openSUSE

11.0

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Start-Up

SUSE

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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: hardware components such as monitors or printers and network connections such as Internet access. Find how to install or remove software, how to administer users and groups, and how to make use of the various system languages available with openSUSE.

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.

Mobility

> Get an overview of the features openSUSE offers to support mobile working with laptops, mobile storage devices such as external hard disks and PDAs or cellular phones. Learn how to use NetworkManager to easily integrate your machine into different network environments or different types of networks. Find advice on how to exchange files between different systems, be it on different partitions of one computer (Linux/Windows*), or from one computer to another (Linux/Linux, Linux/Windows).

Help and Documentation

> 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.

1 Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the User Comments feature at the bottom of each page of the online documentation and enter your comments there.

2 Additional Documentation

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

Start-Up
> 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 Quick Start
> Gives a short introduction to the KDE desktop and some key applications running on it.

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

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 interaction of key system components and the set-up of various network and file services openSUSE offers.

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

Novell AppArmor Administration Guide
> Contains in-depth information about the use of Novell AppArmor in your environment.

Lessons For Lizards
> A community book project for the openSUSE distribution. A snapshot of the manual written by the open source community is released on an equal footing with the Novell/SUSE manuals. The lessons are written in a cook book style and cover more specific or exotic topics than the traditional manuals. For more information, see `http://developer.novell.com/wiki/index.php/Lessons_for_Lizards`.

Find HTML versions of the openSUSE manuals in your installed system under `/usr/share/doc/manual` or in the help centers of your KDE or GNOME desktop. You can also access the documentation on the Web at `http://www.novell.com/documentation/opensuse110/` where you can download PDF or HTML versions of the manuals. For information where to find the books on your installation media, refer to the Release Notes of this product, available from your installed system under `/usr/share/doc/release-notes/`.

3 Documentation Conventions

The following typographical conventions are used in this manual:

- `/etc/passwd`: filenames and directory names

- *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.

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, go to Linus Torvalds.

Have a lot of fun!

Your SUSE Team

Part I. Installation and Setup

Installation with YaST

1

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 needs and wishes. 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
    Two DVD9 media, only available with the retail box. The installation DVD contains the openSUSE distribution with open source software (OSS) as well as non-open source software (non-OSS) for 32bit and 64bit systems. The second DVD contains a snapshot of `ftp.opensuse.org` with a large number of additional packages.

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 DVDs available on an installation server and make them available all across your network.

DVD-download
    One DVD5, available via download, containing OSS and non-OSS software either 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, however, 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 installation 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 download of the medium.

NOTE: Installing From a 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.

Mini CD
    The Mini CD contains a 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 7).

IMPORTANT: Add-On CDs—Installing Additional Software

Although add-on CDs cannot be used as stand-alone installation media, they can be embedded as additional software sources during the installation. Currently available are CDs with additional languages. Add-on CDs can be used with any of the above installation media.

1.2 Choosing the Installation Method

After having selected the installation medium, determine a suitable installation method and boot option that best match 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 providing the installation data or the boot infrastructure. The installation proceeds exactly as outlined in Section 1.3, "The Installation Workflow" (page 8).

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 use from physical media (Floppy, CD/DVD, or hard disk) for booting 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 7), and Chapter 1, *Remote Installation* (↑Reference) for details.

Installing with `instlux` from Windows
> Choose this installation option, if you prefer a smooth transition from using Windows to Linux. `instlux` 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 `instlux` from Windows" (page 7) 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 instlux are the most straightforward options, but special requirements might call for special setups:

Table 1.1   *Boot Options*

Boot Option	Description
DVD/CD-ROM	This is the easiest boot option. This option can be used if the system has a local CD-ROM drive that is supported by Linux.
instlux	instlux is installed under Microsoft Windows* and makes it possible to boot directly into the installation
Floppy	The images for generating boot floppies are located on DVD 1 in the /boot directory. A README is available in the same directory.
PXE or BOOTP	This 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.
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/loader on the installation media to the hard disk and add the appropriate entry to the existing boot loader of a previous openSUSE installation.

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 from the media or with another boot option. In the boot screen, select the desired installation option. Press F4 then select *SLP*.

The installation program retrieves the location of the network installation source using OpenSLP and configures the network connection with DHCP. If the 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 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 from the media or with another boot option. In the boot screen, select the desired installation option. Press F4 then 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 configures the network connection with DHCP. If the DHCP network 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 `instlux` from Windows

`instlux` is a Microsoft Windows* application that prepares your computer to directly boot into the openSUSE installation without having to adjust BIOS settings. To use instlux, insert the openSUSE media under Windows. The `openSUSE 11.0 Installer` setup automatically starts. Choose a language for the installation and follow the instructions on the screen. The language you choose here is also used for the openSUSE installation. instlux is only available on DVD media.

On the next reboot, the Microsoft Windows boot loader launches. Choose *openSUSE 11.0 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, `instlux` is automatically uninstalled.

1.3 The Installation Workflow

The openSUSE installation is split into three main parts: preparation, installation, configuration. During the preparation phase you configure some basic parameters such as language, time, desktop type, users and passwords. In the installation phase you decide which software to install, where to install it and how to boot the installed system. Upon finishing the installation the machine reboots into the newly installed system and starts the 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 and 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 default, because the CD is often left in the drive. To install the system, select one of the installation options with the arrow keys. The relevant options are:

Installation
> The normal installation mode. All modern hardware functions are enabled. In case the installation fails, see F5*Kernel* (page 10) for boot options that disable potentially problematic functions.

Repair Installed System
> Boots into the graphical repair system. This option is not available when installing from CD.

Rescue System
> Starts a minimal Linux system without a graphical user interface.

Check Installation Media
> If you install from media created from downloaded ISOs, 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 with the CD-KDE and CD-GNOME media.

Memory Test
> Tests your system RAM using repeated read and write cycles. Terminate the test by rebooting. This option is not available with the CD-KDE and CD-GNOME media.

Figure 1.1   *The Boot Screen*
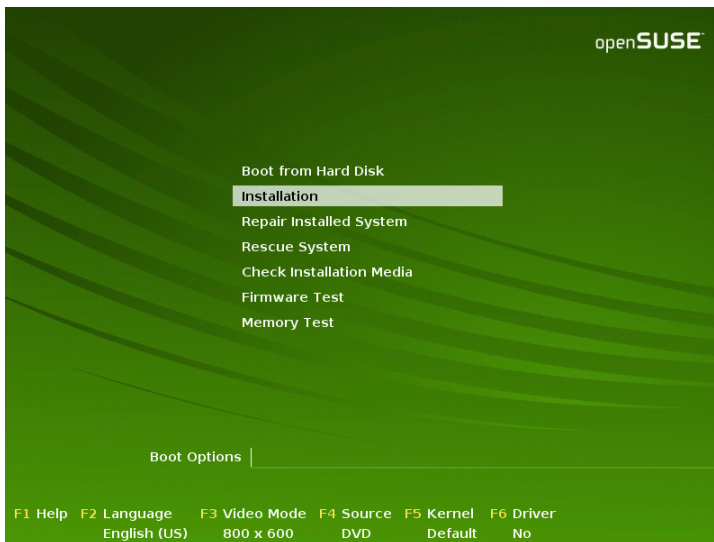
Use the function keys indicated in the bar at the bottom of the screen to change the language, screen resolution, installation source or to add addition driver from your hardware vendor:

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 carried out in a network with an SLP server, select one of the installation sources available on the server with this option. Find information about SLP in Chapter 15, *SLP Services in the Network* (↑Reference).

F5 *Kernel*

In case 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.

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 tell the system that you have an optional disk with a driver update for openSUSE. With *File*, load drivers directly from CD before the installation starts. If you select *Yes*, you are prompted to insert the update disk at the appropriate point in the installation process. *Safe Settings* boots the system with the DMA mode (for CD-ROM drives) and power management functions disabled.

F7 *Arch*

> If you install from an installation medium supporting 32bit and 64bit architectures and have an AMD or Intel 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*.

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 Tab.

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 during the installation.

You can also change the language subsequently in the *Installation Summary*, described in Section 1.12, "Installation Settings" (page 25). For information about language settings in the installed system, see Chapter 6, *Changing Language and Country Settings with YaST* (page 77).

Read the license agreement that is displayed beneath the language and keyboard selection thoroughly. Use *Show License* to display the license agreement full-screen for a better readability. If you agree to the terms, check *I Agree to the License Agreement* and click *Next* to proceed with the installation. If you do not agree to the license agreement, you cannot install openSUSE. Click *Abort* to terminate the installation.

Figure 1.2 *Welcome*
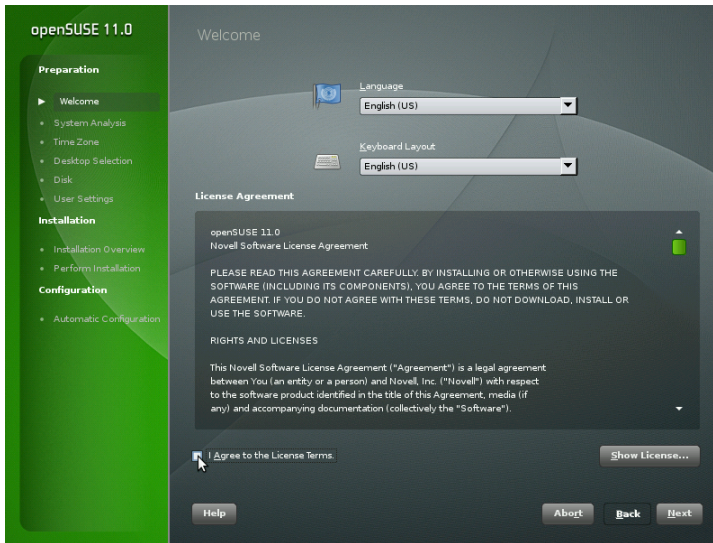
1.7 Installation Mode

After a system analysis where YaST probes for storage devices and tries to find other installed systems on your machine, the installation modes available are displayed:

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

Update
> Select this option to update to a newer version. For more information about system update, see Chapter 5, *Updating the System and System Changes* (↑Reference).

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

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 reparation in expert mode.

This screen also offers to include add-on products during the installation. To include such products, check *Install Add-On Products from Separate Media*. An add-on product can include proprietary third-party products or additional software for your system such as additional languages or non open source software.

Click *Next* to proceed. If you selected to include an add-on product, proceed with Section 1.7.1, "Add-On Products" (page 14), otherwise skip the next section and advance to Section 1.8, "Clock and Time Zone" (page 15).

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 anyway. Choose *Yes, Run the Network Setup* and proceed as described in Section "Network Setup" (page 14). 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, and a directory if no network was configured. While a network is available, you can chooses from additionl remote sources such as HTTP, SLP, FTP and others. It is also possible to specify a URL directly. 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 at any time in the installed systems. Using add-on products in the installed system is described in Section 3.6, "Installing Add-On Products" (page 55).

Network Setup

When invoking the network setup, YaST scans for available network cards. If more than one network card is found, you have to 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*. In the following dialog the actual network configuration is done. 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 14).

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 between *Local Time* and *UTC* (GMT) for *Hardware Clock Set To*. If you run another operating system on your machine, such as Microsoft Windows*, it is likely your system uses *Local Time*. 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. Click *Change* to set the current date and time.

You can either enter time and date *Manually* or, if the network is already configured, use *Synchronize with an NTP Server*. See Chapter 18, *Time Synchronization with NTP* (↑Reference) for more information. When finished, click *Accept* to continue the installation.

1.9 System Type

In openSUSE, you can choose from various desktops (this dialog is not available when installing from the CD-KDE or CD-GNOME). *KDE* and *GNOME* are powerful graphical desktop environments similar to Windows*. Find information about KDE 4 in *KDE Quick Start* and about GNOME in *GNOME Quick Start*. KDE is available in two different versions. KDE 4 is the most recent evolution of KDE with many new technologies. It is less mature than the other desktops. KDE 3.5, the previous KDE generation, is mature and stable.

If you want neither KDE nor GNOME, choose *Other* for more options. The *XFCE Desktop* is a fast and lightweight desktop environment 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   *System Type*

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 only containing Windows FAT or NTFS partitions is selected as the installation target, YaST automatically shrinks 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. See 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 filesystem type or encrypt partitions—, select *Edit Partition Setup* and adjust the settings. Refer to Section "Using the YaST Partitioner" (Chapter 2, *Advanced Disk Setup*, ↑Reference) for details.

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.

Figure 1.7 *Possible Options for Windows Partitions*
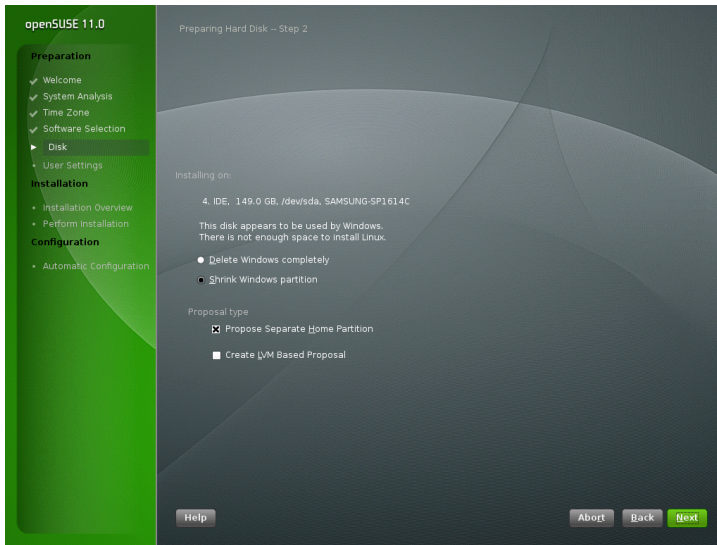
To *Shrink the Windows Partition*, you need to interrupt the installation and boot Windows to prepare before shrinking it. For all Windows file systems, proceed as follows:

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 first bar graph shows how much disk space is currently occupied by Windows and how much space is still available. The second bar graph shows how the space would be distributed after the resizing, according to the current proposal. To change the proposed settings use the slider or the input fields to adjust the partition sizing.

Figure 1.8 *Resizing the Windows Partition*
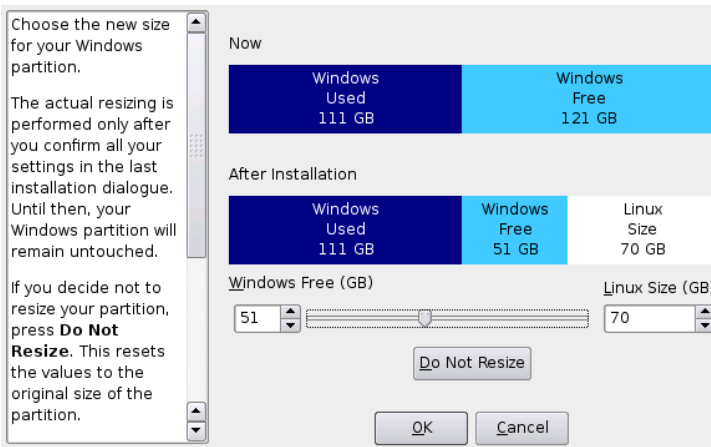
If you leave this dialog by selecting *Next*, the settings are stored and you are returned to the previous dialog. The actual resizing takes place later, before the hard disk is formatted.

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. You can *Edit*, *Resize*, *Create*, or *Delete* partitions. For more information about custom partitioning, refer to Section "Using the YaST Partitioner" (Chapter 2, *Advanced Disk Setup*, ↑Reference).

The Expert Partitioner also offers configuration options for advanced features that are described in detail in the *Reference*:

LVM
> see Section "LVM Configuration" (Chapter 2, *Advanced Disk Setup*, ↑Reference)

RAID
> see Section "Soft RAID Configuration" (Chapter 2, *Advanced Disk Setup*, ↑Reference)

Crypt File
> see Chapter 31, *Encrypting Partitions and Files* (↑Reference)

NFS
> see Chapter 21, *Sharing File Systems with NFS* (↑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 .

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. 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.

IMPORTANT: Username and Password

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

Figure 1.9   *Create New User*
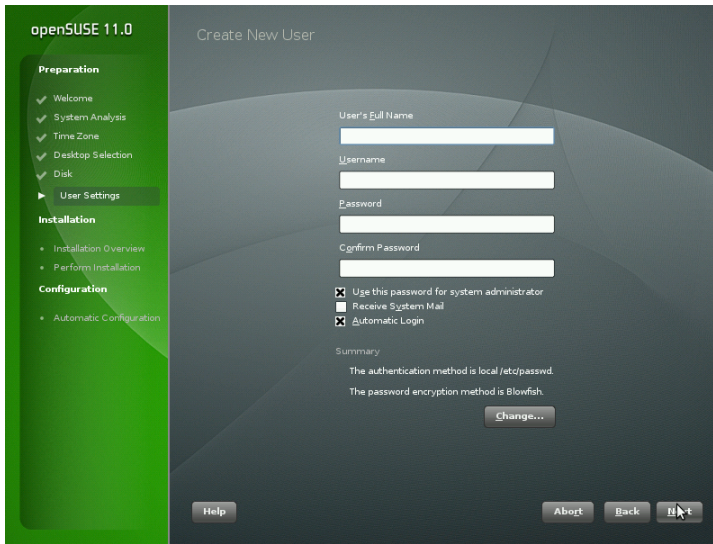
Three additional options are available:

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 24)).

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 if 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 5, *Managing Users with YaST* (page 65)

The default authentication method is *Local (/etc/passwd)*. If a former version of open-SUSE 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 20, *LDAP—A Directory Service*, ↑Reference).

NIS

> Users are administered centrally on a NIS server for all systems in the network. See Section "Configuring NIS Clients" (Chapter 19, *Using NIS*, ↑Reference) for more information.

Windows Domain

> SMB authentication is often used in mixed Linux and Windows networks. . .

Along with user administration via *LDAP* and *NIS*, you can use Kerberos authentication. To use Kerberos authentication, select *Set Up Kerberos Authentication*.

NOTE: Content of the Authentication Menu

If you have chosen a custom package selection for installation, not all mentioned authentication methods may be displayed, because the required packages are not installed.

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, the administrator of the system. Unlike regular users, who may or may not have permission to do certain things on the system, `root` has unlimited power to do anything: 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 1.10   *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. Changing 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 "Configuring the Boot Loader with YaST" (Chapter 9, *The Boot Loader*, ↑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 according to your needs. Select your pattern from the list and see the software packages included 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* (page 49).

Figure 1.11   *Software Selection and System Tasks*
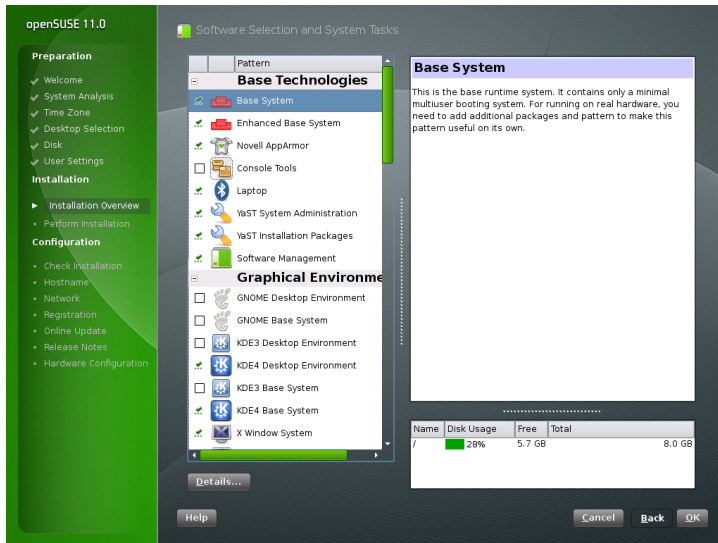
1.12.4 *Locale Settings*

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 tune 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 6, *Changing Language and Country Settings with YaST* (page 77).

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*. Find more information about changing the keyboard layout in Section 2.3,

"Setting Up Keyboard and Mouse" (page 39). When finished, click *Accept* to return to the installation summary.

1.12.5 *Time Zone*

Adjust time zone and clock settings here. You can also configure 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 15).

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 21).

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 8, *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 filesystem or a floppy. Advanced users can also change the PCI ID setup and Kernel Settings by choosing *System 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.

1.13 Performing the Installation

After making all installation settings, click *Install* in the Installation Settings window to start the installation. In the dialog that opens, confirm with *Install* again. 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. When not agreeing to the license, click *I Disagree* and the software will not be installed.

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 31), 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, where you can configure the hardware and set up system services.

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 set up, yet. 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 Configuration

Having rebooted, the system starts the Automatic Configuration. This routine attempts to configure your network and Internet access and sets up your hardware. The whole process does not need any interaction. You can change the settings made by the Automatic Configuration at any time in the installed system. To do so, start YaST and launch the respective module. Continue with Section 1.15, "Graphical Login" (page 35).

1.14.2 Manual 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 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 *Write Hostname to /etc/hosts*. If you often change networks without restarting the desktop environment (e.g. when switching between different WLANs), do not enable this option, 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 14, *Basic Networking*, ↑Reference).

Network Configuration

If you are installing openSUSE on a laptop computer, *Interfaces Controlled by Network-Manager* 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 NetworkManager*. Find detailed information about NetworkManager in Chapter 10, *Managing Network Connections with NetworkManager* (page 147). 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 14, *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 28, *Masquerading and Firewalls*, ↑Reference) 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 14)) 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 64) for checklists of configuration requirements for the various connection types and Section "Configuring the Network Card with YaST" (Chapter 14, *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 61) 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 registering and 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 next 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.

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, configuring the customer center, and updating online. These steps can be performed any time after the system has been initially configured.

Registration

To get technical support and product updates, first register and activate your product. If you are offline or want to skip this step, select *Configure Later*. This also skips openSUSE online update.

In *Include for Convenience*, select whether to send unsolicited additional information when registering. Click on *Details* to obtain in-depth information about data privacy and the data collected.

IMPORTANT: Support for openSUSE

Free installation support is only available for customers of the openSUSE retail box. Make sure to specify your *Registration Code* in order to become entitled for support. Find more information about the free installation support at http://www.novell.com/support/products/opensuse/. Refer to Section 12.4, "Support for openSUSE" (page 197) for more information on all support options available for openSUSE.

Upon a successful registration, a repository containing official online updates is added to the repository catalog. This repository is used in the following *Online Update* step to update your system.

Online Update

If the *Registration* was successful, 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 Section "YaST Online Update" (Chapter 3, *Online Update*, ↑Reference). Directives on how to perform an online update in the installed system are available at Section 3.7, "Keeping the System Up-to-date" (page 56) or Chapter 3, *Online Update* (↑Reference).

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

In addition to the user created in part one of the installation, you can create an additional user in this dialog. To create more users, manage groups, modify defaults for new users and set up network authentication, launch the *User Management*. Refer to Chapter 5, *Managing Users with YaST* (page 65) for more information about user management. To skip this step, just 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* 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 the graphics card and other hardware components connected to the system, such as printers or sound 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 37) . To skip the configuration, select *Skip Configuration* and click *Next*.

However, you should configure the graphics card right away. Although the display settings as configured by YaST should be generally acceptable, most users have very

strong preferences as far as resolution, color depth, and other graphics features are concerned. To change these settings, select the respective item and set the values as desired.

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 in to 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 *KDE Quick Start* and *GNOME Quick Start*.

Setting Up Hardware Components with YaST

2

YaST allows you to configure hardware items at installation time as well as in the installed system. Configure additional graphics cards and monitors, adjust mouse and keyboard settings and configure sound hardware. If you need printer or scanner support, use the appropriate YaST modules to configure these hardware items. Learn which hardware components are connected to your computer by using the YaST Hardware Information module.

2.1 Probing Your Hardware

Use YaST, if you want to know more about your hardware or if you need to find out details like vendor and model of a certain hardware to be able to properly configure it. Here and in the following sections we assume that you already started YaST (for example, by pressing Alt + F2 and entering yast2 followed by the root password, because YaST needs system administrator permissions to change the system files):

1 In YaST click *Hardware > Hardware Information*. Hardware probings 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 plus icons to expand the information about a specific device.

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

2.2 Setting Up Graphics Card and Monitor

After the installation you can change the configuration of your graphics system (graphics card and monitor) according to your needs. Such a change can be necessary because of accessibility issues or hardware upgrades.

Change the resolution, if fonts are too small or if circles appear misshapen:

1 In YaST, click *Hardware > Graphics Card and Monitor*. SaX2 checks the system resources and displays the *Card and Monitor Properties* dialog.

2 Make sure the monitor is properly detected. If not, use *Change* to select the appropriate model from the list.

3 Now select an appropriate *Resolution*.
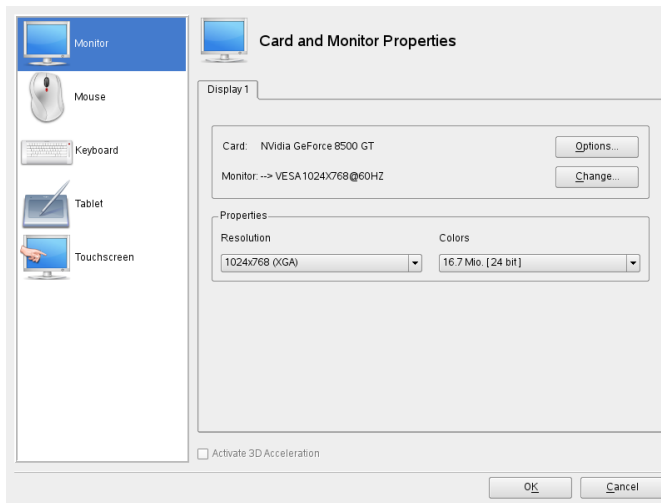
4 Test the new configuration before it is applied to the system. Click *OK > Test* and either *Cancel* or *Save* the configuration.

WARNING: Changing Monitor Frequencies

Although there are safety mechanisms, you should still be very careful when manually changing the allowed monitor frequencies. Incorrect values might destroy your monitor. Always refer to the monitor's manual before changing frequencies.

To activate a second monitor, proceed as follows:

1 In YaST, click *Hardware > Graphics Card and Monitor*. SaX2 checks the system resources and displays the *Card and Monitor Properties* dialog.

2 Make sure the monitor is properly detected. If not, use *Change* to select the appropriate model from the list.

3 Now enable *Activate Dual Head Mode* and click *Configure* for further tuning.

4 Make sure the second monitor is properly detected. If not, use *Change* to select the appropriate model from the list.

5 Decide whether you want to use the second monitor in *Cloned Multihead* or in *Xinerama Multihead* mode and click *Ok*.

6 Test the new configuration before it is applied to the system. Click *OK > Test* and either *Cancel* or *Save* the configuration.

2.3 Setting Up Keyboard and Mouse

Reconfigure input devices such as the keyboard or the mouse, or add more than one of these devices using the YaST Keyboard and Mouse modules.

2.3.1 Keyboard Layout

In case you want to replace a standard 104-key keyboard with a multimedia keyboard or a use different language or country layout, proceed as follows:

1 In YaST, click *Hardware > Keyboard Layout*. The SaX2 configuration tool reads the system resources and displays the *Keyboard Properties* dialog.
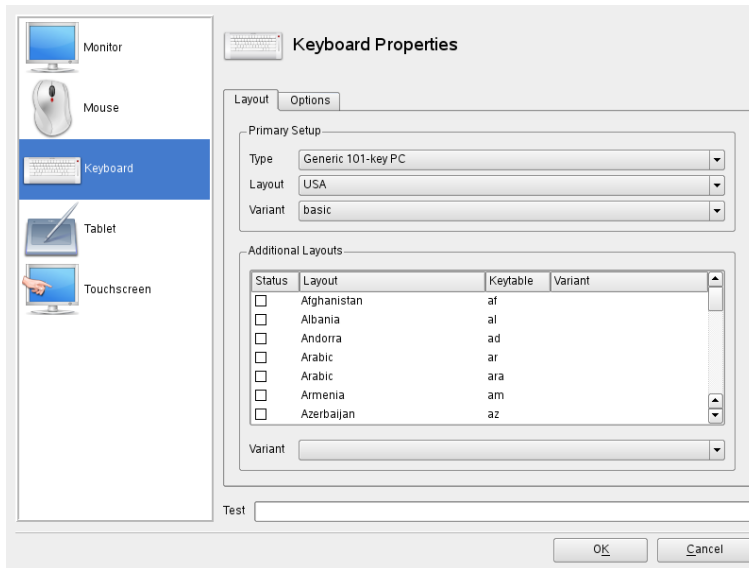
2 Select your keyboard model from the *Type* list.

3 In *Layout*, select the country layout.

4 Depending on the country layout, you can choose a certain *Variant*. The selections are applied immediately for testing.

5 As an option you can enable *Additional Layouts*. Check one or more boxes in the list. This feature is handy if you want to switch between different languages or scripts in the running system without the need for reconfiguration.

6 Before saving the configuration, use the *Test* field at the bottom of the dialog to check if special characters like umlauts and accented characters can be entered and displayed correctly.

7 Click *OK* to leave the configuration dialog and in the following message click *Save* to apply your changes.

2.3.2 Mouse Model

The mouse is usually detected automatically, but you can set up your mouse model manually if the automatic detection fails. Refer to the documentation of your mouse for a description of the model. If you want to modify your mouse configuration, proceed as follows:

1 In YaST, click *Hardware > Mouse Model*. The SaX2 configuration tool reads the system resources and displays the *Mouse Properties* dialog.

2 Click *Change* and select your mouse model from the list displayed.

3 Click *OK* to leave the configuration dialog and apply your changes with *Save*.

In the *Options* part of the dialog, set various options for operating your mouse.

Activate 3-Button Emulation
> If your mouse has only two buttons, a third button is emulated whenever you click both buttons simultaneously.

Activate Mouse Wheel
> Check this box to use a scroll wheel.

Invert X-Axis / *Invert Y-Axis*
> Check these options if you want to change the direction in which the mouse pointer moves.

Activate Left-Hand Button Mapping
> Check this box to switch the button mapping suitable for left-hand usage.

Emulate Wheel with Mouse Button
> If your mouse does not have a scroll wheel but you want to use a similar function-ality, you can assign an additional button for this. Select the button to use. While pressing this button, any movement of the mouse is translated into scroll wheel commands. This feature is especially useful with trackballs.

NOTE: Restarting the X Server

Any changes you make here take effect only after you restart the X server. If you want to restart the X server now, log out from the graphical system and log in again.

2.4 Setting Up Sound Cards

Most sound cards are detected automatically and configured with reasonable values. In YaST, use *Hardware > Sound* if you want to add a problematic sound card that could not be configured automatically or change the default settings. It is also possible to set up additional sound cards or switch their sequence.

TIP: Probing for Old Sound Chips

If you know a legacy sound board is installed in your computer, let YaST probe for old chips, if YaST cannot find a sound board. Within the pop-up click *Yes, probe*.

If YaST cannot detect your sound card automatically, proceed as follows:

1 Click *Add* to open a dialog in which to select a sound card vendor and model. Refer to your sound card documentation for the information required. Find a reference list of sound cards supported by ALSA with their corresponding sound modules in `/usr/share/doc/packages/alsa/cards.txt` and at `http://www.alsa-project.org/alsa-doc/`.

Make your choice and click *Next*.

2 In the *Sound Card Configuration* dialog, choose the configuration level in the first setup screen:

Quick automatic setup
    You are not required to go through any of the further configuration steps and no sound test is performed. The sound card is configured automatically.

Normal setup
    Adjust the output volume and play a test sound.

Advanced setup with possibility to change options
> Customize all settings manually.

Enable *Configure joystick*, if you need to configure a joystick. Click *Next* to continue.

3 In *Sound Card Volume*, test your sound configuration and make adjustments to the volume. You should start at about ten percent to avoid damage to your hearing or the speakers. A test sound should be audible when you click *Test*. If you cannot hear anything, increase the volume. Press *Next > Finish* to complete the sound configuration.

If you want to change the configuration of a sound card, go to the *Sound Configuration* dialog, select a displayed *Card Model* and click *Edit*. Use *Delete* to remove a sound card altogether.

Click *Other* to customize one of the following options manually:

Volume
> Use this dialog is for setting the volume.

Start Sequencer
> For playback of MIDI files, check this option.

Set as Primary Card
> Click *Set as Primary Card* if you want to adjust the sequence of your sound cards. The sound device with index 0 is the default device and thus used by the system and the applications.

The volume and configuration of all sound cards installed are saved when you click *Finish*. 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`.

2.5 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) or to set up printing over the network.

2.5.1 Configuring Local Printers

If an unconfigured local printer is detected, YaST starts automatically to configure it. YaST can configure the printer automatically if the parallel or USB port can be set up automatically and the connected printer can be detected. The printer model must also be listed in the database used during the automatic hardware detection.

If the printer model is unknown or cannot be automatically detected, configure it manually. There are two possible reasons why a printer is not automatically detected:

- The printer does not identify itself correctly. This may apply to very old devices. Try to configure your printer as described in Section "Configuring Manually" (page 44).

- If the manual configuration does not work, 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 or parallel port–related problem.

Configuring Manually

To manually configure the printer, select *Hardware > Printer* in the YaST control center. This opens the printer configuration window in the *Printers and Queues* view, where the detected devices are listed in the upper part. The lower part lists further details for a selected device. If no printer was detected, both parts of the configuration window are empty. Use *Configure* to change the configuration of a listed printer or *Add* to set up a printer not automatically detected. Editing an existing configuration uses the same dialogs as in Adding a Local Printer Manually (page 44). You can also *Delete* an existing entry.

Procedure 2.1   *Adding a Local Printer Manually*

TIP: YaST Print Test

To make sure that everything works correctly, the crucial configuration steps can be checked with the *Print Test Page* function of YaST. The test page also provides important information about the configuration tested. If the output is garbled, for example, with several pages almost empty, you can stop the printer by first removing all paper then stopping the test from YaST.

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1 Start YaST and choose *Hardware* > *Printer* to open the *Printer Configuration* dialog.

2 Click *Add* to open the *Printer Type* window.

3 Choose *Directly Connected Printers*.

4 Select the port to which the printer is connected (usually USB or parallel port) and choose the device in the next configuration screen. It is recommended to *Test the Printer Connection* at this point. If problems occur, select the correct device or choose *Back* to return to the previous dialog.

5 In *Queue Name*, set up a print queue. Specifying a *Name for Printing* is mandatory. It is recommended to choose a recognizable name—with this name, you can later identify the printer in the printing dialogs of applications. Use *Printer Description* and *Printer Location* to further describe the printer. This is optional, but useful if you have more than one printer connected to the machine or if you set up a print server. *Do Local Filtering* should be checked—it is needed for local printers. To enable network access to this printer, check *Share Printer*.

6 The *Printer Queue Edit Dialog* opens on the *Printer Options* tab by default. Change to the *Basic Settings* tab to install a printer driver first. Click *Change Model* and specify the printer by *Manufacturer* and *Model*. If your printer is not listed, you can try *UNKNOWN MANUFACTURER* from the manufacturer list and select an appropriate standard language (the set of commands controlling the printer) from the model list (refer to your printer's documentation to find out which language your printer understands).

Having chosen a printer model from the list, the drivers available are listed under *Driver*. 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 should not be 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, for example, it is most convenient to use a driver that does not support color printing. 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). To change the driver, choose an entry from the list and click on it.

7 Switch back to the tab *Printer Options* to configure the printer settings. If you have access to more than one printer, check *Set as Default* to make the current one the default printer. *Description* and *Location* let you change entries made while following this procedure.

With *Driver Options* specify the default paper size. *More Driver Options* lets you fine-tune the printer setup. Configure options like *Page Type*, *Printing Quality*, and others here. The set of options available depends on the driver you have chosen.

By default no banners are printed at the start and end of a print job. Change this by adjusting the settings under *Banner*.

The *Printer Queue Edit Dialog* also offers options to disable the printer and to configure the network access. Choose the tab *Status* to completely disable the printer by rejecting print jobs. If you want to temporarily disable the printout without losing jobs send to printer, choose *Disable Printout*. All arriving jobs will be queued and printed once you re-enable the printout. If you have enabled to share the printer over the network, configure which hosts and users may access the printer under the tab *Sharing*. You can also disable sharing the printer here.

2.5.2 Configuring Network Printers

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). Ask your network administrator for details on configuring a network printer in your environment.

By default, a *Local Cups Server* which also *Listens to IPP Broadcast Packages* is pre-configured. With this setup you can print to local printers and to any printer on the net, which are managed by a CUPS server. Change this settings on the *Global Settings* view of the YaST printer module. To do all the printing via a single remote CUPS server (and so disable local printing) choose *Do all Your Printing Directly via One Remote CUPS Server* and configure *Server Name* and *Queue*. To print to a network printer not managed by a CUPS server, proceed as described in Configuring a Network Printer with YaST (page 47)

Procedure 2.2   *Configuring a Network Printer with YaST*

1 Start YaST and choose *Hardware > Printer* to open the *Printer Configuration* dialog.

2 Click *Add* in the *Printers and Queues* view to open the *Printer Type* window.

3 Choose *Network Printers* to open a dialog in which to specify further details that should be provided by your network administrator.

2.6 Setting Up a Scanner

You can configure a scanner at any time using YaST. The `sane-backends` package contains hardware drivers and other essentials needed to use a scanner.

1 Connect your scanner to your computer and turn on the scanner.

2 Start YaST and select *Hardware > Scanner*. YaST will check if the `sane-backends` package is available and will try to detect your scanner model automatically.

3 Depending on the results, proceed as follows:

- If you scanner is detected properly, select the entry and click *Edit*.

- If your scanner cannot be automatically detected, try *Other > Restart Detection* first. If this does not work, click *Add* to open the manual configuration dialog and select the appropriate model and driver. Refer to the *Help* text for detailed information.

4 Click *Next* twice.

5 Test the scanner by clicking *Other > Test*.

6 Click *Finish* to close this module.

For details and background information about scanner configuration have a look at our support database article at `http://en.opensuse.org/SDB:Scanner_Setup_from_SUSE_Linux_10.0`.

Installing or Removing Software

<div style="text-align: right; font-size: 3em; font-weight: bold;">3</div>

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. Add additional software repositories to your setup to install packages not shipped with the installation media and let YaST manage them. 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. If you want to add more software to the system, proceed as follows:

1 Click *Software > Software Management* to start the YaST package manager.

2 In the search field enter the name of the software you want to install (e.g. `jhead`, a tool for manipulating JPEG meta data) and press Enter.

3 The package is listed in the right frame. Select it for installation. Once done, you can search for more packages and select them for installation in one go.

4 Click *Accept*.

5 When all selected packages are installed, YaST asks you whether you want to install or remove additional packages. Press *No* to close YaST.

By specifying various search criteria, you can restrict the search to display a few or even only one package. You can also define special search patterns using wild cards and regular expressions in *Search Mode*.

TIP: Quick Search

In addition to the *Search* filter, all lists of the package manager feature a quick search. Click the respective list to gain focus and enter a letter to move the cursor to the first package in the list whose name begins with this letter.

If you do not know the name of the software you are interested in, you can browse through the software catalog in various ways. For example, you can filter by patterns, package groups, languages, or repositories. Filter by patterns, if you are looking for software for a specific task:

1 From the filter list in the upper left corner, select *Patterns*. Now you see various pattern sets listed in the area below.
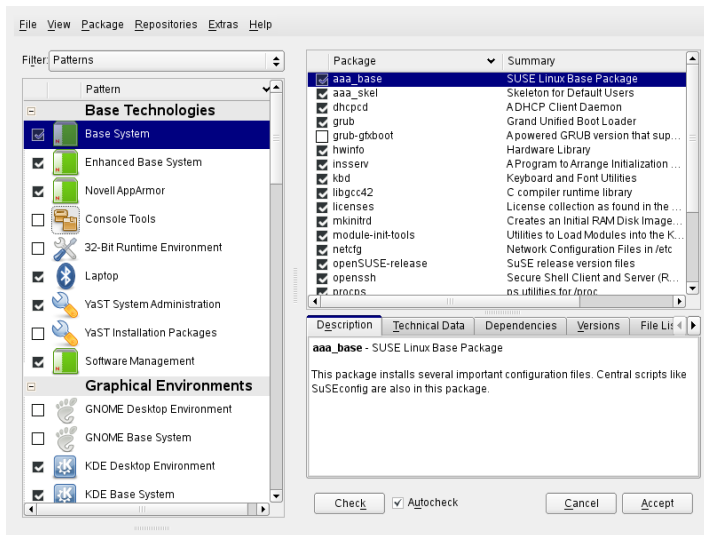
2 From the patterns select one or more patterns you are interested in. If you click on the name of a pattern, for example on *Base Development*, you see the packages it contains, in the right frame. If you activate it, the status markers at the beginning of the line will change: all packages get marked either with the status *Keep* or

Install. The meaning of all the symbols and of font color changes is explained in *Help > Symbols*.

3 Click *Accept*.

Alternatively, filter by package groups. The package groups feature offers a more detailed view of the software grouped by categories. Often packages depend on other packages; if you select a package, you might be requested to install additional packages to resolve possible package dependencies.

Filtering by languages is similar to filtering by package groups. Using the languages view enables you to select packages like translated program messages, documentation, or special fonts which are needed to support a specific language.

3.2 Checking Software Dependencies

The software of one package might only work properly if the required package is also installed. If packages with identical or similar functionality use the same system resource, they should not be installed at the same time, because this would cause a package conflict.

When the package manager starts, it examines the system and displays the installed packages. When you select to install and remove packages, the package manager automatically checks the dependencies and selects any other required packages (resolution of dependencies). If you select or deselect conflicting packages, the package manager indicates this and suggests possible solutions to this problem (resolution of conflicts).

Check Dependencies and *Autocheck* are located under the information window. If you click *Check Dependencies*, the package manager checks if the current package selection results in any unresolved package dependencies or conflicts. In the event of unresolved dependencies, the required additional packages are selected automatically. For package conflicts, the package manager opens a dialog that shows the conflict and offers various options for solving the problem.

If you activate *Autocheck*, any change of a package status triggers an automatic check. This is a useful feature, because the consistency of the package selection is monitored permanently. However, this process consumes resources and can slow down the package manager. For this reason, *Autocheck* is not activated by default. In either case, a consistency check is performed when you confirm your selection with *Accept*.

For example, `sendmail` and `postfix` may not be installed concurrently. Figure 3.1, "Conflict Management of the Package Manager" (page 52) shows the conflict message prompting you to take a decision. `postfix` is already installed. Accordingly, you can refrain from installing `sendmail`, remove `postfix`, or take the risk and ignore the conflict.

WARNING: Handling Package Conflicts

Unless you are very experienced, follow the suggestions of YaST when handling package conflicts, because otherwise the stability and functionality of your system could be endangered by the existing conflict.

Figure 3.1   *Conflict Management of the Package Manager*
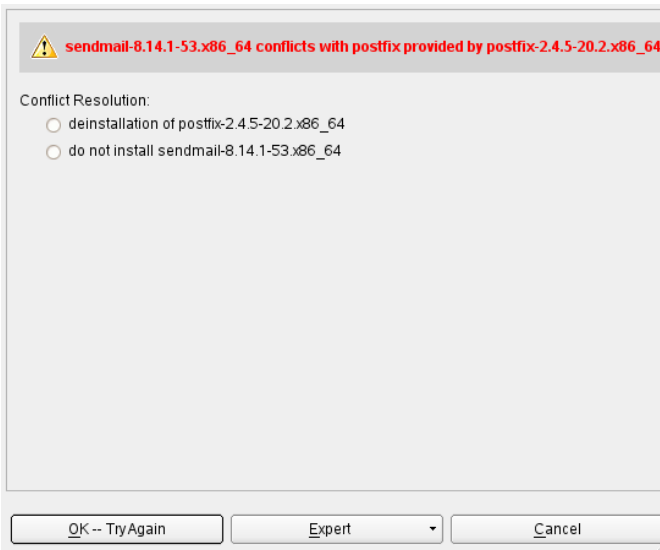
3.3 Packages and Software Repositories

If you want to search for packages originating from one particular software repository, use the *Repositories* filter. In the default configuration, this filter shows a list of all packages from the selected installation source. To restrict the list, use a secondary filter.

To view a list of the all installed packages from the selected repository, select the filter *Repositories* then select *Installation Summary* from *Secondary Filter* list and deactivate all check boxes except *Keep*.

If you are interested in the opposite and want to detect packages not belonging to any repository, also use the *Repositories* filter and select *Unmaintained Packages* as the *Secondary Filter*.

3.4 Removing Software

If you want to remove software from the system, proceed as follows:

1 Make use of a search strategy explained in Section 3.1, "Installing Software" (page 49).

2 Depending on the search strategy, you can either select a complete set or single packages one by one. For patterns, both ways are possible.

3 Click *Accept* and either watch the de-installation progress or adjust your selection, if YaST complains about dependency issues.

3.5 Adding Software Repositories

Add additional software repositories to your system to install third-party software. By default, the product repository such as `openSUSE-DVD 11.0` and a matching update repository are configured. Depending on the initially selected product, a separate language add-on repositories with translations, dictionaries, etc. might also be configured.

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.

To ensure the integrity software repositories can be signed with the GPG Key of the repository maintainer. You can manage these keys in YaST—for more information, see GPG Keys (page 55). Whenever you add a new repository, YaST offers to important

its key. Verify it as any other GPG key and pay attention that it does not change. If you detect a key change, something could be wrong with the repository and you should better disable it as an installation source until you know the cause of the key change.

To add product repositories either click *Software Repositories* directly in the *Software* pane of the YaST control center, or from within the *Software Management*, proceed as follows:

1 In the *Software Management* start screen, click *Repositories* from the menu bar and select *Repository Manager* to display an overview of configured software repositories.

2 Click *Add* to select the media type holding the repository, e.g., *DVD* with the language add-ons. Then click *Next*.

3 YaST asks to insert the medium.

4 Confirm with *Continue*. It takes some moments until YaST has downloaded and parsed the metadata of the repository. Once done you can install software from this repository as described in Section 3.1, "Installing Software" (page 49).

If you want to add a repository of the openSUSE® Build Service, such as a version of Mozilla (`http://download.opensuse.org/repositories/mozilla/`), use the *Community Repositories* configuration dialog of YaST:

1 In the *Software Management* start screen, click *Repositories* from the menu bar and select *Repository Manager* to display an overview of configured software reposit repositories.

2 Click *Add* to select the media type holding the repository, e.g., *Community Repositories* with the Mozilla projects. Then click *Next*.

3 From the list of repositories activate the wanted items such as *openSUSE Build-Service - Mozilla*.

Confirm with *OK*.

4 The new software repository is now listed in the *Configured Software Repositories* overview. Clicking *OK* again you now can install additional packages from this repository as described in Section 3.1, "Installing Software" (page 49).

In the *Configured Software Repositories* overview find several configuration options:

Properties
> By default, after adding a new repository, the repository is *Enabled* and the *Automatically Refresh* is active. This means, YaST will pull in updated meta data automatically and is always aware of new versions.
>
> The *Priority* of a repository is a value between 0 and 99, where 0 is the highest priority. If a package is available in more than one repository the repository with the highest priority wins.

GPG Keys
> Clicking *GPG Keys*, you open the GPG public keys management interface. In the *GPG Keys* subdialog, you can add new keys manually, delete or edit existing keys.

Refresh
> *Refresh* lets you update the repository meta data in various ways.

3.6 Installing Add-On Products

Add-on products are system extensions. You can install a third party add-on product or a special system extension of openSUSE, for example, a CD with support for additional languages or a CD with binary drivers. To install a new add-on, use *Software > Add-On Product*. You can select various types of product media, like CD, FTP, USB mass storage devices (such as USB flash drives or diska) or local directory. You can work also directly with ISO files. To add an add-on as ISO file media, select *Local Directory* then choose *ISO Images*.

3.6.1 Add-Ons

To install a new add-on, proceed as follows:

1 Click *Software > Add-On Product*. You can select various types of product media, like CD, FTP or local directory. You can also use ISO images instead of CD media.

2 To add an add-on as ISO file media, click *Local Directory > Next* and select *ISO Images*.

3 After successfully adding the add-on media, the package manager window appears. If the add-on provides a new pattern, see the new item in the *Patterns* filter. To view the list of all packages from the selected software repository, select the filter *Software Repositories* and choose the repository to view. To view packages from a selected add-on by package groups, select the secondary filter *Package Groups*.

3.6.2 Binary Drivers

Some hardware needs binary-only drivers to function properly. If you have such hardware, refer to the release notes for more information about availability of binary drivers for your system. To read the release notes, open YaST and select *Miscellaneous > Release Notes*.

3.7 Keeping the System Up-to-date

openSUSE offers a continuous stream of software security patches for your product. The openSUSE Updater applet informs you about the availability of patches and lets you easily install them with just a few clicks. The openSUSE community also provides updates to newer versions of software packages. openSUSE Updater keeps a list of all programs installed on your system and informs you whenever newer versions are available.

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 openSUSE Updater applet resides in the system tray (KDE) of your panel or in the notification area (GNOME) as an icon depicting the head of the openSUSE mascot (Geeko), which changes depending on the availability and relevance of patches and the status of openSUSE Updater. Whenever the icon changes, a tool tip displaying the current status is shown, too.

Green Geeko Head with Green Arrows
    No patches or new versions available.

Green Geeko Head with Yellow Arrows (KDE) / Gray Geeko (GNOME)
    openSUSE Updater is busy (for example checking for updates, installing software).

Red Triangle with Exclamation Mark
    Security patches available.

Orange Star with Arrow
    Recommended/Optional patches and/or new versions are available.

Yellow Triangle with Exclamation Mark
    An error occurred.

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

3.7.1 Installing Patches

Whenever the openSUSE Updater icon shows the availability of patches, left-click to
open the software installation window. It lists the number of Security and
Recommended patches available. While the security patches are installed by default,
you can choose whether to install the recommended ones as well. Some patches, such
as new kernel versions, require to restart your computer. Check *Don't install updates
that require a restart* to skip these updates for now. Start updating your system by
clicking *Install*.

Figure 3.2   *openSUSE Updater: Simple Update View*

A click on *Details* opens the `Available Updates` window which shows a detailed list of all patches and allows you to alter the selection of packages that will be installed. Apart from the patch name the *Type* (Security, Recommended or Optional), a short *Summary* and the patch version number is shown. Patches are sorted alphabetically by default—change this by clicking on a column headline (*Name*, *Summary*, *Type*, *New Version*, *Catalog*, or *Restart*). Click *Install* to proceed.

Figure 3.3   *openSUSE Updater: Detailed Update View*
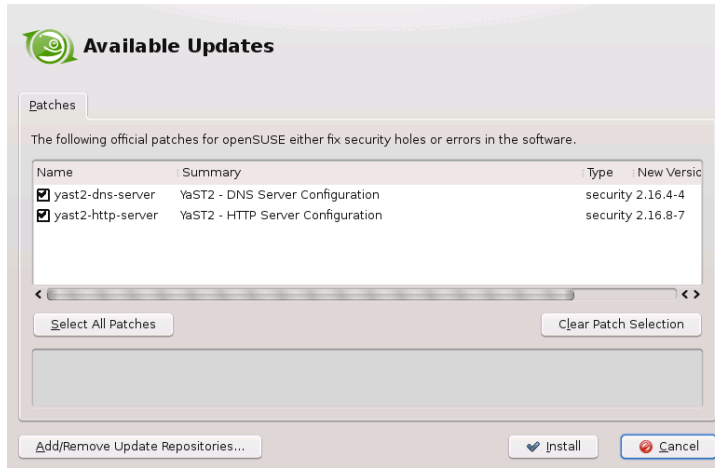
You will be prompted for the `root` password after having proceeded with *Install*. openSUSE Updater performs the installation of the patches. See the system tray (KDE) or the notification area (GNOME) for status messages and a progress meter.

The YaST Online Update offers advanced features to customize the patch installation. Please refer to Section "YaST Online Update" (Chapter 3, *Online Update*, ↑Reference) for more information.

3.7.2 Installing New Software Versions

New software versions are available from software repositories provided by the open-SUSE community. By default no such repositories are preconfigured. To add a repository, right-click on the openSUSE Updater icon and choose *Add/Remove Update Sources*. Before the *Repository Manager* starts, you will be prompted for the `root` password. Please refer to Section 3.5, "Adding Software Repositories" (page 53) for more infor-

mation. A list of popular community repositories is available within the *Repository Manager* module, 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.

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openSUSE Updater does not monitor repositories for new software versions by default. To enable this feature, open the configuration window as described in Section 3.7.3, "Configuring openSUSE Updater" (page 59) and tick the check box of *Show available updates when back-end provides them*. When the openSUSE 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 checking the box in front of an entry, or click *Select All Packages*. Click *Install* to start the installation of the selected software packages. You will be prompted for the `root` password. See the system tray (KDE) or the notification area (GNOME) for status messages and a progress meter.

3.7.3 Configuring openSUSE Updater

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

Figure 3.4 *openSUSE Updater: Configuration*
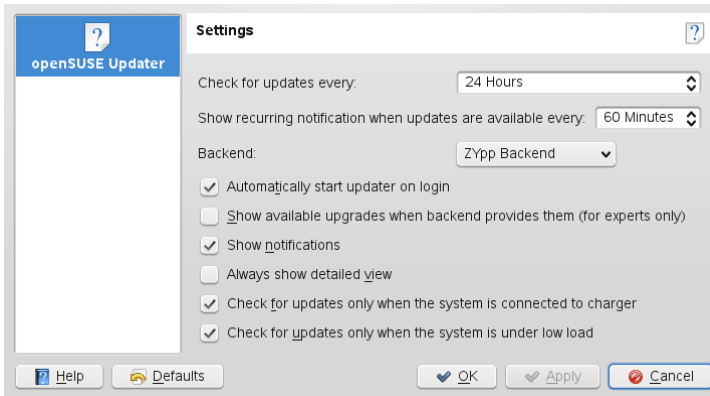
The configuration dialog also offers to change the following settings:

Back-end
Choose between different back-ends. The *ZYpp back-end* is used by default.

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. 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.

Accessing the Internet

4

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 into 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) need to be set up.

Please refer to the checklists below to make sure you have all the data ready to hand when 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.

In a second step you need to enter the data of your ISP, such as login and password, for example.

If you have successfully configured your hardware and ISP data, use the NetworkManager for managing the internet connection. See Chapter 10, *Managing Network Connections with NetworkManager* (page 147) 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 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 "DSL" (Chapter 14, *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 63) 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.

- In case you got a static IP-address from your provider: local and remote IP-addresses for the dial-in server and the gateway.

- 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 14, *Basic Networking*, ↑Reference).

4.1.3 Checklist Modem

In case your modem is not detected automatically, you need to know whether it is connected to a serial port or to an USB port. Please not 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 14, *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 14, *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 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.

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.

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

- Hostname

- Name server

- Gateway

For configuration details, refer to Section "Configuring the Network Card with YaST" (Chapter 14, *Basic Networking*, ↑Reference).

Managing Users with YaST

5

During installation, you have chosen a method for user authentication, either local via `/etc/passwd` or (if a network connection is established), via NIS, LDAP, Kerberos or Samba (see Section 1.11, "Create New User" (page 21)). You can create or modify user accounts and can change the authentication method with YaST at any time.

Every user is assigned a user ID (UID) which identifies him in the system. Apart from the users which can log in to your machine, there are also a number of *system users* for internal use only. Each user is assigned to one or more groups. Similar to *system users*, there are also *system groups* for internal use. For information about the Linux user and group concept, refer to Section 7.1, "User Concept" (page 85).

To administrate users or groups, start YaST and click *Security and Users > User and Group Management*. The *User and Group Administration* dialog opens, showing a list of users or groups in the system.

The dialog provides similar functionality for user and group management. You can easily switch between the user and group administration view by choosing the appropriate tab at the top of the dialog.

Filter options allow you to define the set of users or groups you want to modify: Click *Set Filter* to view and edit users according to certain categories, such as *Local Users* or *LDAP Users*, for instance (if you are part of a network which uses LDAP). With *Set Filter > Customize Filter* you can also set up and use a custom filter.

Figure 5.1   *YaST User and Group Management*
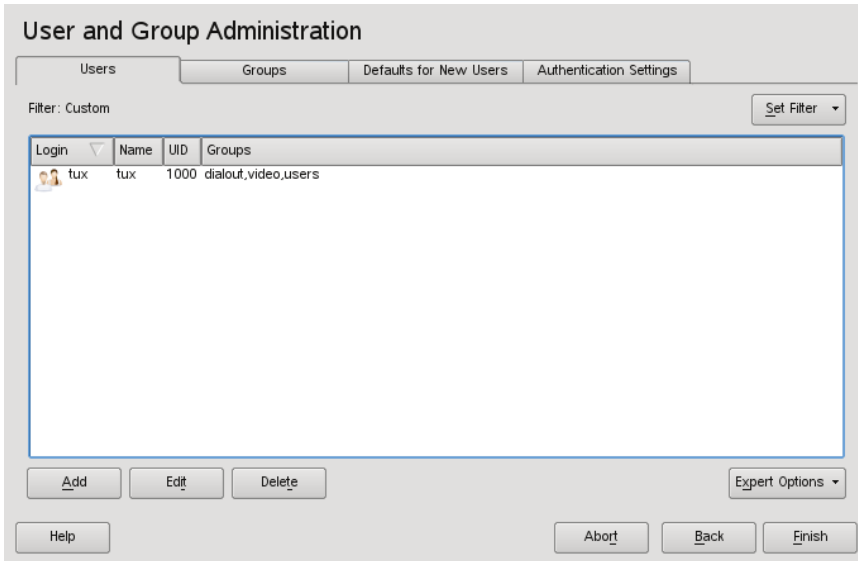
5.1 Managing User Accounts

YaST offers to create, modify, delete or temporarily disable user accounts. Do not modify user accounts unless you are an experienced user and know about the implications.

WARNING: Changing User IDs of Existing Users

After a user ID change, the user will no longer own the files he formerly created in the file system other since file ownership is bound to the user ID, not to the user name. Only the files in the user's home directory are automatically adjusted to reflect this change.

In the following, learn how to set up default user accounts. For some special options, such as auto login, login without password, setting up encrypted home directories or managing quotas for users and groups, refer to Section 5.2, "Special Options" (page 69).

Procedure 5.1   *Adding or Modifying User Accounts*

1 Open the YaST *User and Group Administration* dialog in the *Users* view.

2 With *Set Filter* define the set of users you want to manage. The dialog shows a list of users in the system and the groups the users belong to.

3 To modify options for an existing user, select an entry and click *Edit*.

4 Click *Add* to create a new user account.

5 Enter the appropriate user data on the first tab, such as *Username* (which is used for login) and *Password*. This data is sufficient to create a new user. If you click *OK* now, the system will automatically assign a user ID and set all other values according to the default.

6 Activate *Receive System Mail* if you want any kind of system mails to be delivered to this user's mailbox. This creates a mail alias for `root` and the user can read the system mail without having to log in as `root` first.

7 If you want to adjust further details such as the user ID or the path to the user's home directory, do so on the *Details* tab.

   If you need to relocate the home directory of an existing user, enter the path to the new home directory there and move the contents of the current home directory with *Move to New Location*. Otherwise a new home directory is created without any of the existing data.

8 To force users to regularly change their password or set other password options, switch to *Password Settings* and adjust the options.

9 If all options are set according to your wishes, click *OK*.

10 Click *Expert Options > Write Changes Now* to save all changes without exiting the administration dialog. Or click *Finish* to close the administration dialog and to save the changes. A newly added user can now log in to the system using the login name and password you created.

TIP: Matching User IDs

For a new (local) user on a laptop which should also integrate in a network environment where this user already has a user ID, it is useful to match the (local) user ID to the ID in the network. This ensures that the file ownership of the files the user creates "offline" is the same as if he created them directly on the network.

Procedure 5.2   *Disabling or Deleting User Accounts*

1 Open the YaST *User and Group Administration* dialog in the *Users* view.

2 To temporarily disable a user account without deleting it, select the user from the list and click *Edit*. Activate *Disable User Login*. The user cannot log in to your machine until you enable the account again.

3 To delete a user account, select the user from the list and click *Delete*. Choose if you also want to delete the user's home directory or if you want to retain the data.

Procedure 5.3   *Assigning Users to Groups*

Local users are assigned to several groups according to the default settings which you can access from the *User and Group Administration* dialog on the *Defaults for New Users* tab. To adjust the group assignment for a user, proceed as follows:

1 Open the YaST *User and Group Administration* dialog in the *Users* view. It shows a list of users and of the groups the users belong to.

2 Click *Edit* and switch to the *Details* tab.

3 To change the primary group the user belongs to, click *Default Group* and select the group from the list.

4 To assign the user to additional secondary groups, activate the corresponding check boxes in the *Additional Groups* list.

5 Click *OK* to apply your changes.

6 Click *Expert Options > Write Changes Now* to save all changes without exiting the administration dialog. Or click *Finish* to close the administration dialog and to save the changes.

5.2 Special Options

In addition to the settings for a default user account, openSUSE® offers some special options, such as auto login, login without password, encrypted home directories or quotas for users and groups.

5.2.1 Auto Login and Passwordless Login

If you use KDE or GNOME desktop environment you can configure *Auto Login* for a certain user as well as *Passwordless Login* for all users. Auto login causes a user to become automatically logged in to the desktop environment on boot. This functionality can only be activated for one user at a time. Login without password allows all users to log in to the system after they have entered their username in the login manager.

WARNING: Potential Security Risk

Enabling *Auto Login* or *Passwordless Login* on a machine that can be accessed by more than one person bears a potential security risk. Without the need to authenticate any user can gain access to your system and your data. If your system contains confidential data, do not use this functionality.

If you want to activate auto login or login without password, access these functions in the YaST *User and Group Administration* with *Expert Options > Login Settings*.

5.2.2 Managing Encrypted Home Directories

To protect data in home directories against theft and hard disk removal, you can create encrypted home directories for users. These are encrypted with LUKS (Linux Unified Key Setup), which results in an image and an image key generated for the user. The image key is protected with the user's login password. When the user logs in to the system, the encrypted home directory is mounted and the contents are made available to the user.

With YaST, you can create encrypted home directories for new or existing users. To encrypt or modify encrypted home directories of already existing users, you need to know the user's current login password. By default, all existing user data is copied to the new encrypted home directory, but it is not deleted from the unencrypted directory.

Procedure 5.4 *Creating Encrypted Home Directories*

1 Open the YaST *User and Group Management* dialog in the *Users* view.

2 To encrypt the home directory of an existing user, select an entry and click *Edit*.

Otherwise, click *Add* to create a new user account and enter the appropriate user data on the first tab.

3 In the *Details* tab, activate *Use Encrypted Home Directory*. With *Directory Size in MB*, specify the size of the encrypted image file to be created for this user.
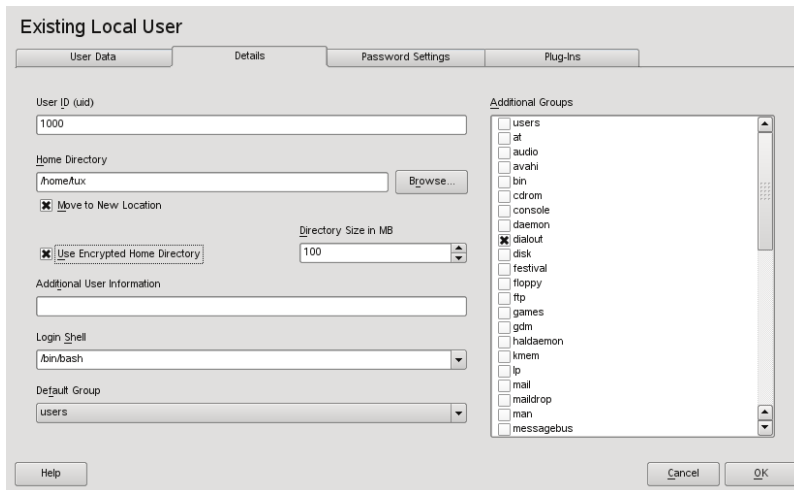
4 Apply your settings with *OK*.

5 Enter the user's current login password to proceed if YaST prompts for it.

6 Click *Expert Options > Write Changes Now* to save all changes without exiting the administration dialog. Or click *Finish* to close the administration dialog and to save the changes.

Procedure 5.5 *Modifying or Disabling Encrypted Home Directories*

Of course, you can also disable the encryption of a home directory or change the size of the image file at any time.

1 Open the YaST *User and Group Administration* dialog in the *Users* view.

2 Select a user from the list and click *Edit*.

3 If you want to disable the encryption, switch to the *Details* tab and disable *Use Encrypted Home Directory*.

If you need to enlarge or reduce the size of the encrypted image file for this users, change the *Directory Size in MB*.

4 Apply your settings with *OK*.

5 Enter the user's current login password to proceed if YaST prompts for it.

6 Click *Expert Options > Write Changes Now* to save all changes without exiting the administration dialog. Or click *Finish* to close the administration dialog and to save the changes.

WARNING: Security Restrictions

Encrypting a user's home directory does not provide strong security from other users. If strong security is required, the system should not be physically shared.

Find background information about encrypted home directories and which actions to take for stronger security in Section "Using Encrypted Home Directories" (Chapter 31, *Encrypting Partitions and Files*, ↑Reference).

5.2.3 Using Fingerprint Authentication

If your system includes the fingerprint reader by UPEK/SGS Thomson Microelectronics shipped with some IBM and Lenovo ThinkPads (also to be found in some other laptops, USB keyboards or as stand-alone device), you can use biometric authentication in addition to standard authentication via login and password. After registering their fingerprint, users can log in to the system either by swiping a finger on the fingerprint reader or by typing in a password.

Fingerprints can either be registered with YaST or from the command line. Find detailed information about configuration and use of fingerprint authentication at Chapter 27, *Using the Fingerprint Reader* (↑Reference).

5.2.4 Managing Quotas

To prevent system capacities from being exhausted unnoticed, system administrators can set up quotas for users or groups. Quotas can be defined for one or more file systems and restrict the amount of disk space that can be used and the number of inodes that can be created there. openSUSE allows usage of `soft` and `hard` quotas. Soft quotas usually define a warning level at which users are informed they are nearing their limit, whereas hard quotas define the limit at which write requests are denied. Additionally, grace intervals can be defined that allow users or groups to temporarily violate their quotas by certain amounts.

Procedure 5.6 *Enabling Quota Support for a Partition*

In order to configure quotas for certain users and groups, you need to enable quota support for the respective partition in the YaST partitioner first.

1 In YaST, select *System > Partitioner* and click *Yes* to proceed.

2 In the *Expert Partitioner*, select the partition for which to enable quotas and click *Edit*.

3 Click *Fstab Options* and activate *Enable Quota Support*.

4 Confirm your changes and leave the *Expert Partitioner*.

Procedure 5.7 *Setting Up Quotas for Users or Groups*

Now you can define soft or hard quotas for specific users or groups and set time periods
as grace intervals.

1 In the YaST *User and Group Administration*, select the user or the group for that
you want to set quotas and click *Edit*.

2 On the *Plug-Ins* tab, select the quota entry and click *Launch* to open the *Quota
Configuration* dialog.

3 From *File System*, select the partition to which the quota should apply.

4 Below *Size Limits*, restrict the amount of disk space. Enter the number of 1 kB
blocks the user or group may have on this partition. Specify a *Soft Limit* and a
Hard Limit value.

5 Additionally, you can restrict the number of inodes the user or group may have
on the partition. Below *Inodes Limits*, enter a *Soft Limit* and *Hard Limit*.

6 You can only define grace intervals if the user or group has already exceeded
the soft limit specified for size or inodes. Otherwise the time-related input fields
are not activated. Specify the time period for which the user or group is allowed
to exceed the limits set above.

7 Confirm your settings with *OK*.

openSUSE also ships command line tools like `repquota` or `warnquota` with which system administrators can control the disk usage or send e-mail notifications to users exceeding their quota. With `quota_nld`, administrators can also forward kernel messages about exceeded quotas to D-BUS. For more information, refer to the `requota`, the `warnquota` and the `quota_nld` man page.

5.3 Managing Groups

With YaST you can also easily add, modify or delete groups.

Procedure 5.8   *Creating and Modifying Groups*

1 Open the YaST *User and Group Management* dialog in the *Groups* view.

2 With *Set Filter* define the set of groups you want to manage. The dialog shows a list of groups in the system.

3 To create a new group, click *Add.*

4 To modify an existing group, select the group and click *Edit.*

5 In the following dialog, enter or change the data. The list on the right shows an overview of all available users and system users which can be members of the group.
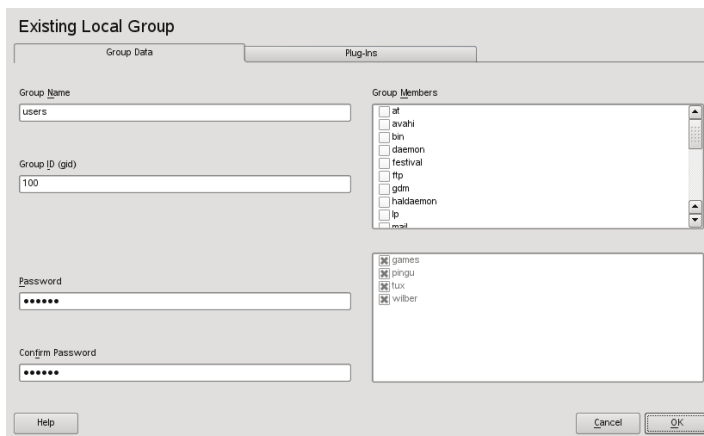
6 To add existing users to a new group select them from the list of possible *Group Members* by checking the corresponding box. To remove them from the group just uncheck the box.

7 Click *OK* to apply your changes.

In order to delete a group, it must not contain any group members. To delete a group, select it from the list and click *Delete*. Click *Expert Options* > *Write Changes Now* to save all changes without exiting the administration dialog. Or click *Finish* to close the administration dialog and to save the changes.

5.4 Changing the User Authentication Method

When your machine is connected to a network, you can change the authentication method you set during installation. The following options are available:

NIS

> Users are administered centrally on a NIS server for all systems in the network. For details, see Chapter 19, *Using NIS* (↑Reference).

LDAP

> Users are administered centrally on an LDAP server for all systems in the network. For details about LDAP, see Chapter 20, *LDAP—A Directory Service* (↑Reference).

> You can manage LDAP users with the YaST user module. All other LDAP settings, including the default settings for LDAP users, have to be defined with the YaST LDAP client module as described in Section "Configuring an LDAP Client with YaST" (Chapter 20, *LDAP—A Directory Service*, ↑Reference) .

Kerberos

> With Kerberos, a user registers once and then is trusted in the complete network for the rest of the session.

Samba

> SMB authentication is often used in mixed Linux and Windows networks.

To change the authentication method, proceed as follows:

1 Open the *User and Group Administration* dialog in YaST.

2 Click the *Authentication Settings* tab to show an overview of the available authentication methods and the current settings.

3 To change the authentication method, click *Configure* and select the authentication method you want to modify. This takes you directly to the client configuration modules in YaST. For information about the configuration of the appropriate client, refer to the following sections:

NIS: Section "Configuring NIS Clients" (Chapter 19, *Using NIS*, ↑Reference)

LDAP: Section "Configuring an LDAP Client with YaST" (Chapter 20, *LDAP—A Directory Service*, ↑Reference)

4 After accepting the configuration, return to the *User and Group Administration* overview.

5 Click *Finish* to close the administration dialog.

Changing Language and Country Settings with YaST

6

Working in different countries or having to work in a multilingual environment requires your computer to be set up to support this. Use the YaST language and timezone modules to install additional system languages and adjust the country and timezone settings accordingly. The YaST language module also lets you change your system language or determine a primary language that you use most often. Install secondary languages to get optional localizations if you need to start applications or desktops in languages other than the primary one. The YaST timezone module allows you to adjust your country and timezone settings and synchronize your system clock against a time server.

6.1 Changing the System Language

Depending on how you use your desktop and whether you want to switch the entire system to another language or just the desktop environment itself, there are several ways to achieve this:

Change the System Language Globally
> Proceed as described in Section 6.1.1, "Installing Additional System Languages" (page 78) and Section 6.1.2, "Switching the System Language" (page 80) to install additional localized packages with YaST and set the default language. Changes are effective after relogin. To ensure that the entire system reflects the change, reboot the system or close and restart all running services, applications, and programs.

Change the Language for the Desktop Only
> Provided you have previously installed the desired language packages for your desktop environment with YaST as described below, you can switch the language

of your desktop using the desktop's control center. After X has been restarted, your entire desktop reflects your new choice of language. Applications not belonging to your desktop framework are not affected by this change and may still appear in the language that was set in YaST.

Temporarily Switch Languages for One Application Only
To run a single application in another language (that has already been installed with YaST), use one of the following commands:

- `LANG=de_DE` *application* to start any standard X application or GNOME application in German. For other languages, use the appropriate language code. Get a list of all language codes available using the `locale -av` command.

- `KDE_LANG=de` *application* to start any KDE application in German. For other languages, use the appropriate language code.

6.1.1 Installing Additional System Languages

The main language was selected during installation (see) and keyboard and time zone settings were adjusted. However, you can install additional languages on your system and determine which of the different languages installed should be taken as the default. Before installing additional languages, determine which of them should be activated after you install it. YaST knows two different language categories:

Primary Language
The primary language set in YaST applies to the entire system, including YaST and the desktop environment. This language is used whenever available unless you manually specify another language.

Secondary Languages
Secondary languages are languages selected manually for a specific situation. For example, use a secondary language to start an application in a certain language, for example, to do word processing in this language.

Figure 6.1   *Setting the Language*
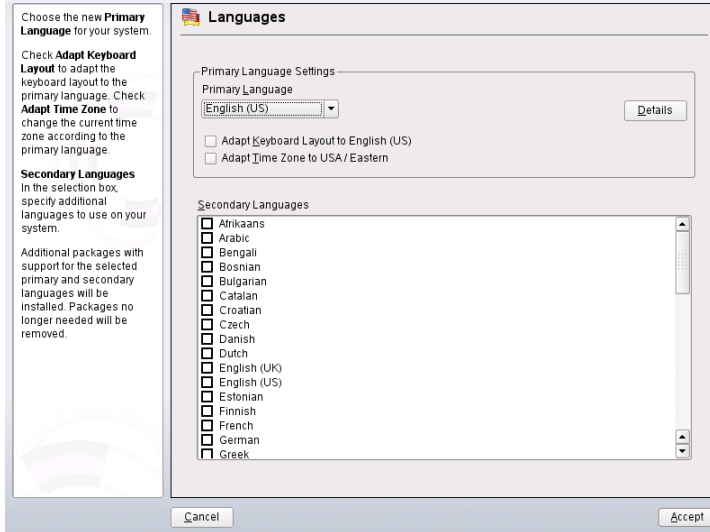
To install an additional language, proceed as follows:

1 As `root`, start YaST.

2 Select *System* > *Language*.

3 Select the desired languages from the list of languages offered in *Secondary
Languages*. When you leave this dialog with *Accept*, YaST installs the additional
localized software packages. The system is multilingual, but you need to set the
desired language explicitly to start an application in a language other than the
primary one.

4 To make this language the default (the primary language), select it under *Primary
Language*:

   4a Adapt the keyboard to the new primary language and adjust the time zone,
   if appropriate.

   4b Select *Details* to change language settings specific to `root` and to determine
   the exact locale:

Locale Settings for User root
>   ctype only adjusts the LC_TYPE variable in /etc/sysconfig/
>   language for root, which sets the localization for language-specific
>   function calls. yes sets the language for root to the same as the lan-
>   guage for local users. no means the language settings for root are not
>   affected by language changes. All locale values remain unset.

Use UTF-8 Encoding
>   Disable this box, if you do not want to use UTF-8 encoding for root.

Detailed Locale Setting
>   If your locale was not included in the list of primary languages available,
>   try explicitly specifying it here. However, some of these localizations
>   may be incomplete.

5 Leave this dialog and apply your settings with *Accept*.

6.1.2 Switching the System Language

Switching the system language is similar to installing additional languages. Use the
YaST language module to change the primary language and to adjust keyboard and
time zone. Once YaST has applied your changes and any open X sessions have been
restarted, YaST, applications, and the desktop reflect your new language settings.

6.2 Changing the Country and Time Settings

Using the YaST date and time module, adjust your system date, clock and time zone
information to the area you are working in. First, select a general region, such as *Europe*
for example. Choose an appropriate time zone that matches the one you are working
in, e.g. *Germany*.

Depending on which operating systems run on your workstation, adjust the hardware
clock settings, accordingly:

- If you run another operating system on your machine, such as Microsoft Windows*, it is likely your system does not use UTC, but local time. In this case, uncheck *Hardware Clock Set To UTC*.

- If you only run Linux on your machine, set the hardware clock to UTC and have the switch form standard time to daylight saving time performed automatically.

You can change the date and time manually or opt for synchronizing your machine against an NTP server, either permanently or just for adjusting your hardware clock. If you want to set date and time manually, proceed as follows:

Figure 6.2   *Setting Country and Time*
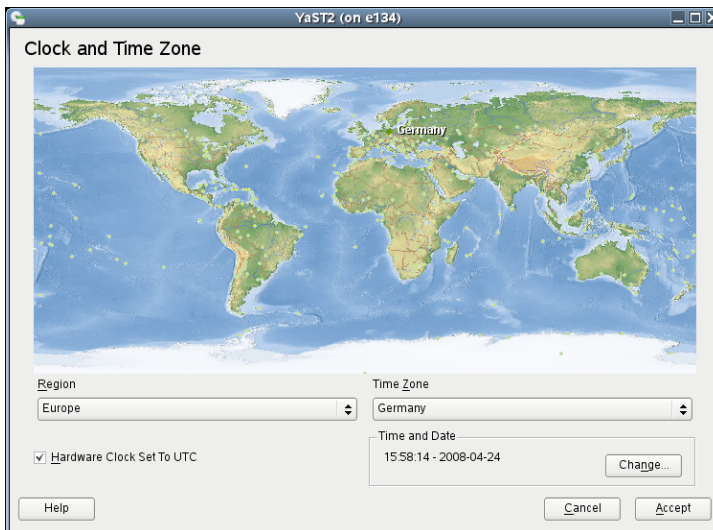
1 Click *Change* to set date and time.

2 Select *Manually* and enter date and time values.

3 Confirm with *Accept*.

If you want to make use of an NTP server:

Figure 6.3   *Setting Date and Time With NTP Server*
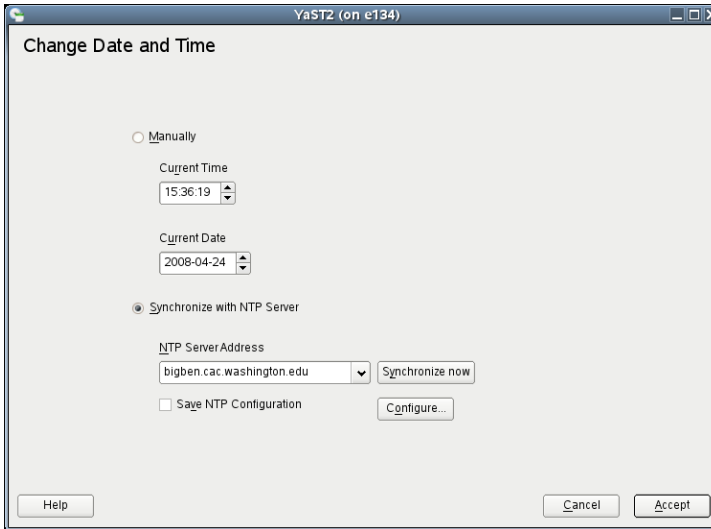
1 Click *Change* to set date and time.

2 Select *Synchronize with NTP Server*.

3 Enter the address of an NTP server, if not prefilled.

4 Press *Synchronize Now*, to get your system time set correctly. If you want to make use of NTP permanently, enable *Save NTP Configuration*.

5 Confirm with *Accept*.

With the *Configure* button, you can also open the advanced NTP configuration. For details, see Section "Configuring an NTP Client with YaST" (Chapter 18, *Time Synchronization with NTP*, ↑Reference).

Part II. Basics

Basic Concepts

7

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 orientate 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.

7.1 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 any user.

7.1.1 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 "normal" user or as 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 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 21)).

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 require `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 8.4, "Becoming Root" (page 109). 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.

7.1.2 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 7.1   *Group Membership for a User in YaST*
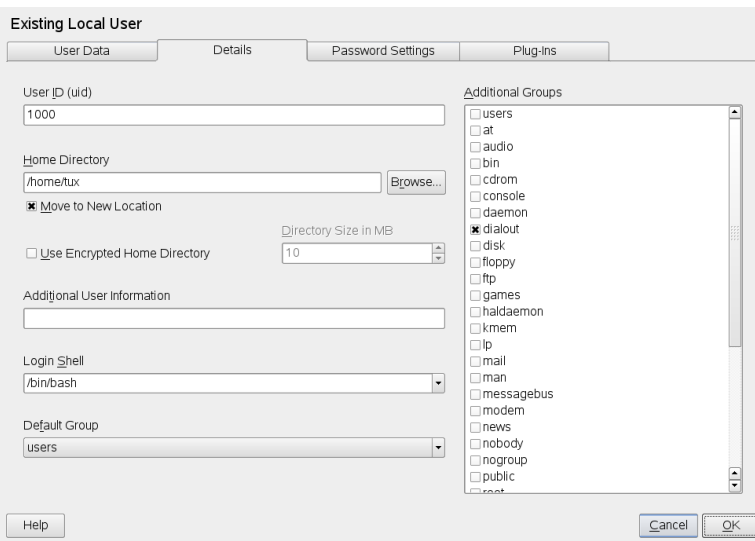
7.2 The Linux File System

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 8.5, "Modifying File Permissions" (page 110).

In Linux, you can choose whether you want to manage files and folders with a file manager or if you rather like to use the command line which is the traditional way. The

last-mentioned 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 8.3, "Working with Files and Directories" (page 105). A file manager provides a graphical and more intuitive way to handle these tasks. The following sections provide you with some basic knowledge of the file system and provide an overview of the default directory structure in Linux.

7.2.1 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 times 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 7.2 *Autodetection of a USB Stick in KDE*
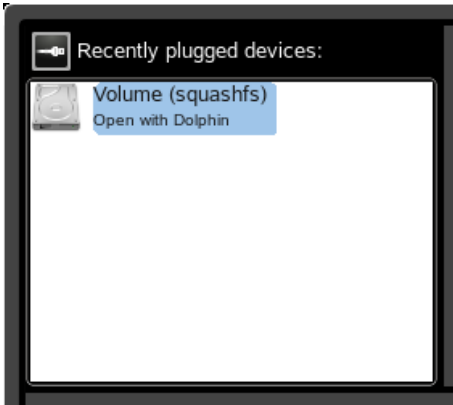
Although this concept of mounting and unmounting may appear complicated or cumbersome at first sight this also offers great flexibility: for example you can easily mount a directory from a another machine over the network and act on that directory as though it were located on your local machine.

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` make 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 8, *Shell Basics* (page 99). If you use the graphical file managers in KDE or GNOME, files and folders are symbolized by various different icons depending on the view you choose.

Figure 7.3   *File and Folders in KDE File Manager*
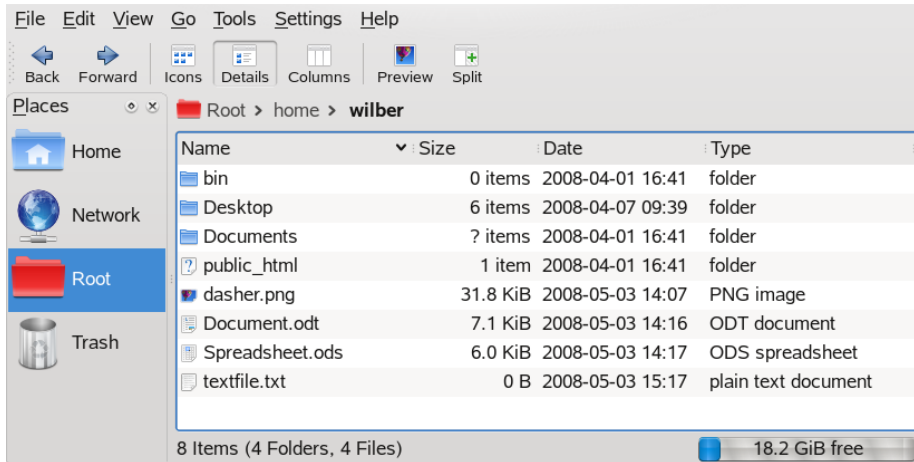
Hidden Files

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 or use a certain command in the shell as described in Section 8.2.2, "Using Commands with Options" (page 102).

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 8.5, "Modifying File Permissions" (page 110).

For more detailed information about file system permissions refer to Section 7.3, "File Access Permissions" (page 95). Apart from the traditional permission concept

for file system objects there are also extensions available which handle permissions more flexibly. Read more in Chapter 12, *Access Control Lists in Linux* (↑Reference).

7.2.2 The Directory Structure

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

Table 7.1 *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 an account on the system. Only 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.

Directory	Contents
/sbin	Essential system binaries.
/srv	Data for services provided by the system.
/tmp	Temporary files.
/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 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 form of hidden files and directories. KDE users find the personal configuration data for their desktop in `.kde` or `.kde4` respectively, 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 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 additional software. Optional software and larger add-on program packages can be found there. KDE3 is located there, whereas KDE4 and GNOME have moved to `/usr` now.

`/root`
> Home directory for the `root` user. Personal data of `root` is located here.

`/sbin`
> As the `s` indicates, this directory holds utilities for the superuser. `/sbin` contains 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.

/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 to 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 programs reserved for the system administrator, such as repair functions.

/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 relating 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

example, the log files of your system are in `/var/log/messages` (only accessible for `root`).

`/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 an NTFS file system, however, you can only read your Windows files from Linux, but not modify them. Learn more in Section 11.3, "Accessing Files on Different OS on the Same Computer" (page 164).

7.3 File Access Permissions

In Linux, objects such as files or folder or processes generally belong to the user who created or initiated them. There are some exceptions from this rule. For more information about the exceptions, refer to Chapter 12, *Access Control Lists in Linux* (↑Reference). 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 to 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.

7.3.1 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 8.5, "Modifying File Permissions" (page 110)).

Figure 7.4 *File Access Permissions in KDE File Manager*
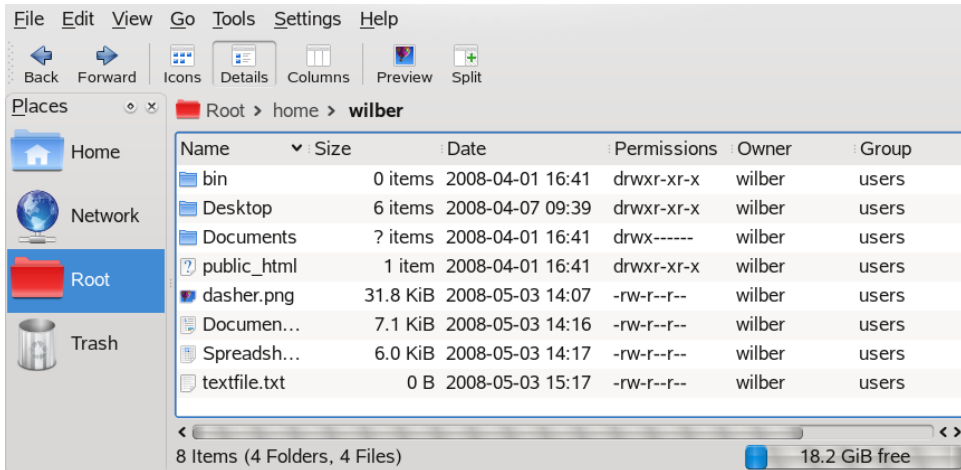
The following example shows the output of an `ls -l` command in a shell. This command lists the contents of a directory and shows the details for each file and folder in that directory.

Example 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
```

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 the example above). 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 by the third block of characters.

7.3.2 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 7.2 *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 completely from the directory as long as they do not have	Users can create, rename or delete files in the directory.

Access Permission	File	Folder
	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.

Shell Basics

8

When working with Linux nowadays, you can communicate with the system nearly 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.

8.1 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 logged in to a desktop such as KDE or GNOME already. 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 password 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 tilde symbol, ~.

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 on 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.

8.2 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 inquiry.

8.2.1 Using Commands without Options

In Section 7.3.1, "Permissions for User, Group and Others" (page 95) 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 7.2.1, "Key Features" (page 88) 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.

8.2.2 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 7.3.1, "Permissions for User, Group and Others" (page 95).

❷ Number of hard links to this file.

❸ Owner of the file or directory. For further information, refer to Section 7.3.1, "Permissions for User, Group and Others" (page 95).

❹ Group assigned to the file or directory. For further information, refer to Section 7.3.1, "Permissions for User, Group and Others" (page 95).

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.

8.2.3 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 blank 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, sometimes neither of them.

8.2.4 Bash Shortcut Keys

When having entered several commands, your shell will soon be filled 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 which help you to keep overview.

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 ↑	Scroll upwards.
Shift + Page ↓	Scroll downwards.
Ctrl + U	Delete from cursor position to start of line.

Shortcut Key	Function
Ctrl + K	Delete from cursor position to the end of line.
Ctrl + D	Closes the shell session.
↑, ↓	Browse in the history of executed commands.

8.3 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 respective file or directory.

Relative Path
    Enter a path to the respective 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 and 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 even shorter, 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 or 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.

8.3.1 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`.

1 First, from your home directory create a subdirectory in `/tmp`:

1a 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.

1b To check what happened, now enter

```
ls -l /tmp
```

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

1c Switch to the newly created directory with

```
cd /tmp/test
```

2 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 to change 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 an existing file without inquiry.

2a 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
```

2b Enter

```
touch ~/Documents/myfile.txt
```

This command creates a new, empty file named `myfile.txt` in the `Documents` directory.

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.

2c Enter

```
ls -l ~/Documents
```

The new file should appear in the list of contents.

2d 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.

2e Check the result by entering

```
ls -l
```

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

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 inquiry.

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
```

8.4 Becoming Root

As you learned in , some tasks in Linux require root permissions, otherwise they cannot be executed. 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.

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 comfortable 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.

8.5 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 7.3, "File Access Permissions" (page 95).

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.

8.5.1 Examples for Changing Access Permissions and Ownership

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

Example 8.1 *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.

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 `users`group 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
```

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.

8.6 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 is getting 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*.

8.6.1 Examples For Using History, Completion and Wildcards

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

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.

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 you already know 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 blank.

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 also had a file named `myfile10 .txt` you would have 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.

Of course, 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.

NOTE: Using Wildcards in rm Commands

Wildcards in a `rm` command can be very useful but also dangerous: you might delete more files from your directory than intended. To see which files would be affected by the `rm`, run your wildcard string with `ls` instead of `rm` first.

8.7 Editing Texts

In order to edit files from the command line, you will get to know the vi editor sooner or later. 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
> This mode is also known as colon mode as you have to enter a colon to switch to this mode. In 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.

8.7.1 Example: Editing with vi

NOTE: Display of Keys

In the following, find several commands that you can enter in vi by just pressing keys. These appear in uppercase as on a keyboard. If you need to enter a key in uppercase, this is stated explicitly by showing a key combination including the Shift key.

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.

8.8 Searching for Files or Contents

Bash offers you several commands to search for files and to search for 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 speedy, 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.

8.8.1 Examples for Searching

KDE and GNOME desktop 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" ~/*
```

8.9 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.

8.10 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 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.

8.10.1 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 If a command generates a lengthy output, like `ls -l` may do, it often 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 a certain user, `tux`, enter

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

8.11 Handling Processes

As you have seen in Section 8.7, "Editing Texts" (page 117), 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. To open a file named `vacation.pdf` in your home directory from a terminal window in KDE or GNOME, simply run `xpdf ~/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:

```
xpdf ~/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 (including the job number and their status):

```
tux@linux:~> jobs
[1]   Running         kpdf book.opensuse.startup-xep.pdf &
[2]-  Running         kpdf 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 xpdf
30187 pts/1   00:00:00 kate
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 Kate 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:

```
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 only aimed to introduce the most basic set of commands for handling jobs and processes. Find an overview for system administrators in Section "Processes" (Chapter 6, *System Monitoring Utilities*, ↑Reference).

8.12 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`.

8.12.1 File Commands

The following section lists the most important commands for file management. It covers anything from general file administration to 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 only change group ownership 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 per-
missions 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 algo-
   rithms. 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 speedy,

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 respective 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 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 should 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 respective drive.

8.12.2 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 10, *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.

8.12.3 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. Mobility

Mobile Computing with Linux

9

Mobile computing is mostly associated with laptops, PDAs, and cellular phones and the data exchange between them. Mobile hardware components, such as external hard disks, flash drives, or digital cameras, can be connected to laptops or desktop systems. A number of software components are involved in mobile computing scenarios and some applications are tailor-made for mobile use.

9.1 Laptops

The hardware of laptops differs from that of a normal desktop system. This is because criteria like exchangeability, occupied space, and power consumption are relevant properties. The manufacturers of mobile hardware have developed standard interfaces like PCMCIA (Personal Computer Memory Card International Association), Mini PCI, and Mini PCIe that can be used to extend the hardware of laptops. The standards cover memory cards, network interface cards, ISDN and modem cards, and external hard disks.

TIP: openSUSE and Tablet PCs

openSUSE also supports Tablet PCs. Tablet PCs come with a touchpad/digitizer that allows you to use a digital pen or even fingertips to edit data right on the screen instead of using mouse and keyboard. They are installed and configured much like any other system. For a detailed introduction to the installation and configuration of Tablet PCs, refer to Chapter 26, *Using Tablet PCs* (↑Reference).

9.1.1 Power Conservation

The inclusion of energy-optimized system components when manufacturing laptops contributes to their suitability for use without access to the electrical power grid. Their contribution towards conservation of power is at least as important as that of the operating system. openSUSE® supports various methods that influence the power consumption of a laptop and have varying effects on the operating time under battery power. The following list is in descending order of contribution towards power conservation:

- Throttling the CPU speed.

- Switching off the display illumination during pauses.

- Manually adjusting the display illumination.

- Disconnecting unused, hotplug-enabled accessories (USB CD-ROM, external mouse, unused PCMCIA cards, WLAN, etc.).

- Spinning down the hard disk when idling.

Detailed background information about power management in openSUSE is provided in Chapter 24, *Power Management* (↑Reference).

9.1.2 Integration in Changing Operating Environments

Your system needs to adapt to changing operating environments when used for mobile computing. A lot of services depend on the environment and the underlying clients must be reconfigured. openSUSE handles this task for you.

Figure 9.1 *Integrating a Mobile Computer in an Existing Environment*
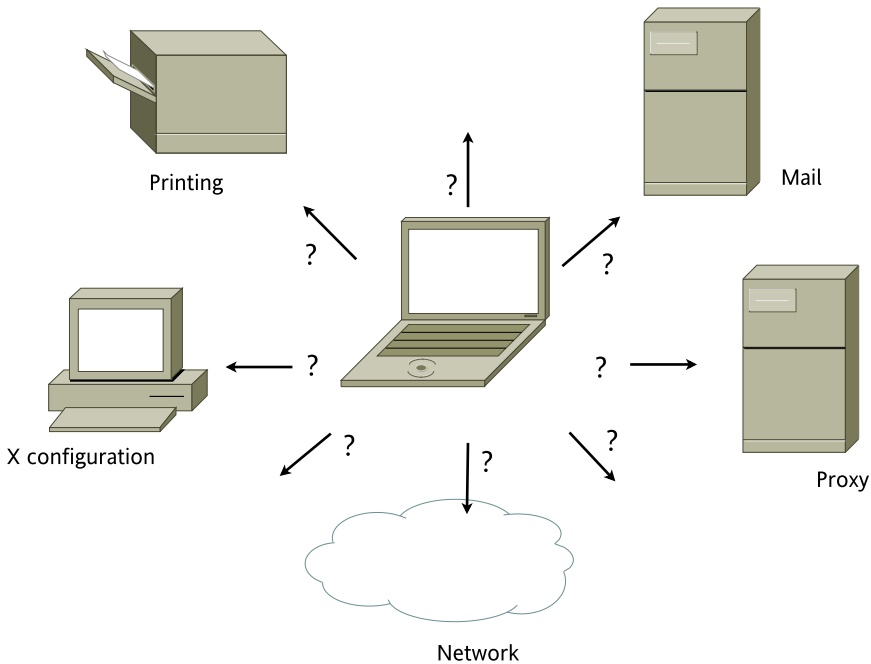
The services affected in the case of a laptop commuting back and forth between a small home network and an office network are:

Network
:   This includes IP address assignment, name resolution, Internet connectivity, and connectivity to other networks.

Printing
:   A current database of available printers and an available print server must be present, depending on the network.

E-Mail and Proxies
:   As with printing, the list of the corresponding servers must be current.

X (Graphical Environment)
:   If your laptop is temporarily connected to a beamer or an external monitor, the different display configurations must be available.

openSUSE offers several ways of integrating a laptop into existing operating environments:

NetworkManager

> NetworkManager is especially tailored for mobile networking on laptops. It provides a means to easily and automatically switch between network environments or different types of networks, such as wireless LAN and ethernet. NetworkManager supports WEP and WPA-PSK encryption in wireless LANs. It also supports dial-up connections (with smpppd). Both desktop environments (GNOME and KDE) include a front-end to NetworkManager. For more information about the desktop applets, see Chapter 4, *Accessing the Internet* (page 61).

Table 9.1   *Use Cases for NetworkManager*

My computer…	Use NetworkManager
is a laptop	Yes
is sometimes attached to different networks	Yes
provides network services (such as DNS or DHCP)	No
only uses a static IP address	No

> Use the YaST tools to configure networking whenever NetworkManager should not handle network configuration.

SCPM

> SCPM (system configuration profile management) allows storage of arbitrary configuration states of a system into a kind of "snapshot" called a *profile*. Profiles can be created for different situations. They are useful when a system is operated in changing environments (home network, office network). It is always possible to switch between profiles. To get SCPM up and running on your system, install the package `kscpm`, add the Profile Chooser KDE applet to your panel, enable SCPM using the YaST Profile Management module, and configure the users that should be allowed to switch profiles without the need of entering the `root` password. Determine whether profile changes should survive a system reboot or whether they should be discarded upon shutdown. Make sure all resource groups (i.e. services like network and printer, for example) are active. Proceed to creating actual profiles using the SUMF (SCPM Unified Management Front-End) tool which is started via

Profile Chooser. Create profiles for all the different setups you want to use this system in. Switching between profiles can either be done in the running system via the Profile Chooser applet or at system boot time via the `F3` key. When switching profiles, SCPM automatically adjusts your system configuration to the new environment laid out in the profile you have chosen.

SLP

The service location protocol (SLP) simplifies the connection of a laptop to an existing network. Without SLP, the administrator of a laptop usually requires detailed knowledge of the services available in a network. SLP broadcasts the availability of a certain type of service to all clients in a local network. Applications that support SLP can process the information dispatched by SLP and be configured automatically. SLP can even be used for the installation of a system, sparing the effort of searching for a suitable installation source. Find detailed information about SLP in Chapter 15, *SLP Services in the Network* (↑Reference).

9.1.3 Software Options

There are various special task areas in mobile use that are covered by dedicated software: system monitoring (especially the battery charge), data synchronization, and wireless communication with peripherals and the Internet. The following sections cover the most important applications that openSUSE provides for each task.

System Monitoring

Two KDE system monitoring tools are provided by openSUSE:

KPowersave

KPowersave is an applet that displays the state of the rechargeable battery in the control panel. The icon adjusts to represent the type of power supply. When working on AC power, a small plug icon is displayed. When working on batteries, the icon changes to a battery. The corresponding menu opens the YaST module for power management after requesting the `root` password. This allows setting the behavior of the system for different power sources. Find information about power management and about the corresponding YaST module in Chapter 24, *Power Management* (↑Reference).

KSysguard

KSysguard is an independent application that gathers all measurable parameters of the system into one monitoring environment. KSysguard has monitors for ACPI (battery status), CPU load, network, partitioning, and memory usage. It can also watch and display all system processes. The presentation and filtering of the collected data can be customized. It is possible to monitor different system parameters in various data pages or collect the data of various machines in parallel over the network. KSysguard can also run as a daemon on machines without a KDE environment. Find more information about this program in its integrated help function or in the SUSE help pages.

In the GNOME desktop, use GNOME Power Manager and System Monitor.

Synchronizing Data

When switching between working on a mobile machine disconnected from the network and working at a networked workstation in an office, it is necessary to keep processed data synchronized across all instances. This could include e-mail folders, directories, and individual files that need to be present for work on the road as well as at the office. The solution in both cases is as follows:

Synchronizing E-Mail

Use an IMAP account for storing your e-mails in the office network. Then access the e-mails from the workstation using any disconnected IMAP–enabled e-mail client, like Mozilla Thunderbird Mail, Evolution, or KMail. The e-mail client must be configured so that the same folder is always accessed for `Sent messages`. This ensures that all messages are available along with their status information after the synchronization process has completed. Use an SMTP server implemented in the mail client for sending messages instead of the systemwide MTA postfix or sendmail to receive reliable feedback about unsent mail.

Synchronizing Files and Directories

There are several utilities suitable for synchronizing data between a laptop and a workstation. For detailed information, refer to Chapter 11, *Copying and Sharing Files* (page 161).

Wireless Communication

As well as connecting to a home or office network with a cable, a laptop can also wirelessly connect to other computers, peripherals, cellular phones, or PDAs. Linux supports three types of wireless communication:

WLAN
> With the largest range of these wireless technologies, WLAN is the only one suitable for the operation of large and sometimes even spatially disjoint networks. Single machines can connect with each other to form an independent wireless network or access the Internet. Devices called *access points* act as base stations for WLAN-enabled devices and act as intermediaries for access to the Internet. A mobile user can switch among access points depending on location and which access point is offering the best connection. Like in cellular telephony, a large network is available to WLAN users without binding them to a specific location for accessing it. Find details about WLAN in Section "Wireless LAN" (Chapter 25, *Wireless Communication*, ↑Reference).

Bluetooth
> Bluetooth has the broadest application spectrum of all wireless technologies. It can be used for communication between computers (laptops) and PDAs or cellular phones, as can IrDA. It can also be used to connect various computers within visible range. Bluetooth is also used to connect wireless system components, like a keyboard or mouse. The range of this technology is, however, not sufficient to connect remote systems to a network. WLAN is the technology of choice for communicating through physical obstacles like walls.

IrDA
> IrDA is the wireless technology with the shortest range. Both communication parties must be within viewing distance of each other. Obstacles like walls cannot be overcome. One possible application of IrDA is the transmission of a file from a laptop to a cellular phone. The short path from the laptop to the cellular phone is then covered using IrDA. The long range transport of the file to the recipient of the file is handled by the mobile network. Another application of IrDA is the wireless transmission of printing jobs in the office.

9.1.4 Data Security

Ideally, you protect data on your laptop against unauthorized access in multiple ways. Possible security measures can be taken in the following areas:

Protection against Theft
> Always physically secure your system against theft whenever possible. Various securing tools, like chains, are available in retail stores.

Strong Authentication
> Use biometric authentication in addition to standard authentication via login and password. openSUSE supports fingerprint authentication. Refer to `http://en.opensuse.org/Using_Fingerprint_Authentication` for more details.

Securing Data on the System
> Important data should not only be encrypted during transmission, but also on the hard disk. This ensures its safety in case of theft. The creation of an encrypted partition with openSUSE is described in Chapter 31, *Encrypting Partitions and Files* (↑Reference). Another possibility is to create encrypted home directories when adding the user with YaST.

> #### IMPORTANT: Data Security and Suspend to Disk
>
> Encrypted partitions are not unmounted during a suspend to disk event. Thus, all data on these partitions is available to any party who manages to steal the hardware and issue a resume of the hard disk.

Network Security
> Any transfer of data should be secured, no matter how it takes place. Find general security issues regarding Linux and networks in Chapter 33, *Security and Confidentiality* (↑Reference).

9.2 Mobile Hardware

openSUSE supports the automatic detection of mobile storage devices over FireWire (IEEE 1394) or USB. The term *mobile storage device* applies to any kind of FireWire or USB hard disk, USB flash drive, or digital camera. These devices are automatically

detected and configured as soon as they are connected with the system over the corresponding interface. The file managers of both GNOME and KDE offer flexible handling of mobile hardware items. To unmount any of these media safely, use the *Safely Remove* (KDE) or *Unmount Volume* (GNOME) feature of either file manager.

External Hard Disks (USB and FireWire)
> As soon as an external hard disk has been correctly recognized by the system, its icon appears in the file manager. Clicking the icon displays the contents of the drive. It is possible to create folders and files here and edit or delete them. To rename a hard disk from the name it had been given by the system, select the corresponding menu item from the menu that opens when the icon is right-clicked. This name change is limited to display in the file manager. The descriptor by which the device is mounted in /media remains unaffected by this.

USB Flash Drives
> These devices are handled by the system just like external hard disks. It is similarly possible to rename the entries in the file manager.

Digital Cameras (USB and FireWire)
> Digital cameras recognized by the system also appear as external drives in the overview of the file manager. KDE allows reading and accessing the pictures at the URL camera:/ . The images can then be processed using digiKam or f-spot. For advanced photo processing use The GIMP.

9.3 Cellular Phones and PDAs

A desktop system or a laptop can communicate with a cellular phone via Bluetooth or IrDA. Some models support both protocols and some only one of the two. The usage areas for the two protocols and the corresponding extended documentation has already been mentioned in Section "Wireless Communication" (page 143). The configuration of these protocols on the cellular phones themselves is described in their manuals.

The support for synchronizing with handheld devices manufactured by Palm, Inc., is already built into Evolution and Kontact. Initial connection with the device is, in both cases, easily performed with the assistance of a wizard. Once the support for Palm Pilots is configured, it is necessary to determine which type of data should be synchronized (addresses, appointments, etc.).

A more sophisticated synchronization solution is available with the program `opensync` (see packages libopensync, msynctool and the respective plugins for the different devices).

9.4 For More Information

The central point of reference for all questions regarding mobile devices and Linux is `http://tuxmobil.org/`. Various sections of that Web site deal with the hardware and software aspects of laptops, PDAs, cellular phones, and other mobile hardware.

A similar approach to that of `http://tuxmobil.org/` is made by `http://www.linux-on-laptops.com/`. Information about laptops and handhelds can be found here.

SUSE maintains a mailing list in German dedicated to the subject of laptops. See `http://lists.opensuse.org/opensuse-mobile-de/`. On this list, users and developers discuss all aspects of mobile computing with openSUSE. Postings in English are answered, but the majority of the archived information is only available in German. Use `http://lists.opensuse.org/opensuse-mobile/` for English postings.

Information about `OpenSync` is available on `http://en.opensuse.org/OpenSync`.

Managing Network Connections with NetworkManager

10

NetworkManager is the ideal solution for a mobile workstation. With NetworkManager, you do not need to worry about configuring network interfaces and switching between wired or wireless networks when you are moving. NetworkManager can automatically connect to known wireless networks. It can also manage several network connections in parallel, the fastest connection is then used as default. You can also switch between available networks manually and manage your network connection using an applet in the system tray.

On laptop computers, NetworkManager is active by default. However it can be at any time activated or deactivated using YaST as described in Section 10.2, "Enabling NetworkManager" (page 148).

10.1 Use Cases for NetworkManager

NetworkManager provides a sophisticated and intuitive user interface which enables users easily to 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.

- You want to use SCPM for network configuration management. To use SCPM and NetworkManager at the same time, disable the network resource in SCPM configuration.

10.2 Enabling NetworkManager

If you want to manage your network connection with NetworkManager, enable NetworkManager in the YaST Network Settings module. If you switch your system from the traditional configuration with YaST to NetworkManager, NetworkManager adopts the configurations from YaST. To enable NetworkManager, proceed as follows:

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

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

3 In the *Network Setup Method* field, activate *User Controlled with NetworkManager*.

4 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 14, *Basic Networking*, ↑Reference) and Section "Wireless LAN" (Chapter 25, *Wireless Communication*, ↑Reference).

5 Click *Finish*.

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.

10.3 NetworkManager and VPN

NetworkManager supports several Virtual Private Network (VPN) technologies:

- NovellVPN—package `NetworkManager-novellvpn`

- OpenVPN—package `NetworkManager-openvpn`

- vpnc (Cisco)—package `NetworkManager-vpnc`

To use VPN with NetworkManager, install the appropriate VPN packages first. You need two packages for each VPN technology: one of the packages above (providing the generic support for NetworkManager), and the respective desktop-specific package for your applet.

For KDE, choose one of the following:

- NovellVPN support for KNetworkManager—package
  `NetworkManager-novellvpn-kde`

- OpenVPN support for KNetworkManager—package
  `NetworkManager-openvpn-kde`

- vpnc (Cisco) support for KNetworkManager—package
  `NetworkManager-vpnc-kde`

For GNOME, choose one of the following:

- NovellVPN support for GNOME NetworkManager applet—package
  `NetworkManager-novellvpn-gnome`

- OpenVPN support for GNOME NetworkManager applet—package
  `NetworkManager-openvpn-gnome`

- vpnc (Cisco) support for GNOME NetworkManager applet—package
  `NetworkManager-vpnc-gnome`

After you have installed the packages, configure your VPN connection as described in Section 10.4.2, "Configuring Network Connections with KNetworkManager" (page 151) or in Section 10.5.2, "Configuring Network Connections with GNOME NetworkManager Applet" (page 154).

10.4 Using KNetworkManager

In KDE, NetworkManager can be controlled with one or more KNetworkManager applets. If the network is set up for NetworkManager control, the applets usually start automatically with the desktop environment and are shown as icons in the system tray.

If your system tray does not show any icons for network connections, KNetworkManager is probably not started. Press Alt + F2 and enter `knetworkmanager` to start it manually.

10.4.1 Overview

The globe icon is the main KNetworkManager icon. Use it to configure new network connections, to disable the use of wireless networks, or to switch to offline mode altogether, if needed. The current network status is shown by the additional icons in the system tray. Hold the mouse cursor over the icons to see details about the connection. Depending on the state of the network connection, the panel icons change appearance:

A wired connection has been established.

Currently there is no connection to the Internet.

A wireless connection has been established. Blue bars show the strength of the signal. More blue bars means better signal strength.


A connection is being established or terminated.

NetworkManager distinguishes two types of connections: trusted and untrusted. A trusted connection is any network that you explicitly selected. All others are untrusted. Right-click the connection icons to show a list of connections that you have already used at least once in the past. The currently used connection is marked in the menu.

Left-click any of the connection applets to choose another network connection at any time. Such a choice takes priority over automatically selected networks. The chosen network is used as long as it is available, meaning that plugging a network cable in does not switch to a wired network connection automatically.

**Figure 10.1** *Available Wireless Networks in the KNetworkManager Applet*

NetworkManager also supports connections to 802.1X protected networks, the use of VPN connections, and UMTS/3G connections. Apart from using NetworkManager, you can also use UMTSmon to control UMTS connections as described at `http://en.opensuse.org/Umtsmon`.

10.4.2 Configuring Network Connections with KNetworkManager

1 Right-click the globe icon in the system tray and select *Edit Connections*.

2 In the dialog that opens, click *New Connections* and select the type of connection to configure. If you choose a wireless connection, KNetworkManager shows a list of available wireless networks.

NOTE: Hidden Networks

To connect to a "hidden" network (a network that does not broadcast its service) you have to know the Extended Service Set Identifier (ESSID) of the network because it cannot be detected automatically. In this case, enter the ESSID and click *Next* to enter the encryption parameters, if necessary.

---

3 Enter your connection details and click *Next*.

4 Click *Save* to save the connection or *Save and Connect* if you want to connect to the network at once.

The newly configured network connection now appears in the list of available networks you get by left-clicking the KNetworkManager icon.

10.5 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 GNOME NetworkManager applet, the applet is probably not started. Press Alt + F2 and enter `nm-applet` to start it manually.

10.5.1 Overview

The current network status is shown in the system tray. The appearance of the icon depends on the state of the network connection. If you are not sure what the icon means, hold your mouse over the icon until an explanation appears.

A wired connection has been established.

Currently there is no connection to the Internet.

A wireless connection has been established. Blue bars indicate the strength of the signal. More blue bars means better signal strength.

The connection is being established or terminated.

NetworkManager distinguishes two types of connections: trusted and untrusted. A trusted connection is any network that you explicitly selected. All others are untrusted. Left-click the NetworkManager icon to show a list of connections that you have already used at least once in the past. The currently used connection is marked in the menu. To get information about the current connection (including the used interface, IP address, and hardware address), right-click the applet icon and choose *Connection Information* from the menu.

Left-click the NetworkManager applet to choose another network connection at any time. Such a choice takes priority over automatically selected networks. The chosen network is used as long as it is available, meaning that plugging a network cable in does not switch to a wired network connection automatically.

Figure 10.2   *Available Networks in GNOME NetworkManager Applet*
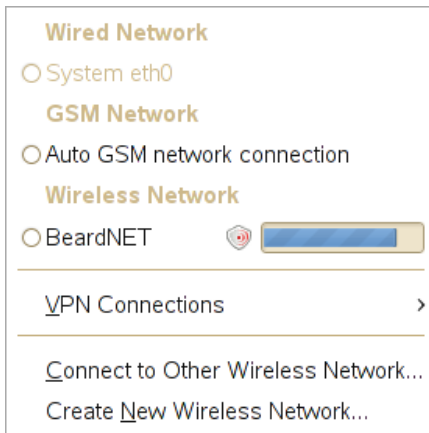
NetworkManager also supports connections to 802.1X protected networks, the use of VPN connections, and UMTS/3G connections. Apart from using NetworkManager, you can also use UMTSmon to control UMTS connections as described at http://en.opensuse.org/Umtsmon.

10.5.2 Configuring Network Connections with GNOME NetworkManager Applet

GNOME NetworkManager applet offers several possibilities to configure network connections. For quick and easy configuration of a new wireless (ADHOC) network, proceed as described in .

To access an advanced configuration dialog with which to configure and modify details for all types of connections, right-click the applet icon and select *Edit Connections*.

The *Network Connection* dialog shows tabs for all types of network connections, such as wired, wireless, UMTS (Mobile Broadband), DSL, and VPN connections.
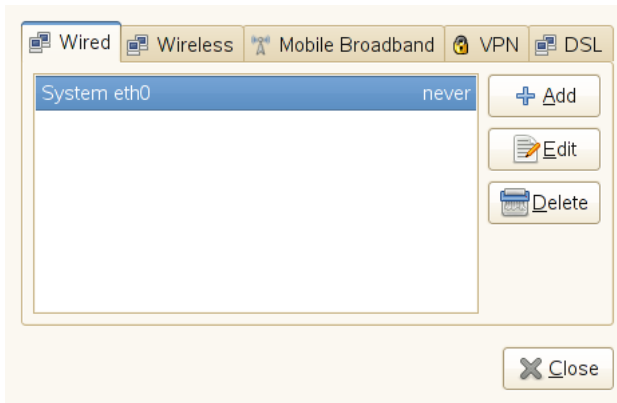
To add a new connection, click the tab for the connection type you want to use and click *Add*. Enter your connection details and click *OK*. The newly configured network connection now appears in the list of available networks you get by left-clicking the NetworkManager icon.

When editing each connection, you can also define if NetworkManager should automatically use this connection or should use this connection systemwide.

10.5.3 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*.

10.5.4 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 10.1   *Connecting to a Wireless Network*

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

2 If the network is encrypted, a dialog opens. Choose the type of *Wireless Security* the network uses and enter the appropriate *Password*.

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

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

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

10.5.5 Configuring Your Wireless Card as an Access Point

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

1 Click *Create New Wireless Network.*

2 Add the network name and set the encryption in the *Wireless Security* dialog.

> **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.

10.5.6 GNOME Keyring Manager

If you do not want to enter your credentials anew each time you want to connect to an encrypted network, you can use GNOME Keyring Manager to store your credentials encrypted on the disk, secured by a master password. Whenever any GNOME application that uses GNOME Keyring needs to access passwords or credentials stored there, a check is made if the keyring is locked or not. If it is locked, you will be prompted for the master password to unlock the keyring. .

10.6 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 scans for available wireless networks, if no wired connection is available. 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.

In a system with a wireless connection only, NetworkManager does not automatically start the connection during boot. You must log in first to establish a connection. To make a wireless connection accessible without login, configure the trusted connection with YaST. Only wireless connections configured with YaST are sufficiently credible for NetworkManager to use them during boot.

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

10.7 Troubleshooting

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

10.7.1 NetworkManager Desktop Applet Does Not Start

NetworkManager applet should start automatically if the network is set up for Network-Manager control. If the applet does not start, first make sure that the appropriate package for your desktop environment is installed. If you are using KDE, the package is `NetworkManager-kde`. For GNOME the package is `NetworkManager-gnome`.

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

10.7.2 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 technology are installed. For more information, see Section 10.3, "NetworkManager and VPN" (page 149). />.

10.7.3 SCPM Does Not Switch the Network Configuration

You are probably using SCPM together with NetworkManager. NetworkManager is not currently able to work with SCPM profiles. Do not use NetworkManager together with SCPM when SCPM profiles also change network settings. To use SCPM and NetworkManager at the same time, disable the network resource in SCPM configuration.

10.7.4 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`.

10.8 For More Information

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

- `http://www.gnome.org/projects/NetworkManager/`—NetworkManager project page

- `http://en.opensuse.org/Projects/KNetworkManager`—KNetworkManager on opensuse.org

- Also check out the information in the following directories for the latest information
  about NetworkManager and the NetworkManager applets: `/usr/share/doc/packages/NetworkManager/`, `/usr/share/doc/packages/NetworkManager-kde/` and `/usr/share/doc/packages/NetworkManager-gnome/`

Copying and Sharing Files

11

If using multiple operating systems (OS) simultaneously, it is often necessary to exchange files among them. Different systems may reside on different partitions on the same machine or on different machines across your network. There are various approaches to file exchange with different basic instructions and possible pitfalls.

WARNING: Scenarios for Private Home Networks Only

Do not use the following scenarios in networks other than your own private and trusted home network that is protected by a firewall. Implementing high security measures for the configurations featured in the following sections is beyond the scope of this document.

Exchanging data may encompass either one of the following tasks:

Copying

    To copy your data means to transfer your data from one system to the other. This results in identical objects on both the source and the target system.

    Synchronizing data is a special way to copy data. If you change a file on one computer, it is automatically changed on the other computer after the synchronization. For example, think of a laptop that contains your modified files and you want to have the same contents on your desktop computer.

Sharing

    Sharing your files means establishing a client/server relationship. The server provides files that can be accessed by the client. When changing a file, you modify it

on the server, not locally on the client. File servers typically serve a large number of clients simultaneously.

11.1 Scenarios

The following list provides a number of possible scenarios involving file transfer:

Different OS on the Same Computer
>   Many users have an operating system preinstalled by their vendor and run Linux in a separate partition. Refer to Section 11.3, "Accessing Files on Different OS on the Same Computer" (page 164) for more information.

Different Computers Not Connected by a Network
>   Save the data to any media (CD, DVD, USB flash drive, or external hard disk) and connect these to the target machine to copy your files. This solution is inexpensive, intuitive, and straightforward. However, you need the appropriate drives or ports on both computers. Media are suited to occasional file transfers with limited file size. If you need a more permanent solution, consider connecting them with a network.

Different Computers Connected to the Same Network
>   Set up a server of any kind on one computer, connect the server and the client, and transfer the files from server to client. Choose from various protocols available and pick the one that best matches your needs and expertise.
>
>   The client/server setup requires more expertise and maintenance efforts, but is better suited to routine transfer needs and exchange with multiple systems. If you are looking for a permanent file exchange, choose a client/server-based method. This method does not impose any limits on the amount of data that can be transferred. See Section 11.2, "Access Methods" (page 163).

Different Computers on Different Networks
>   This scenario requires connection of different networks and is beyond the scope of this document. Transfer files as if the computers were not connected to a network.

11.2 Access Methods

The following methods and protocols are well-suited to file transfer and sharing.

FTP

Use FTP (File Transfer Protocol) if you need to exchange files very often and with different users. Set up an FTP server on one system and access it with clients. There are many graphical client applications available for FTP on Windows*, MacOS, and Linux. Depending on how your FTP server is used, enable read and write permissions. See Section 11.4.4, "Copying Files with FTP" (page 171) for more details on FTP.

NFS

NFS (Network File System) is a client/server system. A server exports one or more directories that can be imported by a client. For more information, see Chapter 21, *Sharing File Systems with NFS* (↑Reference).

Use NFS if you share files very often and for different users. Generally, this protocol is more common in the Linux world than in the Windows world. An NFS export integrates well into your Linux system and you can browse the imported directory structure like any other folder on your local machine. Depending on how you configure it, enable write and read permissions or both on the server. In general, for a home user it makes sense to allow read and write access.

rsync

Use rsync to transfer regularly large volumes of data that does not change considerably. It is available on Linux and Windows. A typical use case for rsync is managing data backups. Refer to the manual page of the `rsync` command and Section 11.4.2, "Transferring Files with rsync" (page 167) for more information.

Unison

Unison is an alternative to rsync. It is used to regularly synchronize files between different computers but has the advantage to behave bidirectionally. Refer to the manual page of the Unison command and Section 11.4.3, "Transferring Files with Unison" (page 169) for more information. Unison is available on Linux and Windows.

SMB

Samba is a client/server system and an implementation of the SMB protocol. It is usually used in Windows networks, but is supported by several operating systems.

Use Samba if you need to share files very often and with different users, especially to Windows systems. Samba as a Linux-only solution is uncommon, use NFS instead. For more information about setting up a Samba server, refer to Section 11.7, "Sharing Files between Linux and Windows with Samba" (page 178).

SSH

SSH (Secure Shell) enables a secure connection between computer. The SSH suite consists of several commands and uses public key encryption to authenticate users. For more information, see Chapter 29, *SSH: Secure Network Operations* (↑Reference).

Use SSH if you copy files occasionally over an untrusted network and if you are the only user doing so. Although there are graphical user interfaces available, SSH is mainly considered a command line utility and is available on Linux and Windows.

11.3 Accessing Files on Different OS on the Same Computer

New computers generally ship with a preinstalled operating system, usually Windows. If you have installed Linux on a different partition, you might want to exchange files between the different operating systems.

Windows can not read Linux partitions per default. If you want to exchange files between these two operating systems, you have to create an "exchange partition". If you prefer a more directly approach look at `http://www.fs-driver.org/` to get a driver supporting an ext2 filesystem on Windows. The following file systems are used by Windows and can be accessed from a Linux machine:

FAT

Various flavors of this file system are used by MS-DOS and Windows 95 and 98. You can create this type of file system with YaST. It is possible to read and write files on FAT partitions from Linux. The size of a FAT partition and even the maximum size of a single file is subject to restrictions, depending on the FAT version. See `http://en.wikipedia.org/wiki/VFAT` for more information about FAT file systems.

NTFS

The NTFS file system is used by Windows NT, Windows 2000, Windows XP, Windows Server 2003 and Windows Vista. openSUSE includes write access support to the NTFS file system. However, the driver for the NTFS-3g filesystem has limited functionality. At the moment there is no support for Windows file permissions and you can not access encoded or compressed files. See http://en.opensuse.org/NTFS-3g for more information about NTFS-3g.

During the installation of openSUSE, your Windows partitions are detected. After starting your Linux system, the Windows partitions usually are mounted. These are possible ways of accessing your Windows data:

KDE

Press Alt + F2 and enter `sysinfo:/`. A new window opens displaying the characteristics of your machine. *Disk Information* lists your partitions. Look at those that are of the file system type `ntfs` or `vfat` and click on these entries. If the partition is not already mounted, KDE mounts the partition now and displays the contents.

Command Line

Just list the contents of `/windows` to see one or more directories containing your Windows drives. The directory `/windows/c` maps to the Windows drive `C:\`, for example.

NOTE: Changing the Accessibility of Windows Partitions

Initially Windows partitions are mounted read-only for normal users to avoid accidental damage to the file system. To grant normal users full access to a mounted Windows partition, change the mount behavior of this Windows partition. Refer to the manual page of the `mount` command for more information on mount options for vfat and to the maual page of `ntfs-3g` on mount options for NTFS.

11.4 Copying Files between Linux Computers

Linux offers a rich set of protocols you can use to copy files between computers. Which protocol you use depends on how much effort you want to invest and whether you need to be compatible with future Windows installations. The following sections feature various methods to transfer files from and to Linux computers. Make sure that you have a working network connection, because otherwise they will not work. All scenarios rely on working name resolution in the network. If your network does not include a name service, use IP addresses directly or add the IP addresses along with respective hostnames to `/etc/hosts` on all clients.

The following example IP addresses and hostnames are used across this section:

Target Hostname	`jupiter.example.com`
Target IP	`192.168.2.100`
Source Hostname	`venus.example.com`
Source IP	`192.168.2.101`
User	`tux`

11.4.1 Copying Files with SSH

The following requirements must be met on both computers that are accessed via SSH:

1. If you use a hostname, make sure each hostname is listed in `/etc/hosts` on both computers (see Section " `/etc/hosts` " (Chapter 14, *Basic Networking*, ↑Reference).) If you use SSH with IP addresses, you do not need to change anything.

2. If you use a firewall, open the SSH port. To do so, start YaST, and select *Security and Users > Firewall*. Go to *Allowed Services* and check whether *SSH* is displayed

as part of the list. If this is not the case, select SSH from *Service to Allow* and click *Add*. Apply your changes and leave YaST with *Next* and *Finish*.

To copy files from one computer to another, you need to know where the files are located. For example, to copy a single file `/srv/foo_file` from computer `jupiter.example.com` to the current directory, use the `scp` command (the dot represents the current directory as the copy target location):

```
scp tux@jupiter.example.com:/srv/foo_file .
```

To copy a whole directory structure, use the recursive mode of `scp`:

```
scp -r tux@jupiter.example.com:/srv/foo_directory .
```

If your network does not provide name resolution, use the server's IP address directly:

```
scp tux@192.168.2.100:/srv/foo_file .
```

If you do not know exactly where your files are, use the `sftp` command.   Copying files in KDE or GNOME with SFTP is very simple. Proceed as follows:

1 Press Alt + F2.

2 Enter the following at the address prompt:

```
sftp://tux@jupiter.example.com
```

3 Enter the password of `tux` on `jupiter.example.com`.

4 Drag and drop the desired files or directories to your desktop or a local directory.

KDE provides another protocol called `fish` that can be used if `sftp` is not available. The use of this protocol is similar to `sftp`. Just replace the `sftp` protocol prefix of the URL with `fish`:

```
fish://tux@jupiter.example.com
```

11.4.2 Transferring Files with rsync

Before using rsync to synchronize files and directories between different computers, make sure that the following requirements are met:

1. The package `rsync` is installed.

2. Identical users are available on both systems.

3. Enough disk space is available on the server.

4. If you want to benefit from rsync's full potential, make sure that rsyncd is installed on the system to use as the server.

rsync is useful for archiving or copying data and can also be used as a daemon to provide directories to the network (see Advanced Setup for rsync Synchronization (page 168)).

rsync Basic Mode

The basic mode of operation of rsync does not require any special configuration. rsync mirrors complete directories onto another system. Its usage is not much different from a regular copying tool, such as scp. The following command creates a backup of the home directory of tux on a backup server called jupiter:

```
rsync -Hbaz -e ssh /home/tux/ tux@jupiter:backup
```

Use the following command to apply your backup:

```
rsync -Haz -e ssh tux@jupiter:backup /home/tux/
```

rsync Daemon Mode

Start the rsyncd daemon on one of your systems to make use of the full functionality of rsync. In this mode, it is possible to create synchronization points (modules) that can be accessed without an account. To use the rsyncd daemon, proceed as follows:

Procedure 11.1   *Advanced Setup for rsync Synchronization*

1 Log in as root and install the rsync package.

2 Configure your synchronization points in /etc/rsyncd.conf. Add a point with its name in brackets and add the path keyword like in the following example:

```
[FTP]
  path = /srv/ftp
 comment = An Example
```

3 Start the rsyncd daemon as `root` with `rcrsyncd start`. To start the rsync service automatically during each system boot, run `insserv rsyncd`.

4 List all files located in the `/srv/ftp` directory (note the double colon):

```
rsync -avz jupiter::FTP
```

5 Initiate the transfer by providing a target directory (in this example, the current directory is represented by a dot):

```
rsync -avz jupiter::FTP .
```

By default, files are not deleted while synchronizing with rsync. To force file deletion, add the `--delete` option. To make sure that `--delete` does not accidentally remove newer files, use the `--update` option instead. Any conflicts that arise must be resolved manually.

11.4.3 Transferring Files with Unison

Before using Unison to synchronize files and directories between different computers, make sure that the following requirements are met:

1. The package `unison` is installed.

2. Enough disk space is available on your local and remote computer.

3. If you want to benefit from Unison's full potential, make sure that Unison is also installed and running on the remote computer.

In case you need help, run Unison with the `-doc topics` option to get a full list of available sections.

For permanent settings, Unison allows to create *profiles* that specify Unison preferences such as the directories (roots) to synchronize, which types of files to ignore, and other options. The profiles are stored as text files in `~/.unison` with the file extension `*.prf`.

Using the GUI

To synchronize different directories with Unison's GUI, proceed as follows:

1 Start Unison by pressing Alt + F2 and entering `unison`.

2 If you run Unison for the first time and without any further option, you are prompted for a source directory. Enter the source directory you want to synchronize and click *OK*.

3 Enter the target directory. It can be either local or remote. If you want to synchronize to a remote directory, choose the method (SSH, RSH or Socket) and enter the hostname and an optional user.

4 If you have not synchronized these two directories before, a warning dialog appears, informing you that Unison will now compare the contents of those directories. Close the warning with *OK* and wait until Unison has collected the information from both directories and displays the differences in the main window.

The left column shows the source directory you have selected, the third column shows the target directory. If there are differences between the directories, the *Action* column shows a symbol, proposing an action. A green arrow indicates that a file has been modified, added or deleted in the source or the target directory. The direction of the arrow indicates the direction that the change would be propagated if you performed the synchronization now. A question mark indicates a conflict (both files have been changed and Unison cannot decide which one to overwrite).

***Figure 11.1**   File Synchronization Proposal*
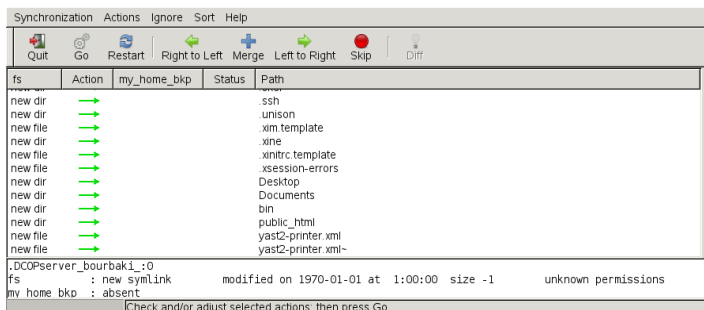
5 To modify the proposals Unison shows for each file (for example, if you want to change the direction), select the file and click *Right to Left* or *Left to Right*.

With *Skip*, exclude a file from synchronization. The symbol in the *Action* column changes accordingly.

6 To start the synchronization, click *Go*.

The next time you start Unison, a dialog box shows the existing profiles, each specifying a pair of directories to be synchronized. Select a profile or create a new profile (for another pair of directories) and perform the synchronization as described above.

Using the Command Line

Unison can also be operated through the command line. To synchronize a local directory to a remote computer, proceed as follows:

1 Open a shell and enter the following command:

```
unison -ui text DIR
        ssh://tux@jupiter.example.com//PATH
```

Replace the placeholders with the respective values.

2 Unison asks you what to do with your files and directories, for example:

```
local                  jupiter
            <----  new file    dir [f]
```

3 Press F if you want to follow Unison's recommendation. For other commands, press ?.

4 Proceed with y, if you want to propagate your updates.

11.4.4 Copying Files with FTP

Before configuring your FTP server, make sure that the following requirements are met:

1. The package `vsftp` is installed.

2. You have `root` access to your FTP server.

3. Enough disk space is available on your computer.

WARNING: For Home Networks Only

This setup is suited for use in home networks only. Do not deploy it to sites unprotected by firewalls and do not enable world wide access.

To configure an FTP server, proceed as follows:

1 Prepare the FTP server:

1a Open a shell, log in as `root`, and save a backup copy of `/etc/vsftpd.conf`:

```
cp /etc/vsftpd.conf /etc/vsftpd.conf.bak
```

1b Create an access point for anonymous FTP

```
mkdir ~ftp/incoming
chown -R ftp:ftp ~ftp/incoming
```

2 Replace the configuration files according to the preferred scenario (refer to the manual page of `vsftpd.conf` for advanced configuration options):

Allowing Anonymous Read and Write Access

```
#
listen=YES

# Enable anonymous access to FTP server
anonymous_enable=YES

#
local_enable=YES
# Enable write access
write_enable=YES
anon_upload_enable=YES
anon_mkdir_write_enable=YES
dirmessage_enable=YES
# Write log file
xferlog_enable=YES
connect_from_port_20=YES
chown_uploads=YES
chown_username=ftp
ftpd_banner=Welcome to FTP service.
anon_root=/srv/ftp
```

Grant Restricted Permissions to FTP Users (Home Only)

```
chroot_local_users=YES
```

3 Restart the FTP server:

```
rcvsftp start
```

On the client, just enter the URL `ftp://HOST` in your browser or FTP client. Replace `HOST` with the hostname or IP address of your server. There are many graphical user interfaces available that are suited to browsing the contents of your FTP server. For a list of them, just enter FTP at the search prompt of the YaST package manager.

11.5 Copying Files between Linux and Windows Computers with SSH

To transfer files from Linux to Windows using SSH, choose one of the following applications:

PuTTY
    PuTTY is a suite of different command line tools for working with an SSH daemon. Download it from `http://www.chiark.greenend.org.uk/~sgtatham/putty.html`.

WinSCP
    WinSCP is very similar to PuTTY, but includes a graphical user interface. Choose from an Explorer or Norton Commander style. Download it from `http://winscp.net`.

To copy a file from Windows to Linux with PuTTY, proceed as follows (on the Windows machine):

1 Start PSCP.

2 Enter the hostname of your SSH server.

3 Enter your login and password to the SSH server.

To connect from Windows to Linux with WinSCP, proceed as follows (on the Windows machine):

1 Start WinSCP.

2 Enter the hostname of the SSH server and username.

3 Click *Login* and acknowledge the following warning.

4 Drag and drop any files or directories from or to your WinSCP window.

NOTE: SSH Fingerprint

With both PuTTY and WinSCP, you must accept the SSH fingerprint when you log in for the first time.

11.6 Sharing Files between Linux Computers

The following sections feature various methods for sharing data. Use one of these if you are looking for a permanent solution for data sharing.

11.6.1 Transferring Files with NFS

To configure the server, proceed as follows:

1 Prepare the system:

    1a Open a shell, log in as `root`, and grant write permissions to all users:

```
mkdir /srv/nfs
chgrp users /srv/nfs
chmod g+w /srv/nfs
```

    1b Make sure that your user name and user ID is known on the client as well as on the server. Refer to Chapter 5, *Managing Users with YaST* (page 65) for detailed instructions about how to create and manage user accounts.

2 Prepare the NFS server:

    2a Start YaST as `root`.

    2b Select *Network Services* > *NFS Server* (this module is not installed by default. If it is missing in YaST, install the package `yast2-nfs-server`).

    2c Enable NFS services with *Start*.

    2d Open the appropriate firewall port with *Open Port in Firewall* if you are using a firewall.

3 Export the directories:

    3a Click *Add directory* and select `/srv/nfs`.

    3b Set the export options to:

```
rw,root_squash,async
```

    3c Repeat these steps, if you need to export more than one directory.

4 Apply your settings and leave YaST. Your NFS server is ready to use.

To manually start the NFS server, enter `rcnfsserver start` as `root`. To stop the server, enter `rcnfsserver stop`. By default, YaST takes care of starting this service at boot time.

To configure the client, proceed as follows:

1 Prepare the NFS client:

   1a Start YaST as `root`.

   1b Select *Network Services > NFS Client*.

   1c Activate *Open Port in Firewall* if using a firewall.

2 Import the remote file system:

   2a Click *Add*.

   2b Enter the name or IP address of the NFS server or click *Choose* to automatically scan the network for NFS servers.

   2c Enter the name of your remote file system or automatically choose it with *Select*.

   2d Enter an appropriate mount point, for example `/mnt`.

   2e Repeat these steps, if you need to import more than one external directory.

3 Apply your settings and leave YaST. Your NFS client is ready to use.

To start the NFS client manually, enter `rcnfs start`.

NOTE: Consistent User Names

If your home network is used by just a small number of users, set up identical users manually on all machines. If, however, you need a larger consistent user base across a larger home network, consider using NIS or LDAP to manage user data. For further information, refer to Chapter 19, *Using NIS* (↑Reference) and Chapter 20, *LDAP—A Directory Service* (↑Reference).

11.6.2 Sharing Files with Samba

This sections introduces various methods to access files on a Samba server. Both KDE and GNOME ship with graphical tools for working with Samba shares. There is also a command line tool for accessing Samba servers.

Accessing Shares with KDE and GNOME

Both the KDE and GNOME desktops can access Samba shares through their file browsers. To access your share, proceed as follows:

1 Press Alt + F2 and enter `smb://jupiter.example.com/`*share*.

The syntax of this URL is `smb://`*HOST*`/`*SHARENAME* with *HOST* representing the hostname (`jupiter.example.com`) or IP address and *SHARENAME* representing the share. See Step 3b (page 179).

2 Log in with the username and password. The password is set in Step 4 (page 179) or just hit Enter if no password is needed.

3 Drag and drop any files or directories from or to your window.

If you do not know your workgroup, enter `smb:/` to list all workgroups available in your network. The Smb4K tool (package `smb4k`) can also be used to display all workgroups in your network and mount them on demand.

Accessing Shares from the Command Line

If you prefer using the command line, use the `smbclient` command. To log in to your Samba server, run:

```
smbclient //jupiter/share -U tux
```

Omit the `-U` option if you are the current user `tux`. After logging in successfully, use some basic commands like `ls` (list contents), `mkdir` (create directory), `get` (download file), and `put` (upload file). Use `help` to display all commands. Refer to the manual page of `smbclient` for more information.

11.7 Sharing Files between Linux and Windows with Samba

Samba is the first choice for transferring files between Windows and Linux machines. These are the most common use cases for Samba:

Transferring Files from Linux to Windows with the SMB Scheme
> In the easiest case you do not have to configure a Linux server. Use the `smb:/` scheme. For more information, see Section "Accessing Shares with KDE and GNOME" (page 177). Make sure that your workgroup is identical on both systems and that your directories are shared.

Transferring Files from Windows to Linux Using a Server
> Configure a Samba server on your Linux computer. See Setting Up a Samba Server (page 178).

TIP: Using Default Registry Entries for Your Windows System

Some Windows versions (95, 98) require a small change in the registry for enabling a different password authentication method. Simplify this step by installing the `samba-doc` package and copy the file `/usr/share/doc/packages/samba/registry` to your Windows drive. Start Windows and incorporate the changes by double-clicking on this file.

Procedure 11.2   *Setting Up a Samba Server*

To set up a Samba server, do the following:

1 Prepare the Samba server:

    1a Start YaST as `root`.

    1b Install the `samba` package.

    1c Create a directory, for example, `/srv/share`.

2 Create the server configuration:

2a Select *Network Services* > *Samba Server*.

2b Select one of the workgroups or enter a new one, for example, `Penguin`.

2c Check *Primary Domain Controller (PDC)*

2d Set *During Boot* if the Samba service should be started every time your computer boots. Otherwise set *Manually*.

2e Activate *Open Port in Firewall* if you use a firewall.

3 Create your Windows share:

3a Change to the *Shares* tab and click *Add*.

3b Enter a name and description. The *Share Name* is used for accessing the share from your clients. *Share Description* describes the purpose of the share.

3c Select your path, for example, `/src/share`.

3d Proceed with *OK*.

3e Activate *Allow Users to Share Their Directories*.

4 Provide a password for all users that are allowed to use this service:

```
smbpasswd -a tux
```

For easier configuration, just hit Enter to leave the password empty. Take into account that the usernames on your Windows and Linux computers are probably different. Configuring a consistent user base for both Windows and Linux is beyond the scope of this document.

5 Start the Samba server:

```
rcnmb start
rcsmb start
```

To check if everything has been successfully configured, enter:

```
smbclient -L localhost
```

After you hit Enter, you should get something like the following:

```
Anonymous login successful
Domain=[PENGUIN] OS=[Unix] Server=[Samba 3.0.22-11-SUSE-CODE10]

    Sharename       Type        Comment
    ---------       ----        -------
    share           Disk        Shared directory
    netlogon        Disk        Network Logon Service
    IPC$            IPC         IPC Service (Samba 3.0.22-11-SUSE-CODE10)
    ADMIN$          IPC         IPC Service (Samba 3.0.22-11-SUSE-CODE10)
Anonymous login successful
Domain=[PENGUIN] OS=[Unix] Server=[Samba 3.0.22-11-SUSE-CODE10]

    Server              Comment
    ---------           -------
    SUSE-DESKTOP        Samba 3.0.22-11-SUSE-CODE10

    Workgroup           Master
    ---------           -------
    TUX-NET             jupiter
```

11.8 For More Information

- http://en.wikipedia.org/wiki/VFAT

- http://en.wikipedia.org/wiki/NTFS

- http://en.wikipedia.org/wiki/Fstab

- http://en.wikipedia.org/wiki/Network_File_System

- http://en.wikipedia.org/wiki/File_Transfer_Protocol

- http://en.wikipedia.org/wiki/SSH

- http://en.wikipedia.org/wiki/Rsync

- http://en.wikipedia.org/wiki/Samba_software

Part IV. Help and Documentation

Help and Documentation

12

openSUSE® comes with various sources of information and documentation, many of which are already integrated in your installed system. For example, both the KDE and GNOME desktop include a help center that offers a wide range of online documentation for your product. There, you can access openSUSE-specific manuals by Novell/SUSE as well as documentation provided by the open source community. Explore your desktop's help center and read where to find other documentation shipped with your product or additional information on the Web.

12.1 Included Help Resources

There are several places where you can find online documentation shipped with your product:

Desktop Help Centers
> The help centers of both the KDE desktop (KDE help center) and the GNOME desktop (Yelp) 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 12.1.1, "Using the KDE Help Center" (page 184) and Section 12.1.2, "Using GNOME Yelp" (page 186).

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 12.1.3, "Documentation Directory" (page 187).

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 12.1.4, "Man Pages" (page 190) and Section 12.1.5, "Info Pages" (page 191).

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 The GIMP, may have different online help packages that can be installed separately with YaST and do not integrate into the help centers.

12.1.1 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 12.1   *Main Window of the KDE Help Center*
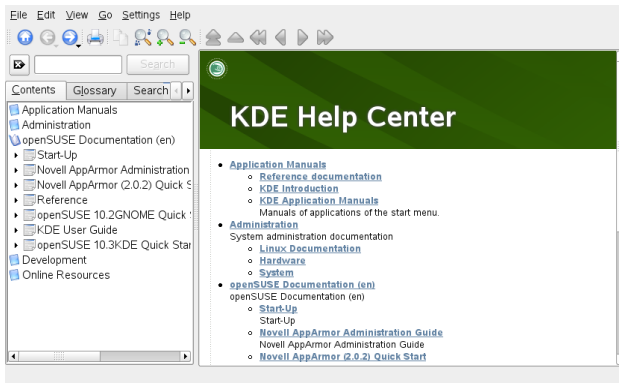
The menu and the toolbar provide options for printing contents from the help center, searching the currently displayed page, and navigating and customizing the help center. The display field in the right part of the window always shows the currently selected contents, such as online manuals, search results, 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 the book icons to open and browse the individual categories. Under the heading *Administration*, for example, you can also browse man (manual) and info (information) pages associated with command line programs. 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 12.1 *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 *Search Options* 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*. 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 12.2 *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 documentation currently available in the help center.

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.

12.1.2 Using GNOME Yelp

On the GNOME desktop, to start Yelp 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 Yelp from the main menu, or from the command line with `yelp` and then browse through the main window of the help center.

Figure 12.2 *Main Window of Yelp*
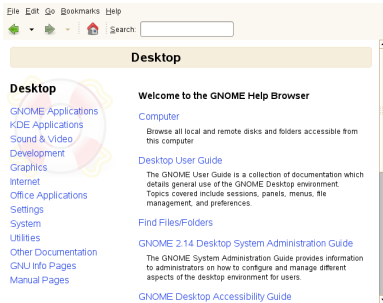
The menu and the toolbar provide options for navigating and customizing the help center, for searching and for printing contents from Yelp. To view a table of contents, click *Help Topics*. The help topics are grouped into categories presented as links. Click one of the links to open a list of topics for that category. To search for an item, just enter the search string into the search field at the top of the window.

12.1.3 Documentation Directory

The traditional directory to find documentation in your installed Linux system is `/usr/share/doc`. Usually, the directory contains information about the packages installed on your system, release notes, manuals, and more.

NOTE: Contents Depends on Installed Packages

In the Linux world, many manuals and other kinds of documentation are available in form of packages, just like software. How much and which information you find in `/usr/share/docs` also depends on the (documentation) packages installed. If you cannot find the subdirectories mentioned here, check if the respective packages are installed on your system and add them with YaST, if needed.

Novell/SUSE Manuals

We provide HTML and PDF versions of our books in different languages. In the `manual` subdirectory, find HTML versions of most of the Novell/SUSE manuals available for your product:

Start-Up
> 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 Quick Start
> Gives a short introduction to the KDE desktop and some key applications running on it.

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

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 interaction of key system components and the set-up of various network and file services openSUSE offers.

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

Novell AppArmor Administration Guide
> Contains in-depth information about the use of Novell AppArmor in your environment.

Lessons For Lizards
> A community book project for the openSUSE distribution. A snapshot of the manual written by the open source community is released on an equal footing with the Novell/SUSE manuals. The lessons are written in a cook book style and cover

more specific or exotic topics than the traditional manuals. For more information, see http://developer.novell.com/wiki/index.php/Lessons _for_Lizards.

If more than one language is installed, /usr/share/doc/manual may contain different language versions of the manuals. The HTML versions of the Novell/SUSE manuals are also available in the help center of both desktops. For information where to find the PDF and HTML versions of the books on your installation media, refer to the openSUSE Release Notes. They are available from your installed system under /usr/share/doc/release-notes/ or online at http://www.novell.com/ documentation/opensuse110.

HOWTOs

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

Package Documentation

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. The following list introduces typical files to be found under /usr/share/doc/packages. None of these entries is mandatory and many packages might just include a few of them.

AUTHORS
    List of the main developers.

BUGS
    Known bugs or malfunctions. Might also contain a link to a Bugzilla Web page where you can search all bugs.

CHANGES , ChangeLog
    Summary of changes from version to version. Usually interesting for developers, because it is very detailed.

```
COPYING , LICENSE
```
Licensing information.

```
FAQ
```
Question and answers collected from mailing lists or newsgroups.

```
INSTALL
```
How to install this package on your system. As the package is already installed by the time you get to read this file, you can safely ignore the contents of this file.

```
README, README.*
```
General information on the software, for what purpose and how to use it.

```
TODO
```
Things that are not implemented yet, but probably will be in the future.

```
MANIFEST
```
List of files with a brief summary.

```
NEWS
```
Description of what is new in this version.

12.1.4 Man Pages

Man pages are an essential part of any Linux system. They explain the usage of a command and all available options and parameters. Man pages can be 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`. Man pages are sorted in categories as shown in Table 12.1, "Man Pages—Categories and Descriptions" (page 191) (taken from the man page for man itself).

Table 12.1   *Man Pages—Categories and Descriptions*

Number	Description
1	Executable programs or shell commands
2	System calls (functions provided by the kernel)
3	Library calls (functions within program libraries)
4	Special files (usually found in /dev)
5	File formats and conventions (`/etc/fstab`)
6	Games
7	Miscellaneous (including macro packages and conventions), for example, man(7), groff(7)
8	System administration commands (usually only for root)
9	Kernel routines (nonstandard)

Each man page consists of several parts labeled *NAME*, *SYNOPSIS*, *DESCRIPTION*, *SEE ALSO*, *LICENSING*, and *AUTHOR*. There may be additional sections available depending on the type of command.

12.1.5 Info Pages

Info pages are another important source of information on your system. Usually they are more verbose than man pages. 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. Not every man page comes with an info page and vice versa.

With KDE or GNOME desktop, you can also access (or print) man pages and info pages:

KDE
In 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, check out *Administration* in the table of contents to browse man pages and info pages.

GNOME
Run `yelp man:ls` or `yelp info:ls` to display the man or info page.

Figure 12.3   *Viewing a Man Page With Konqueror*
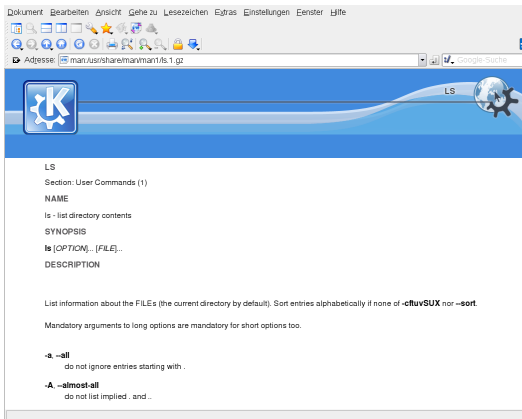
12.2 Additional Help Resources

In addition to the online versions of the Novell/SUSE manuals installed under `/usr/share/doc`, you can also access the product-specific manuals and documentation on the Web.

Find them at `http://www.novell.com/documentation/opensuse110`.

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]

- Novell Technical Support Knowledgebase [http://www.novell.com/support/]

- Product Support Community Resources [http://support.novell.com/forums/index.html]

- 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 specific Linux search engine at http://www.google.com/linux that you might find useful.

12.3 For More Information

Apart from the product-specific help resources, there is a broad range of information available for Linux topics.

12.3.1 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.

12.3.2 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.

HOWTOs

HOWTOs are usually a short, informal, step-by-step guides to accomplishing specific tasks. HOWTOs can 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 reposting 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 a HOWTO or FAQ. They are usually written by experts for experts. Some of these books are old but still valid and ship with openSUSE. Search and install these books and guides with YaST.

12.3.3 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/`.

12.3.4 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 free license (GFDL). Any visitor can edit articles.

12.3.5 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 software 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.

12.4 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.

12.4.1 Free Installation Support

Our free installation support is provided for a period of 90 days following the activation of your registration code 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 256 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). Alternatively, 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 or 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 GNOME Desktop or KDE 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.novell.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.

- http://support.novell.com/eService

- United States and Canada: Phone: +1-800-796-3700 (Monday through Friday from 04:30 a.m. to 12:00 noon EST)

- Germany, Austria, Switzerland: Phone: +49 (0)911-9900-6000 (Monday through Friday from 10:30 to 18:00 CET)

- UK: Phone: +44-1344-326-666 (Monday through Friday from 09:30 to 17:00 GMT)

- All other countries (English only): Phone: +44-1344-326-666 (Monday through Friday from 10:30 to 18:00 CET)

For the most recent contact information, refer to `http://support.novell.com/products/suselinux/contact.html`.

Important Notes

1. Free installation support is offerd to customers with a valid, activated registration code. You can activate your registration code at `http://www.novell.com/usersupport`.

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.novell.com/products/opensuse/support_overview.html`.

4. We can provide support for hardware supported by openSUSE. Refer to our Component Database at `http://www.novell.com/usersupport/hardware` for information about supported hardware components.

Contact Recommendations

We recommend to use `http://support.novell.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 after that providing a practical solution.

12.4.2 Advanced Support

Please be aware that the phone numbers may change during the sales cycle of openSUSE 11.0. Find current numbers as well as a detailed listing of the subjects covered by the Support Service at http://www.novell.com/usersupport.

NOTE: Note

While our expert staff will do their best to provide top-quality support in a reasonable way, we cannot guarantee a workable solution.

12.4.3 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. These 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.novell.com/usersupport or access the community Support Database at http://en.opensuse.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.

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Version 2, June 1991

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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.

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