

# Chapter 13

## Linux Boot Process

This chapter reviews the process that Linux uses to boot.

### Concepts Learned in this Chapter

- How Linux boots
- Bootup display
- System Information

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### **13.1 Boot Process**

Any Operating System must be loaded from the Hard Drive and written to memory. After which, the it must verify its present hardware and configure itself. This is a very complex process. Here we will describe the process that the system uses to boot up and make itself ready for login.

#### **13.1.1 Power On**

Everything starts with the power-on. This initiates the POST and initial BIOS boot.

#### **13.1.2 BIOS Boot**

After the POST is completed, BIOS reads a very short program from its ROM (EEPROM device) that is designed to read another booting program, the Boot Loader, that is located on the Master Boot Record (MBR) on the Hard Drive. BIOS also sets up the minimal hardware configuration for the computer to work – keyboard, minimal video, boot device order.

#### **13.1.3 Boot Loader Program**

On the Master Boot Record of the Hard Drive is a small program that is capable of really loading the full Operating System off of the Hard Drive. It knows where to look on the drive for the actual OS. In the Linux OS, the boot process is displayed as a series of status lines. This process can later be reviewed by issuing the command **dmesg**, which will then be displayed for review.

#### **13.1.3 Boot Process**

The process that Linux goes through to boot may initially appear intimidating, but it does have a logical flow.

1. After the bootstrap program has installed the Kernel, it initiates it initial operation.
2. The next step is for the Kernel to check the system hardware. This is the text that is displayed during the boot. This data is also logged to the **dmesg** file, which may be viewed at a later time.
3. After the Kernel is operational, it then proceeds to install and activate various services. The first utility that is loaded is **init**, often referred to as the grandfather of all other services. (man initlog)
4. Init refers to the **/etc/inittab** file. (“tab” stands for TABLE.) This file sets up various system parameters, including the system run level (0 through 6), what happens when a service is terminated, what services are started, how and what happens in case of a shutdown, and finally how the system treats various virtual tty terminals.
5. After init has been run, the next utility is **/etc/rc.d/rc.sysinit**. The network availability is tested (**/etc/sysconfig/network** file) to see if a network connection is available.

/etc/sysconfig/network file:

NETWORKING=yes

FORWARD\_IPV4=false

HOSTNAME=mypc.mydomain.com

DOMAINNAME=mydomainname.com

GATEWAY=1.2.3.4

GATEWAYDEV=eth0

6. Next, the script utility **/etc/rc.d/init.d/functions** is loaded; this provides various functional capabilities for the other utilities.
7. The utility **/sbin/loglevel** is executed to set the initial loglevel. This specifies the level of messages printed to the stdout (monitor).
8. The console keymap for the designated language is loaded. (Linux has been translated to a multitude of different languages, and thus required the availability of different character sets.)
9. The system font and font variables are loaded from the **/etc/sysconfig/il8n** file. The utility **consolechars** is run if available, otherwise the utility **setfont** is run.
10. The swap device is enabled, as specified in the **/etc/fstab** file.
11. The system hostname and NIS domainname are set. If NIS is not set up, the domainname from the **network** file is used.
12. The file system options are set in the variable **fsckoptions** for later use.
13. File system checking is initiated. If error exist, the system will default to a minimum super user mode to allow possible system repair. (man fsck, man initlog).
14. The file **/proc/cmdline** is checked to see if plug and play (pnp) devices exist. The utility **/sbin/isapnp** is executed.
15. The root ( / ) file system is remounted in the read-write mode. (man mount).
16. If an error occurs in step 13, a quotacheck is initiated. (man quotacheck, man quotaon).
17. The IN\_INITLOG string variable is cleared.
18. Check for file **/etc/HOSTNAME**, else use the **/etc/sysconfig/network** file for the system hostname.
19. The file **/etc/mtab** is cleared. The root ( / ) file system and **/proc** are mounted into **/etc/mtab**.
20. A check is made to see if modules are to be used by checking the file **/proc/cmdline**.
21. Set soft links for **/etc/module** and **System.map**. The Kernel version determines the setup requirements.
22. The **/etc/conf.modules** file is checked to see if sound module are to be installed.
23. The utility **/sbin/raidadd** is executed if hard drive raid configuration is to be configured.
24. File system is again checked against other variable of Step 13.
25. All other filesystems, other than previously mounted root ( / ), /proc, and NFS are mounted.

26. The utility **/sbin/quotaon**, if it exists, is executed.
27. The files **/etc/mtab~**, **/etc/fastboot**, **/etc/forcefsck**, **/var/lock/console/\***, **/var/run/\*.pid**, **/tmp/.X\*-lock**, and **/tmp/.S.PGSQL.\*** are deleted. The file **/var/run/wtmp** is updated.
28. The system clock is set and the file **/etc/sysconfig/clock** is loaded. Environmental values **\$CLOCK** and **\$CLOCKFLAGS** are set.
29. The swap space is activated.
30. If the file **/etc/rc.d/rc.serial** exists, the serial ports are initialized.
31. The script utility **/etc/rc.d/rc.modules** is executed to load backward compatible modules.
32. If a SCSI tape drive is detected, the **st** module is loaded.
33. The preferred X display manager (KDE, GNOME, ...) is set.
34. Dump the syslog to the **/var/log/dmesg** file.
35. The utility **/sbin/update** is executed to flush dirty buffers to the hard drive.
36. The script utility **/etc/rc.d/rc** is initiated.
37. The value of the run level is assigned to the **argv1** variable.
38. The utility **runlevel** is executed. (For the remainder of the process, it will be assumed that run level 3 is initiated, others are identical.) (man runlevel).
39. The variable **CONFIRM=yes** is set in the **/proc/cmdline** file.
40. The text **"/etc/rc.d/rc3.d"** is written to the file **/var/run/runlevel.dir**.
41. A "do loop" is executed that runs all scripts in the **/etc/rc.d/rc3** directory that start with a "K". This kills all specified services.
42. A "do loop" is executed that runs all scripts in the **/etc/rc.d/rc3** directory that start with an "S". This starts all specified services.
43. All service script utilities are maintained in the **/etc/rc.d/init.d** directory, depending upon the vendor design. The **init.d** or **xinit.d** utilities are intended to support various network services, but also supports other configuration options as well. As the various services are started (at boot), each service displays an "OK" message. Status as to whether the service was started or not is not displayed for security reasons.

This completes the boot process. The user is then presented with the login prompt.

#### 13.1.4 System Boot in Outline Format

The following is an outline format of the boot process previously presented.

##### System Boot

##### Kernel Loaded

Init executed – inittab read

**/etc/init**

rc.sysinit

**/etc/rc.d/rc.scripts**

network available

**/etc/sysconfig/network**

functions

daemon

killproc	
pidofproc	
status	
echo_success	
echo_failure	
echo_passed	
success	
echo_success	
failure	
passed	
action	
confirm	
loglevel	/sbin/loglevel
console keymap	/etc/sysconfig/console/mykeymap
system font	/sbin/setsysfont
font variables	/etc/ssconfig/il8n
consolechars	
setfont	
swap partition initiated	/etc/fstab
system name	
hostname	
domainname	
file check options	
filesystem check	
pnv device check	
mount filesystem rw	
quotacheck	
IN_INITLOG cleared	
Check for HOSTNAME	
/etc/mtab initialized	
module check	
links to module-info and System.map created	
sound module installed	/etc/conf.modules
/etc/sound	
/etc/midi	
raid configured	/sbin/raidadd
file system again checked	
other file systems mounted	
quotaon executed	/sbin/quotaon
deleted files	
/etc/mtab~	
/etc/fastboot	
/etc/fsckoptions	
/etc/forcefsck	
update file	
/var/run/wtmp	
system clock set	/etc/sysconfig/clock
/sbin/hwclock	

```

/sbin/clock
swap activated
serial ports initialized
load backward compatible modules /etc/rc.d/rc.modules
load SCSI tape module if required
Set X Display Manager
Update the dmesg file
Dirty buffers flushed /sbin/update
rc script is run /etc/rc.d/rc
argv1 assigned value of run level
runlevel executed
CONFIRM=yes /proc/cmdline
"/etc/rc.d/rc3.d" copied to file /var/run/runlevel.dir
Services in specified run level directory killed
/etc/rc.d/rcX
lrwxrwxrwx 1 root root 14 Aug 7 2001 K05innd -> ../init.d/innd
lrwxrwxrwx 1 root root 23 Dec 19 2001 K10webmin -> /etc/rc.d/init.d/webmin
lrwxrwxrwx 1 root root 16 Aug 17 2001 K12mysqld -> ../init.d/mysqld
lrwxrwxrwx 1 root root 20 Aug 7 2001 K12postgresql -> ../init.d/postgresql
lrwxrwxrwx 1 root root 13 Aug 7 2001 K20nfs -> ../init.d/nfs
lrwxrwxrwx 1 root root 16 Aug 7 2001 K20rstatd -> ../init.d/rstatd
lrwxrwxrwx 1 root root 17 Aug 7 2001 K20rusersd -> ../init.d/rusersd
lrwxrwxrwx 1 root root 16 Aug 7 2001 K20rwalld -> ../init.d/rwalld
lrwxrwxrwx 1 root root 15 Aug 7 2001 K20rwhod -> ../init.d/rwhod
lrwxrwxrwx 1 root root 18 Jan 28 13:04 K30sendmail -> ../init.d/sendmail
lrwxrwxrwx 1 root root 19 Aug 7 2001 K34ypasswdd -> ../init.d/ypasswdd
lrwxrwxrwx 1 root root 18 Aug 7 2001 K40mars-nwe -> ../init.d/mars-nwe
lrwxrwxrwx 1 root root 18 Aug 7 2001 K45arpwatch -> ../init.d/arpwatch
lrwxrwxrwx 1 root root 13 Aug 7 2001 K50tux -> ../init.d/tux
lrwxrwxrwx 1 root root 14 May 9 2002 K61ldap -> ../init.d/ldap
lrwxrwxrwx 1 root root 16 Aug 7 2001 K65identd -> ../init.d/identd
lrwxrwxrwx 1 root root 16 Dec 7 2001 K73ypbind -> ../init.d/ypbind
lrwxrwxrwx 1 root root 14 Aug 7 2001 K74nscd -> ../init.d/nscd
lrwxrwxrwx 1 root root 16 Aug 7 2001 K74ypserv -> ../init.d/ypserv
lrwxrwxrwx 1 root root 16 Dec 7 2001 K74ypxfrd -> ../init.d/ypxfrd

```

#### Services in specified run level directory started

```

/etc/rc.d/rcX
lrwxrwxrwx 1 root root 15 Aug 7 2001 S05kudzu -> ../init.d/kudzu
lrwxrwxrwx 1 root root 18 Aug 7 2001 S08ipchains -> ../init.d/ipchains
lrwxrwxrwx 1 root root 18 May 9 2002 S08iptables -> ../init.d/iptables
lrwxrwxrwx 1 root root 17 Aug 7 2001 S10network -> ../init.d/network
lrwxrwxrwx 1 root root 16 Aug 7 2001 S12syslog -> ../init.d/syslog
lrwxrwxrwx 1 root root 17 Aug 7 2001 S13portmap -> ../init.d/portmap
lrwxrwxrwx 1 root root 17 Aug 7 2001 S14nfslock -> ../init.d/nfslock
lrwxrwxrwx 1 root root 18 Aug 7 2001 S17keytable -> ../init.d/keytable
lrwxrwxrwx 1 root root 16 Aug 7 2001 S20random -> ../init.d/random
lrwxrwxrwx 1 root root 15 Aug 7 2001 S25netfs -> ../init.d/netfs
lrwxrwxrwx 1 root root 14 Aug 7 2001 S26apmd -> ../init.d/apmd
lrwxrwxrwx 1 root root 14 Jan 6 17:20 S26ntpd -> ../init.d/ntpd
lrwxrwxrwx 1 root root 16 Aug 7 2001 S28autofs -> ../init.d/autofs
lrwxrwxrwx 1 root root 13 Aug 7 2001 S40atd -> ../init.d/atd
lrwxrwxrwx 1 root root 15 Apr 20 14:12 S50snmpd -> ../init.d/snmpd
lrwxrwxrwx 1 root root 14 Aug 7 2001 S55sshd -> ../init.d/sshd

```

lrwxrwxrwx	1	root	root	20 Aug 7 2001	S56rawdevices -> ../init.d/rawdevices
lrwxrwxrwx	1	root	root	16 Aug 7 2001	S56xinetd -> ../init.d/xinetd
lrwxrwxrwx	1	root	root	13 Aug 7 2001	S60lpd -> ../init.d/lpd
lrwxrwxrwx	1	root	root	13 Aug 7 2001	S85gpm -> ../init.d/gpm
lrwxrwxrwx	1	root	root	15 Apr 22 2003	S85httpd -> ../init.d/httpd
lrwxrwxrwx	1	root	root	15 Aug 7 2001	S90crond -> ../init.d/crond
lrwxrwxrwx	1	root	root	13 Aug 7 2001	S90xfs -> ../init.d/xfs
lrwxrwxrwx	1	root	root	13 Aug 7 2001	S91smb -> ../init.d/smb
lrwxrwxrwx	1	root	root	17 Aug 7 2001	S95anacron -> ../init.d/anacron
lrwxrwxrwx	1	root	root	15 May 9 2002	S97rhnsd -> ../init.d/rhnsd
lrwxrwxrwx	1	root	root	19 Sep 24 2001	S99linuxconf -> ../init.d/linuxconf
lrwxrwxrwx	1	root	root	11 May 9 2002	S99local -> ../rc.local
lrwxrwxrwx	1	root	root	23 Dec 19 2001	S99webmin -> /etc/rc.d/init.d/webmin

#### /etc/sysconfig directory:

amd	Automatic Mount Daemon
apmd	Advanced Power Management Daemon
arpwatch	Daemon to monitor IP/MAC address table
authconfig	Specifies kind of authorization
clock	Specifies clock properties, such as if UTC ARC offset Zone filename - /etc/localtime
desktop	Specifies default desktop to run under X
dhcpd	Used to pass arguments to dhcp server
firstboot	Run only very first system is booted after installation (RH v8 and later only). Installs additional applications and documentation.
gpm	Mouse configuration daemon
harddisks	Used to tune performance of hard drives
hwconf	Lists hardware detected by the kudzu program
i18n	Sets default language
identd	Specifies how system appears during boot
ipchains	Contains ipchain values used by Kernel at boot time for packet filtering
iptables	Contains iptable values used by Kernel at boot time for packet filtering
irda	Controls how infrared devices are configured
keyboard	Controls behavior of keyboard
kudzu	Specifies hardware probe mode at boot
mouse	Specifies mouse information
named	Passes arguments for the DNS server at boot
netdump	Configuration of network dumps
network	Specifies whether networking should be enabled
ntpd	Specifies arguments for the Network Time Protocol Daemon server
pcmcia	Specifies PCMCIA configuration
radvd	Specifies arguments for router service
rawdevices	Configures raw device binding
redhat-config-users	Configuration of graphical application User Manager

## 13.2 Bootup Display

During the initial bootup process, Unix and Linux provide an output that displays the booting process. This display scrolls past the screen fairly fast, but is viewable at any time by issuing the command:

**\$ dmesg**



```

Linux version 2.4.20-6 (bhcompile@sylvester.devel.redhat.com) (gcc
version 3.2.2 20030222 (Red Hat Linux 3.2.2-5)) #1 Thu Feb 27
10:01:19 EST 2003
BIOS-provided physical RAM map:
  BIOS-e820: 0000000000000000 - 000000000009fc00 (usable)
  BIOS-e820: 000000000009fc00 - 00000000000a0000 (reserved)
  BIOS-e820: 00000000000f0000 - 0000000000100000 (reserved)
  BIOS-e820: 0000000000100000 - 00000000007ff0000 (usable)
  BIOS-e820: 00000000007ff0000 - 00000000007ff3000 (ACPI NVS)
  BIOS-e820: 00000000007ff3000 - 00000000008000000 (ACPI data)
  BIOS-e820: 00000000ffff0000 - 00000000100000000 (reserved)
0MB HIGHMEM available.
127MB LOWMEM available.
On node 0 totalpages: 32752
zone(0): 4096 pages.
zone(1): 28656 pages.
zone(2): 0 pages.
Kernel command line: ro root=LABEL=/ hdd=ide-scsi
ide_setup: hdd=ide-scsi
Initializing CPU#0
Detected 751.341 MHz processor.
Console: colour VGA+ 80x25
Calibrating delay loop... 1497.49 BogoMIPS
Memory: 124668k/131008k available (1312k kernel code, 4932k
reserved, 996k data, 128k init, 0k highmem)
Dentry cache hash table entries: 16384 (order: 5, 131072 bytes)
Inode cache hash table entries: 8192 (order: 4, 65536 bytes)
Mount cache hash table entries: 512 (order: 0, 4096 bytes)
Buffer-cache hash table entries: 4096 (order: 2, 16384 bytes)
Page-cache hash table entries: 32768 (order: 5, 131072 bytes)
CPU: L1 I Cache: 64K (64 bytes/line), D cache 64K (64 bytes/line)
CPU: L2 Cache: 64K (64 bytes/line)
Intel machine check architecture supported.
Intel machine check reporting enabled on CPU#0.
CPU:   After generic, caps: 0183f9ff c1c7f9ff 00000000 00000000
CPU:   Common caps: 0183f9ff c1c7f9ff 00000000 00000000
CPU: AMD Duron(tm) Processor stepping 01
Enabling fast FPU save and restore... done.
Checking 'hlt' instruction... OK.
POSIX conformance testing by UNIFIX
mtrr: v1.40 (20010327) Richard Gooch (rgooch@atnf.csiro.au)
mtrr: detected mtrr type: Intel
PCI: PCI BIOS revision 2.10 entry at 0xfb380, last bus=1
PCI: Using configuration type 1
PCI: Probing PCI hardware
PCI: Using IRQ router VIA [1106/0686] at 00:07.0
Applying VIA southbridge workaround.

```

```

isapnp: Scanning for PnP cards...
isapnp: No Plug & Play device found
Linux NET4.0 for Linux 2.4
Based upon Swansea University Computer Society NET3.039
Initializing RT netlink socket
apm: BIOS version 1.2 Flags 0x07 (Driver version 1.16)
Starting kswapd
VFS: Disk quotas vquot_6.5.1
pty: 2048 Unix98 ptys configured
Serial driver version 5.05c (2001-07-08) with MANY_PORTS
MULTIPORT SHARE_IRQ SERIAL_PCI ISAPNP enabled
ttyS0 at 0x03f8 (irq = 4) is a 16550A
ttyS1 at 0x02f8 (irq = 3) is a 16550A
Real Time Clock Driver v1.10e
Floppy drive(s): fd0 is 1.44M
FDC 0 is a post-1991 82077
NET4: Frame Diverter 0.46
RAMDISK driver initialized: 16 RAM disks of 4096K size 1024
blocksize
Uniform Multi-Platform E-IDE driver Revision: 7.00beta-2.4
ide: Assuming 33MHz system bus speed for PIO modes; override
with idebus=xx
VP_IDE: IDE controller at PCI slot 00:07.1
VP_IDE: chipset revision 6
VP_IDE: not 100% native mode: will probe irqs later
VP_IDE: VIA vt82c686b (rev 40) IDE UDMA100 controller on
pci00:07.1
    ide0: BM-DMA at 0xc000-0xc007, BIOS settings: hda:DMA,
hdb:DMA
    ide1: BM-DMA at 0xc008-0xc00f, BIOS settings: hdc:pio, hdd:DMA
hda: Maxtor 33073H3, ATA DISK drive
hdb: WDC WD800BB-00DKA0, ATA DISK drive
blk: queue c03be900, I/O limit 4095Mb (mask 0xffffffff)
blk: queue c03bea44, I/O limit 4095Mb (mask 0xffffffff)
hdd: LITE-ON LTR-16101B, ATAPI CD/DVD-ROM drive
ide0 at 0x1f0-0x1f7,0x3f6 on irq 14
ide1 at 0x170-0x177,0x376 on irq 15
hda: host protected area => 1
hda: 60032448 sectors (30737 MB) w/2048KiB Cache,
CHS=3736/255/63, UDMA(100)
hdb: host protected area => 1
hdb: 156301488 sectors (80026 MB) w/2048KiB Cache,
CHS=9729/255/63, UDMA(100)
ide-floppy driver 0.99.newide
Partition check:
hda: hda1 hda2 hda3 hda4 < hda5 hda6 >

```

```

hdb: hdb1 hdb2 hdb3 hdb4 < hdb5 hdb6 hdb7 hdb8 hdb9 hdb10
hdb11 hdb12 hdb13 hdb14 hdb15 hdb16 >
ide-floppy driver 0.99.newide
md: md driver 0.90.0 MAX_MD_DEVS=256, MD_SB_DISKS=27
md: Autodetecting RAID arrays.
md: autorun ...
md: ... autorun DONE.
NET4: Linux TCP/IP 1.0 for NET4.0
IP Protocols: ICMP, UDP, TCP, IGMP
IP: routing cache hash table of 512 buckets, 4Kbytes
TCP: Hash tables configured (established 8192 bind 16384)
Linux IP multicast router 0.06 plus PIM-SM
NET4: Unix domain sockets 1.0/SMP for Linux NET4.0.
RAMDISK: Compressed image found at block 0
Freeing initrd memory: 218k freed
VFS: Mounted root (ext2 filesystem).
SCSI subsystem driver Revision: 1.00
PCI: Found IRQ 11 for device 00:0b.0
PCI: Sharing IRQ 11 with 00:07.5
PCI: Sharing IRQ 11 with 00:07.6
i91u: PCI Base=0xDC00, IRQ=11, BIOS=0xCC00, SCSI ID=7
i91u: Reset SCSI Bus ...
scsi0 : Initio INI-9X00U/UW SCSI device driver; Revision: 1.03g
Vendor: CONNER Model: CFP2107S 2.14GB Rev: 1420
Type: Direct-Access ANSI SCSI revision: 02
Vendor: ARCHIVE Model: Python 28388-XXX Rev: 5.AC
Type: Sequential-Access ANSI SCSI revision: 02
Attached scsi disk sda at scsi0, channel 0, id 0, lun 0
SCSI device sda: 4194304 512-byte hdwr sectors (2147 MB)
sda: sda1
Journalled Block Device driver loaded
kjournald starting. Commit interval 5 seconds
EXT3-fs: mounted filesystem with ordered data mode.
Freeing unused kernel memory: 128k freed
usb.c: registered new driver usbdevfs
usb.c: registered new driver hub
usb-uhci.c: $Revision: 1.275 $ time 10:15:52 Feb 27 2003
usb-uhci.c: High bandwidth mode enabled
PCI: Found IRQ 10 for device 00:07.2
PCI: Sharing IRQ 10 with 00:07.3
PCI: Sharing IRQ 10 with 00:0c.0
usb-uhci.c: USB UHCI at I/O 0xc400, IRQ 10
usb-uhci.c: Detected 2 ports
usb.c: new USB bus registered, assigned bus number 1
hub.c: USB hub found
hub.c: 2 ports detected
PCI: Found IRQ 10 for device 00:07.3

```

```

PCI: Sharing IRQ 10 with 00:07.2
PCI: Sharing IRQ 10 with 00:0c.0
usb-uhci.c: USB UHCI at I/O 0xc800, IRQ 10
usb-uhci.c: Detected 2 ports
usb.c: new USB bus registered, assigned bus number 2
hub.c: USB hub found
hub.c: 2 ports detected
usb-uhci.c: v1.275:USB Universal Host Controller Interface driver
usb.c: registered new driver hiddev
usb.c: registered new driver hid
hid-core.c: v1.8.1 Andreas Gal, Vojtech Pavlik <vojtech@suse.cz>
hid-core.c: USB HID support drivers
mice: PS/2 mouse device common for all mice
EXT3 FS 2.4-0.9.19, 19 August 2002 on ide0(3,6), internal journal
Adding Swap: 1028120k swap-space (priority -1)
Adding Swap: 514072k swap-space (priority -2)
kjournald starting. Commit interval 5 seconds
EXT3 FS 2.4-0.9.19, 19 August 2002 on ide0(3,1), internal journal
EXT3-fs: mounted filesystem with ordered data mode.
kjournald starting. Commit interval 5 seconds
EXT3 FS 2.4-0.9.19, 19 August 2002 on sd(8,1), internal journal
EXT3-fs: mounted filesystem with ordered data mode.
kjournald starting. Commit interval 5 seconds
EXT3 FS 2.4-0.9.19, 19 August 2002 on ide0(3,5), internal journal
EXT3-fs: mounted filesystem with ordered data mode.
kjournald starting. Commit interval 5 seconds
EXT3 FS 2.4-0.9.19, 19 August 2002 on ide0(3,3), internal journal
EXT3-fs: mounted filesystem with ordered data mode.
st: Version 20020805, bufsize 32768, wrt 30720, max init. bufs 4, s/g
segs 16
Attached scsi tape st0 at scsi0, channel 0, id 2, lun 0
scsi1 : SCSI host adapter emulation for IDE ATAPI devices
Vendor: LITE-ON Model: LTR-16101B Rev: TS0N
Type: CD-ROM ANSI SCSI revision: 02
parport0: PC-style at 0x378 (0x778) [PCSP,TRISTATE]
parport_pc: Via 686A parallel port: io=0x378
Attached scsi CD-ROM sr0 at scsi1, channel 0, id 0, lun 0
sr0: scsi3-mmc drive: 40x/40x writer cd/rw xa/form2 cdda tray
Uniform CD-ROM driver Revision: 3.12
ip_tables: (C) 2000-2002 Netfilter core team
8139too Fast Ethernet driver 0.9.26
PCI: Found IRQ 10 for device 00:0c.0
PCI: Sharing IRQ 10 with 00:07.2
PCI: Sharing IRQ 10 with 00:07.3
divert: allocating divert_blk for eth0
eth0: RealTek RTL8139 Fast Ethernet at 0xc8978000,
00:a0:0c:c8:49:9a, IRQ 10

```

```

eth0: Identified 8139 chip type 'RTL-8139C'
ip_tables: (C) 2000-2002 Netfilter core team
eth0: Setting 100mbps full-duplex based on auto-negotiated partner
ability 45e1.
ip_tables: (C) 2000-2002 Netfilter core team
parport0: PC-style at 0x378 (0x778) [PCSP,TRISTATE]
parport_pc: Via 686A parallel port: io=0x378
lp0: using parport0 (polling).
lp0: console ready
Via 686a/8233/8235 audio driver 1.9.1-ac2
PCI: Found IRQ 11 for device 00:07.5
PCI: Sharing IRQ 11 with 00:07.6
PCI: Sharing IRQ 11 with 00:0b.0
PCI: Setting latency timer of device 00:07.5 to 64
ac97_codec: AC97 Audio codec, id: ICE17 (ICE1232)
via82cxxx: board #1 at 0xCC00, IRQ 11
Enabled Via MIDI
via_audio: ignoring drain playback error -11
via_audio: ignoring drain playback error -11

```

By scanning this code, the administrator is able to determine if an error may have occurred. This information should be logged to a file for future comparison if a problem might be anticipated.

At this time, the Linux Kernel has been fully installed and is operational.

In scanning this output, you can observe that this particular system has two hard drive (hda and hdb), and that hda has 6 partitions with partitions 5 and 6 being part of the extend partition 4; drive hdb has 16 partitions with partitions 5 through 16 being part of the extended partition 4.

### 13.3 Initializing System Services

After the Kernel has been installed and is operational, as discussed previously, the various services are initialized. These are the lines that are terminated with the **[OK]**. The user (administrator) may observe which services have failed during the initialization. Unfortunately, this list is not directly duplicated as was done with the dmesg, but a review of the files in the /etc/rc.d/init.d directory will show if a given service is suppose to be active or not, after which further investigation may be required to determine what the problem is.

An example of a file in the /etc/rc.d/init.d directory is:

```

# cat rwhod
#!/bin/sh
#
# chkconfig: - 60 20
# description: The rwho protocol lets remote users get a list of all of
\

```

```

#           the users logged into a machine running the rwho daemon
\
#           (similiar to finger).
# processname: rwhod

# Get config.
. /etc/sysconfig/network

# Get functions
. /etc/init.d/functions

# Check that networking is up.
if [ ${NETWORKING} = "no" ] ; then
    exit 0
fi

RETVAL=0

start() {
    echo -n $"Starting rwho services: "
    daemon rwhod
    RETVAL=$?
    echo
    [ $RETVAL -eq 0 ] && touch /var/lock/subsys/rwhod
    return $RETVAL
}

stop() {
    echo -n $"Stopping rwho services: "
    killproc rwhod
    RETVAL=$?
    echo
    [ $RETVAL -eq 0 ] && rm -f /var/lock/subsys/rwhod
    return $RETVAL
}

restart() {
    stop
    start
}

# See how we were called.
case "$1" in
    start)
        start
        ;;
    stop)

```

```

        stop
        ;;
    status)
        status rwhod
        ;;
    restart)
        restart
        ;;
    condrestart)
        [ -f /var/lock/subsys/rwhod ] && restart || :
        ;;
    *)
        echo $"Usage: $0 {start|stop|status|restart}"
        exit 1
        ;;
esac

exit $?

```

The present status of the service may be tested by using the command:

```
chkconfig --list | grep service
```

In our example for the service rwho, we observe:

```
]# chkconfig --list | grep rwhod
rwhod      0:off 1:off 2:off 3:off 4:off 5:off 6:off
```

### **13.4 System Information**

When using the KDE, this can be done using the following process:

1. Click on the **Big K**
2. Click on **Settings**
3. Click on **Information**
  - a. Click on **Interupts**
  - b. Click on **IO Ports**

When configuring the system for sound, it is a good idea to check this file, because you will need to know what values to use – better than the trial and error method.

Another command that can be utilized to learn how the system is configured is **sysinfo**.

### **13.X Commands Used in this Chapter**

**13.Y Chapter Review Questions**



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