

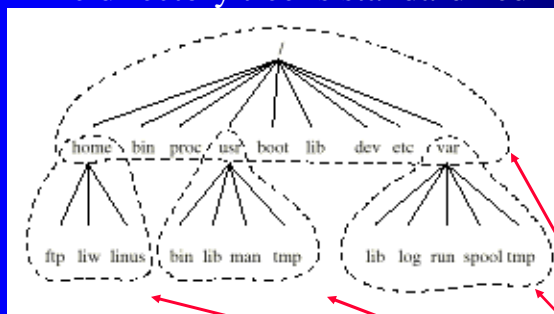
Logical Volume Manager (LVM)

David Morgan

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“File system” hierarchy

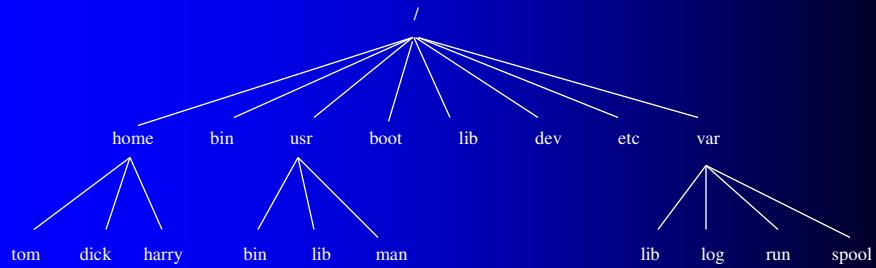
- A tree structure of directories
- The directory tree is standardized



portions can spread
across
different partitions

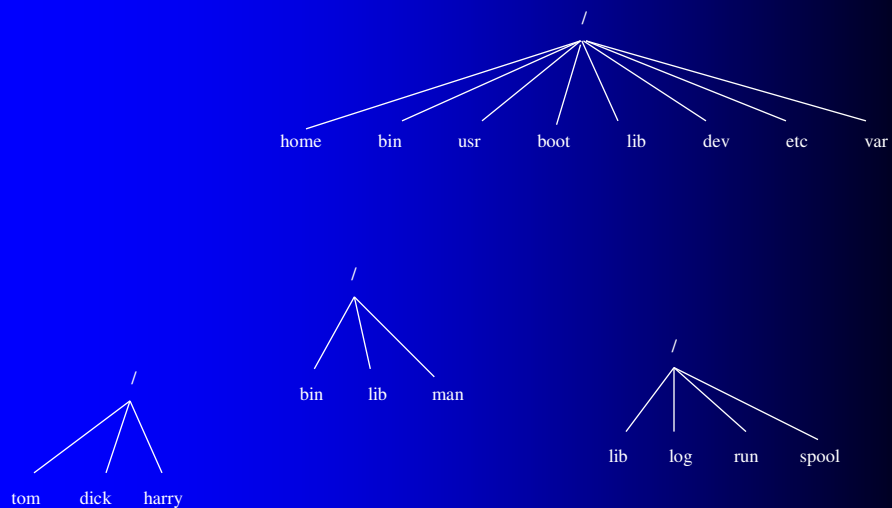
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Standard file system hierarchy



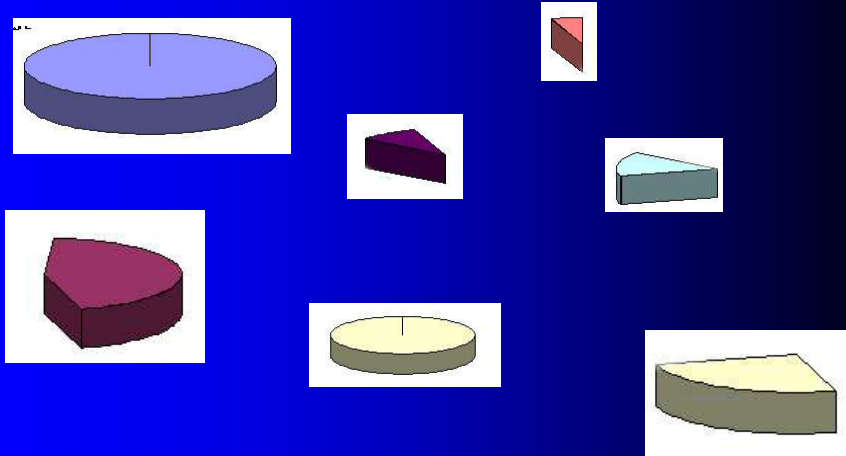
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In some pieces



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Disks and partitions



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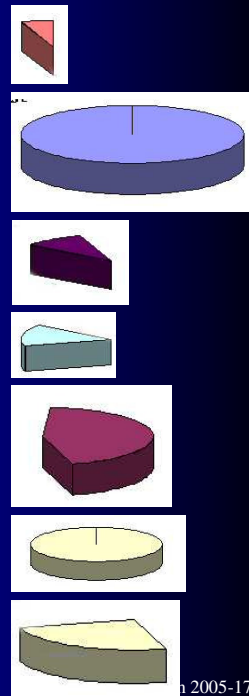
House the pieces

home bin usr boot lib dev etc var

tom dick harry

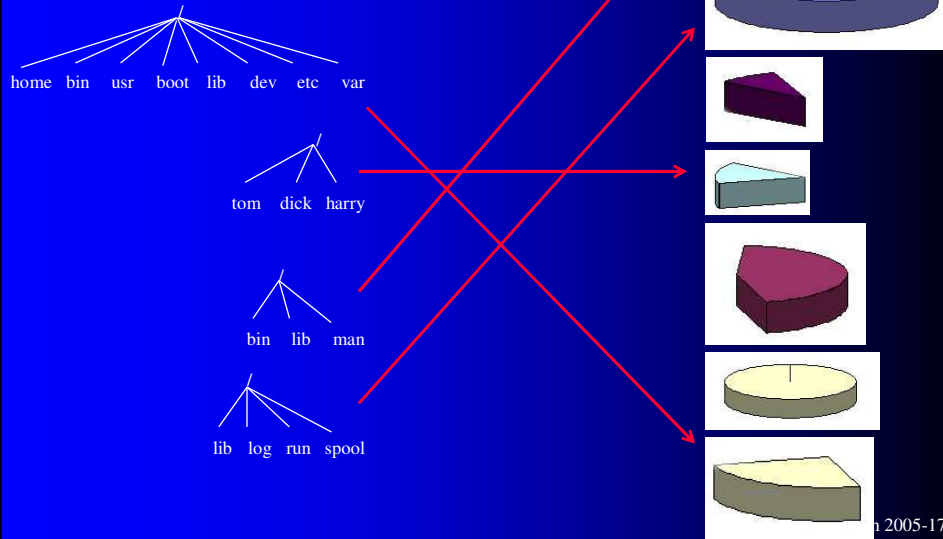
bin lib man

lib log run spool



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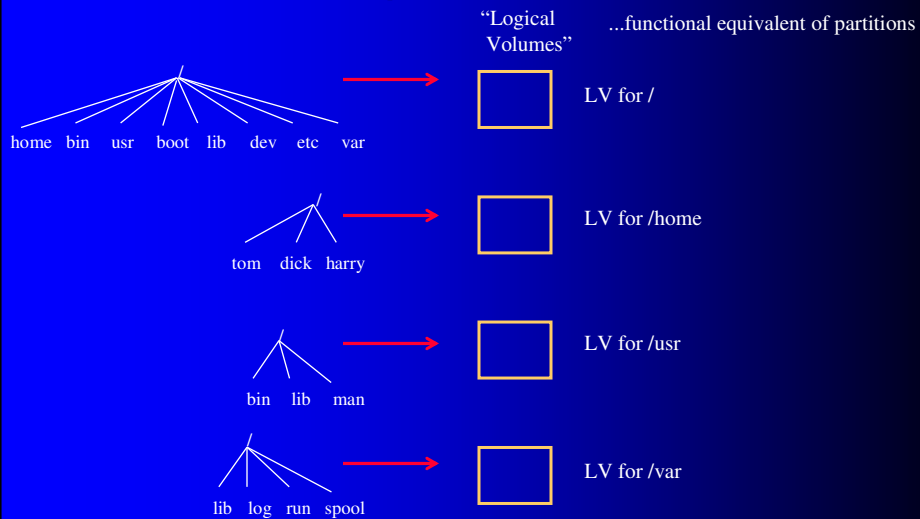
Or maybe



Problem

- Container (partition) size is rigid
- One partition can fill while another has extra space
- Subtree in filled partition can't grow into extra space

Rehouse the pieces

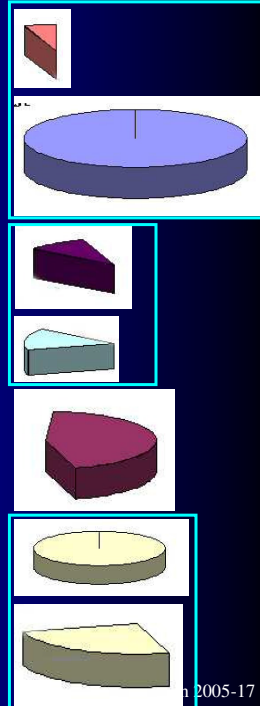


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Reorganize the housing stock

-- into volume groups

physical volumes, grouped:



a.k.a, volume groups

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Distribute the stock

home bin usr boot lib dev etc var

tom dick harry

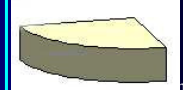
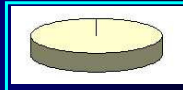
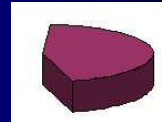
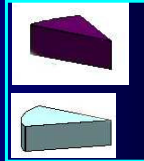
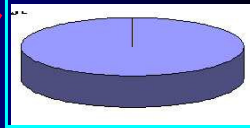
bin lib man

lib log run spool

"Logical volumes:"



"Volume groups:"



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Later, if /usr gets "full" – out of space/gas

home bin usr boot lib dev etc var

tom dick harry

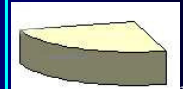
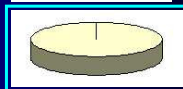
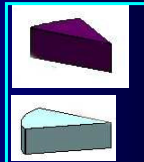
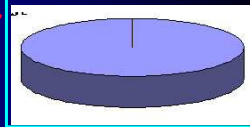
bin lib man

lib log run spool

"Logical volumes:"

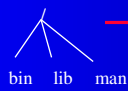
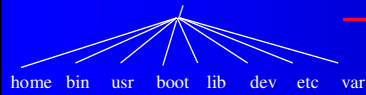


"Volume groups:"



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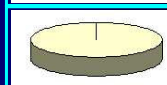
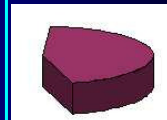
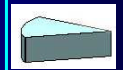
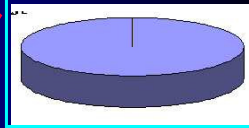
Gas in the tank



"Logical volumes:"

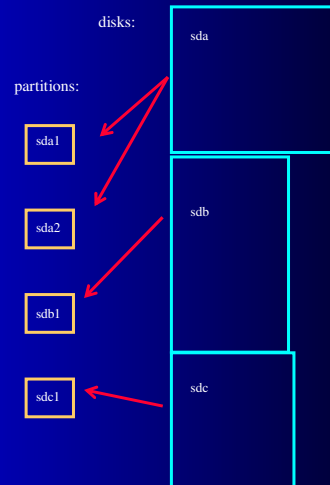
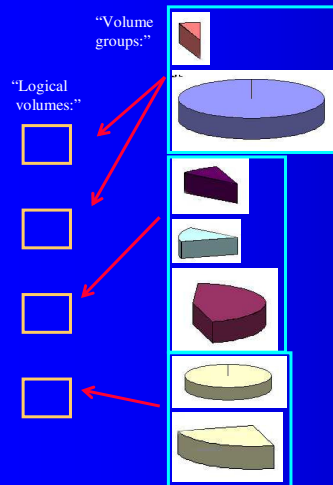


"Volume groups:"



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VGs are like disks, virtually
LVs are like partitions, virtually



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An LVM Fedora installation

- post-Fedora LVM installation (LVs were auto-created)
- disk size is 20GB
- partitions occupy 10GB
- one is LVM type – what's inside?

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# fdisk -l /dev/hda  
  
Disk /dev/hda: 20.5 GB 20547841536 bytes  
255 heads, 63 sectors/track, 2498 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/hda1  *           1             13        104391   83  Linux  
/dev/hda2             14          1288       10241437+  8e  Linux LVM  
[root@hostz ~]#
```

10 GB consumed

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2 logical vols in 1 volume group

Global set of logical volumes, as block devices

Symbolic links to them, categorized into folders by containing volume groups

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# ls -l /dev/mapper  
total 0  
crw----- 1 root root 10, 63 Jan 28 07:58 control  
brw----- 1 root root 253, 1 Jan 28 07:58 VolGroup00-LogVol100  
brw----- 1 root root 253, 0 Jan 28 07:58 VolGroup00-LogVol101  
[root@hostz ~]#  
[root@hostz ~]#  
[root@hostz ~]# ls -o /dev/VolGroup00  
total 0  
lrwxrwxrwx 1 root 31 Jan 28 15:58 LogVol100 -> /dev/mapper/VolGroup00-LogVol100  
lrwxrwxrwx 1 root 31 Jan 28 15:58 LogVol101 -> /dev/mapper/VolGroup00-LogVol101  
[root@hostz ~]#
```

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LVM's hierarchy of "pieces"

- Physical volumes
- Volume groups
- Logical volumes

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General procedure

- Acquire more storage units
 - install new disks or
 - create new partitions
- Turn them into LVM-recognized PVs
- Group them to form new VGs
- Create LVs in the new VGs
- Mount and use the LVs

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Our specific plan

- Create 3 new data partitions
- Turn them into PVs
- Put them all in one new VG
- Create an LV 70% the size of the VG
- Favorite beverage

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Make more physical volumes

- Create partitions from empty space with fdisk
- Set partition type code to 8e with fdisk
- “brand” them with pvcreate command

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Make 3 new data partitions

Made another primary partition and a couple logical partitions, with fdisk

```
root@hostz:~# fdisk -l /dev/hda

Disk /dev/hda: 20.5 GB, 20547841536 bytes
255 heads, 63 sectors/track, 2498 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/hda1 *           1           13        104391   83   Linux
/dev/hda2             14          1288     10241437+   8e   Linux LVM
/dev/hda3            1289          1500       1702890   8e   Linux LVM
/dev/hda4            1501          2498       8018435    5   Extended
/dev/hda5            1501          2000       4016218+   83   Linux
/dev/hda6            2001          2498       4000153+   83   Linux

root@hostz ~]#
```

Aggregate size is 10GB = 2 + 4 + 4

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Set partition type code to 8e

Tagged them with LVM's type code 8e, with fdisk

```
root@hostz:~# fdisk -l /dev/hda

Disk /dev/hda: 20.5 GB, 20547841536 bytes
255 heads, 63 sectors/track, 2498 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/hda1 *           1           13        104391   83   Linux
/dev/hda2             14          1288     10241437+   8e   Linux LVM
/dev/hda3            1289          1500       1702890   8e   Linux LVM
/dev/hda4            1501          2498       8018435    5   Extended
/dev/hda5            1501          2000       4016218+   8e   Linux LVM
/dev/hda6            2001          2498       4000153+   8e   Linux LVM

root@hostz ~]#
```

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Brand them with pvcreate

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# pvcreate /dev/hda3 /dev/hda5 /dev/hda6  
Physical volume "/dev/hda3" successfully created  
Physical volume "/dev/hda5" successfully created  
Physical volume "/dev/hda6" successfully created  
[root@hostz ~]#  
[root@hostz ~]# vgcreate NewVolGrp /dev/hda3 /dev/hda5 /dev/hda6  
Volume group "NewVolGrp" successfully created  
[root@hostz ~]#  
[root@hostz ~]# lvcreate -L7G -n NewLogVol NewVolGrp  
Logical volume "NewLogVol" created  
[root@hostz ~]#  
[root@hostz ~]#
```

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Group them to form a new VG

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# pvcreate /dev/hda3 /dev/hda5 /dev/hda6  
Physical volume "/dev/hda3" successfully created  
Physical volume "/dev/hda5" successfully created  
Physical volume "/dev/hda6" successfully created  
[root@hostz ~]#  
[root@hostz ~]# vgcreate NewVolGrp /dev/hda3 /dev/hda5 /dev/hda6  
Volume group "NewVolGrp" successfully created  
[root@hostz ~]#  
[root@hostz ~]# lvcreate -L7G -n NewLogVol NewVolGrp  
Logical volume "NewLogVol" created  
[root@hostz ~]#  
[root@hostz ~]#
```

New VG name is "NewVolGrp" size is 10GB

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Make LV, 70% of VG

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# pvcreate /dev/hda3 /dev/hda5 /dev/hda6  
Physical volume "/dev/hda3" successfully created  
Physical volume "/dev/hda5" successfully created  
Physical volume "/dev/hda6" successfully created  
[root@hostz ~]#  
[root@hostz ~]# vgcreate NewVolGrp /dev/hda3 /dev/hda5 /dev/hda6  
Volume group "NewVolGrp" successfully created  
[root@hostz ~]#  
[root@hostz ~]# lvcreate -L7G -n NewLogVol NewVolGrp  
Logical volume "NewLogVol" created  
[root@hostz ~]#  
[root@hostz ~]#
```

New LV name is "NewLogVol" size is 7GB

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3 logical vols in 2 volume groups

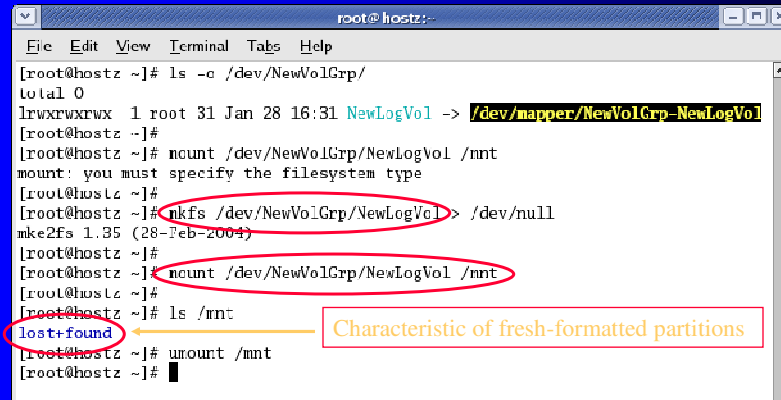
Global set of logical volumes

```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# ls -l /dev/mapper/  
total 0  
crw-rw-rw- 1 root root 10, 63 Jan 28 07:58 control  
brw-rw-rw- 1 root root 253, 2 Jan 28 16:31 NewVolGrp-NewLogVol NEW  
brw-rw-rw- 1 root root 253, 1 Jan 28 07:58 VolGroup00-LogVol100  
brw-rw-rw- 1 root root 253, 0 Jan 28 07:58 VolGroup00-LogVol101  
[root@hostz ~]#  
[root@hostz ~]# ls -o /dev/VolGroup00/  
total 0  
lrwxrwxrwx 1 root 31 Jan 28 15:53 LogVol100 -> /dev/mapper/VolGroup00-LogVol100  
lrwxrwxrwx 1 root 31 Jan 28 15:53 LogVol101 -> /dev/mapper/VolGroup00-LogVol101  
[root@hostz ~]#  
[root@hostz ~]# NEW /dev/NewVolGrp/  
total 0  
lrwxrwxrwx 1 root 31 Jan 28 16:31 NewLogVol -> /dev/mapper/NewVolGrp-NewLogVol NEW  
[root@hostz ~]#
```

categorized by their volume groups

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LV is a partition-equivalent



```
root@hostz:~# ls -la /dev/NewVolGrp/
total 0
lrwxrwxrwx 1 root 31 Jan 28 16:31 NewLogVol -> /dev/mapper/NewVolGrp-NewLogVol1
root@hostz:~#
root@hostz:~# mount /dev/NewVolGrp/NewLogVol /mnt
mount: you must specify the filesystem type
root@hostz:~#
root@hostz:~# mkfs /dev/NewVolGrp/NewLogVol > /dev/null
mkfs2fs 1.35 (28-Feb-2004)
root@hostz:~#
root@hostz:~# mount /dev/NewVolGrp/NewLogVol /mnt
root@hostz:~#
root@hostz:~# ls /mnt
lost+found
root@hostz:~# umount /mnt
root@hostz:~#
```

Characteristic of fresh-formatted partitions

Can format (note containing VG's constituent partitions are never formatted). Then can mount.

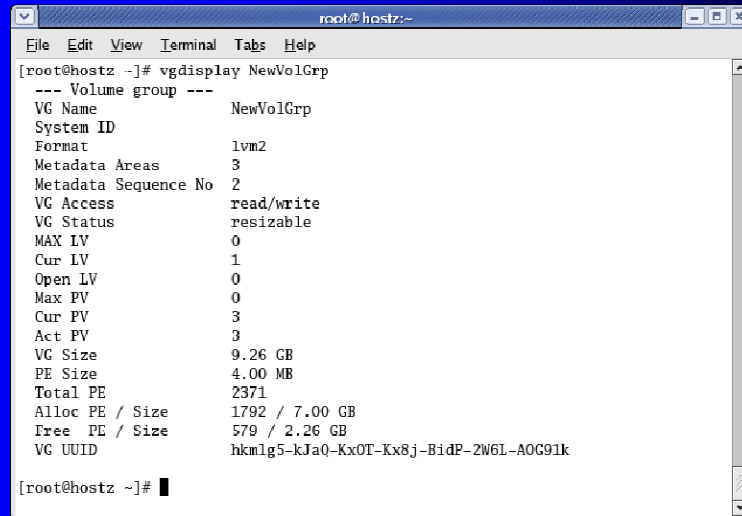
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Diagnostic commands for viewing

- physical volumes
- volume groups
- logical volumes
- summary output
 - pvs
 - vgs
 - lvs
- more verbose output
 - pvdisplay
 - vgdisplay
 - lvdisplay

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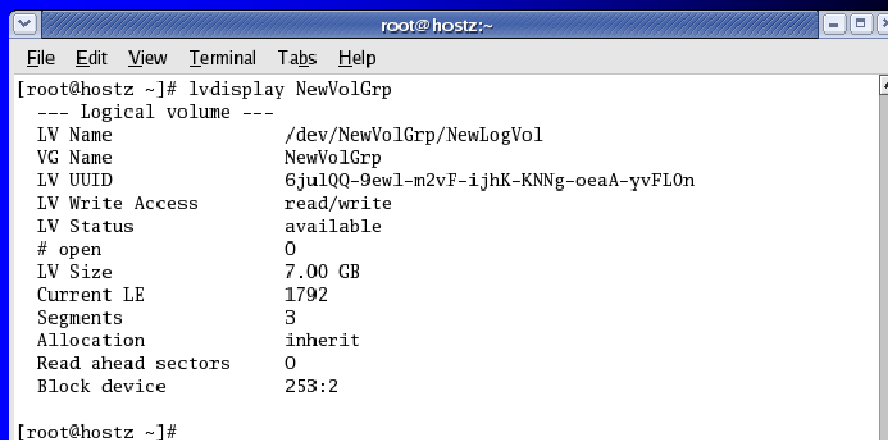
vgdisplay : volume group info



```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# vgdisplay NewVolGrp  
--- Volume group ---  
VG Name                NewVolGrp  
System ID  
Format                 lvm2  
Metadata Areas         3  
Metadata Sequence No   2  
VG Access               read/write  
VG Status               resizable  
MAX LV                 0  
Cur LV                1  
Open LV                0  
Max PV                 0  
Cur PV                3  
Act PV                 3  
VG Size                9.26 GB  
PE Size                4.00 MB  
Total PE               2371  
Alloc PE / Size        1792 / 7.00 GB  
Free PE / Size          579 / 2.26 GB  
VG UUID                hkm1g5-kJaQ-Kx0T-Kx8j-BidP-2W6L-AOG91k  
[root@hostz ~]#
```

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lvdisplay: logical volume info



```
root@hostz:~  
File Edit View Terminal Tabs Help  
[root@hostz ~]# lvdisplay NewVolGrp  
--- Logical volume ---  
LV Name                /dev/NewVolGrp/NewLogVol  
VG Name                NewVolGrp  
LV UUID                6julQQ-9ewl-m2vF-ijhK-KNNg-oeaA-yvFL0n  
LV Write Access        read/write  
LV Status               available  
# open                 0  
LV Size                7.00 GB  
Current LE             1792  
Segments               3  
Allocation              inherit  
Read ahead sectors     0  
Block device           253:2  
[root@hostz ~]#
```

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Practicing on USB storage

- identify the correct name of the device
 - these activities are data-destructive
 - be sure not to mistakenly give the name of your hard disk when manipulating your usb disk
- tools for identifying usb device name after inserting
 - dmesg
 - fdisk -l

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