



v i s t a s o l u t i o n s

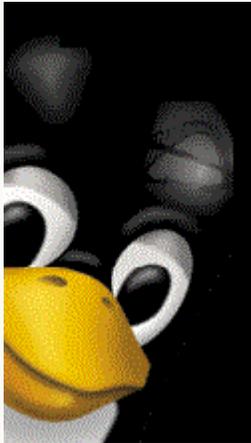
# Vista Solutions

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*Linux*  
*Installation and*  
*Configuration*  
*Hands-On*



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- **Introduction**
  - **Disk Partitioning Tutorial**
  - **System Installation**
  - ***Lab 1: Installation from CD-ROM/DVD***
  - **Boot Managers: LILO and GRUB**
  - **Booting and Start-up**
  - **Hardware Configuration and Troubleshooting**
  - ***Lab 2: Linux System Configuration and Trouble-shooting***
  - **Networking**
  - **File System Layout, What Goes Where**
  - **Software Installation and Update**
  - **Linux File Systems, Software RAID, and Quotas**
  - **Lab 3: More Linux System Configuration**
- **Questions and Wrap-Up (Graduation Time!)**



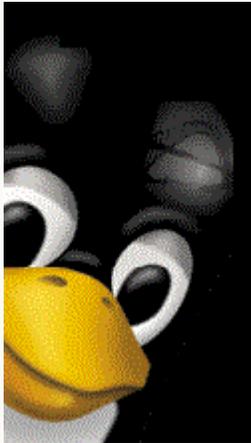
# Warning!

**This seminar is intended for Unix system administrators who have little or no exposure to Linux. If you just spent a week in Linux boot-camp, or if you have years of experience with Linux, then this seminar will be too basic for you.**



# Introduction

- **What is Linux?**
- **What is a Linux Distribution?**
- **Linux Versioning**
- **What is “Open Source Software Development”?**
- **Getting Help and Software**





- **When we say “Linux”, we are really talking about the combination of two things:**
  - An open source kernel, written by Linus Torvalds (Linux)
  - A set of open source tools from the “Free Software Foundation”, the GNU tools
- **Linux is Unix-like, but written to published Unix (POSIX and other) specifications to avoid copyright and patent issues**
- **This is not an exhaustive tutorial, just some of the things that I have run into during my exposure to Linux**
- **This seminar is based on the RedHat Linux distribution version 9.0, there are many others (SuSE, Debian, Red Flag...)**

# What is a Linux distribution?



- **A particular version of the kernel**
  - RedHat 9.0 is based on the 2.4.20-13.9 kernel
- **A particular set of packages and a package manager**
  - May be in Redhat Package Manager (RPM) format
  - May be in Debian (Deb) format
  - May be tar-balls or source packages
- **A particular system structure and “philosophy”**
  - File system layout
  - Approach to system management
- **A set of installation tools**
  - Disk partitioning
  - System installation
- **“Value Added”**
  - Update tools
  - Support
  - Documentation



- **The Linux kernel and most packages follow a similar (but not always identical) versioning scheme**
- **Kernel Version = MajorRelease.MinorRelease.Step**
  - Odd-numbered minor-release kernels are “development”
  - Even-numbered minor-release kernels are “stable”
  - Minor release numbers are incremented with patches
  - Example “2.4.20-13” is a stable kernel
- **Red Hat has started using Major.Minor.Step.Release, as in 2.4.20-13.9 for Redhat 9.0 and 2.4.20-13.8 for Redhat 8.0, etc.**
- **Packages use a similar scheme (more later on this)**
  - `red-carpet-1.3.3-4.ximian.1.i386.rpm`
  - `gdb-5.2-2.i386.rpm`
  - `ethereal-0.9.4-0.7.3.0.i386.rpm`



- **Software protected by the GNU General Public License (GPL) or similar license schemes**
- **There are multiple versions of the GPL and other “open-source” license schemes**
- **From */usr/src/linux2.4/Documentation/COPYING*:**  
***“Also note that the only valid version of the GPL as far as the kernel is concerned is this particular version of the license (ie v2, not v2.2 or v3.x or whatever), unless explicitly otherwise stated.”***  
**-- Linus Torvalds**



## Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. [...]

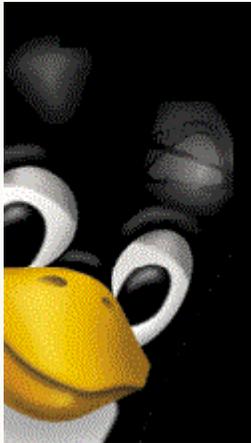
*from: /usr/src/linux2.4/Documentation/COPYING © 1989, 1991 Free Software Foundation, Inc.*



- **Open Source software is available from a \*lot\* of places. I tend to frequent:**
  - <http://rpmfind.net>
  - <http://sourceforge.net>
- **Documentation and HOWTOs can tend to be out of date. The Redhat site is good for Redhat specific documentation and has pointers to other sites. For example:**
  - <http://tldp.org>
- **There are lots of news groups and chat channels devoted to all aspects of Linux and GNU applications**
- **There are formal support channels available for Linux: HP, Redhat, etc.**



# Disk Partitioning Tutorial



- **Floppy Disk Format**
- **The Master Boot Record (MBR)**
- **Partition Layout for a Hard Disks**
- **Device files for Primary Partitions**
- **Devices for Extended Partitions**

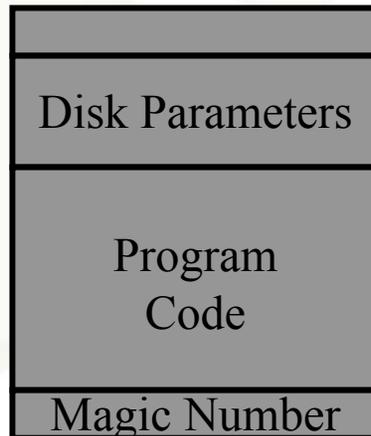
# Data Layout for a Floppy Diskette



*Boot  
Sector*



*MS-DOS  
Boot Sector*



Jump to Program Code



# Data Layout for a Hard Disk (IDE or SCSI)

(without extended partitions)



*Partition  
Boot Record*

*Partition  
Boot Record*

*Partition  
Boot Record*



*Partition 1*

*Partition 2*

*Partition 3*

*Partition 4*

Partition Table

Program  
Code

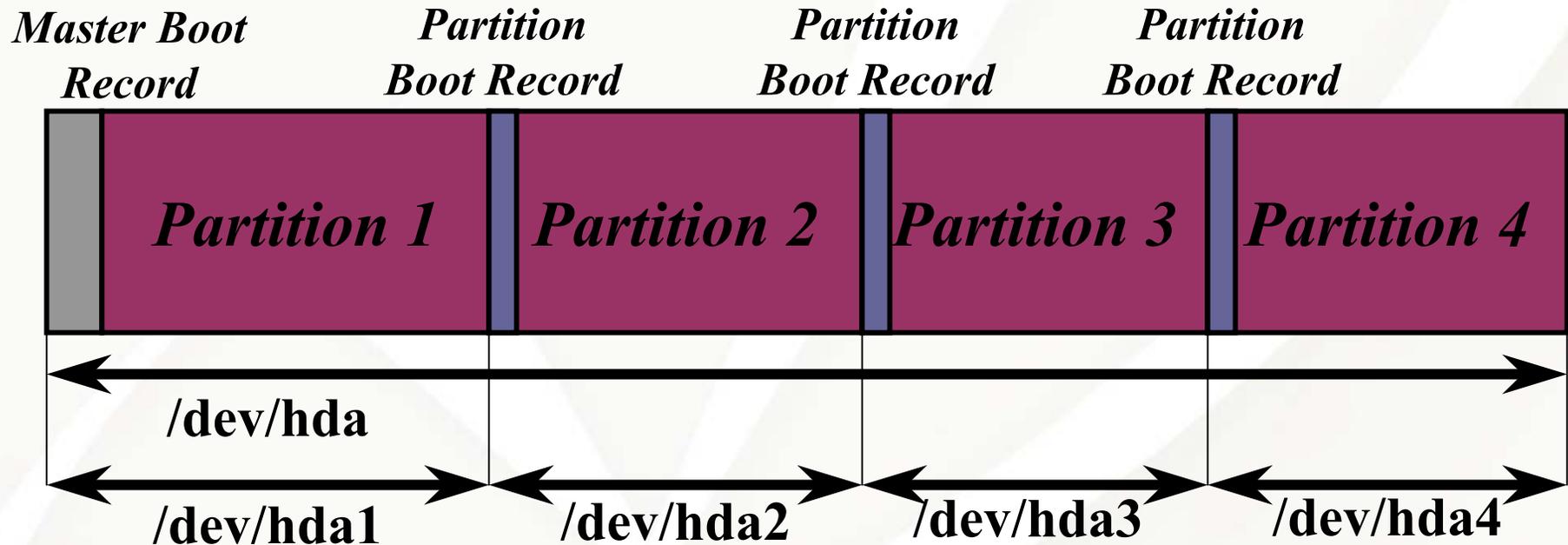
Disk Parameters

Magic Number

*Up to four primary  
partitions per hard  
disk for MS-DOS.*

# Data Layout and Devices for an IDE Hard Disk

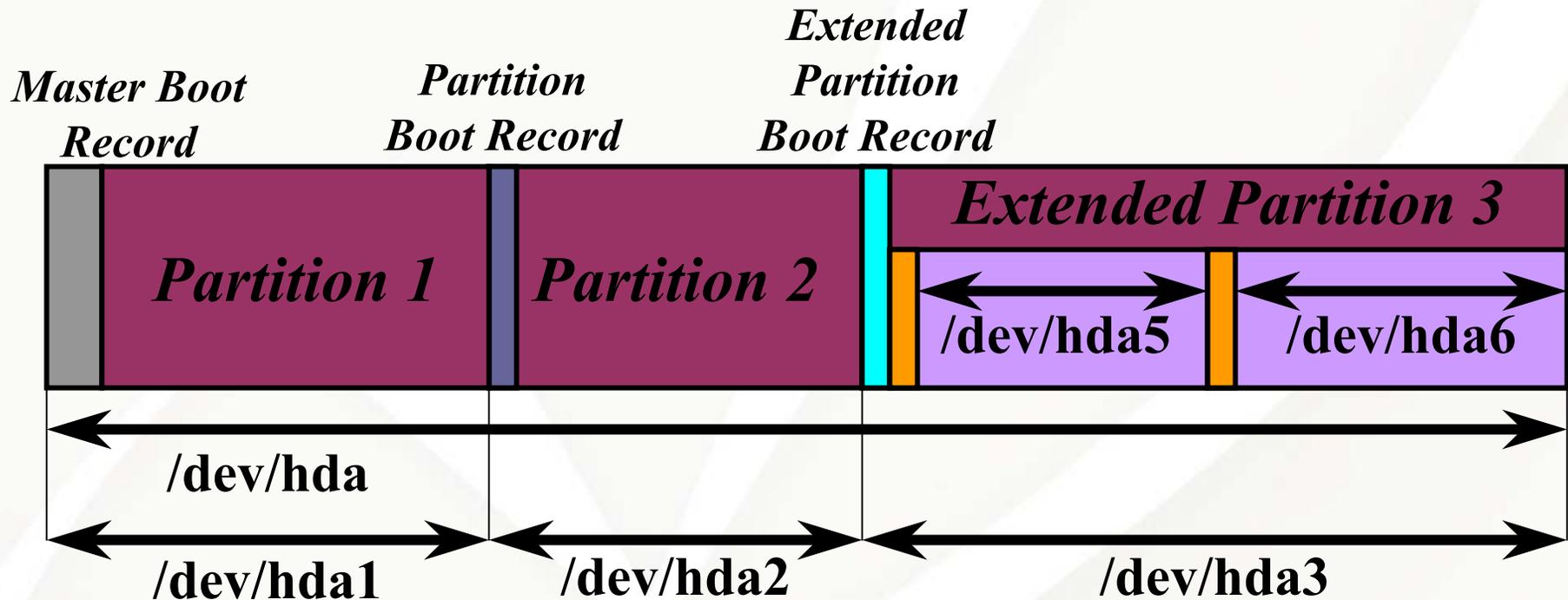
(without extended partitions)



*Note that each partition is accessible as if it were an independent device with its own boot sector. Linux creates devices for this configuration as shown.*

# Data Layout for an IDE Hard Disk

(with extended partitions)



*If more than four partitions are needed, one primary partition is divided into an extended partition containing several logical partitions. Note that the partition tables of the logical partitions are not accessible as the first block of some device.*

# Partition Table from a Real System Using “fdisk”



```
# fdisk /dev/hda
```

The number of cylinders for this disk is set to 1229.  
There is nothing wrong with that, but this is larger than 1024,  
and could in certain setups cause problems with:

- 1) software that runs at boot time (e.g., old versions of LILO)
- 2) booting and partitioning software from other OSs (e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): p

Disk /dev/hda: 255 heads, 63 sectors, 1229 cylinders  
Units = cylinders of 16065 \* 512 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/hda1	*	1	13	104391	83	Linux
/dev/hda2		14	78	522112+	82	Linux swap
/dev/hda3		79	1229	9245407+	83	Linux

Command (m for help): q

# Partition from a Real System Using "parted"



```
# parted /dev/had
```

**GNU Parted 1.4.24**

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This program is free software, covered by the GNU General Public License.**

**This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.**

**Using /dev/hda**

**Information: The operating system thinks the geometry on /dev/hda is 1229/255/63. Therefore, cylinder 1024 ends at 8032.499M.**

```
(parted) p
```

**Disk geometry for /dev/hda: 0.000-9641.953 megabytes  
Disk label type: msdos**

<b>Minor</b>	<b>Start</b>	<b>End</b>	<b>Type</b>	<b>Filesystem</b>	<b>Flags</b>
<b>1</b>	<b>0.031</b>	<b>101.975</b>	<b>primary</b>	<b>ext3</b>	<b>boot</b>
<b>2</b>	<b>101.975</b>	<b>611.850</b>	<b>primary</b>	<b>linux-swap</b>	
<b>3</b>	<b>611.851</b>	<b>9640.568</b>	<b>primary</b>	<b>ext3</b>	

```
(parted) q
```



- **If you have an NTFS file system, then it must be in the first partition on the disk ( example order: Windows NT/XP, Windows 98, /boot, FAT16)**
- **All bootable partitions must be within 1023 cylinders of the start of the drive**
- **Windows will only boot if within the first 4 GB of the disk**
- **There can be only one active/visible partition unless you use a boot manager like PowerQuest BootMagic**
- **Bootable partitions must be on IDE disk 0 or SCSI disk 0 (!)**
- **Only four primary partitions per disk**
- **Windows NT does not know how to read FAT32 file systems, Windows XP does**
- **If your first drive is SCSI or RAID, Linux may not have the drivers built into the kernel, so you MUST configure an initial RAM disk image (initrd) containing the dynamically loadable kernel modules (more later)**

# A Dual-boot System, Linux and Windows XP

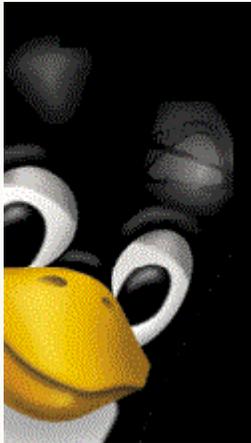


<b>Disk 0</b> Basic 8.47 GB Online	31 MB Healthy (Unknown F)	<b>WINDOWS XP (C:)</b> 7.69 GB NTFS Healthy (System)	769 MB Healthy (Unknown Partition)
<b>Disk 1</b> Basic 8.47 GB Online	<b>Auxiliary (D:)</b> 1.33 GB NTFS Healthy (Page File)	7.14 GB Healthy (Unknown Partition)	

- **31 MB Partition is /boot, inside the 1023 cylinder limit**
- **/boot is the first physical partition, but the *second* partition table entry (I did this with “Partition Magic” from PowerQuest)**
- **The third partition on disk 0 is Linux swap**
- **The second partition on disk 1 is Linux /**
- **Windows XP lives in the second partition on disk 0 and uses the first partition on disk 1 as paging**
- **I installed Windows XP first, then “inserted” Linux and used the GRUB boot manager (more on GRUB later)**



# Installing Redhat Linux



- **Booting the Install Media**
- **Partitioning the Disk**
  - **Normal**
  - **RAID**
  - **LVM**
- **Installing the Boot Loader**
- **Configuring the Network**
- **Configuring the Firewall**
- **Options**
- **Picking Packages**
- **Installing Packages**
- **Video Configuration**
- **Boot Disk Creation**
- **X-Windows Configuration**
- **Reboot**



- **HP-UX**
  - CD-ROM or DVD
  - Ignite-UX (network)
- **Software Distribution Utilities (SDU)**
- **Graphical or text-based installation tool**
- **Three main phases:**
  - Configure disk layout
  - Install system filesets
  - Configure subsystems
- **Redhat Linux**
  - CD-ROM, DVD, or floppy
  - Kickstart (network)
  - Others (systemimager)
- **Redhat Package Manager (RPM)**
- **Graphical or text-based (VGA) installation tool**
- **Three main phases:**
  - Partition the disk
  - Install system packages
  - Configure subsystems



- The Redhat Linux installation tool is called “anaconda”
- Because most graphics cards (all that will work with x86 hardware) have a VGA mode, the installer can work in VGA (80x24 color) mode
- The installer tries to start an X-server for a graphical user interface during install if you don’t select a text-based installation
- You can select which mode the install takes place in at the installation CD prompt with “linux text”
- Obviously, if you have only a serial port, then you are stuck with VGA mode
- If you can, install on a machine with a graphics-enabled card, then use an imaging technique like “systemimager” to “clone” the system image to a non-graphics environment (more on this later)
- Our hardware for this seminar supports bit-mapped graphics, so we will not concentrate on the VGA installation
- Most of the configuration that you do graphically is available after the system is installed in either VGA or X-windows mode.
- There are a number of tools named redhat-config-<something>” that do VGA, X-windows, or command-line configuration of the system. For example, “redhat-config-network” will set up the network parameters for your system



redhat.

Red Hat Linux 9

- To install or upgrade **Red Hat** Linux in graphical mode, press the **<ENTER>** key.
- To install or upgrade **Red Hat** Linux in text mode, type:  
linux text **<ENTER>**.
- Use the function keys listed below for more information.

**[F1-Main] [F2-Options] [F3-General] [F4-Kernel] [F5-Rescue]**

boot: \_

A screenshot of the Red Hat Linux installation welcome screen. The window has a red header bar with the Red Hat logo on the left and the word 'redhat.' in white on the right. The main content area is divided into two panes. The left pane, titled 'Online Help', contains the text: 'Welcome to Red Hat Linux', 'Welcome! This installation process is outlined in detail in the Red Hat Linux Installation Guide available from Red Hat, Inc. Please read through the entire manual before you begin this installation process.', 'HTML and PDF copies of the manual are available online at http://www.redhat.com/docs. There is also an HTML copy on the CD set.', 'If you have purchased a boxed set, be sure to register your product through our website (http://www.redhat.com/apps/activate/).', and 'Throughout this installation you'. The right pane, titled 'Welcome', features a large blue rounded rectangle with the Red Hat logo, the word 'redhat.', an illustration of a computer monitor, a CD, and a pen, and the text 'Red Hat Linux' with a small '9' icon. Below this is the copyright notice 'Copyright ©2003 Red Hat, Inc. All Rights Reserved.'. At the bottom of the window are four buttons: 'Hide Help' (with a red X icon), 'Release Notes' (with a document icon), 'Back' (with a left arrow icon), and 'Next' (with a right arrow icon).

# Installation Language Selection



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Online Help

## Language Selection

Choose the language you would like to use during this installation.

### Language Selection



What language would you like to use during the installation process?

- Chinese(Simplified) (简体中文)
- Chinese(Traditional) (繁體中文)
- Czech (Čeština)
- Danish (Dansk)
- Dutch (Nederlands)
- English (English)**
- French (Français)
- German (Deutsch)
- Icelandic (Íslenska)
- Italian (Italiano)
- Japanese (日本語)
- Korean (한국어)
- Norwegian (Norsk)
- Portuguese (Português)
- Portuguese(Brazilian) (Português (Brasil))
- Russian (Русский)
- Spanish (Español)
- Swedish (Svenska)

 Hide Help

 Release Notes

 Back

 Next



Online Help

## Keyboard Configuration

Choose the layout type for the keyboard (for example, U.S. English) that you would like to use for the system.

### Keyboard

Select the appropriate keyboard for the system.

- Russian (Microsoft)
- Russian (ru1)
- Russian (ru2)
- Russian (win)
- Slovakian
- Slovenian
- Spanish
- Speakup
- Speakup (laptop)
- Swedish
- Swiss French
- Swiss French (latin1)
- Swiss German
- Swiss German (latin1)
- Turkish
- Ukrainian
- United Kingdom
- U.S. English**
- U.S. International

Hide Help   Release Notes   Back   Next



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Online Help

## Mouse Configuration

Choose the correct mouse type for your system.

Do you have a PS/2, USB, Bus or serial mouse? (Hint: If the connector your mouse plugs into is round, it is a PS/2 or a Bus mouse; if rectangular, it is a USB mouse; if trapezoidal, it is a serial mouse.)

Try to find an exact match. If an exact match cannot be found, choose one which is compatible with yours. Otherwise, choose the appropriate **Generic** mouse type.

If you have a serial mouse, pick the device and port it is connected to in the next box.

### Mouse Configuration

 Select the appropriate mouse for the system.

Model

- 2 Button Mouse (serial)
- 2 Button Mouse (USB)
- 3 Button Mouse (PS/2)
- 3 Button Mouse (serial)
- 3 Button Mouse (USB)
- Wheel Mouse (PS/2)**
- Wheel Mouse (USB)

▶ Genius  
▶ Kensington  
▶ Logitech  
▶ Microsoft

Device

- /dev/ttyS0 (COM1 under DOS)
- /dev/ttyS1 (COM2 under DOS)
- /dev/ttyS2 (COM3 under DOS)
- /dev/ttyS3 (COM4 under DOS)

Emulate 3 buttons

 Hide Help

 Release Notes

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Online Help

## Installation Type

Choose the type of installation that will best meet your needs.

An installation will destroy any previously saved information on the selected partitions.

For more information concerning the differences among these installation classes, refer to the Red Hat Linux Installation Guide.

### Installation Type

-  **Personal Desktop**  
Perfect for personal computers or laptops, select this installation type to install a graphical desktop environment and create a system ideal for home or desktop use.
-  **Workstation**  
This option installs a graphical desktop environment with tools for software development and system administration.
-  **Server**  
Select this installation type if you would like to set up file sharing, print sharing, and Web services. Additional services can also be enabled, and you can choose whether or not to install a graphical environment.
-  **Custom**  
Select this installation type to gain complete control over the installation process, including software package selection and authentication preferences.

 Hide Help

 Release Notes

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Online Help

## Disk Partitioning Setup

One of the largest obstacles for a new user during a Linux installation is partitioning. Red Hat Linux makes this process easier by providing automatic partitioning.

By selecting automatic partitioning, you will not have to use partitioning tools to assign mount points, create partitions, or allocate space for your installation.

To partition manually, choose the **Disk Druid** partitioning tool.

Use the **Back** button to choose a different installation, or choose **Next** if you want to proceed with this installation.

## Disk Partitioning Setup

Automatic Partitioning sets partitions based on the selected installation type. You also can customize the partitions once they have been created.

The manual disk partitioning tool, Disk Druid, allows you to create partitions in an interactive environment. You can set the file system types, mount points, partition sizes, and more.

- Automatically partition
- Manually partition with Disk Druid

 Hide Help

 Release Notes

 Back

 Next



The screenshot shows the Red Hat Disk Partitioning Setup window. A warning dialog box is open in the center, titled "Warning". The dialog contains the following text:

**Warning**

 The partition table on device sda was unreadable. To create new partitions it must be initialized, causing the loss of ALL DATA on this drive.

This operation will override any previous installation choices about which drives to ignore.

Would you like to initialize this drive, erasing ALL DATA?

No  Yes

The background window shows the "Disk Partitioning Setup" title bar and the Red Hat logo. The main content area is partially obscured by the dialog box. At the bottom of the window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Automatic Partitioning – Resulting Disk Layout



The screenshot shows the Red Hat Disk Setup utility interface. On the left, there is a help sidebar with the title "Disk Setup" and instructions on how to proceed with automatic partitioning. The main window displays the "Partitioning" section for drive /dev/sda, showing a table of partitions and a list of actions (New, Edit, Delete, Reset, RAID, LVM). At the bottom, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sd sda2 103231 MB	sda3 760 MB
----------------------	----------------

New Edit Delete Reset RAID LVM

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/boot	ext3	✓	102	1	13
/dev/sda2	/	ext3	✓	3232	14	425
/dev/sda3		swap	✓	761	426	522

Hide RAID device/LVM Volume Group members

Hide Help Release Notes Back Next



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Online Help

## Disk Partitioning Setup

One of the largest obstacles for a new user during a Linux installation is partitioning. Red Hat Linux makes this process easier by providing automatic partitioning.

By selecting automatic partitioning, you will not have to use partitioning tools to assign mount points, create partitions, or allocate space for your installation.

To partition manually, choose the **Disk Druid** partitioning tool.

Use the **Back** button to choose a different installation, or choose **Next** if you want to proceed with this installation.

### Disk Partitioning Setup

Automatic Partitioning sets partitions based on the selected installation type. You also can customize the partitions once they have been created.

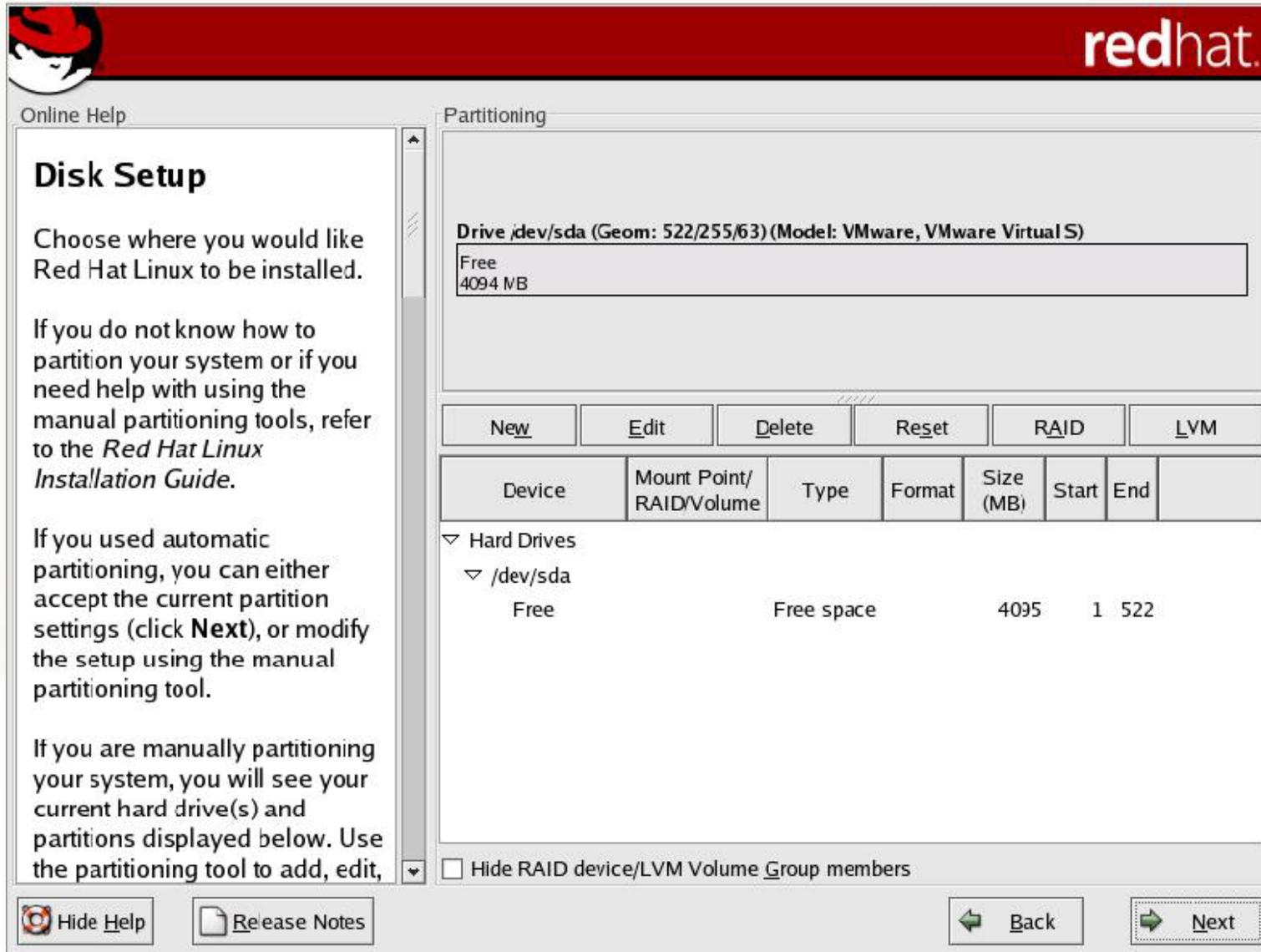
The manual disk partitioning tool, Disk Druid, allows you to create partitions in an interactive environment. You can set the file system types, mount points, partition sizes, and more.

Automatically partition

Manually partition with **Disk Druid**

Hide Help   Release Notes   Back   Next

# Manual Partitioning – Free Disk Space



The screenshot shows the Red Hat manual partitioning tool interface. At the top right is the Red Hat logo. On the left is a sidebar with 'Online Help' and a 'Disk Setup' section. The main area is titled 'Partitioning' and shows details for 'Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)'. A table below shows the disk layout with one free space entry. At the bottom are buttons for 'Hide Help', 'Release Notes', 'Back', and 'Next'.

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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive `/dev/sda` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

Free  
4094 MB

[New](#) [Edit](#) [Delete](#) [Reset](#) [RAID](#) [LVM](#)

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
Free		Free space		4095	1	522

Hide RAID device/LVM Volume Group members

[Hide Help](#) [Release Notes](#) [Back](#) [Next](#)

# Manual Partitioning – Adding /boot



The screenshot shows the Red Hat Disk Setup window with the 'Add Partition' dialog box open. The dialog box has the following fields and options:

- Mount Point:** /boot
- File System Type:** ext3
- Allowable Drives:** A list box containing one entry:  sda 4095 MB VMware, VMware Virtual S
- Size (MB):** 100
- Additional Size Options:**
  - Fixed size
  - Fill all space up to (MB): 1
  - Fill to maximum allowable size
- Force to be a primary partition
- Check for bad blocks

Buttons: Cancel, OK

At the bottom of the dialog box, there is a checkbox:  Hide RAID device/LVM Volume Group members

The background window shows the 'Disk Setup' section with the following text:

**Online Help**

## Disk Setup

Choose where you want to install Red Hat Linux to be installed.

If you do not know how to partition your system, you need help with using the partitioning tool. For more information, see the manual partitioning section of the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can accept the current settings (click **Next**) or you can change the settings using the partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit, or delete partitions.

Buttons: Hide Help, Release Notes, Back, Next

# Manual Partitioning - /boot Added



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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sdFree
103992 MB

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/boot	ext3	✓	102	1	13
Free		Free space		3993	14	522

Hide RAID device/LVM Volume Group members

Hide Help

Release Notes

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# Manual Partitioning – Adding Root Partition



The screenshot shows the Red Hat Disk Setup utility. The main window is titled "Disk Setup" and has a "redhat." logo in the top right. A dialog box titled "Add Partition" is open in the foreground. The dialog box contains the following fields and options:

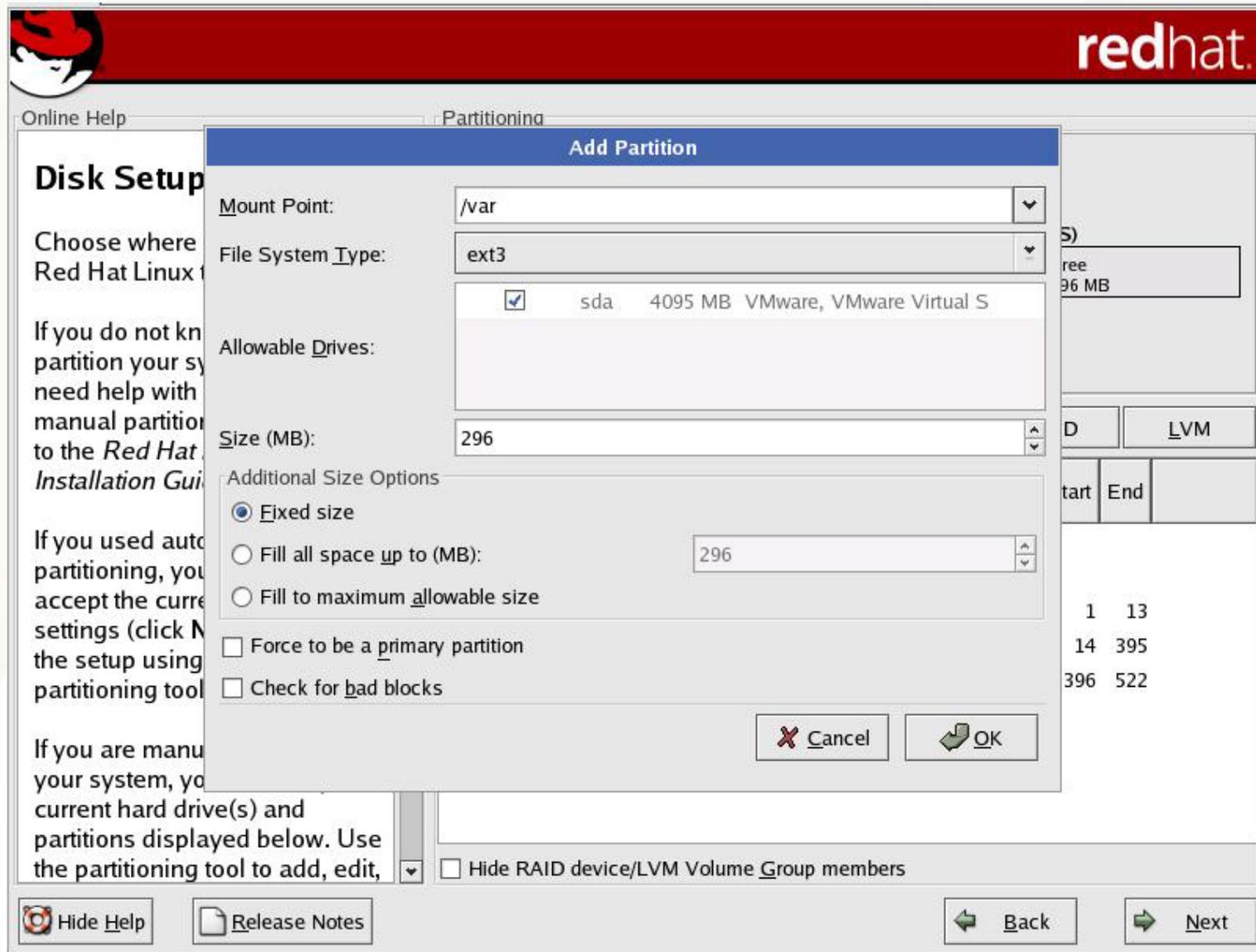
- Mount Point: /
- File System Type: ext3
- Allowable Drives:  sda 4095 MB VMware, VMware Virtual S
- Size (MB): 3000
- Additional Size Options:
  - Fixed size
  - Fill all space up to (MB): 3000
  - Fill to maximum allowable size
- Force to be a primary partition
- Check for bad blocks

At the bottom of the dialog box are "Cancel" and "OK" buttons. Below the dialog box, in the main window, there is a table with columns "Size (B)", "Start", and "End". The table contains the following data:

Size (B)	Start	End
102	1	13
3993	14	522

At the bottom of the main window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Manual Partitioning – Adding A Separate /var



The screenshot shows the Red Hat Disk Setup Partitioning dialog box. The dialog is titled "Add Partition" and is part of the "Disk Setup" window. The "Mount Point" is set to "/var", the "File System Type" is "ext3", and the "Size (MB)" is "296". The "Allowable Drives" list shows "sda" with a checked box. The "Additional Size Options" section has "Fixed size" selected, with a "296" MB value in the input field. There are checkboxes for "Force to be a primary partition" and "Check for bad blocks", both of which are unchecked. The "Cancel" and "OK" buttons are at the bottom right of the dialog. The background shows the "Disk Setup" window with a sidebar containing instructions and a main area showing a disk layout with a table of partition details.

Online Help Partitioning

### redhat.

## Disk Setup

Choose where to install Red Hat Linux

If you do not know how to partition your system, you need help with manual partitioning. Click on the *Red Hat Linux Installation Guide* link in the sidebar.

If you used automatic partitioning, you can accept the current settings (click **Next**) or change the setup using the partitioning tool.

If you are manually partitioning your system, you can view the current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit, or delete partitions.

Hide RAID device/LVM Volume Group members

**Add Partition**

Mount Point: /var

File System Type: ext3

Allowable Drives:

<input checked="" type="checkbox"/>	sda	4095 MB	VMware, VMware Virtual S
-------------------------------------	-----	---------	--------------------------

Size (MB): 296

Additional Size Options

Fixed size

Fill all space up to (MB): 296

Fill to maximum allowable size

Force to be a primary partition

Check for bad blocks

Cancel OK

Start	End
1	13
14	395
396	522

Hide Help Release Notes Back Next

# Manual Partitioning – Adding Swap



The screenshot shows the Red Hat Disk Setup utility. A dialog box titled "Add Partition" is open, allowing the user to configure a new swap partition. The dialog includes fields for Mount Point, File System Type, Allowable Drives, Size (MB), and Additional Size Options. The File System Type is set to "swap" and the Size is set to 100 MB. The "Fill to maximum allowable size" option is selected. The background shows the main Disk Setup window with a partition table and navigation buttons.

**redhat.**

Online Help Partitioning

## Disk Setup

Choose where you want to install Red Hat Linux. You can choose a partition or a range of partitions. If you do not know how to partition your system, you need help with manual partitioning. See the *Red Hat Linux Installation Guide*. If you used automatic partitioning, you can accept the current settings (click **Next**) or use the setup using manual partitioning tool. If you are manually partitioning your system, you can view the current hard drive partitions and partitions displayed below. Use the partitioning tool to add, edit, or delete partitions.

**Add Partition**

Mount Point: <Not Applicable>

File System Type: swap

Allowable Drives:

<input checked="" type="checkbox"/>	sda	4095 MB	VMware, VMware Virtual S
-------------------------------------	-----	---------	--------------------------

Size (MB): 100

Additional Size Options

Fixed size

Fill all space up to (MB): 1

Fill to maximum allowable size

Force to be a primary partition

Check for bad blocks

Cancel OK

Hide RAID device/LVM Volume Group members

Hide Help Release Notes Back Next

Start	End
1	13
14	395
396	433
434	522

# Manual Partitioning – Final Configuration



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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sd/sda2 102996 MB	sda3 298 MB	sda5 698 MB
----------------------	----------------	----------------

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/boot	ext3	✓	102	1	13
/dev/sda2	/	ext3	✓	2996	14	395
/dev/sda3	/var	ext3	✓	298	396	433
▼ /dev/sda4						
/dev/sda5		swap	✓	698	434	522

Hide RAID device/LVM Volume Group members

# Manual RAID Partitioning – RAID 1 (mirroring) Example



The screenshot shows the Red Hat Disk Setup utility. On the left, the 'Disk Setup' section provides instructions on manual partitioning. The main area, titled 'Partitioning', shows two drives: /dev/sda and /dev/sdb, both with 4094 MB of free space. Below the drive information are buttons for 'New', 'Edit', 'Delete', 'Reset', 'RAID', and 'LVM'. A table displays the current partitioning state, showing two free space partitions on both drives. At the bottom, there are buttons for 'Hide Help', 'Release Notes', 'Back', and 'Next'.

**Online Help**

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

Free  
4094 MB

Drive /dev/sdb (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

Free  
4094 MB

[New](#) [Edit](#) [Delete](#) [Reset](#) [RAID](#) [LVM](#)

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
Free		Free space		4095	1	522
▼ /dev/sdb						
Free		Free space		4095	1	522

Hide RAID device/LVM Volume Group members

[Hide Help](#) [Release Notes](#) [Back](#) [Next](#)

# Manual RAID Partitioning – Adding A RAID Partition



The screenshot shows the Red Hat Disk Setup application with the RAID Options dialog box open. The dialog box contains the following text:

**RAID Options**

Software RAID allows you to combine several disks into a larger RAID device. A RAID device can be configured to provide additional speed and reliability compared to using an individual drive. For more information on using RAID devices please consult the Red Hat Linux documentation.

You currently have 0 software RAID partition(s) free to use.

To use RAID you must first create at least two partitions of type 'software RAID'. Then you can create a RAID device which can be formatted and mounted.

What do you want to do now?

- Create a software RAID partition.
- Create a RAID device [default=/dev/md0].
- Clone a drive to create a RAID device [default=/dev/md0].

Buttons: Cancel, OK

The background window shows the Disk Setup interface with the following elements:

- Online Help** (top left)
- Partitioning** (tab)
- redhat.** (top right)
- Disk Setup** (main title)
- Choose where you would like Red Hat Linux to be installed.
- If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.
- If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.
- If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit, or delete partitions.
- Buttons: Hide Help, Release Notes, Back, Next
- Checkbox: Hide RAID device/LVM Volume Group members
- Buttons: RAID, LVM
- Table with columns: Size (MB), Start, End

Size (MB)	Start	End
4095	1	522
4095	1	522

# Manual RAID Partitioning – Selecting Disk



The screenshot shows the Red Hat Disk Setup utility. The main window is titled "Disk Setup" and contains instructions for manual partitioning. A modal dialog box titled "Add Partition" is open, allowing the user to configure a new partition. The dialog includes the following fields and options:

- Mount Point:** <Not Applicable>
- File System Type:** software RAID
- Allowable Drives:** A list of available disks with checkboxes. 

<input checked="" type="checkbox"/>	sda	4095 MB	VMware, VMware Virtual S
<input type="checkbox"/>	sdb	4095 MB	VMware, VMware Virtual S
- Size (MB):** 100
- Additional Size Options:**
  - Fixed size
  - Fill all space up to (MB): 1
  - Fill to maximum allowable size
- Force to be a primary partition
- Check for bad blocks

At the bottom of the dialog are "Cancel" and "OK" buttons. The background window shows a disk layout table with columns for "Start" and "End", and a checkbox for "Hide RAID device/LVM Volume Group members".

# Manual RAID Partitioning – First Partition Added



redhat.

Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sdFree
113977 MB

Drive /dev/sdb (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

Free
4094 MB

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1		software RAID		118	1	15
Free		Free space		3977	16	522
▼ /dev/sdb						
Free		Free space		4095	1	522

Hide RAID device/LVM Volume Group members

# Manual RAID Partitioning – Adding Second Partition



The screenshot shows the 'Disk Setup' window in the Red Hat installer. The 'Partitioning' tab is active, and the 'Add Partition' dialog box is open. The dialog box has the following fields and options:

- Mount Point:** <Not Applicable>
- File System Type:** software RAID
- Allowable Drives:** A list of drives with checkboxes. 'sdb' is selected.
- Size (MB):** 100
- Additional Size Options:**
  - Fixed size
  - Fill all space up to (MB): 1
  - Fill to maximum allowable size
- Force to be a primary partition
- Check for bad blocks

At the bottom of the dialog box are 'Cancel' and 'OK' buttons. Below the dialog box, in the main window, there is a table showing the partition layout:

Start	End
1	13
14	522
1	522

At the bottom of the main window, there are buttons for 'Hide Help', 'Release Notes', 'Back', and 'Next'. A checkbox for 'Hide RAID device/LVM Volume Group members' is also visible.

# Manual RAID Partitioning – Second Partition Complete



redhat.

Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sdFree
103992 MB

Drive /dev/sdb (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sdFree
103992 MB

[New](#) [Edit](#) [Delete](#) [Reset](#) [RAID](#) [LVM](#)

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1		software RAID		102	1	13
	Free	Free space		3993	14	522
▼ /dev/sdb						
/dev/sdb1		software RAID		102	1	13
	Free	Free space		3993	14	522

Hide RAID device/LVM Volume Group members

[Hide Help](#)

[Release Notes](#)

[Back](#)

[Next](#)

# Manual RAID Partitioning – Create RAID Device



The screenshot shows the Red Hat Disk Setup utility. A dialog box titled "RAID Options" is open, providing information about software RAID and asking the user what they want to do. The background window shows the "Partitioning" step for a drive `/dev/sda` (Geom: 522/255/63) (Model: VMware, VMware Virtual S). The RAID options are:

- Create a software RAID partition.
- Create a RAID device [default=/dev/md0].
- Clone a drive to create a RAID device [default=/dev/md0].

Buttons for "Cancel" and "OK" are visible at the bottom of the dialog.

The background window also shows a table of RAID options:

Format	Size (MB)	Start	End
RAID	102	1	13
LVM	3993	14	522

At the bottom of the window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Manual RAID Partitioning – Create RAID /boot



The screenshot shows the Red Hat Disk Setup utility. A modal window titled "Make RAID Device" is open, allowing configuration for a RAID device. The configuration is as follows:

- Mount Point: /boot
- File System Type: ext3
- RAID Device: md0
- RAID Level: RAID1 (highlighted)
- RAID Members: sda1 (102 MB) and sdb1 (102 MB)
- Number of spares: 0

Buttons for "Cancel" and "OK" are visible at the bottom of the modal. In the background, the "Partitioning" section shows a table of disk partitions:

Device	Size (MB)	Start	End
sda1	102	1	13
sda2	3993	14	522
sdb1	102	1	13
sdb2	3993	14	522

At the bottom of the Disk Setup window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Manual RAID Partitioning – First RAID Created



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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive `/dev/sda` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

scFree
103992 MB

Drive `/dev/sdb` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

scFree
103992 MB

New Edit Delete Reset RAID LVM

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ RAID Devices						
<code>/dev/md0</code>	<code>/boot</code>	ext3	✓	101.944		
▼ Hard Drives						
▼ <code>/dev/sda</code>						
<code>/dev/sda1</code>	<code>/dev/md0</code>	software RAID		102	1	13
Free		Free space		3993	14	522
▼ <code>/dev/sdb</code>						
<code>/dev/sdb1</code>	<code>/dev/md0</code>	software RAID		102	1	13
Free		Free space		3993	14	522

Hide RAID device/LVM Volume Group members

Hide Help Release Notes Back Next

# Manual RAID Partitioning – All RAID Devices Complete



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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

scsda2	sda3
103200 MB	792 MB

Drive /dev/sdb (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

scsdb2	sdb3
103200 MB	792 MB

[New](#) [Edit](#) [Delete](#) [Reset](#) [RAID](#) [LVM](#)

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ RAID Devices						
/dev/md0	/boot	ext3	✓	101.944		
/dev/md1	/	ext3	✓	3200.45		
/dev/md2		swap	✓	792.268		
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/dev/md0	software RAID		102	1	13
/dev/sda2	/dev/md1	software RAID		3200	14	421
/dev/sda3	/dev/md2	software RAID		792	422	522

Hide RAID device/LVM Volume Group members

Hide Help

Release Notes

Back

Next

# Manual LVM Partitioning – Adding /boot



redhat.

Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

Partitioning

Drive /dev/sda (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

sdFree  
103992 MB

Drive /dev/sdb (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

Free  
4094 MB

New

Edit

Delete

Reset

RAID

LVM

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/boot	ext3	✓	102	1	13
Free		Free space		3993	14	522
▼ /dev/sdb						
Free		Free space		4095	1	522

Hide RAID device/LVM Volume Group members

Hide Help

Release Notes

Back

Next

# Manual LVM Partitioning – First Physical Volume



The screenshot shows the 'Disk Setup' window in Red Hat Linux, with the 'Partitioning' tab selected. A dialog box titled 'Add Partition' is open, allowing the user to configure a new partition. The 'Mount Point' is set to '<Not Applicable>' and the 'File System Type' is 'physical volume (LVM)'. Under 'Allowable Drives', two drives are listed: 'sda' (4095 MB, VMware, VMware Virtual S) and 'sdb' (4095 MB, VMware, VMware Virtual S). The 'sda' drive is selected with a checked checkbox. The 'Size (MB)' is set to 100. Under 'Additional Size Options', the 'Fill to maximum allowable size' radio button is selected. There are also checkboxes for 'Force to be a primary partition' and 'Check for bad blocks'. At the bottom of the dialog are 'Cancel' and 'OK' buttons. The background window shows a table of partitions with columns for Start and End sectors.

	Start	End
02	1	13
93	14	522
95	1	522

# Manual LVM Partitioning – Second Physical Volume



The screenshot shows the Red Hat Disk Setup application. The main window is titled "Disk Setup" and has a "Partitioning" tab selected. A dialog box titled "Add Partition" is open in the foreground. The dialog box contains the following fields and options:

- Mount Point: <Not Applicable>
- File System Type: physical volume (LVM)
- Allowable Drives: A list of drives with checkboxes. 

<input type="checkbox"/>	sda	4095 MB	VMware, VMware Virtual S
<input checked="" type="checkbox"/>	sdb	4095 MB	VMware, VMware Virtual S
- Size (MB): 100
- Additional Size Options:
  - Fixed size
  - Fill all space up to (MB): 1
  - Fill to maximum allowable size
- Force to be a primary partition
- Check for bad blocks

At the bottom of the dialog box are "Cancel" and "OK" buttons. The background window shows a table of partitions with columns for Start and End values.

	Start	End
02	1	13
93	14	522
95	1	522

At the bottom of the main window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Manual LVM Partitioning – Physical Layout



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Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive `/dev/sda` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

<code>scsda2</code>
103992 MB

Drive `/dev/sdb` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

<code>sdb1</code>
4094 MB

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	End
▼ Hard Drives						
▼ <code>/dev/sda</code>						
<code>/dev/sda1</code>	<code>/boot</code>	ext3	✓	102	1	13
<code>/dev/sda2</code>		LVM PV	✓	3993	14	522
▼ <code>/dev/sdb</code>						
<code>/dev/sdb1</code>		LVM PV	✓	4095	1	522

Hide RAID device/LVM Volume Group members

# Manual LVM Partitioning – Volume Group Information



The screenshot shows the 'Make LVM Volume Group' dialog box in the Red Hat Partitioning tool. The dialog is titled 'Make LVM Volume Group' and has a 'redhat.' logo in the top right corner. It contains the following fields and controls:

- Volume Group Name:** A text input field containing 'Volume00'.
- Physical Extent:** A dropdown menu showing '4 MB'.
- Physical Volumes to Use:** A list of physical volumes with checkboxes. Two are checked: 'sda2' (3984.00 MB) and 'sdb1' (4088.00 MB).
- Used Space:** 0.00 MB (0.0 %)
- Free Space:** 8072.00 MB (100.0 %)
- Total Space:** 8072.00 MB
- Logical Volumes:** A table with columns 'Logical Volume Name', 'Mount Point', and 'Size (MB)'. It is currently empty. To the right of the table are 'Add', 'Edit', and 'Delete' buttons.
- RAID/LVM Selection:** Two buttons, 'RAID' and 'LVM'. The 'LVM' button is selected.
- Size (MB) Table:** A table showing the size of the physical volumes. It has columns 'Size (MB)', 'Start', and 'End'.

Size (MB)	Start	End
102	1	13
3993	14	522
4095	1	522
- Buttons:** 'Cancel' (with a red X icon) and 'OK' (with a green checkmark icon).
- Checkbox:** 'Hide RAID device/LVM Volume Group members' (unchecked).
- Footer:** 'Hide Help' (with a magnifying glass icon), 'Release Notes' (with a document icon), 'Back' (with a left arrow icon), and 'Next' (with a right arrow icon).

# Manual LVM Partitioning – Make Logical Volume



The screenshot shows the Red Hat Partitioning tool interface. At the top, there is a red header with the Red Hat logo and the word "redhat." in white. Below the header, the main window is titled "Partitioning" and contains a "Make LVM Volume Group" dialog box. This dialog box has a "Volume Group Name" field set to "Volume00" and a "Physical Extent" dropdown set to "4 MB". A smaller "Make Logical Volume" dialog box is open in front of it, with a "Mount Point" dropdown, a "File System Type" dropdown set to "ext3", a "Logical Volume Name" field set to "LogVol00", and a "Size (MB)" field set to "8072". Below the size field, it says "(Max size is 8072 MB)". Both dialog boxes have "Cancel" and "OK" buttons. To the right of the "Make Logical Volume" dialog, there are "Add", "Edit", and "Delete" buttons. At the bottom of the main window, there is a "Cancel" and "OK" button, and a checkbox labeled "Hide RAID device/LVM Volume Group members".

**Online Help** | Partitioning

## Make LVM Volume Group

Volume Group Name:

Physical Extent:

## Make Logical Volume

Mount Point:

File System Type:

Logical Volume Name:

Size (MB):   
(Max size is 8072 MB)

Hide RAID device/LVM Volume Group members

Size (MB)	Start	End
102	1	13
3993	14	522
4095	1	522

## Disk Setup

Choose where you want to install Red Hat Linux to be installed.

If you do not know how to manually partition your system, you need help with using the partitioning tool. See the manual partitioning section in the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can accept the current partitioning settings (click **Next**) or you can manually partition the setup using the partitioning tool.

If you are manually partitioning your system, you will see the current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

# Manual LVM Partitioning – Making Root Volume



The screenshot shows the Red Hat Disk Setup utility. The main window is titled "Partitioning" and has a sub-window "Make LVM Volume Group" open. The "Volume Group Name" is "Volume00" and the "Physical Extent" is "4 MB". A smaller "Make Logical Volume" dialog is also open, showing "Mount Point" as "/", "File System Type" as "ext3", "Logical Volume Name" as "LogVol00", and "Size (MB)" as "6304". The main window also shows a table of partitions and a "Hide RAID device/LVM Volume Group members" checkbox.

**Make LVM Volume Group**

Volume Group Name: Volume00  
Physical Extent: 4 MB

**Make Logical Volume**

Mount Point: /  
File System Type: ext3  
Logical Volume Name: LogVol00  
Size (MB): 6304  
(Max size is 8072 MB)

Size (MB)	Start	End
102	1	13
3993	14	522
4095	1	522

Hide RAID device/LVM Volume Group members

## Disk Setup

Choose where you want to install Red Hat Linux to be installed.

If you do not know how to partition your system, you need help with using the manual partitioning tool. See the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can accept the current partition settings (click **Next**) or change the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see the current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit, or delete partitions.

Hide Help

Release Notes

Back

Next

# Manual LVM Partitioning – All Logical Volumes Created



The screenshot shows the 'Make LVM Volume Group' dialog box in the Red Hat Disk Setup Partitioning tool. The Volume Group Name is 'Volume00' and the Physical Extent is '4 MB'. Two physical volumes, 'sda2' (3984.00 MB) and 'sdb1' (4088.00 MB), are selected. The Logical Volumes table shows LogVol00 (6304 MB), LogVol01 (600 MB), and LogVol02 (768 MB). The RAID and LVM tabs are visible, and the LVM tab is active. The 'Cancel' and 'OK' buttons are at the bottom of the dialog box.

**Make LVM Volume Group**

Volume Group Name:

Physical Extent:

Physical Volumes to Use:

- sda2 3984.00 MB
- sdb1 4088.00 MB

Used Space: 7672.00 MB (95.0 %)  
Free Space: 400.00 MB ( 5.0 %)  
Total Space: 8072.00 MB

Logical Volumes

Logical Volume Name	Mount Point	Size (MB)
LogVol00	/	6304
LogVol01	/var	600
LogVol02	N/A	768

Hide RAID device/LVM Volume Group members

RAID LVM

Size (MB)	Start	End
102	1	13
3993	14	522
4095	1	522

Hide Help Release Notes Back Next

# Manual LVM Partitioning – Physical Layout



redhat.

Online Help

## Disk Setup

Choose where you would like Red Hat Linux to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the *Red Hat Linux Installation Guide*.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you will see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit,

### Partitioning

Drive `/dev/sda` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

`sgsda2`  
103992 MB

Drive `/dev/sdb` (Geom: 522/255/63) (Model: VMware, VMware Virtual S)

`sdb1`  
4094 MB

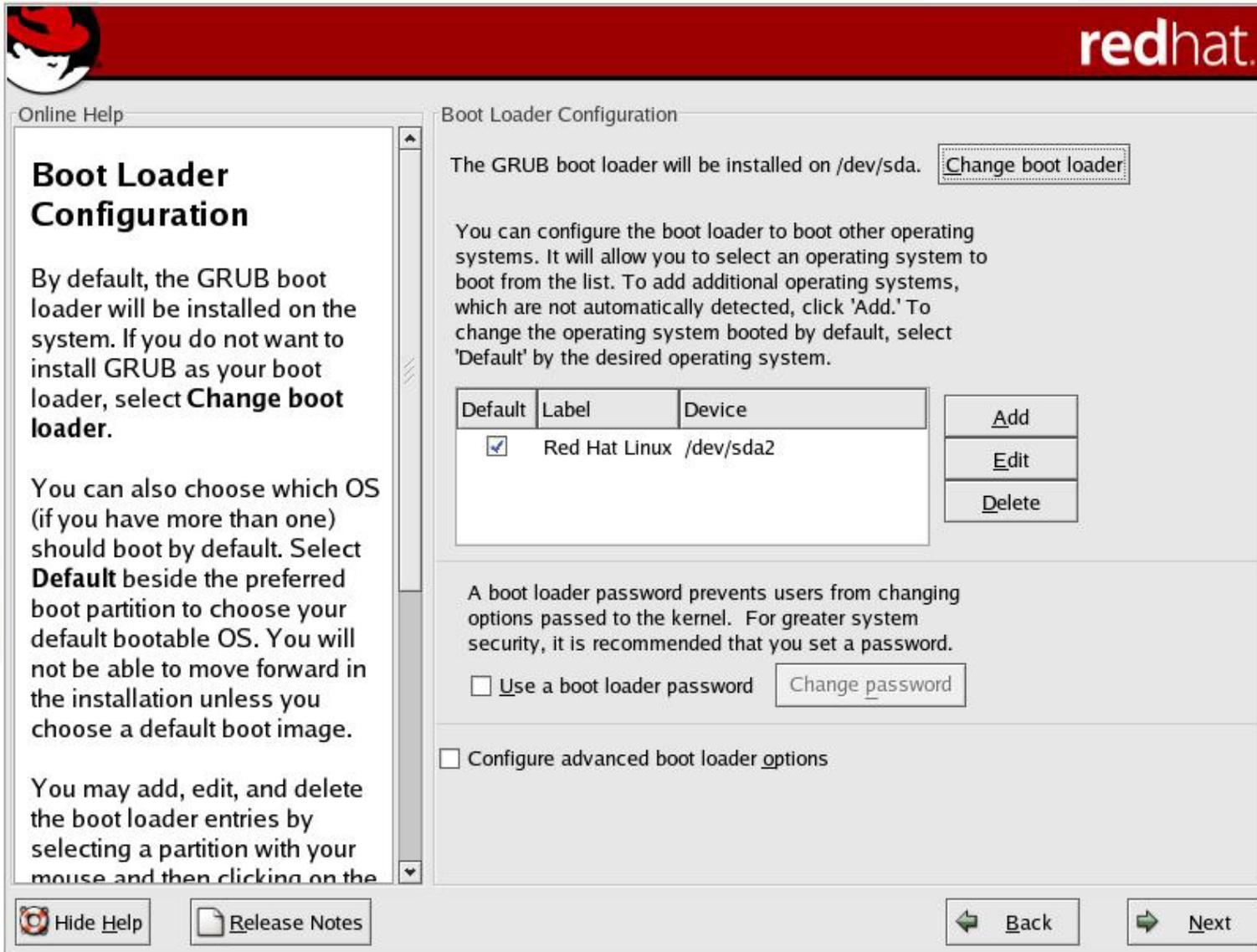
[New](#) [Edit](#) [Delete](#) [Reset](#) [RAID](#) [LVM](#)

Device	Mount Point/ RAID/Volume	Type	Format	Size (MB)	Start	E
▼ LVM Volume Groups						
▼ Volume00						
LogVol00	/	ext3	✓	6304		
LogVol02		swap	✓	768		
LogVol01	/var	ext3	✓	600		
▼ Hard Drives						
▼ /dev/sda						
/dev/sda1	/boot	ext3	✓	102	1	

Hide RAID device/LVM Volume Group members

 Hide Help  Release Notes

 Back  Next



The screenshot shows the Red Hat Boot Loader Configuration window. The window has a red header with the Red Hat logo on the left and the text "redhat." on the right. Below the header, there is a sidebar on the left with the title "Boot Loader Configuration" and a scrollable area containing help text. The main area on the right is titled "Boot Loader Configuration" and contains several sections of text and controls.

**Online Help**

## Boot Loader Configuration

By default, the GRUB boot loader will be installed on the system. If you do not want to install GRUB as your boot loader, select **Change boot loader**.

You can also choose which OS (if you have more than one) should boot by default. Select **Default** beside the preferred boot partition to choose your default bootable OS. You will not be able to move forward in the installation unless you choose a default boot image.

You may add, edit, and delete the boot loader entries by selecting a partition with your mouse and then clicking on the

**Boot Loader Configuration**

The GRUB boot loader will be installed on /dev/sda. [Change boot loader](#)

You can configure the boot loader to boot other operating systems. It will allow you to select an operating system to boot from the list. To add additional operating systems, which are not automatically detected, click 'Add.' To change the operating system booted by default, select 'Default' by the desired operating system.

Default	Label	Device
<input checked="" type="checkbox"/>	Red Hat Linux	/dev/sda2

[Add](#)  
[Edit](#)  
[Delete](#)

A boot loader password prevents users from changing options passed to the kernel. For greater system security, it is recommended that you set a password.

[Use a boot loader password](#) [Change password](#)

[Configure advanced boot loader options](#)

[Hide Help](#) [Release Notes](#) [Back](#) [Next](#)

# Selecting the Boot Loader



The screenshot shows the Red Hat Boot Loader Configuration window. The main window has a red header with the Red Hat logo and the text "redhat.". Below the header, there is an "Online Help" section on the left and a "Boot Loader Configuration" section on the right. The "Boot Loader Configuration" section contains the following text: "The GRUB boot loader will be installed on /dev/sda." followed by a "Change boot loader" button. Below this, it says: "You can configure the boot loader to boot other operating systems. It will allow you to select an operating system to boot from the list. To add additional operating systems," followed by "Add", "Edit", and "Delete" buttons. At the bottom of the main window, there are checkboxes for "Use a boot loader password" (with a "Change password" button) and "Configure advanced boot loader options".

The "Online Help" section on the left is titled "Boot Loader Configuration" and contains the following text: "By default, the GRUB boot loader will be installed on the system. If you do not want to install GRUB as your boot loader, select **Change boot loader**." and "You can also choose which C (if you have more than one) should boot by default. Select **Default** beside the preferred boot partition to choose your default bootable OS. You will not be able to move forward in the installation unless you choose a default boot image." and "You may add, edit, and delete the boot loader entries by selecting a partition with your mouse and then clicking on the".

The "Change Boot Loader" dialog box is open in the center of the screen. It has a blue title bar and contains the following text: "Please select the boot loader that the computer will use. GRUB is the default boot loader. However, if you do not wish to overwrite your current boot loader, select 'Do not install a boot loader.'" followed by three radio button options: "Use GRUB as the boot loader" (which is selected), "Use LILO as the boot loader", and "Do not install a boot loader". At the bottom of the dialog box are "Cancel" and "OK" buttons.

At the bottom of the main window, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".



redhat.

Online Help

## Advanced Boot Loader Configuration

Select where you want the boot loader to be installed. If your system will use only Red Hat Linux, select the Master Boot Record (MBR). For systems on which Win95/98 and Red Hat Linux will reside on a single hard drive, you should also install the boot loader to the MBR.

If you have Windows NT (and you want a boot loader to be installed) you should choose to install it on the first sector of the boot partition.

Click **Change Drive Order** to rearrange the drive order. Changing the drive order may be useful if you have multiple

### Advanced Boot Loader Configuration

Install Boot Loader record on:

- /dev/sda Master Boot Record (MBR)
- /dev/sda1 First sector of boot partition

[Change Drive Order](#)

Force LBA32 (not normally required)

If you wish to add default options to the boot command, enter them into the 'General kernel parameters' field.

General kernel parameters

Hide Help

Release Notes

Back

Next

# Configuring the Network Interfaces



The screenshot shows the Red Hat Network Configuration window. On the left is an 'Online Help' pane with the following text:

### Network Configuration

Any network devices you have on the system will be automatically detected by the installation program and shown in the **Network Devices** list.

To configure the network device, first select the device and then click **Edit**. In the **Edit Interface** screen, you can choose to have the IP and Netmask information configured by DHCP or you can enter it manually. You can also choose to make the device active at boot time.

If you do not have DHCP client access or are unsure as to what this information is, please contact your Network Administrator.

At the bottom of the help pane are buttons for 'Hide Help' and 'Release Notes'.

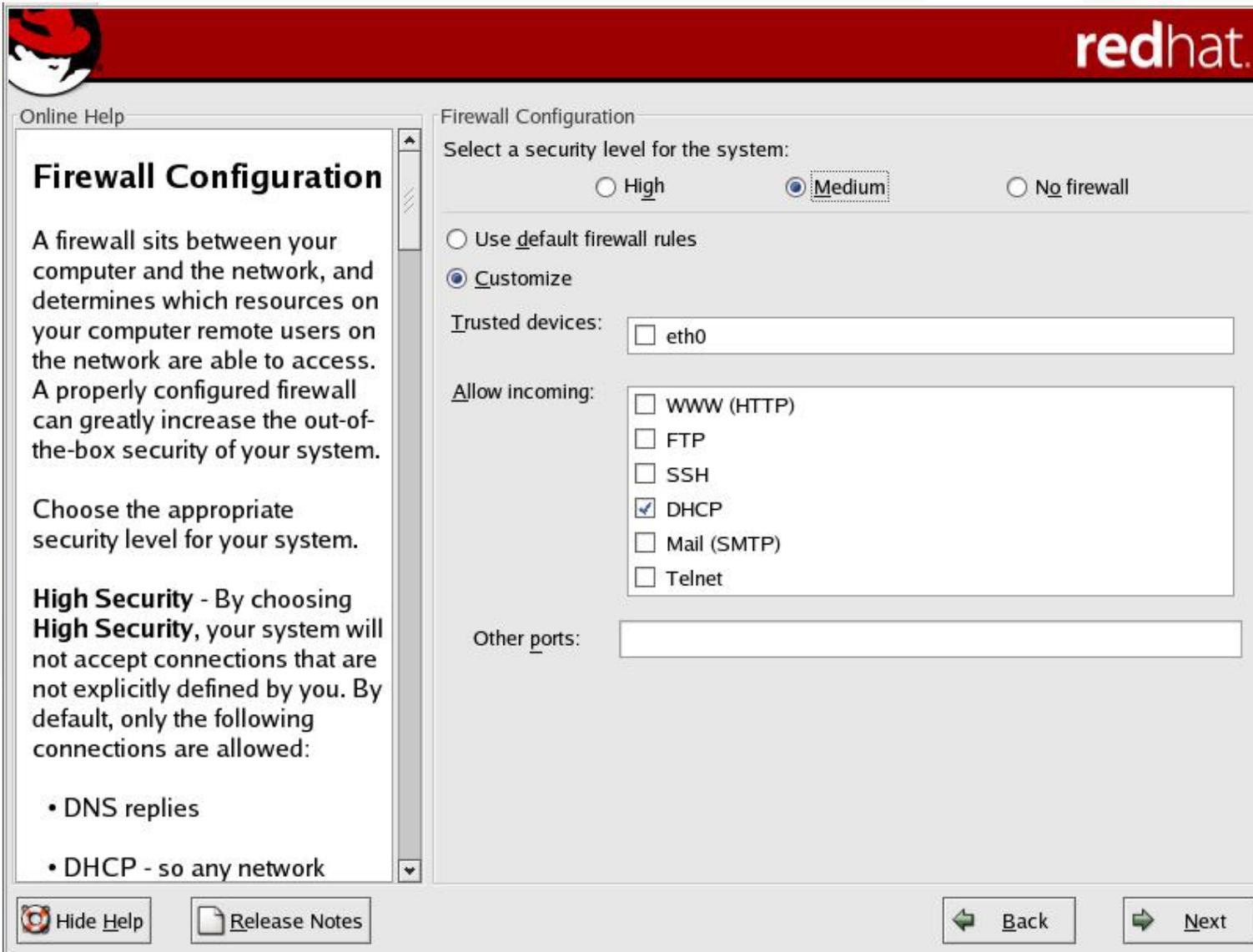
The main window is titled 'Network Configuration' and features the Red Hat logo and 'redhat.' branding at the top. It contains a 'Network Devices' table with the following data:

Active on Boot	Device	IP/Netmask	Edit
<input checked="" type="checkbox"/>	eth0	DHCP	[Edit]

Below the table are sections for 'Hostname' (with options for 'automatically via DHCP' and 'manually'), 'Miscellaneous Settings' (including Gateway, Primary DNS, Secondary DNS, and Tertiary DNS), and a dialog box titled 'Edit Interface eth0'. The dialog box has the following options:

- Configure eth0
- Configure using DHCP
- Activate on boot
- IP Address: [ ][ ][ ][ ]
- Netmask: [ ][ ][ ][ ]
- [Cancel] [OK]

At the bottom of the main window are 'Back' and 'Next' navigation buttons.



The screenshot shows the Red Hat Firewall Configuration window. The window has a red header with the Red Hat logo on the left and the word "redhat." on the right. Below the header, there is a sidebar on the left with the title "Firewall Configuration" and a scrollable area containing text and a list of allowed connections. The main area on the right is titled "Firewall Configuration" and contains several options for configuring the firewall. At the bottom, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

**redhat.**

Online Help

## Firewall Configuration

A firewall sits between your computer and the network, and determines which resources on your computer remote users on the network are able to access. A properly configured firewall can greatly increase the out-of-the-box security of your system.

Choose the appropriate security level for your system.

**High Security** - By choosing **High Security**, your system will not accept connections that are not explicitly defined by you. By default, only the following connections are allowed:

- DNS replies
- DHCP - so any network

Firewall Configuration

Select a security level for the system:

High  Medium  No firewall

Use default firewall rules

Customize

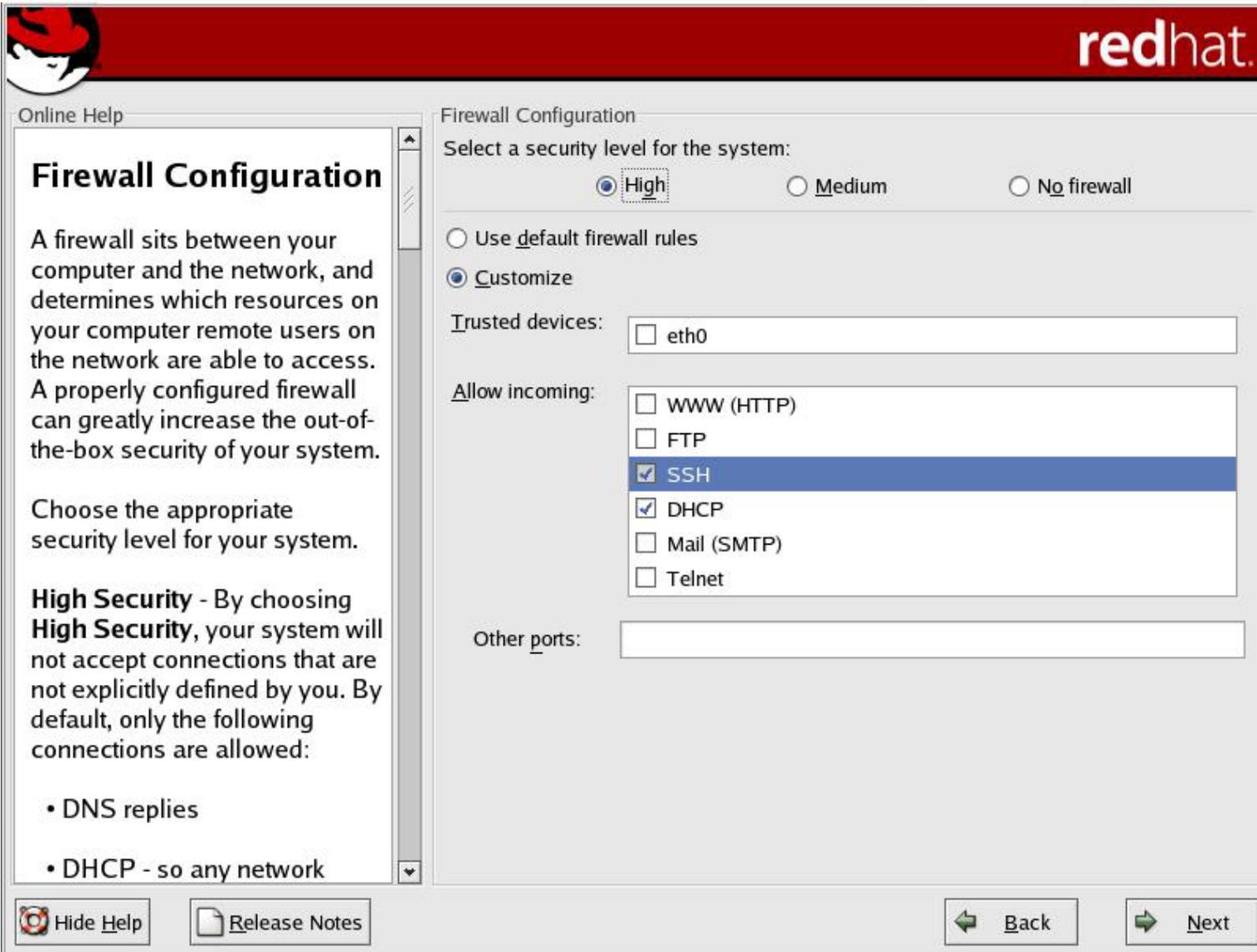
Trusted devices:  eth0

Allow incoming:

- WWW (HTTP)
- FTP
- SSH
- DHCP
- Mail (SMTP)
- Telnet

Other ports:

Hide Help Release Notes Back Next



The screenshot shows the Red Hat Firewall Configuration window. The title bar is red with the Red Hat logo on the left and the text "redhat." on the right. Below the title bar, there is a "Firewall Configuration" section. On the left side, there is a "Firewall Configuration" help panel with a scroll bar. The main area contains the following options:

**Firewall Configuration**

Select a security level for the system:

**H**igh       **M**edium       **N**o firewall

Use **d**efault firewall rules

**C**ustomize

**T**rusted devices:  eth0

**A**llow incoming:

- WWW (HTTP)
- FTP
- S**SH
- D**HCP
- Mail (SMTP)
- Telnet

**O**ther ports:

At the bottom, there are buttons for "Hide Help", "Release Notes", "Back", and "Next".

# Adding System Language Support



**redhat.**

Online Help

## Additional Language Support

Select a language to use as the default language. The default language will be the language used on the system once installation is complete. If you choose to install other languages, it is possible to change the default language after the installation.

Red Hat Linux can install and support several languages. To use more than one language on your system, choose specific languages to be installed, or select all languages to have all available languages installed on the system.

Use the **Reset** button to cancel your selections.

Additional Language Support

Select the default language for the system: English (USA) ▾

Select additional languages to install on the system:

- English (Denmark)
- English (Great Britain)
- English (Hong Kong)
- English (India)
- English (Ireland)
- English (New Zealand)
- English (Philippines)
- English (Singapore)
- English (South Africa)
- English (USA)
- English (Zimbabwe)
- Estonian
- Faroese (Faroe Islands)
- Finnish
- French (Belgium)
- French (Canada)
- French (France)
- French (Luxemburg)

Select All

Select Default Only

Reset

Hide Help

Release Notes

Back

Next

# Selecting the Time Zone



redhat.

Online Help

## Time Zone Selection

You can set your time zone either by selecting your computer's physical location, or by your time zone's offset from Universal Time, Coordinated. (also known as UTC).

Notice the two tabs at the top of the screen. The first tab offers you the ability to configure by location.

From the interactive map, you can click on a specific city, as indicated by the yellow dots, and a red X will appear at your selection.

You can also scroll through the city list and choose your desired time zone.

Time Zone Selection

Location: UTC Offset

America/Los\_Angeles - Pacific Time

Location	Description
America/La_Paz	
America/Lima	
America/Los_Angeles	Pacific Time
America/Louisville	Eastern Time - Kentucky - Louisville area
America/Maceio	Alagoas_Sergipe

System clock uses UTC



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Online Help

## Set Root Password

Use the root account *only* for administration. Once the installation has been completed, create a non-root account for your general use and `su -` to gain root access when you need to fix something quickly. These basic rules will minimize the chances of a typo or incorrect command doing damage to your system.

Set Root Password

Enter the root (administrator) password for the system.

Root Password:

Confirm:

Root password accepted.

Hide Help

Release Notes

Back

Next



Online Help

## Authentication Configuration

You can skip this section if you will not be setting up network passwords. If you are unsure, ask your system administrator for assistance.

Unless you are setting up an **NIS** password, you will notice that both **MD5** and **shadow** are selected. Using both will make your system as secure as possible.

- **Enable MD5 Passwords** - allows a long password to be used (up to 256 characters).
- **Use Shadow Passwords** - provides a very secure method of retaining passwords for you.

Authentication Configuration

Enable **M**D5 passwords

Enable shadow passwords

NIS | LDAP | Kerberos 5 | SMB

Enable NIS

NIS Domain:

Use broadcast to find NIS server

NIS Server:

 Hide Help

 Release Notes

 Back

 Next



redhat.

Online Help

## Authentication Configuration

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### Authentication Configuration

Enable MD5 passwords

Enable shadow s passwords

NIS | LDAP | Kerberos 5 | SMB

Enable NIS

NIS Domain:

Use broadcast to find NIS server

NIS Server:

 Hide Help

 Release Notes

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Online Help

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- **Enable MD5 Passwords** - allows a long password to be used (up to 256 characters).
- **Use Shadow Passwords** - provides a very secure method of retaining passwords for you.

### Authentication Configuration

Enable **MD5** passwords

Enable **shadow** passwords

NIS **LDAP** **Kerberos 5** **SMB**

Enable **NIS**

NIS **D**omain:

Use **b**roadcast to find NIS server

NIS **S**erver:

Reading package information...

Hide **H**elp

Release **N**otes

**B**ack

**N**ext

# Default Package Group Selection



redhat.

Online Help

## Package Group Selection

Select the package (application) groups that you want to install. To select a package group, click on the check box beside it.

Once a package group has been selected, click on **Details** to view which packages will be installed by default and to add or remove optional packages from that group.

To select individual packages, check the **Select Individual Packages** box at the bottom of the screen.

Package Group Selection

### Desktops

**X Window System** [31/33] [Details](#)

Install this group of packages to use the base graphical (X) user interface.

**GNOME Desktop Environment** [35/35] [Details](#)

GNOME is a powerful, graphical user interface which includes a panel, desktop, system icons, and a graphical file manager.

**KDE Desktop Environment** [0/16]

KDE is a powerful, graphical user interface which includes a panel, desktop, system icons, and a graphical file manager.

### Applications

**Editors** [0/4]

Sometimes called text editors, these are programs that allow you to create and edit files. These include Emacs and Vi.

**Engineering and Scientific** [0/7]

This group includes packages for performing mathematical and scientific computations and plotting, as well as unit conversion.

Select individual packages

Total install size: 1,481M

Hide Help

Release Notes

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Next



redhat.

Online Help

## Package Group Selection

Select the package (application) groups that you want to install. To select a package group, click on the check box beside it.

Once a package group has been selected, click on **Details** to view which packages will be installed by default and to add or remove optional packages from that group.

To select individual packages, check the **Select Individual Packages** box at the bottom of the screen.

### Package Group Selection

applications.

#### System

- Administration Tools [0/11]  
 This group is a collection of graphical administration tools for the system, such as for managing user accounts and configuring system hardware.
- System Tools [0/13]  
 This group is a collection of various tools for the system, such as the client for connecting to SMB shares and tools to monitor network traffic.
- Printing Support [0/10]  
 Install these tools to enable the system to print or act as a print server.

#### Miscellaneous

- Minimal  
 Choose this group to get the minimal possible set of packages. Useful for creating small router/firewall boxes, for example.
- Everything**  
 This group includes all the packages available. Note that there are substantially more packages than just the ones in all the other package groups on this page.

Select individual packages Total install size: 4,849M

# Let's Pick Individual Packages to Add



Online Help

## Individual Package Selection

You can choose to view the individual packages in **tree view** or **flat view**.

**Tree view** allows you to see the packages grouped by application type.

**Flat view** allows you to see all of the packages in an alphabetical listing which will appear on the right of the screen.

Using **Tree view**, you will see a listing of package groups. When you expand this list and pick one group, the list of packages in that group will appear in the panel on the right.

Individual Package Selection

Tree View  Flat View

- ▼ All Packages
  - ▼ Amusements
    - Games
    - Graphics
  - ▼ Applications
    - Archiving
    - CPAN
    - Communications
    - Databases
    - Editors
    - Engineering
    - File
    - Internet
    - Multimedia
    - Productivity

Package	Size (MB)
---------	-----------

Total install size: 2,377M

Select all in group Unselect all in group

Hide Help Release Notes Back Next

# So Many Packages, So Little Time ...



Online Help

## Individual Package Selection

You can choose to view the individual packages in **tree view** or **flat view**.

**Tree view** allows you to see the packages grouped by application type.

**Flat view** allows you to see all of the packages in an alphabetical listing which will appear on the right of the screen.

Using **Tree view**, you will see a listing of package groups. When you expand this list and pick one group, the list of packages in that group will appear in the panel on the right.

Individual Package Selection

Tree View  Flat View

- ▼ All Packages
  - ▼ Amusements
    - Games
    - Graphics
  - ▼ Applications
    - Archiving
    - CPAN
    - Communications
    - Databases
    - Editors
    - Engineering
    - File
    - Internet
    - Multimedia
    - Productivity

Package	Size (MB)
<input checked="" type="checkbox"/> 4Suite	10
<input checked="" type="checkbox"/> a2ps	3
<input checked="" type="checkbox"/> <b>abiword</b>	12
<input type="checkbox"/> ac-archive	1
<input checked="" type="checkbox"/> acl	1
<input type="checkbox"/> adjtimex	1
<input checked="" type="checkbox"/> alchemist	1
<input type="checkbox"/> alchemist-devel	1
<input type="checkbox"/> amanda	1
<input type="checkbox"/> amanda-client	1
<input type="checkbox"/> amanda-devel	1
<input type="checkbox"/> amanda-server	1
<input type="checkbox"/> ami	1
<input type="checkbox"/> am-utils	1

Total install size: 2,377M

Select all in group    Unselect all in group

Package: abiword  
Version: 1.0.4  
AbiWord is a cross-platform, open-source word processor. AbiWord supports basic character formatting (bold, underline, italics), paragraph alignment, spell checking, importing Word97 and RTF documents, interactive rulers and tabs, styles, unlimited undo/redo, multiple column control, widow/orphan control, find and replace, and

Hide Help    Release Notes    Back    Next

# Adding a Package to the List



Individual Package Selection

Tree View Flat View

All Packages

- Amusements
  - Games
  - Graphics
- Applications
  - Archiving
  - CPAN
  - Communications
  - Databases
  - Editors
  - Engineering
  - File
  - Internet
  - Multimedia
  - Productivity

Package	Size (MB)
<input type="checkbox"/> gimp-print-cups	21
<input type="checkbox"/> gimp-print-devel	1
<input checked="" type="checkbox"/> gimp-print-plugin	1
<input checked="" type="checkbox"/> gimp-print-utils	1
<input checked="" type="checkbox"/> gkrellm	1
<input type="checkbox"/> glade	3
<input type="checkbox"/> glade2	3
<input type="checkbox"/> glib2-devel	4
<input type="checkbox"/> glibc-debug	50
<input checked="" type="checkbox"/> glibc-devel	6
<input checked="" type="checkbox"/> glibc-kernheaders	4
<input type="checkbox"/> glibc-profile	3
<input type="checkbox"/> glibc-utils	1
<input type="checkbox"/> glib-devel	1

Total install size: 2,379M

Select all in group Unselect all in group

Package: gkrellm  
Version: 2.1.5  
GKrellM charts SMP CPU, load, Disk, and all active net interfaces automatically. An on/off button and online timer for the PPP interface is provided. Monitors for memory and swap usage, file system, internet connections, APM laptop battery, mbox style mailboxes, and cpu temperatures are also included.

Hide Help Release Notes Back Next

# Ready to Install?



redhat.

Online Help

## About to Install

**Caution:** Once you click **Next**, the installation program will begin writing the operating system to the hard drive(s). This process cannot be undone. If you have decided not to continue with this installation, this is the last point at which you can safely abort the installation process.

To abort this installation, remove all installation media, and press your computer's Reset button or reset using **Control-Alt-Delete**.

About to Install



Click next to begin installation of Red Hat Linux.

A complete log of the installation can be found in the `/root/install.log` file after rebooting your system.

A kickstart file containing the installation options selected can be found in the `/root/anaconda-ks.cfg` file after rebooting the system.

 Hide Help

 Release Notes

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redhat.

Online Help

## Installing Packages

We have gathered all the information needed to install Red Hat Linux on the system. It may take a while to install everything, depending on how many packages need to be installed.

Installing Packages

Package:  
Size:  
Summary:

Package Progress:   
Total Progress:

Status	Packages	Size	Time
Total	0	0 M	0:00:00
Con	0	0 M	0:00:00
Ren	0	0 M	0:00:00

Formatting /var file system...

redhat.



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Online Help

## Installing Packages

We have gathered all the information needed to install Red Hat Linux on the system. It may take a while to install everything, depending on how many packages need to be installed.

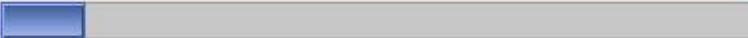
Installing Packages

Package: python-2.2.2-26

Size: 20,072 KBytes

Summary: An interpreted, interactive, object-oriented programming language.

Package Progress: 

Total Progress: 

Status	Packages	Size	Time
Total	668	2379 M	0:16:21
Completed	67	257 M	0:01:46
Remaining	601	2122 M	0:14:35

Hide Help

Release Notes

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redhat.

Online Help

## Boot Diskette Creation

To create a boot diskette, insert a blank diskette into your floppy drive, and click **Next** to continue.

Boot Diskette Creation

The boot diskette allows you to boot your Red Hat Linux system from a floppy diskette. A boot diskette allows you to boot your system in the event your bootloader configuration stops working, if you chose not to install a boot loader, or if your third-party boot loader does not support Linux.

It is highly recommended you create a boot diskette.

Yes, I would like to create a boot diskette

No, I do not want to create a boot diskette

Hide Help

Release Notes

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Next

# Always Create a Boot Disk, If Possible



The screenshot shows the 'Boot Diskette Creation' step in a Red Hat Linux installation. The main window has a red header with the Red Hat logo and 'redhat.' text. Below the header, there's an 'Online Help' section on the left and a 'Boot Diskette Creation' section on the right. The 'Online Help' section contains a title 'Boot Diskette Creation' and a paragraph: 'To create a boot diskette, insert a blank diskette into your floppy drive, and click **Next** to continue.' The 'Boot Diskette Creation' section contains a floppy disk icon and a paragraph: 'The boot diskette allows you to boot your Red Hat Linux system from a floppy diskette. A boot diskette allows you to boot your system in the event your bootloader configuration stops working, if you chose not to install a boot loader, or if your third-party boot loader does not support Linux.' A modal dialog box titled 'Insert a floppy disk' is overlaid on the main window. It features a question mark icon in a shield and the text: 'Please remove any diskettes from the floppy drive, and insert the floppy diskette that is to contain the boot disk.' Below this text, it says 'All data will be ERASED during creation of the boot disk.' At the bottom of the dialog are two buttons: 'Cancel' and 'Make boot disk'. The 'Make boot disk' button is highlighted with a dotted border. At the bottom of the main window, there are four buttons: 'Hide Help', 'Release Notes', 'Back', and 'Next'. The 'Next' button is highlighted with a green arrow.

redhat.

Online Help

## Boot Diskette Creation

To create a boot diskette, insert a blank diskette into your floppy drive, and click **Next** to continue.

Boot Diskette Creation



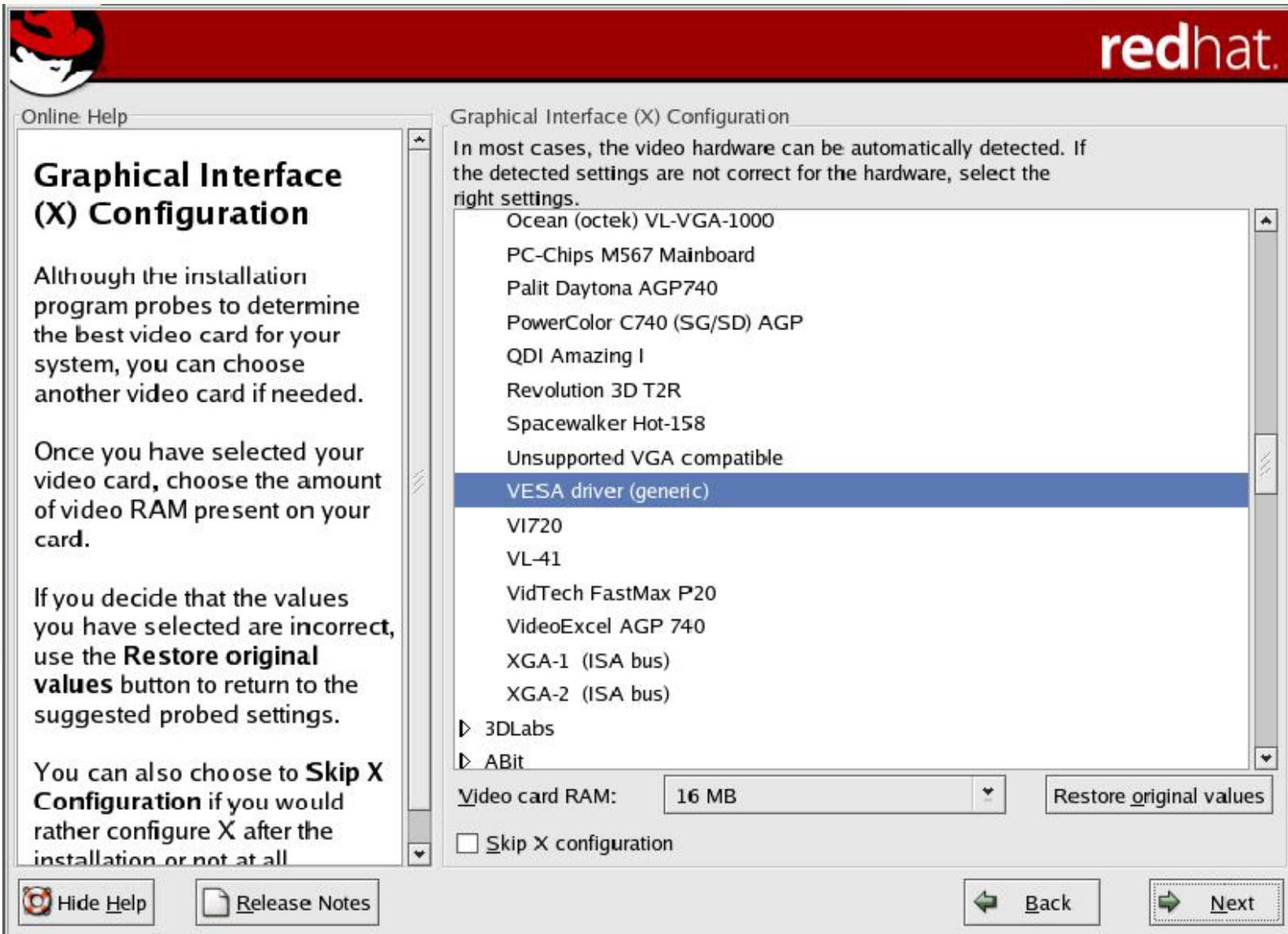
The boot diskette allows you to boot your Red Hat Linux system from a floppy diskette. A boot diskette allows you to boot your system in the event your bootloader configuration stops working, if you chose not to install a boot loader, or if your third-party boot loader does not support Linux.

### Insert a floppy disk

 Please remove any diskettes from the floppy drive, and insert the floppy diskette that is to contain the boot disk.

All data will be ERASED during creation of the boot disk.

# Setting Video Hardware Information



The screenshot shows a window titled "Graphical Interface (X) Configuration" with a red header bar containing the Red Hat logo and the word "redhat.". The window is divided into three main sections: a help pane on the left, a list of video hardware options in the center, and configuration controls at the bottom.

**Online Help**

## Graphical Interface (X) Configuration

Although the installation program probes to determine the best video card for your system, you can choose another video card if needed.

Once you have selected your video card, choose the amount of video RAM present on your card.

If you decide that the values you have selected are incorrect, use the **Restore original values** button to return to the suggested probed settings.

You can also choose to **Skip X Configuration** if you would rather configure X after the installation or not at all.

**Graphical Interface (X) Configuration**

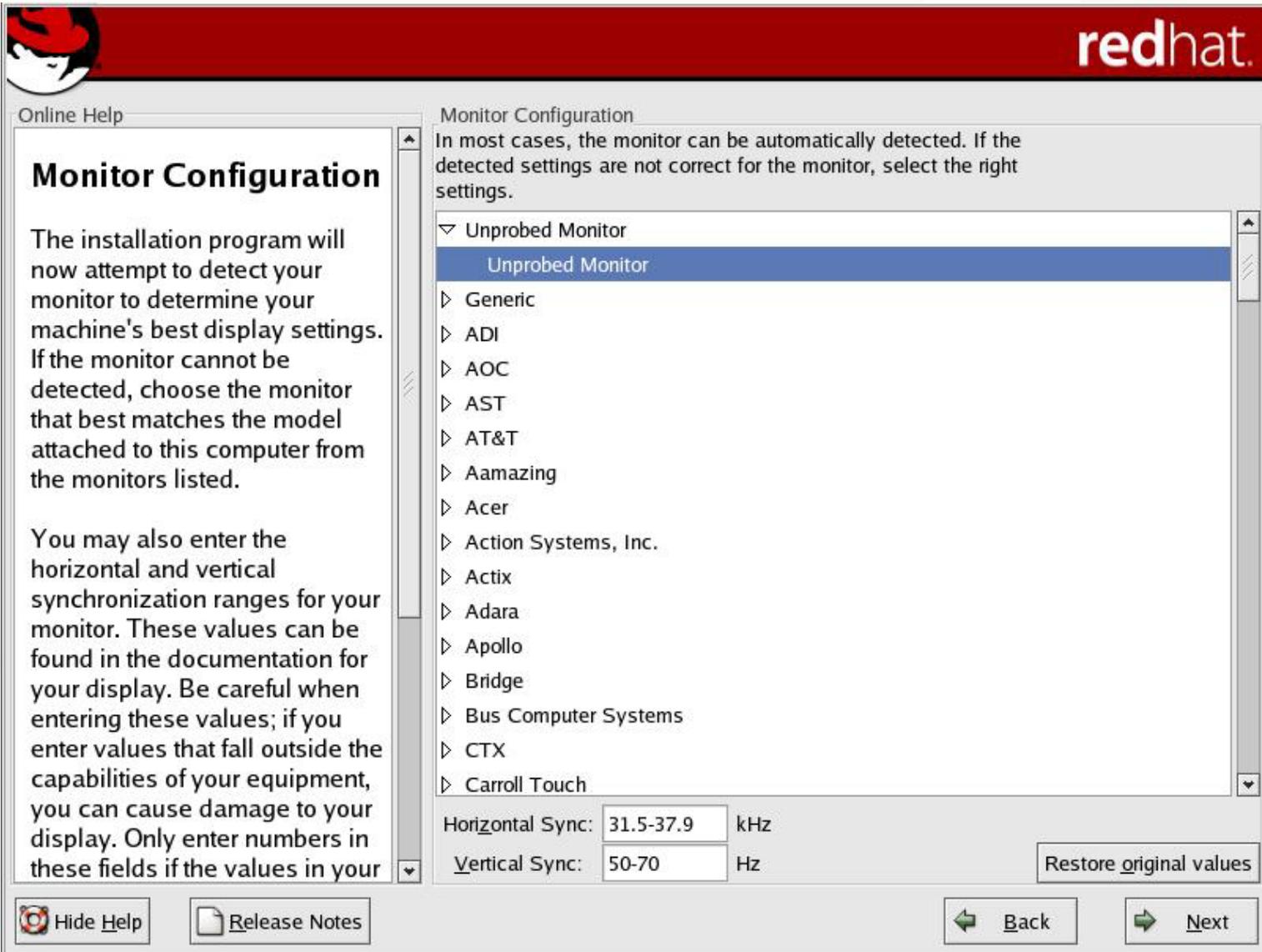
In most cases, the video hardware can be automatically detected. If the detected settings are not correct for the hardware, select the right settings.

- Ocean (octek) VL-VGA-1000
- PC-Chips M567 Mainboard
- Palit Daytona AGP740
- PowerColor C740 (SG/SD) AGP
- QDI Amazing I
- Revolution 3D T2R
- Spacewalker Hot-158
- Unsupported VGA compatible
- VESA driver (generic)**
- VI720
- VL-41
- VidTech FastMax P20
- VideoExcel AGP 740
- XGA-1 (ISA bus)
- XGA-2 (ISA bus)

▶ 3DLabs  
▶ ABit

Video card RAM: 16 MB

Skip X configuration



The screenshot shows the Red Hat Monitor Configuration window. The window has a red header with the Red Hat logo on the left and the text "redhat." on the right. Below the header, there is a "Monitor Configuration" section. On the left side, there is an "Online Help" pane with the title "Monitor Configuration" and two paragraphs of text. The main area of the window contains a list of monitor models under the heading "Unprobed Monitor". The list includes: Generic, ADI, AOC, AST, AT&T, Aamazing, Acer, Action Systems, Inc., Actix, Adara, Apollo, Bridge, Bus Computer Systems, CTX, and Carroll Touch. Below the list, there are two input fields: "Horizontal Sync: 31.5-37.9 kHz" and "Vertical Sync: 50-70 Hz". To the right of these fields is a button labeled "Restore original values". At the bottom of the window, there are four buttons: "Hide Help", "Release Notes", "Back", and "Next".

redhat.

Online Help

## Monitor Configuration

The installation program will now attempt to detect your monitor to determine your machine's best display settings. If the monitor cannot be detected, choose the monitor that best matches the model attached to this computer from the monitors listed.

You may also enter the horizontal and vertical synchronization ranges for your monitor. These values can be found in the documentation for your display. Be careful when entering these values; if you enter values that fall outside the capabilities of your equipment, you can cause damage to your display. Only enter numbers in these fields if the values in your

### Monitor Configuration

In most cases, the monitor can be automatically detected. If the detected settings are not correct for the monitor, select the right settings.

- Unprobed Monitor
- Generic
- ADI
- AOC
- AST
- AT&T
- Aamazing
- Acer
- Action Systems, Inc.
- Actix
- Adara
- Apollo
- Bridge
- Bus Computer Systems
- CTX
- Carroll Touch

Horizontal Sync: 31.5-37.9 kHz

Vertical Sync: 50-70 Hz

Restore original values

Hide Help Release Notes Back Next



**redhat.**

Online Help

## Customize Graphics Configuration

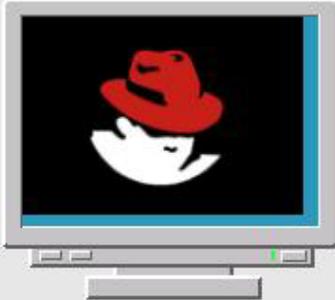
Choose the correct color depth and resolution for your X configuration.

**Color Depth** is the number of distinct colors that can be represented by a piece of hardware or software.

**Screen Resolution** is the the number of dots (pixels) on the entire screen.

You may also be able to choose whether you want to boot your system into a graphical or text environment once Red Hat Linux is installed. Unless you have special needs, booting into a graphical environment (similar to a

Customize Graphical Configuration



Color Depth: True Color (24 Bit) ▾

Screen Resolution: 800x600 ▾

Please choose your login type:

Graphical  Text

Hide Help Release Notes Back Next

# Whew! You're Finished – Well, Almost ...



Congratulations

Congratulations, the installation is complete.

Remove any installation media (diskettes or CD-ROMs) used during the installation.

If you created a boot diskette during this installation as your primary means of booting Red Hat Linux, insert it before rebooting your newly installed system.



For information on Errata (updates and bug fixes), visit:  
<http://www.redhat.com/errata/>

For information on automatic updates through Red Hat Network, visit:  
<http://rhn.redhat.com/>

For information on using and configuring the system, visit:  
<http://www.redhat.com/docs/>  
<http://www.redhat.com/apps/support/>

To register the product for support, visit:  
<http://www.redhat.com/apps/activate/>

Click 'Exit' to reboot the system.

Show Help   Release Notes   Back   Exit



- **Always make a boot disk!**
- GRUB is a good boot manager and replaces LILO ...
- GRUB understands file systems structure and is not dependent on offset like LILO (don't have to re-run it every change you make)
- Make a GRUB boot/installation disk, too!
- **Always make a boot disk!**
- You can place the /boot partition into a small partition on the first IDE/SCSI drive and still mount the Linux root partition from elsewhere
- Note that SCSI disk 0 has the LOWEST priority in the SCSI chain, so the PC BIOS has things a little backwards ...
- **Oh, and -- ALWAYS MAKE A BOOT DISK!**



# Lab #1: Installing Redhat Linux from CD-ROM

**See Lab #1 Handout  
for details**

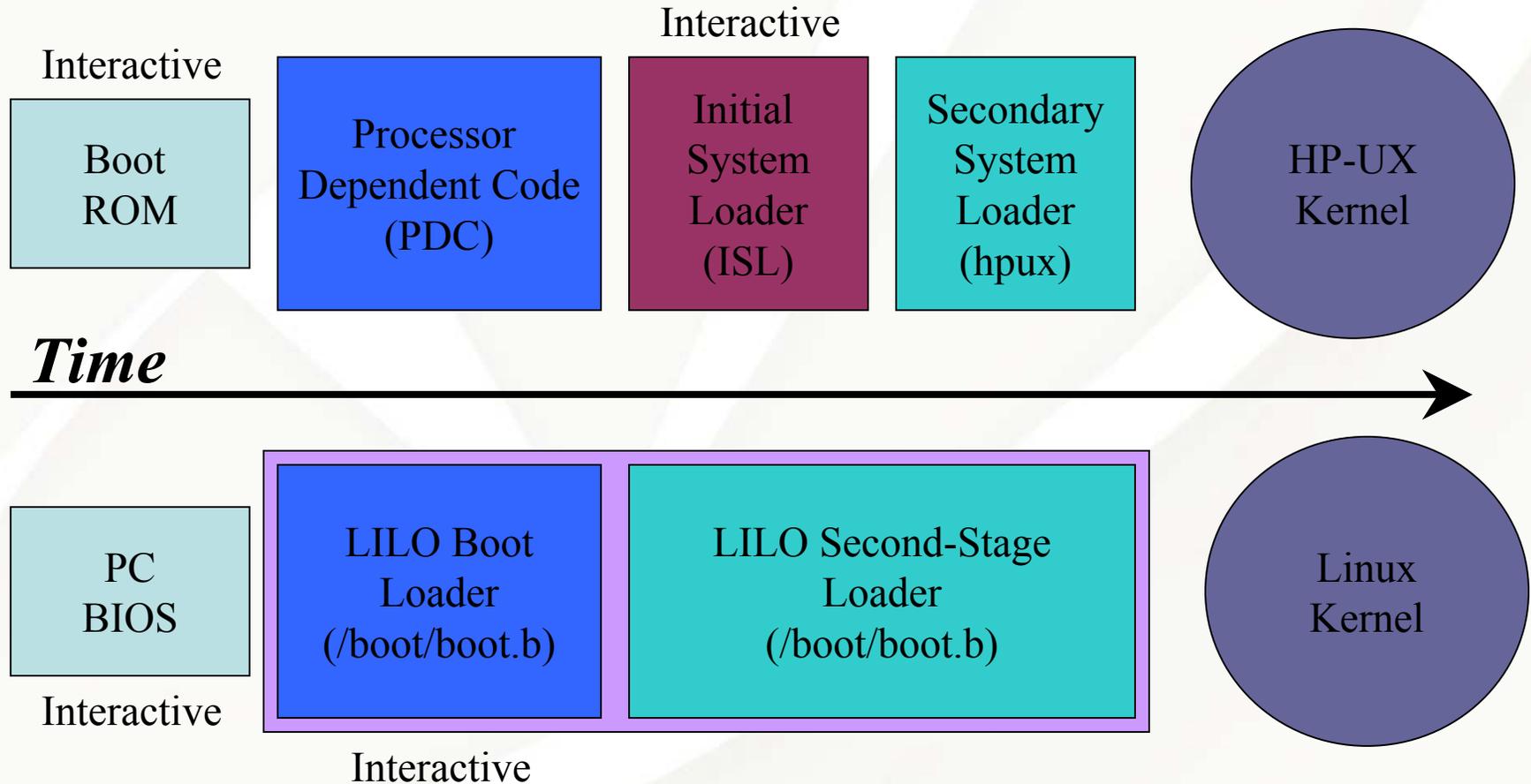


# Linux Boot Loaders

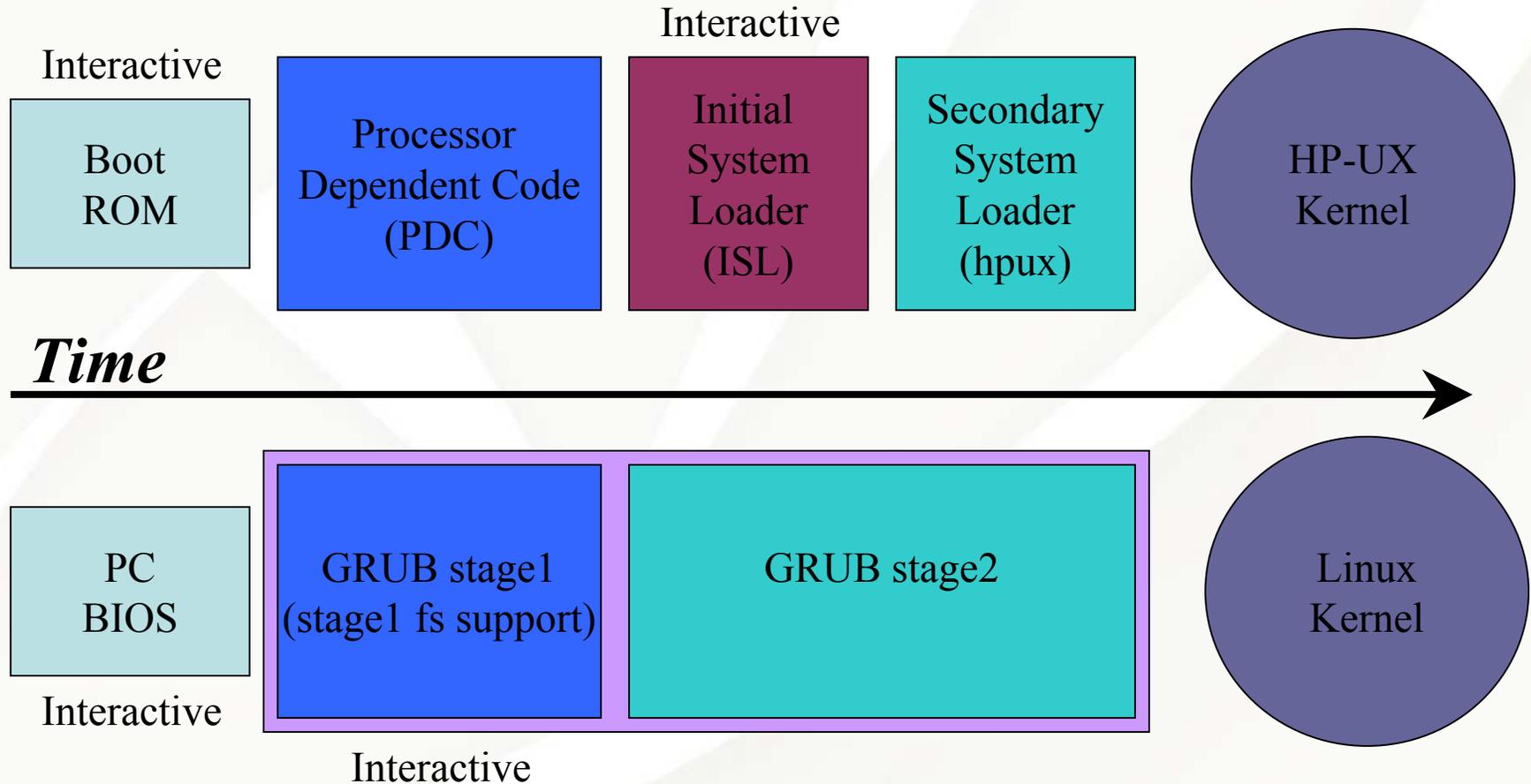
- LILO
- GRUB



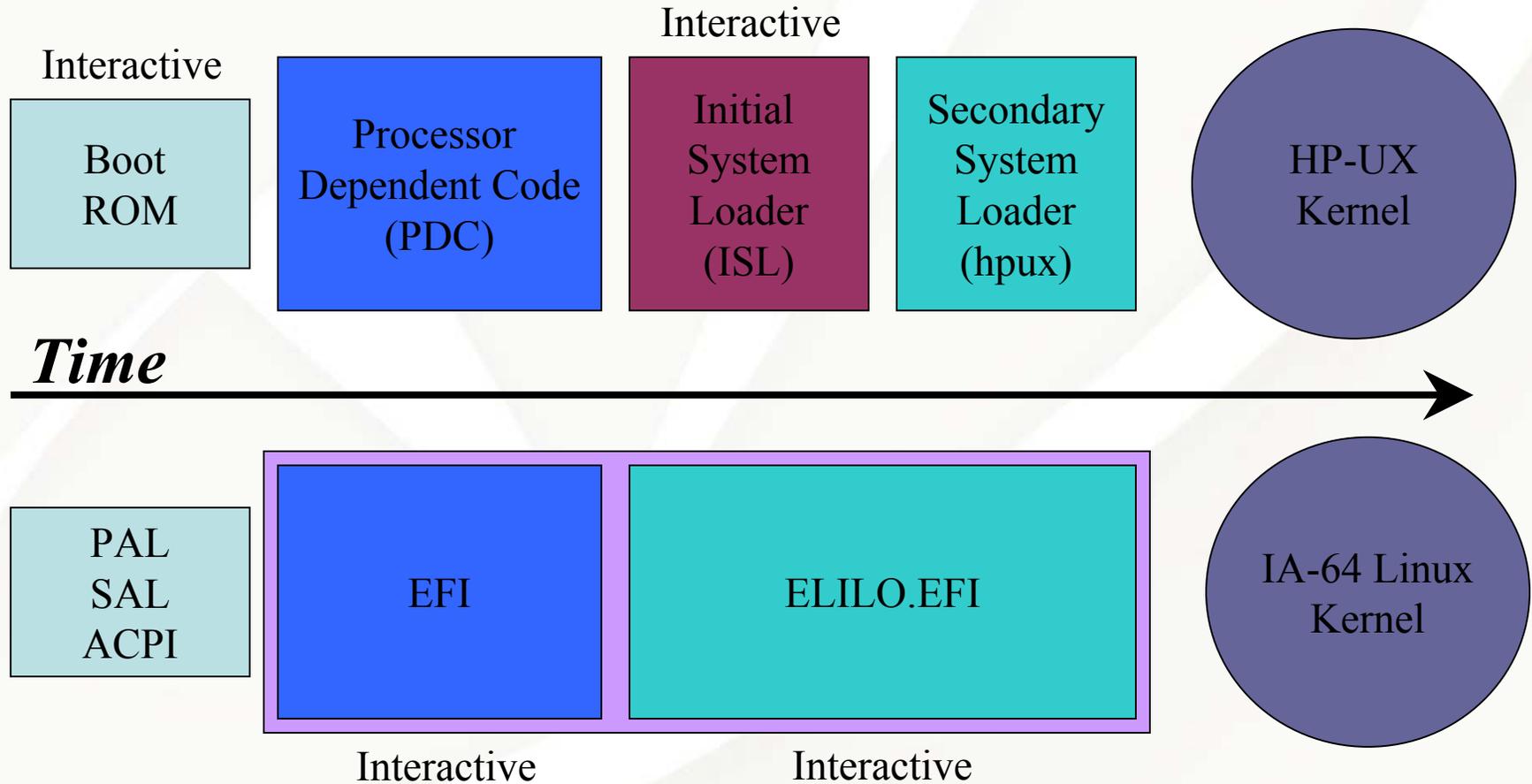
# Comparing LILO Boot Sequence to HP-UX



# Comparing GRUB Boot Sequence to HP-UX



# Comparing ELILO.EFI Boot Sequence to HP-UX





- **LILO is not the only way to boot a Linux system (thank goodness)**
  - a) **Other Linux boot managers (GRUB, bootactv, loadlin, etc.)**
  - b) **Commercially available boot managers (i.e. BootMagic, System Commander, etc.)**
  - c) **Windows NT/XP boot manager**
    1. **“dd if=/dev/hda of=/tmp/linux.bs bs=512 count=1”**
    2. **Move “linux.bs” to Windows NT “root” and configure into “boot.ini” file**
- **The important thing to remember: whatever boot manager is in control must be able to find and access the boot sector containing LILO’s loader**
- **If your system’s hard drive configuration does not meet the Linux booting requirements, then you can boot from a floppy disk**
- **If your system is ONLY Linux, then things are much simpler!**

# Example LILO configuration file



```
boot          = /dev/fd0          # Specify boot device
delay         = 10                # Wait 10 seconds
message = bootmessage           # Text prompt
read-only     # Mount root RO

label = linux_up                 # Uniprocessor
      image_ = vmlinuz-2.2.12-20
      initrd  = initrd-2.2.12-20.img
      root    = /dev/hda5

label = linux_smp                # Multi-processor
      image_ = vmlinuz-2.2.12-20smp
      initrd  = initrd-2.2.12-20smp.img
      root    = /dev/hda5

label = linux_old                # Last week's kernel
      image_ = vmlinuz_old
      initrd  = initrd-2.2.12-20old.img
      root    = /dev/hda5
```



- If properly configured, LILO will present you with a menu of kernels to boot.
- While booting, LILO outputs “L...l...L...O” if working properly. Where it stops is the only diagnostic you will get if something goes wrong. See documentation for LILO to determine where in the boot process things have gone awry.
- Type Ctrl-X to get a text-mode boot prompt
- In text-mode, the TAB key will display possible boot targets
- LILO can boot Windows systems as well as Linux systems
- Run LILO “lilo -v -v -t “ to see all output and TEST the configuration, if something is wrong your system may not boot (time for the boot floppy you made...)
- Be CAREFUL when running LILO, you can inadvertently overwrite the MBR on multi-boot systems when all you want to do is change the BR in the /boot partition!



- **When you update a kernel, you must re-run LILO**
- **You should uninstall LILO before “decommissioning” a system, especially if LILO is installed in the MBR**
- **The default configuration file for LILO is `/etc/lilo.conf`**
- **You can build a “mini” boot partition on a floppy, either by hand or using the `“/sbin/mkbootdisk”` command**
- **The LILO command may be run on a mounted disk by specifying the `“-r <directory>”` option, which will do a “chroot” to that directory**
- **Examine the “mkbootdisk” script for examples of what is needed to build a bootable floppy disk**
- **With the proper symbolic links and naming conventions, you can have a very flexible way to try new kernel configurations**



- **I personally prefer to avoid LILO at all cost**
- **LILO stores file system offset information about the kernel and configuration files in the boot sector, which means that \*any\* time you make a change to LILO or system configurations you must re-run LILO to update the boot sector information**
- **Forget to re-run LILO after changes and your system will be unbootable**
- **LILO also seems to be “resistant” to uninstalling itself from the MBR if you want to replace it ...**
- **MAKE A COPY OF YOUR MASTER BOOT RECORD BEFORE INSTALLING LILO (if multi-boot)!**
  - **`dd if=/dev/hda of=/tmp/boots.orig bs=512 count=1`**



- **`/usr/share/grub/i386-redhat` contains the “raw” GRUB installation files**
- **`/boot/grub` contains grub boot files, including `grub.conf` and the files that provide file-system support**
- **> “info grub” will invoke complete documentation for grub, including installation instructions and examples (using “info” takes some getting used to, it is EMACS in disguise)**
- **GRUB supports `ext2`, `ext3`, `xf`s, `reiserfs`, `fat`, `minix`, `jfs`, `vstafs`, `ffs`**
- **More on GRUB coming up ...**



- You can make a **GRUB** boot disk that will allow you to boot any supported system from the floppy in the event of an emergency
- The **GRUB** files are in `/usr/share/grub/redhat-i386`
- To make a boot disk:
  - a) Make sure the floppy is not write-protected
  - b) All data on the floppy will be destroyed by this process!
  - c) `cd /usr/share/grub/redhat-i386`
  - d) `dd if=stage1 of=/dev/fd0 bs=512 count=1`
  - e) `dd if=stage2 of=/dev/fd0 bs=512 seek=1`



- **/boot/grub/grub.conf is the configuration file location**
- **An example from one of my systems:**

```
# grub.conf generated by anaconda
# Note that you do not have to rerun grub after making changes to this file
# NOTICE: You have a /boot partition. This means that
#     all kernel and initrd paths are relative to /boot/, eg.

#boot=/dev/hdc
default=1
timeout=10
splashimage=(hd0,0)/grub/splash.xpm.gz
title Red Hat Linux (2.4.20-18.9)
    root (hd0,0)
    kernel /vmlinuz-2.4.20-18.9 ro root=LABEL=/ hda=ide-scsi
    initrd /initrd-2.4.20-18.9.img
title Red Hat Linux (2.4.20-13.9)
    root (hd0,0)
    kernel /vmlinuz-2.4.20-13.9 ro root=LABEL=/ hda=ide-scsi
    initrd /initrd-2.4.20-13.9.img
```

# Grub Boot Screen



```
GRUB version 0.93 (638K lower / 391104K upper memory)
```

```
Red Hat Linux (2.4.20-6)
```

Use the ↑ and ↓ keys to select which entry is highlighted.  
Press enter to boot the selected OS, 'e' to edit the  
commands before booting, 'a' to modify the kernel arguments  
before booting, or 'c' for a command-line.



# Grub Edit Screen (type "e" to enter)



```
GRUB version 0.93 (638K lower / 391104K upper memory)
```

```
root (hd0,0)
kernel /vmlinuz-2.4.20-6 ro root=LABEL=/ hda=ide-scsi
initrd /initrd-2.4.20-6.img
```

Use the ↑ and ↓ keys to select which entry is highlighted. Press 'b' to boot, 'e' to edit the selected command in the boot sequence, 'c' for a command-line, 'o' to open a new line after ('O' for before) the selected line, 'd' to remove the selected line, or escape to go back to the main menu.



# Editing GRUB Kernel Definition for Single-User Mode



```
[ Minimal BASH-like line editing is supported. For the first word, TAB
  lists possible command completions. Anywhere else TAB lists the possible
  completions of a device/filename. ESC at any time cancels. ENTER
  at any time accepts your changes.]
```

```
grub edit> kernel /vmlinuz-2.4.20-6 ro root=LABEL=/ hda=ide-scsi single
```



# Finishing the GRUB Edit (type <CR> to return)



```
GRUB version 0.93 (638K lower / 391104K upper memory)
```

```
root (hd0,0)
kernel /vmlinuz-2.4.20-6 ro root=LABEL=/ hda=ide-scsi single
initrd /initrd-2.4.20-6.img
```

Use the ↑ and ↓ keys to select which entry is highlighted. Press 'b' to boot, 'e' to edit the selected command in the boot sequence, 'c' for a command-line, 'o' to open a new line after ('O' for before) the selected line, 'd' to remove the selected line, or escape to go back to the main menu.



# Possible GRUB Commands (type <TAB> to list)



```
grub>
Possible commands are: background blacklist boot cat chainloader clear cmp color
r configfile debug displayapm displaymem embed find foreground fstest geometry h
alt help hide impsprobe initrd install ioprobe kernel lock makeactive map md5cry
pt module modulenounzip pager partnew parttype password pause read reboot root r
ootnoverify savedefault serial setkey setup splashimage terminal terminfo testlo
ad testube unhide uppermem vbeprobe

grub> █
```



# Getting GRUB Help



```
grub> help
background RRGGBB
boot
chainloader [--force] FILE
color NORMAL [HIGHLIGHT]
displayapm
find FILENAME
geometry DRIVE [CYLINDER HEAD SECTOR [
help [--all] [PATTERN ...]
initrd FILE [ARG ...]
makeactive
md5crypt
modulenounzip FILE [ARG ...]
partnew PART TYPE START LEN
reboot
rootnoverify [DEVICE [HDBIAS]]
setkey [TO_KEY FROM_KEY]
splashimage FILE
terminfo [--name=NAME --cursor-address
unhide PARTITION
ubeprobe [MODE]

blocklist FILE
cat FILE
clear
configfile FILE
displaymem
foreground RRGGBB
halt [--no-apm]
hide PARTITION
kernel [--no-mem-option] [--type=TYPE]
map TO_DRIVE FROM_DRIVE
module FILE [ARG ...]
pager [FLAG]
parttype PART TYPE
root [DEVICE [HDBIAS]]
serial [--unit=UNIT] [--port=PORT] [--
setup [--prefix=DIR] [--stage2=STAGE2_
terminal [--dumb] [--no-echo] [--no-ed
testvbe MODE
uppermem KBYTES
```

grub> █



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# Using GRUB From A Boot Disk



```
grub> geometry (hd1)
```

```
Error 21: Selected disk does not exist
```

```
grub> geometry (hd0)
```

```
drive 0x80: C/H/S = 522/255/63, The number of sectors = 8385930, CHS  
Partition num: 0, Filesystem type is ext2fs, partition type 0x83  
Partition num: 1, Filesystem type is ext2fs, partition type 0x83  
Partition num: 2, Filesystem type is ext2fs, partition type 0x83  
Partition num: 4, Filesystem type unknown, partition type 0x82
```

```
grub> root (hd0)
```

```
Filesystem type unknown, using whole disk
```

```
grub> find /grub/grub.conf  
(hd0,0)
```

```
grub> root (hd0,0)
```

```
Filesystem type is ext2fs, partition type 0x83
```

```
grub> configfile /grub/grub.conf
```



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# Ready To Boot (type "b" )



```
GRUB version 0.93 (638K lower / 391104K upper memory)
```

```
Red Hat Linux (2.4.20-6)
```

Use the ↑ and ↓ keys to select which entry is highlighted.  
Press enter to boot the selected OS, 'e' to edit the  
commands before booting, 'a' to modify the kernel arguments  
before booting, or 'c' for a command-line.



# Sample grub.conf File from Dual-boot System



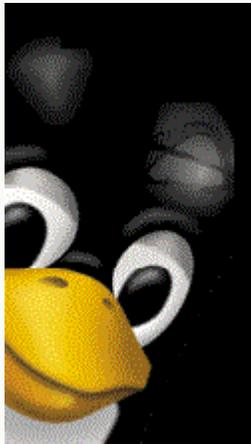
```
# grub.conf generated by anaconda
#
# Note that you do not have to rerun grub after making changes to this file
# NOTICE: You have a /boot partition. This means that
#     all kernel and initrd paths are relative to /boot/, eg.

#boot=/dev/sda
default=2
timeout=10
splashimage=(hd0,2)/grub/splash.xpm.gz
title Red Hat Linux (2.4.20-18.9smp)
    root (hd0,2)
    kernel /vmlinuz-2.4.20-18.9smp ro root=LABEL=/ hda=ide-scsi hdb=ide-scsi
    initrd /initrd-2.4.20-18.9smp.img
title Red Hat Linux (2.4.20-18.9)
    root (hd0,2)
    kernel /vmlinuz-2.4.20-18.9 ro root=LABEL=/ hda=ide-scsi hdb=ide-scsi
    initrd /initrd-2.4.20-18.9.img
title WindowsXP
    rootnoverify (hd0,0)
    chainloader +1
```



# Linux Booting and System Start-up

- Passing Kernel Parameters
- Modifying Kernel Settings
- The /boot Directory
- What's In An initrd.img?
- Run-levels and Start-up
- Enabling Services
- Starting and Stopping Services







- **kernel /vmlinuz-2.4.20-18.9 ro root=LABEL=/  
hda=ide-scsi hdb=ide-scsi**
- **linux ks=ks.cfg**
- **linux console=ttyS00,9600**
- **linux mem=128M**
- **linux nfsroot=192.168.0.102:/shared-roots**
- **linux nosmp**
- **linux maxcpus=4**



- The “*sysctl*” command may be used to set or examine the parameters that affect system behavior, either at boot or “real-time”
- “*sysctl -a*” List all parameters
- “*sysctl -w <parameter>=<value>*” Set a parameter
- “*sysctl -p [<file>]*” Load from file or */etc/sysctl.conf*
- Many drivers and modules also allow setting values through the */proc* file system:

```
echo “213458” > /proc/sys/net/core/rmem_default  
echo “546789” > /proc/sys/net/core/rmem_max
```

changes the default socket buffer memory pool size and maximum size, respectively, for all sockets on the system.

# Listing Parameters with the “sysctl” Command



```
> sysctl -a
```

```
[...]
```

```
net.core.rmem_default = 65535  
net.core.wmem_default = 65535  
net.core.rmem_max = 65535  
net.core.wmem_max = 65535  
vm.max-readahead = 127  
vm.min-readahead = 3  
vm.max_map_count = 65536  
vm.page-cluster = 3  
vm.pagetable_cache = 25 50  
vm.kswapd = 512 32 8  
vm.overcommit_memory = 0  
vm.bdflush = 40 0 0 0 500 3000 60 0  
0  
vm.freepages = 1055 2304 3072  
kernel.overflowgid = 65534  
kernel.overflowuid = 65534
```

```
[...]
```

# The /boot Directory Contents



<b>boot.b</b>	← <b>Boot sector</b>
<b>chain.b</b>	← <b>Chain loader</b>
<b>config-2.4.20-18.9</b>	← <b>Kernel configuration answers</b>
<b>grub</b>	← <b>Grub boot loader directory</b>
<b>initrd-2.4.20-18.9.img</b>	← <b>Kernel initial RAM disk image</b>
<b>kernel.h</b>	← <b>Kernel header file (made at boot)</b>
<b>message</b>	← <b>Boot message (English)</b>
<b>message.ja</b>	← <b>Boot message (Japanese)</b>
<b>module-info</b>	← <b>Link to current module-info</b>
<b>module-info-2.4.20-18.9</b>	← <b>Kernel module loading info</b>
<b>os2_d.b</b>	← <b>Boot for OS2</b>
<b>System.map</b>	← <b>Link to current system map</b>
<b>System.map-2.4.20-18.9</b>	← <b>Kernel symbols and addresses</b>
<b>vmlinuz</b>	← <b>Link to current kernel</b>
<b>vmlinuz-2.4.20-18.9</b>	← <b>Compressed Linux kernel</b>

# The /boot/grub Directory Contents



**device.map**

← **Grub to linux device map (hd0->hdc)**

**e2fs\_stage1\_5**

← **Stage 1 loader for EFS**

**fat\_stage1\_5**

← **Stage 1 loader for FAT**

**ffs\_stage1\_5**

← **Stage 1 loader for FFS**

**grub.conf**

← **Grub configuration file**

**jfs\_stage1\_5**

← **Stage 1 loader for JFS**

**menu.lst**

← **Link to grub.conf**

**minix\_stage1\_5**

← **Stage 1 loader for Minix file system**

**reiserfs\_stage1\_5**

← **Stage 1 loader for ReiserFs**

**splash.xpm.gz**

← **Compressed bitmap background**

**stage1**

← **Grub stage 1**

**stage2**

← **Grub stage 2**

**vstafs\_stage1\_5**

← **Stage 1 loader for VstaFs**

**xfs\_stage1\_5**

← **Stage 1 loader for XFS**

# What's In An "initrd.img" File?



- **The initial RAM disk image file contains startup information for the kernel, which may include the dynamic modules needed to access the local hard disk, or ethernet drivers for a diskless system**
- **This situation occurs when the necessary drivers are not built into the kernel, instead they must be dynamically loaded from the disk**
- **As you may see, it is a classic “Chicken or egg” problem or Catch-22: You cannot access the disk until the drivers that are on the disk are loaded**
- **So, instead of building all potentially necessary drivers into the kernel and making it huge, the initial RAM disk allows the kernel to get to the subset of dynamic modules that it needs during boot**
- **After the initial startup is complete, the kernel unmounts the initial RAM disk and “switches” the root file system to the hard disk.**



- ***cp initrd.2.4.20-18.9.img /tmp***
- ***gunzip < /tmp/initrd.2.4.20.18.9 > /tmp/initrd***
- ***mkdir /tmp/image***
- ***losetup /dev/loop0 /tmp/initrd***
- ***mount -o loop /tmp/initrd /tmp/image***
- ***cd /tmp/image***
- **<Take a look around, particularly at “linuxrc”>**
- ***cd /tmp***
- ***umount /tmp/image***
- ***losetup -d /dev/loop0***
- ***rmdir /tmp/image; rm /tmp/initrd.2.4.20-18.9.img /tmp/initrd***
- **If you look carefully, you can see the point in the boot process where the kernel unmounts the initrd and switches to the hard drive (see “dmesg” or */var/log/messages* or console output)**



## HP-UX Startup

- The world starts with “init”
- */etc/rc.config.d* contains startup data
- */etc/rc* script performs system startup
- */etc* contains startup directories *init.d* and *rc\*.d*
- */sbin/init.d* contains scripts that are linked into */sbin/rc\*.d*
- Each run level has an associated directory that contains startup and shutdown links for each subsystem
- The directory for each intervening run-level is “executed” on run-level change

## Linux Startup

- The world starts with “init”
- */etc/sysconfig* and scripts contain startup data
- */etc/rc.sysinit*, */etc/rc*, and */etc/rc.local* perform startup
- */etc/init.d* and */etc/rc\*.d* are linked into */etc/rc.d/*
- */etc/rc.d/init.d* contains scripts that are linked into */etc/rc\*.d*
- Each run level has an associated directory that contains startup and shutdown links for each subsystem
- Only the directory for the current run-level is “executed” when run-levels are changed



## HP-UX Init run-levels:

0	halt
1	Single-user mode
2	Full multi-user
3	X11
4	Unused

- The “init:3:initdefault:” line in /etc/inittab controls the default level
- The “who -r” command returns the current value of init’s run-level
- No shell information about run-level is available by default
- “init <level>” will change the run level

## Linux Init run-levels:

0	halt
1	Single-user mode
2	Multi-user without NFS
3	Full multi-user
4	Unused
5	X11
6	Reboot

- The “id:5:initdefault:” line in /etc/inittab controls default level
- The “runlevel” command returns previous level and current level (N=none) “N 5”
- Run-level information is available in two shell environment variables: \${RUNLEVEL} and \${PREVLEVEL}
- “init <level>” will change the run level



```
id:5:initdefault:
```

```
# System initialization.
```

```
si::sysinit:/etc/rc.d/rc.sysinit
```

```
l0:0:wait:/etc/rc.d/rc 0
```

```
l1:1:wait:/etc/rc.d/rc 1
```

```
l2:2:wait:/etc/rc.d/rc 2
```

```
l3:3:wait:/etc/rc.d/rc 3
```

```
l4:4:wait:/etc/rc.d/rc 4
```

```
l5:5:wait:/etc/rc.d/rc 5
```

```
l6:6:wait:/etc/rc.d/rc 6
```

```
# Trap CTRL-ALT-DELETE
```

```
ca::ctrlaltdel:/sbin/shutdown -t3 -r \
    now
```

```
pf::powerfail:/sbin/shutdown -f -h +2 \
    "Power Failure; System Shutting \
    Down"
```

```
# If power was restored before the
# shutdown kicked in, cancel it.
```

```
pr:12345:powerokwait:\
    /sbin/shutdown \
    -c "Power Restored; Shutdown \
    Cancelled"
```

```
# Run gettys in standard runlevels
```

```
1:2345:respawn:/sbin/mingetty tty1
```

```
2:2345:respawn:/sbin/mingetty tty2
```

```
3:2345:respawn:/sbin/mingetty tty3
```

```
4:2345:respawn:/sbin/mingetty tty4
```

```
5:2345:respawn:/sbin/mingetty tty5
```

```
6:2345:respawn:/sbin/mingetty tty6
```

```
# Run xdm in runlevel 5
```

```
x:5:respawn:/etc/X11/prefdm \
    -nodaemon
```

# The Redhat “chkconfig” Command



- Each file in */etc/init.d* may contain a special comment line that resembles:

```
# chkconfig: 2345 80 30
```

like this one from the */etc/init.d/sendmail* file.

- This comment tells the “*chkconfig*” command how to enable the associated service.
- “*chkconfig*” will create links in runlevels 2, 3, 4, and 5 with S80sendmail and K30sendmail (Start and Kill)
- “*chkconfig sendmail on*” will create the links but not start the service
- “*chkconfig sendmail off*” will remove the links but not stop the service
- “*chkconfig --list*” will show all services and their status, including services handled by xinetd
- If you don’t see a service listed, but the *chkconfig* information is in the */etc/init.d/<service>* file, try “*chkconfig --add <service>*”
- “*chkconfig --list sendmail*” will show a status line like (on, off):

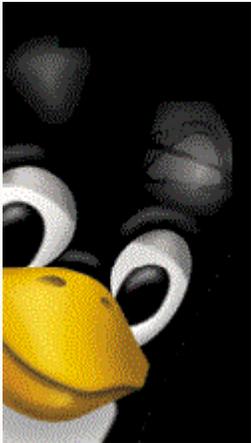
sendmail	0:off	1:off	2:on	3:off	4:off	5:off	6:off
sendmail	0:off	1:off	2:on	3:on	4:on	5:on	6:off



- The “*service*” command will start, stop, or restart a service.
- “*service --status-all*” will return the current status of all services (may take a while ...)
- “*service <service> stop*” will stop the service
- “*service <service> start*” will start the service
- Note: */var/run* has files containing PIDs for running processes, so commands like:  
  
    **kill -SIGHUP \$( < /var/run/<service>.pid)**  
  
will kill the service associated with the .pid file
- “*service <service> restart*” will stop and then start the service
- Neat, huh? Wish that HP-UX did this? 8^)



# Hardware Configuration and Trouble- shooting



- Output From Dmesg
- Kudzu and Hardware Detection
- Listing PCI Devices
- The /proc Filesystem
- XFree86 Logs
- The System Log File
- Network Interface Status



- Linux supports quite a bit of common hardware and some off-brand chips, but not everything is -always- supported
- Whenever something does not get detected, the first step is to find out what is there
- For PCI cards and adapters, “*lspci*” will display devices
- For ISA cards, “*pnpdump*” will display plug-and-play devices on the system – Most systems today do not have ISA slots or cards
- The “*dmesg*” command and */var/log/messages* will display the hardware discovery process during boot
- The “*kudzu*” command is used at boot to discover new devices, you can also run it interactively (see */etc/sysconfig/hwconf*)
- The */proc* file system can also be a help in determining what Linux has and has not discovered (CPU, RAM, SCSI, USB, etc.)

# Output From “dmesg” Command (in /var/log/dmesg)



```
Linux version 2.4.20-13.9 (bhcompile@porky.devel.redhat.com) (gcc version 3.2.2 20030222 \
  (Red Hat Linux 3.2.2-5)) #1 Mon May 12 10:55:37 EDT 2003
BIOS-provided physical RAM map:
BIOS-e820: 0000000000000000 - 000000000009f800 (usable)
BIOS-e820: 000000000009f800 - 00000000000a0000 (reserved)
BIOS-e820: 00000000000e6c00 - 0000000000100000 (reserved)
BIOS-e820: 0000000000100000 - 000000001fef0000 (usable)
BIOS-e820: 000000001fef0000 - 000000001feffc00 (ACPI data)
BIOS-e820: 000000001feffc00 - 000000001ff00000 (ACPI NVS)
BIOS-e820: 000000001ff00000 - 0000000020000000 (reserved)
BIOS-e820: 00000000fff00000 - 0000000100000000 (reserved)
0MB HIGHMEM available.
510MB LOWMEM available.
On node 0 totalpages: 130800
zone(0): 4096 pages.
zone(1): 126704 pages.
zone(2): 0 pages.
Kernel command line: ro root=LABEL=/ hda=ide-scsi
ide_setup: hda=ide-scsi
Initializing CPU#0
Detected 731.117 MHz processor.
Console: colour VGA+ 80x25
Calibrating delay loop... 1458.17 BogoMIPS
Memory: 510204k/523200k available (1355k kernel code, 10432k reserved, 1004k data, 132k init,
  0k highmem)
[...]
```



- **The `/etc/rc.sysinit` file saves a copy of the `dmesg` output in `/var/log/dmesg`**
- **This can be very useful as the `dmesg` buffer is circular: as messages are added to it, the earliest messages disappear**
- **The `/var/log/dmesg` file contains information that can help you troubleshoot the system startup:**
  - **Which drives and partitions are available**
  - **What disk (IDE or SCSI) interfaces were found**
  - **Information about what memory was found**
- **This is a feature that has been on Redhat Linux for quite a while**

# The “kudzu” Configured Hardware Database



```
-  
class: VIDEO  
bus: PCI  
detached: 0  
driver: Card: Intel 810  
desc: "Intel Corp.[82810 CGC [Chipset Graphics  
Controller]"  
vendorId: 8086  
deviceId: 7121  
subVendorId: 8086  
subDevicId: 7121  
pciType: 1  
-  
class: OTHER  
bus: PCI  
detached: 0  
driver: agpgart  
desc: "Intel Corp.[82810 GMCH [Graphics Memory  
Controller Hub]"  
vendorId: 8086  
deviceId: 7120  
subVendorId: 0000  
subDevicId: 0000  
pciType: 1  
-
```

- The information in the kudzu database, */usr/sysconfig/hwconf*, can be helpful in tracking down issues
- The “vendorId” and “deviceId” values are used to identify hardware devices in */usr/share/hwdata/pcitable* entries
- Any device that is not found in the *pcitable* file will show up as “Unknown” and will not have a module loaded for it

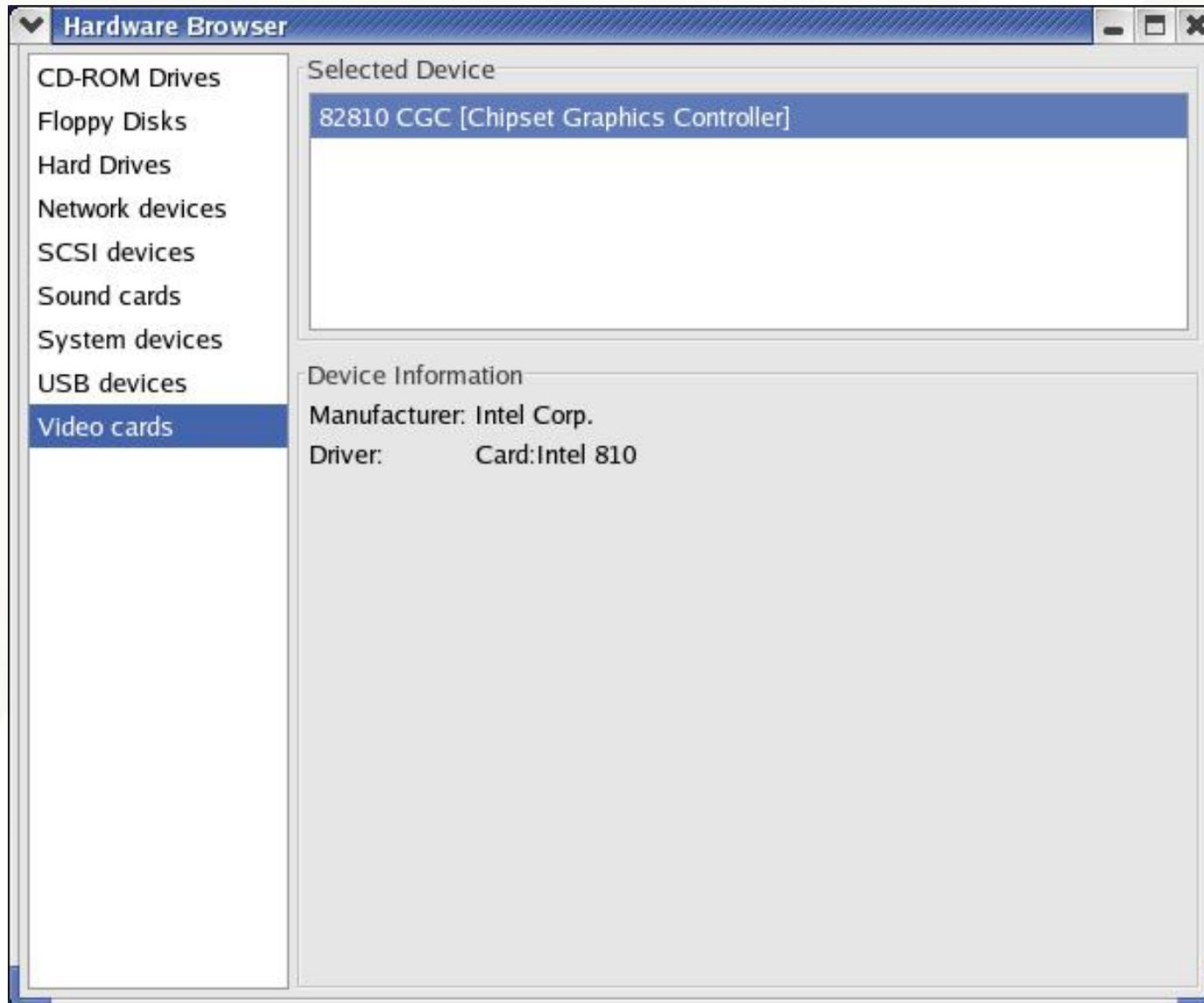
- Example for Intel 810 Video:

```
0x8086 0x7120 "agpgart" "Intel Corp.[82810 GMCH \  
[Graphics Memory Controller Hub]"
```

- The state of the hardware scan is kept in */etc/sysconfig/hwconf*, */etc/modules.conf*, and in */etc/sysconfig/ifcfg-\** files
- The */boot/module-info* file is also involved in matching the device to the module that drives it
- Example from *module-info*:

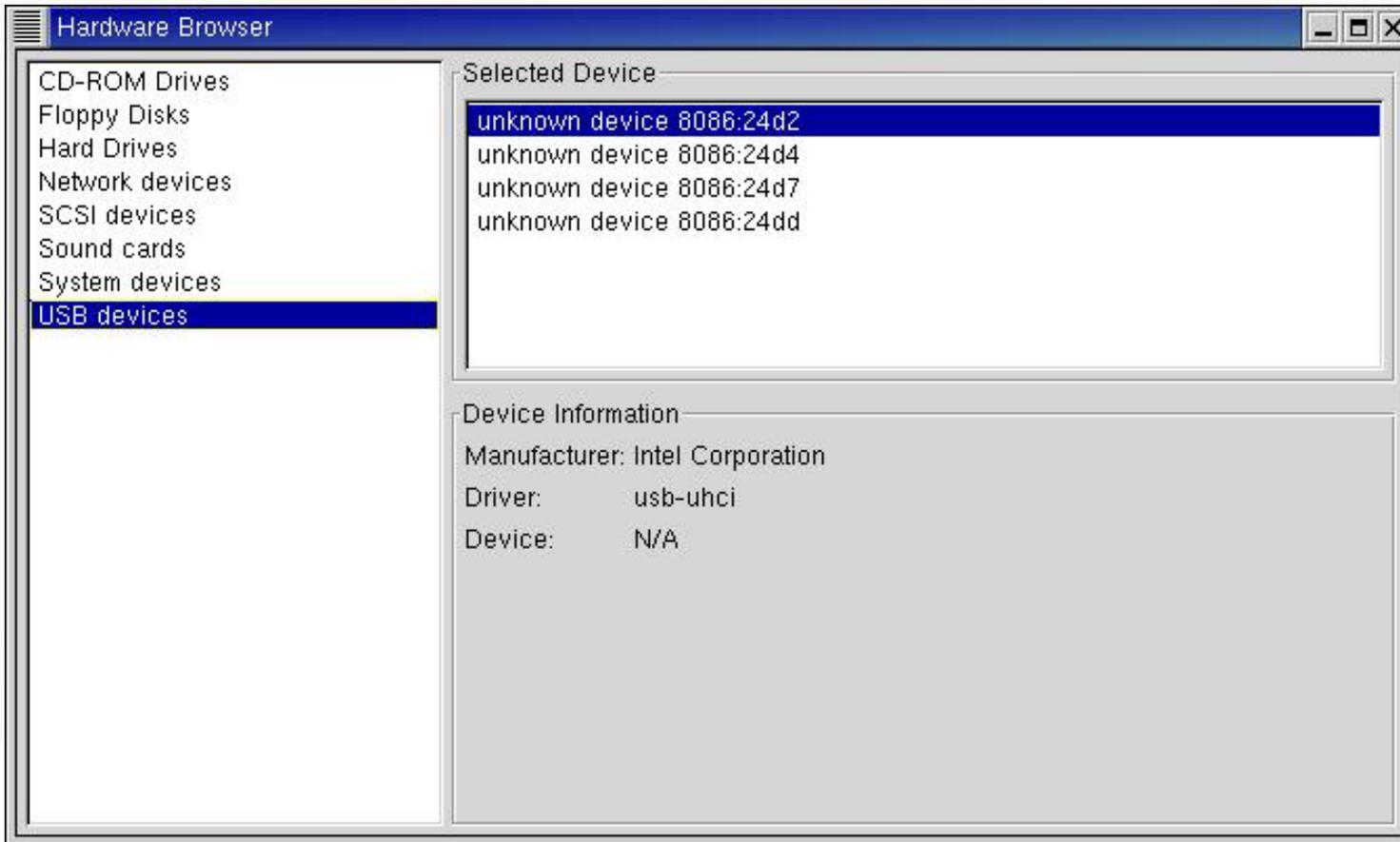
```
agpart  
video  
"Intel i810 Graphics Controller"
```

# Using the “hwbrowser” Application



Here's our Intel graphics controller showing up in the hardware browser

# Now An Unknown Hardware Device ...



We know this is an Intel device because the “vendorId” is 0x8086, but the system does not recognize it. This is a USB2.0 chipset running on a Redhat 7.2 version that does not support the device. At least we can figure out what is happening ... eventually

# The “lspci” Command



***#lspci***

**00:00.0 Host bridge: Intel Corp. 82810 GMCH [Graphics Memory Controller Hub] (rev 03)**

**00:01.0 VGA compatible controller: Intel Corp. 82810 CGC [Chipset Graphics Controller] (rev 03)**

**00:1e.0 PCI bridge: Intel Corp. 82801AA PCI Bridge (rev 02)**

**00:1f.0 ISA bridge: Intel Corp. 82801AA ISA Bridge (LPC) (rev 02)**

**00:1f.1 IDE interface: Intel Corp. 82801AA IDE (rev 02)**

**00:1f.2 USB Controller: Intel Corp. 82801AA USB (rev 02)**

**00:1f.3 SMBus: Intel Corp. 82801AA SMBus (rev 02)**

**00:1f.5 Multimedia audio controller: Intel Corp. 82801AA AC'97 Audio (rev 02)**

**01:0b.0 SCSI storage controller: Adaptec AHA-7850 (rev 03)**

**01:0d.0 Ethernet controller: Accton Technology Corporation SMC2-1211TX (rev 10)**

**01:0e.0 Communication controller: Lucent Microelectronics LT WinModem**



- **At first, the */proc* file system is a little, er, opaque and seems like magic**
- **It is a directory hierarchy that communicates with the kernel and modules**
- **This is not too much different than having a device file like */dev/ttyS0* invoke the serial port driver and communicate with the physical hardware device**
- **The kernel and modules will register with the */proc* file system if they support reads, writes, or both**
- ***/proc* is one of the most useful system administration tools when it comes to what the system is doing**
- **Many of the tools on Linux (i.e. top, gkrellm, etc.) use information from */proc***
- **When you access */proc* files with reads or writes, the kernel code or module “underneath” gets your request and can return or set data values in kernel memory**
- **We will return to */proc* in more detail a while**

# Output From /proc/pci



```
# cat /proc/pci
```

## PCI devices found:

Bus 0, device 0, function 0:

Host bridge: Intel Corp. 82810 GMCH  
[Graphics Memory Controller Hub]  
(rev 3).

Bus 0, device 1, function 0:

VGA compatible controller: Intel Corp.  
82810 CGC [Chipset Graphics  
Controller] (rev 3).

IRQ 10.

Prefetchable 32 bit memory at 0xf8000000  
[0xfbffffff].

Non-prefetchable 32 bit memory at  
0xf4000000 [0xf407ffff].

Bus 0, device 30, function 0:

PCI bridge: Intel Corp. 82801AA PCI Bridge  
(rev 2).

Master Capable. No bursts. Min Gnt=6.

Bus 0, device 31, function 0:

ISA bridge: Intel Corp. 82801AA ISA Bridge  
(LPC) (rev 2).

Bus 0, device 31, function 1:

IDE interface: Intel Corp. 82801AA IDE  
(rev 2).

I/O at 0x1800 [0x180f].

Bus 0, device 31, function 2:

USB Controller: Intel Corp. 82801AA USB  
(rev 2).

IRQ 11.

I/O at 0x1820 [0x183f].

Bus 0, device 31, function 3:

SMBus: Intel Corp. 82801AA SMBus (rev 2).  
IRQ 9.

I/O at 0x1810 [0x181f].

Bus 0, device 31, function 5:

Multimedia audio controller: Intel Corp.  
82801AA AC'97 Audio (rev 2).

IRQ 9.

I/O at 0x1200 [0x12ff].

I/O at 0x1300 [0x133f].

Bus 1, device 11, function 0:

SCSI storage controller: Adaptec AHA-7850  
(rev 3).

IRQ 9.

Master Capable. Latency=64. Min  
Gnt=4. Max Lat=4.

I/O at 0x3000 [0x30ff].

Non-prefetchable 32 bit memory at  
0xf4100000 [0xf410ffff].



- Troubleshooting X-windows server and graphics card problems is easier if you use */var/log/XFree86.0.log*

**XFree86 Version 4.3.0 (Red Hat Linux release: 4.3.0-2)**

**Release Date: 27 February 2003**

**X Protocol Version 11, Revision 0, Release 6.6**

**Build Operating System: Linux 2.4.20-3bigmem i686 [ELF]**

**Build Date: 27 February 2003**

[...]

**(II) I810(0): Monitor0: Using hsync range of 30.00-80.00 kHz**

**(II) I810(0): Monitor0: Using vrefresh range of 56.00-85.00 Hz**

**(II) I810(0): Clock range: 12.00 to 136.00 MHz**

[...]

**(\*\*) I810(0): DPI set to (72, 67)**

[...]

**(--) I810(0): Virtual size is 1024x768 (pitch 1024)**

[...]

**(==) Depth 24 pixmap format is 32 bpp**

[...]

# The System Log File: /var/log/messages



Jun 19 15:52:20 hppav1 kernel: ICH: IDE controller at PCI slot 00:1f.1

Jun 19 15:52:20 hppav1 kernel: ICH: chipset revision 2

Jun 19 15:52:20 hppav1 kernel: ICH: not 100%% native mode: will probe irqs later

Jun 19 15:52:20 hppav1 kernel: ide0: BM-DMA at 0x1800-0x1807, BIOS settings:  
hda:pio, hdb:pio

Jun 19 15:52:20 hppav1 kernel: ide1: BM-DMA at 0x1808-0x180f, BIOS settings:  
hdc:DMA, hdd:pio

Jun 19 15:52:20 hppav1 kernel: hda: LG CD-RW CED-8083B, ATAPI CD/DVD-ROM drive

Jun 19 15:52:20 hppav1 kernel: hdc: QUANTUM FIREBALLct15 30, ATA DISK drive

Jun 19 15:52:20 hppav1 kernel: blk: queue c03cc404, I/O limit 4095Mb

Jun 19 15:52:20 hppav1 kernel: ide0 at 0x1f0-0x1f7,0x3f6 on irq 14

Jun 19 15:52:20 hppav1 apmd[1784]: Charge: \* \* \* (-1% unknown)

Jun 19 15:52:20 hppav1 kernel: ide1 at 0x170-0x177,0x376 on irq 15

Jun 19 15:52:20 hppav1 kernel: hdc: attached ide-disk driver.

Jun 19 15:52:20 hppav1 kernel: hdc: host protected area => 1

Jun 19 15:52:20 hppav1 kernel: hdc: 58633344 sectors (30020 MB) w/418KiB Cache,  
CHS=58168/16/63, UDMA(66)

Jun 19 15:52:20 hppav1 kernel: Partition check:

Jun 19 15:52:21 hppav1 kernel: hdc: [PTBL] [3877/240/63] hdc1 hdc2 hdc3

Jun 19 15:52:28 hppav1 kernel: eth0: SMC1211TX EZCard 10/100 \\  
(RealTek RTL8139) at 0xe0955000, 00:10:b5:7c:70:42, IRQ 9

Jun 19 15:52:28 hppav1 kernel: eth0: Setting 100mbps full-duplex based on \  
auto-negotiated partner ability 45e1.



- **One of the most frequent performance problems is the mis-negotiation of network link speeds and duplex: 100baseT-HD versus 100baseT-FD, etc.**
- **The “media independent interface tool”, “*mii-tool*” will tell you what your network interface has negotiated**
- **The *mii-tool* will also tell you what your network interface is “advertising” as far as capabilities and what its “link partner” is advertising**
- **This goes a long way towards troubleshooting “auto”-negotiation issues**



## **# *mii-tool -v eth0***

**eth0: negotiated 100baseTx-FD, link ok**  
**product info: vendor 00:00:00, model 0 rev 0**  
**basic mode: autonegotiation enabled**  
**basic status: autonegotiation complete, link ok**  
**capabilities: 100baseTx-FD 100baseTx-HD 10baseT-FD 10baseT-HD**  
**advertising: 100baseTx-FD 100baseTx-HD 10baseT-FD 10baseT-HD**  
**link partner: 100baseTx-FD 100baseTx-HD 10baseT-FD 10baseT-HD flow-control**

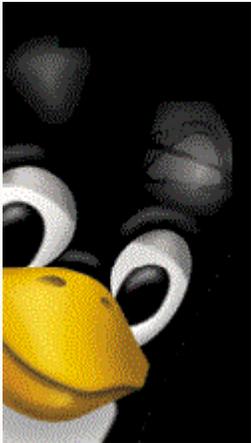
## **# *mii-tool -v --force=100baseTx-FD eth0***

- **Your interface hardware must support the MII (Media Independent Interface) standard**
- **Most modern network hardware appears to support MII operations**



# Linux Networking

- Initialization Scripts
- Administrative Commands
- Networking Tidbits





```
# cat /etc/sysconfig/network  
NETWORKING=yes
```

```
# cat /etc/sysconfig/network-scripts/ifcfg-eth0  
DEVICE="eth0"  
ONBOOT="yes"  
BOOTPROTO="dhcp"
```

- These settings are all you need if you have a DHCP server that is configured to return default gateway, hostname, IP address, netmask, NIS server, etc.
- The DHCP server matches the hardware ethernet address (Media Access Control or MAC) to the host-specific information and passes default parameters for the subnet



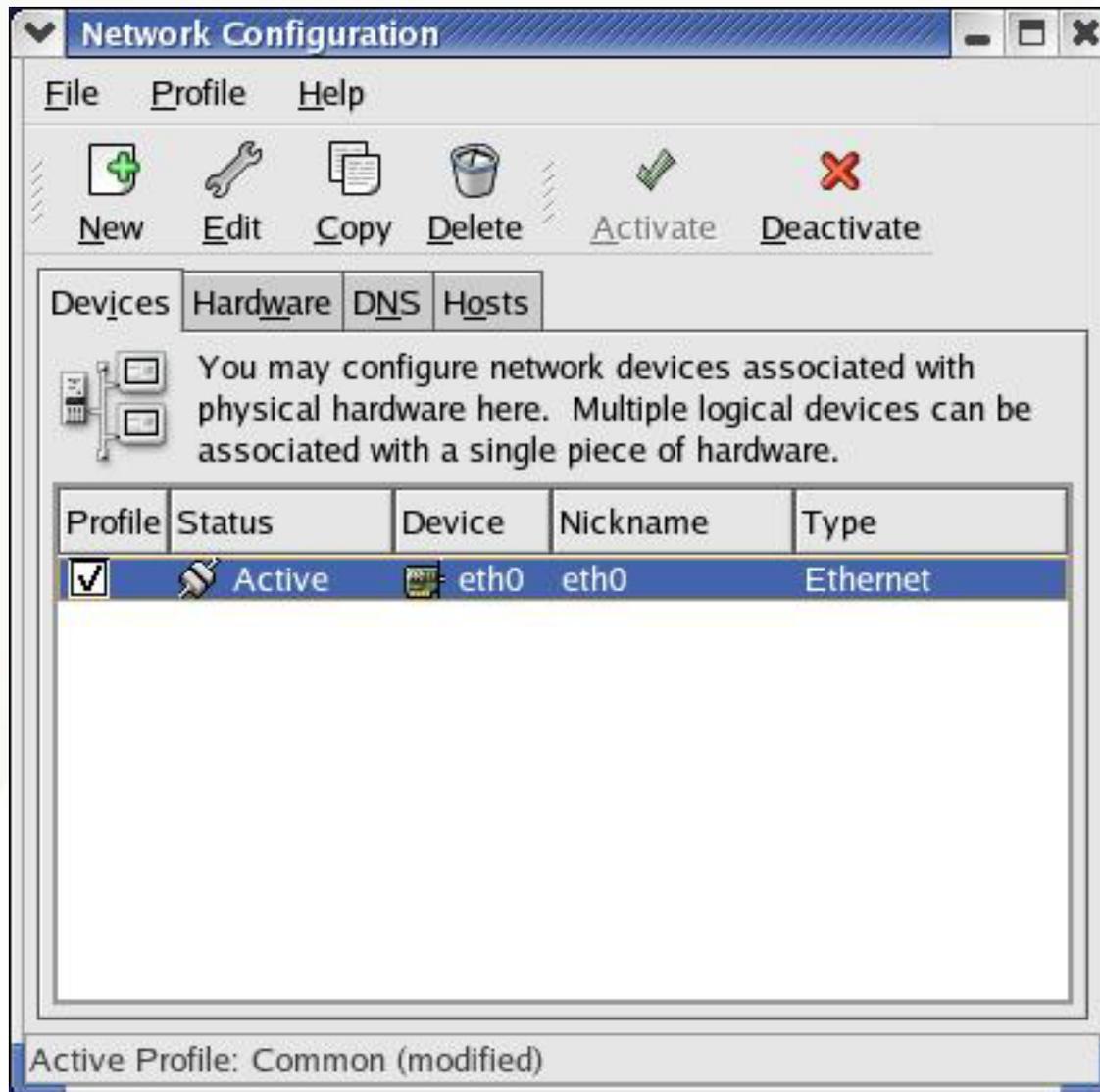
```
# cat /etc/sysconfig/network
```

```
NETWORKING=yes  
HOSTNAME="hppav"  
GATEWAY=192.168.0.1  
NISDOMAIN="home.domain"
```

```
# cat /etc/sysconfig/network-scripts/ifcfg-eth0
```

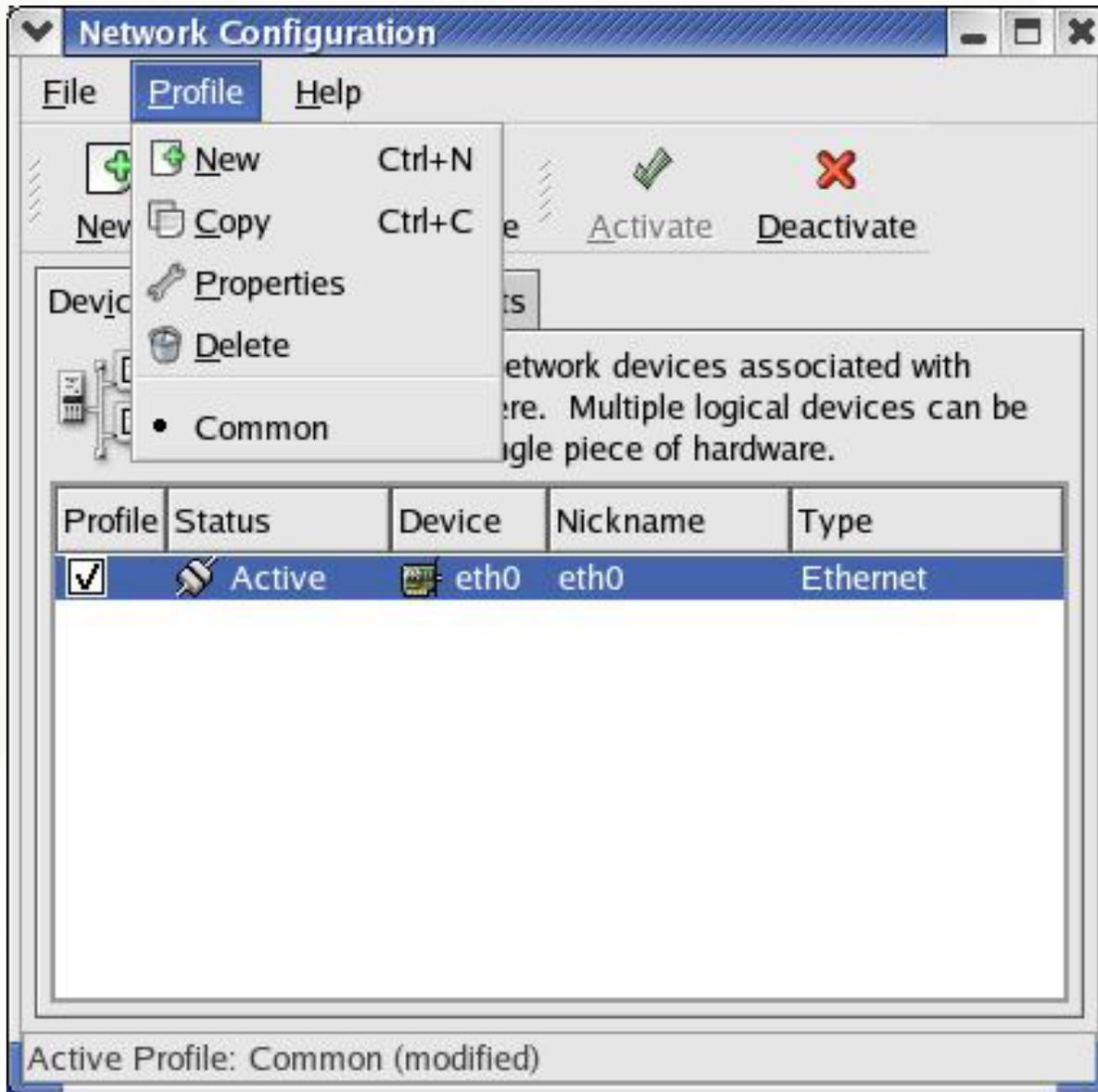
```
DEVICE="eth0"  
ONBOOT="yes"  
BOOTPROTO=static  
NETWORK=192.168.0.0  
IPADDR=192.168.0.101  
NETMASK=255.255.255.0  
BROADCAST=192.168.0.255
```

# Using “redhat-config-network”

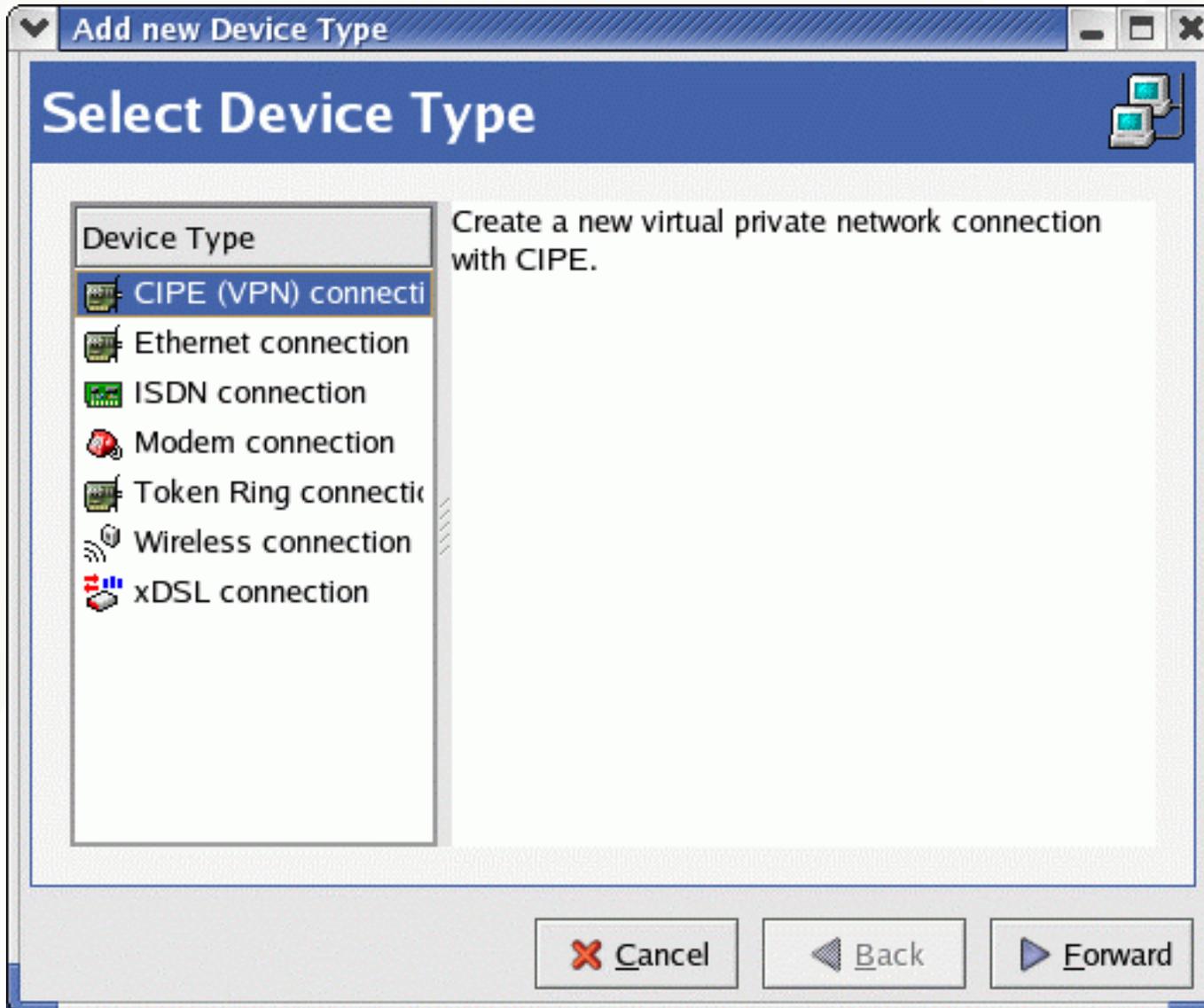


This tool is specifically aimed at configuring ethernet interfaces and the associated services like name lookup

# Using “redhat-config-network” and Network Profiles



You may create network profiles that can be activated in different network situations. The default profile name is “Common” and will contain the configuration information that you create initially. You can create a new profile and save network configuration into it.



This tool is more like a “wizard” that leads you through the steps of adding and configuring various network interface types. A similar interface for text-based configuration is available as `redhat-config-network-tui`



- **Activating a network profile from the command line:**  
***“redhat-config-network-cmd --profile <profile-name> --activate”***
- **You can “channel bond” two interfaces with the “ifenslave” command. See the information in */usr/src/linux2.4/Documentation/networking/bonding.txt* for details**
- **You can create aliases for your network device that have different network settings. A network alias has the format *device:0*, *device:1*, etc. For example the *eth0:0* device is an alias for the *eth0* interface and all routes will point to the *eth0* device. See the information in */usr/src/linux2.4/Documentation/networking/alias.txt* for details**
- **Linux “prefers” the use of the “*ip*” command in place of certain other networking commands. It needs a little help in the documentation department (like a man page, for instance), but it can do a \*lot\* there is documentation, but it is in postscript**
- **Linux supports IPv6, so you can start reading 128-bit MAC addresses**
- **Linux also supports traffic shaping on outgoing packets – this is left as an exercise to the motivated student**

# Network Alias Example



```
# ifconfig eth0:0 196.234.128.1  
# ifconfig
```

```
eth0 Link encap:Ethernet HWaddr 00:10:B5:7C:70:42  
inet addr:192.168.0.103 Bcast:192.168.0.255 Mask:255.255.255.0  
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1  
RX packets:253803 errors:0 dropped:0 overruns:0 frame:0  
TX packets:228867 errors:0 dropped:0 overruns:0 carrier:0  
collisions:0 txqueuelen:100  
RX bytes:30364299 (28.9 Mb) TX bytes:24157683 (23.0 Mb)  
Interrupt:9 Base address:0x5000
```

```
eth0:0 Link encap:Ethernet HWaddr 00:10:B5:7C:70:42  
inet addr:196.234.128.1 Bcast:196.234.128.255 Mask:255.255.255.0  
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1  
RX packets:253803 errors:0 dropped:0 overruns:0 frame:0  
TX packets:228867 errors:0 dropped:0 overruns:0 carrier:0  
collisions:0 txqueuelen:100  
RX bytes:30364299 (28.9 Mb) TX bytes:24157683 (23.0 Mb)  
Interrupt:9 Base address:0x5000
```

# Using the Linux “ip” Command



## *# ip route list*

```
192.168.0.0/24 dev eth0 proto kernel scope link src 192.168.0.103
196.234.128.0/24 dev eth0 proto kernel scope link src 196.234.128.1
169.254.0.0/16 dev eth0 scope link
127.0.0.0/8 dev lo scope link
default via 192.168.0.1 dev eth0
```

## *# ip addr list*

```
1: lo: <LOOPBACK,UP> mtu 16436 qdisc noqueue
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 brd 127.255.255.255 scope host lo
2: eth0: <BROADCAST,MULTICAST,UP> mtu 1500 qdisc pfifo_fast qlen 100
    link/ether 00:10:b5:7c:70:42 brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.103/24 brd 192.168.0.255 scope global eth0
    inet 196.234.128.1/24 brd 196.234.128.255 scope global eth0:0
```

## *# ip link list*

```
1: lo: <LOOPBACK,UP> mtu 16436 qdisc noqueue
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: eth0: <BROADCAST,MULTICAST,UP> mtu 1500 qdisc pfifo_fast qlen 100
    link/ether 00:10:b5:7c:70:42 brd ff:ff:ff:ff:ff:ff
```



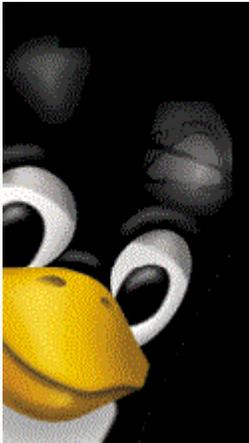
# Lab #2: Linux System Trouble-shooting and Configuration

**See Lab #2 Handout  
for details**

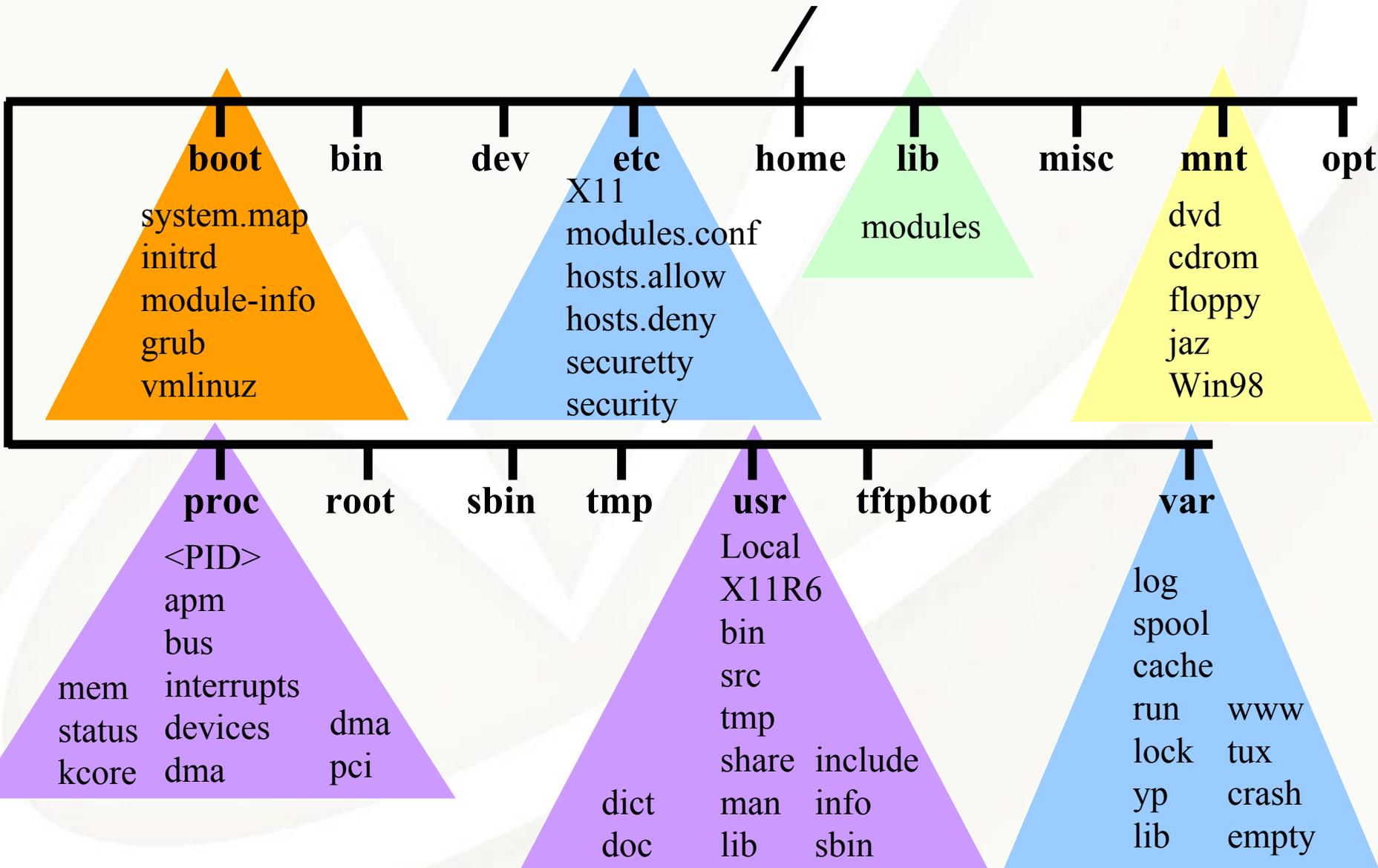


# The Linux Filesystem Layout

- A Simple Roadmap
- Device Files
- A Real /etc/fstab
- Interesting Side-Trips
- An Important Redhat-ism
- Introduction to /proc



# A Simple Roadmap of the Linux Filesystem



# Some Device Names from a Real System



<i>Description</i>	<i>Use</i>	<i>Device Name</i>
<b>IDE Drive 0</b> <b>/dev/hda</b>	<b>WinXP/Linux</b>	
<b>Windows partition</b>	<b>Windows XP</b>	<b>/dev/hda1</b>
<b>Linux partition</b>	<b>/boot</b>	<b>/dev/hda2</b>
<b>CD-ROM stacker</b>		<b>/dev/hdc</b>
<b>HP R/W CD-ROM</b>		<b>/dev/hdd</b>
<b>Floppy drive</b>		<b>/dev/fd0</b>
<b>SCSI address 0</b>	<b>Linux swap</b>	<b>/dev/sda1</b>
<b>SCSI address 0</b>	<b>Linux /</b>	<b>/dev/sda5</b>
<b>SCSI address 1</b>	<b>Linux /vmdata</b>	<b>/dev/sdb1</b>
<b>SCSI address 1</b>	<b>Linux swap</b>	<b>/dev/sdb5</b>



<i>Description</i>	<i>Use</i>	<i>Device Name</i>
<b>SCSI address 2</b>	<b>Linux /vmdata1</b>	<b>/dev/sdc1</b>
<b>SCSI address 2</b>	<b>Linux swap</b>	<b>/dev/sdc5</b>
<b>SCSI address 3</b>	<b>Linux /vmdata2</b>	<b>/dev/sdd1</b>
<b>SCSI address 3</b>	<b>Linux swap</b>	<b>/dev/sdd5</b>
<b>SCSI address 4</b>	<b>HP Photo scanner</b>	<b>/dev/sge</b>
<b>SCSI address 5</b>	<b>HP 6200C scanner</b>	<b>/dev/sgf</b>
<b>SCSI address 6</b>	<b>JAZ 1 GB drive</b>	<b>/dev/sde4</b>
<b>COM1</b>	<b>V.90 modem</b>	<b>/dev/ttyS0</b>
<b>Parallel port</b>	<b>HP P1000 printer</b>	<b>/dev/lp0</b>

# Example /etc/fstab File



<b>/dev/sda5</b>	<b>/</b>	<b>ext3</b>	<b>defaults</b>	<b>1</b>	<b>1</b>
<b>/dev/hda2</b>	<b>/boot</b>	<b>ext3</b>	<b>defaults</b>	<b>1</b>	<b>2</b>
<b>/dev/sdb1</b>	<b>/vmdata</b>	<b>ext3</b>	<b>defaults</b>	<b>1</b>	<b>2</b>
<b>/dev/sdc1</b>	<b>/vmdata1</b>	<b>ext3</b>	<b>defaults</b>	<b>1</b>	<b>2</b>
<b>/dev/sdd1</b>	<b>/vmdata2</b>	<b>ext3</b>	<b>defaults</b>	<b>1</b>	<b>2</b>
<b>/dev/sda1</b>	<b>swap</b>	<b>swap</b>	<b>pri=1</b>	<b>0</b>	<b>0</b>
<b>/dev/sdb5</b>	<b>swap</b>	<b>swap</b>	<b>pri=1</b>	<b>0</b>	<b>0</b>
<b>/dev/sdc5</b>	<b>swap</b>	<b>swap</b>	<b>pri=1</b>	<b>0</b>	<b>0</b>
<b>/dev/sdd5</b>	<b>swap</b>	<b>swap</b>	<b>pri=1</b>	<b>0</b>	<b>0</b>
<b>/dev/fd0</b>	<b>/mnt/floppy</b>	<b>ext2</b>	<b>owner,noauto</b>	<b>0</b>	<b>0</b>
<b>/dev/cdrom</b>	<b>/mnt/cdrom</b>	<b>iso9660</b>	<b>owner,noauto,ro</b>	<b>0</b>	<b>0</b>
<b>/dev/hdd</b>	<b>/mnt/cd-rw</b>	<b>iso9660</b>	<b>noauto,ro</b>	<b>0</b>	<b>0</b>
<b>/dev/sde4</b>	<b>/mnt/jaz</b>	<b>vfat</b>	<b>fat=16</b>	<b>0</b>	<b>0</b>
<b>none</b>	<b>/proc</b>	<b>proc</b>	<b>defaults</b>	<b>0</b>	<b>0</b>
<b>none</b>	<b>/dev/pts</b>	<b>devpts</b>	<b>gid=5,mode=620</b>	<b>0</b>	<b>0</b>



- ***/etc/pam.d***                    **directory containing PAM config**
- ***/etc/profile.d***                **directory containing system-wide shell profiles**
- ***/etc/logrotate.d***            **directory controlling log rotation**
  - ***/usr/sbin/logrotate*** **command**
  - ***/etc/logrotate.conf***
- ***/etc/rc.d***                    **directory containing startup scripts**
- ***/proc***                        **directory containing system information**
  - ***/proc/bus/usb*** **directory containing usb device information**
  - ***/proc/bus/pci*** **directory containing pci device information**



- **`/etc/pam.d`**                      directory containing PAM config
  - **`/etc/profile.d`**                directory containing shell profiles
  - **`/etc/logrotate.d`**                directory controlling log rotation
  - **`/etc/rc.d`**                        directory containing run-level definitions
  - **`/etc/init.d`**                      directory containing service scripts
  - **`/etc/xinetd.d`**                    directory containing inetd service definitions
- 
- **These “.d” directories make it easy for packages to install and remove themselves from the system without affecting other packages or risking damage to configuration files**
  
  - **Typical service installation might:**
    - **Add service script to `/etc/init.d`**
    - **Run `chkconfig` to create links in `/etc/rc*.d`**
    - **Add service information to `/etc/xinetd.d`**
    - **Add log processing to `/etc/logrotate.d`**
  
  - **Because logrotate is setup to “*include /etc/logrotate.d*”, all files become part of the configuration without grepping, awking, or sedding.**
  - **This is *very* manageable once you catch the paradigm!**

# Example /proc File System Contents



```
1/      1402/ 1475/ 1587/ 1756/ 1781/ 1792/ 4/      763/ bus/      ide/      mdstat
slabinfo
1014/   1438/ 1488/ 1589/ 1757/ 1782/ 1793/ 5/      8/      cmdline   interrupts meminfo
stat
1056/   1461/ 1543/ 1591/ 1758/ 1783/ 1794/ 536/   846/   cpuinfo   iomem     misc
swaps
1078/   1462/ 1557/ 1592/ 1760/ 1784/ 1825/ 541/   879/   devices   ioports    modules
sys/
1099/   1463/ 1569/ 1594/ 1762/ 1785/ 1828/ 561/   90/    dma       irq/      mounts@
sysvipc/
1167/   1464/ 1571/ 1595/ 1764/ 1786/ 183/   590/   900/   driver/   kcore     mtrr
tty/
12/     1465/ 1579/ 1598/ 1766/ 1787/ 1971/ 6/     950/   execdomains kmsg      net/
uptime
1241/   1466/ 1581/ 1599/ 1768/ 1789/ 2/     7/     968/   fb        ksyms
partitions version
1354/   1467/ 1583/ 1749/ 1770/ 1790/ 2014/ 702/   986/   filesystems loadavg    pci
vmnet/
1371/   1474/ 1585/ 1755/ 1772/ 1791/ 3/     722/   apm      fs/       locks     self@
```

PROC (5)

Linux Programmer's Manual

NAME

`proc` - process information pseudo-filesystem

DESCRIPTION

`/proc` is a pseudo-filesystem which is used as an interface to kernel data structures rather than reading and interpreting `/dev/kmem`. Most of it is read-only, but some files allow kernel variables to be changed.

# Example /proc/1 (PID 1 – Init ) Directory Contents



```
-r--r--r--      1 root      root      0 Jul 29 22:46 cmdline
lrwxrwxrwx      1 root      root      0 Jul 29 22:46 cwd -> /
-r-----      1 root      root      0 Jul 29 22:46 environ
rwxrwxrwx       1 root      root      0 Jul 29 22:46 exe ->
    /sbin/init
dr-x-----      2 root      root      0 Jul 29 22:46 fd
-r--r--r--      1 root      root      0 Jul 29 22:46 maps
-rw-----      1 root      root      0 Jul 29 22:46 mem
-r--r--r--      1 root      root      0 Jul 29 22:46 mounts
lrwxrwxrwx      1 root      root      0 Jul 29 22:46 root -> /
-r--r--r--      1 root      root      0 Jul 29 22:46 stat
-r--r--r--      1 root      root      0 Jul 29 22:46 statm
-r--r--r--      1 root      root      0 Jul 29 22:46 status
```



# Software Installation and Update

- The Redhat Package Manager (RPM)
- Useful Commands
- Verifying Packages
- Using Redhat's "up2date"





- Installation and update of software on Linux (at least the RedHat distributions and several others) is done via the “rpm” command
- Packages may contain sources, binaries, configuration information and scripts, and PGP signatures for verification
- The system keeps a database of all installed packages, their revisions, and their dependencies
- To find out what packages are installed, “rpm -qa”
- To install a package,  
    “rpm -ivh <package>”
- To update a package,  
    “rpm -Uvh <package>”
- The kernel, libraries, and applications may be updated LIVE! (including glibc)
- Source RPMs (SRPMs) may be installed and used to build software and create regular RPMs (all SRPMs are on the Redhat distribution CD-ROMs)

# Some Useful RPM Commands



```
# rpm -q --whatprovides /bin/l  
fileutils-4.1-10
```

```
# rpm -qa | grep real  
ethereal-0.9.4-0.7.3.0  
ethereal-gnome-0.9.4-0.7.3.0
```

```
# rpm --checksig RealPlayer-8.0-1.i386.rpm  
RealPlayer-8.0-1.i386.rpm: md5 OK
```

```
# rpm -q --filesbypkg ethtool  
ethtool /usr/sbin/ethtool  
ethtool /usr/share/doc/ethtool-1.5  
ethtool /usr/share/doc/ethtool-1.5/AUTHORS  
ethtool /usr/share/doc/ethtool-1.5/COPYING  
ethtool /usr/share/doc/ethtool-1.5/ChangeLog  
ethtool /usr/share/doc/ethtool-1.5/INSTALL  
ethtool /usr/share/doc/ethtool-1.5/NEWS  
ethtool /usr/share/doc/ethtool-1.5/README  
ethtool /usr/share/man/man8/ethtool.8.gz
```



- **Downloading binaries from the Internet is fraught with danger, but open-source also means that anyone can modify the source and add trojans, back-doors, etc. and make untrustworthy packages available**
- **First, download packages from trusted sources, and even then you should verify all packages that you download**
- **There are two basic levels of verification:**
  - **Ensuring that the package has not been corrupted**
  - **Ensuring that the package is signed by someone you trust**
- **An MD5 checksum is provided within RPM packages to ensure that the package has not been corrupted**
- **All packages from Redhat are signed with the Redhat GNU Privacy Guard (GPG) key**

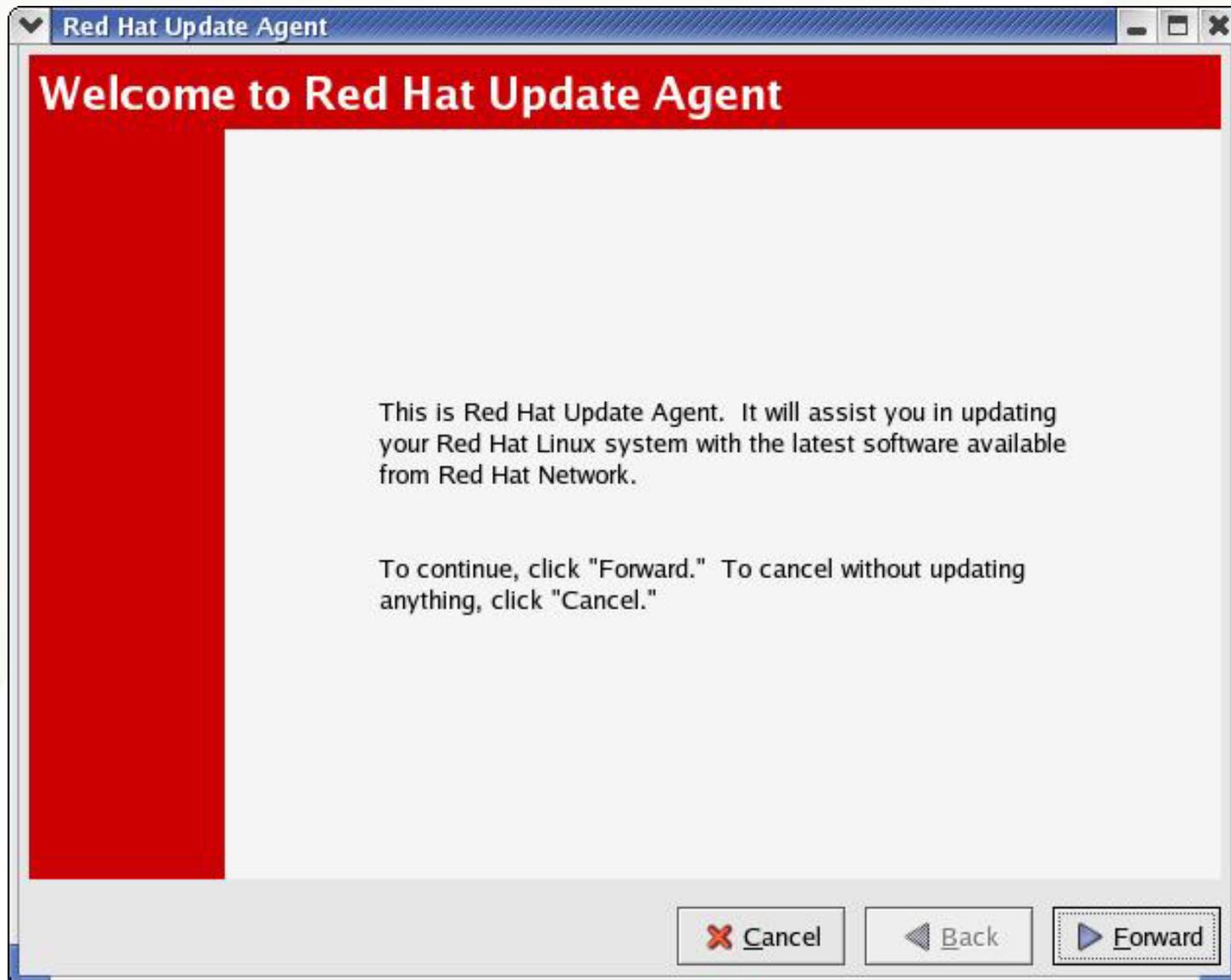


- Since you will be doing your installation and updates as the “root” user, importing the Redhat GPG key is an important step
- This may have been done for you during system installation, you can check by executing `“rpm -qa gpg-pubkey*”`, which should respond with `“gpg-pubkey-db42a60e-37ea5438”`
- If you need to import the key, then execute `“rpm --import /usr/share/rhn/RPM-GPG-KEY”` as the “root” user
- The key is also available on the Redhat distribution CDs
- You can check the MD5 checksum of the package with `“rpm -K --nosignature <rpm-file>”` you should see `“<rpm-file>: md5 OK”`
- You can verify that the package was signed by Redhat with `“rpm -K <rpm-file>”` you should see the message `“md5 gpg OK”`



- RedHat provides an automated way of keeping your system packages up to date, the "up2date" command
- For 90 days after purchase, or if you buy support, you may connect to the RedHat FTP server with this tool
- All updated packages are presented in a graphical interface, and you may select the ones you want
- The packages are downloaded and installed
- Packages are stored in `/var/spool/up2date` if you select the "keep after installation" option and are removed otherwise
- "`up2date -update`" will download all matching packages and update your system

# Starting "up2date"



# Update Channels in “up2date”



The screenshot shows a window titled "Red Hat Update Agent" with a red header bar containing the word "Channels" and the Red Hat logo. Below the header is a table with two columns: "Description" and "Channel". The first row is selected and has a checkmark in the left margin. Below the table is a text block with instructions and a URL. At the bottom, there is a "Channel Information" section and three buttons: "Cancel", "Back", and "Forward".

	Description	Channel
<input checked="" type="checkbox"/>	Red Hat Linux 9 i386	redhat-linux-i386-9

To subscribe or unsubscribe from channels, or for more information about the channels available, see:  
<https://rhn.redhat.com>

Channel Information  
Red Hat Linux 9 i386

# Selecting Packages from “up2date”



Red Hat Update Agent

## Available Package Updates

Select all packages

	Package Name	Version	Release	Arch	Size
<input checked="" type="checkbox"/>	php	4.2.2	17.2	i386	1327 kB
<input checked="" type="checkbox"/>	php-devel	4.2.2	17.2	i386	269 kB
<input checked="" type="checkbox"/>	php-imap	4.2.2	17.2	i386	411 kB
<input checked="" type="checkbox"/>	php-ldap	4.2.2	17.2	i386	37 kB
<input checked="" type="checkbox"/>	php-manual	4.2.2	17.2	i386	13418 kB
<input checked="" type="checkbox"/>	php-mysql	4.2.2	17.2	i386	26 kB

Package Information View Advisory

The PHP HTML-embedded scripting language. (PHP: Hypertext Preprocessor)

PHP is an HTML-embedded scripting language. PHP attempts to make it easy for developers to write dynamically generated webpages. PHP also offers built-in database integration for several commercial and non-commercial database management systems, so writing a database-enabled webpage with PHP is fairly simple. The most common

Total size of selected packages to download: 15749 kB

# Downloading “up2date” Packages



Red Hat Update Agent

## Retrieving Packages

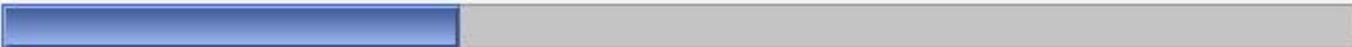


Retrieving: php-manual-4.2.2-17.2.i386.rpm

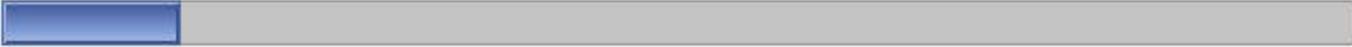
The PHP manual, in HTML format.

The php-manual package provides comprehensive documentation for the PHP HTML-embedded scripting language, in HTML format. PHP is an HTML-embedded scripting language.

4520 of 13418 kB transferred at 61 kB/sec  
Package transfer time: 00:03:37 (00:02:24 remaining)



Total progress:

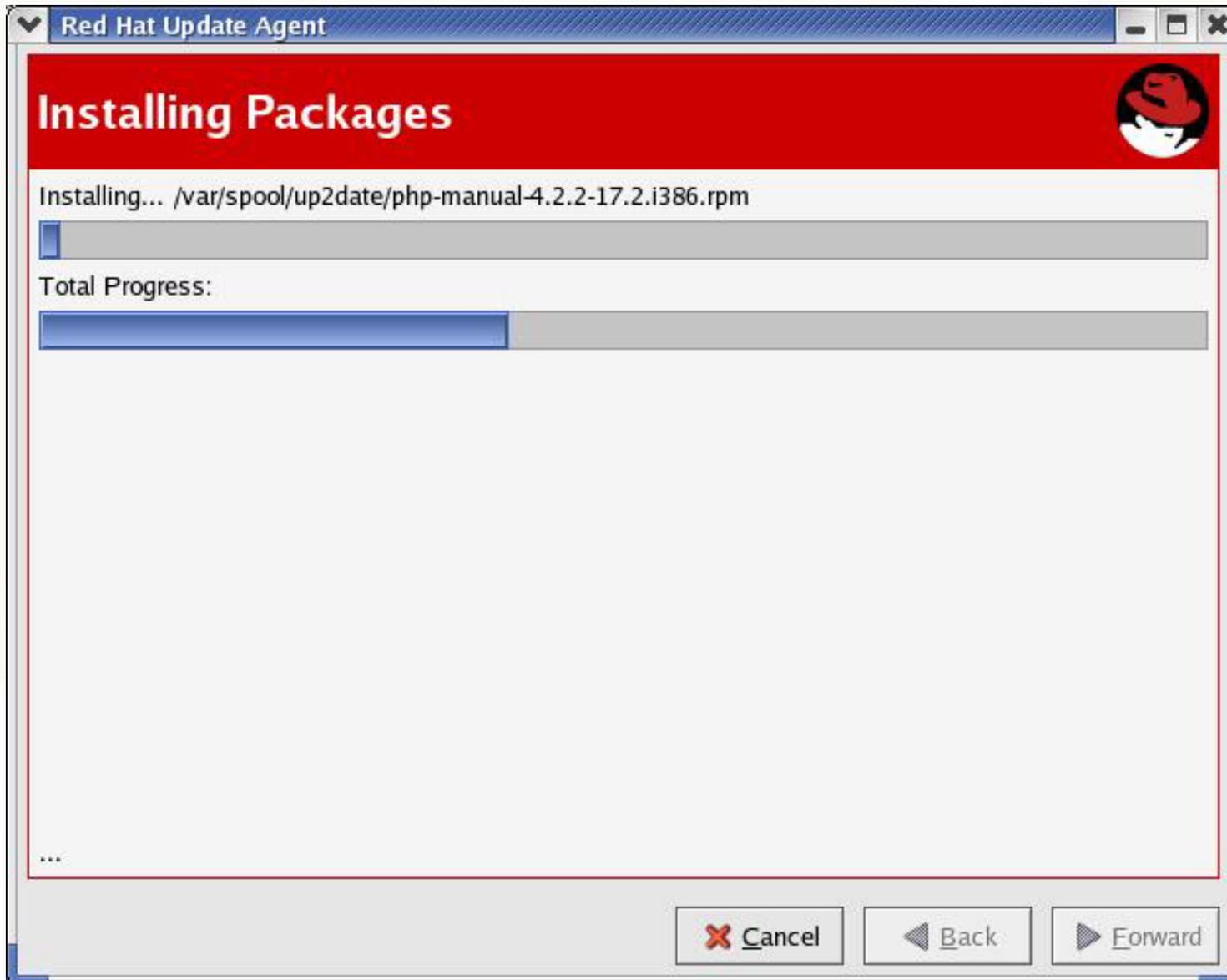


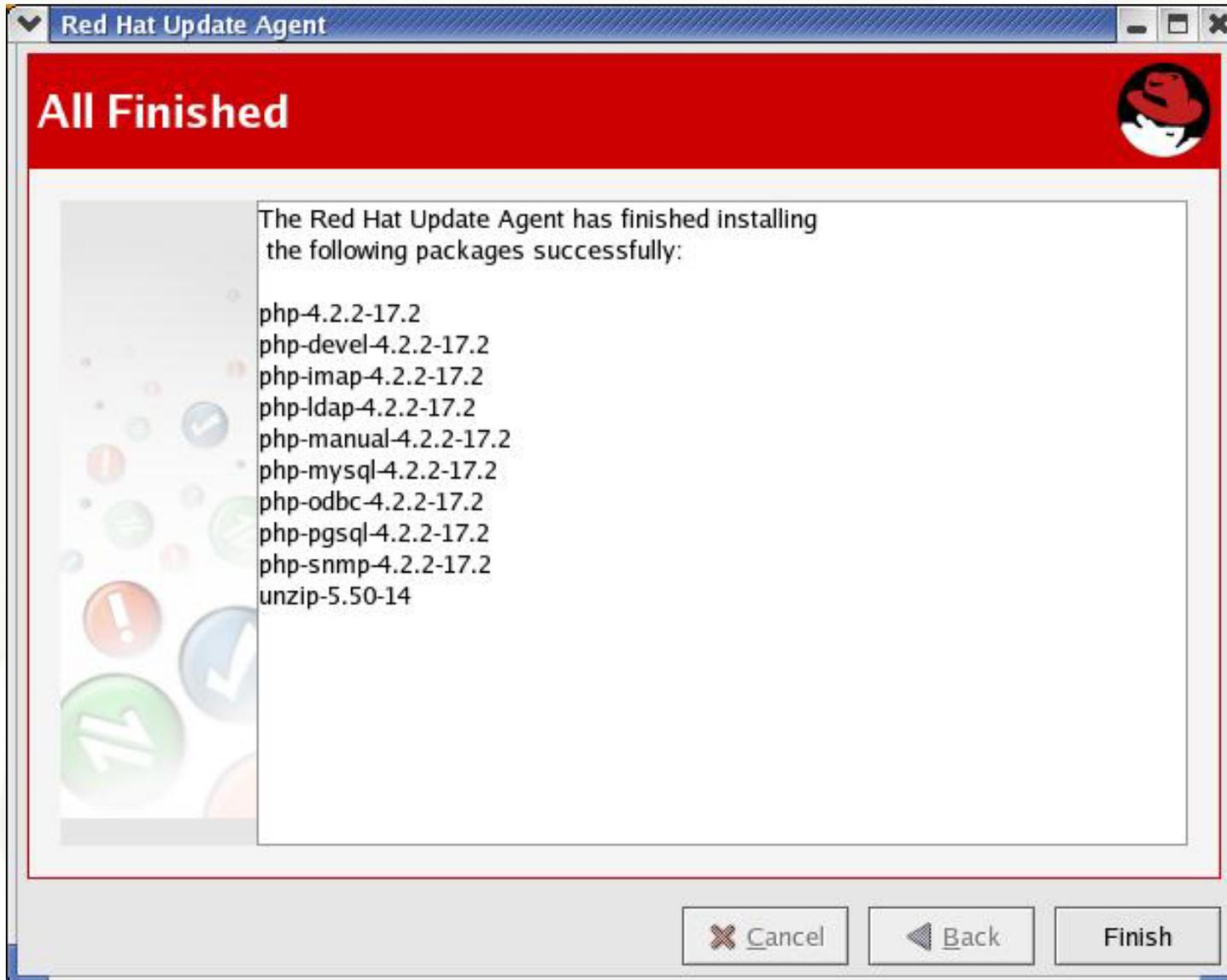
...

The image shows a screenshot of the Red Hat Update Agent window. The window title is "Red Hat Update Agent". The main heading is "Retrieving Packages" in a red banner. Below the banner, it shows the package name "php-manual-4.2.2-17.2.i386.rpm" and a description: "The PHP manual, in HTML format. The php-manual package provides comprehensive documentation for the PHP HTML-embedded scripting language, in HTML format. PHP is an HTML-embedded scripting language." It also displays transfer statistics: "4520 of 13418 kB transferred at 61 kB/sec" and "Package transfer time: 00:03:37 (00:02:24 remaining)". There are two progress bars: one for the current package and one for the total progress. At the bottom, there are three buttons: "Cancel", "Back", and "Forward".

# Installing “up2date” Packages







- JAVA at <http://www.blackdown.org>
- StarOffice from Sun Microsystems
- Open Office from <http://www.OpenOffice.org>
- Real Player from <http://www.Real.com>
- Vmware at <http://www.VMware.com>
- Mozilla browser from <http://www.Mozilla.org>
- XV X-windows image viewer/editor at <http://www.trilon.com/xv/xv.html>
- Other applications at <http://FreshMeat.net> or <http://SourceForge.net> (make absolutely sure that you type Freshmeat.NET or you will visit a site that your employer might not like)
- RPMs from <ftp://Updates.Redhat.com> or <http://RpmFind.net>



# Linux File Systems, RAID, and Quotas

- Working with EXT2 and EXT3
- Other File Systems
- Software RAID
- Overview of Quotas





- **The default Redhat file system, EXT2 was upgraded at Redhat release 7.2 to EXT3**
- **The EXT2 file system is still available**
- **EXT3 Provides:**
  - Journaling to reduce e2fsck (fsck) times in the event of a failure
  - Easy transition from EXT2 to EXT3 (and back)
  - Control over the amount and type of data being journaled at mount time
- **EXT2/EXT3 tools:**
  - `resize2fs`
  - `e2fsck`
  - `tune2fs`
  - `mke2fs`



- `“mke2fs -b 4096 -j -J size=400 -L MYLABEL -O sparse_super -T largefile4 -v -m 1 /dev/sda1”`

makes an EXT3 file system with a journal sized at 400 MB, a block size of 4KB, one inode for every 4 MB of file data, reserving 1% of the disk for the root user, and limited duplicate superblocks on the device partition /dev/sda1

- `“mount -t ext3 -o data=ordered /dev/sda1 /mnt/test”`

mounts the previously created file system with all data written to the file system before the metadata is committed to the journal

- The settings for the EXT3 `data=<mode>` are either *journal*, *ordered (default)*, or *writeback*. “*journal*” writes all data to the journal before committing it to the file system, “*ordered*” writes data to the file system before writing meta-data to journal, and “*writeback*” does not preserve data and meta-data ordering



- **“*tune2fs -l /dev/sda1*”** will list the contents of the superblock
- **“*tune2fs -L MYLABEL*”** will set the file system label value, which can be used by mount, fsck, and /etc/fstab instead of the block special device by specifying **“*LABEL=MYLABEL*”** in its place
- **Note that Linux has the habit of shifting device names when new devices are added to the system, the ability to use “*LABEL=<value>*” for the device special file in the mount request removes the dependency on the device name (i.e. /dev/sda1)**



- **Usage: chattr [-RV] --+=ASDacdijsTtu -v version files ...**
- **Attributes that may be set on an EXT\* file system:**
  - **A** Don't update atime on access
  - **S** Synchronous updates
  - **D** Synchronous updates of directory (2.5.19 and later)
  - **a** Append only
  - **c** Compress
  - **d** No dump
  - **i** Immutable (cannot be deleted, written to, or linked)
  - **j** Data journaling
  - **s** Secure deletion
  - **T** Top of directory hierarchy (2.5.19 and later)
  - **t** No tail merging
  - **u** Undeletable



- **Commonly used file systems:**
  - **ext2/ext3** default Redhat fs
  - **jfs** journaled fs from IBM
  - **umsdos filenames** DOS fs, plus UID/GID, permissions, long
  - **msdos** DOS fs, 8.3 file names
  - **vfat** later version of FAT, long names
  - **reiserfs** popular journaled fs for Linux
  - **ISO9660** CD-ROM/DVD fs includes Sierra and Rockridge
  - **xf**s journaled fs from SGI, must be added to Redhat
  - **smb Samba** Microsoft server message block, CIFS and
  - **nfs** network file system from Sun Microsystems
- **Less commonly used**
  - **cramfs** read-only compressed fs
  - **minix** first file system to run under Linux
  - **xiafs** extension of minix
  - **ext** first extended fs, extension of minix
  - **ncpfs** uses NCP protocol for Novell Netware
  - **sysv** Xenix fs, SystemV/386 fs, Coherent fs



- **The software RAID feature of Linux is handy and easy to use**
- **Remember that all parity calculations and I/O are being performed by the local CPU (i.e. they are not hidden inside dedicated RAID box)**
- **Linux Software RAID modes:**
  - Linear Concatenates disks (0% space overhead)
  - 0 Striped data (0% space overhead)
  - 1 Mirrored data (100% space overhead)
  - 4 One disk for parity (33% space overhead)  
(infrequently used)
  - 5 Parity on multiple disks (~20% space overhead)



- **Create /etc/raidtab entry**
- ***“mkraid /dev/md<nn>”***
- ***“raidstart /dev/md<nn>”***
- **Create file system**
- **Mount device**
  
- **See <http://en.tldp.org/HOWTO/Software-RAID-HOWTO-6.html> for information on how to recover from RAID failures**
  
- **Commands**
  - ***mkraid*** ***create MD device from raidtab***
  - ***raidstart*** ***start an MD device***
  - ***raidstop*** ***stop an MD device***
  - ***raidhotadd*** ***recovery tool, add disk to array***
  - ***raidhotremove*** ***recovery tool, remove disk from array***
  - ***“cat /proc/mdstat”*** ***get live MD device status***
  - ***lsraid -R -a /dev/md0*** ***recreate raidtab from live array***

# Software RAID Table from Rob's Server



```
###
### 20030307 Rob Lucke
###
raiddev                /dev/md1
  raid-level           5
  nr-raid-disks        4
  nr-spare-disks       0
  chunk-size           64
  parity-algorithm     left-symmetric

  device               /dev/sda
  raid-disk            0
  device               /dev/sdb
  raid-disk            1
  device               /dev/sdc
  raid-disk            2
  device               /dev/sdd
  raid-disk            3
```

You can see the speed calculation for this algorithm in the “*dmesg*” output from the system boot, see next slide



[...]

**raid5: measuring checksumming speed**

**8regs : 731.136 MB/sec**

**32regs : 372.736 MB/sec**

**pll\_mmx : 888.832 MB/sec**

**p5\_mmx : 931.840 MB/sec**

**raid5: using function: p5\_mmx (931.840 MB/sec)**

**md: raid5 personality registered as nr 4**

**Journalled Block Device driver loaded**

**md: Autodetecting RAID arrays.**

**md: autorun ...**

**md: ... autorun DONE.**

[...]



```
# cat /proc/mdstat
```

```
Personalities : [raid5]
read_ahead 1024 sectors
md1 : active raid5 sdd[3] sdc[2] sdb[1] sda[0]
      215061888 blocks level 5, 64k chunk, algorithm 2 [4/4] [UUUU]

unused devices: <none>
```



The “U” indicates “up-to-date” or some such status. If the array is updating parity, the “U” will change to “\_”.



- Note that if you are using RAID 5, there is a special option to the “*mke2fs*” command to set the file system stride to match the array chunk size:

**“-R stride=<fs\_blocks\_per\_chunk>”**

- Example: an ext3 file system created with 4KB (the maximum) block size and a Linux software RAID 5 device with a 128 KB chunk size. The option for “*mke2fs*” would be: “-R stride=32” because  $32 \times 4 = 128$
- The “RAID HowTo” and several other sources report that setting this properly is important but don’t quantify the effect
- The author has not verified the performance impact of the different settings on file system performance (yet)



- Linux disk quotas are calculated on a per file-system basis
- Quotas are enabled for local file systems at file-system mount time
- Quotas may be enabled per user, per group, or both
- The mount options are *“usrquota”* and *“grpquota”*
- Once the file-systems are mounted with the quota options, current usage statistics are generated with the *“quotacheck”* command
- The system manager establishes individual settings for groups and users with the *“edquota”* command, which uses the text editor defined by the EDITOR environment variable to modify the settings
- As part of on-going maintenance, *“quotacheck”* should be run periodically to update the quota information
- Use the *“repquota”* command to report on the current quota status



- **Linux quota commands:**
  - **quotacheck** check and update quota statistics
  - **edquota** edit quota settings
  - **repquota** report quota usages per filesystem
  - **quota** report quota information per user or group
  - **quotaon** enable file-system quotas
  - **quotaoff** disable file-system quotas (link to [quotaon](#))
  - **quotastats** report quota system performance statistics
- **Linux quota files:**
  - **aquota.user** per file-system user quota information
  - **aquota.group** per file-system group quota information



# Linux DHCP, NFS, NIS, and Samba

- **Configuring DHCP**
- **Configuring NFS**
- **Configuring NIS**
- **Samba and Swat**





- The DHCP server can be a big help to you as a system manager it can “fill in” lots of client configuration information for you
- You can specify default parameters to all client systems serviced by the DHCP server
- The server configuration file is */etc/dhcpd.conf*
- The DHCP client (dhcpcd) will fill in all of the information in configuration files on the system at boot time
- To see the client information for DHCP, look at the */var/lib/dhcp/dhclient-eth0.leases* file
- See man pages for *dhcp.conf*, *dhcp.leases*, *dhcp-options*, and *dhclient.conf*





```
# Laptop wireless 802.11b address
#
host sonyvaio {
    hardware ethernet 00:04:23:4d:45:ca;
    fixed-address 192.168.0.253;
}
```

```
host hpxw4100 {
    hardware ethernet 00:30:6e:4c:34:4e;
    fixed-address 192.168.0.111;
}
```

```
# Netgear ME-102 wireless access point
```

```
#
host ngme102 {
    hardware ethernet 00:09:5B:39:E6:79;
    fixed-address 192.168.0.254;
}
```

```
# Netgear FVS318 DSL router/switch
```

```
#
host FVS318 {
    hardware ethernet 00:09:5B:00:C5:2E;
    fixed-address 192.168.0.1;
}
```

```
}
```

Entry specifying  
hostname, MAC  
address, and IP  
address for one  
system



- **From */var/lib/dhcp/dhclient-eth0.leases*:**

```
lease {  
  interface "eth0";  
  fixed-address 192.168.0.103;  
  option subnet-mask 255.255.255.0;  
  option routers 192.168.0.1;  
  option dhcp-lease-time 86400;  
  option dhcp-message-type 5;  
  option domain-name-servers 192.168.0.1;  
  option dhcp-server-identifier 192.168.0.110;  
  option nis-domain "home.domain";  
  option nis-servers 192.168.0.101;  
  option ntp-servers 192.168.0.101;  
  option broadcast-address 192.168.0.255;  
  option domain-name "dsl-verizon.net";  
  renew 5 2003/7/4 01:29:59;  
  rebind 5 2003/7/4 11:33:53;  
  expire 5 2003/7/4 14:33:53;  
}
```

Default information  
passed from the  
DHCP server

Note that the DHCP  
server identified  
itself in the reply to  
the client's  
broadcast



- Make sure you installed the DHCP server rpm file ...
- Create the `/etc/dhcpd.conf` file
- Execute “`chkconfig dhcpd on`” to create startup links
- Execute “`service dhcpd start`” to start the server
- Check the `/var/log/messages` file for DHCP server logging messages
- Edit the `/etc/dhcpd.conf` file as necessary
- Execute “`service dhcpd restart`” to stop and restart the DHCP server
- Note that `/etc/sysconfig/dhcpd` contains a variable definition, `DHCPDARGS`, that is sourced by the startup – this is useful for setting options:

**DHCPDARGS=“eth0”**

- Note: There is a DHCP protocol relay agent “`dhcrelay`” that can forward DHCP requests from a subnet to a server with no direct connection, see “`man dhcrelay`” for information



- The NFS client software on Linux seems to work okay with NFS PV2 and PV3 (without large 32KB blocks?)
- The NFS server software on Linux seems to have problems, maybe related to the buffer cache and does not yet support all of the PV3 stuff
- Some of the statistics we are used to from “*nfsstat*” are not available – darn it, we have to fly blind
- Server support of NFS over TCP/IP and large blocks (32KB) may not be supported without kernel patches (experimental patches, that is)
- Careful! The default values for “*rsize*” and “*wsize*” is 1024 bytes (1 KB) – you have to set the values in the mount/automount options fields
- If you have a firewall, you must ensure that the *portmapper* service is accessible by your NFS clients or the network is filled with silence
- This all changes on a weekly basis, it seems ...



- **Useful NFS client commands:**
  - ***“service autofs start”***
  - ***“service autofs status”***
  - ***“service autofs reload”***
  - ***“service autofs stop”***
  - ***“chkconfig autofs on”***
- **There is an */etc/auto.misc* file loaded by default that has some interesting Linux twists on autofs mounts**
- **The “normal” *auto.master* behavior exists, either a local file or from NIS**



- **Useful commands:**
  - *“chkconfig nfs on”*
  - *“chkconfig nfslock on”*
  - *“chkconfig portmap on”*
  - *“service nfs start”*
  - *“service nfslock start”*
  - *“service portmap start”*
- **Note that the “portmap” service must be visible through any firewall for NFS server to work**
- **Also, the daemons that are associated with Sun RPC all start with the “rpc.” prefix, for example “rpc.mountd”**
- **Redhat’s “portmap” is compiled to use TCP wrappers, so *hosts.allow* and *hosts.deny* work in addition to the controls in the */etc/exports* file**
- **As an aside, example after example shows the use of the “soft” option for mounts: Do not use this unless you \*want\* data corruption!**

# Sun RPC Daemons from "pmap\_dump" Command



*#pmap\_dump*

100000	2	tcp	111	portmapper	100003	2	udp	2049	nfs
100000	2	udp	111	portmapper	100003	3	udp	2049	nfs
100024	1	udp	32768	status	100021	1	udp	32770	nlockmgr
100024	1	tcp	32768	status	100021	3	udp	32770	nlockmgr
100007	2	udp	702	ypbind	100021	4	udp	32770	nlockmgr
100007	1	udp	702	ypbind	100005	1	udp	32771	mountd
100007	2	tcp	705	ypbind	100005	1	tcp	32770	mountd
100007	1	tcp	705	ypbind	100005	2	udp	32771	mountd
391002	2	tcp	32769	sgi_fam	100005	2	tcp	32770	mountd
100011	1	udp	859	rquotad	100005	3	udp	32771	mountd
100011	2	udp	859	rquotad	100005	3	tcp	32770	mountd
100011	1	tcp	862	rquotad					
100011	2	tcp	862	rquotad					

## Example “auto.misc” File



```
# $Id: auto.misc,v 1.2 1997/10/06 21:52:04 hpa Exp $  
# This is an automounter map and it has the following format  
# key [ -mount-options-separated-by-comma ] location  
# Details may be found in the autofs(5) manpage
```

```
cd      -fstype=iso9660,ro,nosuid,nodev    :/dev/cdrom
```

```
# the following entries are samples to pique your imagination
```

```
#linux      -ro,soft,intr      ftp.example.org:/pub/linux  
#boot       -fstype=ext2           :/dev/hda1  
#floppy     -fstype=auto         :/dev/fd0  
#floppy     -fstype=ext2           :/dev/fd0  
#e2floppy   -fstype=ext2           :/dev/fd0  
#jaz        -fstype=ext2           :/dev/sdc1  
#removable  -fstype=ext2           :/dev/hdd
```



```
# ypcat -k auto.master
```

```
/data auto.data -vers=3,rsize=32768,wsiz=32768
```

```
/home auto.home -vers=3,rsize=32768,wsiz=32768
```

```
# ypcat -k auto.data
```

```
music nec2:/bigdata/SambaShare/Music
```

```
software nec2:/bigdata/SambaShare/Software
```

```
pictures nec2:/bigdata/SambaShare/Pictures
```

```
bigdata nec2:/bigdata
```

```
# ypcat -k auto.home
```

```
teri nec2:/bigdata/LocalHomes/Teri
```

```
rob nec2:/bigdata/LocalHomes/Rob
```



```
# Check for and source configuration file otherwise set defaults
# TUNE_QUEUE: controls whether to up the size of input queues
[ -f /etc/sysconfig/nfs ] && . /etc/sysconfig/nfs
```

```
[ -z "$MOUNTD_NFS_V2" ] && MOUNTD_NFS_V2=auto
[ -z "$MOUNTD_NFS_V3" ] && MOUNTD_NFS_V3=auto
```

```
# Number of servers to be started by default
[ -z "$RPCNFSDCOUNT" ] && RPCNFSDCOUNT=32
```

```
# Remote quota server
[ -z "$RQUOTAD" ] && RQUOTAD=`type -path rpc.rquotad`
```

```
# Get the initial values for the input sock queues
# at the time of running the script.
```

```
if [ "$TUNE_QUEUE" = "yes" ]; then
    RMEM_DEFAULT=`/sbin/sysctl -n net.core.rmem_default`
    RMEM_MAX=`/sbin/sysctl -n net.core.rmem_max`
    # 256kb recommended minimum size based on SPECsfs NFS benchmarks
    [ -z "$NFS_QS" ] && NFS_QS=262144
fi
```



start)

```
# Start daemons.
```

```
# Apply input queue increase for nfs server
```

```
if [ "$TUNE_QUEUE" = "yes" ]; then
```

```
    /sbin/sysctl -w net.core.rmem_default=$NFSD_QS >/dev/null 2>&1
```

```
    /sbin/sysctl -w net.core.rmem_max=$NFSD_QS >/dev/null 2>&1
```

```
fi
```

```
action $"Starting NFS services: " /usr/sbin/exportfs -r
```

```
if [ -n "$RQUOTAD" -a "$RQUOTAD" != "no" ]; then
```

```
    echo -n "Starting NFS quotas: "
```

```
    daemon rpc.rquotad
```

```
    echo
```

```
fi
```

```
echo -n $"Starting NFS daemon: "
```

```
daemon rpc.nfsd $RPCNFSDCOUNT
```

```
echo
```

- Two important “tunes” for an NFS server are done here.
- 1) increase the network memory allocation pool for incoming packets and
  - 2) start the “nfsd” threads to answer incoming requests



- You should create the `/etc/sysconfig/nfs` file for your NFS server and add the following lines:

```
TUNE_QUEUE=yes  
RPCNFSDCOUNT=<number of threads to start>
```

- This is much safer than modifying the `/etc/init.d/nfs` script, which is what you used to have to do with earlier revisions of Linux
- How many threads *should* you start? Well, in the words of a consultant, “That depends ...” on:
  - The number of client requests
  - The network link to the server (is it 100baseT or GbE?)
  - Whether you are seeing NFS socket overflows (port 2049)

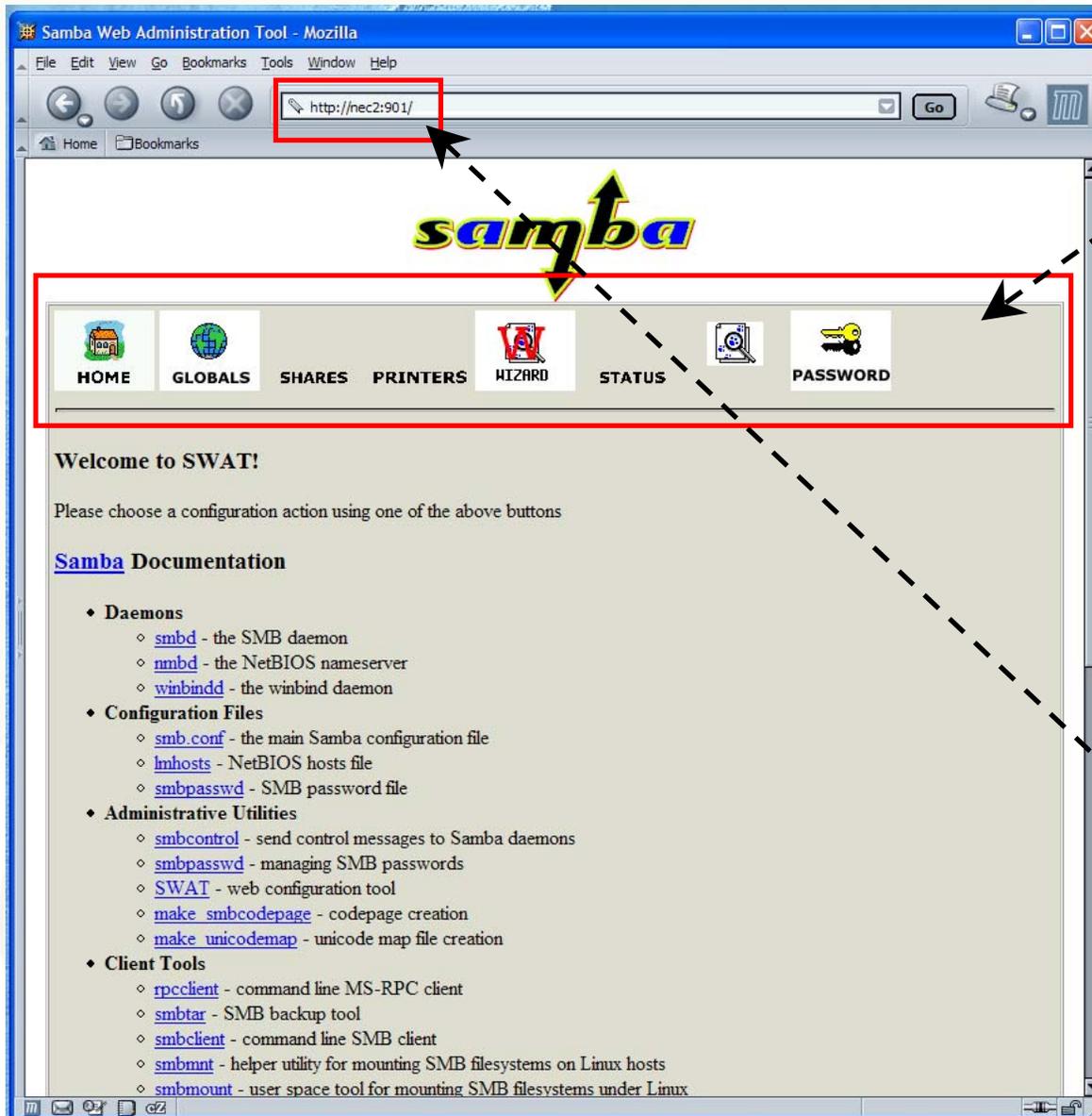


- NIS works much as you would expect
- For clients, there is a `/etc/yp.conf` file that determines how to find the server
- Setting `NISDOMAIN="<domain>"` in the `/etc/sysconfig/network` script will properly execute the `"domainname"` command at boot time
- `"chkconfig ypbind on"` `"service ypbind start"` will fire up the client side
- For the client, you must make sure that your password encoding (remember MD5?) matches whatever the server is providing – non-Linux servers will not provide what Linux is expecting
- If you have a Linux NIS server, you can merge the shadow file and the password file before creating the `passwd` map – there is an option in `/var/yp/Makefile` for that, but it defeats the security
- Your Linux NIS server must *provide* password encoding that any client will expect – if the system type doesn't handle MD5, you must use the lowest common denominator



- **Samba provides server message block (SMB) and common internet file system (CIFS) protocol to Microsoft® Windows® clients**
- **Samba works *\*very\** well and also provides domain controller functionality that will map NIS and/or passwd information to the proper authentication**
- **Samba may be used to export data from your NFS server so that Microsoft Windows clients can see the same data as their Linux brethren**
- **Samba can be quite complex to configure if you start using all of the features, but is not too hard for simple situations**
- **Note that there is an O'Reilly book on Samba that is invaluable if you will be setting up large or complex environments**
- **We will show some initial ways to get Samba up and running so you can experiment ...**

# Introduction to Samba Web Administration Tool (SWAT)



The SWAT command toolbar gives you access to configuration information in the Samba configuration file in an easy-to-use graphical interface

There are, of course, security issues with opening this service, but the *xinetd* configuration file for Swat lets you control where the tool is run from with the *only\_from* option.

Swat is run from port 901 by entering the browser URL  
*http://<server>:901*

# The Swat Globals Form



Settings that determine how the share appears to Windows clients

Password options that determine interoperability with NIS or the `/etc/passwd` file

# A Swat Share Form



Always make sure to “Commit Changes” after making changes to the form information – otherwise you will lose your work ... bad form!

Settings for the base path to the share’s storage and the share comment seen by Windows clients

File access, valid user list, default file and directory create masks, default ownership, and the hosts that are allowed to connect



```
# Samba config file created using SWAT  
# Global parameters
```

```
[global]
```

```
netbios name = NEC2  
server string = Nec2 Samba Server  
security = SHARE  
encrypt passwords = Yes  
obey pam restrictions = Yes  
pam password change = Yes  
passwd program = /usr/bin/passwd %u  
passwd chat = *New*password* %n\n *Retype*new*password* %n\n *passwd:*all*authentication*tokens*updated*successfully*  
unix password sync = Yes  
log file = /var/log/samba/%m.log  
max log size = 0  
socket options = TCP_NODELAY SO_RCVBUF=8192 SO_SNDBUF=8192  
local master = No  
dns proxy = No  
wins server = 192.168.0.101  
hosts allow = 192.168.0.  
printing = lprng
```



## **[printers]**

**comment = All Printers**  
**path = /var/spool/samba**  
**printable = Yes**  
**browseable = No**

## **[Raid5]**

**comment = RAID 5 Storage on Nec2**  
**path = /bigdata/SambaShare**  
**valid users = rob,teri**  
**force group = share**  
**read only = No**  
**create mask = 0774**  
**directory mask = 0775**

## **[Music]**

**comment = Nec2 RAID5 Music Storage**  
**path = /bigdata/SambaShare/Music**  
**valid users = rob teri**  
**force user = rob**  
**force group = share**  
**read only = No**



- The Samba configuration information is underneath the */etc/samba* directory
- Files in this directory include:
  - *smbpasswd*                      Contains UID and password for users
  - *smbusers*                        Maps Windows users to Unix names
  - *lmhosts*                         Windows hosts for NetBIOS
  - *smb.conf*                         Samba configuration file
- The */var/log/samba* directory contains log files for *smbd*, *nmbd*, and clients that have connected (or attempted to connect)
- For each client connection, a new *smbd* process is created
- The *nmbd* daemon handles the netBIOS name service requests for Samba clients



# Miscellaneous Linux Tidbits

- HP-UX to Linux Commands
- MANPATH
- Shared Library Loading
- Using “*strace*”





## HP-UX

*swapinfo*

*chown root:root /root\_home*

*rm*

*ll*

*bdf*

*lanscan*

## Linux

*swapon -s*

*chown root.root /dev/fd0*

*rm -f* (defaults to “safe”)

*alias ll='ls -al'*

*df*

*ifconfig*

**Note:** Many Linux commands support both the “-v” option style and the GNU “--verbose” option style. Check the man page for the command for details



- The “*man*” command on Linux works differently than you might be used to:
  - The MANPATH variable is usually empty
  - The “*man*” command uses */etc/man.conf* to determine a base level of paths for man pages
  - The “*man*” command will also search according to your PATH variable value, looking “in the neighborhood of the executable” for man pages – this works well for self-contained packages
  - If you set MANPATH, it will *override* all other behavior, which will make things stop working – lots of software that is not written explicitly for Linux will set MANPATH and break things
  - If your “*man*” command behavior is strange, check for something setting “*MANPATH=\${MANPATH}:NewPath*” during installation
  - Like, execute “*man man*”, man, if you want gory details



- Occasionally, we all have to deal with shared library loading issues, particularly if we are installing software
- Useful shared library information:
  - *ldd* list executable's shared library dependencies
  - *ld.so* shared object loader, see *ld.so(8)*
  - */etc/ld.so.conf* configuration file for shared libraries in the */usr/lib* and */lib* directories
  - *ldconfig* program to configure shared library cache information, see *ldconfig(8)*
  - `LD_LIBRARY_PATH` one of many environment variables that affect the libraries loaded by an application



- A useful tool for system administrators is the “*strace*” utility – it can tell you *everything* that an application is doing while it is running
- You can use “*strace*” to see:
  - application environment startup
  - shared library loading
  - kernel calls
  - library calls
  - ... and a whole lot more ...
- An example: After installing a to-remain-unnamed load-balancing facility, applications on the system slowed way down. Using “*strace*” on the “*ls*” command we were able to see that the shared library searches were failing multiple times before finally loading the correct system libraries. We traced this to the application adding its shared library paths on the front of the LD\_LIBRARY\_PATH variable, instead of at the end. We found this operation in a startup file being sourced by every user’s shell at invocation, and fixed it. We would never have found this without “*strace*”.

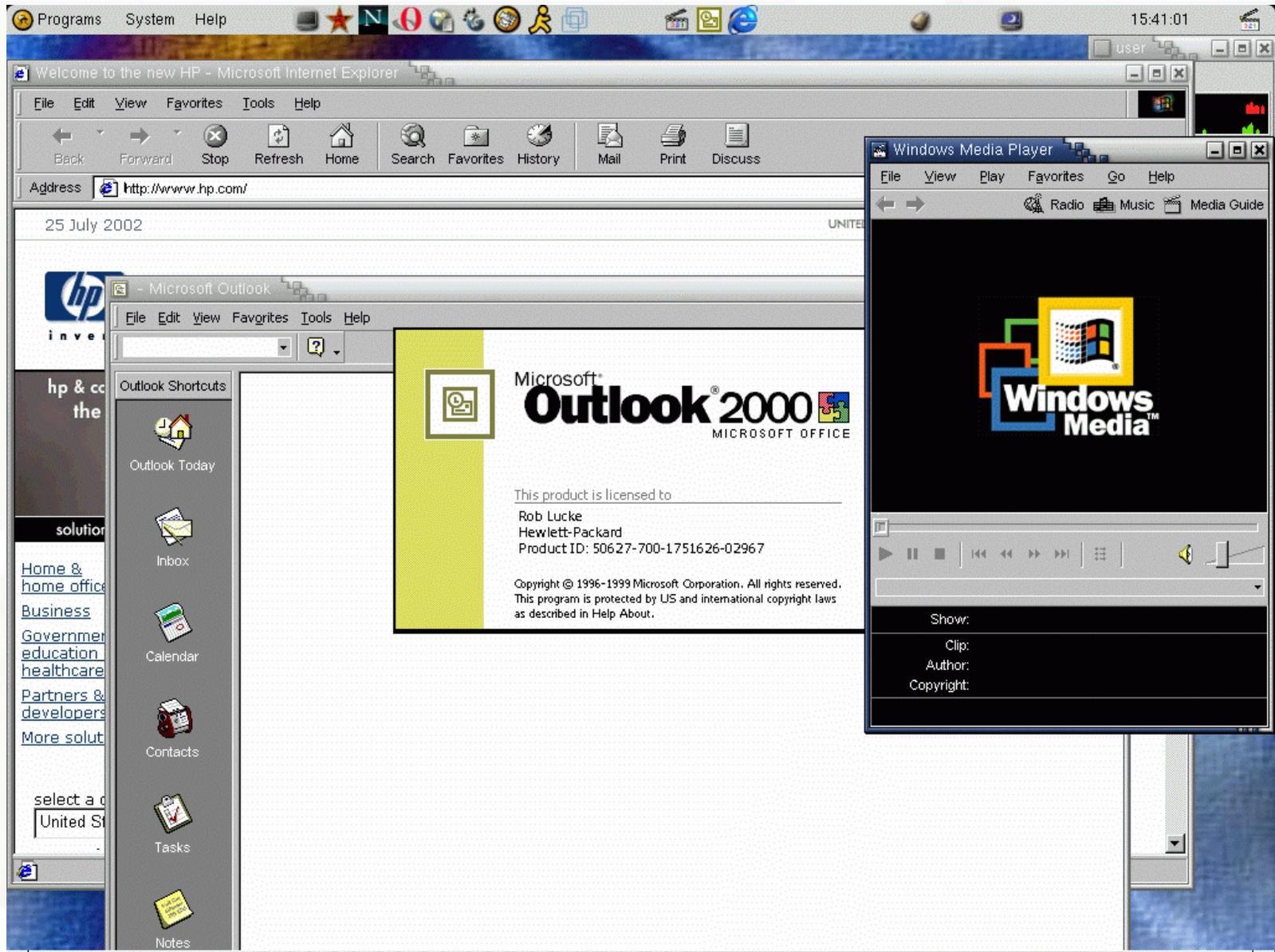
# Example of “strace” Output



```
execve("/bin/ls", ["ls", "."], [/* 38 vars */]) = 0
uname({sys="Linux", node="hppav1", ...}) = 0
brk(0) = 0x80586c8
old_mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x40016000
open("/etc/ld.so.preload", O_RDONLY) = -1 ENOENT (No such file or directory)
open("/etc/ld.so.cache", O_RDONLY) = 3
fstat64(3, {st_mode=S_IFREG|0644, st_size=116342, ...}) = 0
old_mmap(NULL, 116342, PROT_READ, MAP_PRIVATE, 3, 0) = 0x40017000
close(3) = 0
open("/lib/libtermcap.so.2", O_RDONLY) = 3
read(3, "\177ELF\1\1\1\0\0\0\0\0\0\0\0\3\0\3\0\1\0\0\0\340\r\0"..., 512) = 512
fstat64(3, {st_mode=S_IFREG|0755, st_size=11784, ...}) = 0
old_mmap(NULL, 14856, PROT_READ|PROT_EXEC, MAP_PRIVATE, 3, 0) = 0x40034000
old_mmap(0x40037000, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED, 3, 0x2000) = 0x40037000
close(3) = 0
open("/lib/tls/libc.so.6", O_RDONLY) = 3
```

You get the idea, this goes on for pages and pages on a complicated application

# Running Windows Applications in CrossOver Office



# Running Windows in a VMware Virtual Machine





# Lab #3: More Linux System Configuration

**See Lab #3 Handout  
for details**