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Linux on z/VM System Programmer Survival Guide

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Agenda

- **Missing Kernel or Initrd**
- **Missing Network connections**
- **Expanding a root LV**
- **LVM Recovery**
- **Customized Initrd**

Missing Kernel symptoms

00: I 201 CL

00: zIPL v1.3.2 interactive boot menu

00:

00: 0. default (linux)

00:

00: 1. linux

00:

00: Note: VM users please use '#cp vi vmsg <input>'

00:

00: Please choose (default will boot in 15 seconds):

00: Booting default (linux)...

00: **HCPGIR453W CP entered; program interrupt loop**

Missing Initrd symptoms

```
NET: Registered protocol family 1
NET: Registered protocol family 17
md: Autodetecting RAID arrays.
md: autorun ...
md: ... autorun DONE.
```

```
VFS: Cannot open root device "LABEL=/" or unknown-block(0,0)
```

```
Please append a correct "root=" boot option
```

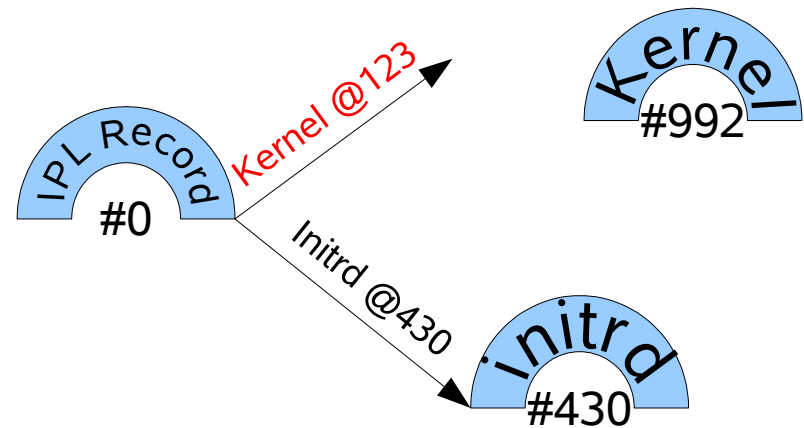
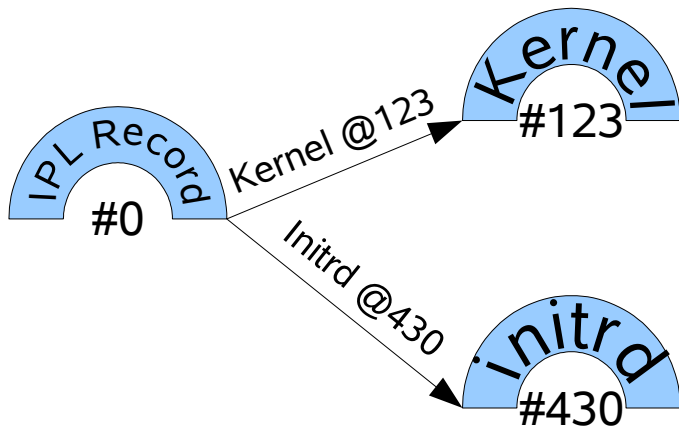
```
Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(0,0)
```

```
01: HCPGSP2629I The virtual machine is placed in CP mode due to a SIGP stop from
CPU 00.
```

```
00: HCPGIR450W CP entered; disabled wait PSW 00020001 80000000
00000000 002F2F92
```

How did we end up here?

- **Installed Kernel service without running zipl**
 - Might take days or weeks to notice if you don't IPL right away
- **Ran mkinitrd without then running zipl**
- **Physically moved any of the files in /boot**



Fixing a missing Kernel or Initrd

- **Fixing a broken linux system requires another linux system**
 - Any other Linux system with access to the broken system's DASD
 - If no other systems have access to the broken system's DASD, use the initial install media to get something running.
- **mount the broken system's partitions**
- **chroot into the system**
- **run zipl**

Getting the RHEL 4 & 5 installer to see DASD

- **IPL the installer**
- **follow the prompts on the 3270 console to set up the network**
- **SSH to the install system when prompted**
 - The script which runs after SSHing in loads the dasd modules
- **Close the SSH session once the “Choose a language” prompt appears**
- **Open another SSH session to get a shell prompt**

Getting the SLES 9 installer to see DASD

- **IPL the installer**
- **follow the prompts on the 3270 console to set up the network**
- **Choose 0 when asked “Please specify the installation Source:”**
 - Cancels out of the installer
- **SSH to the install system to get a shell prompt**
- **Run: `modprobe dasd_eckd_mod`**

Getting the SLES 10 installer to see DASD

- **IPL the installer**
- **Follow the prompts to install a new system, choose network install and SSH display type**
 - The system will load another ram disk from the install server
- **SSH in to the system when prompted**
- **Run: `modprobe dasd_eckd_mod`**

From the shell prompt - 1

■ Vary the volumes online

- echo 1 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0201/online
- cat /proc/dasd/devices
 - 0.0.0201(ECKD) at (94: 0) is dasda : active at
blocksize: 4096, 599400 blocks, 2341 MB

■ RHEL 4 & 5 – create the device nodes

- mknod /dev/dasda b 94 0
- mknod /dev/dasda1 b 94 1

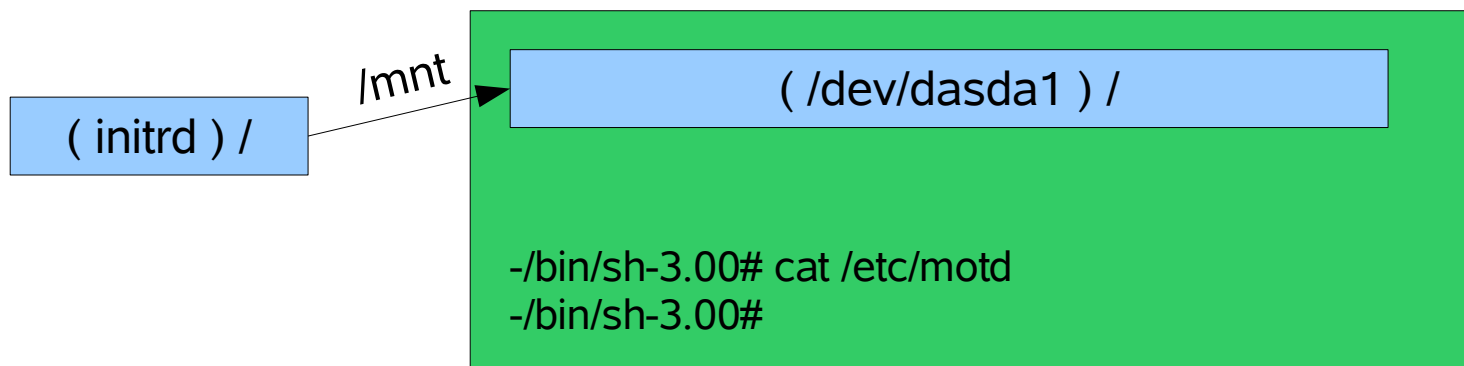
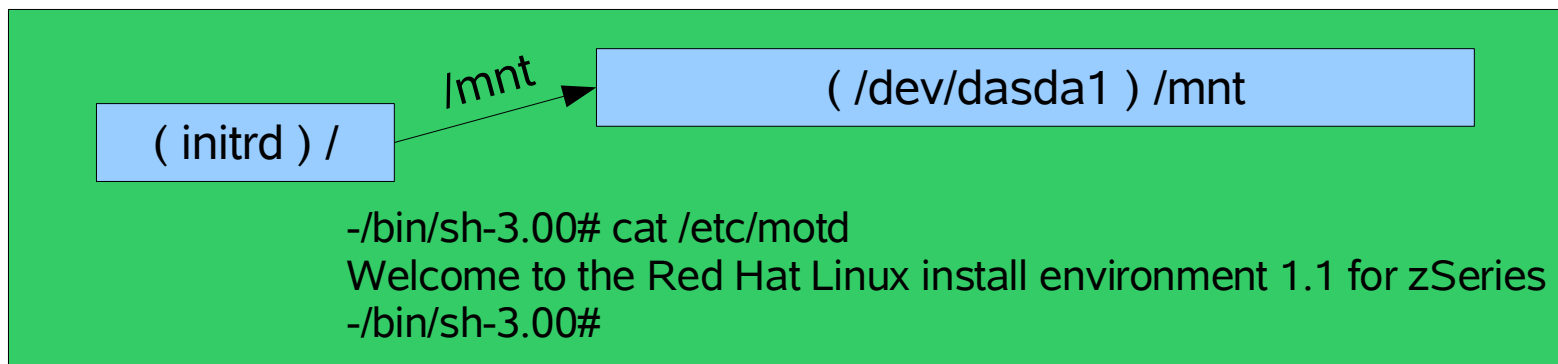
■ Mount the / and /boot file systems

- Might have to create the mountpoints on RHEL 5
- mount /dev/dasda1 /mnt

From the shell prompt - 2

- **Chroot into the mounted / file system**

- chroot /mnt



From the shell prompt - 3

- **Run zipl in the chroot environment to fix the IPL record**

- /sbin/zipl

- Using config file '/etc/zipl.conf'
Building bootmap '/boot//bootmap'
Building menu 'rh-automatic-menu'
Adding #1: IPL section 'linux' (default)
Preparing boot device: 0201.
Done.

- **exit the chroot environment**

- exit

- **Unmount the partitions**

- umount /mnt

- **Vary the devices offline**

- echo 0 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0201/online

Missing Network Connection

- **Can't ssh, ftp, ping...**
- **3270 console access only**
 - ASCII console may be available depending on hardware & z/VM release
- **No GUI tools**
- **3270 is line mode only – no curses tools, no vi, no emacs***

* no one should be using emacs anyway – it rots your brain

Fixing a Missing Network Connection

- **Just get something working so you can ssh in**
- **Determine if it is a hardware or a software problem**
- **Define the device triplet to the qeth driver**
 - echo “0.0.1f00,0.0.1f01,0.0.1f02” >
/sys/bus/ccwgroup/drivers/qeth/group
- **Set the portname if needed**
 - echo '9DOTLAN' >
/sys/bus/ccwgroup/drivers/qeth/0.0.1f00/portname
- **Set Layer2 if needed**
 - echo 1 > /sys/bus/ccwgroup/drivers/qeth/0.0.1f00/layer2

Fixing a Missing Network Connection

- **Vary it online**
 - `echo 1 > /sys/bus/ccwgroup/drivers/qeth/0.0.1f00/online`
- **Ifconfig the device up manually**
 - `ifconfig eth0 9.12.20.154 netmask 255.255.255.0 up`
- **Add any needed routes**
 - `route add default gw 9.12.20.1`
- **SSH in and fix it permanently with the distro's tools**

Expanding a root logical volume

- **If you use auto partition when you install RHEL 4 your / will be on a LV**
- **It is not possible to unmount /**
- **It is not yet possible to resize an ext3 volume while its mounted**
 - Resize2fs can expand a volume online
 - Kernel \geq 2.6.10
 - E2fsprogs \geq 1.39-1
 - RHEL 5 can do it

Expanding a root logical volume

■ Shutdown the owning system

- You've already added the 202 disk as a PV to the volume group and grown the LV containing the root fs

■ Link the volumes to another Linux system

- `vmcp link testa001 201 901 mr`
- `vmcp link testa001 202 902 mr`

■ Vary the volumes online

- `echo 1 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0901/online`
- `echo 1 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0902/online`

■ Pvs can to discover the volume group name

- `pvs can`
 - `PV /dev/dasdc2 VG VolGroup00 lvm2 [2.19 GB / 0 free]`
 - `PV /dev/dasdd1 VG VolGroup00 lvm2 [2.28 GB / 0 free]`
 - `Total: 2 [4.47 GB] / in use: 2 [4.47 GB] / in no VG: 0 [0]`

Expanding a root logical volume

■ Import the volume group

- `vgexport VolGroup00 && vgimport VolGroup00`

■ Activate the volume group

- `vgchange VolGroup00 -a y`

- 2 logical volume(s) in volume group "VolGroup00" now active

■ Fsck the logical volume

- `e2fsck -f /dev/VolGroup00/LogVol00`

- I'm assuming here (yes, I know the joke) that the logical volume has already been expanded, just not the filesystem

Expanding a root logical volume

■ Expand the logical volume

- `resize2fs /dev/VolGroup00/LogVol00`
 - `resize2fs 1.35 (28-Feb-2004)`
 - Resizing the filesystem on `/dev/VolGroup00/LogVol00` to 1064960 (4k) blocks.
 - The filesystem on `/dev/VolGroup00/LogVol00` is now 1064960 blocks long.

■ Vary the volumes offline and detach them

- `echo 0 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0902/online`
- `echo 0 > /sys/bus/ccw/drivers/dasd-eckd/0.0.0901/online`
- `vmcp det 901`
- `vmcp det 902`

Scanning logical volumes

Reading all physical volumes. This may take a while...

Couldn't find device with uuid 'JzhQIZ-k0ko-1Mgt-qGzl-tvNf-GNS6-feLWdR'.

Couldn't find all physical volumes for volume group VolGroup00.

Couldn't find device with uuid 'JzhQIZ-k0ko-1Mgt-qGzl-tvNf-GNS6-feLWdR'.

Couldn't find all physical volumes for volume group VolGroup00.

Volume group "VolGroup00" not found

ERROR: /bin/lvm exited abnormally! (pid 190)

Activating logical volumes

Couldn't find device with uuid 'JzhQIZ-k0ko-1Mgt-qGzl-tvNf-GNS6-feLWdR'.

Couldn't find all physical volumes for volume group VolGroup00.

Couldn't find device with uuid 'JzhQIZ-k0ko-1Mgt-qGzl-tvNf-GNS6-feLWdR'.

Couldn't find all physical volumes for volume group VolGroup00.

Volume group "VolGroup00" not found

ERROR: /bin/lvm exited abnormally! (pid 191)

Creating root device

Mounting root filesystem

mount: error 6 mounting ext3

mount: error 2 mounting none

Switching to new root

switchroot: mount failed: 22

umount /initrd/dev failed: 2

Kernel panic - not syncing: Attempted to kill init!

01: HCPGSP2629I The virtual machine is placed in CP mode due to a SIGP stop from CPU 00.

00: HCPGIR450W CP entered; disabled wait PSW 00020001 80000000 00000000 00040DA0

Fixing an LVM group which is missing volumes

- **All volumes must be attached and online when the “Scanning logical volumes” step runs in the initrd**
- **The initrd must be updated to bring those devices online by default when it loads the dasd driver**
- **But – we have yet another un-bootable system...**
- **Link the volumes to another system and vary them online to Linux**
- **Activate the volume group with vgchange**

Fixing an LVM group which is missing volumes

- **Mount the root logical volume and any sub trees**
 - `mount /dev/VolGroup00/LogVol00 /mnt`
 - `mount /dev/dasdc1 /mnt/boot`
- **Chroot into the broken system**
 - `Chroot /mnt`
- **Edit `/etc/modprobe.conf` to add the missing volumes to the `dasd` list**
 - `options dasd_mod dasd=201-202`

Fixing an LVM group which is missing volumes

- **Make the new initrd with mkinitrd**
 - May have to force mkinitrd to load the dasd drivers with a parameter
 - Use the -v flag to generate verbose output
 - Look for the messages for dasd_mod
 - Look for the messages for the file system type
 - Look for the messages for device mapper modules


```
mkinitrd -v --with dasd_eckd_mod /boot/initrd-2.6.9-42.EL.img.new 2.6.9-42.EL
```

```
Creating initramfs
```

```
Looking for deps of module ide-disk
```

```
Looking for deps of module ext3 jbd
```

```
Looking for deps of module jbd
```

```
Looking for deps of module dm-mod
```

```
Looking for deps of module dm-mirror dm-mod
```

```
Looking for deps of module dm-mod
```

```
Looking for deps of module dm-zero dm-mod
```

```
Looking for deps of module dm-mod
```

```
Looking for deps of module dm-snapshot dm-mod
```

```
Looking for deps of module dm-mod
```

```
Looking for deps of module dasd_eckd_mod dasd_mod
```

```
Looking for deps of module dasd_mod
```

```
Using modules: ./kernel/fs/jbd/jbd.ko ./kernel/fs/ext3/ext3.ko ./kernel/drivers/md/dm-mod.ko
```

```
./kernel/drivers/md/dm-mirror.ko ./kernel/drivers/md/dm-zero.ko ./kernel/drivers/md/dm-snapshot.ko
```

```
./kernel/drivers/s390/block/dasd_mod.ko ./kernel/drivers/s390/block/dasd_eckd_mod.ko
```

...some output trimmed here...

```
Loading module jbd
```

```
Loading module ext3
```

```
Loading module dm-mod
```

```
Loading module dm-mirror
```

```
Loading module dm-zero
```

```
Loading module dm-snapshot
```

```
Loading module dasd_mod with options dasd=201-202
```

```
Loading module dasd_eckd_mod
```

Fixing an LVM group which is missing volumes

- **Edit /etc/zipl.conf – add a new section using the new initrd**

```
[defaultboot]
default=linux
target=/boot/
[linux1]
    image=/boot/vmlinuz-2.6.9-42.EL
    ramdisk=/boot/initrd-2.6.9-42.EL.img.new
    parameters="root=/dev/VolGroup00/LogVol00"
[linux]
    image=/boot/vmlinuz-2.6.9-42.EL
    ramdisk=/boot/initrd-2.6.9-42.EL.img
    parameters="root=/dev/VolGroup00/LogVol00"
```

- **Run zipl to update the boot record to include the new initrd**

```
Using config file '/etc/zipl.conf'
Building bootmap '/boot//bootmap'
Building menu 'rh-automatic-menu'
Adding #1: IPL section 'linux1'
Adding #2: IPL section 'linux' (default)
Preparing boot device: 0901.
Done.
```

Fixing an LVM group which is missing volumes

- **Exit the chroot**
 - exit
- **Unmount the volumes**
 - unmount /mnt/boot
 - unmount /mnt
- **Vary the devices offline to Linux and detach them**
- **IPL your fixed system**

Creating a custom initrd

- **An initrd is one of 2 things:**
 - A file which contains a file system that is gzipped
 - A cpio archive of files that is gzipped
- **In either case, it is possible to add software to the initrd**
 - Bacula Client
 - TSM client
 - Lightweight editor
 - Dasd utilities

Creating a custom initrd

- **Copy the install initrd to a linux system**
- **Rename the initrd to something that ends in .gz**
- **Uncompress the file with gunzip**
- **Test the resulting file to see what it is**
 - # file initrd.sles10
 - initrd.sles10: ASCII cpio archive (SVR4 with no CRC)
 - # file initrd.img
 - initrd.img: Linux rev 1.0 ext2 filesystem data

Creating a custom initrd

■ XOR

- extract files from the cpio archive
 - # cpio -id < ../initrd.sles10
 - 49077 blocks
- mount the ext2 file system
 - mount initrd.img initrd -o loop

■ Copy the software into the initrd with tar or cpio

■ Check the software's library needs with ldd

```
# ldd ./dsmc
libcrypt.so.1 => /lib/libcrypt.so.1 (0x77fa4000)
libpthread.so.0 => /lib/libpthread.so.0 (0x77f8e000)
libdl.so.2 => /lib/libdl.so.2 (0x77f8a000)
libstdc++-libc6.2-2.so.3 => /usr/lib/libstdc++-libc6.2-2.so.3 (0x77f3b000)
libm.so.6 => /lib/libm.so.6 (0x77ea9000)
libc.so.6 => /lib/libc.so.6 (0x77d7a000)
/lib/ld.so.1 (0x77fe6000)
```

Creating a custom initrd

- **Make sure all the indicated libraries exist within the initrd**
 - Copy them in too if not
 - You may run in to space problems with a loopback mounted file
- **XOR**
 - rebuild the cpio archive
 - `# find . | cpio -o > ../initrd.sles10.withtasm`
 - 88183 blocks
 - unmount the ext2 file system
 - `umount initrd.img`

Creating a custom initrd

- **Gzip the resulting file**
- **Rename it to show it is not the normal initrd**
 - `initrd.img.withtsm`
- **Keep it somewhere safe till it's needed**

Using a custom initrd

- **Follow the instructions in the “Getting the XXXX V installer to see the DASD” slides earlier in this presentation**
 - Substitute the altered initrd in place of the default one
- **Ssh in to the initrd system**
- **Attach and vary the DASD online to linux**
- **Pvscan and vgchange to bring LVM online if needed**
- **Mount the file systems**
- **Use the programs you added to the initrd to save the day**

Useful Sources of information

- **IBMVM list:**

- <http://listserv.uark.edu/scripts/wa.exe?SUBED1=ibmvm&A=1>

- **LINUX390 list:**

- <http://www2.marist.edu/htbin/wlvindex?linux-390>

- **Redbooks:**

- **RHEL 4 cookbook**

- <http://www.redbooks.ibm.com/abstracts/sg247272.html?Open>

- **SLES 9 cookbook**

- <http://www.redbooks.ibm.com/abstracts/sg246695.html?Open>

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