

LVM

(Logical Volume Manager)



TOPICS IN LVM

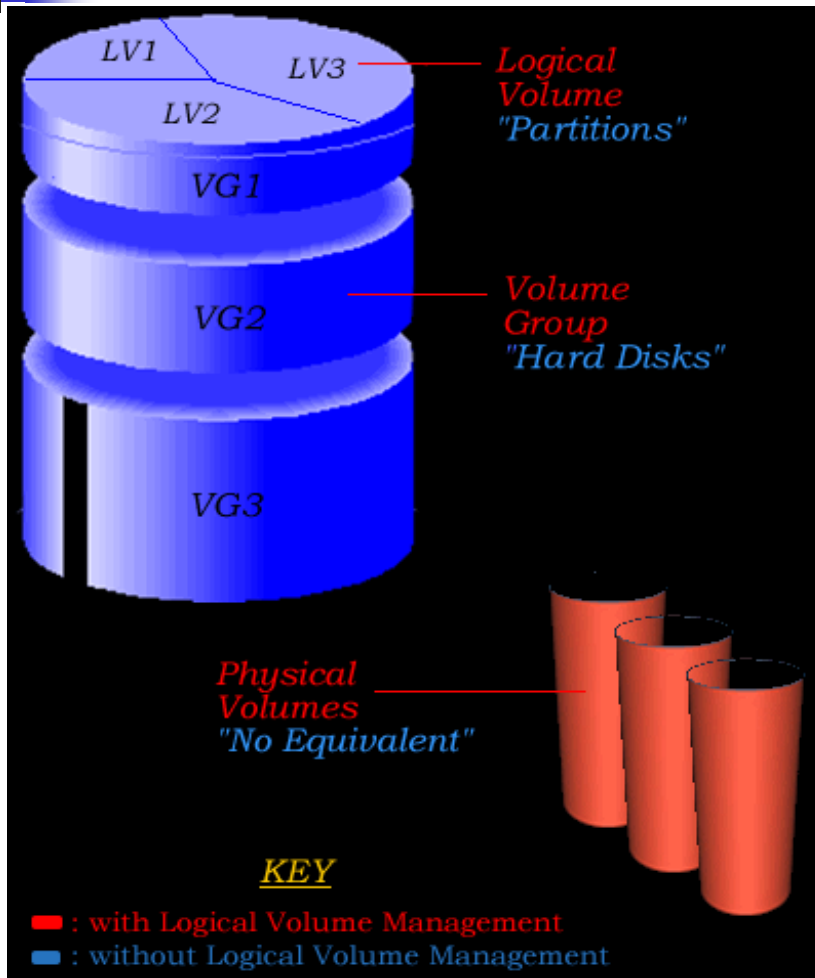
- What is LVM
- LVM Configuration
- Creating Physical Volume
- Creating Volume Groups
- Creating Logical Volume
- How to increase volume groups
- How to extend Logical Volume
- How to extend File System



What is Logical Volume Management?

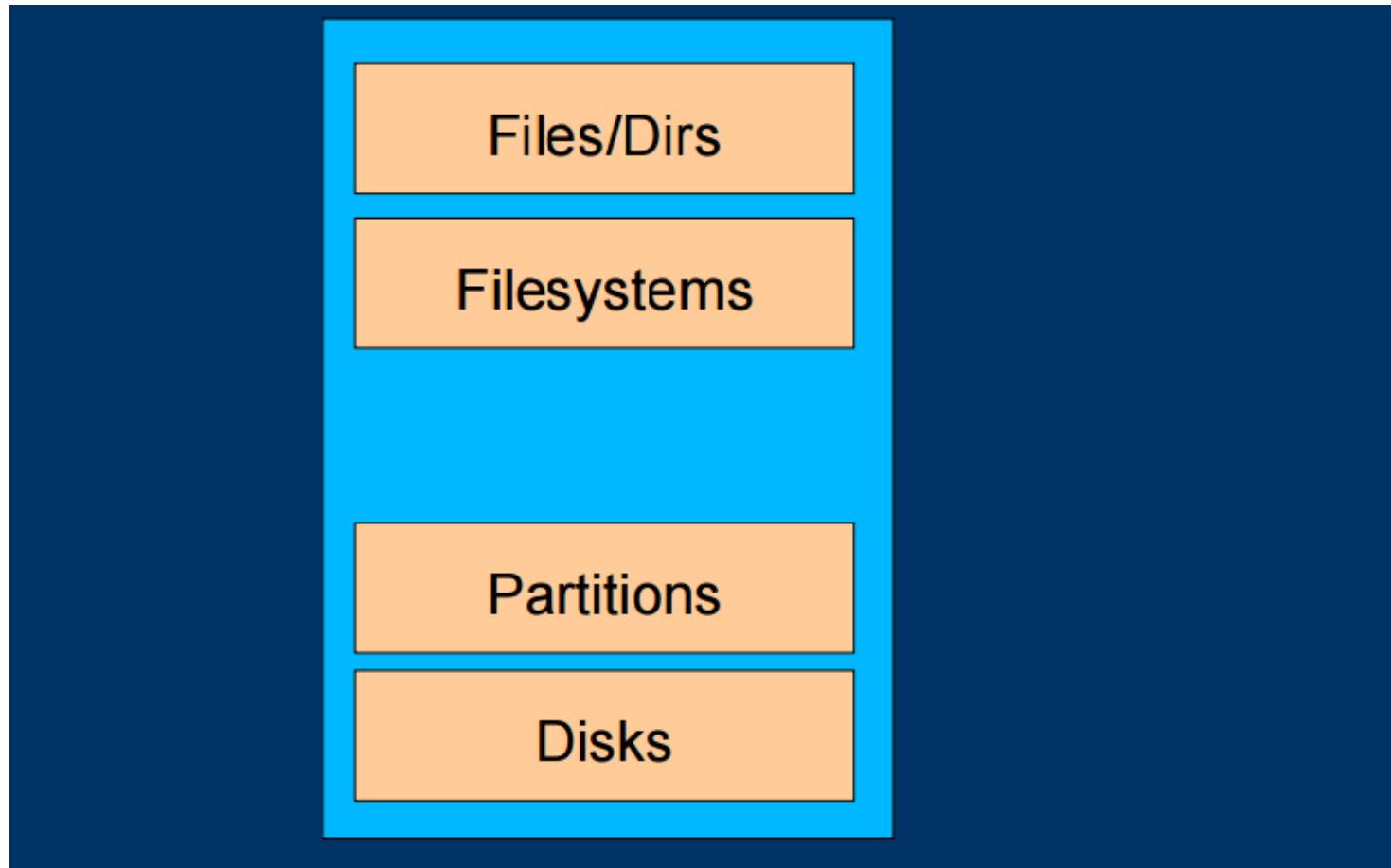
- Software that allows the user to edit the storage configuration without manipulating the actual hardware and vice versa.

How Does LVM Work?



The LVM hides information about where information is stored, on which hardware, and where exactly on that hardware from the entire Operating System allowing it to manipulate the configuration of the storage capacities.

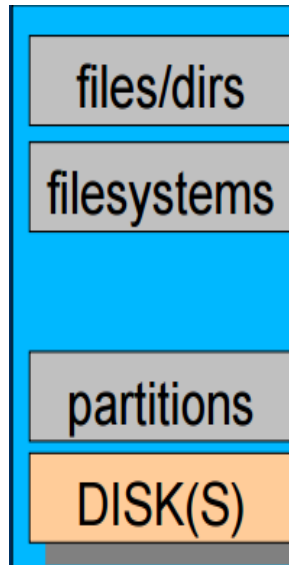
Layers in a typical system (before LVM)





What is a Disk?

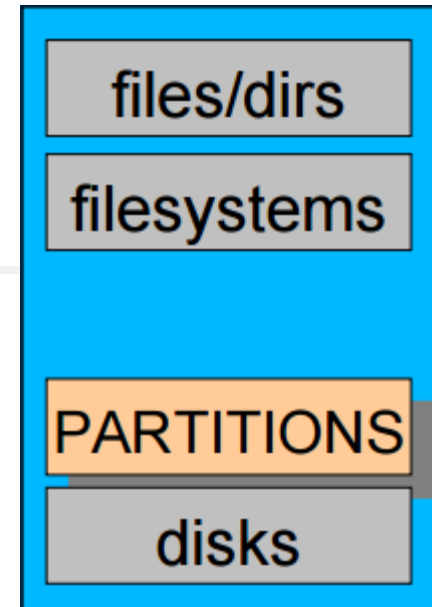
- Lets look at some terms first, starting from the bottom and working our way up ●
- The harddisk is the only Hardware piece we're going to talk about here ●
- It has various techie things in it:
 - Cylinders, Heads, Sectors, mbr, partitions
 - It's own cpu, cache, firmware etc ●
- but for this discussion a hard disk on a modern system can be seen as one continuous row of logical blocks. ●
- Typical disk names in Linux are hda, sda





Partitions

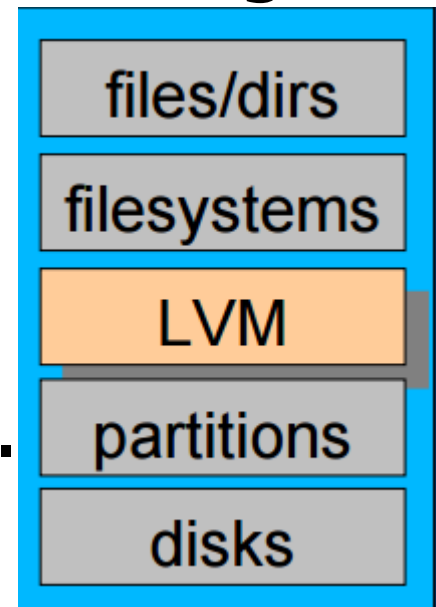
- To store data on a disk this continuous row of logical blocks needs to be cut in sections called partitions.
- The original IBM PC from 1981 only had 4 primary partitions – On linux you can see them as hda1-hda4
- This was later improved by adding extended partitions
 - On linux they show up as partition hda5 and up .
- Normally managed by fdisk or some graphical partition/volume manager





LVM- New Terms

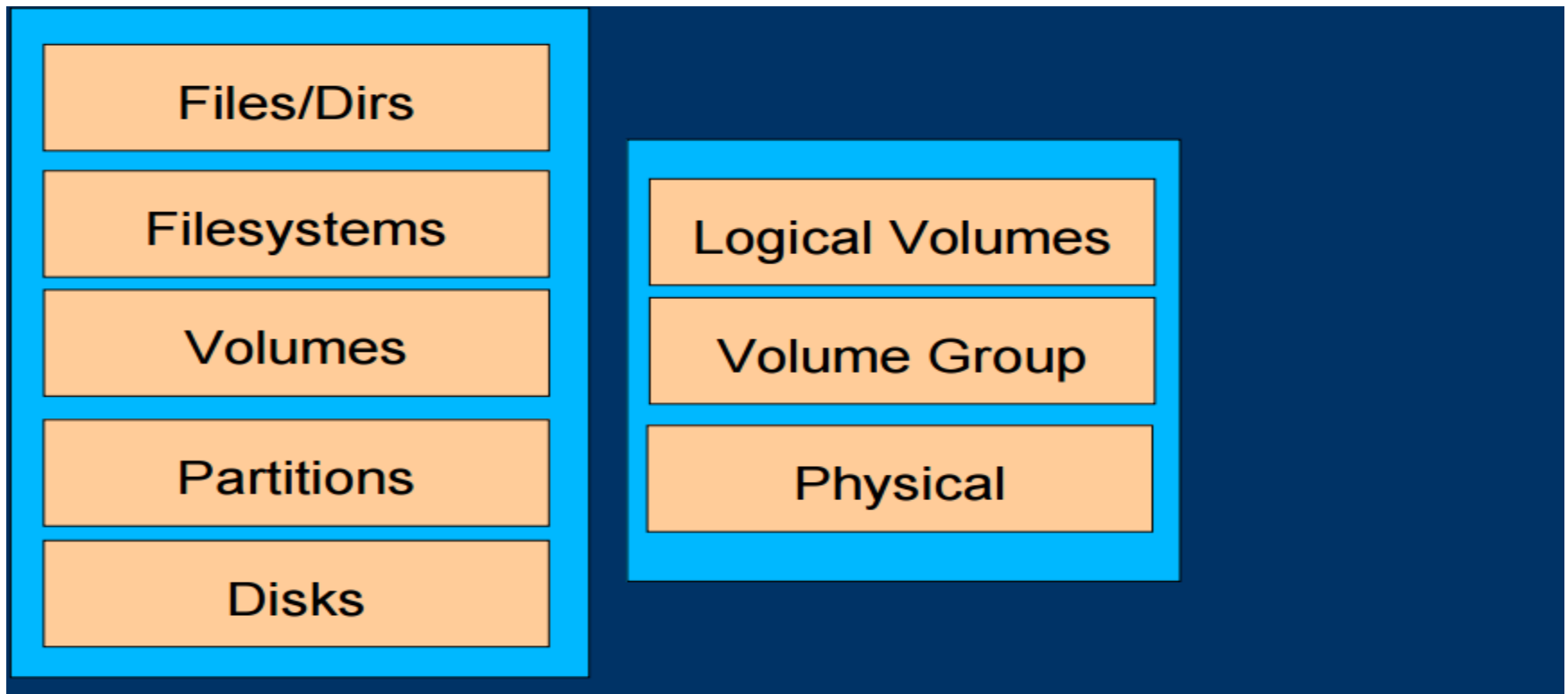
- Physical Volumes PVs – collects all disk partitions.
- Volume Group VGs – creates one big virtual disk .
- Logical Volumes LVs – from the VG you can then create filesystems within LVs.





LVM in Layers

- Here is a simplified picture of the LVM structure showing PV, VG and LG





LVM2

- LVM2 is introduced from RHEL 4
- LVM2 Supports LVM1 also.
- LVM1 can be converted into LVM2 using “vgconvert” command.



PE and LE

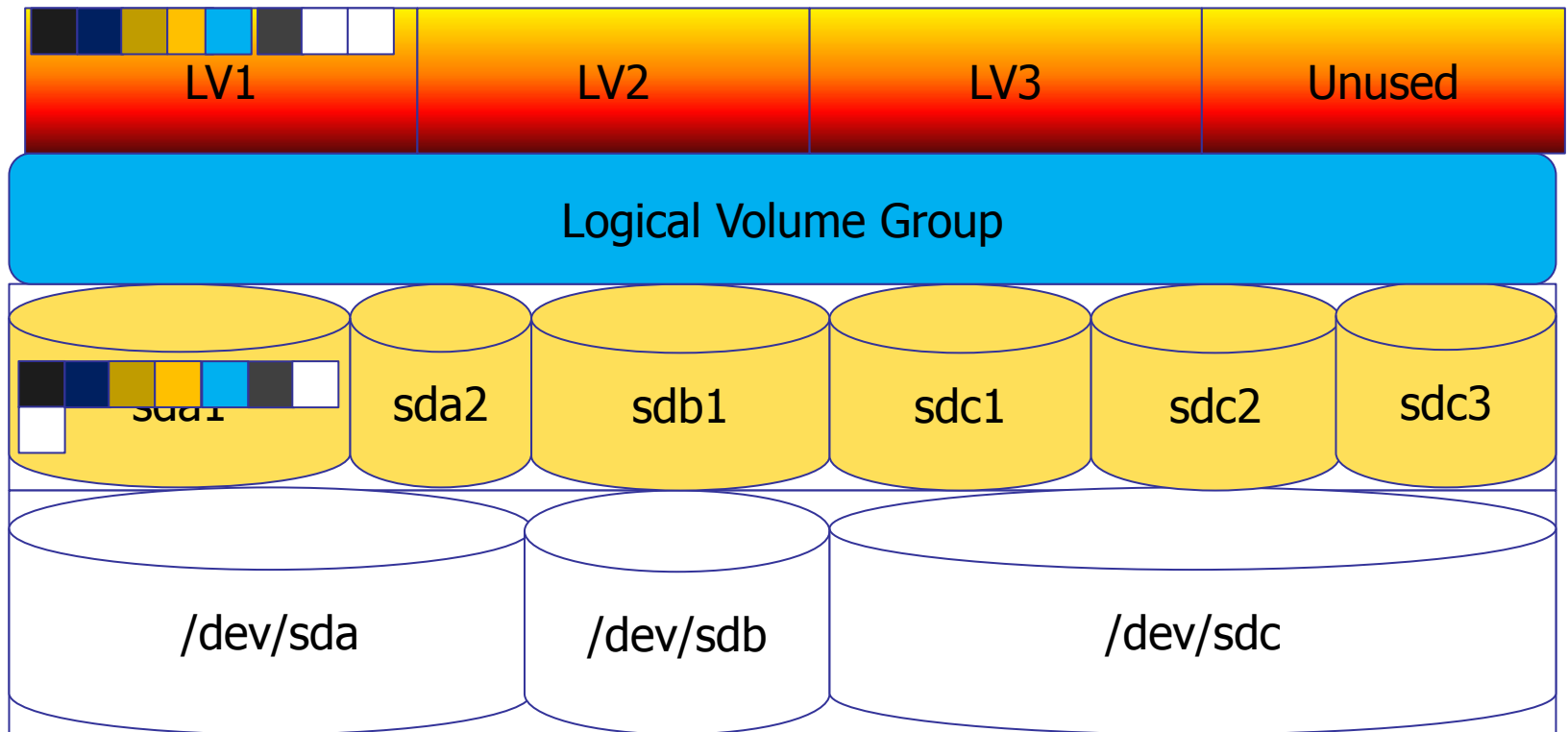
- Physical Extent – A Fixed amount of disk space on the physical storage. A Partition would always be multiples of this physical storage.
- Logical Extent – A Fixed amount of disk space on the logical volume. A Logical volume is multiples of this logical storage.
- $\text{Size of Physical Extent} = \text{Size of Logical Extent}$
- Usually it is 4 MB



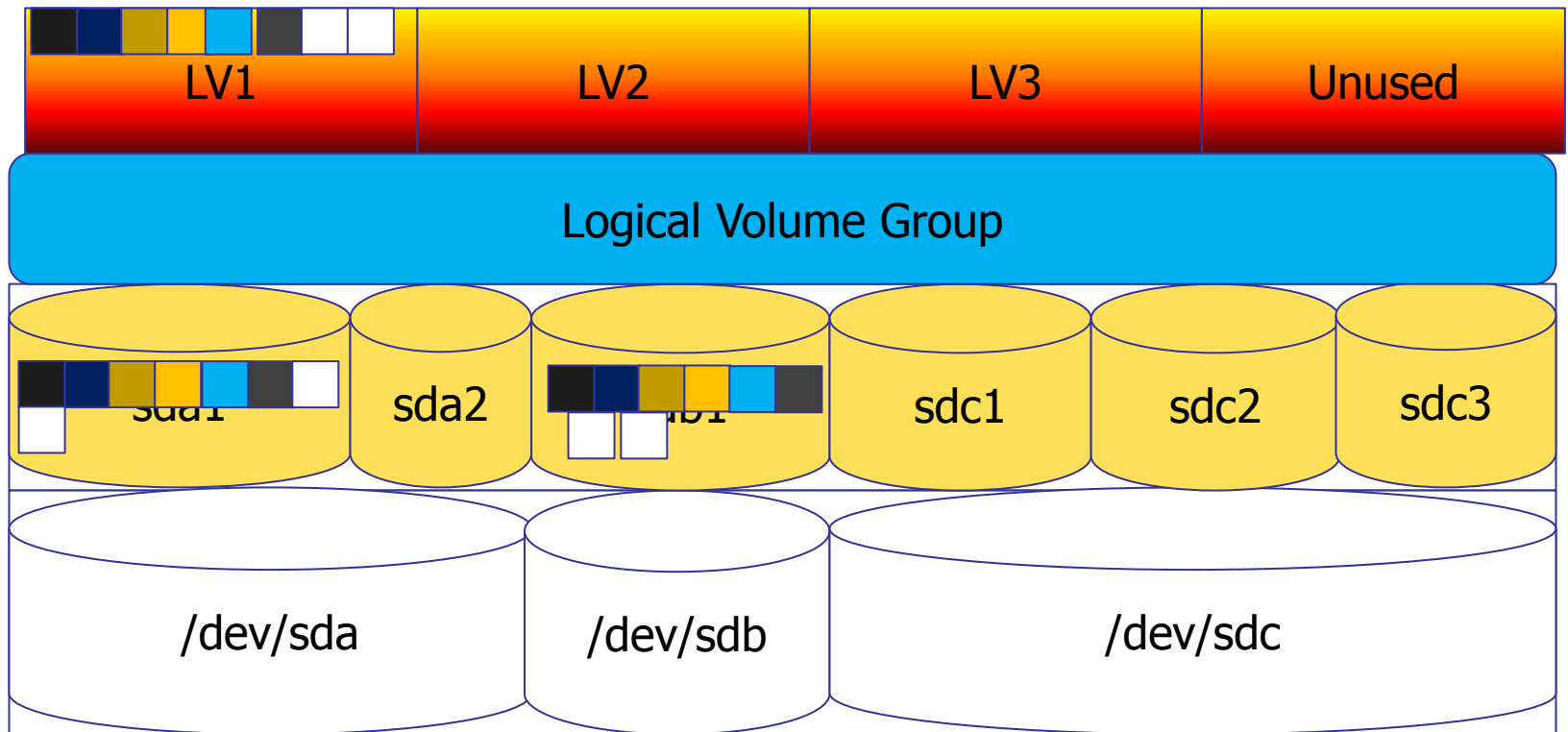
Types of Logical Volumes

- Based on how Physical Extents and Logical Extents are linked to one another, Logical volumes can be created in 3 different types.
 - Linear
 - Mirrored
 - Stripped

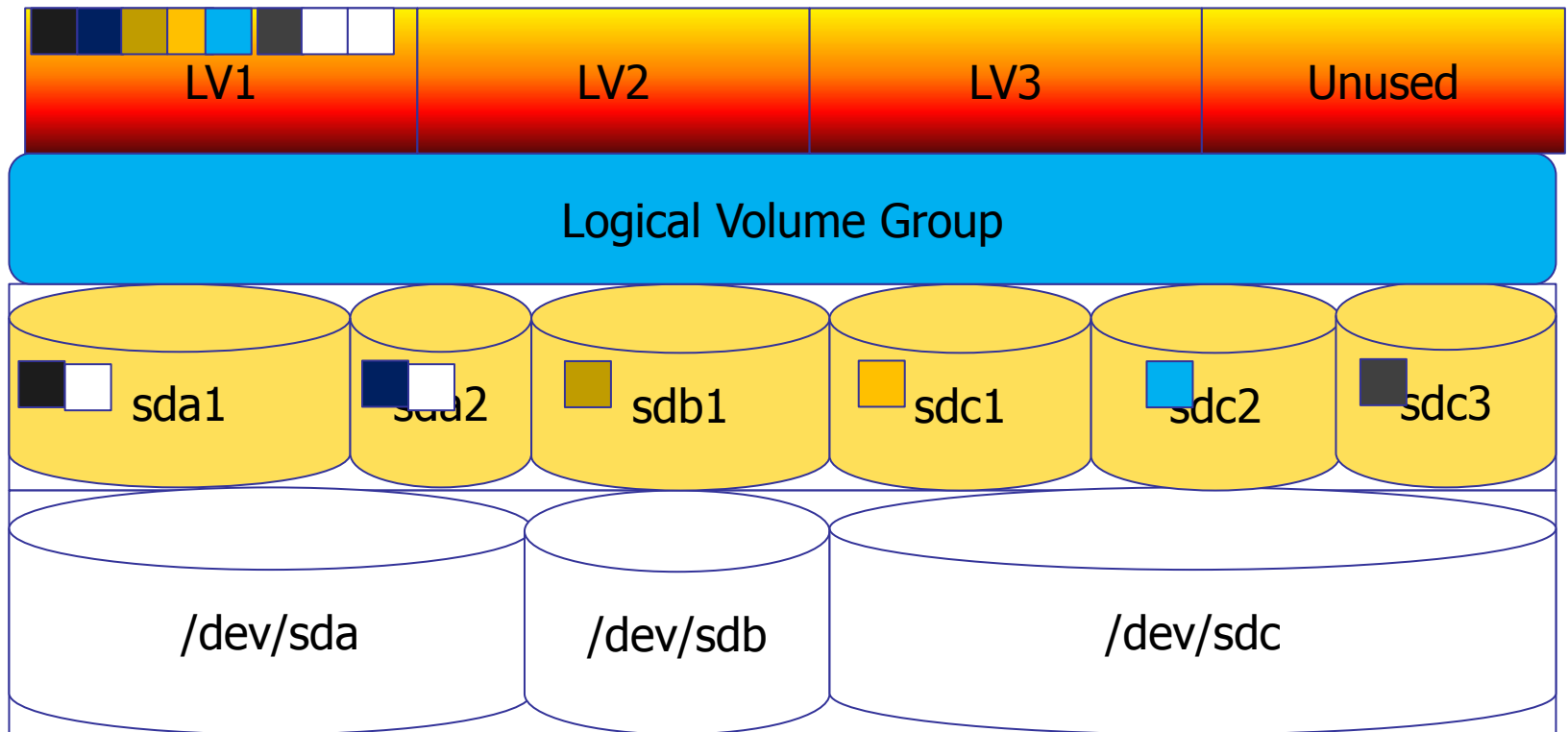
Linear Logical Volumes



Mirrored Logical Volumes



Stripped Logical Volumes



Physical Volumes Details

■ pvdisplay

```
File Edit View Search Terminal Help
[root@host1 Desktop]# pvdisplay
--- Physical volume ---
PV Name                /dev/sda2
VG Name                vg_host1
PV Size                24.51 GiB / not usable 3.00 MiB
Allocatable            yes (but full)
PE Size                4.00 MiB
Total PE               6274
Free PE                0
Allocated PE           6274
PV UUID                x5KSek-VsUg-BWI2-MIXY-vZPW-mwcy-rBCLpb
```


Physical Volumes Summary

pvs

```
File Edit View Search Terminal Help
[root@host1 Desktop]# pvs
  PV          VG          Fmt  Attr  PSize  PFree
  /dev/sda2  vg_host1  lvm2 a-   24.51g    0
[root@host1 Desktop]#
```


Volume Group Summary

■ vgs

```
File Edit View Search Terminal Help
[root@host1 Desktop]# vgs
  VG          #PV #LV #SN Attr   VSize  VFree
vg_host1      1   2   0 wz--n- 24.51g    0
[root@host1 Desktop]#
```

Logical Volume Details



lvdisplay

--- Logical volume ---

LV Name	/dev/vg_host1/lv_root
VG Name	vg_host1
LV UUID	dYgQkM-2gY7-BgZR-UH0E-4hAX-13iP-ZXhRkY
LV Write Access	read/write
LV Status	available
# open	1
LV Size	20.54 GiB
Current LE	5258
Segments	1
Allocation	inherit
Read ahead sectors	auto
- currently set to	256
Block device	253:0

--- Logical volume ---

LV Name	/dev/vg_host1/lv_swap
VG Name	vg_host1
LV UUID	0D5QNA-D0dz-aCVt-BAXh-snkt-VzDP-p82HKj
LV Write Access	read/write
LV Status	available
# open	1
LV Size	3.97 GiB
Current LE	1016
Segments	1
Allocation	inherit
Read ahead sectors	auto
- currently set to	256
Block device	253:1

Logical Volume Summary

lvs

```
File Edit View Search Terminal Help
[root@host1 Desktop]# lvs
  LV      VG      Attr   LSize   Origin Snap%   Move Log Copy%  Convert
  lv_root vg_host1 -wi-ao 20.54g
  lv_swap vg_host1 -wi-ao  3.97g
You have mail in /var/spool/mail/root
[root@host1 Desktop]#
```



PROCEDURE FOR ADDING A DISK IN MACHIENE

- Before adding a new disk we have to check the disks which are available in our machine.
- Take outputs by using commands
- `fdisk -l ----` it will give the total disk information in your system
- `df -h -----` it will show the disk free information in your system



Steps :

- Go to edit vmware machine settings
- Click on hard disk and then click on add
- Select hard disk and then next
- Choose create a new virtual disk and then next
- Choose virtual disk type scsi (becoz scsi hot swappable, redundant, faster capacity) then next
- Specify the size we want to give (max size is 10 gb) and then next
- And click on ok



How to scan a new disk

Syntax:

```
echo " - - - " > /sys/class/scsi_host/host0/scan
```

```
echo " - - - " > /sys/class/scsi_host/host1/scan
```

```
echo " - - - " > /sys/class/scsi_host/host2/scan
```




How to partition disk

- Use fdisk /dev/sdb1
- We will get options like
- m for help
- n for create a new partition
- Note: we can create up to 3 primary partitions and one extended partition
- Specify the cylinder size



Current LVM CONFIGURATION

- Then press t (change partition type)
- Then press L (list of codes)
- (linux – 83 and **linux lvm – 8e**)
- select linux lvm code 8e and then press p to view the partition setup (so we can review before writing changes to disk.)
- then press w (write changes to disk)



Creating Physical Volume

- `pvccreate /dev/sdb1`
- we can create lvm physical volumes on partition
- physical volumes will be placed in volume groups



Creating Volume Groups

■ `vgcreate` `vglinux` `/dev/sdb1`

command vgroupname devicename

Creating logical volume

`Lvcreate` `-L` `2G` `-n` `lvlinux` `vglinux`

Command size of lv size lv create lvname vgroupname



Create file system

- `mkfs.ext3 /dev/vglinux/lvlinux`
- Or `mkfs -t ext3 /dev/vglinux/lvlinux`
- Make a directory `mkdir /ora`
- Mount the disk into that mount point
`#mount /dev/vglinux/lvlinux /ora`



Mounting disks permanently

- We have to mount the disk info in fstab to make it permanently.
- To make it persistent across Reboot.
- Vi /etc/fstab
- Mount disk in fstab

■ /dev/vglinux/lvlinux	/linux	ext3	default	0	0
devicename	mountpoint	filesystem type	mount options	dumping	chk seq



Troubleshooting

- We can unmount these disk by using
- `umount /linux`
- `umount -f /linux`
- `umount -l /linux`



Increasing Volume Group

- Adding a new hard drive (/dev/sdb1) to volume group.
- we have to create physical volume
- `vgextend vglinux /dev/sdb1`
-

Add new disc to Volume

```
[root@localhost ~]# pvcreate /dev/sdd
Physical volume "/dev/sdd" successfully created
[root@localhost ~]# vgextend vgtest /dev/sdd
Volume group "vgtest" successfully extended
You have mail in /var/spool/mail/root
[root@localhost ~]# vgs
VG          #PV #LV #SN Attr   VSize  VFree
VolGroup    1   2   0 wz--n- 19.51g    0
vgtest      3   3   0 wz--n-  2.99g 1.00g
[root@localhost ~]#
```



Extending LVM

- `lvextend -L 4G /dev/vglinux/lvlinux`

Or

`lvextend -L +2G /dev/vglinux/lvlinux`



Extending File System

- `resize2fs /dev/vglinux/lvlinux`
- `resize2fs /dev/sdb1 400M`
- lvm configuration file
(`/etc/lvm/lvm.conf`)



Lvm configuration files

- **/etc/lvm/lvm.conf** Central configuration file read by the tools.
- **/etc/lvm/.cache** Device name filter cache file.
- **/etc/lvm/backup/** Directory for automatic volume group metadata backups.
- **/etc/lvm/archive/** Directory for automatic volume group metadata archives.
- **/var/lock/lvm/** In single-host configuration, lock files to prevent parallel tool runs from corrupting the metadata; in a cluster, cluster-wide DLM is used.



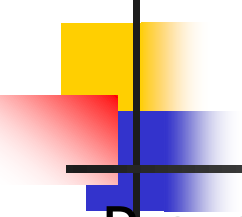
Lvm daemons

- LVMKD
- LVMDEVD
- VMMSCHEDD
- LVMATTACHD
- lvmdevd is a LVM device update/recovery daemon. One per each group.
- The lvmetad daemon is not currently supported across the nodes of a cluster, and requires that the locking type be local file-based locking.



Lvm troubleshooting

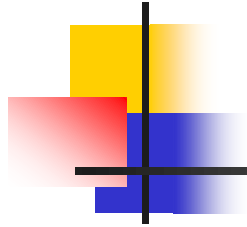
- While working on linux production boxes, some times system admin mistakenly delete LVM partitions. Using the command '**vgcfgrestore**' we can recover deleted LVM partitions.
- Linux keeps the backup copies of lvm configuration in the /etc/lvm/archive directory.
- # vgcfgrestore --list < Volume-Group-Name >
- # vgcfgrestore --list vglinux
- recover the LVM partition using vgcfgrestore and archive file.
- # vgcfgrestore -f /etc/lvm/archive/ <file-name>
<Voulme-Group-Name>
- # vgcfgrestore -f /etc/lvm/archive/ vglinux_00002-692643462.vg vglinux

- 
-
- Procedure to recover logical volume when it's got deleted
 - Lvs
 - umount /app
 - lvremove /dev/vgapp/lvapp
 - Now we need to check the Archive folder and check the file
vgapp* ..recent one. or check the last few vgapp
 - Now restore volume group
vgcfgrestore vgapp -f /etc/lvm/archive/vgapp_00007.vg
 - scan lv you will find lv in inactive state # lvscan
 - # lvchange -a y /dev/vgapp/lvapp
 - #lvs



Lvchange –change attributes

- Lvchange allows you to change the attributes of a logical volume including making them known to the kernel ready for use.
- -a (available)
- -y (Activate)
- -n (deactivate)



-
- Now run `mount -a`, it will check `fstab`
 - `df -h /app`



LVM Commands, PV

- Here are some of the PV commands
 - pvscan - scan all disks for physical volumes
 - pvdisplay - display attributes of a physical volume
 - pvcreate - initialize a disk or partition for use by LVM
 - pvchange - change attributes of a physical volume
 - pvmove – move physical extents from one disk to another disk.



LVM Commands, VG

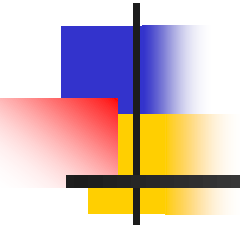
- Here are some of the VG commands
 - vgscan - scan all disks for volume groups
 - vgrename - rename a volume group
 - vgremove - remove a volume group
 - vgreduce - reduce a volume group
 - vgmerge - merge two volume groups
 - vgextend - add physical volumes to a volume group
 - vgdisplay - display attributes of volume groups
 - vgcreate - create a volume group



LVM Commands, LV

- Here are some of the LV commands
 - `lvscan` - scan (all disks) for logical volumes
 - `lvrename` - rename a logical volume
 - `lvremove` - remove a logical volume
 - `lvreduce` - reduce the size of a logical volume
 - `lvextend` - extend the size of a logical volume
 - `lvdisplay` - display attributes of a logical volume
 - `lvcreate` - create a logical volume in an existing volume group

Reducing size of LV





Reducing size

- Reduce file system size

```
# umount /rama1
```

- Run fsck forcefully on the file system

```
# e2fsck -f /dev/mapper/vgtest-lvrama1
```

- Reduce logical volume size

```
# resize2fs /dev/mapper/vgtest-lvrama1 200M
```

```
# lvreduce -L-100M /dev/vgtest/lvrama1
```

```
# mount /rama1
```

If we consider warning



```
# lvchange -a n /dev/mapper/vgtest-lvrama1
```

```
# lvreduce -L-100M /dev/mapper/vgtest-lvrama1
```

```
# lvchange -a y /dev/mapper/vgtest-lvrama1
```

```
# resize2fs /dev/mapper/vgtest-lvrama1
```

```
# mount /rama1
```



Additional options for lvcreate

- To specify number of LEs to be used for creating Logical Volume

```
# lvcreate -l 200 -n <volume_name> <volume_group>
```

- To create a volume on a specific Physical Volume

```
# lvcreate -L 100M -n <volume_name> <volume_group> <pv_path>
```

- To create volume taking LEs from different PVs

```
# lvcreate -l 200 -n <volume_name> <volume_group> <pv_path1>:n1-n2  
<pv_path2>:n3-n4
```

(sum of (n2-n1)+(n4-n3) should be 200)

```
# lvcreate -l 100 -n <volume_name> <volume_group> <pv_path>:n1-n2:n3-
```




Additional options for lvcreate

lvcreate -l 30%FREE -n <volume_name> <volume_group>

lvcreate -l 15%VG -n <volume_name> <volume_group>



Additional Commands

- To remove a Physical volume from a logical volume
- `vgreduce <volumename> <pv_name>`
- But make sure that physical volume does not contain any data.
- In case, if the physical volume contains data, move that data to another physical volume in the same logical volume
- `pvmove <source_pv> <destination_pv>`
- You can split existing logical volume group
- `vgsplit <existing_vg> <new_vg> <pvs_list>`