

# Add Disk Space to a VM when a Partition is Full



Document ID: 119025

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Jun 29, 2015

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## Introduction

This document describes how to add disk space to Linux Virtual Machines (VMs).

## Background Information

Linux (and Linux VMs) are installed on hard disks, whether real or virtual. On top of this is stacked a Volume Manager followed by a filesystem which is what is typically used.

For a Linux VM, these steps are required in order to increase the size of a filesystem:

1. Determine where you need to add space and decide how much.
2. Check to see if unallocated space is available in the volume group.
3. Check to see if there is available space in the datastore.
4. Use free space in the datastore in order to increase space for the VM.
5. Add the new space to the partition.
6. Resize the physical volume.
7. Extend the size of the volume group so that it uses the new space.
8. Resize the filesystem on the logical volume so that it uses the new space.

**Note:** Many of the resizing options are RISKY and can leave the VM in an unbootable state or corrupt data. Use caution.

**Note:** Before you increase disk space ensure you have cleaned up the existing filesystem. Often there are files in /tmp, /var/tmp, /var/tmp/broadhop and /var/log that are not needed and can be deleted instead of the addition of disk space.

## Procedure

## Section 1 – Determine where you need to add space and decide how much

1. Use the Disk Free (*df*) command in order to find which partition needs more space and where it is located. Record the Filesystem and Mounted On values. For example, Filesystem: /dev/mapper/VolGroup00-LogVol03 Mounted On: /data .

#*df -h*

Filesystem:\_\_\_\_\_ Mounted On:\_\_\_\_\_

This is sample output for the *df -h* command:

```
[root@sessionmgr02 ~]# df -h
Filesystem          Size Used Avail Use% Mounted on
/dev/mapper/VolGroup00-LogVol00
    18G 2.4G  15G  15% /
/dev/mapper/VolGroup00-LogVol02
    5.7G 140M  5.3G   3% /home
/dev/mapper/VolGroup00-LogVol03
    30G  27G  1.5G  97% /data
/dev/sda1             99M  40M   55M  43% /boot
tmpfs                 16G   0    16G   0% /dev/shm
tmpfs                 8.0G 1.1G  7.0G  13% /data/sessions.1
```

2. Use the Physical Volume Display command (*pvd**isplay*) in order to see the Physical Volume (PV) Name where the Volume Group is located. Record the PV Name value (for example 'PV Name: /dev/sda2').

# *pvd**isplay*

PV Name:\_\_\_\_\_

This is sample output for the *pvd**isplay* command:

```
[root@sessionmgr02 ~]# pvdisplay
--- Physical volume ---
PV Name           /dev/sda2
VG Name            VolGroup00
PV Size            69.89 GB / not usable 18.64 MB
Allocatable       yes
PE Size (KByte)   32768
Total PE          2236
Free PE           320
Allocated PE      1916
PV UUID           HO3ICX-nRhO-FaBA-MvB3-Z1zv-JLG4-vNFQeU
```

**Note:** The PV Name (/dev/sda2) shows two things. The first part (/dev/sda) shows the device and the second part (2) shows the partition number.

3. Write down how much disk space you want (or need) to add here (for example, 5 for 5 gigabytes).

Disk Space to Add <amount>:\_\_\_\_\_

## Section 2 – Check for available unallocated space in the volume group

1. Enter the Volume Group Display command (*vg**display*) in order to check the Free Physical Extent (PE) Size. Record the Alloc PE / Size and Free PE / Size values. For example, Alloc PE / Size: 59.88 Free PE / Size: 15.00 .

```
# vgsdisplay
```

Alloc PE / Size: \_\_\_\_\_ Free PE / Size: \_\_\_\_\_

This shows sample output for the *vgsdisplay* command:

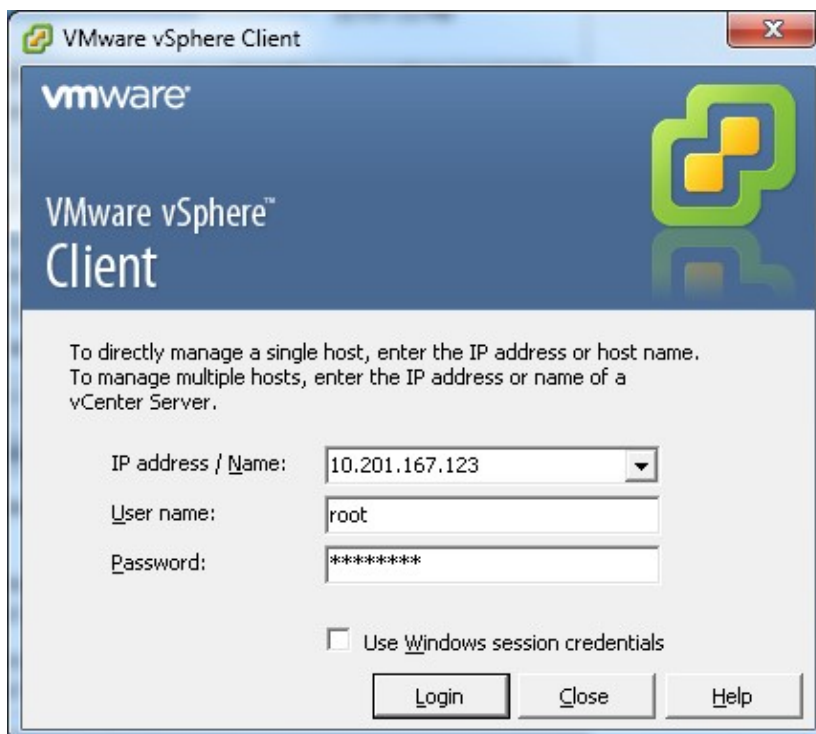
```
[root@sessionmgr02 ~]# vgsdisplay
--- Volume group ---
VG Name                VolGroup00
System ID
Format                 lvm2
Metadata Areas         1
Metadata Sequence No   9
VG Access               read/write
VG Status               resizable
MAX LV                 0
Cur LV                 4
Open LV                 4
Max PV                 0
Cur PV                 1
Act PV                 1
VG Size                 74.88 GB
PE Size                 32.00 MB
Total PE                2396

Alloc PE / Size        1916 / 59.88 GB
Free PE / Size         480 / 15.00 GB
VG UUID                pPSNBU-FRWO-z3aC-iAxS-ewaw-jOFT-dTcBKd
```

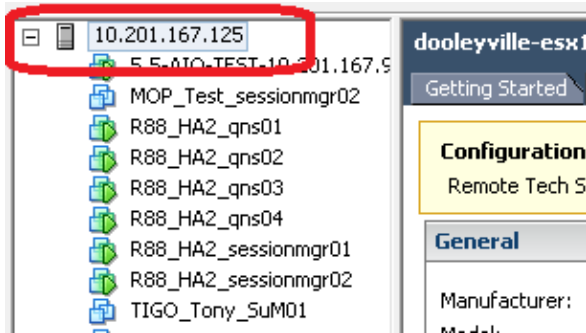
2. If the Free PE Size space is larger than the space you need to add, proceed to *Section 7* of this document. Otherwise, continue to *Section 3*.

## Section 3 – Check to see if there is enough available space in the datastore

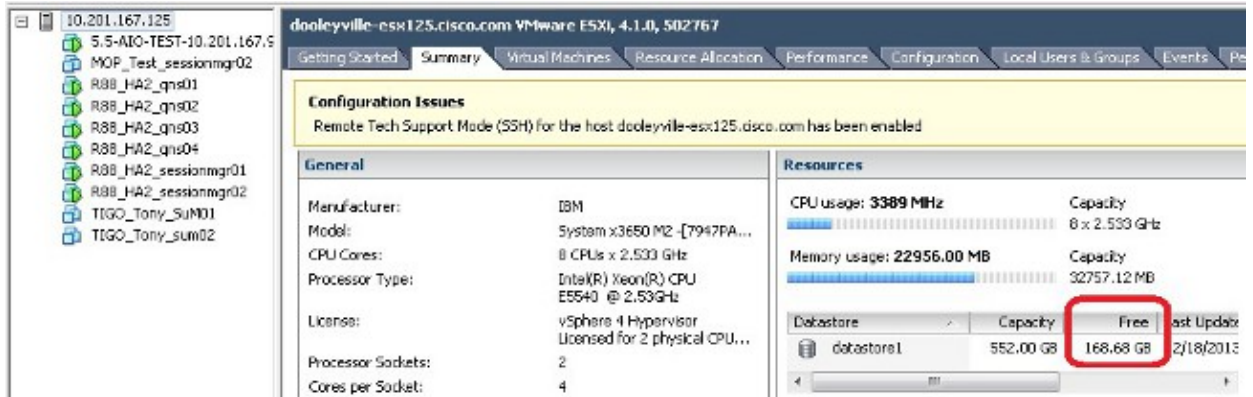
1. Log into the vSphere client as an administrator (e.g. root).



2. Select the top level item in the tree (usually the IP of the system).



3. Check the Free space on the Datastore under the Summary tab in order to ensure there is enough room to expand the partition.



*Note:* If there is enough free space for this expansion, continue with **Section 4**. If there is not enough free space, stop this procedure and add disk space to the datastore before you proceed.

## Section 4 – Use Free Space in the Datastore in order to increase space for the VM

1. Log into the VM and power it down with the *shutdown -h now* command.

```
# shutdown -h now
```

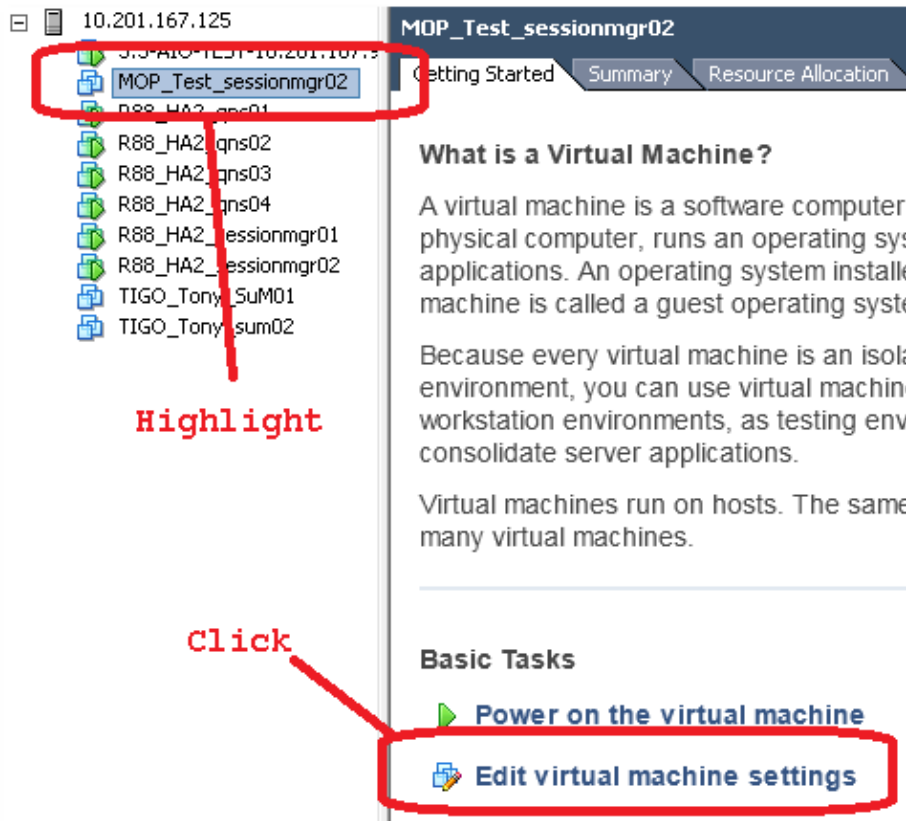
This sample shows output for the *shutdown -h now* command:

```
[root@sessionmgr02 ~]# shutdown -h now
```

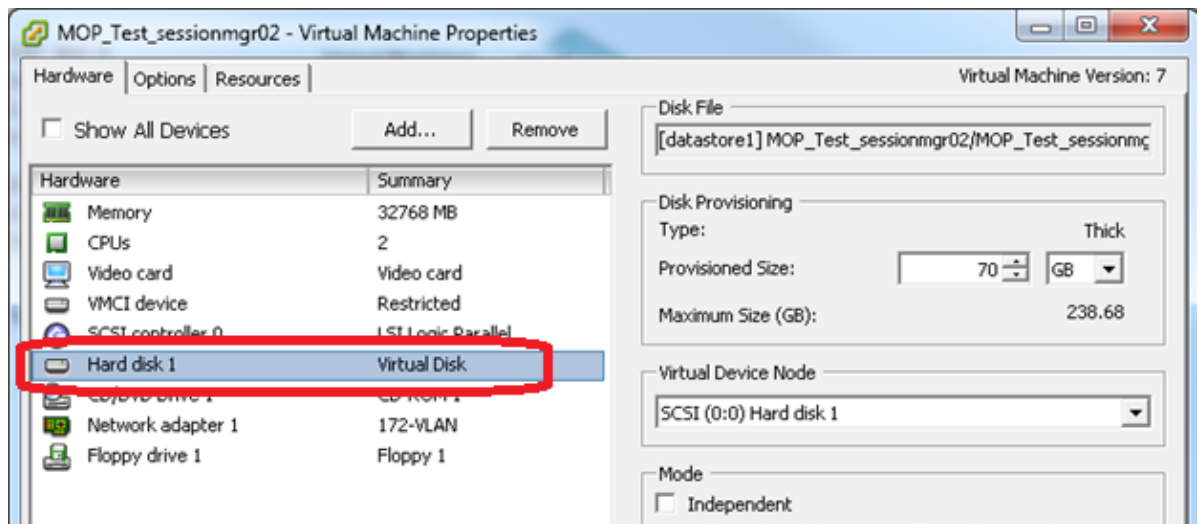
```
Broadcast message from root (pts/0) (Wed Dec 18 11:48:20 2013):
```

```
The system is going down for system halt NOW!
```

2. In the VMWare vSphere Client, select/highlight the Virtual Machine. Then in the Getting Started tab click *Edit virtual machine settings*.

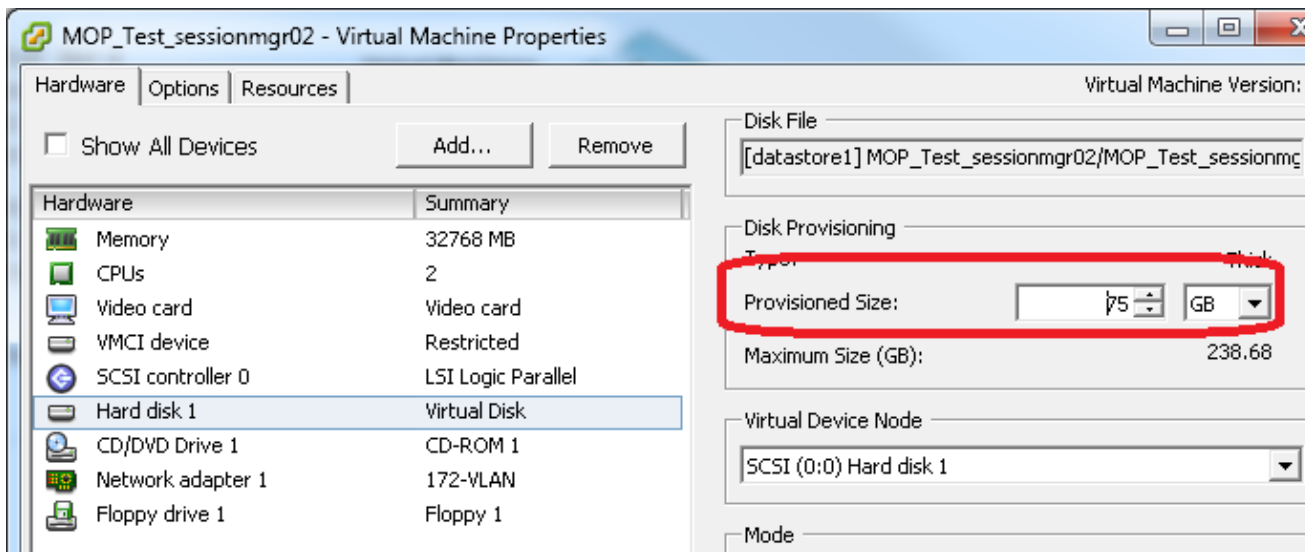


3. In the pop-up window, choose *Hard Disk 1*.

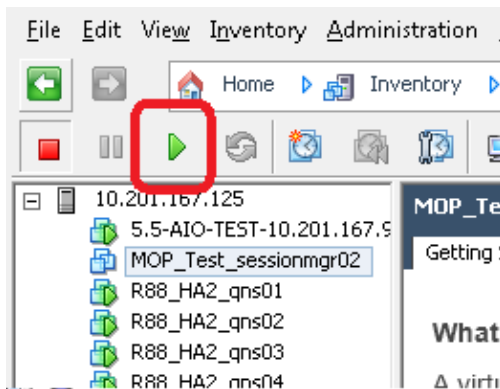


4. Increase the Provisioned Size of the Hard Disk by the amount you chose in Section 1 Step 3. Then click *OK*.

*Note:* The increased amount must be less than the amount of free space on the datastore. **Do not overprovision.**



5. In vSphere, click on the **Green** triangle in order to power on the highlighted VM.



**Note:** Wait 5 minutes for the VM to completely load.

6. After the VM boots up, log into the VM as root.

```
# ssh <vm_name>
```

This sample shows output for the *ssh* command:

```
[root@pcrfclient01 ~]# ssh 172.10.1.30
\\Last login: Wed Dec 18 11:48:14 2013 from 172.10.1.9
Spacewalk kickstart on 2010-08-23
[root@sessionmgr02 ~]#
```

7. Find the disk size with the Fixed Disk (*fdisk*) command for the PV Name you wrote down in Section 1 Step 2. Record the disk size. For example, Disk Size: 75.0 GB .

```
# fdisk -l /dev/sda
```

Disk Size: \_\_\_\_\_

This sample shows output for the *fdisk -l /dev/sda* command:

```
[root@sessionmgr02 ~]# fdisk -l /dev/sda

Disk /dev/sda2: 75.0 GB, 75047454720 bytes
255 heads, 63 sectors/track, 9124 cylinders
```

Units = cylinders of 16065 \* 512 = 8225280 bytes

This example output shows that /dev/sda2 currently has 75G allocated to it.

## Section 5 – Add the new space to the partition

1. In order to resize the partition, enter the *fdisk* command and use the PV Name (from Section 1 Step 2) without the number on the end.

```
# fdisk <pv_name without the number on the end>
```

This sample shows output for the *fdisk /dev/sda* command:

```
[root@sessionmgr02 ~]# fdisk /dev/sda
```

```
The number of cylinders for this disk is set to 9137.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)
```

Command (m for help):

2. At the command prompt, enter *p* and press *Enter* in order to view the partition table.

```
Command (m for help): p
```

This example shows output that shows the partition table after you type the letter '*p*':

```
Command (m for help): p
```

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 9137 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Device Boot      Start      End      Blocks      Id System
/dev/sda1 *         1         13       104391      83 Linux
/dev/sda2           14       9137     73288530     8e Linux LVM
```

Command (m for help):

3. Record the Start and Id values for the partition that you want to resize. For example, from the example output in Step 2, Start: 14 Id: 8e .

Start: \_\_\_\_\_ Id: \_\_\_\_\_

4. Delete the Partition entry for the device you want to resize. Enter *d* at the command prompt.

```
Command (m for help): d
```

This example shows the results after you enter *d*:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 9137 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Device Boot      Start      End      Blocks      Id System
/dev/sda1 *         1         13       104391      83 Linux
/dev/sda2          14       9137     73288530     8e Linux LVM
```

Command (m for help): *d*

Partition number (1-4):

5. At the Partition number prompt, enter the partition number you want to delete and press **Enter**. (The number at the end of the Device name is the partition number.)

Partition number (1-4): <number>

This example shows the results after you enter the partition number:

Disk /dev/sda: 75.1 GB, 75161927680 bytes  
255 heads, 63 sectors/track, 9137 cylinders  
Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

Command (m for help): d  
Partition number (1-4): 2

Command (m for help):

6. At the Command prompt, enter **n** in order to create a new partition.

Command (m for help): n

This example shows the results after you enter **n**:

Disk /dev/sda: 75.1 GB, 75161927680 bytes  
255 heads, 63 sectors/track, 5221 cylinders  
Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

Command (m for help): d  
Partition number (1-4): 2

Command (m for help): n  
Command action  
e extended  
p primary partition (1-4)  
Command (m for help): **n**

7. Enter **p** for a primary partition.

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

This example shows output after you enter **p**:

Disk /dev/sda: 75.1 GB, 75161927680 bytes  
255 heads, 63 sectors/track, 5221 cylinders  
Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

Command (m for help): d  
Partition number (1-4): 2

Command (m for help): n



```
Command action
  e   extended
  p   primary partition (1-4)
p
Partition number (1-4):
```

8. At the Partition number prompt enter the partition number and press **Enter** (same partition number as the one deleted). In this example, the number is 2.

```
Partition number (1-4): 2
```

This example shows the results after you enter the partition number:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 5221 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

```
Command (m for help): d
Partition number (1-4): 2
```

```
Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)
p
Partition number (1-4): 2
```

```
First cylinder (14-9137, default 14):
```

9. Verify that the default value for the First cylinder number matches the Start value from Step 3 of this Section. If it does, press **Enter** in order to accept the default. If it does not match, ensure that it does not overlap with any existing partitions then manually enter the value and press **Enter**.

This example shows the results after you accept the default value and press Enter:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 5221 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

```
Command (m for help): d
Partition number (1-4): 2
```

```
Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)
p
Partition number (1-4): 2
```

```
First cylinder (14-9790, default 14):
```

```
Using default value 14
```

```
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):
```

10. For the Last cylinder value press **Enter** in order to use the default value.

This sample shows the results after you accept the default value and press Enter:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 5221 cylinders
```

Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

Command (m for help): d  
Partition number (1-4): 2

Command (m for help): n  
Command action  
e extended  
p primary partition (1-4)  
p  
Partition number (1-4): 2  
First cylinder (14-9790, default 14):  
Using default value 14  
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):  
Using default value 9790

Command (m for help):

11. At the Command prompt, enter *t* and press **Enter**.

Command (m for help): t

This example shows the results after you enter *t*:

Disk /dev/sda: 75.1 GB, 75161927680 bytes  
255 heads, 63 sectors/track, 5221 cylinders  
Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

Command (m for help): d  
Partition number (1-4): 2

Command (m for help): n  
Command action  
e extended  
p primary partition (1-4)  
p  
Partition number (1-4): 2  
First cylinder (14-9790, default 14):  
Using default value 14  
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):  
Using default value 9790

Command (m for help): t  
Partition number (1-4):

12. At the Partition number prompt, enter the partition number you want to resize and press **Enter**.

Partition number (1-4): 2

This example shows the results after you enter the partition number:

Disk /dev/sda: 75.1 GB, 75161927680 bytes  
255 heads, 63 sectors/track, 5221 cylinders  
Units = cylinders of 16065 \* 512 = 8225280 bytes

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

```
Command (m for help): d
Partition number (1-4): 2
```

```
Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)
```

```
P
Partition number (1-4): 2
First cylinder (14-9790, default 14):
Using default value 14
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):
Using default value 9790
```

```
Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes):
```

13. At the Hex code prompt, type the hex code. This is the Id value from Step 3 in this Section. Press **Enter**.

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

This example shows the results after you enter the hex code:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 5221 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sda1	*	1	13	104391	83	Linux
/dev/sda2		14	9137	73288530	8e	Linux LVM

```
Command (m for help): d
Partition number (1-4): 2
```

```
Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)
```

```
P
Partition number (1-4): 2
First cylinder (14-9790, default 14):
Using default value 14
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):
Using default value 9790
```

```
Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes): 8e
Changed system type of partition 2 to 8e (Linux LVM)
```

```
Command (m for help):
```

14. At the Command prompt, enter **w** in order to write the partition to the disk.

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

This example shows the results after you enter **w** at the prompt:

```
Disk /dev/sda: 75.1 GB, 75161927680 bytes
255 heads, 63 sectors/track, 5221 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
```

Device	Boot	Start	End	Blocks	Id	System
--------	------	-------	-----	--------	----	--------

```

/dev/sda1 *          1          13          104391      83 Linux
/dev/sda2          14          9137       73288530   8e Linux LVM

```

```

Command (m for help): d
Partition number (1-4): 2

```

```

Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)

```

```

p
Partition number (1-4): 2
First cylinder (14-9790, default 14):
Using default value 14
Last cylinder or +size or +sizeM or +sizeK (14-9790, default 9790):
Using default value 9790

```

```

Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes): 8e
Changed system type of partition 2 to 8e (Linux LVM)

```

```

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.
Syncing disks.
[root@sessionmgr02 ~]#

```

This exits fdisk and takes you to the root prompt.

15. Reboot the VM in order to ensure the new settings match up with the kernel.

```
# init 6
```

16. After the VM completes the reboot (about 5 minutes) log into (ssh) the VM as root.
17. Check in order to ensure the disk size is now larger with the `fdisk -l <PV Name>` command in order to view the new partition size (PV Name is from Section 1 Step 2).

```

[root@sessionmgr02 ~]# fdisk -l /dev/sda

Disk /dev/sda2: 80.4 GB, 80418562560 bytes
255 heads, 63 sectors/track, 9777 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

```

This example output shows that /dev/sda now has 80Gigabytes allocated to it.

## Section 6 – Resize the Physical Volume

**Warning:** This procedure is somewhat *RISKY*. *Use caution*.

1. Enter the Physical Volume Resize (`pvresize`) command followed by the PV Name in order to resize the partition to fit into the currently allocated disk space.

```
# pvresize /dev/sda2
```

This example shows the results after you enter the `pvresize` command:

```
[root@sessionmgr02 ~]# pvresize /dev/sda2
```

Physical volume "/dev/sda2" changed

1 physical volume(s) resized / 0 physical volume(s) not resized

2. Enter the **vgdisplay** command in order to check the Free PE Size to see the additional space added.

This example shows the results after you enter the **vgdisplay** command:

```
[root@sessionmgr02 ~]# vgdisplay
--- Volume group ---
VG Name                VolGroup00
System ID
Format                 lvm2
Metadata Areas         1
Metadata Sequence No  9
VG Access              read/write
VG Status              resizable
MAX LV                 0
Cur LV                4
Open LV                4
Max PV                 0
Cur PV                1
Act PV                1
VG Size                74.88 GB
PE Size                32.00 MB
Total PE               2396
Alloc PE / Size        1916 / 59.88 GB
Free PE / Size       480 / 15.00 GB
VG UUID                pPSNBU-FRWO-z3aC-iAxS-ewaw-jOFT-dTcBKd
```

The example shows the disk space added in the previous section.

## Section 7 – Extend the size of the Volume Group in order to use the new space

1. Enter the **df** command in order to locate the partition that needs more space again in order to verify the information originally recorded in Section 1 Step 1 is correct.

Record the Filesystem and Mounted on values from the output of the **df** command.

```
# df -h
```

Filesystem:\_\_\_\_\_Mounted on:\_\_\_\_\_

```
[root@sessionmgr02 ~]# df -h
Filesystem          Size Used Avail Use% Mounted on
/dev/mapper/VolGroup00-LogVol00
                      18G 2.4G  15G  15% /
/dev/mapper/VolGroup00-LogVol02
                      5.7G 140M  5.3G   3% /home
/dev/mapper/VolGroup00-LogVol03
                      30G  27G  1.5G  97% /data
/dev/sda1             99M  40M   55M  43% /boot
tmpfs                  16G   0    16G   0% /dev/shm
tmpfs                  8.0G 1.1G  7.0G  13% /data/sessions.1
```

2. Write the amount of space you need to add to the partition (same as Section 1 Step 3).

Disk Space to Add <amount>:\_\_\_\_\_

3. Enter the Logical Volume Extend command (*lvextend -L+<amount>G <Filesystem>*) in order to add the new disk space (<amount> from Section 1 Step 2) to the Filesystem that needs it (from Section 7 Step 1).

```
# lvextend -L+5G /dev/mapper/VolGroup-LogVol-03
```

This example shows the results after you enter the *lvextend* command:

```
[root@sessionmgr02 ~]# lvextend -L+5G /dev/mapper/VolGroup00-LogVol103
Extending logical volume LogVol103 to 45.00 GB
Logical volume LogVol103 successfully resized
[root@sessionmgr02 ~]#
```

This adds the newly added space to the Logical Volume.

## Section 8 – Resize the filesystem on the logical volume in order to use the new space

1. Enter the Resize Filesystem command (*resize2fs <Filesystem>*) in order to resize the filesystem (from Section 1 Step 1). This makes the additional disk space available for use.

**Warning:** This command may take some time to complete.

```
# resize2fs <filesystem>
```

This example shows the results after you enter the *resize2fs* command:

```
[root@sessionmgr02 ~]# resize2fs /dev/mapper/VolGroup00-LogVol103
resize2fs 1.39 (29-May-2006)
Filesystem at /dev/mapper/VolGroup00-LogVol103 is
mounted on /data; on-line resizing required
Performing an on-line resize of /dev/mapper/VolGroup00-LogVol103
to 11796480 (4k) blocks.
The filesystem on /dev/mapper/VolGroup00-LogVol103 is now 11796480 blocks long.
```

```
[root@sessionmgr02 ~]#
```

2. Enter the *df -h* command in order to see if the disk space is now available.

```
# df -h
```

Example results from entering the *df -h* command:

```
[root@sessionmgr02 ~]# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/mapper/VolGroup00-LogVol100
                          18G       2.4G   15G   15% /
/dev/mapper/VolGroup00-LogVol102
                          5.7G    140M   5.3G    3% /home
/dev/mapper/VolGroup00-LogVol103
                          44G    22G    21G   52% /data
/dev/sda1                  99M       40M   55M   43% /boot
tmpfs                      16G         0    16G    0% /dev/shm
tmpfs                      8.0G     4.0K   8.0G    1% /data/sessions.1
```