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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

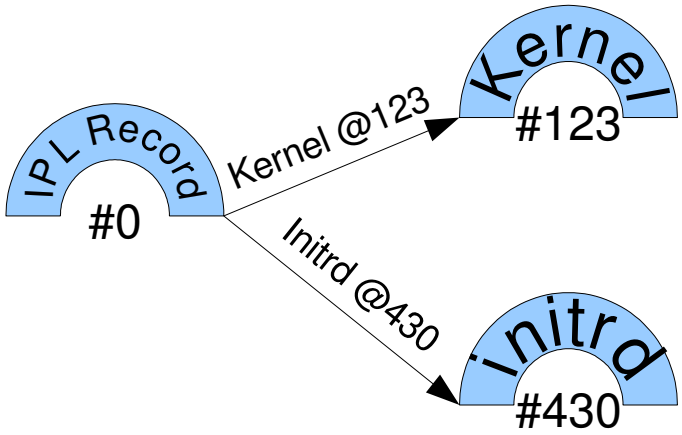
Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(0,0)

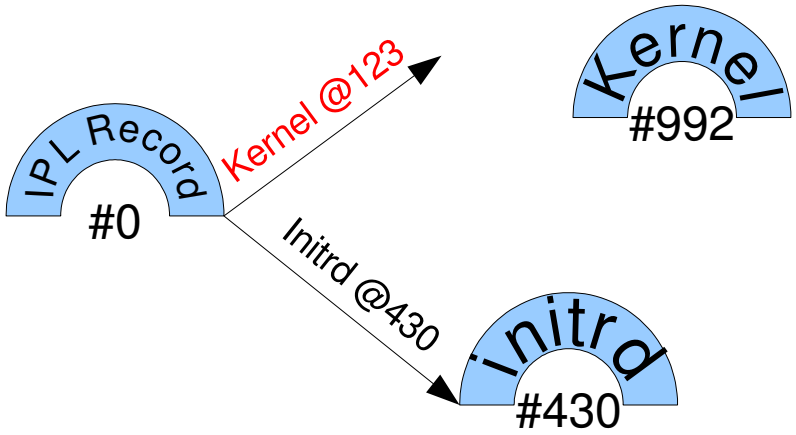
01: HCPGSP2629I The virtual machine is placed in CP mode due to a SIGP stop from CPU 00.

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

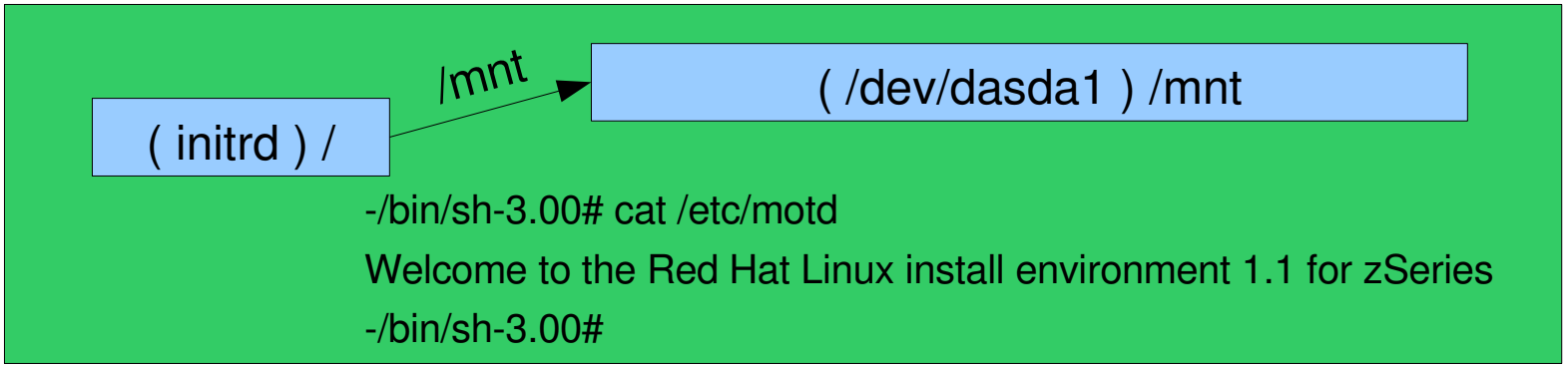
- IPL the installer
- Follow the prompts to install a new system, choose network install and SSH display type
  - The system will load another ram disk from the install server
- SSH in to the system when prompted
- Run: modprobe dasd_eckd_mod

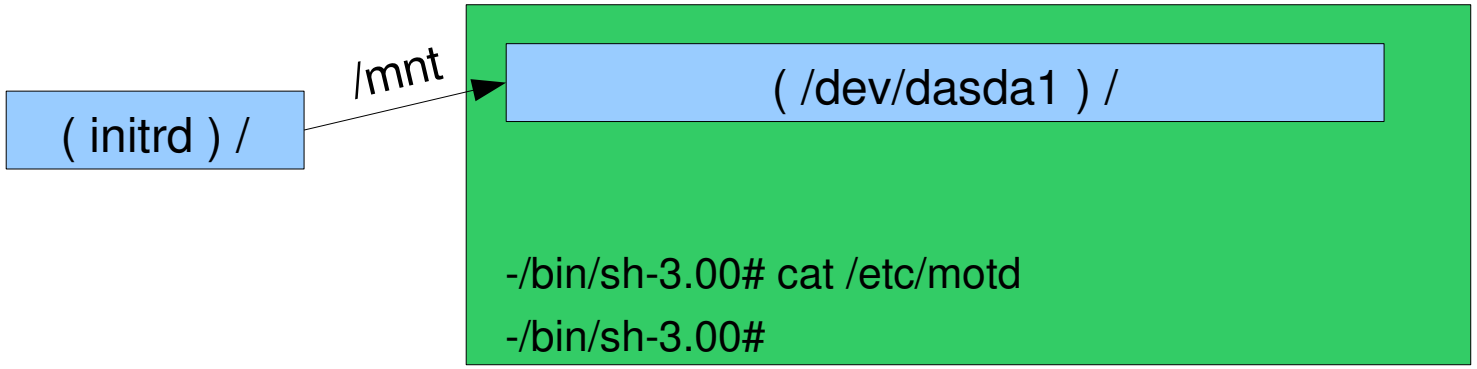
From the shell prompt - 1

- 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 and is the leading cause of arthritis among systems programmers

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 >= 2.6.10
    - E2fsprogs >=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 VG 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
- Pvscan to discover the volume group name
  - pvscan
    - 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 'JzhQlZ-k0ko-1Mgt-qGzI-tvNf-GNS6-feLWdR'.
  Couldn't find all physical volumes for volume group VolGroup00.
  Couldn't find device with uuid 'JzhQlZ-k0ko-1Mgt-qGzI-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 'JzhQlZ-k0ko-1Mgt-qGzI-tvNf-GNS6-feLWdR'.
  Couldn't find all physical volumes for volume group VolGroup00.
  Couldn't find device with uuid 'JzhQlZ-k0ko-1Mgt-qGzI-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.withtsm
      - 88183 blocks
  - unmount the ext2 file system
    - unmount 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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