



February 2011 - Version 4

# Linux P2V migrations using MondoRescue

By Hewlett Packard

Main Writer: Lester Wade

Contributions from: René Ribaud, Gallig Renaud, Bruno Cornec

License: Creative Commons Attribution-Share Alike 3.0

MondoRescue is a backup and recovery tool for Linux, it's packaged for various distributions and supports common architectures (i386, x86\_64 and ia64). It allows online and offline backups to network storage, local disks, cd/dvd and tape. It supports a large variety of filesystems (including but not limited to ext2, ext3, ReiserFS and XFS) and partition/disk layouts (software raid, hardware raid and LVM1/2). During a restore MondoRescue will also resize partitions depending upon the new disk geometry. Those coming from an HP-UX background may liken MondoRescue to HP Ignite-UX.

The methods MondoRescue uses to archive and restore a machine means it's well suited for use as a P2V/P2P (physical-2-virtual/physical-2-physical) migration tool.

This document is aimed at users with a basic understanding of Linux, virtualization solutions and some familiarity in partitioning and configuring disks. It details the process for migrating a physical machine into a VMware virtualized environment. The process can easily be adapted to apply to other virtualization products such as Xen, Citrix XenServer, VirtualBox and KVM/QEMU as well as to other physical machines with different hardware components.

Migrations from HP hardware utilizing the SmartArray controller, such as ProLiant servers, will also be mentioned. This is to ensure the reader is aware of a current bug in MondoRescue and how to work around it.

This document is updated to include specific instructions relating to the migration of current distributions. **The current version of MondoRescue at time of writing is 2.2.9.5-1. This document recommends you use the latest version available. Throughout the examples in this document, substitute any version numbers for the latest available from the MondoRescue site unless explicitly stated.**

If you have suggestions on improvements for this document, you can contact me @ lester.wade\_at\_hp.com

You can also solicit help from the MondoRescue community using the mailing lists, you can subscribe here: <https://lists.sourceforge.net/lists/listinfo/mondo-devel>.



The document is structured as follows:

## Table of Contents

<a href="#">Linux P2V migrations using MondoRescue.....</a>	<a href="#">1</a>
<a href="#">Setting the Scene.....</a>	<a href="#">3</a>
<a href="#">Application &amp; Key Features.....</a>	<a href="#">3</a>
<a href="#">How MondoRescue Works.....</a>	<a href="#">4</a>
<a href="#">Document Structure.....</a>	<a href="#">4</a>
<a href="#">Archiving &amp; Restoring.....</a>	<a href="#">4</a>
<a href="#">Pre-requisites and Assumptions.....</a>	<a href="#">4</a>
<a href="#">Installing MondoRescue.....</a>	<a href="#">5</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">5</a>
<a href="#">Archiving the server.....</a>	<a href="#">6</a>
<a href="#">Restoring the server.....</a>	<a href="#">7</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">11</a>
<a href="#">Migrating SUSE Linux Enterprise Server.....</a>	<a href="#">12</a>
<a href="#">SUSE Linux Enterprise Server 11 (&amp; SP1).....</a>	<a href="#">12</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">12</a>
<a href="#">Post-migration Configuration .....</a>	<a href="#">13</a>
<a href="#">SUSE Linux Enterprise Server 10 (SP2 &amp; SP3).....</a>	<a href="#">14</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">14</a>
<a href="#">Post-migration Configuration .....</a>	<a href="#">15</a>
<a href="#">SUSE Linux Enterprise Server 9.....</a>	<a href="#">16</a>
<a href="#">Pre-migration Configuration .....</a>	<a href="#">16</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">16</a>
<a href="#">Migrating Red Hat Enterprise Linux.....</a>	<a href="#">16</a>
<a href="#">Red Hat Enterprise Linux 6.....</a>	<a href="#">16</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">16</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">17</a>
<a href="#">Red Hat Enterprise Linux 4 &amp; 5.....</a>	<a href="#">17</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">17</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">18</a>
<a href="#">Red Hat Enterprise Linux 3.....</a>	<a href="#">18</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">18</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">19</a>
<a href="#">Migrating Debian .....</a>	<a href="#">19</a>
<a href="#">Debian 5.0 “Lenny” &amp; Debian 4.0 “Etch”.....</a>	<a href="#">19</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">19</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">19</a>
<a href="#">Migrating Ubuntu Server .....</a>	<a href="#">21</a>
<a href="#">Ubuntu Server 10.04 LTS.....</a>	<a href="#">21</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">21</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">22</a>
<a href="#">Ubuntu Server 8.04 LTS.....</a>	<a href="#">23</a>
<a href="#">Pre-migration Configuration.....</a>	<a href="#">23</a>
<a href="#">Post-migration Configuration.....</a>	<a href="#">23</a>
<a href="#">Working with LVM and the HP Smart Array controller .....</a>	<a href="#">24</a>
<a href="#">Troubleshooting .....</a>	<a href="#">25</a>
<a href="#">Summary.....</a>	<a href="#">25</a>
<a href="#">Acknowledgement.....</a>	<a href="#">26</a>



## Setting the Scene

MondoRescue was originally developed by Hugo Rabson and a small team. Development duties have now been handed over to Bruno Cornec and Andree Leidenfrost. Bruno Cornec is the EMEA Linux Profession Lead for HP.

As the commercial virtualization solutions from vendors such as VMware, Citrix and Microsoft become more prevalent, the requirement for migration tools has increased. A company may maintain hundreds or thousands of existing physical servers which they will want move into the virtual environment rather than build from scratch. The ability to quickly and easily migrate servers is a key factor.

Effective migration tools for Linux are few and far between. Existing products which support Linux include Platespin PowerConvert and VMware Converter. Up until recently, neither of these tools supported 64bit Linux migrations.

MondoRescue has been proven successfully in large scale system migrations.

## Application & Key Features

How can MondoRescue be used? Does it meet my requirements? Does it suit my environment?

Before progressing through this document it's worth spending time looking at the potential application of MondoRescue. The reader is probably wondering whether MondoRescue can fulfill a specific requirement and this section will outline some key features of MondoRescue to try to answer some of those questions.

Key Features:

- Network connection between target and source machine is not required. This is useful in environments where security is of key concern, a sysadmin may not want to open ports on perimeter firewalls for services such as NFS or SSH.
- The archival of a system can be made onto the local disk of the source machine, DVD/CD media, USB stick or shared network volume (e.g; NFS).
- As a backup tool, MondoRescue is capable of Incremental snapshots of the source system.
- The system does not need to be taken offline for archival (although it is recommended if data is volatile).
- MondoRescue will automatically resize partitions if the target machine has a different sized disk (sized by ratio new/old).
- MondoRescue is available for 32 and 64bit x86 architectures and ia64. Note that you must be migrating/restoring to the same architecture.
- MondoRescue packages are available for RedHat, Fedora, CentOS, OpenSUSE, SLES, Mandriva, Debian, Ubuntu, Gentoo, Asianux and Slackware. Source packages are also available.



## How MondoRescue Works

A migration using MondoRescue consists of two steps. The first is the use of the **mondoarchive** utility to examine the server, group files into filesets dependant on size, archive and compress these filesets and finally to create a bootable CD/DVD containing the archive(s).

Secondly, **mondorestore** will repartition the disk(s) on the target virtual machine, create filesystems, restore mountpoints and unpack the archived data.

## Document Structure

This document is structured so as to provide specifics when archiving and restoring various Linux distributions. If you are already familiar with MondoRescue and how to archive and restore a system, skip straight to your distribution specific section of this document. If you haven't used MondoRescue before or need guidance on how to archive and restore, I'd recommend starting [here](#) before proceeding.

**TIP** - Whilst this document focuses on migrating your server to a virtual machine, the process for migrating between different hardware (P2P - Physical-to-Physical) follows the same principals.

## Archiving & Restoring

This section gives guidance on how to archive and restore as part of a P2V migration. It uses RHEL 4 AS x86\_64 running on an HP ProLiant DL380 as the source hardware and assumes VMware as the target virtualisation platform.

## Pre-requisites and Assumptions

This document presumes the following:

- You have a 64bit (not essential for following the guide) source server running Red Hat Enterprise Linux 4 (or 5).
- Your virtualization environment is fully configured and a target virtual machine for the migration has been created and configured appropriately.
- There is network connectivity between the source machine and virtualization host
- You have access to the Internet for obtaining MondoRescue
- The target virtualization environment is VMware (server, workstation or ESX), although other products will follow very similar guidelines.

**NOTE** - If you're using LVM and plan to migrate from a system with different disk controllers to the destination server, you will want to look at [this](#) section.



## Installing MondoRescue

Installing the latest version of MondoRescue is recommended. The example operating system used for this section is Red Hat Enterprise Linux 4 AS. The RPM's can be downloaded from the MondoRescue site with the following commands (provided a direct connection to the Internet is available):

```
mkdir /tmp/mondo
cd /tmp/mondo
wget ftp://ftp.mondorescue.org/rhel/4/afio-2.4.7-1.x86\_64.rpm
ftp://ftp.mondorescue.org/rhe/4/buffer-1.19-1.x86\_64.rpm
ftp://ftp.mondorescue.org/rhel/4/mindi-2.0.7-3.rhel4.x86\_64.rpm
ftp://ftp.mondorescue.org/rhel/4/mindi-busybox-1.7.3-1.rhel4.x86\_64.rpm
ftp://ftp.mondorescue.org/rhel/4/mondo-2.2.9-3.rhel4.x86\_64.rpm
ftp://ftp.mondorescue.org/rhel/4/mondo-doc-2.2.9-3.rhel4.noarch.rpm
```

Installing the RPM's is a simple case of:

```
rpm -ivh *.rpm
```

**TIP** - You may find MondoRescue present in one of your distributions repositories.

**TIP** - For RHEL5+ you can download a YUM repo file from the MondoRescue website in the directories containing your RPM's (e.g; [ftp://ftp.mondorescue.org/rhel/5/x86\\_64/mondorescue.repo](ftp://ftp.mondorescue.org/rhel/5/x86_64/mondorescue.repo))

## Pre-migration Configuration

Prior to the migration of the physical server, it's necessary to prepare the system for the move.

**TIP** - For migrations in a production environment it's good practice to use a temporary IP address on the source machine. This will mean users and services can't connect to the server during the migration.

Firstly, the initrd (INITial Ram Disk) must be altered to include drivers (modules) for the LSI Logic SCSI controller. A physical machines disk controller will most likely differ from that which the virtual guest (or target machine) will use. In the case of VMware (server, workstation and ESX) the LSI Logic disk controller is emulated (or BusLogic in some cases).

You can check the contents of the initrd with the following command:

```
zcat /boot/initrd-`uname -r`.img | cpio -itv | grep mpt
```

The MPT Fusion modules for the LSI Logic controllers should be displayed.

If your initrd does not contain the required modules, the following command will build a new initrd containing them:

```
mkinitrd --with=mptspi /boot/initrd-`uname -r`-virt.img `uname -r`
```

An entry in the GRUB menu should be added so that once the machine is



migrated, it boots using the new initrd. Duplicate the default entry and alter it:

```
title Red Hat Enterprise Linux AS (2.6.9-67.ELsmp)
root (hd0,0)
kernel /vmlinuz-2.6.9-67.ELsmp ro root=/dev/VolGroup00/LogVol100
rhgb quiet
initrd /initrd-2.6.9-67.ELsmp-virt.img
```

Ensure the new entry is the default entry.

Next, a declaration in `/etc/modprobe.conf` (`/etc/modules.conf` for RHEL 3) should be added:

```
alias scsi_hostadapter qla2400
alias scsi_hostadapter1 mptspi
alias eth0 e1000
```

**TIP** - You can also edit GRUB and `/etc/modprobe.conf` after `mondorestore` has restored your system, just before rebooting the machine.

If your target system uses an Intel SATA controller you have to instead declare:

```
alias scsi_hostadapter ata_piix
```

You should also edit the `/usr/sbin/mindi` file to include the disk controller modules for the *target* machine. Look for the `FORCE_MODS` line and edit:

```
FORCE_MODS="mptsas mptspi"
```

or you can load the driver with `modprobe mptspi` so that `mindi` picks it up when generating boot disks.

**TIP** - Whilst your new `initrd` will be used by the minimal boot environment through which `mondorestore` runs, you may want to ensure some modules are always included regardless. The `/usr/sbin/mindi` file and `FORCE_MODS` option can aid you in this, as seen above.

## Archiving the server

The method in this section is to archive the system to a `.iso` image on the local disk. This requires plenty of free space depending upon the amount of data to be archived (MondoRescue doesn't archive free space). If you have an NFS share available, you may want to archive to that.

**TIP** - Make sure you've assigned the system a temporary IP address prior to the archive, or disabled network interfaces. This may prevent clients trying to connect to your system unknowingly during an archive.

Presuming that MondoRescue has been installed, run the following command to generate an `.iso` image:

```
mondoarchive -O -i -N -g -d /storage -T /usr/mondo/tmp -S /usr/mondo/scratch -E "/video /junk" -s 4480m
```

The options are as follows:



- O This tells mondoarchive to backup
- i The -i option specifies that ISO files are to be used as the media
- N Exclude all mounted network filesystems
- g GUI mode
- d Specifies the backup device/directory, in this case it was /storage
- T Specifies the full path of the temporary directory to be used during archival
- S Specifies the full path of the scratch directory where ISO images are built
- E Exclude these directories, /video and /junk as examples
- s The size of the ISO files, 4480m for a single sided DVD

The archival operation may take some time and depends upon how much data is to be archived. The MondoRescue GUI displays current progress.

Alternatively, running `mondoarchive` without options will take you through the interactive GUI.

**TIP** - As the archival is conducted live on the system, you may want to stop all processes maintaining coherent information, such as RDBMS systems for which the operation could cause a data synchronisation issue.

Once the archival is complete, copy the ISO image to the virtualization host. You could place it on a NFS share, or copy it directly to local storage:

```
scp /storage/mondorescue-1.iso user@virtualhost:/scratch/
```

## Restoring the server

On your virtual host, edit the virtual machine onto which you'd like to migrate and connect the virtual CD/DVD-ROM drive - mounting the iso image MondoRescue created and that you transferred in the previous step.

Start the virtual machine and boot from the CD/DVD-ROM drive. The bootable CD/DVD image contains a small operating environment based on mindi, which builds using the kernel and initrd from the source machine during the archive process.

On Proliant servers this can also be done using the iLO (Integrated Lights Out) interface and virtual media.

When booting from the image, the following menu will appear:



```
These disks were generated on the following system:-
  localhost.localdomain
  Red Hat Enterprise Linux AS release 4 (Nahant Update 4)
  Kernel 2.6.9-42.EL
  on a i686 architecture

To format and restore all files automatically, type 'nuke' <enter>.
To restore some/all files interactively, type 'interactive' <enter>.
To compare the archives with your filesystem, type 'compare' <enter>.
To boot to a command-line prompt (expert mode), type 'expert' <enter>.
You may add one or more of the following parameters as well:-

oondont eject - mondorestore will not eject the CD; this is useful if, for
oo             instance, your PC's case has a concealed CD-ROM drive
oconoresize  - your mountlist will not be adjusted to use your unallocated
oo             hard disk space
ootextonly   - do not call any Newt library routines; this is unattractive
oo             but valuable if you find your Newt library has bugs in it

e.g. Type 'nuke dont eject textonly' if you have an unstable Newt library and
a PC whose CD-ROM drive tray would be damaged if it unexpectedly ejected.

boot: _
```

Figure 1: MondoRescue main menu

Notice in figure 1 that the operating system, kernel and architecture of the system on which the disk was created is shown.

If left for 30 seconds, the MondoRescue GUI will appear prompting you to choose a function. Alternatively 'nuke' will run a non-interactive system restore and 'expert' will drop to a shell prompt.

Type 'interactive' and press enter. Mindi will then load a basic operating environment, using driver modules contained on the original host system (the one you archived).

```
Probing nezk-pci...
Probing mi...
Probing forcedeth...
Probing eepr100...
Probing e100...
Probing e1000...
Probing bnx2...
Probing 8390...
Probing 8139too...
Probing 8139cp...
Probing 3c59x...
Probing i2o_core...
Probing i2o_block...
Probing mptspi...
Probing mptscsi...
Probing mptscsih...
Probing mptsas...
Probing mptfc...
Probing mptctl...
Probing mptbase...
Probing ide-cs...
Probing edd...
Probing loop...
Probing floppy...
```

Figure 2: Mindi Booting...

Figure 2 shows the Mindi environment booting, kernel modules are being loaded. Note the mpt\* modules for LSI Logic controllers typically used by VMware virtual machines.

The first menu in interactive mode will ask you what you want to do. Select 'Interactively' to be prompted at each stage of the restore process. This will also allow you to make any necessary changes.

At the next screen, select the media from which you would like to restore.





Choose 'DVD Disks'.

The next screen will prompt you to alter the mountpoints if required.

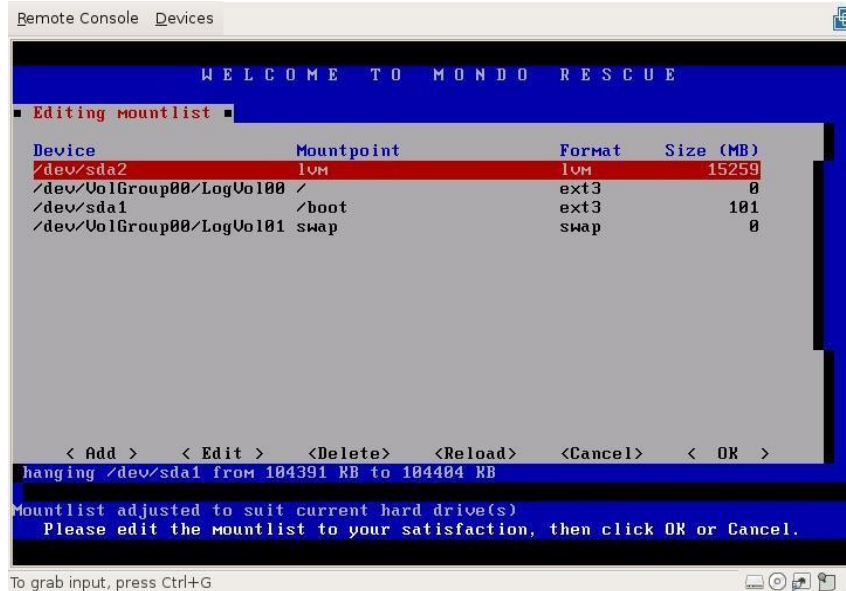


Figure 3: Editing mountpoints

Figure 3 shows that MondoRescue has picked up the correct sizing for the partitions given the size of the new disk, it will alter any sizes by comparing the size of the new disk and the size of the old and altering proportionally. Check to ensure the mountpoints are correct and select 'OK' to proceed. Say 'Yes' to any warning messages if you know the mountlist is correct.

MondoRescue will then ask if you definitely want to erase and format the disks, select 'Yes'. Once the countdown has finished, MondoRescue will begin to partition your drives.

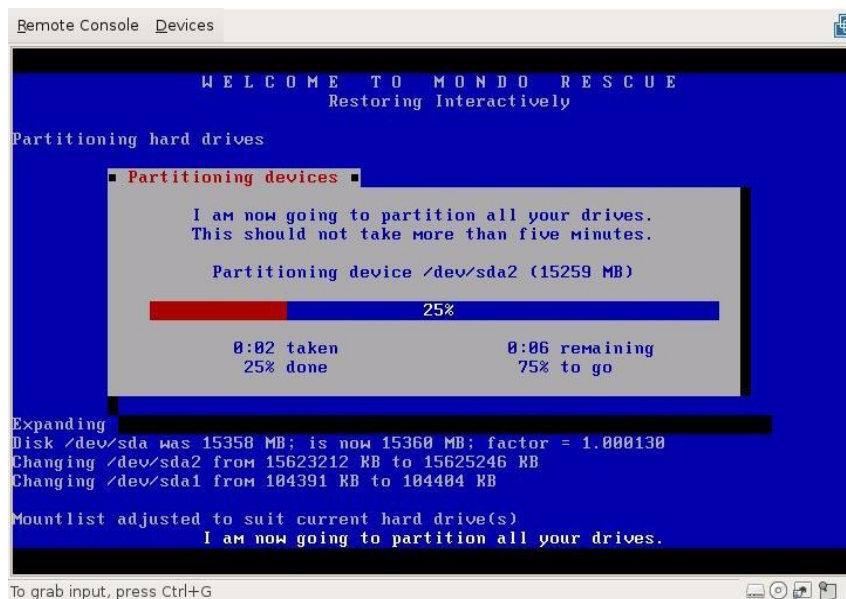


Figure 4: Partitioning devices



Figure 4 shows MondoRescue partitioning `/dev/sda2`. In this guide, `/dev/sda2` is an LVM partition so MondoRescue will also handle the creation of physical volumes, volume groups and logical volumes based on the layout of the source system.

Next, MondoRescue will format the partitions with the same filesystems used on the source machine.

Once the format has completed successfully (errors would be displayed), MondoRescue will ask whether you'd like all of your data restored. Select 'Yes' to begin the restoration.

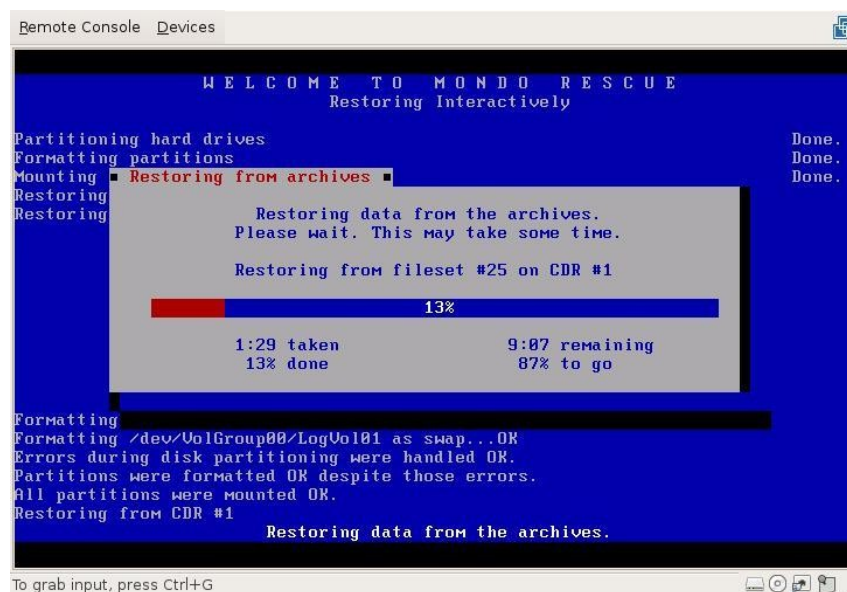


Figure 5: Restoring data

MondoRescue will rebuild the file structure from the archived data. Depending on how much data was on the system and the performance of the virtual host, this can take a while. This is probably a good time to grab a coffee.

Once the restore is complete, MondoRescue will ask you whether you'd like to initialise the boot loader.

Select 'Yes' and select 'No' when asked whether you changed the mountlist or not (presuming you haven't!). Prior to rebooting the system, MondoRescue will ask one last question - whether you would like to label any partitions.

Typically a standard install of Red Hat will label the boot partition as `/boot`. This will then be referenced in `/etc/fstab` and `/boot/grub/menu.lst`. It's important to ensure that the partition is relabeled correctly, else referred to by its path e.g; `/dev/sda1` in the aforementioned configuration files. If you don't, be prepared to edit `/etc/grub.conf` and correct the kernel boot options.

By selecting 'Yes' to label partitions, the restore wizard will exit and drop you to a shell prompt. From here you can use the following command to check filesystem labels and relabel your `/boot` partition:

```
e2label /dev/sda1
```



```
e2label /dev/sda1 /boot
```

Before continuing, you may want to use your virtualization tool to take a snapshot before rebooting, in order to be able to come back to that point and fix anything you may have forgotten.

Type 'exit' and hit return if everything looks ok. This will reboot the virtual machine.

The system should boot successfully. You've now migrated your physical server to a virtual server.

## **Post-migration Configuration**

You should reconfigure network interfaces by creating/editing/removing ifcfg-ethX files in /etc/sysconfig/network-scripts/.

Conduct a set of basic tests when your configuration reflects the virtualized environment. This might include generic tests such as:

- Check that users can login
- Check partitions, filesystems and mountpoints
- Check network connectivity
- Check applications



# Migrating SUSE Linux Enterprise Server

This section of the migration document contains instructions on how to archive and restore various versions of SUSE Linux Enterprise Server.

## SUSE Linux Enterprise Server 11 (& SP1)

This section covers the migration specifics for SLES11 and SLES11 SP1.

### *Pre-migration Configuration*

Pre-requisites are afio, buffer, newt. Download these RPM's from the MondoRescue FTP site:

```
wget ftp://ftp.mondorescue.org/sles/10/x86\_64/afio-2.5-64.x86\_64.rpm ftp://ftp.mondorescue.org/sles/10/x86\_64/buffer-1.19-740.x86\_64.rpm
ftp://ftp.mondorescue.org/sles/11/x86\_64/libnewt0\_52-0.52.10-1.31.x86\_64.rpm ftp://ftp.mondorescue.org/sles/11/x86\_64/newt-0.52.10-1.31.x86\_64.rpm
ftp://ftp.mondorescue.org/sles/11/x86\_64/mindi-busybox-1.7.3-2.sles11.x86\_64.rpm
ftp://ftp.mondorescue.org/sles/11/x86\_64/mindi-2.0.7.5-1.sles11.x86\_64.rpm
ftp://ftp.mondorescue.org/sles/11/x86\_64/mondo-2.2.9.4-1.sles11.x86\_64.rpm
```

**TIP** - You could add the mondorescue ftp directory as a repository to zypper, using the following command: `zypper ar --repo ftp://ftp.mondorescue.org/sles/11/x86_64/mondorescue.repo -f`

Now that MondoRescue is installed you can prepare the initrd with the LSI logic scsi adapter modules (mptspi) that will be required for the system to boot under VMware. Alter the modules depending upon your virtualisation platform.

To do this, edit `/etc/sysconfig/kernel` and add the modules (mptspi for LSI Logic disk controllers) to the "INITRD\_MODULES" line. Run 'depmod' to create an updated list of module dependencies and then mkinitrd to create a new initrd with the modules included. Running mkinitrd without any options will update the existing initrd, rather than creating a new one.

**TIP** - You might want to create a new initrd to preserve your current environment rather than alter your current initrd image. If you create a new initrd, remember to either reboot your system to use the new initrd image or edit `/usr/sbin/mindi` and specify the modules on the FORCE\_MODS line prior to archival.

```
depmod
mkinitrd
```

Since SLES10 SP1, SLES has listed devices in `/etc/fstab` by their DeviceID. The latest versions of MondoRescue support this behaviour but you may find it



easier (more readable) if you alter the fstab entries to list devices by device name (e.g; /dev/sda1). This will ensure clean entries in fstab and device.map after restore. You can do this manually or through the YaST partitioner:

## yast disk

Select Settings, then select “Default Mount by” and choose 'Device Name' as the identification method:

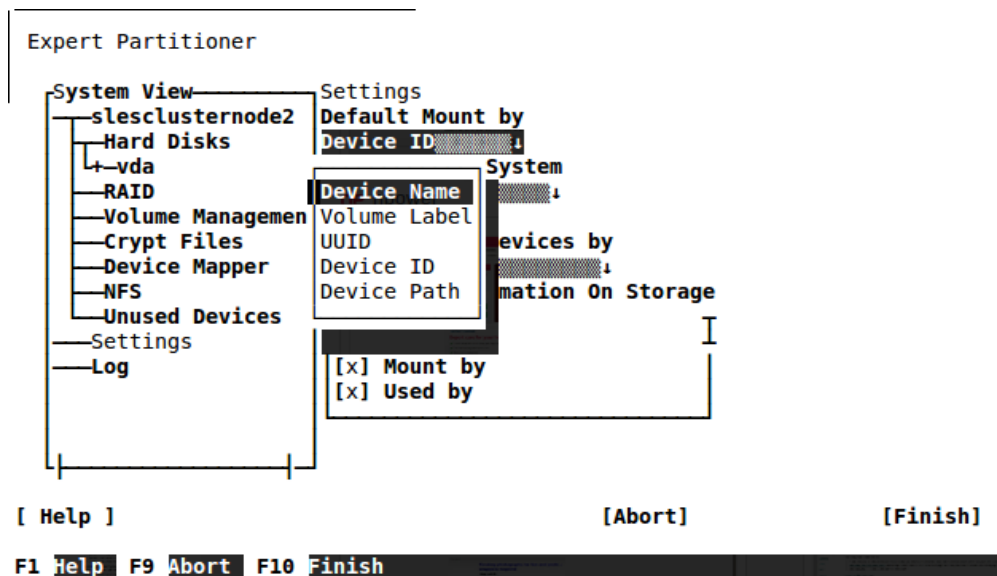


Figure 6: SLES11 - Mount by Device Name

You can now begin the archival of your system using mondoarchive. Follow the guidance from the working example [here](#) to complete an archive.

### Post-migration Configuration

Once archived you can mount the resulting iso file on the virtual machine and begin a restore. After the restore is complete, you'll need to check /etc/fstab, /boot/grub/device.map and /boot/grub/menu.lst and alter the entries in these files if required.

**TIP** - If your system doesn't boot, it could be that GRUB didn't install correctly. This can be rectified by booting from your SLES 11 DVD image and selecting “repair system” – choose “expert tools” and “reinstall boot loader” from the repair tool.

Having migrated the system, your network adapter will have changed. In SLES, the easiest way to rectify this is to use YaST to delete the configuration for your old adapter and create a new one.

## # yast lan

Delete the adapter configuration which is no longer present, having migrated from a DL380G5 the onboard NICs would have been Broadcom NetXtreme 2's (bnx2 module) for example. Then save settings and re-create a new adapter configuration (again in yast) for the new target hardware.



## SUSE Linux Enterprise Server 10 (SP2 & SP3)

So far this document has covered the migration of Red Hat Enterprise Linux 4 and 5. This section will outline specifics relating to the migration of a vanilla install of SLES 10 (SP2) 64bit.

### *Pre-migration Configuration*

Pre-requisites are afio, buffer, newt and newt-devel. Download these RPM's from the MondoRescue FTP site:

```
wget ftp://ftp.mondorescue.org/sles/10/afio-2.5-64.x86_64.rpm
ftp://ftp.mondorescue.org/sles/10/buffer-1.19-740.x86_64.rpm
ftp://ftp.mondorescue.org/sles/10/mindi-2.0.7.3-
1.sles10.x86_64.rpm ftp://ftp.mondorescue.org/sles/10/mindi-
busybox-1.7.3-1.sles10.x86_64.rpm
ftp://ftp.mondorescue.org/sles/10/mondo-2.2.9.3-
1.sles10.x86_64.rpm ftp://ftp.mondorescue.org/sles/10/newt-0.52.2-
1.2.x86_64.rpm ftp://ftp.mondorescue.org/sles/10/newt-devel-
0.52.2-1.2.x86_64.rpm
```

mttools, gcc, gcc-c++ are also pre-requisites. Download these from Novell's SLES10 yast repositories using zypper (along with dependencies):

```
zypper in gcc gcc-c++ mttools
```

Install the afio, buffer and newt RPM's:

```
rpm -ivh newt-0.52.2-1.2.x86_64.rpm newt-devel-0.52.2-
1.2.x86_64.rpm afio-2.5-64.x86_64.rpm buffer-1.19-740.x86_64.rpm
```

Then install the MondoRescue RPM's:

```
rpm -ivh mondo* mindi*
```

Now that MondoRescue is installed you can prepare the initrd with the LSI logic scsi adapter modules that will be required for the system to boot under VMware. Alter the modules depending upon your virtualisation platform.

To do this, edit /etc/sysconfig/kernel and add the modules (mptspi for LSI Logic disk controllers) to the "INITRD\_MODULES" line. Run 'depmod' to create an updated list of module dependencies and then mkinitrd to create a new initrd with the modules included. Running mkinitrd without any options will update the existing initrd, rather than creating a new one.

**TIP** - You might want to create a new initrd to preserve your current environment rather than alter your current initrd image. If you create a new initrd, remember to either reboot your system to use the new initrd image or edit /usr/sbin/mindi and specify the modules on the FORCE\_MODS line prior to archival.

```
depmod
mkinitrd
```

**NOTE** - Unless you specifically require the fdomain module (for certain Adaptec controllers), add fdomain to the DENY\_MODS line in /usr/sbin/mindi PRIOR to



archival. Failure to do so may result in your system hanging whilst booting into the restore environment.

**NOTE** - Unless required, specify the `scsi_debug` module on the `DENY_MODS` line in `/usr/sbin/mindi`. This will remove any anomalous devices when restoring within VMware and moving from `/dev/hd*` devices to `/dev/sd*` devices.

Since SP1, SLES10 has listed devices in `/etc/fstab` by their DeviceID. When migrating to different disks it's recommended that you alter the `fstab` entries to list devices by device name (e.g; `/dev/sda1`). You can do this manually or through the YaST partitioner:

### yaST disk

Select your partition(s), then select 'edit' and 'fstab options'. Then choose 'Device Name' as the identification method:

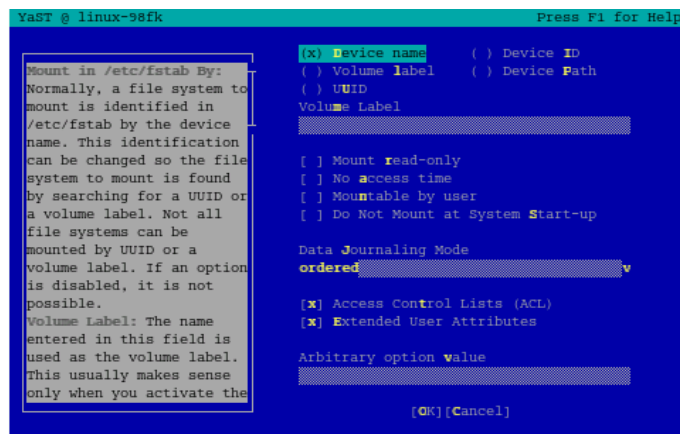


Figure 7: YaST - device name labelling

You can now begin the archival of your system using `mondoarchive`. Follow the guidance from the working example [here](#) to complete an archive.

### Post-migration Configuration

Once archived you can mount the resulting iso file on the virtual machine and begin a restore. After the restore is complete, you'll need to check `/etc/fstab`, `/boot/grub/device.map` and `/boot/grub/menu.lst` and alter the entries in these files if required.

**TIP** - If your system doesn't boot, it could be that GRUB didn't install correctly. This can be rectified by booting from your SLES 10 SP2 DVD image and selecting "rescue system". Once booted and `chrooted` into your environment you can type: `grub-install /dev/sda` to install GRUB into the MBR of your primary disk.

Having migrated the system, your network adapter will have changed. In SLES, the easiest way to rectify this is to use YaST to delete the configuration for your old adapter and create a new one.

### # yaST lan

Delete the adapter configuration which is no longer present, having migrated



from a DL380G5 the onboard NICs would have been Broadcom NetXtreme 2's (bnx2 module) for example.

## SUSE Linux Enterprise Server 9

This section contains guidance for those wanting to migrate SLES 9, based on the 2.4 Linux Kernel.

### *Pre-migration Configuration*

Modify `/etc/sysconfig/kernel`. Change the `INITRD_MODULES` section at the top and add in your target hardware's driver modules:

```
INITRD_MODULES="scsi_mod sd_mod ext3 mptbase mptscsih pcnet32"
```

Update or generate a new `initrd` to include the modules specified in `/etc/sysconfig/kernel`:

```
mkinitrd
```

**TIP** - If you generate a new `initrd`, don't forget to update the grub menu with a new entry to use the new `initrd`.

You can now begin the archival of your system using `mondoarchive`. Follow the guidance from the previous [section\(s\)](#) to complete an archive.

### *Post-migration Configuration*

Use YaST to alter the network adapter configuration:

```
yast lan
```

Remove any entries for old hardware and configure the new adapter.

## Migrating Red Hat Enterprise Linux

This section covers the pre-migration and post-migration configuration steps required when migrating Red Hat Enterprise Linux versions.

### Red Hat Enterprise Linux 6

This section outlines specific methodology for migrating RHEL6 systems.

**NOTE** - Ensure you have `mindy-busybox` version 1.18.3-1 or higher installed, otherwise your restore will fail.

### *Pre-migration Configuration*

The first step is to identify your target hardware and ensure the driver modules needed are included in the `initrd` of the system to be migrated. Check they are present, in the example below we check for LSILogic disk controller modules:

```
zcat /boot/initrd-`uname -r`.img | cpio -itv | grep mpt
```

If you need to add any driver modules, them to `/usr/sbin/mindy`, like so:





```
FORCE_MODS="mptsas mptspi"
```

This will ensure that mindi picks up the required modules when generating boot disks.

Continue with the [archival](#) as demonstrated in the example at the beginning of this document.

### ***Post-migration Configuration***

Once you have rebooted into your new environment, you can

## **Red Hat Enterprise Linux 4 & 5**

The pre and post migration steps for RHEL 4 and 5 are the same. This section outlines the methodology which is also used in the working example of this document found [here](#).

### ***Pre-migration Configuration***

The first step is to identify your target hardware and ensure the driver modules needed are included in the initrd of the system to be migrated. Check they are present, in the example below we check for LSILogic disk controller modules:

```
zcat /boot/initrd-`uname -r`.img | cpio -itv | grep mpt
```

If you need to add any driver modules, use the mkinitrd command to generate a new initrd, including any required modules. Below we add the modules to support LSILogic disk controllers:

```
mkinitrd --with=mptspi /boot/initrd-`uname -r`-virt.img `uname -r`
```

Edit grub to give a new selection on boot for the initrd containing your modules:

```
title Red Hat Enterprise Linux AS (2.6.9-67.ELsmp)
root (hd0,0)
kernel /vmlinuz-2.6.9-67.ELsmp ro root=/dev/VolGroup00/LogVol100
rhgb quiet
initrd /initrd-2.6.9-67.ELsmp-virt.img
```

After you have archived and restored the server you can select this menu entry when booting.

You now have two choices. You can either reboot and select your new boot entry and thus use the new initrd, or you can edit /usr/sbin/mindi and add the modules to the FORCE\_MODS line, like so:

```
FORCE_MODS="mptsas mptspi"
```

Either of these methods will ensure that mindi picks up the required modules when generating boot disks.

Next, edit /etc/modprobe.conf and add a new entry for the target SCSI adapter and network adapter:

```
alias scsi_hostadapter cciss
```



```
alias scsi_hostadapter1 mptspi
```

```
alias eth0 pcnet32
```

Continue with the [archival](#) as demonstrated in the example at the beginning of this document.

### *Post-migration Configuration*

For RHEL 4 & 5, edit the interface configuration files in `/etc/sysconfig/network-scripts/` to reflect your new network configuration. Clean up `/etc/modprobe.conf` as appropriate and then check your system functionality.

## Red Hat Enterprise Linux 3

This section contains notes for those wanting to migrate RHEL 3, based on the 2.4 Linux kernel.

### *Pre-migration Configuration*

Archival may fail due to the version of tar in RHEL3 being picky about symlinks, tar is used during archival of files. This can be rectified by creating the following symlinks:

```
ln -sf /bin/gawk /usr/bin && ln -sf /usr/sbin/smbmount /usr/bin &&  
ln -sf /bin/loadkeys /usr/bin
```

**TIP** - For RHEL3 and VMware, emulate a BusLogic SCSI controller rather than LSILogic.

Add the disk controller modules required by the target hardware to a new initrd:

```
mkinitrd -with=BusLogic /boot/initrd-`uname -r`-virt.img `uname  
-r`
```

Edit grub to give a selection on boot for the initrd containing your modules:

```
title Red Hat Enterprise Linux AS (2.4.21-50.EL)  
root (hd0,0)  
kernel /vmlinuz-2.4.21-50.EL ro root=LABEL=/ rhgb quiet  
initrd /initrd-2.4.21-50.EL-virt.img
```

You can then select this new grub entry once you have restored to your new platform and boot for the first time.

Add the modules to the `/usr/sbin/mindi` file:

```
FORCE_MODS="BusLogic"
```

The following declaration in `/etc/modules.conf` should be added:

```
alias scsi_hostadapter BusLogic  
alias eth0 pcnet32
```

These are device aliases for the target hardware; BusLogic controller and AMD PCnet NIC.



Continue with archival as specified [here](#).

### ***Post-migration Configuration***

For RHEL 3, edit ifcfg-ethX files in /etc/sysconfig/network-scripts/ to reflect your new network configuration, such as MAC addresses and IP's.

## **Migrating Debian**

This section covers specifics relating to the migration of Debian 4.0 and 5.0 systems. Debian 5.0 is referred to by example, with notes for Debian 4.0 explicitly stated.

### **Debian 5.0 “Lenny” & Debian 4.0 “Etch”**

#### ***Pre-migration Configuration***

The default installation of Debian 5.0 (and 4.0) includes the MPT Fusion modules in the initrd (for LSI Logic adapters). This means regenerating a new initrd isn't necessary.

Check this is the case with the following command:

```
# zcat /boot/initrd-<mykernel>-server.img | cpio -itv | grep mpt
```

The information returned should show the mptbase, mptscsih, mptsas, mptspi modules all included.

MondoRescue depends on the following packages which you should install from Debian's apt repositories.

For Debian 5.0:

```
# sudo apt-get install binutils dosfstools mkisofs syslinux  
syslinux-common gawk parted libparted mtools afio buffer cdrecord
```

For Debian 4.0:

```
# sudo apt-get install binutils dosfstools mkisofs syslinux bzip2  
gawk parted libparted mtools afio buffer cdrecord
```

Then download and install MondoRescue:

```
# mkdir /tmp/mondo && cd /tmp/mondo && wget  
ftp://ftp.mondorescue.org/debian/5.0/mindi\_2.0.7.3-1\_amd64.deb  
ftp://ftp.mondorescue.org/debian/5.0/mindi-busybox\_1.7.3-1\_amd64.deb ftp://ftp.mondorescue.org/debian/5.0/mondo\_2.2.9.3-1\_amd64.deb && dpkg -i *.deb
```

Packages for Debian 4.0 can be found at: <ftp://ftp.mondorescue.org/debian/4.0/> Archive and restore the system as defined in the main section [here](#).

#### ***Post-migration Configuration***

As your network adapter is likely to have changed, you will need to edit the





You should then go ahead and alter the rest of the system configuration to reflect it's new home.

## Migrating Ubuntu Server

This section covers specifics relating to the migration of Ubuntu Server.

### Ubuntu Server 10.04 LTS

#### Pre-migration Configuration

The base installation of Ubuntu 10.04 already includes the MPT Fusion driver family (for LSI Logic adapters) in the initrd. You can check this with the following command:

```
# zcat /boot/initrd.img`uname -r` | cpio -itv | grep mpt
```

MondoRescue is available in the standard apt repositories but is usually a few versions out of date. It is recommended that you download the latest versions from the MondoRescue website.

Ensure the following dependencies are installed:

```
# sudo apt-get install afio binutils buffer gawk genisoimage  
liblzo2-2 lzop mtools syslinux wodim
```

**TIP** – You could try installing the mondo packages with “dpkg -i” then using “apt-get -f install” to fix the missing dependencies, providing you have direct access to the repositories.

Then install the MondoRescue packages:

```
# mkdir /tmp/mondo && cd /tmp/mondo && wget  
ftp://ftp.mondorescue.org/ubuntu/9.10/mondo\_2.2.9.3-1\_amd64.deb  
ftp://ftp.mondorescue.org/ubuntu/9.10/mindi-busybox\_1.7.3-1\_amd64.deb ftp://ftp.mondorescue.org/ubuntu/9.10/mindi\_2.0.7.3-1\_amd64.deb && sudo dpkg -i m*.deb
```

By default Ubuntu 10.04 refers to partitions in /etc/fstab by uuid. You should change this to device name referencing by manually changing the entries. Otherwise you will be left with erroneous entries in /etc/fstab for the old partitions:

```
/dev/fd0      /media/floppy0    auto          rw,user,noauto,exec,utf8 0 0  
/dev/sda1    /                  ext4          defaults              0 0  
/dev/sda2    swap              swap          0 0  
proc         /proc            proc          nodev,noexec,nosuid    0 0
```

Figure 9: /etc/fstab on Ubuntu 10.04

NOTE – Ubuntu 10.04 uses Grub 2. Grub 2 refers to root devices within its configuration file (/boot/grub/grub.cfg) by UUID. This behaviour can be disabled. After altering /etc/fstab edit /etc/default/grub and uncomment the following line:





Also edit the network interface configuration in `/etc/network/interfaces` appropriately to reflect your new environment.

## Ubuntu Server 8.04 LTS

### *Pre-migration Configuration*

The base installation of Ubuntu Server 8.04 includes the MPT Fusion driver family in the `initrd` already. You can check this with the following command:

```
# zcat /boot/initrd-<mykernel>-server.img | cpio -itv | grep mpt
```

MondoRescue is available in the standard apt repositories but is slightly out of date (version 2.2.4 at time of writing). This guide presumes you are using version 2.2.9.

Ensure the following dependencies are installed:

```
# sudo apt-get install afio buffer wodim binutils mkisofs syslinux gawk
```

**TIP** - You could try installing the mondo packages with “`dpkg -i`” then using “`apt-get -f install`” to fix the missing dependencies.

Then go ahead and download and install MondoRescue:

```
# mkdir /tmp/mondo && cd /tmp/mondo && wget
ftp://ftp.mondorescue.org/ubuntu/8.04/mondo_2.2.9_amd64.deb
ftp://ftp.mondorescue.org/ubuntu/8.04/mindi-busybox_1.7.3-
1_amd64.deb
ftp://ftp.mondorescue.org/ubuntu/8.04/mindi_2.0.7_amd64.deb &&
sudo dpkg -i m*.deb
```

**NOTE** - By default Ubuntu 8.04 refers to partitions in `/etc/fstab` by `uuid`. You should change this to device name referencing by manually changing the entries. Otherwise you will be left with erroneous entries in `/etc/fstab` for the old partitions.

Archive and restore the system as defined in the main section [here](#).

### *Post-migration Configuration*

After you have migrated the system, alter `/etc/udev/udev.rules.d/60-persistent-net.rules` and remove redundant rules for the previous network adapters. Edit the rule for the newly detected adapter and alter the device name appropriately.

Next, edit `/etc/network/interfaces` which controls the adapter configuration, setting IP address and network settings appropriately for your new environment.



## Working with LVM and the HP Smart Array controller

If you're working with HP ProLiant's, or HP products which use the Smart Array controller (cciss module) then you're quite likely to come up against [bug#183](#). Essentially this bug means that if you are cloning a system which uses LVM on Smart Array onto a different disk controller, LVM will not be restored correctly.

To work around this it is necessary to take the following steps:

When booting from the rescue iso, enter expert mode and configure the partitions prior to restoring in interactive mode. It's important that all mountpoints that existed on the source machine are serviced (unless you want to retire some of them).

- Boot from the MondoRescue ISO created during archival and enter expert mode
- Use fdisk / parted to partition the virtual disk manually
- Create volume groups and logical volumes on the appropriate LVM partition (you should use /tmp/i-want-my-lvm as a template)
- Create your filesystems on the volumes/disks
- Once the disk is prepared enter interactive mode (type 'interactive' at the shell prompt)
- Edit the mountlist when prompted. Ensure each mountpoint is serviced by partitions / logical volumes created in step 2 and 3. Ignore any sizing discrepancies
- Hit 'OK' and DO NOT let MondoRescue partition or format your disks
- Select 'Yes' when asked whether you'd like to restore all your data
- At this point you can pick up this guide from [here](#). See the troubleshooting section below if anything happened to go wrong





# Troubleshooting

## **Problem 1**

Attempting to log onto the migrated machine causes the user to be dumped back at the login prompt.

## **Solution 1**

This may be an SELinux issue. Boot from a rescue CD, chroot to the mounted filesystem and disable SELinux with the system-config-securitylevel tool (Red Hat only).

## **Problem 2**

Migrated system fails to boot.

## **Solution 2**

Check the following; ensure filesystems are labeled as appropriate, check that the grub bootloader configuration is correct (re-install grub if required), make sure that mountpoints are correct in `/etc/fstab` and that the `mpt*` LSI Logic modules (for VMware) are included in `/etc/modprobe.conf` and that they exist on the system (`updatedb` or `find / -name mptbase.ko` etc.). You may also want to check to see if Mindi included them during ISO creation (see `/usr/sbin/mindi`).

## **Problem 3**

Filesystems fail to mount during startup.

## **Solution 3**

Check `/etc/fstab` to ensure assignments are correct. Also make sure that the volumes actually exist as expected.

## **Problem 4**

VM boots with 'operating system not found' error message

## **Solution 4**

There is a good chance that the bootloader is not installed properly. Install GRUB by using the 'grub-install' command. You'll need to boot into a rescue environment then mount and chroot to your root partition. The command takes the option of your disk device (e.g: `/dev/sda`). Once GRUB is reinstalled, check `/boot/grub/menu.lst` and `/boot/grub/device.map`.

# Summary

MondoRescue is an extremely flexible tool which lends itself to many different roles. Typically used for full and incremental system backups it works equally well for the migration of servers within both physical and virtual environments. You can find out more information about MondoRescue from [www.mondorescue.org](http://www.mondorescue.org).



## **Acknowledgement**

Many thanks to the MondoRescue team in their assistance and willingness to help when I was originally assessing this method for P2V/P2P migrations.