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        F2=Refresh        F3=Cancel        F8=Image
F9=Shell       F10=Exit          Enter=Do
Volume groups

- 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

```sh
# lsvg rootvg

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOLUME GROUP:</td>
<td>rootvg</td>
</tr>
<tr>
<td>VG IDENTIFIER:</td>
<td>000bc6fd00004c00000000e10fdd7f52</td>
</tr>
<tr>
<td>VG STATE:</td>
<td>active</td>
</tr>
<tr>
<td>PP SIZE:</td>
<td>16 megabyte(s)</td>
</tr>
<tr>
<td>TOTAL PPs:</td>
<td>1084 (17344 megabytes)</td>
</tr>
<tr>
<td>FREE PPs:</td>
<td>1032 (16512 megabytes)</td>
</tr>
<tr>
<td>USED PPs:</td>
<td>52 (832 megabytes)</td>
</tr>
<tr>
<td>OPEN LVs:</td>
<td>10</td>
</tr>
<tr>
<td>QUORUM:</td>
<td>2</td>
</tr>
<tr>
<td>VG DESCRIPTORS:</td>
<td>3</td>
</tr>
<tr>
<td>MAX LVs:</td>
<td>256</td>
</tr>
<tr>
<td>STALE PPs:</td>
<td>0</td>
</tr>
<tr>
<td>AUTO ON:</td>
<td>yes</td>
</tr>
<tr>
<td>MAX PPs per VG:</td>
<td>32512</td>
</tr>
<tr>
<td>MAX PPs per PV:</td>
<td>1016</td>
</tr>
<tr>
<td>MAX PVs:</td>
<td>32</td>
</tr>
<tr>
<td>AUTO SYNC:</td>
<td>no</td>
</tr>
<tr>
<td>LTG size (Dynamic):</td>
<td>256 kilobyte(s)</td>
</tr>
<tr>
<td>HOT SPARE:</td>
<td>no</td>
</tr>
<tr>
<td>BB POLICY:</td>
<td>relocatable</td>
</tr>
</tbody>
</table>
```
List volume group information (physical volumes)

```bash
# lsvg -p rootvg

rootvg:

<table>
<thead>
<tr>
<th>PV_NAME</th>
<th>PV STATE</th>
<th>TOTAL PPs</th>
<th>FREE PPs</th>
<th>FREE DISTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>hdisk0</td>
<td>active</td>
<td>159</td>
<td>52</td>
<td>24..00..00..00..28</td>
</tr>
<tr>
<td>hdisk1</td>
<td>active</td>
<td>159</td>
<td>78</td>
<td>32..02..00..12..32</td>
</tr>
</tbody>
</table>
```
List volume group information (logical volumes)

```bash
# lsvg -l rootvg

rootvg:
<table>
<thead>
<tr>
<th>LVNAME</th>
<th>TYPE</th>
<th>LPs</th>
<th>PPs</th>
<th>PVs</th>
<th>LV STATE</th>
<th>MOUNT POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>hd6</td>
<td>paging</td>
<td>32</td>
<td>32</td>
<td>1</td>
<td>open/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd5</td>
<td>boot</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>closed/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd8</td>
<td>jfslog</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd9var</td>
<td>jfs2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>/var</td>
</tr>
<tr>
<td>hd4</td>
<td>jfs2</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>open/syncd</td>
<td>/</td>
</tr>
<tr>
<td>hd2</td>
<td>jfs2</td>
<td>101</td>
<td>101</td>
<td>1</td>
<td>open/syncd</td>
<td>/usr</td>
</tr>
<tr>
<td>hd3</td>
<td>jfs2</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>open/syncd</td>
<td>/tmp</td>
</tr>
<tr>
<td>hd1</td>
<td>jfs2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>/home</td>
</tr>
<tr>
<td>hd10opt</td>
<td>jfs2</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>open/syncd</td>
<td>/opt</td>
</tr>
<tr>
<td>hd11admin</td>
<td>jfs2</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>open/syncd</td>
<td>/admin</td>
</tr>
<tr>
<td>lv00</td>
<td>jfs2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>open/syncd</td>
<td>/home/john</td>
</tr>
<tr>
<td>lv01</td>
<td>jfs2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>open/syncd</td>
<td>/home/fred</td>
</tr>
</tbody>
</table>
```
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 yes +
at system restart?
Volume group MAJOR NUMBER [] +#
Create VG Concurrent Capable? no +
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 yes +
at system restart?
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
# smit chvg

## Change a Volume Group

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

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

F1=Help F2=Refresh F3=Cancel F4=List
F5=Reset F6=Command F7=Edit F8=Image
F9=Shell F10=Exit Enter=Do

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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 \texttt{-L} flag on the \texttt{chvg} or \texttt{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:
    \texttt{varyonvg -M \LTGsize}
  – The \texttt{mkvg -L} flag is no longer supported
  – The \texttt{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 \texttt{chvg -L 0}

• To display the LTG size of a disk, use the command:
  \# /usr/sbin/lquerypv \texttt{-M \texttt{<hdisk#>}}
Hot spare

- 1st copy of data1 LV
- 2nd copy of data1 LV
- 1st copy of data2 LV
- 2nd copy of data2 LV

Synchronization

Hot spare
Extending and reducing volume groups

★ Does not retain current disk contents

# extendvg myvg hdisk6

# reducevg myvg hdisk5
Remove a Volume Group

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

* VOLUME GROUP name

F1=Help          F2=Refresh          F3=Cancel          F4=List
F5=Reset         F6=Command         F7=Edit            F8=Image
F9=Shell         F10=Exit           Enter=Do
Activate/Deactivate a volume group

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

```bash
varyonvg [ -f ] Volumegroup

# varyonvg datavg
```

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

```bash
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

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Advanced RAID support

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

  \[
  \text{chvg -g Volumegroup}
  \]

  # chvg -g datavg

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

  \[
  \text{chvg -b [ y/n ] Volumegroup}
  \]

  # 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

Physical volumes

Logical Volume Manager

Logical Partitions

Logical volume

Logical volume
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

- Read request
- Copy 1
- Copy 2
- Copy 3

Forced synchronization

Synchronize the read partitions
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
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          F2=Refresh          F3=Cancel          F8=Image
F9=Shell         F10=Exit           Enter=Do
Show logical volume characteristics

• Physical volume map:

```bash
# lslv -l lv00

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

• Logical partition map:

```bash
# 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           1                      +
    partition
  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

<table>
<thead>
<tr>
<th>F1=Help</th>
<th>F2=Refresh</th>
<th>F3=Cancel</th>
<th>F4=List</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5=Reset</td>
<td>F6=Command</td>
<td>F7=Edit</td>
<td>F8=Image</td>
</tr>
<tr>
<td>F9=Shell</td>
<td>F0=Exit</td>
<td>Enter=Do</td>
<td></td>
</tr>
</tbody>
</table>
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:
<table>
<thead>
<tr>
<th>LVNAME</th>
<th>TYPE</th>
<th>LPs</th>
<th>PPs</th>
<th>PVs</th>
<th>LV STATE</th>
<th>MOUNT POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>hd6</td>
<td>paging</td>
<td>32</td>
<td>32</td>
<td>1</td>
<td>open/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd5</td>
<td>boot</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>closed/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd8</td>
<td>jfslog</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>N/A</td>
</tr>
<tr>
<td>hd9var</td>
<td>jfs2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>open/syncd</td>
<td>/var</td>
</tr>
<tr>
<td>hd4</td>
<td>jfs2</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>open/syncd</td>
<td>/</td>
</tr>
<tr>
<td>hd2</td>
<td>jfs2</td>
<td>101</td>
<td>101</td>
<td>1</td>
<td>open/syncd</td>
<td>/usr</td>
</tr>
<tr>
<td>hd3</td>
<td>jfs2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>/tmp</td>
</tr>
<tr>
<td>hd1</td>
<td>jfs2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>open/syncd</td>
<td>/home</td>
</tr>
<tr>
<td>hd10opt</td>
<td>jfs2</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>open/syncd</td>
<td>/opt</td>
</tr>
<tr>
<td>hd11admin</td>
<td>jfs2</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>open/syncd</td>
<td>/admin</td>
</tr>
<tr>
<td>lv00</td>
<td>jfs2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>open/syncd</td>
<td>/home/john</td>
</tr>
<tr>
<td>lv01</td>
<td>jfs2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>open/syncd</td>
<td>/home/fred</td>
</tr>
</tbody>
</table>
```
## Show logical volume characteristics

```
# lslv lv02

<table>
<thead>
<tr>
<th>LOGICAL VOLUME:</th>
<th>lv02</th>
<th>VOLUME GROUP:</th>
<th>course</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV IDENTIFIER:</td>
<td>00000000000004c00000000e5cf75106f.4</td>
<td>PERMISSION:</td>
<td>read/write</td>
</tr>
<tr>
<td>VG STATE:</td>
<td>active/complete</td>
<td>LV STATE:</td>
<td>opened/syncd</td>
</tr>
<tr>
<td>TYPE:</td>
<td>jfs2</td>
<td>WRITE VERIFY:</td>
<td>off</td>
</tr>
<tr>
<td>MAX LPs:</td>
<td>128</td>
<td>PP SIZE:</td>
<td>4 megabyte(s)</td>
</tr>
<tr>
<td>COPIES:</td>
<td>1</td>
<td>SCHED POLICY:</td>
<td>parallel</td>
</tr>
<tr>
<td>LPs:</td>
<td>10</td>
<td>PPs:</td>
<td>10</td>
</tr>
<tr>
<td>STALE PPs:</td>
<td>0</td>
<td>BB POLICY:</td>
<td>relocatable</td>
</tr>
<tr>
<td>INTER-POLICY:</td>
<td>minimum</td>
<td>RELOCATABLE:</td>
<td>yes</td>
</tr>
<tr>
<td>INTRA-POLICY:</td>
<td>middle</td>
<td>UPPER BOUND:</td>
<td>32</td>
</tr>
<tr>
<td>MOUNT POINT:</td>
<td>/home/malcolm</td>
<td>LABEL:</td>
<td>/home/malcolm</td>
</tr>
<tr>
<td>MIRROR WRITE CONSISTENCY:</td>
<td>on/ACTIVE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EACH LP COPY ON A SEPARATE PV ?:</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serialize IO ?:</td>
<td>NO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
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
    PHYSICAL VOLUME names        []
    POSITION on physical volume middle
    RANGE of physical volumes minimum
    MAXIMUM NUMBER of PHYSICAL VOLUMES [32] #
    Allocate each logical partition copy yes
    on a SEPARATE physical volume?
    File containing ALLOCATION MAP []
    SYNCHRONIZE the data in the new logical partition copies?

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  bebc800000000000000000802evg79c9     rootvg    active
  ```

- List the contents of a physical volume:

  ```
  # lspv hdisk0
  
  PHYSICAL VOLUME:   hdisk0                  VOLUME GROUP:      rootvg
  PV IDENTIFIER:     da1c923411d52ec91cd600802eda72c9
  VG IDENTIFIER:     000bc6fd00004c000000000e10fdd7f52
  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:

<table>
<thead>
<tr>
<th>LV NAME</th>
<th>LPs</th>
<th>PPs</th>
<th>DISTRIBUTION</th>
<th>MOUNT POINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>hd1</td>
<td>1</td>
<td>1</td>
<td>00..00..00..12..00</td>
<td>/home</td>
</tr>
<tr>
<td>hd3</td>
<td>4</td>
<td>4</td>
<td>00..03..00..00..00</td>
<td>/tmp</td>
</tr>
<tr>
<td>hd2</td>
<td>101</td>
<td>101</td>
<td>00..00..17..12..00</td>
<td>/usr</td>
</tr>
<tr>
<td>hd4</td>
<td>9</td>
<td>9</td>
<td>00..00..13..00..00</td>
<td>/</td>
</tr>
<tr>
<td>hd8</td>
<td>1</td>
<td>1</td>
<td>00..00..01..00..00</td>
<td>N/A</td>
</tr>
<tr>
<td>hd6</td>
<td>8</td>
<td>8</td>
<td>00..00..00..08..00</td>
<td>N/A</td>
</tr>
<tr>
<td>hd5</td>
<td>2</td>
<td>2</td>
<td>01..00..00..00..00</td>
<td>N/A</td>
</tr>
<tr>
<td>hd9var</td>
<td>2</td>
<td>2</td>
<td>00..00..02..00..00</td>
<td>/var</td>
</tr>
<tr>
<td>hd10opt</td>
<td>5</td>
<td>5</td>
<td>00..00..02..00..00</td>
<td>/opt</td>
</tr>
<tr>
<td>hd11admin</td>
<td>8</td>
<td>8</td>
<td>00..00..02..00..00</td>
<td>/admin</td>
</tr>
</tbody>
</table>
```
List a physical volume partition map

```sh
# 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   hd6     paging N/A
 155-186   used       outer middle hd8     jfslog N/A
 187-307   free       outer middle hd9var jfs2  /var
 308-308   used       center      hd10opt jfs2  /opt
 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 jfs2  /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      hd10opt jfs2  /opt
 461-613   free       inner middle hd2     jfs2  /usr
 614-767   free       inner edge   N/A      N/A   N/A
```

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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):
  
  ```bash
  # lspv
  ```

- List the volume groups:
  
  ```bash
  # lsvg
  ```

- List what logical volumes are contained in each volume group:
  
  ```bash
  # lsvg -l vgname
  ```

- List the logical volumes on each disk:
  
  ```bash
  # lspv -l pvname
  ```
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.