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Using Logical Volume Manager (LVM) to Reduce the Hassle of Managing Disk Space on Linux

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Agenda

- Quick overview of concepts and terminology
- Starting with nothing
- Adding space
- Removing space
- Displaying information
- LVM (Sub)Commands

- I will take questions during the presentation unless time gets short.
- This is the first time this session has been given. Constructive feedback is very much welcome.



Overview

- Logical Volume Manager (LVM) is used to create “pools” of disk storage.
- Additional storage devices can be added dynamically.
- Currently in-use devices can be removed dynamically.
 - Moving data off currently in-use devices can be done dynamically.
- Space in the pool can be given to and taken from a particular use dynamically.
- We won't be covering everything you could possibly do with LVM.



Terminology

- Physical Volume (PV) – Actual underlying storage device.
 - DASD Volume
 - Minidisk
 - SCSI over FCP DISK
- Volume Group (VG) – One or more PVs collected together.
- Logical Volume (LV) – A Logical/virtual storage device created from space owned by one (and only one) VG.
- Logical / Physical Extent – Minimum amount of allocation space that can be used or removed. (Default is 4MB.)



Sample File System Layout

```
# df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/dasda1	388M	119M	250M	33%	/
/dev/dasda2	97M	4.2M	88M	5%	/home
/dev/dasda3	74M	21M	50M	30%	/opt
/dev/dasdc1	1.2G	1.1G	100M	92%	/srv
/dev/dasdb1	291M	17M	260M	6%	/tmp
/dev/dasdb2	1.2G	915M	183M	84%	/usr
/dev/dasdb3	245M	69M	164M	30%	/var



Sample LVM File System Layout

```
# df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/dasda1	388M	119M	250M	33%	/
/dev/vg1/home	97M	4.2M	88M	5%	/home
/dev/vg1/opt	74M	21M	50M	30%	/opt
/dev/vg1/srv	1.2G	1.1G	100M	92%	/srv
/dev/vg1/tmp	291M	17M	260M	6%	/tmp
/dev/vg1/usr	1.2G	915M	183M	84%	/usr
/dev/vg1/var	245M	69M	164M	30%	/var



Starting With Nothing

- Need one or more disk storage devices
 - Make sure you know what the “node names” are for these:
 - /dev/dasda2
 - /dev/sda1
- Create a Physical Volume (PV)
- Create a Volume Group (VG) with one or more initial PVs
- Create one or more Logical Volumes (LV)



Starting With Nothing

- `pvcreate /dev/dasda2`
- `vgcreate vg1 /dev/dasda2`
- `vgchange -a y vg1`
- `lvcreate -n logicalvol1 -L 100M vg1`
- `lvcreate -n logicalvol2 -L 50M vg1`
- `lvcreate -n logicalvol3 -l 13 vg1 (42MB)`



Adding Space

- Need one or more additional disk storage volumes
- Create Physical Volume(s)
- Extend the Volume Group (VG)

- Create more Logical Volumes (LV)
- Expand existing Logical Volumes



Adding Space

- `pvcreate /dev/dasdb1 /dev/dasdc1`
- `vgextend vg1 /dev/dasdb1 /dev/dasdc1`

- `lvcreate -n lvol3 -L 2G vg1`
- `lvresize -L +500M /dev/vg1/srv`
- `lvextend -L +500M /dev/vg1/srv`
- `lvextend -l +125 /dev/vg1/srv`
- `lvresize -L 2500M /dev/vg1/srv`

- `lvresize` and `lvextend` are synonymous (in this particular case)



Removing Space

- Remove space from a Logical Volume
 - Resize the file system on the Logical Volume
 - Resize the Logical Volume
- Remove a Physical Volume from the Volume Group
 - Determine if the Physical Volume is still in use
 - Move data off the Physical Volume if needed
 - Remove the Physical Volume from the Volume Group



Removing Space From an LV

- File system resizing is dependent on the file system being used. It may or may not be allowed while the file system is mounted. (EXT3 does not allow it.)
- `lvresize -L -300M /dev/vg1/lvol2`
- `lvreduce -L -300M /dev/vg1/lvol3`
- `lvreduce -L 1G /dev/vg1/lvol4`
- `lvresize -l 250 /dev/vg1/lvol4`
- `lvresize` and `lvreduce` are synonymous (in this particular case)



Removing PV From a Volume Group

- `pvdisplay -m /dev/dasdb1`
- `pvmove /dev/dasdb1`
- `pvmove /dev/dasdb1 /dev/dasdc1`
- `vgreduce vg1 /dev/dasdb1`
- `pvremove /dev/dasdb1` (optional but prudent)



Displaying Information

- Physical Volume
 - pvdisplay
 - pvs
- Logical Volume
 - lvdisplay
 - lvs
- Volume Group
 - vgdisplay
 - vgs



pvdisplay

```
# pvdisplay /dev/dasdb1
--- Physical volume ---
PV Name                /dev/dasdb1
VG Name                vg01
PV Size                2.29 GB / not usable 42.94 MB
Allocatable            yes (but full)
PE Size (KByte)        32768
Total PE               72
Free PE                0
Allocated PE           72
PV UUID                b7v5M6-EIdc-VwV1-LgzU-gnW9-Pz7I-IeNIInW
```



pvdisplay

```
# pvdisplay -m /dev/dasdb1
--- Physical volume ---
PV Name                /dev/dasdb1
VG Name                vg01
PV Size                2.29 GB / not usable 42.94 MB
Allocatable           yes (but full)
PE Size (KByte)       32768
Total PE              72
Free PE               0
Allocated PE          72
PV UUID               b7v5M6-EIdc-VwV1-LgzU-gnW9-Pz7I-IeNInW

--- Physical Segments ---
Physical extent 0 to 71:
  Logical volume       /dev/vg01/usr
  Logical extents      0 to 71
```




lvdisplay

```
# lvdisplay /dev/vg01/tmp
--- Logical volume ---
LV Name                /dev/vg01/tmp
VG Name                vg01
LV UUID                000000-0000-0000-0000-0000-0000-000002
LV Write Access        read/write
LV Status              available
# open                 1
LV Size                3.41 GB
Current LE             109
Segments               2
Allocation             normal
Read ahead sectors     1024
Block device           253:2
```



lvdisplay

```
# lvdisplay -m /dev/vg01/tmp
--- Logical volume ---
LV Name                /dev/vg01/tmp
VG Name                vg01
LV UUID                000000-0000-0000-0000-0000-0000-0000002
LV Write Access        read/write
LV Status              available
# open                 1
LV Size                3.41 GB
Current LE             109
Segments               2
Allocation             normal
Read ahead sectors     1024
Block device           253:2

--- Segments ---
Logical extent 0 to 95:
  Type                  linear
  Physical volume       /dev/dasdd1
  Physical extents      120 to 215

Logical extent 96 to 108:
  Type                  linear
  Physical volume       /dev/dasdd1
  Physical extents      95 to 107
```



vgdisplay

```
# vgdisplay vg01
--- Volume group ---
VG Name                vg01
System ID              lslack321149984288
Format                lvml
VG Access              read/write
VG Status              resizable
MAX LV                256
Cur LV               8
Open LV               7
Max PV                256
Cur PV               3
Act PV               3
VG Size               26.94 GB
PE Size               32.00 MB
Total PE              862
Alloc PE / Size       857 / 26.78 GB
Free PE / Size        5 / 160.00 MB
VG UUID               jg5SuT-sGQe-YM7W-W4Xe-Vhn0-Xuk6-Dyghml
```



vgdisplay (and others)

- `vgdisplay -v`
 - Provides information about all LVs and PVs in the VG.

vgs

VG	#PV	#LV	#SN	Attr	VSize	VFree
vg01	3	8	0	wz--n-	26.94G	160.00M

pvs

PV	VG	Fmt	Attr	PSize	PFree
/dev/dasdb1	vg01	lvm1	a-	2.25G	0
/dev/dasdc1	vg01	lvm1	a-	2.25G	0
/dev/dasdd1	vg01	lvm1	a-	22.44G	160.00M



```
# lvs
LV          VG      Attr   LSize   Origin Snap%   Move Log Copy%   Convert
build      vg01   -wn-a-  5.41G
ccache     vg01   -wn-ao 768.00M
current    vg01   -wn-ao  7.00G
opt        vg01   -wn-ao 320.00M
slack-10.2 vg01   -wn-ao  4.00G
tmp        vg01   -wn-ao  3.41G
usr        vg01   -wn-ao  5.28G
var        vg01   -wn-ao 640.00M
```



LVM (Sub)Commands

- dumpconfig (subcmd only)
- formats (subcmd only)
- help (subcmd only)
- lvchange
- lvconvert
- lvcreate
- lvdisplay
- lvextend
- lvmchange
- lvmddiskscan
- lvmsadc
- lvmsar
- lvreduce
- lvremove
- lvrename
- lvresize
- lvs
- lvscan
- pvchange
- pvresize
- pvck
- pvcreate
- pvdata
- pvdisplay



LVM (Sub)Commands (2)

- pvmove
- pvremove
- pvs
- pvscan
- segtypes
- vgcfgbackup
- vgcfgrestore
- vgchange
- vgck
- vgconvert
- vgcreate
- vgdisplay
- vgexport
- vgextend
- vgimport
- vgmerge
- vgmknodes
- vgreduce
- vgremove
- vgrename
- vgs
- vgscan
- vgsplit