

Increasing the size of a Linux LVM by expanding a VM disk

This document describes how to increase the disk space for a VMware virtual machine running Linux that is using logical volume manager (LVM).

Note: These steps only apply to EXT4 file systems. See the following link for EXT3 file systems.
http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1006371

The example below is for a VMware virtual machine running CentOS-7. It was initially set up with a 100gb disk, and was increased by 40gb for a total final size of 140gb. More specifically, it increased the /home partition by 40gb.

```
[root@testvm ~]# df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/mapper/centos_osprey--redirect--c7-root	29G	3.9G	24G	14%	/
devtmpfs	31G	0	31G	0%	/dev
tmpfs	31G	0	31G	0%	/dev/shm
tmpfs	31G	8.7M	31G	1%	/run
tmpfs	31G	0	31G	0%	/sys/fs/cgroup
/dev/sda1	497M	126M	372M	26%	/boot
/dev/mapper/centos_osprey--redirect--c7-home	59G	53M	56G	1%	/home

```
[root@testvm ~]#
```

Identify the partition type

First confirm that the partition type is actually Linux LVM by running the below command.

```
[root@testvm ~]# fdisk -l
```

```
~
~
~
```

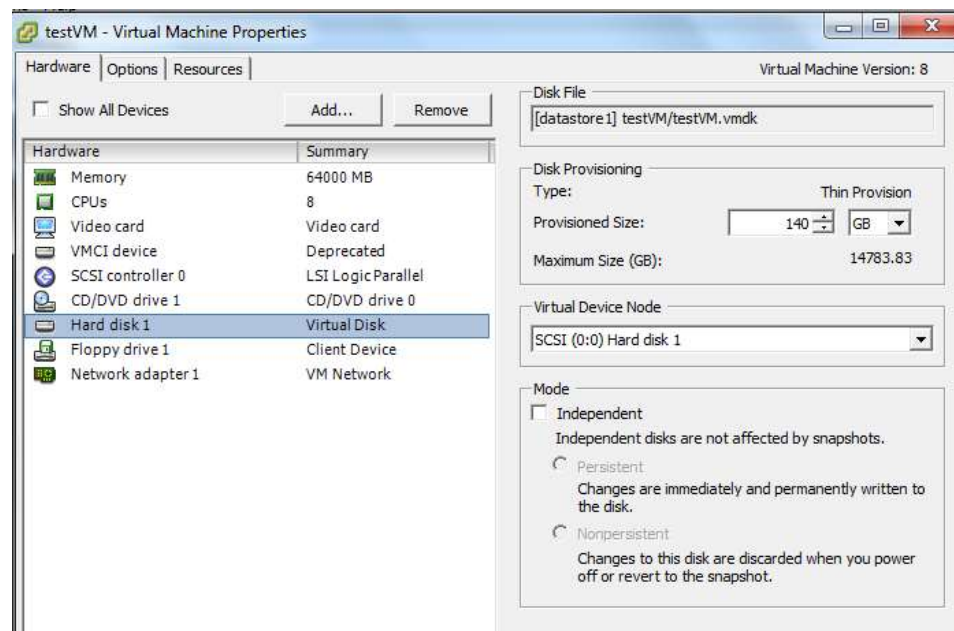
Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	2048	1026047	512000	83	Linux
/dev/sda2		1026048	209592319	104283136	8e	Linux LVM

As you can see in the above display, /dev/sda2 is listed as "Linux LVM" and it has the ID of 8e. The 8e hex code shows that it is a Linux LVM, while 83 shows a Linux native partition. You may continue after you have confirmed that you are actually working with an LVM.

Increase the virtual hard disk

First off increase the allocated disk space on the virtual machine itself. This is done by right clicking the virtual machine in vSphere, selecting edit settings, and then selecting the hard disk. In the image below I have changed the previously set hard disk of 100gb to 140gb.

If you are not able to modify the size of the disk, the provisioned size setting is greyed out. Alternatively you may need to shut down the virtual machine if it does not allow you to add or increase disks on the fly, if this is the case make the change then power it back on.



Detect the new disk space

Once the physical disk has been increased at the hardware level, you will need to get into the operating system and create a new partition that makes use of this space to proceed.

Before you can do this you need to check that the new unallocated disk space is detected by the server. You can use “`fdisk -l`” to list the primary disk. You will most likely see that the disk space is still showing as the same original size, if so you can reboot the server to force it to detect the changes.

```
[root@testvm ~]# fdisk -l
```

```
Disk /dev/sda: 150.3 GB, 150323855360 bytes, 293601280 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
Disk label type: dos
Disk identifier: 0x0009d162
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	2048	1026047	512000	83	Linux
/dev/sda2		1026048	209592319	104283136	8e	Linux LVM

Partition the new disk space

As outlined previously, the disk in the example is `/dev/sda`, so `fdisk` is used to create a new primary partition to make use of the new expanded disk space. *Note that 4 primary partitions are not already in place, making this method possible.*

```
[root@testvm ~]# fdisk /dev/sda
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.

(‘n’ was selected for adding a new partition)

Command (m for help): **n**

Partition type:

- p** primary (2 primary, 0 extended, 2 free)
- e** extended

(‘p’ is then selected as we are making a primary partition)

Select (default p): **p**

As I already have /dev/sda1 and /dev/sda2 as shown in previous images, I have gone with using ‘3’ for this new partition which will be created as /dev/sda3

Partition number (3,4, default 3): **<enter>**

Press enter twice above as by default the first and last cylinders of the unallocated space should be correct.

First sector (209592320-293601279, default 209592320): **<enter>**

Using default value 209592320

Last sector, +sectors or +size{K,M,G} (209592320-293601279, default 293601279): **<enter>**

Using default value 293601279

Partition 3 of type Linux and of size 40.1 GiB is set

(‘t’ is selected to change to a partition’s system ID, in this case we change to ‘3’)

Command (m for help): **t**

Partition number (1-3, default 3): **3**

The hex code ‘8e’ was entered as this is the code for a Linux LVM which is what we want this partition to be, as we will be joining it with the original /dev/sda5 Linux LVM.

Hex code (type L to list all codes): **8e**

Changed type of partition 'Linux' to 'Linux LVM'

‘w’ is used to write the table to disk and exit, basically all the changes that have been done will be saved and then you will be exited from fdisk.

Command (m for help): **w**

The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.

The kernel still uses the old table. The new table will be used at

the next reboot or after you run `partprobe(8)` or `kpartx(8)`

Syncing disks.

You will see a WARNING message which basically means that in order to use the new table with the changes, a system reboot is required.

```
[root@testvm ~]# fdisk -l
```

```
Disk /dev/sda: 150.3 GB, 150323855360 bytes, 293601280 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
Disk label type: dos
Disk identifier: 0x0009d162
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	2048	1026047	512000	83	Linux
/dev/sda2		1026048	209592319	104283136	8e	Linux LVM
/dev/sda3		209592320	293601279	42004480	8e	Linux LVM

Increase the logical volume

The `pvccreate` command creates a physical volume for later use by the logical volume manager (LVM). In this case the physical volume will be the new `/dev/sda3` partition.

```
[root@testvm ~]# pvccreate /dev/sda3
Device /dev/sda3 not found (or ignored by filtering).
```

In order to get around this you can reboot.

```
[root@testvm ~]# reboot
Last login: Thu Feb  4 12:24:49 2016 from will2015.transnexus.com
[root@testvm ~]#
```

```
[root@testvm ~]# pvccreate /dev/sda3
Physical volume "/dev/sda3" successfully created
```

Next confirm the name of the current volume group using the `vgdisplay` command. The name will vary depending on your setup.

```
[root@testvm ~]# vgdisplay
--- Volume group ---
VG Name                centos_osprey-redirect-c7
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                99.45 GiB
PE Size                4.00 MiB
Total PE                25459
Alloc PE / Size         25459 / 99.45 GiB
Free PE / Size          0 / 0
VG UUID                0QPmBX-ns5g-zzL9-WksU-Nktb-4o6z-AeXh75
```

Now extend the 'centos_osprey-redirect-c7' volume group by adding in the physical volume of /dev/sda3 which was created using the pvcreate command earlier.

```
[root@testvm ~]# vgextend centos_osprey-redirect-c7 /dev/sda3
Volume group "centos_osprey-redirect-c7" successfully extended
```

Use the pvscan command to scan all disks for physical volumes. This should confirm the original /dev/sda2 partition and the newly created physical volume /dev/sda3.

```
[root@testvm ~]# pvscan
PV /dev/sda2   VG centos_osprey-redirect-c7   lvm2 [99.45 GiB / 0    free]
PV /dev/sda3   VG centos_osprey-redirect-c7   lvm2 [40.05 GiB / 40.05 GiB free]
Total: 2 [139.50 GiB] / in use: 2 [139.50 GiB] / in no VG: 0 [0    ]
```

Next increase the logical volume (rather than the physical volume). This basically means that you are taking the original logical volume and extending it over the new partition/physical volume of /dev/sda3.

You need to first confirm the name of the logical volume using lvdisplay. This name will vary depending on your setup.

```
[root@testvm ~]# lvdisplay
--- Logical volume ---
LV Path                /dev/centos_osprey-redirect-c7/root
LV Name                 root
VG Name                 centos_osprey-redirect-c7
LV UUID                JrrRNs-4vEM-vCx5-e8yM-peUy-Dn3w-Jeh2dD
LV Write Access         read/write
LV Creation host, time localhost, 2016-01-22 14:57:55 -0500
LV Status               available
# open                  1
LV Size                 29.45 GiB
Current LE              7539
Segments                1
Allocation              inherit
Read ahead sectors      auto
- currently set to      8192
Block device            253:1

--- Logical volume ---
LV Path                /dev/centos_osprey-redirect-c7/home
LV Name                 home
VG Name                 centos_osprey-redirect-c7
LV UUID                t50ZXI-FwyV-oVrM-zICT-dBvf-UB1w-o1RLtd
LV Write Access         read/write
LV Creation host, time localhost, 2016-01-22 14:57:56 -0500
LV Status               available
# open                  1
LV Size                 60.00 GiB
Current LE              15360
Segments                1
Allocation              inherit
Read ahead sectors      auto
- currently set to      8192
Block device            253:2
```

```

--- Logical volume ---
LV Path                /dev/centos_osprey-redirect-c7/swap
LV Name                swap
VG Name                centos_osprey-redirect-c7
LV UUID                iLW1b0-3g2h-BADd-1m7v-7CTQ-vSaA-2lBBVL
LV Write Access        read/write
LV Creation host, time localhost, 2016-01-22 14:57:56 -0500
LV Status              available
# open                 2
LV Size                10.00 GiB
Current LE             2560
Segments               1
Allocation             inherit
Read ahead sectors     auto
- currently set to    8192
Block device           253:0

```

The logical volume is then extended using the `lvextend` command.

```

[root@testvm ~]# lvextend home /dev/sda3
Path required for Logical Volume "home".
Please provide a volume group name
Run `lvextend --help' for more information.
[root@testvm ~]#
[root@testvm ~]#
[root@testvm ~]# lvextend /dev/centos_osprey-redirect-c7/home /dev/sda3
Size of logical volume centos_osprey-redirect-c7/home changed from 60.00 GiB (15360 extents)
to 100.05 GiB (25614 extents).
Logical volume home successfully resized

```

The final step will be to resize the file system so that it can take advantage of the additional space. This is done by using the `resize2fs` command for EXT based file systems. This may take some time to complete.

Alternatively if you're running the XFS file system (default as of RedHat/CentOS 7) you can grow the file system with "`xfs_growfs /dev/centos_osprey-redirect-c7/home`".

```

[root@testvm ~]# resize2fs /dev/centos_osprey-redirect-c7/home
resize2fs 1.42.9 (28-Dec-2013)
Filesystem at /dev/centos_osprey-redirect-c7/home is mounted on /home; on-line resizing
required
old_desc_blocks = 8, new_desc_blocks = 13
The filesystem on /dev/centos_osprey-redirect-c7/home is now 26228736 blocks long.

```

```

[root@testvm ~]#
[root@testvm ~]#
[root@testvm ~]# df -h

```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/mapper/centos_osprey--redirect--c7-root	29G	3.9G	24G	14%	/
devtmpfs	31G	0	31G	0%	/dev
tmpfs	31G	0	31G	0%	/dev/shm
tmpfs	31G	8.7M	31G	1%	/run
tmpfs	31G	0	31G	0%	/sys/fs/cgroup
/dev/mapper/centos_osprey--redirect--c7-home	99G	60M	94G	1%	/home
/dev/sda1	497M	126M	372M	26%	/boot