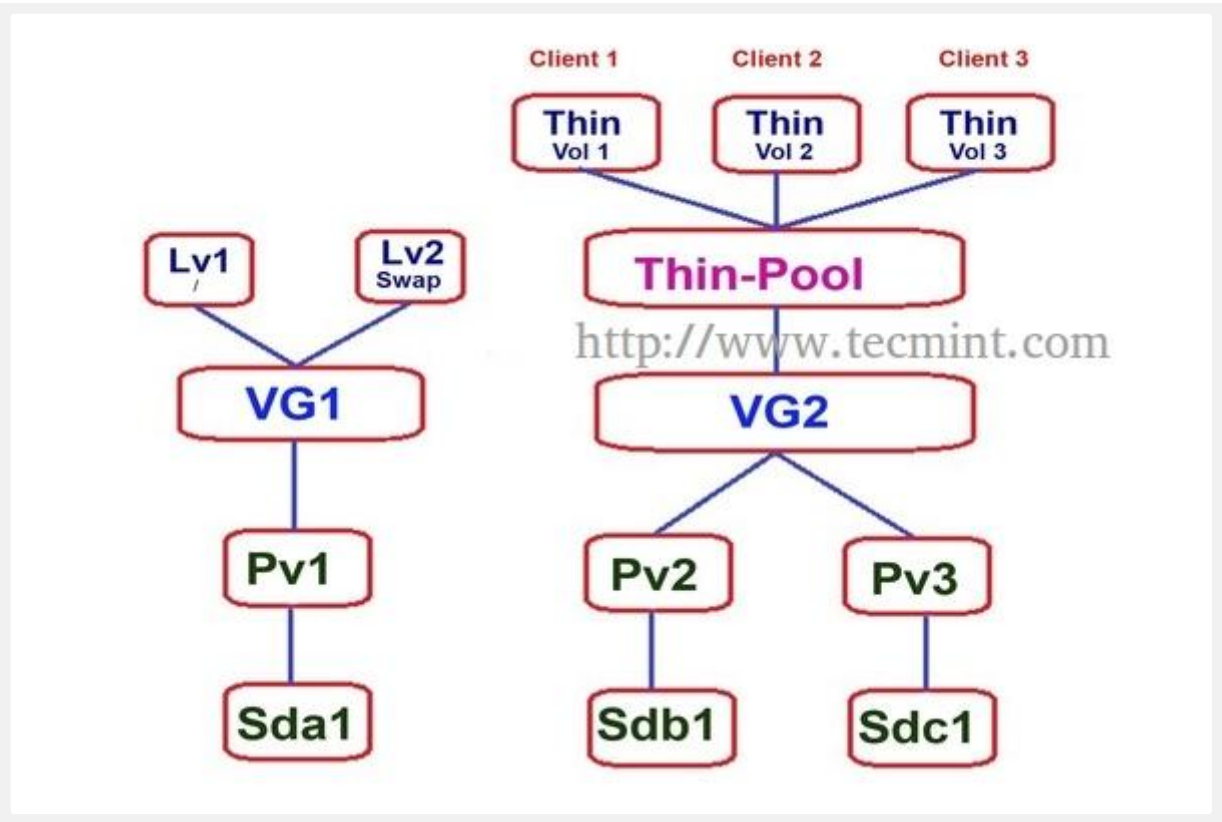
Setup Thin Provisioning Volumes in Logical Volume Management (LVM) – Part IV

by Babin Lonston | Published: August 22, 2014 | Last Updated: January 7, 2015

Logical Volume management has great features such as snapshots and Thin Provisioning. Previously in (Part – III) we have seen how to snapshot the logical volume. Here in this article, we will going to see how to setup thin Provisioning volumes in LVM.



Setup Thin Provisioning in LVM

What is Thin Provisioning?

Thin Provisioning is used in lvm for creating virtual disks inside a thin pool. Let us assume that I have a **15GB** storage capacity in my server. I already have 2 clients who has 5GB storage each. You are the third client, you asked for 5GB storage. Back then we use to provide the whole 5GB (Thick Volume) but you may use 2GB from that 5GB storage and 3GB will be free which you can fill it up later.

But what we do in thin Provisioning is, we use to define a thin pool inside one of the large volume group and define the thin volumes inside that thin pool. So, that whatever files you write will be stored and your storage will be shown as 5GB. But the full 5GB will not allocate the entire disk. The same process will be done for other clients as well. Like I said there are 2 clients and you are my 3rd client.

So, let us assume how much total GB I have assigned for clients? Totally 15GB was already completed, If someone comes to me and ask for 5GB can I give? The answer is "**Yes**", here in thin Provisioning I can give 5GB for 4th Client even though I have assigned 15GB.

Warning: From 15GB, if we are Provisioning more than 15GB it is called Over Provisioning.

How it Works? and How we provide storage to new Clients?

I have provided you 5GB but you may used only 2GB and other 3GB will be free. In Thick Provisioning we can't do this, because it will allocate the whole space at first itself.

In thin Provisioning if I'm defining 5GB for you it won't allocate the whole disk space while defining a volume, it will grow till 5GB according to your data write, Hope you got it! same like you, other clients too won't use the full volumes so there will be a chance to add 5GB to a new client, This is called over Provisioning.

But it's compulsory to monitored each and every volume growth, if not it will end-up in a disaster. While over Provisioning is done if the all 4 clients write the data's badly to disk you may face an issue because it will fill up your 15GB and overflow to get drop the volumes.

Requirements

- Create Disk Storage with LVM in Linux – PART 1

- How to Extend/Reduce LVM's in Linux – Part II
- How to Create/Restore Snapshot of Logical Volume in LVM – Part III

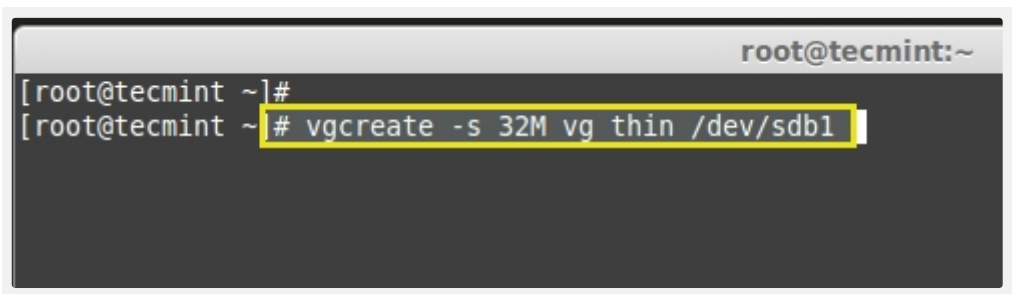
My Server Setup

- Operating System – CentOS 6.5 with LVM Installation
- Server IP – 192.168.0.200

Step 1: Setup Thin Pool and Volumes

Let's do it practically how to setup the thin pool and thin volumes. First we need a large size of Volume group. Here I'm creating Volume group with **15GB** for demonstration purpose. Now, list the volume group using the below command.

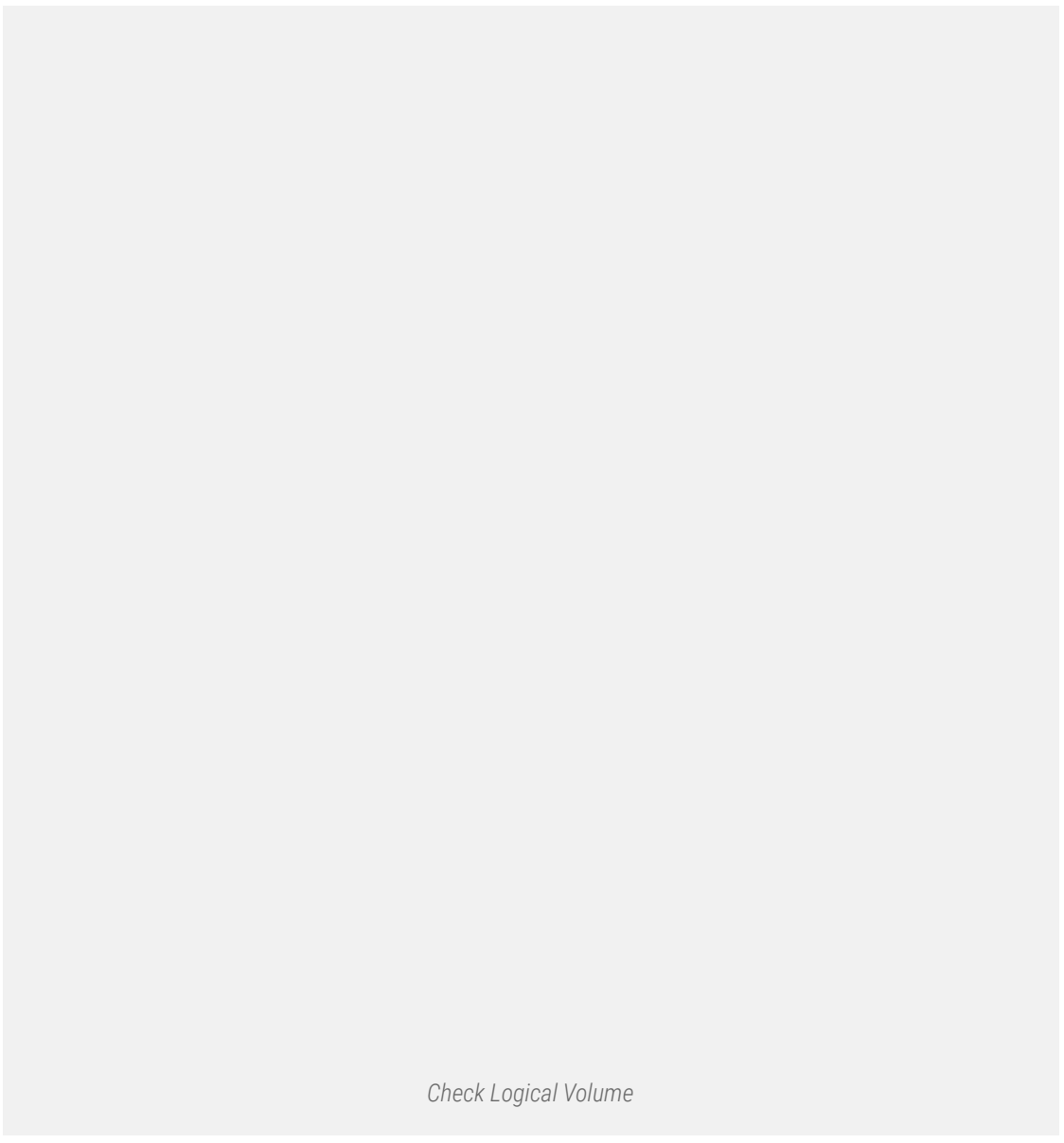
```
# vgcreate -s 32M vg_thin /dev/sdb1
```



Listing Volume Group

Next, check for the size of Logical volume availability, before creating the thin pool and volumes.

```
# vgs
# lvs
```



Check Logical Volume

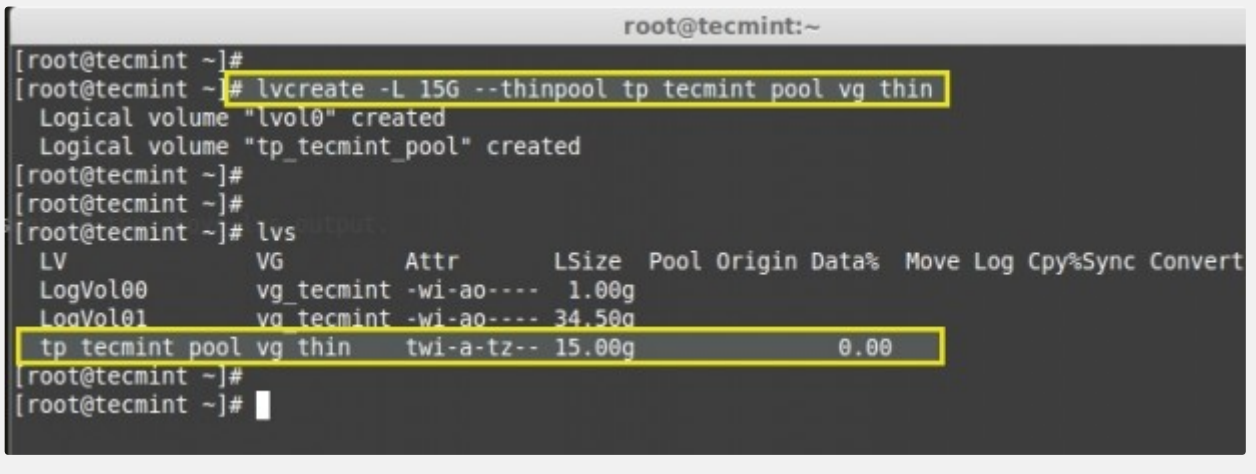
We can see there is only default logical volumes for file-system and swap is present in the above lvs output.

Creating a Thin Pool

To create a Thin pool for 15GB in volume group (vg_thin) use the following command.

```
# lvcreate -L 15G --thinpool tp_tecmint_pool vg_thin
```

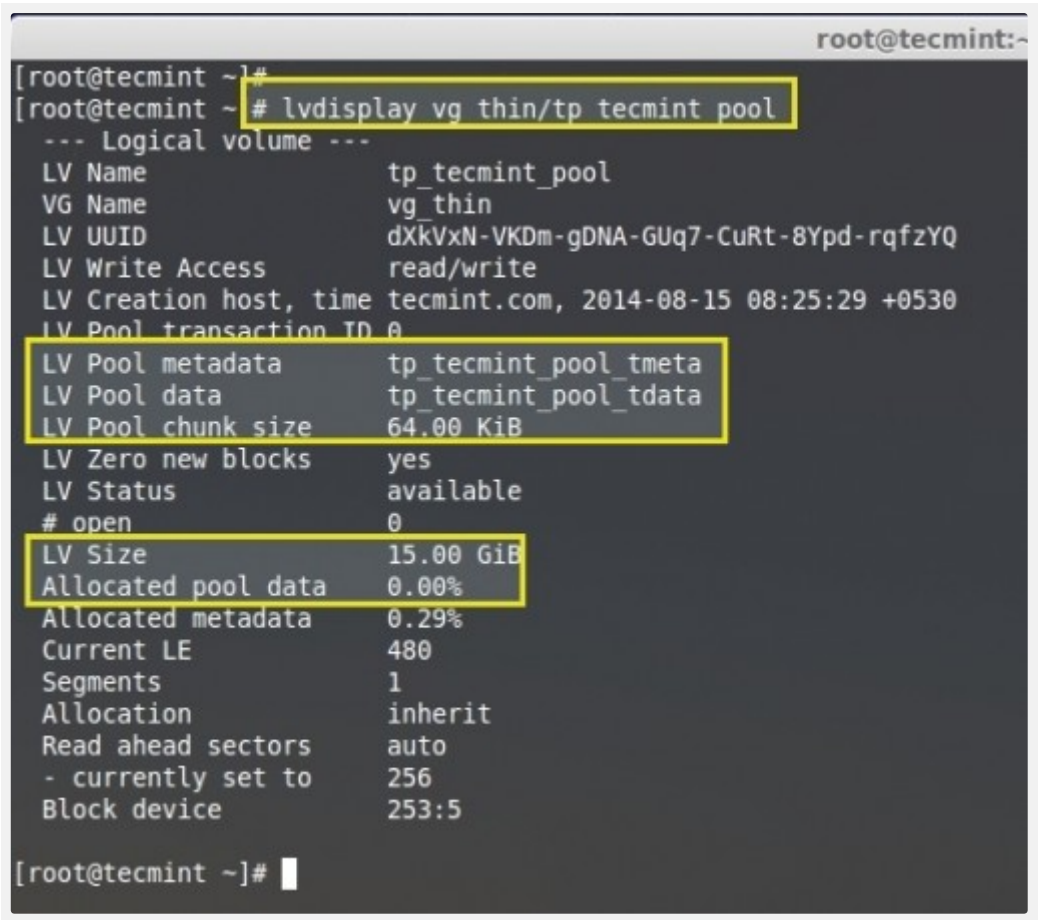
- -L – Size of volume group
- –thinpool – To o create a thinpool
- tp_tecmint_pool– Thin pool name
- vg_thin – Volume group name were we need to create the pool



Create Thin Pool

To get more detail we can use the command 'lvdisplay'.

```
# lvdisplay vg_thin/tp_tecmint_pool
```



Logical Volume Information

Here we haven't created Virtual thin volumes in this thin-pool. In the image we can see Allocated pool data showing **0.00%**.

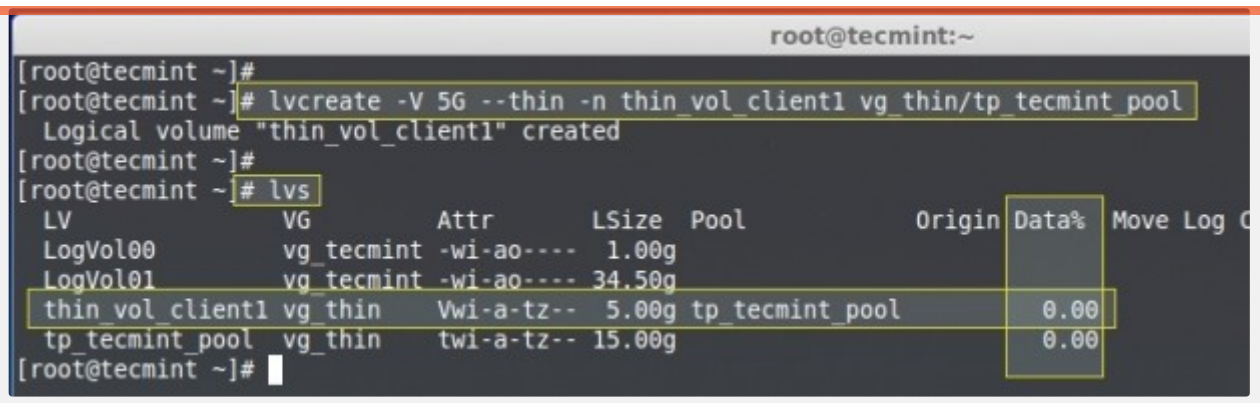
Creating Thin Volumes

Now we can define thin volumes inside the thin pool with the help of 'lvcreate' command with option -V (Virtual).

```
# lvcreate -V 5G --thin -n thin_vol_client1 vg_thin/tp_tecmint_pool
```

I have created a Thin virtual volume with the name of **thin_vol_client1** inside the **tp_tecmint_pool** in my **vg_thin** volume group. Now, list the logical volumes using below command.

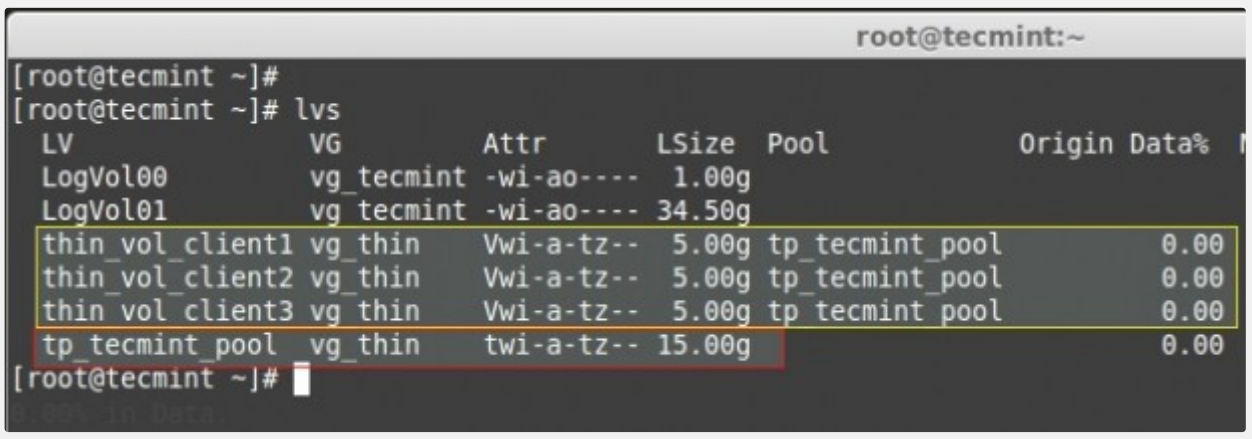
```
# lvs
```



List Logical Volumes

Just now, we have created the thin volume above, that's why there is no data showing i.e. **0.00%M**.

Fine, let me create **2** more Thin volumes for other 2 clients. Here you can see now there are **3** thin volumes created under the pool (**tp_tecmint_pool**). So, from this point, we came to know that I have used all 15GB pool.



Create Thin Volumes

Creating File System

Now, create mount points and mount these three thin volumes and copy some files in it using below commands.

```
# mkdir -p /mnt/client1 /mnt/client2 /mnt/client3
```

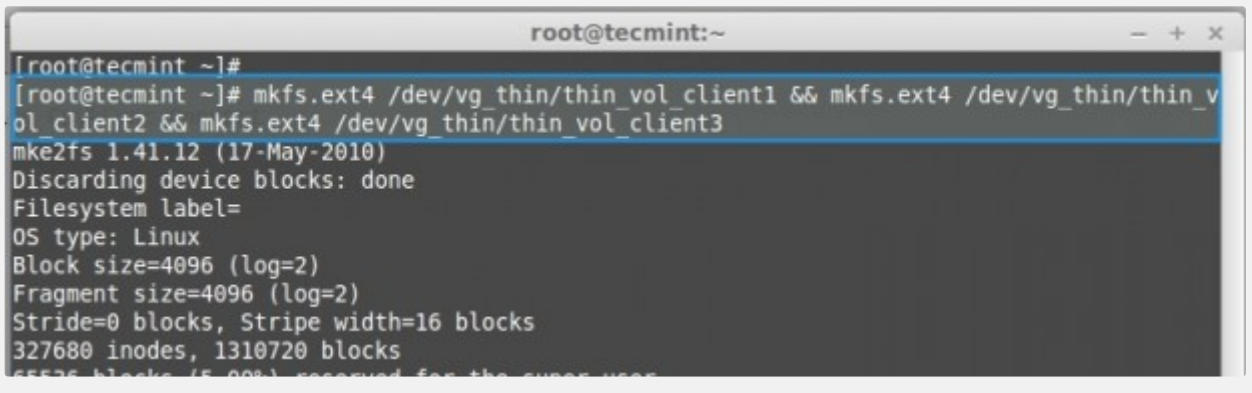
List the created directories.

```
# ls -l /mnt/
```

Creating Mount Points

Create the file system for these created thin volumes using ‘mkfs’ command.

```
# mkfs.ext4 /dev/vg_thin/thin_vol_client1 && mkfs.ext4 /dev/vg_thin/thin_vol_client2 && mkfs.ext4 /dev/vg_thin/thin_
```



Create File System

Mount all three client volumes to the created mount point using ‘mount’ command.

```
# mount /dev/vg_thin/thin_vol_client1 /mnt/client1/ && mount /dev/vg_thin/thin_vol_client2 /mnt/client2/ && mount /
```

List the mount points using ‘df’ command.

```
# df -h
```

```
root@tecmint:~
[root@tecmint ~]#
[root@tecmint ~]# mount /dev/vg_thin/thin_vol_client1 /mnt/client1/ && mount /dev/vg_thin/
thin_vol_client2 /mnt/client2/ && mount /dev/vg_thin/thin_vol_client3 /mnt/client3/
[root@tecmint ~]#
[root@tecmint ~]# df -h
Filesystem                          Size  Used Avail Use% Mounted on
/dev/mapper/vg_tecmint-LogVol01      34G  2.2G   31G   7% /
tmpfs                               939M     0  939M   0% /dev/shm
/dev/vda1                           485M   39M  421M   9% /boot
/dev/mapper/vg_thin-thin_vol_client1  5.0G  138M  4.6G   3% /mnt/client1
/dev/mapper/vg_thin-thin_vol_client2  5.0G  138M  4.6G   3% /mnt/client2
/dev/mapper/vg_thin-thin_vol_client3  5.0G  138M  4.6G   3% /mnt/client3
[root@tecmint ~]#
```

Print Mount Points

Here, we can see all the 3 clients volumes are mounted and therefore only **3%** of data are used in every clients volumes. So, let's add some more files to all 3 mount points from my desktop to fill up some space.

```
babin@          /media/babin/       /Linux ISO's $ scp proxmox-ve_3.0-0428106c-13.iso
root@192.168.0.200:/mnt/client1
root@192.168.0.200's password:
proxmox-ve_3.0-0428106c-13.iso                100%  458MB  45.8MB/s   00:10
babin@          /media/babin/       /Linux ISO's $ scp linuxmint-17-cinnamon-dvd-64bit
.iso root@192.168.0.200:/mnt/client2
root@192.168.0.200's password:
linuxmint-17-cinnamon-dvd-64bit.iso           100% 1227MB  27.3MB/s   00:45
babin@          /media/babin/       /Linux ISO's $ scp sol-10-u6-ga1-x86-dvd.iso root@
192.168.0.200:/mnt/client3
root@192.168.0.200's password:
sol-10-u6-ga1-x86-dvd.iso
```

Add Files To Volumes

Now list the mount point and see the space used in every thin volumes & list the thin pool to see the size used in pool.

```
# df -h
# lvdisplay vg_thin/tp_tecmint_pool
```

```
[root@tecmint ~]# df -h
Filesystem                          Size  Used Avail Use% Mounted on
/dev/mapper/vg_tecmint-LogVol01      34G  2.2G   31G   7% /
tmpfs                               939M     0  939M   0% /dev/shm
/dev/vda1                           485M   39M  421M   9% /boot
/dev/mapper/vg_thin-thin_vol_client1  5.0G  596M  4.1G  13% /mnt/client1
/dev/mapper/vg_thin-thin_vol_client2  5.0G  1.4G  3.4G  29% /mnt/client2
/dev/mapper/vg_thin-thin_vol_client3  5.0G  2.3G  2.4G  49% /mnt/client3
[root@tecmint ~]#
[root@tecmint ~]# lvdisplay vg_thin/tp_tecmint_pool
  --- Logical volume ---
  LV Name                tp_tecmint_pool
  VG Name                vg_thin
  LV UUID                dXkVxN-VKDm-gDNA-GUq7-CuRt-8Ypd-rqfzYQ
  LV Write Access        read/write
  LV Creation host, time tecmint.com, 2014-08-15 08:25:29 +0530
  LV Pool transaction ID 3
  LV Pool metadata       tp_tecmint_pool_tmeta
  LV Pool data           tp_tecmint_pool_tdata
  LV Pool chunk size     64.00 KiB
  LV Zero new blocks     yes
  LV Status              available
  # open                 0
  LV Size                15.00 GiB
  Allocated pool data    29.41%
  Allocated metadata     7.03%
  Current LE             480
  Segments               1
  Allocation             inherit
  Read ahead sectors     auto
  - currently set to     256
  Block device           253:5

[root@tecmint ~]#
```

Check Mount Point Size

```
root@tecmint:~
[root@tecmint ~]#
[root@tecmint ~]# lvs
  LV              VG         Attr       LSize  Pool           Origin Data%  Move
  LogVol00        vg_tecmint -wi-ao----  1.00g
  LogVol01        vg_tecmint -wi-ao---- 34.50g
  thin_vol_client1 vg_thin   Vwi-aotz--  5.00g tp_tecmint_pool        13.05
  thin_vol_client2 vg_thin   Vwi-aotz--  5.00g tp_tecmint_pool        28.07
  thin_vol_client3 vg_thin   Vwi-aotz--  5.00g tp_tecmint_pool        47.11
  tp_tecmint_pool  vg_thin   twi-a-tz-- 15.00g                       29.41
[root@tecmint ~]#
```

Check Thin Pool Size

The above command shows, the three mount pints along with their sizes in percentage.

```
13% of datas used out of 5GB for client1
29% of datas used out of 5GB for client2
49% of datas used out of 5GB for client3
```

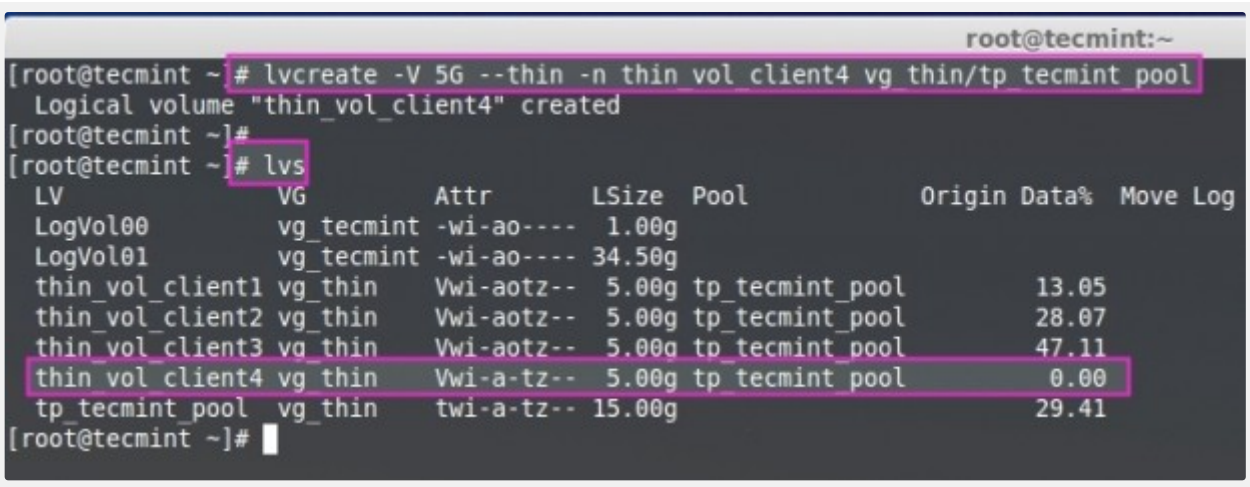
While looking into the thin-pool we can see only **30%** of data is written totally. This is the total of above three clients virtual volumes.

Over Provisioning

Now the **4th** client came to me and asked for 5GB storage space. Can I give? Because I had already given 15GB Pool to 3 clients. Is it possible to give 5GB more to another client? Yes it is possible to give. This is when we use **Over Provisioning**, which means giving the space more than what I have.

Let me create 5GB for the 4th Client and verify the size.

```
# lvcreate -V 5G --thin -n thin_vol_client4 vg_thin/tp_tecmint_pool
# lvs
```

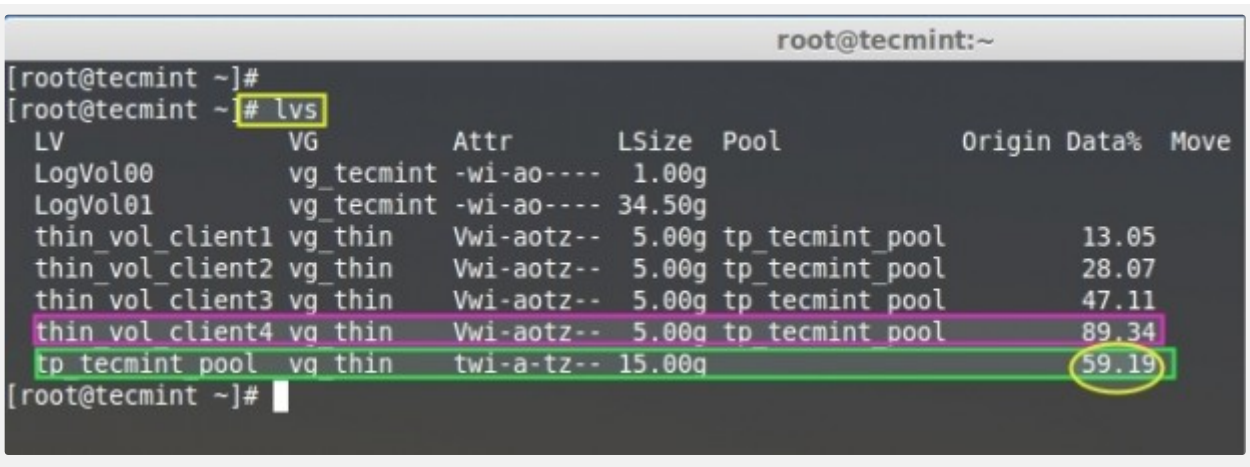


Create thin Storage

I have only 15GB size in pool, but I have created 4 volumes inside thin-pool up-to 20GB. If all four clients start to write data to their volumes to fill up the pace, at that time, we will face critical situation, if not there will no issue.

Now I have created file system in **thin_vol_client4**, then mounted under **/mnt/client4** and copy some files in it.

```
# lvs
```



Verify Thin Storage

We can see in the above picture, that the total used size in newly created client 4 up-to **89.34%** and size of thin pool as **59.19%** used. If all these users are not writing badly to volume it will be free from overflow, drop. To avoid the overflow we need to extend the thin-pool size.

Important: Thin-pools are just a logical volume, so if we need to extend the size of thin-pool we can use the same command like, we've used for logical volumes extend, but we can't reduce the size of thin-pool.

```
# lvextend
```

Here we can see how to extend the logical thin-pool (**tp_tecmint_pool**).

```
# lvextend -L +15G /dev/vg_thin/tp_tecmint_pool
```

Extend Thin Storage

Next, list the thin-pool size.

```
# lvs
```

```
root@tecmint:~
[root@tecmint ~]#
[root@tecmint ~]# lvs
  LV              VG         Attr       LSize  Pool           Origin Data%  M
  LogVol00        vg_tecmint -wi-ao----  1.00g
  LogVol01        vg_tecmint -wi-ao---- 34.50g
  thin_vol_client1 vg_thin    Vwi-a-tz--  5.00g tp_tecmint_pool         13.05
  thin_vol_client2 vg_thin    Vwi-a-tz--  5.00g tp_tecmint_pool         28.07
  thin_vol_client3 vg_thin    Vwi-a-tz--  5.00g tp_tecmint_pool         47.11
  thin_vol_client4 vg_thin    Vwi-a-tz--  5.00g tp_tecmint_pool         89.34
  tp_tecmint_pool  vg_thin    twi-a-tz-- 30.00g                        29.59
[root@tecmint ~]#
```

Verify Thin Storage

Earlier our **tp_tecmint_pool** size was 15GB and 4 thin volumes which was over Provision by 20GB. Now it has extended to 30GB so our over Provisioning has been normalized and thin volumes are free from overflow, drop. This way you can add ever more thin volumes to the pool.

Here, we have seen how to create a thin-pool using a large size of volume group and create thin-volumes inside a thin-pool using Over-Provisioning and extending the pool. In the next article we will see how to setup a lvm Striping.