Oracle® Solaris Trusted Extensions Label Administration

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Preface

Labels, clearances, and handling instructions are used to protect information on a system that is configured with Trusted Extensions software. The components of labels, clearances, and handling instructions are specified in the `label_encodings` file. This guide provides background information for creating or modifying this file. This guide provides examples, and helps you create and install a `label_encodings` file that is appropriate for your site.

Who Should Use This Guide

This guide is for security administrators. Security administrators are responsible for defining the organization's labels. Some security administrators are also responsible for implementing the labels. This book is used for both defining and implementing labels.

Note – Even though Trusted Extensions can be configured with no visible labels, labels are always being used. Labels provide mandatory access control (MAC), and MAC is always enforced. Therefore, the site's `label_encodings` file must be in place before any user or role accounts are created.

Trusted Extensions installs a default `label_encodings` file. The security administrator must provide a file that is appropriate for the site.

The security administrator who implements the labels must be familiar with Solaris Operating System (Solaris OS) administration. The necessary level of knowledge can be acquired through training and documentation. For details, see "Documentation, Support, and Training" on page 13.

How the Solaris Trusted Extensions Guides Are Organized

The following table lists the topics that are covered in the Solaris Trusted Extensions gui des and the audience for each guide. For the Trusted Extensions man pages, see Appendix D, "List of Trusted Extensions Man Pages," in *Oracle Solaris Trusted Extensions Configuration and Administration*.

Title of Guide	Topics	Audience
Oracle Solaris Trusted Extensions User Guide	Describes the basic features of Solaris Trusted Extensions. This book contains a glossary.	End users, administrators, developers
Oracle Solaris Trusted Extensions Configuration and Administration	Part I describes how to prepare for, enable, and initially configure Trusted Extensions. Part II describes how to administer a Trusted Extensions system. This book contains a glossary.	Administrators, developers
Oracle Solaris Trusted Extensions Developer's Guide	Describes how to develop applications with Solaris 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

How This Guide Is Organized

- Chapter 1, "Labels in Trusted Extensions Software (Overview)," discusses labels-related concepts for the security administrator who prepares the site's `label_encodings` file.
- Chapter 2, "Planning Labels in Trusted Extensions(Tasks)," provides planning steps for the security administrator who prepares the site's `label_encodings` file. This chapter also describes the encodings files that Trusted Extensions provides.
- Chapter 3, "Creating a Label Encodings File (Tasks)," describes how to create, customize, and verify the `label_encodings` file.
- Chapter 4, "Labeling Printer Output (Tasks)," describes the labels and handling instructions on printer output and provides procedures for modifying them.
- Chapter 5, "Customizing the `LOCAL DEFINITIONS` Section (Tasks)," describes the optional `LOCAL DEFINITIONS` section of the `label_encodings` file.
- Chapter 6, "Planning an Organization's Encodings File (Example)," models how a site analyzes its label requirements and creates a `label_encodings` file.
- Appendix A, "Encodings File for SecCompany (Example)," contains the example of the `label_encodings` file from Chapter 6, "Planning an Organization's Encodings File (Example)."

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 Software Resources

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

Labels in Trusted Extensions Software (Overview)

This chapter prepares the security administrator to create the file that encodes labels for Trusted Extensions. This chapter covers the following topics:

- "Labels and Security Policy" on page 15
- "Types of Labels, Their Components and Uses" on page 16

This chapter assumes that you have read the following material:

- Chapter 9, "Getting Started as a Trusted Extensions Administrator (Tasks)," in *Oracle Solaris Trusted Extensions Configuration and Administration* guide, which prepares the security administrator to assume the Security Administrator role
- "Labels in Trusted Extensions Software" in *Oracle Solaris Trusted Extensions Configuration and Administration*

Labels and Security Policy

Site security policy is the security policy that an organization establishes to protect its proprietary information. With Trusted Extensions software, labels and mandatory access control (MAC) can be part of this policy. Labels implement a set of rules that is a part of system security policy. *System security policy* is the set of rules that is enforced by system software to protect information that is being processed on the system. The term "security policy" can refer to the policy itself or to the implementation of the policy.

All systems that are configured with Trusted Extensions have labels. Labels are specified in a `label_encodings` file. For a description of the file, see the `label_encodings(4)` man page. For descriptions of the encodings files that Trusted Extensions provides, see "Sources for Encodings Files" on page 36.

Trusted Extensions installs a default version of the `label_encodings` file. The default version supplies several commercial labels. This version can sometimes be used in non-production

environments for learning purposes. A site can also customize one of the `label_encodings` files that Trusted Extensions provides. For an example of a site-specific file, see Appendix A, "Encodings File for SecCompany (Example)."

Every system in a Trusted Extensions network needs its own copy of the site's `label_encodings` file. For interoperability, the `label_encodings` file on every system in the network must be compatible. At the very least, each system must recognize the labels on every other system.

Certain types of labels must be defined. The security administrator specifies the numeric values and the bits that define the internal representation of labels. Users and roles view the textual representation of labels. The labeling software translates between the internal form and the textual form. The `label_encodings` file provides the rules for translating the internal representation of labels to their textual form. The textual form can be visible on the desktop. The internal representation is recorded in the audit trail and is interpreted by the `praudit` command.

The *security administrator* is the person who defines and plans the implementation of an organization's security policy. The security administrator establishes information protection procedures, makes sure that users and administrators are properly trained, and monitors compliance.

The *Security Administrator role* is created in the software. The role is assigned to one or more administrators who fully understand Trusted Extensions administration. These administrators are cleared to view and protect the highest level of information that is processed by Trusted Extensions. One responsibility of the security administrator is to create the site's `label_encodings` file to replace the version that is installed by default. The administrator can also decide whether labels are visible on the desktop. Even when labels are not visible, objects and processes on the system are labeled, and MAC is enforced.

Trusted Extensions provides the Security Administrator role with the tools and capabilities to put the organization's security policy into effect. To assume the role, you first log in as a regular user, then you assume the role. At your site, the security administrator who defines the site's security policy might or might not be the same person who implements the policy.

Types of Labels, Their Components and Uses

Trusted Extensions defines two types of labels:

- Sensitivity labels, often referred to as *labels*
- Clearance labels, referred to as *clearances*

Sensitivity labels, label ranges, and a label limit or *clearance* determine who can access which objects on the system. Clearance labels are assigned to users. Sensitivity labels are assigned to processes, including user processes, and to files and directories.

Some objects have a label range. These objects can be accessed at a particular label within the defined label range. A label range from `ADMIN_LOW` to `ADMIN_HIGH` allows access at all labels. The security administrator can narrow that label range. Objects with label ranges include the following:

- All hosts and networks with which communications are allowed
- Zones
- User accounts and role accounts
- Allocatable devices, such as tape drives, diskette drives, CD-ROM and DVD devices, and audio devices
- Other devices that are not allocatable, for example, printers, workstations (which are controlled through the label range of the frame buffer), and serial lines when they are used as a login device

The various procedures for setting labels on these objects is described in *Oracle Solaris Trusted Extensions Configuration and Administration*. "Device Manager GUI" in *Oracle Solaris Trusted Extensions Configuration and Administration* describes how to set label ranges on devices.

Label Ranges Restrict Access

Label ranges set limits on the following:

- The labels at which hosts can send and receive information.
- The labels at which processes acting on behalf of users and roles can access files and directories in zones.
- The labels at which users can allocate devices, thereby restricting the labels at which files can be written to storage media in these devices.
- The labels at which users can send jobs to printers.
- The labels at which users can log in to workstations. In addition to the user's label range, a label range on the frame buffer can be used to restrict access to a system.

Labels are automatically assigned to email messages. Emails are only visible in an email reader at the label of the message. The label of an email is printed when the email is printed.

Labels Are Used in Access Control Decisions

Labels are used to implement and control access on a system. Labels implement mandatory access control (MAC). With Trusted Extensions, both discretionary access control (DAC) checks and MAC checks must pass before access is allowed to an object. As in the Solaris OS, DAC is based on permission bits and access control lists (ACLs). For more information, see Chapter 7, "Controlling Access to Files (Tasks)," in *System Administration Guide: Security Services*.

MAC compares the label of a process that is running an application with the label or the label range of any object that the process tries to access. The labels implement the set of rules that enforce policy. One rule is *read down-read equal*. This rule applies when a process tries to access an object. The label of the process has to be greater than or equal to the label of the object, as in:

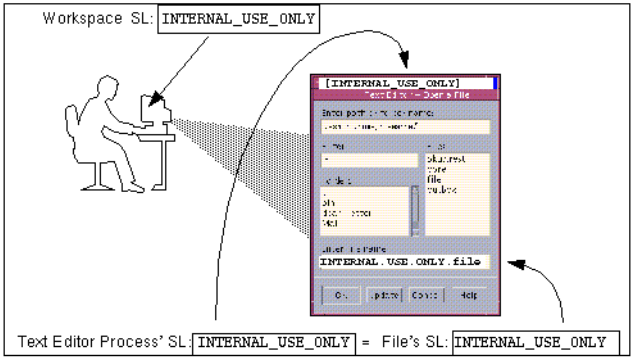
```
Label[Process] >= Label[Object]
```

On a system that is configured with Trusted Extensions, files and directories have slightly different access rules from each other and from process objects, network endpoint objects, device objects, and X window objects. In addition, an object can be accessed in three different ways. A slightly different set of rules applies for each way:

- The name of the file, directory, or device can be viewed.
- The contents or the attributes of the file, directory, or device can be viewed.
- The contents or the attributes of the file, directory, or device can be modified.

The following figure shows a system that uses labels to make an access control decision. Note that "SL" means "Sensitivity Label".

FIGURE 1–1 Comparing the Label of a Text Editor With the Label of a File



In the preceding figure, a user opens a text editor in a workspace with the label `INTERNAL_USE_ONLY`. The system sets the label of the process that is running the text editor to be equal to the label of the current workspace. Therefore, the text editor displays a label of `INTERNAL_USE_ONLY`. When the text editor attempts to open a file for editing, the label of the process that is running the text editor is compared to the label of the file. When the two labels are equal, access for writing is allowed.

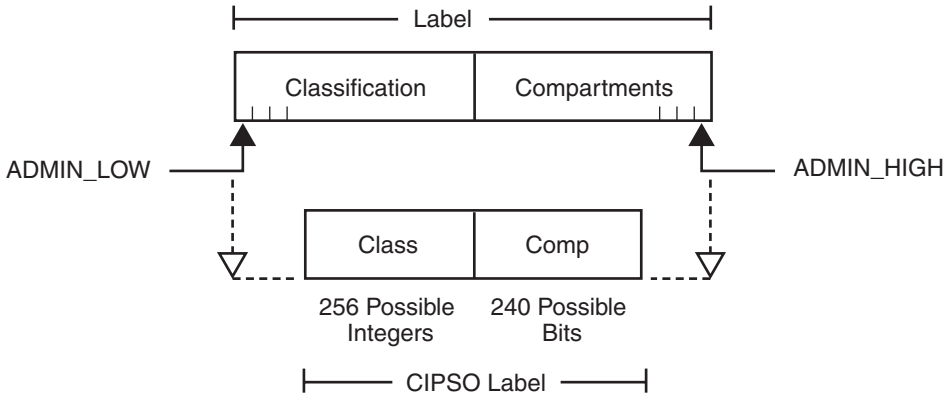
If the label of a file is less than the label of the text editor, the file can be opened for reading only. For example, the `INTERNAL_USE_ONLY` text editor can open and read a system file at `ADMIN_LOW`, but the text file cannot be changed. Also, because of the read down requirement, a user cannot view a file whose label is higher than the current working label.

Label Components

Labels and clearances consist of a single *classification* and zero or more *compartment*s. The classification portion of a label indicates a *relative level of protection*. When a label is assigned to an object, the label's classification indicates the sensitivity of the information that is contained in the object. When a clearance is assigned to a user, the classification portion of the clearance label indicates the user's level of trust.

Trusted Extensions supports Common IP Security Option (CIPSO) labels. Each label has a classification field that allows 256 values, and a 256-bit compartments field. You cannot use 0 (zero) for a classification, so you can define a total of 255 classifications. For CIPSO labels, 240 compartment bits are available, for a total of 2^{240} compartment combinations. The components are illustrated in the following figure. Note that “Class” means “Classification” and “Comp” means “Compartment”.

FIGURE 1–2 CIPSO Label Definition



The `ADMIN_HIGH` label and the `ADMIN_LOW` label are administrative labels. These labels define the upper bound and lower bound of all labels on a system.

Each compartment has one or more compartment bits assigned. The same compartment bit can be assigned to more than one compartment.

The textual format of a classification appears similar to the following:

```
CLASSIFICATIONS:

name= TOP SECRET; sname= TS; value= 6;initial compartments= 4-5;
```

The compartment portion of a label is optional. Compartments in a label can be used to represent different kinds of groupings, such as workgroups, departments, divisions, or geographical areas. Compartments can also further identify how information will be handled.

When initial compartments are part of the classification definition, then compartments are part of that label. In the following excerpt, name indicates a compartment that can be used with the TS classification.

```
WORDS:

name= A;          compartments= 0;
name= B;          compartments= 1;
name= CNTRY1;     sname= c1;     compartments= ~4;
name= CNTRY2;     sname= c2;     compartments= ~5;
```

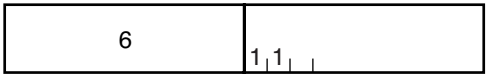
Possible labels from the preceding classifications and compartments include TS, TS A, TS B, and TS AB. A file with the TS A label would be available only to users who have the TS classification and the A compartment in their clearances. For an illustration, see Figure 1–3.

Label Dominance

When any type of label has a security level that is equal to or greater than the security level of a second label, the first label is said to *dominate* the second label. This comparison of security levels is based on classifications and compartments in the labels. The classification of the dominant label must be equal to or higher than the classification of the second label. Additionally, the dominant label must include all the compartments in the second label. Two equal labels are said to dominate each other.

By these criteria, TS A dominates TS, and TS dominates TS. The classification and compartment bits of the Top Secret (TS) label are shown in the following figure.

FIGURE 1–3 Representation of the TS, TS A, TS B, and TS AB Labels




```
TOP SECRET        A
value = 6         compartments = 0
                  B
                  compartments = 1
```

Another kind of dominance, *strict dominance*, is sometimes required for access. One label *strictly dominates* another label when the first label has a security level that is greater than the security level of the other label. Strict dominance is dominance without equality. The classification of the first label is higher than the classification of the second label. The first label contains all the compartments in the second label. Or, if the classifications of both labels are the same, the first label contains all the compartments in the second label, in addition to one or more additional compartments.

Labels that are not in a dominance relationship are said to be *disjoint*. Disjoint labels are appropriate for separating departments at a company. For example, the label `TS HR` (Human Resources) would be disjoint from `TS Sales`.

Accreditation Ranges, Label Ranges, and Valid Labels

Certain combinations of label components can be disqualified by rules in the `label_encodings` file. Combination rules *implicitly* define the organization's usable labels. The security administrator is responsible for specifying combination rules.

A *valid* or *well-formed* label is a label that satisfies a combination rule. The security administrator defines combination rules by using any of the following means:

- A *minimum clearance* and a *minimum sensitivity label* must be specified.

  These system-wide minimum labels establish the lowest clearance and the lowest label that any regular user can have.
- *Initial compartments* (compartment bits) can be assigned to a classification.

  Initial compartment bits are always associated with the classification in a label. For more details, see "Classification Name Syntax" on page 43.
- A *minimum classification*, an *output minimum classification*, and a *maximum classification* can be associated with any word.
- *Hierarchies* among words can be defined by the *bit patterns* that are chosen for each word.
- *Required combinations* of words can be specified.
- *Combination constraints* can be specified for words.

Two *accreditation ranges* are implicitly specified in the `label_encodings` file:

- "System Accreditation Range" on page 21
- "User Accreditation Range" on page 23

The term *accreditation range* is also used for the label ranges that are assigned to user and role accounts, printers, hosts, networks, and other objects. Because rules can constrain the set of valid labels, label ranges and accreditation ranges might not include all the potential combinations of label components in a range.

System Accreditation Range

The system accreditation range includes the administrative labels `ADMIN_HIGH` and `ADMIN_LOW`. The system accreditation range also includes all the well-formed labels that are constructed from the label components in the `label_encodings` file.

Administrative role accounts are usually the only accounts that can work at every label within the system accreditation range. An organization can also set up regular user accounts so that users can perform a task that requires an administrative label.

The following figure shows an example of how rules can constrain the labels that are permitted in a system accreditation range.

FIGURE 1–4 How System Accreditation Range Is Constrained by Rules

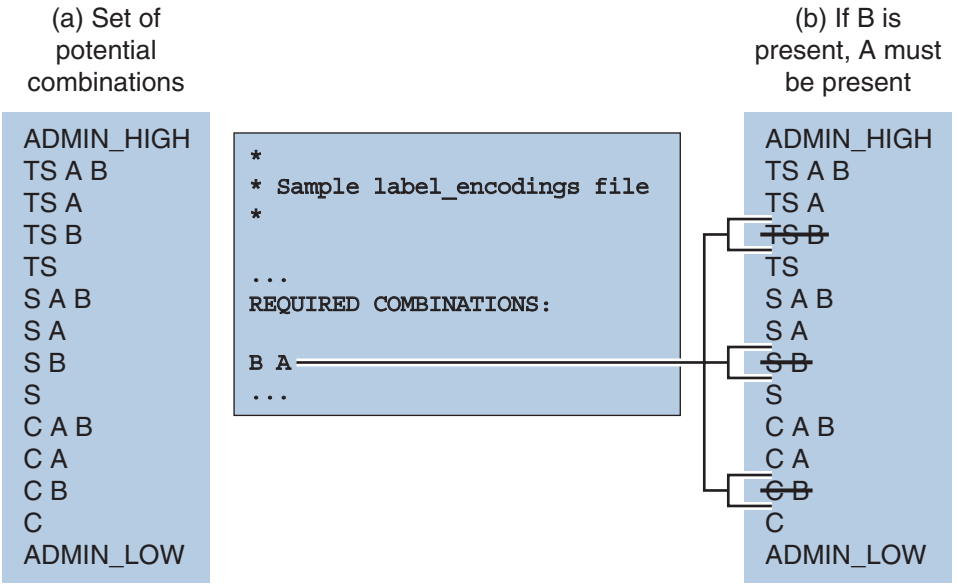


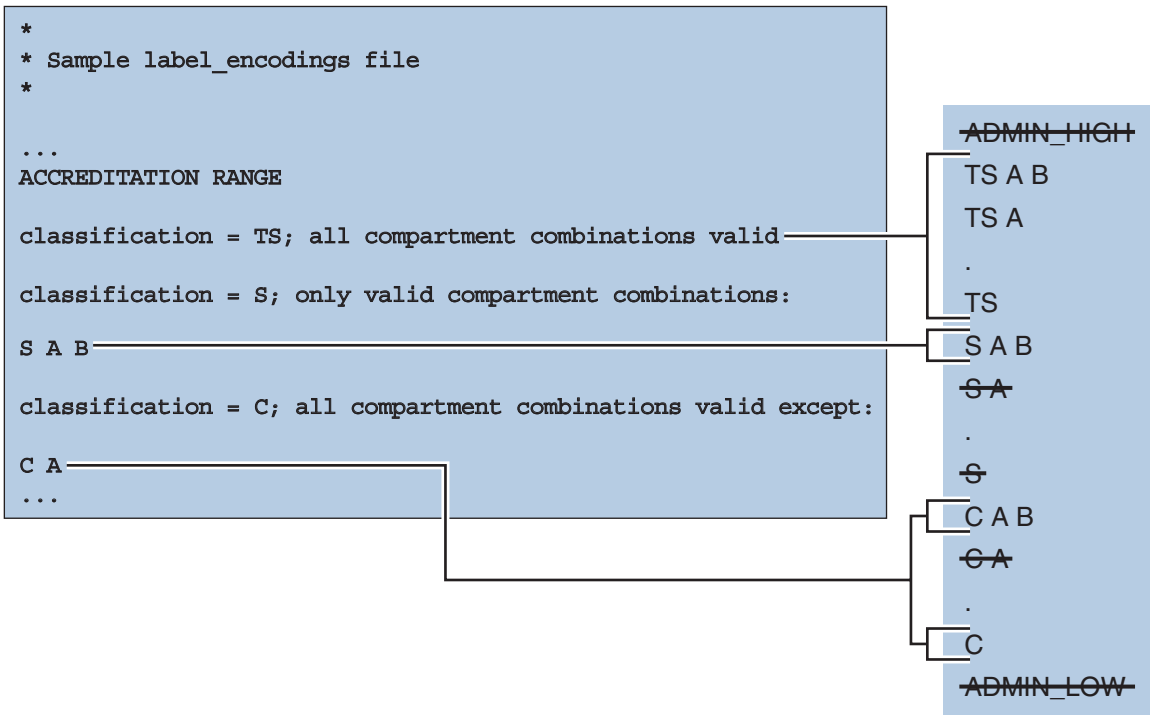
Figure 1–4 (a) shows all potential combinations given the classifications, `TS` (`TOP SECRET`), `S` (`SECRET`), and `C` (`CONFIDENTIAL`), and the compartments, `A` and `B`.

Figure 1–4 (b) shows a typical rule from the `REQUIRED COMBINATIONS` subsection of the `SENSITIVITY LABELS` section and its effects. The lines bracket the labels that are disqualified by the rule. Disqualified labels appear with lines through them. The `REQUIRED COMBINATIONS` syntax `B A` means that any label that has `B` as a compartment must also contain `A`. The converse is not true. Compartment A is not required to be combined with any other compartments. Because compartment `B` is only permitted when `A` is also present, the labels `TS B`, `S B`, and `C B` are not well-formed. Labels that are not well-formed are not in the system accreditation range.

User Accreditation Range

The *user accreditation range* is the largest set of labels that regular users can access when using Trusted Extensions. The user accreditation range always excludes ADMIN_HIGH and ADMIN_LOW. The user accreditation range is further constrained by any rules that constrain the "System Accreditation Range" on page 21. In addition, the user accreditation range can be constrained by a set of rules in the ACCREDITATION RANGE section of the label_encodings file. Figure 1–5 continues the Figure 1–4 example. Figure 1–5 shows three different types of rules in the ACCREDITATION RANGE section and their effects on the user accreditation range. The lines bracket to the well-formed labels that the particular rule permits.

FIGURE 1–5 ACCREDITATION RANGE Section of label_encodings File



As shown in the box to the right, the user accreditation range excludes ADMIN_HIGH and ADMIN_LOW. The rule for the TS classification (shown in Figure 1–4) includes all TS combinations except TS B. However, because TS B, and S B and C B, were previously overruled by the REQUIRED COMBINATIONS rule B A (as shown in Figure 1–4), TS A B, TS A, and TS are the only allowed TS combinations. As shown in Figure 1–5, because S A B is defined as the only valid combination for the S classification, S B is excluded again. All C combinations except C A are

valid, according the rule for the C classification. However, because C B was overruled earlier, the only permitted combinations for the C classification are C A B and C.

Account Label Range

The *account label range* is the range of labels that is available to a user account or role account. This range governs the labels at which the user can work when logging in to the system.

The labels that are available in the account label range have the following constraints:

- The user clearance defines the upper bound of the account label range.

  A clearance does not have to be a valid label. Because it must dominate all labels at which the user can work, the clearance must contain all the components of all the labels at which the user can work.
- The minimum label sets the lower bound of the account label range.

  The minimum sensitivity label in the `label_encodings` file defines an absolute minimum on labels at which any user can work.

EXAMPLE 1–1 Defining a Valid Clearance That Is Not a Valid Label

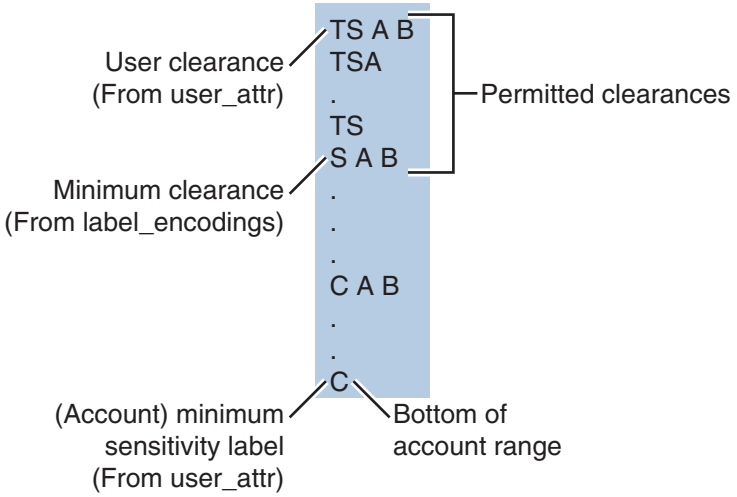
Consider a `label_encodings` file that prohibits the combination of compartments A, B, and C in a label. The valid clearance in this `label_encodings` file is not a valid label for a user.

- The minimum label would be TS with no compartments.
- TS A B C would be a valid clearance. TS A B C would not be a valid label.
- Valid labels for a user would be TS, TS A, TS B, and TS C.

Account Label Range Examples

The possible clearances and minimum labels that can be assigned to a user are shown in the following example. These labels are based on the accreditation examples from the previous sections.

FIGURE 1–6 Constraints on Account Label Ranges



In this example, TS A B is the highest label in the system accreditation range. This label contains the only two compartments, A and B, that are permitted to appear together in a label with any classification. TS A B is the clearance assigned to the account.

C is the user's minimum label. The definitions in the account label range constrain the user to work at labels TS A B, TS A, TS, S A B, C A B, or C.

The permitted clearances are TS A B, TS A, TS and S A B. A minimum clearance of S A B is set in the `label_encodings` file.

Even if TS A B were not a valid label, the security administrator could assign the label as a clearance. The assignment would allow the user to use any valid labels that are dominated by TS and that contain the words A and B. In contrast, if TS were assigned as the account clearance, the user could work at the labels TS and C only. TS without any compartments does not dominate S A B or C A B.

Table 1–1 provides a more complex example. The example illustrates the differences between the possible label combinations, the system accreditation range, the user accreditation range, and some example account label ranges.

TABLE 1–1 Accreditation Range and Account Label Range Examples

	Accreditation Range		Account Label Range		
Possible Labels	System	User	TS A B Clearance, S A B Min Label	TS Clearance, C Min Label	ADMIN_LOW Clearance and Min Label, solaris.label.delegate Authorization
ADMIN_HIGH	ADMIN_HIGH				
TS A B	TS A B		TS A B		

TABLE 1–1 Accreditation Range and Account Label Range Examples *(Continued)*

	Accreditation Range		Account Label Range		
Possible Labels	System	User	TS A B Clearance, S A B Min Label	TS Clearance, C Min Label	ADMIN_LOW Clearance and Min Label, solaris.label.delegate Authorization
TS A	TS A	TS A	TS A		
TS	TS	TS	TS	TS	
S A B	S A B	S A B	S A B		
S A					
S				S	
C A B	C A B				
C A	C A				
C	C	C		C	
ADMIN_LOW	ADMIN_LOW				ADMIN_LOW

- Regular users without any authorizations can work only with the labels in the User Accreditation Range column.
- The fourth column shows the Account Label Range for a user with a clearance of TS A B and a minimum label of S A B. This range allows the user to work with the labels TS A B, TS A, TS, and S A B.
- The fifth column shows an account with a clearance of TS and a minimum label of C. This account would be allowed to work only with TS, S, and C labels because all the other valid labels that are dominated by TS include the compartments A and B. A and B are not in the clearance.
- The sixth column shows a user who is authorized to work outside the user accreditation range. This user is assigned a single label of ADMIN_LOW.

Session Range

The *session range* is the set of labels that is available to a user account during a Trusted Extensions session. The session range is a function of the following constraints:

- The label range of the user
- The label that the user chose at login
- The label range of the local system

The session range of a single-label account is the label of the account. Choosing from a range of labels is possible only when a user account is configured to use multiple labels. User with

accounts that are configured to use multiple labels can choose different labels during the session. To specify a label, see "How to Change the Label of a Workspace" in *Oracle Solaris Trusted Extensions User Guide*.

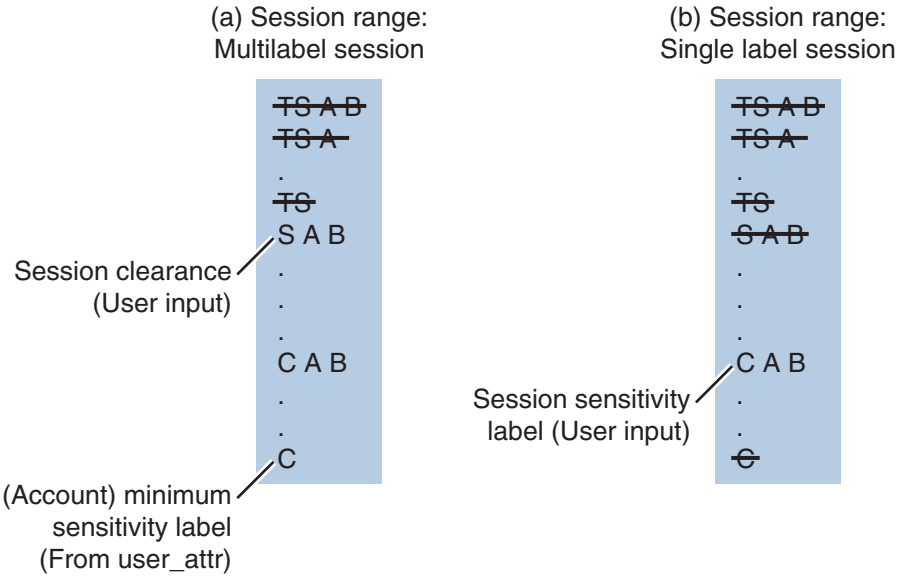
The single label or session clearance that is chosen at login is in effect throughout the session until logout. During a multilabel session, the user can work at any valid label that is dominated by the session clearance and that dominates the user's minimum label.

Figure 1–7 continues the Figure 1–6 example. As shown in Figure 1–6, the user can specify a session clearance that uses any well-formed label between TS A B and S A B.

Figure 1–7 (a) shows the labels that are available if the user selects a multilabel session with a session clearance of S A B. Because the other intermediate labels between S A B and C are not well-formed, the user can only work at S A B, C A B, or C.

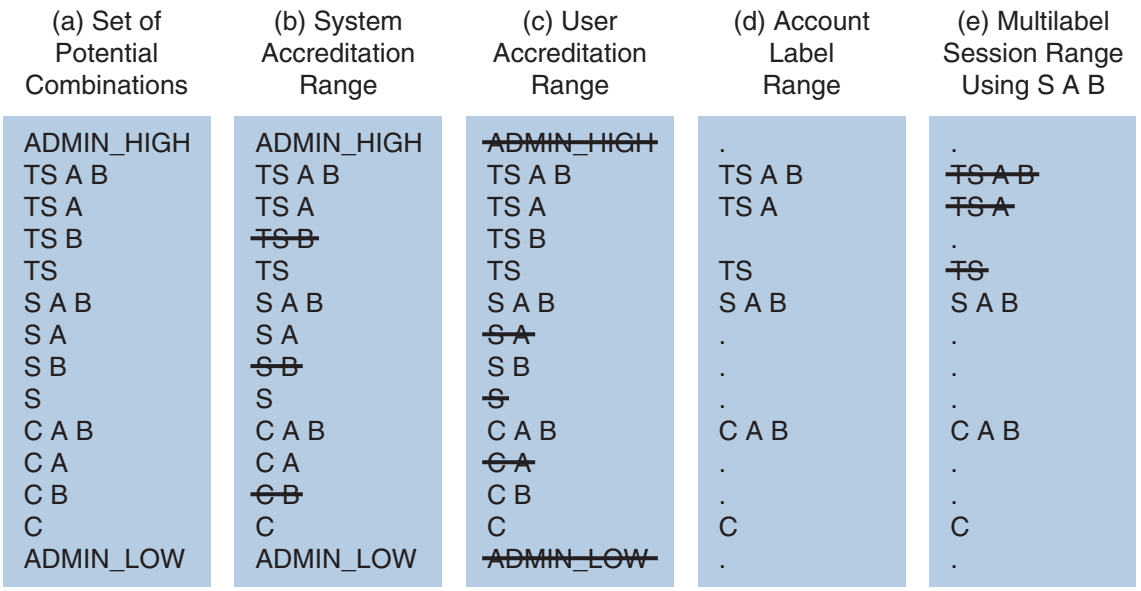
Figure 1–7 (b) shows the labels that are available if the user selects a single-label session with a session label of C A B. Note that C A B is below the minimum clearance. However, C A B is accessible because the user is selecting a session label, not a clearance. Because the session is single-label, the user can work at only one label. In this example, the user specified C A B, although S A B or C could have been chosen instead.

FIGURE 1–7 Comparison of Session Ranges



The following figure summarizes the progressive eliminations of available labels. The eliminated labels are shown with a line through them in the range where they are filtered out. The filtered out labels are not shown in subsequent ranges.

FIGURE 1–8 Cumulative Effect of Constraints on a Session Range



Label Availability in Trusted Extensions Sessions

The following table shows session label limitations and availability based on users' session choices. The table continues the example from Figure 1–8.

TABLE 1–2 Labels in Trusted Extensions Sessions

	Multilevel Session		Single-level Session	
	General Case	Example #1	General Case	Example #2
		Multilevel with clearance of SECRET A B		Single-level with session label of SECRET A B
Initial workspace label (at first login)	Lowest label in account label range.	CONFIDENTIAL	Session label is specified by user	SECRET A B
Available workspace labels	Any label in account label range up to the session clearance	CONFIDENTIAL CONFIDENTIAL A B SECRET A B	Session label is specified by user	SECRET A B

- The left column identifies the types of label settings that are used in sessions.
- The middle two columns apply to a multilevel session.

- The right two columns apply to a single-level session.
- The columns that are labeled `General Case` describe how the label types are determined.
- The columns marked `Example` show a typical user's session selections at login.

In Example #1, the initial workspace label is set to `CONFIDENTIAL`, which is the label at the lower bound of the user's account label range. The user can work at a label of `CONFIDENTIAL`, `CONFIDENTIAL A B`, or `SECRET A B`.

In Example #2, the user's initial workspace label is `SECRET A B`. Because the session is single-level, the only available workspace label is `SECRET A B`.

Labeled Workspaces

Labeled workspaces enable users to work at multiple labels during a single session.

If the user selects a range of labels for the session, the first workspace that appears is at the user's *minimum label*. In Trusted GNOME, panels exist for other workspaces. By entering a workspace and selecting a label, all windows created in that workspace run processes at the selected label.

For details about working in a labeled system, see *Oracle Solaris Trusted Extensions User Guide*.

Label Administration

Several aspects about how labels appear to users can be configured. Label visibility, label color, and labels on printed output can be configured. Some actions on labels require authorization or privilege. For example, upgrading or downgrading an object's label requires an authorization. Manipulating a label between its internal and its textual representation can require a privilege.

Label Visibility

Labels can appear in title bars of applications on the desktop. On a single-label system, you might not want labels to be visible. Label visibility is configurable in the `policy.conf` file for a system and in the `user_attr` database for individual users. For information about the configuration procedures, see "Managing a Label Encodings File (Task Map)" on page 48.

Typically, the content of files at a lower label can be read by a user at a higher label. For example, system files and commonly available executables are assigned an `ADMIN_LOW` label. According to the read down-read equal rule, users who work at any label can read `ADMIN_LOW` files. As in the Solaris OS, DAC permissions can prevent read access. Zones also protect files from being read. If a lower-level zone is not mounted, a user in a higher-level zone cannot access the files for reading.

Files that contain data that must not be viewed by regular users, such as system log files and the `label_encodings` files, are maintained at `ADMIN_HIGH`. To allow administrators access to protected system files, the `ADMIN_LOW` and `ADMIN_HIGH` administrative labels are assigned as the minimum label and clearance for roles.

Labels on Printed Output

The labels that are printed on banner, trailer and body pages of print jobs can be customized. Also, accompanying text that appears on the banner and trailer pages can be customized. For more information, see Chapter 4, "Labeling Printer Output (Tasks)."

Authorizations for Relabeling Information

The authorization to upgrade information to a label that dominates the label of the current information is called the `Upgrade File Label` authorization. The authorization that is used to downgrade information to a label that is lower than the label of the current information is called the `Downgrade File Label` authorization. For definitions of these authorizations, see the `/etc/security/auth_attr` file.

Privileges for Translating Labels

Label translation occurs whenever programs manipulate labels. Labels are translated to and from the textual strings to the internal representation. For example, when a program such as `getlabel` obtains the label of a file, before the label can be displayed to the user, the internal representation of the label is translated into readable output, that is, into a textual string. When the `setlabel` program sets a label specified on the command line, the textual string (that is, the label's name) is translated into the label's internal representation. Trusted Extensions permits label translations only if the calling process's label dominates the label that is to be translated. If a process attempts to translate a label that the process's label does not dominate, the translation is disallowed. The `sys_trans_label` privilege is required to override this restriction.

◆ ◆ ◆ CHAPTER 2

Planning Labels in Trusted Extensions(Tasks)

This chapter covers the following topics:

For a greater level of detail and for further reference, see the *Compartmented Mode Workstation Labeling: Encodings Format*: Defense Intelligence Agency document [DDS-2600-6216-93]. This Defense Intelligence Agency (DIA) reference is included in the Trusted Extensions document set. When using the DIA reference, keep in mind that information labels and their components are not used in Trusted Extensions.

Planning Labels in Trusted Extensions (Task Map)

Planning labels requires general knowledge of site security policy and specific knowledge of the syntax of the `label_encodings` file. The security administrator is responsible for planning labels.

The following task map describes the planning tasks and points to more information.

Task	Description	For Instructions
Study and outline your `label_encodings` file.	Make a `label_encodings` file that enforces your site security policy.	"How to Plan for Labels" on page 32
Build an extensible `label_encodings` file.	Create a file that can be modified without affecting existing label definitions.	"How to Plan the Encodings File" on page 32

How to Plan for Labels

1. **Allow time to build a correct `label_encodings` file.**

   Building the encodings for a site and making them correct can be a time-consuming process. A system cannot be configured until the correct `label_encodings` file is installed.

2. **Know your site's security policy.**

   Many sites already have a security policy that was developed according to government methods. Commercial businesses, even businesses that do not have much experience in planning labeled security, can start by examining their goals for information protection. These goals can be used to make some common-sense decisions about how to use labels. If the company has developed legal requirements for labeling printed information and email, those guidelines are a good place to start.

   - For more information about setting up site security policy, see Appendix A, "Site Security Policy," in *Oracle Solaris Trusted Extensions Configuration and Administration*.
   - For an example of planning a customized `label_encodings` file that is based on company requirements, see Chapter 6, "Planning an Organization's Encodings File (Example)."

3. **Study the U. S. government's `label_encodings` file.**

   The government's description of the file is in the *Compartmented Mode Workstation Labeling: Encodings Format:* Defense Intelligence Agency document [DDS-2600-6216-93].

4. **Determine your site's entries in the `LOCAL DEFINITIONS` section of the file.**

   For suggestions and examples, see Chapter 5, "Customizing the `LOCAL DEFINITIONS` Section (Tasks)."

5. **Finalize your encodings before installing Trusted Extensions.**

   Changing the `label_encodings` file on a running system is risky. For more information, see the `label_encodings(4)` man page.

How to Plan the Encodings File

The following practices help you create a correct `label_encodings` file that can be safely extended later.

Caution – For `CLASSIFICATIONS` and `COMPARTMENTS`, the security administrator can later change the textual representation. However, the integer and bit values cannot be changed without potentially serious complications.

1. **Create a `label_encodings` file.**

   For ideas, see "Sources for Encodings Files" on page 36. For the procedure, see "Managing a Label Encodings File (Task Map)" on page 48.

2. **Leave gaps in the `label_encodings` file to add items.**

   a. **Leave gaps when you number classifications.**

      For example, you could number classifications in increments of 10. The increments allow intermediate classifications to be added later.

   b. **Leave gaps in compartment bits.**

      Leave gaps in compartment bit numbers for possible later additions.

   c. **Reserve some initial compartment bits for later definition.**

      If your site uses inverse compartments, see "Default and Inverse Words" on page 45. To learn more about inverse compartments, see *Compartmented Mode Workstation Labeling: Encodings Format*.

3. **Determine classifications for the site.**

   As described in Figure 1–2, the total number of classification values that you can use is 254. Do not use classification 0.

   A Trusted Extensions system treats a classification value of 10 as more security-sensitive than a classification value of 2. The textual representations are not used to determine security levels.

   The same classification value cannot be assigned to different names. Each classification must be higher or lower, or disjoint, from any other classification. Every classification must be distinct.

   A table can be used to plan classifications. For a completed example, see Table 6–2.

4. **Determine the compartments for the site.**

   Decide how data and programs are grouped. Decide whether any data or programs can be intermixed. For example, perhaps purchase order data should not be viewable by programs that manage personnel files. Perhaps purchase order data should be accessible to programs that address shipment tracking problems.

   At this point, do not think in terms of users. Think of *what*, not *who*.

5. **Name the classifications and compartments.**

   `CLASSIFICATIONS` and `WORDS` (for compartments) in the `label_encodings` file have two forms: a mandatory long name and an optional short name. Short names can be used interchangeably with long names when labels are being specified.

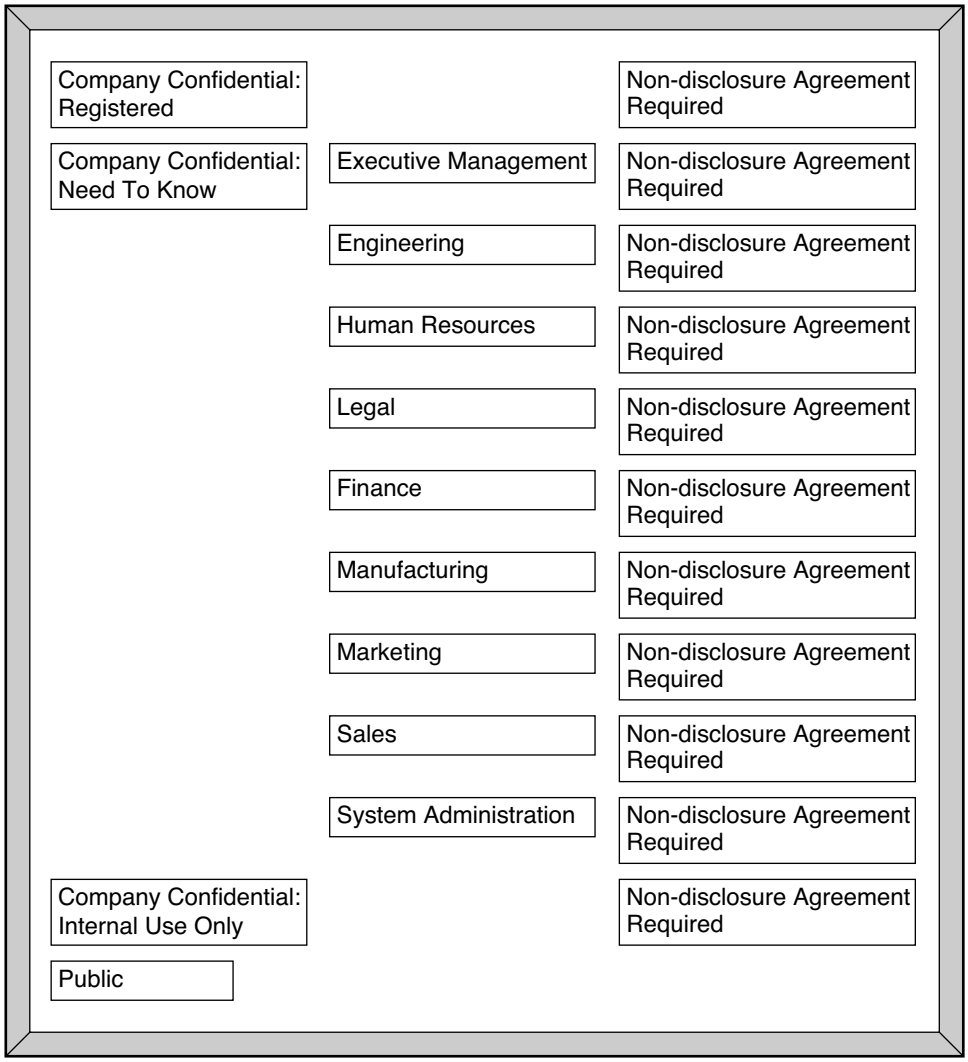
6 **Arrange the relationships among the classifications and among the compartments.**

Compartments are not intrinsically hierarchical. However, compartments can be configured to have hierarchical relationships. Before setting up relationships, study the example section in *Compartmented Mode Workstation Labeling: Encodings Format*.

To make this step easier, use a large board and pieces of paper that represent your classifications and compartments. For an example, see Figure 2–1. With this method, you can visualize the relationships and rearrange the pieces until they all fit together.

Note – Unless you are creating a set of encodings that must be compatible with another organization's labels, you can assign any valid number as a compartment bit. Keep track of the numbers that you use and their relationships to each other.

FIGURE 2–1 Sample Planning Board for Label Relationships



7 Arrange the labels in order of increasing sensitivity.

8 Decide which clearances to assign to which users.

You can use a table to plan clearances. For a completed example, see Table 6–5.

When you assign a clearance to a user, the classification component of the clearance must dominate all classifications at which the user can work. The clearance can be equal to the user's highest work classification. The compartment component of the clearance must include all compartments that the user might need.

9 **Associate the definitions for each compartment with an internal format of integers, bit patterns, and logical relationship statements.**

A table can be used to track compartment bit assignments. For a completed example, see Table 6–4.

10 **Copy the `WORDS` section under `SENSITIVITY LABELS` to the `INFORMATION LABELS` section.**

Although Trusted Extensions does not support information labels, the `INFORMATION LABELS: WORDS:` section must be identical to the `SENSITIVITY LABELS: WORDS:` section to be a valid encodings file.

11 **Decide which colors to associate with which labels.**

For suggestions and examples, see "Specifying Colors for Labels" on page 72.

12 **Analyze the label relationships.**

On a system that is configured with Trusted Extensions, use the `chk_encodings -a` command to generate a detailed report on the label relationships in your `label_encodings` file.

```
# chk_encodings -a encodings-file
```

Sources for Encodings Files

The `label_encodings` file is a flat text file. On a system that is configured with Trusted Extensions, the label of the file is `ADMIN_HIGH` to prevent regular users from reading it. The maximum line length in the `label_encodings` file is 256 bytes. The file can be edited with any text editor. The security administrator is responsible for the creation and distribution of the `label_encodings` file.

Note – The `label_encodings` file can be created or edited on any system. However, the file must be checked and tested on a host that is configured with Trusted Extensions.

Some organizations have a government-furnished `label_encodings` file that is based on Defense Intelligence Agency (DIA) specifications. Other organizations might want to derive their encodings file from one of the files that are provided by Trusted Extensions.

Encodings Files From Trusted Extensions

Trusted Extensions installs the following sample `label_encodings` files in the `/etc/security/tsol` directory. These samples can be modified to meet your site requirements.

`label_encodings`	Is installed by Trusted Extensions software as the default. This file uses commercial labels, such as Confidential: Need to Know.

`label_encodings.example`	Is similar to the example in Appendix A, "Encodings File for SecCompany (Example)." The introduction to the appendix describes the label components in the file. Chapter 6, "Planning an Organization's Encodings File (Example)," describes each step for creating this file.
`label_encodings.gfi.single`	Is the U.S. government single-level file.
`label_encodings.single`	Is Oracle's version of the U.S. government single-level file. The color assignments are different.
`label_encodings.gfi.multi`	Is the U.S. government multilevel file.
`label_encodings.multi` file	Is Oracle's version of the U.S. government multilevel file. The combinations are less restricted, the minimum clearance is higher, the default user label is lower, and the colors are different.

Alternatively, you can build a `label_encodings` file from scratch. The syntax and structure of the `label_encodings` file is provided in "Encodings File Syntax" on page 41.

Default `label_encodings` File

By default, the `/etc/security/tsol/label_encodings` is installed with the following contents:

```
ACCREDITATION RANGE:
classification= PUB; all compartment combinations valid;

classification= SBX; all compartment combinations valid;

classification= CNF; all compartment combinations valid except:
CNF

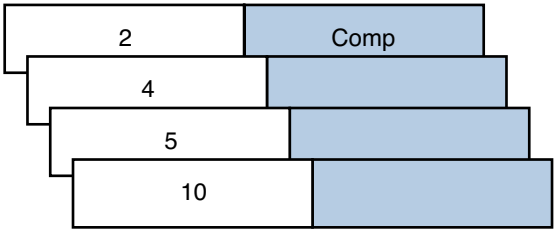
minimum clearance= PUB;
minimum sensitivity label= PUB;
minimum protect as classification= PUB;
```

The `ACCREDITATION RANGE` definition restricts the user to the following label:

- `PUBLIC` is defined as the lowest classification.
- `CONFIDENTIAL` is defined as a higher classification.
- `SANDBOX` is defined as the highest classification.
- `PUBLIC` is defined as the minimum clearance.
- `PUBLIC` is defined as the minimum sensitivity label.
- `PUBLIC` is defined as the minimum "Protect As" classification.

The Classifications section of the default file is illustrated in the following figure.

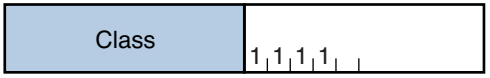
FIGURE 2–2 Classifications in the Default `label_encodings` File




```
CLASSIFICATIONS:
PUBLIC         value = 2
CONFIDENTIAL   value = 4
SANDBOX        value = 5
MAX LABEL      value = 10
```

The Compartments section of the file is illustrated in the following figure.

FIGURE 2–3 Compartments in the Default `label_encodings` File




```
SENSITIVITY LABELS:
WORDS:
INTERNAL USE ONLY  compartments = 1 ~2
NEED TO KNOW       compartments = 1-2 ~3
RESTRICTED         compartments = 1-3
PLAYGROUND         compartments = 0 ~1 ~2 ~3
```

Differences Between Simplified GFI Label Encodings Files

Trusted Extensions installs two government-furnished files, `label_encodings.gfi.single` and `label_encodings.gfi.multi`. The `label_encodings.gfi.single` file is a single-level file, and the `label_encodings.gfi.multi` file is a multilevel version of the single-level file. The files also differ in the settings in the `ACCREDITATION RANGE` section. The `ACCREDITATION RANGE` section describes which classifications and compartments are available to regular users.

Oracle provides two simplified versions of these files, `label_encodings.single` and `label_encodings.multi`. The differences are described in the following sections.

Simplified GFI Multilevel Label Encodings File

The ACCREDITATION RANGE settings in the label_encodings.multi follow:

```
ACCREDITATION RANGE:
classification= u;   all compartment combinations valid;
classification= c;   all compartment combinations valid;
classification= s;   all compartment combinations valid;
classification= ts;   all compartment combinations valid;

minimum clearance= c;
minimum sensitivity label= u;
minimum protect as classification= u;
```

The ACCREDITATION RANGE definition enables the site to use all the classifications and compartments that are defined in the label_encodings.multi file, as follows:

- UNCLASSIFIED, CLASSIFIED, SECRET, and TOP SECRET are defined with all compartment combinations valid.
- CLASSIFIED is defined as the minimum clearance.
- UNCLASSIFIED is defined as the minimum sensitivity label.
- UNCLASSIFIED is defined as the minimum protect as classification.

Simplified GFI Single-Level Label Encodings File

The ACCREDITATION RANGE settings in the label_encodings.single file follow:

```
ACCREDITATION RANGE:  classification= s;
only valid compartment combinations:  s a b rel cntry1
minimum clearance= s Able Baker NATIONALITY: CNTRY1;
minimum sensitivity label= s A B REL CNTRY1;
minimum protect as classification= s;
```

The ACCREDITATION RANGE definition restricts the user to the following label:

- SECRET is defined as the only classification
- SECRET A B REL CNTRY1 is defined as the only valid compartment combination
- SECRET ABLE BAKER NATIONALITY: CNTRY1 is defined as the minimum clearance
- SECRET A B REL CNTRY1 is defined as the minimum sensitivity label
- SECRET is defined as the minimum "Protect As" classification

Oracle Extensions to label_encodings File

Oracle's implementation of the label_encodings file supports a LOCAL DEFINITIONS section. This section is optional and can be appended to an existing label_encodings file. The word LOCAL in the keyword that starts the section means *local to Oracle's implementation*.

Options in the LOCAL DEFINITIONS section set label translation options and associate colors with labels. The title bars of application windows display each label against a background of the color that is specified for that label. If an invalid color or no color is specified in the COLOR NAMES option, a default color is supplied. Chapter 5, "Customizing the LOCAL DEFINITIONS Section (Tasks)," describes how to modify the Oracle extensions for your site.

◆ ◆ ◆ CHAPTER 3

Creating a Label Encodings File (Tasks)

This chapter describes how to create, modify, analyze, and verify a `label_encodings` file. This chapter covers the following topics:

Encodings File Syntax

The `label_encodings` file contains a `VERSION` specification and seven mandatory sections:

- `CLASSIFICATIONS`
- `INFORMATION LABELS`
- `SENSITIVITY LABELS`
- `CLEARANCES`
- `CHANNELS`
- `PRINTER BANNERS`
- `ACCREDITATION RANGE`

The sections must appear in that order. An optional `LOCAL DEFINITIONS` section can follow.

In the following table, *mandatory keyword* means only that the keyword must be present. Not all keywords must have definitions. The notes for each section indicate what must be defined and what is optional.

TABLE 3–1 `label_encodings` Keywords

Section	Notes
`VERSION=`	Mandatory keyword. The version specification is the single keyword `VERSION=`, followed by a character string that identifies this particular version of encodings.

TABLE 3–1 `label_encodings` Keywords *(Continued)*

Section	Notes
`CLASSIFICATIONS:`	Mandatory keyword. At least one classification must be defined.

`INFORMATION LABELS:`
`WORDS:`
`REQUIRED COMBINATIONS:`
`COMBINATION CONSTRAINTS:`
	Mandatory keywords. Even though information labels are not used in Trusted Extensions software, you must assign one bit to an information label word for each bit that you assign to a sensitivity label word. The sensitivity label words are defined in the following section.

`SENSITIVITY LABELS:`
`WORDS:`
`REQUIRED COMBINATIONS:`
`COMBINATION CONSTRAINTS`
	Mandatory keywords, although the `WORDS` definitions are optional. If you define sensitivity label words, the same bits must be assigned to `WORDS` in both the `INFORMATION LABELS` and `CLEARANCES` sections. The words that are assigned to the bits do not need to be the same.

`CLEARANCES:`
`WORDS:`
`REQUIRED COMBINATIONS:`
`COMBINATION CONSTRAINTS`
	Mandatory keywords. One bit must be assigned to a clearance word for any sensitivity label word that you have defined. Clearance labels can allow combinations of words that have been disallowed in the definitions for sensitivity label words.

`CHANNELS:`	Mandatory keyword.
`PRINTER BANNERS:`	Mandatory keyword.
`ACCREDITATION RANGE:`	Mandatory keyword. A rule must be defined for each classification name. The minimum clearance, minimum sensitivity label, and minimum "Protect As" classification must be defined.
`LOCAL DEFINITIONS:`	Optional keyword.

For all the required sections, the keywords in the preceding table must be present, but not all of the sections must have definitions. For example, a `label_encodings` file with only `CLASSIFICATIONS` and `ACCREDITATION RANGE` definitions is valid.

Word Order Requirements

The order in which words are configured for sensitivity labels and clearances is not enforced. However, the order is important when you set up relationships between words. By convention, the `WORDS` in the `SENSITIVITY LABELS` section are arranged in increasing order of sensitivity.

For the effect of word order, see "Specifying Channels" on page 63. Detailed information is provided in *Compartmented Mode Workstation Labeling: Encodings Format*: Defense Intelligence Agency document [DDS-2600-6216-93].

If a compartment word is defined for one type of label (by assigning the compartment word to one or more bits) in the `label_encodings` file, then the same bits must be assigned to a word in the definition of the other types of labels. While all types of labels use the same classification names, the words that are used for each type of label can be different. The words can be different even when they are encoded with the same bits and literally refer to the same thing. Clearance labels can allow combinations of words that have been disallowed in the definitions for sensitivity label words.

Classification Name Syntax

The classification is the hierarchical portion of a label. Each label has one and only one classification. A site can define up to 255 classifications. An integer value from 1 to 255 can be assigned to a classification in the `label_encodings` file. The value `0` is reserved for the `ADMIN_LOW` administrative label. The value `32,767` is reserved for the `ADMIN_HIGH` administrative label. For an illustration of a CIPSO label, see Figure 1–2.

Classifications are defined once for clearances and once for sensitivity labels in the `CLASSIFICATIONS` section of the `label_encodings` file.

A classification with a higher value dominates a classification with a lower value. The following table shows two sets of label names that are assigned the same values in different encodings files. The left column shows sample sensitivity labels from the `label_encodings.example` file. The middle column shows labels from the `label_encodings.gfi.multi` file. A label with the `Registered` or `Top Secret` classification, with a value of 6, dominates the labels that are listed in its column.

Commercial Example	U.S. Government Example	Value
`Registered`	`Top Secret`	6
`Need to Know`	`Secret`	5
`Internal Use Only`	`Confidential`	4
`Public`	`Unclassified`	1

Keywords for Classifications

The following list describes the keywords that can be defined for classifications. For examples of initial compartment definitions, see "Default and Inverse Words" on page 45.

`name=` Mandatory. Cannot contain (/), (,) or (;). All other alphanumeric characters and white space are allowed. Users can specify the `name`, the `sname` or the `aname` when specifying labels.

`sname=` Mandatory in classifications only. The short name appears in sensitivity labels.

`aname=`	Optional. The alternative name that can be specified by users when a classification is needed.
`value=`	Mandatory. The values that you assign to represent the hierarchy among the classifications. Leave gaps for later expansion. `0` is reserved for `ADMIN_LOW`. Values can start at `1` and go to `255`.
`initial compartments=`	Optional. Specify bit numbers for any default compartment words. Default compartment words initially appear in any label that has the associated classification. Advanced: Specify bit numbers for any inverse words. The minimum classification must not have initial compartments. For a description of inverse words, see "Default and Inverse Words" on page 45.
`initial markings=`	Obsolete. Do not define.

The following example shows the beginning of the `label_encodings.multi` file.

EXAMPLE 3–1 Classifications With Initial Compartments in `label_encodings.multi` File

```
VERSION= Trusted Solaris Multi-Label Sample Version - 5.6 05/07/27

*
*    WARNING:  If CIPSO Tag Type 1 network labels are to be used:
*
*        a) All CLASSIFICATIONS values must be less than or equal to 255.
*        b) All COMPARTMENTS bits must be less than or equal to 239.
*

CLASSIFICATIONS:

*
name= UNCLASSIFIED;  sname= U;  value= 1;
name= CONFIDENTIAL;  sname= C;  value= 4; initial compartments= 4-5 190-239;
name= SECRET;        sname= S;  value= 5; initial compartments= 4-5 190-239;
name= TOP SECRET;    sname= TS; value= 6; initial compartments= 4-5 190-239;
```

Each classification has the mandatory `name`, `sname`, and `value` fields. The `CONFIDENTIAL`, `SECRET`, and `TOP SECRET` classifications have `initial compartments`. The lowest classification, `UNCLASSIFIED`, has no initial compartments.

The initial compartment bit assignments of `4-5` and `190-239` signify that bits `4`, `5`, and `190` through `239` are turned on. These bits are set to `1` in a label with this classification.

Some of the initial compartments are later used to define *default* and *inverse* words. Some initial compartments are reserved for possible later definitions of inverse words.

The following example shows a set of classifications that has no initial compartments.

EXAMPLE 3–2 Classifications With No Initial Compartments in `label_encodings.example` File

```
CLASSIFICATIONS:

name= PUBLIC; sname= PUBLIC; value= 1;
name= INTERNAL_USE_ONLY; sname= INTERNAL; aname= INTERNAL; value= 4;
name= NEED_TO_KNOW; sname= NEED_TO_KNOW; aname= NEED_TO_KNOW; value= 5;
name= REGISTERED; sname= REGISTERED; aname= REGISTERED; value= 6;
```

Default and Inverse Words

When a bit is defined as an initial compartment, the bit is set to `1` in every label that contains the classification. Any bit that is specified for an initial compartment can be defined later in the `label_encodings` file as a *default compartment word* (*default word*) or an *inverse compartment word* (*inverse word*).

- A *default word* is a word that appears in any label that contains the classification.
- An *inverse word* is a word that appears in a label that has the associated classification when another word that you define with the inverse compartment's bit is not present.

EXAMPLE 3–3 Assigning Initial Compartments

In this example, the `PUBLIC` classification is assigned no initial compartments, while the `WEB COMPANY` classification is assigned initial compartments `4` and `5`. A label that includes the `PUBLIC` classification has no default compartments. A label that includes the `WEB COMPANY` classification always has compartment bits `4` and `5` turned on.

```
name= PUBLIC;  sname= P;  value= 1;
name= WEB COMPANY;  sname= WEBCO;  value= 4; initial compartments= 4-5
```

The following shows how these initial compartment bits can be assigned to words.

EXAMPLE 3–4 Defining Default and Inverse `SENSITIVITY LABELS` Words

In this example, compartment bits `4` and `5` are assigned to the word `DIVISION ONLY`. Each compartment bit is also associated with an inverse word. The sensitivity label name `WEBC AMERICA` is assigned to the inverse compartment bit `~4`. The sensitivity label name `WEBC WORLD` is assigned to the inverse compartment bit `~5`. These assignments have the following results:

- A sensitivity label with the `WEB COMPANY` classification initially includes the word `DIVISION ONLY`. The label's binary representation has the compartment bits `4` and `5` turned on.
- A sensitivity label with the `PUBLIC` classification always has compartment bits `4` and `5` turned off. The inverse words `WEBC AMERICA` and `WEBC WORLD` are included in the label.

  Because a `minclass` of `IUO` is specified for the inverse words, `WEBC AMERICA` and `WEBC WORLD` are not displayed in the `PUBLIC` sensitivity label. The presence of these two inverse words is understood.

EXAMPLE 3–4 Defining Default and Inverse SENSITIVITY LABELS Words *(Continued)*

```
SENSITIVITY LABELS:

WORDS:

name= DIVISION ONLY;  sname= DO;       minclass= WEB COMPANY; compartments= 4-5;
name= WEBC AMERICA;   sname= WEBCA;    minclass= WEB COMPANY; compartments= ~4;
name= WEBC WORLD;     sname= WEBCW;    minclass= WEB COMPANY; compartments= ~5;
```

Compartment Words

Compartments are optional words that can be defined to appear in labels. Compartments are called *categories* in some other trusted systems. Compartments are used to indicate the special handling procedures to be used for the information whose label contains the compartment and the general class of people who might have access to the information.

Compartment words are assigned to non-hierarchical bits. However, hierarchies can be established between compartment words. These hierarchies are based on rules for including bits from one compartment word in the bits that are defined for another compartment word.

Compartment words are optionally defined in the WORDS subsection for each label type. Each compartment word is assigned to one or more bits.

While all types of labels use the same classifications, the words that are used for each type of label can be different. The words can be different even when they are encoded with the same bits and literally refer to the same thing.

The following example shows the WEB COMPANY compartment word. The word is specified with a short name (sname) of WEBCO and compartment bits 40-50.

EXAMPLE 3–5 Sample Compartment Definition for a Sensitivity Label

```
WORDS:

name= WEB COMPANY; sname= WEBCO; compartments= 40-50;
```

Along with its classification field, each label has a 256-bit compartment field, of which 239 are available for CIPSO labels. Each bit is assignable in zero or more compartment words. Each word can have one or more compartment bits assigned. Out of the 239 available bits, many compartment words can be created. For an example, see the compartments planner in Table 6–3.

The classification, compartments, and combination requirements affect the accreditation range. The `ACCREDITATION RANGE` for each classification setting must be one of the following strings:

- `only valid compartment combinations;`
- `all compartment combinations valid;`
- `all compartment combinations valid except;`

Hierarchical Compartment Words

Hierarchical compartments can be used to differentiate between documents that are available to everyone in a larger group, and documents that are available to subgroups only.

EXAMPLE 3–6 Using Bit Combinations to Establish Hierarchies

By defining a word that uses one bit and a second word that uses that same bit along with a second bit, you define a hierarchical relationship between the two words. The more general compartment word must be defined below the word that is more specific. For example, by defining a word that uses bit number `1` and another word that uses bits number `1` and `2`, you give the two words a hierarchical relationship.

In this example, a Sales compartment is defined with two subcompartments, Direct_Sales, and Indirect_Sales. A single classification that is named WebCo is previously defined.

```
name= Direct_Sales;   compartments= 1, 2
name= Indirect_Sales;   compartments= 1, 3
name= Sales;   compartments= 1
```

This definition allows the WebCo company to differentiate between documents that can be accessed by anyone in the entire sales department, documents that can be accessed only by members of the direct sales department, and documents that can be accessed only by members of the indirect sales department.

The assignments and effects are as follows:

- The security administrator assigns the `WebCo Direct_Sales` clearance to employees in the direct sales department. The `WebCo Indirect_Sales` clearance is assigned to employees in the indirect sales department.
- Documents that are created by an employee who is working at the `WebCo Direct_Sales` label are labeled with the label that is only accessible to employees in the direct sales department.
- Anyone in the indirect or direct sales departments can work at the `WebCo Sales` label because the compartment word `Sales` is below both the `Direct_Sales` and `Indirect_Sales` words. Creating documents at the `WebCo Sales` label makes the documents available to everyone in the sales department.

EXAMPLE 3–7 Using `REQUIRED COMBINATIONS` to Establish Hierarchies

If two words are specified together in the `REQUIRED COMBINATIONS` section, the second label is added to the label whenever the first word is used.

In this example, the definitions of the `Direct_Sales`, `Indirect_Sales`, and `Sales` compartments serve essentially the same purpose as in Example 3–6. The difference is that the `Direct_Sales` word will always have the `Sales` word with it.

```
name= Direct_Sales;   compartments= 2
name= Indirect_Sales;   compartments= 3
name= Sales;   compartments= 1

REQUIRED COMBINATIONS:

Direct_Sales            Sales
Indirect_Sales          Sales
```

Managing a Label Encodings File (Task Map)

Caution – The safest time to modify a `label_encodings` file is when the first host is installed. Proceed with caution when modifying a file that is in use. For details, see the `label_encodings(4)` man page.

The following task map describes the tasks for modifying and installing a `label_encodings` file.

Task	For Instructions
Create or modify the `label_encodings` file.	"How to Create a `label_encodings` File" on page 49
Test the `label_encodings` file.	"How to Analyze and Verify the `label_encodings` File" on page 49
Distribute the `label_encodings` file.	"How to Distribute the `label_encodings` File" on page 50
Debug a `label_encodings` file.	"How to Debug a `label_encodings` File" on page 55
Change a classification definition.	"How to Add or Rename a Classification" on page 50
Create default or inverse words.	"How to Specify Default and Inverse Words" on page 52
Customize a single-label file.	"How to Create a Single-Label Encodings File" on page 53
Specify a label name.	Example 3–9
Add a `LOCAL DEFINITIONS` section.	"Modifying Oracle Extensions (Task Map)" on page 75

▼ How to Create a `label_encodings` File

For sample files, see the `/etc/security/tsol` directory on an installed system. The files are described in "Encodings Files From Trusted Extensions" on page 36.

You can create a `label_encodings` file before you install Trusted Extensions on your first system. On that first system, you check the file. You can also create this file on the first system that you install with Trusted Extensions. The `label_encodings` file must be accurate and tested before a second system is configured with Trusted Extensions.

Before You Begin On a system that is configured with Trusted Extensions, you must be in the Security Administrator role in the global zone. On other systems, you can create and edit the file in any text editor.

1. **Create a backup copy of the original label encodings file.**

   `# cp` *encodings-filename encodings-filename.orig*

2. **In an editor, open the label encodings file.**

3. **Modify the label encodings file.**

   For details, see "How to Plan the Encodings File" on page 32.

4. **Save your changes.**

Next Steps Continue with "How to Analyze and Verify the `label_encodings` File" on page 49.

▼ How to Analyze and Verify the `label_encodings` File

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

1. **Check the label definitions and the relationships of the labels.**

   In a terminal, use the `chk_encodings -a` command to analyze and report on label relationships.

   `$ /usr/sbin/chk_encodings -a` *encodings-file*

   If the file does not pass, see "How to Debug a `label_encodings` File" on page 55 for assistance. Do not continue to the next step until the file represents your label relationships correctly.

2. **Verify the syntax of the file.**

   a. **Run the `chk_encodings` command.**

      `# /usr/sbin/chk_encodings` *encodings-file*

b. Resolve errors.

If the command reports errors, the errors *must* be resolved before continuing.

3 Make the file the active `label_encodings` file.

```
# cp /full-pathname-of-label-encodings-file \
 /etc/security/tsol/label.encodings.site
# cd /etc/security/tsol
# cp label_encodings label_encodings.tx.orig
# cp label.encodings.site label_encodings
```

4 Test the encodings file.

Where possible, test the file on a few systems before approving the file for all systems at your site. For example, install one labeled system as a file server and another labeled system as a user's system. Communicate between the two at all labels. Transfer files at all labels, and so on.

Next Steps When the file is ready to be installed on the network, see "How to Distribute the `label_encodings` File" on page 50.

▼ How to Distribute the `label_encodings` File

1 Create a master copy of the `label_encodings` file.

For copying instructions, see "How to Copy Files to Portable Media in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration and Administration*.

Note – Store the master copy on labeled media in a protected location.

---

2 Immediately after installing a system with Trusted Extensions, copy the master file onto the system.

For copying instructions, see "How to Copy Files From Portable Media in Trusted Extensions" in *Oracle Solaris Trusted Extensions Configuration and Administration*.

▼ How to Add or Rename a Classification

Before You Begin You must be in the Security Administrator role in the global zone. To be able to add classifications, you left gaps in the classification numbers in the `label_encodings` file.

1 Back up the `label_encodings` file.

```
# cp label_encodings label_encodings.orig
```

2 Edit the `label_encodings` file.

```
# /usr/bin/gedit encodings-file
```

3 Update the version number.

In the VERSION= section update the version number and the date.

```
VERSION= Sun Microsystems, Inc. Example Version - 5.11 09/05/28
```

SCCS keywords are used for the version number and the date. For details, see the sccs(1) man page.

```
VERSION= Sun Microsystems, Inc. Example Version - %I% %E%
```

4 Add or rename the classification by performing one of the following:

- **In the CLASSIFICATIONS section, add the new classification.**

  Specify a long name, short name, and numeric value.

  ```
  name= REGISTERED; sname= R; value= 15;
  ```

- **In the CLASSIFICATIONS section, rename an existing classification.**

  ```
  * name= INTERNAL_USE_ONLY; sname= IUO; value= 12;
  name= INTERNAL; sname= I; value= 12;
  ```

5 Add the new classification to the ACCREDITATION RANGE section.

The following example shows three new classifications that are added to the ACCREDITATION RANGE section. Each classification is specified with all compartment combinations valid.

Note – If you rename a classification, update the name in the ACCREDITATION RANGE section.

```
ACCREDITATION RANGE:

classification= UNCLASSIFIED;        all compartment combinations valid;

* i is new in this file
classification= INTERNAL_USE_ONLY;   all compartment combinations valid;

* n is new in this file
classification= NEED_TO_KNOW;        all compartment combinations valid;

classification= CONFIDENTIAL;        all compartment combinations valid except:
c
c a
c b

classification= SECRET;               only valid compartment combinations:
. . .
* r is new in this file
classification= REGISTERED;           all compartment combinations valid;
```

6 Adjust the `ACCREDITATION RANGE` section, if necessary.

You might need to make the new classification a minimum classification.

```
minimum clearance= u;
minimum sensitivity label= u;
minimum protect as classification= u;
```

Note – Make sure that you set a minimum clearance that is dominated by all the clearances that you plan to assign to users. Similarly, make sure that the minimum sensitivity label is dominated by all the minimum labels that you plan to assign to users.

Next Steps Verify the file by performing "How to Analyze and Verify the `label_encodings` File" on page 49.

Distribute the file by following "How to Distribute the `label_encodings` File" on page 50.

▼ How to Specify Default and Inverse Words

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

1 Back up the `label_encodings` file.

```
# cp label_encodings label_encodings.orig
```

2 Edit the `label_encodings` file.

```
# /usr/bin/gedit encodings-file
```

3 Specify initial compartments.

In the `CLASSIFICATIONS` section, specify the initial compartments as part of the classification definition. For example, in the following `CLASSIFICATIONS` section, `WEB COMPANY` has two initial compartments, 4 and 5:

```
CLASSIFICATIONS:
name= PUBLIC;  sname= P;  value= 1;
name= WEB COMPANY;  sname= WEBCO;  value= 2; initial compartments= 4-5 ;
```

4 Specify a default word by assigning an initial compartment bit to the word.

In the following example, the initial compartment bits, 4 and 5, are assigned to three words:

```
name= DIVISION ONLY;  sname= DO;  minclass=  IUO; compartments= 4-5;
name= WEBC AMERICA;  sname= WEBCA; minclass= IUO; compartments= 4;
name= WEBC WORLD;  sname= WEBCW; minclass= IUO; compartments= 5;
```

5 Specify an inverse word.

Inverse words are created by preceding an initial compartment with a tilde (~).

In the following example, the initial compartment bits, 4 and 5, are preceded by a tilde in the WEBC words:

```
name= DIVISION ONLY;  sname= DO;  minclass=  IUO; compartments= 4-5;
name= WEBC AMERICA;  sname= WEBCA; minclass= IUO; compartments= ~4;
name= WEBC WORLD;  sname= WEBCW; minclass= IUO; compartments= ~5;
```

6 **Save your changes.**

Next Steps Verify the file by performing "How to Analyze and Verify the label_encodings File" on page 49.

Troubleshooting For any compartment bits that are not reserved for later assignment, you need to assign a word to the bit in the following sections:

- SENSITIVITY LABELS: WORDS:
- INFORMATION LABELS: WORDS:
- COMPARTMENTS: WORDS:

▼ How to Create a Single-Label Encodings File

Certain labels must always be present in a label_encodings file:

- One sensitivity label in the user accreditation range must be defined
- One clearance in the user accreditation range must be defined
- One information label in the user accreditation range must be defined

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

1 **Open an existing encodings file or create a new one.**

Provide a name that is different from the installed label_encodings file.

```
# /usr/bin/gedit label_encodings.myco.single
```

2 **Specify one classification and only the desired compartments.**

For example, you could set up an encodings file with the INTERNAL_USE_ONLY classification, and specify no words.

```
VERSION= MyCompany Single-Label Encodings - 1.01 10/10/10
. . .
CLASSIFICATIONS:

name= INTERNAL_USE_ONLY;       sname= INTERNAL;  value= 5;

INFORMATION LABELS:

WORDS:
```

```
SENSITIVITY LABELS:

WORDS:

CLEARANCES:

WORDS:

CHANNELS:

WORDS:

PRINTER BANNERS:

WORDS:
```

3 **In the `ACCREDITATION RANGE` section, include only one classification and one valid compartment combination.**

In the following example, the `INTERNAL` classification is encoded.

```
ACCREDITATION RANGE:

classification= INTERNAL;
only valid compartment combinations:

INTERNAL

minimum clearance= INTERNAL;
minimum sensitivity label= INTERNAL;
minimum protect as classification= INTERNAL;
```

4 **Add and modify the `LOCAL DEFINITIONS` section.**

For details, see "Modifying Oracle Extensions (Task Map)" on page 75.

Example 3–8 Defining the Accreditation Range in a Single-Label Encodings File

The following example shows the settings in the `ACCREDITATION RANGE` section for a single-level label encodings file. A single `ANY_CLASS` classification is defined. Compartment words `A`, `B`, and `REL CNTRY 1` are specified for all types of labels.

```
ACCREDITATION RANGE:

classification= ANY_CLASS;      only valid compartment combinations:

ANY_CLASS A B REL CNTRY1

minimum clearance= ANY_CLASS A B REL CNTRY1;
minimum sensitivity label= ANY_CLASS A B REL CNTRY1;
minimum protect as classification= ANY_CLASS;
```

Example 3–9 Changing the Single Label Name

In this example, the `label_encodings.example` file is changed to handle a single-label company. The `name=` value is changed from `SECRET` to `INTERNAL_USE_ONLY`. The `sname=` value is changed from `s` to `INTERNAL`. Neither the `value=` nor the `initial compartments=` definition is changed.

```
CLASSIFICATIONS:
name= INTERNAL_USE_ONLY;  sname= INTERNAL;  value= 5; initial compartments= 4-5
190-239;
```

In the `ACCREDITATION RANGE` section, the short name of the classification is replaced. Also, the minimum values are replaced with the new `sname`.

```
ACCREDITATION RANGE:

classification= INTERNAL;      only valid compartment combinations:

INTERNAL

minimum clearance= INTERNAL;
minimum sensitivity label= INTERNAL;
minimum protect as classification= INTERNAL;
```

Next Steps Verify the file by performing "How to Analyze and Verify the `label_encodings` File" on page 49.

Distribute the file by following "How to Distribute the `label_encodings` File" on page 50.

▼ How to Debug a `label_encodings` File

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

1. **In an editor, check the entries in the `INFORMATION LABELS: WORDS:` section.**

   The entries must exactly match the entries in the `SENSITIVITY LABELS: WORDS:` section.

   Tip – Encode the sensitivity label words, then copy the words to the `INFORMATION LABELS` section.

2. **Check that no label in the user accreditation range has a value of 0 with no compartment bits.**

   This step ensures that no label is indistinguishable from the label `ADMIN_HIGH`.

3. **Check that no label in the user accreditation range has a value of 255 with all compartment bits from 0 to 239.**

   This step ensures that no label is indistinguishable from the label `ADMIN_HIGH`.

4. **Check that no compartment has a value higher than 239.**
   This step ensures that all labels can be mapped to CIPSO labels.

5. **For labels that cannot be resolved, do the following:**

   a. **Reset any objects with the new labels to a low system label, `ADMIN_LOW`.**

   b. **Restore a known, usable `label_encodings` file from backup.**

   c. **Use the `chk_encodings -a` command to analyze the label problems in the faulty file.**

◆ ◆ ◆ CHAPTER 4

Labeling Printer Output (Tasks)

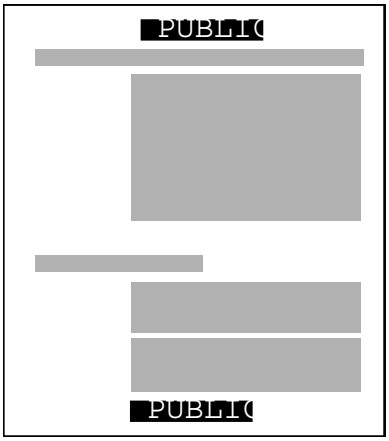
This chapter describes how Trusted Extensions labels and handling instructions are printed on printer output. This chapter also describes how the Security Administrator role can make changes to the default printer output. This chapter covers the following topics:

Labels on Body Pages

By default, each print job's label is printed at the top and bottom of every body page.

Figure 4–1 shows the label `PUBLIC` printed at the top and bottom of a print job's body page.

FIGURE 4–1 Label Automatically Printed on Body Pages



The Security Administrator role can change the defaults so that a higher label is printed instead of the label of the print job. To print a higher label, see "Specifying Channels" on page 63. To remove labels from printed output, see "Reducing Printing Restrictions in Trusted Extensions (Task Map)" in *Oracle Solaris Trusted Extensions Configuration and Administration*.

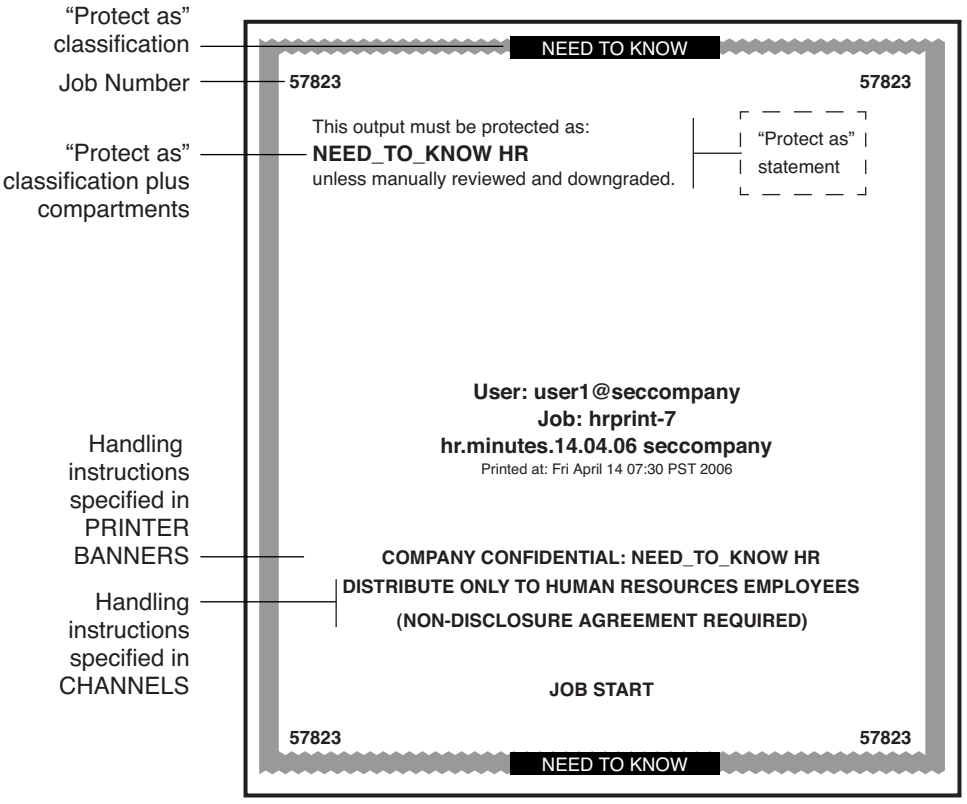
Security Text on Banner and Trailer Pages

By default, both a *banner page* and a *trailer page* are automatically created for each print job. The banner and trailer pages contain label-related text and handling instructions for protecting printer output.

The fields and the text that are printed on the banner page are shown in Figure 4–2. The callouts show the names of the labels and the strings that appear by default.

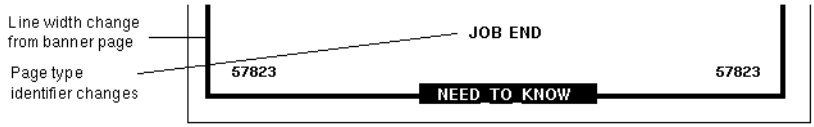
The text, labels, and warnings that appear on print jobs are configurable. The text can also be replaced with text in another language for localization.

FIGURE 4–2 Typical Banner Page of a Labeled Print Job



The differences on the trailer page are shown in the following figure. A thick black line is used as a frame on the trailer page, instead of the thicker gray frame on the banner page. The page type identifier on a trailer page is JOB END.

FIGURE 4–3 Differences on a Trailer Page



The parts of banner and trailer pages that the Security Administrator role can configure are described in the following sections:

- "Specifying the "Protect As" Classification" on page 60
- "Specifying Printer Banners" on page 61

- "Specifying Channels" on page 63

In addition, the Security Administrator role can make the following changes in a print configuration file that is called `tsol_separator.ps` in the `/usr/lib/lp/postscript` directory:

- Localize (translate) the text on the banner and trailer pages
- Specify alternates to default labels that are printed at the top and bottom of body pages
- Change or omit any of the text or labels

To customize the configuration file, see the comments in the `tsol_separator.ps` file in the `/usr/lib/lp/postscript` directory. For further details, see Chapter 21, "Managing Labeled Printing (Tasks)," in *Oracle Solaris Trusted Extensions Configuration and Administration*.

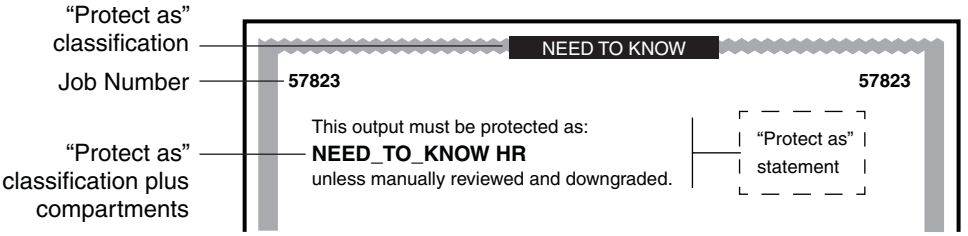
Specifying the "Protect As" Classification

The "Protect As" classification is printed in two places:

- On the top and bottom of banner and trailer pages
- In the middle of the *Protect As statement*, together with compartments from the job's label

The following figure shows the "Protect As" statement on labeled print output.

FIGURE 4–4 "Protect As" Statement



In another example, a site uses `INTERNAL_USE_ONLY` as the minimum "Protect As" classification. The site has three classifications with the values that are shown in the first two columns of the following table. The third column shows the "Protect As" classification. This classification is printed on the banner and trailer pages for the print job when the classification in the left column is in the job's label.

TABLE 4–1 Effect of Minimum "Protect As" Classification on Printer Output

Classification of Print Job	Value	"Protect As" Classification Printed on Banner and Trailer Pages
`NEED_TO_KNOW`	3	`NEED_TO_KNOW`

TABLE 4–1 Effect of Minimum "Protect As" Classification on Printer Output *(Continued)*

Classification of Print Job	Value	"Protect As" Classification Printed on Banner and Trailer Pages
INTERNAL_USE_ONLY	2	INTERNAL_USE_ONLY
PUBLIC	1	INTERNAL_USE_ONLY

As the preceding table illustrates, any print job whose label includes either the PUBLIC or the INTERNAL_USE_ONLY classification would print INTERNAL_USE_ONLY in the "Protect As" statement and at the top and bottom of banner and trailer pages. Any print jobs whose label includes the NEED_TO_KNOW classification would print NEED_TO_KNOW in the same locations.

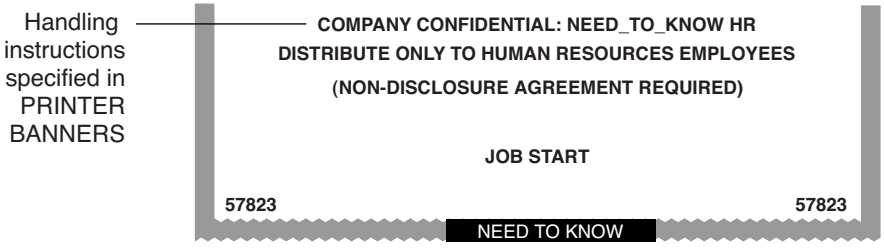
Specifying Printer Banners

The PRINTER BANNERS section in the label_encodings file contains the first line or lines that can appear in the handling instructions in the lower third of the banner and trailer pages.

At commercial sites, the Security Administrator role can associate any text in the PRINTER BANNERS section with any compartment bit. The compartment bit must also be assigned to a word in the SENSITIVITY LABELS section of the label_encodings file. In the following example, the printer banner is the line that reads COMPANY CONFIDENTIAL: NEED_TO_KNOW HR.

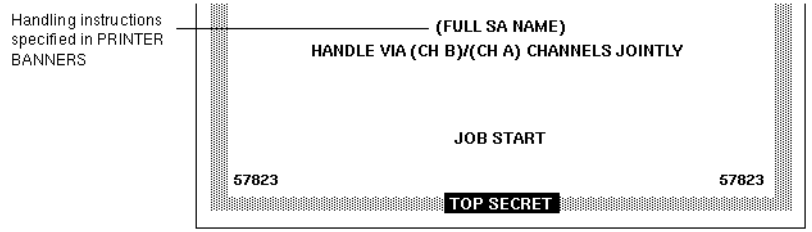
Compartments from the print job's label are printed in the "Protect As" field along with the print job's "Protect As" classification. In the following example, the compartment HR from the label is printed as an access-related word along with the "Protect As" classification because all compartments are treated as access-related.

FIGURE 4–5 Commercial Use of PRINTER BANNERS Section on Banner Page



By convention in U.S. government installations, the printer banners line displays any warnings that are associated with the *subcompartments* of the job's sensitivity label. The following example shows a typical PRINTER BANNERS section at a U.S. government installation. Any string could be specified instead of the string that is shown here: (FULL SA NAME).

FIGURE 4–6 U.S. Government Use of PRINTER BANNERS Section on Banner Page



Following are the encodings for the printer banner line (FULL SA NAME) in Figure 4–6"

```
PRINTER BANNERS:

WORDS:
. . .
name= (FULL SA NAME);                    compartments= 2;
```

Next are the SENSITIVITY LABELS definitions for the same compartments that are used in the PRINTER BANNERS definitions in Figure 4–6. Note that compartment bit 2 is associated with the subcompartment word SA:

```
SENSITIVITY LABELS:

WORDS:
  .
  .
  .
name= SB;                    minclass= TS; compartments= 3-5;
name= SA;                    minclass= TS; compartments= 2;
```

The printer banner displays as (FULL SA NAME) for the following reasons:

- The label contains the subcompartment word SA.
- Compartment bit 2 is associated with the subcompartment word SA.
- Compartment bit 2 is associated with the string (FULL SA NAME) in the PRINTER BANNERS encodings.

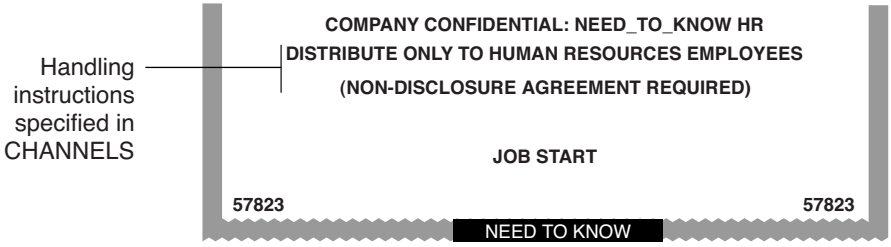
For a sample PRINTER BANNERS planner, see "Planning the Printer Banners in a Worksheet" on page 96.

Specifying Channels

The CHANNELS section in the label_encodings file defines the lines that can appear below the PRINTER BANNERS lines on the lower third of the banner and trailer pages. The CHANNELS section can be specified to print a string whenever the label of a print job contains a certain compartment.

Commercial sites can customize the text in the CHANNELS section with any compartment bit. The following figure shows a CHANNELS warning on a print job's banner page at a commercial site.

FIGURE 4–7 Commercial Use of CHANNELS Section on Banner Page



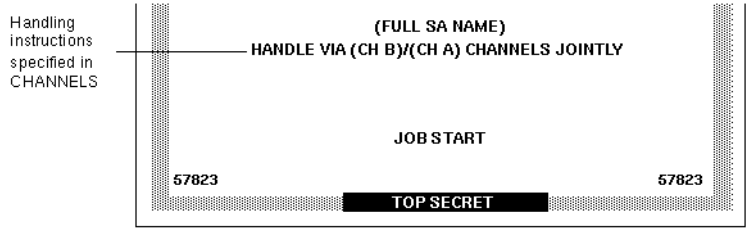
By convention in U.S. government installations, the channels lines of the banner page show the warnings that are associated with the *compartments* of the print job's label. Figure 4–8 shows a typical CHANNELS warning on a print job's banner page at a government installation: HANDLE VIA (CH B)/(CH A) CHANNELS JOINTLY.

The following discussion shows how the CHANNELS string HANDLE VIA (CH B)/(CH A) CHANNELS JOINTLY is specified for a print job whose label includes the compartment words A and B. For the purpose of the example, only (CH A) and (CH B) apply. However, because the compartment bit for a third channel (CH C) is included in the definitions, (CH C) is also mentioned in this discussion.

The example illustrates these features:

- Two compartment bits are associated individually with one set of words and together with another set of words.
- A third compartment bit is included with the encodings for the first two bits.
- One suffix is defined for when *any combination of one or more* channel words is in the label.
- Another suffix is defined for when a *single* channel word is in the label.
- A third suffix is defined for when *more than one* channel word is in the print job's label.

FIGURE 4–8 U.S. Government Use of CHANNELS Section on Banner Page



In the following example, two suffixes CHANNELS JOINTLY and CHANNELS ONLY and a prefix HANDLE VIA are defined.

EXAMPLE 4–1 Suffixes and Prefixes in the CHANNELS Section in a U.S. Government label_encodings File

```
CHANNELS:

WORDS:
name= CHANNELS JOINTLY;         suffix;
name= CHANNELS ONLY;            suffix;
name= HANDLE VIA;               prefix;
```

Next, the channel names (CH A), (CH B), and (CH C) are specified in two different ways to achieve the following results:

- When any one of the three compartment bits that is associated with channels is in the label, the HANDLE VIA: prefix is printed.
- When only one of the three compartment bits that is associated with channels is in the label, the CHANNELS ONLY suffix is printed after the channel name (CH A), (CH B), or (CH C).
- When more than one compartment bit that is associated with channels is in the label, the prefix is followed by each channel name separated by a slash (/). This channel name is then followed by the CHANNELS JOINTLY suffix.

In the following example, the first three lines that define CHANNELS words in the preceding example are repeated.

This example focuses on how (CH A), (CH B), and (CH C) are encoded to appear with the CHANNELS ONLY suffix.

- (CH A) is encoded with bit 0 turned on and bits 1 and 6 explicitly turned off using the tilde (~): 0 ~1 ~6
- (CH B) is encoded with bit 1 turned on and bits 0 and 6 explicitly turned off using the tilde (~): ~0 1 ~6
- (CH C) is encoded with bit 6 turned on and bits 0 and 1 explicitly turned off using the tilde (~): ~0 ~1 6

```
CHANNELS:

WORDS:

name= CHANNELS JOINTLY;         suffix;
name= CHANNELS ONLY;            suffix;
name= HANDLE VIA;               prefix;
name= (CH A);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= 0 ~1 ~6;
name= (CH B);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= ~0 1 ~6;
name= (CH C);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= ~0 ~1 6;
```

The first three lines of name definitions in the `CHANNELS` section have the following results:

- The `HANDLE VIA` prefix and the `CHANNELS ONLY` suffix are printed when *one* of the words that is associated with bits `0`, `1`, and `6` elsewhere in the `label_encodings` file is in the print job's label
- The `HANDLE VIA` prefix and `CHANNELS ONLY` suffix are printed:
  - With `(CH A)` when compartment bit 0 is turned on in the label, and compartment bits `1` and `6` are turned off
  - With `(CH B)` when compartment bit 1 is turned on in the label, and compartment bits `0` and `6` are turned off
  - With `(CH C)` when compartment bit `6` is turned on in the label, and compartment bits `0` and `1` are turned off

The last three lines in the preceding example are repeated in the following example. The repetition shows how `(CH A)`, `(CH B)`, and `(CH C)` are encoded to appear with the `CHANNELS JOINTLY` suffix when more than one of the words that is associated with bits `0`, `1`, and `6` is in the print job's label. A slash is inserted between the channels names when more than one of the bits that is defined in the `CHANNELS` section is in the print job's label.

EXAMPLE 4–2 Encodings for More Than One Channel in `CHANNELS` Section in a U.S. Government Encodings File

```
name= (CH A);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= 0 ~1 ~6;
name= (CH B);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= ~0 1 ~6;
name= (CH C);   prefix= HANDLE VIA; suffix= CHANNELS ONLY; compartments= ~0 ~1 6;

name= (CH C);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 6;
name= (CH B);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 1;
name= (CH A);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 0;
```

These `CHANNELS` definitions illustrate the importance of order when compartments are being encoded. The first three lines handle the cases when only one of the channels' compartment bits is turned on, so the last three lines can handle cases when more than one bit is turned on. Therefore, none of the last three lines need to have any compartment bits explicitly set to `0`. The result of these last three lines is that the suffix `CHANNELS JOINTLY` is always printed when any of two or more of the three compartment words that are associated with the channels is in the label.

- `(CH C)` is printed with `CHANNELS JOINTLY` when bit `6` is turned on, and either of bit `0` or `1`, or both, are also turned on.
- `(CH B)` is printed with `CHANNELS JOINTLY` when bit `1` is turned on, and either of bit `0` or `6`, or both, are also turned on.
- `(CH A)` is printed with `CHANNELS JOINTLY` when bit `0` is turned on, and either of bit `6` or `1`, or both, are also turned on.

The following excerpt from the `label_encodings` file shows that compartment bit `6` is associated with the label word `CC`.

```
SENSITIVITY LABELS:


WORDS:
  .
  .
  .
name= CC;                       minclass= TS; compartments= 6;
```

The next excerpt shows that compartment bit `1` is associated with the sensitivity label word `B`.

```
SENSITIVITY LABELS:

WORDS:
  .  .  .
name= B;                        minclass=  C; compartments= 1;
```

The next excerpt shows that compartment bit `0` is associated with sensitivity label word `A`.

```
SENSITIVITY LABELS:

WORDS:
   .   .   .
name= A;                        minclass=  C; compartments= 0;
```

To summarize, the channels line prints as `HANDLE VIA (CH B)/(CH A) CHANNELS JOINTLY` because of the following specifications:

- `HANDLE VIA` is defined to always appear with any `CHANNELS` word.
- The sensitivity label has two access-related words, `A` and `B`, that are associated with two compartment bits, `0` and `1`.
- Because two of the bits that are defined for `CHANNELS` words appear in the print job's label, the `CHANNELS WORDS (CH A)` and `(CH B)` are followed by `CHANNELS JOINTLY`.

  Any string that must print before the channel name is specified as a *prefix*. Any string that must print after the channel name is specified as a *suffix*.

For a sample `CHANNELS` planner, see "Planning the Channels in a Worksheet" on page 96.

Configuring Security Text on Print Jobs (Task Map)

The following task map describes how to format body pages and banner pages with labels.

Task	For Instructions
Print text on the banner page of a printout.	"How to Specify the Text in PRINTER BANNERS" on page 67
Print handling instructions.	"How to Specify Handling Instructions in CHANNELS" on page 68
Protect printouts at a higher label than the print job.	"How to Set a Minimum "Protect As" Classification" on page 69
Configure printers to label output.	"Configuring Labeled Printing (Task Map)" in *Oracle Solaris Trusted Extensions Configuration and Administration*

▼ How to Specify the Text in PRINTER BANNERS

In this procedure, you create the strings that appear at the top of the banner page and at the start of the handling instructions on the bottom of the page.

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

- For background information, see "Specifying Printer Banners" on page 61.
- For assistance, use "Planning the Printer Banners in a Worksheet" on page 96.

1 Edit the `label_encodings` file.

```
# env | grep EDITOR
/usr/bin/gedit
# /usr/bin/gedit encodings-file
```

2 Modify the PRINTER BANNERS section of the file.

a. Create prefixes and suffixes.

These strings are associated with the text in the printer banner lines of banner and trailer pages.

```
PRINTER BANNERS:

WORDS:

name= ORCON;                    prefix;
```

b. Specify the names of words to associate with any existing compartments in sensitivity labels.

You can associate compartments with particular prefixes and suffixes. Prefixes precede the compartment text and suffixes follow the compartment text on the printed output

```
name= (FULL SB NAME);           compartments= 3;
name= (FULL SA NAME);           compartments= 2;
```

Next Steps Continue with "How to Analyze and Verify the `label_encodings` File" on page 49.

▼ How to Specify Handling Instructions in `CHANNELS`

In this procedure, you create the strings that state handling instructions on printer banner pages.

Before You Begin You must be in the Security Administrator role in the global zone. You have planned the prefixes and suffixes.

For assistance, use "Planning the Channels in a Worksheet" on page 96.

1 Edit the `label_encodings` file.

```
# /usr/bin/gedit encodings-file
```

2 Modify the `CHANNELS` section of the file.

a. Specify the prefixes and suffixes.

The `WORDS` in the `CHANNELS` lines of banner and trailer pages become prefixes or suffixes. For example:

```
CHANNELS:

WORDS:
name= CHANNELS JOINTLY;         suffix;
name= CHANNELS ONLY;            suffix;
name= HANDLE VIA;               prefix;
```

b. Specify the names of words to associate with existing compartments in sensitivity labels.

Use your defined prefixes and suffixes.

```
name= (CH C);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 6;
name= (CH B);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 1;
name= (CH A);   prefix= HANDLE VIA; suffix= CHANNELS JOINTLY; compartments= 0;
```

Next Steps Continue with "How to Analyze and Verify the `label_encodings` File" on page 49.

▼ How to Set a Minimum "Protect As" Classification

The minimum "Protect As" classification protects all printer output at the specified minimum classification or above. Site security policy might require this setting if lower-level information must be protected at a higher label.

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

1. **Edit the `label_encodings` file.**

   `# /usr/bin/gedit` *encodings-file*

2. **Specify a classification as the value for the `minimum protect as classification` entry.**

   This entry is defined in the `ACCREDITATION RANGE` section of the `label_encodings` file.

Example 4–3 Minimum "Protect As" Classification From a `label_encodings` File

This example shows a minimum "Protect As" classification. This classification is defined in the `ACCREDITATION RANGE` section of the default `label_encodings` file. With this setting, files that are labeled `INTERNAL` print with `NEED_TO_KNOW` on the banner and trailer pages.

```
minimum protect as classification= NEED_TO_KNOW;
```

Next Steps Continue with "How to Analyze and Verify the `label_encodings` File" on page 49.

◆ ◆ ◆ CHAPTER 5

Customizing the LOCAL DEFINITIONS Section (Tasks)

This chapter describes how to customize the LOCAL DEFINITIONS section of the label_encodings file for Trusted Extensions. This chapter covers the following topics:

LOCAL DEFINITIONS Section

Oracle provides additional keywords that are not defined in the government-furnished *Compartmented Mode Workstation Labeling: Encodings Format* document. These Oracle keyword extensions are defined in the LOCAL DEFINITIONS section. The following is the LOCAL DEFINITIONS section from Oracle's default label_encodings file:

```
*
* Local site definitions and locally configurable options.
*

LOCAL DEFINITIONS:

Classification Name= Classification;
Compartments Name= Sensitivity;

Default User Sensitivity Label= PUB;
Default User Clearance= CNF NEED TO KNOW;

COLOR NAMES:

     label= Admin_Low;           color= #bdbdbd;

     label= PUB;                 color= blue violet;
     label= SBX PLAYGROUND;      color= yellow;
     label= CNF;                 color= navy blue;
     label= CNF : INTERNAL USE ONLY;  color= blue;
     label= CNF : NEED TO KNOW;  color= #00bfff;
     label= CNF : RESTRICTED;    color= #87ceff;
```

```
     label= Admin_High;          color= #636363;

*
* End of local site definitions
*
```

Contents of LOCAL DEFINITIONS Section

The security administrator can do the following in the LOCAL DEFINITIONS section of the label_encodings file:

- Specify a user clearance and a user minimum label that is different from the definitions in the ACCREDITATION RANGE section.

  For the procedure, see "How to Specify Default User Labels" on page 76.
- Specify which colors are assigned to labels.

  Color definitions are optional. However, assigning colors to labels is highly recommended.

  For the procedure, see "How to Assign a Color to a Label or Word" on page 77.
- Specify the names for column headings in label builder dialog boxes. The column headings indicate classifications and compartments.

  For the procedure, see "How to Name Column Headings in Label Builders" on page 78.

For more information, see the label_encodings(4) man page.

Specifying Colors for Labels

In the LOCAL DEFINITIONS section of the label_encodings file, the COLOR NAMES keyword is followed by zero or more color assignments. If no color is defined for a classification after the COLOR NAMES keyword, the color black is used. The default color values for the default label_encodings file are shown in the following excerpt.

```
COLOR NAMES:

     label= Admin_Low;           color= #bdbdbd;

     label= PUB;                 color= blue violet;
     label= SBX PLAYGROUND;      color= yellow;
     label= CNF;                 color= navy blue;
     label= CNF : INTERNAL USE ONLY;  color= blue;
     label= CNF : NEED TO KNOW;  color= #00bfff;
     label= CNF : RESTRICTED;    color= #87ceff;

     label= Admin_High;          color= #636363;
```

Colors are assigned to labels and to words within labels with the following syntax:

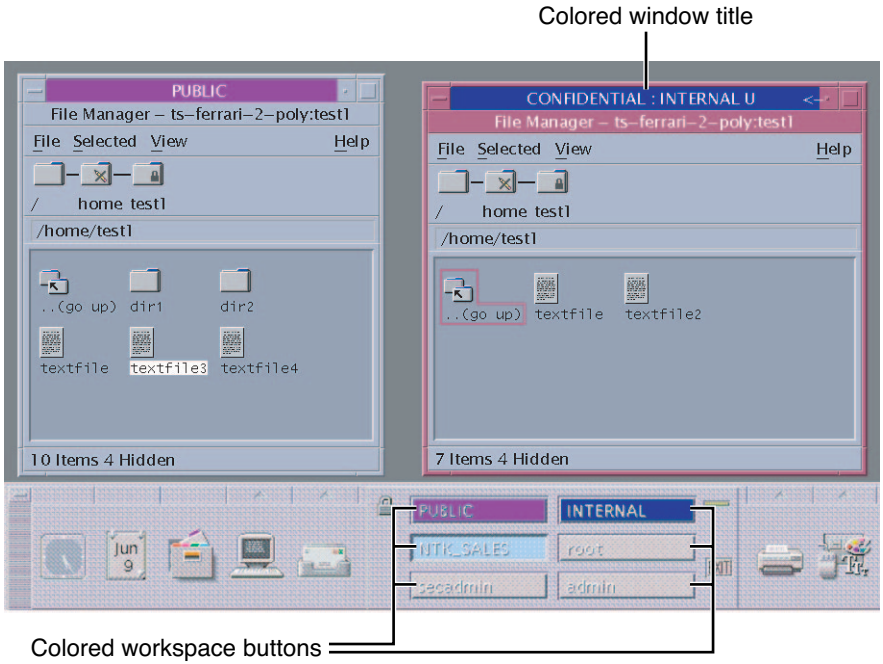
```
label= label-name;      color= color-name;
word= label-name;       color= color-name;
```

The value of *color-name* can be either a text color name or a hexadecimal color value. The color is associated with a word or a label. The color that is assigned to a label's component displays as a background color whenever a label includes the specified label components. The desktop software computes a complementary color for the lettering.

For an introduction to color values, see "Color Values" on page 75. A full discussion of how to specify color is outside the scope of this guide. For more information, see the `X11`(5) man page in the `/usr/X11/share/man/man5` or `/usr/share/man/man5` directory. Also, color specifications are covered in the *XWindows Systems User's Guide* (Vol. III), ISBN number 0-937175-29-3.

Color is assigned to a label's components according to the ordering rules that are described in the following section. For a desktop example of color use, see the following figure. The `PUBLIC`, `INTERNAL`, and `NTK_SALES` workspace buttons are colored differently from each other and from standard workspace buttons.

FIGURE 5–1 Window Labels With Colors From `COLOR NAMES`



Order of Color Specification

The color that is used for any label is determined according to the following rules:

1. If a label contains a compartment word that has one or more colors specified, then the color value associated with the first `word=` value is used.
2. If a label contains none of the compartment words that are associated with colors, and an exact match exists for the label name, then the specified label color is used.
3. If there is no exact match for the label name, then the color that is associated with the first specified `label=` value for the *classification* of the label is used.
4. If the classification has no assigned color, then the color that is assigned to the first label that contains the same classification is used.

EXAMPLE 5–1 Colors Assigned According to Ordering Rules

In this example, a system has the following color definitions:

```
label= u;       color= green
label= c;       color= blue
label= S;       color= red;
word= B;        color= orange;
label= TS;      color= yellow;
label= TS SA;   color= khaki;
```

The ordering rules result in the following color display:

- The label `TS A` displays with a yellow background because yellow is the color assigned to the `TS` classification. (Rule 3)
- Any label with the `C` classification displays with the color blue, unless the label also contains the word `B`. (Rule 2)
- A label with the `C B` classification displays with the color orange because word `B` is orange. (Rule 1)
- Any label with the `U` classification always displays with the color green. As defined in the `label_encodings` file, word `B` cannot appear with the classification `U`. (Rule 2)

EXAMPLE 5–2 Color Assigned to a Label With No Assigned Color

This example illustrates Rule 4. The label `TS` displays the color khaki because `TS SA` is the only label that includes the `TS` classification. `TS SA` is defined to display the color khaki.

```
label= u;       color= green
label= c;       color= blue
label= S;       color= red;
word= B;        color= orange;
label= TS SA;   color= khaki;
```

Color Values

The `/usr/openwin/lib/rgb.txt` database translates color names into red, green, and blue values. You can refer to the `rgb.txt` file for color names to use for your site's labels. You can also use hexadecimal color values.

Briefly, here are a few high-level points about color values:

- Color values specify the amount of red, green, and blue (RGB) that compose the color.
- RGB values can be specified with three hexadecimal numbers from 0 to FF. Each hexadecimal number indicates the amount of red, green, or blue in the color. For example:
  - Pure white is #FFFFFF
  - Pure red is #FF0000
  - Pure black is #000000

  For more information, see the `X11`(5) man page.
- The number of colors that are available on the screen depends on several factors:
  - Amount of memory available for specifying colors
  - Number of color planes
  - How many other clients are using color cells
  - Whether private color maps are being used by other applications

For a sample color name planner, see Table 6–8. To assign colors, see "How to Assign a Color to a Label or Word" on page 77.

Changing Column Headings on Label Builders

To change the column headings, see "How to Name Column Headings in Label Builders" on page 78.

Modifying Oracle Extensions (Task Map)

The following task map describes how to modify Oracle extensions in the `label_encodings` file.

Purpose	Instructions
Add a `LOCAL DEFINITIONS` section to your encodings file.	"How to Add Oracle Extensions to an Encodings File" on page 76
Change label and clearance defaults for users.	"How to Specify Default User Labels" on page 76
Specify colors for labels.	"How to Assign a Color to a Label or Word" on page 77
Customize label builder headings.	"How to Name Column Headings in Label Builders" on page 78

How to Add Oracle Extensions to an Encodings File

The LOCAL DEFINITIONS section of the label_encodings file enables you to specify default user labels and colors for labels.

Before You Begin You must be in the Security Administrator role in the global zone. You must have an encodings file that does not have a LOCAL DEFINITIONS section.

- **Add the LOCAL DEFINITIONS section to your label_encodings file.**

  Append the section from an Oracle-supplied label_encodings file. Oracle-supplied files are in the /etc/security/tsol directory.

How to Specify Default User Labels

Before You Begin You must be in the Security Administrator role in the global zone. You must have an encodings file with a LOCAL DEFINITIONS section.

1. **Back up the label_encodings file.**

   ```
   # cp label_encodings label_encodings.orig
   ```

2. **Edit the label_encodings file.**

   ```
   # env | grep EDITOR
   /usr/bin/gedit
   # /usr/bin/gedit label_encodings
   ```

3. **Find the line in the LOCAL DEFINITIONS section that begins with Default User Sensitivity Label.**

   ```
   Default User Sensitivity Label= u;
   Default User Clearance= c;
   ```

4. **Replace the sensitivity label with your desired minimum user label.**

   The following example shows a new minimum label of c.

   ```
   Default User Sensitivity Label= c;
   ```

5. **Replace the clearance with your desired user clearance.**

   The following example shows a new clearance of s.

   ```
   Default User Clearance= s;
   ```

6. **Save your changes.**

Next Steps Continue with "How to Analyze and Verify the label_encodings File" on page 49.

How to Assign a Color to a Label or Word

To minimize color-flashing, use color names or hexadecimal color values that you know have been specified for other applications. The default color values have been chosen with memory limitations for color in mind.

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

1 Back up the `label_encodings` file.

```
# cp label_encodings label_encodings.orig
```

2 Edit the `label_encodings` file.

```
# /usr/bin/gedit label_encodings
```

3 Find the `COLOR NAMES` section.

```
COLOR NAMES:
          label= Admin_Low;       color= #bdbdbd;
          ...
          label= Admin_High;      color= #636363;
```

4 Define a color for each classification.

In this example, the classification `REGISTERED` is assigned the color red. The `NEED_TO_KNOW` classification is assigned the color blue.

```
label= REGISTERED;  color= red;
label= NEED TO KNOW; color= blue;
```

5 (Optional) Define colors for individual compartment words.

To distinguish certain compartment words irrespective of the classification with which they are associated, assign a separate color to those words.

a. Determine the possible color names on your system.

The names are defined in a local color database. For more information, see the `X11`(5) man page.

```
% grep Red /usr/X11/lib/X11/rgb.txt
...
255  69   0            OrangeRed
219 112 147            PaleVioletRed
...
139   0   0            DarkRed
```

b. Assign the color names.

For example, assign the color OrangeRed to the `EMGT` compartment:

```
word= EMGT; color= OrangeRed;
```

6 **(Optional) Define colors for labels.**

In this example, assign the color MediumPurple4 to the NEED TO KNOW label.

```
label= NEED TO KNOW; color= MediumPurple4;
```

7 **Save your changes.**

Next Steps Continue with "How to Analyze and Verify the label_encodings File" on page 49.

▼ How to Name Column Headings in Label Builders

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

1 **Back up the label_encodings file.**

```
# cp label_encodings label_encodings.orig
```

2 **Edit the label_encodings file.**

```
# /usr/bin/gedit label_encodings
```

3 **Find the Classification Name line in the LOCAL DEFINITIONS section.**

This line and the following line define the column headings in the label builder.

```
Classification Name= Classification;
Compartments Name= Sensitivity;
```

4 **Assign different names to the column headings.**

The following example shows the column headings from label_encodings.example.

```
Classification Name= Classification;
Compartments Name= Departments;
```

5 **Save your changes.**

Next Steps Continue with "How to Analyze and Verify the label_encodings File" on page 49.

◆ ◆ ◆ CHAPTER 6

Planning an Organization's Encodings File (Example)

This chapter discusses the creation of a set of Trusted Extensions labels that meet a company's goals for information protection. This chapter covers the following topics:

The `label_encodings` file that results from this planning is provided in Appendix A, "Encodings File for SecCompany (Example)." A version of this file is installed as the `label_encodings.example` file.

Identifying the Site's Label Requirements

SecCompany, Inc. is the name of a fictional company whose label requirements are modeled in this example. To protect the corporation's intellectual property, the company's legal department mandates that employees use three labels on all sensitive email and printed materials. The three labels, from most sensitive to least sensitive, are the following:

- `Confidential: Registered`
- `Confidential: Need To Know`
- `Confidential: Internal Use Only`

The legal department also approves the use of an optional fourth label, `Public`. The `Public` label is for information that can be distributed to anyone without restrictions.

Satisfying Information Protection Goals

At SecCompany, the manager in charge of information protection makes use of all possible channels to communicate labeling requirements. However, some employees do not understand the requirements. Other employees forget about the requirements or ignore them. Even when labels are properly applied, the information is not always properly handled, stored, and distributed. For example, reports indicate that registered information is sometimes found unattended. Copies of registered information have been left next to copy machines and printers, in break rooms, and in lobbies.

The legal department wants a better way to ensure that information is properly labeled without relying totally on employee compliance. The system administrators want a better way to control the following:

- Who can view sensitive information
- Who can modify sensitive information
- Which information is printed on which printers
- How printer output is handled
- How email at various levels of security is distributed internally and externally

Trusted Extensions Features That Address Labeling and Access

Trusted Extensions software does not leave labeling decisions up to the discretion of computer users. All printer output from print servers that are configured with Trusted Extensions is automatically labeled according to the site's requirements.

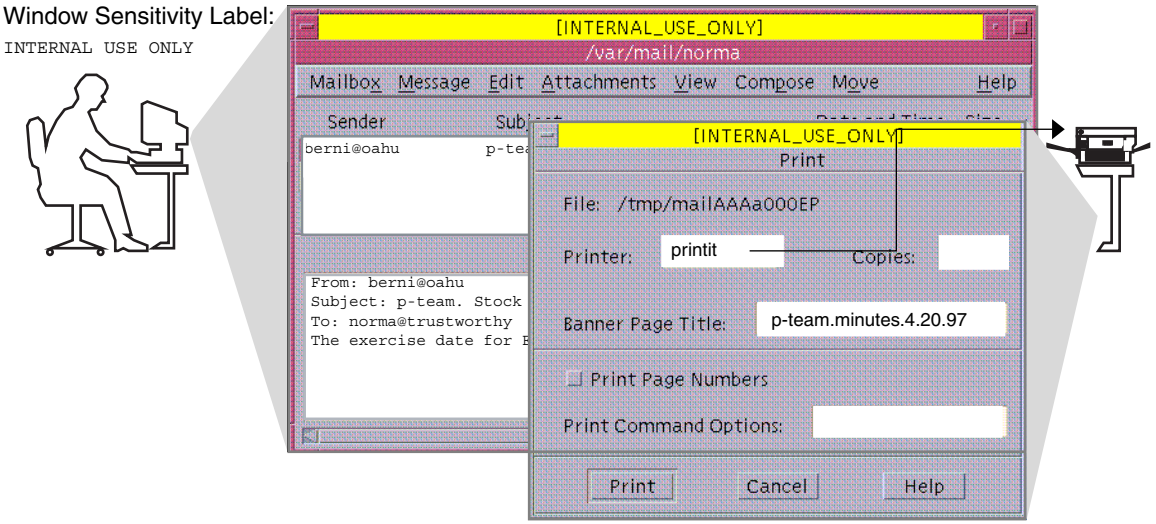
Even though security was not yet fully understood at the company, the manager in charge of information protection knew that Trusted Extensions could implement the following features immediately:

- Automatic labeling of print jobs
- Printers with restricted access by label
- Email with restricted access by label

In Trusted Extensions, each print job is automatically assigned a *label*. The label corresponds either to the *level* at which the user is working or to the user's level of responsibility.

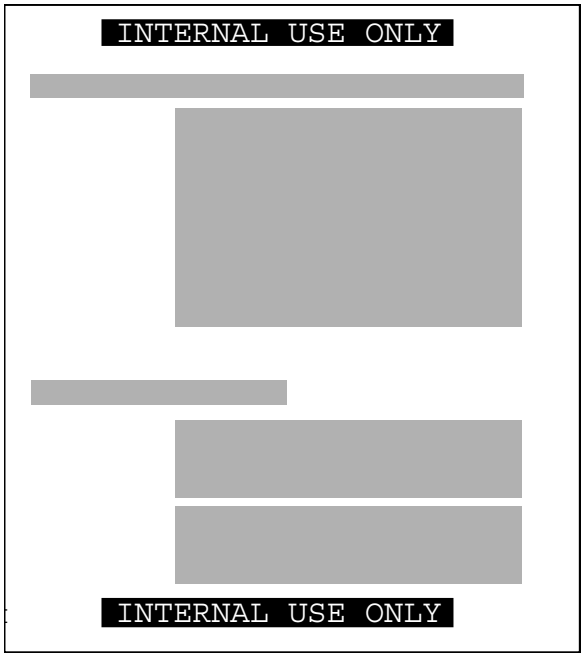
The following figure shows an employee working at a level of `INTERNAL_USE_ONLY`. At this level, the work should be accessible only by people who have signed nondisclosure agreements with SecCompany. When an employee who has signed a nondisclosure agreement sends email to the printer, the print job is automatically assigned the label `INTERNAL_USE_ONLY`.

FIGURE 6–1 Automatic Labeling of Print Jobs



The following figure shows the email that was sent to the printer in Figure 6–1. The user's working label, `INTERNAL_USE_ONLY`, is printed at the top and bottom of every page.

FIGURE 6–2 Label Automatically Printed on Body Pages



Banner and trailer pages can include *handling instructions*. Printed below the sensitivity label, handling instructions provides distribution instructions for the printed material. The following example shows the text on the banner page of a print job. The sensitivity level of the print job is `NEED_TO_KNOW` in the department of `HUMAN_RESOURCES`.

```
NEED_TO_KNOW HR

DISTRIBUTE_ONLY_TO HUMAN RESOURCES (NON-DISCLOSURE AGREEMENT REQUIRED)
```

The instructions state that the information is only for human resources personnel who need to know the information. Also, the human resources personnel must have signed a nondisclosure agreement.

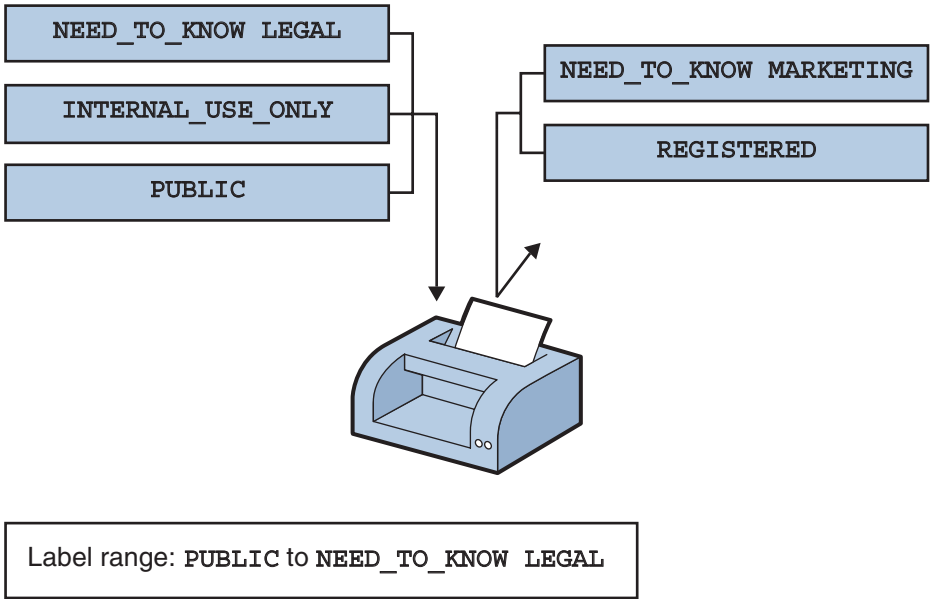
To retrieve a labeled printout, users must have access to a printer that prints at the label of the print job. A printer can be configured to print jobs at every label. For security, printers are configured to print only jobs within a restricted label range.

For example, Figure 6–3 illustrates that the legal department's printer has been set up to print only jobs that have been assigned one of three labels:

- NEED_TO_KNOW LEGAL – Can be viewed only by permanent employees of SecCompany with a need to know within the legal department
- INTERNAL_USE_ONLY – Can be viewed only by permanent employees of SecCompany and customers who have signed nondisclosure agreements
- PUBLIC – Can be viewed by anyone

This printer setup excludes jobs that are sent at any other label. For example, this printer would reject jobs at the labels NEED_TO_KNOW MARKETING and REGISTERED.

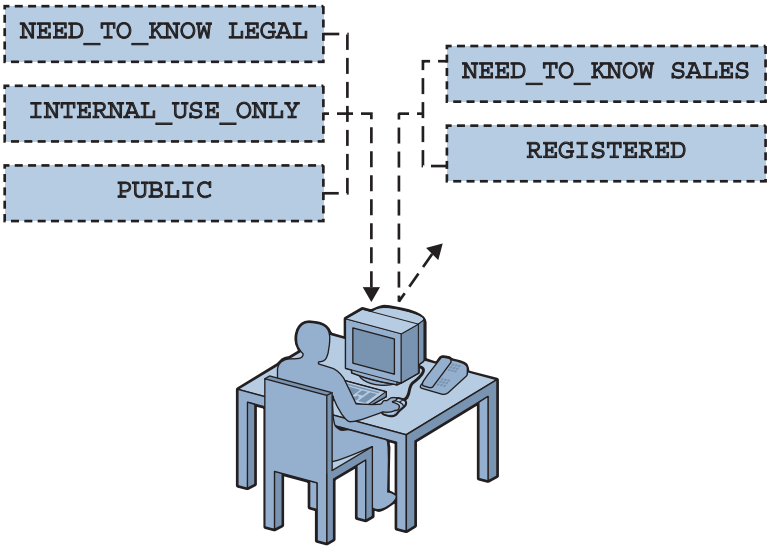
FIGURE 6–3 How a Printer With a Restricted Label Range Handles Print Jobs



Printers in locations that are accessible to all employees can be similarly restricted. For example, printers can be configured to print jobs only at the two labels that all employees can view, INTERNAL_USE_ONLY and PUBLIC.

Similar to how the printer label range controls which jobs can be printed on a particular printer, a user's *account label range* limits which email the person can handle. The following figure shows email that is being labeled at the sensitivity label of the user's mail application. The email is sent to the mail application at that label.

FIGURE 6–4 User Receiving Email Within the Account Label Range



At SecCompany, gateways to the Internet are configured to screen email so that emails at inappropriate labels cannot be sent outside of the company. Inappropriate labels are any labels except PUBLIC.

Climbing the Security Learning Curve

The manager in charge of information protection identifies an experienced administrator with the following qualifications:

- Is assessed to be trustworthy
- Knows how to administer Solaris systems
- Understands the organization's information-processing goals well enough to be responsible for overseeing and implementing the site's security

That person is assigned the job of security administrator.

Long before installing Trusted Extensions software, the security administrator starts to learn about security and to prepare a plan for the site's security policy. First, the security administrator reads the following documents:

- Chapter 1, "Security Planning for Trusted Extensions," in *Oracle Solaris Trusted Extensions Configuration and Administration* – For guidance on creating a site's security policy
- *Oracle Solaris Trusted Extensions User Guide* – To become familiar with label types and label appearance
- *Oracle Solaris Trusted Extensions Configuration and Administration* – To become familiar with security administrator responsibilities and tools
- Chapter 1, "Labels in Trusted Extensions Software (Overview)" – To review label concepts

Then, the security administrator starts with a plan for the site's labels. The planning process is described in the following sections.

Analyzing the Requirements for Each Label

The security administrator agrees that the set of labels that are mandated by the legal department is a useful starting point. However, further analysis is needed before the labels can be encoded.

Requirements for `CONFIDENTIAL: INTERNAL_USE_ONLY`

The `CONFIDENTIAL: INTERNAL_USE_ONLY` label is for information that is proprietary to the company but can be distributed to all employees because of its low level of sensitivity. All employees have signed nondisclosure agreements before starting employment. Information with this label might also be distributed to other people. For example, the employees of vendors and contractors who have signed a nondisclosure agreement can receive the information. Because the Internet can be snooped, information with this label cannot be sent over the Internet. However, the information can be sent over email within the company.

Suitable use of the `CONFIDENTIAL: INTERNAL_USE_ONLY` label includes the following:

- Spending guidelines
- Internal job postings

Requirements for `CONFIDENTIAL: NEED_TO_KNOW`

The `CONFIDENTIAL: NEED_TO_KNOW` label is for information that is proprietary to the company, has a higher level of sensitivity than `INTERNAL_USE_ONLY`, and has a more limited audience. Distribution is limited to employees who need to know the information. Other people who need to know the information and who have signed nondisclosure agreements might also be in the audience.

For example, if only the group of people working on a particular project should view certain information, then NEED_TO_KNOW should be used on that information. Whenever information must be restricted to a particular group, the name of the group needs to be specified on the paper version of the information.

Including the name of a group in the CONFIDENTIAL: NEED_TO_KNOW label makes it clear that the information must not be given to anyone outside of the group. Information with this label cannot be sent over the Internet, but it can be sent over email within the company.

Suitable use of the NEED_TO_KNOW label includes the following:

- Product design documents
- Project details
- Employee Status Change form

Requirements for CONFIDENTIAL: REGISTERED

The CONFIDENTIAL: REGISTERED label is for information that is proprietary to the company, has a very high level of sensitivity, and could significantly harm the company if released. Registered information must be numbered and tracked by the owner. Each copy must be assigned to a specific person. The copy must be returned to the owner for destruction after being read. Copies can be made only by the owner of the information. Use of brownish-red paper is recommended because this color cannot be copied.

This label is used when only one specific group of people is allowed to view the proprietary information. This information cannot be shown to anyone who is not authorized by the owner. The information cannot be shown to employees of other companies who have not signed a nondisclosure agreement, even if the owner authorizes the disclosure. Information with this label cannot be sent through email.

Suitable use of the CONFIDENTIAL: REGISTERED label includes the following:

- End of quarter financial information that has not yet been released
- Sales forecasts
- Marketing forecasts

Names of Groups With NEED_TO_KNOW Label

The security administrator decides that the NEED_TO_KNOW label will contain the names of groups or departments. The security Administrator asks for suggestions about what words to use to define groups or areas of interest within the organization. The following group names are in the initial list:

- Engineering
- Executive Management

- Finance
- Human Resources
- Legal
- Manufacturing
- Marketing
- Sales
- System Administration

Later, the security administrator adds the Project Team group, which enables all members of the Engineering and Marketing groups to share project data.

Understanding the Set of Labels

The next step for the security administrator is to resolve the following issues:

- How to use the classifications and compartments to encode the labels and clearances
- Which handling instructions will appear on printed output

The security administrator uses a large board. Pieces of paper are marked with the words that will be in the labels, as shown in Figure 6–5. This setup illustrates the relationships among labels. The pieces are rearranged until they all fit together.

The administrator drafts the following label relationships:

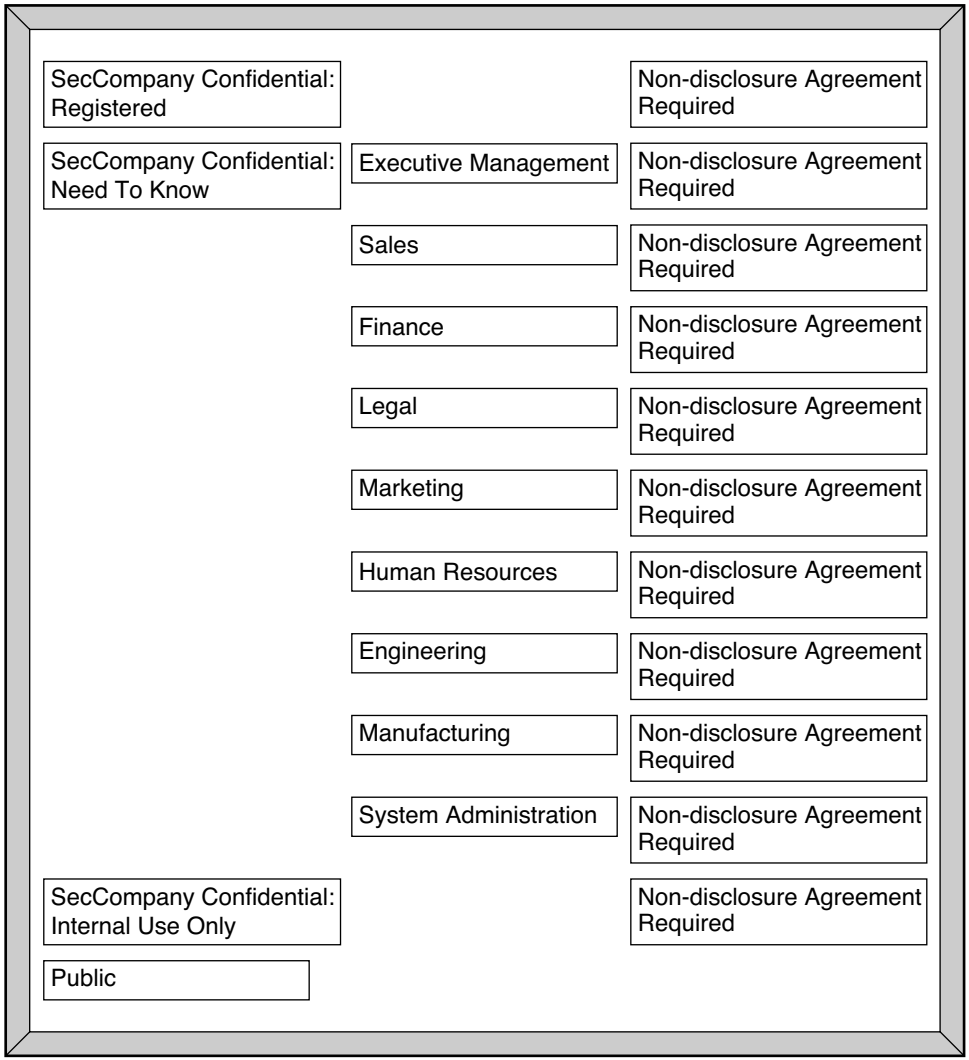
- The four labels are hierarchical with the `REGISTERED` label as the highest label. The `PUBLIC` label is the lowest.
- Only one label needs to be associated with group names

  The list of people who are cleared to receive registered information is limited on a case-by-case basis. Therefore, `REGISTERED` does not need any associated group names. `INTERNAL_USE_ONLY` applies to all employees and people who have signed nondisclosure agreements. `PUBLIC` labels are for everybody. Therefore, `INTERNAL_USE_ONLY` and `PUBLIC` labels do not need further qualification. The `NEED_TO_KNOW` label does need to be associated with non-hierarchical words, such as `NEED_TO_KNOW MARKETING` or `NEED_TO_KNOW ENGINEERING`. The words that identify the group or department can also be included in a user's clearance, as part of establishing that user's need to know.
- Each label except the `PUBLIC` label requires the person who is accessing the information to have signed a nondisclosure agreement.

  A phrase such as `NON-DISCLOSURE AGREEMENT REQUIRED` is a good reminder that this requirement exists.
- The handling instructions on banner and trailer pages must have clear wording on how to handle the information. These instructions are based on the classification and on any group name that can appear in the label.

Along with information about the sensitivity of the printer output, handling instructions must explain that a nondisclosure agreement is required when the label requires such an agreement.

FIGURE 6–5 Sample Planning Board for Label Relationships at SecCompany



Defining the Set of Labels

In this section, SecCompany's set of labels is defined in lists that include the following required aspects of labels:

- Classifications
- Other words
- Relationships between and among the words
- Classification restrictions that are associated with use of each word
- Intended use of the words in sensitivity labels and clearances
- Intended use of the words in labeling system output, such as printouts and email

Planning the Classifications

Because the four labels are hierarchical, they are encoded as hierarchical classifications.

With the legal department's approval, the security administrator shortens the labels by omitting `SecCompany Confidential:` from the label names. Long classifications make labels hard to read in window title bars. The name of a label is truncated from right to left in title bars. Because the truncated names of all the label names above `PUBLIC` would begin with the words `SECCOMPANY CONFIDENTIAL`, the truncated names would be indistinguishable without manually extending the frame for each window.

The security administrator defines the following labels:

- `REGISTERED`
- `NEED_TO_KNOW`
- `INTERNAL_USE_ONLY`
- `PUBLIC`

Planning the Compartments

The group names will be encoded as non-hierarchical *compartments*. Compartments will be restricted to appear only in labels that have the `NEED_TO_KNOW` classification. Compartment restrictions are encoded in the `ACCREDITATION RANGE` section under `COMBINATION CONSTRAINTS` in the `label_encodings` file.

User *clearances* will control which users can create files and directories that have a group name in the label. User clearances will also control which users can create documents that have a label with more than one group name along with the `NEED_TO_KNOW` classification.

Planning the Use of Words in MAC

The classifications and compartments in sensitivity labels and user clearances are used in mandatory access control (MAC). Therefore, the legal department's hierarchical labels and the group names need to be encoded as classifications and compartments so that they can be used in the labels that control which individual employees can access files and do other work.

SecCompany defines two sensitivity labels:

- `PUBLIC`, which is assigned the lowest value in the user accreditation range
- `INTERNAL_USE_ONLY`, which is assigned the next highest value above `PUBLIC`

An employee with no authorizations whose clearance is `PUBLIC` and whose minimum label is `PUBLIC` can use the system as follows:

- Works only in a `PUBLIC` workspace
- Creates files only at the `PUBLIC` label
- Reads email only at the `PUBLIC` label
- Uses printers that have `PUBLIC` in their label range

In contrast, an employee with no authorizations whose clearance is `INTERNAL_USE_ONLY` can use the system as follows:

- Works in either a `PUBLIC` or an `INTERNAL_USE_ONLY` workspace
- Creates files at either the `PUBLIC` label or the `INTERNAL_USE_ONLY` label, depending on the employee's current workspace
- Receives and sends email at either sensitivity label
- Can print a file that is labeled `PUBLIC` on any printer with `PUBLIC` in its label range
- Can send a file labeled `INTERNAL_USE_ONLY` to any printer with `INTERNAL_USE_ONLY` in its label range

Planning the Use of Words in Labeling System Output

When the sensitivity label of a print job contains a group name compartment, the mandatory printer banner and trailer pages print the following text:

`DISTRIBUTE_ONLY_TO` *Group Name* `(Non-Disclosure Agreement Required)`

Planning Unlabeled Printer Output

The `Print Without Labels` authorization allows a user or a role to use the `lp -o nolabels` option to suppress the printing of top and bottom labels on body pages of a print job. The security administrator can give the `Print Without Labels` authorization to everyone or to no one.

The Print PostScript File authorization allows a user to submit a PostScript file to the printer. PostScript printing is usually not allowed because of the risk that a knowledgeable user can change the labels in the PostScript file.

To permit technical writers to produce master copies of documents without labels printed on them, the security administrator gives the Print Without Labels and Print PostScript File authorizations to all the writers.

Planning for Supporting Procedures

The security administrator creates security policies to enforce the labeling strategy.

Rules for Protecting a REGISTERED File or Directory

The security administrator realizes that anyone with a clearance that includes the word REGISTERED can access any registered information anywhere in the company. Further precautions are needed. For example, users who have REGISTERED in their clearance must be instructed to use UNIX permissions to protect their files. Permissions must be set so that only the owner can view or modify the file. The following example shows a user who is applying discretionary access control to protect the contents of a REGISTERED directory.

As the following example shows, the user who creates a file or directory while working at an sensitivity label of REGISTERED needs to set the file's permissions to be read and write for the owner only. Directory permissions are set to be readable, writable, and searchable only by the owner. These permissions ensure that another user who can work at the REGISTERED label cannot read the file.

EXAMPLE 6–1 Using DAC to Protect Registered Information

```
% plabel
REGISTERED
% mkdir registered.dir
% chmod 700 registered.dir
% cd registered.dir
% touch registered.file
% ls -l
-rwxrwxrwx registered.file
% chmod 600 registered.file
% ls -l
-rw------- registered.file
```

Rules for Configuring Printers

The following table shows how printers that are available to various SecCompany departments need to be configured.

TABLE 6–1 Label Ranges on SecCompany Printers at Various Locations

Printer Location	Type of Access	Label Range
Lobby or public meeting room	Anyone	`PUBLIC` only
Internal company printer room	Available to all people who have signed nondisclosure agreements	`PUBLIC` to `INTERNAL_USE_ONLY`
Restricted area for one group	Members of a group specified in the `NEED_TO_KNOW` *group-name* compartment	`NEED_TO_KNOW` *group-name* only
Strictly controlled area	Available only to people who have the `REGISTERED` classification in their clearance	`REGISTERED` only

For more information, see Chapter 21, "Managing Labeled Printing (Tasks)," in *Oracle Solaris Trusted Extensions Configuration and Administration*.

Rules for Handling Printer Output

People who have access to restricted printers are instructed to do the following:

- Protect information according to the instructions on the banner and trailer pages of printed output.
- Shred jobs that do not have both a banner and a trailer page. Also, shred jobs that do not have matching job numbers on the banner and trailer pages.

Planning the Classification Values in a Worksheet

The worksheet in the following table shows names and hierarchical values that are defined for the four classifications for SecCompany. Because the value `0` is reserved for the administrative `ADMIN_LOW` label, the value of the `PUBLIC` classification is set to `1`. The values of the other classifications are set higher in ascending order of sensitivity.

Note – The names of groups in the labels are specified later, as `WORDS` in the `SENSITIVITY LABELS` and `CLEARANCES` sections.

TABLE 6–2 Classifications Planner for SecCompany

name=	sname=/aname=	value=	initial compartments= bit numbers/WORD
`PUBLIC`	`PUB`	1	None
`INTERNAL_USE_ONLY`	`IUO`	4	None

TABLE 6–2 Classifications Planner for SecCompany *(Continued)*

name=	sname=/aname=	value=	initial compartments= bit numbers/WORD
NEED_TO_KNOW	NTK	5	None
REGISTERED	REG	6	None

Planning the Compartment Values and Combination Constraints in a Worksheet

The following table defines the relationships between words and classifications. The relationships were determined by using the planning board in Figure 6–5. PUBLIC and INTERNAL_USE_ONLY can never appear in a label with any compartment. NEED_TO_KNOW can appear in a label with any of the compartments or all of the compartments. The classification and compartment values are listed in ascending bit order.

TABLE 6–3 Compartments and User Accreditation Range Combinations Planner for SecCompany

Classification	Compartment Name/ sname/ Bit	Combination Constraints
PUBLIC		PUBLIC Only valid combinations
INTERNAL_USE_ONLY		INTERNAL_USE_ONLY Only valid combinations
NEED_TO_KNOW	EXECUTIVE_MANAGEMENT_GROUP/ EMGT/ 11	NEED_TO_KNOW All combinations valid
	SALES/ SALES/ 12	
	FINANCE/ FIN/ 13	
	LEGAL/ LEGAL/ 14	
	MARKETING/ MKTG/ 15 20	
	HUMAN_RESOURCES/ HR/ 16	
	ENGINEERING/ ENG/ 17 20	
	MANUFACTURING/ MFG/ 18	
	SYSTEM_ADMINISTRATION/ SYSADM/ 19	
	PROJECT_TEAM/ SYSADM/ 20	
	ALL_DEPARTMENTS/ ALL/ 11-20	

TABLE 6–3 Compartments and User Accreditation Range Combinations Planner for SecCompany *(Continued)*

Classification	Compartment Name/ sname/ Bit	Combination Constraints
REGISTERED		REGISTERED Only valid combinations

The security administrator uses the following table to track which bits have been used for compartments.

TABLE 6–4 Compartment Bits Planner for SecCompany

11	12	13	14	15	16	17	18	19	20	

Planning the Clearances in a Worksheet

The components of these labels are also assigned to users in clearances. The worksheet's Clearance Planner in Table 6–5 defines the label components to be used in clearances at SecCompany.

The following key to Table 6–5 lists the components in descending classification bit order and ascending compartment bit order:

Abbreviation	Name	Component
REG	REGISTERED	CLASS
NTK	NEED_TO_KNOW	CLASS
IUO	INTERNAL_USE_ONLY	CLASS
PUB	PUBLIC	CLASS
EMGT	EXECUTIVE_MANAGEMENT_GROUP	COMP
SALES	SALES	COMP
FIN	FINANCE	COMP
LEGAL	LEGAL	COMP
MKTG	MARKETING	COMP
HR	HUMAN_RESOURCES	COMP
ENG	ENGINEERING	COMP
MFG	MANUFACTURING	COMP

Abbreviation	Name	Component
SYSADM	SYSTEM_ADMINISTRATION	COMP
P_TEAM	PROJECT_TEAM	COMP
ALL	ALL_DEPARTMENTS	COMP

TABLE 6–5 Clearance Planner for SecCompany

CLASS	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP	COMP	Notes
REG	EMGT	ENG	FIN	HR	LEGAL	MFG	MKTG	SALES	SYSADM	P_TEAM	ALL	Highest possible label, not used *
REG												Assigned to personnel as needed §
NTK	EMGT											Assigned to EMGT group
NTK		ENG										Assigned to ENG group
NTK			FIN									Assigned to FIN group
NTK				HR								Assigned to HR group
NTK					LEGAL							Assigned to LEGAL group
NTK						MFG						Assigned to MFG group
NTK							MKTG					Assigned to MKTG group
NTK								SALES				Assigned to SALES group
NTK									SYSADM			Assigned to SYSADM group
NTK										P_TEAM		Assigned to P_TEAM group
NTK											ALL	Assigned to all groups
IUO												Assigned to people with NDAs
PUB												Assigned to anyone

* The highest possible label in the system consists of the highest classification and all of the defined compartments. Because no one is permitted to access all information in all departments, this label is not in the user accreditation range. No one is assigned this clearance.

§ When working at the REGISTERED sensitivity label, the user must set permissions to restrict access to everyone except the owner. UNIX file permissions of 600 and directory permissions of 700 restrict access.

Planning the Printer Banners in a Worksheet

The SecCompany legal department wants the following to appear on banner and trailer pages of printed output:

```
SecCompany Confidential:
```

The PRINTER BANNERS section of the `label_encodings` file can be used to associate a string with any compartment that appears in the sensitivity label of the print job. In this encodings file, only the NEED_TO_KNOW classification has compartments. The following table shows how the desired wording is specified as a prefix and assigned to each compartment. The abbreviation NTK is assigned to each channel so that the wording in the PRINTER BANNERS section includes the group name, as follows:

`SecCompany Confidential:` *group-name*

In the following planner, the words in the second column are listed in order of ascending bit order.

TABLE 6–6 Printer Banners Planner for SecCompany

Prefix	Printer Banner (Word, No Suffix)
SECCOMPANY CONFIDENTIAL:	EXECUTIVE_MANAGEMENT_GROUP
SECCOMPANY CONFIDENTIAL:	SALES
SECCOMPANY CONFIDENTIAL:	FINANCE
SECCOMPANY CONFIDENTIAL:	LEGAL
SECCOMPANY CONFIDENTIAL:	MARKETING
SECCOMPANY CONFIDENTIAL:	HUMAN_RESOURCES
SECCOMPANY CONFIDENTIAL:	ENGINEERING
SECCOMPANY CONFIDENTIAL:	MANUFACTURING
SECCOMPANY CONFIDENTIAL:	SYSTEM_ADMINISTRATION
SECCOMPANY CONFIDENTIAL:	PROJECT_TEAM
SECCOMPANY CONFIDENTIAL:	ALL_DEPARTMENTS

Planning the Channels in a Worksheet

The SecCompany legal department wants the following handling instructions to appear on banner and trailer pages on printed output:

`DISTRIBUTE_ONLY_TO` *group-name* `EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)`

This goal is met by assigning in the CHANNELS section the same compartment bits that were assigned to group names in Table 6–3. SecCompany plans to use the same group names in both the compartments and the channels.

The words that precede the channel name are specified as *prefixes*. The words that follow the channel name are specified as *suffixes*. The security administrator specifies prefixes and suffixes in the following planner. The planner lists the channels in ascending compartment bit order.

TABLE 6–7 Channels Planner for SecCompany

Prefix	Channel	Suffix
DISTRIBUTE_ONLY_TO	EXECUTIVE_MANAGEMENT_GROUP	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	SALES	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	FINANCE	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	LEGAL	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	MARKETING	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	HUMAN_RESOURCES	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	ENGINEERING	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	MANUFACTURING	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	SYSTEM_ADMINISTRATION	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	PROJECT_TEAM	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)
DISTRIBUTE_ONLY_TO	ALL_DEPARTMENTS	EMPLOYEES (NON-DISCLOSURE_AGREEMENT_REQUIRED)

Planning the Minimum Labels in an Accreditation Range

The following minimum values must be set:

- Minimum sensitivity label
- Minimum clearance
- Minimum “Protect As” classification

SecCompany wants employees to be able to use all the defined sensitivity labels. Also, the company wants to be able to assign the PUBLIC clearance to some employees. Therefore, the minimum sensitivity label and the minimum clearance need to be set to PUBLIC.

The minimum “Protect As” classification is printed on banner and trailer pages instead of the actual classification from the job's sensitivity label. The minimum “Protect As” classification can be set higher than the *actual* minimum classification. However, SecCompany requirements

allow the minimum “Protect As” classification to always be equal to the real classification of the print job's sensitivity label. The security administrator specifies the value PUBLIC for the minimum sensitivity label, minimum clearance, and minimum “Protect As” classification.

Planning the Colors in a Worksheet

The color that is assigned to a label displays as the background color whenever the name of the label appears at the top of a window. The lettering is displayed in a color that is computed by the windowing system to complement the background. At SecCompany, the security administrator chooses to keep the colors that are already assigned to the administrative labels in the default label_encodings file. The administrator assigns green to PUBLIC, yellow to INTERNAL_USE_ONLY, blue to labels that contain NEED_TO_KNOW (with different shades of blue assigned to each compartment), and red to REGISTERED. The following table shows the color assignments, and the default color assignments for the ADMIN_LOW and ADMIN_HIGH labels.

TABLE 6–8 Color Names Planner for SecCompany

Label or Name (label= or name=)	Color
ADMIN_LOW	#BDBDBD
PUBLIC	green
INTERNAL_USE_ONLY	yellow
NEED_TO_KNOW	blue
NEED_TO_KNOW EMGT	#7FA9EB
NEED_TO_KNOW SALES	#87CEFF
NEED_TO_KNOW FIN	#00BFFF
NEED_TO_KNOW LEGAL	#7885D0
NEED_TO_KNOW MKTG	#7A67CD
NEED_TO_KNOW HR	#7F7FFF
NEED_TO_KNOW ENG	#007FFF
NEED_TO_KNOW MFG	#0000BF
NEED_TO_KNOW SYSADM	#5B85D0
NEED_TO_KNOW P_TEAM	#9E7FFF
NEED_TO_KNOW ALL	#4D658D
REGISTERED	red
ADMIN_HIGH	#636363

Editing and Installing the label_encodings File

The SecCompany setup team for Trusted Extensions makes a printed copy and an online copy of the installed label_encodings file. The copy is used in case of problems with the new version of the file that the security administrator supplies.

The security administrator uses a text editor to create the label_encodings file and then uses the chk_encodings -a command to check the file. After the file passes all semantic and syntactic checks, the security administrator backs up the current version of the label_encodings file, and installs the new label_encodings file.

Specifying the Version

The following example shows the SecCompany VERSION string in the label_encodings file.

EXAMPLE 6–2 SecCompany VERSION String

```
VERSION= SecCompany, Inc. Example Version - 2.2 10/10/20
```

Specifying the Classifications

The following example shows the SecCompany classifications and values from Table 6–2 in the CLASSIFICATIONS section.

EXAMPLE 6–3 SecCompany CLASSIFICATIONS Section

```
CLASSIFICATIONS:

name= PUBLIC; sname= PUB; value= 1;
name= INTERNAL_USE_ONLY; sname= IUO; aname= IUO; value= 4;
name= NEED_TO_KNOW; sname= NTK; aname= NTK; value= 5;
name= REGISTERED; sname= REG; aname= REG; value= 6;
```

Note – A classification cannot contain the slash (/) or comma (,) character. The classifications are specified from the lowest value to the highest.

Specifying the Sensitivity Labels

The compartments from Table 6–3 are specified in the following example. The labels do not have any required combinations or combination constraints.

EXAMPLE 6–4 SecCompany WORDS in the SENSITIVITY LABELS Section

```
SENSITIVITY LABELS:

WORDS:

name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS:
```

Specifying the Information Labels

Even though information labels are not used, values must be supplied under the INFORMATION LABELS: WORDS: section of the label_encodings file for the file to pass the encodings check. The security administrator copies the words from the SENSITIVITY LABELS: WORDS: section. The result is shown in the following example.

EXAMPLE 6–5 SecCompany WORDS in the INFORMATION LABELS Section

```
INFORMATION LABELS:

WORDS:

name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS
```

Specifying the Clearances

Because the clearance words are the same as the sensitivity labels words, the words in the following example are the same as the words in "Specifying the Sensitivity Labels" on page 99.

EXAMPLE 6–6 SecCompany WORDS in the CLEARANCES Section

```
CLEARANCES:

WORDS:

name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS:
```

Specifying the Channels

The security administrator specifies one channel for each group name compartment. Each channel uses the same compartment bits that are assigned to the compartment words in the SENSITIVITY LABELS: WORDS: section. The prefix is defined as DISTRIBUTE_ONLY_TO. The suffix is defined as (NON-DISCLOSURE AGREEMENT REQUIRED). The following is the proposed wording for handling instructions:

```
DISTRIBUTE_ONLY_TO group-name (NON-DISCLOSURE AGREEMENT REQUIRED)
```

The channel specifications in the following example create this wording.

Note – No compartments are assigned to the prefixes and suffixes. The prefixes and suffixes are used to define the channels.

EXAMPLE 6–7 SecCompany WORDS in the CHANNELS Section

```
CHANNELS:

WORDS:

name= DISTRIBUTE_ONLY_TO;       prefix;
name= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);    suffix;
```

EXAMPLE 6–7 SecCompany WORDS in the CHANNELS Section *(Continued)*

```
name= ALL_DEPARTMENTS; prefix= DISTRIBUTE_ONLY_TO; compartments= 11-20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= EXECUTIVE_MANAGEMENT_GROUP; prefix= DISTRIBUTE_ONLY_TO; compartments= 11;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= SALES; prefix= DISTRIBUTE_ONLY_TO; compartments= 12;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= FINANCE; prefix= DISTRIBUTE_ONLY_TO; compartments= 13;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= LEGAL; prefix= DISTRIBUTE_ONLY_TO; compartments= 14;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= MARKETING; prefix= DISTRIBUTE_ONLY_TO; compartments= 15 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= HUMAN_RESOURCES; prefix= DISTRIBUTE_ONLY_TO; compartments= 16;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= ENGINEERING; prefix= DISTRIBUTE_ONLY_TO; compartments= 17 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= MANUFACTURING; prefix= DISTRIBUTE_ONLY_TO; compartments= 18;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= SYSTEM_ADMINISTRATION; prefix= DISTRIBUTE_ONLY_TO; compartments= 19;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= PROJECT_TEAM; prefix= DISTRIBUTE_ONLY_TO; compartments= 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
```

Specifying the Printer Banners

Note – The term *printer banner* has a specialized meaning in the label_encodings file. A printer banner appears as a string on the banner page of printed output when the compartment that is associated with the printer banner string is part of a job's label.

The SecCompany PRINTER BANNERS section is shown in the following example. For a sample banner page, see Figure 4–2.

Note – No compartments are assigned to the prefixes and suffixes.

EXAMPLE 6–8 SecCompany WORDS in the PRINTER BANNERS Section

```
PRINTER BANNERS:

WORDS:

name= SECCOMPANY CONFIDENTIAL:;          prefix;
name= (NON-DISCLOSURE AGREEMENT REQUIRED);     suffix;

name= ALL_DEPARTMENTS; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 11-20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= EXECUTIVE_MANAGEMENT_GROUP; prefix= SECCOMPANY CONFIDENTIAL:;
```

EXAMPLE 6–8 SecCompany WORDS in the PRINTER BANNERS Section *(Continued)*

```
compartments= 11; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= SALES; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 12; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= FINANCE; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 13; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= LEGAL; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 14 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= MARKETING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 15; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= HUMAN_RESOURCES; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 16; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= ENGINEERING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 17 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= MANUFACTURING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 18; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= SYSTEM_ADMINISTRATION; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 19; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= PROJECT_TEAM; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
```

Specifying the Accreditation Range

The ACCREDITATION RANGE: section in the following example shows the combination constraints from Table 6–3, and the minimum clearance, minimum sensitivity label, and minimum "Protect As" classification from "Planning the Minimum Labels in an Accreditation Range" on page 97. PUBLIC, INTERNAL_USE_ONLY, and REGISTERED are defined to never appear in a label with any compartment. NEED_TO_KNOW is defined to appear in a label with any combination of compartments.

EXAMPLE 6–9 SecCompany ACCREDITATION RANGE Section

```
ACCREDITATION RANGE:

classification= PUBLIC; only valid compartment combinations:
PUB

classification= INTERNAL_USE_ONLY; only valid compartment combinations:
IUO

classification= NEED_TO_KNOW; all compartment combinations valid;

classification= REGISTERED; only valid compartment combinations:
REG

minimum clearance= PUB;
minimum sensitivity label= PUB;
minimum protect as classification= PUB;
```

Specifying the Local Definitions

SecCompany sets the default user labels, and customizes column headings and colors in the LOCAL DEFINITIONS section.

Specifying the Default User Labels

SecCompany enables all users to access the PUBLIC label.

EXAMPLE 6–10 SecCompany Default User Labels

```
Default User Sensitivity Label= PUB;
Default User Clearance= PUB;
```

Specifying the Column Headings in Label Builders

A label builder is displayed whenever the user needs to set a label. The SecCompany security administrator modified the Compartments column heading to Departments.

EXAMPLE 6–11 SecCompany Column Headings in the label_encodings File

```
Classification Name= Classification;
Compartments Name= Departments;
```

Specifying the Color Names

The security administrator used the worksheet in Table 6–8 to complete the Color Names section.

EXAMPLE 6–12 SecCompany COLOR NAMES Section

```
COLOR NAMES:

        label= Admin_Low;       color= #BDBDBD;

        label= PUBLIC;        color= green;
        label= INTERNAL_USE_ONLY;  color= yellow;
        label= NEED_TO_KNOW;  color= blue;
        label= NEED_TO_KNOW EMGT;  color= #7FA9EB;
        label= NEED_TO_KNOW SALES;  color= #87CEFF;
        label= NEED_TO_KNOW FIN;  color= #00BFFF;
        label= NEED_TO_KNOW LEGAL;  color= #7885D0;
        label= NEED_TO_KNOW MKTG;  color= #7A67CD;
        label= NEED_TO_KNOW HR;  color= #7F7FFF;
        label= NEED_TO_KNOW ENG;  color= #007FFF;
        label= NEED_TO_KNOW MFG;  color= #0000BF;
        label= NEED_TO_KNOW P_TEAM;  color= #9E7FFF;
        label= NEED_TO_KNOW SYSADM; color= #5B85D0;
        label= NEED_TO_KNOW ALL; color= #4D658D;
        label= REGISTERED;  color= red;

        label= Admin_High;      color= #636363;
```

EXAMPLE 6–12 SecCompany COLOR NAMES Section *(Continued)*

```
*
* End of local site definitions
```

Configuring Users and Printers for Labels

The security administrator has completed the `label_encodings` file. However, apart from the `label_encodings` file, labeling decisions at SecCompany need to be enforced on users and on printers.

For every user, the security administrator needs to specify the following:

- The appropriate clearance

  The default, `PUBLIC`, is too low for employees, but is required to prevent non-employees from accessing company files. For assistance, see "Planning the Clearances in a Worksheet" on page 94.

- The appropriate minimum label

  The default, `PUBLIC`, is not a company label. Company files start at the `INTERNAL_USE_ONLY` label. For assistance, see "Planning the Minimum Labels in an Accreditation Range" on page 97.

The security administrator can hide labels from users and can enable users to bypass certain Trusted Extensions print security features by assigning authorizations to the users.

For more information, see "Managing Users and Rights (Task Map)" in *Oracle Solaris Trusted Extensions Configuration and Administration*.

For every printer, the security administrator can specify a label range. On public printers, the administrator might choose to turn off visible labels. For printer configuration procedures, see "Managing Printing in Trusted Extensions (Task Map)" in *Oracle Solaris Trusted Extensions Configuration and Administration*.

◆ ◆ ◆ APPENDIX A

Encodings File for SecCompany (Example)

This appendix contains the `label_encodings` file that was customized for SecCompany, Inc. in Chapter 6, "Planning an Organization's Encodings File (Example)." This appendix also contains a sample of the debugging steps that the security administrator performed to create a syntactically correct file. Sample output from the `chk_encodings -a` command is provided.

SecCompany's `label_encodings` File

Note – This file is similar to the `label_encodings.example` file that is delivered by Trusted Extensions.

At SecCompany, `PUBLIC` is the sensitivity label for communications across the Internet. `INTERNAL_USE_ONLY` is the sensitivity label for communications within the company.

The `ALL_DEPARTMENTS` compartment word gets turned on when all defined compartment bits are on. This compartment word works as a toggle in a label builder.

```
* ident "@(#)label_encodings.seccompany        %I% %E%"
*
* Copyright 2010 SecCompany, Inc.  All rights reserved.
* Use is subject to license terms.
*
*
* These confidential labels are required by SecCompany's
* legal and information protection departments.
* Department names can be used for controlling
* access to information across department boundaries.

* These labels are used for mandatory access control
```

```
* checks based on user clearance labels and labels and
* sensitivity labels on files and directories.


VERSION= SecCompany, Inc. Example Version - 2.2 10/10/20



CLASSIFICATIONS:

name= PUBLIC; sname= PUB; value= 1;
name= INTERNAL_USE_ONLY; sname= IUO; aname= IUO; value= 4;
name= NEED_TO_KNOW; sname= NTK; aname= NTK; value= 5;
name= REGISTERED; sname= REG; aname= REG; value= 6;


INFORMATION LABELS:

WORDS:

name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS:

SENSITIVITY LABELS:

WORDS:

name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS:

CLEARANCES:

WORDS:
```

```
name= ALL_DEPARTMENTS; sname= ALL; compartments= 11-20; minclass= NEED_TO_KNOW;
name= EXECUTIVE_MANAGEMENT_GROUP; sname= EMGT; compartments= 11;minclass= NEED_TO_KNOW;
name= SALES; sname= SALES; compartments= 12; minclass= NEED_TO_KNOW;
name= FINANCE; sname= FIN; compartments= 13; minclass= NEED_TO_KNOW;
name= LEGAL; sname= LEGAL; compartments= 14; minclass= NEED_TO_KNOW;
name= MARKETING; sname= MKTG; compartments= 15 20; minclass= NEED_TO_KNOW;
name= HUMAN_RESOURCES; sname= HR; compartments= 16; minclass= NEED_TO_KNOW;
name= ENGINEERING; sname= ENG; compartments= 17 20; minclass= NEED_TO_KNOW;
name= MANUFACTURING; sname= MFG; compartments= 18; minclass= NEED_TO_KNOW;
name= SYSTEM_ADMINISTRATION; sname= SYSADM; compartments= 19; minclass= NEED_TO_KNOW;
name= PROJECT_TEAM; sname= P_TEAM; compartments= 20; minclass= NEED_TO_KNOW;

REQUIRED COMBINATIONS:

COMBINATION CONSTRAINTS:

CHANNELS:

WORDS:

name= DISTRIBUTE_ONLY_TO;    prefix;
name= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);    suffix;

name= ALL_DEPARTMENTS; prefix= DISTRIBUTE_ONLY_TO; compartments= 11-20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= EXECUTIVE_MANAGEMENT_GROUP; prefix= DISTRIBUTE_ONLY_TO; compartments= 11;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= SALES; prefix= DISTRIBUTE_ONLY_TO; compartments= 12;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= FINANCE; prefix= DISTRIBUTE_ONLY_TO; compartments= 13;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= LEGAL; prefix= DISTRIBUTE_ONLY_TO; compartments= 14;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= MARKETING; prefix= DISTRIBUTE_ONLY_TO; compartments= 15 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= HUMAN_RESOURCES; prefix= DISTRIBUTE_ONLY_TO; compartments= 16;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= ENGINEERING; prefix= DISTRIBUTE_ONLY_TO; compartments= 17 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= MANUFACTURING; prefix= DISTRIBUTE_ONLY_TO; compartments= 18;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= SYSTEM_ADMINISTRATION; prefix= DISTRIBUTE_ONLY_TO; compartments= 19;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);
name= PROJECT_TEAM; prefix= DISTRIBUTE_ONLY_TO; compartments= 20;
suffix= EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED);

PRINTER BANNERS:

WORDS:

name= SECCOMPANY CONFIDENTIAL:;          prefix;
name= (NON-DISCLOSURE AGREEMENT REQUIRED);     suffix;

name= ALL_DEPARTMENTS; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 11-20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= EXECUTIVE_MANAGEMENT_GROUP; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 11; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= SALES; prefix= SECCOMPANY CONFIDENTIAL:;
```

```
compartments= 12; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= FINANCE; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 13; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= LEGAL; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 14 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= MARKETING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 15; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= HUMAN_RESOURCES; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 16; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= ENGINEERING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 17 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= MANUFACTURING; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 18; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= SYSTEM_ADMINISTRATION; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 19; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);
name= PROJECT_TEAM; prefix= SECCOMPANY CONFIDENTIAL:;
compartments= 20; suffix=(NON-DISCLOSURE AGREEMENT REQUIRED);

ACCREDITATION RANGE:

classification= PUBLIC; only valid compartment combinations:
PUB

classification= INTERNAL_USE_ONLY; only valid compartment combinations:
IUO

classification= NEED_TO_KNOW; all compartment combinations valid;

classification= REGISTERED; only valid compartment combinations:
REG

minimum clearance= PUB;
minimum sensitivity label= PUB;
minimum protect as classification= PUB;

*
* Local site definitions and locally configurable options.
*
LOCAL DEFINITIONS:
*

Classification Name= Classification;
Compartments Name= Departments;

Default User Sensitivity Label= PUB;
Default User Clearance= PUB;

COLOR NAMES:

     label= Admin_Low;         color= #bdbdbd;

     label= PUBLIC;          color= green;
     label= INTERNAL_USE_ONLY;      color= yellow;
     label= NEED_TO_KNOW;      color= blue;
     label= NEED_TO_KNOW EMGT;       color= #7FA9EB;
     label= NEED_TO_KNOW SALES;      color= #87CEFF;
     label= NEED_TO_KNOW FIN;      color= #00BFFF;
     label= NEED_TO_KNOW LEGAL;       color= #7885D0;
     label= NEED_TO_KNOW MKTG;       color= #7A67CD;
```

```
     label= NEED_TO_KNOW HR;       color= #7F7FFF;
     label= NEED_TO_KNOW ENG;       color= #007FFF;
     label= NEED_TO_KNOW MFG;       color= #0000BF;
     label= NEED_TO_KNOW P_TEAM;   color= #9E7FFF;
     label= NEED_TO_KNOW SYSADM;   color= #5B85D0;
     label= NEED_TO_KNOW ALL;       color= #4D658D;
     label= REGISTERED;           color= red;

     label= Admin_High;         color= #636363;

*
* End of local site definitions
*
```

SecCompany's Verification of the `label_encodings` File

After the `chk_encodings -a` command several times, the security administrator corrected the syntax of the `label_encodings` file. The following corrections provide a sample:

```
Label encodings conversion error:
```

```
In PRINTER BANNERS WORDS, word "ALL_DEPARTMENTS": SUFFIX "(NON-DISCLOSURE
AGREEMENT REQUIRED)" not found.
```

Description: The final parenthesis after `REQUIRED` in the `ALL_DEPARTMENTS` entry was missing. The security administrator typed the parenthesis.

```
Label encodings conversion error at line 168:
```

```
In ACCREDITATION RANGE, classification "INTERNAL_USE_ONLY": SENSITIVITY LABEL
"INTERNAL_USE_ONLY" not in canonical form. Is IUO what was intended?
```

Description: The security administrator replaced `INTERNAL_USE_ONLY` with `IUO` at line 168.

```
Label encodings conversion error at line 172:
```

```
In ACCREDITATION RANGE, classification "NEED_TO_KNOW": No sensitivity labels
allowed after ALL COMPARTMENT COMBINATIONS VALID.
```

Description: The security administrator removed `NEED_TO_KNOW` at line 172.

```
"DEFAULT USER SENSITIVITY LABEL= PUBLIC" is not in canonical form. Is PUB what is
intended?
```

Description: The security administrator replaced `PUBLIC` with `PUB`.

```
Label encodings conversion error at line 206: Invalid color label "NEED_TO_KNOW
EMG".
```

Description: The security administrator replaced `EMG` with `EMGT`.

The following is an excerpt from the successful execution of the `chk_encodings -a` command.

```
No errors found in label_encodings.seccompany.
```

```
---> VERSION = SECCOMPANY, INC. EXAMPLE VERSION - 2.2 10/10/20 <---

---> CLASSIFICATIONS <---

Classification 1: PUBLIC (PUB)
    Initial Compartment bits: NONE
    Initial Markings bits: NONE
Classification 4: INTERNAL_USE_ONLY (IUO) / IUO
    Initial Compartment bits: NONE
    Initial Markings bits: NONE
Classification 5: NEED_TO_KNOW (NTK) / NTK
    Initial Compartment bits: NONE
    Initial Markings bits: NONE
Classification 6: REGISTERED (REG) / REG
    Initial Compartment bits: NONE
    Initial Markings bits: NONE

---> COMPARTMENTS AND MARKINGS USAGE ANALYSIS <---

Normal compartment bits defined: 11-20
Regular inverse compartment bits defined: NONE
Compartment bits reserved as 1 but not defined: NONE

Normal marking bits defined: NONE
Regular inverse marking bits defined: NONE
Marking bits reserved as 1 but not defined: NONE

---> INFORMATION LABEL WORDS <---
...

---> SENSITIVITY LABEL WORDS <---

Word: ALL_DEPARTMENTS (ALL)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above: NONE
   Words hierarchically below:
      EXECUTIVE_MANAGEMENT_GROUP (EMGT)
      SALES (SALES)
      FINANCE (FIN)
      LEGAL (LEGAL)
      MARKETING (MKTG)
      HUMAN_RESOURCES (HR)
      ENGINEERING (ENG)
      MANUFACTURING (MFG)
      SYSTEM_ADMINISTRATION (SYSADM)
      PROJECT_TEAM (P_TEAM)

Word: EXECUTIVE_MANAGEMENT_GROUP (EMGT)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
   Words hierarchically below: NONE

Word: SALES (SALES)
   Valid classification range: NTK -> REG
   Type: Normal
```

```
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
   Words hierarchically below: NONE

...
Word: MARKETING (MKTG)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
   Words hierarchically below:
      PROJECT_TEAM (P_TEAM)

...
Word: PROJECT_TEAM (P_TEAM)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
      MARKETING (MKTG)
      ENGINEERING (ENG)
   Words hierarchically below: NONE

---> CLEARANCE WORDS <---

Word: ALL_DEPARTMENTS (ALL)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above: NONE
   Words hierarchically below:
      EXECUTIVE_MANAGEMENT_GROUP (EMGT)
      SALES (SALES)
      FINANCE (FIN)
      LEGAL (LEGAL)
      MARKETING (MKTG)
      HUMAN_RESOURCES (HR)
      ENGINEERING (ENG)
      MANUFACTURING (MFG)
      SYSTEM_ADMINISTRATION (SYSADM)
      PROJECT_TEAM (P_TEAM)

Word: EXECUTIVE_MANAGEMENT_GROUP (EMGT)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
   Words hierarchically below: NONE

...
Word: MARKETING (MKTG)
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
   Words hierarchically below:
      PROJECT_TEAM (P_TEAM)
...

Word: PROJECT_TEAM (P_TEAM)
```

```
   Valid classification range: NTK -> REG
   Type: Normal
   Words hierarchically above:
      ALL_DEPARTMENTS (ALL)
      MARKETING (MKTG)
      ENGINEERING (ENG)
   Words hierarchically below: NONE

---> CHANNEL WORDS <---

Prefix Word: DISTRIBUTE_ONLY_TO

Suffix Word: EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)

Word: DISTRIBUTE_ONLY_TO ALL_DEPARTMENTS EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above: NONE
   Words hierarchically below:
      DISTRIBUTE_ONLY_TO EXECUTIVE_MANAGEMENT_GROUP EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO SALES EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO FINANCE EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO LEGAL EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO MARKETING EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO HUMAN_RESOURCES EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO ENGINEERING EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO MANUFACTURING EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO SYSTEM_ADMINISTRATION EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO PROJECT_TEAM EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)

Word: DISTRIBUTE_ONLY_TO EXECUTIVE_MANAGEMENT_GROUP EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above:
      DISTRIBUTE_ONLY_TO ALL_DEPARTMENTS EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
   Words hierarchically below: NONE

...
Word: DISTRIBUTE_ONLY_TO PROJECT_TEAM EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above:
      DISTRIBUTE_ONLY_TO ALL_DEPARTMENTS EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO MARKETING EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
      DISTRIBUTE_ONLY_TO ENGINEERING EMPLOYEES (NON-DISCLOSURE AGREEMENT REQUIRED)
   Words hierarchically below: NONE

---> PRINTER BANNER WORDS <---

Prefix Word: SECCOMPANY CONFIDENTIAL:

Suffix Word: (NON-DISCLOSURE AGREEMENT REQUIRED)

Word: SECCOMPANY CONFIDENTIAL: ALL_DEPARTMENTS (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above: NONE
   Words hierarchically below:
      SECCOMPANY CONFIDENTIAL: EXECUTIVE_MANAGEMENT_GROUP (NON-DISCLOSURE AGREEMENT REQUIRED)
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      SECCOMPANY CONFIDENTIAL: SALES (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: FINANCE (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: LEGAL (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: MARKETING (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: HUMAN_RESOURCES (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: ENGINEERING (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: MANUFACTURING (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: SYSTEM_ADMINISTRATION (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: PROJECT_TEAM (NON-DISCLOSURE AGREEMENT REQUIRED)

Word: SECCOMPANY CONFIDENTIAL: EXECUTIVE_MANAGEMENT_GROUP (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above:
      SECCOMPANY CONFIDENTIAL: ALL_DEPARTMENTS (NON-DISCLOSURE AGREEMENT REQUIRED)
   Words hierarchically below: NONE
...
Word: SECCOMPANY CONFIDENTIAL: PROJECT_TEAM (NON-DISCLOSURE AGREEMENT REQUIRED)
   Valid classification range: PUB -> REG
   Type: Normal
   Words hierarchically above:
      SECCOMPANY CONFIDENTIAL: ALL_DEPARTMENTS (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: LEGAL (NON-DISCLOSURE AGREEMENT REQUIRED)
      SECCOMPANY CONFIDENTIAL: ENGINEERING (NON-DISCLOSURE AGREEMENT REQUIRED)
   Words hierarchically below: NONE

---> LOCAL DEFINITIONS <---

Classification Field Name is "CLASSIFICATION"
Compartments Field Name is "DEPARTMENTS"

Default User Clearance = "PUB"

Default User Sensitivity Label = "PUB"

---> SENSITIVITY LABEL to COLOR MAPPING <---

    ADMIN_LOW = "#BDBDBD"
    PUB = "GREEN"
    IUO = "YELLOW"
    NTK = "BLUE"
    NTK EMGT = "#7FA9EB"
    NTK SALES = "#87CEFF"
    NTK FIN = "#00BFFF"
    NTK LEGAL = "#7885D0"
    NTK MKTG = "#7A67CD"
    NTK HR = "#7F7FFF"
    NTK ENG = "#007FFF"
       NTK MFG = "#0000BF"
    NTK P_TEAM = "#9E7FFF"
    NTK SYSADM = "#5B85D0"
    NTK ALL = "#4D658D"
    REG = "RED"
    ADMIN_HIGH = "#636363"
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