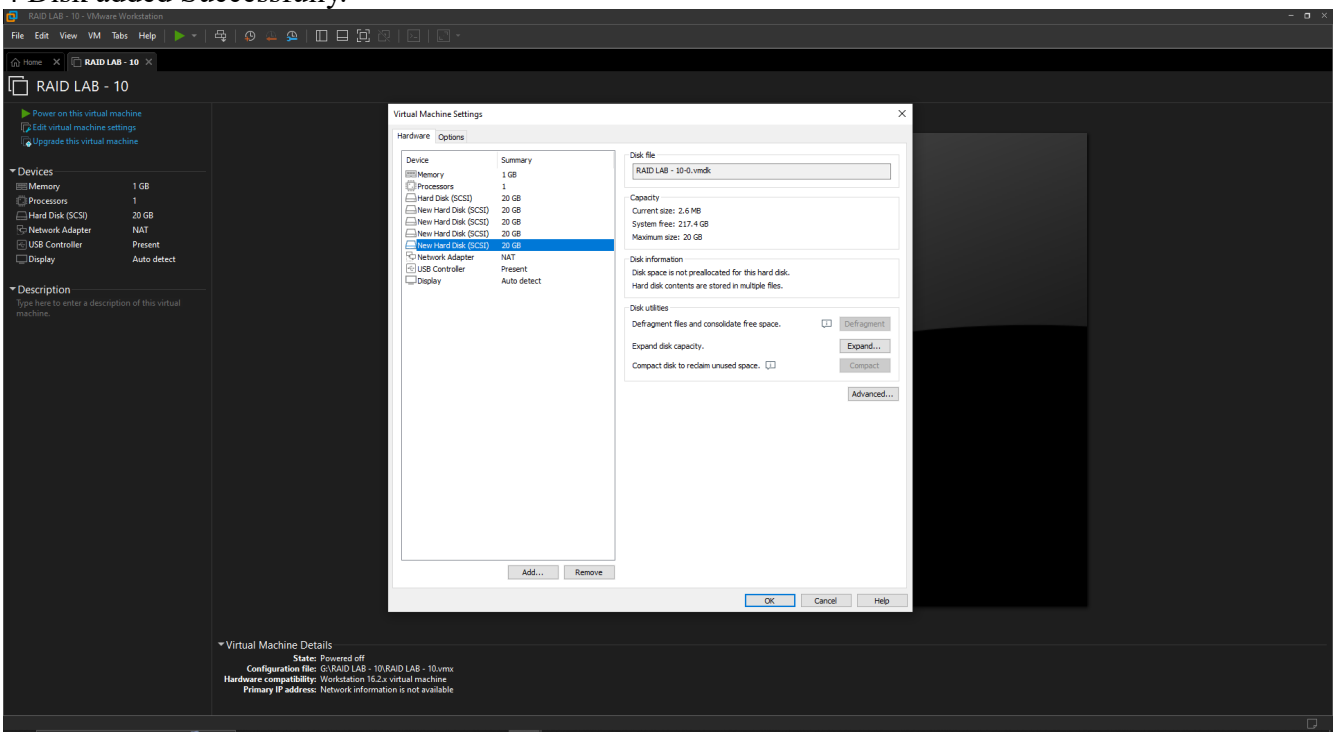
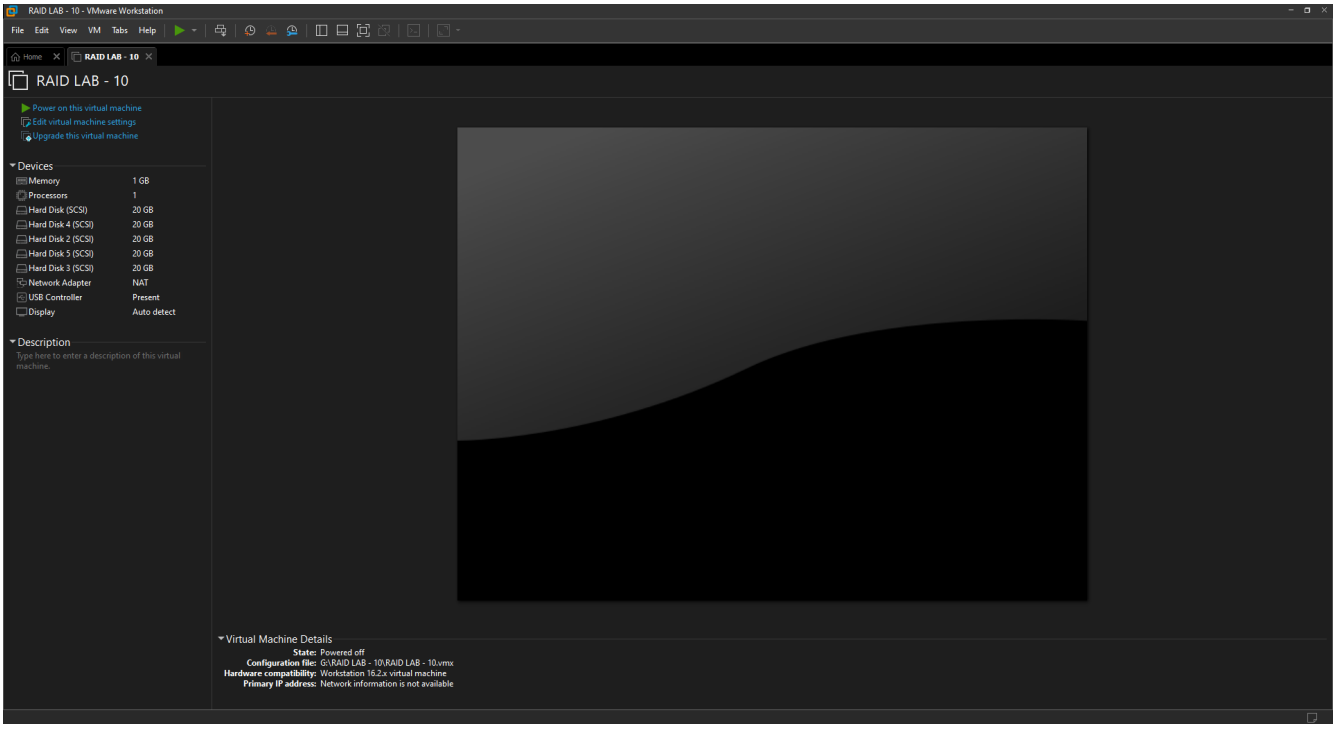
Q1. Set up a RAID 10 array with at least 3 or more disk on Linux to quickly achieve lost information and provide secure data storage.

ANS:

4 Disk added Successfully.





Disks:

```
[root@localhost ~]# lsblk
NAME              MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                 8:0    0   20G  0 disk
├─sda1              8:1    0    1G  0 part /boot
└─sda2              8:2    0   19G  0 part
  ├─centos-root 253:0    0   17G  0 lvm  /
  └─centos-swap 253:1    0    2G  0 lvm  [SWAP]
sdb                 8:16   0   20G  0 disk
sdc                 8:32   0   20G  0 disk
sdd                 8:48   0   20G  0 disk
sde                 8:64   0   20G  0 disk
```

Yum install Mdadm:

```
[root@localhost ~]# yum install mdadm
Loaded plugins: fastestmirror
Determining fastest mirrors
 * base: centos.mirror.net.in
 * extras: centos.mirror.net.in
 * updates: centos.mirror.net.in
base                                                    | 3.6 kB  00:00:00
extras                                                  | 2.9 kB  00:00:00
updates                                                 | 2.9 kB  00:00:00
updates/7/x86_64/primary_db                             |  24 MB  00:00:02
Resolving Dependencies
--> Running transaction check
---> Package mdadm.x86_64 0:4.1-9.el7_9 will be installed
--> Processing Dependency: libreport-filesystem for package: mdadm-4.1-9.el7_9.x86_64
--> Running transaction check
---> Package libreport-filesystem.x86_64 0:2.1.11-53.el7.centos will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package                 Arch       Version                Repository     Size
================================================================================
Installing:
 mdadm                   x86_64     4.1-9.el7_9            updates       439 k
Installing for dependencies:
 libreport-filesystem    x86_64     2.1.11-53.el7.centos   base           41 k

Transaction Summary
================================================================================
Install  1 Package (+1 Dependent package)

Total download size: 480 k
Installed size: 1.0 M
Is this ok [y/d/N]: y
Downloading packages:
(1/2): libreport-filesystem-2.1.11-53.el7.centos.x86_64.rpm    |  41 kB  00:00:00
(2/2): mdadm-4.1-9.el7_9.x86_64.rpm                            | 439 kB  00:00:00
--------------------------------------------------------------------------------
Total                                                925 kB/s | 480 kB  00:00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : libreport-filesystem-2.1.11-53.el7.centos.x86_64              1/2
  Installing : mdadm-4.1-9.el7_9.x86_64                                      2/2
  Verifying  : mdadm-4.1-9.el7_9.x86_64                                      1/2
  Verifying  : libreport-filesystem-2.1.11-53.el7.centos.x86_64              2/2

Installed:
  mdadm.x86_64 0:4.1-9.el7_9

Dependency Installed:
  libreport-filesystem.x86_64 0:2.1.11-53.el7.centos

Complete!
```

Create Raid-10:

```
[root@localhost ~]# mdadm --create --verbose /dev/md0 --level=10 --raid-devices=4 /dev/sdb /dev/sdc /dev/sdd /dev/sde
mdadm: layout defaults to n2
mdadm: layout defaults to n2
mdadm: chunk size defaults to 512K
mdadm: size set to 20954112K
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
```

Details:

```
[root@localhost ~]# mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Fri Jan 19 16:29:08 2024
        Raid Level : raid10
        Array Size : 41908224 (39.97 GiB 42.91 GB)
     Used Dev Size : 20954112 (19.98 GiB 21.46 GB)
      Raid Devices : 4
     Total Devices : 4
       Persistence : Superblock is persistent

       Update Time : Fri Jan 19 16:29:08 2024
             State : clean, resyncing
    Active Devices : 4
   Working Devices : 4
    Failed Devices : 0
     Spare Devices : 0

            Layout : near=2
        Chunk Size : 512K

Consistency Policy : resync

     Resync Status : 4% complete

              Name : localhost.localdomain:0  (local to host localhost.localdomain)
              UUID : 4ae0da0b:ccb08e4d:c4dfd8d1:92b06a17
            Events : 0

    Number   Major   Minor   RaidDevice State
       0       8       16        0      active sync set-A   /dev/sdb
       1       8       32        1      active sync set-B   /dev/sdc
       2       8       48        2      active sync set-A   /dev/sdd
       3       8       64        3      active sync set-B   /dev/sde
```

Partition:

```
[root@localhost ~]# fdisk /dev/md0
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0x1083b75c.

Command (m for help): m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   g   create a new empty GPT partition table
   G   create an IRIX (SGI) partition table
   l   list known partition types
   m   print this menu
   n   add a new partition
   o   create a new empty DOS partition table
   p   print the partition table
   q   quit without saving changes
   s   create a new empty Sun disklabel
   t   change a partition's system id
   u   change display/entry units
   v   verify the partition table
   w   write table to disk and exit
   x   extra functionality (experts only)

Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-83816447, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-83816447, default 83816447):
Using default value 83816447
Partition 1 of type Linux and of size 40 GiB is set
```

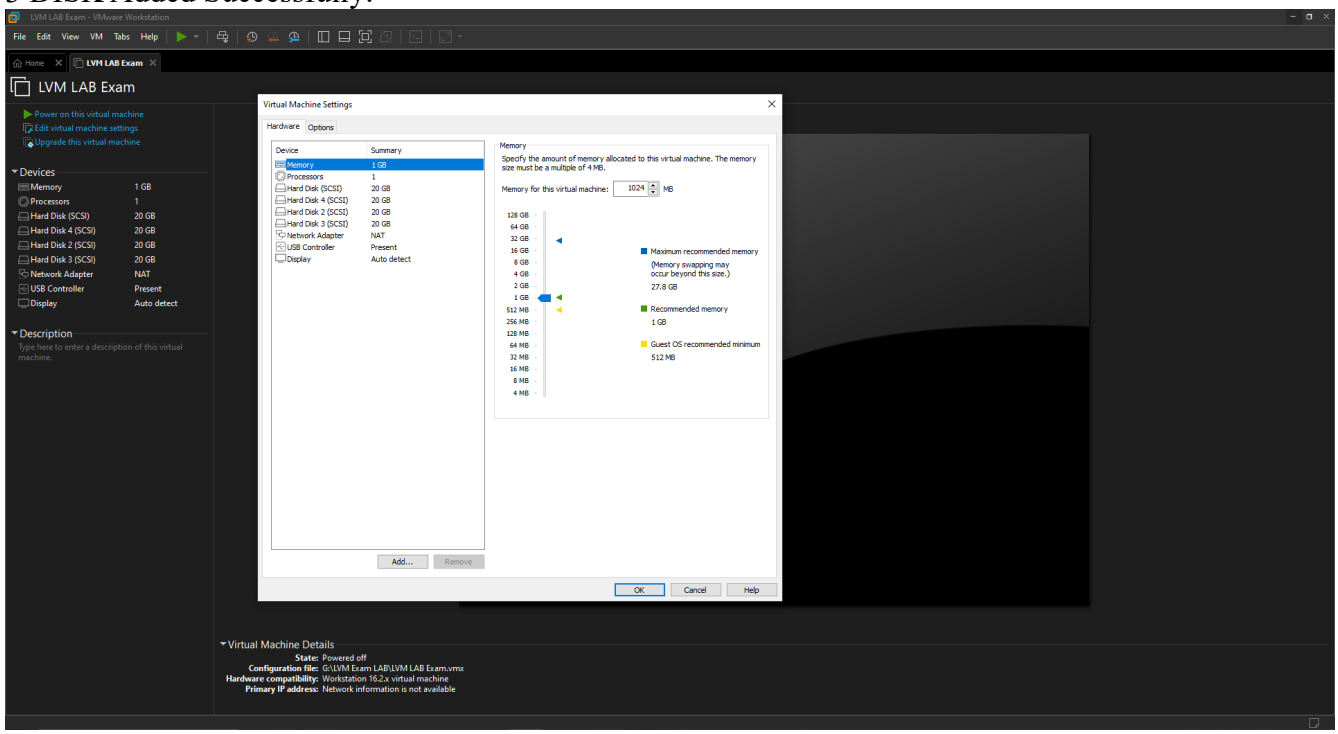
```
[root@localhost ~]# lsblk
NAME            MAJ:MIN RM SIZE RO TYPE   MOUNTPOINT
sda               8:0    0  20G  0 disk
├─sda1            8:1    0   1G  0 part   /boot
└─sda2            8:2    0  19G  0 part
  ├─centos-root 253:0    0  17G  0 lvm    /
  └─centos-swap 253:1    0   2G  0 lvm    [SWAP]
sdb               8:16   0  20G  0 disk
└─md0             9:0    0  40G  0 raid10
  └─md0p1       259:0    0  40G  0 md
sdc               8:32   0  20G  0 disk
└─md0             9:0    0  40G  0 raid10
  └─md0p1       259:0    0  40G  0 md
sdd               8:48   0  20G  0 disk
└─md0             9:0    0  40G  0 raid10
  └─md0p1       259:0    0  40G  0 md
sde               8:64   0  20G  0 disk
└─md0             9:0    0  40G  0 raid10
  └─md0p1       259:0    0  40G  0 md
[root@localhost ~]# mkfs.ext4 /dev/md0p1
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=128 blocks, Stripe width=256 blocks
2621440 inodes, 10476800 blocks
523840 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=2157969408
320 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

[root@localhost ~]# mkdir /mnt/raid10
[root@localhost ~]# mount /dev/md0p1 /mnt/raid10/
```

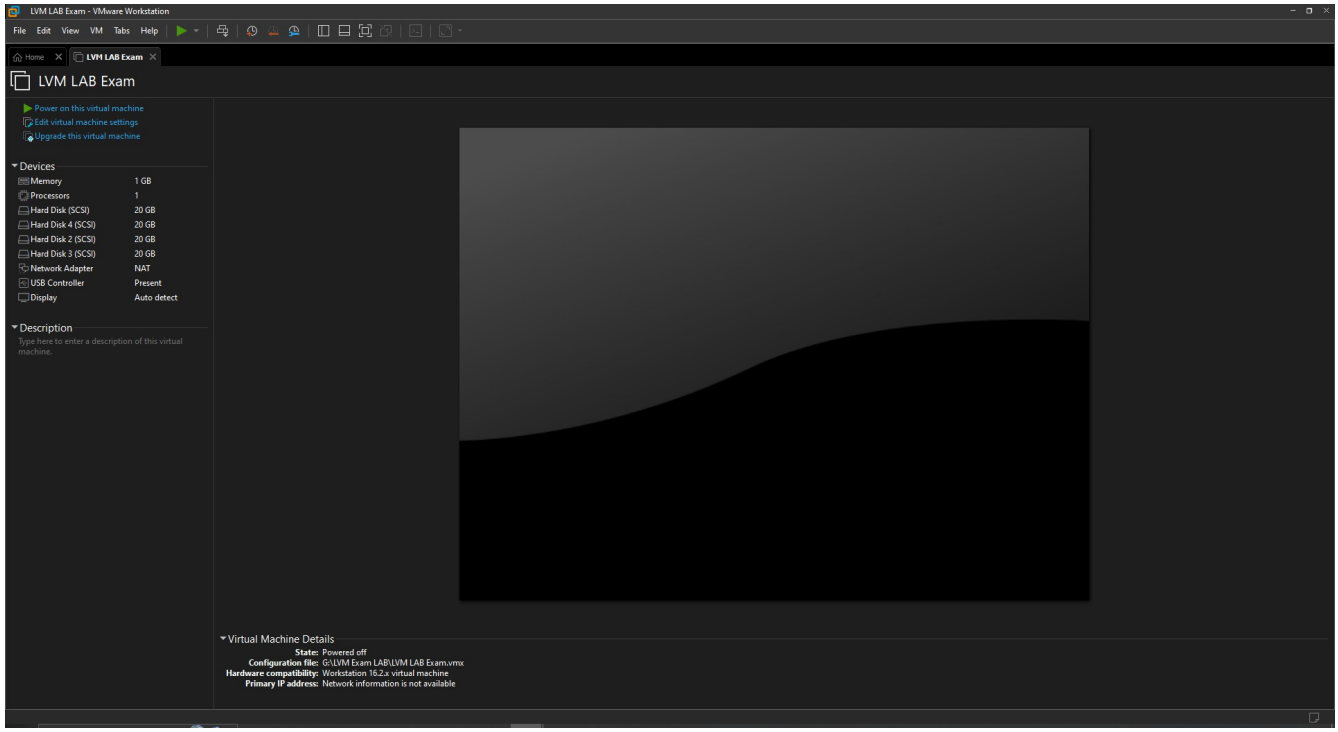
Details:

```
[root@localhost ~]# mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Fri Jan 19 16:29:08 2024
        Raid Level : raid10
        Array Size : 41908224 (39.97 GiB 42.91 GB)
     Used Dev Size : 20954112 (19.98 GiB 21.46 GB)
      Raid Devices : 4
     Total Devices : 4
       Persistence : Superblock is persistent

       Update Time : Fri Jan 19 16:30:17 2024
             State : active, resyncing
    Active Devices : 4
   Working Devices : 4
    Failed Devices : 0
     Spare Devices : 0

            Layout : near=2
        Chunk Size : 512K

Consistency Policy : resync

     Resync Status : 31% complete

              Name : localhost.localdomain:0  (local to host localhost.localdomain)
              UUID : 4ae0da0b:ccb08e4d:c4dfd8d1:92b06a17
            Events : 12

    Number   Major   Minor   RaidDevice State
       0       8       16        0      active sync set-A   /dev/sdb
       1       8       32        1      active sync set-B   /dev/sdc
       2       8       48        2      active sync set-A   /dev/sdd
       3       8       64        3      active sync set-B   /dev/sde
```

Q2. Create a one volume group from three physical volumes of 1 GB in size, create one logical volume of 2 GB with ext4 file system later extend it with 500MB

3 DISK Added Successfully:





Disks:

```
[root@localhost ~]# script lvmlab.txt
Script started, file is lvmlab.txt
[root@localhost ~]# lsblk
NAME            MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda               8:0    0  20G  0 disk
├─sda1            8:1    0   1G  0 part /boot
└─sda2            8:2    0  19G  0 part
  ├─centos-root 253:0    0  17G  0 lvm  /
  └─centos-swap 253:1    0   2G  0 lvm  [SWAP]
sdb               8:16   0  20G  0 disk
sdc               8:32   0  20G  0 disk
sdd               8:48   0  20G  0 disk
```

Physical Volume:

```
[root@localhost ~]# pvcreate /dev/sdb /dev/sdc /dev/sdd
  Physical volume "/dev/sdb" successfully created.
  Physical volume "/dev/sdc" successfully created.
  Physical volume "/dev/sdd" successfully created.
```

Volume Group:

```
[root@localhost ~]# vgcreate HPCSA /dev/sdb /dev/sdc /dev/sdd
  Volume group "HPCSA" successfully created
```

Logical Volume:

```
[root@localhost ~]# lvcreate -n hpcsa_lab --size 2G HPCSA
  Logical volume "hpcsa_lab" created.
[root@localhost ~]# lvs
  LV        VG     Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  hpcsa_lab HPCSA  -wi-a-----   2.00g
  root      centos -wi-ao---- <17.00g
  swap      centos -wi-ao----   2.00g
```

Partition:

```
[root@localhost ~]# fdisk /dev/mapper/HPCSA-hpcsa_lab
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0x04ddea78.

Command (m for help): m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   g   create a new empty GPT partition table
   G   create an IRIX (SGI) partition table
   l   list known partition types
   m   print this menu
   n   add a new partition
   o   create a new empty DOS partition table
   p   print the partition table
   q   quit without saving changes
   s   create a new empty Sun disklabel
   t   change a partition's system id
   u   change display/entry units
   v   verify the partition table
   w   write table to disk and exit
   x   extra functionality (experts only)

Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p):
Using default response p
Partition number (1-4, default 1):
First sector (2048-4194303, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-4194303, default 4194303):
Using default value 4194303
Partition 1 of type Linux and of size 2 GiB is set
```

Create File System, mount point and mount the logical volume:

```
[root@localhost ~]# mkfs.ext4 /dev/mapper/HPCSA-hpcsa_lab
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
131072 inodes, 524288 blocks
26214 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=536870912
16 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912

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

[root@localhost ~]# mkdir lab
[root@localhost ~]# mount /dev/mapper/HPCSA-hpcsa_lab lab
```

Logical Volume Extended:

```
[root@localhost ~]# lvextend -L +500MB /dev/mapper/HPCSA-hpcsa_lab
  Size of logical volume HPCSA/hpcsa_lab changed from 2.00 GiB (512 extents) to <2.49 GiB (637 extents).
  Logical volume HPCSA/hpcsa_lab successfully resized.
[root@localhost ~]# lvs
  LV        VG     Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  hpcsa_lab HPCSA  -wi-ao----  <2.49g
  root      centos -wi-ao---- <17.00g
  swap      centos -wi-ao----   2.00g
```

```
[root@localhost ~]# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                   8:0    0   20G  0 disk
├─sda1                8:1    0    1G  0 part /boot
└─sda2                8:2    0   19G  0 part
  ├─centos-root     253:0    0   17G  0 lvm  /
  └─centos-swap     253:1    0    2G  0 lvm  [SWAP]
sdb                   8:16   0   20G  0 disk
└─HPCSA-hpcsa_lab 253:2    0  2.5G  0 lvm  /root/lab
sdc                   8:32   0   20G  0 disk
sdd                   8:48   0   20G  0 disk
```