

eh1act02 – LVM (Logical Volume Management)

GENERAL CONDITIONS

1- Deadline: **30-3-2025**

2- Send your report as a **PDF** file attached to an e-mail with the following specifications:

a) E-mail address: **cf(at)collados.org** or **jordi.binefa(at)fje.edu** depending on who is your teacher

b) File Names:

b.1) ASIX1:

asix1_surname_name_eh1act02.odt

asix1_surname_name_eh1act02.pdf

b2.) DAW1:

daw1_surname_name_eh1act02.odt

daw1_surname_name_eh1act02.pdf

c) Subject:

c.1) ASIX1: **asix1_surname_name_eh1act02**

c.2) DAW1: **daw1_surname_name_eh1act02**

3- Make this report individually.

4- Left, right, top and bottom margins: **2cm**.

5- Character format: a) Font: **Arial**, b) Size: **10**, c) Questions typeface: **Bold**, d) Answers typeface: **Regular(Blue/Red)**.

DOCUMENTATION

1- Basic ideas about LVM:

- LVM stands for Logical Volume Management.
- LVM allows to easily combine multiple physical hard drives and/or physical partitions with the purpose of creating virtual drives called logical drives.
- Although in the physical world we have connected two or more physical drives to the computer, with LVM, the operating system works as if only one logical drive had been installed.
- The new logical drive can be partitioned, formatted and mounted as it were a physical drive.
- Logical volumes provide multiples advantages in storage management that would be impossible to offer working directly with the phisycal hard drives and their partitions

2- Advantges of LVM:

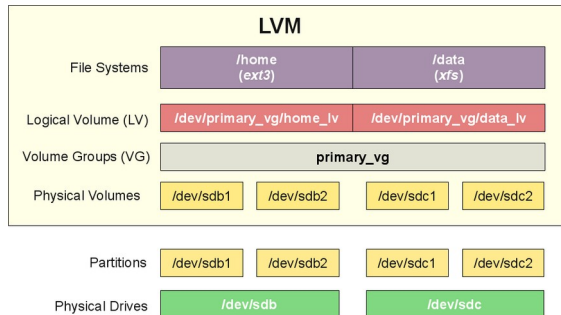
- If your system is running out of disk space, you can add another physical drive and extend the logical volume. To the operating system is as if you had moved your data a new bigger hard drive but time consuming and cost of the operation will be lower in comparition to moving data to a real new bigger physical drive.
- Combined with [hot swapping](#) technology, LVM allows you to dynamically expand, move and create volumes on the fly (without having to shut donv your computer). That means, for instance, that if your system is running out of disk space you can add additional storage space without service disruption.
- Another adavantages: [snapshots](#), filesystem encryption, data relocation, easily taking old drives out of service.

3- LVM definitions:

- Physical Volume: Physical Volumes correspond to physical disks or partitions. They are physical block devices such as `/dev/sda`, `/dev/sdb`, `/dev/sdc1`....
- Volume Group:
 - It is a combination of physical volumes. A volume group is the equivalent of a virtual hard disk.
 - A volume group needs a unique name.
 - A volume group can be partitioned.
 - File systems can not be installed on a volume group (i.e., you can not format a volume group)
 - Volume groups can not be mounted.

- Logical Volume:
 - A logical volumes is the equivalent of a virtual partition of a volume group.
 - Data is stored in logical volumes.
 - A logical volumen needs a unique name
 - A logical volume can not be partitioned because it is a virtual partition.
 - A logical volume has to be formatted if you want storage data.
 - A logical volume has to be mounted if you want storage data.

4- LVM basic diagram:



5- LVM vs RAID:

- LVM does not provide data redundancy, fault tolerance and increase of performance.
- LVM provides snapshots (backups), filesystem encryption, data relocation, combination of hard drive with different sizes.
- In modern servers, system administrators combine RAID and LVM.

6- Software required to manage logical volumes:

- On Linux Debian a package called **lvm2** has to be installed to provide management of logical volumes.
- **lvm2:**
 - Provides to the operating system with software layer required to manage logical volumes.
 - Provides to the system administrator tools to interact with the operating system and manage logical volumes.
- Installation:

```
sudo aptitude update
sudo aptitude install lvm2
```

7- Commands and steps to manage a LVM:

- The steps required to **create** and store data in a LVM include:
 - i. Create LVM physical partitions on your physical hard drives.
 - ii. Mark the physical partitions as a physical volumes → command **pvcreate**
 - iii. Create volume group made of 2 or more physical volume → command **vgcreate**
 - iv. Create logical volumes → command **lvcreate**
 - v. Build filesystems (format) → command **mkfs**
 - vi. Mount filesystems → command **mount**
 - vii. (optional) Mount filesystems during the boot process → Modify **/etc/fstab**

- The steps required to **remove** a LVM include:
 - (optional) Not mount filesystems during the boot process → Modify **/etc/fstab**
 - Unmount filesystems → command **mount**
 - Remove logical volumes → command **lvremove**
 - Remove volume groups → command **vgremove**
 - Unmark the physical partitions as a physical volumes → command **pvremove**
 - (optional) Remove or create new physical partitions.
- Commands to **monitor and display attributes** of logical volumes include:
 - Monitor and display attributes of logical volumes → **lvdisplay**
 - Monitor and display attributes of volume groups → **vgdisplay**
 - Monitor and display attributes of physical volumes → **pvdisplay**

7- Working with physical volumes - Examples:

- Marking /dev/sda2 as a physical volume: **sudo pvcreate /dev/sda2**
- Unmarking /dev/sda2 as a physical volume: **sudo pvremove /dev/sda2**
- Monitoring /dev/sda2: **sudo pvdisplay /dev/sda2**

8- Working with volume groups – Examples:

- Creating a volume group called vg1 made of /dev/sda2 and /dev/sdb3:
sudo vgcreate vg1 /dev/sda2 /dev/sdb3
- Removing volume group vg1: **sudo vgremove vg1**
- Monitoring volume group vg1: **sudo vgdisplay vg1**

9- Working with logical volumes – Examples:

- Creating a logical volume called lv1 in a volume group called vg1:
sudo lvcreate -l 100%FREE -n lv1 /dev/vg1
- Formatting lv1 as Ext4: **sudo mkfs -t ext4 /dev/vg1/lv1**
- Mounting lv1 as Ext4 on /mnt/lv1: **sudo mount -t ext4 /dev/vg1/lv1 /mnt/lv1**
- Mounting lv1 during the boot process → Add at the end of **/etc/fstab**:
/dev/vg1/lv1 /mnt/lv1 ext4 defaults 0 0
- Removing logical volume lv1: **sudo lvremove /dev/vg1/lv1**
- Monitoring logical volume lv1: **sudo lvdisplay /dev/vg1/lv1**
- Unmounting /mnt/lv1: **sudo umount /mnt/lv1**

10- External references:

- <https://wiki.debian.org/LVM>
- <https://wiki.ubuntu.com/Lvm>
- https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/4/html/Cluster_Logical_Volume_Manager/LVM_CLI.html

2- PRACTICAL EXERCISE

PART I

1- Remove **RAID** devices created in **eh1act1**. Remove hard drives created in **eh1act1** as well.

2- Add 3 new hard drives to SATA 1 to SATA3:

- **SATA1** → Identified as **eh1act02d1** and size equal to **30GiB**
- **SATA2** → Identified as **eh1act02d2** and size equal to **40GiB**
- **SATA3** → Identified as **eh1act02d3** and size equal to **50GiB**

3- Install **lvm2** on your system

4- Check the device identifier of the **3** new drives running the command **lsblk**.

5- Running fdisk:

- Create a new empty mbr(msdos) partition table on the first physical hard drive.
- Create one single primary partition for the full size of first physical hard drive.
- Change the partition type to **8e - Linux LVM**.
- Write changes to the disk
- Check changes on the disk

6- Running fdisk:

- Create a new empty mbr(msdos) partition table on the second physical hard drive.
- Create one single primary partition for the full size of second physical hard drive.
- Change the partition type to **8e - Linux LVM**.
- Write changes to the disk
- Check changes on the disk

7- Running fdisk:

- Create a new empty mbr(msdos) partition table on the third physical hard drive.
- Create one single primary partition for the full size of third physical hard drive.
- Change the partition type to **8e - Linux LVM**.
- Write changes to the disk
- Check changes on the disk

8- Mark the partitions created in questions **5,6** and **7** as physical volumes. Show information about the physical volumes.

9- Create a volume group called **vg01** made of the physical volumes marked in question **8**. Show information about the volume group.

10- Create a logical volume called **lv01** in the volume group created in question **9**. Show information about the logical volume.

11- Build a **ext4** filesystem on **lv01**.

12- Mount **lv01** on a folder called **/mnt/lv01**. Check clearly that logical volume **lv01** was mounted on **/mnt/lv01**.

13- Permissions and ownership of **/mnt/lv01**:

- Make **users** the group of **/mnt/lv01**
- Change recursively permissions of **/mnt/lv01** to **770**
- Show permissions and ownership of **/mnt/lv01**

PART II

1- Unmount **/mnt/lv01**. Check clearly that logical volume **lv01** was unmounted from **/mnt/lv01**.

2- Remove logical volume **lv01**. Check that the logical volume was removed.

3- Remove volume group **vg01**. Check that the volume group was removed.

4- Unmark physical volumes marked in **PART I - question 8**. Check that the physical volumes were unmarked.

5- Remove partitions created in **PART I - question 5 to 7**.