

Fedora 10 Installation Guide

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by Stuart Ellis and Paul W. Frields

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Chapter 1. Introduction

This guide covers installation of Fedora, a Linux distribution built on free and open source software. This manual helps you install Fedora on desktops, laptops, and servers. The installation system is easy to use even if you lack previous knowledge of Linux or computer networks. If you select default options, Fedora provides a complete desktop operating system, including productivity applications, Internet utilities, and desktop tools.

This document does not detail all of the features of the installation system.

Background

About Fedora

To find out more about Fedora, refer to <http://fedoraproject.org/>. To read other documentation on Fedora related topics, refer to <http://docs.fedoraproject.org/>.

Getting Additional Help

For information on additional help resources for Fedora, visit <http://fedoraproject.org/wiki/Communicate>.

About This Document

Goals

This guide helps a reader:

1. Understand how to locate the Fedora distribution online
2. Create configuration data that allows a computer to boot Fedora
3. Understand and interact with the Fedora installation program
4. Complete basic post-installation configuration of a Fedora system

Other Sources of Documentation

This guide does not cover use of Fedora. To learn how to use an installed Fedora system, refer to <http://docs.fedoraproject.org/> for other documentation.

Audience

This guide is intended for new and intermediate Fedora users. Advanced Fedora users with questions about detailed operation of expert installation features should consult the Anaconda development mailing list at <http://www.redhat.com/archives/anaconda-devel-list/>.

Feedback

The Fedora Documentation Project (Fedora Docs Project) is a group of volunteer writers, editors, translators, and other contributors who create content for free and open source software. The Fedora Docs Project maintains this document and is always interested in reader feedback.

To send feedback regarding this document, file a bug in Bugzilla. To file a bug, fill in "Fedora Documentation" as the Product, choose the name of this document from the Component list, and choose "devel" as the version. Fedora Docs Project volunteers receive your feedback, and may contact you for additional information, if necessary.

Chapter 2. Quick Start for Experts

This section offers a very brief overview of installation tasks for experienced readers who are eager to get started. Note that many explanatory notes and helpful hints appear in the following chapters of this guide. If an issue arises during the installation process, consult the appropriate chapters in the full guide for help.

Experts Only

This section is intended only for experts. Other readers may not be familiar with some of the terms in this section, and should move on to Chapter 3, *New Users* instead.

Overview

The installation procedure is fairly simple, and consists of only a few steps:

1. Download files to make media or another bootable configuration.
2. Prepare system for installation.
3. Boot the computer and run the installation process.
4. Reboot and perform post-installation configuration.

Download Files

Do any one of the following:

Verify your downloads

Downloads may fail for any number of reasons. Always verify the sha1sum of the downloaded files.

1.

Download the ISO image for a Live image. Create CD media from the ISO file using your preferred application. You may also use the `livecd-tools` package to write the image to other bootable media such as a USB flash disk. To install the distribution to your hard disk, use the shortcut on the desktop after you log in.

2. Download the ISO images for the full distribution on CD or DVD. Create CD or DVD media from the ISO files using your preferred application, or put the images on a Windows FAT32 or Linux ext2/ext3 partition.
3. Download the `boot.iso` image for a minimal boot CD or USB flash drive. Write the image to the appropriate physical media to create bootable media. The boot media contains no packages but must be pointed at a hard disk or online repository to complete the installation.
4. Download the `netinst.iso` image for a reduced-size boot CD. Write the image to the appropriate physical media to create bootable media.
5. Download the `vmlinuz` kernel file and the `initrd.img` ramdisk image from the distribution's `isolinux/` directory. Configure your operating system to boot the kernel and load the ramdisk image. For further information on installation without media, refer to Appendix B, *Installing Without Media*.

For information on setting up a network boot server from which you can install Fedora, refer to Appendix C, *Setting Up an Installation Server*.

Prepare for Installation

Back up any user data you need to preserve.

Resizing Partitions

The installation program provides functions for resizing ext2, ext3, ext4, xfs, and NTFS formatted partitions. Refer to Chapter 12, *Disk Partitioning* for more information.

Install Fedora

Boot from the desired media, with any options appropriate for your hardware and installation mode. Refer to Appendix A, *Boot Options* for more information about boot options. If you boot from the Live CD, select the "Install to Hard Disk" option from the desktop to run the installation program. If you boot from minimal media or a downloaded kernel, select a network or hard disk resource from which to install.

Proceed through all the steps of the installation program. The installation program does not change your system until you make a final confirmation to proceed. When installation is finished, reboot your system.

Perform Post-installation Steps

After the system reboots, it displays additional configuration options. Make appropriate changes to your system and proceed to the login prompt.

Chapter 3. New Users

This chapter explains how to get the files you need to install and run Fedora on your computer. Concepts in this chapter may be new, especially if this is your first free operating system. If you have any trouble with this chapter, find help by visiting the Fedora Forums at <http://www.fedoraforum.org/>.

Download Links

To follow a Web based guide to downloading, visit <http://get.fedoraproject.org/>. For guidance on which architecture to download, refer to the section called “Which Architecture Is My Computer?”.

How Do I Download Installation Files?

The Fedora Project distributes Fedora in many ways, mostly free of cost and downloaded over the Internet. The most common distribution method is CD and DVD media. There are several types of CD and DVD media available, including:

- A full set of the software on DVD media
- Live images you can use to try Fedora, and then install to your system if you so choose
- Reduced-size bootable CD and USB flash disk images you can use to install over an Internet connection
- Source code on DVD media

Most users want the Live image or the full set of installable software on DVD or CDs. The reduced bootable images are suitable for use with a fast Internet connection and install Fedora on one computer. Source code discs are not used for installing Fedora, but are resources for experienced users and software developers.

Downloading media

Users with a broadband Internet connection can download *ISO images* of CD and DVD media or images of USB flash disks. An ISO image is a copy of an entire disc in a format suitable for writing directly to a CD or DVD. A USB flash disk image is a copy of an entire disk in a format suitable for writing directly to a USB flash disk.

For more information on burning CDs and DVDs, refer to the section called “How Do I Make Fedora Media?”.

Fedora software is available for download at no cost in a variety of ways.

From a Mirror

To find the freely downloadable distributions of Fedora, look for a *mirror*. A mirror is a computer server open to the public for free downloads of software, including Fedora. Mirrors offer both free open source software and closed source software. To locate a mirror, visit <http://mirrors.fedoraproject.org/publiclist> using a Web browser, and choose a server from the list. The web page lists mirrors by geographic location. Mirrors geographically closer to you are ideal for faster downloading speeds.

Mirrors publish Fedora software under a well-organized hierarchy of folders. For example, the Fedora 9 distribution normally appears in the directory `fedora/linux/releases/9/`. This directory contains

a folder for each architecture supported by that release of Fedora. CD and DVD media files appear inside that folder, in a folder called `iso/`. For example, you can find the file for the DVD distribution of Fedora 9 for `x86_64` at `fedora/linux/releases/9/x86_64/iso/F-9-x86_64-DVD.iso`.

From BitTorrent

BitTorrent is a way to download information in cooperation with other computers. Each computer cooperating in the group downloads pieces of the information in a particular torrent from other peers in the group. Computers that have finished downloading all the data in a torrent remain in the swarm to *seed*, or provide data to other peers. If you download using BitTorrent, as a courtesy you should seed the torrent at least until you have uploaded the same amount of data you downloaded.

If your computer does not have software installed for BitTorrent, visit the BitTorrent home page at <http://www.bittorrent.com/download/> to download it. BitTorrent client software is available for Windows, Mac OS, Linux, and many other operating systems.

You do not need to find a special mirror for BitTorrent files. The BitTorrent protocol ensures that your computer participates in a nearby group. To download and use the Fedora BitTorrent files, visit <http://torrent.fedoraproject.org/>.

Minimal Boot Images

Minimal boot CD and USB flash disk images are not available through BitTorrent.

Which Architecture Is My Computer?

Releases are separated by *architecture*, or type of computer processor. Use the following table to determine the architecture of your computer according to the type of processor. Consult your manufacturer's documentation for details on your processor if necessary.

Processor and Architecture Types

Processor Manufacturer and Model: Intel (except Atom 230, Atom 330, Core 2 Duo, Centrino Core 2 Duo, or Xeon), AMD (except 64 or x2 dual-core), VIA C4, Apple MacBook Pro

Architecture Type for Fedora: `i386`

Processor Manufacturer and Model: Intel Atom 230, Atom 330, Core 2 Duo, Centrino Core 2 Duo, and Xeon; AMD Athlon64/x2, Sempron64/x2, Duron64

Architecture Type for Fedora: `x86_64`

Processor Manufacturer and Model: Apple Macintosh G3, G4, G5, PowerBook, and other non-Intel models

Architecture Type for Fedora: `ppc`

`i386` Works for Most Windows Compatible Computers

If you are unsure what type of processor your computer uses, and your computer is not a non-Intel based Apple Macintosh, choose `i386`.

Intel Atom Processor Architectures Vary

The N and Z Series Atom processors are based on the `i386` architecture. The 230 and 330 Series Atom processors are based on the `x86_64` architecture. See <http://ark.intel.com/cpugroup.aspx?familyID=29035> for more details.

Which Files Do I Download?

You have several options to download Fedora. Read the options below to decide the best one for you.

Each file available for download in a Fedora distribution includes the architecture type in the file name. For example, the file for the DVD distribution of Fedora 9 for x86_64 is named `Fedora-9-x86_64-DVD.iso`. Refer to the section called “Which Architecture Is My Computer?” if you are unsure of your computer's architecture.

1. **Full Distribution on DVD.** If you have plenty of time, a fast Internet connection, and wish to install a broader choice of software, download the full DVD version. Once burned to DVD, the media is bootable and includes an installation program. The DVD version contains a mode to perform rescue operations on your Fedora system in an emergency. You can download the DVD version directly from a mirror, or via BitTorrent.
2. **Live Image.** If you want to try Fedora before you install it on your computer, download the Live image version. If your computer supports booting from CD, you can boot the operating system without making any changes to your hard disk. The Live image also provides an "Install to Hard Disk" desktop shortcut. If you decide you like what you see, and want to install it, simply activate the selection to copy Fedora to your hard disk. You can download the Live image directly from a mirror, or using BitTorrent.
3. **Minimal Boot Media.** If you have a fast Internet connection but do not want to download the entire distribution, you can download a small boot image. Fedora offers images for a minimal boot environment on CD. Once you boot your system with the minimal media, you can install Fedora directly over the Internet. Although this method still involves downloading a significant amount of data over the Internet, it is almost always much less than the size of the full distribution media. Once you have finished installation, you can add or remove software to your system as desired.

Download Size

Installing the default software for Fedora over the Internet requires more time than the Live image, but less time than the entire DVD distribution. Actual results depend on the actual software you select and network traffic conditions.

The following table explains where to find the desired files on a mirror site.

Locating Files

Media Type: Full distribution on DVD

File Locations: `fedora/linux/releases/9/Fedora/arch/iso/F-9-arch-DVD.iso`

Media Type: Live image

File Locations: `fedora/linux/releases/9/Live/arch/iso/F-9-arch-Live.iso`,
`fedora/linux/releases/9/Live/arch/iso/F-9-KDE-arch-Live.iso`

Media Type: Minimal CD boot media

File Locations: `fedora/linux/releases/9/Fedora/arch/os/images/boot.iso`

How Do I Make Fedora Media?

You can turn Fedora ISO files into either CD or DVD discs. You can turn Fedora Live ISO files into bootable USB media.

Making CD or DVD Discs

To learn how to turn ISO images into CD or DVD media, refer to <http://docs.fedoraproject.org/readme-burning-isos/>.

Making USB Media

To make bootable USB media, use a Fedora Live image. You can use either a Windows or Linux system to make the bootable USB media.

USB Image Writing is Nondestructive

Writing the Live image to the USB media is *nondestructive*. Any existing data on the media will not be harmed.

Before you begin, make sure you have sufficient free space available on your USB media. You do not need to repartition or reformat your media. *It is always a good idea to back up important data before performing sensitive disk operations.*

1. Download a Live ISO file as shown in the section called “Which Files Do I Download?”.
2. Download the Windows liveusb-creator program at <http://fedorahosted.org/liveusb-creator>.
3. Follow the instructions given at the site and in the liveusb-creator program to create the bootable USB media.

USB media often comes in the form of flash devices sometimes called *pen drives*, *thumb disks*, or *keys*; or as an externally connected hard disk device. Almost all media of this type is formatted as a vfat file system. You can create bootable USB media on media formatted as ext2, ext3, or vfat.

Unusual USB Media

In a few cases with oddly formatted or partitioned USB media, the image writing may fail.

1. Download a Live ISO file as shown in the section called “Which Files Do I Download?”.
2. Install the livecd-tools package on your system. For Fedora systems, use the following command:

```
su -c 'yum -y install livecd-tools'
```

3. Plug in your USB media.
4. Find the device name for your USB media. If the media has a volume name, look up the name in /dev/disk/by-label, or use the **findfs**:

```
su -c 'findfs LABEL="MyLabel"'
```

If the media does not have a volume name, or you do not know it, consult the /var/log/messages log for details:

```
su -c 'less /var/log/messages'
```

5. Use the **livecd-iso-to-disk** command to write the ISO image to the media:

```
su -c 'livecd-iso-to-disk the_image.iso /dev/sdX1'
```

Replace `sdx1` with the device name for the partition on the USB media. Most flash drives and external hard disks use only one partition. If you have changed this behavior or have oddly partitioned media, you may need to consult other sources of help.

What If I Cannot Download Fedora?

If you do not have a fast Internet connection, or if you have a problem creating boot media, downloading may not be an option. Fedora DVD and CD distribution media is available from a number of online sources around the world at a minimal cost. Use your favorite Web search engine to locate a vendor, or refer to <http://fedoraproject.org/wiki/Distribution>.

How Do I Start the Installation Program?

To start the installation program from minimal boot media, a Live image, or the distribution DVD, follow this procedure:

1. Power off your computer system.
2. Disconnect any external FireWire or USB disks that you do not need for installation. Refer to the section called “FireWire and USB Disks” for more information.
3. Insert the media in your computer and turn it on.

You may need to hit a specific key or combination of keys to boot from the media, or configure your system's *Basic Input/Output System*, or BIOS, to boot from the media. On most computers you must select the boot or BIOS option promptly after turning on the computer. Most Windows-compatible computer systems use a special key such as **F1**, **F2**, **F12**, or **Del** to start the BIOS configuration menu. On Apple computers, the **C** key boots the system from the DVD drive. On older Apple hardware you may need to press **Cmd +Opt+Shift+Del** to boot from DVD drive.

Configuring the BIOS

If you are not sure what capabilities your computer has, or how to configure the BIOS, consult the documentation provided by the manufacturer. Detailed information on hardware specifications and configuration is beyond the scope of this document.

Chapter 4. Beginning the Installation

Aborting the Installation

To abort the installation process at any time before the Installing Packages screen, either press **Ctrl+Alt+Del** or power off the computer with the power switch. Fedora makes no changes to your computer until package installation begins.

The Boot Menu

The boot media displays a graphical boot menu with several options. If no key is hit within 60 seconds, the default boot option runs. To choose the default, either wait for the timer to run out or hit **Enter** on the keyboard. To select a different option than the default, use the arrow keys on your keyboard, and hit **Enter** when the correct option is highlighted. If you want to customize the boot options for a particular option, hit the **Tab** key.

Using Boot Options

For a listing and explanation of common boot options, refer to Appendix A, *Boot Options*.

When using Fedora Live media, press any key during the initial boot countdown to bring up the Boot Options menu. The boot options include:

- **Boot.** This option is the default. If you select this option, only the kernel and startup programs load into memory. This option takes less time to load. As you use programs, they are loaded from the disc, which takes more time. This mode can be used on machines with less total memory.
- **Verify and Boot.** This option lets you verify the disc before you run the Live CD environment. Refer to the section called “Verifying Media” for more information on the verification process.
- **Memory Test.** This option runs an exhaustive test on the memory on your system. For more information, refer to the section called “Loading the Memory (RAM) Testing Mode”.
- **Boot from local drive.** This option boots the system from the first installed disk. If you booted this disc accidentally, use this option to boot from the hard disk immediately without starting the installer.

If you boot the DVD, rescue CD, or minimal boot media, the boot menu options include:

- **Install or upgrade an existing system.** This option is the default. Choose this option to install Fedora onto your computer system using the graphical installation program.
- **Install or upgrade an existing system (text mode).** Choose this option to install Fedora onto your computer system using the text-based installation program. If your computer system has problems using the graphical installation program, you can install the system with this option. Installing with this option does **not** prevent you from using a graphical interface on the system once it is installed.
- **Rescue installed system.** Choose this option to repair a problem with your installed Fedora system that prevents you from booting normally. Although Fedora is an exceptionally stable computing platform, it is still possible for occasional problems to occur that prevent booting. The rescue environment contains utility programs that allow you fix a wide variety of these problems.

Installing from a Different Source

All boot media except the distribution DVD present a menu that allows you to choose the installation source, such as the network or a hard disk. If you are booting the distribution DVD and do not want to

install from the DVD, hit **Tab** at the boot menu. Add a space and the option `askmethod` to the end of the line that appears below the menu.

You can install Fedora from the ISO images stored on hard disk, or from a network using NFS, FTP, or HTTP methods. Experienced users frequently use one of these methods because it is often faster to read data from a hard disk or network server than from a CD or DVD.

The following table summarizes the different boot methods and recommended installation methods to use with each:

Boot Method: DVD

Installation Method: DVD, network, or hard disk

Boot Method: Minimal boot CD or USB, rescue CD

Installation Method: Network or hard disk

Boot Method: Live CD or USB

Installation Method: Install to Hard Disk application

Chapter 6, *Installation Methods* contains detailed information about installing from alternate locations.

Verifying Media

The distribution DVD media and the Live CD media offer an option to verify the integrity of the media. Recording errors sometimes occur while producing CD or DVD media in home computer equipment. An error in the data for package chosen in the installation program can cause the installation to abort. To minimize the chances of data errors affecting the installation, verify the media before installing.

BitTorrent Automatically Verifies File Integrity

If you use BitTorrent, any files you download are automatically validated. If your file completes downloading you do not need to check it. Once you burn your CD or DVD, however, during the installation you should still use `mediacheck` to verify the integrity of the media.

Verifying the Live CD

If you boot from the Live CD, choose `Verify and Boot` from the boot menu. The verification process runs automatically during the boot process, and if it succeeds, the Live CD continues loading. If the verification fails, create a new Live CD using the ISO image you downloaded earlier.

Verifying the DVD

If you boot from the Fedora distribution DVD, the option to verify the media appears after you choose to install Fedora. If the verification succeeds, the installation process proceeds normally. If the process fails, create a new DVD using the ISO image you downloaded earlier.

Booting from the Network using PXE

To boot with PXE, you need a properly configured server, and a network interface in your computer that supports PXE. For information on how to configure a PXE server, refer to Appendix C, *Setting Up an Installation Server*.

Configure the computer to boot from the network interface. This option is in the BIOS, and may be labeled `Network Boot` or `Boot Services`. Once you properly configure PXE booting, the computer can boot the Fedora installation system without any other media.

To boot a computer from a PXE server:

1. Ensure that the network cable is attached. The link indicator light on the network socket should be lit, even if the computer is not switched on.
2. Switch on the computer.
3. A menu screen appears. Press the number key that corresponds to the desired option.

PXE Troubleshooting

If your PC does not boot from the netboot server, ensure that the BIOS is configured to boot first from the correct network interface. Some BIOS systems specify the network interface as a possible boot device, but do not support the PXE standard. Refer to your hardware documentation for more information.

Multiple NICs and PXE installation

Some servers with multiple network interfaces may not assign eth0 to the first network interface as BIOS knows it, which can cause the installer to try using a different network interface than was used by PXE. To change this behavior, use the following in `pxelinux.cfg/*` config files:

```
IPAPPEND 2
APPEND ksdevice=bootif
```

The configuration options above causes the installer to use the same network interface as BIOS and PXE use. You can also use the following option:

```
ksdevice=link
```

This option causes the installer to use the first network device it finds that is linked to a network switch.

Graphical and Text Interfaces

Fedora 10 supports graphical and text-based installations. However, the installer image must either fit in RAM or appear on local storage, such as the installation DVD or Live Media. Therefore, only systems with more than 192MB of RAM or that boot from the installation DVD or Live Media can use the graphical installer. Systems with 192MB RAM or less automatically scale back to using the text-based installer. If you prefer to use the text-based installer, type `linux text` at the `boot:` prompt.

If one of the following situations occurs, the installation program uses a text mode:

- The installation system fails to identify the display hardware on your computer
- Your computer has less than 192 MB of RAM
- You choose the text mode installation from the boot menu

The text screens provide the same functions as the standard screens. You can configure your system for graphical interface use after installation.

Graphical Interface Usage

Installing in text mode does **not** prevent you from using a graphical interface on your system once it is installed. If you have trouble configuring your system for graphical interface use, consult other sources for troubleshooting help as shown in the section called “Getting Additional Help”.

Chapter 5. Identifying Your Locale

Language Selection

The installation program displays a list of languages supported by Fedora. Highlight the correct language on the list and select Next.

To select support for additional languages, customize the installation at the package selection stage. For more information, refer to the section called “Additional Language Support”.

Installing from Fedora Live Media

If you install from Fedora Live Media, you may not see a locale selection screen. For additional locale support, use the Add/Remove Software application after you boot your newly installed Fedora system, following installation.

Keyboard Configuration

The installation program displays a list of the keyboard layouts supported by Fedora. Highlight the correct layout on the list, and select Next.

Chapter 6. Installation Methods

- If you booted the distribution DVD and did not use the alternate installation source option `askmethod`, the next stage loads automatically from the DVD. Proceed to Chapter 7, *Welcome Dialog*.
- If you used the `askmethod` option or booted from minimal boot media or a PXE server, proceed to the section called “Alternative Installation Methods”.

CD/DVD Activity

If you boot any Fedora installation media, the installation program loads its next stage from that disc. This happens regardless of which installation method you choose, unless you eject the disc before you proceed. The installation program still downloads *package data* from the source you choose.

Alternative Installation Methods

Even if you booted from alternative media, you can still install Fedora from CD or DVD media. Alternately, you can install from ISO images stored on your computer's hard disk, or from a network server.

- To install from CD or DVD media, insert a Fedora DVD or the first installation CD, select Local CD/DVD, and proceed to Chapter 7, *Welcome Dialog*.
- To install from ISO images on a hard disk, select Hard drive and proceed to the section called “Installation from a Hard Drive”.
- To install from a NFS server or other network location, such as a Web or FTP server, proceed to the section called “Installation TCP/IP Configuration”.

Installation from a Hard Drive

Once you have booted your computer, you may use ISO image files of the Fedora discs to continue the installation process. The ISO files must be located on a hard drive that is either internal to the computer, or attached to the machine by USB. You can use this option to install Fedora on computers that have neither a network connection nor CD or DVD drives.

The partition on the hard drive holding the ISO files must be formatted with the `ext2`, `ext3` or `vfat` file system. In Fedora, `vfat` includes a range of file systems, such as FAT-16 and FAT-32, found on most removable media. External hard drives usually contain `vfat` (FAT-32) file systems. Some Microsoft Windows systems also use `vfat` file systems on internal hard disk partitions.

Before you begin installation from a hard drive, check the partition type to ensure that Fedora can read it. To check a partition's file system under Windows, use the Disk Management tool. To check a partition's file system under Linux, use the `fdisk` utility.

Cannot Install from LVM Partitions

You cannot use ISO files on partitions controlled by LVM (Logical Volume Management).

Select the partition containing the ISO files from the list of available partitions. Internal IDE, SATA, SCSI, and USB drive device names begin with `/dev/sd`. Each individual drive has its own letter, for example `/dev/sda`. Each partition on a drive is numbered, for example `/dev/sda1`.

Also specify the Directory holding images. Enter the full directory path from the drive that contains the ISO image files. The following table shows some examples of how to enter this information:

Partition type: VFAT, NTFS
Volume: D:\n
Original path to files: D:\Downloads\F9
Directory to use: Downloads/F9
Partition type: ext2, ext3
Volume: /home
Original path to files: /home/user1/F9
Directory to use: user1/F9

Select OK to continue. Proceed with Chapter 7, *Welcome Dialog*.

Installation TCP/IP Configuration

The installation program is network-aware and can use network settings for a number of functions. For instance, you can install Fedora from a network server using FTP, HTTP, or NFS protocols. You can also instruct the installation program to consult additional software repositories later in the process.

By default, the installation program uses DHCP to automatically provide network settings. If you use a cable or DSL modem, router, firewall, or other network hardware to communicate with the Internet, DHCP is a suitable option. In a business environment, consult with your network administrators for appropriate settings. If your network has no DHCP server, clear the check box labeled Use dynamic IP configuration (DHCP).

The installation program supports both IPv4 and IPv6 protocols. If you are not sure which addressing scheme your network uses, it is safe to leave both options selected. Refer also to Chapter 9, *Network Configuration* for more information on configuring your network.

DHCP Responses Take Time

If you select options for a protocol not used on your network, or vice versa, it may take additional time to receive network settings from the DHCP server.

These settings apply only during the installation process. The installation program allows you to configure the final network configuration later.

You can install from a Web, FTP, or NFS server either on your local network or, if you are connected, on the Internet. You may install Fedora from your own private mirror, or use one of the public mirrors maintained by members of the community. To ensure that the connection is as fast and reliable as possible, use a server that is close to your own geographical location.

The Fedora Project maintains a list of Web and FTP public mirrors, sorted by region, at <http://fedoraproject.org/wiki/Mirrors>. To determine the complete directory path for the installation files, add `/9/Fedora/architecture/os/` to the path shown on the web page. A correct mirror location for an i386 system resembles the URL `http://mirror.example.com/pub/fedora/linux/releases/9/Fedora/i386/os`.

- If you are installing via NFS, proceed to the section called “NFS Installation Setup”.
- If you are installing via Web or FTP, proceed to the section called “Web and FTP Installation Setup”.

NFS Installation Setup

To install from a NFS server, select NFS from the Installation Method menu and select OK. Enter the name or IP address of the NFS server and the directory where the installation files reside.

NFS Mirror Availability

Public NFS mirrors are rare due to security concerns with NFS that do not necessarily apply to FTP or HTTP servers. The Fedora Project does not maintain a list of public NFS mirrors for Fedora.

Select OK to continue. Proceed with Chapter 7, *Welcome Dialog*.

Web and FTP Installation Setup

Enter the name or IP address of the network server and the directory where the installation files reside. Select OK to continue. Proceed with Chapter 7, *Welcome Dialog*.

Chapter 7. Welcome Dialog

After the installation program loads its next stage, a welcome dialog appears. Select Next to continue.

Initializing the Hard Disk

If no readable partition tables are found on existing hard disks, the installation program asks to initialize the hard disk. This operation makes any existing data on the hard disk unreadable. If your system has a brand new hard disk with no operating system installed, or you have removed all partitions on the hard disk, answer Yes.

RAID or Other Nonstandard Configurations

Certain RAID systems or other nonstandard configurations may be unreadable to the installation program and the aforementioned prompt may appear. The installation program responds to the physical disk structures it is able to detect.

Detach Unneeded Disks

If you have a nonstandard disk configuration that can be detached during installation and detected and configured afterward, power off the system, detach it, and restart the installation.

Chapter 8. Upgrading an Existing System

The installation system automatically detects any existing installation of Fedora. The upgrade process updates the existing system software with new versions, but does not remove any data from users' home directories. The existing partition structure on your hard drives does not change. Your system configuration changes only if a package upgrade demands it. Most package upgrades do not change system configuration, but rather install an additional configuration file for you to examine later.

Upgrade Examine

If your system contains a Fedora or Red Hat Linux installation, a dialog appears asking whether you want to upgrade that installation. To perform an upgrade of an existing system, choose the appropriate installation from the drop-down list and select Next.

Manually Installed Software

Software which you have installed manually on your existing Fedora or Red Hat Linux system may behave differently after an upgrade. You may need to manually recompile this software after an upgrade to ensure it performs correctly on the updated system.

Upgrading Using the Installer

Installations are Recommended

In general, the Fedora Project recommends that you keep user data on a separate `/home` partition and perform a fresh installation. For more information on partitions and how to set them up, refer to Chapter 12, *Disk Partitioning*.

If you choose to upgrade your system using the installation program, any software not provided by Fedora that conflicts with Fedora software is overwritten. Before you begin an upgrade this way, make a list of your system's current packages for later reference:

```
rpm -qa --qf '%{NAME} %{VERSION}-%{RELEASE} %{ARCH}\n' > ~/old-pkglist.t
```

After installation, consult this list to discover which packages you may need to rebuild or retrieve from non-Fedora software repositories.

Next, make a backup of any system configuration data:

```
su -c 'tar czf /tmp/etc-`date +%F`.tar.gz /etc'
su -c 'mv /tmp/etc-*.tar.gz /home'
```

You should also make a complete backup of any important data before performing an upgrade. Important data may include the contents of your entire `/home` directory as well as content from services such as an Apache, FTP, or SQL server, or a source code management system. Although upgrades are not destructive, if you perform one improperly there is a small possibility of data loss.

Storing Backups

Note that the above examples store backup materials in a `/home` directory. If your `/home` directory is not a separate partition, *you should not follow these examples verbatim!* Store your backups on another device such as CD or DVD discs or an external hard disk.

For more information on completing the upgrade process later, refer to the section called “Finishing an Upgrade”.

Upgrading Boot Loader Configuration

Your completed Fedora installation must be registered in the *boot loader* to boot properly. A boot loader is software on your machine that locates and starts the operating system. Refer to Chapter 13, *Boot Loader* for more information about boot loaders.

If the existing boot loader was installed by a Linux distribution, the installation system can modify it to load the new Fedora system. To update the existing Linux boot loader, select Update boot loader configuration. This is the default behavior when you upgrade an existing Fedora or Red Hat Linux installation.

GRUB is the standard boot loader for Fedora. If your machine uses another boot loader, such as BootMagic™, System Commander™, or the loader installed by Microsoft Windows, then the Fedora installation system cannot update it. In this case, select Skip boot loader updating. When the installation process completes, refer to the documentation for your product for assistance.

Install a new boot loader as part of an upgrade process only if you are certain you want to replace the existing boot loader. If you install a new boot loader, you may not be able to boot other operating systems on the same machine until you have configured the new boot loader. Select Create new boot loader configuration to remove the existing boot loader and install GRUB.

After you make your selection, click Next to continue.

Chapter 9. Network Configuration

Setup simply prompts for the hostname and the settings used during installation are written to the system. Many networks have a *DHCP* (Dynamic Host Configuration Protocol) service that automatically supplies connected systems with domain name, leaving the user to enter a host name. By default, Fedora activates all network interfaces on your computer and configures them to use DHCP.

Fedora contains complete support for both *IPv4* and *IPv6*. By default, Fedora configures network interfaces on your computer for both IPv4 and IPv6 support, and to use DHCP over both IPv4 and IPv6. For more information about IPv6, refer to <http://en.wikipedia.org/wiki/IPv6>.

Many home Internet routers and firewalls do not include support for IPv6. The default settings will not harm your system or router in any way. However, the speed of some services improves drastically if you disable IPv6 on any interface on a network that does not use IPv6.

IPv6 and Boot Options

You can disable IPv6 support in the installation program using the boot option `noipv6`. The installation program does not configure network interfaces for IPv6 if you use this option. For more information on boot options, refer to Appendix A, *Boot Options*.

Modem Configuration

The Network Configuration screen does not list modems. Configure these devices after installation with the Network utility. The settings for your modem are specific to your particular Internet Service Provider (ISP).

Hostname

On some networks, the DHCP provider also provides the name of the computer, or *hostname*. The complete hostname includes both the name of the machine and the name of the domain of which it is a member, such as *machine1.example.com*. The machine name (or "short hostname") is *machine1*, and the domain name is *example.com*.

To set up a home network that is behind an Internet firewall or router, you may want to use *hostname.localdomain* for your Fedora system. If you have more than one computer on this network, you should give each one a separate host name in this domain.

Valid Hostnames

You may give your system any name provided that the full hostname is unique. The hostname may include letters, numbers and hyphens.

If your Fedora system is connected *directly* to the Internet, you must pay attention to additional considerations to avoid service interruptions or risk action by your upstream service provider. A full discussion of these issues is beyond the scope of this document.

Miscellaneous Settings

To manually configure a network interface, you may also provide other network settings for your computer. All of these settings are the IP addresses of other systems on the network.

A *gateway* is the device that provides access to other networks. Gateways are also referred to as *routers*. If your system connects to other networks through a gateway, enter its IP address in the Gateway box.

Most software relies on the *DNS* (Domain Name Service) provider to locate machines and services on the network. DNS converts hostnames to IP addresses and vice versa. A Fedora system may use more than one DNS server. If the primary DNS server does not respond, the computer sends any query to the secondary DNS server, and so on. To assign DNS servers, type their IP addresses into the Primary DNS or Secondary DNS boxes.

Select Next once you are satisfied with the network settings for your system.

Chapter 10. Time Zone Selection

This screen allows you to specify the correct time zone for the location of your computer. Specify a time zone even if you plan to use NTP (Network Time Protocol) to maintain the accuracy of the system clock.

Selecting a Time Zone

Fedora displays on the screen two methods for selecting the time zone. To select a time zone using the map, first place your mouse pointer over your region on the map. Click once to magnify that region on the map. Next, select the yellow dot that represents the city nearest to your location. Once you select a dot, it becomes a red X to indicate your selection.

To select a time zone using the list, select the name of the city nearest to your location. The cities are listed in alphabetical order.

Universal Co-ordinated Time (UTC)

For purposes of addressing time zones, Universal Co-ordinated Time is also known as Greenwich Mean Time (GMT).

If Fedora is the only operating system on your computer, select System clock uses UTC. The system clock is a piece of hardware on your computer system. Fedora uses the timezone setting to determine the offset between the local time and UTC on the system clock. This behavior is standard for UNIX-like operating systems.

Windows and the System Clock

Do not enable the System clock uses UTC option if your machine also runs Microsoft Windows. Microsoft operating systems change the BIOS clock to match local time rather than UTC. This may cause unexpected behavior under Fedora.

Select Next to proceed.

Chapter 11. Set the Root Password

Fedora uses a special account named `root` for system administration. The `root` account on a Linux system is not subject to most normal account restrictions. As the system owner or administrator, you may sometimes require special privileges to configure or modify the system. In those cases, use the `root` account.

Using the `root` Account

Avoid logging in to Fedora as `root` when possible. Any administration tools which require `root` privileges will prompt you for the password.

The Fedora installation program requires the `root` password to be at least six characters long. Because the `root` account may potentially control any part of the system, use the following guidelines to create a good password:

- Use a combination of uppercase letters, lowercase letters, numbers, punctuation and other characters.
- Do not use a word or name. Obscuring the word or name with substitute characters is not effective.
- Do not use the same password for more than one system.

The following are examples of good passwords:

- `f9*@1Ls99A`
- `HL8$391%*rb`
- `Iwtb,10^th`

Enter the `root` password into the Root Password field. Fedora displays the characters as asterisks for security. Type the same password into the Confirm field to ensure it is set correctly. After you set the root password, select Next to proceed.

Chapter 12. Disk Partitioning

Fedora creates and uses several *partitions* on the available hard drives. You may customize both the partitions, and how the drives on your system are managed. The section called “General Information on Partitions” explains drive partitions in more detail.

RAID and Other Disk Devices

Hardware RAID

RAID, or Redundant Array of Independent Disks, allows a group, or *array*, of drives to act as a single device. Configure any RAID functions provided by the mainboard of your computer, or attached controller cards, before you begin the installation process. Each active RAID array appears as one drive within Fedora.

On systems with more than one hard drive you may configure Fedora to operate several of the drives as a Linux RAID array without requiring any additional hardware.

Software RAID

You can use the Fedora installation program to create Linux software RAID arrays, where RAID functions are controlled by the operating system rather than dedicated hardware. These functions are explained in detail in the section called “Disk Druid”.

FireWire and USB Disks

Some FireWire and USB hard disks may not be recognized by the Fedora installation system. If configuration of these disks at installation time is not vital, disconnect them to avoid any confusion.

Post-installation Usage

You can connect and configure external FireWire and USB hard disks after installation. Most such devices are recognized by the kernel and available for use at that time.

General Information on Partitions

A Fedora system has at least three partitions:

- A `/boot` partition
- A `/` partition
- A `swap` partition

Many systems have more partitions than the minimum listed above. Choose partitions based on your particular system needs. For example, consider creating a separate `/home` partition on systems that store user data. Refer to the section called “Advice on Partitions” for more information.

If you are not sure how best to configure the partitions for your computer, accept the default partition layout.

The RAM installed in your computer provides a pool of memory for running systems. Linux systems use *swap partitions* to expand this pool, by automatically moving portions of memory between RAM and swap partitions if insufficient RAM is available. In addition, certain power management features store all of the memory for a suspended system in the available swap partitions. If you manually specify the partitions on your system, create one swap partition that has more capacity than the computer RAM.

Data partitions provide storage for files. Each data partition has a *mount point*, to indicate the system directory whose contents reside on that partition. A partition with no mount point is not accessible by users. Data not located on any other partition resides in the / (or *root*) partition.

Root and /root

The / (or *root*) partition is the top of the directory structure. The /root (sometimes pronounced "slash-root") directory is the home directory of the user account for system administration.

In the minimum configuration shown above:

- All data under the /boot/ directory resides on the /boot partition. For example, the file /boot/grub/grub.conf resides on the /boot partition.
- Any file outside of the /boot partition, such as /etc/passwd, resides on the / partition.

Subdirectories may be assigned to partitions as well. Some administrators create both /usr and /usr/local partitions. In that case, files under /usr/local, such as /usr/local/bin/foo, are on the /usr/local partition. Any other files in /usr/, such as /usr/bin/foo, are in the /usr partition.

If you create many partitions instead of one large / partition, upgrades become easier. Refer to the description of Disk Druid's Edit option for more information.

Leave Excess Capacity Unallocated

Only assign storage capacity to those partitions you require immediately. You may allocate free space at any time, to meet needs as they occur. To learn about a more flexible method for storage management, refer to the section called "Understanding LVM".

Partition Types

Every partition has a *partition type*, to indicate the format of the *file system* on that partition. The file system enables Linux to organize, search, and retrieve files stored on that partition. Use the *ext3* file system for data partitions that are not part of LVM, unless you have specific needs that require another type of file system.

Minimum Partition Sizes

The following table summarizes minimum partition sizes for the partitions containing the listed directories. You *do not* have to make a separate partition for each of these directories. For instance, if the partition containing /foo must be at least 500 MB, and you do not make a separate /foo partition, then the / (root) partition must be at least 500 MB.

Directory: /

Minimum size: 250 MB
Directory: /usr
Minimum size: 250 MB
Directory: /tmp
Minimum size: 50 MB
Directory: /var
Minimum size: 384 MB
Directory: /home
Minimum size: 100 MB
Directory: /boot
Minimum size: 75 MB

Understanding LVM

LVM (Logical Volume Management) partitions provide a number of advantages over standard partitions. LVM partitions are formatted as *physical volumes*. One or more physical volumes are combined to form a *volume group*. Each volume group's total storage is then divided into one or more *logical volumes*. The logical volumes function much like standard partitions. They have a file system type, such as `ext3`, and a mount point.

The /boot Partition and LVM

The boot loader cannot read LVM volumes. You must make a standard, non-LVM disk partition for your /boot partition.

To understand LVM better, imagine the physical volume as a pile of *blocks*. A block is simply a storage unit used to store data. Several piles of blocks can be combined to make a much larger pile, just as physical volumes are combined to make a volume group. The resulting pile can be subdivided into several smaller piles of arbitrary size, just as a volume group is allocated to several logical volumes.

An administrator may grow or shrink logical volumes without destroying data, unlike standard disk partitions. If the physical volumes in a volume group are on separate drives or RAID arrays then administrators may also spread a logical volume across the storage devices.

You may lose data if you shrink a logical volume to a smaller capacity than the data on the volume requires. To ensure maximum flexibility, create logical volumes to meet your current needs, and leave excess storage capacity unallocated. You may safely grow logical volumes to use unallocated space, as your needs dictate.

LVM and the Default Partition Layout

By default, the installation process creates / and swap partitions within LVM volumes, with a separate /boot partition.

Understanding Encryption

Fedora includes functions to encrypt your storage. You may find this function useful if you have a laptop or if you worry about your disk storage falling out of your control. This disk encryption requires you to provide an additional passphrase at boot time or whenever you first access the disk storage.

You may choose to encrypt either all partitions, or only selected ones. A typical use case includes encrypting partitions containing /home, /var, and /tmp, along with the swap partition. There is usually

no need to encrypt `/usr`, since this directory usually contains only system executables and libraries that have no intrinsic privacy value. The `/boot` partition is never encrypted and should not be used for sensitive data.

Encrypted Storage Performance

Storage encryption creates a slight performance decrease. You may wish to weigh this drawback against the benefits of security and privacy that encryption provides.

To make the encryption effective, choose a good passphrase. You can find more information about good passphrases in Chapter 11, *Set the Root Password*.

The encryption provided uses the Linux Unified Key System (LUKS) for encryption. For more information on LUKS, refer to <http://luks.endorphin.org/>.

Advice on Partitions

Optimal partition setup depends on the usage for the Linux system in question. The following tips may help you decide how to allocate your disk space.

- If you expect that you or other users will store data on the system, create a separate partition for the `/home` directory within a volume group. With a separate `/home` partition, you may upgrade or reinstall Fedora without erasing user data files.
- Each kernel installed on your system requires approximately 6 MB on the `/boot` partition. Unless you plan to install a great many kernels, the default partition size of 100 MB for `/boot` should suffice.
- The `/var` directory holds content for a number of applications, including the Apache web server. It also is used to store downloaded update packages on a temporary basis. Ensure that the partition containing the `/var` directory has enough space to download pending updates and hold your other content.

Pending Updates

Because Fedora is a rapidly progressing collection of software, many updates may be available late in a release cycle. You can add an update repository to the sources for installation later to minimize this issue. Refer to the section called “Installing from Additional Repositories” for more information.

- The `/usr` directory holds the majority of software content on a Fedora system. For an installation of the default set of software, allocate at least 4 GB of space. If you are a software developer or plan to use your Fedora system to learn software development skills, you may want to at least double this allocation.
- Consider leaving a portion of the space in an LVM volume group unallocated. This unallocated space gives you flexibility if your space requirements change but you do not wish to remove data from other partitions to reallocate storage.
- If you separate subdirectories into partitions, you can retain content in those subdirectories if you decide to install a new version of Fedora over your current system. For instance, if you intend to run a MySQL database in `/var/lib/mysql`, make a separate partition for that directory in case you need to reinstall later.

The following table is a possible partition setup for a system with a single, new 80 GB hard disk and 1 GB of RAM. Note that approximately 10 GB of the volume group is unallocated to allow for future growth.

Example Usage

This setup is not optimal for all use cases.

Example 12.1. Example Partition Setup

Partition: /boot

Size and type: 100 MB ext3 partition

Partition: swap

Size and type: 2 GB swap

Partition: LVM physical volume

Size and type: Remaining space, as one LVM volume group

The physical volume is assigned to the default volume group and divided into the following logical volumes:

Partition: /

Size and type: 3 GB ext3

Partition: /usr

Size and type: 8 GB ext3

Partition: /usr/local

Size and type: 2 GB ext3

Partition: /var

Size and type: 4 GB ext3

Partition: /home

Size and type: 50 GB ext3

General Disk Setup

The on-screen dialog lists the available drives. By default, the installation process may affect all of the drives on your computer. To prevent the installation program from repartitioning specific drives, clear the check box next to those drives on this list.

By default, the installation process erases any existing Linux partitions on the selected drives, and replaces them with the default set of partitions for Fedora. All other types of partitions remain unchanged. For example, partitions used by Microsoft Windows, and system recovery partitions created by the computer manufacturer, are both left intact. You may choose an alternative from the drop-down list:

Remove all partitions on selected drives and create default layout

If the selected hard disks are brand new, or if you want to destroy all data currently on the selected drives, use this option. This option removes all partitions on all selected drives, even those used by non-Linux operating systems.

This Option Destroys All Data

Once you have selected all installation options and proceed, all data on the selected drives will be destroyed. *Use this option with caution.*

Remove linux partitions on selected drives and create default layout

If the selected drives have any Linux partitions, this option removes them and installs Fedora into the resulting free space. This option does not modify partitions assigned to other non-Linux operating systems. It does not discriminate, however, between partitions assigned to different Linux distributions, and will remove all of them.

Use free space on selected drives and create default layout

If the selected drives have free space that has not been assigned to a partition, this option installs Fedora into the free space. This option ensures that no existing partition is modified by the installation process.

Create custom layout

You manually specify the partitioning on the selected drives. The next screen enables you to configure the drives and partitions for your computer. If you choose this option, Fedora creates no partitions by default.

Select Encrypt system to encrypt all partitions except the `/boot` partition.

Select Review and modify partitioning layout to customize the set of partitions that Fedora creates, to configure your system to use drives in RAID arrays, or to modify the boot options for your computer. If you choose one of the alternative partitioning options, this is automatically selected.

Use the Advanced storage options option if:

- You want to install Fedora to a drive connected through the *iSCSI* protocol. Select Advanced storage options, then select Add iSCSI target, then select Add drive. Provide an IP address and the iSCSI initiator name, and select Add drive.
- You want to disable a *dmraid* device that was detected at boot time.

Choose a partitioning option, and select Next to proceed.

If you do not select an option to customize the partition layout, proceed to the section called “Making Disk Changes”. If you choose Create custom layout or Review and modify partitioning layout, proceed to the section called “Disk Druid”.

Disk Druid

Disk Druid is an interactive program for editing disk partitions. Users run it only within the Fedora installation system. Disk Druid enables you to configure Linux software RAID and *LVM* to provide more extensible and reliable data storage.

Modifying the Default LVM Layout

The default layout pools all of the available storage into a single LVM physical volume, with one LVM logical volume for the system. To make capacity available for additional partitions, Edit the logical volume with the mount point `/`, and reduce its size as necessary.

Disk Druid displays the following actions in the installation program:

New Select this option to add a partition or LVM physical volume to the disk. In the Add partition dialog, choose a mount point and a partition type. If you have more than one disk on the system, choose which disks the partition may inhabit. Indicate a size in megabytes for the partition. If you wish to encrypt the partition, select that option.

Illegal Partitions

The `/bin/`, `/dev/`, `/etc/`, `/lib/`, `/proc/`, `/root/`, and `/sbin/` directories may not be used for separate partitions in Disk Druid. These directories reside on the `/` (root) partition.

The `/boot` partition may not reside on an LVM volume group. Create the `/boot` partition before configuring any volume groups.

You may also choose from three options for sizing your partition:

Fixed size	Use a fixed size as close to your entry as possible.
Fill all space up to	Grow the partition to a maximum size of your choice.
Fill to maximum allowable size	Grow the partition until it fills the remainder of the selected disks.

Partition Sizes

The actual partition on the disk may be slightly smaller or larger than your choice. Disk geometry issues cause this effect, not an error or bug.

Select the Encrypt partition option to encrypt all information on the disk partition.

After you enter the details for your partition, select OK to continue. If you chose to encrypt the partition, the installer prompts you to assign a passphrase by typing it twice. For hints on using good passphrases, refer to Chapter 11, *Set the Root Password*.

Edit Select this option to edit an existing partition, LVM volume group, or an LVM physical volume that is not yet part of a volume group. To change the size of a LVM physical volume partition, first remove it from any volume groups.

Removing LVM Physical Volumes

If you remove an LVM physical volume from a volume group, you erase any logical volumes it contains.

Edit a partition to change its size, mount point, or file system type. Use this function to:

- correct a mistake in setting up your partitions
- migrate Linux partitions if you are upgrading or reinstalling Fedora
- provide a mount point for non-Linux partitions such as those used on some Windows operating systems
- resize an existing NTFS, ext2, or ext3 partition

Windows Partitions

You may not label Windows partitions that use the `NTFS` file system with a mount point in the Fedora installer. You may label `fat` (`FAT16` or `FAT32`) partitions with a mount point.

If you need to make *drastic* changes to your partition configuration, you may want to delete partitions and start again. If your disk contains data that you need to keep, back it up before you edit any partitions. If you edit the size of a partition, you may lose all data on it.

If your system contains many separate partitions for system and user data, it is easier to upgrade your system. The installation program allows you to erase or retain data on specific partitions. If your user data is on a separate `/home` partition, you can retain that data while erasing system partitions such as `/boot`.

To change the partition's mount point, enter the new mount point in the space provided. To resize the partition, select `Resize` and enter a new size, or click and hold the arrow controls to dial the size up or down as needed. To encrypt the partition, select `Encrypt` and provide a passphrase by typing it twice at the prompt. Refer to Chapter 11, *Set the Root Password* for information on using good passphrases.

Delete Select this option to erase an existing partition or LVM physical volume. To delete an LVM physical volume, first delete any volume groups of which that physical volume is a member.

If you make a mistake, use the `Reset` option to abandon all the changes you have made.

Reset Select this option to force Disk Druid to abandon all changes made to disk partitions.

RAID Select this option to set up software RAID on your Fedora system.

Create a software RAID partition Choose this option to add a partition for software RAID. This option is the only choice available if your disk contains no software RAID partitions.

Create a RAID device Choose this option to construct a RAID device from two or more existing software RAID partitions. This option is available if two or more software RAID partitions have been configured.

Clone a drive to create a RAID device Choose this option to set up a RAID *mirror* of an existing disk. This option is available if two or more disks are attached to the system.

LVM Select this option to set up LVM on your Fedora system. First create at least one partition or software RAID device as an LVM physical volume, using the `New` dialog. For more information on LVM, refer to the section called “Understanding LVM”.

To assign one or more physical volumes to a volume group, first name the volume group. Then select the physical volumes to be used in the volume group. Finally, configure logical volumes on any volume groups using the Add, Edit and Delete options.

You may not remove a physical volume from a volume group if doing so would leave insufficient space for that group's logical volumes. Take for example a volume group made up of two 5 GB LVM physical volume partitions, which contains an 8 GB logical volume. The installer would not allow you to remove either of the component physical volumes, since that would leave only 5 GB in the group for an 8 GB logical volume. If you reduce the total size of any logical volumes appropriately, you may then remove a physical volume from the volume group. In the example, reducing the size of the logical volume to 4 GB would allow you to remove one of the 5 GB physical volumes.

LVM Unavailable in Text Installs

LVM initial set up is not available in a text-mode installation. The installer allows you to edit pre-configured LVM volumes. If you need to create an LVM configuration from scratch, hit **Alt+F2** to use the terminal, and run the **lv** command. To return to the text-mode installation, hit **Alt+F1**.

After you finish setting up and reviewing your partition configuration, select Next to continue the installation process.

Making Disk Changes

To proceed, the installer makes important changes to the disk configuration. This is the last point at which you can quit the installer and still retain your original system configuration. If you have chosen to resize existing Windows NTFS partitions without erasing or formatting them, the data in those partitions is retained.

Select Write changes to disk to proceed.

Chapter 13. Boot Loader

A *boot loader* is a small program that reads and launches the operating system. Fedora uses the GRUB boot loader by default. If you have multiple operating systems, the boot loader determines which one to boot, usually by offering a menu.

You may have a boot loader installed on your system already. An operating system may install its own preferred boot loader, or you may have installed a third-party boot loader. If your boot loader does not recognize Linux partitions, you may not be able to boot Fedora. Use GRUB as your boot loader to boot Linux and most other operating systems. Follow the directions in this chapter to install GRUB.

Installing GRUB

If you install GRUB, it may overwrite your existing boot loader.

Keeping Your Existing Boot Loader Settings

By default, the installation program installs GRUB in the *master boot record*, or MBR, of the device for the root file system. To decline installation of a new boot loader, select No boot loader will be installed.

Boot Loader Required

Your computer must have GRUB or another boot loader installed in order to start, unless you create a separate startup disk to boot from.

You may need to customize the GRUB installation to correctly support some hardware or system configurations. To specify compatibility settings, select Configure advanced boot loader options. This causes a second screen of options to appear when you choose Next. The section called “Advanced Boot Loader Options” explains the features of the additional screen.

Booting Additional Operating Systems

If you have other operating systems already installed, Fedora attempts to automatically detect and configure GRUB to boot them. You may manually configure any additional operating systems if GRUB does not detect them.

To add, remove, or change the detected operating system settings, use the options provided.

Add Select Add to include an additional operating system in GRUB.

Select the disk partition which contains the bootable operating system from the drop-down list and give the entry a label. GRUB displays this label in its boot menu.

Edit To change an entry in the GRUB boot menu, select the entry and then select Edit.

Delete To remove an entry from the GRUB boot menu, select the entry and then select Delete.

Setting a Boot Loader Password

GRUB reads many file systems without the help of an operating system. An operator can interrupt the booting sequence to choose a different operating system to boot, change boot options, or recover from a

system error. However, these functions may introduce serious security risks in some environments. You can add a password to GRUB so that the operator must enter the password to interrupt the normal boot sequence.

GRUB Passwords Not Required

You may not require a GRUB password if your system only has trusted operators, or is physically secured with controlled console access. However, if an untrusted person can get physical access to your computer's keyboard and monitor, that person can reboot the system and access GRUB. A password is helpful in this case.

To set a boot password, select the Use a boot loader password check box. The Change password button will become active. Select Change password to display an entry dialog. Type the desired password, and then confirm it by typing it again in the spaces provided.

Choose a Good Password

Choose a password that is easy for you to remember but hard for others to guess.

Forgotten GRUB Passwords

GRUB stores the password in encrypted form, so it *cannot* be read or recovered. If you forget the boot password, boot the system normally and then change the password entry in the `/boot/grub/grub.conf` file. If you cannot boot, you may be able to use the "rescue" mode on the first Fedora installation disc to reset the GRUB password.

If you do need to change the GRUB password, use the **grub-md5-crypt** utility. For information on using this utility, use the command **man grub-md5-crypt** in a terminal window to read the manual pages.

Advanced Boot Loader Options

The default boot options are adequate for most situations. The installation program writes the GRUB boot loader in the master boot record (MBR), overwriting any existing boot loader.

You may keep your current boot loader in the MBR and install GRUB as a secondary boot loader. If you choose this option, the installer program will write GRUB to the first sector of the Linux `/boot` partition.

GRUB as a Secondary Boot Loader

If you install GRUB as a secondary boot loader, you must reconfigure your primary boot loader whenever you install and boot from a new kernel. The kernel of an operating system such as Microsoft Windows does not boot in the same fashion. Most users therefore use GRUB as the primary boot loader on dual-boot systems.

You may also need the advanced options if your BIOS enumerates your drives or RAID arrays differently than Fedora expects. If necessary, use the Change Drive Order dialog to set the order of the devices in Fedora to match your BIOS.

On a few systems, Fedora may not configure the disk drive geometry for large disks correctly because of limitations within the BIOS. To work around this problem, mark the Force LBA32 check box.

The Linux kernel usually auto-detects its environment correctly, and no additional kernel parameters are needed. However, you may provide any needed kernel parameter using the advanced boot loader options.

Kernel Parameters

For a partial list of the kernel command line parameters, type the following command in a terminal window: `man bootparam`. For a comprehensive and authoritative list, refer to the documentation provided in the kernel sources.

To alter any of these settings, mark the Configure advanced boot loader options check box. Select Next and the advanced boot options menu appears.

Optional Menu

Fedora displays the advanced boot options menu *only* if the advanced configuration check box described above has been selected.

Chapter 14. Software Selection

Installing from a Live Image

If you install from a Fedora Live image, you cannot make package selections. This installation method transfers a copy of the Live image rather than installing packages from a repository. To change the package selection, complete the installation, then use the Add/Remove Software application to make desired changes.

By default, the Fedora installation process loads a selection of software that is suitable for a desktop system. To include or remove software for common tasks, select the relevant items from the list:

Office and Productivity

This option provides the OpenOffice.org productivity suite, the Planner project management application, graphical tools such as the GIMP, and multimedia applications.

Software Development

This option provides the necessary tools to compile software on your Fedora system.

Web server

This option provides the Apache Web server.

Installing from Additional Repositories

You can define additional *repositories* to increase the software available to your system during installation. A repository is a network location that stores software packages along with *metadata* that describes them. Many of the software packages used in Fedora require other software to be installed. The installer uses the metadata to ensure that these requirements are met for every piece of software you select for installation.

The Fedora software repository is automatically selected for you. The Additional Fedora Software repository contains software beyond the selection found on the default installation source. All software in Fedora is entirely free and open source.

To include software from *repositories* other than the Fedora package collection, select Add additional software repositories. You may provide the location of a repository of third-party software. Depending on the configuration of that repository, you may be able to select non-Fedora software during installation.

To edit an existing software repository location, select the repository in the list and then select Modify repository.

Network Access Required

If you change the repository information during a non-network installation, such as from a Fedora DVD, the installer prompts you for network configuration information.

If you select Add additional software repositories, the Add repository dialog appears. Provide a Repository name and the Repository URL for its location.

Fedora Software Mirrors

To find a Fedora software mirror near you, refer to <http://fedoraproject.org/wiki/Mirrors>.

Once you have located a mirror, to determine the URL to use, find the directory on the mirror that *contains* a directory named *repodata*. For instance, the "Everything" repository for Fedora is typically located in a directory tree *releases/9/Everything/arch/os*, where *arch* is a system architecture name.

Once you provide information for an additional repository, the installer reads the package metadata over the network. Software that is specially marked is then included in the package group selection system. See the section called “Customizing the Software Selection” for more information on selecting packages.

Backtracking Removes Repository Metadata

If you choose Back from the package selection screen, any extra repository data you may have entered is lost. This allows you to effectively cancel extra repositories. Currently there is no way to cancel only a single repository once entered.

Customizing the Software Selection

Select Customize now to specify the software packages for your final system in more detail. This option causes the installation process to display an additional customization screen when you select Next.

Installing Support for Additional Languages

Select Customize now to install support for additional languages. Refer to the section called “Additional Language Support” for more information on configuring language support.

Fedora divides the included software into *package groups*. For ease of use, the package selection screen displays these groups as categories.

To view the package groups for a category, select the category from the list on the left. The list on the right displays the package groups for the currently selected category.

To specify a package group for installation, select the check box next to the group. The box at the bottom of the screen displays the details of the package group that is currently highlighted. *None* of the packages from a group will be installed unless the check box for that group is selected.

If you select a package group, Fedora automatically installs the base and mandatory packages for that group. To change which optional packages within a selected group will be installed, select the Optional Packages button under the description of the group. Then use the check box next to an individual package name to change its selection.

After you choose the desired packages, select Next to proceed. Fedora checks your selection, and automatically adds any extra packages required to use the software you select.

Changing Your Mind

The packages that you select are not permanent. After you boot your system, use the Add/Remove Software tool to either install new software or remove installed packages. To run this tool, from the main menu, select System # Administration # Add/Remove Software. The Fedora software management system downloads the latest packages from network servers, rather than using those on the installation discs.

Additional Language Support

Your Fedora system automatically supports the language that you selected at the start of the installation process. To include support for additional languages, select the package group for those languages from the Languages category.

Core Network Services

All Fedora installations include the following network services:

- centralized logging through syslog
- email through SMTP (Simple Mail Transfer Protocol)
- network file sharing through NFS (Network File System)
- remote access through SSH (Secure SHell)
- resource advertising through mDNS (multicast DNS)

The default installation also provides:

- network file transfer through HTTP (HyperText Transfer Protocol)
- printing through CUPS (Common UNIX Printing System)
- remote desktop access through VNC (Virtual Network Computing)

Some automated processes on your Fedora system use the email service to send reports and messages to the system administrator. By default, the email, logging, and printing services do not accept connections from other systems. Fedora installs the NFS sharing, HTTP, and VNC components without enabling those services.

You may configure your Fedora system after installation to offer email, file sharing, logging, printing and remote desktop access services. The SSH service is enabled by default. You may use NFS to access files on other systems without enabling the NFS sharing service.

Chapter 15. Installing Packages

Fedora reports the installation progress on the screen as it writes the selected packages to your system. Network and DVD installations require no further action. If you are using CDs to install, Fedora prompts you to change discs periodically. After you insert a disc, select OK to resume the installation.

After installation completes, select Reboot to restart your computer. Fedora ejects any loaded discs before the computer reboots.

Installing from a Live Image

If you install from a Fedora Live image, no reboot prompt appears. You may continue to use the Live image as desired, and reboot the system at any time to enjoy the newly installed Fedora system.

Chapter 16. First Boot

The Setup Agent launches the first time that you start a new Fedora system. Use Setup Agent to configure the system for use before you log in.

Select Forward to start the Setup Agent.

Graphical Interface Required

Setup Agent requires a graphical interface. If you did not install one, or if Fedora has trouble starting it, you may see a slightly different setup screen.

License Agreement

This screen displays the overall licensing terms for Fedora. Each software package in Fedora is covered by its own license. All licensing guidelines for Fedora are located at <http://fedoraproject.org/wiki/Legal/Licenses>.

To proceed, select Understood, please proceed and then select Forward.

System User

Create a user account for yourself with this screen. Always use this account to log in to your Fedora system, rather than using the `root` account.

Enter a user name and your full name, and then enter your chosen password. Type your password once more in the Confirm Password box to ensure that it is correct. Refer to Chapter 11, *Set the Root Password* for guidelines on selecting a secure password.

Creating Extra User Accounts

To add additional user accounts to your system after the installation is complete, choose System # Administration # Users & Groups.

To configure Fedora to use network services for authentication or user information, select Use Network Login....

Date and Time

If your system does not have Internet access or a network time server, manually set the date and time for your system on this screen. Otherwise, use *NTP* (Network Time Protocol) servers to maintain the accuracy of the clock. NTP provides time synchronization service to computers on the same network. The Internet contains many computers that offer public NTP services.

The initial display enables you to set the date and time of your system manually.

Select the Network Time Protocol tab to configure your system to use NTP servers instead.

Setting the Clock

To change these settings later, choose System # Administration # Date & Time.

To configure your system to use network time servers, select the Enable Network Time Protocol option. This option disables the settings on the Date and Time tab and enables the other settings on this screen.

By default, Fedora is configured to use three separate groups, or *pools*, of time servers. Time server pools create redundancy, so if one time server is unavailable, your system synchronizes with another server.

To use an additional time server, select Add, and type the DNS name of the server into the box. To remove a server or server pool from the list, select the name and click Delete.

If your machine is always connected to the Internet through a wired connection, select the Synchronize system clock before starting service option. This option may cause a short delay during startup but ensures accurate time on your system even if the clock is significantly wrong at boot time.

Laptops and NTP

Do not use this option with laptop computers that sometimes use wireless networks.

If the hardware clock in your computer is highly inaccurate, you may turn off your local time source entirely. To turn off the local time source, select Show advanced options and then deselect the Use Local Time Source option. If you turn off your local time source, the NTP servers take priority over the internal clock.

If you enable the Enable NTP Broadcast advanced option, Fedora attempts to automatically locate time servers on the network.

Hardware Profile

The Setup Agent displays a screen that allows you to anonymously submit your hardware information to the Fedora Project. Developers use these hardware details to guide further support efforts. You can read more about this project and its development at <http://smolts.org/>.

To opt in to this important work, select Send Profile. If you choose not to submit any profile data, do not change the default. Select Next to continue to the login screen.

Update Your System

To ensure the security of your system, run a package update after the installation completes. Chapter 17, *Your Next Steps* explains how to update your Fedora system.

Chapter 17. Your Next Steps

Fedora provides you with a complete operating system with a vast range of capabilities, supported by a large community.

Updating Your System

The Fedora Project releases updated software packages for Fedora throughout the support period of each version. Updated packages add new features, improve reliability, resolve bugs, or remove security vulnerabilities. To ensure the security of your system, update regularly, and as soon as possible after a security announcement is issued. Refer to the section called “Subscribing to Fedora Announcements and News” for information on the Fedora announcements services.

An update applet reminds you of updates when they are available. This applet is installed by default in Fedora. It checks for software updates from all configured repositories, and runs as a background service. It generates a notification message on the desktop if updates are found, and you can click the message to update your system's software.

To update your system with the latest packages manually, use the Update System:

1. Choose System # Administration # Update System.
2. To review the list of updated packages, select Review.
3. Click Update System to begin the update process.
4. If one or more updates require a system reboot, the update process displays a dialog with the option to Reboot Now. Either select this option to reboot the system immediately, or Cancel it and reboot the system at a more convenient time.
5. If a reboot is not required the update will conclude with a dialog that indicates that the System Update Completed and all selected updates have been successfully installed as well as a button to Close Update System

To update packages from the command-line, use the **yum** utility. Type this command to begin a full update of your system with **yum**:

```
su -c 'yum update'
```

Enter the `root` password when prompted.

Refer to <http://docs.fedoraproject.org/yum/> for more information on **yum**.

Network Connection Required

Ensure that your system has an active network connection before you run the Update Software tool, or the **yum** utility. The update process downloads information and packages from a network of servers.

If your Fedora system has a permanent network connection, you may choose to enable daily system updates. To enable automatic updates, follow the instructions on the webpage <http://docs.fedoraproject.org/yum/sn-updating-your-system.html>.

Finishing an Upgrade

System Updates Recommended

Once you have rebooted your system after performing an upgrade, you should also perform a manual system update. Consult the section called “Updating Your System” for more information.

If you chose to upgrade your system from a previous release rather than perform a fresh installation, you may want to examine the differences in the package set. The section called “Upgrading Using the Installer” advised you to create a package listing for your original system. You can now use that listing to determine how to bring your new system close to the original system state.

Most software repository configurations are stored in packages that end with the term *release*. Check the old package list for the repositories that were installed:

```
awk '{print $1}' ~/old-pkglist.txt | grep 'release$'
```

If necessary, retrieve and install these software repository packages from their original sources on the Internet. Follow the instructions at the originating site to install the repository configuration packages for use by **yum** and other software management tools on your Fedora system.

Then run the following commands to make a list of other missing software packages:

```
awk '{print $1}' ~/old-pkglist.txt | sort | uniq > ~/old-pkgnames.txt
rpm -qa --qf '%{NAME}\n' | sort | uniq > ~/new-pkgnames.txt
diff -u ~/old-pkgnames.txt ~/new-pkgnames.txt | grep '^-' | sed 's/^-//' > /tmp/pkgs-to-install.txt
```

Now use the file `/tmp/pkgs-to-install.txt` with the **yum** command to restore most or all of your old software:

```
su -c 'yum install `cat /tmp/pkgs-to-install.txt`'
```

Missing Software

Due to changes in package complements between Fedora releases, it is possible this method may not restore all the software on your system. You can use the routines above to again compare the software on your system, and remedy any problems you find.

Switching to a Graphical Login

If you installed using a text login and wish to switch to a graphical login, follow this procedure.

1. Switch users to the `root` account:

```
su -
```

Provide the administrator password when prompted.

2. If you have not already done so, install one of the graphical desktop environments. For instance, to install the GNOME desktop environment, use this command:

```
yum groupinstall "GNOME Desktop Environment"
```

This step may take some time as your Fedora system downloads and installs additional software. You may be asked to provide the installation media depending on your original installation source.

3. Run the following command to edit the `/etc/inittab` file:

```
nano /etc/inittab
```

4. Find the line that includes the text `initdefault`. Change the numeral 3 to 5.
5. Hit **Ctrl+O** to write the file to disk, and then hit **Ctrl+X** to exit the program.
6. Type **exit** to logout of the administrator account.

If desired, you can reboot the system using the **reboot** command. Your system will restart and present a graphical login.

If you encounter any problems with the graphical login, consult one of the help sources listed in the section called “Getting Additional Help”.

Subscribing to Fedora Announcements and News

To receive information about package updates, subscribe to either the announcements mailing list, or the RSS feeds.

Fedora Project announcements mailing list

<https://www.redhat.com/mailman/listinfo/fedora-announce-list>

Fedora Project RSS feeds

<http://fedoraproject.org/infofeed/>

The announcements mailing list also provides you with news on the Fedora Project, and the Fedora community.

Security Announcements

Announcements with the keyword *[SECURITY]* in the title identify package updates that resolve security vulnerabilities.

Finding Documentation and Support

Members of the Fedora community provides support through mailing lists, Web forums and Linux User Groups (LUGs) across the world.

The Web site for the formally endorsed forums is <http://forums.fedoraforum.org/>.

The following resources provide information on many aspects of Fedora:

- The FAQ on the Fedora Project website <http://fedoraproject.org/wiki/FAQ/>

- The documents available from the Fedora Documentation Project Web site <http://docs.fedoraproject.org/>
- The Linux Documentation Project (LDP) <http://www.tldp.org/>
- The Red Hat Enterprise Linux documentation, much of which also applies to Fedora <http://www.redhat.com/docs/manuals/enterprise/>

Many other organizations and individuals also provide tutorials and HOWTOs for Fedora on their Web sites. You can locate information on any topic by using Google's Linux search site, located at <http://www.google.com/linux>.

Joining the Fedora Community

The Fedora Project is driven by the individuals that contribute to it. Community members provide support and documentation to other users, help to improve the software included in Fedora by testing, and develop new software alongside the programmers employed by Red Hat. The results of this work are available to all.

To make a difference, start here:

<http://join.fedoraproject.org/>

Appendix A. Boot Options

The Fedora installation system includes a range of functions and options for administrators. To use boot options, enter `linux option` at the `boot:` prompt.

If you specify more than one option, separate each of the options by a single space. For example:

```
linux option1 option2 option3
```

Anaconda Boot Options

The anaconda installer has many boot options, most are listed on the wiki <http://fedoraproject.org/wiki/Anaconda/Options>.

Kernel Boot Options

The <http://fedoraproject.org/wiki/KernelCommonProblems> page lists many common kernel boot options. The full list of kernel options is in the file `/usr/share/doc/kernel-doc-version/Documentation/kernel-parameters.txt`, which is installed with the `kernel-doc` package.

Rescue Mode

The Fedora installation and *rescue discs* may either boot with *rescue mode*, or load the installation system. For more information on rescue discs and rescue mode, refer to the section called “Booting Your Computer with the Rescue Mode”.

Configuring the Installation System at the Boot Menu

You can use the boot menu to specify a number of settings for the installation system, including:

- language
- display resolution
- interface type
- Installation method
- network settings

Specifying the Language

To set the language for both the installation process and the final system, specify the ISO code for that language with the `lang` option. Use the `keymap` option to configure the correct keyboard layout.

For example, the ISO codes `e1_GR` and `gr` identify the Greek language and the Greek keyboard layout:

```
linux lang=e1_GR keymap=gr
```

Configuring the Interface

You may force the installation system to use the lowest possible screen resolution (640x480) with the `lowres` option. To use a specific display resolution, enter `resolution=setting` as a boot option. For example, to set the display resolution to 1024x768, enter:

```
linux resolution=1024x768
```

To run the installation process in `text` mode, enter:

```
linux text
```

To enable support for a serial console, enter `serial` as an additional option.

Specifying the Installation Method

Use the `askmethod` option to display additional menus that enable you to specify the installation method and network settings. You may also configure the installation method and network settings at the `boot :` prompt itself.

To specify the installation method from the `boot :` prompt, use the `method` option. Refer to Installation Methods for the supported installation methods.

Installation Methods

Installation Method: CD or DVD drive

Option Format: `method=cdrom`

Installation Method: Hard Drive

Option Format: `method=hd://device/`

Installation Method: HTTP Server

Option Format: `method=http://server.mydomain.com/directory/`

Installation Method: FTP Server

Option Format: `method=ftp://server.mydomain.com/directory/`

Installation Method: NFS Server

Option Format: `method=nfs:server.mydomain.com:/directory/`

Manually Configuring the Network Settings

By default, the installation system uses DHCP to automatically obtain the correct network settings. To manually configure the network settings yourself, either enter them in the Configure TCP/IP screen, or at the `boot :` prompt. You may specify the `ip` address, `netmask`, `gateway`, and `dns` server settings for the installation system at the prompt. If you specify the network configuration at the `boot :` prompt, these settings are used for the installation process, and the Configure TCP/IP screen does not appear.

This example configures the network settings for an installation system that uses the IP address 192.168.1.10:

```
linux ip=192.168.1.10 netmask=255.255.255.0 gateway=192.168.1.1 dns=19
```

Configuring the Installed System

Use the Network Configuration screen to specify the network settings for the new system. Refer to Chapter 9, *Network Configuration* for more information on configuring the network settings for the installed system.

Enabling Remote Access to the Installation System

You may access either graphical or text interfaces for the installation system from any other system. Access to a text mode display requires **telnet**, which is installed by default on Fedora systems. To remotely access the graphical display of an installation system, use client software that supports the VNC (Virtual Network Computing) display protocol. A number of providers offer VNC clients for Microsoft Windows and Mac OS, as well as UNIX-based systems.

Installing a VNC Client on Fedora

Fedora includes `vncviewer`, the client provided by the developers of VNC. To obtain `vncviewer`, install the `vnc` package.

The installation system supports two methods of establishing a VNC connection. You may start the installation, and manually login to the graphical display with a VNC client on another system. Alternatively, you may configure the installation system to automatically connect to a VNC client on the network that is running in *listening mode*.

Enabling Remote Access with VNC

To enable remote graphical access to the installation system, enter two options at the prompt:

```
linux vnc vncpassword=qwerty
```

The `vnc` option enables the VNC service. The `vncpassword` option sets a password for remote access. The example shown above sets the password as **qwerty**.

VNC Passwords

The VNC password must be at least six characters long.

Specify the language, keyboard layout and network settings for the installation system with the screens that follow. You may then access the graphical interface through a VNC client. The installation system displays the correct connection setting for the VNC client:

```
Starting VNC...
The VNC server is now running.
Please connect to computer.mydomain.com:1 to begin the install...
Starting graphical installation...
```

Press <enter> for a shell

You may then login to the installation system with a VNC client. To run the vncviewer client on Fedora, choose Applications # Accessories # VNC Viewer, or type the command `vncviewer` in a terminal window. Enter the server and display number in the VNC Server dialog. For the example above, the VNC Server is `computer.mydomain.com:1`.

Connecting the Installation System to a VNC Listener

To have the installation system automatically connect to a VNC client, first start the client in listening mode. On Fedora systems, use the `-listen` option to run `vncviewer` as a listener. In a terminal window, enter the command:

```
vncviewer -listen
```

Firewall Reconfiguration Required

By default, `vncviewer` uses TCP port 5500 when in listening mode. To permit connections to this port from other systems, choose System # Administration # Security Level and Firewall. Select Other ports, and Add. Enter **5500** in the Port(s) field, and specify `tcp` as the Protocol.

Once the listening client is active, start the installation system and set the VNC options at the `boot :` prompt. In addition to `vnc` and `vncpassword` options, use the `vnconnect` option to specify the name or IP address of the system that has the listening client. To specify the TCP port for the listener, add a colon and the port number to the name of the system.

For example, to connect to a VNC client on the system `desktop.mydomain.com` on the port 5500, enter the following at the `boot :` prompt:

```
linux vnc vncpassword=qwerty vnconnect=desktop.mydomain.com:5500
```

Enabling Remote Access with Telnet

To enable remote access to a text mode installation, use the `telnet` option at the `boot :` prompt:

```
linux text telnet
```

You may then connect to the installation system with the `telnet` utility. The `telnet` command requires the name or IP address of the installation system:

```
telnet computer.mydomain.com
```

Telnet Access Requires No Password

To ensure the security of the installation process, only use the `telnet` option to install systems on networks with restricted access.

Logging to a Remote System During the Installation

By default, the installation process sends log messages to the console as they are generated. You may specify that these messages go to a remote system that runs a *syslog* service.

To configure remote logging, add the `syslog` option. Specify the IP address of the logging system, and the UDP port number of the log service on that system. By default, syslog services that accept remote messages listen on UDP port 514.

For example, to connect to a syslog service on the system `192.168.1.20`, enter the following at the `boot:` prompt:

```
linux syslog=192.168.1.20:514
```

Configuring a Log Server

Fedora uses **syslogd** to provide a syslog service. The default configuration of **syslogd** rejects messages from remote systems.

Only Enable Remote Syslog Access on Secured Networks

The **syslogd** service includes no security measures. Crackers may slow or crash systems that permit access to the logging service, by sending large quantities of false log messages. In addition, hostile users may intercept or falsify messages sent to the logging service over the network.

To configure a Fedora system to accept log messages from other systems on the network, edit the file `/etc/sysconfig/syslog`. You must use `root` privileges to edit the file `/etc/sysconfig/syslog`. Add the option `-r` to the **SYSLOGD_OPTIONS**:

```
SYSLOGD_OPTIONS="-m 0 -r"
```

Restart the **syslogd** service to apply the change:

```
su -c '/sbin/service syslog restart'
```

Enter the `root` password when prompted.

Firewall Reconfiguration Required

By default, the syslog service listens on UDP port 514. To permit connections to this port from other systems, choose System # Administration # Security Level and Firewall. Select Other ports, and Add. Enter **514** in the Port(s) field, and specify **udp** as the Protocol.

Automating the Installation with Kickstart

A *Kickstart* file specifies settings for an installation. Once the installation system boots, it can read a Kickstart file and carry out the installation process without any further input from a user.

Every Installation Produces a Kickstart File

The Fedora installation process automatically writes a Kickstart file that contains the settings for the installed system. This file is always saved as `/root/anaconda-ks.cfg`. You may use this file to repeat the installation with identical settings, or modify copies to specify settings for other systems.

Fedora includes a graphical application to create and modify Kickstart files by selecting the options that you require. Use the package `system-config-kickstart` to install this utility. To load the Fedora Kickstart editor, choose Applications # System Tools # Kickstart.

Kickstart files list installation settings in plain text, with one option per line. This format lets you modify your Kickstart files with any text editor, and write scripts or applications that generate custom Kickstart files for your systems.

To automate the installation process with a Kickstart file, use the `ks` option to specify the name and location of the file:

```
linux ks=location/kickstart-file.cfg
```

You may use Kickstart files that are held on either removable storage, a hard drive, or a network server. Refer to Kickstart Sources for the supported Kickstart sources.

Kickstart Sources

Kickstart Source: CD or DVD drive

Option Format: `ks=cdrom:/directory/ks.cfg`

Kickstart Source: Hard Drive

Option Format: `ks=hd:/device/directory/ks.cfg`

Kickstart Source: Other Device

Option Format: `ks=file:/device/directory/ks.cfg`

Kickstart Source: HTTP Server

Option Format: `ks=http://server.mydomain.com/directory/ks.cfg`

Kickstart Source: FTP Server

Option Format: `ks=ftp://server.mydomain.com/directory/ks.cfg`

Kickstart Source: NFS Server

Option Format: `ks=nfs:server.mydomain.com:/directory/ks.cfg`

To obtain a Kickstart file from a script or application on a Web server, specify the URL of the application with the `ks=` option. If you add the option `kssendmac`, the request also sends HTTP headers to the Web application. Your application can use these headers to identify the computer. This line sends a request with headers to the application `http://server.mydomain.com/kickstart.cgi`:

```
linux ks=http://server.mydomain.com/kickstart.cgi kssendmac
```

Enhancing Hardware Support

By default, Fedora attempts to automatically detect and configure support for all of the components of your computer. Fedora supports the majority of hardware in common use with the software *drivers* that are included with the operating system. To support other devices you may supply additional drivers during the installation process, or at a later time.

Adding Hardware Support with Driver Disks

The installation system can load drivers from disks, pen drives, or network servers to configure support for new devices. After the installation is complete, remove any driver disks and store them for later use.

Hardware manufacturers may supply driver disks for Fedora with the device, or provide image files to prepare the disks. To obtain the latest drivers, download the correct file from the website of the manufacturer.

Driver Disks Supplied as Zipped Files

Driver disk images may be distributed as compressed archives, or zip files. For identification, the names of zip files include the extensions `.zip`, or `.tar.gz`. To extract the contents of a zipped file with a Fedora system, choose Applications # Accessories # Archive Manager.

To format a disk or pen drive with an image file, use the `dd` utility. For example, to prepare a diskette with the image file `drivers.img`, enter this command in a terminal window:

```
dd if=drivers.img of=/dev/fd0
```

To use a driver disk in the installation process, specify the `dd` option at the `boot :` prompt:

```
linux dd
```

When prompted, select Yes to provide a driver disk. Choose the drive that holds the driver disk from the list on the Driver Disk Source text screen.

The installation system can also read drivers from disk images that are held on network servers. Refer to Driver Disk Image Sources for the supported sources of driver disk image files.

Driver Disk Image Sources

Image Source: Select a drive or device

Option Format: `dd`

Image Source: HTTP Server

Option Format: `dd=http://server.mydomain.com/directory/drivers.img`

Image Source: FTP Server

Option Format: `dd=ftp://server.mydomain.com/directory/drivers.img`

Image Source: NFS Server

Option Format: `dd=nfs:server.mydomain.com:/directory/drivers.img`

Overriding Automatic Hardware Detection

For some models of device automatic hardware configuration may fail, or cause instability. In these cases, you may need to disable automatic configuration for that type of device, and take additional steps to manually configure the device after the installation process is complete.

Check the Release Notes

Refer to the Release Notes for information on known issues with specific devices.

To override the automatic hardware detection, use one or more of the following options:

Hardware Options

Compatibility Setting: Disable all hardware detection
Option: `noprobe`

Compatibility Setting: Disable graphics, keyboard, and mouse detection
Option: `headless`

Compatibility Setting: Disable automatic monitor detection (DDC)
Option: `skipddc`

Compatibility Setting: Use basic VESA driver for video
Option: `xdriver=vesa`

Compatibility Setting: Disable mainboard APIC
Option: `noapic`

Compatibility Setting: Disable power management (ACPI)
Option: `acpi=off`

Compatibility Setting: Disable Direct Memory Access (DMA) for IDE, SATA, and ATAPI drives
Option: `libata.dma=0`

Compatibility Setting: Enable DMA only for IDE and SATA drives
Option: `libata.dma=1`

Compatibility Setting: Disable BIOS-assisted RAID
Option: `nodmraid`

Compatibility Setting: Disable Firewire device detection
Option: `nofirewire`

Compatibility Setting: Disable parallel port detection
Option: `noparport`

Compatibility Setting: Disable PC Card (PCMCIA) device detection
Option: `nopcmcia`

Compatibility Setting: Disable USB storage device detection
Option: `nousbstorage`

Compatibility Setting: Disable all USB device detection
Option: `nousb`

Compatibility Setting: Force Firewire device detection
Option: `firewire`

Compatibility Setting: Prompt user for ISA device configuration
Option: `isa`

Additional Screen

The `isa` option causes the system to display an additional text screen at the beginning of the installation process. Use this screen to configure the ISA devices on your computer.

Using the Maintenance Boot Modes

Loading the Memory (RAM) Testing Mode

Faults in memory modules may cause your system to freeze or crash unpredictably. In some cases, memory faults may only cause errors with particular combinations of software. For this reason, you should test the memory of a computer before you install Fedora for the first time, even if it has previously run other operating systems.

Fedora includes the Memtest86 memory testing application. To boot your computer in memory testing mode, choose Memory test at the boot menu. The first test starts immediately. By default, Memtest86 carries out a total of ten tests.

To halt the tests and reboot your computer, enter **Esc** at any time.

Booting Your Computer with the Rescue Mode

You may boot a command-line Linux system from either a rescue disc or an installation disc, without installing Fedora on the computer. This enables you to use the utilities and functions of a running Linux system to modify or repair systems that are already installed on your computer.

The rescue disc starts the rescue mode system by default. To load the rescue system with the installation disc, choose Rescue installed system from the boot menu.

Specify the language, keyboard layout and network settings for the rescue system with the screens that follow. The final setup screen configures access to the existing system on your computer.

By default, rescue mode attaches an existing operating system to the rescue system under the directory `/mnt/sysimage/`.

Appendix B. Installing Without Media

This section discusses how to install Fedora to your system without making any additional physical media. Instead, you can use your existing GRUB boot loader to start the installation program.

Linux Required

This procedure assumes you are already using Fedora or another relatively modern Linux distribution, and the GRUB boot loader. It also assumes you are a somewhat experienced Linux user.

Retrieving Boot Files

To perform an installation without media or a PXE server, your system must have two files stored locally, a kernel and an initial RAM disk.

1. Download a Live image or DVD distribution, or to locate an installation mirror, visit <http://mirrors.fedoraproject.org/publiclist/Fedora/9/>.
2. Locate the `isolinux/` folder using one of the following methods:
 - If you chose to download an image, open it with the appropriate desktop tool. If you are using Fedora, double-click the file to open it with the Archive Manager. Open the `isolinux/` folder.
 - If you chose not to download a whole image because you wish to install via the network, locate the desired release. In general, once you find a suitable mirror, browse to the `releases/9/Fedora/arch/os/isolinux/` folder.

Installation Types Available

If you download an image, you may then choose a hard disk-based installation or a network installation. If you only download selected files from a mirror, you may only perform a network installation.

3. Copy the `vmlinuz` and `initrd.img` files from the chosen source to the `/boot/` directory, renaming them to `vmlinuz-install` and `initrd.img-install`. You must have root privileges to write files into the `/boot/` directory.

Editing the GRUB Configuration

The GRUB boot loader uses the configuration file `/boot/grub/grub.conf`. To configure GRUB to boot from the new files, add a boot stanza to `/boot/grub/grub.conf` that refers to them.

A minimal boot stanza looks like the following listing:

```
title Installation
    root (hd0,0)
    kernel /vmlinuz-install
    initrd /initrd.img-install
```

You may wish to add options to the end of the `kernel` line of the boot stanza. These options set preliminary options in Anaconda which the user normally sets interactively. For a list of available installer boot options, refer to Appendix A, *Boot Options*.

The following options are generally useful for medialess installations:

- `ip=`
- `method=`
- `lang=`
- `keymap=`
- `ksdevice=` (if installation requires an interface other than `eth0`)
- `vnc` and `vncpassword=` for a remote installation

When you are finished, change the `default` option in `/boot/grub/grub.conf` to point to the new first stanza you added:

```
default 0
```

Booting to Installation

Reboot the system. GRUB boots the installation kernel and RAM disk, including any options you set. You may now refer to the appropriate chapter in this guide for the next step. If you chose to install remotely using VNC, refer to the section called “Enabling Remote Access to the Installation System” for assistance in connecting to the remote system.

Appendix C. Setting Up an Installation Server

Experience Required

This appendix is intended for users with previous Linux experience. If you are a new user, you may want to install using minimal boot media or the distribution DVD instead.

In the past, administrators needed to perform a great deal of manual configuration to produce an installation server. However, if you have a Red Hat Enterprise Linux, CentOS, or Fedora server on your local network, you can use cobbler to perform these tasks.

To perform the tasks in this section, switch to the `root` account with the command `su -`. As an alternative, you can run a command with the `-c` option, using the form `su -c 'command'`.

Setting Up cobbler

To install cobbler use the following command:

```
yum -y install cobbler
```

The `cobbler` command can check its own settings for validity and report the results. Run the following command to check the settings:

```
cobbler check
```

Change the settings in the `/var/lib/cobbler/settings` file to reflect the IP address information for the server. You must change at least the `server` and `next_server` options, although these options may point to the same IP address.

If you are not already running a DHCP server, you should also change the `manage_dhcp` option to `1`. If you are running a DHCP server, configure it according to the instructions found in the `syslinux` package documentation. For more information, refer to your local files `/usr/share/doc/syslinux-version/syslinux.doc` and `/usr/share/doc/syslinux-version/pxelinux.doc`.

Setting Up the Distribution

To set up a distribution from a full Fedora DVD or ISO image, use this procedure.

Network Locations

To create a local mirror from an existing network source, skip this section and refer instead to the section called “Mirroring a Network Location”.

1. If you are using a DVD disc or ISO image, Create a directory mount point:

```
mkdir /mnt/dvd
```

To mount a physical DVD disc, use the following command:

```
mount -o context=system_u:object_r:httpd_sys_content_t:s0 /
```

To mount a DVD ISO image, use the following command:

```
mount -ro loop,context=system_u:object_r:httpd_sys_content_
```

2. To support NFS installation, create a file `/etc/exports` and add the following line to it:

```
/mnt/dvd *(ro,async)
```

Start the NFS server using the following commands:

```
/sbin/service rpcbind start  
/sbin/service nfs start
```

3. To support HTTP installation, use **yum** to install the Apache web server if it is not already installed:

```
yum -y install httpd
```

Make a link to the mounted disc in the Apache public content area:

```
ln -s /mnt/dvd /var/www/html/distro
```

Mirroring a Network Location

If you do not have discs or ISO images for a distribution, you can use **cobbler** to create an installation server. The **cobbler** command can fetch the distribution over the network as part of the import process.

Locate the distribution on the network. The location may be on the local network or reached at a remote site via FTP, HTTP, or rsync protocols. Note the URI, which will be in one of the following forms:

- `http://mirror.example.com/pub/fedora/linux/releases/9/Fedora/arch/os`
- `ftp://mirror.example.com/pub/fedora/linux/releases/9/Fedora/arch/os`
- `rsync://mirror.example.com/fedora/linux/releases/9/Fedora/arch/os`

Importing the Distribution

To offer a distribution through more than one installation method, perform additional **cobbler import** tasks using a different name for each method. For best results, use the installation method as part of the name, so it appears in the client's boot menu.

1. To import the DVD disc or ISO distribution into **cobbler**, run this command:

```
cobbler import --path=/mnt/dvd --name=distro_name
```

For *distro_name*, substitute a meaningful name for the distribution.

To import a local or remote network distribution into **cobbler**, run this command. Replace *network_URI* with the URI you found in the section called “Mirroring a Network Location”, and *distro_name* as above:

```
cobbler import --mirror=network_URI --name=distro_name
```

Importing a Source

When **cobbler** imports a distribution with the commands above, it copies all the files to the server's local storage, which may take some time.

If you do not want to make local copies of the distribution because clients can already reach its location, use the `--available-as` option.

```
cobbler import --path=/mnt/dvd --name=distro_name --available-as=name  
cobbler import --mirror=network_URI --name=distro_name --available-as=name
```

For *network_URI*, substitute the appropriate network location of the distribution. This URI indicates how the server makes the distribution available to its clients. The examples above assume that your **cobbler** server reaches the mirror location at the same URI as the clients. If not, substitute an appropriate URI for the `--mirror` option. The following examples are URI locations that work if you have been following the procedures in this section, and your server's IP address is 192.168.1.1:

- `nfs://192.168.1.1:/mnt/dvd`
- `http://192.168.1.1/distro`

If necessary, replace `192.168.1.1` with the IP address for your **cobbler** server.

2. Run the command **cobbler sync** to apply the changes. To check that your **cobbler** server is listening on the correct ports, use the **netstat -lp** command.

Firewall Considerations

Depending on your server's configuration, you may need to use the **system-config-securitylevel** command to permit access to some or all of these network services:

- 67 or bootps, for the DHCP/BOOTP server
- 69 or tftp, for providing the PXE loader
- 80 or http, if the **cobbler** server is to provide HTTP installation service
- 20 and 21 or ftp, if the **cobbler** server is to provide FTP installation service

- 111 or sunrpc, if the **cobbler** server is to provide NFS installation service

Appendix D. Other Technical Documentation

This document provides a reference for using the Fedora installation software, known as **anaconda**. To learn more about **anaconda**, visit the project Web page: <http://www.fedoraproject.org/wiki/Anaconda>.

Both **anaconda** and Fedora systems use a common set of software components. For detailed information on key technologies, refer to the Web sites listed below:

Boot Loader	Fedora uses the GRUB boot loader. Refer to http://www.gnu.org/software/grub/ for more information.
Disk Partitioning	Fedora uses parted to partition disks. Refer to http://www.gnu.org/software/parted/ for more information.
Storage Management	Logical Volume Management (LVM) provides administrators with a range of facilities to manage storage. By default, the Fedora installation process formats drives as LVM volumes. Refer to http://www.tldp.org/HOWTO/LVM-HOWTO/ for more information.
Audio Support	The Linux kernel used by Fedora incorporates PulseAudio audio server. For more information about PulseAudio, refer to the project documentation: http://www.pulseaudio.org/wiki/Documentation .
Graphics System	Both the installation system and Fedora use the Xorg suite to provide graphical capabilities. Components of Xorg manage the display, keyboard and mouse for the desktop environments that users interact with. Refer to http://www.x.org/ for more information.
Remote Displays	Fedora and anaconda include VNC (Virtual Network Computing) software to enable remote access to graphical displays. For more information about VNC, refer to the documentation on the RealVNC Web site: http://www.realvnc.com/documentation.html .
Command-line Interface	By default, Fedora uses the GNU bash shell to provide a command-line interface. The GNU Core Utilities complete the command-line environment. Refer to http://www.gnu.org/software/bash/bash.html for more information on bash . To learn more about the GNU Core Utilities, refer to http://www.gnu.org/software/coreutils/ .
Remote System Access	Fedora incorporates the OpenSSH suite to provide remote access to the system. The SSH

service enables a number of functions, which include access to the command-line from other systems, remote command execution, and network file transfers. During the installation process **anaconda** may use the **scp** feature of OpenSSH to transfer crash reports to remote systems. Refer to the OpenSSH Web site for more information: <http://www.openssh.com/>.

Access Control

SELinux provides Mandatory Access Control (MAC) capabilities that supplement the standard Linux security features. Refer to the SELinux Project Pages for more information: <http://docs.fedoraproject.org/selinux-guide>.

Firewall

The Linux kernel used by Fedora incorporates the **netfilter** framework to provide firewall features. The Netfilter project website provides documentation for both **netfilter**, and the **iptables** administration facilities: <http://netfilter.org/documentation/index.html>.

Software Installation

Fedora uses **yum** to manage the RPM packages that make up the system. Refer to <http://docs.fedoraproject.org/yum/> for more information.

Virtualization

Virtualization provides the capability to simultaneously run multiple operating systems on the same computer. Fedora also includes tools to install and manage the secondary systems on a Fedora host. You may select virtualization support during the installation process, or at any time thereafter. Refer to <http://www.fedoraproject.org/wiki/Tools/Virtualization> for more information.

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