openSUSE 11.3
Start-Up

July 01, 2010

Start-Up

Contents

About This Guide

This manual will see you through your initial contact with openSUSE®. Check out the various parts of this manual to learn how to install, use and enjoy your system.

Installation and Setup
> Guides you through the installation process and the basic configuration of your system. Introduces YaST, the central tool for installation and configuration of your system. Learn how to set up or modify key components of your system and how to connect to the internet.

Basics
> This part mainly addresses to users changing to Linux from other operating systems. It introduces basic Linux concepts such as the user concept, the structure of the file system and access permissions for files and directories. An introduction to the shell is also provided, although you hardly ever need the command line to interact with your system nowadays.

Help and Troubleshooting
> Provides an overview of where to find help and additional documentation in case you need more information or want to perform specific tasks with your system. Also find a compilation of the most frequent problems and annoyances and learn how to solve these problems on your own.

This manual documents milestone 7 of openSUSE 11.3.

Many chapters in this manual contain links to additional documentation resources. This includes documentation that is available on the system as well as documentation available on the Internet.

For an overview of the documentation available for your product and the latest documentation updates, refer to http://www.novell.com/documentation/opensuse113 or to the following section.

1 Available Documentation

We provide HTML and PDF versions of our books in different languages. The following manuals for users and administrators are available on this product:

Start-Up (page 1)
> Guides you through the installation and basic configuration of your system. For newcomers, the manual also introduces basic Linux concepts such as the file system, the user concept and access permissions and gives an overview of the features openSUSE offers to support mobile computing. Provides help and advice in troubleshooting.

KDE User Guide (↑*KDE User Guide*)
> Introduces the KDE desktop of openSUSE. It guides you through using and config-uring the desktop and helps you perform key tasks. It is intended mainly for users who want to make efficient use of KDE as their default desktop.

GNOME User Guide (↑*GNOME User Guide*)
> Introduces the GNOME desktop of openSUSE. It guides you through using and configuring the desktop and helps you perform key tasks. It is intended mainly for end users who want to make efficient use of GNOME desktop as their default desktop.

Application Guide (↑*Application Guide*)
> Learn how to use and configure key desktop applications on openSUSE. This guide introduces browsers and e-mail clients as well as office applications and collabo-ration tools. It also covers graphics and multimedia applications.

Reference (↑*Reference*)
> Gives you a general understanding of openSUSE and covers advanced system administration tasks. It is intended mainly for system administrators and home users with basic system administration knowledge. It provides detailed information about advanced deployment scenarios, administration of your system, the inter-action of key system components and the set-up of various network and file ser-vices. openSUSE offers.

Security Guide (↑*Security Guide*)
> Introduces basic concepts of system security, covering both local and network security aspects. Shows how to make use of the product inherent security software like Novell AppArmor (which lets you specify per program which files the program may read, write, and execute) or the auditing system that reliably collects infor-mation about any security-relevant events.

In addition to the comprehensive manuals, several quick start guides are available:

KDE Quick Start (↑*KDE Quick Start*)
> Gives a short introduction to the KDE desktop and some key applications running on it.

GNOME Quick Start (↑*GNOME Quick Start*)
> Gives a short introduction to the GNOME desktop and some key applications running on it.

Installation Quick Start (↑*Installation Quick Start*)
> Lists the system requirements and guides you step-by-step through the installation of openSUSE from DVD, or from an ISO image.

Novell AppArmor Quick Start
> Helps you understand the main concepts behind Novell® AppArmor.

Find HTML versions of most product manuals in your installed system under `/usr/share/doc/manual` or in the help centers of your desktop. Find the latest documentation

updates at http://www.novell.com/documentation where you can download PDF or HTML versions of the manuals for your product.

2 Feedback

Several feedback channels are available:

Bugs and Enhancement Requests
> To report bugs for a product component, or to submit enhancement requests, please use https://bugzilla.novell.com/. For documentation bugs, submit a bug against the component *Documentation* for the respective product.
>
> If you are new to Bugzilla, you might find the following articles helpful:
>
> * http://en.opensuse.org/openSUSE:Submitting_bug_reports
>
> * http://en.opensuse.org/openSUSE:Bug_reporting_FAQ

User Comments
> We want to hear your comments and suggestions about this manual and the other documentation included with this product. Use the User Comments feature at the bottom of each page in the online documentation or go to http://www.novell.com/documentation/feedback.html and enter your comments there.

3 Documentation Conventions

The following typographical conventions are used in this manual:

* /etc/passwd: directory names and filenames

* *placeholder*: replace *placeholder* with the actual value

* PATH: the environment variable PATH

* ls, --help: commands, options, and parameters

* user: users or groups

* [Alt], [Alt] + [F1]: a key to press or a key combination; keys are shown in uppercase as on a keyboard

* *File*, *File > Save As*: menu items, buttons

* *Dancing Penguins* (Chapter *Penguins*, ↑Another Manual): This is a reference to a chapter in another manual.

4 About the Making of This Manual

This book is written in Novdoc, a subset of DocBook (see http://www.docbook.org). The XML source files were validated by **xmllint**, processed by **xsltproc**, and converted into XSL-FO using a customized version of Norman Walsh's stylesheets. The final PDF is formatted through XEP from RenderX. The open source tools and the environment used to build this manual are available in the package susedoc that is shipped with openSUSE.

5 Source Code

The source code of openSUSE is publicly available. To download the source code, proceed as outlined under http://www.novell.com/products/suselinux/source_code .html. If requested we send you the source code on a DVD. We need to charge a $15 or €15 fee for creation, handling and postage. To request a DVD of the source code, send an e-mail to sourcedvd@suse.de [mailto:sourcedvd@suse.de] or mail the request to:

```
SUSE Linux Products GmbH
Product Management
openSUSE
Maxfeldstr. 5
D-90409 Nürnberg
Germany
```

6 Acknowledgments

With a lot of voluntary commitment, the developers of Linux cooperate on a global scale to promote the development of Linux. We thank them for their efforts—this distribution would not exist without them. Furthermore, we thank Frank Zappa and Pawar. Special thanks, of course, goes to Linus Torvalds.

Have a lot of fun!

Your SUSE Team

Part I. Installation and Setup

1 Installation with YaST

Install your openSUSE® system with YaST, the central tool for installation and configuration of your system. YaST guides you through the installation process and the basic configuration of your system. During the installation and configuration process, YaST analyzes both your current system settings and your hardware components and proposes installation settings based on this analysis. By default, YaST displays an overview of all installation steps on the left hand side of the window and provides online help texts for each step. Click *Help* to view the help text.

If you are a first-time user of openSUSE, you might want to follow the default YaST proposals in most parts, but you can also adjust the settings as described here to fine-tune your system according to your preferences. Many parts of the basic system configuration, such as user accounts or system language, can also be modified after the installation process.

1.1 Choosing the Installation Media

When installing openSUSE, choose from several media available either online or in the retail box:

DVD-retail
One DVD containing the openSUSE distribution for 32bit and 64bit systems. The second medium contains proprietary add-on software.

This installation option does not require any network access for installation, nor do you need to set up external repositories to install the full openSUSE. You can, however, make the contents of the DVD available on an installation server and make them available all across your network.

DVD-download
One DVD5, available via download for 32bit or 64bit systems.

Choose this installation option if you want a fully-fledged openSUSE system. Beyond the downloading of the DVD ISO, there is no network connection required to make use of this installation option. Once the medium has been fully downloaded and the physical medium created, you can go ahead with the installation. You can also make the contents of the DVDs available on an installation server and make them available all across your network.

KDE4/GNOME LiveCD
The LiveCD versions, available via download, include the KDE4 or GNOME desktops together with the most popular applications for 32-bit or 64-bit systems.

Choose this medium option for a first look at openSUSE. The LiveCD version runs on your computer using RAM without touching your hard drive and no installation is needed. However, you can also install openSUSE from the running live system. There is no network connection required beyond the mere downloading of the medium.

TIP: Booting the LiveCD from an USB Stick

Live CD iso images can also be used as boot images for USB sticks. Create a bootable USB stick by using the command-line program **dd** with the following syntax:

dd if=*ISO_IMAGE* of=*USB_STICK_DEVICE* bs=4M

dd is available on Linux and MacOS by default. A Microsoft Windows* version can be downloaded from http://www.chrysocome.net/dd.

Warning: Using this **dd** command will erase all data on the USB device!

Mini CD

The Mini CD contains the minimal Linux system needed to run the installation. The installation system itself and the installation data are loaded from a network source. To install from a network providing SLP, please start the installation as described in Section 1.2.1, "Installing from a Network Server Using SLP" (page 6). To install from a HTTP, FTP, NFS, or SMB server, follow the instructions in Section 1.2.2, "Installing from a Network Source without SLP" (page 6).

IMPORTANT: Add-On CDs—Installing Additional Software

Although add-on CDs (extensions or third-party products) cannot be used as stand-alone installation media, they can be embedded as additional software sources during the installation. Currently CDs with additional languages are available as add-on CDs for openSUSE.

1.2 Choosing the Installation Method

After having selected the installation medium, determine the suitable installation method and boot option that best matches your needs:

Installing from the openSUSE Media

Choose this option if you want to perform a stand-alone installation and do not want to rely on a network to provide the installation data or the boot infrastructure. The installation proceeds exactly as outlined in Section 1.3, "The Installation Workflow" (page 7).

Installing from the LiveCD

In order to install from a LiveCD, boot the live system from CD. In the running system, launch the installation routine by clicking on the *Install* icon on the desktop. Phase one of the installation will be carried out in a window on the

desktop. It is not possible to update or repair an existing system with a LiveCD, you can only perform a new installation (with automatic configuration).

Installing from a Network Server

Choose this option if you have an installation server available in your network or want to use an external server as the source of your installation data. This setup can be configured to boot from physical media (Floppy, CD/DVD, or hard disk) or configured to boot via network using PXE/BOOTP. Refer to Section 1.2.1, "Installing from a Network Server Using SLP" (page 6), Section 1.2.2, "Installing from a Network Source without SLP" (page 6), or Chapter 1, *Remote Installation* (↑*Reference*) for details.

Installing with openSUSE 11.3 Installer from Windows

Choose this installation option if you prefer a smooth transition from using Windows to using Linux. openSUSE 11.3 Installer allows you to boot into the openSUSE installation right from a running Windows by modifying the Windows boot loader. This installation option is only available from the DVD media. Refer to Section 1.2.3, "Installing with the openSUSE 11.3 Installer from Windows" (page 6) for details.

openSUSE supports several different boot options from which you can choose, depending on the hardware available and on the installation scenario you prefer. Booting from the openSUSE media or using openSUSE 11.3 Installer are the most straightforward options, but special requirements might call for special setups:

Table 1.1   *Boot Options*

Boot Option	Description
DVD	This is the easiest boot option. This option can be used if the system has a local DVD-ROM drive that is supported by Linux.
openSUSE 11.3 Installer	openSUSE 11.3 Installer is installed under Microsoft Windows and makes it possible to boot directly into the installation
PXE or BOOTP	Booting over the network must be supported by the system's BIOS or firmware, and a boot server must be available in the network. This task can also be handled by another openSUSE system. See http://en.opensuse.org/SuSE_install_with_PXE _boot for more information.Refer to Chapter 1, *Remote Installation* (↑*Reference*) for more information.
Hard Disk	openSUSE installation can also be booted from the hard disk. To do this, copy the kernel (linux) and the installation system (initrd) from the directory /boot/*architecture*/ on the installation media to the hard disk and add an appropriate entry to the existing boot loader of a previous openSUSE installation.

TIP: Booting from DVD on UEFI machines

►**amd64 em64t:** DVD1 can be used as a boot medium for machines equipped with UEFI (Unified Extensible Firmware Interface). Refer to your vendor's documentation for specific information. If booting fails, try to enable CSM (Compatibility Support Module) in your firmware. ◄

1.2.1 Installing from a Network Server Using SLP

If your network setup supports OpenSLP and your network installation source has been configured to announce itself via SLP (described in Section "Setting Up the Server Holding the Installation Sources" (Chapter 1, *Remote Installation*, ↑*Reference*)), boot the system, press [F4] in the boot screen and select *SLP* from the menu.

The installation program configures the network connection with DHCP and retrieves the location of the network installation source from the OpenSLP server. If the automatic DHCP network configuration fails, you are prompted to enter the appropriate parameters manually. The installation then proceeds as described below with the exception of the network configuration step that is needed prior to adding additional repositories. This step is not needed as the network is already configured and active at this point.

1.2.2 Installing from a Network Source without SLP

If your network setup does not support OpenSLP for the retrieval of network installation sources, boot the system and press [F4] in the boot screen to select the desired network protocol (NFS, HTTP, FTP, or SMB/CIFS). Provide the server's address and the path to the installation media.

The installation program automatically configures the network connection with DHCP. If this configuration fails, you are prompted to enter the appropriate parameters manually. The installation retrieves the installation data from the source specified. The installation then proceeds as described below with the exception of the network configuration step needed prior to adding additional repositories. This step is not needed as the network is already configured and active at this point.

1.2.3 Installing with the `openSUSE 11.3 Installer` from Windows

`openSUSE 11.3 Installer` is a Microsoft Windows application that prepares your computer to directly boot into the openSUSE installation without having to adjust BIOS settings. It is only available on DVD media. To use the installer, insert the openSUSE media under Windows. The openSUSE 11.3 `Installer` setup automatically starts (if not, run openSUSE11_2_LOCAL.exe from the DVD). Choose a language for the installation and follow the instructions on the screen. The language you choose here is also preconfigured to be used for the openSUSE installation.

On the next reboot, the Microsoft Windows boot loader launches. Choose *openSUSE 11.3 Installer* to start the openSUSE installation. In order to proceed with the installation, you will be prompted to insert the installation media. The installation proceeds

as described below. When Microsoft Windows is booted again, openSUSE 11.3 Installer is automatically uninstalled.

TIP: Installing openSUSE alongside Microsoft Windows

openSUSE can easily be installed alongside Microsoft Windows. Carry out the installation as described below—an existing Windows installation will automatically be detected and a dual boot option will be installed. If Windows covers the whole installation disk, the installation routine will make a proposal to shrink an existing Windows partition in order to make room for the openSUSE. Please read Section "Resizing a Windows Partition" (page 15) prior to the installation for detailed information.

1.3 The Installation Workflow

The openSUSE installation is split into three main parts: preparation, installation, and configuration. During the preparation phase you configure some basic parameters such as language, time, desktop type, users, passwords, hard disk setup and installation scope. In the non-interactive installation phase the software is installed and the system is prepared for the first boot. Upon finishing the installation the machine reboots into the newly installed system and starts the final system configuration. You can choose whether to do a fully automatic or a manual configuration. In this stage, network and Internet access, as well as hardware components such as printers, are set up.

1.4 System Start-Up for Installation

You can install openSUSE from local installation sources, such as the openSUSE CDs or DVD, or from network source of an FTP, HTTP, NFS, or SMB server. Any of these approaches requires physical access to the system to install as well as user interaction during the installation. The installation procedure is basically the same regardless of the installation source. Any exceptions are sufficiently highlighted in the following workflow description.

1.5 The Boot Screen

The boot screen displays a number of options for the installation procedure. *Boot from Hard Disk* boots the installed system and is selected by default, because the CD is often left in the drive. Select one of the other options with the arrow keys and press [Enter] to boot it. The relevant options are:

Installation
    The normal installation mode. All modern hardware functions are enabled. In case the installation fails, see [F5]*Kernel* (page 9) for boot options that disable potentially problematic functions.

Repair Installed System

Boots into the graphical repair system. More information on repairing an installed system is available in Section 9.6.4, "Recovering a Corrupted System" (page 152). This option is not available on LiveCDs.

Rescue System

Starts a minimal Linux system without a graphical user interface. For more information, see Section "Using the Rescue System" (page 157). This option is not available on LiveCDs.

Check Installation Media

This option is only available when you install from media created from downloaded ISOs. In this case it is recommended to check the integrity of the installation medium. This option starts the installation system before automatically checking the media. In case the check was successful, the normal installation routine starts. If a corrupt media is detected, the installation routine aborts.

Firmware Test

Starts a BIOS checker that validates ACPI and other parts of your BIOS. This option is not available on the LiveCDs.

Memory Test

Tests your system RAM using repeated read and write cycles. Terminate the test by rebooting. For more information, see Section 9.2.5, "Fails to Boot" (page 134). This option is not available on the LiveCDs.

Figure 1.1   *The Boot Screen*

Use the function keys indicated in the bar at the bottom of the screen to change the language, screen resolution, installation source or to add an additional driver from your hardware vendor:

[F1]*Help*

Get context-sensitive help for the active element of the boot screen. Use the arrow keys to navigate, [Enter] to follow a link, and [Esc] to leave the help screen.

[F2]*Language*

Select the display language and a corresponding keyboard layout for the installation. The default language is English (US).

[F3]*Video Mode*

Select various graphical display modes for the installation. Select *Text Mode* if the graphical installation causes problems.

[F4]*Source*

Normally, the installation is performed from the inserted installation medium. Here, select other sources, like FTP or NFS servers. If the installation is deployed on a network with an SLP server, select an installation source available on the server with this option. Find information about SLP in Chapter 22, *SLP Services in the Network* (↑*Reference*).

[F5]*Kernel*

If you encounter problems with the regular installation, this menu offers to disable a few potentially problematic functions. If your hardware does not support ACPI (advanced configuration and power interface) select *No ACPI* to install without ACPI support. *No local APIC* disables support for APIC (Advanced Programmable Interrupt Controllers) which may cause problems with some hardware. *Safe Settings* boots the system with the DMA mode (for CD/DVD-ROM drives) and power management functions disabled.

If you are not sure, try the following options first: *Installation—ACPI Disabled* or *Installation—Safe Settings*. Experts can also use the command line (*Boot Options*) to enter or change kernel parameters.

[F6]*Driver*

Press this key to notify the system that you have an optional driver update for openSUSE. With *File* or *URL*, load drivers directly before the installation starts. If you select *Yes*, you are prompted to insert the update disk at the appropriate point in the installation process.

[F7]*Arch*

If you install from an installation medium supporting 32bit and 64bit architectures and have a processor with 64-bit support, select whether to install a 64-bit or 32-bit system. By default, a 64-bit system is installed on a computer with 64-bit support. To install a 32-bit system, press [F7] then select *32bit*.

TIP: Using IPv6 during the Installation

By default you can only assign IPv4 network addresses to your machine. To enable IPv6 during installation, enter one of the following parameters at the bootprompt: `ipv6=1` (accept IPv4 and IPv6) or `ipv6only=1` (accept IPv6 only).

After starting the installation, openSUSE loads and configures a minimal Linux system to run the installation procedure. To view the boot messages and copyright notices during this process, press [Esc]. On completion of this process, the YaST installation program starts and displays the graphical installer.

TIP: Installation without a Mouse

If the installer does not detect your mouse correctly, use [Tab] for navigation, arrow keys to scroll, and [Enter] to confirm a selection. Various buttons or selection fields contain a letter with an underscore. Use [Alt] + [Letter] to select a button or a selection directly instead of navigating there with the [Tab] button.

1.6 Welcome

Start the installation of openSUSE by choosing your language. Changing the language will automatically preselect a corresponding keyboard layout. Override this proposal by selecting a different keyboard layout from the drop-down menu. The language selected here is also used to assume a time zone for the system clock. This setting—along with the selection of secondary languages to install on your system—can be modified later in the *Installation Summary*, described in Section 1.12, "Installation Settings" (page 20). For information about language settings in the installed system, see Chapter 9, *Changing Language and Country Settings with YaST* (↑*Reference*).

Read the license agreement that is displayed beneath the language and keyboard selection thoroughly. Use *License Translations...* to access translations. If you agree to the terms, click *Next* to proceed with the installation. If you do not agree to the license agreement click *Abort* to terminate the installation.

Figure 1.2 *Welcome*
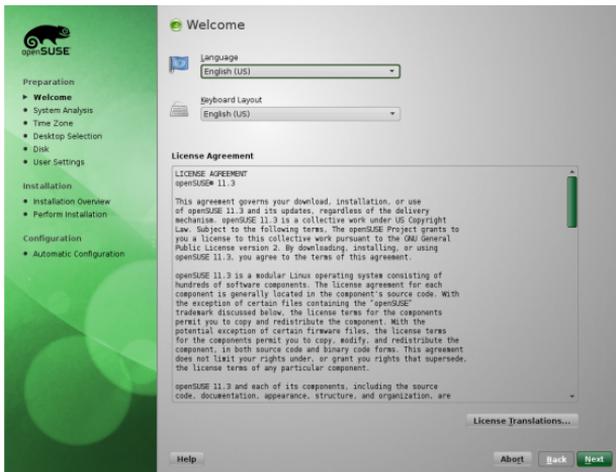
1.7 Installation Mode

After a system analysis (where YaST probes for storage devices and tries to find other installed systems on your machine) the available installation modes are displayed. This step is skipped when installing from a LiveCD, since this medium only supports a new installation with automatic configuration.

New installation
> Select this option to start a new installation from scratch.

Update
> Select this option to update an existing installation to a newer version. For more information about system updates, see Chapter 14, *Upgrading the System and System Changes* (↑*Reference*).

Repair Installed System
> Choose this option to repair a damaged system that is already installed. More information is available in .

Figure 1.3   *Installation Mode*
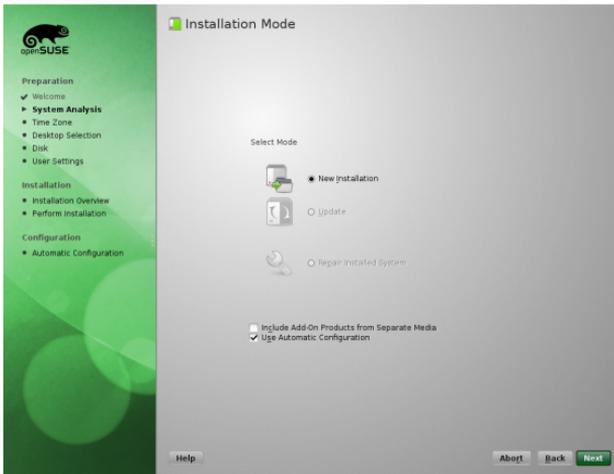
By default, the automatic configuration is used when performing a new installation. In this mode the system automatically configures your hardware and the network, so the installation is performed with minimal user interaction. If necessary, you can change every configuration that is set up later in the installed system using YaST. In repair mode the automatic configuration attempts to fix errors automatically. Uncheck *Use Automatic Configuration* if you prefer a manual configuration during the installation or to start the system's repair-process in expert mode.

Check *Include Add-On Products from Separate Media* to include add-on products during the installation. An add-on product can include extensions, third-party products or additional software for your system such as support for additional languages.

Click *Next* to proceed. If you selected to include an add-on product, proceed with Section 1.7.1, "Add-On Products" (page 12), otherwise skip the next section and advance to Section 1.8, "Clock and Time Zone" (page 13).

1.7.1 Add-On Products

Add-on products can be installed either from a local source (CD, DVD, or directory) or from a network source (HTTP, FTP, NFS, CIFS,...). When installing from a network source, you need to configure the network first (unless you are performing a network installation— in this case the existing network configuration is used). Choose *Yes, Run the Network Setup* and proceed as described in Section "Network Setup" (page 12). If the add-on product is available locally, select *No, Skip the Network Setup*.

Click *Next* and specify the product source. Source types available are *CD*, *DVD*, *Hard Disk*, *USB Mass Storage*, a *Local Directory* or a *Local ISO Image* (if no network was configured). If the add-on product is available on removable media, the system automatically mounts the media and reads its contents. If the add-on product is available on hard disk, choose *Hard Disk* to install from an unmounted hard drive, or *Local Directory/Local ISO Image* to install from the local file system. Add-on products may be delivered as a repository or as a set of rpm files. In the latter case, check *Plain RPM Directory*. Whenever a network is available, you can choose from additional remote sources such as HTTP, SLP, FTP, etc. It is also possible to specify a URL directly.

Check *Download Repository Description Files* to download the files describing the repository now. If unchecked, they will be downloaded once the installation starts. Proceed with *Next* and insert a CD or DVD if required. Depending on the product's content it may be necessary to accept additional license agreements.

It is also possible to configure add-on products later. Using add-on products on the installed system is described in Chapter 6, *Installing Add-On Products* (↑*Reference*).

Network Setup

When invoking the network setup, YaST scans for available network cards. If more than one network card is found, you must choose the card to configure from the list.

If an ethernet network adapter is not already connected, a warning will open. Make sure the network cable is plugged in and choose *Yes, Use It*. If your network is equipped with a DHCP server, choose *Automatic Address Setup (via DHCP)*. To manually set up the network choose *Static Address Setup* and specify *IP Address*, *Netmask*, *Default Gateway IP*, and the *DNS Server IP*.

Some networks require the use of a proxy server to access the Internet. Tick the check box *Use Proxy for Accessing the Internet* and enter the appropriate specifications. Click *Accept* to perform the network setup. The installation procedure will

continue with the add-on products or repositories setup as described in Section 1.7.1, "Add-On Products" (page 12).

1.8 Clock and Time Zone

In this dialog, select your region and time zone. Both are preselected according to the selected installation language. To change the preselected values, either use the map or the drop down lists for *Region* and *Time Zone*. When using the map, point the cursor at the rough direction of your region and left-click to zoom. Now choose your country or region by left-clicking. Right-click to return to the world map.

Figure 1.4   *Clock and Time Zone*
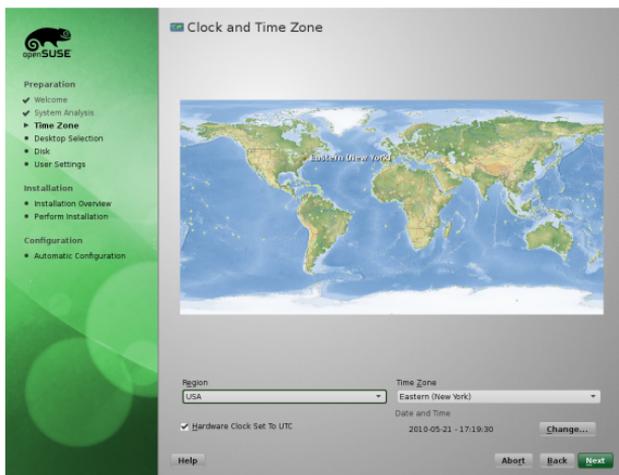
To set up the clock, choose whether the *Hardware Clock is Set to UTC*. If you run another operating system on your machine, such as Microsoft Windows, it is likely your system uses local time instead. If you only run Linux on your machine, set the hardware clock to UTC and have the switch from standard time to daylight saving time performed automatically.

If a network is already configured, the time is automatically synced via Network Time Protocol (NTP) with a time server. Click *Change* to either alter the NTP settings or to *Manually* set the time. See Chapter 25, *Time Synchronization with NTP* (↑*Reference*) for more information on configuring the NTP service. When finished, click *Accept* to continue the installation.

1.9 Desktop Selection

In openSUSE, you can choose from various desktops. The major ones, *KDE* and *GNOME*, are powerful graphical desktop environments similar to Windows. Find information about these in the *KDE User Guide* (↑*KDE User Guide*) and the *GNOME User*

Guide (↑*GNOME User Guide*). This step is skipped when installing from a LiveCD, since this medium is already preconfigured to either use KDE or GNOME.

If you prefer a different desktop, choose *Other* for more options. The *XFCE Desktop* and the *LXDE Desktop* are fast and lightweight desktop environments suitable for modest hardware. With *Minimal X Window*, install a graphical window manager that allows for running stand-alone X applications and console windows but does not provide the usual integrated desktop functionality. In *Minimal Server Selection (Text Mode)*, only console terminals are available.

Figure 1.5   *Desktop Selection*

1.10 Suggested Partitioning

Define a partition setup for openSUSE in this step. In most cases a reasonable scheme that can be accepted without change is proposed. If a hard disk containing only Windows FAT or NTFS partitions is selected as the installation target, YaST proposes to shrink one of these partitions. Accept the proposal with *Next* and proceed with the installation. Experienced users can also customize the proposal or apply their own partitioning scheme.

The proposed partitioning is *Partition Based* by default. If you prefer an *LVM Based* setup, check the respective option to automatically convert the proposal. Refer to Section "LVM Configuration" (Chapter 2, *Advanced Disk Setup*, ↑*Reference*) for more information about the Logical Volume Manager (LVM).

To make small changes in the proposal (like changing the file system type or encrypt partitions), select *Edit Partition Setup* and adjust the settings. See Section "Using the YaST Partitioner" (Chapter 2, *Advanced Disk Setup*, ↑*Reference*) for instructions.

Figure 1.6   *Suggested Partitioning*
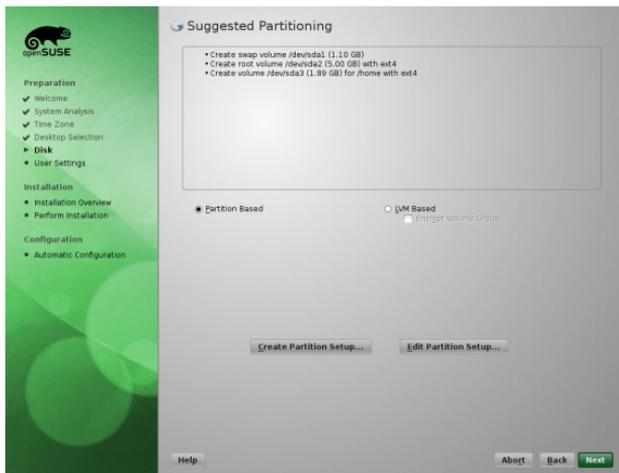
1.10.1 Partitioning a Specific Disk

If your machine contains more than one hard disk and you want to restrict the partitioning proposal to just one disk, choose *Create Partition Setup* and then select a specific disk from the list. If the chosen hard disk does not contain any partitions yet, the whole hard disk will be used for the proposal. Otherwise, you can choose which existing partition(s) to utilize. To add a separate partition for you personal data check *Propose a Separate Home Partition*. Instead of the default partition-based proposal, it is possible to *Create an LVM Based Proposal*. Choose two times *Next* to proceed to the next step.

Resizing a Windows Partition

If the selected hard disk only contains a Windows FAT or NTFS partition, YaST offers to delete or shrink this partition. If you select *Delete Windows Completely*, the Windows partition is marked for deletion and the space is used for the installation of openSUSE.

WARNING: Deleting Windows

If you delete Windows, all data will be lost beyond recovery as soon as the formatting starts.

To *Shrink the Windows Partition*, you need to interrupt the installation and boot Windows to prepare the partition before shrinking it. For all Windows file systems, proceed as follows:

1. Deactivate a `Virtual Memory` file, if there is one.

2. Run `scandisk`.

3. Run `defrag`.

After these preparations, restart the openSUSE installation. When you turn to the partitioning setup, proceed as before and select *Shrink Windows Partition*. After a quick check of the partition, the dialog for resizing the Windows partition opens.

The bar graph shows how much disk space is currently occupied by Windows and how much space is still available. To change the proposed settings use the slider or the input fields to adjust the partition sizing.

Figure 1.7   *Resizing the Windows Partition*
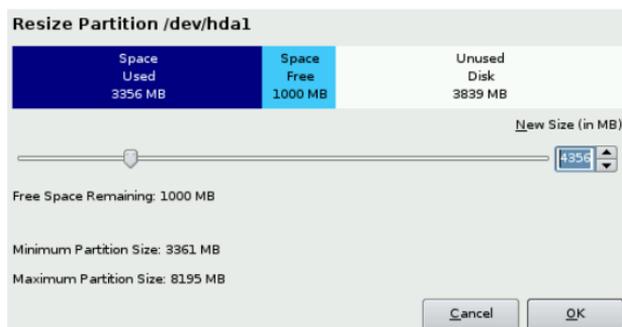
If you leave this dialog by selecting *Next*, the settings are stored and you are returned to the previous dialog. The actual resizing takes place later, before the hard disk is formatted.

IMPORTANT: Writing on NTFS Partitions

By default, the Windows versions NT, 2000, and XP use the NTFS file system. openSUSE includes read and write access to the NTFS file system, but this feature has a few limitations. This means that you cannot read or write encrypted or compressed files. Furthermore, the Windows file permissions are not honored at the moment. See http://en.opensuse.org/NTFS for more information.

1.10.2 Custom Partitioning

Set up your own partitioning scheme by selecting *Create Partition Setup* and then *Custom Partitioning*. The Expert Partitioner opens, displaying the current partition setup. Expand the *Hard Disks* in the System View pane by clicking on the +, then click on one of the listed hard disks. Now you can *Add*, *Edit*, *Resize*, or *Delete* partitions. For more information about custom partitioning and configuring advanced features, refer to Section "Using the YaST Partitioner" (Chapter 2, *Advanced Disk Setup*, ↑*Reference*)

1.11 Create New User

Create a local user in this step. Administrating local users is a suitable option for stand-alone workstations. If setting up a client on a network with centralized user authentication, click *Change* and proceed with the Section 1.11.1, "Expert Settings" (page 18).

After entering the first name and last name, either accept the proposal or specify a new *Username* that will be used to log in. Finally, enter a password for the user. Reenter it for confirmation (to ensure that you did not type something else by mistake). To provide effective security, a password should be between five and eight characters long. The maximum length for a password is 72 characters. However, if no special security modules are loaded, only the first eight characters are used to discern the password. Passwords are case-sensitive. Special characters (7-bit ASCII) and the digits 0 to 9 are allowed. Other special characters like umlauts or accented characters are not allowed.

Passwords you enter are checked for weakness. When entering a password that is easy to guess (such as a dictionary word or a name) you will see a warning. It is a good security practice to use strong passwords.

IMPORTANT: Username and Password

Remember both your username and the password because they are needed each time you log in to the system.

Figure 1.8 *Create New User*
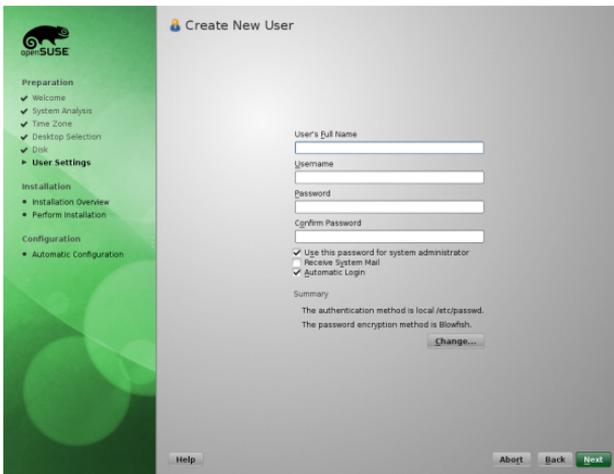
Three additional options are available:

Use this Password for the System Administrator
>If checked, the same password you have entered for the user will be used for the system administrator `root`. This option is suitable for stand-alone workstations or machines in a home network that are administrated by a single user. When not checked, you are prompted for a system administrator password in the next step of the installation workflow (see Section 1.11.2, "Password for the System Administrator `root`" (page 19)).

Receive System Mail
>Checking this box sends messages created by the system services to the user. These are usually only sent to `root`, the system administrator. This option is useful for the most frequently used account, because it is highly recommended to log in as `root` only in special cases.
>
>The mails sent by system services are stored in the local mailbox `/var/spool/mail/`*username*, where *username* is the login name of the selected user. To read e-mails after installation, you can use any e-mail client, for example KMail or Evolution.

Automatic Login
>This option automatically logs the current user in to the system when it starts. This is mainly useful if the computer is operated by only one user.

WARNING: Automatic Login

With the automatic login enabled, the system boots straight into your desktop with no authentication at all. If you store sensitive data on your system, you should not enable this option as long as the computer can also be accessed by others.

1.11.1 Expert Settings

Click *Change* in the Create User dialog to set up network authentication or, if present, import users from a previous installation. Also change the password encryption type in this dialog.

You can also add additional user accounts or change the user authentication method in the installed system. For detailed information about user management, see Chapter 8, *Managing Users with YaST* (↑*Reference*).

The default authentication method is *Local (/etc/passwd)*. If a former version of openSUSE or another system using `/etc/passwd` is detected, you may import local users. To do so, check *Read User Data from a Previous Installation* and click *Choose*. In the next dialog, select the users to import and finish with *OK*.

Access to the following network authentication services can be configured:

LDAP

Users are administered centrally on an LDAP server for all systems in the network. More information is available in Section "Configuring an LDAP Client with YaST" (Chapter 4, *LDAP—A Directory Service*, ↑*Security Guide*).

NIS

Users are administered centrally on an NIS server for all systems in the network. See Section "Configuring NIS Clients" (Chapter 3, *Using NIS*, ↑*Security Guide*) for more information.

Windows Domain

SMB authentication is often used in mixed Linux and Windows networks. and Section "Configuring a Linux Client for Active Directory" (Chapter 5, *Active Directory Support*, ↑*Security Guide*).

Along with user administration via *LDAP* and *NIS*, you can use Kerberos authentication. To use it, select *Set Up Kerberos Authentication*. For more information on Kerberos, refer to Chapter 6, *Network Authentication with Kerberos* (↑*Security Guide*).

1.11.2 Password for the System Administrator `root`

If you have not chosen *Use this Password for the System Administrator* in the previous step, you will be prompted to enter a Password for the System Administrator `root`. Otherwise this configuration step is skipped.

`root` is the name of the superuser, or the administrator of the system. Unlike regular users (who may or may not have permission to access certain areas or execute certain commands on the system), `root` has unlimited access to change the system configuration, install programs, and set up new hardware. If users forget their passwords or have other problems with the system, `root` can help. The `root` account should only be used for system administration, maintenance, and repair. Logging in as `root` for daily work is rather risky: a single mistake could lead to irretrievable loss of system files.

For verification purposes, the password for `root` must be entered twice. Do not forget the `root` password. Once entered, this password cannot be retrieved.

The `root` can be changed any time later in the installed system. To do so run YaST and start *Security and Users > User and Group Management*.

WARNING: The root User

The user `root` has all the permissions needed to make changes to the system. To carry out such tasks, the `root` password is required. You cannot carry out any administrative tasks without this password.

1.12 Installation Settings

On the last step before the real installation takes place, you can alter installation settings suggested by YaST and also review the settings you made so far. To modify the suggestions, either click *Change* and select the category to change or click on one of the headlines. After configuring any of the items presented in these dialogs, you are always returned to the Installation Settings window, which is updated accordingly.

Figure 1.9 *Installation Settings*

TIP: Restoring the Default Settings

You can reset all changes to the defaults by clicking *Change > Reset to Defaults*. YaST then shows the original proposal again.

1.12.1 *Partitioning*

Review and, if necessary, change the partition setup you configured earlier. Modifying the partition setup opens the Expert Partitioner described in Section "Using the YaST Partitioner" (Chapter 2, *Advanced Disk Setup*, ↑*Reference*).

1.12.2 *Booting*

YaST proposes a boot configuration for your system. Other operating systems found on your computer, such as Microsoft Windows or other Linux installations, will automatically be detected and added to the boot loader. However, openSUSE will be booted by default. Normally, you can leave these settings unchanged. If you need a custom setup, modify the proposal for your system. For information, see Section "Con-

figuring the Boot Loader with YaST" (Chapter 17, *The Boot Loader GRUB*, ↑*Reference*).
The boot method should only be changed by experienced users.

1.12.3 *Software*

openSUSE contains a number of software patterns for various application purposes.
Click *Software* to start the pattern selection and modify the installation scope accord-
ing to your needs. Select your pattern from the list and see a pattern description in
the right part of the window. Each pattern contains a number of software packages
needed for specific functions (e.g. Multimedia or Office software). For a more detailed
selection based on software packages to install, select *Details* to switch to the YaST
Software Manager.

You can also install additional software packages or remove software packages from
your system at any later time with the YaST Software Manager. For more information,
refer to Chapter 3, *Installing or Removing Software* (↑*Reference*).

Figure 1.10   *Software Selection and System Tasks*
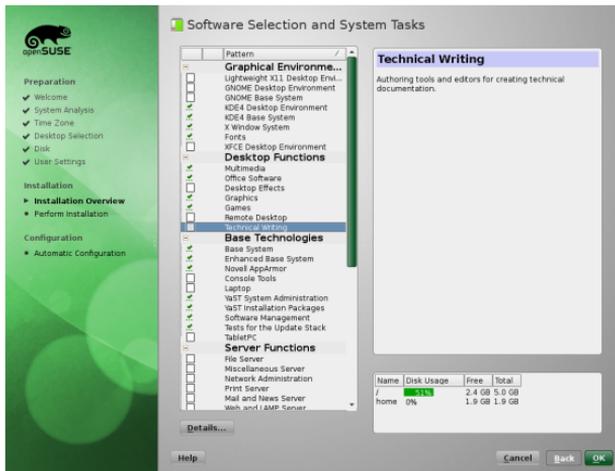
1.12.4 *Locale Settings*

Here you can change the system *Language* and *Keyboard Layout* you defined in the
first step of the installation. It is also possible to add additional languages. To adjust
the system language settings, select *Language*. Select a language from the list. The
primary language is used as the system language. You can also adapt keyboard
layout and time zone to the primary language if the current settings differ. *Details*
lets you modify language settings for the user `root`, set `UTF-8` support, or further
specify the language (e.g. select South African English).

Choose secondary languages to be able to switch to one of these languages at any time without having to install additional packages. For more information, see Chapter 9, *Changing Language and Country Settings with YaST* (↑*Reference*).

To change the keyboard layout, select *Keyboard Layout*. By default, the layout corresponds to the language chosen for installation. Select the keyboard layout from the list. Use the *Test* field at the bottom of the dialog to check if you can enter special characters of that layout correctly. Options to fine-tune various settings are available under *Expert Mode*. When finished, click *Accept* to return to the installation summary.

1.12.5 Time Zone

Adjust time zone and clock settings here. Provided a network is configured, you can also set up a Network Time Protocol (NTP) client that automatically synchronizes your computer with a time server. This is the same configuration as shown earlier in Section 1.8, "Clock and Time Zone" (page 13).

1.12.6 User Settings

Change the current *User* settings and change or set the *Root Password* here. This is the same configuration as shown earlier in Section 1.11, "Create New User" (page 17).

1.12.7 Default Runlevel

openSUSE can boot to different runlevels. Normally, there should be no need to change anything here, but if necessary set the default runlevel with this dialog. Refer to Section "Configuring System Services (Runlevel) with YaST" (Chapter 16, *Booting and Configuring a Linux System*, ↑*Reference*) for more information about runlevel configuration.

1.12.8 System

This dialog presents all the hardware information YaST could obtain about your computer. When called, the hardware detection routine is started. Depending on your system, this may take some time. Select any item in the list and click *Details* to see detailed information about the selected item. Use *Save to File* to save a detailed list to either the local file system or a floppy. Advanced users can also change the PCI ID setup and Kernel Settings by choosing *Kernel Settings*.

1.12.9 Installation from Images

Installing from images considerably speeds up the installation. Images contain compressed snapshots of installed systems matching your selection of patterns. Packages not contained in the images deployed will be installed conventionally.

Unless your custom software selection does not match any of the available images, this feature is *Enabled* by default. In case of problems, *Disable* it for debugging purposes.

1.12.10 *Firewall*

By default SuSEfirewall2 is enabled on all configured network interfaces. To globally disable the firewall for this computer, click on *Disable*. If the firewall is enabled, you may *Open* the SSH port in order to allow remote connections via secure shell.

1.13 Performing the Installation

After configuring all installation settings, click *Install* in the Installation Settings window to start the installation. Some software may require a license confirmation. If your software selection includes such software, license confirmation dialogs are displayed. Click *Accept* to install the software package. When not agreeing to the license, click *I Disagree* and the software package will not be installed. In the dialog that follows, confirm with *Install* again.

The installation usually takes between 15 and 30 minutes, depending on the system performance and the selected software scope. After having prepared the hard disk, having saved and restored the user settings, and having deployed the installation images, the software installation starts. During this procedure a slide show introduces the features of openSUSE. Choose *Details* to switch to the installation log or *Release Notes* to read important up-to-date information which was not available when the manuals were printed.

NOTE: Release Notes

The release notes that can be viewed during this step are the ones printed on the installation CD. A newer version may be available on the Internet. When manually configuring network and Internet access as described in Section "Network Configuration" (page 24), the latest version of the release notes will be displayed at the end of the installation.

After the software installation has completed, the basic system is set up. Among others, "Finishing the Basic Installation" includes installing the boot manager, initializing fonts and more. Next YaST boots into the new Linux system to start the system configuration.

TIP: Existing SSH Host Keys

If you install openSUSE on a machine with existing Linux installations, the installation routine automatically imports the SSH host key with the most recent access time from an existing installation.

1.14 Configuration of the Installed System

The system is now installed, but not yet configured for use. The hardware, the network and other services are not yet set up. If you follow the default installation path, the system will be automatically configured. If you have deselected the *Automatic Configuration*, the manual system configuration starts.

1.14.1 Automatic System Configuration

Having rebooted, the system starts the Automatic Configuration. This routine attempts to configure your network and Internet access and sets up your hardware. This process does not need any interaction. You can change the settings made by Automatic Configuration at any time on the installed system with YaST. Continue with Section 1.15, "Graphical Login" (page 27).

1.14.2 Manual System Configuration

Having rebooted, the system starts the manual configuration. If the configuration fails at one of the steps of this stage, it restarts and continues from the last successful step.

Hostname and Domain Name

The hostname is the computer's name in the network. The domain name is the name of the network. A hostname and domain are proposed by default. If your system is part of a network, the hostname has to be unique in this network, whereas the domain name has to be common to all hosts on the network.

In many networks, the system receives its name over DHCP. In this case it is not necessary to modify the proposed hostname and domain name. Select *Change Hostname via DHCP* instead. To be able to access your system using this hostname, even when it is not connected to the network, select *Assign Hostname to Loopback IP*. Do n ot enable this option when your machine provides network services. If you often change networks without restarting the desktop environment (e.g. when switching between different WLANs), do not enable this option either, because the desktop system may get confused when the hostname in `/etc/hosts` changes.

To change hostname settings at any time after installation, use YaST *Network Devices > Network Settings*. For more information, see Section "Configuring the Network Card with YaST" (Chapter 21, *Basic Networking*, ↑*Reference*).

Network Configuration

If you are installing openSUSE on a laptop computer, *Interfaces Controlled by NetworkManager* is enabled. NetworkManager is a tool that enables automatic connection with minimal user intervention. It is ideal for WLAN and mobile computing. If you want to use the traditional method without NetworkManager, click *Disable Network-Manager*. Find detailed information about NetworkManager in Chapter 5, *Using NetworkManager* (page 55). If you are installing openSUSE on any other type of machine, the traditional method without NetworkManager is selected by default. This configuration step also lets you configure the network devices of your system and make security settings, for example, for a firewall or proxy.

The network can also be configured after the system installation has been completed. If you skip it now, your system is left offline unable to retrieve any available updates. To configure your network connection later, select *Skip Configuration* and click *Next*.

The following network settings can be configured in this step:

General Network Settings

Enable or disable the use of NetworkManager as described above. Also change the IPv6 support here. By default the IPv6 support is enabled. To disable it, click *Disable IPv6*. For more information about IPv6, see Section "IPv6—The Next Generation Internet" (Chapter 21, *Basic Networking*, ↑*Reference*).

Firewall

By default SuSEfirewall2 is enabled on all configured network interfaces. To globally disable the firewall for this computer, click on *Disable*. If the firewall is enabled, you may *Open* the SSH port in order to allow remote connections via secure shell. To open the detailed firewall configuration dialog, click on *Firewall*. See Section ↑"Configuring the Firewall with YaST" (Chapter 14, *Masquerading and Firewalls*, ↑*Security Guide*) for detailed information.

Network Interfaces

All network cards detected by YaST are listed here. If you have already set up a network connection during the installation (as described in Section "Network Setup" (page 12)) the card used for this connection is listed as *Configured*. A click on *Network Interfaces* opens the *Network Settings* dialog, where you can change existing configurations, set up networks cards not configured yet, or add and configure additional cards. See Section 4.2, "Internet Connection Via Network" (page 53) for checklists of configuration requirements for the various connection types and Section "Configuring the Network Card with YaST" (Chapter 21, *Basic Networking*, ↑*Reference*) for configuration details.

DSL Connections, *ISDN Adapters*, and *Modems*

If your computer is equipped with an internal DSL modem, an internal ADSL Fritz Card, an ISDN card or a modem, clicking on the respective headline opens the configuration dialog. Refer to Chapter 4, *Accessing the Internet* (page 51) for further information.

VNC Remote Administration

To enable remote administration of your machine via VNC, click *VNC Remote Administration*. Choose *Allow Remote Administration* in the following dialog and adjust your firewall settings accordingly.

Proxy

If you have a proxy server controlling the Internet access in your network, configure the proxy URLs and authentication details in this dialog.

TIP: Resetting the Network Configuration to the Default Values

Reset the network settings to the original proposed values by clicking *Change > Reset to Defaults*. This discards any changes made.

Test Internet Connection

After having configured a network connection, you can test it. For this purpose, YaST establishes a connection to the openSUSE server and downloads the latest release notes. Read them at the end of the installation process. A successful test is also a

prerequisite for the automatic addition of the default repositories and for updating online.

If you have multiple network interfaces, verify that the desired card is used to connect to the Internet. If not, click *Change Device*.

To start the test, select *Yes, Test Connection to the Internet* and click *Next*. In the following dialog, view the progress of the test and the results. Detailed information about the test process is available via *View Logs*. If the test fails, click *Back* to return to the network configuration to correct your entries.

Proceed with *Next*. If the test was successful, the official software repositories for openSUSE and the update repository will be configured. Downloading the repository data for the first time may take some time.

If you do not want to test the connection at this point, select *No, Skip This Test* then *Next*. This also skips downloading the release notes, and updating online. These steps can be performed any time after the system has been initially configured.

Online Update

If an Internet connection has been established, and updates are available, select whether to perform a YaST online update. If there are any patched packages available on the servers, download and install them now to fix known bugs or security issues. For detailed instructions see Chapter 4, *YaST Online Update* (↑*Reference*). Directives on how to perform an online update in the installed system are available at Section 3.3, "Keeping the System Up-to-date" (page 44) or Chapter 4, *YaST Online Update* (↑*Reference*). This step is skipped if no updates are available or no Internet connection has been established. Patches fixing security issues and recommended patches applying to your installation are automatically preselected. Click *Accept* to install them and *Next* to proceed with the system configuration.

IMPORTANT: Downloading Software Updates

The download of updates might take quite some time, depending on the bandwidth of the Internet connection and the size of the update files. In case the patch system itself is updated, the online update will restart and download more patches after the restart. If the kernel was updated, the system will reboot before completing the configuration.

New Local User

If no local user was created in phase one, you can create one in this dialog—otherwise this step is skipped. To create more users, manage groups, modify defaults for new users and set up network authentication, launch *User Management*. Refer to Chapter 8, *Managing Users with YaST* (↑*Reference*) for more information about user management. To skip this step, click *Next* without entering any data.

Release Notes

After completing the user authentication setup, YaST displays the release notes. Reading them is recommended, because they contain important up-to-date information which was not available when the manuals were printed. If you successfully tested the Internet connection, read the most recent version of the release notes, as fetched from openSUSE's servers. Use *Miscellaneous > Release Notes* in YaST or start the SUSE Help Center to view the release notes after installation.

Hardware Configuration

At the end of the installation, YaST opens a dialog for the configuration of a printer, the sound system and TV cards. Click the individual components to start the hardware configuration. For the most part, YaST detects and configures the devices automatically.

You can skip any peripheral devices and configure them later, as described in Chapter 2, *Setting Up Hardware Components with YaST* (page 29). To skip the configuration, select *Skip Configuration* and click *Next*.

TIP: Resetting Hardware Configuration to the Default Values

You can cancel any changes to the hardware configuration by clicking *Change > Reset to Defaults*. YaST then shows the original proposal again.

Installation Completed

After a successful installation, YaST shows the Installation Completed dialog. In this dialog, select whether to clone your newly installed system for AutoYaST. To clone your system, select *Clone This System for AutoYaST*. The profile of the current system is stored in `/root/autoyast.xml`.

AutoYaST is a system for installing one or more openSUSE systems automatically without user intervention. AutoYaST installations are performed using a control file with installation and configuration data. Finish the installation of openSUSE with *Finish* in the final dialog.

1.15 Graphical Login

openSUSE is now fully installed and configured. Unless you enabled the automatic login function or customized the default runlevel, you should see the graphical login on your screen in which to enter a username and password to log into the system. On single user systems with automatic login enabled, the desktop starts automatically.

For a short introduction to the KDE or GNOME desktop environments, refer to the *GNOME Quick Start* (↑*GNOME Quick Start*) and the *KDE Quick Start* (↑*KDE Quick Start*). Find detailed information about both desktop environments and about the applications to run on KDE or GNOME in the *KDE User Guide* (↑*KDE User Guide*) and

the *GNOME User Guide* (↑*GNOME User Guide*). These manuals can be accessed via the *Help* function in both KDE and GNOME.

2 Setting Up Hardware Components with YaST

YaST allows you to configure hardware items at installation time as well as on an already-installed system. Configure audio hardware, printers or scanner support or learn which hardware components are connected to your computer by using the YaST Hardware Information module.

TIP: Graphics card, monitor, mouse and keyboard settings

Graphics card, monitor, mouse and keyboard can be configured with either KDE or GNOME tools.

2.1 Hardware Information

Use the YaST hardware information module if you want to know more about your hardware or if you need to find out details like vendor and model of a certain piece of hardware to be able to properly configure it.

1 Start YaST and click *Hardware* > *Hardware Information*. Hardware probing starts immediately and it will take some time until you see the hardware information tree in a separate window.

2 In the hardware information tree recursively click on the entries to expand the information about a specific device.

3 Click *Save to File...* to save the output to a file.

4 Click *Close* to leave the hardware information overview.

2.2 Setting Up Sound Cards

YaST detects most sound cards automatically and configures them with the appropriate values. If you want to change the default settings, or need to set up a sound card that could not be configured automatically, use the YaST sound module. There, you can also set up additional sound cards or switch their order.

To start the sound module, start YaST and click *Hardware* > *Sound*. Alternatively, start the *Sound Configuration* dialog directly by running `yast2 sound &` as user root from a command line.

The dialog shows all sound cards that are already configured.

If YaST cannot detect your sound card automatically, configure it manually as described in Procedure 2.1, "Configuring a New Sound Card" (page 30). For this, you need to know your sound card vendor and model. If in doubt, refer to your sound card documentation for the required information. During configuration, you can choose between various setup options:

Quick Automatic Setup
> You are not required to go through any of the further configuration steps—the sound card is configured automatically. You can set the volume or any options you want to change later.

Normal Setup
> Allows you to adjust the output volume and play a test sound during the configuration.

Advanced setup with possibility to change options
> For experts only. Allows you to customize all parameters of the sound card.

IMPORTANT: Advanced Configuration

Only use this option if you know exactly what your are doing. Otherwise leave the parameters untouched and use the normal or the automatic setup options.

Procedure 2.1 *Configuring a New Sound Card*

1 In the YaST *Sound Configuration* dialog, click *Add*.

2 Select your sound card vendor and model and click *Next*.

For a reference list of sound cards supported by ALSA with their corresponding sound modules, see http://www.alsa-project.org/main/index.php/Matrix: Main.

3 Choose one of the setup options and click *Next*.

4 If you have chosen *Normal Setup*, you can now *Test* your sound configuration and make adjustments to the volume. You should start at about ten percent volume to avoid damage to your hearing or the speakers.

5 If all options are set according to your wishes, click *Next*.

The *Sound Configuration* dialog shows the newly configured or modified sound card.

6 To remove a sound card configuration that you no longer need, select the respective entry and click *Delete*.

7 Click *OK* to save the changes and leave the YaST sound module.

Procedure 2.2   *Modifying Sound Card Configurations*

1 To change the configuration of an individual sound card (for experts only!), select the sound card entry in the *Sound Configuration* dialog and click *Edit*.

This takes you to the *Sound Card Advanced Options* where you can fine-tune a number of parameters. For more information, click *Help*.

2 To adjust the volume of an already configured sound card or to test the sound card, select the sound card entry in the *Sound Configuration* dialog and click *Other*. Select the respective menu item.

3 For playback of MIDI files, select *Other* > *Start Sequencer*.

4 When a supported sound card is detected (like a Creative `Soundblaster Live`, `Audigy` or `AWE` sound card), you can also install SoundFonts for playback of MIDI files:

4a Insert the original driver CD-ROM into your CD or DVD drive.

4b Select *Other* > *Install SoundFonts* to copy SF2 SoundFonts™ to your hard disk. The SoundFonts are saved in the directory `/usr/share/sfbank/ creative/`.

5 If you have configured more than one sound card in your system you can adjust the order of your sound cards. To set a sound card as primary device, select the sound card in the *Sound Configuration* and click *Other* > *Set as the Primary Card*. The sound device with index `0` is the default device and thus used by the system and the applications.

6 To enable or disable the PulseAudio sound system, click *Other* > *PulseAudio Configuration*. If enabled, PulseAudio daemon is used to play sounds. Disable *PulseAudio Support* in case you want to use something else system-wide.

The volume and configuration of all sound cards are saved when you click *OK* and leave the YaST sound module. The mixer settings are saved to the file `/etc/asound .conf` and the ALSA configuration data   is appended to the end of the files `/etc/ modprobe.d/sound` and `/etc/sysconfig/hardware`.

2.3 Setting Up a Printer

YaST can be used to configure a local printer that is directly connected to your machine (normally with USB or parallel port) and to set up printing with network printers.

It is also possible to share printers over the network. Further information about printing (general information, technical details, and troubleshooting) is available in Chapter 11, *Printer Operation* (↑*Reference*).

In YaST, click *Hardware > Printer* to start the printer module. By default it opens in the *Printer Configurations* view, displaying a list of all printers that are available and configured. This is especially useful when having access to a lot of printers via the network. From here you can also *Print a Test Page* and configure local printers.

2.3.1 Configuring Local Printers

Usually a local USB printer is automatically detected. There are two possible reasons why a USB printer is not automatically detected:

- The USB printer is switched off.

- The communication between printer and computer is not possible. Check the cable and the plugs to make sure that the printer is properly connected. If this is the case, the problem may not be printer-related, but rather a USB related problem.

Configuring a printer is basically a three-step process. First specify the connection type, then choose a driver, and name the printing queue for this setup.

For many printer models, several drivers are available. When configuring the printer, YaST defaults to the one marked `recommended` as a general rule. Normally it is not necessary to change the driver—the `recommended` one should produce the best results. However, if you want a color printer to print only in black and white, it is most convenient to use a driver that does not support color printing, for example. If you experience performance problems with a PostScript printer when printing graphics, it may help to switch from a PostScript driver to a PCL driver (provided your printer understands PCL).

If no driver for your printer is listed, you can try to select a generic driver with an appropriate standard language from the list. Refer to your printer's documentation to find out which language (the set of commands controlling the printer) your printer understands. If this does not work, refer to Section "Adding Drivers with YaST" (page 33) for another possible solution.

A printer is never used directly, but always through a print queue. This ensures that simultaneous jobs can be queued and processed one after the other. Each printer queue is assigned to a specific driver, and a printer can have multiple queues. This makes it possible to set up a second queue on a color printer that prints black and white only, for example. Refer to Section "The Workflow of the Printing System" (Chapter 11, *Printer Operation*, ↑*Reference*) for more information about print queues.

Procedure 2.3   *Adding a New Local Printer*

1 Start the YaST printer module with *Hardware > Printer*

2 Click *Add* in the *Printer Configurations* screen

3 If your printer is already listed under `Specify the Connection`, proceed with the next step. Otherwise, try to *Detect More* or start the *Connection Wizard*.

4 Enter the vendor name and the model name into the input box under `Find and Assign a Driver` and click *Search for*.

5 Choose the driver marked as recommended that best matches your printer. If no suitable drivers is displayed

    5a check your search term

    5b broaden your search by clicking *Find More*

    5c add a driver as described in Section "Adding Drivers with YaST" (page 33)

6 Specify the `Default paper size`

7 Enter a unique name for the printer queue in the *Set Arbitrary Name* field.

8 The printer is now configured with the default settings and ready to use. Click *OK* to return to the *Printer Configurations* view. The newly configured printer is now visible in the printers list.

Adding Drivers with YaST

If no suitable driver is available in the *Find and Assign a Driver* dialog when adding a new printer, no PPD (PostScript Printer Description) file for your model is available. For more information about PPD files, refer to Section "Installing the Software" (Chapter 11, *Printer Operation*, ↑*Reference*).

Get PPD files directly from your printer vendor or from the driver CD of a PostScript printer. For details, see Section "No Suitable PPD File Available for a PostScript Printer" (Chapter 11, *Printer Operation*, ↑*Reference*). Conversely, you can also find PPD files at `http://www.linuxfoundation.org/en/OpenPrinting/`, the "OpenPrinting.org printer database". When downloading PPD files from OpenPrinting.org, keep in mind that it always shows the latest Linux support status, which is not necessarily met by openSUSE.

Procedure 2.4   *Adding a PPD file*

1 Start the YaST printer module with *Hardware > Printer*

2 Click *Add* in the *Printer Configurations* screen

3 Click *Driver Packages* in the `Find and Assign a Driver` section

4 Enter the full path to the PPD file into the input box under `Make a Printer Description File Available` or choose the file from a dialog box by clicking on *Browse*

5 Click *OK* to return to the `Add New Printer Configuration` screen.

6 In order to directly use this PPD file, proceed as described in Procedure 2.3, "Adding a New Local Printer" (page 32). Otherwise, click *Cancel*.

Editing a Local Printer Configuration

By editing an existing configuration for a local printer you can not only change basic settings as connection type and driver, but also adjust the default settings for paper size, resolution, media source, etc. You can change the identifier of the printer by altering the printer descriptions.

Procedure 2.5 *Editing a Local Printer*

1 Start the YaST printer module with *Hardware > Printer*

2 In the *Printer Configurations* screen, choose a local printer from the list and click *Edit*.

3 Change the connection type or the driver as described in Procedure 2.3, "Adding a New Local Printer" (page 32). This should only be necessary in case you have problems with the current configuration.

4 Make this printer the default by checking *Default Printer*.

5 Adjust the default settings by clicking *All Options for the Current Driver*. To change a setting, expand the list of options by clicking the relative + sign. Change the default by clicking on an option. Apply your changes by clicking *OK*

2.3.2 Configuring Printing via the Network with YaST

Network printers are not detected automatically. They must be configured manually using the YaST printer module. Depending on your network setup, you can print to a print server (CUPS, LPD, SMB, or IPX) or directly to a network printer (preferably via TCP). Access the configuration view for network printing by choosing *Printing via Network* from the left pane in the YaST printer module.

Using CUPS

In a Linux environment CUPS is usually used to print via the network. The simplest setup is to only print via a single CUPS server which can directly be accessed by all clients. Printing via more than one CUPS server requires a running local CUPS daemon that communicates with the remote CUPS servers.

Procedure 2.6   *Printing via a Single CUPS server*

1 Start the YaST printer module with *Hardware > Printer*

2 Launch the *Print via Network* screen from the left pane.

3 Check *Do All Your Printing Directly via One Single CUPS Server* and specify the name or IP address of the server.

4 Click *Test Server* to make sure you have chosen the correct name or IP address.

5 Click OK to return to the *Printer Configurations* screen. All printers available via the CUPS server are now listed.

Procedure 2.7   *Printing via multiple CUPS servers*

1 Start the YaST printer module with *Hardware > Printer*

2 Launch the *Print via Network* screen from the left pane.

3 Check *Accept Printer Announcements from CUPS Servers*

4 Specify which servers to use under `General Settings`. You may accept connections from all networks available, from the local network, or from specific hosts. If you choose the latter option, you need to specify the hostnames or IP addresses, as well.

5 Confirm by clicking *OK* and then *Yes* when asked to start a local CUPS server. After the server has started you will return to the *Printer Configurations* screen. Click *Refresh list* to see the printers detected by now. Click this button again, in case more printer are to be available.

Using Print Servers other than CUPS

If your network offers print services via print servers other than CUPS, start the YaST printer module with *Hardware > Printer* and launch the *Print via Network* screen from the left pane. Start the *Connection Wizard* and choose the appropriate *Connection* type. Ask your network administrator for details on configuring a network printer in your environment.

2.3.3 Sharing Printers Over the Network

Printers managed by a local CUPS daemon can be shared over the network and so turn your machine into a CUPS server. Usually you share a printer by enabling CUPS' so-called "browsing mode". If browsing is enabled, the local printer queues are made available on the network for listening to remote CUPS daemons. It is also possible to set up a dedicated CUPS server that manages all printing queues and can directly be accessed by remote clients. In this case it is not necessary to enable browsing.

Procedure 2.8   *Sharing Printers*

1 Start the YaST printer module with *Hardware > Printer*

2 Launch the *Share Printers* screen from the left pane.

3 Select *Allow Remote Access*. For more detailed configuration, additional options are available:

- Check *For computers within the local network* and enable browsing mode by also checking *Publish printers by default within the local network*.

- *Add* the network interface to be used by the CUPS server. If you want to share your printers via specified network interfaces, add those in the input box below.

- In case you like to restrict access to your CUPS server to certain networks or IP addresses, specify these via the two input boxes.

4 Click *OK* to restart the CUPS server and return to the *Printer Configurations* screen.

5 Regarding CUPS and firewall settings, see http://en.opensuse.org/SDB:CUPS _and_SANE_Firewall_settings.

2.4 Setting Up a Scanner

You can configure a USB or SCSI scanner with YaST. The sane-backends package contains hardware drivers and other essentials needed to use a scanner. Scanners connected to a parallel port cannot be configured with YaST. If you own a HP All-In-One device, see Section 2.4.1, "Configuring an HP All-In-One Device" (page 37), instructions on how to configure a network scanner are available at Section 2.4.3, "Scanning over the Network" (page 37).

Procedure 2.9   *Configuring a USB or SCSI Scanner*

1 Connect your USB or SCSI scanner to your computer and turn it on.

2 Start YaST and select *Hardware > Scanner*. YaST builds the scanner database and tries to detect your scanner model automatically.

If a USB or SCSI scanner is not properly detected, try *Other > Restart Detection*.

3 To activate the scanner select it from the list of detected scanners and click *Edit*.

4 Choose your model form the list and click *Next* and *Finish*.

5 Use *Other > Test* to make sure you have chosen the correct driver.

6 Leave the configuration screen with *OK*.

2.4.1 Configuring an HP All-In-One Device

An HP All-In-One device can be configured with YaST even if it is connected to the parallel port or is made available via the network. If you own a USB HP All-In-One device, start configuring as described in Procedure 2.9, "Configuring a USB or SCSI Scanner" (page 36). If it is detected properly and the *Test* succeeds, it is ready to use.

If your USB device is not properly detected, or your HP All-In-One device is connected to the parallel port or the network, run the HP Device Manager:

1 Start YaST and select *Hardware* > *Scanner*. YaST loads the scanner database.

2 Start the HP Device Manager with *Other* > *Run hp-setup* and follow the on-screen instructions. After having finished the HP Device Manager, the YaST scanner module automatically restarts the auto detection.

3 Test it by choosing *Other* > *Test*.

4 Leave the configuration screen with *OK*.

2.4.2 Sharing a Scanner over the Network

openSUSE allows the sharing of a scanner over the network. To do so, configure your scanner as follows:

1 Configure the scanner as described in Section 2.4, "Setting Up a Scanner" (page 36).

2 Choose *Other* > *Scanning via Network*.

3 Enter the hostnames of the clients (separated by a comma) that should be allowed to use the scanner under *Server Settings* > *Permitted Clients for saned* and leave the configuration dialog with *OK*.

2.4.3 Scanning over the Network

To use a scanner that is shared over the network, proceed as follows:

1 Start YaST and select *Hardware* > *Scanner*.

2 Open the network scanner configuration menu by *Other* > *Scanning via Network*.

3 Enter the hostname of the machine the scanner is connected to under *Client Settings* > *Servers Used for the net Metadriver*

4 Leave with *OK*. The network scanner is now listed in the Scanner Configuration window and is ready to use.

3 Installing, Removing and Updating Software

Change the software collection of your system using YaST. In YaST's software management tool search for software components you want to add or remove. YaST resolves all the dependencies for you. Keep your system up-to-date by managing software updates with openSUSE Updater.

3.1 Installing Software

Software is available via RPM packages. Each package contains the program itself, the configuration files, and additional documentation. You can also install software patterns. If you want the program (package) to be added to the system, proceed as follows (if you have KDE running—for GNOME see below):

Procedure 3.1   *Installing Single Software Packages under KDE*

1 Start YaST and click *Software > Software Management* to start the package manager.

2 Enter the name of the software you want to install in the search field (for example, `jhead`, a tool for manipulating JPEG meta data) and press [Enter].

If you do not now the package name of the desired software, the *RPM Groups* view may help. The software packages are sorted by functionality in this view. `jhead`, for example, can be found under *Productivity > Graphics*.

3 The packages found are listed in the right pane. Select a package for installation by right clicking it and choosing *Install*. If this option is not available, the package is either already installed or marked as taboo. The package status is indicated by the symbol in front of the package name—hit [Shift] + [F1] for help.

4 In order to select more packages, repeat the steps mentioned above. Once you are finished click *Accept* to start the installation.

5 Certain packages are dependent on other packages, such as shared libraries. YaST automatically resolves these dependencies. In this case, a list of additional packages that have automatically been chosen for installation is presented. Accept them by clicking *Continue*.

On the other hand, some packages cannot co-exist with others on the system. In this case a list of packages that have automatically been chosen for deletion is presented. Accept them by clicking *Continue*.

If your choice results in a dependency conflict that cannot be automatically solved, you need to manually solve these conflicts as described in Section "Checking Software Dependencies" (Chapter 3, *Installing or Removing Software*, ↑*Reference*).

6 Once all selected packages are installed, the YaST package manager automatically terminates.

Procedure 3.2 *Installing Single Software Packages under GNOME*

1 Start YaST and click *Software > Software Management* to start the package manager.

2 From the grouping menu in the upper left corner, select *Groups*. Choose *All Packages* from the left pane. Enter the name of the software you want to install in the search field (for example, jhead, a tool for manipulating JPEG meta data).

3 Right-click the package you want to install in the main pane and click *Install*.

4 In order to select more packages, repeat the previous steps. Once you are finished click *Apply* twice to start the installation.

5 Certain packages are dependent on other packages, such as shared libraries. YaST automatically resolves these dependencies. In this case, a list of additional packages that have automatically been chosen for installation is presented in the *Summary Of Changes* window. Accept them by clicking *Apply*.

On the other hand, some packages cannot co-exist with others on the system. In this case a list of packages that have automatically been chosen for deletion is presented. Accept them by clicking *Apply*.

If your choice results in a dependency conflict that cannot be automatically solved, you will need to manually solve these conflicts as described in Section "Checking Software Dependencies" (Chapter 3, *Installing or Removing Software*, ↑*Reference*).

You can also install software patterns. Patterns are a set of packages consisting of tools for a specific task; for example, there is a pattern for "Technical Writing" that consists of XML tools, special editors, the LaTeX environment, and more. To install a pattern, proceed as follows (if you have KDE running—for GNOME see below):

Procedure 3.3 *Installing Software Patterns under KDE*

1 Start YaST and click *Software > Software Management* to start the YaST package manager.

2 From the *View* button in the upper left corner, select *Patterns*. Now you see various pattern sets listed in the left pane.
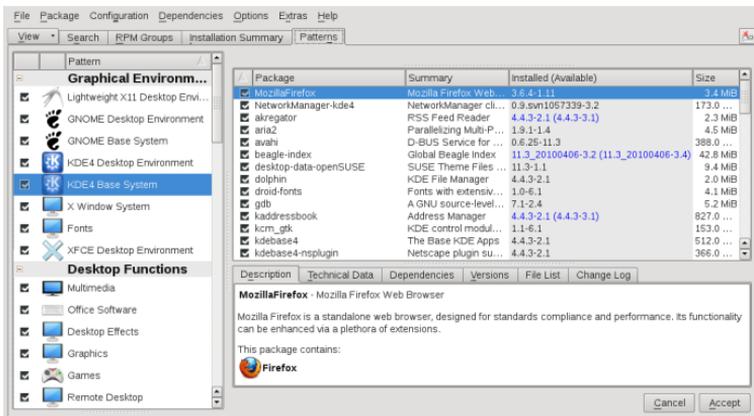
3 Click on a pattern name for a list of all packages included in the pattern. Choose one or more patterns for installation by clicking the checkbox on front of the pattern's name.

4 Click *Accept* to proceed.

5 Confirm the automatic changes that were made to resolve dependencies with *Continue*.

Procedure 3.4 *Installing Software Patterns under GNOME*

1 Start YaST and click *Software > Software Management* to start the package manager.
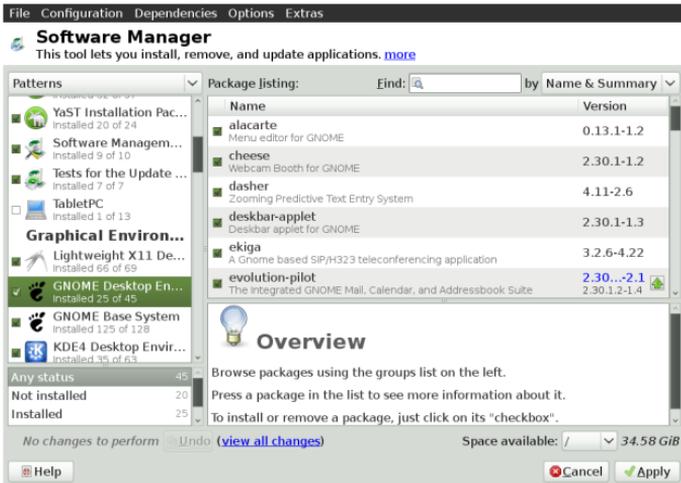
2 From the grouping menu in the upper left corner, select *Patterns*. Now you see various pattern sets listed in the left pane.

3 Clicking on a pattern's name, for example on *Technical Writing*, opens the list of packages it contains in the right pane. To install the pattern, right-click on the pattern's name and choose *Install*. Add or deselect single packages in the right pane.

4 Click *Apply* to install the listed packages.

3.2 Removing Software

If you want to remove software from the system, proceed as follows if you have KDE running (for GNOME see below):

Procedure 3.5   *Removing Software under KDE*

1 Start YaST and click *Software > Software Management* to start the package manager.

2 Search for single packages as described in Section 3.1, "Installing Software" (page 39).

3 Mark packages for deletion by right-clicking them and choosing *Delete*.

4 Click *Accept* to proceed.

5 If you have chosen to delete a package on which other packages are dependent, your choice results in a dependency conflict that cannot be automatically solved. In this case, it is recommended to not delete the package. You can try to manually solve this conflict as described in Section "Checking Software Dependencies" (Chapter 3, *Installing or Removing Software*, ↑*Reference*), but

be aware that each change you make may lead to other conflicts. To discard all changes you made, click *Cancel* two times and then *Abandon*.

With GNOME running, proceed as follows:

1 Start YaST and click *Software > Software Management* to start the package manager.

2 From the grouping menu in the upper left corner, select *Groups*. From the left pane choose *All Packages* from the top list and *Installed* from the bottom list. Search for single packages as described in Section 3.1, "Installing Software" (page 39).

3 Right-click the package you want to remove in the main pane and click *Remove*.
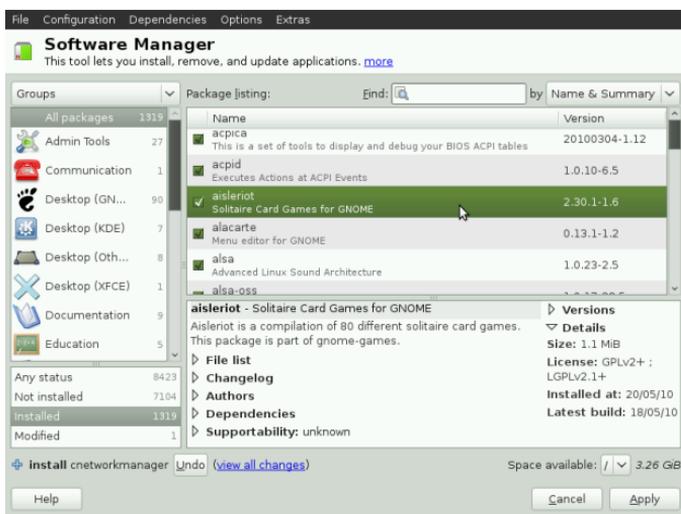
4 In order to select more packages, repeat the previous steps. Once you are finished click *Apply* to start the removal.

5 If you have chosen to delete a package on which other packages are dependent, your choice results in a dependency conflict that cannot be automatically solved. In this case, it is recommended to not delete the package. You can try to manually solve this conflict as described in Section "Checking Software Dependencies" (Chapter 3, *Installing or Removing Software*, ↑*Reference*), but be aware that each change you make may lead to other conflicts. To discard all changes you made, click *Undo* in the bottom status line.

3.3 Keeping the System Up-to-date

openSUSE offers a continuous stream of software security patches for your product. The update applet informs you about the availability of patches and lets you easily install them with just a few clicks.

3.3.1 Using the KDE Updater Applet

The openSUSE community also provides updates to newer versions of software packages. The updater applet optionally keeps a list of all programs installed on your system and informs you whenever newer versions are available. The updater can also search for and install new drivers when new hardware is attached.

NOTE: Patches vs. New Versions

The patches offered by openSUSE either fix security holes or serious errors in the software. A patch normally does not upgrade to a newer version and does not offer additional functionality. A new program version offered by the community may offer fixes, too, but primarily adds new functionality.

The updater applet resides in the system tray of your panel depicting the head of the SUSE mascot (Geeko), which changes depending on the availability and relevance of patches and the status of the updater. Whenever the icon changes, a tool tip displays the current status. The applet is started by default. To start it manually, choose *Applications > System > Desktop Applet > Online Update Applet* from the main menu. Alternatively, press [Alt] + [F2] and enter `kupdateapplet`.

The updater icon shows the following states:

Green Geeko Head with Green Arrows
   No patches available. When new versions are available, a tool tip appears when the mouse is moved over the icon.

Green Geeko Head with Yellow Arrows
   The updater applet is busy (for example checking for updates, installing software).

Red Triangle with Exclamation Mark
   Security patches available.

Orange Star with Arrow
   Recommended patches are available.

Blue square with Arrow
   Optional patches are available.

Yellow Triangle with Exclamation Mark
   An error has occurred.

Blue Circle with Question Mark
No update repository is defined. When you click the updater applet in this state, you are asked if you want to check for updates. If you agree, the YaST *Online Update Configuration* module is started.

Installing Patches

The Online Update Applet offers two modes for installing patches: the simple installation mode will automatically install all security and recommended patches, while the detailed mode lets you choose which patches to install.

Procedure 3.6   *Installing Patches: Simple Mode*

1 Whenever the update applet shows the availability of patches, left-click to open the software installation window.

2 Choose whether to skip the installation of patches that are recommended and those that require a restart. It is recommended to install both.

3 Click *Install* to start the patch installation.

4 In case you have started the patch installation for the first time, you will be asked to enter the `root` password in order to proceed. If you also check *Remember authorization* you will never be asked again to provide the password.

5 You can monitor the installation status by hovering the mouse over the update applet icon.

Figure 3.1   *KDE Updater Applet: Simple Update View*

Procedure 3.7   *Installing Patches: Detailed Mode*

1 Whenever the update applet shows the availability of patches, left-click to open the software installation window.

2 Click *Details* to make the updater show a detailed list of all patches, including the package name, the repository where the package comes from and whether a reboot is needed after installation or not.

3 Click on a patch name for more information. Select or de-select a patch by clicking its checkbox. By default, security and recommended patches are pre-selected.

4 Click *Install* to start the patch installation.

5 In case you have started the patch installation for the first time, you will be asked to enter the `root` password in order to proceed. If you also check *Remember authorization* you will never be asked again to provide the password.

6 The updater performs the installation of the patches. You can monitor the installation status by hovering the mouse over the update applet icon. See the system tray for status messages and a progress meter.

Figure 3.2 *KDE Updater Applet: Detailed Update View*
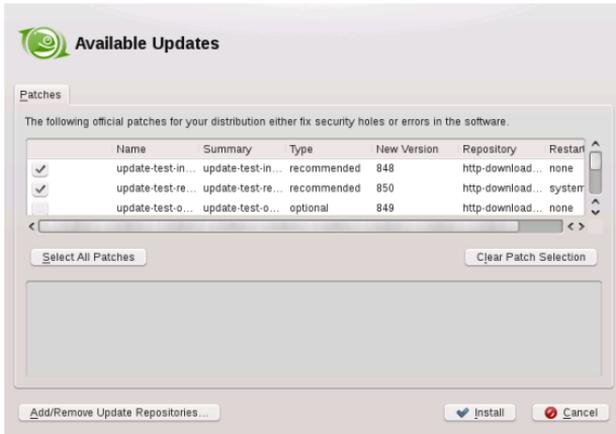
Installing New Software Versions

New software versions are available from software repositories provided by the openSUSE community. By default, no such repositories are preconfigured. To add a repository, right-click on the updater icon and choose *Add/Remove Update Sources*. You need to enter the `root` password to start the *Configured Software Repositories* module. A list from which you can choose popular community repositories is already preconfigured (*Add > Community Repositories*). For even more community repositories refer to http://en.opensuse.org/Additional_YaST_Package_Repositories.

WARNING: Trusting External Software Sources

Before adding external software repositories to your list of repositories make sure this repository can be trusted. openSUSE is not responsible for any potential problems arising from software installed from third party software repositories.

The updater applet does not monitor repositories for new software versions by default. To enable this feature, open the configuration window as described in Section "Configuring the Updater Applet" (page 47) and activate the check box *Show Available Upgrades When Back-End Provides Them*. When the updater icon indicates the

availability of updates, click on the icon to launch the software installation window. Click on *Details* and then on the *Upgrade* tab to open the list with new software versions. Either select single packages by activating the box in front of an entry, or click *Select All Packages*. *Install* starts the installation of the selected software packages. You will be prompted for the root password. See the system tray for status messages and a progress meter.

NOTE: The YaST Online Update

The YaST Online Update offers advanced features to customize the installation of software updates. Please refer to Chapter 4, *YaST Online Update* (↑*Reference*) for more information.

Configuring the Updater Applet

By default the updater is started on login, checks for updates every 24 hours, shows recurring notifications every 60 minutes and monitors the availability of patches. To change this behavior, right-click the applet icon and choose *Configure Applet*.

Figure 3.3   *KDE Updater Applet: Configuration*
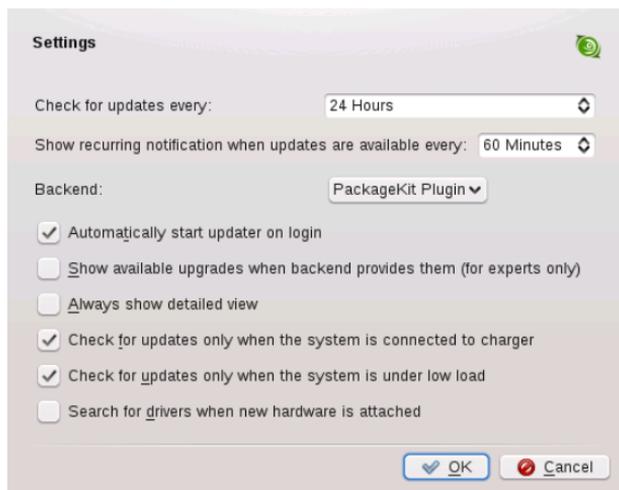
The configuration dialog also offers to change the following settings:

Check for Updates Every
  Choose the interval between checks for updates in hours.

Show Recurring Notification...
  Choose the interval between notifications in minutes.

Automatically Start Updater on Login
Start the applet automatically when the user logs in. Active by default.

Back-End
Choose between different back-ends. The *Package Kit Plugin* is used by default. If you prefer the *ZYpp Plugin*, make sure to install the package `kupdateapplet-zypp`.

Always Show Detailed View
Activate this option when you prefer the detailed patch view that lists all patches available with short summaries rather than the simple view.

Check for Updates only When System Is Connected to Charger
Prohibits checking for updates when running on batteries in order to save power. This option is activated by default but only affects mobile computers.

Check for Updates only When System Is under Low Load
Prohibits checking for updates when the system is under heavy load. This option is activated by default.

Search for Drivers When New Hardware is Attached
Provided a repository offering appropriate drivers, the updater can automatically install drivers for hardware such as USB devices.

3.3.2 Using the GNOME Update Applet

The update applet resides in the notification area of the panel. Its icon changes depending on the availability and relevance of patches and the status of the update. To invoke the applet manually, choose *Computer > More Applications > System > Software Update*.

NOTE: Icon visibility

By default, the update applet icon is only visible in the notification area, if patches are available.

Open box with a globe
The update is busy (for example checking for updates or installing software).

Red Star with Exclamation Mark
Security patches are available.

Orange Star with an Up Arrow
Important patches are available.

Yellow Star with a Down Arrow
Trivial patches are available.

Yellow Triangle with Exclamation Mark
An error has occurred.

Installing Software Updates

1 Whenever software updates are available, the applet icon appears in the panel.

2 Click on the applet icon to start the *Software Update* applet.

3 It is safe to install all preselected software updates in one go. If you have special demands, you can modify the preselected set by changing the state of the check boxes in the *Install* column.

Click *Install Updates*.

Figure 3.4   GNOME Software Update: Detailed Update View
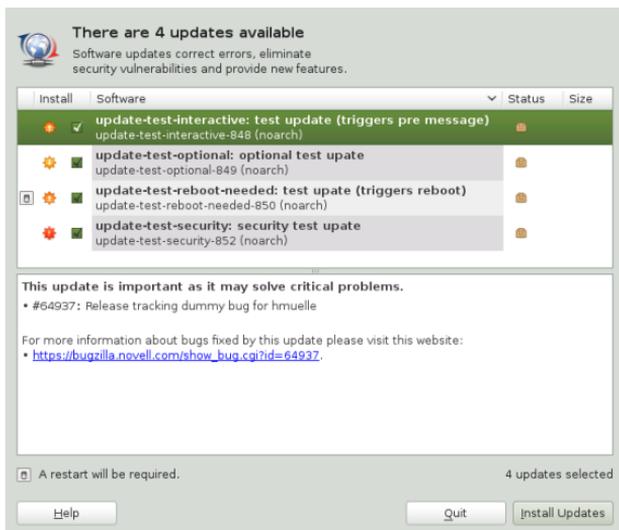
You will be prompted for the `root` password after having proceeded with *Install Updates*. The update applet performs the installation of the software updates. After having finished the installation, choose whether to *Install More Updates* or *Close* the *Software Update* applet.

NOTE: The YaST Online Update

The YaST Online Update offers advanced features to customize the installation of software updates. Please refer to Chapter 4, *YaST Online Update* (↑*Reference*) for more information.

Configuring the Software Update Applet

To configure the update applet, right-click the update icon in the panel and choose *Preferences*. The configuration dialog lets you modify the following settings:

Check for Updates
> Choose how often a check for updates is performed: *Hourly*, *Daily*, *Weekly*, or *Never*.

Automatically Install
> Configure whether patches are installed automatically or not (default). Automatic installation can be chosen for either security patches only or for all patches.

Figure 3.5   *GNOME Update Applet: Configuration*
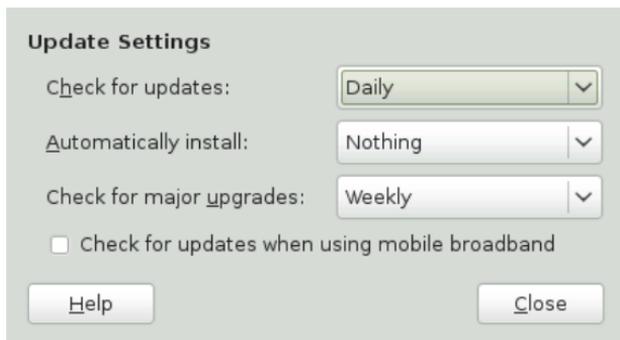
More options are configurable using **gconf-editor**: *apps > gnome-packagekit*.

4 Accessing the Internet

If you have chosen not to configure Internet access during the installation, you can perform this task at any time using YaST. How to configure your computer to access the Internet depends on your environment. If the computer you are installing is part of a network which already is connected to the Internet, the only thing to do is to link your machine to the network. If you are installing a machine that is directly connected to the Internet, the hardware and the access to the Internet Service Provider (ISP) needs to be set up.

Please refer to the checklists below to make sure you have all the necessary data ready before starting to configure the Internet access.

4.1 Direct Internet Connection

When your computer is directly connected to the Internet, you first need to configure the hardware that is used for this task. This can either be an internal device (such as an ISDN card) or an external device (for example, a modem). In most cases it is detected automatically.

Next, you need to enter the data provided by your ISP (such as login credentials, gateway, or name server, for example). You should have received a data sheet from your ISP where all the necessary data is listed.

If you have successfully configured your hardware and ISP data, use the NetworkManager for managing the internet connection. See Chapter 5, *Using NetworkManager* (page 55) for details.

4.1.1 Checklist DSL

There are different types of DSL devices available that use different point-to-point protocol (PPP) methods:

- a regular ethernet card connected to the external DSL modem uses PPP over Ethernet (PPPoE). In Austria the Point-to-Point Tunneling Protocol (PPTP) is used. With PPTP the external modem also has a static IP address.

- an internal DSL modem uses PPP over ATM (PPPoATM)

- an internal ADSL Fritz Card uses CAPI for ADSL

The DSL configuration module already contains the data for major ISPs in some countries. If your ISP is not listed, you will need to know how name resolving (DNS) and IP allocation is handled (in most cases this data is received automatically when

connecting). Regardless whether you choose an ISP from the list or add a custom provider, you need to enter at least your login and password.

For configuration details, refer to Section "DSL" (Chapter 21, *Basic Networking*, ↑*Reference*).

4.1.2 Checklist ISDN

In case your internal ISDN card is not detected automatically you will need to know the vendor and the name of the device.

NOTE: ISDN Modem or Terminal Adapter

If you are using an external ISDN modem or terminal adapter, refer to Section 4.1.3, "Checklist Modem" (page 52) instead.

In order to configure the ISDN device you will need the following data:

- ISDN Protocol (depends on your country)

- Area code and phone number.

- Interface type (SyncPPP or RawIP). If unsure, select SyncPPP, because RawIP is only used in connection with certain telephone systems.

- Local and remote IP addresses for the dial-in server and the gateway, in the case that you were given a static IP address from your provider.

- The ISDN configuration module already contains the data for major ISPs in some countries. If your ISP is not listed, you will need to know how name resolving (DNS) and IP allocation is handled (in most cases this data is received automatically when connecting). Regardless whether you chose an ISP from the list or added a custom provider, you need to enter at least your login and password.

For configuration details, refer to Section "ISDN" (Chapter 21, *Basic Networking*, ↑*Reference*).

4.1.3 Checklist Modem

If your modem is not detected automatically, you will need to know whether it is connected to a serial port or to a USB port. Please note that not all USB modems and internal modems are supported by openSUSE®.

The modem configuration module already contains the data for major ISPs in some countries. If your ISP is not listed, you will need to know its dial-in number and how name resolving (DNS) and IP allocation is handled (in most cases this data is received automatically when connecting). Regardless whether you chose an ISP from the list or added a custom provider, you need to enter at least your login and password.

For configuration details, refer to Section "Modem" (Chapter 21, *Basic Networking*, ↑*Reference*).

4.1.4 Checklist Cable Modem

Accessing the Internet through the TV cable requires a cable modem. Such a modem is connected to the computer via ethernet cable. Therefore it is only necessary to configure your network card accordingly. For details, refer to Section "Cable Modem" (Chapter 21, *Basic Networking*, ↑*Reference*).

4.2 Internet Connection Via Network

If your machine is part of a network which is already connected to the Internet, it is very easy to gain Internet access (just configure your network card and connect your machine to the existing network and you are done). This not only applies to large company networks, but to small home networks as well. Even if the machine you are installing is only connected to a router (e.g. a DSL router) it is already part of a network. It is irrelevant whether you are using a wireless network adapter or a wired one.

NOTE: Routing and Name Services

In the following it is assumed that the network is connected to the Internet and provides routing and name services. In case these services are provided by a router, make sure the router is configured correctly before setting up the client.

4.2.1 Checklist Network

If your network provides DHCP (Dynamic Host Configuration Protocol) check the appropriate check box when setting up the network card and you are done (all parameters needed will be provided by the DHCP server).

If DHCP is not available, ask your network administrator for the following details:

- Hostname
- Name server
- Gateway

For configuration details for wired network cards, refer to Section "Configuring the Network Card with YaST" (Chapter 21, *Basic Networking*, ↑*Reference*), for wireless network cards see Section "Configuration with YaST" (Chapter 32, *Wireless LAN*, ↑*Reference*).

5 Using NetworkManager

NetworkManager is the ideal solution for laptops and other portable computers. It supports state-of-the-art encryption types and standards for network connections, including connections to 802.1X protected networks. 802.1X is the "IEEE Standard for Local and Metropolitan Area Networks—Port-Based Network Access Control". With NetworkManager, you do not need to worry about configuring network interfaces and switching between wired or wireless networks when you are moving. Network-Manager can automatically connect to known wireless networks or manage several network connections in parallel—the fastest connection is then used as default. Furthermore, you can manually switch between available networks and manage your network connection using an applet in the system tray.

Instead of only one connection being active, multiple connections may be active at once. This enables you to unplug your laptop from an Ethernet and remain connected via a wireless connection.

5.1 Use Cases for NetworkManager

NetworkManager provides a sophisticated and intuitive user interface, which enables users to easily switch their network environment. However, NetworkManager is not a suitable solution in the following cases:

- Your computer provides network services for other computers in your network, for example, it is a DHCP or DNS server.

- Your computer is a Xen server or your system is a virtual system inside Xen.

5.2 Enabling NetworkManager

On laptop computers, NetworkManager is enabled by default. However, it can be at any time enabled or disabled in the YaST Network Settings module.

1 Run YaST and go to *Network Devices* > *Network Settings*.

2 The *Network Settings* dialog opens. Go to the *Global Options* tab.

3 To configure and manage your network connections with NetworkManager, select *User Controlled with NetworkManager*.

4 Click *OK*.

5 After choosing the method for managing network connections, set up your network card using automatic configuration via DHCP or a static IP address or configure your modem (for dial-up connections, use *Network Devices > Modem*). To configure an internal or USB ISDN modem, select *Network Devices > ISDN*. To configure an internal or USB DSL modem, select *Network Devices > DSL*.

Find a detailed description of the network configuration with YaST in Section "Configuring a Network Connection with YaST" (Chapter 21, *Basic Networking*, ↑*Reference*) and Chapter 32, *Wireless LAN* (↑*Reference*).

After having enabled NetworkManager, configure your network connections with the NetworkManager as described in Section 5.3, "Configuring Network Connections" (page 56).

If you want to deactivate NetworkManager and control network the traditional way, choose the *Traditional Method with ifup* option in the *Network Setup Method* field.

5.3 Configuring Network Connections

After having enabled NetworkManager in YaST, configure your network connections with the NetworkManager front-ends available in KDE and GNOME. The network configuration dialogs for both front-ends are very similar. They show tabs for all types of network connections, such as wired, wireless, mobile broadband, DSL, and VPN connections. On each tab, you can add, edit or delete connections of that type. In the KDE configuration dialog, the appropriate tabs are only active if the connection type is available on your system (depending on hardware and software). By default, KNetworkManager also displays comprehensive tooltips for the input fields and options available on each tab.

To open the network configuration dialog in GNOME, press [Alt] + [F2] and enter `nm-connection-editor` or in the GNOME Control Center select *System > Network Connections*.

Figure 5.1 *GNOME Network Connections Dialog*
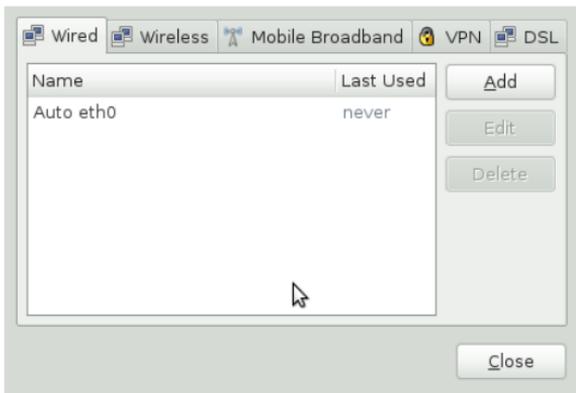
If you use KDE, open the main menu and click *Configure Desktop*. In the *Personal Settings* then select *Network Settings* on the *General* tab to open the network configuration dialog.

Figure 5.2 *KDE Network Configuration Dialog*
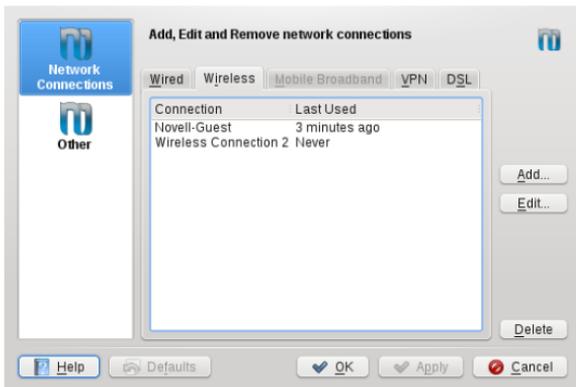
Alternatively, you can also start the configuration dialogs from the NetworkManager applet in the system tray. In KDE, left-click the icon and select *Manage Connections*. In GNOME, right-click the icon and select *Edit Connections*.

NOTE: Availability of Options

Depending on your system set-up, you may not be allowed to configure connections. In a secured environment, some options might be locked or require `root` permission. Ask your system administrator for details.

Procedure 5.1 *Adding or Editing Connections*

When configuring network connections with NetworkManager, you can also define `system connections` that can be shared by all users. In contrast to `user connections`, system connections are made available right after NetworkManager is started—before any users log in. For more details about both types of connections, refer to Section 5.7.1, "User and System Connections" (page 66).

Currently, the `system connection` option is not available in KNetworkManager. To set up system connections, you need to use YaST in this case.

NOTE: Hidden Networks

To connect to a "hidden" network (a network that does not broadcast its service) you have to know the Service Set Identifier or Extended Service Set Identifier (SSID or ESSID) of the network because it cannot be detected automatically.

---

1 To add a new connection, click the tab for the connection type you want to use and click *Add*.

2 Enter a *Connection Name* and your connection details.

3 For a hidden network, enter the (E)SSID and in the *Wireless Security* tab the encryption parameters.

4 You can tie the connection to a certain device, if more than one physical device per connection type is available (for example, your machine is equipped with two ethernet cards or two wireless cards).

   If you use KDE, do so by using the *Restrict to Interface* option. If you use GNOME, enter the *MAC address* of the device you want to tie the connection to and confirm your settings.

5 If you want NetworkManager to automatically use a certain connection, activate *Connect Automatically* for this connection.

6 To turn a connection into a `system connection` activate *Available to all users* (GNOME). To create and edit system connections, `root` permission is required.

After having confirmed your changes, the newly configured network connection appears in the list of available networks you get by left-clicking the NetworkManager applet.

Figure 5.3   *KNetworkManager—Configured and Available Connections*

At the moment, Bluetooth connections cannot be configured with NetworkManager.

5.4 Using KNetworkManager

The KDE front-end for NetworkManager is the KNetworkManager applet. If the network has been set up for NetworkManager control, the applet usually starts automatically with the desktop environment and is shown as an icon in the system tray.

If your system tray does not show any network connection icon, the applet is probably not started. Press [Alt] + [F2] and enter `knetworkmanager` to start it manually.

KNetworkManager only shows wireless networks that you have configured a connection for. It hides connections when you are out of range of a wireless network, or when the network cable is disconnected, thus always giving you a clear view of which connections may be used.

5.4.1 Connecting to Wired Networks

If your computer is connected to an existing network with a network cable, use KNetworkManager to choose the network connection.

1 Left-click the applet icon to show a menu with available networks. The connection currently being used is selected in the menu and marked as *Active*.

2 If you want to use a different configuration with the wired network, click *Manage Connections* and add another wired connection as described in Procedure 5.1, "Adding or Editing Connections" (page 58).

3 Click the KNetworkManager icon and select the newly configured connection to activate it.

5.4.2 Connecting to Wireless Networks

By default, KNetworkManager only shows wireless networks that you have configured a connection for—provided they are both available and visible. To connect to a wireless network for the first time, proceed as follows:

1 Left-click the applet icon and select *Wireless 802.11 (Create Network Connection)*. KNetworkManager shows a list of available visible wireless networks, including details about signal strength and security.

2 To connect to a visible network, select the network from the list and click *Connect*. If the network is encrypted, a dialog opens. Choose the type of *Security* the network uses and enter the appropriate credentials.

3 To connect to a network that does not broadcast its service set identifier ((E)SSID) and therefore cannot be detected automatically, select *Connect to Other Network*.

4 In the dialog that opens, enter the ESSID and set encryption parameters, if necessary.

5 Confirm your changes and click *OK*. NetworkManager now activates the new connection.

6 To terminate a connection and to disable wireless networking, click the applet icon and uncheck *Enable Wireless*. This can be useful if you are on a plane or in any other environment where wireless networking is not allowed.

A wireless network that has been chosen explicitly will remain connected as long as possible. If a network cable is plugged in during that time, any connections that have been set to *Connect Automatically* will be connected, while the wireless connection remains up.

5.4.3 Configuring Your Wireless Card as an Access Point

If your wireless card supports access point mode, you can use NetworkManager for configuration.

NOTE: Availability of Options

Depending on your system set-up, you may not be allowed to configure connections. In a secured environment, some options might be locked or require `root` permission. Ask your system administrator for details.

---

1 Click the KNetworkManager applet and select *Create Network Connection > New Ad-Hoc Network*.

2 In the following configuration dialog, enter a name for your network in the *SSID* field.

3 Set the encryption on the *Wireless Security* tab.

IMPORTANT: Unprotected Wireless Networks Are a Security Risk

If you set *Security* to None, everybody can connect to your network, reuse your connectivity and intercept your network connection. To restrict access to your access point and to secure your connection, use encryption. You can choose between various WEP and WPA–based encryptions. If you are not sure which technology is best for you, read Section "Authentication" (Chapter 32, *Wireless LAN*, ↑*Reference*).

---

4 On the *IP Address* tab, make sure the *Configure* option is set to *Shared* (which is the default option for ad-hoc networks).

5 Confirm your configuration with *OK*.

5.4.4 Customizing KNetworkManager

You can customize some aspects of KNetworkManager: the number of icons displayed in the system tray, which tool tips to show and how to store your password and credentials for network connections. For more information about the last aspect, refer to Section 5.7.2, "Storing Passwords and Credentials" (page 66).

To explore the options available, start the *Personal Settings* from the main menu, select *Network Connections* on the *General* tab and click *Other* on the left-hand side of the configuration dialog.

As KNetworkManager can keep multiple connections active at once, you might wish to be informed about the connection status for several connections at one glance. You can do so by using multiple NetworkManager icons in your system tray, each representing a different group of connection types (for example, one icon for wired connections, another icon for wireless connections).

1 In the configuration dialog, switch to the *Tray Icon* tab.

2 Click *More Icons*. A new icon entry appears in the list.

3 Select the network connection types you want to be represented by this icon and group them under the respective icon.
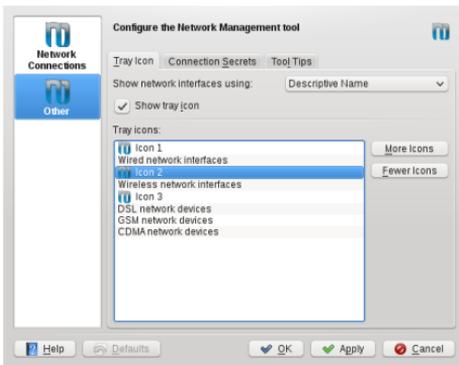
4 Confirm your changes.

Now the system tray shows multiple NetworkManager icons from which you then can access the connection types tied to that icon.

When configuring a network connection as described in Procedure 5.1, "Adding or Editing Connections" (page 58), KNetworkManager also allows you to customize the icon displayed for this connection. To change the icon, click the icon button next to *Connection Name* and in the following dialog, select the icon of your choice. After confirming your changes, the new icon is displayed in the list of available connections you get by clicking the KNetworkManager icon in the system tray.

5.5 Using GNOME NetworkManager Applet

In GNOME, NetworkManager can be controlled with the GNOME NetworkManager applet. If the network is set up for NetworkManager control, the applet usually starts automatically with the desktop environment and is shown as an icon in the system tray.

If your system tray does not show any network connection icon, the applet is probably not started. Press [Alt] + [F2] and enter `nm-applet` to start it manually.

5.5.1 Connecting to Wired Networks

If your computer is connected to an existing network with a network cable, use the NetworkManager applet to choose the network connection.

1 Left-click the applet icon to show a menu with available networks. The currently used connection is selected in the menu.

2 To switch to another network, choose it from the list.

3 To switch off all network connections, both wired and wireless, right-click the applet icon and uncheck *Enable Networking*.

5.5.2 Connecting to Wireless Networks

Available visible wireless networks are listed in the GNOME NetworkManager applet menu under *Wireless Networks*. The signal strength of each network is also shown in the menu. Encrypted wireless networks are marked with a shield icon.

Procedure 5.3 *Connecting to a Wireless Network*

1 To connect to a wireless network, left-click the applet icon and choose an entry from the list of available wireless networks.

2 If the network is encrypted, a dialog opens. It shows the type of encryption the network uses (*Wireless Security*) and holds a number of input fields according to the respective encryption and authentication settings. Enter the appropriate credentials.

3 To connect to a network that does not broadcast its service set identifier ((E)SSID) and therefore cannot be detected automatically, left-click the NetworkManager icon and choose *Connect to Hidden Wireless Network*.

4 In the dialog that opens, enter the ESSID and set encryption parameters on the *Wireless Security* tab if necessary.

5 To disable wireless networking, right-click the applet icon and uncheck *Enable Wireless*. This can be useful if you are on a plane or in any other environment where wireless networking is not allowed.

A wireless network that has been chosen explicitly will remain connected as long as possible. If a network cable is plugged in during that time, any connections that have been set to *Connect Automatically* will be connected, while the wireless connection remains up.

5.5.3 Configuring Your Wireless Card as an Access Point

If your wireless card supports access point mode, you can use NetworkManager for configuration.

NOTE: Availability of Options

Depending on your system set-up, you may not be allowed to configure connections. In a secured environment, some options might be locked or require `root` permission. Ask your system administrator for details.

---

1 Click the NetworkManager applet and select *Create New Wireless Network*.

2 Enter a *Network Name* and set the encryption to use with the *Wireless Security* drop-down list.

IMPORTANT: Unprotected Wireless Networks Are a Security Risk

If you set *Wireless Security* to None, everybody can connect to your network, reuse your connectivity and intercept your network connection. To restrict access to your access point and to secure your connection, use encryption. You can choose between various WEP and WPA–based encryptions. If you are not sure which technology is best for you, read Section "Authentication" (Chapter 32, *Wireless LAN*, ↑*Reference*).

5.6 NetworkManager and VPN

NetworkManager supports several Virtual Private Network (VPN) technologies. For each technology, openSUSE comes with a base package providing the generic support for NetworkManager. In addition to that, you also need to install the respective desktop-specific package for your applet.

NovellVPN
   To use this VPN technology, install

   • `NetworkManager-novellvpn` and

- `NetworkManager-novellvpn-kde4` or `NetworkManager-novellvpn-gnome`.

NovellVPN support for KDE is not available yet, but is currently being worked on.

OpenVPN
  To use this VPN technology, install

  - `NetworkManager-openvpn` and

  - `NetworkManager-openvpn-kde4` or `NetworkManager-openvpn-gnome`.

vpnc (Cisco)
  To use this VPN technology, install

  - `NetworkManager-vpnc` and

  - `NetworkManager-vpnc-kde4` or `NetworkManager-vpnc-gnome`.

PPTP (Point-to-Point Tunneling Protocol)
  To use this VPN technology, install

  - `NetworkManager-pptp` and

  - `NetworkManager-pptp-kde4` or `NetworkManager-pptp-gnome`.

After you have installed the packages, configure your VPN connection as described in Section 5.3, "Configuring Network Connections" (page 56).

5.7 NetworkManager and Security

NetworkManager distinguishes two types of wireless connections, trusted and untrusted. A trusted connection is any network that you explicitly selected in the past. All others are untrusted. Trusted connections are identified by the name and MAC address of the access point. Using the MAC address ensures that you cannot use a different access point with the name of your trusted connection.

NetworkManager periodically scans for available wireless networks. If multiple trusted networks are found, the most recently used is automatically selected. NetworkManager waits for your selection in case that all networks are untrusted.

If the encryption setting changes but the name and MAC address remain the same, NetworkManager attempts to connect, but first you are asked to confirm the new encryption settings and provide any updates, such as a new key.

If you switch from using a wireless connection to offline mode, NetworkManager blanks the ESSID. This ensures that the card is disconnected.

5.7.1 User and System Connections

NetworkManager knows two types of connections: user and system connections. User connections are connections that become available to NetworkManager when the first user logs in. Any required credentials are asked from the user and when the user logs out, the connections are disconnected and removed from NetworkManager. Connections that are defined as system connection can be shared by all users and are made available right after NetworkManager is started—before any users log in. In case of system connections, all credentials must be provided at the time the connection is created. Such system connections can be used to automatically connect to networks that require authorization. For information how to configure user or system connections with NetworkManager, refer to Section 5.3, "Configuring Network Connections" (page 56).

For KDE, system connections with NetworkManager are currently not supported (use YaST instead).

5.7.2 Storing Passwords and Credentials

If you do not want to re-enter your credentials each time you want to connect to an encrypted network, you can use the desktop-specific tools GNOME Keyring Manager or KWalletManager to store your credentials encrypted on the disk, secured by a master password.

With KNetworkManager, you can configure if and how to store your credentials in KDE. To do so, left-click the KNetworkManager icon and select *Manage Connections*. Click *Other > Connection Secrets* and select one of the following options:

Do Not Store (Always Prompt)
    This is useful if you are working in an environment where storing credentials is considered a security risk.

In File (Unencrypted)

WARNING: Security Risk

Storing your network credentials unencrypted is a security risk. Everybody who has access to your computer can reuse your connectivity and intercept your network connection.

If you choose this option, your passwords are stored unencrypted in the respective connection file that is created for each connection. Find them under `$HOME/.kde4/share/apps/networkmanagement/connections`.

In Secure Storage (Encrypted)
    If you choose this options, your credentials are stored in KWalletManager. For more information on KWalletManager, see Chapter 8, *Managing Passwords with KWallet Manager* (↑*KDE User Guide*).

5.8 Frequently Asked Questions

In the following, find some frequently asked questions about configuring special network options with NetworkManager.

How to tie a connection to a specific device?
By default, connections in NetworkManager are device type-specific: they apply to all physical devices with the same type. If more than one physical device per connection type is available (for example, your machine is equipped with two ethernet cards), you can tie a connection to a certain device.

To do so in GNOME, first look up the MAC address of your device (use the *Connection Information* available from the applet, or use the output of command line tools like `nm-tool` or `ifconfig`). Then start the dialog for configuring network connections and choose the connection you want to modify. On the *Wired* or *Wireless* tab, enter the *MAC Address* of the device and confirm your changes.

If you use KDE, start the dialog for configuring network connections and choose the connection you want to modify. On the *Ethernet* or *Wireless* tab, use the *Restrict to Interface* option to select the network interface to which to tie the connection.

How to specify a certain access point in case multiple access points with the same ESSID are detected?
When multiple access points with different wireless bands (a/b/g/n) are available, the access point with the strongest signal is automatically chosen by default. To override this, use the *BSSID* field when configuring wireless connections.

The Basic Service Set Identifier (BSSID) uniquely identifies each Basic Service Set. In an infrastructure Basic Service Set, the BSSID is the MAC address of the wireless access point. In an independent (ad-hoc) Basic Service Set, the BSSID is a locally administered MAC address generated from a 46-bit random number.

Start the dialog for configuring network connections from the GNOME Control Center with *System > Network Configurations* or in KDE 4 from the *Personal Settings* with *Network Settings*. Choose the wireless connection you want to modify and click *Edit*. On the *Wireless* tab, enter the BSSID.

How to share network connections to other computers?
The primary device (the device which is connected to the Internet) does not need any special configuration. However, you need to configure the device that is connected to the local hub or machine as follows:

1. Start the dialog for configuring network connections from the GNOME Control Center with *System > Network Connections* or in KDE 4 from the *Personal Settings* with *Advanced > Network Settings*. Choose the connection you want to modify and click *Edit*. If you are using GNOME, switch to the *IPv4 Settings* tab and from the *Method* drop-down list, choose *Shared to other computers*. If you are using KDE, switch to the *IP Address* tab and from the *Configure* drop-

down list, choose *Shared*. That will enable IP traffic forwarding and run a DHCP server on the device. Confirm your changes in NetworkManager.

2. As the DCHP server uses port 67, make sure that it is not blocked by the firewall: On the machine sharing the connections, start YaST and select *Security and Users > Firewall*. Switch to the *Allowed Services* category. If *DCHP Server* is not already shown as *Allowed Service*, select *DCHP Server* from *Services to Allow* and click *Add*. Confirm your changes in YaST.

How to provide static DNS information with automatic (DHCP, PPP, VPN) addresses?
In case a DHCP server provides invalid DNS information (and/or routes), you can override it. Start the dialog for configuring network connections from the GNOME Control Center with *System > Network Configurations* or in KDE 4 from the *Personal Settings* with *Advanced > Network Settings*. Choose the connection you want to modify and click *Edit*. If you are using GNOME, switch to the *IPv4 Settings* tab, and from the *Method* drop-down list, choose *Automatic (DHCP) addresses only*. If you are using KDE, switch to the *IP Address* tab, and from the *Configure* drop-down list, choose *Automatic (DHCP) addresses only*. Enter the DNS information in the *DNS Servers* and *Search Domains* fields. From the drop-down list at the bottom of the tab, select *Routes* if you want to *Ignore automatically obtained routes*. Confirm your changes.

How to make NetworkManager connect to password protected networks before a user logs in?
Define a `system connection` that can be used for such purposes. For more information, refer to Section 5.7, "NetworkManager and Security" (page 65).

5.9 Troubleshooting

Connection problems can occur. Some common problems related to NetworkManager include the applet not starting or a missing VPN option. Methods for resolving and preventing these problems depend on the tool used.

NetworkManager Desktop Applet Does Not Start
The GNOME and KDE NetworkManager applets start automatically if the network is set up for NetworkManager control. If the applet does not start, check if NetworkManager is enabled in YaST as described in Section 5.2, "Enabling Network-Manager" (page 55). Then make sure that the appropriate package for your desktop environment is also installed. If you are using KDE 4, the package is `NetworkManager-kde4`. For GNOME users the package is `NetworkManager-gnome`.

If the desktop applet is installed but is not running for some reason, start it manually with the command **nm-applet** (GNOME) or **knetworkmanager** (KDE).

NetworkManager Applet Does Not Include the VPN Option
Support for NetworkManager, applets, and VPN for NetworkManager is distributed in separate packages. If your NetworkManager applet does not include the VPN option, check if the packages with NetworkManager support for your VPN technol-

ogy are installed. For more information, see Section 5.6, "NetworkManager and VPN" (page 64).

No Network Connection Available
> If you have configured your network connection correctly and all other components for the network connection (router, etc.) are also up and running, it sometimes helps to restart the network interfaces on your computer. To do so, log in to a command line as `root` and run `rcnetwork restart`.

5.10 For More Information

More information about NetworkManager can be found on the following Web sites and directories:

NetworkManager Project Page
> http://projects.gnome.org/NetworkManager/

KDE NetworkManager Front-End
> http://userbase.kde.org/NetworkManagement

Package Documentation
> Also check out the information in the following directories for the latest information about NetworkManager and the GNOME and KDE NetworkManager applets:

> - /usr/share/doc/packages/NetworkManager/,

> - /usr/share/doc/packages/NetworkManager-kde4/, and

> - /usr/share/doc/packages/NetworkManager-gnome/.

Part II. Basics

6 Basic Concepts

If this is your first encounter with a Linux system you probably want to learn something about the basic concepts of Linux before getting started. The graphical user interfaces of Linux, Mac OS* and Windows* show rather similar desktop components, which makes it easy to move from one graphical environment to the next. However, if you take a look at the underlying system you will soon notice some differences.

The following sections are meant to guide you through the first steps with your Linux system and to help Linux "newbies" to familiarize themselves in their new operating system. You will learn about the user concept of Linux, the structure of the Linux file system (where to find what in the directory tree) and how to deal with access permissions for files and directories, which are an essential feature in Linux.

Users who have been working with Mac OS will probably recognize that the concepts explained in the following sections are rather similar to what they know already from Mac OS. Windows users may realize some crucial differences which are worth noticing.

6.1 User Concept

From the beginning, Linux has been designed as a multiuser system: Any number of users can simultaneously work on one machine. These users can connect to the system via different terminals or network connections. Usually users need to log in to the system before starting a session. Personal information and individual desktop configuration are stored separately for each user.

6.1.1 Distinct User Roles

Among the users working on a machine, Linux distinguishes between different kinds of user roles: you can log in to a Linux machine as a "normal" user or as a superuser (administrator), traditionally called `root` in Linux. The superuser has privileges which authorize him to access all parts of the system and to execute administrative tasks. He or she has the unrestricted capacity to make changes to the system and has unlimited access to all files. If you are logged in as a normal user you lack these privileges. User and `root` can of course be the same physical person but acting in different roles.

The `root` user account is always created on your Linux system by default — during installation you are therefore requested to specify a password for `root`. Which other users can log in to your system depends on the method of authentication you choose during installation (see Section 1.11, "Create New User" (page 17)).

For your daily work, you usually log in to your system as normal user. Performing some administrative tasks or running certain programs such as YaST requires root permissions. You can easily switch from your normal account to root and back to your normal user account after accomplishing the administrative task. How to do so in a shell is described in Section 7.4, "Becoming Root" (page 93). If you are working with a graphical user interface you are usually prompted to enter the root password when necessary. Closing the application which required root permissions results in withdrawal of the root privileges: you automatically switch back to your normal user account.

While this concept might not look very appealing at first, it adds to security. A user without root privileges cannot damage the entire system. Any damage caused is strictly limited to the user's own account and data. Any operation executed with root privileges may potentially harm the entire system. Anyone intending to harm a running Linux system must gain root privileges first. This is why it is much harder to create viruses for Linux systems. They must overcome the root barrier first.

6.1.2 Groups

Every user in a Linux system belongs at least to one group. A group, in this case, can be defined as a set of connected users with certain collective privileges. Groups are usually defined according to functional roles or the data and resources the members of the group need to access. When a new user account is created on your system, the user is usually assigned to a default, primary group. The system administrator can change this primary group or assign the user to an additional group, if necessary.

Figure 6.1   *Group Membership for a User in YaST*

6.2 The Linux File System

All users, including the superuser, have their own home directories where all private data, like documents, bookmarks, or e-mail, are stored. System directories holding central configuration files or executable files can only be modified by the superuser. Read more about access permissions and how to modify them according to your needs in Section 7.5, "Modifying File Permissions" (page 94).

In Linux, you can choose whether you want to manage files and folders with a file manager or with the command line, which is the traditional way. The latter method is often faster but requires some deeper knowledge of several commands to list, create, delete, or edit files and their properties. For more information about commands for manipulating files refer to Section 7.3, "Working with Files and Directories" (page 89). A file manager provides a graphical and more intuitive way to handle these tasks. Learn more about the file managers of GNOME and KDE in Section "Managing Folders and Files with Nautilus" (Chapter 2, *Working with Your Desktop*, ↑*GNOME User Guide*) and Section "Using Dolphin File Manager" (Chapter 2, *Working with Your Desktop*, ↑*KDE User Guide*). The following sections provide you with some basic knowledge of the file system and provide an overview of the default directory structure in Linux.

6.2.1 Key Features

In Linux, all files and directories are located in a tree-like structure. The topmost directory is referred to as the file system *root* or just / (not to be confused with the `root` user). The counterpart of / in a Windows system would probably be `C:\`. All other directories in Linux can be accessed from the root directory and are arranged in a hierarchical structure.

Find the key features of the Linux file system in the following list which also highlights some of the major differences between the Linux and the Windows/DOS file system:

Specifying Paths
  As opposed to Windows, Linux does not use backslashes to separate the components of a pathname, it uses slashes instead. For example, the private data of users in Windows may be stored under `C:\My Documents\Letters`, whereas in Linux it would be stored under `/home/`*username*`/Letters`.

Partitions, Drives/Devices and Directories
  Linux does not use drive letters as Windows does. From the mere appearance of a pathname in Linux you can not tell whether you are addressing a partition, a drive/device, a network device or an "ordinary" directory.

Mounting and Unmounting
  Another crucial difference between Windows/DOS and Linux is the concept of *mounting* and *unmounting* partitions, drives or directories. Windows detects partitions and drives during the boot process and assigns a drive letter to them. In Linux, however, partitions or devices are usually not visible in the directory tree unless they are *mounted*, that means integrated into the file system at a specific location in the directory tree. As a normal user you cannot access data

on a partition or a device unless it is mounted. But don't worry— most of the time you do not have to mount partitions or devices manually. During the installation of your system, you can define partitions to be mounted automatically when the system is started. Removable devices are usually also detected and mounted automatically by your system. The desktop environments such as KDE or GNOME will inform you about the appearance of a new device.

Figure 6.2   *Autodetection of a USB Stick in KDE*

Although this concept of mounting and unmounting may appear complicated or cumbersome at first sight this also offers great flexibility. For example you can easily mount a directory from a another machine over the network and act on that directory as though it were located on your local machine.

Case-Sensitivity

Linux distinguishes between uppercase and lowercase letters in the file system. For example, whether you name a file `test.txt`, `TeST.txt` or `Test.txt` makes a difference in Linux. This also holds true for directories: You cannot access a directory named `Letters` by the name `letters`.

File Extensions

As opposed to Windows, files in Linux *may* have a file extension, such as `.txt`, but do not need to have one. When you start working with the shell this sometimes makes it difficult for beginners to differentiate between files and folders, depending on the command you use to list the contents of a directory. Learn more about some basic shell commands in Chapter 7, *Shell Basics* (page 85). If you use the graphical file managers in GNOME or KDE (see Section "Managing Folders and Files with Nautilus" (Chapter 2, *Working with Your Desktop*, ↑*GNOME User Guide*) and Section "Using Dolphin File Manager" (Chapter 2, *Working with Your Desktop*, ↑*KDE User Guide*)) files and folders are symbolized by various different icons depending on the view you choose.

Figure 6.3   *File and Folders in KDE File Manager*
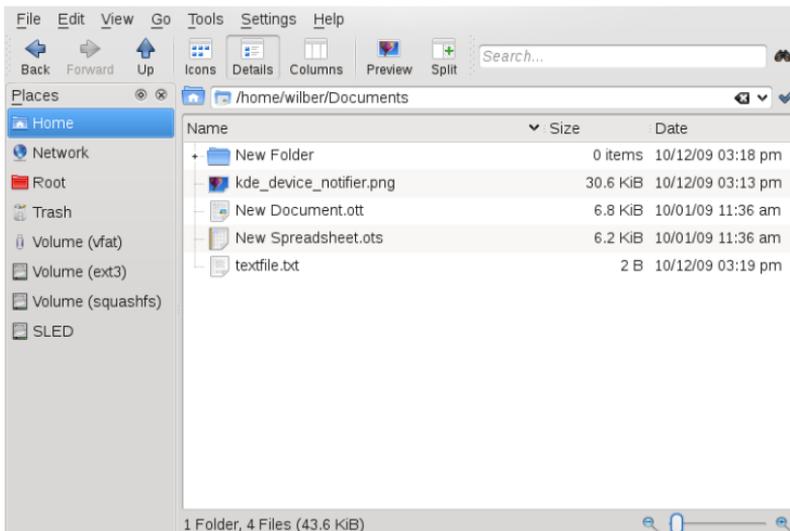
Hidden Files

Similar to Windows, Linux also distinguishes between "normal" files and *hidden files* which are often configuration files that you usually do not want to access or see as a normal user. In Linux, hidden files are indicated by a dot in front (for example, `.hiddenfile`). In order to access hidden files you can switch view in the file managers as described in Section "Using Dolphin File Manager" (Chapter 2, *Working with Your Desktop*, ↑*KDE User Guide*) or use a certain command in the shell as described in Section 7.2.2, "Using Commands with Options" (page 87).

File System Permissions

Because Linux is a multiuser system, every file in a Linux file system belongs to a user and a group. Only the owner of a file or directory (or, of course, `root`) can grant other users access permission to it. Linux basically distinguishes between three different types of access permissions: write permission, read permission and execute permission. You can only access a file or a folder if you have at least read permission to it. There are several ways to change the access permissions of files and folders: either traditionally via the shell or with the help of your desktop's file manager. If you have `root` privileges, you can also change the owner and the group of a file or folder. Read how to do so in a shell in Section 7.5, "Modifying File Permissions" (page 94).

For more detailed information about file system permissions refer to Section 6.3, "File Access Permissions" (page 81). Apart from the traditional permission concept for file system objects there are also extensions available which handle permissions more flexibly. Read more in Chapter 10, *Access Control Lists in Linux* (↑*Security Guide*).

6.2.2 The Directory Structure

The following table provides a short overview of the most important higher-level directories that you find on a Linux system. Find more detailed information about the directories and important subdirectories in the following list.

Table 6.1   *Overview of a Standard Directory Tree*

Directory	Contents
/	Root directory—the starting point of the directory tree.
/bin	Essential binary files, such as commands that are needed by both the system administrator and normal users. Usually also contains the shells, such as Bash.
/boot	Static files of the boot loader.
/dev	Files needed to access host-specific devices.
/etc	Host-specific system configuration files.
/home	Holds the home directories of all users who have accounts on the system. However, root's home directory is not located in /home but in /root.
/lib	Essential shared libraries and kernel modules.
/media	Mount points for removable media.
/mnt	Mount point for temporarily mounting a file system.
/opt	Add-on application software packages.
/root	Home directory for the superuser root.
/sbin	Essential system binaries.
/srv	Data for services provided by the system.
/tmp	Temporary files.

Directory	Contents
/usr	Secondary hierarchy with read-only data.
/var	Variable data such as log files.
/windows	Only available if you have both Microsoft Windows* and Linux installed on your system. Contains the Windows data.

The following list provides more detailed information and gives some examples of which files and subdirectories can be found in the directories:

/bin
   Contains the basic shell commands that may be used both by `root` and by other users. These commands include `ls`, `mkdir`, `cp`, `mv`, `rm` and `rmdir`. /bin also contains Bash, the default shell in openSUSE.

/boot
   Contains data required for booting, such as the boot loader, the kernel, and other data that is used before the kernel begins executing user-mode programs.

/dev
   Holds device files that represent hardware components.

/etc
   Contains local configuration files that control the operation of programs like the X Window System. The /etc/init.d subdirectory contains scripts that are executed during the boot process.

/home/*username*
   Holds the private data of every user who has an account on the system. The files located here can only be modified by their owner or by the system administrator. By default, your e-mail directory and personal desktop configuration are located here in the form of hidden files and directories. KDE users find the personal configuration data for their desktop in .kde4 and GNOME users find it in .gconf. For information about hidden files, refer to .

NOTE: Home Directory in a Network Environment

If you are working in a network environment, your home directory may be mapped to a directory in the file system other than /home.

/lib
   Contains the essential shared libraries needed to boot the system and to run the commands in the root file system. The Windows equivalent for shared libraries are DLL files.

`/media`

    Contains mount points for removable media, such as CD-ROMs, USB sticks and digital cameras (if they use USB). `/media` generally holds any type of drive except the hard drive of your system. As soon as your removable medium has been inserted or connected to the system and has been mounted, you can access it from here.

`/mnt`

    This directory provides a mount point for a temporarily mounted file system. `root` may mount file systems here.

`/opt`

    Reserved for the installation of third-party software. Optional software and larger add-on program packages can be found here.

`/root`

    Home directory for the `root` user. The personal data of `root` is located here.

`/sbin`

    As the `s` indicates, this directory holds utilities for the superuser. `/sbin` contains the binaries essential for booting, restoring and recovering the system in addition to the binaries in `/bin`.

`/srv`

    Holds data for services provided by the system, such as FTP and HTTP.

`/tmp`

    This directory is used by programs that require temporary storage of files.

IMPORTANT: Cleaning up `/tmp` at Boot Time

Data stored in `/tmp` are not guaranteed to survive a system reboot. It, for example, depends on settings in `/etc/sysconfig/cron`.

`/usr`

    `/usr` has nothing to do with users, but is the acronym for UNIX system resources. The data in `/usr` is static, read-only data that can be shared among various hosts compliant with the Filesystem Hierarchy Standard (FHS). This directory contains all application programs and establishes a secondary hierarchy in the file system. KDE4 and GNOME are also located here. `/usr` holds a number of subdirectories, such as `/usr/bin`, `/usr/sbin`, `/usr/local`, and `/usr/share/doc`.

`/usr/bin`

    Contains generally accessible programs.

`/usr/sbin`

    Contains system daemons and programs reserved for the system administrator that are not essential for booting the system.

`/usr/local`

In this directory the system administrator can install local, distribution-independent extensions.

`/usr/share/doc`

Holds various documentation files and the release notes for your system. In the `manual` subdirectory find an online version of this manual. If more than one language is installed, this directory may contain versions of the manuals for different languages.

Under `packages` find the documentation included in the software packages installed on your system. For every package, a subdirectory `/usr/share/doc/packages/`*packagename* is created that often holds README files for the package and sometimes examples, configuration files or additional scripts.

If HOWTOs are installed on your system `/usr/share/doc` also holds the `howto` subdirectory in which to find additional documentation on many tasks related to the setup and operation of Linux software.

`/var`

Whereas `/usr` holds static, read-only data, `/var` is for data which is written during system operation and thus is variable data, such as log files or spooling data. For an overview of the most important log files you can find under `/var/log/`, refer to Table 9.1, "Log Files" (page 129).

`/windows`

Only available if you have both Microsoft Windows and Linux installed on your system. Contains the Windows data available on the Windows partition of your system. Whether you can edit the data in this directory depends on the file system your Windows partition uses. If it is FAT32, you can open and edit the files in this directory. For NTFS, openSUSE also includes write access support. However, the driver for the NTFS-3g file system has limited functionality. Learn more in Section "Accessing Files on Different OS on the Same Computer" (Chapter 34, *Copying and Sharing Files*, ↑*Reference*).
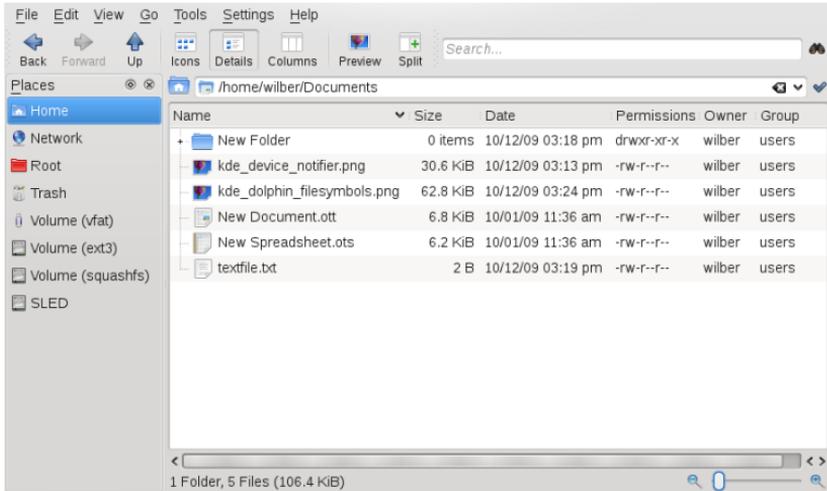
6.3 File Access Permissions

In Linux, objects such as files or folders or processes generally belong to the user who created or initiated them. There are some exceptions to this rule. For more information about the exceptions, refer to Chapter 10, *Access Control Lists in Linux* (↑*Security Guide*). The group which is associated with a file or a folder depends on the primary group the user belongs to when creating the object.

When you create a new file or directory, initial access permissions for this object are set according to a predefined scheme. As an owner of a file or directory, you can change the access permissions for this object. For example, you can protect files holding sensitive data against read access by other users and you can authorize the members of your group or other users to write, read, or execute several of your files where appropriate. As `root`, you can also change the ownership of files or folders.

6.3.1 Permissions for User, Group and Others

Three permission sets are defined for each file object on a Linux system. These sets include the read, write, and execute permissions for each of three types of users—the owner, the group, and other users. You can view and change the access permissions of a file or folder in the file managers of your desktop or in a shell (see Section 7.5, "Modifying File Permissions" (page 94)).

Figure 6.4   *File Access Permissions in KDE File Manager*

The following example shows the output of an `ls -l` command in a shell. This command lists the contents of a directory and shows the details for each file and folder in that directory.

Example 6.1   *Access Permissions For Files and Folders*

```
-rw-r----- 1 tux users      0 2006-06-23 16:08 checklist.txt
-rw-r--r-- 1 tux users  53279 2006-06-21 13:16 gnome_quick.xml
-rw-rw---- 1 tux users      0 2006-06-23 16:08 index.htm
-rw-r--r-- 1 tux users  70733 2006-06-21 09:35 kde-start.xml
-rw-r--r-- 1 tux users  47896 2006-06-21 09:46 kde_quick.xml
drwxr-xr-x 2 tux users     48 2006-06-23 16:09 local
-r-xr-xr-x 1 tux users 624398 2006-06-23 15:43 tux.jpg
```

As shown in the third column, all objects belong to user tux. They are assigned to the group users which is the primary group the user tux belongs to. To retrieve the access permissions the first column of the list must be examined more closely. Let's have a look at the file kde-start.xml:

Type	User Permissions	Group Permissions	Permissions for Others
-	rw-	r--	r--

The first column of the list consists of one leading character followed by nine characters grouped in three blocks. The leading character indicates the file type of the object: in this case, the hyphen (–) shows that kde-start.xml is a file. If you find the character d instead, this shows that the object is a directory, like local in Example 6.1, "Access Permissions For Files and Folders" (page 82).

The next three blocks show the access permissions for the owner, the group and other users (from left to right). Each block follows the same pattern: the first position shows read permissions (r), the next position shows write permissions (w), the last one shows execute permission (x). A lack of either permission is indicated by -. In our example, the owner of kde-start.xml has read and write access to the file but cannot execute it. The users group can read the file but cannot write or execute it. The same holds true for the other users as shown in the third block of characters.

6.3.2 Files and Folders

Access permissions have a slightly different impact depending on the type of object they apply to: file or directory. The following table shows the details:

Table 6.2 *Access Permissions For Files And Directories*

Access Permission	File	Folder
Read (r)	Users can open and read the file.	Users can view the contents of the directory. Without this permission, users cannot list the contents of this directory with **ls -l**, for example. However, if they only have execute permission for the directory, they can nevertheless access certain files in this directory if they know of their existence.
Write (w)	Users can change the file: They can add or drop data and can even delete the contents of the file. However, this does not include the permission to remove the file com-	Users can create, rename or delete files in the directory.

Access Permission	File	Folder
	pletely from the directory as long as they do not have write permissions for the directory where the file is located.	
Execute (x)	Users can execute the file. This permission is only relevant for files like programs or shell scripts, not for text files. If the operating system can execute the file directly, users do not need read permission to execute the file. However, if the file must me interpreted like a shell script or a perl program, additional read permission is needed.	Users can change into the directory and execute files there. If they do not have read access to that directory they cannot list the files but can access them nevertheless if they know of their existence.

Note that access to a certain file is always dependent on the correct combination of access permissions for the file itself *and* the directory it is located in.

7 Shell Basics

When working with Linux these days, you can communicate with the system almost without ever requiring a command line interpreter (the shell). After booting your Linux system, you are usually directed to a graphical user interface that guides you through the login process and the following interactions with the operating system. The graphical user interface in Linux (the X Window System or X11) is initially configured during installation. Both KDE and GNOME desktop (and other window managers you can install) use it for interaction with the user.

Nevertheless, it is useful to have some basic knowledge of working with a shell because you might encounter situations where the graphical user interface is not available. For example, if some problem with the X Window System occurs. If you are not familiar with a shell, you might feel a bit uncomfortable at first when entering commands, but the more you get used to it, the more you will realize that the command line is often the quickest and easiest way to perform some daily tasks.

For UNIX or Linux several shells are available which differ slightly in behavior and in the commands they accept. The default shell in openSUSE® is Bash (GNU Bourne-Again Shell).

The following sections will guide you through your first steps with the Bash shell and will show you how to complete some basic tasks via the command line. If you are interested in learning more or rather feel like a shell "power user" already, refer to Chapter 20, *Bash and Bash Scripts* (↑*Reference*).

7.1 Starting a Shell

Basically, there are two different ways to start a shell from the graphical user interface which usually shows after you have booted your computer:

- you can leave the graphical user interface or

- you can start a terminal window *within* the graphical user interface.

While the first option is always available, you can only make use of the second option when you are already logged in to a desktop such as KDE or GNOME. Whichever way you choose, there is always a way back and you can switch back and forth between the shell and the graphical user interface.

If you want to give it a try, press [Ctrl] + [Alt] + [F2] to leave the graphical user interface. The graphical user interface disappears and you are taken to a shell which prompts you to log in. Type your username and press [Enter]. Then type your pass-

word and press [Enter]. The prompt now changes and shows some useful information as in the following example:

❶   ❷   ❸
tux@linux:~>

❶ Your login.

❷ The hostname of your computer.

❸ Path to the current directory. Directly after login, the current directory usually is your home directory, indicated by the ~ symbol (tilde) .

When you are logged in at a remote computer the information provided by the prompt always shows you which system you are currently working on.

When the cursor is located behind this prompt, you can pass commands directly to your computer system. For example, you can now enter `ls -l` to list the contents of the current directory in a detailed format. If this is enough for your first encounter with the shell and you want to go back to the graphical user interface, you should log out from your shell session first. To do so, type `exit` and press [Enter]. Then press [Alt] + [F7] to switch back to the graphical user interface. You will find your desktop and the applications running on it unchanged.

When you are already logged in to the GNOME or the KDE desktop and want to start a terminal window within the desktop, press [Alt] + [F2] and enter `konsole` (for KDE) or `gnome-terminal` (for GNOME). This opens a terminal window on your desktop. As you are already logged in to your desktop, the prompt shows information about your system as described above. You can now enter commands and execute tasks just like in any shell which runs parallel to your desktop. To switch to another application on the desktop just click on the corresponding application window or select it from the taskbar of your panel. To close the terminal window press [Alt] + [F4].

7.2 Entering Commands

As soon as the prompt appears on the shell it is ready to receive and execute commands. A command can consist of several elements. The first element is the actual command, followed by parameters or options. You can type a command and edit it by using the following keys: [←], [→], [Home], [End], [<—] (Backspace), [Del], and [Space]. You can correct typing errors or add options. The command is not executed until you press [Enter].

IMPORTANT: No News Is Good News

The shell is not verbose: in contrast to some graphical user interfaces, it usually does not provide confirmation messages when commands have been executed. Messages only appear in case of problems or errors —or if you explicitly ask for them by executing a command with a certain option.

Also keep this in mind for commands to delete objects. Before entering a command like `rm` (without any option) for removing a file, you should know if you really want to get rid of the object: it will be deleted irretrievably, without confirmation.

7.2.1 Using Commands without Options

In Section 6.3.1, "Permissions for User, Group and Others" (page 82) you already got to know one of the most basic commands: `ls`, which used to list the contents of a directory. This command can be used with or without options. Entering the plain `ls` command shows the contents of the current directory:

```
tux@knox:~> ls
bin Desktop Documents public_html tux.txt
tux@knox:~>
```

As you already learned in Section 6.2.1, "Key Features" (page 75) files in Linux may have a file extension or a suffix, such as `.txt`, but do not need to have one. This makes it difficult to differentiate between files and folders in this output of the `ls`. By default, the colors in the Bash shell give you a hint: directories are usually shown in blue, files in black.

7.2.2 Using Commands with Options

A better way to get more details about the contents of a directory is using the `ls` command with a string of options. Options modify the way a command works so that you can get it to carry out specific tasks. Options are separated from the command with a blank and are usually prefixed with a hyphen. The `ls -l` command shows the contents of the same directory in full detail (long listing format):

```
tux@knox:~> ls -l
drwxr-xr-x 1 tux users      48 2006-06-23 16:08 bin
drwx---r-- 1 tux users   53279 2006-06-21 13:16 Desktop
drwx------ 1 tux users     280 2006-06-23 16:08 Documents
drwxr-xr-x 1 tux users   70733 2006-06-21 09:35 public_html
-rw-r--r-- 1 tux users   47896 2006-06-21 09:46 tux.txt
tux@knox:~>
```

This output shows the following information about each object:

drwxr-xr-x❶ 1❷ tux❸ users❹ 48❺ 2006-06-23 16:08❻ bin❼

❶ Type of object and access permissions. For further information, refer to Section 6.3.1, "Permissions for User, Group and Others" (page 82).

❷ Number of hard links to this file.

❸ Owner of the file or directory. For further information, refer to Section 6.3.1, "Permissions for User, Group and Others" (page 82).

❹ Group assigned to the file or directory. For further information, refer to Section 6.3.1, "Permissions for User, Group and Others" (page 82).

❺ File size in bytes.

❻ Date and time of the last change.

❼ Name of the object.

Usually, you can combine several options by prefixing only the first option with a hyphen and then write the others consecutively without a blank. For example, if you want to see all files in a directory in long listing format, you can combine the two options `-l` and `-a` (show all files) for the `ls` command. Executing `ls -la` shows also hidden files in the directory, indicated by a dot in front (for example, `.hiddenfile`).

The list of contents you get with `ls` is sorted alphabetically by filenames. But like in a graphical file manager, you can also sort the output of `ls -l` according to various criteria such as date, file extension or file size:

- For date and time, use `ls -lt` (displays newest first).

- For extensions, use `ls -lx` (displays files with no extension first).

- For file size, use `ls -lS` (displays largest first).

To revert the order of sorting, add `-r` as an option to your `ls` command. For example, `ls -lr` gives you the contents list sorted in reverse alphabetical order, `ls -ltr` shows the oldest files first. There are lots of other useful options for `ls`. In the following section you will learn how to investigate them.

7.2.3 Getting Help

Nobody is expected to know all options of all commands by heart. If you remember the command name but are not sure about the options or the syntax of the command, choose one of the following possibilities:

`--help` option
> If you only want to look up the options of a certain command, try entering the command followed by a space and `--help`. This `--help` option exists for many commands. For example, `ls --help` displays all the options for the `ls` command.

Manual Pages
> To learn more about the various commands, you can also use the manual pages. Manual pages also give a short description of what the command does. They can be accessed with **man** followed by the name of the command, for example, **man ls**.

> The man pages are displayed directly in the shell. To navigate them, move up and down with [Page ↑] and [Page ↓]. Move between the beginning and the end of a document with [Home] and [End]. End this viewing mode by pressing [Q]. Learn more about the **man** command itself with **man man**.

Info Pages
> Info pages usually provide even more information about commands. To view the info page for a certain command, enter **info** followed by the name of the command

(for example, `info ls`). You can browse an info page with a viewer directly in the shell and display the different sections, called "nodes." Use [Space] to move forward and [<—] to move backwards. Within a node, you can also browse with [Page ↑] and [Page ↓] but only [Space] and [<—] will take you also to the previous or subsequent node. Like for the man pages, press [Q] to end the viewing mode.

Note that man pages and info pages do not exist for all commands. Sometimes both are available (usually for key commands), sometimes only a man page or an info page exists, and sometimes neither of them are available.

7.2.4 Bash Shortcut Keys

After having entered several commands, your shell will begin to fill up with all sorts of commands and the corresponding outputs. In the following table, find some useful shortcut keys for navigating and editing in the shell.

Shortcut Key	Function
[Ctrl] + [L]	Clears the screen and moves the current line to the top of the page.
[Ctrl] + [C]	Aborts the command which is currently being executed.
[Shift] + [Page ↑]	Scrolls upwards.
[Shift] + [Page ↓]	Scrolls downwards.
[Ctrl] + [U]	Deletes from cursor position to start of line.
[Ctrl] + [K]	Deletes from cursor position to the end of line.
[Ctrl] + [D]	Closes the shell session.
[↑], [↓]	Browses in the history of executed commands.

7.3 Working with Files and Directories

To address a certain file or directory, you must specify the path leading to that directory or file. As you may know from MS DOS or Mac OS already, there are two ways to specify a path:

Absolute Path
    Enter the entire path from the root directory to the relevant file or directory.

Relative Path
> Enter a path to the relevant file or directory by using the current directory as a starting point. This implies to give the levels you have to move up or down in the file system tree to reach the target directory of file, starting from the current directory.

Paths contain filenames, directories or both, separated by slashes. Absolute paths always start with a slash. Relative paths do not have a slash at the beginning, but can have one or two dots.

When entering commands, you can choose either way to specify a path, depending on your preferences or the amount of typing, both will lead to the same result. To change directories, use the **cd** command and specify the path to the directory.

NOTE: Handling Blanks in Filenames or Directory Names

If a filename or the name of a directory contains a space, either escape the space using a back slash (\) in front of the blank or enclose the filename in single quotes. Otherwise Bash interprets a filename like My Documents as the names of two files or directories, My and Documents in this case.

When specifying paths, the following "shortcuts" can save you a lot of typing:

- The tilde symbol (~) is a shortcut for home directories. For example, to list the contents of your home directory, use **ls** ~. To list the contents of another user's home directory, enter **ls** *~username* (or course, this will only work if you have permission to view the contents, see). For example, entering **ls** **~tux** would list the contents of the home directory of a user named *tux*. You can use the tilde symbol as shortcut for home directories also if you are working in a network environment where your home directory may not be called /home but can be mapped to any directory in the file system.

  From anywhere in the file system, you can reach your home directory by entering **cd** ~ or by simply entering **cd** without any options.

- When using relative paths, refer to the current directory with a dot (.). This is mainly useful for commands such as **cp** or **mv** by which you can copy or move files and directories.

- The next higher level in the tree is represented by two dots (..). In order to switch to the parent directory of your current directory, enter **cd ..**, to go up two levels from the current directory enter **cd ../..** etc.

To apply your knowledge, find some examples below. They address basic tasks you may want to execute with files or folders using Bash.

7.3.1 Examples for Working with Files and Directories

Suppose you want to copy a file located somewhere in your home directory to a subdirectory of `/tmp` that you need to create first.

Procedure 7.1   *Creating and Changing Directories*

From your home directory create a subdirectory in `/tmp`:

1 Enter

mkdir /tmp/test

mkdir stands for "make directory". This command creates a new directory named `test` in the `/tmp` directory. In this case, you are using an absolute path to create the `test` directory.

2 To check what happened, now enter

ls -l /tmp

The new directory `test` should appear in the list of contents of the `/tmp` directory.

3 Switch to the newly created directory with

cd /tmp/test

Procedure 7.2   *Creating and Copying Files*

Now create a new file in a subdirectory of your home directory and copy it to `/tmp/test`. Use a relative path for this task.

IMPORTANT: Overwriting of Existing Files

Before copying, moving or renaming a file, check if your target directory already contains a file with the same name. If yes, consider changing one of the filenames or use **cp** or **mv** with options like `-i`, which will prompt before overwriting an existing file. Otherwise Bash will overwrite the existing file without confirmation.

---

1 To list the contents of your home directory, enter

ls -l ~

It should contain a subdirectory called `Documents` by default. If not, create this subdirectory with the **mkdir** command you already know:

mkdir ~/Documents

2 To create a new, empty file named `myfile.txt` in the `Documents` directory, enter

`touch ~/Documents/myfile.txt`

Usually, the **touch** command updates the modification and access date for an existing file. If you use **touch** with a filename which does not exist in your target directory, it creates a new file.

3 Enter

`ls -l ~/Documents`

The new file should appear in the list of contents.

4 To copy the newly created file, enter

`cp ~/Documents/myfile.txt .`

Do not forget the dot at the end.

This command tells Bash to go to your home directory and to copy `myfile.txt` from the `Documents` subdirectory to the current directory, `/tmp/test`, without changing the name of the file.

5 Check the result by entering

`ls -l`

The file `myfile.txt` should appear in the list of contents for `/tmp/test`.

Procedure 7.3 *Renaming and Removing Files or Directories*

Now suppose you want to rename `myfile.txt` into `tuxfile.txt`. Finally you decide to remove the renamed file and the `test` subdirectory.

1 To rename the file, enter

`mv myfile.txt tuxfile.txt`

2 To check what happened, enter

`ls -l`

Instead of `myfile.txt`, `tuxfile.txt` should appear in the list of contents.

mv stands for `move` and is used with two options: the first option specifies the source, the second option specifies the target of the operation. You can use **mv** either

• to rename a file or a directory,

- to move a file or directory to a new location or

- to do both in one step.

3 Coming to the conclusion that you do not need the file any longer, you can delete it by entering

```
rm tuxfile.txt
```

Bash deletes the file without any confirmation.

4 Move up one level with **cd ..** and check with

```
ls -l test
```

if the `test` directory is empty now.

5 If yes, you can remove the `test` directory by entering

```
rmdir test
```

7.4 Becoming Root

As you learned in Section 6.1, "User Concept" (page 73), some tasks in Linux require `root` permissions, otherwise they cannot be executed.

7.4.1 Using su

In order to temporarily become `root` in a shell, proceed as follows:

1 Enter **su**. You are prompted for the `root` password.

2 Enter the password. If you mistyped the `root` password, the shell displays a message. In this case, you have to re-enter **su** before retyping the password. If your password is correct, a hash symbol **#** appears at the end of the prompt, signaling that you are acting as `root` now.

3 Execute your task. For example, transfer ownership of a file to a new user which only `root` is allowed to do:

```
chown wilber kde_quick.xml
```

4 After having completed your tasks as `root`, switch back to your normal user account. To do so, enter

```
exit
```

The hash symbol disappears and you are acting as "normal" user again.

7.4.2 Using sudo

Alternatively, you can also use **sudo** (superuser "do") to execute some tasks which normally are for `root`s only. With sudo, administrators can grant certain users `root` privileges for some commands. Depending on the system configuration, users can then run `root` commands by entering their normal password only. Due to a timestamp function, users are only granted a "ticket" for a restricted period of time after having entered their password. The ticket usually expires after a few minutes. In openSUSE, sudo requires the `root` password by default (if not configured otherwise by your system administrator).

For users, sudo is convenient as it prevents you from switching accounts twice (to `root` and back again). To change the ownership of a file using sudo, only one command is necessary instead of three:

```
sudo chown wilber kde_quick.xml
```

After you have entered the password which you are prompted for, the command is executed. If you enter a second `root` command shortly after that, you are not prompted for the password again, because your ticket is still valid. After a certain amount of time, the ticket automatically expires and the password is required again. This also prevents unauthorized persons from gaining `root` privileges in case a user forgets to switch back to his normal user account again and leaves a `root` shell open.

7.5 Modifying File Permissions

In Linux, objects such as files or folder or processes generally belong to the user who created or initiated them. The group which is associated with a file or a folder depends on the primary group the user belongs to when creating the object. When you create a new file or directory, initial access permissions for this object are set according to a predefined scheme. For further details refer to Section 6.3, "File Access Permissions" (page 81).

As the owner of a file or directory (and, of course, as `root`), you can change the access permissions to this object.

To change object attributes like access permissions of a file or folder, use the **chmod** command followed by the following parameters:

- the users for which to change the permissions,

- the type of access permission you want to remove, set or add and

- the files or folders for which you want to change permissions separated by spaces.

The users for which you can change file access permissions fall into the following categories: the owner of the file (user, u), the group that own the file (group, g) and the other users (others, o). You can add, remove or set one or more of the following permissions: read, write or execute.

As root, you can also change the ownership of a file: with the command **chown** (change owner) you can transfer ownership to a new user.

7.5.1 Examples for Changing Access Permissions and Ownership

The following example shows the output of an `ls -l` command in a shell.

Example 7.1 *Access Permissions For Files and Folders*

```
-rw-r----- 1 tux users      0 2006-06-23 16:08 checklist.txt
-rw-r--r-- 1 tux users  53279 2006-06-21 13:16 gnome_quick.xml
-rw-rw---- 1 tux users      0 2006-06-23 16:08 index.htm
-rw-r--r-- 1 tux users  70733 2006-06-21 09:35 kde-start.xml
-rw-r--r-- 1 tux users  47896 2006-06-21 09:46 kde_quick.xml
drwxr-xr-x 2 tux users     48 2006-06-23 16:09 local
-r-xr-xr-x 1 tux users 624398 2006-06-23 15:43 tux.jpg
```

In the example above, user tux owns the file kde-start.xml and has read and write access to the file but cannot execute it. The users group can read the file but cannot write or execute it. The same holds true for the other users as shown by the third block of characters.

Procedure 7.4 *Changing Access Permissions*

Suppose you are tux and want to modify the access permissions to your files:

1 If you want to grant the users group also write access to kde-start.xml, enter

chmod g+w kde-start.xml

2 To grant the users group and other users write access to kde-start.xml, enter

chmod go+w kde-start.xml

3 To remove write access for all users, enter

chmod -w kde-start.xml

If you do not specify any kind of users, the changes apply to all users— the owner of the file, the owning group and the others. Now even the owner tux does not have write access to the file without first reestablishing write permissions.

4 To prohibit the usersgroup and others to change into the directory local, enter

chmod go-x local

5 To grant others write permissions for two files, for kde_quick.xml and gnome _quick.xml, enter

```
chmod o+w  kde_quick.xml gnome_quick.xml
```

Procedure 7.5 *Changing Ownership*

Suppose you are *tux* and want to transfer the ownership of the file `kde_quick.xml` to an other user, named `wilber`. In this case, proceed as follows:

1 Enter the username and password for `root`.

2 Enter

```
chown wilber kde_quick.xml
```

3 Check what happened with

```
ls -l kde_quick.xml
```

You should get the following output:

```
-rw-r--r-- 1 wilber users  47896 2006-06-21 09:46 kde_quick.xml
```

4 If the ownership is set according to your wishes, switch back to your normal user account.

7.6 Useful Features of the Shell

As you probably noticed in the examples above, entering commands in Bash can include a lot of typing. In the following, get to know some features of the Bash that can make your work a lot easier and save a lot of typing.

History
By default, Bash "remembers" commands you have entered. This feature is called *history*. You can browse through commands that have been entered before, select one you want to repeat and then execute it again. To do so, press [↑] repeatedly until the desired command appears at the prompt. To move forward through the list of previously entered commands, press [↓]. For easier repetition of a certain command from Bash history, just type the first letter of the command you want to repeat and press [Page ↑].

You can now edit the selected command (for example, change the name of a file or a path), before you execute the command by pressing [Enter]. To edit the command line, just move the cursor to the desired position using the arrow keys and start typing.

You can also search for a certain command in the history. Press [Ctrl] + [R] to start an incremental search function. showing the following prompt:

```
(reverse-i-search)`':
```

Just type one or several letters from the command you are searching for. Each character you enter narrows down the search. The corresponding search result is shown on the right side of the colon whereas your input appears on the left of the colon. To accept a search result, press [Esc]. The prompt now changes to its normal appearance and shows the command you chose. You can now edit the command or directly execute it by pressing [Enter].

Completion
> Completing a filename or directory name to its full length after typing its first letters is another helpful feature of Bash. To do so, type the first letters then press [→|] (Tabulator). If the filename or path can be uniquely identified, it is completed at once and the cursor moves to the end of the filename. You can then enter the next option of the command, if necessary. If the filename or path cannot be uniquely identified (because there are several filenames starting with the same letters), the filename or path is only completed up to the point where it becomes ambiguous again. You can then obtain a list of them by pressing [→|] a second time. After this, you can enter the next letters of the file or path then try completion again by pressing [→|]. When completing filenames and paths with the help of [→|], you can simultaneously check whether the file or path you want to enter really exists (and you can be sure of getting the spelling right).

Wild Cards
> You can replace one or more characters in a filename with a wild card for pathname expansion. Wild cards are characters that can stand for other characters. There are three different types of these in Bash:

Wild Card	Function
?	Matches exactly one arbitrary character
*	Matches any number of characters
[*set*]	Matches one of the characters from the group specified inside the square brackets, which is represented here by the string *set*.

7.6.1 Examples For Using History, Completion and Wildcards

The following examples illustrate how to make use of these convenient features of Bash.

Procedure 7.6   *Using History and Completion*

If you already did the example your shell buffer should be filled with commands which you can retrieve using the history function.

1 Press [↑] repeatedly until **cd ~** appears.

2 Press [Enter] to execute the command and to switch to your home directory.

By default, your home directory contains two subdirectories starting with the same letter, Documents and Desktop.

3 Enter **cd D** and press [→|].

Nothing happens since Bash cannot identify to which one of the subdirectories you want to change.

4 Press [→|] again to see the list of possible choices:

```
tux@knox:~> cd D Desktop/    Documents/ tux@knox:~> cd D
```

5 The prompt still shows your initial input. Type the next character of the subdirectory you want to go to and press [→|] again.

Bash now completes the path.

6 You can now execute the command with [Enter].

Procedure 7.7 *Using Wildcards*

Now suppose that your home directory contains a number of files with various file extensions. It also holds several versions of one file which you saved under different filenames myfile1.txt, myfile2.txt etc. You want to search for certain files according to their properties.

1 First, create some test files in your home directory:

> **1a** Use the **touch** command to create several (empty) files with different file extensions, for example .pdf, .xml and .jpg.
>
> You can do this consecutively (do not forget to use the Bash history function) or with only one **touch** command: simply add several filenames separated by a space.
>
> **1b** Create at least two files that have the same file extension, for example .html.
>
> **1c** To create several "versions" of one file, enter
>
> touch myfile{1..5}.txt
>
> This command creates five consecutively numbered files:
>
> myfile1.txt,⋯,myfile5.txt

1d List the contents of your home directory. It should look similar to this:

```
-rw-r--r-- 1 tux users   0 2006-07-14 13:34 foo.xml
-rw-r--r-- 1 tux users   0 2006-07-14 13:47 home.html
-rw-r--r-- 1 tux users   0 2006-07-14 13:47 index.html
-rw-r--r-- 1 tux users   0 2006-07-14 13:47 toc.html
-rw-r--r-- 1 tux users   0 2006-07-14 13:34 manual.pdf
-rw-r--r-- 1 tux users   0 2006-07-14 13:49 myfile1.txt
-rw-r--r-- 1 tux users   0 2006-07-14 13:49 myfile2.txt
-rw-r--r-- 1 tux users   0 2006-07-14 13:49 myfile3.txt
-rw-r--r-- 1 tux users   0 2006-07-14 13:49 myfile4.txt
-rw-r--r-- 1 tux users   0 2006-07-14 13:49 myfile5.txt
-rw-r--r-- 1 tux users   0 2006-07-14 13:32 tux.png
```

2 With the help of wild cards, select certain subsets of the files according to various criteria:

2a To list all files with the .html extension, enter

```
ls -l *.html
```

2b To list all "versions" of myfile.txt, enter

```
ls -l myfile?.txt
```

Note that you can only use the ? wild card here because the numbering of the files is single-digit. As soon as you have a file named myfile10 .txt you must to use the * wild card to view all versions of myfile.txt (or add another question mark, so your string looks like **myfile??.txt**).

2c To remove, for example, version 1-3 and version 5 of myfile.txt, enter

```
rm myfile[1-3,5].txt
```

2d Check the result with

```
ls -l
```

Of all myfile.txt versions only myfile4.txt should be left.

You can also combine several wild cards in one command. In the example above, **rm myfile[1-3,5].*** would lead to the same result as **rm myfile[1-3,5].txt** because there are only files with the extension .txt available.

7.7 Editing Texts

In order to edit files from the command line, you will need to know the vi editor. vi is a default editor which can be found on nearly every UNIX/Linux system. It can run several operating modes in which the keys you press have different functions. This does not make it very easy for beginners, but you should know at least the most basic operations with vi. There may be situations where no other editor than vi is available.

Basically, vi makes use of three operating modes:

command mode
> In this mode, vi accepts certain key combinations as commands. Simple tasks such as searching words or deleting a line can be executed.

insert mode
> In this mode, you can write normal text.

extended mode
> In this mode, also known as colon mode (as you have to enter a colon to switch to this mode), vi can execute also more complex tasks such as searching and replacing text.

In the following (very simple) example, you will learn how to open and edit a file with vi, how to save your changes and quit vi.

7.7.1 Example: Editing with vi

1. To create and open a new file with vi, enter

   `vi textfile.txt`

   By default, vi opens in *command* mode in which you cannot enter text.

2. Press [I] to switch to insert mode. The bottom line changes and indicates that you now can insert text.

3 Write some sentences. If you want to insert a new line, first press [Esc] to switch back to command mode. Press [O] to insert a new line and to switch to insert mode again.

4 In the insert mode, you can edit the text with the arrow keys and with [Del].

5 To leave vi, press [Esc] to switch to command mode again. Then press [:] which takes you to the extended mode. The bottom line now shows a colon.

6 To leave vi and save your changes, type `wq` (`w` for `write`; `q` for `quit`) and press [Enter]. If you want to save the file under a different name, type `w` *`filename`* and press [Enter].

To leave vi without saving, type `q!` instead and press [Enter].

7.8 Searching for Files or Contents

Bash offers you several commands to search for files and to search for the contents of files:

`locate`
This utility is only available if you have installed the `findutils-locate` package. With this command you can find out in which directory a specified file is located. If desired, use wild cards to specify filenames. The program is very quick, because it uses a database specifically created for the purpose (rather than searching through the entire file system). This very fact, however, also results in a major drawback: locate is unable to find any files created after the latest update of its database. The database can be generated by `root` running **updatedb**.

`find`
With **find**, search for a file in a given directory. The first argument specifies the directory in which to start the search. The option -name must be followed by a search string, which may also include wild cards. Unlike **locate**, which uses a database, **find** scans the actual directory.

`grep`
The **grep** command finds a specific search string in the specified text files. If the search string is found, the command displays the line in which `searchstring` was found, along with the filename. If desired, use wild cards to specify filenames.

7.8.1 Examples for Searching

The KDE and GNOME desktops store user-specific application data in hidden directories, for example `.kde` and `.gnome`.

1 To locate these directories on your computer, enter

```
locate .kde
```

if you have installed KDE desktop or

```
locate .gnome
```

if you have installed GNOME desktop.

You will see that **locate** displays all file names in the database that contain the string .kde or .gnome anywhere. To learn how to modify this behavior refer to the man page of **locate**.

2 To search your home directory for all occurrences of filenames that contain the file extension .txt, use

```
find ~ -name '*.txt' -print
```

3 To search a directory (in this case, your home directory) for all occurrences of files which contain, for example, the word music, enter

```
grep music ~/*
```

Note that grep is case-sensitive— unless you use it with the -i option. With the command above you will not find any files containing Music.

If you want to use a search string which consists of more than one word, enclose the string in double quotation marks, for example:

```
grep "music is great" ~/*
```

7.9 Viewing Text Files

When searching for the contents of a file with **grep**, the output gives you the line in which the searchstring was found along with the filename. Often this contextual information is still not enough information to decide whether you want to open and edit this file. Bash offers you several commands to have a quick look at the contents of a text file directly in the shell, without opening an editor.

head
  With **head** you can view the first lines of a text file. If you do not specify the command any further, **head** shows the first 10 lines of a text file.

tail
  The **tail** command is the counterpart of **head**. If you use **tail** without any further options it displays the last 10 lines of a text file. This can be very useful to view log files of your system, where the most recent messages or log entries are usually found at the end of the file.

less
  With **less**, display the whole contents of a text file. To move up and down half a page use [Page ↑] and [Page ↓]. Use [Space] to scroll down one page. [Home]

takes you to the beginning, and [End] to the end of the document. To end the viewing mode, press [Q].

more

Instead of `less`, you can also use the older program `more`. It has basically the same function—however, it is less convenient because it does not allow you to scroll backwards. Use [Space] to move forward. When you reach the end of the document, the viewer closes automatically.

cat

The **cat** command displays the contents of a file, printing the entire contents to the screen without interruption. As **cat** does not allow you to scroll it is not very useful as viewer but it is rather often used in combination with other commands.

7.10 Redirection and Pipes

Sometimes it would be useful if you could write the output of a command to a file for further editing or if you could combine several commands, using the output of one command as the input for the next one. The shell offers this function by means of redirection or pipes.

Normally, the standard output in the shell is your screen (or an open shell window) and the standard input is the keyboard. With the help of certain symbols you can redirect the input or the output to another object, such as a file or another command.

Redirection

With > you can forward the output of a command to a file (output redirection), with < you can use a file as input for a command (input redirection).

Pipe

By means of a pipe symbol | you can also redirect the output: with a pipe, you can combine several commands, using the output of one command as input for the next command. In contrast to the other redirection symbols > and <, the use of the pipe is not constrained to files.

7.10.1 Examples for Redirection and Pipe

1 To write the output of a command like **ls** to a file, enter

```
ls -l > filelist.txt
```

This creates a file named `filelist.txt` that contains the list of contents of your current directory as generated by the **ls** command.

However, if a file named `filelist.txt` already exists, this command overwrites the existing file. To prevent this, use >> instead of >. Entering

```
ls -l >> filelist.txt
```

simply appends the output of the `ls` command to an already existing file named `filelist.txt`. If the file does not exist, it is created.

2 Redirections also works the other way round. Instead of using the standard input from the keyboard for a command, you can use a file as input:

```
sort < filelist.txt
```

This will force the **sort** command to get its input from the contents of `filelist.txt`. The result is shown on the screen. Of course, you can also write the result into another file, using a combination of redirections:

```
sort  < filelist.txt > sorted_filelist.txt
```

3 If a command generates a lengthy output, like `ls -l` may do, it may be useful to pipe the output to a viewer like `less` to be able to scroll through the pages. To do so, enter

```
ls -l | less
```

The list of contents of the current directory is shown in `less`.

The pipe is also often used in combination with the **grep** command in order to search for a certain string in the output of another command. For example, if you want to view a list of files in a directory which are owned by the user tux, enter

```
ls -l | grep tux
```

7.11 Starting Programs and Handling Processes

As you have seen in , programs can be started from the shell. Applications with a graphical user interface need the X Window System and can only be started from a terminal window within a graphical user interface. For example, if you want to open a file named `vacation.pdf` in your home directory from a terminal window in KDE or GNOME, simply run **okular ~/vacation.pdf** (or **evince ~/vacation.pdf**) to start a PDF viewer displaying your file.

When looking at the terminal window again you will realize that the command line is blocked as long as the PDF viewer is open, meaning that your prompt is not available. To change this, press [Ctrl] + [Z] to suspend the process and enter **bg** to send the process to the background. Now you can still have a look at `vacation.pdf` while your prompt is available for further commands. An easier way to achieve this is by sending a process to the background directly when starting it. To do so, add an ampersand at the end of the command:

```
okular ~/vacation.pdf &
```

If you have started several background processes (also named jobs) from the same shell, the **jobs** command gives you an overview of the jobs. It also shows the job number in brackets and their status:

```
tux@linux:~> jobs
[1]   Running          okular book.opensuse.startup-xep.pdf &
[2]-  Running          okular book.opensuse.reference-xep.pdf &
[3]+  Stopped          man jobs
```

To bring a job to the foreground again, enter **fg** *job_number*.

Whereas **job** only shows the background processes started from a specific shell, the **ps** command (run without options) shows a list of all your processes—those you started. Find an example output below:

```
tux@linux:~> ps
PID TTY          TIME CMD
15500 pts/1    00:00:00 bash
28214 pts/1    00:00:00 okular
30187 pts/1    00:00:00 kwrite
30280 pts/1    00:00:00 ps
```

In case a program cannot be terminated in the normal way, use the **kill** command to stop the process (or processes) belonging to that program. To do so, specify the process ID (PID) shown by the output of **ps**. For example, to shut down the KWrite editor in the example above, enter

```
kill 30187
```

This sends a *TERM* signal that instructs the program to shut itself down.

Alternatively, if the program or process you want to terminate is a background job and is shown by the **jobs** command, you can also use the **kill** command in combination with the job number to terminate this process. When identifying the job with the job number, you must prefix the number with a percent character (**%**):

```
kill %job_number
```

If **kill** does not help—as is sometimes the case for "runaway" programs—try

```
kill -9 PID
```

This sends a *KILL* signal instead of a *TERM* signal, bringing the specified process to an end in most cases.

This section is intended to introduce the most basic set of commands for handling jobs and processes. Find an overview for system administrators in Section "Processes" (Chapter 13, *System Monitoring Utilities*, ↑*Reference*).

7.12 Important Linux Commands

This section gives insight into the most important commands. There are many more commands than listed in this chapter. Along with the individual commands, parameters are listed and, where appropriate, a typical sample application is introduced. To learn more about the various commands, use the manual pages, accessed with `man` followed by the name of the command, for example, `man ls`.

Man pages are displayed directly in the shell. To navigate them, move up and down with [Page ↑] and [Page ↓]. Move between the beginning and the end of a document with [Home] and [End]. End this viewing mode by pressing [Q]. Learn more about the `man` command itself with `man man`.

In the following overview, the individual command elements are written in different typefaces. The actual command and its mandatory options are always printed as `command option`. Specifications or parameters that are not required are placed in `[square brackets]`.

Adjust the settings to your needs. It makes no sense to write `ls file` if no file named `file` actually exists. You can usually combine several parameters, for example, by writing `ls -la` instead of `ls -l -a`.

7.12.1 File Commands

The following section lists the most important commands for file management. It covers everything from general file administration to the manipulation of file system ACLs.

File Administration

`ls` `[options] [files]`
   If you run `ls` without any additional parameters, the program lists the contents of the current directory in short form.

   `-l`
      Detailed list

   `-a`
      Displays hidden files

`cp` `[options] source target`
   Copies `source` to `target`.

   `-i`
      Waits for confirmation, if necessary, before an existing `target` is overwritten

   `-r`
      Copies recursively (includes subdirectories)

mv [options] source target

    Copies source to target then deletes the original source.

    -b

        Creates a backup copy of the source before moving

    -i

        Waits for confirmation, if necessary, before an existing targetfile is overwritten

rm [options] files

    Removes the specified files from the file system. Directories are not removed by **rm** unless the option -r is used.

    -r

        Deletes any existing subdirectories

    -i

        Waits for confirmation before deleting each file

ln [options] source target

    Creates an internal link from source to target. Normally, such a link points directly to source on the same file system. However, if **ln** is executed with the -s option, it creates a symbolic link that only points to the directory in which source is located, enabling linking across file systems.

    -s

        Creates a symbolic link

cd [options] [directory]

    Changes the current directory. **cd** without any parameters changes to the user's home directory.

mkdir [options] directory

    Creates a new directory.

rmdir [options] directory

    Deletes the specified directory if it is already empty.

chown [options] username[:[group]] files

    Transfers ownership of a file to the user with the specified username.

    -R

        Changes files and directories in all subdirectories

chgrp [options] groupname files

    Transfers the group ownership of a given file to the group with the specified group name. The file owner can change group ownership only if a member of both the current and the new group.

chmod [`options`] `mode files`
    Changes the access permissions.

    The `mode` parameter has three parts: `group`, `access`, and `access type`. `group` accepts the following characters:

    u
        User

    g
        Group

    o
        Others

    For `access`, grant access with + and deny it with –.

    The `access type` is controlled by the following options:

    r
        Read

    w
        Write

    x
        Execute—executing files or changing to the directory

    s
        Setuid bit—the application or program is started as if it were started by the owner of the file

    As an alternative, a numeric code can be used. The four digits of this code are composed of the sum of the values 4, 2, and 1—the decimal result of a binary mask. The first digit sets the set user ID (SUID) (4), the set group ID (2), and the sticky (1) bits. The second digit defines the permissions of the owner of the file. The third digit defines the permissions of the group members and the last digit sets the permissions for all other users. The read permission is set with 4, the write permission with 2, and the permission for executing a file is set with 1. The owner of a file would usually receive a 6 or a 7 for executable files.

gzip [`parameters`] `files`
    This program compresses the contents of files using complex mathematical algorithms. Files compressed in this way are given the extension `.gz` and need to be uncompressed before they can be used. To compress several files or even entire directories, use the **tar** command.

    -d
        Decompresses the packed gzip files so they return to their original size and can be processed normally (like the command **gunzip**)

tar `options archive files`

> **tar** puts one or more files into an archive. Compression is optional. **tar** is a quite complex command with a number of options available. The most frequently used options are:

> `-f`
>> Writes the output to a file and not to the screen as is usually the case

> `-c`
>> Creates a new tar archive

> `-r`
>> Adds files to an existing archive

> `-t`
>> Outputs the contents of an archive

> `-u`
>> Adds files, but only if they are newer than the files already contained in the archive

> `-x`
>> Unpacks files from an archive (*extraction*)

> `-z`
>> Packs the resulting archive with **gzip**

> `-j`
>> Compresses the resulting archive with **bzip2**

> `-v`
>> Lists files processed

> The archive files created by **tar** end with `.tar`. If the tar archive was also compressed using **gzip**, the ending is `.tgz` or `.tar.gz`. If it was compressed using **bzip2**, the ending is `.tar.bz2`.

locate `patterns`

> This command is only available if you have installed the `findutils-locate` package. The **locate** command can find in which directory a specified file is located. If desired, use wild cards to specify filenames. The program is very fast, because it uses a database specifically created for the purpose (rather than searching through the entire file system). This very fact, however, also results in a major drawback: locate is unable to find any files created after the latest update of its database. The database can be generated by `root` with **updatedb**.

updatedb `[options]`

> This command performs an update of the database used by **locate**. To include files in all existing directories, run the program as `root`. It also makes sense to

place it in the background by appending an ampersand (&), so you can immediately continue working on the same command line (**updatedb &**). This command usually runs as a daily cron job (see cron.daily).

find [options]
   With **find**, search for a file in a given directory. The first argument specifies the directory in which to start the search. The option **-name** must be followed by a search string, which may also include wild cards. Unlike **locate**, which uses a database, **find** scans the actual directory.

Commands to Access File Contents

file [options] [files]
   With **file**, detect the contents of the specified files.

   -z
      Tries to look inside compressed files

cat [options] files
   The **cat** command displays the contents of a file, printing the entire contents to the screen without interruption.

   -n
      Numbers the output on the left margin

less [options] files
   This command can be used to browse the contents of the specified file. Scroll half a screen page up or down with [PgUp] and [PgDn] or a full screen page down with [Space]. Jump to the beginning or end of a file using [Home] and [End]. Press [Q] to exit the program.

grep [options] searchstring files
   The grep command finds a specific search string in the specified files. If the search string is found, the command displays the line in which searchstring was found along with the filename.

   -i
      Ignores case

   -H
      Only displays the names of the relevant files, but not the text lines

   -n
      Additionally displays the numbers of the lines in which it found a hit

   -l
      Only lists the files in which searchstring does not occur

diff [options] file1 file2

    The **diff** command compares the contents of any two files. The output produced by the program lists all lines that do not match. This is frequently used by programmers who need only to send their program alterations and not the entire source code.

    -q

        Only reports whether the two files differ

    -u

        Produces a "unified" diff, which makes the output more readable

File Systems

mount [options] [device] mountpoint

    This command can be used to mount any data media, such as hard disks, CD-ROM drives, and other drives, to a directory of the Linux file system.

    -r

        Mount read-only

    -t filesystem

        Specify the file system, commonly ext2 for Linux hard disks, msdos for MS-DOS media, vfat for the Windows file system, and iso9660 for CDs

    For hard disks not defined in the file /etc/fstab, the device type must also be specified. In this case, only root can mount it. If the file system needs to also be mounted by other users, enter the option user in the appropriate line in the /etc/fstab file (separated by commas) and save this change. Further information is available in the mount(1) man page.

umount [options] mountpoint

    This command unmounts a mounted drive from the file system. To prevent data loss, run this command before taking a removable data medium from its drive. Normally, only root is allowed to run the commands **mount** and **umount**. To enable other users to run these commands, edit the /etc/fstab file to specify the option user for the relevant drive.

7.12.2 System Commands

The following section lists a few of the most important commands needed for retrieving system information and controlling processes and the network.

System Information

df [options] [directory]

    The **df** (disk free) command, when used without any options, displays information about the total disk space, the disk space currently in use, and the free space on

all the mounted drives. If a directory is specified, the information is limited to the drive on which that directory is located.

-h

Shows the number of occupied blocks in gigabytes, megabytes, or kilobytes—in human-readable format

-T

Type of file system (ext2, nfs, etc.)

du [options] [path]

This command, when executed without any parameters, shows the total disk space occupied by files and subdirectories in the current directory.

-a

Displays the size of each individual file

-h

Output in human-readable form

-s

Displays only the calculated total size

free [options]

The command **free** displays information about RAM and swap space usage, showing the total and the used amount in both categories. See Section "The free Command" (Chapter 18, *Special System Features*, ↑*Reference*) for more information.

-b

Output in bytes

-k

Output in kilobytes

-m

Output in megabytes

date [options]

This simple program displays the current system time. If run as root, it can also be used to change the system time. Details about the program are available in the date(1) man page.

Processes

top [options]

top provides a quick overview of the currently running processes. Press [H] to access a page that briefly explains the main options for customizing the program.

ps [options] [process_ID]

    If run without any options, this command displays a table of all your own programs or processes—those you started. The options for this command are not preceded by hyphen.

    aux

        Displays a detailed list of all processes, independent of the owner

kill [options] process_ID

    Unfortunately, sometimes a program cannot be terminated in the normal way. In most cases, you should still be able to stop such a runaway program by executing the **kill** command, specifying the respective process ID (see **top** and **ps**). **kill** sends a *TERM* signal that instructs the program to shut itself down. If this does not help, the following parameter can be used:

    -9

        Sends a *KILL* signal instead of a *TERM* signal, bringing the specified process to an end in almost all cases

killall [options] processname

    This command is similar to **kill**, but uses the process name (instead of the process ID) as an argument, killing all processes with that name.

Network

ping [options] hostname_or_IP address

    The **ping** command is the standard tool for testing the basic functionality of TCP/IP networks. It sends a small data packet to the destination host, requesting an immediate reply. If this works, **ping** displays a message to that effect, which indicates that the network link is basically functioning.

    -c*number*

        Determines the total number of packages to send and ends after they have been dispatched (by default, there is no limitation set)

    -f

        flood ping: sends as many data packages as possible; a popular means, reserved for root, to test networks

    -i*value*

        Specifies the interval between two data packages in seconds (default: one second)

host [options] hostname [server]

    The domain name system resolves domain names to IP addresses. With this tool, send queries to name servers (DNS servers).

ssh [options] [user@]hostname [command]
> SSH is actually an Internet protocol that enables you to work on remote hosts across a network. SSH is also the name of a Linux program that uses this protocol to enable operations on remote computers.

Miscellaneous

passwd [options] [username]
> Users may change their own passwords at any time using this command. The administrator root can use the command to change the password of any user on the system.

su [options] [username]
> The **su** command makes it possible to log in under a different username from a running session. Specify a username and the corresponding password. The password is not required from root, because root is authorized to assume the identity of any user. When using the command without specifying a username, you are prompted for the root password and change to the superuser (root). Use **su** - to start a login shell for a different user.

halt [options]
> To avoid loss of data, you should always use this program to shut down your system.

reboot [options]
> Does the same as **halt** except the system performs an immediate reboot.

clear
> This command cleans up the visible area of the console. It has no options.

7.12.3 For More Information

There are many more commands than listed in this chapter. For information about other commands or more detailed information, the O'Reilly publication *Linux in a Nutshell* is recommended.

Part III. Help and Troubleshooting

8 Help and Documentation

openSUSE® comes with various sources of information and documentation, many of which are already integrated in your installed system:

Desktop Help Centers
  The help centers of both the KDE desktop (KDE help center) and the GNOME desktop (Help) provide central access to the most important documentation resources on your system, in searchable form. These resources include online help for installed applications, man pages, info pages, and the Novell/SUSE manuals delivered with your product. Learn more about your desktop's help center in Section 8.1, "Using the KDE Help Center" (page 117) and Section 8.2, "Using GNOME Help" (page 119).

Separate Help Packages for Some Applications
  When installing new software with YaST, the software documentation is installed automatically in most cases, and usually appears in the help center of your desktop. However, some applications, such as GIMP, may have different online help packages that can be installed separately with YaST and do not integrate into the help centers.

Documentation in /usr/share/doc
  This traditional help directory holds various documentation files and the release notes for your system. Find more detailed information in Section "Documentation Directory" (Chapter 35, *Help and Documentation*, ↑*Reference*).

Man Pages and Info Pages for Shell Commands
  When working with the shell, you do not need to know the options of the commands by heart. Traditionally, the shell provides integrated help by means of man pages and info pages. Read more in Section "Man Pages" (Chapter 35, *Help and Documentation*, ↑*Reference*) and Section "Info Pages" (Chapter 35, *Help and Documentation*, ↑*Reference*).

8.1 Using the KDE Help Center

From the KDE desktop, you can access the KDE help center in various ways: If you need information from within an application, simply click the application's *Help* button or press [F1] to open the application's documentation in the help center. If you start the help center from the main menu, or from the command line with `khelpcenter`, you are taken to the main window of the help center from which you can browse the help topics.

Figure 8.1   *Main Window of the KDE Help Center*
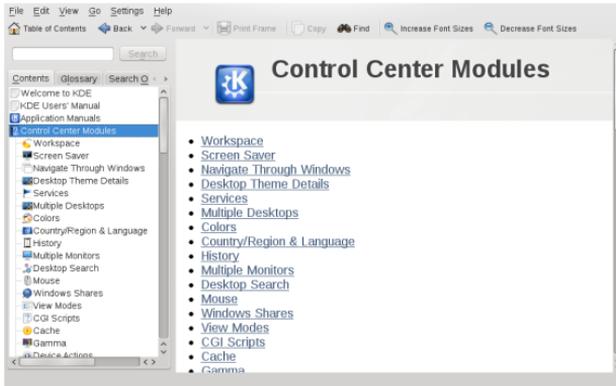
The menu and the toolbar provide options for printing contents from the help center, searching the currently displayed page, and navigating and customizing the help center. The display field in the right part of the window always shows the currently selected contents, such as online manuals, search results, or Web pages.

The navigation area in the left part of the window contains several tabs:

Contents
Presents a tree view of all available information sources. The help center addresses various target groups, such as users, administrators, and developers. Click on an entry to open and browse the individual categories. The help center also provides access to some online databases that cover special hardware and software issues for your product. All these sources can be searched conveniently once a search index has been generated.

The contents of your help center depends on which software packages are currently installed and which languages are selected as your system languages.

Glossary
Provides a quick reference where you can look up the definitions of words that might be unfamiliar to you.

Search Options
Holds options for the full text search of the help center. You can combine several search criteria.

Procedure 8.1   *Searching the Help Center*

To use the full text search KDE help center offers, generate a search index and set the search parameters. If the search index has not yet been generated, the system automatically prompts you to do so when you click the *Search* tab.

1 To search for a term, click into the text field and enter the search string.

2 To combine your search strings with operands, click *Method* and select the operand to use.

3 Choose an option from *Max. Results* to limit the number of hits to display.

4 To restrict your search to certain types of documentation, choose an option from *Scope selection*. With *Default*, a predefined selection of documents is searched. *All* includes all types of documents in the search. *Custom* lets you define which documents to include in your search. Just activate the documents you want in the list.

5 When you have set the options according to your wishes, click *Search*. The search results are then displayed as a list of links in the display field and can be navigated with mouse clicks.

Procedure 8.2   *Generating a New Search Index*

1 To create a new search index, select *Settings > Build Search Index* from the menu. A window opens, showing a list of the documentation currently available in the help center. In case no search index exists, you are automatically asked to build one, once you enter a search term into the search field.

2 Select the documents to integrate in the search index and click *Build Index*. After the index has been generated, you can use the full text search.

8.2 Using GNOME Help

On the GNOME desktop, to start Help directly from an application, either click the *Help* button or press [F1]. Both options take you directly to the application's documentation in the help center. However, you can also start Help from the main menu, or from the command line with `yelp` and then browse through the main window of the help center.

Figure 8.2   *Main Window of Help*
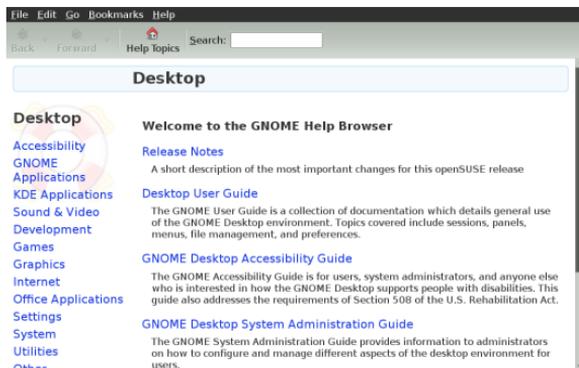
The menu and the toolbar provide options for navigating and customizing the help center, for searching and for printing contents from Help. To view a table of contents, click the home icon or press [Alt] + [Home]. The help topics are grouped into categories presented as links. Click one of the links to open a list of topics for that category. To search for an item, just enter the search string into the search field at the top of the window.

8.3 Browsing Man and Info Pages From Your Desktop

With the KDE or GNOME desktop, you can also access (or print) man pages and info pages:

KDE
In Dolphin or Konqueror, to view the man page for `ls`, type `man:/ls` in the location bar. If there are different categories for a command, Konqueror displays them as links. To display the info page for `grep`, for example, type `info:/grep`.

In the KDE help center, click *UNIX Manual Pages* or *Browse Info Pages*in the table of contents to browse man pages and info pages. You may also use the search and limit the scope to *UNIX Manual Pages*.

GNOME
Run `yelp man:ls` or `yelp info:ls` to display the man or info page. Alternatively enter `man:ls` or `info:ls` in the search field of Yelp.

Figure 8.3   *Viewing a Man Page With Konqueror*
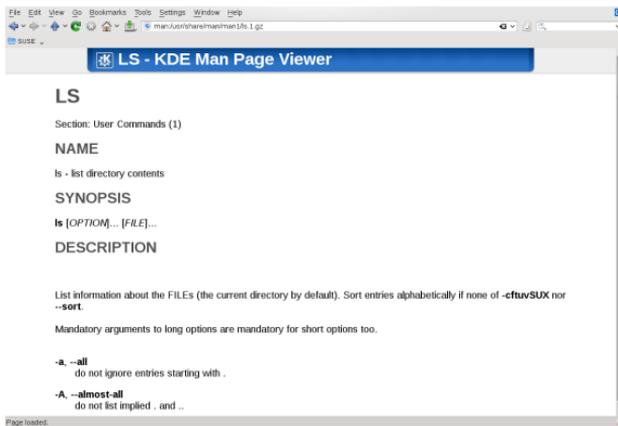
8.4 Additional Help Resources

In addition to the online versions of the openSUSE manuals installed under `/usr/share/doc`, you can also access the product-specific manuals and documentation on the Web. For an overview of all documentation available for openSUSE check out your product-specific documentation Web page at http://www.novell.com/documentation/.

If you are searching for additional product-related information, you can also refer to the following Web sites:

- openSUSE Wiki English [http://en.opensuse.org] and http://www.opensuse.org

- SUSE Support Database [http://en.opensuse.org/SDB:SDB]

- openSUSE Forums [http://forums.opensuse.org/]

- KDE Documentation Web site [http://www.kde.org/documentation]

- Documentation Web site for KDE applications [http://www.kde-apps.org]

- GNOME Documentation Web site [http://www.gnome.org/learn/]

You might also want to try general-purpose search engines. For example, you might try the search terms `Linux CD-RW help` or `OpenOffice file conversion problem` if you were having trouble with the CD burning or with OpenOffice.org file conversion. Google™ also has a Linux-specific search engine at http://www.google.com/linux that you might find useful.

8.5 For More Information

Apart from the product-specific help resources, there is a broad range of information available for Linux topics.

8.5.1 Online Resources for openSUSE

The openSUSE community are helpful people. If you have a specific question you can write to several mailing lists, communicate with Internet Relay Chat (IRC), or browse through Web Forums. Find more information at http://en.opensuse.org/Communicate.

8.5.2 The Linux Documentation Project

The Linux Documentation Project (TLDP) is run by a team of volunteers who write Linux-related documentation (see http://www.tldp.org). The set of documents contains tutorials for beginners, but is mainly focused on experienced users and professional system administrators. TLDP publishes HOWTOs, FAQs, and guides (handbooks) under a free license. Parts of the documentation from TLDP is also available on openSUSE

HOWTOs

HOWTOs are usually a short, informal, step-by-step guides to accomplishing specific tasks. HOWTOs can also be found in the package `howto` and are installed under `/usr/share/doc/howto`.

Frequently Asked Questions

FAQs (frequently asked questions) are a series of questions and answers. They originate from Usenet newsgroups where the purpose was to reduce continuous re-posting of the same basic questions.

Guides

Manuals and guides for various topics or programs can be found at `http://www.tldp.org/guides.html`. They range from *Bash Guide for Beginners* to *Linux Filesystem Hierarchy* to *Linux Administrator's Security Guide* . Generally, guides are more detailed and exhaustive than HOWTOs or FAQs. They are usually written by experts for experts.

8.5.3 Usenet

Created in 1979 before the rise of the Internet, Usenet is one of the oldest computer networks and still in active use. The format and transmission of Usenet articles is very similar to e-mail, but is developed for a many-to-many communication.

Usenet is organized into seven topical categories: `comp.*` for computer-related discussions, `misc.*` for miscellaneous topics, `news.*` for newsgroup-related matters, `rec.*` for recreation and entertainment, `sci.*` for science-related discussions, `soc.*` for social discussions, and `talk.*` for various controversial topics. The top levels are split in subgroups. For instance, `comp.os.linux.hardware` is a newsgroup for Linux-specific hardware issues.

Before you can post an article, have your client connect to a news server and subscribe to a specific newsgroup. News clients include Knode or Evolution. Each news server communicates to other news servers and exchanges articles with them. Not all newsgroups may be available on your news server.

Interesting newsgroups for Linux users are `comp.os.linux.apps`, `comp.os.linux.questions`, and `comp.os.linux.hardware`. If you cannot find a specific newsgroup, go to `http://www.linux.org/docs/usenetlinux.html`. Follow the general Usenet rules available online at `http://www.faqs.org/faqs/usenet/posting-rules/part1/`.

8.5.4 Wikipedia: The Free Online Encyclopedia

Wikipedia is "a multilingual encyclopedia designed to be read and edited by anyone" (see `http://en.wikipedia.org`). The content of Wikipedia is created by its users and is published under a dual free license (GFDL and CC-BY-SA). However, as Wikipedia can be edited by any visitor, it should be used only as a starting point or general guide. There is much incorrect or incomplete information in it.

8.5.5 Standards and Specifications

There are various sources that provide information about standards or specifications.

http://www.linux-foundation.org/en/LSB
> The Linux Foundation is an independent nonprofit organization that promotes the distribution of free and open source software. The organization endeavors to achieve this by defining distribution-independent standards. The maintenance of several standards, such as the important LSB (Linux Standard Base), is supervised by this organization.

http://www.w3.org
> The World Wide Web Consortium (W3C) is one of the best-known standards organizations. It was founded in October 1994 by Tim Berners-Lee and concentrates on standardizing Web technologies. W3C promotes the dissemination of open, license-free, and manufacturer-independent specifications, such as HTML, XHTML, and XML. These Web standards are developed in a four-stage process in *working groups* and are presented to the public as *W3C recommendations* (REC).

http://www.oasis-open.org
> OASIS (Organization for the Advancement of Structured Information Standards) is an international consortium specializing in the development of standards for Web security, e-business, business transactions, logistics, and interoperability between various markets.

http://www.ietf.org
> The Internet Engineering Task Force (IETF) is an internationally active cooperative of researchers, network designers, suppliers, and users. It concentrates on the development of Internet architecture and the smooth operation of the Internet by means of protocols.
>
> Every IETF standard is published as an RFC (Request for Comments) and is available free-of-charge. There are six types of RFC: proposed standards, draft standards, Internet standards, experimental protocols, information documents, and historic standards. Only the first three (proposed, draft, and full) are IETF standards in the narrower sense (see http://www.ietf.org/rfc/rfc1796.txt).

http://www.ieee.org
> The Institute of Electrical and Electronics Engineers (IEEE) is an organization that draws up standards in the areas of information technology, telecommunication, medicine and health care, transport, and others. IEEE standards are subject to a fee.

http://www.iso.org
> The ISO Committee (International Organization for Standards) is the world's largest developer of standards and maintains a network of national standardization institutes in over 140 countries. ISO standards are subject to a fee.

http://www.din.de , http://www.din.com

The Deutsches Institut für Normung (DIN) is a registered technical and scientific association. It was founded in 1917. According to DIN, the organization is "the institution responsible for standards in Germany and represents German interests in worldwide and European standards organizations."

The association brings together manufacturers, consumers, trade professionals, service companies, scientists and others who have an interest in the establishment of standards. The standards are subject to a fee and can be ordered using the DIN home page.

8.6 Support for openSUSE

Useful support information for openSUSE is available in a number of sources.

- Free installation support for retail box customer

- Free community support http://en.opensuse.org/Communicate

If you encounter problems with the installation or use of openSUSE that you are unable to solve, our experienced support staff can offer practical assistance with the free installation support for registered releases. Nearly all common customer problems can be eliminated quickly and competently. You can use the extensive support offered through the community, as well.

8.6.1 Free Installation Support

Our free installation support is provided for a period of 90 days following the activation of your registration code http://www.open-slx.com/register or following the release of the next version. If you cannot find an answer to your question in any of the available information sources, we will gladly provide assistance for the following issues:

- Installation on a typical home user system or laptop equipped with a single processor, at least 512 MB RAM, and 3 GB of free hard disk space.

- Resizing of one Windows partition that occupies the entire hard disk.

- Dual-boot installation with Windows, limited to Linux Support.

- Installation of a local ATAPI CD or DVD drive.

- Installation from a remote CD/DVD drive

- Installation on the first or second hard disk in an IDE-only system (/dev/sda or /dev/sdb) or supported S-ATA system, excluding RAID.

- Integration of a standard keyboard and standard mouse.

- Configuration of the graphical user interface (without the hardware acceleration feature of the graphics card).

- Installation of the boot manager in the MBR of the first hard disk without modifying the BIOS mapping.

- Setup of Internet access with a supported PCI ISDN card or external serial modem (not USB). Conversely, setup of DSL based on PPPoE with a supported NIC.

- Basic configuration of a supported WLAN adapter.

- Basic configuration of an ALSA-supported PCI sound card.

- Basic configuration of a locally-attached compatible printer with YaST.

- Basic configuration of an IDE CD writer for use with k3b (CD burning application) without changing the jumper setting.

- Configuration of a supported PCI ethernet card for LAN access with either DHCP (client) or static IP. This does not include the configuration of the LAN or any other computers or network components. It also does not cover the configuration of the computer as a router. Fault analysis is limited to checking for proper loading of the kernel module and the correct local network settings.

- Configuration of an e-mail client (Evolution and KMail) for collecting mail from a POP3 account. Fault analysis is limited to checking for proper settings in the e-mail client.

- Support for the package selection KDE Desktop or GNOME Desktop.

- Upgrade from the previous version of the product.

- Kernel updates (only official Novell update RPMs).

- Installation of bug fixes and security updates from the official update server using online update or the manual method.

For a detailed listing of the subjects covered by the free installation support, check http://support.open-slx.com/products/suselinux/support_overview.html.

In case you are not sure if your support is covered, please do not hesitate to give us a call. We are happy to assist.

Contact Information for Free Installation Support

Reach our support staff under the following links and phone numbers. Our installation support is offered through call back. After your problem description our staff either tries to call you back in the next 2 hours or arrange a time for a call back. Please register your product at http://www.open-slx.com/register prior to your support request.

- http://support.open-slx.com/eService

- United States and Canada: +1-404-5854-269

- Germany, Austria, Switzerland: Phone: +49 (0)911-8946-0303

- UK: +44-2030-025-943

- All other countries (English only): please see `http://support.open-slx.com/products/opensuse/contact.html`

For the most recent contact information, refer to `http://support.open-slx.com/products/opensuse/contact.html`.

Important Notes

1. Free installation support is offered to customers with a valid and activated registration code. You can activate your registration code at `http://www.open-slx.com/register`.

2. The registration code is not transferable to another person.

3. The free support covers the initial installation on one computer. Refer to our Web site for further information `http://support.open-slx.com/products/suselinux/support_overview.html`.

Contact Recommendations

We recommend using `http://support.open-slx.com/eService` to open a service request and to provide us with the relevant information like problem description and log files. It helps us to avoid misspelled commands, links, or directory names, which often cause frustrating problems and are particularly common during phone conversations. You will receive a reply soon, providing a practical solution.

8.6.2 Preparing a Support Request

We endeavor to help you as quickly and precisely as possible. The effort and time needed is considerably reduced if the question is formulated clearly. Please have answers to the following questions ready before contacting us:

1. Which program and version are you using? During which process does the problem occur?

2. What exactly is the problem? Try to describe the error as precisely as possible, using phrases with words such as *when* (for example, "When X is pressed, this error appears").

3. What hardware do you use (graphics card, monitor, printer, ISDN card, etc.)? You can get this information from the YaST *Hardware Information* module.

Detailed documentation can be found in manuals, online help, and the Support Database. This comprehensive documentation of openSUSE gives guidance to solve

a variety of problems. The SUSE Help Center on your desktop provides additional information about installed packages, the vital HOWTOs, and info pages.

You can access the latest Support Database articles online at http://www.open-slx .com/usersupport or access the community Support Database at http://en.open-slx .org/SDB. The Support Database, one of the most frequently used databases in the Linux world, offers our customers a wealth of analysis and solution approaches. You can retrieve tested solutions using the keyword search, history function, or version-dependent search.

9 Common Problems and Their Solutions

This chapter describes a range of potential problems and their solutions. Even if your situation is not precisely listed here, there may be one similar enough to offer hints to the solution of your problem.

9.1 Finding and Gathering Information

Linux reports things in a very detailed way. There are several places to look when you encounter problems with your system, most of which are standard to Linux systems in general, and some of which are relevant to openSUSE systems. The two most important system logs are `/var/log/boot.msg` and `/var/log/messages`.

A list of the most frequently checked log files follows with the description of their typical purpose. Paths containing ~ refer to the current user's home directory.

Table 9.1   *Log Files*

Log File	Description
`~/.xsession-errors`	Messages from the desktop applications currently running.
`/var/log/apparmor/`	Log files from AppArmor, see Part "Confining Privileges with Novell AppArmor" (↑*Security Guide*) for detailed information.
`/var/log/audit/audit.log`	Log file from Audit to track any access to files, directories, or resources of your system, and trace system calls. See Part "*The Linux Audit Framework*" (↑*Security Guide*) for detailed information.
`/var/log/boot.msg`	Messages from the kernel reported during the boot process.
`/var/log/mail.*`	Messages from the mail system.

Log File	Description
`/var/log/messages`	Ongoing messages from the kernel and system log daemon (when running).
`/var/log/NetworkManager`	Log file from NetworkManager to collect problems with network connectivity
`/var/log/samba/`	Directory containing Samba server and client log messages.
`/var/log/SaX.log`	Hardware messages from the SaX display and KVM system.
`/var/log/warn`	All messages from the kernel and system log daemon with the "warning" level or higher.
`/var/log/wtmp`	Binary file containing user login records for the current machine session. View it with `last`.
`/var/log/Xorg.*.log`	Various start-up and runtime logs from the X Window system. It is useful for debugging failed X start-ups.
`/var/log/YaST2/`	Directory containing YaST's actions and their results.
`/var/log/zypper.log`	Log file of zypper.

Apart from log files, your machine also supplies you with information about the running system. See Table 9.2: System Information With the `/proc` File System

Table 9.2   *System Information With the /proc File System*

File	Description
`/proc/cpuinfo`	Contains processor information, including its type, make, model, and performance.
`/proc/dma`	Shows which DMA channels are currently being used.
`/proc/interrupts`	Shows which interrupts are in use, and how many of each have been in use.

File	Description
/proc/iomem	Displays the status of I/O (input/output) memory.
/proc/ioports	Shows which I/O ports are in use at the moment.
/proc/meminfo	Displays memory status.
/proc/modules	Displays the individual modules.
/proc/mounts	Displays devices currently mounted.
/proc/partitions	Shows the partitioning of all hard disks.
/proc/version	Displays the current version of Linux.

Apart from the /proc file system, the Linux kernel exports information with the sysfs module, an in-memory filesystem. This module represents kernel objects, their attributes and relationships. For more information about sysfs, see the context of udev in Chapter 19, *Dynamic Kernel Device Management with udev* (↑*Reference*). Table 9.3 contains an overview of the most common directories under /sys.

Table 9.3   *System Information With the /sys File System*

File	Description
/sys/block	Contains subdirectories for each block device discovered in the system. Generally, these are mostly disk type devices.
/sys/bus	Contains subdirectories for each physical bus type.
/sys/class	Contains subdirectories grouped together as a functional types of devices (like graphics, net, printer, etc.)
/sys/device	Contains the global device hierarchy.

Linux comes with a number of tools for system analysis and monitoring. See Chapter 13, *System Monitoring Utilities* (↑*Reference*) for a selection of the most important ones used in system diagnostics.

Each of the following scenarios begins with a header describing the problem followed by a paragraph or two offering suggested solutions, available references for more detailed solutions, and cross-references to other scenarios that are related.

9.2 Installation Problems

Installation problems are situations when a machine fails to install. It may fail entirely or it may not be able to start the graphical installer. This section highlights some of the typical problems you may run into, and offers possible solutions or workarounds for these kinds of situations.

9.2.1 Checking Media

If you encounter any problems using the openSUSE installation media, check the integrity of your installation media. Boot from the media and choose *Check Installation Media* from the boot menu. In a running system, start YaST and choose *Software > Media Check*. Media problems are more probable with the media you burn yourself. Burning the media at a low speed (4x) helps avoiding problems.

9.2.2 Hardware Information

Display detected hardware and technical data using *Hardware > Hardware Information* in YaST. Click any node of the tree for more information about a device. This module is especially useful, when submitting a support request for which you need information about your hardware.

Save the displayed hardware information to a file by clicking *Save to File*. Select the desired directory and filename then click *Save* to create the file.

9.2.3 No Bootable DVD Drive Available

If your computer does not contain a bootable DVD-ROM drive or if the one you have is not supported by Linux, there are several options you can install your machine without a built-in DVD drive:

Using an External Boot Device

    If it is supported by your BIOS and the installation kernel, boot from external DVD drives or USB storage devices.

Network Boot via PXE

    If a machine lacks a DVD drive, but provides a working ethernet connection, perform a completely network-based installation. See Section "Remote Installation via VNC—PXE Boot and Wake on LAN" (Chapter 1, *Remote Installation*, ↑*Reference*) and Section "Remote Installation via SSH—PXE Boot and Wake on LAN" (Chapter 1, *Remote Installation*, ↑*Reference*) for details.

External Boot Devices

Linux supports most existing DVD drives. If the system has neither a DVD drive nor a floppy disk, it is still possible that an external DVD drive, connected through USB, FireWire, or SCSI, can be used to boot the system. This depends mainly on the interaction of the BIOS and the hardware used. Sometimes a BIOS update may help if you encounter problems.

When installing from a KDE or GNOME Live CD, you can also create a "Live USB stick" to boot from. Refer to http://en.opensuse.org/Live_USB_stick for detailed instructions.

9.2.4 Booting from Installation Media Fails

One reason why a machine does not boot the installation media can be an incorrect boot sequence setting in BIOS. The BIOS boot sequence must have DVD drive set as the first entry for booting. Otherwise the machine would try to boot from another medium, typically the hard disk. Guidance for changing the BIOS boot sequence can be found the documentation provided with your motherboard, or in the following paragraphs.

The BIOS is the software that enables the very basic functions of a computer. Motherboard vendors provide a BIOS specifically made for their hardware. Normally, the BIOS setup can only be accessed at a specific time—when the machine is booting. During this initialization phase, the machine performs a number of diagnostic hardware tests. One of them is a memory check, indicated by a memory counter. When the counter appears, look for a line, usually below the counter or somewhere at the bottom, mentioning the key to press to access the BIOS setup. Usually the key to press is one of [Del], [F1], or [Esc]. Press this key until the BIOS setup screen appears.

Procedure 9.1   *Changing the BIOS Boot Sequence*

    1 Enter the BIOS using the proper key as announced by the boot routines and wait for the BIOS screen to appear.

    2 To change the boot sequence in an AWARD BIOS, look for the *BIOS FEATURES SETUP* entry. Other manufacturers may have a different name for this, such as *ADVANCED CMOS SETUP*. When you have found the entry, select it and confirm with [Enter].

3 In the screen that opens, look for a subentry called *BOOT SEQUENCE* or *BOOT ORDER*. The boot sequence looks something like `C,A` or `A,C`. In the former case, the machine first searches the hard disk (C) then the floppy drive (A) to find a bootable medium. Change the settings by pressing [PgUp] or [PgDown] until the sequence is `A,CDROM,C`.

4 Leave the BIOS setup screen by pressing [Esc]. To save the changes, select *SAVE & EXIT SETUP*, or press [F10]. To confirm that your settings should be saved, press [Y].

Procedure 9.2   *Changing the Boot Sequence in a SCSI BIOS (Adaptec Host Adapter)*

1 Open the setup by pressing [Ctrl] + [A].

2 Select *Disk Utilities*. The connected hardware components are now displayed.

Make note of the SCSI ID of your DVD drive.

3 Exit the menu with [Esc].

4 Open *Configure Adapter Settings*. Under *Additional Options*, select *Boot Device Options* and press [Enter].

5 Enter the ID of the DVD drive and press [Enter] again.

6 Press [Esc] twice to return to the start screen of the SCSI BIOS.

7 Exit this screen and confirm with *Yes* to boot the computer.

Regardless of what language and keyboard layout your final installation will be using, most BIOS configurations use the US keyboard layout as depicted in the following figure:

Figure 9.1   *US Keyboard Layout*

9.2.5 Fails to Boot

Some hardware types, mainly very old or very recent ones, fail to install. In many cases, this may happen because support for this type of hardware is missing in the

installation kernel, or due to certain functionality included in this kernel, such as ACPI, that can still cause problems on some hardware.

If your system fails to install using the standard *Installation* mode from the first installation boot screen, try the following:

1 With the DVD still in the drive, reboot the machine with [Ctrl] + [Alt] + [Del] or using the hardware reset button.

2 When the boot screen appears, press [F5], use the arrow keys of your keyboard to navigate to *No ACPI* and press [Enter] to launch the boot and installation process. This option disables the support for ACPI power management techniques.

3 Proceed with the installation as described in Chapter 1, *Installation with YaST* (page 3).

If this fails, proceed as above, but choose *Safe Settings* instead. This option disables ACPI and DMA support. Most hardware will boot with this option.

If both of these options fail, use the boot options prompt to pass any additional parameters needed to support this type of hardware to the installation kernel. For more information about the parameters available as boot options, refer to the kernel documentation located in `/usr/src/linux/Documentation/kernel-parameters.txt`.

TIP: Obtaining Kernel Documentation

Install the `kernel-source` package to view the kernel documentation.

There are various other ACPI-related kernel parameters that can be entered at the boot prompt prior to booting for installation:

`acpi=off`
This parameter disables the complete ACPI subsystem on your computer. This may be useful if your computer cannot handle ACPI at all or if you think ACPI in your computer causes trouble.

`acpi=force`
Always enable ACPI even if your computer has an old BIOS dated before the year 2000. This parameter also enables ACPI if it is set in addition to `acpi=off`.

`acpi=noirq`
Do not use ACPI for IRQ routing.

`acpi=ht`
Run only enough ACPI to enable hyper-threading.

`acpi=strict`
Be less tolerant of platforms that are not strictly ACPI specification compliant.

`pci=noacpi`
Disable PCI IRQ routing of the new ACPI system.

`pnpacpi=off`
This option is for serial or parallel problems when your BIOS setup contains wrong interrupts or ports.

`notsc`
Disable the time stamp counter. This option can be used to work around timing problems on your systems. It is a recent feature, if you see regressions on your machine, especially time related or even total hangs, this option is worth a try.

`nohz=off`
Disable the nohz feature. If your machine hangs, this option may help. Otherwise it is of no use.

Once you have determined the right parameter combination, YaST automatically writes them to the boot loader configuration to make sure that the system boots properly next time.

If unexplainable errors occur when the kernel is loaded or during the installation, select *Memory Test* in the boot menu to check the memory. If *Memory Test* returns an error, it is usually a hardware error.

9.2.6 Fails to Launch Graphical Installer

After you insert the medium into your drive and reboot your machine, the installation screen comes up, but after you select *Installation*, the graphical installer does not start.

There are several ways to deal with this situation:

- Try to select another screen resolution for the installation dialogs.

- Select *Text Mode* for installation.

- Do a remote installation via VNC using the graphical installer.

Procedure 9.3 *Change Screen Resolution for Installation*

   1 Boot for installation.

   2 Press [F3] to open a menu from which to select a lower resolution for installation purposes.

   3 Select *Installation* and proceed with the installation as described in Chapter 1, *Installation with YaST* (page 3).

Procedure 9.4 *Installation in Text Mode*

   1 Boot for installation.

2 Press [F3] and select *Text Mode*.

3 Select *Installation* and proceed with the installation as described in Chapter 1, *Installation with YaST* (page 3).

Procedure 9.5   *VNC Installation*

1 Boot for installation.

2 Enter the following text at the boot options prompt:

`vnc=1 vncpassword=`*`some_password`*

Replace *some_password* with the password to use for VNC installation.

3 Select *Installation* then press [Enter] to start the installation .

Instead of starting right into the graphical installation routine, the system continues to run in a text mode, then halts, displaying a message containing the IP address and port number at which the installer can be reached via a browser interface or a VNC viewer application.

4 If using a browser to access the installer, launch the browser and enter the address information provided by the installation routines on the future open-SUSE machine and hit [Enter]:

`http://`*`ip_address_of_machine`*`:5801`

A dialog opens in the browser window prompting you for the VNC password. Enter it and proceed with the installation as described in Chapter 1, *Installation with YaST* (page 3).

> **IMPORTANT**
>
> Installation via VNC works with any browser under any operating system, provided Java support is enabled.

Provide the IP address and password to your VNC viewer when prompted. A window opens, displaying the installation dialogs. Proceed with the installation as usual.

9.2.7 Only Minimalistic Boot Screen Started

You inserted the medium into the drive, the BIOS routines are finished, but the system does not start with the graphical boot screen. Instead it launches a very minimalistic text-based interface. This may happen on any machine not providing sufficient graphics memory for rendering a graphical boot screen.

Although the text boot screen looks minimalistic, it provides nearly the same functionality as the graphical one:

Boot Options
> Unlike the graphical interface, the different boot options cannot be selected using the cursor keys of your keyboard. The boot menu of the text mode boot screen offers some keywords to enter at the boot prompt. These keywords map to the options offered in the graphical version. Enter your choice and hit [Enter] to launch the boot process.

Custom Boot Options
> After selecting a boot option, enter the appropriate keyword at the boot prompt or enter some custom boot options as described in Section 9.2.5, "Fails to Boot" (page 134). To launch the installation process, press [Enter].

Screen Resolutions
> Use the F keys to determine the screen resolution for installation. If you need to boot in text mode, choose [F3].

9.3 Boot Problems

Boot problems are situations when your system does not boot properly (does not boot to the expected runlevel and login screen).

9.3.1 Fails to Load the GRUB Boot Loader

If the hardware is functioning properly, it is possible that the boot loader is corrupted and Linux cannot start on the machine. In this case, it is necessary to reinstall the boot loader. To reinstall the boot loader, proceed as follows:

1 Insert the installation media into the drive.

2 Reboot the machine.

3 Select *Installation* from the boot menu.

4 Select a language.

5 Accept the license agreement.

6 In the *Installation Mode* screen, select *Other* and set the installation mode to *Repair Installed System*.

7 Once in the YaST System Repair module, select *Expert Tools* then select *Install New Boot Loader*.

8 Restore the original settings and reinstall the boot loader.

9 Leave YaST System Repair and reboot the system.

Other reasons for the machine not booting may be BIOS-related:

BIOS Settings
> Check your BIOS for references to your hard drive. GRUB may simply not be started if the hard drive itself cannot be found with the current BIOS settings.

BIOS Boot Order
> Check whether your system's boot order includes the hard disk. If the hard disk option was not enabled, your system may install properly, but fails to boot when access to the hard disk is required.

9.3.2 No Graphical Login

If the machine comes up, but does not boot into the graphical login manager, anticipate problems either with the choice of the default runlevel or the configuration of the X Window System. To check the runlevel configuration, log in as the `root` user and check whether the machine is configured to boot into runlevel 5 (graphical desktop). A quick way to check this is to examine the contents of `/etc/inittab`, as follows:

```
tux@mercury:~> grep "id:" /etc/inittab
id:5:initdefault:
```

The returned line indicates that the machine's default runlevel (`initdefault`) is set to 5 and that it should boot to the graphical desktop. If the runlevel is set to any other number, use the YaST Runlevel Editor module to set it to 5.

IMPORTANT

Do not edit the runlevel configuration manually. Otherwise SuSEconfig (run by YaST) will overwrite these changes on its next run. If you need to make manual changes here, disable future SuSEconfig changes by setting *CHECK_INITTAB* in `/etc/sysconfig/suseconfig` to no.

If the runlevel is set to 5, your desktop or X Windows software is probably misconfigured or corrupted. Examine the log files at `/var/log/Xorg.*.log` for detailed messages from the X server as it attempted to start. If the desktop fails during start, it may log error messages to `/var/log/messages`. If these error messages hint at a configuration problem in the X server, try to fix these issues. If the graphical system still does not come up, consider reinstalling the graphical desktop.

TIP: Starting X Window System Manually

One quick test: the `startx` command should force the X Window System to start with the configured defaults if the user is currently logged in on the console. If that does not work, it should log errors to the console.

9.4 Login Problems

Login problems are those where your machine does, in fact, boot to the expected welcome screen or login prompt, but refuses to accept the username and password, or accepts them but then does not behave properly (fails to start the graphic desktop, produces errors, drops to a command line, etc.).

9.4.1 Valid Username and Password Combinations Fail

This usually occurs when the system is configured to use network authentication or directory services and, for some reason, is unable to retrieve results from its configured servers. The `root` user, as the only local user, is the only user that can still log in to these machines. The following are some common reasons why a machine appears functional but is unable to process logins correctly:

- The network is not working. For further directions on this, turn to Section 9.5, "Network Problems" (page 145).

- DNS is not working at the moment (which prevents GNOME or KDE from working and the system from making validated requests to secure servers). One indication that this is the case is that the machine takes an extremely long time to respond to any action. Find more information about this topic in Section 9.5, "Network Problems" (page 145).

- If the system is configured to use Kerberos, the system's local time may have drifted past the accepted variance with the Kerberos server time (this is typically 300 seconds). If NTP (network time protocol) is not working properly or local NTP servers are not working, Kerberos authentication ceases to function because it depends on common clock synchronization across the network.

- The system's authentication configuration is misconfigured. Check the PAM configuration files involved for any typographical errors or misordering of directives. For additional background information about PAM and the syntax of the configuration files involved, refer to Chapter 2, *Authentication with PAM* (↑*Security Guide*).

- The home partition is encrypted. Find more information about this topic in Section 9.4.3, "Login to Encrypted Home Partition Fails" (page 143).

In all cases that do not involve external network problems, the solution is to reboot the system into single-user mode and repair the configuration before booting again into operating mode and attempting to log in again. To boot into single-user mode:

1 Reboot the system. The boot screen appears, offering a prompt.

2 Enter **1** at the boot prompt to make the system boot into single-user mode.

3 Enter the username and password for `root`.

4 Make all the necessary changes.

5 Boot into the full multiuser and network mode by entering `telinit 5` at the command line.

9.4.2 Valid Username and Password Not Accepted

This is by far the most common problem users encounter, because there are many reasons this can occur. Depending on whether you use local user management and authentication or network authentication, login failures occur for different reasons.

Local user management can fail for the following reasons:

- The user may have entered the wrong password.

- The user's home directory containing the desktop configuration files is corrupted or write protected.

- There may be problems with the X Window System authenticating this particular user, especially if the user's home directory has been used with another Linux distribution prior to installing the current one.

To locate the reason for a local login failure, proceed as follows:

1 Check whether the user remembered his password correctly before you start debugging the whole authentication mechanism. If the user may not remember his password correctly, use the YaST User Management module to change the user's password. Pay attention to the [Caps Lock] key and unlock it, if necessary.

2 Log in as `root` and check `/var/log/messages` for error messages of the login process and of PAM.

3 Try to log in from a console (using [Ctrl] + [Alt] + [F1]). If this is successful, the blame cannot be put on PAM, because it is possible to authenticate this user on this machine. Try to locate any problems with the X Window System or the desktop (GNOME or KDE). For more information, refer to Section 9.4.4, "Login Successful but GNOME Desktop Fails" (page 144) and Section 9.4.5, "Login Successful but KDE Desktop Fails" (page 144).

4 If the user's home directory has been used with another Linux distribution, remove the `Xauthority` file in the user's home. Use a console login via [Ctrl] + [Alt] + [F1] and run `rm .Xauthority` as this user. This should eliminate X authentication problems for this user. Try graphical login again.

5 If graphical login still fails, do a console login with [Ctrl] + [Alt] + [F1]. Try to start an X session on another display—the first one (:0) is already in use:

```
startx -- :1
```

This should bring up a graphical screen and your desktop. If it does not, check the log files of the X Window System (`/var/log/Xorg.`*displaynumber*`.log`) or

the log file for your desktop applications (`.xsession-errors` in the user's home directory) for any irregularities.

6 If the desktop could not start because of corrupt configuration files, proceed with Section 9.4.4, "Login Successful but GNOME Desktop Fails" (page 144) or Section 9.4.5, "Login Successful but KDE Desktop Fails" (page 144).

The following are some common reasons why network authentication for a particular user may fail on a specific machine:

- The user may have entered the wrong password.

- The username exists in the machine's local authentication files and is also provided by a network authentication system, causing conflicts.

- The home directory exists but is corrupt or unavailable. Perhaps it is write protected or is on a server that is inaccessible at the moment.

- The user does not have permission to log in to that particular host in the authentication system.

- The machine has changed hostnames, for whatever reason, and the user does not have permission to log in to that host.

- The machine cannot reach the authentication server or directory server that contains that user's information.

- There may be problems with the X Window System authenticating this particular user, especially if the user's home has been used with another Linux distribution prior to installing the current one.

To locate the cause of the login failures with network authentication, proceed as follows:

1 Check whether the user remembered their password correctly before you start debugging the whole authentication mechanism.

2 Determine the directory server which the machine relies on for authentication and make sure that it is up and running and properly communicating with the other machines.

3 Determine that the user's username and password work on other machines to make sure that his authentication data exists and is properly distributed.

4 See if another user can log in to the misbehaving machine. If another user can log in without difficulty or if `root` can log in, log in and examine the `/var/log/messages` file. Locate the time stamps that correspond to the login attempts and determine if PAM has produced any error messages.

5 Try to log in from a console (using [Ctrl] + [Alt] + [F1]). If this is successful, the problem is not with PAM or the directory server on which the user's home

is hosted, because it is possible to authenticate this user on this machine. Try to locate any problems with the X Window System or the desktop (GNOME or KDE). For more information, refer to Section 9.4.4, "Login Successful but GNOME Desktop Fails" (page 144) and Section 9.4.5, "Login Successful but KDE Desktop Fails" (page 144).

6 If the user's home directory has been used with another Linux distribution, remove the `Xauthority` file in the user's home. Use a console login via [Ctrl] + [Alt] + [F1] and run **rm .Xauthority** as this user. This should eliminate X authentication problems for this user. Try graphical login again.

7 If graphical login still fails, do a console login with [Ctrl] + [Alt] + [F1]. Try to start an X session on another display—the first one (`:0`) is already in use:

`startx -- :1`

This should bring up a graphical screen and your desktop. If it does not, check the log files of the X Window System (`/var/log/Xorg.`*displaynumber*`.log`) or the log file for your desktop applications (`.xsession-errors` in the user's home directory) for any irregularities.

8 If the desktop could not start because of corrupt configuration files, proceed with Section 9.4.4, "Login Successful but GNOME Desktop Fails" (page 144) or Section 9.4.5, "Login Successful but KDE Desktop Fails" (page 144).

9.4.3 Login to Encrypted Home Partition Fails

It is recommended to use an encrypted home partition for laptops. If you cannot log in to your laptop, the reason is usually simple: your partition could not be unlocked.

During the boot time, you have to enter the passphrase to unlock your encrypted partition. If you do not enter it, the boot process continues, leaving the partition locked.

To unlock your encrypted partition, proceed as follows:

1 Switch to the text console with [Ctrl] + [Alt] + [F1].

2 Become `root`.

3 Restart the unlocking process again with:

`/etc/init.d/boot.crypto restart`

4 Enter your passphrase to unlock your encrypted partition.

5 Exit the text console and switch back to the login screen with [Alt] + [F7].

6 Log in as usual.

9.4.4 Login Successful but GNOME Desktop Fails

If this is the case, it is likely that your GNOME configuration files have become corrupted. Some symptoms may include the keyboard failing to work, the screen geometry becoming distorted, or even the screen coming up as a bare gray field. The important distinction is that if another user logs in, the machine works normally. It is then likely that the problem can be fixed relatively quickly by simply moving the user's GNOME configuration directory to a new location, which causes GNOME to initialize a new one. Although the user is forced to reconfigure GNOME, no data is lost.

1 Switch to a text console by pressing [Ctrl] + [Alt] + [F1].

2 Log in with your user name.

3 Move the user's GNOME configuration directories to a temporary location:

```
mv .gconf  .gconf-ORIG-RECOVER
mv .gnome2 .gnome2-ORIG-RECOVER
```

4 Log out.

5 Log in again, but do not run any applications.

6 Recover your individual application configuration data (including the Evolution e-mail client data) by copying the ~/.gconf-ORIG-RECOVER/apps/ directory back into the new ~/.gconf directory as follows:

```
cp -a .gconf-ORIG-RECOVER/apps .gconf/
```

If this causes the login problems, attempt to recover only the critical application data and reconfigure the remainder of the applications.

9.4.5 Login Successful but KDE Desktop Fails

There are several reasons why a KDE desktop would not allow users to login. Corrupted cache data can cause login problems as well as corrupt KDE desktop configuration files.

Cache data is used at desktop start-up to increase performance. If this data is corrupted, start-up is slowed down or fails entirely. Removing them forces the desktop start-up routines to start from scratch. This takes more time than a normal start-up, but data is intact after this and the user can login.

To remove the cache files of the KDE desktop, issue the following command as `root`:

```
rm -rf /tmp/kde-user /tmp/ksocket-user
```

Replace *user* with your username. Removing these two directories just removes the corrupted cache files. No real data is harmed using this procedure.

Corrupted desktop configuration files can always be replaced with the initial configuration files. If you want to recover the user's adjustments, carefully copy them back from their temporary location after the configuration has been restored, using the default configuration values.

To replace a corrupted desktop configuration with the initial configuration values, proceed as follows:

1 Switch to a text console by pressing [Ctrl] + [Alt] + [F1].

2 Log in with your username.

3 Move the KDE configuration directory and the `.skel` files to a temporary location:

- For KDE3 use these commands:

```
mv .kde  .kde-ORIG-RECOVER
mv .skel .skel-ORIG-RECOVER
```

- For KDE4 use these commands:

```
mv .kde4  .kde4-ORIG-RECOVER
mv .skel .skel-ORIG-RECOVER
```

4 Log out.

5 Log in again.

6 After the desktop has started successfully, copy the user's own configurations back into place:

```
cp -a KDEDIR/share .kde/share
```

Replace *KDEDIR* with the directory from .

IMPORTANT

If the user's own adjustments caused the login to fail and continue to do so, repeat the procedure as described above, but do not copy the `.kde/share` directory.

9.5 Network Problems

Many problems of your system may be network-related, even though they do not seem to be at first. For example, the reason for a system not allowing users to log

in may be a network problem of some kind. This section introduces a simple check list you can apply to identify the cause of any network problem encountered.

Procedure 9.6   *How to Identify Network Problems*

When checking the network connection of your machine, proceed as follows:

1 If you use an ethernet connection, check the hardware first. Make sure that your network cable is properly plugged into your computer and router (or hub, etc.). The control lights next to your ethernet connector are normally both be active.

If the connection fails, check whether your network cable works with another machine. If it does, your network card causes the failure. If hubs or switches are included in your network setup, they may be faulty, as well.

2 If using a wireless connection, check whether the wireless link can be established by other machines. If not, contact the wireless network's administrator.

3 Once you have checked your basic network connectivity, try to find out which service is not responding. Gather the address information of all network servers needed in your setup. Either look them up in the appropriate YaST module or ask your system administrator. The following list gives some of the typical network servers involved in a setup together with the symptoms of an outage.

DNS (Name Service)
A broken or malfunctioning name service affects the network's functionality in many ways. If the local machine relies on any network servers for authentication and these servers cannot be found due to name resolution issues, users would not even be able to log in. Machines in the network managed by a broken name server would not be able to "see" each other and communicate.

NTP (Time Service)
A malfunctioning or completely broken NTP service could affect Kerberos authentication and X server functionality.

NFS (File Service)
If any application needs data stored in an NFS mounted directory, it will not be able to start or function properly if this service was down or misconfigured. In the worst case scenario, a user's personal desktop configuration would not come up if their home directory containing the `.gconf` or `.kde` subdirectories could not be found due to a faulty NFS server.

Samba (File Service)
If any application needs data stored in a directory on a faulty Samba server, it will not be able to start or function properly.

NIS (User Management)
If your openSUSE system relies on a faulty NIS server to provide the user data, users will not be able to log in to this machine.

LDAP (User Management)
If your openSUSE system relies on a faulty LDAP server to provide the user data, users will not be able to log in to this machine.

Kerberos (Authentication)
Authentication will not work and login to any machine fails.

CUPS (Network Printing)
Users cannot print.

4 Check whether the network servers are running and whether your network setup allows you to establish a connection:

> **IMPORTANT**
>
> The debugging procedure described below only applies to a simple network server/client setup that does not involve any internal routing. It assumes both server and client are members of the same subnet without the need for additional routing.

4a Use `ping` *IP address* or *hostname* (replace *hostname* with the hostname of the server) to check whether each one of them is up and responding to the network. If this command is successful, it tells you that the host you were looking for is up and running and that the name service for your network is configured correctly.

If ping fails with `destination host unreachable`, either your system or the desired server is not properly configured or down. Check whether your system is reachable by running `ping` *IP address* or *your_hostname* from another machine. If you can reach your machine from another machine, it is the server that is not running at all or not configured correctly.

If ping fails with `unknown host`, the name service is not configured correctly or the hostname used was incorrect. For further checks on this matter, refer to . If ping still fails, either your network card is not configured correctly or your network hardware is faulty.

4b Use `host` *hostname* to check whether the hostname of the server you are trying to connect to is properly translated into an IP address and vice versa. If this command returns the IP address of this host, the name service is up and running. If the `host` command fails, check all network configuration files relating to name and address resolution on your host:

`/etc/resolv.conf`

This file is used to keep track of the name server and domain you are currently using. It can be modified manually or automatically adjusted by YaST or DHCP. Automatic adjustment is preferable. However, make sure that this file has the following structure and all network addresses and domain names are correct:

```
search fully_qualified_domain_name
nameserver ipaddress_of_nameserver
```

This file can contain more than one name server address, but at least one of them must be correct to provide name resolution to your host. If needed, adjust this file using the YaST Network Setting module (Hostname/DNS tab).

If your network connection is handled via DHCP, enable DHCP to change hostname and name service information by selecting *Change Hostname via DHCP* and *Update Name Servers and Search List via DHCP* in the YaST DNS and Hostname module.

`/etc/nsswitch.conf`

This file tells Linux where to look for name service information. It should look like this:

```
...
hosts: files dns
networks: files dns
...
```

The dns entry is vital. It tells Linux to use an external name server. Normally, these entries are automatically managed by YaST, but it would be prudent to check.

If all the relevant entries on the host are correct, let your system administrator check the DNS server configuration for the correct zone information. For detailed information about DNS, refer to Chapter 23, *The Domain Name System* (↑*Reference*). If you have made sure that the DNS configuration of your host and the DNS server are correct, proceed with checking the configuration of your network and network device.

4c If your system cannot establish a connection to a network server and you have excluded name service problems from the list of possible culprits, check the configuration of your network card.

Use the command **ifconfig** *network_device* (executed as root) to check whether this device was properly configured. Make sure that both inet address and Mask are configured correctly. An error in the IP address or a missing bit in your network mask would render your network con-

figuration unusable. If necessary, perform this check on the server as well.

4d If the name service and network hardware are properly configured and running, but some external network connections still get long time-outs or fail entirely, use `traceroute` *fully_qualified_domain_name* (executed as `root`) to track the network route these requests are taking. This command lists any gateway (hop) that a request from your machine passes on its way to its destination. It lists the response time of each hop and whether this hop is reachable at all. Use a combination of traceroute and ping to track down the culprit and let the administrators know.

Once you have identified the cause of your network trouble, you can resolve it yourself (if the problem is located on your machine) or let the system administrators of your network know about your findings so they can reconfigure the services or repair the necessary systems.

9.5.1 NetworkManager Problems

If you have a problem with network connectivity, narrow it down as described in Procedure 9.6, "How to Identify Network Problems" (page 146). If NetworkManager seems to be the culprit, proceed as follows to get logs providing hints on why NetworkManager fails:

1 Open a shell and log in as `root`.

2 Restart the NetworkManager:

```
rcnetwork restart -o nm
```

3 Open a web page, for example, http://www.opensuse.org as normal user to see, if you can connect.

4 Collect any information about the state of NetworkManager in `/var/log/NetworkManager`.

For more information about NetworkManager, refer to Chapter 5, *Using NetworkManager* (page 55).

9.6 Data Problems

Data problems are when the machine may or may not boot properly but, in either case, it is clear that there is data corruption on the system and that the system needs to be recovered. These situations call for a backup of your critical data, enabling you to recover the system state from before your system failed. openSUSE offers dedicated YaST modules for system backup and restoration as well as a rescue system that can be used to recover a corrupted system from the outside.

9.6.1 Managing Partition Images

Sometimes you need to perform a backup from an entire partition or even hard disk. Linux comes with the **dd** tool which can create a exact copy of your disc. Combined with `gzip` you save some space.

Procedure 9.7   *Backing and Restoring up Harddiscs*

1 Start a Shell as user `root`.

2 Select your source device. Typically this is something like /dev/sda (labeled as *SOURCE*).

3 Decide where you want to store your image (labeled as *BACKUP_PATH*). It must be different from your source device. In other words: if you make a backup from /dev/sda, your image file need not to be stored under /dev/sda.

4 Run the commands to create a compressed image file:

```
dd if=/dev/SOURCE | gzip > /BACKUP_PATH/image.gz
```

5 Restore the hard disk with the following commands:

```
gzip -dc /BACKUP_PATH/image.gz | dd of=/dev/SOURCE
```

If you only need a partition to backup, replace the *SOURCE* placeholder with your respective partition. In this case, your image file can lie on the same hard disk, but on a different partition.

9.6.2 Backing Up Critical Data

System backups can be easily managed using the YaST System Backup module:

1 As root, start YaST and select *System* > *System Backup*.

2 Create a backup profile holding all details needed for the backup, filename of the archive file, scope, and type of the backup:

    2a Select *Profile Management* > *Add*.

    2b Enter a name for the archive.

    2c Enter the path to the location of the backup if you want to keep a local backup. For your backup to be archived on a network server (via NFS), enter the IP address or name of the server and the directory that should hold your archive.

    2d Determine the archive type and click *Next*.

2e Determine the backup options to use, such as whether files not belonging to any package should be backed up and whether a list of files should be displayed prior to creating the archive. Also determine whether changed files should be identified using the time-consuming MD5 mechanism.

Use *Expert* to enter a dialog for the backup of entire hard disk areas. Currently, this option only applies to the Ext2 file system.

2f Finally, set the search constraints to exclude certain system areas from the backup area that do not need to be backed up, such as lock files or cache files. Add, edit, or delete items until your needs are met and leave with *OK*.

3 Once you have finished the profile settings, you can start the backup right away with *Create Backup* or configure automatic backup. It is also possible to create other profiles tailored for various other purposes.

To configure automatic backup for a given profile, proceed as follows:

1 Select *Automatic Backup* from the *Profile Management* menu.

2 Select *Start Backup Automatically*.

3 Determine the backup frequency. Choose *daily*, *weekly*, or *monthly*.

4 Determine the backup start time. These settings depend on the backup frequency selected.

5 Decide whether to keep old backups and how many should be kept. To receive an automatically generated status message of the backup process, check *Send Summary Mail to User root*.

6 Click *OK* to apply your settings and have the first backup start at the time specified.

9.6.3 Restoring a System Backup

Use the YaST System Restoration module to restore the system configuration from a backup. Restore the entire backup or select specific components that were corrupted and need to be reset to their old state.

1 Start *YaST > System > System Restoration*.

2 Enter the location of the backup file. This could be a local file, a network mounted file, or a file on a removable device, such as a floppy or a DVD. Then click *Next*.

   The following dialog displays a summary of the archive properties, such as the filename, date of creation, type of backup, and optional comments.

3 Review the archived content by clicking *Archive Content*. Clicking *OK* returns you to the *Archive Properties* dialog.

4 *Expert Options* opens a dialog in which to fine-tune the restore process. Return to the *Archive Properties* dialog by clicking *OK*.

5 Click *Next* to open the view of packages to restore. Press *Accept* to restore all files in the archive or use the various *Select All*, *Deselect All*, and *Select Files* buttons to fine-tune your selection. Only use the *Restore RPM Database* option if the RPM database is corrupted or deleted and this file is included in the backup.

6 After you click *Accept*, the backup is restored. Click *Finish* to leave the module after the restore process is completed.

9.6.4 Recovering a Corrupted System

There are several reasons why a system could fail to come up and run properly. A corrupted file system following a system crash, corrupted configuration files, or a corrupted boot loader configuration are the most common ones.

openSUSE offers two different methods to resolve these situations. You can either use the YaST System Repair functionality or boot the rescue system. The following sections cover both types of system repair methods.

Using YaST System Repair

NOTE: Keyboard and Language Settings

If you change the language settings after booting, your keyboard is adapted as well.

Before launching the YaST System Repair module, determine in which mode to run it to best fit your needs. Depending on the severity and cause of your system failure (and your expertise), there are three different modes to choose from:

Automatic Repair
   If your system failed due to an unknown cause and you basically do not know which part of the system is to blame for the failure, use *Automatic Repair*. An extensive automated check will be performed on all components of your installed

system. For a detailed description of this procedure, refer to Section "Automatic Repair" (page 153).

Customized Repair

If your system failed and you already know which component is to blame, you can cut the lengthy system check with *Automatic Repair* short by limiting the scope of the system analysis to those components. For example, if the system messages prior to the failure seem to indicate an error with the package database, you can limit the analysis and repair procedure to checking and restoring this aspect of your system. For a detailed description of this procedure, refer to Section "Customized Repair" (page 155).

Expert Tools

If you already have a clear idea of what component failed and how this should be fixed, you can skip the analysis runs and directly apply the tools necessary for the repair of the relevant component. For details, refer to Section "Expert Tools" (page 155).

Choose one of the repair modes as described above and proceed with the system repair as outlined in the following sections.

Automatic Repair

To start the automatic repair mode of YaST System Repair, proceed as follows:

1 Insert the installation medium of openSUSE into your DVD drive.

2 Reboot the system.

3 On the boot screen, select *Repair Installed System*.

4 Confirm the license agreement and click *Next*.

5 Select *Automatic Repair*.

YaST now launches an extensive analysis of the installed system. The progress of the procedure is displayed at the bottom of the screen with two progress bars. The upper bar shows the progress of the currently running test. The lower bar shows the overall progress of the analysis. The log window in the top section tracks the currently running test and its result. See Figure 9.2, "Automatic Repair Mode" (page 154).

Figure 9.2   *Automatic Repair Mode*
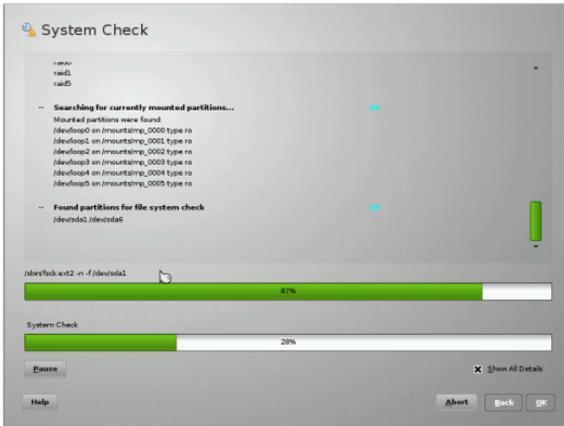
The following main test runs are performed with every run. They contain, in turn, a number of individual subtests:

Check Partition Tables
   Checks the validity and coherence of the partition tables of all detected hard disks.

Check Swap Areas
   The swap partitions of the installed system are detected, tested, and offered for activation, where applicable. This offer should be accepted for the sake of a higher system repair speed.

Check File Systems
   All detected file systems are subjected to a file system–specific check.

Check fstab Entries
   The entries in the file are checked for completeness and consistency. All valid partitions are mounted.

Check Package Database
   This checks whether all packages necessary for the operation of a minimal installation are present. While it is optionally possible to also analyze the base packages, this takes a long time because of their vast number.

Check Boot Loader Configuration
   The boot loader configuration of the installed system (GRUB or LILO) is checked for completeness and coherence. Boot and root devices are examined and the availability of the initrd modules is checked.

6 Whenever an error is encountered, the procedure stops and a dialog opens outlining the details and possible solutions.

Read the screen messages carefully before accepting the proposed fix. If you decide to decline a proposed solution, your system remains unchanged.

7 After the repair process has been terminated successfully, click *OK* and *Finish* and remove the installation media. The system automatically reboots.

Customized Repair

To launch the *Customized Repair* mode and selectively check certain components of your installed system, proceed as follows:

1 Insert the installation medium of openSUSE into your DVD drive.

2 Reboot the system.

3 At the boot screen, select *Repair Installed System*.

4 Confirm the license agreement and click *Next*.

5 Select *Customized Repair*.

Choosing *Customized Repair* shows a list of test runs that are all marked for execution at first. The total range of tests matches that of automatic repair. If you already know where no damage is present, unmark the corresponding tests. Clicking *Next* starts a narrower test procedure that probably has a significantly shorter running time.

Not all test groups can be applied individually. The analysis of the fstab entries is always bound to an examination of the file systems, including existing swap partitions. YaST automatically resolves such dependencies by selecting the smallest number of necessary test runs. YaST does not support encrypted partitions. If you have one, YaST informs you about it.

6 Whenever an error is encountered, the procedure stops and a dialog opens outlining the details and possible solutions.

Read the screen messages carefully before accepting the proposed fix. If you decide to decline a proposed solution, your system remains unchanged.

7 After the repair process has been terminated successfully, click *OK* and *Finish* and remove the installation media. The system automatically reboots.

Expert Tools

If you are knowledgeable with openSUSE and already have a very clear idea of what needs to be repaired in your system, directly apply the tools, skipping the system analysis.

To make use of the *Expert Tools* feature of the YaST System Repair module, proceed as follows:

1 Insert the installation medium of openSUSE into your DVD drive.

2 Reboot the system.

3 At the boot screen, select *Repair Installed System*.

4 Confirm the license agreement and click *Next*.

5 Select *Expert Tools* and choose a repair option.

6 After the repair process has been terminated successfully, click *OK* and *Finish* and remove the installation media. The system automatically reboots.

The *Expert Tools* provides the following options to repair your faulty system:

Install New Boot Loader
This starts the YaST boot loader configuration module. Find details in Section "Configuring the Boot Loader with YaST" (Chapter 17, *The Boot Loader GRUB*, ↑*Reference*).

Boot Installed System
Try to boot an already-installed Linux system.

Start Partitioning Tool
This starts the expert partitioning tool in YaST.

Repair File System
This checks the file systems of your installed system. You are first offered a selection of all detected partitions and can then choose the ones to check.

Recover Lost Partitions
It is possible to attempt to reconstruct damaged partition tables. A list of detected hard disks is presented first for selection. Clicking *OK* starts the examination. This can take a while depending on the speed of your computer and the size and speed of the hard disk.

IMPORTANT: *Reconstructing a Partition Table*

The reconstruction of a partition table is tricky. YaST attempts to recognize lost partitions by analyzing the data sectors of the hard disk. The lost partitions are added to the rebuilt partition table when recognized. This is, however, not successful in all imaginable cases.

Save System Settings to Floppy
This option saves important system files to a floppy disk. If one of these files becomes damaged, it can be restored from disk.

Verify Installed Software
This checks the consistency of the package database and the availability of the most important packages. Any damaged installed packages can be reinstalled with this tool.

Using the Rescue System

openSUSE contains a rescue system. The rescue system is a small Linux system that can be loaded into a RAM disk and mounted as root file system, allowing you to access your Linux partitions from the outside. Using the rescue system, you can recover or modify any important aspect of your system:

- Manipulate any type of configuration file.

- Check the file system for defects and start automatic repair processes.

- Access the installed system in a "change root" environment.

- Check, modify, and reinstall the boot loader configuration.

- Resize partitions using the parted command. Find more information about this tool at the GNU Parted website `http://www.gnu.org/software/parted/parted.html`.

The rescue system can be loaded from various sources and locations. The simplest option is to boot the rescue system from the original installation medium:

1 Insert the installation medium into your DVD drive.

2 Reboot the system.

3 At the boot screen, press [F4] and choose *DVD-ROM*. Then choose *Rescue System* from the main menu.

4 Enter `root` at the `Rescue:` prompt. A password is not required.

If your hardware setup does not include a DVD drive, you can boot the rescue system from a network source (including the openSUSE FTP server). The following example applies to a remote boot scenario—if using another boot medium, such as a DVD, modify the `info` file accordingly and boot as you would for a normal installation.

1 Enter the configuration of your PXE boot setup and add the lines `install=`*protocol*`://`*instsource* and `rescue=1`. If you need to start the repair system, use `repair=1` instead. As with a normal installation, *protocol* stands for any of the supported network protocols (NFS, HTTP, FTP, etc.) and *instsource* for the path to your network installation source.

2 Boot the system using "Wake on LAN", as described in Section "Wake on LAN" (Chapter 1, *Remote Installation*, ↑*Reference*).

3 Enter `root` at the `Rescue:` prompt. A password is not required.

Once you have entered the rescue system, you can make use of the virtual consoles that can be reached with [Alt] + [F1] to [Alt] + [F6].

A shell and many other useful utilities, such as the mount program, are available in the /bin directory. The sbin directory contains important file and network utilities for reviewing and repairing the file system. This directory also contains the most important binaries for system maintenance, such as fdisk, mkfs, mkswap, mount, mount, init, and shutdown, and ifconfig, ip, route, and netstat for maintaining the network. The directory /usr/bin contains the vi editor, find, less, and ssh.

To see the system messages, either use the command **dmesg** or view the file /var/log/messages.

Checking and Manipulating Configuration Files

As an example for a configuration that might be fixed using the rescue system, imagine you have a broken configuration file that prevents the system from booting properly. You can fix this using the rescue system.

To manipulate a configuration file, proceed as follows:

1 Start the rescue system using one of the methods described above.

2 To mount a root file system located under /dev/sda6 to the rescue system, use the following command:

mount /dev/sda6 /mnt

All directories of the system are now located under /mnt

3 Change the directory to the mounted root file system:

cd /mnt

4 Open the problematic configuration file in the vi editor. Adjust and save the configuration.

5 Unmount the root file system from the rescue system:

umount /mnt

6 Reboot the machine.

Repairing and Checking File Systems

Generally, file systems cannot be repaired on a running system. If you encounter serious problems, you may not even be able to mount your root file system and the system boot may end with a "kernel panic". In this case, the only way is to repair the system from the outside. It is strongly recommended to use the YaST System Repair for this task (see Section "Using YaST System Repair" (page 152) for details). However, if you need to do a manual file system check or repair, boot the rescue system. It contains the utilities to check and repair the ext2, ext3, ext4, reiserfs, xfs, dosfs, and vfat file systems.

Accessing the Installed System

If you need to access the installed system from the rescue system to, you need to do this in a *change root* environment. For example, to modify the boot loader configuration, or to execute a hardware configuration utility.

To set up a change root environment based on the installed system, proceed as follows:

1 First mount the root partition from the installed system and the device file system (change the device name to your current settings):

```
mount /dev/sda6 /mnt
mount --bind /dev /mnt/dev
```

2 Now you can "change root" into the new environment:

```
chroot /mnt
```

3 Then mount /proc and /sys:

```
mount /proc
mount /sys
```

4 Finally, mount the remaining partitions from the installed system:

```
mount -a
```

5 Now you have access to the installed system. Before rebooting the system, unmount the partitions with **umount -a** and leave the "change root" environment with **exit**.

WARNING: Limitations

Although you have full access to the files and applications of the installed system, there are some limitations. The kernel that is running is the one that was booted with the rescue system, not with the change root environment. It only supports essential hardware and it is not possible to add kernel modules from the installed system unless the kernel versions are exactly the same (which is unlikely). So you cannot access a sound card, for example. It is also not possible to start a graphical user interface.

Also note that you leave the "change root" environment when you switch the console with [Alt] + [F1] to [Alt] + [F6].

Modifying and Reinstalling the Boot Loader

Sometimes a system cannot boot because the boot loader configuration is corrupted. The start-up routines cannot, for example, translate physical drives to the actual locations in the Linux file system without a working boot loader.

To check the boot loader configuration and reinstall the boot loader, proceed as follows:

1 Perform the necessary steps to access the installed system as described in Section "Accessing the Installed System" (page 159).

2 Check whether the following files are correctly configured according to the GRUB configuration principles outlined in Chapter 17, *The Boot Loader GRUB* (↑*Reference*) and apply fixes if necessary.

  - /etc/grub.conf

  - /boot/grub/device.map

  - /boot/grub/menu.lst

  - /etc/sysconfig/bootloader

3 Reinstall the boot loader using the following command sequence:

```
grub --batch < /etc/grub.conf
```

4 Unmount the partitions, log out from the "change root" environment, and reboot the system:

```
umount -a
exit
reboot
```

A GNU Licenses

This appendix contains the GNU General Public License version 2 and the GNU Free Documentation License version 1.2.

GNU General Public License

Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc. 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

GNU GENERAL PUBLIC LICENSE TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0.   This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1.   You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2.   You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a)   You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b)   You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c)   If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3.   You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

a)   Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

b)   Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c)   Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4.   You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5.   You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6.   Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7.   If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8.   If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9.   The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10.   If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

11.   BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS

IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MER-CHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
one line to give the program's name and an idea of what it does.
Copyright (C) yyyy name of author


This program is free software; you can redistribute it and/or
modify it under the terms of the GNU General Public License
as published by the Free Software Foundation; either version 2
of the License, or (at your option) any later version.


This program is distributed in the hope that it will be useful,
but WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
GNU General Public License for more details.


You should have received a copy of the GNU General Public License
along with this program; if not, write to the Free Software
Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA.
```

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details
type `show w'. This is free software, and you are welcome
to redistribute it under certain conditions; type `show c'
for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright
interest in the program `Gnomovision'
(which makes passes at compilers) written
by James Hacker.


signature of Ty Coon, 1 April 1989
Ty Coon, President of Vice
```

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License [http://www.fsf.org/licenses/lgpl.html] instead of this License.

GNU Free Documentation License

Version 1.2, November 2002

Copyright (C) 2000,2001,2002 Free Software Foundation, Inc. 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not "Transparent" is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, "Title Page" means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

COPYING IN QUANTITY

If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public

has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

A.   Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

B.   List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, to-gether with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

C.   State on the Title page the name of the publisher of the Modified Version, as the publisher.

D.   Preserve all the copyright notices of the Document.

E.   Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

F.   Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

G.   Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

H.   Include an unaltered copy of this License.

I.   Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

J.   Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

K.   For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

L.   Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

M.   Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

N.   Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Section.

O.   Preserve any Warranty Disclaimers.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties--for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".

COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify, sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See http://www.gnu.org/copyleft/.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

```
Copyright (c) YEAR YOUR NAME.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.2
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts.
A copy of the license is included in the section entitled "GNU
Free Documentation License".
```

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the "with...Texts." line with this:

```
with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

Index

Symbols

A

access permissions
    directory, 83
    file, 83
    file system, 81
AutoYaST
    cloning system, 27

B

Bash
    commands, 86
    completion, 97
    features, 96
    history, 96
    jobs, 104
    pipes, 103
    processes, 104
    redirection, 103
    searching, 101
    shortcut keys, 89
    wild cards, 97
boot screen, 7
booting
    DVDs, from, 133

C

cards
    sound, 29
case-sensitivity
    directory name, 76
    file name, 76
cat, 103, 110
cd, 107
chgrp, 107
chmod, 108
chown, 107
clear, 114
commands, 102-103, 106-114
    bg, 104
    cat, 110

    cd, 107
    chgrp, 107
    chmod, 94, 108
    chown, 95, 107
    clear, 114
    cp, 106
    date, 112
    df, 111
    diff, 111
    du, 112
    fg, 105
    file, 110
    find, 101, 110
    free, 112
    grep, 101, 110
    gzip, 108
    halt, 114
    help, 88
    host, 113
    info, 88
    jobs, 105
    kill, 105, 113
    killall, 113
    less, 110
    ln, 107
    locate, 101, 109
    ls, 106
    man, 88, 106
    mkdir, 107
    mount, 111
    mv, 107
    passwd, 114
    ping, 113
    ps, 105, 113
    reboot, 114
    rm, 107
    rmdir, 107
    ssh, 114
    su, 114
    tar, 109
    top, 112
    umount, 111
    updatedb, 109
Completion
    Bash, 97
configuration files
    asound.conf, 31
    fstab, 111
    modprobe.d/sound, 31