusted Extensions

The No Users option in the Allocatable By section of the Device Configuration dialog box is used most often for the frame buffer and printer, which do not have to be allocated to be used.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **From the Trusted Path menu, select Allocate Device.**
2. **In the Device Allocation Manager, click the Device Administration button.**

3. **Select the new printer or frame buffer.**

   a. **To make the device nonallocatable, click No Users.**

   b. **(Optional) Restrict the label range on the device.**

      i. **Set the minimum label.**

         Click the Min Label... button. Choose a minimum label from the label builder. For information about the label builder, see "Label Builder in Trusted Extensions" on page 43.

      ii. **Set the maximum label.**

         Click the Max Label... button. Choose a maximum label from the label builder.

Example 17–1 Preventing Remote Allocation of the Audio Device

The No Users option in the Allocatable By section prevents remote users from hearing conversations around a remote system.

The security administrator configures the audio device in the Device Allocation Manager as follows:

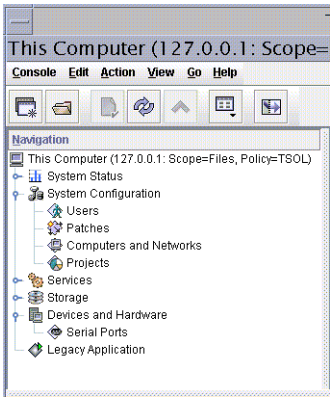
```
Device Name: audio
For Allocations From: Trusted Path
Allocatable By: Authorized Users
Authorizations: solaris.device.allocate

Device Name: audio
For Allocations From: Non-Trusted Pathh
Allocatable By: No Users
```

▼ How to Configure a Serial Line for Logins

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Open the Solaris Management Console in the Files scope.**

FIGURE 17–1 Serial Ports Tool in the Solaris Management Console



2 **Under Devices and Hardware, navigate to Serial Ports.**

Provide a password when prompted. Follow the online help to configure the serial port.

3 **To change the default label range, open the Device Allocation Manager.**

The default label range is `ADMIN_LOW` to `ADMIN_HIGH`.

Example 17–2 Restricting the Label Range of a Serial Port

After creating a serial login device, the security administrator restricts the label range of the serial port to a single label, `Public`. The administrator sets the following values in the Device Administration dialog boxes.

```
Device Name: /dev/term/[a|b]
Device Type: tty
Clean Program: /bin/true
Device Map: /dev/term/[a|b]
Minimum Label: Public
Maximum Label: Public
Allocatable By: No Users
```

▼ How to Configure an Audio Player Program for Use in Trusted CDE

The following procedure enables an audio player to open automatically in a Trusted CDE workspace when a user inserts a music CD. For the user's procedure, see the example in "How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*.

Note – In a Trusted JDS workspace, users specify the behavior of removable media just as they specify it in a non-trusted workspace.

Before You Begin You must be in the System Administrator role in the global zone.

1. **Edit the `/etc/rmmount.conf` file.**

   Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

2. **Add your site's CD player program to the `cdrom` action in the file.**

   `action` *media* `action_`*program*`.so` *path-to-program*

Example 17–3 Configuring an Audio Player Program for Use

In the following example, the system administrator makes the `workman` program available to all users of a system. The `workman` program is an audio player program.

```
# /etc/rmmount.conf file
action cdrom action_workman.so /usr/local/bin/workman
```

▼ How to Prevent the File Manager From Displaying After Device Allocation

By default, the File Manager displays when a device is mounted. If you are not mounting devices that have file systems, you might want to prevent the File Manager from displaying.

Before You Begin You must be in the System Administrator role in the global zone.

1. **Edit the `/etc/rmmount.conf` file.**

   Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

2. **Find the following `filemgr` actions:**

   ```
   action cdrom action_filemgr.so
   action floppy action_filemgr.so
   ```

3. **Comment out the appropriate action.**

   The following example shows the `action_filemgr.so` actions commented out for both the `cdrom` and `diskette` devices.

   ```
   # action cdrom action_filemgr.so
   # action floppy action_filemgr.so
   ```

When a CDROM or diskette is allocated, the File Manager does not display.

▼ How to Add a Device_Clean Script in Trusted Extensions

If no `device_clean` script is specified at the time a device is created, the default script, `/bin/true`, is used.

Before You Begin Have ready a script that purges all usable data from the physical device and that returns `0` for success. For devices with removable media, the script attempts to eject the media if the user does not do so. The script puts the device into the allocate error state if the medium is not ejected. For details about the requirements, see the `device_clean(5)` man page.

You must be in the System Administrator role in the global zone.

1. **Copy the script into the `/etc/security/lib` directory.**
2. **In the Device Administration dialog box, specify the full path to the script.**
   a. **Open the Device Allocation Manager.**
   b. **Click the Device Administration button.**
   c. **Select the name of the device, and click the Configure button.**
   d. **In the Clean Program field, type the full path to the script.**
3. **Save your changes.**

Customizing Device Authorizations in Trusted Extensions (Task Map)

The following task map describes procedures to change device authorizations at your site.

Task	Description	For Instructions
Create new device authorizations.	Creates site-specific authorizations.	"How to Create New Device Authorizations" on page 236
Add authorizations to a device.	Adds site-specific authorizations to selected devices.	"How to Add Site-Specific Authorizations to a Device in Trusted Extensions" on page 239

Task	Description	For Instructions
Assign device authorizations to users and roles.	Enables users and roles to use the new authorizations.	"How to Assign Device Authorizations" on page 239

How to Create New Device Authorizations

If no authorization is specified at the time a device is created, by default, all users can use the device. If an authorization is specified, then, by default, only authorized users can use the device.

To prevent all access to an allocatable device without using authorizations, see Example 17–1.

Before You Begin You must be in the Security Administrator role in the global zone.

1. **Edit the `auth_attr` file.**

   Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.

2. **Create a heading for the new authorizations.**

   Use the reverse-order Internet domain name of your organization followed by optional additional arbitrary components, such as the name of your company. Separate components by dots. End heading names with a dot.

   domain-suffix`.`*domain-prefix*`.`*optional*`.:::`*Company* `Header::help=`*Company*`.html`

3. **Add new authorization entries.**

   Add the authorizations, one authorization per line. The lines are split for display purposes. The authorizations include `grant` authorizations that enable administrators to assign the new authorizations.

   ```
   domain-suffix.domain-prefix.grant:::Grant All Company Authorizations::
   help=CompanyGrant.html
   domain-suffix.domain-prefix.grant.device:::Grant Company Device Authorizations::
   help=CompanyGrantDevice.html
   domain-suffix.domain-prefix.device.allocate.tape:::Allocate Tape Device::
   help=CompanyTapeAllocate.html
   domain-suffix.domain-prefix.device.allocate.floppy:::Allocate Floppy Device::
   help=CompanyFloppyAllocate.html
   ```

4. **Save the file and close the editor.**

5. **If you are using LDAP as your naming service, update the `auth_attr` entries on the Sun Java System Directory Server (LDAP server).**

   For information, see the `ldapaddent(1M)` man page.

6. **Add the new authorizations to the appropriate rights profiles. Then assign the profiles to users and roles.**

   Use the Solaris Management Console. Assume the Security Administrator role, then follow the Oracle Solaris procedure "How to Create or Change a Rights Profile" in *System Administration Guide: Security Services*.

7. **Use the authorization to restrict access to tape and diskette drives.**

   Add the new authorizations to the list of required authorizations in the Device Allocation Manager. For the procedure, see "How to Add Site-Specific Authorizations to a Device in Trusted Extensions" on page 239.

Example 17–4 Creating Fine-Grained Device Authorizations

A security administrator for NewCo needs to construct fine-grained device authorizations for the company.

First, the administrator writes the following help files, and places the files in the `/usr/lib/help/auths/locale/C` directory:

```
Newco.html
NewcoGrant.html
NewcoGrantDevice.html
NewcoTapeAllocate.html
NewcoFloppyAllocate.html
```

Next, the administrator adds a header for all of the authorizations for `newco.com` in the `auth_attr` file.

```
# auth_attr file
com.newco.:::NewCo Header::help=Newco.html
```

Next, the administrator adds authorization entries to the file:

```
com.newco.grant:::Grant All NewCo Authorizations::
help=NewcoGrant.html
com.newco.grant.device:::Grant NewCo Device Authorizations::
help=NewcoGrantDevice.html
com.newco.device.allocate.tape:::Allocate Tape Device::
help=NewcoTapeAllocate.html
com.newco.device.allocate.floppy:::Allocate Floppy Device::
help=NewcoFloppyAllocate.html
```

The lines are split for display purposes.

The `auth_attr` entries create the following authorizations:

- An authorization to grant all NewCo's authorizations
- An authorization to grant NewCo's device authorizations
- An authorization to allocate a tape drive

- An authorization to allocate a diskette drive

Example 17–5 Creating Trusted Path and Non-Trusted Path Authorizations

By default, the Allocate Devices authorization enables allocation from the trusted path and from outside the trusted path.

In the following example, site security policy requires restricting remote CD-ROM allocation. The security administrator creates the `com.someco.device.cdrom.local` authorization. This authorization is for CD-ROM drives that are allocated with the trusted path. The `com.someco.device.cdrom.remote` authorization is for those few users who are allowed to allocate a CD-ROM drive outside the trusted path.

The security administrator creates the help files, adds the authorizations to the `auth_attr` database, adds the authorizations to the devices, and then places the authorizations in rights profiles. The profiles are assigned to users who are allowed to allocate devices.

- The following are the `auth_attr` database entries:

```
com.someco.:::SomeCo Header::help=Someco.html
com.someco.grant:::Grant All SomeCo Authorizations::
help=SomecoGrant.html
com.someco.grant.device:::Grant SomeCo Device Authorizations::
help=SomecoGrantDevice.html
com.someco.device.cdrom.local:::Allocate Local CD-ROM Device::
help=SomecoCDAllocateLocal.html
com.someco.device.cdrom.remote:::Allocate Remote CD-ROM Device::
help=SomecoCDAllocateRemote.html
```

- The following is the Device Allocation Manager assignment:

  The Trusted Path enables authorized users to use the Device Allocation Manager when allocating the local CD-ROM drive.

```
Device Name: cdrom_0
For Allocations From: Trusted Path
Allocatable By: Authorized Users
Authorizations: com.someco.device.cdrom.local
```

  The Non-Trusted Path enables users to allocate a device remotely by using the `allocate` command.

```
Device Name: cdrom_0
For Allocations From: Non-Trusted Path
Allocatable By: Authorized Users
Authorizations: com.someco.device.cdrom.remote
```

- The following are the rights profile entries:

```
# Local Allocator profile
com.someco.device.cdrom.local

# Remote Allocator profile
com.someco.device.cdrom.remote
```

- The following are the rights profiles for authorized users:

```
# List of profiles for regular authorized user
Local Allocator Profile
...

# List of profiles for role or authorized user
Remote Allocator Profile
...
```

How to Add Site-Specific Authorizations to a Device in Trusted Extensions

Before You Begin You must be in the Security Administrator role, or in a role that includes the Configure Device Attributes authorization. You must have already created site-specific authorizations, as described in "How to Create New Device Authorizations" on page 236.

1. **Follow the "How to Configure a Device in Trusted Extensions" on page 227 procedure.**
   a. **Select a device that needs to be protected with your new authorizations.**
   b. **Open the Device Administration dialog box.**
   c. **In the Device Configuration dialog box, click the Authorizations button.**
      The new authorizations are displayed in the Not Required list.
   d. **Add the new authorizations to the Required list of authorizations.**
2. **To save your changes, click OK.**

How to Assign Device Authorizations

The Allocate Device authorization enables users to allocate a device. The Allocate Device authorization, and the Revoke or Reclaim Device authorization, are appropriate for administrative roles.

Before You Begin You must be in the Security Administrator role in the global zone.

If the existing profiles are not appropriate, the security administrator can create a new profile. For an example, see "How to Create a Rights Profile for Convenient Authorizations" on page 92.

- **Assign to the user a rights profile that contains the Allocate Device authorization.**
  For assistance, see the online help. For the step-by-step procedure, see "How to Change the RBAC Properties of a User" in *System Administration Guide: Security Services*.

The following rights profiles enable a role to allocate devices:

- All Authorizations
- Device Management
- Media Backup
- Media Restore
- Object Label Management
- Software Installation

The following rights profiles enable a role to revoke or reclaim devices:

- All Authorizations
- Device Management

The following rights profiles enable a role to create or configure devices:

- All Authorizations
- Device Security

Example 17–6 Assigning New Device Authorizations

In this example, the security administrator configures the new device authorizations for the system and assigns the rights profile with the new authorizations to trustworthy users. The security administrator does the following:

1. Creates new device authorizations, as in "How to Create New Device Authorizations" on page 236
2. In the Device Allocation Manager, adds the new device authorizations to the tape and diskette drives
3. Places the new authorizations in the rights profile, NewCo Allocation
4. Adds the NewCo Allocation rights profile to the profiles of users and roles who are authorized to allocate tape and diskette drives

Authorized users and roles can now use the tape drives and diskette drives on this system.

◆ ◆ ◆ CHAPTER 18

Trusted Extensions Auditing (Overview)

This chapter describes the additions to auditing that Trusted Extensions provides.

Trusted Extensions and Auditing

On a system that is configured with Trusted Extensions software, auditing is configured and is administered similarly to auditing on an Oracle Solaris system. However, the following are some differences.

- Trusted Extensions software adds audit classes, audit events, audit tokens, and audit policy options to the system.
- By default, auditing is enabled in Trusted Extensions software.
- Oracle Solaris per-zone auditing is not supported. In Trusted Extensions, all zones are audited identically.
- Trusted Extensions provides administrative tools to administer the users' audit characteristics and to edit audit files.
- Two roles, System Administrator and Security Administrator, are used to configure and administer auditing in Trusted Extensions.

  The security administrator plans what to audit and any site-specific, event-to-class mappings. As in the Oracle Solaris OS, the system administrator plans disk space requirements for the audit files, creates an audit administration server, and installs audit configuration files.

Audit Management by Role in Trusted Extensions

Auditing in Trusted Extensions requires the same planning as in the Oracle Solaris OS. For details about planning, see Chapter 29, "Planning for Oracle Solaris Auditing," in *System Administration Guide: Security Services*.

Role Setup for Audit Administration

In Trusted Extensions, auditing is the responsibility of two roles. The System Administrator role sets up the disks and the network of audit storage. The Security Administrator role decides what is to be audited, and specifies the information in the audit configuration files. As in the Oracle Solaris OS, you create the roles in software. The rights profiles for these two roles are provided. The initial setup team created the Security Administrator role during initial configuration. For details, see "Create the Security Administrator Role in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*.

Note – A system only records the security-relevant events that the audit configuration files configure the system to record (that is, by preselection). Therefore, any subsequent audit review can only consider the events that have been recorded. As a result of misconfiguration, attempts to breach the security of the system can go undetected, or the administrator is unable to detect the user who is responsible for an attempted breach of security. Administrators must regularly analyze audit trails to check for breaches of security.

Audit Tasks in Trusted Extensions

The procedures to configure and manage auditing in Trusted Extensions differ slightly from Oracle Solaris procedures.

- Audit configuration is performed in the global zone by one of two administrative roles. Then, the system administrator copies specific customized audit files from the global zone to every labeled zone. By following this procedure, user actions are audited identically in the global zone and in labeled zones.

  For details, see "Audit Tasks of the Security Administrator" on page 243 and "Audit Tasks of the System Administrator" on page 243
- Trusted Extensions administrators use a trusted editor to edit audit configuration files. In Trusted CDE, Trusted Extensions administrators use CDE actions to invoke the trusted editor. For the list of actions, see "Trusted CDE Actions" on page 35.
- Trusted Extensions administrators use the Solaris Management Console to configure specific users. User-specific audit characteristics can be specified in this tool. Specifying user characteristics is only required when the user's audit characteristics differ from the audit characteristics of the systems on which the user works. For an introduction to the tool, see "Solaris Management Console Tools" on page 38.

Audit Tasks of the Security Administrator

The following tasks are security-relevant, and are therefore the responsibility of the security administrator. Follow the Oracle Solaris instructions, but use the Trusted Extensions administrative tools.

Task	For Oracle Solaris Instructions	Trusted Extensions Instructions
Configure audit files.	"Configuring Audit Files (Task Map)" in *System Administration Guide: Security Services*	Use the trusted editor. For details, see "How to Edit Administrative Files in Trusted Extensions" on page 54.
(Optional) Change default audit policy.	"How to Configure Audit Policy" in *System Administration Guide: Security Services*	Use the trusted editor.
Disable and re-enable auditing.	"How to Disable the Audit Service" in *System Administration Guide: Security Services*	Auditing is enabled by default.
Manage auditing.	"Solaris Auditing (Task Map)" in *System Administration Guide: Security Services*	Use the trusted editor. Ignore per-zone audit tasks.

Audit Tasks of the System Administrator

The following tasks are the responsibility of the system administrator. Follow the Oracle Solaris instructions, but use the Trusted Extensions administrative tools.

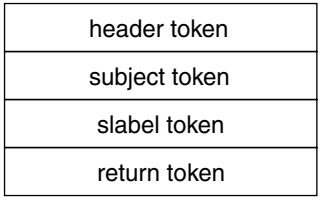
Task	For Oracle Solaris Instructions	Trusted Extensions Instructions
Create a ZFS file system that is dedicated to audit files. Create an `audit_warn` alias.	"Managing Audit Records" in *System Administration Guide: Security Services* "How to Configure the audit_warn Email Alias" in *System Administration Guide: Security Services*	Perform all administration in the global zone. Use the trusted editor.
Copy or loopback mount customized audit files to labeled zones.	"Configuring the Audit Service in Zones (Tasks)" in *System Administration Guide: Security Services*	Loopback mount or copy the files to every labeled zone after the zones are created. Copy the files to the first labeled zone, then copy the zone.
(Optional) Distribute audit configuration files.	No instructions	See "How to Copy Files From Portable Media in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration Guide*
Manage auditing.	"Solaris Auditing (Task Map)" in *System Administration Guide: Security Services*	Ignore per-zone audit tasks.

Task	For Oracle Solaris Instructions	Trusted Extensions Instructions
Select audit records by label.	"How to Select Audit Events From the Audit Trail" in *System Administration Guide: Security Services*	To select records by label, use the `auditreduce` command with the `-l` option.

Trusted Extensions Audit Reference

Trusted Extensions software adds audit classes, audit events, audit tokens, and audit policy options to the Oracle Solaris OS. Several auditing commands are extended to handle labels. Trusted Extensions audit records include a label, as shown in the following figure.

FIGURE 18–1 Typical Audit Record on a Labeled System



Trusted Extensions Audit Classes

The audit classes that Trusted Extensions software adds to the Oracle Solaris OS are listed alphabetically in the following table. The classes are listed in the `/etc/security/audit_class` file. For more information about audit classes, see the `audit_class(4)` man page.

TABLE 18–1 X Server Audit Classes

Short Name	Long Name	Audit Mask
xc	X - Object create/destroy	0x00800000
xp	X - Privileged/administrative operations	0x00400000
xs	X - Operations that always silently fail, if bad	0x01000000
xx	X - All X events in the xc, xp, and xs classes (metaclass)	0x01c00000

The X server audit events are mapped to these classes according to the following criteria:

- **xc** – This class audits server objects for creation or for destruction. For example, this class audits `CreateWindow()`.
- **xp** – This class audits for use of privilege. Privilege use can be successful or unsuccessful. For example, `ChangeWindowAttributes()` is audited when a client attempts to change the attributes of another client's window. This class also includes administrative routines such as `SetAccessControl()`.
- **xs** – This class audits routines that do not return X error messages to clients on failure when security attributes cause the failure. For example, `GetImage()` does not return a `BadWindow` error if it cannot read from a window for lack of privilege.

  These events should be selected for audit on success only. When xs events are selected for failure, the audit trail fills with irrelevant records.
- **xx** – This class includes all of the X audit classes.

Trusted Extensions Audit Events

Trusted Extensions software adds audit events to the system. The new audit events and the audit classes to which the events belong are listed in the `/etc/security/audit_event` file. The audit event numbers for Trusted Extensions are between 9000 and 10000. For more information about audit events, see the `audit_event(4)` man page.

Trusted Extensions Audit Tokens

The audit tokens that Trusted Extensions software adds to the Oracle Solaris OS are listed alphabetically in the following table. The tokens are also listed in the `audit.log(4)` man page.

TABLE 18–2 Trusted Extensions Audit Tokens

Token Name	Description
"`label` Token" on page 246	Sensitivity label
"`xatom` Token" on page 246	X window atom identification
"`xclient` Token" on page 247	X client identification
"`xcolormap` Token" on page 247	X window color information
"`xcursor` Token" on page 247	X window cursor information
"`xfont` Token" on page 248	X window font information
"`xgc` Token" on page 248	X window graphical context information
"`xpixmap` Token" on page 248	Xwindow pixel mapping information

TABLE 18–2 Trusted Extensions Audit Tokens *(Continued)*

Token Name	Description
"xproperty Token" on page 248	X window property information
"xselect Token" on page 249	X window data information
"xwindow Token" on page 250	X window window information

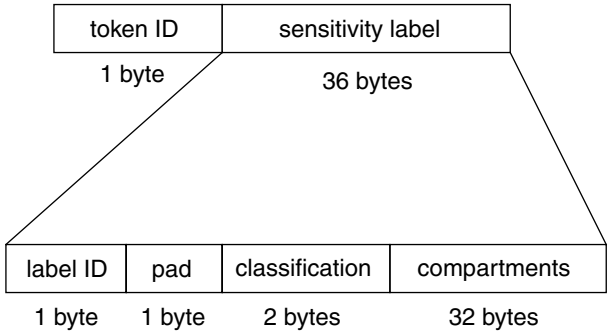
label Token

The label token contains a sensitivity label. This token contains the following fields:

- A token ID
- A sensitivity label

The following figure shows the token format.

FIGURE 18–2 label Token Format



A label token is displayed by the praudit command as follows:

```
sensitivity label,ADMIN_LOW
```

xatom Token

The xatom token contains information concerning an X atom. This token contains the following fields:

- A token ID
- The string length
- A text string that identifies the atom

An xatom token is displayed by praudit as follows:

```
X atom,_DT_SAVE_MODE
```

`xclient` Token

The `xclient` token contains information concerning the X client. This token contains the following fields:

- A token ID
- The client ID

An `xclient` token is displayed by `praudit` as follows:

```
X client,15
```

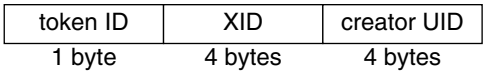
`xcolormap` Token

The `xcolormap` token contains information about the colormaps. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

The following figure shows the token format.

FIGURE 18–3 Format for `xcolormap`, `xcursor`, `xfont`, `xgc`, `xpixmap`, and `xwindow` Tokens



An `xcolormap` token is displayed by `praudit` as follows:

```
X color map,0x08c00005,srv
```

`xcursor` Token

The `xcursor` token contains information about the cursors. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

Figure 18–3 shows the token format.

An `xcursor` token is displayed by `praudit` as follows:

```
X cursor,0x0f400006,srv
```

`xfont` Token

The `xfont` token contains information about the fonts. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

Figure 18–3 shows the token format.

An `xfont` token is displayed by `praudit` as follows:

```
X font,0x08c00001,srv
```

`xgc` Token

The `xgc` token contains information about the xgc. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

Figure 18–3 shows the token format.

An `xgc` token is displayed by `praudit` as follows:

```
Xgraphic context,0x002f2ca0,srv
```

`xpixmap` Token

The `xpixmap` token contains information about the pixel mappings. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

Figure 18–3 shows the token format.

An `xpixmap` token is displayed by `praudit` as follows:

```
X pixmap,0x08c00005,srv
```

`xproperty` Token

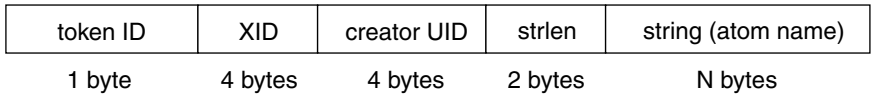
The `xproperty` token contains information about various properties of a window. This token contains the following fields:

- A token ID
- The X server identifier

- The creator's user ID
- A string length
- A text string that identifies the atom

The following figure shows an `xproperty` token format.

FIGURE 18–4 `xproperty` Token Format



An `xproperty` token is displayed by `praudit` as follows:

```
X property,0x000075d5,root,_MOTIF_DEFAULT_BINDINGS
```

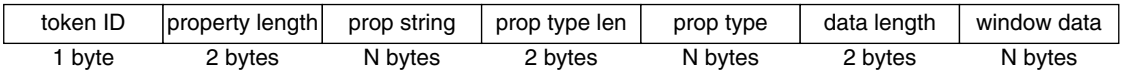
`xselect` Token

The `xselect` token contains the data that is moved between windows. This data is a byte stream with no assumed internal structure and a property string. This token contains the following fields:

- A token ID
- The length of the property string
- The property string
- The length of the property type
- The property type string
- A length field that gives the number of bytes of data
- A byte string that contains the data

The following figure shows the token format.

FIGURE 18–5 `xselect` Token Format



An `xselect` token is displayed by `praudit` as follows:

```
X selection,entryfield,halogen
```

`xwindow` Token

The `xwindow` token contains information about a window. This token contains the following fields:

- A token ID
- The X server identifier
- The creator's user ID

Figure 18–3 shows the token format.

An `xwindow` token is displayed by `praudit` as follows:

```
X window,0x07400001,srv
```

Trusted Extensions Audit Policy Options

Trusted Extensions adds two audit policy options to existing Oracle Solaris auditing policy options. List the policies to see the additions:

```
$ auditconfig -lspolicy
...
windata_down Include downgraded window information in audit records
windata_up   Include upgraded window information in audit records
...
```

Extensions to Auditing Commands in Trusted Extensions

The `auditconfig`, `auditreduce`, and `bsmrecord` commands are extended to handle Trusted Extensions information:

- The `auditconfig` command includes the Trusted Extensions audit policies. For details, see the `auditconfig`(1M) man page.
- The `auditreduce` command adds the `-l` option for filtering records according to the label. For details, see the `auditreduce`(1M) man page.
- The `bsmrecord` command includes the Trusted Extensions audit events. For details, see the `bsmrecord`(1M) man page.

◆ ◆ ◆ CHAPTER 19

Software Management in Trusted Extensions (Tasks)

This chapter contains information about ensuring that third-party software runs in a trustworthy manner on a system that is configured with Trusted Extensions.

Adding Software to Trusted Extensions

Any software that can be added to an Oracle Solaris system can be added to a system that is configured with Trusted Extensions. Additionally, programs that use Trusted Extensions APIs can be added. Adding software to a Trusted Extensions system is similar to adding software to an Oracle Solaris system that is running non-global zones.

For example, packaging issues affect systems that have installed non-global zones. Package parameters define the following:

- **The zone scope of the package –** The scope determines the type of zone in which a specific package can be installed.
- **The visibility of the package –** Visibility determines whether a package must be installed and be identical in all zones.
- **The limitation of the package –** One limitation is whether a package must be installed in the current zone only.

In Trusted Extensions, programs are typically installed in the global zone for use by regular users in labeled zones. For details about installing packages in zones, see Chapter 25, "About Packages and Patches on a Solaris System With Zones Installed (Overview)," in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*. Also, see the `pkgadd(1M)` man page.

At a Trusted Extensions site, the system administrator and the security administrator work together to install software. The security administrator evaluates software additions for adherence to security policy. When the software requires privileges or authorizations to succeed, the Security Administrator role assigns an appropriate rights profile to the users of that software.

To import software from removable media requires authorization. An account with the Allocate Device authorization can import or export data from removable media. Data can include executable code. A regular user can only import data at a label within that user's clearance.

The System Administrator role is responsible for adding the programs that the security administrator approves.

Oracle Solaris Security Mechanisms for Software

Trusted Extensions uses the same security mechanisms as the Oracle Solaris OS. The mechanisms include the following:

- **Authorizations –** Users of a program can be required to have a particular authorization. For information about authorizations, see "Oracle Solaris RBAC Elements and Basic Concepts" in *System Administration Guide: Security Services*. Also, see the `auth_attr(4)` and `getauthattr(3SECDB)` man pages.
- **Privileges –** Programs and processes can be assigned privileges. For information about privileges, see Chapter 8, "Using Roles and Privileges (Overview)," in *System Administration Guide: Security Services*. Also, see the `privileges(5)` man page.

  The `ppriv` command provides a debugging utility. For details, see the `ppriv(1)` man page. For instructions on using this utility with programs that work in non-global zones, see "Using the ppriv Utility" in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*.
- **Right Profiles –** Rights profiles collect security attributes in one place for assignment to users or roles. For information about rights profiles, see "RBAC Rights Profiles" in *System Administration Guide: Security Services*. Trusted Extensions adds CDE actions to the type of executables that can be assigned security attributes.
- **Trusted libraries –** Dynamically shared libraries that are used by `setuid`, `setgid`, and privileged programs can be loaded only from trusted directories. As in the Oracle Solaris OS, the `crle` command is used to add a privileged program's shared library directories to the list of trusted directories. For details, see the `crle(1)` man page.

Evaluating Software for Security

When software has been assigned privileges or when it runs with an alternate user ID or group ID, the software becomes *trusted*. Trusted software can bypass aspects of the Trusted Extensions security policy. Be aware that you can make software trusted even though it might not be worthy of trust. The security administrator must wait to give privileges to software until careful scrutiny has revealed that the software uses the privileges in a trustworthy manner.

Programs fall into three categories on a trusted system:

- **Programs that require no security attributes –** Some programs run at a single level and require no privileges. These programs can be installed in a public directory, such as `/usr/local`. For access, assign the programs as commands in the rights profiles of users and roles.
- **Programs that run as root –** Some programs execute with `setuid 0`. Such programs can be assigned an effective UID of `0` in a rights profile. The security administrator then assigns the profile to an administrative role.

  Tip – If the application can use privileges in a trustworthy manner, assign the needed privileges to the application, and do not execute the program as `root`.

- **Programs that require privileges –** Some programs might need privileges for reasons that are not obvious. Even if a program is not performing any function that seems to violate system security policy, the program might be doing something internally that violates security. For example, the program could be using a shared log file, or the program could be reading from `/dev/kmem`. For security concerns, see the `mem(7D)` man page.

  Sometimes, an internal policy override is not particularly important to the application's correct operation. Rather, the override provides a convenient feature for users.

  If your organization has access to the source code, check if you can remove the operations that require policy overrides without affecting the application's performance.

Developer Responsibilities When Creating Trusted Programs

Even though a program's developer can manipulate privilege sets in the source code, if the security administrator does not assign the required privileges to the program, the program will fail. The developer and security administrator need to cooperate when creating trusted programs.

A developer who writes a trusted program must do the following:

1. Understand where the program requires privileges to do its work.
2. Know and follow techniques, such as privilege bracketing, for safely using privileges in programs.

3. Be aware of the security implications when assigning privileges to a program. The program must not violate security policy.
4. Compile the program by using shared libraries that are linked to the program from a trusted directory.

   For additional information, see *Oracle Solaris Security for Developers Guide*. For examples of code for Trusted Extensions, see *Oracle Solaris Trusted Extensions Developer's Guide*.

Security Administrator Responsibilities for Trusted Programs

The security administrator is responsible for testing and evaluating new software. After determining that the software is trustworthy, the security administrator configures rights profiles and other security-relevant attributes for the program.

The security administrator responsibilities include the following:

1. Make sure that the programmer and the program distribution process is trusted.
2. From one of the following sources, determine which privileges are required by the program:
   - Ask the programmer.
   - Search the source code for any privileges that the program expects to use.
   - Search the source code for any authorizations that the program requires of its users.
   - Use the debugging options to the `ppriv` command to search for use of privilege. For examples, see the `ppriv(1)` man page.
3. Examine the source code to make sure that the code behaves in a trustworthy manner regarding the privileges that the program needs to operate.

   If the program fails to use privilege in a trustworthy manner, and you can modify the program's source code, then modify the code. A security consultant or developer who is knowledgeable about security can modify the code. Modifications might include privilege bracketing or checking for authorizations.

   The assignment of privileges must be manual. A program that fails due to lack of privilege can be assigned privileges. Alternatively, the security administrator might decide to assign an effective UID or GID to make the privilege unnecessary.

Trusted Processes in the Window System

In Solaris Trusted Extensions (CDE), the following window system processes are trusted:

- Front Panel
- Subpanels of the Front Panel
- Workspace Menu
- File Manager
- Application Manager

The window system's trusted processes are available to everyone, but access to administrative actions is restricted to roles in the global zone.

In the File Manager, if an action is not in one of the account's profiles, the icon for the action is not visible. In the Workspace Menu, if an action is not in one of the account's profiles, the action is visible, but an error displays if the action is invoked.

In Trusted CDE, the window manager, `dtwm`, calls the `Xtsolusersession` script. This script works with the window manager to invoke actions that are started from the window system. The `Xtsolusersession` script checks the account's rights profiles when the account attempts to launch an action. In either case, if the action is in an assigned rights profile, the action is run with the security attributes that are specified in the profile.

Adding Trusted CDE Actions

The process of creating and using CDE actions in Trusted Extensions is similar to the process in the Oracle Solaris OS. Adding actions is described in the Chapter 4, "Adding and Administering Applications," in *Solaris Common Desktop Environment: Advanced User's and System Administrator's Guide*.

As in the Oracle Solaris OS, the use of actions can be controlled by the rights profile mechanism. In Trusted Extensions, several actions have been assigned security attributes in the rights profiles of administrative roles. The security administrator can also use the Rights tool to assign security attributes to new actions.

The following table summarizes the main differences between an Oracle Solaris system and a Trusted Extensions system when you create and use actions.

TABLE 19–1 Constraints on CDE Actions in Trusted Extensions

Oracle Solaris CDE Actions	Trusted CDE Actions
New actions can be created by anyone within the originator's home directory.	An action is usable only if the action is in a rights profile that is assigned to the user. The search path for actions differs. Actions in a user's home directory are processed last instead of first. Therefore, no one can customize existing actions.
A new action is automatically usable by its creator.	Users can create a new action in their home directory, but the action might not be usable. Users with the All profile can use an action that they create. Otherwise, the security administrator must add the name of the new action to one of the account's rights profiles. To start the action, the user uses the File Manager. The system administrator can place actions in public directories.

TABLE 19–1 Constraints on CDE Actions in Trusted Extensions *(Continued)*

Oracle Solaris CDE Actions	Trusted CDE Actions
Actions can be dragged and dropped to the Front Panel.	The Front Panel is part of the trusted path. The window manager recognizes only the administratively added actions that are located in the `/usr/dt` and `/etc/dt` subdirectories. Even with the All profile, a user cannot drag a new action to the Front Panel. Actions from a user's home directory are not recognized by the window manager. The manager only checks the public directories.
Actions can do privileged operations if they are run by `root`.	Actions can do privileged operations if the actions have been assigned privileges in a rights profile that has been assigned to a user.
Actions are not managed by the Solaris Management Console.	Actions are assigned to rights profiles in the Rights tool of the Solaris Management Console. If new actions are added, the security administrator can make the new actions available.

Managing Software in Trusted Extensions (Tasks)

Managing software in Trusted Extensions is similar to managing software on an Oracle Solaris system that has installed non-global zones. For details about zones, see Part II, "Zones," in *System Administration Guide: Oracle Solaris Containers-Resource Management and Oracle Solaris Zones*.

▼ How to Add a Software Package in Trusted Extensions

Before You Begin You must be in a role that can allocate a device.

1 Start from the appropriate workspace.

- **To install a software package in the global zone, stay in the global zone.**
- **To install a software package in a labeled zone, create a workspace at that label.**

  For details, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User's Guide*.

2 Allocate the CD-ROM drive.

For details, see "How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*.

3 Install the software.

For details, see "Where to Find Software Management Tasks" in *System Administration Guide: Basic Administration*.

4 **Deallocate the device when you are finished.**

For details, see "How to Allocate a Device in Trusted Extensions" in *Oracle Solaris Trusted Extensions User's Guide*.

▼ How to Install a Java Archive File in Trusted Extensions

This procedure downloads a Java archive (JAR) file to the global zone. From the global zone, the administrator can make it available to regular users.

Before You Begin The security administrator has verified that the source of the Java program is trustworthy, that the method of delivery is secure, and that the program can run in a trustworthy manner.

You are in the System Administrator role in the global zone. In Trusted CDE, the Software Installation rights profile includes the Open action for Java code.

1 **Download the JAR file to the `/tmp` directory.**

For example, if you are selecting software from `http://www.sunfreeware.com`, use the site's "Solaris `pkg-get` tool" instructions.

2 **Open the File Manager and navigate to the `/tmp` directory.**

3 **Double-click the downloaded file.**

4 **To install the software, answer the questions in the dialog boxes.**

5 **Read the installation log.**

Example 19–1 Downloading a JAR File to a User Label

To limit the security risk, the system administrator downloads the software to a single label within a regular user's accreditation range. Then, the security administrator tests the JAR file at that label. When the software passes the test, the security administrator then downgrades the label to `ADMIN_LOW`. The system administrator installs the software on an NFS server to make it available to all users.

1. First, the system administrator creates a workspace at a user label.
2. In that workspace, he downloads the JAR file.
3. At that label, the security administrator tests the file.
4. Then, the security administrator changes the label of the file to `ADMIN_LOW`.
5. Finally, the system administrator copies the file to an NFS server whose label is `ADMIN_LOW`.

◆ ◆ ◆ APPENDIX A

Quick Reference to Trusted Extensions Administration

Trusted Extensions interfaces extend the Oracle Solaris OS. This appendix provides a quick reference of the differences. For a detailed list of interfaces, including library routines and system calls, see Appendix B, "List of Trusted Extensions Man Pages."

Administrative Interfaces in Trusted Extensions

Trusted Extensions provides interfaces for its software. The following interfaces are available only when Trusted Extensions software is running:

`txzonemgr` script	Provides a menu-based wizard for creating, installing, initializing, and booting labeled zones. The title of the menu is Labeled Zone Manager. This script also provides menu items for networking options, name services options, and for clienting the global zone to an existing LDAP server.
Trusted CDE actions	In Trusted CDE, Workspace Menu –> Application Manager –> Trusted_Extensions contains CDE actions that configure files, install and boot zones, and simplify other Trusted Extensions tasks. For the tasks that these actions perform, see "Trusted CDE Actions" on page 35. Trusted CDE online help also describes these actions.
Admin Editor	This trusted editor is used to edit system files. In Trusted CDE, Workspace Menu –> Application Manager –> Trusted_Extensions –> Admin Editor invokes the Admin Editor. In Trusted JDS, the editor is invoked from the command line. You provide the file to be edited as the argument, as in: `/usr/dt/bin/trusted_edit` *filename*

Device Allocation Manager	In Trusted Extensions, this GUI is used to administer devices. The Device Administration dialog box is used by administrators to configure devices. The Device Allocation Manager is used by roles and regular users to allocate devices. The GUI is available from the Trusted Path menu.
Label Builder	This application is invoked when the user can choose a label or a clearance. This application also appears when a role assigns labels or label ranges to devices, zones, users, or roles.
Selection Manager	This application is invoked when an authorized user or authorized role attempts to upgrade or downgrade information.
Trusted Path menu	This menu handles interactions with the trusted computing base (TCB). For example, this menu has a Change Password menu item. In Trusted CDE, you access the Trusted Path menu from the workspace switch area. In Trusted JDS, you access the Trusted Path menu by clicking the trusted symbol at the left of the trusted stripe.
Administrative commands	Trusted Extensions provides commands to obtain labels and perform other tasks. For a list of the commands, see "Command Line Tools in Trusted Extensions" on page 44.

Oracle Solaris Interfaces Extended by Trusted Extensions

Trusted Extensions adds to existing Oracle Solaris configuration files, commands, and GUIs.

Administrative commands	Trusted Extensions adds options to selected Oracle Solaris commands. For a list, see Table 2–5
Configuration files	Trusted Extensions adds two privileges, `net_mac_aware` and `net_mlp`. For the use of `net_mac_aware`, see "Access to NFS Mounted Directories in Trusted Extensions" on page 135. Trusted Extensions adds authorizations to the `auth_attr` database. For a list, see "Additional Rights and Authorizations in Trusted Extensions" in *Solaris Trusted Extensions Transition Guide*. Trusted Extensions adds executables, including CDE actions, to the `exec_attr` database.

	Trusted Extensions modifies existing rights profiles in the `prof_attr` database. It also adds profiles to the database. Trusted Extensions adds CDE actions to the executables that can be privileged in the `exec_attr` database. Trusted Extensions adds fields to the `policy.conf` database. For the fields, see "`policy.conf` File Defaults in Trusted Extensions" on page 78. Trusted Extensions adds audit tokens, audit events, audit classes, and audit policy options. For a list, see "Trusted Extensions Audit Reference" on page 244.
Solaris Management Console	Trusted Extensions adds a Security Templates tool to the Computers and Networks tool set. Trusted Extensions adds a Trusted Network Zones tool to the Computers and Networks tool set. Trusted Extensions adds a Trusted Extensions Attributes tab to the Users tool and the Administrative Roles tool.
Shared directories from zones	Trusted Extensions enables you to share directories from labeled zones. The directories are shared at the label of the zone by creating an `/etc/dfs/dfstab` file from the global zone.

Tighter Security Defaults in Trusted Extensions

Trusted Extensions establishes tighter security defaults than the Oracle Solaris OS:

Auditing	By default, auditing is enabled. An administrator can turn off auditing. However, auditing is typically required at sites that install Trusted Extensions.
Devices	By default, device allocation is enabled. By default, device allocation requires authorization. Therefore, by default, regular users cannot use removable media. An administrator can remove the authorization requirement. However, device allocation is typically required at sites that install Trusted Extensions.
Printing	Regular users can print only to printers that include the user's label in the printer's label range.

By default, printed output has trailer and banner pages. These pages, and the body pages, include the label of the print job.

By default, users cannot print PostScript files.

Roles — Roles are available in the Oracle Solaris OS, but their use is optional. In Trusted Extensions, roles are required for proper administration.

Making the `root` user a role is possible in the Oracle Solaris OS. In Trusted Extensions, the `root` user is made a role to better audit who is acting as superuser.

Limited Options in Trusted Extensions

Trusted Extensions narrows the range of Oracle Solaris configuration options:

Desktop — Trusted Extensions offers two desktops, the Solaris Trusted Extensions (CDE) and the Solaris Trusted Extensions (JDS).

Trusted Extensions offers the Solaris Trusted Extensions (GNOME) desktop.

Naming service — The LDAP naming service is supported. All zones must be administered from one naming service.

Zones — The global zone is an administrative zone. Only the `root` user or a role can enter the global zone. Therefore, administrative interfaces that are available to regular Oracle Solaris users are not available to regular Trusted Extensions users. For example, in Trusted Extensions, users cannot bring up the Solaris Management Console.

Non-global zones are labeled zones. Users work in labeled zones.

◆ ◆ ◆ APPENDIX B

List of Trusted Extensions Man Pages

Trusted Extensions is a configuration of the Oracle Solaris OS. This appendix provides a short description of the Oracle Solaris man pages that include Trusted Extensions information.

Trusted Extensions Man Pages in Alphabetical Order

The following man pages describe Trusted Extensions software on an Oracle Solaris system. These man pages are relevant only on a system that is configured with Trusted Extensions.

Oracle Solaris Man Page	Synopsis
add_allocatable(1M)	Adds entries to allocation databases
atohexlabel(1M)	Converts a human-readable label to its internal text equivalent
blcompare(3TSOL)	Compares binary labels
blminmax(3TSOL)	Determines the bound of two labels
chk_encodings(1M)	Checks the label encodings file syntax
dtappsession(1)	Starts a new Application Manager session
fgetlabel(2)	Gets the file's label
getdevicerange(3TSOL)	Gets the label range of a device
getlabel(1)	Displays the label of files
getlabel(2)	Gets the label of a file
getpathbylabel(3TSOL)	Gets the zone pathname
getplabel(3TSOL)	Gets the label of a process
getuserrange(3TSOL)	Gets the label range of a user

getzoneidbylabel(3TSOL)	Gets zone ID from zone label
getzonelabelbyid(3TSOL)	Gets zone label from zone ID
getzonelabelbyname(3TSOL)	Gets zone label from zone name
getzonepath(1)	Displays the root path of the zone that corresponds to the specified label
getzonerootbyid(3TSOL)	Gets zone root pathname from zone root ID
getzonerootbylabel(3TSOL)	Gets zone root pathname from zone label
getzonerootbyname(3TSOL)	Gets zone root pathname from zone name
hextoalabel(1M)	Converts an internal text label to its human-readable equivalent
labelbuilder(3TSOL)	Creates a Motif-based user interface for interactively building a valid label or clearance
labelclipping(3TSOL)	Translates a binary label and clips the label to the specified width
label_encodings(4)	Describes the label encodings file
label_to_str(3TSOL)	Converts labels to human-readable strings
labels(5)	Describes Trusted Extensions label attributes
libtsnet(3LIB)	Is the Trusted Extensions network library
libtsol(3LIB)	Is the Trusted Extensions library
m_label(3TSOL)	Allocates and frees resources for a new label
pam_tsol_account(5)	Checks account limitations that are due to labels
plabel(1)	Gets the label of a process
remove_allocatable(1M)	Removes entries from allocation databases
sel_config(4)	Is the selection rules for copy, cut, paste, and drag-and-drop operations
setflabel(3TSOL)	Moves a file to a zone with the corresponding sensitivity label
smtnrhdb(1M)	Manages entries in the Trusted Extensions networking database
smtnrhtp(1M)	Manages entries in the template database for Trusted Extensions networking

smtnzonecfg(1M)	Manages entries in the configuration database for Trusted Extensions networking in non-global zones
str_to_label(3TSOL)	Parses human-readable strings to a label
tnctl(1M)	Configures Trusted Extensions network parameters
tnd(1M)	Is the trusted network daemon
tninfo(1M)	Displays kernel-level Trusted Extensions network information and statistics
trusted_extensions(5)	Introduces Trusted Extensions
TrustedExtensionsPolicy(4)	Is the configuration file for Trusted Extensions X Server Extension
tsol_getrhtype(3TSOL)	Gets the host type from Trusted Extensions network information
updatehome(1M)	Updates the home directory copy and link files for the current label
XTSOLgetClientAttributes(3XTSOL)	Gets the label attributes of an X client
XTSOLgetPropAttributes(3XTSOL)	Gets the label attributes of a window property
XTSOLgetPropLabel(3XTSOL)	Gets the label of a window property
XTSOLgetPropUID(3XTSOL)	Gets the UID of a window property
XTSOLgetResAttributes(3XTSOL)	Gets all label attributes of a window or a pixmap
XTSOLgetResLabel(3XTSOL)	Gets the label of a window, a pixmap, or a colormap
XTSOLgetResUID(3XTSOL)	Gets the UID of a window or a pixmap
XTSOLgetSSHeight(3XTSOL)	Gets the height of the screen stripe
XTSOLgetWorkstationOwner(3XTSOL)	Gets the ownership of the workstation
XTSOLIsWindowTrusted(3XTSOL)	Determines if a window is created by a trusted client
XTSOLMakeTPWindow(3XTSOL)	Make this window a Trusted Path window
XTSOLsetPolyInstInfo(3XTSOL)	Sets polyinstantiation information
XTSOLsetPropLabel(3XTSOL)	Sets the label of a window property
XTSOLsetPropUID(3XTSOL)	Sets the UID of a window property

XTSOLsetResLabel(3XTSOL)	Sets the label of a window or a pixmap
XTSOLsetResUID(3XTSOL)	Sets the UID of a window, a pixmap, or a colormap
XTSOLsetSessionHI(3XTSOL)	Sets the session high sensitivity label to the window server
XTSOLsetSessionLO(3XTSOL)	Sets the session low sensitivity label to the window server
XTSOLsetSSHeight(3XTSOL)	Sets the height of the screen stripe
XTSOLsetWorkstationOwner(3XTSOL)	Sets the ownership of the workstation

Oracle Solaris Man Pages That Are Modified by Trusted Extensions

Trusted Extensions adds information to the following Oracle Solaris man pages.

Oracle Solaris Man Page	Trusted Extensions Modification
allocate(1)	Adds options to support allocating a device in a zone and cleaning the device in a windowed environment
auditconfig(1M)	Adds the window policy for labeled information
audit_class(4)	Adds X server audit classes
audit_event(4)	Adds audit events
auditreduce(1M)	Adds a label selector
auth_attr(4)	Adds label authorizations
automount(1M)	Adds the capability to mount, and therefore view, lower-level home directories
cancel(1)	Adds label restrictions to a user's ability to cancel a print job
deallocate(1)	Adds options to support deallocating a device in a zone, cleaning the device in a windowed environment, and specifying the type of device to deallocate
device_clean(5)	Is invoked by default in Trusted Extensions
exec_attr(4)	Adds CDE actions as a type of profile object
getpflags(2)	Recognizes the NET_MAC_AWARE and NET_MAC_AWARE_INHERIT process flags

getsockopt(3SOCKET)	Gets the mandatory access control status, SO_MAC_EXEMPT, of the socket
getsockopt(3XNET)	Gets the mandatory access control status, SO_MAC_EXEMPT, of the socket
ifconfig(1M)	Adds the all-zones interface
is_system_labeled(3C)	Determines whether the system is configured with Trusted Extensions
ldaplist(1)	Adds Trusted Extensions network databases
list_devices(1)	Adds attributes, such as labels, that are associated with a device
lp(1)	Adds the -nolabels option
lpadmin(1M)	Adds label restrictions to the administrator's ability to administer printing
lpmove(1M)	Adds label restrictions to the administrator's ability to move a print job
lpq(1B)	Adds label restrictions to the display of print queue information
lprm(1B)	Adds label restrictions to the caller's ability to remove print requests
lpsched(1M)	Adds label restrictions to the administrator's ability to stop and restart the print service
lpstat(1)	Adds label restrictions to the display of the print service status
netstat(1M)	Adds the -R option to display extended security attributes
privileges(5)	Adds Trusted Extensions privileges, such as PRIV_FILE_DOWNGRADE_SL
prof_attr(4)	Adds rights profiles, such as Object Label Management
route(1M)	Adds the -secattr option to add extended security attributes to a route
setpflags(2)	Sets the NET_MAC_AWARE per-process flag
setsockopt(3SOCKET)	Sets the SO_MAC_EXEMPT option
setsockopt(3XNET)	Sets the mandatory access control, SO_MAC_EXEMPT, on the socket
smexec(1M)	Adds options to support the CDE action type
smrole(1M)	Adds options to support a role's label

smuser(1M)	Adds options to support a user's label and other security attributes, such as permitted idle time
socket.h(3HEAD)	Supports the SO_MAC_EXEMPT option for unlabeled peers
tar(1)	Adds including labels in tar files and extracting files according to label
tar.h(3HEAD)	Adds attribute types that are used in labeled tar files
ucred_getlabel(3C)	Adds getting the label value on a user credential
user_attr(4)	Adds user security attributes that are specific to Trusted Extensions

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