



Unit 9

Working with the Logical Volume Manager



Unit objectives

After completing this unit, you should be able to:

- Add, change, and delete:
 - Volume groups
 - Logical volumes
 - Physical volumes
- Describe mirroring
- Describe striping

Logical Volume Manager

```
# smit lvm
```

Logical Volume Manager

Move cursor to desired item and press Enter.

```
Volume Groups
Logical Volumes
Physical Volumes
Paging Space
```

F1=Help

F9=Shell

F2=Refresh

F10=Exit

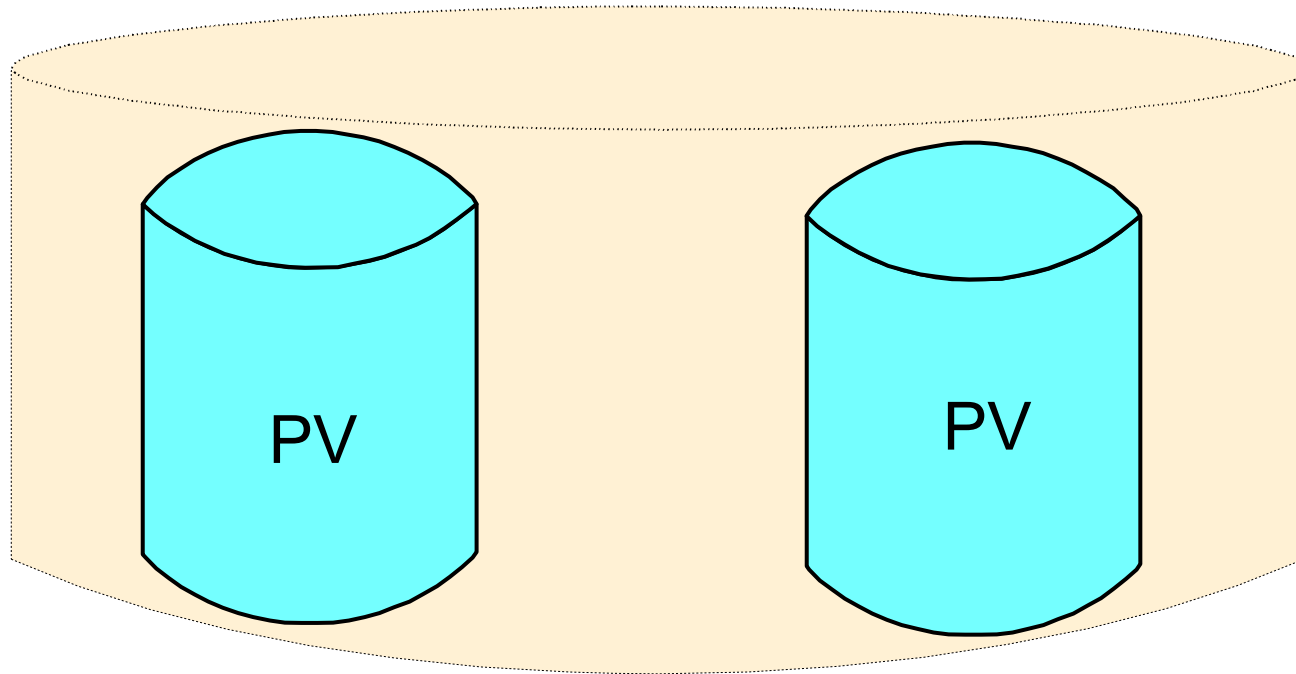
F3=Cancel

Enter=Do

F8=Image

Volume groups

Volume group



- Physical Volume (PV)
 - Hard disk
- Volume Group (VG)
 - Collection of related disks (PVs)

SMIT Volume Groups menu

smit vg

Volume Groups

Move cursor to desired item and press Enter.

- List All Volume Groups
- Add a Volume Group
- Set Characteristics of a Volume Group
- List Contents of a Volume Group
- Remove a Volume Group
- Activate a Volume Group
- Deactivate a Volume Group
- Import a Volume Group
- Export a Volume Group
- Mirror a Volume Group
- Unmirror a Volume Group
- Synchronize LVM Mirrors
- Back Up a Volume Group
- Remake a Volume Group
- Preview Information about a Backup
- Verify the Readability of a Backup (Tape only)
- View the Backup Log
- List Files in a Volume Group Backup
- Restore Files in a Volume Group Backup

F1=Help

F2=Refresh

F3=Cancel

F8=Image

F9=Shell

F10=Exit

Enter=Do

List all volume groups

```
# lsvg  
rootvg  
payrollvg
```

```
# lsvg -o  
rootvg
```

List volume group contents

```
# lsvg rootvg
```

```
VOLUME GROUP:      rootvg          VG IDENTIFIER:    000bc6fd00004c00000000e10fdd7f52
VG STATE:          active          PP SIZE:          16 megabyte(s)
VG PERMISSION:     read/write      TOTAL PPs:        1084 (17344 megabytes)
MAX LVs:           256            FREE PPs:         1032 (16512 megabytes)
LVs:               11            USED PPs:         52 (832 megabytes)
OPEN LVs:          10            QUORUM:           2
TOTAL PVs:         2            VG DESCRIPTORS:   3
STALE PVs:         0            STALE PPs:        0
ACTIVE PVs:        2            AUTO ON:          yes
MAX PPs per VG:    32512
MAX PPs per PV:    1016          MAX PVs:          32
LTG size (Dynamic): 256 kilobyte(s)  AUTO SYNC:        no
HOT SPARE:         no            BB POLICY:        relocatable
```

List volume group information (physical volumes)

```
# lsvg -p rootvg
```

```
rootvg:
```

PV_NAME	PV STATE	TOTAL PPs	FREE PPs	FREE DISTRIBUTION
hdisk0	active	159	52	24..00..00..00..28
hdisk1	active	159	78	32..02..00..12..32

List volume group information (logical volumes)

```
# lsvg -l rootvg
```

```
rootvg:
```

LVNAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
hd6	paging	32	32	1	open/syncd	N/A
hd5	boot	2	2	1	closed/syncd	N/A
hd8	jfslog	1	1	1	open/syncd	N/A
hd9var	jfs2	1	1	1	open/syncd	/var
hd4	jfs2	9	9	1	open/syncd	/
hd2	jfs2	101	101	1	open/syncd	/usr
hd3	jfs2	4	4	1	open/syncd	/tmp
hd1	jfs2	1	1	1	open/syncd	/home
hd10opt	jfs2	5	5	1	open/syncd	/opt
hd11admin	jfs2	8	8	1	open/syncd	/admin
lv00	jfs2	1	2	2	open/syncd	/home/john
lv01	jfs2	4	4	2	open/syncd	/home/fred

Add a Volume Group

```
# smit mkvg
```

Add a Volume Group

Move cursor to desired item and press Enter.

```
Add an Original Volume Group
Add a Big Volume Group
Add a Scalable Volume Group
```

Add an Original Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[Entry Fields]

VOLUME GROUP name	[]	
Physical partition SIZE in megabytes		+
* PHYSICAL VOLUME names	[]	+
FORCE the creation of volume group?	no	+
Activate volume group AUTOMATICALLY at system restart?	yes	+
Volume group MAJOR NUMBER	[]	+#
Create VG Concurrent Capable?	no	+

Add a Scalable Volume Group

```
# smit mkvg
```

Add a Scalable Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

	[Entry Fields]	
VOLUME GROUP name	[]	
Physical partition SIZE in megabytes		+
* PHYSICAL VOLUME names	[]	+
FORCE the creation of volume group?	no	+
Activate volume group AUTOMATICALLY at system restart?	yes	+
Volume group MAJOR NUMBER	[]	+#
Create VG Concurrent Capable?	no	+
Max PPs per VG in units of 1024	32	+
Max Logical Volumes	256	+

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

F8=Image

F9=Shell

F10=Exit

Enter=Do

Set Characteristics of a Volume Group

```
# smit vgsc
```

Set Characteristics of a Volume Group

Move cursor to desired item and press Enter.

Change a Volume Group

Add a Physical Volume to a Volume Group

Remove a Physical Volume from a Volume Group

Reorganize a Volume Group

F1=Help

F2=Refresh

F3=Cancel

F8=Image

F9=Shell

F10=Exit

Enter=Do

Change a Volume Group

```
# smit chvg
```

Change a Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

	[Entry Fields]	
* VOLUME GROUP name	rootvg	
* Activate volume group AUTOMATICALLY at system restart?	yes	+
* A QUORUM of disks required to keep the volume group on-line ?	yes	+
Convert this VG to Concurrent Capable?	no	+
Change to big VG format?	no	+
Change to scalable VG format?	no	+
LTG Size in kbytes	128	+
Set hotspare characteristics	n	+
Set synchronization characteristics of stale partitions	n	+
Max PPs per VG in units of 1024	32	+
Max Logical Volumes	256	+

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

F8=Image

F9=Shell

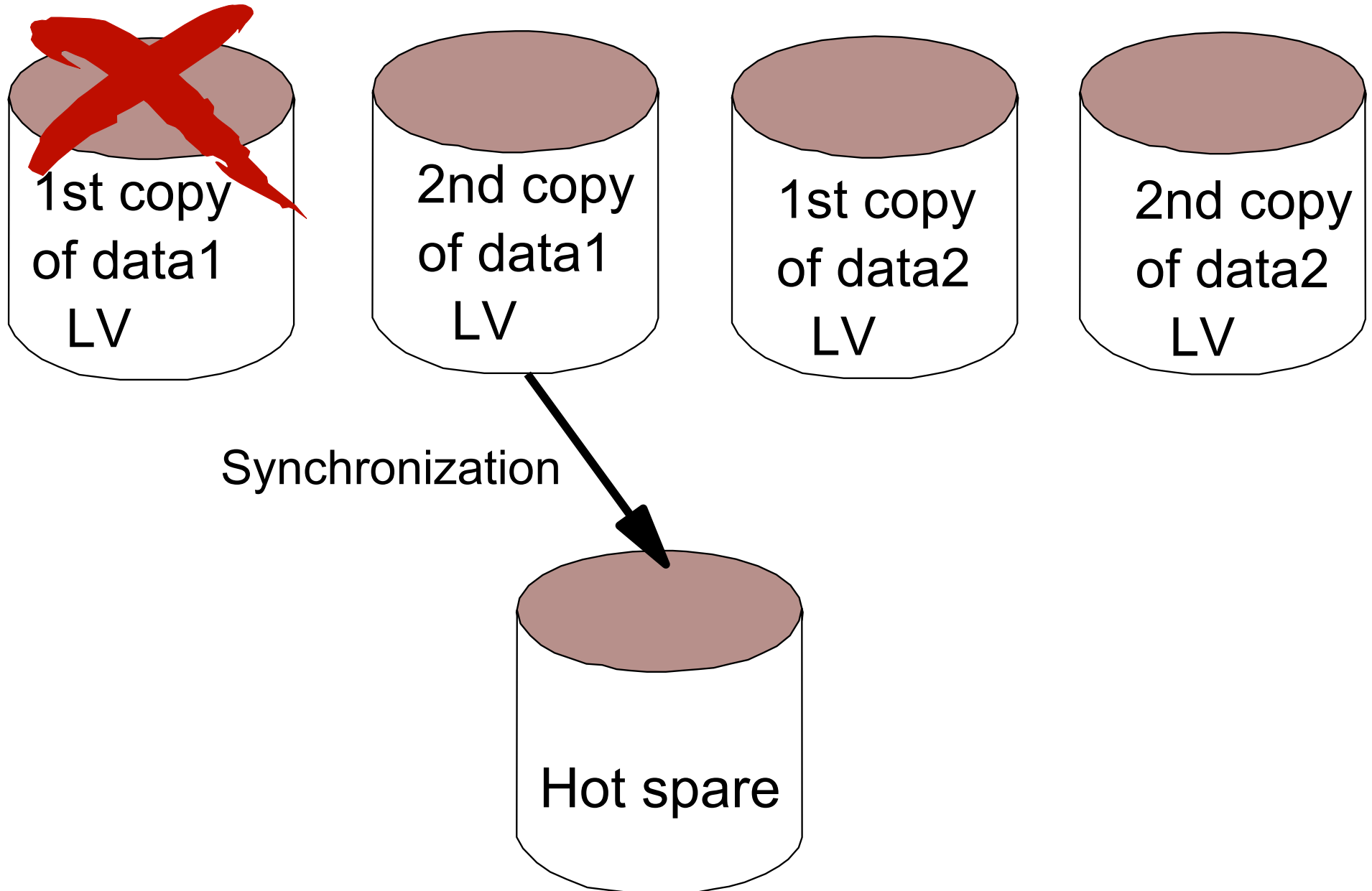
F10=Exit

Enter=Do

Logical track group (LTG) size

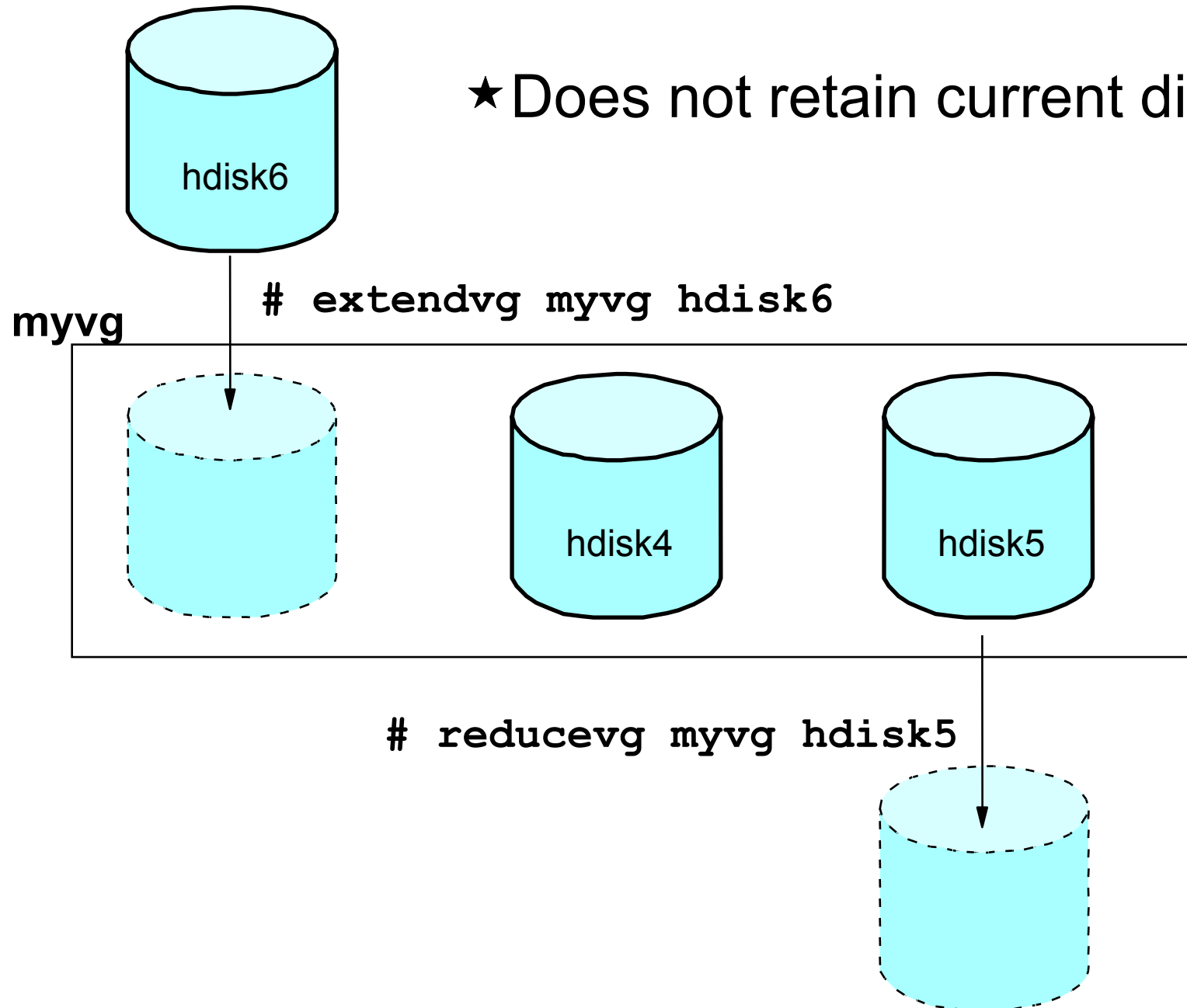
- LTG is the maximum transfer size of a logical volume
- Prior to AIX 5L V5.3:
 - Default LTG size is 128 KB
 - LTG size can be changed by the `-L` flag on the `chvg` or `mkvg` command
- AIX 5L V5.3 and V6.1:
 - AIX dynamically sets the LTG size (calculated at each volume group activation)
 - LTG size can be changed with the command:
`varyonvg -M <LTGsize>`
 - The `mkvg -L` flag is no longer supported
 - The `chvg -L` flag has no effect on volume groups created in AIX 5L V5.3 or later
 - Enable variable LTG on old volume groups using `chvg -L 0`
- To display the LTG size of a disk, use the command:
`# /usr/sbin/lquerypv -M <hdisk#>`

Hot spare



Extending and reducing volume groups

★ Does not retain current disk contents



Remove a Volume Group

```
# smit reducevg2
```

Remove a Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* VOLUME GROUP name

[Entry Fields]

[] +

F1=Help

F5=Reset

F9=Shell

F2=Refresh

F6=Command

F10=Exit

F3=Cancel

F7=Edit

Enter=Do

F4=List

F8=Image

Activate/Deactivate a volume group

- Activate a volume group (make it available for use):

```
varyonvg [ -f ] VolumeGroup
```

```
# varyonvg datavg
```

- Deactivate a volume group (make it unavailable for use):

```
varyoffvg VolumeGroup
```

```
# varyoffvg datavg
```

Import/Export a Volume Group

```
# smit importvg
```

Import a Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

	[Entry Fields]	
VOLUME GROUP name	[]	
* PHYSICAL VOLUME name	[]	+
Volume Group MAJOR NUMBER	[]	+#

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

F8=Image

F9=Shell

F10=Exit

Enter=Do

Advanced RAID support

- Checks all disks in a volume group if they have grown in size:

```
chvg -g Volumegroup
```

```
# chvg -g datavg
```

- Turns on bad block relocation policy of a volume group:

```
chvg -b [ y/n ] Volumegroup
```

```
# chvg -b y datavg
```

- Turns off bad block relocation policy of a volume group:

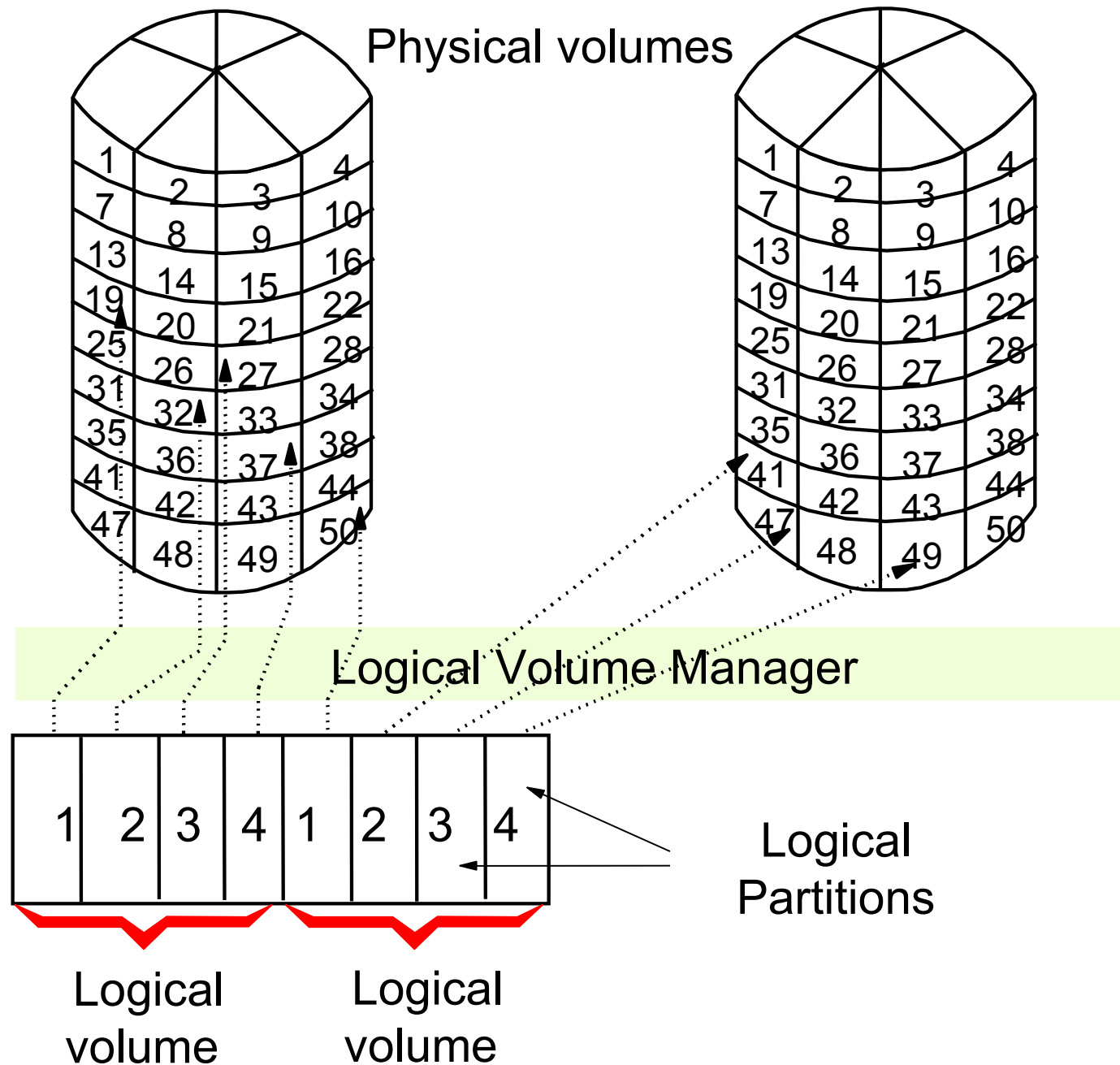
```
# chvg -b n datavg
```

Exercise 9: Working with LVM (parts 1-2)

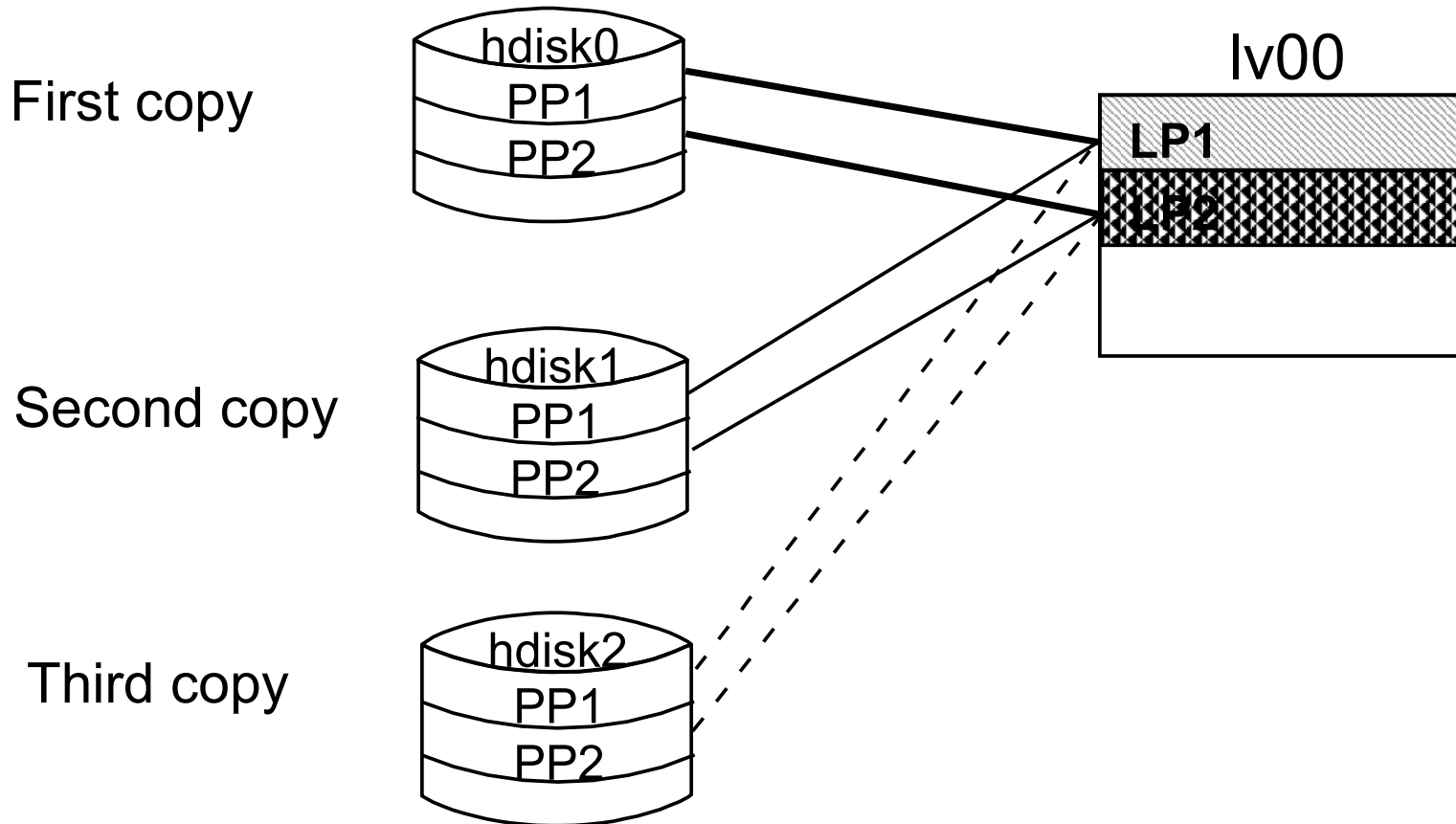


- Part 1 - Adding and removing a disk from a volume group
- Part 2 - Creating and removing a volume group

Logical storage

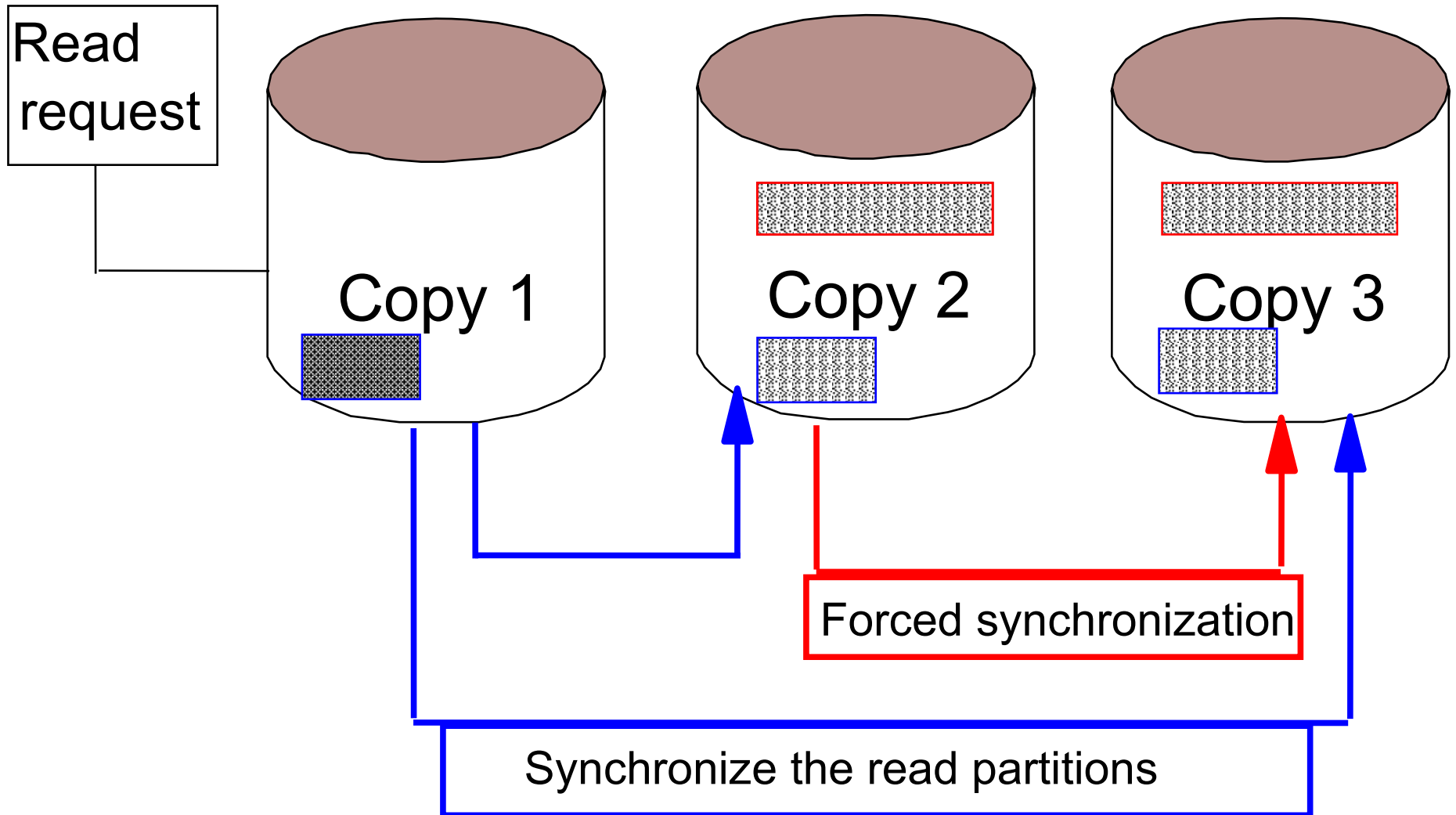


Mirroring



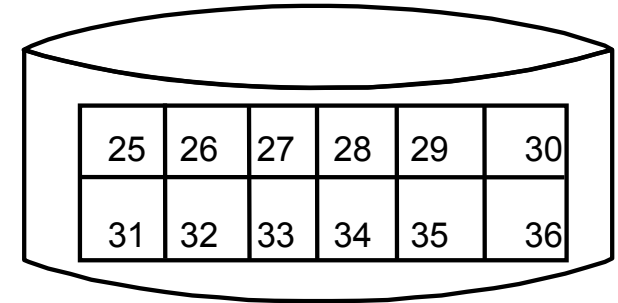
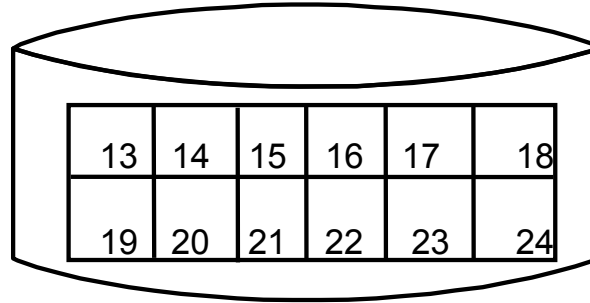
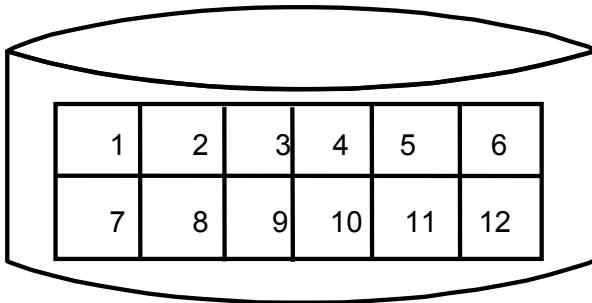
- Mirroring is when a logical partition maps to more than one physical partition of the same volume group
- Scheduling policy:
 - Parallel: Physical partitions written simultaneously
 - Sequential: Physical partitions written in sequence

Mirror write consistency

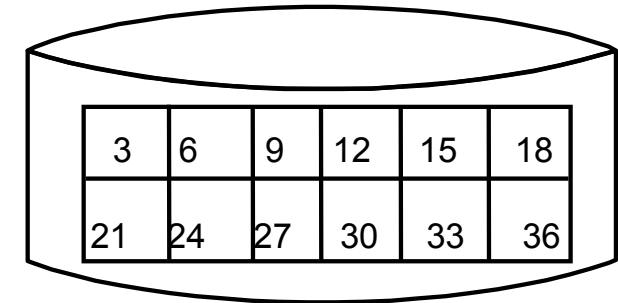
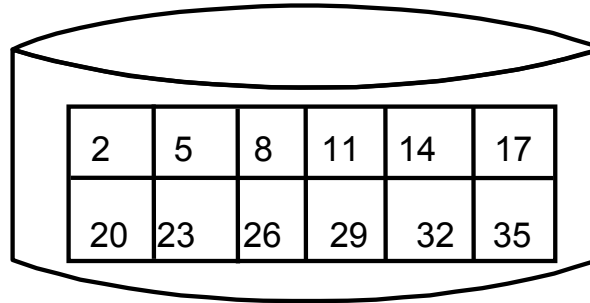
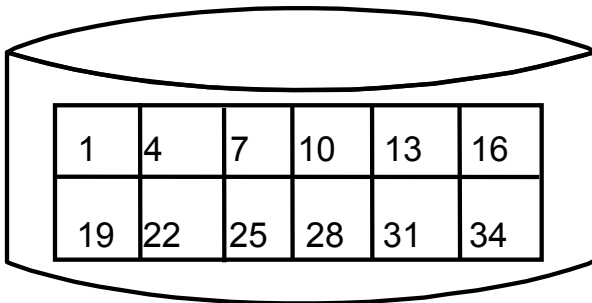


Striping

- Normal flow of data blocks when a logical volume is spread across physical volumes:



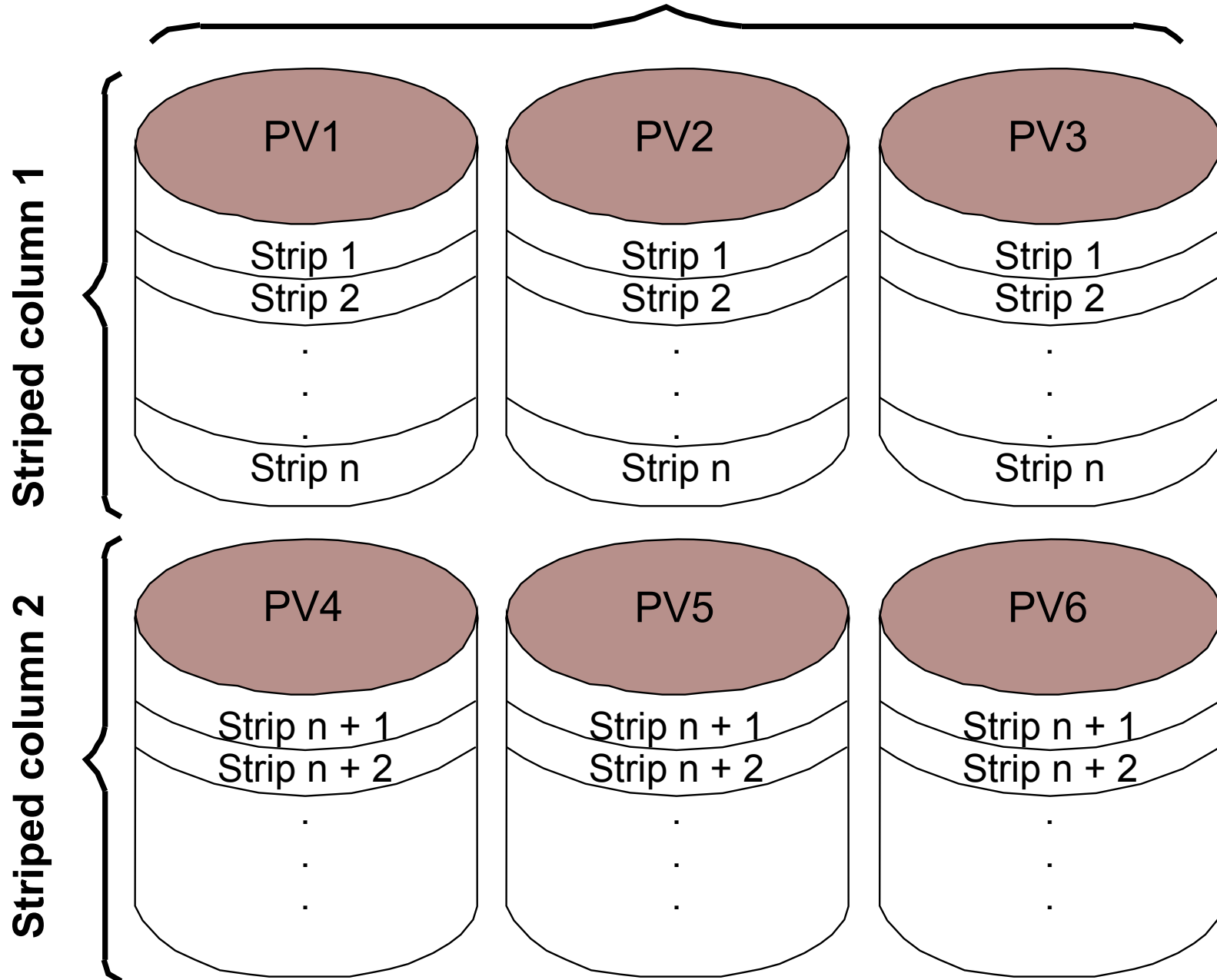
- The layout of stripe units when a logical volume is set up to stripe:



- Consecutive stripe units are created on different physical volumes
- Striping increases read/write sequential throughput by evenly distributing stripe units among disks
- Stripe unit size is specified at creation time

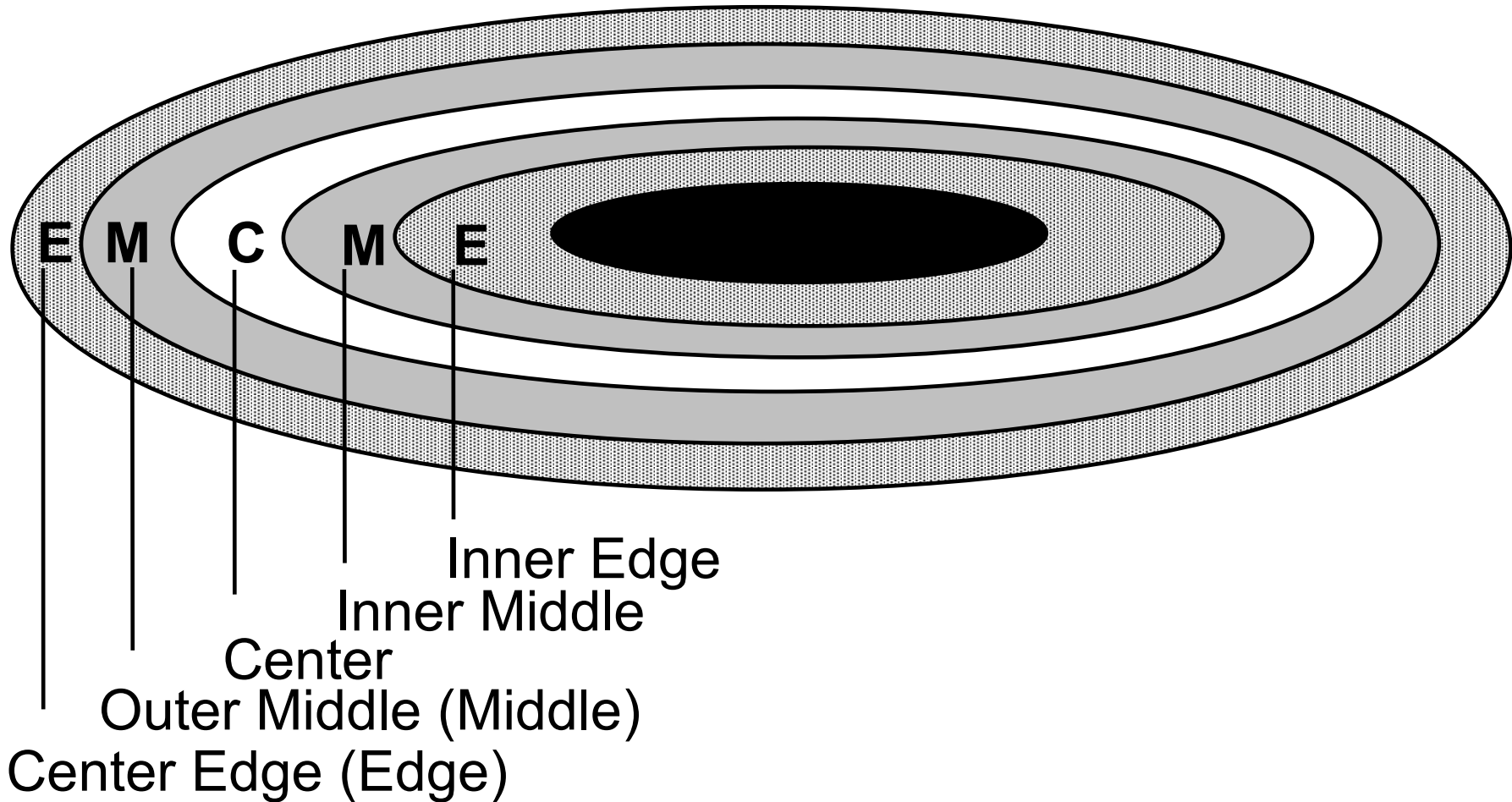
Striped columns

Striped logical volume: strip width = 3, upper bound = 6



Logical volume policies

Intra-physical volume allocation policy:



Inter-physical volume allocation policy:

- ▶ Maximum number of physical volumes to use
- ▶ Range of physical volumes to use

SMIT Logical Volumes menu

smit lv

Logical Volumes

Move cursor to desired item and press Enter.

List All Logical Volumes by Volume Group
Add a Logical Volume
Set Characteristic of a Logical Volume
Show Characteristics of a Logical Volume
Remove a Logical Volume
Copy a Logical Volume

F1=Help
F9=Shell

F2=Refresh
F10=Exit

F3=Cancel
Enter=Do

F8=Image

Show logical volume characteristics

- Physical volume map:

```
# lslv -l lv00

lv00:/home/john
PV          COPIES          IN BAND          DISTRIBUTION
hdisk0      010:000:000      70%              000:000:007:003:000
```

- Logical partition map:

```
# lslv -m lv00

lv00:/home/john
LP          PP1      PV1          PP2      PV2          PP3      PV3
00010134    hdisk0
0002        0135     hdisk0
00030136    hdisk0
```

Add a Logical Volume

```
# smit mklv
```

Add a Logical Volume

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]	[Entry Fields]	
Logical volume NAME	[]	
* VOLUME GROUP name	rootvg	
* Number of LOGICAL PARTITIONS	[]	#
PHYSICAL VOLUME names	[]	+
Logical volume TYPE	[]	+
POSITION on physical volume	outer_middle	+
RANGE of physical volumes	minimum	+
MAXIMUM NUMBER of PHYSICAL VOLUMES to use for allocation	[]	#
Number of COPIES of each logical partition	1	+
Mirror Write Consistency?	active	+
Allocate each logical partition copy	yes	+

[MORE...11]

F1=Help	F2=Refresh	F3=Cancel	F4=List
F5=Reset	F6=Command	F7=Edit	F8=Image
F9=Shell	F0=Exit	Enter=Do	

Remove a Logical Volume

```
# smit rmlv
```

Remove a Logical Volume

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

[TOP]

LOGICAL VOLUME name

[Entry Fields]

[] +

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

F8=Image

F9=Shell

F0=Exit

Enter=Do

Set Characteristics of a Logical Volume

```
# smit lvsc
```

Set Characteristics of a Logical Volume

Move cursor to desired item and press Enter.

Change a Logical Volume

Rename a Logical Volume

Increase the Size of a Logical Volume

Add a Copy to a Logical Volume

Remove a Copy from a Logical Volume

F1=Help

F2=Refresh

F3=Cancel

F8=Image

F9=Shell

F10=Exit

Enter=Do

List all logical volumes by volume group

```
# lsvg -o | lsvg -i -l
```

```
rootvg:
```

LVNAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
hd6	paging	32	32	1	open/syncd	N/A
hd5	boot	2	2	1	closed/syncd	N/A
hd8	jfslog	1	1	1	open/syncd	N/A
hd9var	jfs2	2	2	1	open/syncd	/var
hd4	jfs2	9	9	1	open/syncd	/
hd2	jfs2	101	101	1	open/syncd	/usr
hd3	jfs2	4	1	1	open/syncd	/tmp
hd1	jfs2	1	1	1	open/syncd	/home
hd10opt	jfs2	5	5	1	open/syncd	/opt
hd11admin	jfs2	8	8	1	open/syncd	/admin
lv00	jfs2	1	2	2	open/syncd	/home/john
lv01	jfs2	4	4	2	open/syncd	/home/fred

Show logical volume characteristics

```
# lslv lv02
```

```
LOGICAL VOLUME:    lv02                VOLUME GROUP:    course
LV IDENTIFIER:     0000000000004c00000000e5cf75106f.4  PERMISSION:      read/write
VG STATE:          active/complete      LV STATE:         opened/syncd
TYPE:              jfs2                 WRITE VERIFY:     off
MAX LPs:           128                   PP SIZE:          4 megabyte(s)
COPIES:            1                     SCHED POLICY:    parallel
LPs:               10                    PPs:              10
STALE PPs:         0                     BB POLICY:        relocatable
INTER-POLICY:      minimum                RELOCATABLE:     yes
INTRA-POLICY:      middle                  UPPER BOUND:     32
MOUNT POINT:       /home/malcolm          LABEL:            /home/malcolm
MIRROR WRITE CONSISTENCY: on/ACTIVE
EACH LP COPY ON A SEPARATE PV ?: yes
Serialize IO ?    NO
```

Add Copies to a Logical Volume

smit mklvcopy

Add Copies to a Logical Volume

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

	[Entry Fields]	
* LOGICAL VOLUME name	lv00	
* NEW TOTAL number of logical partition copies	2	+
PHYSICAL VOLUME names	[]	+
POSITION on physical volume	middle	+
RANGE of physical volumes	minimum	+
MAXIMUM NUMBER of PHYSICAL VOLUMES to use for allocation	[32]	#
Allocate each logical partition copy on a SEPARATE physical volume?	yes	+
File containing ALLOCATION MAP	[]	
SYNCHRONIZE the data in the new logical partition copies?	no	+

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

F8=Image

F9=Shell

F10=Exit

Enter=Do

Reorganize a Volume Group

```
# smit reorgvg
```

Reorganize a Volume Group

Type or select values in entry fields.

Press Enter AFTER making all desired changes.

```
                                [Entry Fields]
* VOLUME GROUP name            vg3
  LOGICAL VOLUMES              [lv04 lv07]          +
```

F1=Help

F2=Refresh

F3=Cancel

F4=List

F5=Reset

F6=Command

F7=Edit

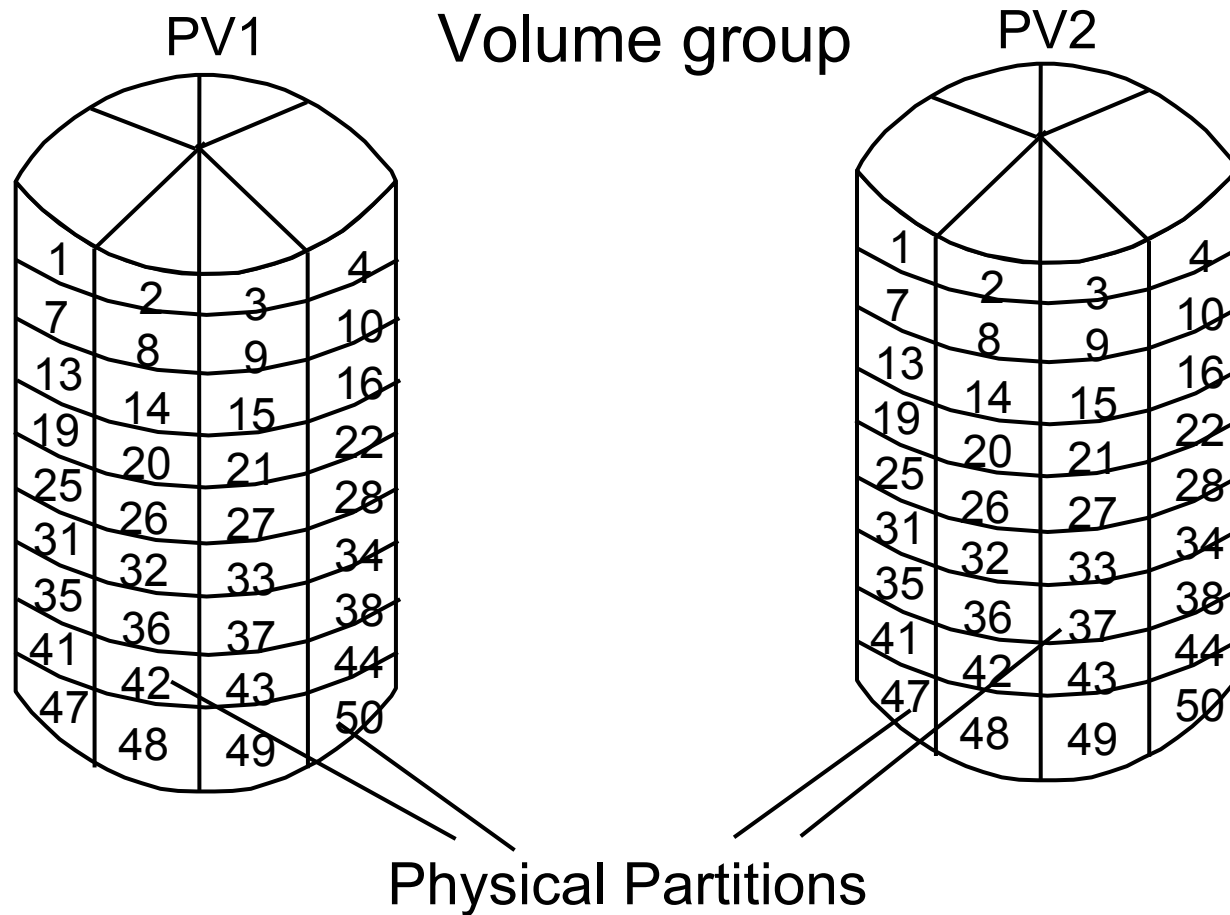
F8=Image

F9=Shell

F10=Exit

Enter=Do

Physical volumes



- Physical volume (PV)
 - Hard disk
- Physical partition (PP)
 - Smallest assignable unit of allocation on a physical disk

SMIT Physical Volumes menu

```
# smit pv
```

Physical Volumes

Move cursor to desired item and press Enter.

List All Physical Volumes in System

Add a Disk

Change Characteristics of a Physical Volume

List Contents of a Physical Volume

Move Contents of a Physical Volume

F1=Help

F2=Refresh

F3=Cancel

F8=Image

F9=Shell

F10=Exit

Enter=Do

List physical volume information

- List all physical volumes in system:

```
# lspv

hdisk0    da1c923411d52ec91cd600802eda72c9    rootvg    active
hdisk1    bebc80000000000000000000802evg79c9    rootvg    active
```

- List the contents of a physical volume:

```
# lspv hdisk0

PHYSICAL VOLUME:    hdisk0                VOLUME GROUP:    rootvg
PV IDENTIFIER:    da1c923411d52ec91cd600802eda72c9
VG IDENTIFIER:    000bc6fd00004c00000000e10fdd7f52
PV STATE:        active
STALE PARTITIONS:    0                    ALLOCATABLE:    yes
PP SIZE:        4 megabyte(s)    LOGICAL VOLUMES:    6
TOTAL PPs:    95 (380 megabytes)    VG DESCRIPTORS:    2
FREE PPs:    3 (12 megabytes)    HOT SPARE:    no
USED PPs:    92 (368 megabytes)    MAX REQUEST    256 KB
FREE DISTRIBUTION:    00..03..00..00..00
USED DISTRIBUTION:    19..16..19..19..19
```

List logical volumes on a physical volume

```
# lspv -l hdisk0
hdisk0:
LV NAME      LPs      PPs      DISTRIBUTION      MOUNT POINT
hd1          1        1        00..00..00..12..00  /home
hd3          4        4        00..03..00..00..00  /tmp
hd2         101      101      00..00..17..12..00  /usr
hd4          9        9        00..00..13..00..00  /
hd8          1        1        00..00..01..00..00  N/A
hd6          8        8        00..00..00..08..00  N/A
hd5          2        2        01..00..00..00..00  N/A
hd9var       2        2        00..00..02..00..00  /var
hd10opt      5        5        00..00..02..00..00  /opt
hd11admin   8        8        00..00..02..00..00  /admin
```


List a physical volume partition map

```
# lspv -p hdisk0
hdisk0:
PP RANGE      STATE      REGION      LV NAME      TYPE      MOUNT POINT
1-2           used      outer edge  hd5          boot      N/A
3-154        free      outer edge
155-186      used      outer middle hd6          paging    N/A
187-307      free      outer middle
308-308      used      center      hd8          jfslog    N/A
309-309      used      center      hd4          jfs2      /
310-313      used      center      hd2          jfs2      /usr
314-314      used      center      hd9var       jfs2      /var
315-317      used      center      hd3          jfs2      /tmp
318-318      used      center      hd1          jfs2      /home
319-319      used      center      hd10opt      jf22      /opt
320-360      used      center      hd2          jfs2      /usr
361-363      used      center      hd10opt      jfs2      /opt
364-364      used      center      hd3          jfs2      /tmp
365-372      used      center      hd4          jfs2      /
373-380      used      center      hd11admin    jfs2      /admin
381-423      used      center      hd2          jfs2      /usr
424-424      used      center      hd9var       jfs2      /var
425-425      used      center      hd10opt      jfs2      /opt
426-438      used      center      hd2          jfs2      /usr
439-460      free      center
461-613      free      inner middle
614-767      free      inner edge
```

Add or move contents of physical volumes

- A disk can be either added:
 - Through SMIT
 - Configured through configuration manager when the system boots up
- Move the contents of a physical volume:

```
migratepv [ -l lvname ] sourcePV targetPV ..
```

```
# migratepv -l lv02 hdisk0 hdisk6
```

Documenting the disk storage setup

- List of the disks on the system (PVID and volume group):

```
# lspv
```

- List the volume groups:

```
# lsvg
```

- List what logical volumes are contained in each volume group:

```
# lsvg -l vgname
```

- List the logical volumes on each disk:

```
# lspv -l pvname
```

Checkpoint

1. True or False? A logical volume can span more than one physical volume.
2. True or False? A logical volume can span more than one volume group.
3. True or False? The contents of a physical volume can be divided between two volume groups.
4. True or False? If mirroring logical volumes, it is not necessary to perform a backup.
5. True or False? SMIT can be used to easily increase or decrease the size of a logical volume.
6. True or False? Striping is done at a logical partition level.

Checkpoint solutions

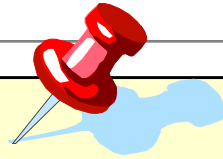
- True or False? A logical volume can span more than one physical volume.
- True or False? A logical volume can span more than one volume group.
- True or False? The contents of a physical volume can be divided between two volume groups.
- True or False? If mirroring logical volumes, it is not necessary to perform a backup. False. You still need to back up to external media.
- True or False? SMIT can be used to easily increase or decrease the size of a logical volume. False. SMIT can only be used to increase a file system. Decreasing one requires backing up the file system, removing it, re-creating it, and then restoring.
- True or False? Striping is done at a logical partition level. False. It is done at a stripe unit level.

Exercise 9: Working with LVM (parts 3-5)



- Part 3 - Exploring your storage environment
- Part 4 - Adding a volume group
- Part 5 - Adding a logical volume

Unit summary



- SMIT or high-level commands can be used to add, change, or delete volume groups, physical volumes and logical volumes.
- Mirroring is a way to have two or three copies of a logical volume for high availability requirements.
- Disk striping is used to provide high performance in large, sequentially accessed file systems.