



Logical Volume Management (LVM)



Unit objectives

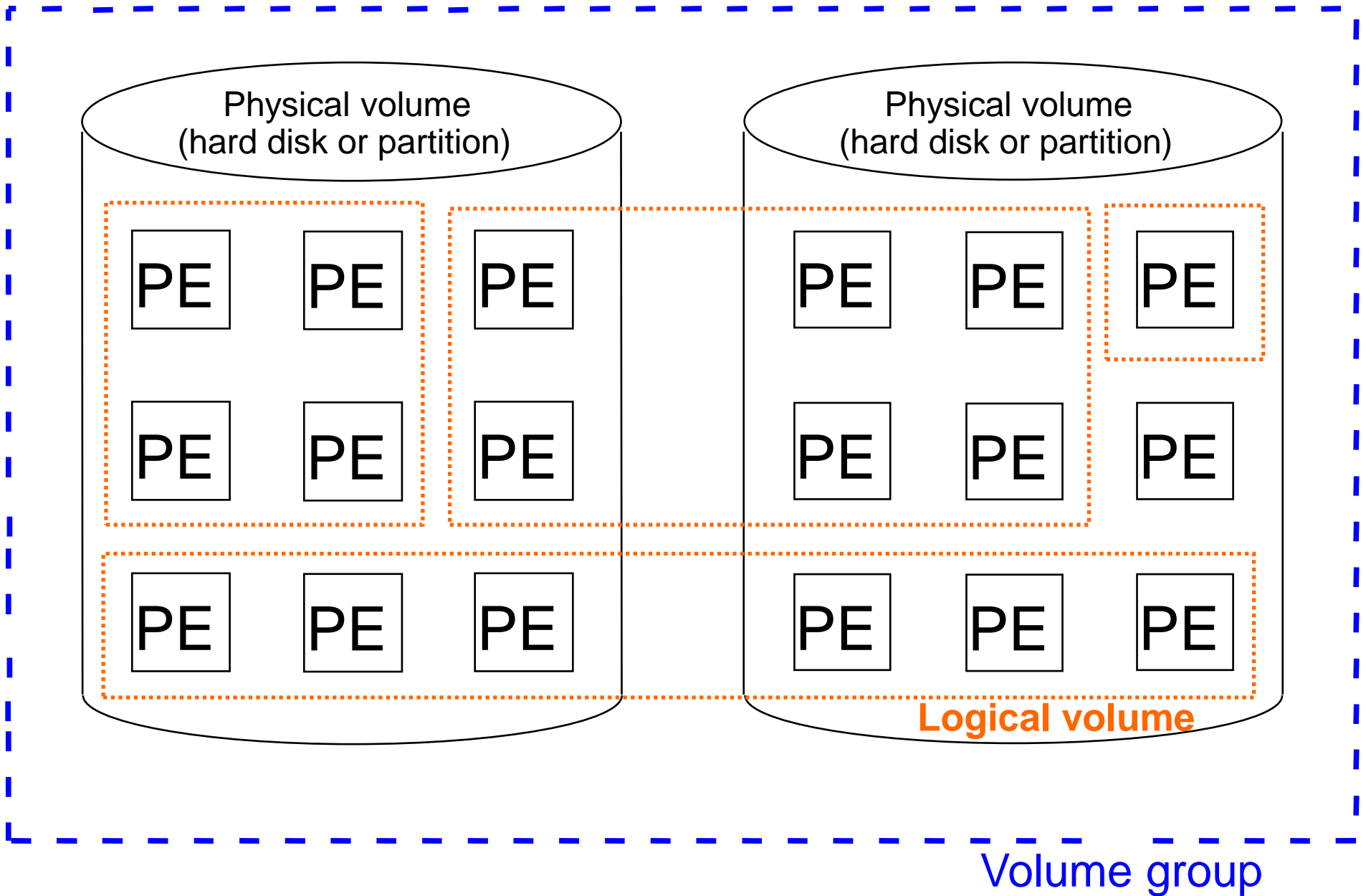
After completing this unit, you should be able to:

- Understand LVM
- LVM Implementation
- Basic LVM Commands
- Extend or Reduce VG
- Extend or Reduce LV
- Review additional LVM considerations

Logical volume management (1 of 3)

- Traditional disk partitioning scheme has several disadvantages:
 - Virtually impossible to resize or move a partition
 - Partition size is limited by disk size
- Logical volume management solves these disadvantages:
 - One or more physical volumes (hard disks, partitions) are assigned to a volume group (VG).
 - All physical volumes (PV) are split into physical extents (PE) of identical size (default 4 MB).
 - PEs in a VG can be combined into logical volumes (LV), which can be used like any block device.
- An LV can span multiple disks.
- To increase the size of an LV, add PEs.
- To increase the size of a VG, add PVs.

Logical volume management (2 of 3)



Logical volume management (3 of 3)



- Raw disks : sd | hd | nvme | san luns
- PV : pvcreate | pvremove | pvmove
- VG : vgcreate | vgextend | vgreduce
- FS : mkfs | mkfs.xfs | mkfs.ext4
- Mount : mount /dev/vg/lv /mnt
- User : cd | touch | mkdir | more | vi | cat ...

LVM implementation overview

- Add hard disks and/or create partitions (type 0x8e) on existing hard disks
- Initialize physical volumes (disks or partitions)

```
# pvcreate /dev/sda3  
# pvcreate /dev/sdb
```

- Create volume group **datavg** with physical volumes

```
# vgcreate datavg /dev/sda3 /dev/sdb
```

- Create logical volume in volume group

```
# lvcreate -L 50M -n dblv01 datavg
```

- Can now use /dev/datavg/dblv01 as block device

Physical volume commands

- **pvcreate** *<pv>*

- Initializes a physical volume by putting an (empty) volume group descriptor area at the start of the PV



- **pvmove** [*-n <lv>*] *<source pv>* [*<destination pv>*]

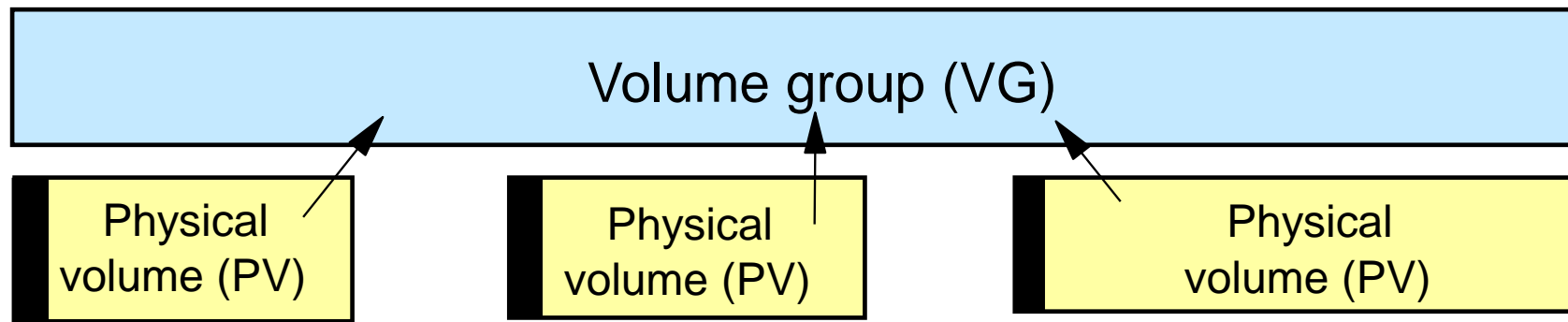
- Move PEs from one PV to another PV in the volume group

- **pvdiskplay** *<pv>*

- List information about a PV

Volume group commands

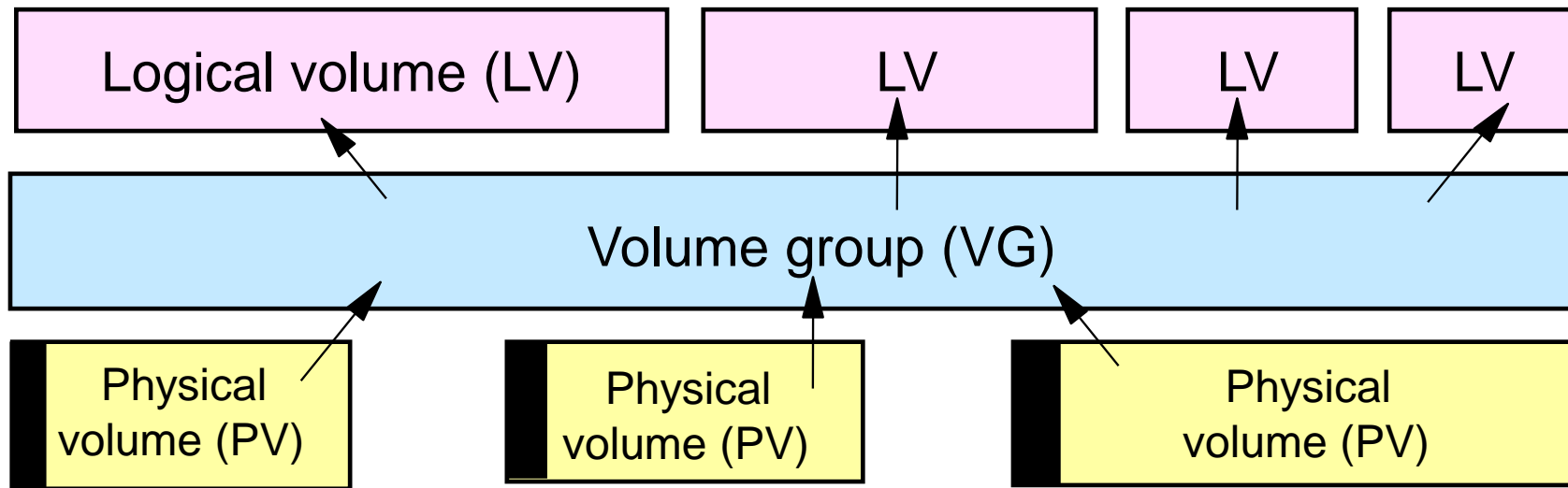
- **vgcreate** [-s <pe size>] <vg name> <pv> [<pv>...]
 - Create a volume group



- **vgs | vgdisplay** [<vg>]
 - Display information about a volume group
- **vgremove** <vg>
 - Delete a volume group

Logical volume commands

- `lvcreate -L <size> [-n <lv name>] <vg> [<pv>...]`
 - Create a logical volume in a volume group
 - Use `-m` option to enable mirroring



- `lvs | lvdisplay <lv> [<lv>...]`
 - Display information about a logical volume
- `lvremove <lv> [<lv>...]`
 - Remove a logical volume

Extending or reducing a volume group

- To add or remove a physical volume to or from a volume group, use the **vgextend** and **vgreduce** commands.
- To move physical extents from one physical volume to another, use **pvmove**.

```
# vgextend vg00 /dev/sdb6
# vgreduce vg00 /dev/sda5
ERROR: can't reduce volume group "vg00" by used
physical volume "/dev/sda5"
# pvmove /dev/sda5 /dev/sdb6
# vgreduce vg00 /dev/sda5
```

Extending or reducing a logical volume

- To extend/shrink a logical volume use the **lvextend**/**lvreduce** commands.
 - Use **-L** option to specify size in bytes
 - Use **-l** option to specify size in PEs
- **lvextend**/**lvreduce** do *not* extend/shrink a file system in the LV automatically!
(Extending/shrinking a file system will be covered later.)

Command	Results
lvextend -l 128	Resize the logical volume to <i>exactly</i> 128 extents in size.
lvextend -l +128	Add 128 extents to the current size of the logical volume.
lvextend -L 128M	Resize the logical volume to <i>exactly</i> 128 MiB.
lvextend -L +128M	Add 128 MiB to the current size of the logical volume.
lvextend -l +50%FREE	Add 50 percent of the current free space in the VG to the LV.

Resize LV with ext4 file system

- Can do on the fly even users are **connected**
- Can only increase file system
- Use `lvresize` and `resize2fs` command

```
# lvresize -L +100m /dev/datavg/ext4
# lvs datavg/ext4
# resize2fs /dev/datavg/ext4
# df -m
```

- Can do on the fly when users **not connected**
- Use `lvresize` and `--resizefs` parameter
- Can increase & decrease file system

```
# lvresize -L +100m --resizefs /dev/datavg/ext4
Answer Y ← will unmount, adjust, then remount
# lvs datavg/ext4
# df -m
```

Resize LV with xfs file system

- Can do on the fly even users are **connected**
- Can increase/decrease file system
- Use `lvresize` and `xfs_growfs` command

```
# lvresize -L +100m /dev/datavg/xfs
# lvs datavg/xfs
# xfs_growfs /dev/datavg/xfs
# df -m
```

```
# lvresize -L 500m /dev/datavg/xfs
# lvresize -L -50m /dev/datavg/xfs
# xfs_growfs /dev/datavg/xfs
# df -m
```

Create swap space using logical volume

- Improve flexibility
- Improve speed when combined with striping
- Improve reliability when combined with RAID

```
# swapon
NAME          TYPE          SIZE          USED          PRIO
/dev/dm-1 partition    2G           128.4M        -2
# lvcreate -L 100m -n swap1 datavg
# mkswap /dev/datavg/swap1
# swapon /dev/datavg/swap1
```

Extend swap space in logical volume

- Must deactivate first. All data will be moved out to remaining active swap device
- Extend / Reduce size
- Re-activate

```
# swapon
NAME          TYPE          SIZE          USED          PRIO
/dev/dm-1     partition     2G            128.4M        -2
/dev/dm-4     partition     100M          0B            -3
# swapoff /dev/dm-4
# lvextend -L +100m /dev/datavg/swap1
# mkswap /dev/datavg/swap1
# swapon /dev/datavg/swap1
```

Additional LVM considerations

- Do not put /boot on LVM.
- Advanced LVM features:
 - Stripe logical volumes across disks
 - Creating Snapshots
 - Splitting volume groups
 - Migrating volume groups to other system
 - Extending PVs (useful on LUNs)
 - Combine with RAIDs
- Cluster LVM (CLVM) allows for concurrent access.
 - Useful in clusters with data on SAN

Quiz

1. Which are LVM components ? [choose two]
 - a) Group Extend
 - b) Logical Volume
 - c) Physical Extend
 - d) Logical Group

2. Which is correct sequence?
 - a) lvcreate > pvcreate > vgcreate > mkfs > mount
 - b) vgcreate > lvcreate > pvcreate > mkfs > mount
 - c) pvcreate > vgcreate > lvcreate > mkfs > mount
 - d) vgcreate > pvcreate > > lvcreate > mkfs > mount

3. Which command moves all extends from /dev/sda to /dev/sdg in vgA?
 - a) mv /dev/sda /dev/sdg
 - b) mv -ar /dev/sda /dev/sdg
 - c) pvmove /dev/sda /dev/sdg
 - d) pvmove -ar /dev/sda /dev/sdg

4. True or False: LV with XFS file system type can resize on the fly

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Unit summary

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