Hentzenwerke Whitepaper Series

# *From GUI to Text: A Windows User's Guide to Running Linux without a GUI*

**By Whil Hentzen**

**Most folks who are moving to Linux from Windows use distributions that by default have Linux start up with the GUI. All fine and good, but one side effect is that they often get stymied when they need to boot Linux to or run Linux in a text-based interface. This document describes how to perform a number of basic tasks in Linux, using only the text-based interface.**

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# 1. Preface

## 1.1 Copyright

## 1.2 Revisions

### 1.2.1 History

| Version | Date | Synopsis | Author |
|---|---|---|---|
| 1.0.0 | 2004/7/23 | Original | WH |
| 1.1 | 2004/7/28 | Fixed typos, added section 11 on changing the runlevel during startup. | |

### 1.2.2 New version

The newest version of this document will be found at www.hentzenwerke.com.

### 1.2.3 Feedback and corrections

If you have questions, comments, or corrections about this document, please feel free to email me at 'books@hentzenwerke.com'. I also welcome suggestions for passages you find unclear.

## 1.3 References and acknowledgments

Thanks to Carl Karsten, Ed Leafe, Paul McNett, and Ted Roche for various tips, Tom Francis for proofreading, Michael Schwendt for tips on section 11, and the rest of the ProLinux crowd (www.leafe.com) for general ambiance.

## 1.4 Disclaimer

No warranty! This material is provided as is, with no warranty of fitness for any particular purpose. Use the concepts, examples and other content at your own risk. There may be errors and inaccuracies that in some configurations may be damaging to your system. The author(s) disavows all liability for the contents of this document.

Before making any changes to your system, ensure that you have backups and other resources to restore the system to its state before making those changes.

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## 1.5 Prerequisites

This document was written using Fedora Core 2.0 and assumes a beginner's familiarity with use of Linux via the GUI and very rudimentary use of the Command Window.

# 2. A 60 second explanation of Linux runlevels

You are likely familiar with the various modes that Microsoft Windows has - the lowest, "Safe", mode being a bare-bones boot up with no networking, almost no devices, and not even a graphical user interface. This mode is used for getting Windows started and debugging boot problems, such as when Windows 'blue-screens' during bootup. Other Windows modes add bits and pieces of functionality in, such as drivers for various pieces of hardware, the GUI, and networking. These modes are strictly a defensive measure to assist with debugging problematic Windows behavior, and have no regular use once a system is up and running properly.

Linux systems operate on a number of levels that correspond roughly to the various 'modes' that Microsoft Windows has. These are called 'runlevels' but, unlike Windows, Linux was designed from the ground up with runlevel functionality in order to provide flexibility across a variety of environments and configurations.

For example, runlevel 3 is configured in mainstream distributions such as Red Hat, Fedora Core and SuSE to provide full multi-user capabilities with networking and a text-based interface. Runlevel 5 is the same as runlevel 3, but with an additional step of loading a graphical user interface for the user. Many servers are configured to boot into runlevel 3 as part of their normal operation, since they don't need a GUI to do their job.

The concept of the plumbing behind runlevels is easy to understand. Generally speaking, there is a collection of programs used to start up a machine (and another set of programs that are run during machine shutdown). Different runlevels invoke subsets of these programs. The definition of which programs are included in one runlevel's subset versus another's are contained in a series of directories named /etc/rcN.d, where N runs from 0 to 6, matching the various runlevels available. Thus, the program that starts the GUI, startx, is included in /etc/rc5.d, but not in /etc/rc3.d.

## 3. Getting Linux to load to a text interface

So, you want to boot Linux into runlevel 3 because all you need is a text based interface. When Linux boots up, one of the things it does early on in the process is look in a file called /etc/inittab for a line that looks like this:

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

The number after the first colon defines which runlevel will be used during startup. In this example, the '5' in this line (this is an inittab file from a Fedora Core machine) indicates that the machine will be booted to the GUI, with multi-user functionality and networking. The other runlevels and their corresponding numbers for Fedore Core as are follows (this block of text comes directly out of the comments in the inittab file - your distribution will likely have similar comments indicating what each of the runlevels stands for):

```
# Default runlevel.
#   0 - halt (Do NOT set initdefault to this)
#   1 - Single user mode
#   2 - Multiuser, without NFS (The same as 3, if you do not have networking)
#   3 - Full multiuser mode
#   4 - unused
#   5 - X11
#   6 - reboot (Do NOT set initdefault to this)
```

You've probably noticed a system message display on the screen to the effect of

```
Setting runlevel to 6
```

when you've shut your machine down. So, in order to get this machine to boot just to the text based interface, you want to change the '5' to a '3' in /etc/inittab. Just open the file (as root), change the '5' to a '3' in that line, save the file and reboot.

If you're going to play around with the various runlevels, you'll probably find yourself editing and saving /etc/inittab over and over again. Since an error in editing inittab can cause your machine not to boot, or to behave in unexpected ways, here's a trick to prevent those errors.

Let's suppose you've got your original inittab set to a runlevel of 5. Make a copy of the original inittab, naming it 'inittab5'. This will be your backup, in case you mess up the original. Now, make a second copy of the original (the one with a runlevel of 5), and name it 'inittab3'. Edit /etc/inittab3, and change the runlevel from '5' to '3'. If you're going to work with other runlevels, make more copies of the inittab original, naming them 'inittab1', and so on.

Now you've got a set of inittab files in /etc something like so:

```
inittab
inittab1
inittab3
inittab5
```

When you want to boot with a runlevel of 3, copy the inittab3 file on top of inittab, like so:

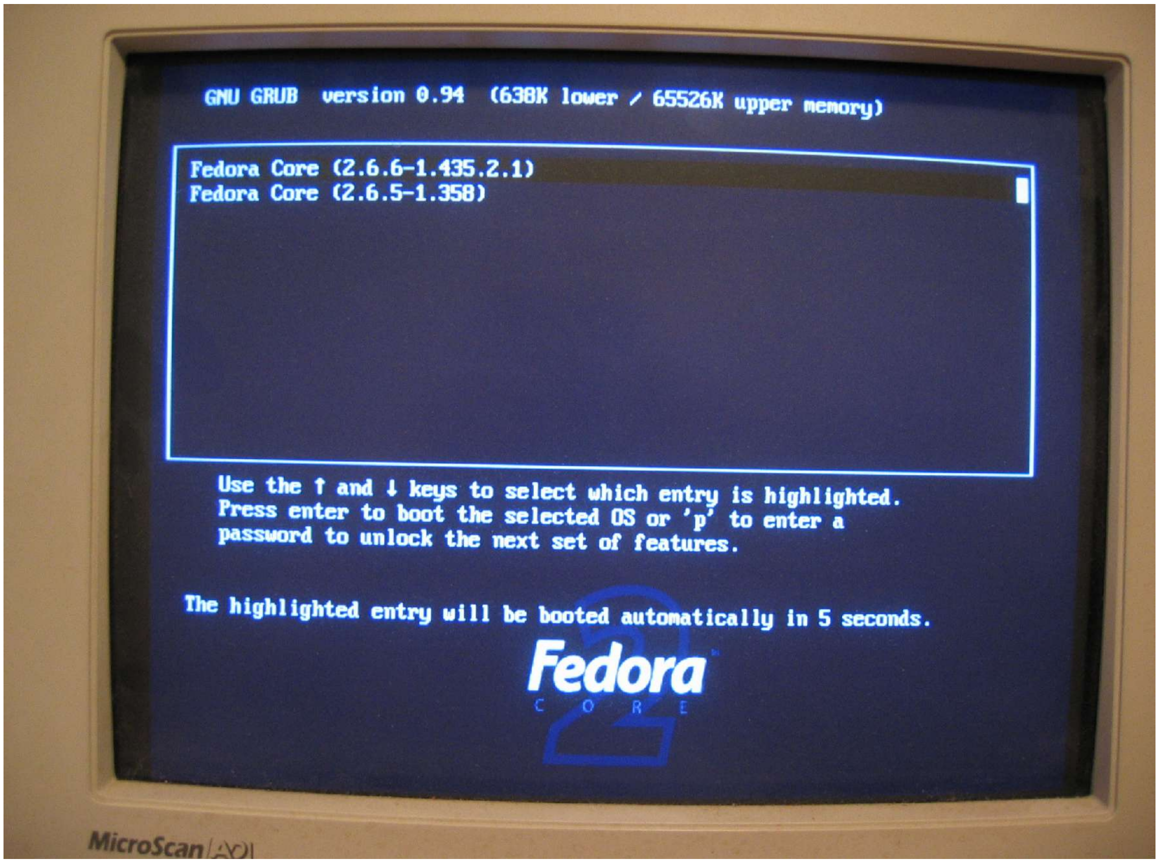
```
# cp /etc/inittab3 /etc/inittab
```

and reboot. The beauty of this is that you can rescue your system and restore it to a known good inittab as long as you can get to a command prompt and have access to the 'cp' command - you don't even have to load up an editor and make changes. (To experienced Linux folk, that may not seem like a big deal, but for someone who is just getting used to this text based interface stuff, being confronted with having to use vi or emacs on a system that suddenly isn't booting properly can be daunting.)

## 4. Logging in without the graphical login screen

One of the first questions users who are contemplating the use of Linux without a GUI is, "How do I log in if I don't have the graphical login screen?" The short answer is that the text-based interface will display a prompt for a username (and then a password) after booting is complete.

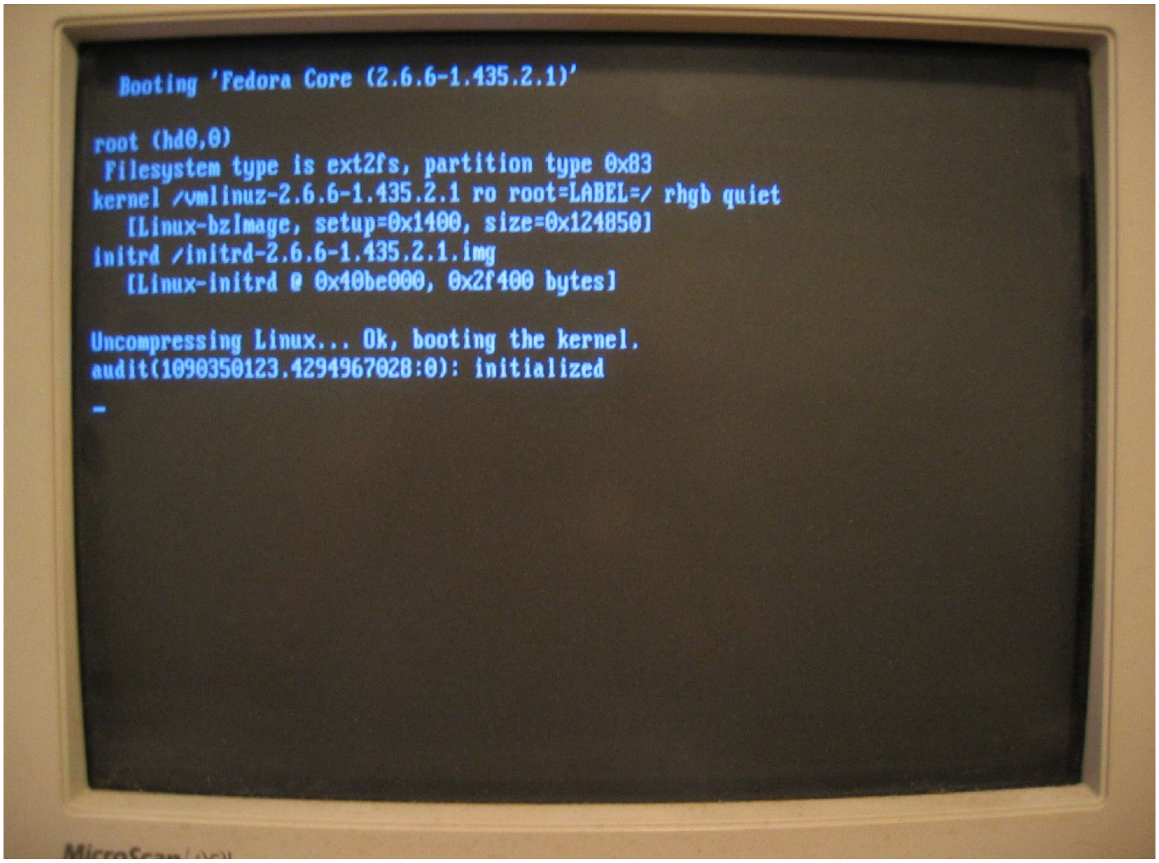
The long answer is the same, but includes sample screen shots. After you've changed the runlevel in inittab as described in the previous section, reboot. Once you reboot, you'll be faced with a series of screens that look something like the following figures. **Figure 1** shows the boot loader screen where you can choose which kernel is loaded.



```
    GNU GRUB  version 0.94  (638K lower / 65526K upper memory)

 Fedora Core (2.6.6-1.435.2.1)
 Fedora Core (2.6.5-1.358)

      Use the ↑ and ↓ keys to select which entry is highlighted.
      Press enter to boot the selected OS or 'p' to enter a
      password to unlock the next set of features.

   The highlighted entry will be booted automatically in 5 seconds.
```

***Figure 1**. The same boot loader screen displays regardless of which runlevel you're using.*

**Figure 2** shows the progression of the boot responses after selection of a kernel in the boot loader screen.

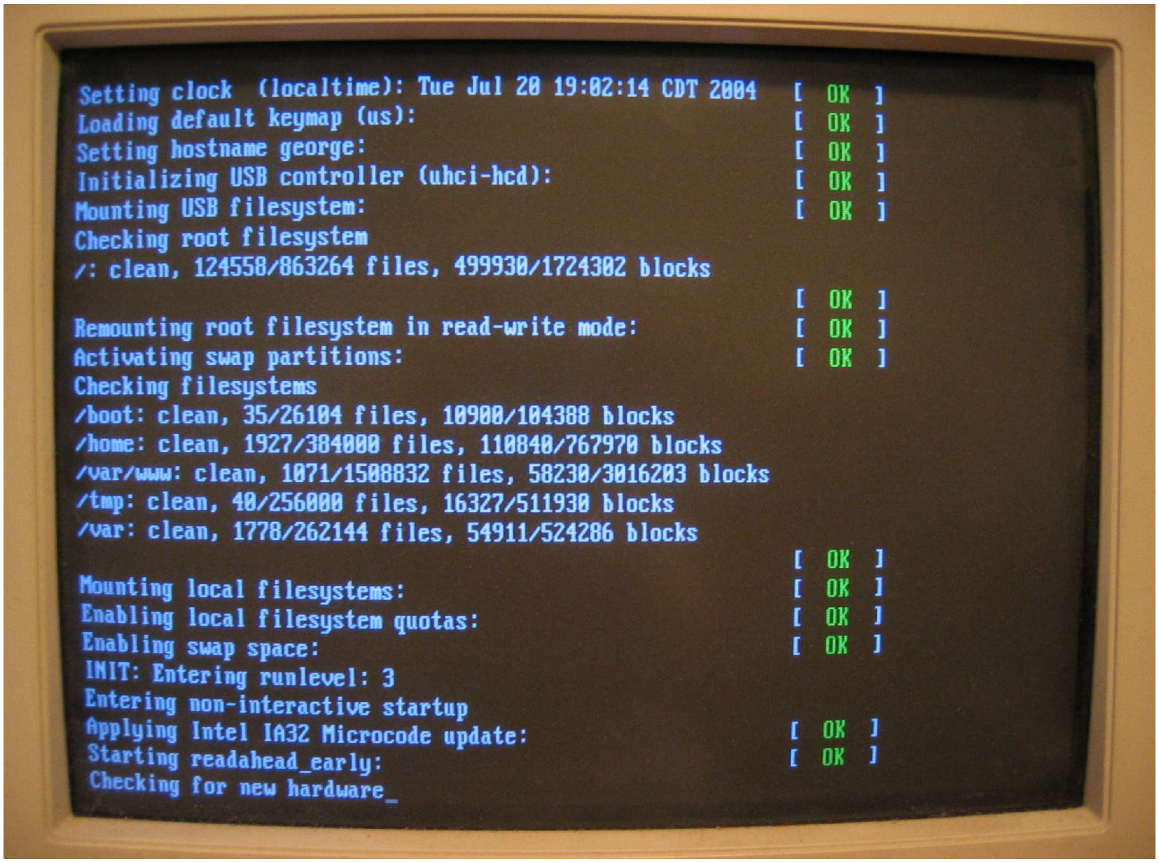


```
  Booting 'Fedora Core (2.6.6-1.435.2.1)'

root (hd0,0)
 Filesystem type is ext2fs, partition type 0x83
kernel /vmlinuz-2.6.6-1.435.2.1 ro root=LABEL=/ rhgb quiet
   [Linux-bzImage, setup=0x1400, size=0x124850]
initrd /initrd-2.6.6-1.435.2.1.img
   [Linux-initrd @ 0x40be000, 0x2f400 bytes]

Uncompressing Linux... Ok, booting the kernel.
audit(1090350123.4294967028:0): initialized

_
```

***Figure 2.*** *The booting process displays responses as it moves along.*

**Figure 3** shows the continuation of the boot process. Note the line fifth from the bottom that says

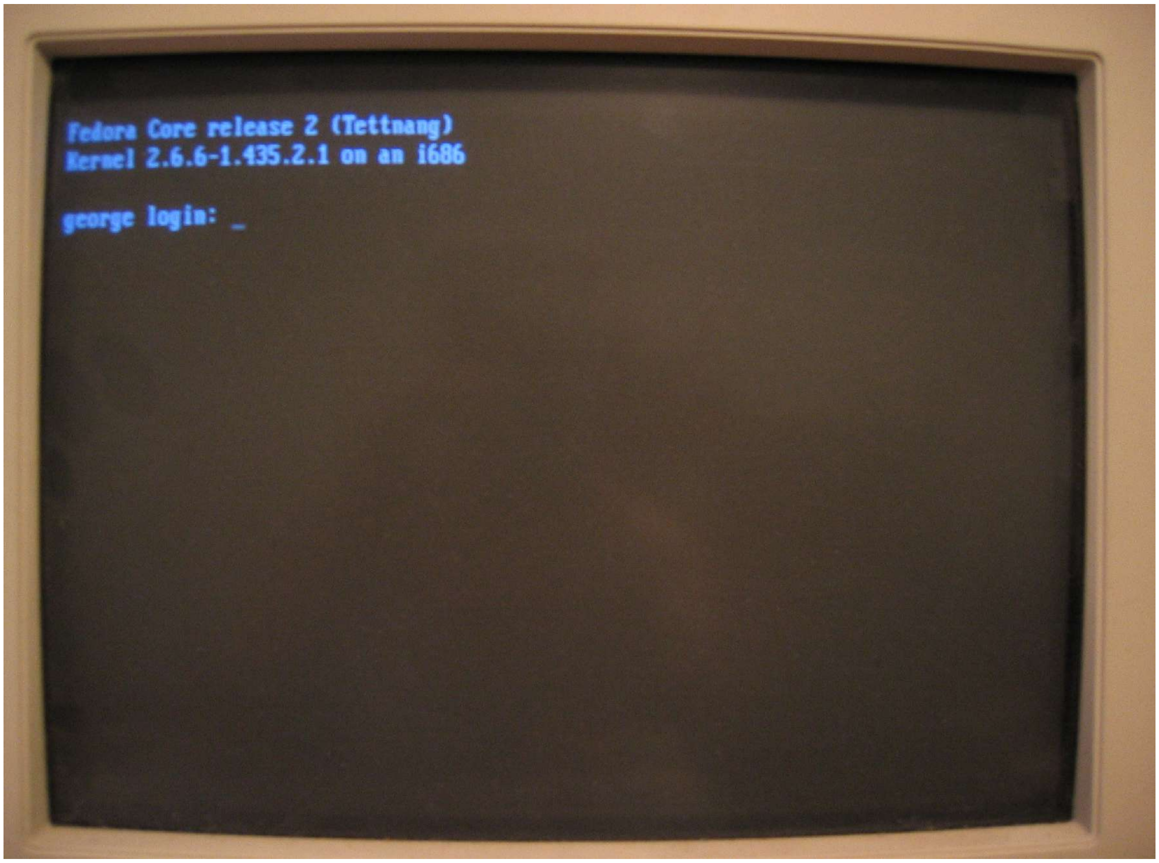
```
INIT: Entering runlevel: 3
```



```
Setting clock  (localtime): Tue Jul 20 19:02:14 CDT 2004   [  OK  ]
Loading default keymap (us):                               [  OK  ]
Setting hostname george:                                   [  OK  ]
Initializing USB controller (uhci-hcd):                    [  OK  ]
Mounting USB filesystem:                                   [  OK  ]
Checking root filesystem
/: clean, 124558/863264 files, 499930/1724302 blocks
                                                           [  OK  ]
Remounting root filesystem in read-write mode:             [  OK  ]
Activating swap partitions:                                [  OK  ]
Checking filesystems
/boot: clean, 35/26104 files, 10900/104388 blocks
/home: clean, 1927/384000 files, 110840/767970 blocks
/var/www: clean, 1071/1508832 files, 58230/3016203 blocks
/tmp: clean, 40/256000 files, 16327/511930 blocks
/var: clean, 1778/262144 files, 54911/524286 blocks
                                                           [  OK  ]
Mounting local filesystems:                                [  OK  ]
Enabling local filesystem quotas:                          [  OK  ]
Enabling swap space:                                       [  OK  ]
INIT: Entering runlevel: 3
Entering non-interactive startup
Applying Intel IA32 Microcode update:                      [  OK  ]
Starting readahead_early:                                  [  OK  ]
Checking for new hardware_
```

***Figure 3.*** *The boot process includes feedback on which runlevel is being executed.*

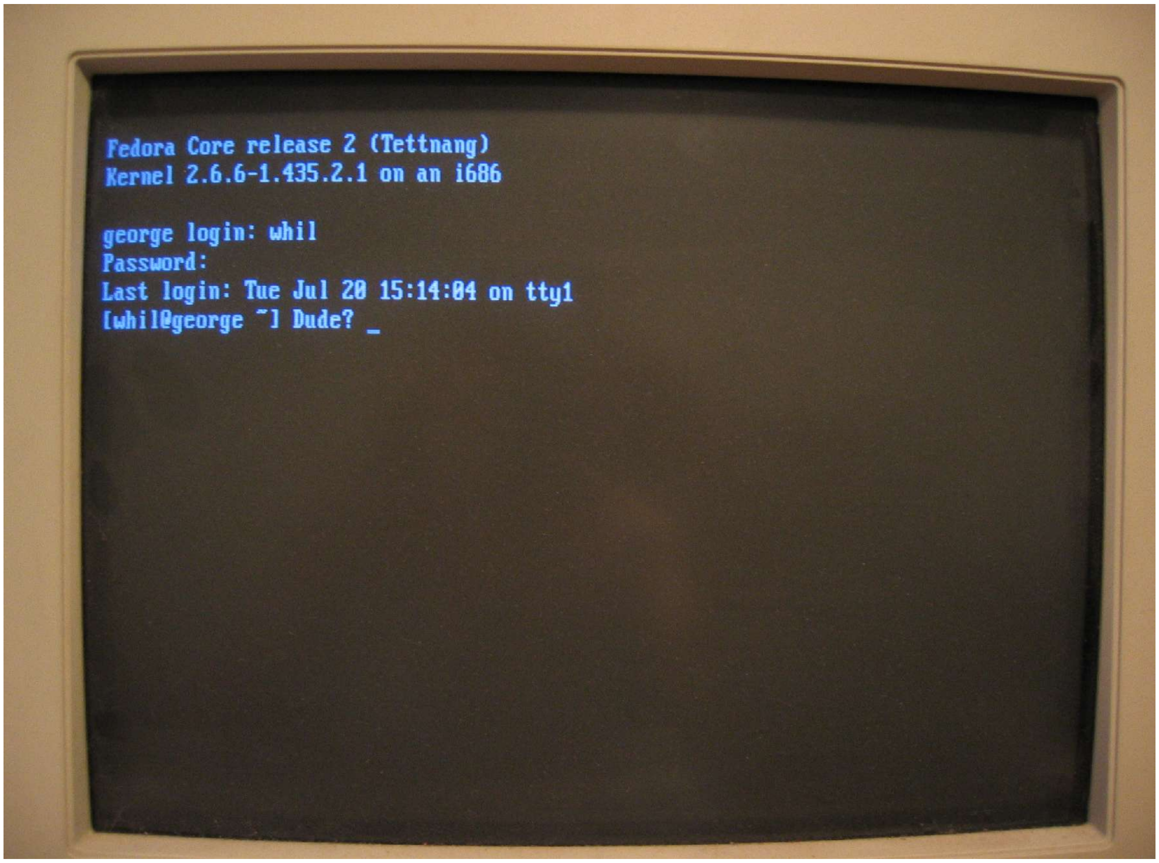
Once the boot process is complete, the system will display a login prompt, as shown in **Figure 4** for the system called 'george'.



```
Fedora Core release 2 (Tettnang)
Kernel 2.6.6-1.435.2.1 on an i686

george login: _
```

***Figure 4.*** *Once the boot process is complete, the system displays a user login prompt.*

Upon successful entry of a username and password then displays a command prompt, as shown in**Figure 5**.



```
Fedora Core release 2 (Tettnang)
Kernel 2.6.6-1.435.2.1 on an i686

george login: whil
Password:
Last login: Tue Jul 20 15:14:04 on tty1
[whil@george ~] Dude? _
```

***Figure 5.*** *A command prompt will be displayed after the successful entry of a username and password.*

In this example, the command prompt includes the user's name, the machine name, the current directory, and a whimsical closing. At this point, the system acts just like you'd opened a command window in the GUI.

# 5. Logging out

The next logical question, after getting in, is how to get out. Specifically, “How do you log out?”

Any user can log out of their session and return to the login prompt (shown previously in Figure 4) by typing 'exit'. You can also type “Ctrl-D” to be returned to the login prompt.

# 6. Switching users

Suppose you're logged in as yourself, and you need to run a few commands as root, or as another user. There are several ways to do this. The novice method is to log out as the first user, getting to the login prompt, and then logging in as a different one, but there are better ways.

## 6.1. Using the su command to switch to become root

The first way, particularly useful if you don't need to go back and forth between multiple users, is to use the su (“substitute user”) command. By default, issuing the 'su' command without any arguments will prompt you for the password for the root user, like so:

```
[whil@testbox ~] Dude? su
Password?
[root@testbox /home/whil] I AM ROOT:
```

This turns you into the root user, but with one important caveat – it does not include the root user's environment. As you can see by the last line in the sample listing, the current directory is still /home/whil, not root's home directory (/root).

If you include a space and a hyphen after the su command, root's environment will be included, like so:

```
[whil@testbox ~] Dude? su -
```

```
Password?
[root@testbox ~] I AM ROOT:
```

In order to get back to the original user, type 'exit' or Ctrl-D.

## 6.2. Using the su command to switch to become another user

You can also use 'su' in conjunction with the -l (the letter 'ell') parameter in order to become another user. Include the username of the target user, like so:

```
[whil@testbox ~] Dude? su -l herman
Password?
[herman@testbox ~] Yes, Lilly?
```

If you use the su -l command as root to become another user on the system, you won't be prompted for a password, which makes sense since root is the super user for the system. Of course, that begs the question why you'd want to do so, but I'm sure there's some scenario where it would make sense.

## 6.3. The sudo command

An alternative to su is the sudo command. A complete explanation of sudo is beyond the scope of this document, but a brief introduction is in order. The sudo command allows you to run a single command as a different user. By default, the other user is root, but you can specify a different user's login name as well. The sudo command only works after your userid has been added to the /etc/sudoers file (editing /etc/sudoers has to be done using the 'visudo' command).

```
[whil@freedom ~] Dude? sudo ls /root
Password:
whil is not in the sudoers file.  This incident will be reported.
[whil@freedom ~] Dude?
```

The password prompted for is for the original user, not for root, and serves as authentication that the person executing the sudo command isn't just some passerby who happened upon a computer with a live prompt. Upon failure of sudo as shown, mail is sent to root (although this can be changed in the sudoers file.)

Once the user 'whil' is added to sudoers, the exchange will look like this:

```
[whil@freedom ~] Dude? sudo ls /root
Password:
anaconda-ks.cfg  install.log         plugininstall.results
Desktop          install.log.syslog
[whil@freedom ~] Dude?
```

## 6.4. Multiple sessions

Mainstream Linux distributions are installed with six 'sessions' available to each user, providing the ability to log in multiple times, as the same or different users. You can switch from one session to another with the keystroke combination Ctrl-Alt-F where “F” is one of the six functions keys, F1 through F6. When Linux starts up, you're in session automatically. Press Ctrl-Alt-F2 and you'll be greeted with a second log in prompt, as shown in Figure 4, where you can log in as a different user.

And because this is Linux, the work you do as one user in one session isn't going to interfere with the work you may be doing, say, in the background, as another user in another session. Well, except if you're logged on as root in one session and are messing with the files and permissions of the user who is logged in under a different session.

## 6.5 Determining the current session and user

So you're working on your machine, and get called away to a chocolate chip cookie and milk emergency. Twenty minutes later you return in a sugar coma, and you've quite forgotten which session you're in, or even what user you're logged in as.

The command

```
tty
```

will return a response like

```
/dev/tty1
```

which tells you that you're in session 1, while the command

```
who
```

will return a response like

```
whil   tty1    Jul 20  16:00
```

which tells you who the currently logged in user is, which session you're in, and when the login occurred.

### 6.6 How sessions are defined

Remember that /etc/inittab file described in section 3 that defines the default runlevel? It also has a section that defines the sessions available. The section looks something like this:

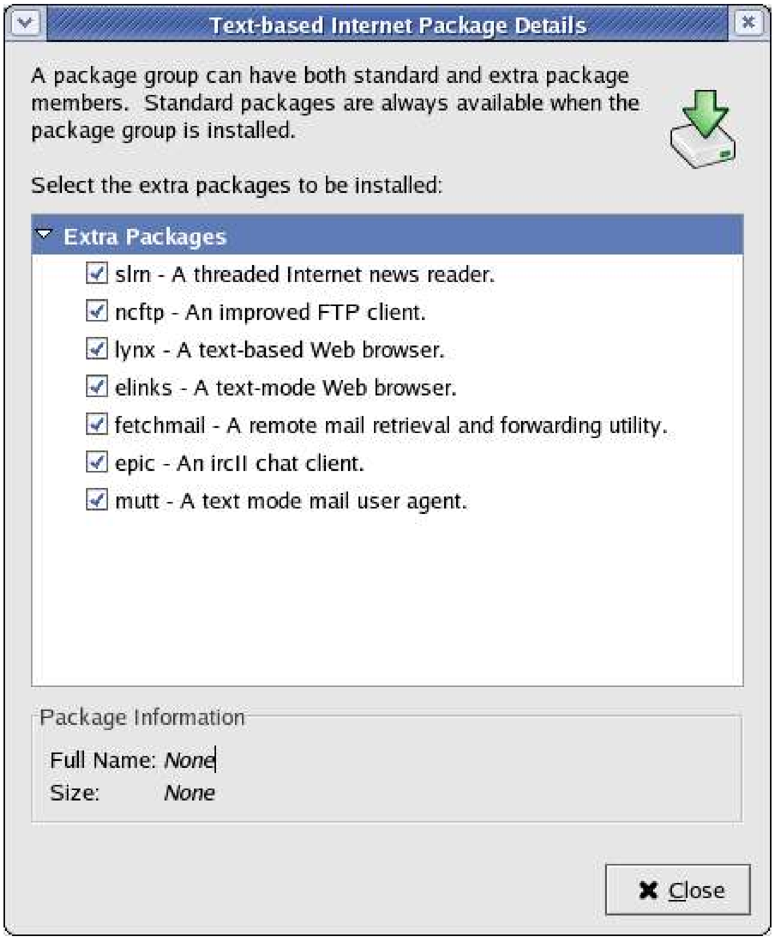
```
# Run gettys in standard runlevels
1:2345:respawn:/sbin/mingetty tty1
2:2345:respawn:/sbin/mingetty tty2
3:2345:respawn:/sbin/mingetty tty3
4:2345:respawn:/sbin/mingetty tty4
5:2345:respawn:/sbin/mingetty tty5
6:2345:respawn:/sbin/mingetty tty6
```

## 7. What programs can you run from the text-based interface?

Obviously, there are a variety of operating system commands that you can run from the command prompt. Like MS-DOS, some commands are internal to the kernel while others are standalone programs, usually located in /bin, such as cp (copy) and ps (process status). Details on these commands are covered in other whitepapers.

It may seem amazing, but there are software programs that provide similar functionality at the command prompt that you're used to through the GUI. For example, Linux distributions all come with text based email clients, web browsers, ftp programs, and so on.

For example, the character based email client, mutt, is installed as part of the Text-based Internet group of applications during installation. Similarly, lynx is a popular character based Web browser. **Figure 6** shows all of the Text-based Internet packages that are part of Fedora Core.



Text-based Internet Package Details

A package group can have both standard and extra package members. Standard packages are always available when the package group is installed.

Select the extra packages to be installed:

Extra Packages

- ☑ slrn - A threaded Internet news reader.
- ☑ ncftp - An improved FTP client.
- ☑ lynx - A text-based Web browser.
- ☑ elinks - A text-mode Web browser.
- ☑ fetchmail - A remote mail retrieval and forwarding utility.
- ☑ epic - An ircII chat client.
- ☑ mutt - A text mode mail user agent.

Package Information

Full Name: *None*

Size: *None*

***Figure 6**. Lynx and mutt are among the Text-based Internet applications included with Fedora Core.*

How do you run these programs? First, determine if they're on your system with the 'whereis' command, like so:

```
[whil@freedom ~] Dude? whereis mutt
mutt: /usr/bin/mutt /usr/share/man/man1/mutt.1.gz
[whil@freedom ~] Dude? whereis lynx
lynx: /usr/bin/lynx /etc/lynx.cfg /usr/share/man/man1/lynx.1.gz
```

The /usr/bin directory is ordinarily in a regular user's path, so all you need to do to run one of these programs is type its name at the command prompt:

```
[whil@freedom ~] Dude? mutt
```

The application will be opened full screen, just like in those old PC-DOS days.

## 8. Loading the GUI when in text mode

There are times you may want to get into the GUI from the text-based interface. It would be terribly inconvenient to have to edit (or copy) the inittab file and then reboot. Old-timers may remember that Windows 3.1 was actually a program that ran on top of DOS. You could type 'win' at the DOS prompt and Windows' graphical interface would load up. Linux's various GUIs operate on the same principle. Simply type

```
startx
```

at the command prompt (after you've logged in as a user), and the GUI will be loaded for you. Once you're in the GUI, you're still logged in as the user you logged in as at the text interface login prompt.

Note that you haven't changed runlevels simply by starting the GUI. You're still in your original runlevel – you've just executed a program, startx, that happens to also be automatically started when the machine is booted with another runlevel.

### 8.1 Multiple sessions with the GUI

By the way, the technique with multiple sessions described in 6.4 also works when you're in the GUI. Press Ctrl-Alt+F4, for example, and you'll be in session 4, with a text based login screen like shown in Figure 4. However, it can be unnerving to have a complete graphical user interface on the screen, and then suddenly be confronted with a text-based log in prompt. To get back to the GUI after doing so, press Ctrl-Alt-F7 and you'll be returned to the GUI.

## 9. Getting back to the text interface from the GUI

If you want to get back to the text interface from the GUI, select the Start | Logout menu item. Instead of being logged out and returned to a graphical login screen like you would have you had loaded the GUI during bootup, you'll be returned to the text interface you started from.

## 10. Shutting down from the text interface

To shutdown the computer, log on as the root user, and issue the 'shutdown' command, as shown in the following examples. To shut down and reboot as soon as the shutdown was properly performed:

```
#shutdown -r now
```

To shut down and reboot five minutes after shutdown is complete.

```
#shutdown -r +5
```

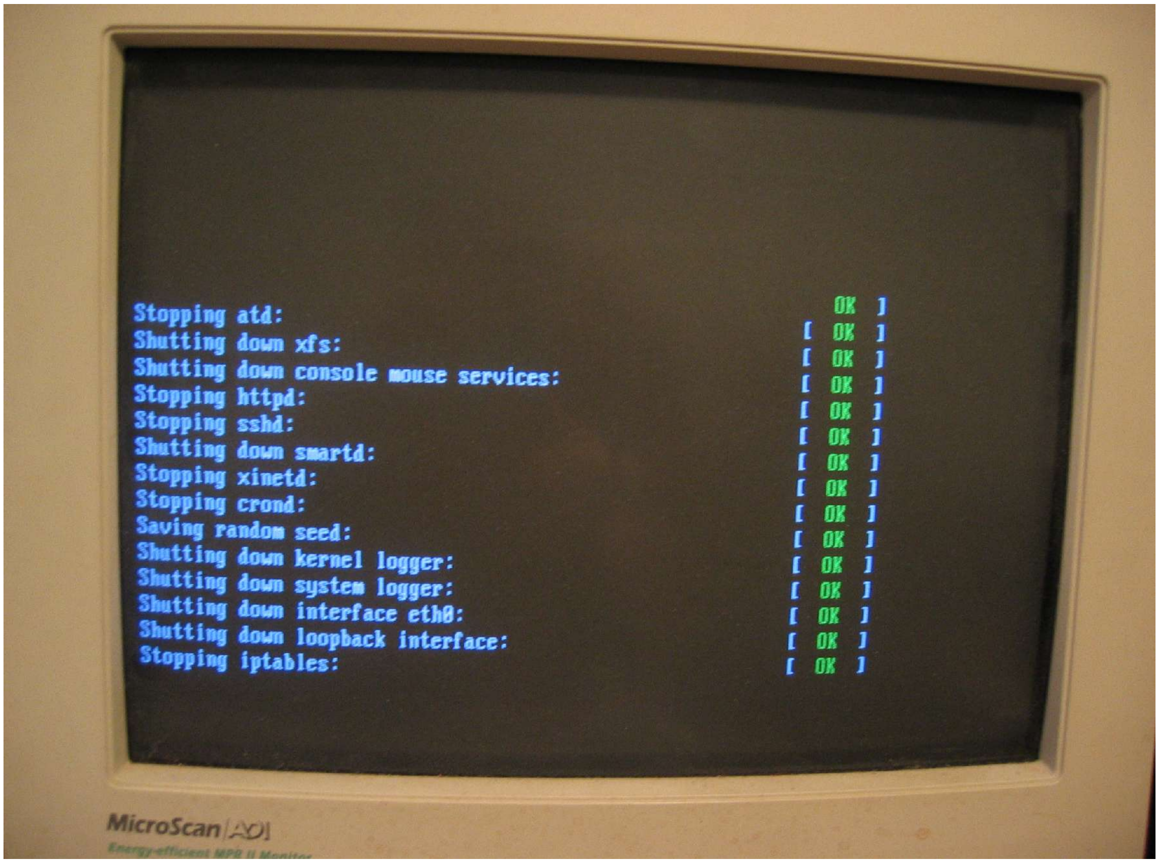
Shut down and halt or turn the machine off.

```
#shutdown -h
```

You can use the 'three-fingered-salute' (Ctrl-Alt-Delete) to initiate an orderly shutdown if it's been defined in /etc/inittab, like so:

```
# Trap CTRL-ALT-DELETE
ca::ctrlaltdel:/sbin/shutdown -t3 -r now
```

Note that the initiation of shutdown doesn't appear instantaneously - it can take a few seconds for the shutdown process feedback to appear on the screen, as shown in **Figure 7**.



```
Stopping atd:                                       OK  ]
Shutting down xfs:                                [  OK  ]
Shutting down console mouse services:             [  OK  ]
Stopping httpd:                                   [  OK  ]
Stopping sshd:                                    [  OK  ]
Shutting down smartd:                             [  OK  ]
Stopping xinetd:                                  [  OK  ]
Stopping crond:                                   [  OK  ]
Saving random seed:                               [  OK  ]
Shutting down kernel logger:                      [  OK  ]
Shutting down system logger:                      [  OK  ]
Shutting down interface eth0:                     [  OK  ]
Shutting down loopback interface:                 [  OK  ]
Stopping iptables:                                [  OK  ]
```

***Figure 7****. It takes a few moments for the shutdown process to appear on the screen after shutdown has been commenced.*

By default, only the root user can use Ctrl-Alt-Delete to shut down a machine. You can allow other users to issue Ctrl-Alt-Delete to shutdown a machine by creating a shutdown.allow file in /etc that includes the names of the such users. For example, if you wanted to allow 'herman' to be able to Ctrl-Alt-Delete, just create a text file that contained the word

```
herman
```

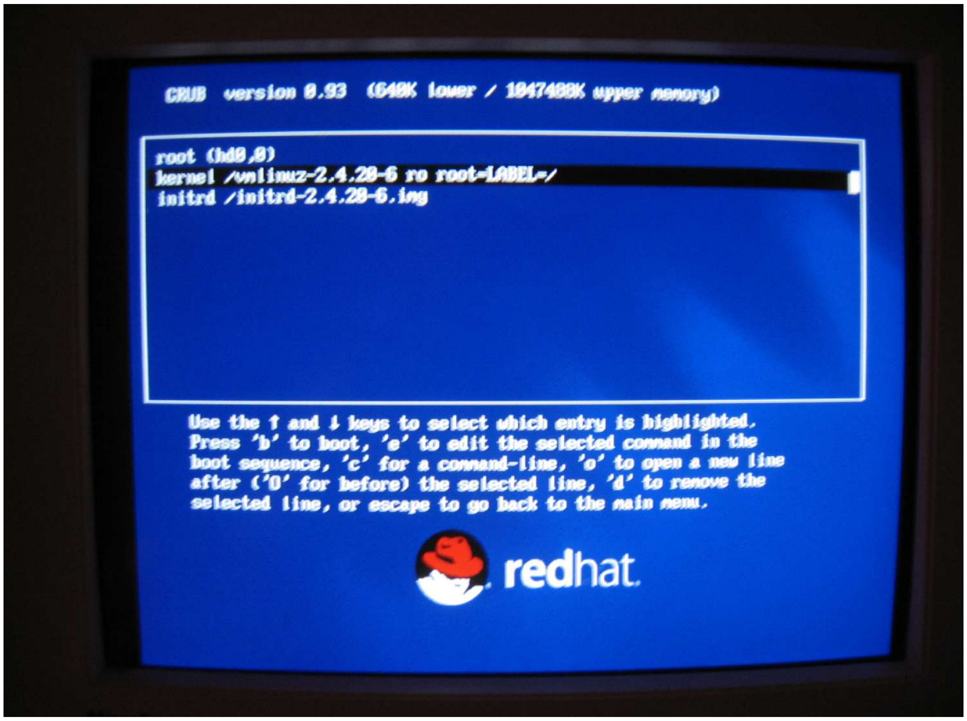
and save it as /etc/shutdown.allow

## 11. Changing the runlevel during startup

Suppose you've got the runlevel in /etc/inittab set to 5, but at some point, you want to boot the system into runlevel 3 directly. Here's how.

First, boot the machine until the graphical boot loader screen displays, as shown in Figure 1. You'll need to be quick for step number two, because you've only got a few seconds before the machine automatically boots the highlighted kernel.

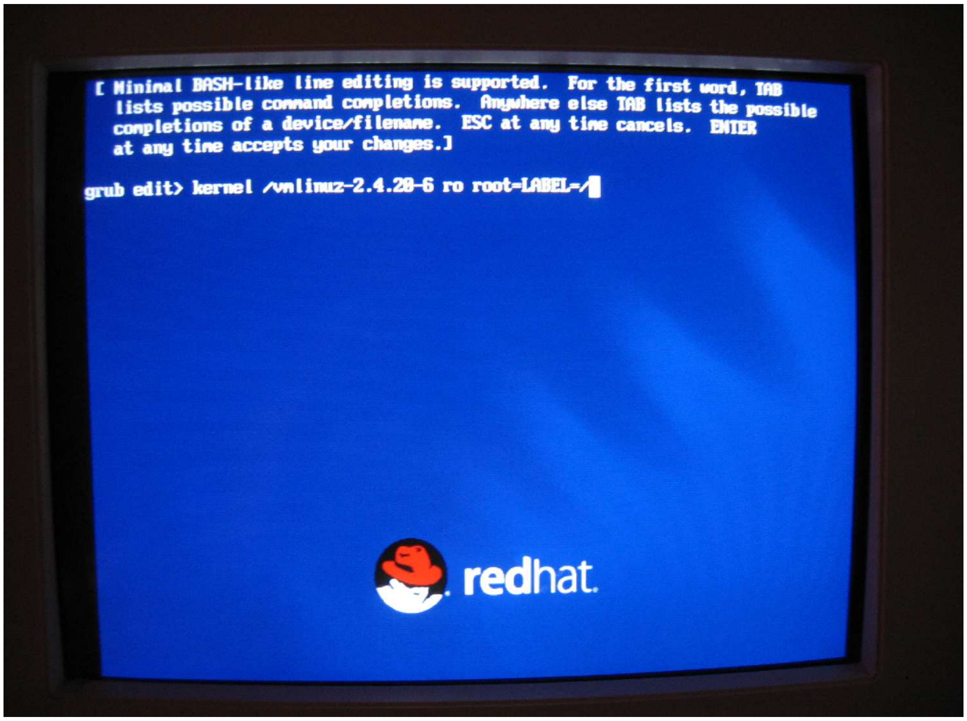
Step two is to press the letter 'e' in order to edit the boot loader. The Next, move the highlight down to the line that begins with “kernel” as shown in **Figure 8**.



```
GRUB  version 0.93  (640K lower / 1047488K upper memory)

root (hd0,0)
kernel /vmlinuz-2.4.20-6 ro root=LABEL=/
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.
```

***Figure 8**. Move the hightlight to the line beginning with 'kernel' in order to change the runlevel.*

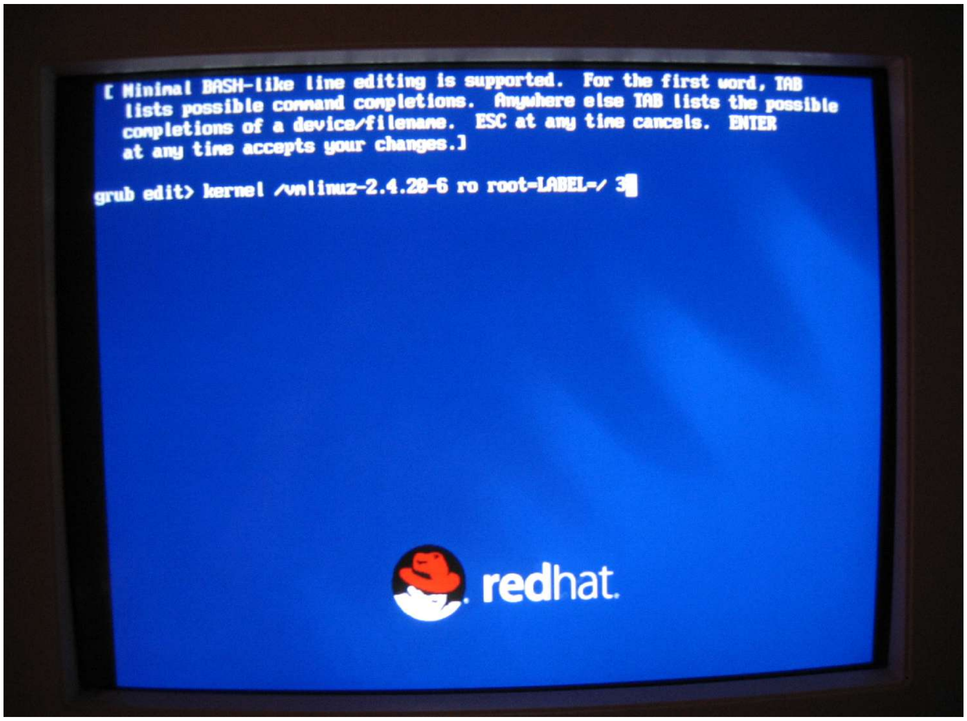
Press the letter 'e' again to edit this line, as shown in **Figure 9**.



```
[ 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=/
```

***Figure 9**. Pressing 'e' switches you into the grub edit screen.*

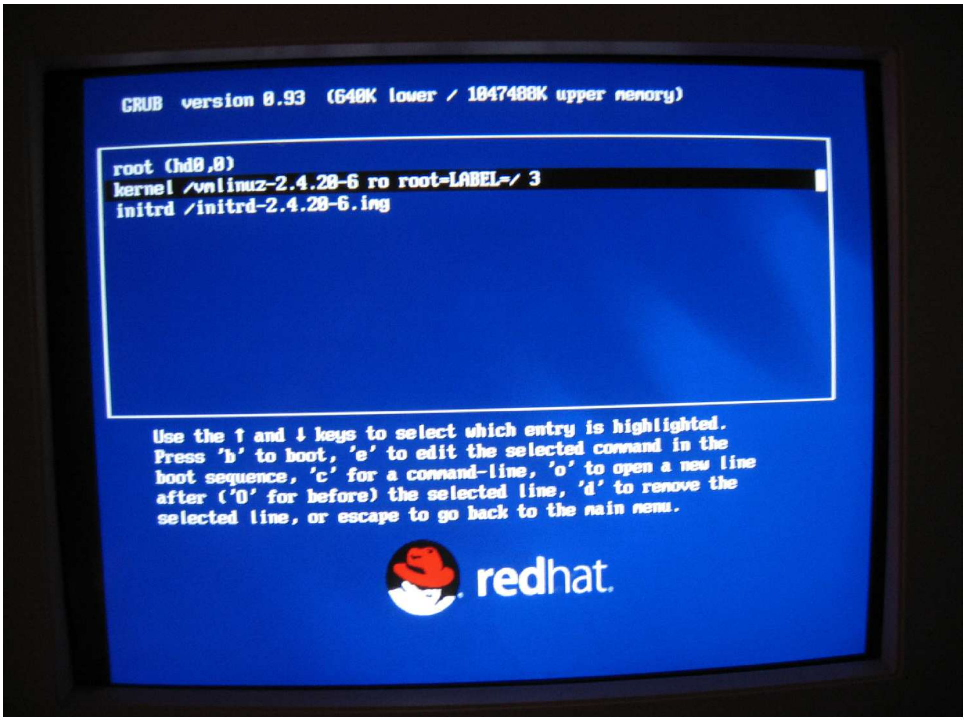
Press the space bar and then type the number of the runlevel you want to enter. **Figure 10** shows a '3' being typed for runlevel 3.



```
[ 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=/ 3
```

***Figure 10****. Enter the number of the runlevel you want to boot into, after typing a space.*

Press Enter, and you'll be returned to the graphical boot loader screen with your modification included, as shown in **Figure 11**.



```
GRUB  version 0.93  (640K lower / 1047488K upper memory)

root (hd0,0)
kernel /vmlinuz-2.4.20-6 ro root=LABEL=/ 3
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.
```

***Figure 11****. Press 'b' once you're back to the graphical boot loader screen to continue booting.*

Press 'b' to continue with the boot process. The regular boot process will continue, and the next screen you see will be similar to Figure 2.

## 12. Where to go for more information

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