This tutorial will help you in extending LVM partition without rebooting the server.

1- At first, I want to expand the size in the \root directory, as shown below by using "df -h" command line the \root has only 66 GB available.

```
[root@localhost ~]# df -h
Filesystem               Size  Used Avail Use% Mounted on
devtmpfs                  16G     0   16G   0% /dev
tmpfs                     16G     0   16G   0% /dev/shm
tmpfs                     16G   12M   16G   1% /run
tmpfs                     16G     0   16G   0% /sys/fs/cgroup
/dev/mapper/rhel-root     71G  5.5G   66G   8% /
/dev/sda1               1014M  192M  823M  19% /boot
/dev/mapper/rhel-home     20G   33M   20G   1% /home
tmpfs                    3.2G     0  3.2G   0% /run/user/0
```

2- By using "lsblk" it's shows that the VM has unmounted disk drive in "sdb" with a size of 1T.

```
[root@localhost ~]# lsblk
NAME            MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda               8:0    0   100G  0 disk
├─sda1            8:1    0     1G  0 part /boot
└─sda2            8:2    0  98.9G  0 part
  ├─rhel-root 253:0      0    71G  0 lvm  /
  ├─rhel-swap 253:1      0   7.9G  0 lvm  [SWAP]
  └─rhel-home 253:2      0    20G  0 lvm  /home
sdb              8:16    0    1T  0 disk
sr0             11:0     1 1024M  0 rom
```

3- "We need to create a new partition. Run fdisk /dev/sdb, where /dev/sdb is the label of our disk (Disk /dev/sdb):"[1]

4- Then type "n" for create a new partition

```
[root@localhost ~]# fdisk /dev/sdb
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 0x1baed589.

Command (m for help): n
```

<center>5-"P" for primary:</center>

```
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
```

<center>5- Press "ENTER button" 3 times to choose the default sitting:</center>

```
Partition number (1-4, default 1):
First sector (2048-2147483647, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-2147483647, default 2147483647):
Using default value 2147483647
Partition 1 of type Linux and of size 1024 GiB is set
```

<center>6- Then "t" to "indicate the type of partition" [1]:</center>

7- "L" to list all OS type therefore we will choose "8e" in our case since it's Linux LVM.

```
Command (m for help): t
Selected partition 1
Hex code (type L to list all codes): L

  0   Empty             24   NEC DOS          81   Minix / old Lin bf   Solaris
  1   FAT12             27   Hidden NTFS Win  82   Linux swap / So c1   DRDOS/sec (FAT-
  2   XENIX root        39   Plan 9           83   Linux           c4   DRDOS/sec (FAT-
  3   XENIX usr         3c   PartitionMagic   84   OS/2 hidden C:  c6   DRDOS/sec (FAT-
  4   FAT16 <32M        40   Venix 80286      85   Linux extended  c7   Syrinx
  5   Extended          41   PPC PReP Boot    86   NTFS volume set da   Non-FS data
  6   FAT16             42   SFS              87   NTFS volume set db   CP/M / CTOS / .
  7   HPFS/NTFS/exFAT   4d   QNX4.x           88   Linux plaintext de   Dell Utility
  8   AIX               4e   QNX4.x 2nd part  8e   Linux LVM       df   BootIt
  9   AIX bootable      4f   QNX4.x 3rd part  93   Amoeba          e1   DOS access
  a   OS/2 Boot Manag   50   OnTrack DM       94   Amoeba BBT      e3   DOS R/O
  b   W95 FAT32         51   OnTrack DM6 Aux  9f   BSD/OS          e4   SpeedStor
  c   W95 FAT32 (LBA)   52   CP/M             a0   IBM Thinkpad hi eb   BeOS fs
  e   W95 FAT16 (LBA)   53   OnTrack DM6 Aux  a5   FreeBSD         ee   GPT
  f   W95 Ext'd (LBA)   54   OnTrackDM6       a6   OpenBSD         ef   EFI (FAT-12/16/
 10   OPUS              55   EZ-Drive         a7   NeXTSTEP        f0   Linux/PA-RISC b
 11   Hidden FAT12      56   Golden Bow       a8   Darwin UFS      f1   SpeedStor
 12   Compaq diagnost   5c   Priam Edisk      a9   NetBSD          f4   SpeedStor
 14   Hidden FAT16 <3   61   SpeedStor        ab   Darwin boot     f2   DOS secondary
 16   Hidden FAT16      63   GNU HURD or Sys  af   HFS / HFS+      fb   VMware VMFS
 17   Hidden HPFS/NTF   64   Novell Netware   b7   BSDI fs         fc   VMware VMKCORE
 18   AST SmartSleep    65   Novell Netware   b8   BSDI swap       fd   Linux raid auto
 1b   Hidden W95 FAT3   70   DiskSecure Mult  bb   Boot Wizard hid fe   LANstep
 1c   Hidden W95 FAT3   75   PC/IX            be   Solaris boot    ff   BBT
 1e   Hidden W95 FAT1   80   Old Minix
Hex code (type L to list all codes): 8e
Changed type of partition 'Linux' to 'Linux LVM'
```

8- "w" to save changes.

```
Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@localhost ~]#
```

9- "To use the created volume in LVM, initialize it with the "**pvcreate**" command:" [1]

```
[root@localhost ~]# pvcreate /dev/sdb1
  Physical volume "/dev/sdb1" successfully created.
```

10-"vgdisplay" to show the name of the volume group, VG "rhel".

```
[root@localhost ~]# vgdisplay
  --- Volume group ---
  VG Name               rhel
  System ID
  Format                lvm2
  Metadata Areas        1
  Metadata Sequence No  4
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                3
  Open LV               3
  Max PV                0
  Cur PV                1
  Act PV                1
  VG Size               <98.88 GiB
  PE Size               4.00 MiB
  Total PE              25313
  Alloc PE / Size       25312 / <98.88 GiB
  Free  PE / Size       1 / 4.00 MiB
  VG UUID               hM
```

11-"Add our partition to below group:" [1]

```
[root@localhost ~]# vgextend rhel /dev/sdb1
  Volume group "rhel" successfully extended
```

12-"Using "**lvdisplay**", we look at the name and path to the logical one that needs to be expanded (by default, this is root and **/dev/rhel/root**):" [1]

```
[root@localhost ~]# lvdisplay
  --- Logical volume ---
  LV Path                /dev/rhel/root
  LV Name                root
  VG Name                rhel
  LV UUID                Am
  LV Write Access        read/write
  LV Creation host, time localhost, 2020-04-20 13:01:24 +0300
  LV Status              available
  # open                 1
  LV Size                71.00 GiB
  Current LE             18176
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     8192
  Block device           253:0

  --- Logical volume ---
  LV Path                /dev/rhel/home
  LV Name                home
  VG Name                rhel
  LV UUID                HA
  LV Write Access        read/write
  LV Creation host, time localhost, 2020-04-20 13:01:25 +0300
  LV Status              available
  # open                 1
  LV Size                20.00 GiB
  Current LE             5120
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     8192
  Block device           253:2

  --- Logical volume ---
  LV Path                /dev/rhel/swap
  LV Name                swap
  VG Name                rhel
  LV UUID                EM
  LV Write Access        read/write
  LV Creation host, time localhost, 2020-04-20 13:01:26 +0300
  LV Status              available
  # open                 2
  LV Size                <7.88 GiB
  Current LE             2016
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     8192
  Block device           253:1
```

13-**"lvextend"** specify the path to the logical volume.

```
[root@localhost ~]# lvextend /dev/rhel/root /dev/sdb1
  Size of logical volume rhel/root changed from 71.00 GiB (18176 extents) to <1.07 TiB (280319 extents).
  Logical volume rhel/root successfully resized.
```

14-**"xfs_growfs"** expand the file system and execute.

```
[root@localhost ~]# lvextend /dev/rhel/root /dev/sdb1
  Size of logical volume rhel/root changed from 71.00 GiB (18176 extents) to <1.07 TiB (280319 extents).
  Logical volume rhel/root successfully resized.
[root@localhost ~]# xfs_growfs /dev/rhel/root
meta-data=/dev/mapper/rhel-root  isize=512    agcount=4, agsize=4653056 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=0 spinodes=0
data     =                       bsize=4096   blocks=18612224, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0 ftype=1
log      =internal               bsize=4096   blocks=9088, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
data blocks changed from 18612224 to 287046656
```

15-"df -h" Check the result:

```
[root@localhost ~]# df -h
Filesystem              Size  Used Avail Use% Mounted on
devtmpfs                 16G     0   16G   0% /dev
tmpfs                    16G     0   16G   0% /dev/shm
tmpfs                    16G   12M   16G   1% /run
tmpfs                    16G     0   16G   0% /sys/fs/cgroup
/dev/mapper/rhel-root   1.1T  5.5G  1.1T   1% /
/dev/sda1              1014M  192M  823M  19% /boot
/dev/mapper/rhel-home   20G   33M   20G   1% /home
tmpfs                   3.2G     0  3.2G   0% /run/user/0
```

References:

1- https://pocketadmin.tech/en/centos-8-extend-lvm/