A Beginner's Guide To LVM

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On this page

This guide shows how to work with LVM (Logical Volume Management) on Linux. It also describes how to use LVM together with RAID1 in an extra chapter. As LVM is a rather abstract topic, this article comes with a Debian Etch VMware image that you can download and start, and on that Debian Etch system you can run all the commands I execute here and compare your results with mine. Through this practical approach you should get used to LVM very fast.

However, I do not issue any guarantee that this tutorial will work for you!

1 Preliminary Note

This tutorial was inspired by two articles I read:

- http://www.linuxdevcenter.com/pub/a/linux/2006/04/27/managing-disk-space-with-lvm.html
- http://www.debian-administration.org/articles/410

These are great articles, but hard to understand if you've never worked with LVM before. That's why I have created this Debian Etch VMware image that you can download and run in VMware Server or VMware Player (see http://www.howtoforge.com/import_vmware_images to learn how to do that).

I installed all tools we need during the course of this guide on the Debian Etch system (by running

```
apt-get install lvm2 dmsetup mdadm reiserfsprogs xfsprogs
```

) so you don't need to worry about that.

The Debian Etch system's network is configured through DHCP, so you don't have to worry about conflicting IP addresses. The root password is *howtoforge*. You can also connect to that system with an SSH client like PuTTY. To find out the IP address of the Debian Etch system, run

```
ifconfig
```

The system has six SCSI hard disks, */dev/sda* - */dev/sdf*. */dev/sda* is used for the Debian Etch system itself, while we will use */dev/sdb* - */dev/sdf* for LVM and RAID. */dev/sdb* - */dev/sdf* each have 80GB of disk space. In the beginning we will act as if each has only 25GB of disk space (thus using only 25GB on each of them), and in the course of the tutorial we will "replace" our 25GB hard disks with 80GB hard disks, thus demonstrating how you can replace small hard disks with bigger ones in LVM.

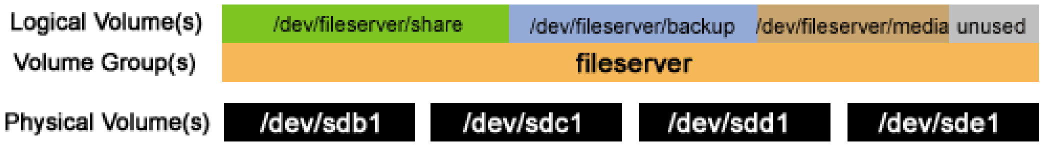
The article http://www.linuxdevcenter.com/pub/a/linux/2006/04/27/managing-disk-space-with-lvm.html uses hard disks of 250GB and 800GB, but some commands such as *pvmove* take a long time with such hard disk sizes, that's why I decided to use hard disks of 25GB and 80GB (that's enough to understand how LVM works).

1.1 Summary

Download this Debian Etch VMware image (~310MB) and start it like this. Log in as root with the password *howtoforge*.

2 LVM Layout

Basically LVM looks like this:



You have one or more physical volumes (*/dev/sdb1* - */dev/sde1* in our example), and on these physical volumes you create one or more volume groups (e.g. *fileserver*), and in each volume group you can create one or more logical volumes. If you use multiple physical volumes, each logical volume can be bigger than one of the underlying physical volumes (but of course the sum of the logical volumes cannot exceed the total space offered by the physical volumes).

It is a good practice to not allocate the full space to logical volumes, but leave some space unused. That way you can enlarge one or more logical volumes later on if you feel the need for it.

In this example we will create a volume group called *fileserver*, and we will also create the logical volumes */dev/fileserver/share*, */dev/fileserver/backup*, and */dev/fileserver/media* (which will use only half of the space offered by our physical volumes for now - that way we can switch to RAID1 later on (also described in this tutorial)).

3 Our First LVM Setup

Let's find out about our hard disks:

```
fdisk -l
```

The output looks like this:

```
server1:~# fdisk -l

Disk /dev/sda: 21.4 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          18      144553+  83  Linux
/dev/sda2              19        2450    19535040   83  Linux
/dev/sda4            2451        2610     1285200   82  Linux swap / Solar
is

Disk /dev/sdb: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdb doesn't contain a valid partition table

Disk /dev/sdc: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdc doesn't contain a valid partition table

Disk /dev/sdd: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdd doesn't contain a valid partition table

Disk /dev/sde: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sde doesn't contain a valid partition table

Disk /dev/sdf: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdf doesn't contain a valid partition table
```

There are no partitions yet on */dev/sdb* - */dev/sdf*. We will create the partitions */dev/sdb1*, */dev/sdc1*, */dev/sdd1*, and */dev/sde1* and leave */dev/sdf* untouched for now. We act as if our hard disks had only 25GB of space instead of 80GB for now, therefore we assign 25GB to */dev/sdb1*, */dev/sdc1*, */dev/sdd1*, and */dev/sde1*:

```
fdisk /dev/sdb
```

```
server1:~# fdisk /dev/sdb

The number of cylinders for this disk is set to 10443.
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): <-- m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   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
Command action
   e   extended
   p   primary partition (1-4)
<-- p
Partition number (1-4): <-- 1
First cylinder (1-10443, default 1): <-- <ENTER>
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-10443, default 10443): <--
+25000M

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

 0  Empty           1e  Hidden W95 FAT1 80  Old Minix       be  Solaris boo
t
 1  FAT12           24  NEC DOS         81  Minix / old Lin bf  Solaris
 2  XENIX root      39  Plan 9          82  Linux swap / So c1  DRDOS/sec
(FAT-
 3  XENIX usr       3c  PartitionMagic  83  Linux           c4  DRDOS/sec
(FAT-
 4  FAT16 <32M      40  Venix 80286     84  OS/2 hidden C:  c6  DRDOS/sec
(FAT-
 5  Extended        41  PPC PReP Boot   85  Linux extended  c7  Syrinx
 6  FAT16           42  SFS             86  NTFS volume set da  Non-
FS data
 7  HPFS/NTFS       4d  QNX4.x          87  NTFS volume set db  CP/M / CTO
S / .
```

```
 8  AIX             4e  QNX4.x 2nd part 88  Linux plaintext de  Dell Utili
ty
 9  AIX bootable    4f  QNX4.x 3rd part 8e  Linux LVM       df  BootIt
 a  OS/2 Boot Manag 50  OnTrack DM      93  Amoeba          e1  DOS access
 b  W95 FAT32       51  OnTrack DM6 Aux 94  Amoeba BBT      e3  DOS R/O
 c  W95 FAT32 (LBA) 52  CP/M            9f  BSD/OS          e4  SpeedStor
 e  W95 FAT16 (LBA) 53  OnTrack DM6 Aux a0  IBM Thinkpad hi eb  BeOS fs
 f  W95 Ext'd (LBA) 54  OnTrackDM6      a5  FreeBSD         ee  EFI GPT
10  OPUS            55  EZ-Drive        a6  OpenBSD         ef  EFI (FAT-
12/16/
11  Hidden FAT12    56  Golden Bow      a7  NeXTSTEP        f0  Linux/PA-
RISC b
12  Compaq diagnost 5c  Priam Edisk     a8  Darwin UFS      f1  SpeedStor
14  Hidden FAT16 <3 61  SpeedStor       a9  NetBSD          f4  SpeedStor
16  Hidden FAT16    63  GNU HURD or Sys ab  Darwin boot     f2  DOS second
ary
17  Hidden HPFS/NTF 64  Novell Netware  b7  BSDI fs         fd  Linux raid
 auto
18  AST SmartSleep  65  Novell Netware  b8  BSDI swap       fe  LANstep
1b  Hidden W95 FAT3 70  DiskSecure Mult bb  Boot Wizard hid ff  BBT
1c  Hidden W95 FAT3 75  PC/IX
Hex code (type L to list codes): <-- 8e
Changed system type of partition 1 to 8e (Linux LVM)

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

Now we do the same for the hard disks /dev/sdc - /dev/sde:

```
fdisk /dev/sdc
fdisk /dev/sdd
fdisk /dev/sde
```

Then run

```
fdisk -l
```

again. The output should look like this:

```
server1:~# fdisk -l

Disk /dev/sda: 21.4 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          18      144553+  83  Linux
/dev/sda2              19        2450    19535040   83  Linux
/dev/sda4            2451        2610     1285200   82  Linux swap / Solar
is

Disk /dev/sdb: 85.8 GB, 85899345920 bytes
```

```
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sdc: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdc1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sdd: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdd1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sde: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sdf: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/sdf doesn't contain a valid partition table
```

Now we prepare our new partitions for LVM:

```
pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
```

```
server1:~# pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
  Physical volume "/dev/sdb1" successfully created
  Physical volume "/dev/sdc1" successfully created
  Physical volume "/dev/sdd1" successfully created
  Physical volume "/dev/sde1" successfully created
```

Let's revert this last action for training purposes:

```
pvremove /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
```

```
server1:~# pvremove /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
  Labels on physical volume "/dev/sdb1" successfully wiped
  Labels on physical volume "/dev/sdc1" successfully wiped
  Labels on physical volume "/dev/sdd1" successfully wiped
  Labels on physical volume "/dev/sde1" successfully wiped
```

Then run

```
pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
```

again:

```
server1:~# pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
  Physical volume "/dev/sdb1" successfully created
  Physical volume "/dev/sdc1" successfully created
  Physical volume "/dev/sdd1" successfully created
  Physical volume "/dev/sde1" successfully created
```

Now run

```
pvdisplay
```

to learn about the current state of your physical volumes:

```
server1:~# pvdisplay
  --- NEW Physical volume ---
  PV Name               /dev/sdb1
  VG Name
  PV Size               23.29 GB
  Allocatable           NO
  PE Size (KByte)       0
  Total PE              0
  Free PE               0
  Allocated PE          0
  PV UUID               G8lu2L-Hij1-NVde-sOKc-OoVI-fadg-Jd1vyU

  --- NEW Physical volume ---
  PV Name               /dev/sdc1
  VG Name
  PV Size               23.29 GB
  Allocatable           NO
  PE Size (KByte)       0
  Total PE              0
  Free PE               0
  Allocated PE          0
  PV UUID               40GJyh-IbsI-pzhn-TDRq-PQ3l-3ut0-AVSE4B

  --- NEW Physical volume ---
  PV Name               /dev/sdd1
  VG Name
  PV Size               23.29 GB
  Allocatable           NO
  PE Size (KByte)       0
  Total PE              0
  Free PE               0
  Allocated PE          0
  PV UUID               4mU63D-4s26-uL00-r0pO-Q0hP-mvQR-2YJN5B

  --- NEW Physical volume ---
  PV Name               /dev/sde1
  VG Name
  PV Size               23.29 GB
  Allocatable           NO
  PE Size (KByte)       0
  Total PE              0
  Free PE               0
  Allocated PE          0
  PV UUID               3upcZc-4eS2-h4r4-iBKK-gZJv-AYt3-EKdRK6
```

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From: Reply

First of all i'll shall congratulate you for the great guide.

I'll rather call it a "Introduction Guide" than a "Beginner Guide" , never than less it's very usefull.

Instead of having LVM on top ou those 2 RAID-1 devices and considering the disks capacity, you can use 4 disk RAID-5 system thus have more 25% usable space.

This will make the process more complex but you will be rewarded with more 80GB ;)

This must be done after you replace the first 2 Harddrives.

Initilize only one disk, let's say /dev/sdc

```
pvcreate /dev/sdc
```

Add the 80GB disk to the volume

```
vgextend fileserver /dev/sdc
```

pvmove all all volumes from the md[01] devices to the 80GB disk

```
pvmove /dev/md0 /dev/md1
```

note: this is very slow better use -v for periodic update

Remove all other devices from the volume

```
vgreduce fileshare /dev/md0 /dev/md1
```

Reboot and replace the disks

Initialize the new disks for raid

```
fdisk /dev/sdb
fdisk /dev/sdd
fdisk /dev/sde
```

create the raid-5 with one missing device

```
mdadm --create /dev/md0 -a -l 5 -n 4 /dev/sdb1 /dev/sdd1 /dev/sde1 missing
```

Add the new md0 device to the Volume

```
pvcreate /dev/md0 && vgextend fileserver /dev/md0
```

Move the data from the 80GB disk

```
pvmove /dev/sdc
```

(wait)

Remove the 80GB disk from the volume group

```
vgreduce fileshare /dev/sdc
```

Initialize the disk for RAID

fdisk /dev/sdc and change the type to fd (Linux raid autodetect)

Add the disk to the RAID md0

```
mdadm --manage /dev/md0 -add /dev/sdc1
```

Wait for full sync

```
cat /proc/mdstat
```

And you are now with a 240GB RAID-5 volume

```
df -h
```

A 4 disk RAID-5 is not as performant as the RAID-1 but that's the trade off .

José Borges Ferreira

From: lingeswaran Reply

Step by Step Tutorial available in UnixArena.
http://www.unixarena.com/2013/08/how-to-install-lvm-on-linux-and-disk.html
http://www.unixarena.com/2013/08/linux-lvm-volume-group-operations.html
http://www.unixarena.com/2013/08/linux-lvm-volume-creation-operation.html

From: Reply

Be aware that when you initialize a device into a Volume or into a md RAID some unique IDs are assign and written into the first sector of that device. When you do some testing on some virtual enviorment such as VMWare you may ran into this problem. So as a part of the initilization process you better do a
#dd if=/dev/zero of=/dev/diskname bs=1k count=1
#blockdev --rereadpt /dev/sdc
before everything else.

José Borges Ferreira

From: Reply

Source /dev/sda, destination /dev/sdb
sfdisk -d /dev/sda|sfdisk /dev/sdb

From: Reply

I'm very sorry if I overlooked a note or a posting on this, but how do I set the CLI keyboard layout to qwerty (us 101/104) on Debian Etch.
I immediately ran into problems, it seems your vmware image was made using a german keyboard layout (?)

Thanx!

From: admin Reply

Run
apt-get install console-data console-tools debconf
dpkg-reconfigure console-data
or connect ot the virtual machine with an SSH client such as PuTTY. In PuTTY you use your client machine's keymap.

From: tonyg Reply

I just wanted to say THANK YOU for this resource. I've been referring back to this article for the past 2 years now, it's saved my butt, and my data, a few times now. Thanks!!!

From: Sun_Blood Reply

Just one word. GREAT!
This was a perfect start for me to learn on hot to use LVM. Now I'll setup my new NAS =)

From: Anonymous Reply

Out of the 6 drives on the image - drives 3 and 4 appear to be corrupt on my VM VirtualBox Manager.

From: Mark Reply

What a great introduction to LVM! Thank you so much for taking the trouble to put all this together.

From: Ramesh Reply

Thank you very much for the Excellent article. I appreciate your effort.

From: Anonymous Reply

Thank you for this guide. I just ran into lvm at work and this is extremely helpful.
I am trying out the vm you provided for practice. Login info in howtoforge is incorrect.
the user is: root
password : howtoforge

From: Anonymous Reply

I wanted to say thank you for the great and useful guide. On the internet we should find articles like this. Well done!!!

From: pointer2null Reply

I've just had a quick read of the tutorial and will run through it soon.
One thing I do notice is you give very clear instructions on how to execute each stage, but no explanation of why it is being done(and to a smaller degree, or what is accomplished in each step).

Still, it's a valuable resource. :)

> **From:** Anonymous Reply
>
> Try to use EasyRSH in Google Play - it's quick reference guide for Solaris, HPUX, Redhat OSs

From: albert gharbi Reply

Thank a lots. very excellent.that was very usefull and practical.

From: Rich Reply

Excellent tuorial. There seems to be so little 'easy' documentation out there for managing disks and LVs in Linux. This tutorial is perfect for those that want to get started and understand the process rather than copy/paste snippets from other forums. Great job!

From: John Snow Reply

Thank you very much, as a newer admin to the unix world I was struggling with this concept, but this made it extremely clear.

From: zensan Reply

Creating one Volume Group over 4 physical devices is SOOO WROONG! Admin who do this on server without RAID Array for those physical devices should've been thrown into abyss where as an punishment would be fixing byte by byte such volumes for eternity.
However this tutorial is useful example for creating LVM, the basic concept in chapter 2 should have been removed in favor of concept from chapter 7 (or simply put warning there "do not do this except for training!"). I bet most of newbie admins creating layout from chapter 2 will not change this later (until will be too late and massive data loss happened).

From: KBR Reply

Very helpful. Thanks

From: Keith Reply

The command sequence

```
    mv /etc/fstab /etc/fstab_orig
    cat /dev/null > /etc/fstab
    vi /etc/fstab
```

can be shortened to

```
    cp /etc/fstab /etc/fstab_orig
    vi /etc/fstab
```

Doing so also has the benefit that you only need to append the /etc/fstab with

```
    /dev/fileserver/share   /var/share     ext3       rw,noatime    0 0
    /dev/fileserver/backup    /var/backup      xfs        rw,noatime    0 0
    /dev/fileserver/media    /var/media      reiserfs   rw,noatime    0 0
```

From: Keith Reply

Both lvreduce and lvextend have the -r, --resizefs option [Resize underlying filesystem together with the logical volume using fsadm(8)].

```
    lvextend -L50G /dev/fileserver/share
    e2fsck -f /dev/fileserver/share
    resize2fs /dev/fileserver/share
```

can be shortened with the just:

```
    lvextend -r -L50G /dev/fileserver/share
```

From: Nathan Reply

Thank you so much for this tutorial. I have spent the last 3 days pulling my hair out trying to get lvm to work properly and learn it in general. I followed probably 20 howto's and posted in 3 forums before I found this guide. This was written EXACTLY the way I learn best. doing it repetitively and systematically. I wish I would have found this sooner. I was beyond frustrated. Thank you again!

From: ThaSwede Reply

Thank you Falko for a great guide that helped me after 3 days of complete and utter frustration wrapping my head around this simple set of tasks. I just wasnt getting it until I found this guide. Now Im a LVM ninja lol not really but I was able to setup my dev system using your instructions after almost giving up from previous howto's. Your style of instruction apparently works for me specifically.
Appreciate the time and effort you put into it!
~Nathan~

From: john Reply

Her Im sorry that Windows are the winner bye miles. Follow many guides but all end with only root can write to a LVM-disk. I cant be root in GU and dont share.

From: Ad Reply

Great guide, thank you :)

From: Martin Reply

Thanks, this was one hell of a tutorial. I just have one question: is there any downside to having multiple RAIDs using the same devices? Any performance penalty or space waste? It's probably OK for two but what if I had more, like 10 or 20?

From: Karthik Reply

Well explained and very easy to understand.

From: Hans Linkels Reply

Thanks for this great tutorial. I have tried most steps on a LVM created for this purpose.
Showing how to change things and then how to reverse those changes is excellent. The reader understands what can be reversed and what not.
Also the step by step explanation in the correct sequence is very easy to follow. It is much better than just a description what what can be done.

From: Prad Reply

Excellent tutorial, thank you !!

From: sudhams reddy Reply

It helped a lot in troubleshooting and as well as o learn the basic to high level of LVM partiontion...
Keep doing that!!!!

From: apr Reply

thank you

From: Apona K. Reply

Very nice guide! But it lacks any mentioning of encryption. Encryption should be everywhere by default by now... What about LUKS / dm-crypt? :)

From: David Reply

Great howto!
One recipee I would like to add (because it took me a while figuring this out myself) is how to enlarge your volumes after increasing the size of a virtual additional disk in VMWare (.e.g. in a use case where this disk is used for data and the data is growing). In the situation below the physical volume is on the first partition of the disk labeled as sdb, so adapt for your specific situation:

- Backup your data- Increase size of disk in VMWare- Restart your VM - unmount the volume on the changed disk if necessary- sudo parted /dev/sdb resizepart 1 100%- sudo pvresize /dev/sdb1- sudo lvextend -l +100%FREE /dev/fileserver/share- sudo e2fsck -f /dev/fileserver/share- sudo resize2fs /dev/fileserver/share- remount /dev/fileserver/share - check increased size with df -h
Have fun,
David

From: Ertugrul Dur Reply

You are literally the best man! I truly appreciate the work! No one or no other book has clarified and solidified the LVM concept better than you. I am in the process of buying a new server and want to set up RAID with LVM and will definitely use your guide for assistance. Incredible Work! I would really love for you to continue writing tutorials on other subjects in such clarity and detail! Thank you so much! If you had a book, I would be your first customer!

From: jeff knapp Reply

The etch download doesn't work

From: Gurusamy Reply

Thank you very much for this though tutorial. Helped alot!

From: James Coleman Reply

Useful guide on shrinking logical volume. Thanks!
Just a note on english verb shrink - it is irregular - so past tense is "We shrank" or "We have shrunk".
https://en.wiktionary.org/wiki/shrink#Verb

From: Hans Linkels Reply

Thank you for this article. It should serve as an example for many others. 95% of all articles, blogs and HowTo's present a simple step-by-step guide about how to get to a solution. Most of them are even copies of other ones, containing exactly the same information.
What most of those articles lack is an explanation of how and why, and most important, how to recover from a mistake or an error. If everything goes well, you don't need that many documentation anyway.
By describing in this article how LVM is built-up step by step (not a step-by-step guide!), tearing down steps and than rebuilding them this gives a perfect insight about what can be done in every step of LVM building.
I have this article as eternal bookmark in my browser and I use it over and over again.

From: linuxito Reply

how to know the equivalen 40gb = 10485760

From: Peter Reply

I have very important question, since no one has asked that: do all the partitions have to be completely empty? Or let me rephrase that: can do everything written in the article not worrying about what on the physical volumes? I'm just a little bit worried wouldn't I kill my system and destroy all the files by messing them as you described.

From: Vince Reply

Excellent documentation, not even needing this right now but was an enjoyable and followable read.

Tutorials › A Beginner's Guide To LVM

Tutorial Info

Author:	falko
Tags:	linux, other, storage

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Now let's create our volume group *fileserver* and add */dev/sdb1* - */dev/sde1* to it:

```
vgcreate fileserver /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
```

```
server1:~# vgcreate fileserver /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
  Volume group "fileserver" successfully created
```

Let's learn about our volume groups:

```
vgdisplay
```

```
server1:~# vgdisplay
  --- Volume group ---
  VG Name               fileserver
  System ID
  Format                lvm2
  Metadata Areas        4
  Metadata Sequence No  1
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                0
  Open LV               0
  Max PV                0
  Cur PV                4
  Act PV                4
  VG Size               93.14 GB
  PE Size               4.00 MB
  Total PE              23844
  Alloc PE / Size       0 / 0
  Free  PE / Size       23844 / 93.14 GB
  VG UUID               3Y1WVF-BLET-QkKs-Qnrs-SZxI-wrNO-dTqhFP
```

Another command to learn about our volume groups:

```
vgscan
```

```
server1:~# vgscan
  Reading all physical volumes.  This may take a while...
  Found volume group "fileserver" using metadata type lvm2
```

For training purposes let's rename our volumegroup `fileserver` into `data`:

```
vgrename fileserver data
```

```
server1:~# vgrename fileserver data
  Volume group "fileserver" successfully renamed to "data"
```

Let's run `vgdisplay` and `vgscan` again to see if the volume group has been renamed:

```
vgdisplay
```

```
server1:~# vgdisplay
  --- Volume group ---
  VG Name               data
  System ID
  Format                lvm2
  Metadata Areas        4
  Metadata Sequence No  2
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                0
  Open LV               0
  Max PV                0
  Cur PV                4
  Act PV                4
  VG Size               93.14 GB
  PE Size               4.00 MB
  Total PE              23844
  Alloc PE / Size       0 / 0
  Free  PE / Size       23844 / 93.14 GB
  VG UUID               3Y1WVF-BLET-QkKs-Qnrs-SZxI-wrNO-dTqhFP
```

```
vgscan
```

```
server1:~# vgscan
  Reading all physical volumes.  This may take a while...
  Found volume group "data" using metadata type lvm2
```

Now let's delete our volume group `data`:

```
vgremove data
```

```
server1:~# vgremove data
  Volume group "data" successfully removed
```

```
vgdisplay
```

No output this time:

```
server1:~# vgdisplay
```

```
vgscan
```

```
server1:~# vgscan
  Reading all physical volumes.  This may take a while...
```

Let's create our volume group `fileserver` again:

```
vgcreate fileserver /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
```

```
server1:~# vgcreate fileserver /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
  Volume group "fileserver" successfully created
```

Next we create our logical volumes `share` (40GB), `backup` (5GB), and `media` (1GB) in the volume group `fileserver`. Together they use a little less than 50% of the available space (that way we can make use of RAID1 later on):

```
lvcreate --name share --size 40G fileserver
```

```
server1:~# lvcreate --name share  --size 40G fileserver
  Logical volume "share" created
```

```
lvcreate --name backup --size 5G fileserver
```

```
server1:~# lvcreate --name backup --size  5G fileserver
  Logical volume "backup" created
```

```
lvcreate --name media --size 1G fileserver
```

```
server1:~# lvcreate --name media  --size  1G fileserver
  Logical volume "media" created
```

Let's get an overview of our logical volumes:

```
lvdisplay
```

```
server1:~# lvdisplay
  --- Logical volume ---
  LV Name                /dev/fileserver/share
  VG Name                fileserver
  LV UUID                280Mup-H9aa-sn0S-AXH3-04cP-V6p9-lfoGgJ
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                40.00 GB
  Current LE             10240
  Segments               2
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:0

  --- Logical volume ---
  LV Name                /dev/fileserver/backup
  VG Name                fileserver
  LV UUID                zZeuKg-Dazh-aZMC-Aa99-KUSt-J6ET-KRe0cD
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                5.00 GB
  Current LE             1280
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:1

  --- Logical volume ---
  LV Name                /dev/fileserver/media
  VG Name                fileserver
  LV UUID                usfvrv-BC92-3pFH-2NW0-2N3e-6ERQ-4Sj7YS
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                1.00 GB
  Current LE             256
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:2
```

```
lvscan
```

```
server1:~# lvscan
  ACTIVE            '/dev/fileserver/share' [40.00 GB] inherit
  ACTIVE            '/dev/fileserver/backup' [5.00 GB] inherit
  ACTIVE            '/dev/fileserver/media' [1.00 GB] inherit
```

For training purposes we rename our logical volume `media` into `films`:

```
lvrename fileserver media films
```

```
server1:~# lvrename fileserver media films
  Renamed "media" to "films" in volume group "fileserver"
```

```
lvdisplay
```

```
server1:~# lvdisplay
  --- Logical volume ---
  LV Name                /dev/fileserver/share
  VG Name                fileserver
  LV UUID                280Mup-H9aa-sn0S-AXH3-04cP-V6p9-lfoGgJ
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                40.00 GB
  Current LE             10240
  Segments               2
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:0

  --- Logical volume ---
  LV Name                /dev/fileserver/backup
  VG Name                fileserver
  LV UUID                zZeuKg-Dazh-aZMC-Aa99-KUSt-J6ET-KRe0cD
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                5.00 GB
  Current LE             1280
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:1

  --- Logical volume ---
  LV Name                /dev/fileserver/films
  VG Name                fileserver
  LV UUID                usfvrv-BC92-3pFH-2NW0-2N3e-6ERQ-4Sj7YS
  LV Write Access        read/write
  LV Status              available
  # open                 0
  LV Size                1.00 GB
  Current LE             256
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:2
```

```
lvscan
```

```
server1:~# lvscan
  ACTIVE            '/dev/fileserver/share' [40.00 GB] inherit
  ACTIVE            '/dev/fileserver/backup' [5.00 GB] inherit
  ACTIVE            '/dev/fileserver/films' [1.00 GB] inherit
```

Next let's delete the logical volume `films`:

```
lvremove /dev/fileserver/films
```

```
server1:~# lvremove /dev/fileserver/films
Do you really want to remove active logical volume "films"? [y/n]: <-- y
  Logical volume "films" successfully removed
```

We create the logical volume *media* again:

```
lvcreate --name media --size 1G fileserver
```

```
server1:~# lvcreate --name media  --size  1G fileserver
  Logical volume "media" created
```

Now let's enlarge *media* from 1GB to 1.5GB:

```
lvextend -L1.5G /dev/fileserver/media
```

```
server1:~# lvextend -L1.5G /dev/fileserver/media
  Extending logical volume media to 1.50 GB
  Logical volume media successfully resized
```

Let's shrink it to 1GB again:

```
lvreduce -L1G /dev/fileserver/media
```

```
server1:~# lvreduce -L1G /dev/fileserver/media
  WARNING: Reducing active logical volume to 1.00 GB
  THIS MAY DESTROY YOUR DATA (filesystem etc.)
Do you really want to reduce media? [y/n]: <-- y
  Reducing logical volume media to 1.00 GB
  Logical volume media successfully resized
```

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If you get this error, you'll need to "deregister" the partition table from the kernel.
kpartx -d /dev/fileserver/films
lvremove /dev/fileserver/films

From: Andre de Araujo

Reply

Correct is: #lvextend -L +1.5G /dev/fileserver/media

From: Adrian Varan

Reply

"+" is optional (read the manual). If you use +1.5G then the 1.5G is added to the actual size (1.5+1=2.5G), without "+" the 1.5G represents the new absolute value of the logical volume.

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Author:	falko
Tags:	linux, other, storage

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Until now we have three logical volumes, but we don't have any filesystems in them, and without a filesystem we can't save anything in them. Therefore we create an ext3 filesystem in *share*, an xfs filesystem in *backup*, and a reiserfs filesystem in *media*:

```
mkfs.ext3 /dev/fileserver/share
```

```
server1:~# mkfs.ext3 /dev/fileserver/share
mke2fs 1.40-WIP (14-Nov-2006)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
5242880 inodes, 10485760 blocks
524288 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=0
320 block groups
32768 blocks per group, 32768 fragments per group
16384 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 265
4208,
        4096000, 7962624

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

This filesystem will be automatically checked every 23 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

```
mkfs.xfs /dev/fileserver/backup
```

```
server1:~# mkfs.xfs /dev/fileserver/backup
meta-
data=/dev/fileserver/backup isize=256    agcount=8, agsize=163840 blks
```

```
         =                       sectsz=512   attr=0
data     =                       bsize=4096   blocks=1310720, imaxpct=25
         =                       sunit=0      swidth=0 blks, unwritten=1
naming   =version 2              bsize=4096
log      =internal log           bsize=4096   blocks=2560, version=1
         =                       sectsz=512   sunit=0 blks
realtime =none                   extsz=65536  blocks=0, rtextents=0
```

```
mkfs.reiserfs /dev/fileserver/media
```

```
server1:~# mkfs.reiserfs /dev/fileserver/media
mkfs.reiserfs 3.6.19 (2003 www.namesys.com)

A pair of credits:
Alexander  Lyamin  keeps our hardware  running,  and was very  generous  t
o our
project in many little ways.

Chris Mason wrote the journaling code for V3,  which was enormously more u
seful
to users than just waiting until  we could create a wandering log filesyst
em as
Hans would have unwisely done without him.
Jeff Mahoney optimized the bitmap  scanning code for V3,  and performed th
e big
endian cleanups.


Guessing about desired format.. Kernel 2.6.17-2-486 is running.
Format 3.6 with standard journal
Count of blocks on the device: 262144
Number of blocks consumed by mkreiserfs formatting process: 8219
Blocksize: 4096
Hash function used to sort names: "r5"
Journal Size 8193 blocks (first block 18)
Journal Max transaction length 1024
inode generation number: 0
UUID: 2bebf750-6e05-47b2-99b6-916fa7ea5398
ATTENTION: YOU SHOULD REBOOT AFTER FDISK!
        ALL DATA WILL BE LOST ON '/dev/fileserver/media'!
Continue (y/n):y
Initializing journal - 0%....20%....40%....60%....80%....100%
Syncing..ok

Tell your friends to use a kernel based on 2.4.18 or later, and especially
 not a
kernel based on 2.4.9, when you use reiserFS. Have fun.

ReiserFS is successfully created on /dev/fileserver/media.
```

Now we are ready to mount our logical volumes. I want to mount *share* in */var/share*, *backup* in */var/backup*, and *media* in */var/media*, therefore we must create these directories first:

```
mkdir /var/media /var/backup /var/share
```

Now we can mount our logical volumes:

```
mount /dev/fileserver/share /var/share
mount /dev/fileserver/backup /var/backup
mount /dev/fileserver/media /var/media
```

Now run

```
df -h
```

You should see your logical volumes in the output:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
```

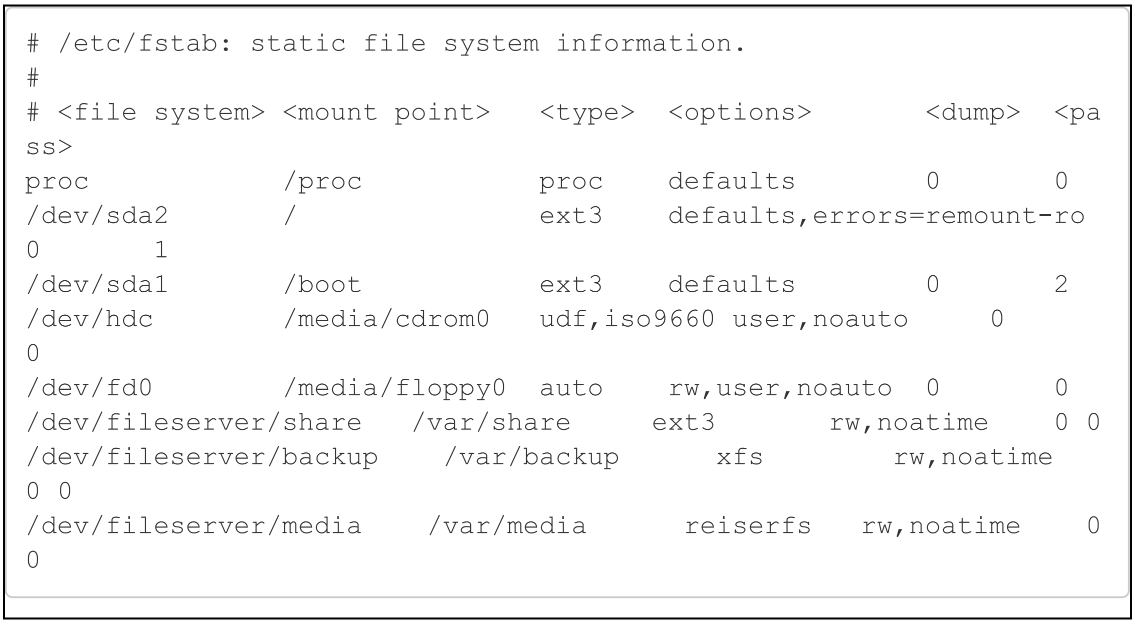
Congratulations, you've just set up your first LVM system! You can now write to and read from `/var/share`, `/var/backup`, and `/var/media` as usual.

We have mounted our logical volumes manually, but of course we'd like to have them mounted automatically when the system boots. Therefore we modify `/etc/fstab`:

```
mv /etc/fstab /etc/fstab_orig
cat /dev/null > /etc/fstab
```

```
vi /etc/fstab
```

Put the following into it:



```
# /etc/fstab: static file system information.
#
# <file system> <mount point>   <type>  <options>       <dump>  <pa
ss>
proc            /proc           proc    defaults        0       0
/dev/sda2       /               ext3    defaults,errors=remount-ro
0       1
/dev/sda1       /boot           ext3    defaults        0       2
/dev/hdc        /media/cdrom0   udf,iso9660 user,noauto     0
0
/dev/fd0        /media/floppy0  auto    rw,user,noauto  0       0
/dev/fileserver/share   /var/share     ext3       rw,noatime    0 0
/dev/fileserver/backup    /var/backup      xfs        rw,noatime
0 0
/dev/fileserver/media    /var/media      reiserfs   rw,noatime    0
0
```

If you compare it to our backup of the original file, `/etc/fstab_orig`, you will notice that we added the lines:

```
/dev/fileserver/share   /var/share     ext3       rw,noatime    0 0
/dev/fileserver/backup    /var/backup      xfs        rw,noatime    0 0
/dev/fileserver/media    /var/media      reiserfs    rw,noatime    0 0
```

Now we reboot the system:

```
shutdown -r now
```

After the system has come up again, run

```
df -h
```

again. It should still show our logical volumes in the output:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
```

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Great guide!
Thanks a lot - helped me out :-)

From: Navin Pathak Reply

Dear Freinds,
I have started learn linux from few days and now days I am learning LVM I have search a lot of document and finaly choose your site and start working today through your guide line for LVM I have completed today near entry to fstab of logical valume so I feel very well with your documents.
Thanks a lot you all who spend a time to cretae such a nice lvm real practical.
my one suggetion is that please explain the term of PE,LE and metadata.
again thanks.

Regards
Navin Pathak
TTSL India.

From: SN Reply

There's a Zimbra backup script based on LVM, I have no idea of LVM so I searched and found this amazing topic. Thanks so much for your work.
Regards,
SN

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4 Resize Logical Volumes And Their Filesystems

On this page

In this chapter we will learn how to resize our logical volume *share* which has an ext3 filesystem. (I will show how to resize logical volumes with xfs and reiserfs filesystems further down this tutorial.)

First we must unmount it:

```
umount /var/share
```

share should not be listed anymore in the

```
df -h
```

output:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
```

Now let's enlarge *share* from 40GB to 50GB:

```
lvextend -L50G /dev/fileserver/share
```

```
server1:~# lvextend -L50G /dev/fileserver/share
  Extending logical volume share to 50.00 GB
  Logical volume share successfully resized
```

Until now we have enlarged only *share*, but not the ext3 filesystem on *share*. This is what we do now:

```
e2fsck -f /dev/fileserver/share
```

```
server1:~# e2fsck -f /dev/fileserver/share
e2fsck 1.40-WIP (14-Nov-2006)
Pass 1: Checking inodes, blocks, and sizes
Pass 2: Checking directory structure
Pass 3: Checking directory connectivity
Pass 4: Checking reference counts
Pass 5: Checking group summary information
/dev/fileserver/share: 11/5242880 files (9.1% non-
contiguous), 209588/10485760 blocks
```

Make a note of the total amount of blocks (*10485760*) because we need it when we shrink *share* later on.

```
resize2fs /dev/fileserver/share
```

```
server1:~# resize2fs /dev/fileserver/share
resize2fs 1.40-WIP (14-Nov-2006)
Resizing the filesystem on /dev/fileserver/share to 13107200 (4k) blocks.
The filesystem on /dev/fileserver/share is now 13107200 blocks long.
```

Let's mount *share*:

```
mount /dev/fileserver/share /var/share
```

and in the

```
df -h
```

output share should now have 50GB instead of 40:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
```

```
                      1.0G   33M  992M   4% /var/media
/dev/mapper/fileserver-share
                       50G  180M   47G   1% /var/share
```

Shrinking a logical volume is the other way round: first we must shrink the filesystem before we reduce the logical volume's size. Let's shrink share to 40GB again:

```
umount /var/share
```

```
df -h
```

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
```

```
e2fsck -f /dev/fileserver/share
```

```
server1:~# e2fsck -f /dev/fileserver/share
e2fsck 1.40-WIP (14-Nov-2006)
Pass 1: Checking inodes, blocks, and sizes
Pass 2: Checking directory structure
Pass 3: Checking directory connectivity
Pass 4: Checking reference counts
Pass 5: Checking group summary information
/dev/fileserver/share: 11/6553600 files (9.1% non-
contiguous), 251733/13107200 blocks
```

When resizing an ext3 filesystem to a certain size (instead of all available space), `resize2fs` takes the number of blocks as argument (you can as well specify the new size in MB, etc. See

```
man resize2fs
```

for more details). From our previous operation we know the 40GB equals `10485760` blocks so we run

```
resize2fs /dev/fileserver/share 10485760
```

```
server1:~# resize2fs /dev/fileserver/share 10485760
resize2fs 1.40-WIP (14-Nov-2006)
Resizing the filesystem on /dev/fileserver/share to 10485760 (4k) blocks.
The filesystem on /dev/fileserver/share is now 10485760 blocks long.
```

We've shrinked the filesystem, now we must shrink the logical volume, too:

```
lvreduce -L40G /dev/fileserver/share
```

```
server1:~# lvreduce -L40G /dev/fileserver/share
  WARNING: Reducing active logical volume to 40.00 GB
  THIS MAY DESTROY YOUR DATA (filesystem etc.)
Do you really want to reduce share? [y/n]: <-- y
  Reducing logical volume share to 40.00 GB
  Logical volume share successfully resized
```

We can ignore the warning that data might be destroyed because we have shrinked the filesystem before.

Let's mount `share` again:

```
mount /dev/fileserver/share /var/share
```

The output of

```
df -h
```

should now look like this:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   88K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
```

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From: jonathan young Reply

This guide is so idiot-proofed and full of explanations. Thank you so much, you saved my bacon. I am a beginning linux administrator (as a sideline to being a web architect) and LVM is so brand new to me, I was scared to resize lv's and now i'm like "wow, this is easy"
thank you so much!

From: acname Reply

perfect manual. thanx a lot

From: Anonymous Reply

need to not use if fdisk if drive is over 2 TB though.

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Tutorial Info

Author:	falko
Tags:	linux, other, storage

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5 Adding A Hard Drive And Removing Another One

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- 5 Adding A Hard Drive And Removing Another One

We haven't used `/dev/sdf` until now. We will now create the partition `/dev/sdf1` (25GB) and add that to our `fileserver` volume group.

```
fdisk /dev/sdf
```

```
server1:~# fdisk /dev/sdf
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF d
isklabel
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that, of course, the previous
content won't be recoverable.


The number of cylinders for this disk is set to 10443.
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)
Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(r
ite)

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
   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
Command action
   e   extended
   p   primary partition (1-4)
<-- p
Partition number (1-4): <-- 1
First cylinder (1-10443, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-10443, default 10443): <--
+25000M

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

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

Let's prepare `/dev/sdf1` for LVM:

```
pvcreate /dev/sdf1
```

```
server1:~# pvcreate /dev/sdf1
  Physical volume "/dev/sdf1" successfully created
```

Add `/dev/sdf1` to our `fileserver` volume group:

```
vgextend fileserver /dev/sdf1
```

Run

```
vgdisplay
```

`VG Size` should now be bigger than before:

```
server1:~# vgdisplay
  --- Volume group ---
  VG Name               fileserver
  System ID
  Format                lvm2
  Metadata Areas        5
  Metadata Sequence No  12
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                3
  Open LV               3
  Max PV                0
  Cur PV                5
  Act PV                5
  VG Size               116.43 GB
  PE Size               4.00 MB
  Total PE              29805
  Alloc PE / Size       11776 / 46.00 GB
  Free  PE / Size       18029 / 70.43 GB
  VG UUID               iWr1Vk-7h7J-hLRL-SHbx-3p87-Rq47-L1GyEO
```

That's it. `/dev/sdf1` has been added to the fileserver volume group.

Now let's remove `/dev/sdb1`. Before we do this, we must copy all data on it to `/dev/sdf1`:

```
pvmove /dev/sdb1 /dev/sdf1
```

This can take some minutes:

```
server1:~# pvmove /dev/sdb1 /dev/sdf1
  /dev/sdb1: Moved: 1.9%
  /dev/sdb1: Moved: 3.8%
  /dev/sdb1: Moved: 5.8%
  /dev/sdb1: Moved: 7.8%
  /dev/sdb1: Moved: 9.7%
  /dev/sdb1: Moved: 11.6%
  /dev/sdb1: Moved: 13.6%
  /dev/sdb1: Moved: 15.6%
  /dev/sdb1: Moved: 17.5%
  /dev/sdb1: Moved: 19.4%
  /dev/sdb1: Moved: 21.4%
  [...]
  /dev/sdb1: Moved: 85.7%
  /dev/sdb1: Moved: 87.7%
  /dev/sdb1: Moved: 89.7%
  /dev/sdb1: Moved: 91.7%
  /dev/sdb1: Moved: 93.6%
  /dev/sdb1: Moved: 95.5%
  /dev/sdb1: Moved: 97.5%
  /dev/sdb1: Moved: 99.4%
  /dev/sdb1: Moved: 100.0%
```

Next we remove `/dev/sdb1` from the `fileserver` volume group:

```
vgreduce fileserver /dev/sdb1
```

```
server1:~# vgreduce fileserver /dev/sdb1
  Removed "/dev/sdb1" from volume group "fileserver"
```

```
vgdisplay
```

```
server1:~# vgdisplay
  --- Volume group ---
  VG Name               fileserver
  System ID
  Format                lvm2
  Metadata Areas        4
  Metadata Sequence No  16
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                3
  Open LV               3
  Max PV                0
  Cur PV                4
  Act PV                4
  VG Size               93.14 GB
  PE Size               4.00 MB
  Total PE              23844
  Alloc PE / Size       11776 / 46.00 GB
  Free  PE / Size       12068 / 47.14 GB
  VG UUID               iWr1Vk-7h7J-hLRL-SHbx-3p87-Rq47-L1GyEO
```

Then we run

```
pvremove /dev/sdb1
```

/dev/sdb1 shouldn't be listed as a physical volume anymore:

```
pvdisplay
```

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdc1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               1682
  Allocated PE          4279
  PV UUID               40GJyh-IbsI-pzhn-TDRq-PQ3l-3ut0-AVSE4B

  --- Physical volume ---
  PV Name               /dev/sdd1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               4681
  Allocated PE          1280
  PV UUID               4mU63D-4s26-uL00-r0pO-Q0hP-mvQR-2YJN5B

  --- Physical volume ---
  PV Name               /dev/sde1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               5705
  Allocated PE          256
  PV UUID               3upcZc-4eS2-h4r4-iBKK-gZJv-AYt3-EKdRK6

  --- Physical volume ---
  PV Name               /dev/sdf1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes (but full)
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               0
  Allocated PE          5961
  PV UUID               1xgo2I-SBjj-0MAz-1mDu-OLZ1-3NdO-mLkS20
```

You could now remove `/dev/sdb` from the system (if this was a real system and not a virtual machine).

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From: Sebastian Reply

Thank you very much for this though tutorial. Helped alot!

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6 Return To The System's Original State

On this page

In this chapter we will undo all changes from the previous chapters to return to the system's original state. This is just for training purposes so that you learn how to undo an LVM setup.

First we must unmount our logical volumes:

```
umount /var/share
umount /var/backup
umount /var/media
```

```
df -h
```

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  665M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   92K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
```

Then we delete each of them:

```
lvremove /dev/fileserver/share
```

```
server1:~# lvremove /dev/fileserver/share
Do you really want to remove active logical volume "share"? [y/n]: <-- y
  Logical volume "share" successfully removed
```

```
lvremove /dev/fileserver/backup
```

```
                                        server1:~# lvremove /dev/fileserve
r/backup
Do you really want to remove active logical volume "backup"? [y/n]: <-- y
  Logical volume "backup" successfully removed
```

```
lvremove /dev/fileserver/media
```

```
server1:~# lvremove /dev/fileserver/media
Do you really want to remove active logical volume "media"? [y/n]: <-- y
  Logical volume "media" successfully removed
```

Next we remove the volume group `fileserver`:

```
vgremove fileserver
```

```
server1:~# vgremove fileserver
  Volume group "fileserver" successfully removed
```

Finally we do this:

```
pvremove /dev/sdc1 /dev/sdd1 /dev/sde1 /dev/sdf1
```

```
server1:~# pvremove  /dev/sdc1 /dev/sdd1 /dev/sde1 /dev/sdf1
  Labels on physical volume "/dev/sdc1" successfully wiped
  Labels on physical volume "/dev/sdd1" successfully wiped
  Labels on physical volume "/dev/sde1" successfully wiped
  Labels on physical volume "/dev/sdf1" successfully wiped
```

```
vgdisplay
```

```
server1:~# vgdisplay
  No volume groups found
```

```
pvdisplay
```

should display nothing at all:

```
server1:~# pvdisplay
```

Now we must undo our changes in `/etc/fstab` to avoid that the system tries to mount non-existing devices. Fortunately we have made a backup of the original file that we can copy back now:

```
mv /etc/fstab_orig /etc/fstab
```

Reboot the system:

```
shutdown -r now
```

Afterwards the output of

```
df -h
```

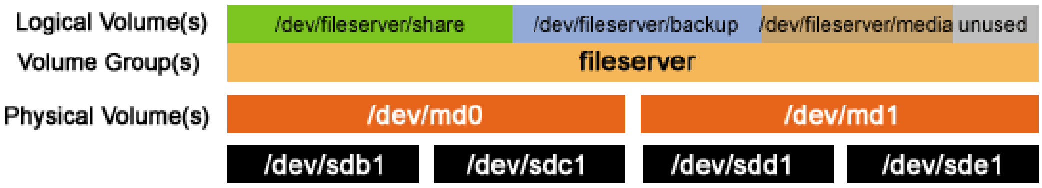
should look like this:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  666M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   92K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
```

Now the system is like it was in the beginning (except that the partitions */dev/sdb1* - */dev/sdf1* still exist - you could delete them with *fdisk* but we don't do this now - as well as the directories */var/share*, */var/backup*, and */var/media* which we also don't delete).

7 LVM On RAID1

In this chapter we will set up LVM again and move it to a RAID1 array to guarantee for high-availability. In the end this should look like this:



This means we will make the RAID array */dev/md0* from the partitions */dev/sdb1* + */dev/sdc1*, and the RAID array */dev/md1* from the partitions */dev/sdd1* + */dev/sde1*. */dev/md0* and */dev/md1* will then be the physical volumes for LVM.

Before we come to that, we set up LVM as before:

```
pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
vgcreate fileserver /dev/sdb1 /dev/sdc1 /dev/sdd1 /dev/sde1
lvcreate --name share --size 40G fileserver
lvcreate --name backup --size 5G fileserver
lvcreate --name media --size 1G fileserver
```

```
mkfs.ext3 /dev/fileserver/share
mkfs.xfs /dev/fileserver/backup
mkfs.reiserfs /dev/fileserver/media
```

Then we mount our logical volumes:

```
mount /dev/fileserver/share /var/share
mount /dev/fileserver/backup /var/backup
mount /dev/fileserver/media /var/media
```

The output of

```
df -h
```

should now look like this:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  666M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   92K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.0G   33M  992M   4% /var/media
```

Now we must move the contents of `/dev/sdc1` and `/dev/sde1` (`/dev/sdc1` is the second partition of our future `/dev/md0`, `/dev/sde1` the second partition of our future `/dev/md1`) to the remaining partitions, because we will afterwards remove them from LVM and format them with the type `fd` (Linux RAID autodetect) and move them to `/dev/md0` resp. `/dev/md1`.

```
modprobe dm-mirror
pvmove /dev/sdc1
```

```
vgreduce fileserver /dev/sdc1
pvremove /dev/sdc1
```

```
pvdisplay
```

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdb1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes (but full)
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               0
  Allocated PE          5961
  PV UUID               USDJyG-VDM2-r406-OjQo-h3eb-c9Mp-4nvnvu

  --- Physical volume ---
  PV Name               /dev/sdd1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               4681
  Allocated PE          1280
  PV UUID               qdEB5d-389d-O5UA-Kbwv-mn1y-74FY-4zublN

  --- Physical volume ---
  PV Name               /dev/sde1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               1426
  Allocated PE          4535
  PV UUID               4vL1e0-sr2M-awGd-qDJm-ZrC9-wuxW-2lEqp2
```

```
pvmove /dev/sde1
```

```
vgreduce fileserver /dev/sde1
pvremove /dev/sde1
```

```
pvdisplay
```

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdb1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes (but full)
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               0
  Allocated PE          5961
  PV UUID               USDJyG-VDM2-r406-OjQo-h3eb-c9Mp-4nvnvu

  --- Physical volume ---
  PV Name               /dev/sdd1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               146
  Allocated PE          5815
  PV UUID               qdEB5d-389d-O5UA-Kbwv-mn1y-74FY-4zublN
```

Now we format `/dev/sdc1` with the type `fd` (Linux RAID autodetect):

```
fdisk /dev/sdc
```

```
server1:~# fdisk /dev/sdc

The number of cylinders for this disk is set to 10443.
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): <-- m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   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): <-- t
Selected partition 1
Hex code (type L to list codes): <-- L

 0  Empty           1e  Hidden W95 FAT1 80  Old Minix       be  Solaris boo
t
 1  FAT12           24  NEC DOS         81  Minix / old Lin bf  Solaris
 2  XENIX root      39  Plan 9          82  Linux swap / So c1  DRDOS/sec
(FAT-
 3  XENIX usr       3c  PartitionMagic  83  Linux           c4  DRDOS/sec
(FAT-
 4  FAT16 <32M      40  Venix 80286     84  OS/2 hidden C:  c6  DRDOS/sec
(FAT-
 5  Extended        41  PPC PReP Boot   85  Linux extended  c7  Syrinx
 6  FAT16           42  SFS             86  NTFS volume set da  Non-
FS data
 7  HPFS/NTFS       4d  QNX4.x          87  NTFS volume set db  CP/M / CTO
S / .
 8  AIX             4e  QNX4.x 2nd part 88  Linux plaintext de  Dell Utili
ty
 9  AIX bootable    4f  QNX4.x 3rd part 8e  Linux LVM       df  BootIt
 a  OS/2 Boot Manag 50  OnTrack DM      93  Amoeba          e1  DOS access
 b  W95 FAT32       51  OnTrack DM6 Aux 94  Amoeba BBT      e3  DOS R/O
 c  W95 FAT32 (LBA) 52  CP/M            9f  BSD/OS          e4  SpeedStor
 e  W95 FAT16 (LBA) 53  OnTrack DM6 Aux a0  IBM Thinkpad hi eb  BeOS fs
 f  W95 Ext'd (LBA) 54  OnTrackDM6      a5  FreeBSD         ee  EFI GPT
10  OPUS            55  EZ-Drive        a6  OpenBSD         ef  EFI (FAT-
12/16/
11  Hidden FAT12    56  Golden Bow      a7  NeXTSTEP        f0  Linux/PA-
RISC b
12  Compaq diagnost 5c  Priam Edisk     a8  Darwin UFS      f1  SpeedStor
14  Hidden FAT16 <3 61  SpeedStor       a9  NetBSD          f4  SpeedStor
16  Hidden FAT16    63  GNU HURD or Sys ab  Darwin boot     f2  DOS second
```

```
ary
17  Hidden HPFS/NTF 64  Novell Netware  b7  BSDI fs         fd  Linux raid
 auto
18  AST SmartSleep  65  Novell Netware  b8  BSDI swap       fe  LANstep
1b  Hidden W95 FAT3 70  DiskSecure Mult bb  Boot Wizard hid ff  BBT
1c  Hidden W95 FAT3 75  PC/IX
Hex code (type L to list codes): <-- fd
Changed system type of partition 1 to fd (Linux raid autodetect)

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

Now do the same with /dev/sde1:

```
fdisk /dev/sde
```

The output of

```
fdisk -l
```

should now look like this:

```
server1:~# fdisk -l

Disk /dev/sda: 21.4 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          18      144553+  83  Linux
/dev/sda2              19        2450    19535040   83  Linux
/dev/sda4            2451        2610     1285200   82  Linux swap / Solar
is

Disk /dev/sdb: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sdc: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdc1               1        3040    24418768+  fd  Linux raid autodet
ect

Disk /dev/sdd: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
```

```
/dev/sdd1               1        3040    24418768+  8e  Linux LVM

Disk /dev/sde: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1               1        3040    24418768+  fd  Linux raid autodet
ect

Disk /dev/sdf: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdf1               1        3040    24418768+  8e  Linux LVM
```

Next we add `/dev/sdc1` to `/dev/md0` and `/dev/sde1` to `/dev/md1`. Because the second nodes (`/dev/sdb1` and `/dev/sdd1`) are not ready yet, we must specify `missing` in the following commands:

```
mdadm --create /dev/md0 --auto=yes -l 1 -n 2 /dev/sdc1 missing
```

```
server1:~# mdadm --create /dev/md0 --auto=yes -l 1 -n 2 /dev/sdc1 missing
mdadm: array /dev/md0 started.
```

```
mdadm --create /dev/md1 --auto=yes -l 1 -n 2 /dev/sde1 missing
```

```
server1:~# mdadm --create /dev/md1 --auto=yes -l 1 -n 2 /dev/sde1 missing
mdadm: array /dev/md1 started.
```

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From: Robert Reply

Bloody well **excellent** lvm2 guide.
Thank You.

From: Chris Reply

Hi
nice guide, and the vmware image is a great idea.
in your first RAID example, it looks like you've missed some of the pvmove arguments (it just has the source volume, not the dest volume).
cheers

From: Anonymous Reply

Apparently not - I was confused about that too at first, but actually working through the tutorial confirmed that this is not the case.

A quick check of the LVM docs reveals that **pvmove** with no arguments (other than the device) moves all the data on the device to free space in the volume group, wherever it can find it.

It's basically "move this data to anywhere else" as opposed to "move this data to this particular place" which is what we were doing with the previous uses of **pvmove**.

From: ilayaraja Reply

very very usefull for beginers

From: oldtimer_mando Reply

Awesome! Thanks!

From: Imran Reply

really a very nice and useful guide for beginner, Thanks you so much

From: Sajid Reply

Excellent details and easy to follow, great work!

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Tutorial Info

Author: falko
Tags: linux, other, storage

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Afterwards we prepare `/dev/md0` and `/dev/md1` for LVM:

```
pvcreate /dev/md0 /dev/md1
```

```
server1:~# pvcreate /dev/md0 /dev/md1
  Physical volume "/dev/md0" successfully created
  Physical volume "/dev/md1" successfully created
```

and extend our `fileserver` volume group:

```
vgextend fileserver /dev/md0 /dev/md1
```

```
server1:~# vgextend fileserver /dev/md0 /dev/md1
  Volume group "fileserver" successfully extended
```

The outputs of

```
pvdisplay
```

and

```
vgdisplay
```

should look like this:

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/sdb1
  VG Name               fileserver
```

```
PV Size               23.29 GB / not usable 0
Allocatable           yes (but full)
PE Size (KByte)       4096
Total PE              5961
Free PE               0
Allocated PE          5961
PV UUID               USDJyG-VDM2-r406-OjQo-h3eb-c9Mp-4nvnvu

--- Physical volume ---
PV Name               /dev/sdd1
VG Name               fileserver
PV Size               23.29 GB / not usable 0
Allocatable           yes
PE Size (KByte)       4096
Total PE              5961
Free PE               146
Allocated PE          5815
PV UUID               qdEB5d-389d-O5UA-Kbwv-mn1y-74FY-4zublN

--- Physical volume ---
PV Name               /dev/md0
VG Name               fileserver
PV Size               23.29 GB / not usable 0
Allocatable           yes
PE Size (KByte)       4096
Total PE              5961
Free PE               5961
Allocated PE          0
PV UUID               7JHUXF-1R2p-OjbJ-X1OT-uaeg-gWRx-H6zx3P

--- Physical volume ---
PV Name               /dev/md1
VG Name               fileserver
PV Size               23.29 GB / not usable 0
Allocatable           yes
PE Size (KByte)       4096
Total PE              5961
Free PE               5961
Allocated PE          0
PV UUID               pwQ5AJ-RwVK-EebA-0Z13-d27d-2IdP-HqT5RW


                                      server1:~# vgdisplay
--- Volume group ---
VG Name               fileserver
System ID
Format                lvm2
Metadata Areas        4
Metadata Sequence No  14
VG Access             read/write
VG Status             resizable
MAX LV                0
Cur LV                3
Open LV               3
Max PV                0
Cur PV                4
Act PV                4
VG Size               93.14 GB
PE Size               4.00 MB
Total PE              23844
Alloc PE / Size       11776 / 46.00 GB
Free  PE / Size       12068 / 47.14 GB
VG UUID               dQDEHT-kNHf-UjRm-rmJ3-OUYx-9G1t-aVskI1
```

Now we move the contents of `/dev/sdb1` to `/dev/md0` and the contents of `/dev/sdd1` to `/dev/md1`, then we remove `/dev/sdb1` and `/dev/sdd1` from LVM:

```
pvmove /dev/sdb1 /dev/md0
```

```
pvmove /dev/sdd1 /dev/md1
```

```
vgreduce fileserver /dev/sdb1 /dev/sdd1
pvremove /dev/sdb1 /dev/sdd1
```

Now only `/dev/md0` and `/dev/md1` should be left as physical volumes:

```
pvdisplay
```

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/md0
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes (but full)
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               0
  Allocated PE          5961
  PV UUID               7JHUXF-1R2p-OjbJ-X1OT-uaeg-gWRx-H6zx3P

  --- Physical volume ---
  PV Name               /dev/md1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               146
  Allocated PE          5815
  PV UUID               pwQ5AJ-RwVK-EebA-0Z13-d27d-2IdP-HqT5RW
```

Now we format `/dev/sdb1` with `fd` (Linux RAID autodetect):

```
fdisk /dev/sdb
```

```
server1:~# fdisk /dev/sdb

The number of cylinders for this disk is set to 32635.
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): <-- m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   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): <-- t
Selected partition 1
Hex code (type L to list codes): <-- fd
Changed system type of partition 1 to fd (Linux raid autodetect)

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

Do the same with `/dev/sdd1`:

```
fdisk /dev/sdd
```

Next add `/dev/sdb1` to `/dev/md0` and `/dev/sdd1` to `/dev/md1`:

```
mdadm --manage /dev/md0 --add /dev/sdb1
```

```
server1:~# mdadm --manage /dev/md0 --add /dev/sdb1
mdadm: added /dev/sdb1
```

```
mdadm --manage /dev/md1 --add /dev/sdd1
```

```
server1:~# mdadm --manage /dev/md1 --add /dev/sdd1
mdadm: added /dev/sdd1
```

Now the two RAID arrays will be synchronized. This will take some time, you can check with

```
cat /proc/mdstat
```

when the process is finished. The output looks like this for an unfinished process:

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md1 : active raid1 sdd1[2] sde1[0]
      24418688 blocks [2/1] [U_]
      [=>...................]  recovery =  6.4% (1586560/24418688) finish=
1.9min speed=198320K/sec

md0 : active raid1 sdb1[2] sdc1[0]
      24418688 blocks [2/1] [U_]
      [==>..................]  recovery = 10.5% (2587264/24418688) finish=
2.8min speed=129363K/sec

unused devices: <none>
```

and like this when the process is finished:

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md1 : active raid1 sdd1[1] sde1[0]
      24418688 blocks [2/2] [UU]

md0 : active raid1 sdb1[1] sdc1[0]
      24418688 blocks [2/2] [UU]

unused devices: <none>
```

If you have a look at `PV Size` in the output of

```
pvdisplay
```

you will see that `2 * 23.29GB = 46.58GB` are available, however only `40GB (share) + 5GB (backup) + 1GB (media) = 46GB` are used which means we could extend one of our logical devices with about 0.5GB. I've already shown how to extend an ext3 logical volume (`share`), so we will resize `media` now which uses reiserfs. reiserfs filesystems can be resized without unmounting:

```
lvextend -L1.5G /dev/fileserver/media
```

```
server1:~# lvextend -L1.5G /dev/fileserver/media
  Extending logical volume media to 1.50 GB
  Logical volume media successfully resized
```

```
resize_reiserfs /dev/fileserver/media
```

```
server1:~# resize_reiserfs /dev/fileserver/media
resize_reiserfs 3.6.19 (2003 www.namesys.com)




resize_reiserfs: On-line resizing finished successfully.
```

The output of

```
df -h
```

looks like this:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  666M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M   92K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.5G   33M  1.5G   3% /var/media
```

If we want our logical volumes to be mounted automatically at boot time, we must modify `/etc/fstab` again (like in chapter 3):

```
mv /etc/fstab /etc/fstab_orig
cat /dev/null > /etc/fstab
```

```
vi /etc/fstab
```

Put the following into it:

```
# /etc/fstab: static file system information.
#
# <file system> <mount point>   <type>  <options>       <dump>  <pa
ss>
proc            /proc           proc    defaults        0       0
/dev/sda2       /               ext3    defaults,errors=remount-ro
0       1
/dev/sda1       /boot           ext3    defaults        0       2
/dev/hdc        /media/cdrom0   udf,iso9660 user,noauto     0
0
/dev/fd0        /media/floppy0  auto    rw,user,noauto  0       0
/dev/fileserver/share   /var/share     ext3       rw,noatime    0 0
/dev/fileserver/backup    /var/backup      xfs        rw,noatime
0 0
/dev/fileserver/media    /var/media      reiserfs    rw,noatime    0
0
```

If you compare it to our backup of the original file, `/etc/fstab_orig`, you will notice that we added the lines:

```
/dev/fileserver/share   /var/share     ext3       rw,noatime    0 0
/dev/fileserver/backup    /var/backup      xfs        rw,noatime    0 0
/dev/fileserver/media    /var/media      reiserfs    rw,noatime    0 0
```

Now we reboot the system:

```
shutdown -r now
```

After the system has come up again, run

```
df -h
```

again. It should still show our logical volumes in the output:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  666M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M  100K   10M   1% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                      5.0G  144K  5.0G   1% /var/backup
/dev/mapper/fileserver-media
                      1.5G   33M  1.5G   3% /var/media
```

Now we are finished with our LVM on RAID1 setup.

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Fantastic guide, covers many scenarios (adding drives, removing drives, resizing, etc). I find myself always coming back to double check my LVM setups. A+

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Author:	falko
Tags:	linux, other, storage

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8 Replacing The Hard Disks With Bigger Ones

On this page

We are currently using four hard disks with a size of 25GB each (at least we are acting like that). Now let's assume this isn't enough anymore, and we need more space in our RAID setup. Therefore we will replace our 25GB hard disks with 80GB hard disks (in fact we will still use the current hard disks, but use their full capacity now - in the real life you would replace your old, small hard disks with new, bigger ones).

The procedure is as follows: first we remove */dev/sdb* and */dev/sdd* from the RAID arrays, replace them with bigger hard disks, put them back into the RAID arrays, and then we do the same again with */dev/sdc* and */dev/sde*.

First we mark */dev/sdb1* as failed:

```
mdadm --manage /dev/md0 --fail /dev/sdb1
```

```
server1:~# mdadm --manage /dev/md0 --fail /dev/sdb1
mdadm: set /dev/sdb1 faulty in /dev/md0
```

The output of

```
cat /proc/mdstat
```

looks now like this:

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdc1[0] sdb1[2](F)
      24418688 blocks [2/1] [U_]
```

```
md1 : active raid1 sde1[0] sdd1[1]
      24418688 blocks [2/2] [UU]

unused devices: <none>
```

Then we remove */dev/sdb1* from the RAID array */dev/md0*:

```
mdadm --manage /dev/md0 --remove /dev/sdb1
```

```
server1:~# mdadm --manage /dev/md0 --remove /dev/sdb1
mdadm: hot removed /dev/sdb1
```

```
cat /proc/mdstat
```

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdc1[0]
      24418688 blocks [2/1] [U_]

md1 : active raid1 sde1[0] sdd1[1]
      24418688 blocks [2/2] [UU]

unused devices: <none>
```

Now we do the same with */dev/sdd1*:

```
mdadm --manage /dev/md1 --fail /dev/sdd1
```

```
server1:~# mdadm --manage /dev/md1 --fail /dev/sdd1
mdadm: set /dev/sdd1 faulty in /dev/md1
```

```
cat /proc/mdstat
```

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdc1[0]
      24418688 blocks [2/1] [U_]

md1 : active raid1 sde1[0] sdd1[2](F)
      24418688 blocks [2/1] [U_]

unused devices: <none>
```

```
mdadm --manage /dev/md1 --remove /dev/sdd1
```

```
server1:~# mdadm --manage /dev/md1 --remove /dev/sdd1
mdadm: hot removed /dev/sdd1
```

```
cat /proc/mdstat
```

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdc1[0]
      24418688 blocks [2/1] [U_]

md1 : active raid1 sde1[0]
      24418688 blocks [2/1] [U_]

unused devices: <none>
```

On a real system you would now shut it down, pull out the 25GB */dev/sdb* and */dev/sdd* and replace them with 80GB ones. As I said before, we don't have to do this because all hard disks already have a capacity of 80GB.

Next we must format */dev/sdb* and */dev/sdd*. We must create a */dev/sdb1* resp. */dev/sdd1* partition, type *fd* (Linux RAID autodetect), size 25GB (the same settings as on the old hard disks), and a */dev/sdb2* resp. */dev/sdd2* partition, type *fd*, that cover the rest of the hard disks. As */dev/sdb1* and */dev/sdd1* are still present on our hard disks, we only have to create */dev/sdb2* and */dev/sdd2* in this special example.

```
fdisk /dev/sdb
```

```
server1:~# fdisk /dev/sdb

The number of cylinders for this disk is set to 10443.
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): <-- p

Disk /dev/sdb: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1        3040    24418768+  fd  Linux raid autodet
ect

Command (m for help): <-- n
Command action
   e   extended
   p   primary partition (1-4)
<-- p
Partition number (1-4): <-- 2
First cylinder (3041-10443, default 3041): <-- <ENTER>
Using default value 3041
Last cylinder or +size or +sizeM or +sizeK (3041-10443, default 10443): <--
<ENTER>
Using default value 10443
```

```
Command (m for help): <-- t
Partition number (1-4): <-- 2
Hex code (type L to list codes): <-- fd
Changed system type of partition 2 to fd (Linux raid autodetect)

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

Calling ioctl() to re-read partition table.
Syncing disks.
```

Do the same for */dev/sdd*:

```
fdisk /dev/sdd
```

The output of

```
fdisk -l
```

looks now like this:

```
server1:~# fdisk -l

Disk /dev/sda: 21.4 GB, 21474836480 bytes
255 heads, 63 sectors/track, 2610 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          18      144553+  83  Linux
/dev/sda2              19        2450    19535040   83  Linux
/dev/sda4            2451        2610     1285200   82  Linux swap / Solar
is

Disk /dev/sdb: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1               1        3040    24418768+  fd  Linux raid autodet
ect
/dev/sdb2            3041       10443    59464597+  fd  Linux raid autodet
ect

Disk /dev/sdc: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdc1               1        3040    24418768+  fd  Linux raid autodet
ect

Disk /dev/sdd: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
```

```
/dev/sdd1               1        3040    24418768+  fd  Linux raid autodet
ect
/dev/sdd2            3041       10443    59464597+  fd  Linux raid autodet
ect

Disk /dev/sde: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sde1               1        3040    24418768+  fd  Linux raid autodet
ect

Disk /dev/sdf: 85.8 GB, 85899345920 bytes
255 heads, 63 sectors/track, 10443 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot      Start         End      Blocks   Id  System
/dev/sdf1               1        3040    24418768+  8e  Linux LVM

Disk /dev/md1: 25.0 GB, 25004736512 bytes
2 heads, 4 sectors/track, 6104672 cylinders
Units = cylinders of 8 * 512 = 4096 bytes

Disk /dev/md1 doesn't contain a valid partition table

Disk /dev/md0: 25.0 GB, 25004736512 bytes
2 heads, 4 sectors/track, 6104672 cylinders
Units = cylinders of 8 * 512 = 4096 bytes

Disk /dev/md0 doesn't contain a valid partition table
```

Now we add `/dev/sdb1` to `/dev/md0` again and `/dev/sdd1` to `/dev/md1`:

```
mdadm --manage /dev/md0 --add /dev/sdb1
```

```
server1:~# mdadm --manage /dev/md0 --add /dev/sdb1
mdadm: re-added /dev/sdb1
```

```
mdadm --manage /dev/md1 --add /dev/sdd1
```

```
server1:~# mdadm --manage /dev/md1 --add /dev/sdd1
mdadm: re-added /dev/sdd1
```

Now the contents of both RAID arrays will be synchronized. We must wait until this is finished before we can go on. We can check the status of the synchronization with

```
cat /proc/mdstat
```

The output looks like this during synchronization:

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdb1[1] sdc1[0]
```

```
      24418688 blocks [2/1] [U_]
      [=>...................]  recovery =  9.9% (2423168/24418688) finish=
2.8min speed=127535K/sec

md1 : active raid1 sdd1[1] sde1[0]
      24418688 blocks [2/1] [U_]
      [=>...................]  recovery =  6.4% (1572096/24418688) finish=
1.9min speed=196512K/sec

unused devices: <none>
```

and like this when it's finished:

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [raid
6] [raid10]
md0 : active raid1 sdb1[1] sdc1[0]
      24418688 blocks [2/2] [UU]

md1 : active raid1 sdd1[1] sde1[0]
      24418688 blocks [2/2] [UU]

unused devices: <none>
```

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Now we do the same process again, this time replacing */dev/sdc* and */dev/sde*:

On this page

```
mdadm --manage /dev/md0 --fail /dev/sdc1
mdadm --manage /dev/md0 --remove /dev/sdc1
mdadm --manage /dev/md1 --fail /dev/sde1
mdadm --manage /dev/md1 --remove /dev/sde1
```

```
fdisk /dev/sdc
fdisk /dev/sde
```

```
mdadm --manage /dev/md0 --add /dev/sdc1
mdadm --manage /dev/md1 --add /dev/sde1
```

```
cat /proc/mdstat
```

Wait until the synchronization has finished.

Next we create the RAID arrays */dev/md2* from */dev/sdb2* and */dev/sdc2* as well as */dev/md3* from */dev/sdd2* and */dev/sde2*.

```
mdadm --create /dev/md2 --auto=yes -l 1 -n 2 /dev/sdb2 /dev/sdc2
```

```
server1:~# mdadm --create /dev/md2 --auto=yes -l 1 -n 2 /dev/sdb2
/dev/sdc2
mdadm: array /dev/md2 started.
```

```
mdadm --create /dev/md3 --auto=yes -l 1 -n 2 /dev/sdd2 /dev/sde2
```

```
server1:~# mdadm --create /dev/md3 --auto=yes -l 1 -n 2 /dev/sdd2
/dev/sde2
mdadm: array /dev/md3 started.
```

The new RAID arrays must be synchronized before we go on, so you should check

```
cat /proc/mdstat
```

```
server1:~# cat /proc/mdstat
Personalities : [linear] [multipath] [raid0] [raid1] [raid5] [raid4] [
raid6] [raid10]
md3 : active raid1 sde2[1] sdd2[0]
      59464512 blocks [2/2] [UU]
      [=>...................]  resync =  5.1% (3044224/59464512) finis
h=5.5min speed=169123K/sec

md2 : active raid1 sdc2[1] sdb2[0]
      59464512 blocks [2/2] [UU]
      [=>...................]  resync =  5.5% (3312512/59464512) finis
h=9.3min speed=100379K/sec

md0 : active raid1 sdc1[0] sdb1[1]
      24418688 blocks [2/2] [UU]

md1 : active raid1 sde1[0] sdd1[1]
      24418688 blocks [2/2] [UU]

unused devices: <none>
```

After the synchronization has finished, we prepare `/dev/md2` and `/dev/md3` for LVM:

```
pvcreate /dev/md2 /dev/md3
```

```
server1:~# pvcreate /dev/md2 /dev/md3
  Physical volume "/dev/md2" successfully created
  Physical volume "/dev/md3" successfully created
```

and add `/dev/md2` and `/dev/md3` to our `fileserver` volume group:

```
vgextend fileserver /dev/md2 /dev/md3
```

```
server1:~# vgextend fileserver /dev/md2 /dev/md3
  Volume group "fileserver" successfully extended
```

Now let's run our `*display` commands:

```
pvdisplay
```

```
server1:~# pvdisplay
  --- Physical volume ---
  PV Name               /dev/md0
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes (but full)
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               0
  Allocated PE          5961
  PV UUID               7JHUXF-1R2p-OjbJ-X1OT-uaeg-gWRx-H6zx3P

  --- Physical volume ---
  PV Name               /dev/md1
  VG Name               fileserver
  PV Size               23.29 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              5961
  Free PE               18
  Allocated PE          5943
  PV UUID               pwQ5AJ-RwVK-EebA-0Z13-d27d-2IdP-HqT5RW

  --- Physical volume ---
  PV Name               /dev/md2
  VG Name               fileserver
  PV Size               56.71 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              14517
  Free PE               14517
  Allocated PE          0
  PV UUID               300kTo-evxm-rfmf-90LA-4YOJ-2LG5-t4JHnf

  --- Physical volume ---
  PV Name               /dev/md3
  VG Name               fileserver
  PV Size               56.71 GB / not usable 0
  Allocatable           yes
  PE Size (KByte)       4096
  Total PE              14517
  Free PE               14517
  Allocated PE          0
  PV UUID               LXFSW6-7LQX-ZGGU-dV95-jQgg-TK44-U5JOjO
```

```
vgdisplay
```

```
server1:~# vgdisplay
  --- Volume group ---
  VG Name               fileserver
  System ID
  Format                lvm2
  Metadata Areas        4
  Metadata Sequence No  26
  VG Access             read/write
  VG Status             resizable
  MAX LV                0
  Cur LV                3
  Open LV               3
  Max PV                0
  Cur PV                4
  Act PV                4
  VG Size               159.98 GB
  PE Size               4.00 MB
  Total PE              40956
  Alloc PE / Size       11904 / 46.50 GB
  Free  PE / Size       29052 / 113.48 GB
  VG UUID               dQDEHT-kNHf-UjRm-rmJ3-OUYx-9G1t-aVskI1
```

```
lvdisplay
```

```
server1:~# lvdisplay
  --- Logical volume ---
  LV Name                /dev/fileserver/share
  VG Name                fileserver
  LV UUID                bcn3Oi-vW3p-WoyX-QlF2-xEtz-uz7Z-4DllYN
  LV Write Access        read/write
  LV Status              available
  # open                 1
  LV Size                40.00 GB
  Current LE             10240
  Segments               2
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:0

  --- Logical volume ---
  LV Name                /dev/fileserver/backup
  VG Name                fileserver
  LV UUID                vfKVnU-gFXB-C6hE-1L4g-il6U-78EE-N8Sni8
  LV Write Access        read/write
  LV Status              available
  # open                 1
  LV Size                5.00 GB
  Current LE             1280
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:1

  --- Logical volume ---
  LV Name                /dev/fileserver/media
  VG Name                fileserver
  LV UUID                H1gagh-wTwH-Og0S-cJNQ-BgX1-zGlM-LwLVzE
  LV Write Access        read/write
  LV Status              available
  # open                 2
  LV Size                1.50 GB
  Current LE             384
  Segments               1
  Allocation             inherit
  Read ahead sectors     0
  Block device           253:2
```

If your outputs look similar, you have successfully replaced your small hard disks with bigger ones.

Now that we have more disk space (`2* 23.29GB + 2 * 56.71GB = 160GB`) we could enlarge our logical volumes. Until now you know how to enlarge ext3 and reiserfs partitions, so let's enlarge our `backup` logical volume now which uses xfs:

```
lvextend -L10G /dev/fileserver/backup
```

```
server1:~# lvextend -L10G /dev/fileserver/backup
  Extending logical volume backup to 10.00 GB
  Logical volume backup successfully resized
```

To enlarge the xfs filesystem, we run

```
xfs_growfs /dev/fileserver/backup
```

```
server1:~# xfs_growfs /dev/fileserver/backup
meta-
data=/dev/fileserver/backup isize=256    agcount=8, agsize=163840 blks
         =                       sectsz=512   attr=0
data     =                       bsize=4096   blocks=1310720, imaxpct=
25
         =                       sunit=0      swidth=0 blks, unwritten
=1
naming   =version 2              bsize=4096
log      =internal               bsize=4096   blocks=2560, version=1
         =                       sectsz=512   sunit=0 blks
realtime =none                   extsz=65536  blocks=0, rtextents=0
data blocks changed from 1310720 to 2621440
```

The output of

```
df -h
```

should now look like this:

```
server1:~# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/sda2              19G  666M   17G   4% /
tmpfs                  78M     0   78M   0% /lib/init/rw
udev                   10M  116K  9.9M   2% /dev
tmpfs                  78M     0   78M   0% /dev/shm
/dev/sda1             137M   17M  114M  13% /boot
/dev/mapper/fileserver-share
                       40G  177M   38G   1% /var/share
/dev/mapper/fileserver-backup
                       10G  272K   10G   1% /var/backup
/dev/mapper/fileserver-media
                      1.5G   33M  1.5G   3% /var/media
```

That's it! If you've made it until here, you should now be used to LVM and LVM on RAID.

9 Links

- Managing Disk Space with LVM: http://www.linuxdevcenter.com/pub/a/linux/2006/04/27/managing-disk-space-with-lvm.html
- A simple introduction to working with LVM: http://www.debian-administration.org/articles/410
- Debian: http://www.debian.org

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Comments

From: Reply

Great howto, Falko.
I have needed this in the past and i have already bookmarked it for the next time. I just don't work withthis stuff enough to memorize it.
You have a real talent for technical writing.
Thanks,
G

From: Reply

This was exactly what I needed to get my home file server running on LVM. I will need this again when I add disks and again when I move everything over to raid.

From: Tormod Reply

Excellent howto! I just noticed that the example fstab entries look wrong (in both examples): /dev/fileserver/share versus /dev/mapper/fileserver-share

> **From:** Tormod Reply
>
> Well, scratch that. It is correct anyway, silly me just had to try it out to see: /dev/fileserver/share is a soft link to /dev/mapper/fileserver-share

From: Anonymous Reply

I have about 2 years of experience using RAID and LVM, and I must say - in all of the literature and documentation I've ever encountered, _none_ of it ever came close to making things so simple and clear as you have just done. You've articulated the ideas of logical volumes, volume groups, and physical volumes well, and have provided concise examples.

Well done.

From: Craig Reply

One of the best howto I have come across -- wish they were all this good.

From: Gisli Reply

I agree with everyone here. Best howto I've come accross! Everything right to the point and with examples. Nice work!!

From: Vahid Pazirandeh Reply

Wow. Very well written howto. Well thought out examples. Thanks a lot to all who were involved.
I agree with an earlier comment - I have used Linux for many years and have read through lots of tutorials. This was so easy to read! :)

From: Anonymous Reply

In my 15 years with linux I have never, ever, seen such good howto. Very easy to follow and understand. In 30 mins my confidence level on LVM/RAID was boosted from 0 to 80.
I wish there were more howtos like this!

From: csg Reply

Congratulations for this hard work, very clear and concise.
Looking forward to have it running.
Thanks for your work.

From: Gianluca Reply

Excellent HowTo, pls complete this guide with LVM snapshot examples.

From: Anonymous Reply

excellent tutorial that briefs how to manage disks in linux platforms..Thanks for your effort to have this tutorial get prepared..

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