Boot + Root + Raid + Lilo : Software Raid mini–HOWTO
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*Boot + Root + Raid + Lilo: Software Raid mini–HOWTO*

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This document provides a cookbook for setting up root raid using the 0.90 raidtools for bootable raid mounted on root using standard LILO. Also covered is the conversion of a conventional disk to a raid1 or raid5 mirror set without the loss of data on the original disk.

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1. Introduction

1.1 Acknowledgements

The essence of the information I've put together here was originally provided by Harald Nordgård–Hansen <hnh@bukharin.hiof.no> and posted to the raid mail list in a lilo.conf file with commentary by Martin Bene <mb@sime.com>. Many thanks for your contribution. I've tried to put this information and the helpful work of many others who contribute to the raid mail list and linux raid project into a COOKBOOK form, including many examples from real systems so that bootable root raid is easy to set up and understand. One section is devoted to the conversion of a standard single drive system to RAID. The key to the conversion, in my humble opinion, is the understanding of bootable root raid.

1.2 Bugs

Yes, I'm sure there are some. If you'd be good enough to report them, I will correct the document. ;-)

1.3 Copyright Notice

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2. What you need BEFORE YOU START

The packages you need and the documentation that answers the most common questions about setting up and running raid are listed below. Please review them throughly.

2.1 Required Packages

You need to obtain the most recent versions of these packages.
2.2 Where to get Up-to-date copies of this document.

Click here to browse the author's latest version of this document. Corrections and suggestions welcome!

Boot Root Raid + LILO HOWTO

Available in LaTeX (for DVI and PostScript), plain text, and HTML.

http://www.linuxdoc.org/HOWTO/Boot+Root+Raid+LILO.html

Available in SGML and HTML.

ftp.bizsystems.net/pub/raid/

2.3 Documentation -- Recommended Reading

If you plan on using raid1/5 over raid0, please read:

/usr/src/linux/Documentation/initrd.txt

as well as the documentation and man pages that accompany the raidtools set.

and..... Software-RAID-HOWTO.html

2.4 RAID resources

Mailing lists can be joined at:

• This one seems quiet: majordomo@nuclecu.unam.mx send a message to subscribe raiddev

   send mail to: raiddev@nuclecu.unam.mx

• Raid development: majordomo@vger.rutgers.edu send a message to subscribe linux-raid

   send mail to: linux-raid@vger.rutgers.edu (this seems to be the most active list)

3. Bootable Raid

I'm not going to cover the fundamentals of setting up raid0/1/5 on Linux, that is covered in detail elsewhere.

2.2 Where to get Up-to-date copies of this document.
The problem I will address is setting up raid on root and making it bootable with standard LILO. The documentation that comes with the LILO sources (not the man pages) and with the raidtools−0.90, covers the details of booting and boot parameters as well as general raid setup – respectively.

There are two scenarios which are covered here. Set up of bootable root raid and the conversion of an existing non−raid system to bootable root raid without data loss.

### 3.1 Booting RAID 1 with standard LILO

To make the boot information redundant and easy to maintain, set up a small RAID1 and mount it on the `/boot` directory of your system disk. LILO does not know about device 0x9?? and can not find the information at boot time because the raid sub system is not active then. As a simple work around, you can pass LILO the geometry information of the drive(s) and from that, LILO can determine the position of the information needed to load the kernel even though it is on the RAID1 partition. This is because the RAID1 partition is the same as a standard partition but with a raid super−block written at the end. The boot raid set should fall with the first 1024 mbytes of the disk drive. In theory the start of the raid partition could fall anywhere in the 1024 megs, but in practice I was unable to get it to work unless the boot–raid started at the first block of the set. This is probably because of something dumb that I did, but it was not worth following up at the time. Since then I’ve simply set up all my systems with the boot–raid set as the first partition. I have root raid system configurations with bootable RAID1 mounted on `/boot` with root raid sets as follows: RAID1, RAID5, RAID10 & RAID1−10 ( 1 mirror + 1 raid0 set). The last has a very peculiar lilo file pair since none of the disk geometries are the same, however, the principals are the same for the initial boot process. The RAID10 and RAID1−10 root mounts require the use of `initrd` to mount root after the boot process has taken place. See the appendices for the configuration files for all of these example systems.

A conventional LILO config file stripped down looks like this:

```plaintext
# lilo.conf − assumes drive less than 1024
  boot = /dev/hda
  delay = 40 # extra, but nice
  vga = normal # not normally needed
  image = /bzImage
  root = /dev/hda1
  read−only
  label = Linux
```

A raid LILO config file pair would look like this:

```plaintext
# lilo.conf.hda − primary ide master
  disk=/dev/md0
  bios=0x80
  sectors=63
  heads=16
  cylinders=39770
  partition=/dev/md1
  start=63
  boot=/dev/hda
  map=/boot/map
  install=/boot/boot.b
  image=/boot/bzImage
  root=/dev/md0
  read−only
  label=LinuxRaid

# ------------------------
```

## 3.1 Booting RAID 1 with standard LILO
# lilo.conf.hdc - secondary ide master
    disk=/dev/md0
    bios=0x80 # see note below
    sectors=63
    heads=16
    cylinders=39770
    partition=/dev/md1
    start=63
    boot=/dev/hdc # this is the other disk
    map=/boot/map
    install=/boot/boot.b
    image=/boot/bzImage
    root=/dev/md0
    read-only
    label=LinuxRaid

# BIOS=line -- if your bios is smart enough (most are not) to detect that that the first disk is missing or
failed and will automatically boot from the second disk, then bios=81 would be the appropriate entry here.
This is more common with SCSI bios than IDE bios. I simply plan on relocating the drive so it will replace
the dead drive C: in the event of failure of the primary boot drive.

The geometry information for the drive can be obtained from fdisk with the command:

defisk -ul (little L)
defisk -ul /dev/hda

Disk /dev/hda: 16 heads, 63 sectors, 39770 cylinders
Units = sectors of 1 * 512 bytes

Device Boot Start End Blocks Id System
/dev/hda1 63 33263 16600+ fd Linux raid autodetect
/dev/hda2 33264 443519 205128 82 Linux swap
/dev/hda3 443520 40088159 19822320 fd Linux raid autodetect

* note the listing of the START of each partition

3.2 Detailed explaination of lilo.conf for raid boot

The raid lilo.conf file above, commented in detail for each entry.

# lilo.conf.hda - primary ide master
# the location of the /boot directory that will be
# designated below as containing the kernel, map, etc...
# note that this is NOT the actual partition containing
# the boot image and info, but rather the device
# that logically contains this directory.
# in this example, /dev/md1 is mounted on /dev/md0/boot
disk=/dev/md0

# tell LILO which bios device to use for boot, i.e. C: drive
bios=0x80
# tell LILO the geometry of the device
# this is usually but not always the "logical"
# geometry. Check the /proc file system or watch
# the boot messages when the kernel probes for the drive
# sectors=63

3.2 Detailed explaination of lilo.conf for raid boot
heads=16
cylinders=39770

#       this is a dummy entry to make LILO happy so it
#       will recognize the raid set 0x9?? and then find
#       the START of the boot sector. To really see
#       what this was for, read the documentation
#       that comes with the LILO source distribution.
#       This parameter "must" be different than the
#       disk= entry above. It can be any other mdx
#       device, used or unused and need not be the one
#       that contains the /boot information
#
#       partition=/dev/md1
#
#       the first sector of the partition containing /boot information
#       start=63
#
#       the real device that LILO will write the boot information to
#       boot=/dev/hda
#
#       logically where LILO will put the boot information
#       map=/boot/map
#       install=/boot/boot.b
#
#       logically where lilo will find the kernel image
#       image=/boot/bzImage
#
#       standard stuff after this
#       root may be a raid1/4/5 device
#       root=/dev/md0
#       read-only
#       label=LinuxRaid

4. **Upgrading from non-raid to RAID1/4/5**

Upgrading a non-raid system to raid is fairly easy and consists of several discrete steps described below. The description is for a system with a boot partition, root partition and swap partition.

OLD disk in the existing system:

```
/dev/hda1     boot, may be dos+lodlin or lilo
/dev/hda2     root
/dev/hda3     swap
```

We will add an additional disk and convert the entire system to RAID1. You could easily add several disks and make a RAID5 set instead using the same procedure.

4.1 **Step 1 – prepare a new kernel**

Download a clean kernel, raidtools−0.90 (or the most recent version), and the kernel patch to upgrade the kernel to 0.90 raid.

Compile and install the raidtools and READ the documentation.
Compile and install the kernel to support all the flavors (0/1/4/5 ?) of raid that you will be using. Make sure to specify autostart of raid devices in the kernel configuration. Test that the kernel boots properly and examine /proc/mdstat to see that the raid flavors you will use are supported by the new kernel.

4.2 Step 2 – set up raidtab for your new raid.

The new disk will be added to an additional IDE controller as the master device, thus becoming /dev/hdc

/dev/hdc1 16megs -- more than enough for several kernel images
/dev/hdc2 most of the disk
/dev/hdc3 some more swap space, if needed. otherwise add to hdc2

Change the partition types for /dev/hdc1 and /dev/hdc2 to "fd" for raid-autostart.

Using the failed-disk parameter, create a raidtab for the desired RAID1 configuration. The failed disk must be the last entry in the table.

# example raidtab
# md0 is the root array
raiddev /dev/md0
raid-level 1
nr-raid-disks 2
chunk-size 32
# Spare disks for hot reconstruction
nr-spare-disks 0
persistent-superblock 1
device /dev/hdc2
raid-disk 0
# this is our old disk, mark as failed for now
device /dev/hda2
failed-disk 1

# md1 is the /boot array
raiddev /dev/md1
raid-level 1
nr-raid-disks 2
chunk-size 32
# Spare disks for hot reconstruction
nr-spare-disks 0
persistent-superblock 1
device /dev/hdc1
raid-disk 0
# boot is marked failed as well
device /dev/hda1
failed-disk 1

4.3 Create, format, and configure RAID

Create the md devices with the commands:

    mkraid /dev/md0
    mkraid /dev/md1

The raid devices should be created and start. Examination of /proc/mdstat should show the raid personalities in the kernel and the raid devices running.

4.2 Step 2 – set up raidtab for your new raid.
Format the boot and root devices with:

```
mke2fs /dev/md0
mke2fs /dev/md1
```

Mount the new root device somewhere handy and create the /boot directory and mount the boot partition.

```
mount /dev/md0 /mnt
mkdir /mnt/boot
mount /dev/md1 /mnt/boot
```

**4.4 Copy the current OS to the new raid device**

This is pretty straightforward.

```
cd /
c# set up a batch file to do this
cp -a /bin /mnt
cp -a /dev /mnt
cp -a /etc /mnt
cp -a (all directories except /mnt, /proc, and nsf mounts) /mnt
```

This operation can be tricky if you have mounted or linked other disks to your root file system. The example above assumes a very simple system, you may have to modify the procedure somewhat.

**4.5 Test your new RAID**

Make a boot floppy and rdev the kernel.

```
dd if=kernal.image of=/dev/fd0 bs=2k
rdev /dev/fd0 /dev/md0
rdev -r /dev/fd0 0
rdev -R /dev/fd0 1
```

Modify the fstab on the RAID device to reflect the new mount points as follows:

```
/dev/md0 / ext2 defaults 1 1
/dev/md1 /boot ext2 defaults 1 1
```

Dismount the raid devices and boot the new file system to see that all works correctly.

```
umount /mnt/boot
umount /mnt
raidstop /dev/md0
raidstop /dev/md1
shutdown -r now
```

Your RAID system should now be up and running in degraded mode with a floppy boot disk. Carefully check that you transferred everything to the new raid system. If you mess up here without a backup, YOU ARE DEAD!

If something did not work, reboot your old system and go back and fix things up until you successfully complete this step.
4.6 Integrate old disk into raid array

Success in the previous step means that the raid array is now operational, but without redundancy. We must now re−partition the old drive(s) to fit into the new raid array. Remember that if the geometries are not the same, the the partition size on the old drive must be the same or larger than the raid partitions or they can not be added to the raid set.

Re−partition the old drive as required. Example:

```
/dev/hda1     same or larger than /dev/hdc1
/dev/hda2     same or larger than /dev/hdc2
/dev/hda3     anything left over for swap or whatever...
```

Change the failed−disk parameter in the raidtab to raid−disk and hot add the new (old) disk partitions to the raid array.

```
raidhotadd /dev/md1 /dev/hda1
raidhotadd /dev/md0 /dev/hda2
```

Examining /proc/mdstat should show one or more of the raid devices reconstructing the data for the new partitions. After a minute or two... or so, the raid arrays should be fully synchronized (this could take a while for a large partition).

Using the procedure described in the first sections of this document, set up bootable raid on the new raid pair. Hang on to that boot floppy while setting up and testing this last step.

5. Appendix A. – example raidtab

RAID1 example described in the first sections of this document

```
df
Filesystem           1k−blocks      Used Available Use% Mounted on
/dev/md0              19510780   1763188  16756484  10% /
/dev/md1                 15860       984     14051   7% /boot

# -----------------------

cd /dev/hda

fdisk −ul /dev/hda

Disk /dev/hda: 16 heads, 63 sectors, 39770 cylinders
Units = sectors of 1 * 512 bytes

Device Boot Start   End     Blocks  Id  System
/dev/hda1     63   33263  16600+  fd  Linux raid autodetect
/dev/hda2 33264   443519  205128   83  Linux native
/dev/hda3 443520  40088159 19822320 fd  Linux raid autodetect

# -----------------------

cd /dev/hdc

fdisk −ul /dev/hdc

Disk /dev/hdc: 16 heads, 63 sectors, 39770 cylinders
Units = sectors of 1 * 512 bytes
```
Device Boot Start End Blocks Id System
/dev/hdc1 63 33263 16600+ fd Linux raid autodetect
/dev/hdc2 33264 443519 205128 82 Linux swap
/dev/hdc3 443520 40088159 19822320 fd Linux raid autodetect

# md0 is the root array, about 20 gigs
raiddev /dev/md0
raid-level 1
nr-raid-disks 2
chunk-size 32
# Spare disks for hot reconstruction
nr-spare-disks 0
persistent-superblock 1
device /dev/hda3
raid-disk 0
device /dev/hdc3
raid-disk 1

# md1 is the /boot array, about 16 megs
raiddev /dev/md1
raid-level 1
nr-raid-disks 2
chunk-size 32
# Spare disks for hot reconstruction
nr-spare-disks 0
persistent-superblock 1
device /dev/hda1
raid-disk 0
device /dev/hdc1
raid-disk 1

# ---------------------------

# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md0
# geometry
  bios=0x80
  sectors=63
  heads=16
  cylinders=39770
# dummy
  partition=/dev/md1
# start of device "disk" above
  start=63

boot=/dev/hda
map=/boot/map
install=/boot/boot.b
image=/boot/bzImage
root=/dev/md0
label=LinuxRaid
read-only

# ---------------------------

# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md0

4.6 Integrate old disk into raid array
# geometry
bios=0x80
sectors=63
heads=16
cylinders=39770
# dummy
partition=/dev/md1
# start of device "disk" above
start=63

boot=/dev/hdc
map=/boot/map
install=/boot/boot.b
image=/boot/bzImage
root=/dev/md0
label=LinuxRaid
read-only

6. Appendix B. – SCSI reference implementation RAID5

4 disk SCSI RAID5

def
Filesystem 1k-blocks Used Available Use% Mounted on
/dev/md0 11753770 2146076 9000678 19% /
/dev/md1 15739 885 14042 6% /boot

# --------------------------
fdisk -ul /dev/sda

Disk /dev/sda: 64 heads, 32 sectors, 4095 cylinders
Units = sectors of 1 * 512 bytes

    Device Boot Start   End     Blocks   Id  System
/dev/sda1   32  32767  16368   fd  Linux raid autodetect
/dev/sda2  32768  292863 130048   5  Extended
/dev/sda3 292864  838659 4046848   fd  Linux raid autodetect
/dev/sda5  32800 260095 113648   82  Linux swap
/dev/sda6 260128  292863  16368   83 Linux native - test

# --------------------------
fdisk -ul /dev/sdb

Disk /dev/sdb: 64 heads, 32 sectors, 4095 cylinders
Units = sectors of 1 * 512 bytes

    Device Boot Start   End     Blocks   Id  System
/dev/sdb1   32  32767  16368   fd  Linux raid autodetect
/dev/sdb2  32768  292863 130048   5  Extended
/dev/sdb3 292864  838659 4046848   fd  Linux raid autodetect
/dev/sdb5  32800 260095 113648   82  Linux swap
/dev/sdb6 260128  292863  16368   83 Linux native - test

# --------------------------
# fdisk -ul /dev/sdc

6. Appendix B. – SCSI reference implementation RAID5
Disk /dev/sdc: 64 heads, 32 sectors, 4095 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sdc2</td>
<td></td>
<td>32</td>
<td>292863</td>
<td>146416</td>
<td>5</td>
<td>Extended</td>
</tr>
<tr>
<td>/dev/sdc3</td>
<td>292864</td>
<td>8386559</td>
<td>4046848</td>
<td>fd</td>
<td>Linux raid autodetect</td>
<td></td>
</tr>
<tr>
<td>/dev/sdc5</td>
<td>64</td>
<td>260095</td>
<td>130016</td>
<td>83</td>
<td>Linux native − development</td>
<td></td>
</tr>
<tr>
<td>/dev/sdc6</td>
<td>260128</td>
<td>292863</td>
<td>16368</td>
<td>83</td>
<td>Linux native − test</td>
<td></td>
</tr>
</tbody>
</table>

# -----------------------------

fdisk -ul /dev/sdd

Disk /dev/sdd: 64 heads, 32 sectors, 4095 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sdd2</td>
<td></td>
<td>32</td>
<td>292863</td>
<td>146416</td>
<td>5</td>
<td>Extended</td>
</tr>
<tr>
<td>/dev/sdd3</td>
<td>292864</td>
<td>8386559</td>
<td>4046848</td>
<td>fd</td>
<td>Linux raid autodetect</td>
<td></td>
</tr>
<tr>
<td>/dev/sdd5</td>
<td>64</td>
<td>260095</td>
<td>130016</td>
<td>83</td>
<td>Linux native − development</td>
<td></td>
</tr>
<tr>
<td>/dev/sdd6</td>
<td>260128</td>
<td>292863</td>
<td>16368</td>
<td>83</td>
<td>Linux native − test</td>
<td></td>
</tr>
</tbody>
</table>

# -----------------------------

# raidtab

raiddev /dev/md0
  raid-level 5
  nr-raid-disks 4
  persistent-superblock 1
  chunk-size 32

# Spare disks for hot reconstruction
  nr-spare-disks 0
  device /dev/sda3
  raid-disk 0
  device /dev/sdb3
  raid-disk 1
  device /dev/sdc3
  raid-disk 2
  device /dev/sdd3
  raid-disk 3

# boot partition

raiddev /dev/md1
  raid-level 1
  nr-raid-disks 2
  persistent-superblock 1
  chunk-size 32

# Spare disks for hot reconstruction
  nr-spare-disks 0
  device /dev/sda1
  raid-disk 0
  device /dev/sdb1
  raid-disk 1

# -----------------------------

# cat lilo.conf.sda

6. Appendix B. – SCSI reference implementation RAID5
# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md0
# geometry
bios=0x80
sectors=32
heads=64
cylinders=4095
# dummy
partition=/dev/md1
# start of device "disk" above
start=32

boot=/dev/sda
map=/boot/map
install=/boot/boot.b
image=/boot/bzImage
root=/dev/md0
label=LinuxRaid
read-only

# ------------------------
# cat lilo.conf.sdb
# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md0
# geometry
bios=0x80
sectors=32
heads=64
cylinders=4095
# dummy
partition=/dev/md1
# start of device "disk" above
start=32

boot=/dev/sdb
map=/boot/map
install=/boot/boot.b
image=/boot/bzImage
root=/dev/md0
label=LinuxRaid
read-only

7. Appendix C. − ide RAID10 with initrd

RAID1 over striped RAID0 pair... the disks in the RAID0 sets are not quite the same size, but close enough.

/dev/md0 is the /boot partition and is autostarted by the kernel
/dev/md1 and /dev/md3 are the two RAID0 sets autostarted by the kernel
/dev/md2 is the root partition and is started by initrd

df  Filesystem       1k-blocks  Used  Available  Use%   Mounted on
/dev/md2  118531    76485    35925    68%   /
/dev/md0   1917     1361     457     75%   /boot
fdisk -ul /dev/hda

Disk /dev/hda: 4 heads, 46 sectors, 903 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/hda1</td>
<td></td>
<td>46</td>
<td>4231</td>
<td>2093</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
<tr>
<td>/dev/hda2</td>
<td></td>
<td>4232</td>
<td>166151</td>
<td>80960</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
</tbody>
</table>

fdisk -ul /dev/hdb

Disk /dev/hdb: 5 heads, 17 sectors, 981 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/hdb1</td>
<td></td>
<td>17</td>
<td>83384</td>
<td>41684</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
</tbody>
</table>

fdisk -ul /dev/hdc

Disk /dev/hdc: 7 heads, 17 sectors, 1024 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/hdc1</td>
<td></td>
<td>17</td>
<td>84013</td>
<td>41998+</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
<tr>
<td>/dev/hdc2</td>
<td></td>
<td>84014</td>
<td>121855</td>
<td>18921</td>
<td>82</td>
<td>Linux swap</td>
</tr>
</tbody>
</table>

fdisk -ul /dev/hdd

Disk /dev/hdd: 4 heads, 46 sectors, 903 cylinders
Units = sectors of 1 * 512 bytes

<table>
<thead>
<tr>
<th>Device</th>
<th>Boot</th>
<th>Start</th>
<th>End</th>
<th>Blocks</th>
<th>Id</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/hdd1</td>
<td></td>
<td>46</td>
<td>4231</td>
<td>2093</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
<tr>
<td>/dev/hdd2</td>
<td></td>
<td>4232</td>
<td>166151</td>
<td>80960</td>
<td>fd</td>
<td>Linux raid autodetect</td>
</tr>
</tbody>
</table>

# raidtab

raiddev /dev/md0
  raid-level 1
  nr-raid-disks 2
  persistent-superblock 1
  chunk-size 8
  device /dev/hda1
  raid-disk 0
  device /dev/hdd1
  raid-disk 1

raiddev /dev/md1
  raid-level 0
  nr-raid-disks 2
  persistent-superblock 1
  chunk-size 8

7. Appendix C. – ide RAID10 with initrd
device /dev/hdd2
raid-disk 0
device /dev/hdb1
raid-disk 1

raiddev /dev/md2
raid-level 1
nr-raid-disks 2
persistent-superblock 1
chunk-size 8
device /dev/md1
raid-disk 0
device /dev/md3
raid-disk 1

raiddev /dev/md3
raid-level 0
nr-raid-disks 2
persistent-superblock 1
chunk-size 8
device /dev/hda2
raid-disk 0
device /dev/hdc1
raid-disk 1

# ----------------------------

cat linuxrc
#!/bin/sh
# ver 1.02 2-22-00
#
#################### really BEGIN 'linuxrc' ####################
#
# mount the proc file system
/bin/mount /proc

# start raid 1 made of raid 0's
/bin/raidstart /dev/md2

# tell the console what's happening
/bin/cat /proc/mdstat

# Everything is fine, let the kernel mount /dev/md2
# tell the kernel to switch to /dev/md2 as the /root device
# The 0x900 value is the device number calculated by:
# 256*major_device_number + minor_device_number
echo "/dev/md2 mounted on root"
echo 0x902>/proc/sys/kernel/real-root-dev

# umount /proc to deallocate initrd device ram space
/bin/umount /proc
exit

# ----------------------------

cat initrd
./bin/ash
./bin/echo
./bin/raidstart

7. Appendix C. – ide RAID10 with initrd
8. Appendix D. – ide RAID1–10 with initrd

This is a system made up of an assortment of odds and ends. The root mounted raid device is comprised of a RAID1 made up of one RAID0 array from odd sized disks and a larger regular disk partition. Examination of the lilo.conf files may give you better insight into the reasoning behind the various parameters.

/dev/md0 is the /boot partition and is autostarted by the kernel
/dev/md1 is one half of the mirror set for md2, autostarted by kernel
/dev/md2 is the other half of the mirror set for md2
/dev/md4 is the RAID1 /dev/md1 + /dev/hda3, started by initrd
df
Filesystem  1k-blocks  Used  Available  Use%  Mounted on
/dev/md2   138381  74421  56815  57%  /
/dev/md0     2011   1360    549  71%  /boot

# ---------------

fdisk −ul /dev/hda

Disk /dev/hda: 8 heads, 46 sectors, 903 cylinders
Units = sectors of 1 * 512 bytes

Device Boot Start End Blocks Id System
/dev/hda1  46  4415  2185  fd  Linux raid autodetect
/dev/hda2  4416  43423  19504  82  Linux swap
/dev/hda3  43424  332303  144440  83  Linux native

# ---------------

fdisk −ul /dev/hdc

Disk /dev/hdc: 8 heads, 39 sectors, 762 cylinders
Units = sectors of 1 * 512 bytes

Device Boot Start End Blocks Id System
/dev/hdc1  39  4367  2164+  fd  Linux raid autodetect
/dev/hdc2  4368  70199  32916  82  Linux swap
/dev/hdc3  70200 237743  83772  fd  Linux raid autodetect

# ---------------

fdisk −ul /dev/hdd

Disk /dev/hdd: 4 heads, 39 sectors, 762 cylinders
Units = sectors of 1 * 512 bytes

Device Boot Start End Blocks Id System
/dev/hdd1  39 118871  59416+ fd  Linux raid autodetect

# ---------------

# raidtab
#
raiddev /dev/md0
  raid-level  1
  nr-raid-disks  2
  persistent-superblock  1
  chunk-size  8
  device  /dev/hda1
  raid-disk  0
  device  /dev/hda1
  raid-disk  0

raiddev /dev/md1
  raid-level  0
  nr-raid-disks  2
  persistent-superblock  1
  chunk-size  8
  device  /dev/hdc3
  raid-disk  0
  device  /dev/hdd1

8. Appendix D. − ide RAID1−10 with initrd
raid-disk       1

raiddev /dev/md2
  raid-level       1
  nr-raid-disks    2
  persistent-superblock  1
  chunk-size       8
  device          /dev/md1
  raid-disk       1
  device          /dev/hda3
  raid-disk       0

# ---------------

cat linuxrc
#!/bin/sh
# ver 1.02 2-22-00
#
####### really BEGIN 'linuxrc' #############
#
# mount the proc file system
/bin/mount /proc

# autostart /boot partition and raid0
/bin/raidstart /dev/md2

# tell the console what's happening
/bin/cat /proc/mdstat

# Everything is fine, let the kernel mount /dev/md2
# tell the kernel to switch to /dev/md2 as the /root device
# The 0x900 value is the device number calculated by:
#  256*major_device_number + minor_device_number
# echo "/dev/md2 mounted on root"
# echo 0x902>/proc/sys/kernel/real-root-dev

# umount /proc to deallocate initrd device ram space
/bin/umount /proc
exit

# ---------------

contents of initrd.gz

./bin
./bin/ash
./bin/echo
./bin/raidstart
./bin/mount
./bin/umount
./bin/cat
./bin/sh
./dev/tty1
./dev/md0
./dev/md1
./dev/md2
./dev/md3
./dev/console
./dev/hda
./dev/hda1
./dev/hda2
./dev/hda3

8. Appendix D. – ide RAID1–10 with initrd
cat lilo.conf.hda
# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md2
# geometry
# bios=0x80
cylinders=903
# heads=8
# sectors=46
# geometry for 2nd disk
# bios will be the same because it will have to be moved to hda
# cylinders=762
# heads=8
# sectors=39

# dummy
partition=/dev/md0
# start of device "disk" above
start=46
# second device
# start=39

# seem to have some trouble with 2.2.14 recognizing the right IRQ
append = "#ide=0x170,0x376,12 ether=10,0x300,eth0 ether=5,0x320,eth1"

boot=/dev/hda
map=/boot/map
install=/boot/boot.b
initrd=/boot/initrd.gz
image=/boot/zImage
root=/dev/md2
label=LinuxRaid
read-only

# -----------------------------

cat lilo.conf.hdc
# GLOBAL SECTION
# device containing /boot directory
disk=/dev/md2
# geometry
  bios=0x80
#  cylinders=903
#  heads=8
#  sectors=46
# geometry for 2nd disk
# bios will be the same because it will have to be moved to hda
  cylinders=762
  heads=8
  sectors=39

# dummy
  partition=/dev/md0
# start of device "disk" above
#  start=46
# second device
#  start=39

# seem to have some trouble with 2.2.14 recognizing the right IRQ
  append = "ide1=0x170,0x376,12 ether=10,0x300,eth0 ether=5,0x320,eth1"

boot=/dev/hdc
map=/boot/map
install=/boot/boot.b

initrd=/boot/initrd.gz

image=/boot/zImage
root=/dev/md2
label=LinuxRaid
read-only