Logical Volume Management (LVM)

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Status: Tested

Logical Volume Management, or LVM, provides a method of allocating and managing space on mass-storage devices that is more advanced and flexible than the traditional method of partitioning storage volumes.

To find out how to set up LVM in Ubuntu, refer to this guide, which will also show you how to resize and move partitions, and how to create snapshots.

Key concepts

There are 3 concepts that LVM manages:

- **Physical volumes (PV)**: correspond to disks. They represent the lowest abstraction level of LVM, and are used to create a volume group.
- **Volume groups (VG)**: are collections of physical volumes. They are pools of disk space that logical volumes can be allocated from.
- **Logical volumes (LV)**: correspond to partitions – they usually hold a filesystem. Unlike partitions though, they can span multiple disks (because of the way volume groups are organised) and do not have to be physically contiguous.

lets open our home lab and try how LVM works.

Requirements:

Linux machine running baremetal or VM.

3 Disk (OS,PV1,PV2)

Simulating:

- Create PV

- Create VG
- Creating LV
- Create file system
- Mounting
- Reduce LV
- Remove from VG
- Remove from OS

Ubuntu with 3 disk, disk #1 Operating System, disk #2 & #3 alocated for Volume Group

```
ubuntu@ubuntu:~$ sudo fdisk -l

Disk /dev/sda: 8 GiB, 8589934592 bytes, 16777216 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 534EB29B-2FE8-482C-BB79-8C98AE4D1174

Device Start End Sectors Size Type
/dev/sda1 2048 4095 2048 1M BIOS boot
/dev/sda2 4096 16775167 16771072 8G Linux filesystem

Disk /dev/sdb: 10 GiB, 10737418240 bytes, 20971520 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/sdc: 15 GiB, 16106127360 bytes, 31457280 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

ubuntu@ubuntu:~$
```

Disk Capacity

```
/dev/sda 8G
/dev/sdb 10G
/dev/sdc 15G
```

Creating PV

Creating (PV) Physical Volume for `/dev/sdb` and `/dev/sdc`

```
ubuntu@ubuntu:~$ sudo lvm

lvm> pvcreate /dev/sdb
Physical volume "/dev/sdb" successfully created.
lvm> pvcreate /dev/sdc
Physical volume "/dev/sdc" successfully created.

lvm> pvdisplay
"/dev/sdb" is a new physical volume of "10.00 GiB"
--- NEW Physical volume ---
PV Name /dev/sdb
VG Name
PV Size 10.00 GiB
Allocatable NO
PE Size 0
Total PE 0
Free PE 0
Allocated PE 0
PV UUID qaRqDq-0MmA-OAAC-4QnH-vvXF-12Fc-EdRep3

"/dev/sdc" is a new physical volume of "15.00 GiB"
--- NEW Physical volume ---
PV Name /dev/sdc
VG Name
PV Size 15.00 GiB
Allocatable NO
PE Size 0
Total PE 0
```

```
Free PE 0
Allocated PE 0
PV UUID BgjRNz-7cjU-CpFe-6nNn-OxaV-OZUa-3dLsDh


lvm>
```

Creating VG

Creating Volume Group (VG) and attaching `/dev/sdb` into Volume Group

```
lvm> vgcreate ubuntu-vg /dev/sdb
Volume group "ubuntu-vg" successfully created


lvm> vgs
VG #PV #LV #SN Attr VSize VFree
ubuntu-vg 1 0 0 wz--n- <10.00g <10.00g
lvm> vgdisplay
--- Volume group ---
VG Name ubuntu-vg
System ID
Format lvm2
Metadata Areas 1
Metadata Sequence No 1
VG Access read/write
VG Status resizable
MAX LV 0
Cur LV 0
Open LV 0
Max PV 0
Cur PV 1
Act PV 1
VG Size <10.00 GiB
PE Size 4.00 MiB
Total PE 2559
Alloc PE / Size 0 / 0
Free PE / Size 2559 / <10.00 GiB
VG UUID E2OrNE-p76Y-UwIl-NiQs-ozHJ-C8ZT-xc1Mqy


lvm> pvs
```

```
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g <10.00g
/dev/sdc lvm2 --- 15.00g 15.00g

lvm>
```

Creating LV

Create Logical Volume (LV) and use all (100%) of free space on `ubuntu-vg` .

```
lvm> lvcreate -l 100%free -n ubuntu-lv ubuntu-vg
Logical volume "ubuntu-lv" created.
lvm>

lvm> lvdisplay
--- Logical volume ---
LV Path /dev/ubuntu-vg/ubuntu-lv
LV Name ubuntu-lv
VG Name ubuntu-vg
LV UUID d4pPYZ-HwAx-w4wK-NzNr-xd2P-FXPp-fmLaYr
LV Write Access read/write
LV Creation host, time ubuntu, 2024-05-19 09:54:44 +0000
LV Status available
# open 0
LV Size <10.00 GiB
Current LE 2559
Segments 1
Allocation inherit
Read ahead sectors auto
- currently set to 256
Block device 253:0

lvm>
```

Creating file system

Create file system and ready to mount.

```
ubuntu@ubuntu:~$ sudo mkfs -t ext4 /dev/ubuntu-vg/ubuntu-lv

mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 2620416 4k blocks and 655360 inodes
Filesystem UUID: 3f80be60-f70e-4fd0-ac0d-4f5995be2c11
Superblock backups stored on blocks:
32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

ubuntu@ubuntu:~$
```

Mounting

Preparing for mounting by create folder `/data` , change owner folder and mounting the LV.

```
sudo mkdir /data
sudo chown ubuntu:ubuntu /data
sudo mount /dev/ubuntu-vg/ubuntu-lv /data
```

continue by updating `fstab` for automatic mounting every boot

```
#sudo nano /etc/fstab
#add this line
/dev/ubuntu-vg/ubuntu-lv /data ext4 defaults
```

test `fstab` before reboot using `sudo mount -a` when no error you are good to go.

```
ubuntu@ubuntu:~$ df -h

Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 764K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
```

```
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 9.8G 24K 9.3G 1% /data

ubuntu@ubuntu:~$
```

now we try to filling disk with data. as you can see the `/data` usage is `1%` of 9.8G total.

Bellow `/data` usage `100%` (9.3G of 9.8G) after filling with data/file.

```
ubuntu@ubuntu:/$ df -h

Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 756K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 9.8G 9.3G 0 100% /data

ubuntu@ubuntu:/$
```

Volume are full and no longer able to add another data/files, we need to add more space by attaching new Physical Volume (PV) into our ubuntu-vg (VG) for expand capacity.

```
ubuntu@ubuntu:~$ sudo lvm

lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g 0
/dev/sdc lvm2 --- 15.00g 15.00g

lvm> pvdisplay
--- Physical volume ---
PV Name /dev/sdb
VG Name ubuntu-vg
PV Size 10.00 GiB / not usable 4.00 MiB
Allocatable yes (but full)
PE Size 4.00 MiB
Total PE 2559
Free PE 0
```

```
Allocated PE 2559
PV UUID qaRqDq-0MmA-OAAC-4QnH-vvXF-12Fc-EdRep3

"/dev/sdc" is a new physical volume of "15.00 GiB"
--- NEW Physical volume ---
PV Name /dev/sdc
VG Name
PV Size 15.00 GiB
Allocatable NO
PE Size 0
Total PE 0
Free PE 0
Allocated PE 0
PV UUID BgjRNz-7cjU-CpFe-6nNn-OxaV-OZUa-3dLsDh

lvm>
```

by using `pvdisplay` command we can see that `/dev/sdc` is not part of group VG `ubuntu-vg`.

Now we add PV into VG `ubuntu-vg` by execute command `vgextend ubuntu-vg /dev/sdc` .

this time, we only use 8G disk space of 15G total from disk capacity

```
lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g 0
/dev/sdc lvm2 --- 15.00g 15.00g
lvm>
lvm> vgextend ubuntu-vg /dev/sdc
Volume group "ubuntu-vg" successfully extended
lvm>

lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g 0
/dev/sdc ubuntu-vg lvm2 a-- <15.00g <15.00g

lvm>
lvm> lvextend -L +8G ubuntu-vg/ubuntu-lv
Size of logical volume ubuntu-vg/ubuntu-lv changed from <10.00 GiB (2559 extents) to <18.00
GiB (4607 extents).
```

```
Logical volume ubuntu-vg/ubuntu-lv successfully resized.

lvm>
lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g 0
/dev/sdc ubuntu-vg lvm2 a-- <15.00g <7.00g

lvm>
```

after lvextend command successfully our LV has been expanding to 18G, 10G (/dev/sdb) + 8G (dev/sdc)

```
lvm> lvs
LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert
ubuntu-lv ubuntu-vg -wi-ao---- <18.00g
lvm> lvdisplay
--- Logical volume ---
LV Path /dev/ubuntu-vg/ubuntu-lv
LV Name ubuntu-lv
VG Name ubuntu-vg
LV UUID d4pPYZ-HwAx-w4wK-NzNr-xd2P-FXPp-fmLaYr
LV Write Access read/write
LV Creation host, time ubuntu, 2024-05-19 09:54:44 +0000
LV Status available
# open 1
LV Size <18.00 GiB
Current LE 4607
Segments 2
Allocation inherit
Read ahead sectors auto
- currently set to 256
Block device 253:0
```

but remember, the 18G of LV is just capacity that we allocated, doesn't mean useable until we do resize filesystem by execute command `resize2fs` .

```
ubuntu@ubuntu:~$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 756K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
```

```
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 9.8G 9.3G 0 100% /data

ubuntu@ubuntu:~$
```

```
ubuntu@ubuntu:~$ sudo resize2fs /dev/ubuntu-vg/ubuntu-lv
resize2fs 1.46.5 (30-Dec-2021)
Filesystem at /dev/ubuntu-vg/ubuntu-lv is mounted on /data; on-line resizing required
old_desc_blocks = 2, new_desc_blocks = 3
The filesystem on /dev/ubuntu-vg/ubuntu-lv is now 4717568 (4k) blocks long.

ubuntu@ubuntu:~$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 756K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 18G 9.3G 7.6G 56% /data

ubuntu@ubuntu:~$
```

sekarang VG `ubuntu-vg/ubuntu-lv` telah berubah menjadi 18G, untuk membuktikannya mari kita lakukan pengisian data/file kembali.

```
ubuntu@ubuntu:~$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 756K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 18G 14G 2.8G 84% /data

ubuntu@ubuntu:~$
```

saat ini kita akan simulasikan kebutuuhan menyimpan data sudahlah tidak besar dan kita akan me-reduce (shrink) Volume dan mengeluarkan /dev/sdc dari VG

```
ubuntu@ubuntu:/data$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 764K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
/dev/mapper/ubuntu--vg-ubuntu--lv 18G 2.0G 15G 12% /data
tmpfs 391M 4.0K 391M 1% /run/user/1000

ubuntu@ubuntu:/data$
```

terlihat folder `/data` masih memiki data/file namun isinya sudah tidak sebanyak sebelumnya yg mencapai 14G.

sebelum proses dilakukan sangat di sarankan untuk membackup dahulu, sebagai pencegahan jika terjadi keadaan yg tidak dinginkan, dan lakukan simulasi di evironmen lain dahulu sebagai gambaran tantangan yg akan di hadapi pada proses didepan.

STOP.....!!! LAKUKAN BACKUP DAN SIMULASI dahulu sangat disarankan !

jika sudah yakin mari kita mulai

```
ubuntu@ubuntu:/$ sudo umount /data

ubuntu@ubuntu:/$ sudo e2fsck -f /dev/ubuntu-vg/ubuntu-lv
e2fsck 1.46.5 (30-Dec-2021)
Pass 1: Checking inodes, blocks, and sizes
Pass 2: Checking directory structure
Pass 3: Checking directory connectivity
Pass 4: Checking reference counts
Pass 5: Checking group summary information
/dev/ubuntu-vg/ubuntu-lv: 12/1179648 files (0.0% non-contiguous), 622552/4717568 blocks

ubuntu@ubuntu:/$

ubuntu@ubuntu:/$ sudo lvreduce --resizefs -L 5G /dev/ubuntu-vg/ubuntu-lv
fsck from util-linux 2.37.2
/dev/mapper/ubuntu--vg-ubuntu--lv: clean, 12/1179648 files, 622552/4717568 blocks
resize2fs 1.46.5 (30-Dec-2021)
```

```
Resizing the filesystem on /dev/mapper/ubuntu--vg-ubuntu--lv to 1310720 (4k) blocks.
The filesystem on /dev/mapper/ubuntu--vg-ubuntu--lv is now 1310720 (4k) blocks long.
Size of logical volume ubuntu-vg/ubuntu-lv changed from <18.00 GiB (4607 extents) to 5.00 GiB
(1280 extents).
Logical volume ubuntu-vg/ubuntu-lv successfully resized.

ubuntu@ubuntu:/$
```

Note: The LVM environment offers three commands to resize: `lvresize`, `lvreduce`, and `lvextend`. The resize let you change the size (bigger or smaller), the reduce only allows smaller sizes (i.e. at most X Gb) and the extend only allows larger sizes (i.e. at least X Gb).

```
ubuntu@ubuntu:/$ sudo mount /data

ubuntu@ubuntu:/$ ls
bin data etc lib lib64 lost+found mnt proc run snap sys usr
boot dev home lib32 libx32 media opt root sbin srv tmp var

ubuntu@ubuntu:/$ cd /data/

ubuntu@ubuntu:/data$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 392M 764K 391M 1% /run
/dev/sda2 7.8G 2.6G 4.8G 36% /
tmpfs 2.0G 0 2.0G 0% /dev/shm
tmpfs 5.0M 0 5.0M 0% /run/lock
tmpfs 391M 4.0K 391M 1% /run/user/1000
/dev/mapper/ubuntu--vg-ubuntu--lv 4.9G 2.0G 2.6G 44% /data

ubuntu@ubuntu:/data$ du -h

ubuntu@ubuntu:/data$ sudo lvm
lvm> lvs
LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert
ubuntu-lv ubuntu-vg -wi-ao---- 5.00g

lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g <5.00g
/dev/sdc ubuntu-vg lvm2 a-- <15.00g <15.00g
```

```
lvm> pvdisplay
--- Physical volume ---
PV Name /dev/sdb
VG Name ubuntu-vg
PV Size 10.00 GiB / not usable 4.00 MiB
Allocatable yes
PE Size 4.00 MiB
Total PE 2559
Free PE 1279
Allocated PE 1280
PV UUID qaRqDq-0MmA-OAAC-4QnH-vvXF-12Fc-EdRep3
--- Physical volume ---
PV Name /dev/sdc
VG Name ubuntu-vg
PV Size 15.00 GiB / not usable 4.00 MiB
Allocatable yes
PE Size 4.00 MiB
Total PE 3839
Free PE 3839
Allocated PE 0
PV UUID BgjRNz-7cjU-CpFe-6nNn-OxaV-OZUa-3dLsDh
```

dapat di lihat /dev/sdc masih berada dalam VG ubuntu-vg namun tidak digunakan.

```
lvm> pvdisplay
--- Physical volume ---
PV Name /dev/sdb
VG Name ubuntu-vg
PV Size 10.00 GiB / not usable 4.00 MiB
Allocatable yes
PE Size 4.00 MiB
Total PE 2559
Free PE 1279
Allocated PE 1280
PV UUID qaRqDq-0MmA-OAAC-4QnH-vvXF-12Fc-EdRep3
--- Physical volume ---
PV Name /dev/sdc
VG Name ubuntu-vg
PV Size 15.00 GiB / not usable 4.00 MiB
```

```
Allocatable yes
PE Size 4.00 MiB
Total PE 3839
Free PE 3839
Allocated PE 0
PV UUID BgjRNz-7cjU-CpFe-6nNn-OxaV-OZUa-3dLsDh

lvm> pvmove /dev/sdc
No data to move for ubuntu-vg.

lvm> vgdisplay
--- Volume group ---
VG Name ubuntu-vg
System ID
Format lvm2
Metadata Areas 2
Metadata Sequence No 5
VG Access read/write
VG Status resizable
MAX LV 0
Cur LV 1
Open LV 1
Max PV 0
Cur PV 2
Act PV 2
VG Size 24.99 GiB
PE Size 4.00 MiB
Total PE 6398
Alloc PE / Size 1280 / 5.00 GiB
Free PE / Size 5118 / 19.99 GiB
VG UUID E2OrNE-p76Y-UwIl-NiQs-ozHJ-C8ZT-xc1Mqy

lvm> vgreduce ubuntu-vg /dev/sdc
Removed "/dev/sdc" from volume group "ubuntu-vg"

lvm>
lvm> vgdisplay
--- Volume group ---
VG Name ubuntu-vg
System ID
```

```
Format lvm2
Metadata Areas 1
Metadata Sequence No 6
VG Access read/write
VG Status resizable
MAX LV 0
Cur LV 1
Open LV 1
Max PV 0
Cur PV 1
Act PV 1
VG Size <10.00 GiB
PE Size 4.00 MiB
Total PE 2559
Alloc PE / Size 1280 / 5.00 GiB
Free PE / Size 1279 / <5.00 GiB
VG UUID E2OrNE-p76Y-UwIl-NiQs-ozHJ-C8ZT-xc1Mqy

lvm> pvdisplay
--- Physical volume ---
PV Name /dev/sdb
VG Name ubuntu-vg
PV Size 10.00 GiB / not usable 4.00 MiB
Allocatable yes
PE Size 4.00 MiB
Total PE 2559
Free PE 1279
Allocated PE 1280
PV UUID qaRqDq-0MmA-OAAC-4QnH-vvXF-12Fc-EdRep3
"/dev/sdc" is a new physical volume of "15.00 GiB"
--- NEW Physical volume ---
PV Name /dev/sdc
VG Name
PV Size 15.00 GiB
Allocatable NO
PE Size 0
Total PE 0
Free PE 0
Allocated PE 0
PV UUID BgjRNz-7cjU-CpFe-6nNn-OxaV-OZUa-3dLsDh
```

```
lvm> lvdisplay
--- Logical volume ---
LV Path /dev/ubuntu-vg/ubuntu-lv
LV Name ubuntu-lv
VG Name ubuntu-vg
LV UUID d4pPYZ-HwAx-w4wK-NzNr-xd2P-FXPp-fmLaYr
LV Write Access read/write
LV Creation host, time ubuntu, 2024-05-19 09:54:44 +0000
LV Status available
# open 1
LV Size 5.00 GiB
Current LE 1280
Segments 1
Allocation inherit
Read ahead sectors auto
- currently set to 256
Block device 253:0

lvm>
lvm> lvs
LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert
ubuntu-lv ubuntu-vg -wi-ao---- 5.00g

lvm> pvs
PV VG Fmt Attr PSize PFree
/dev/sdb ubuntu-vg lvm2 a-- <10.00g <5.00g
/dev/sdc lvm2 --- 15.00g 15.00g
lvm> vgs
VG #PV #LV #SN Attr VSize VFree
ubuntu-vg 1 1 0 wz--n- <10.00g <5.00g
lvm>

ubuntu@ubuntu:/data$ sudo fdisk -l
Disk /dev/sda: 8 GiB, 8589934592 bytes, 16777216 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
```

```
Disk identifier: 534EB29B-2FE8-482C-BB79-8C98AE4D1174
Device Start End Sectors Size Type
/dev/sda1 2048 4095 2048 1M BIOS boot
/dev/sda2 4096 16775167 16771072 8G Linux filesystem
Disk /dev/sdb: 10 GiB, 10737418240 bytes, 20971520 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk /dev/sdc: 15 GiB, 16106127360 bytes, 31457280 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk /dev/mapper/ubuntu--vg-ubuntu--lv: 5 GiB, 5368709120 bytes, 10485760 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
ubuntu@ubuntu:/data$
ubuntu@ubuntu:/data$ sudo fdisk -l
Disk /dev/sda: 8 GiB, 8589934592 bytes, 16777216 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 534EB29B-2FE8-482C-BB79-8C98AE4D1174
Device Start End Sectors Size Type
/dev/sda1 2048 4095 2048 1M BIOS boot
/dev/sda2 4096 16775167 16771072 8G Linux filesystem
Disk /dev/sdb: 10 GiB, 10737418240 bytes, 20971520 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk /dev/mapper/ubuntu--vg-ubuntu--lv: 5 GiB, 5368709120 bytes, 10485760 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
ubuntu@ubuntu:/data$
```

LVM memudahkan dalam peng-alokasi-an partisi/volume, mudah untuk di perbesar dan di perkecil (expand - shrink), kita dapat menambahkan storage menjadi satu volume sebanyak yg kita mau. walaupun begitu ada yg perlu di perhatikan.

- LVM bukan penganti RAID
- LVM tidak menambah performa kecepatan transfer. LVM berkerja sepert RAID 0
- LVM tidak fault tolerance, dengan kata lain, jika salah satu disk dalam VG rusak maka kita akan kehilangan data atau mungkin malah kehilangan seluruh VG
- Untuk mereduce LVM diperlukan unmount, oleh sebab itu disarakan Gunakan LVM diluar path default agar bisa di unmount on the fly
- Gunakan LVM diatas RAID, dimana RAID sebagai Fault tolerance dapat memberikan ketangguhan system dari resiko data lost karena disk rusak/bad sector.

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