Tru64 UNIX and HP-UX File Systems and Volume Managers

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Agenda

- Volume Manager Overview
- Logical Volume Manager (LVM)
- Logical Storage Manager (LSM)
- VxVM – LSM Feature Comparison
- File Systems
- Comparison File Systems and Volume Managers
- Resources

Volume Manager Overview

- Comparison may fail
  - No LVM within Tru64 UNIX
  - Only abstraction Layer within Tru64 UNIX
  - Tru64 UNIX LSM similar to VERITAS VxVM
    - Based on VxVM V2.3 code base

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Volume Manager Overview

- Tru64 UNIX
  - abstraction layer between physical disk and file system
  - Logical volume is implemented through
    - Hardware (RAID)
    - Device driver (partition, LSM)
    - File system (AdvFS)
  - no management for logical volumes needed
    - No LVM commands available
    - Must configure RAID, AdvFS or partitions, though

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Volume Manager Overview

- HP-UX
  - More than abstraction layer
  - Used for managing disk partitions
  - Limitations:
    - No striped mirrors
    - No hotspare
    - No RAID5
  - „whole disk approach" (no LVM)
    - File system cannot span multiple disks
    - Only one file system partition
    - Difficult to extend

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Logical Volume Manager (LVM)

- LVM naming
  - Physical volume
  - Volume group
  - Logical volume
    - Associated to volume group
  - LVM extent
    - Smallest allocatable unit of space
    - Associated to logical volume

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Logical Volume Manager (LVM)

- LVM commands
  - „pvcreate", initialize a physical volume
    - Write physical volume reserved area
    - Write volume group reserved area
  - „vgcreate", create volume group
    - Physical volume is broken into physical extents (PE)
    - Groups logical volumes
  - „lvcreate", create logical volumes
    - Creates both block and raw LV
    - Consists of sequentially numbered logical extents (LE)
    - LE points to PE on physical volume
    - Contains file system

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Logical Volume Manager (LVM)

- Look at LVM configurations with
  - pvdisplay, vgdisplay, lvdisplay
- Delete LVM configurations with
  - pvremove, vgremove, lvremove
- Extend LVM configurations with
  - vgextend (add physical volumes to group)
  - lvextend (increase space or mirror to volume)
- Reduce LVM configurations with
  - vgreduce (remove physical volumes from group)
  - lvreduce (reduce space or number of mirror copies)

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Logical Volume Manager (LVM)

```
wallace:/# lvdisplay -v /dev/vg00/lvol2
--- Logical volumes ---
LV Name                         /dev/vg00/lvol2
VG Name                         /dev/vg00
LV Permission                   read/write
LV Status                       available/syncd
Mirror copies                   1
---snip---snip---snip---

    --- Distribution of logical volume ---
    PV Name              LE on PV   PE on PV
    /dev/dsk/c1t15d0       750        750
    /dev/dsk/c3t15d0       750        750

    --- Logical extents ---
    LE    PV1                PE1    Status 1 PV2                PE2    Status 2
    00000 /dev/dsk/c1t15d0   00075  current  /dev/dsk/c3t15d0   00075  current
    00001 /dev/dsk/c1t15d0   00076  current  /dev/dsk/c3t15d0   00076  current
---snip---snip---snip---
    00748 /dev/dsk/c1t15d0   00823  current  /dev/dsk/c3t15d0   00823  current
    00749 /dev/dsk/c1t15d0   00824  current  /dev/dsk/c3t15d0   00824  current

wallace:/#
wallace:/#
```

Logical Volume Manager (LVM)

- Additional commands
  - vgchange (activate/deactivate, control membership)
    - Related to ServiceGuard
  - vgcfgbackup (create or update group configuration)
  - vgcfgrestore (display or restore group configuration)
    - Displays only vgcfgbackup info, no life configuration
  - lvsplit, lvmerge (split or merge LVM mirror)
  - vgsync, lvsync (LVM mirror synchronization)
  - Even more commands for:
    - Boot disk preparation, export/import of volume groups, ...
    - HP-UX LVM Reference
      - http://docs.hp.com/hpux/onlinedocs/B2355-60103/00/42/4255-con.html

Logical Volume Manager (LVM)

- Things to take care off
  - lvextend adds space, does not notify file system
    - FS superblock and metadata structures need notification
    - umount, extendfs and mount file system
    - Or use fsadm utility for online notification/expansion (license)
  - lvreduce may corrupt data
    - Backup, umount, newfs, mount and restore FS
    - fsadm utility works sometimes
      - Checks for used blocks at end of FS
      - Defragment may help
  - Reducing FS does not reduce logical volume

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Logical Volume Manager (LVM)

- LVM and VERITAS VxVM can co-exist
  - On same system but not on same disk
    - LVM and VxVM configuration data located on disks
- VERITAS VxVM is mandatory for VERITAS CFS
- No need to use LVM for root anymore
  - VERITAS VxVM has rootability
- LVM will continue to be enhanced
  - LVM will remain HP-UX 11i default volume manager

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Logical Volume Manager (LVM)

- LVM Example
  - Initialize disk
    - pvcreate /dev/rdisk/c0t0d0
  - Create pseudo device for LVM subsystem
    - mkdir /dev/vg01
    - mknod /dev/vg01/group c 64 0x030000
    - Check owner/permission (root/640)

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Logical Volume Manager (LVM)

- LVM Example cont.
  - Create volume group
    - vgcreate –s <pe_size> /dev/vg01 <pv_path> <pv_path> …
  - Create logical volume
    - lvcreate –L <size> -n <name> /dev/vg01
  - Create and mount file system
    - newfs <special>
    - mount ...

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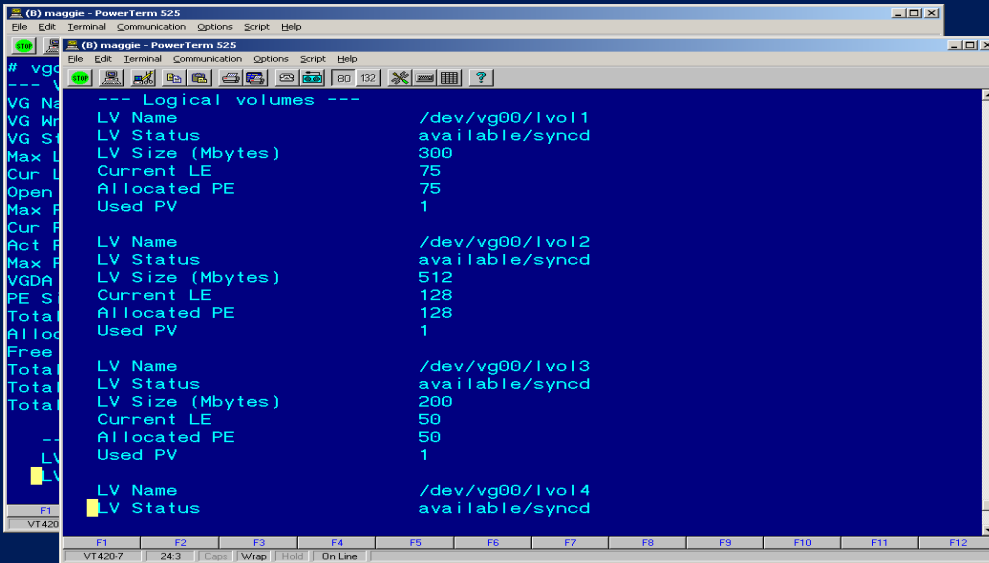
Logical Volume Manager (LVM)

- Default system disk layout

/dev/vg00/lvol3	/	vxfs
/dev/vg00/lvol1	/stand	hfs
/dev/vg00/lvol4	/tmp	vxfs
/dev/vg00/lvol5	/home	vxfs
/dev/vg00/lvol6	/opt	vxfs
/dev/vg00/lvol7	/usr	vxfs
/dev/vg00/lvol8	/var	vxfs

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Logical Volume Manager (LVM)

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Logical Storage Manager (LSM)

- Tru64 UNIX LSM based on V2.3 VxVM code
  - VxVM commands and outputs almost equal to LSM
  - Just replace „vol" with „vx"
- Various shell-level LSM commands available
  - volassist, volclonedg, vold, voldctl, voldg, voldisk, voldiskadd, voldiskadm, voldisksetup, voledit, volencap, volevac, volinfo, volinstall, voliod, vollogcnvt, volmake, volmend, volmigrate, volmirror, volnotify, volplex, volprint, volreattach, volreconfig, volrecover, volrestore, volrootmir, volsave, volsd, volsetup, volstat, voltrace, volume, volunmigrate, volunroot, volwatch
- GUI based commands „lsmsa", „dxlsm"

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Logical Storage Manager (LSM)

- LSM naming
  - Subdisk
    - Logical representation of contiguous disk blocks
    - Compare with LVM PE's
  - Plex
    - Made up of one or more subdisks
    - Instance of volume data
  - Volume
    - Contains at least one plex; two or more for mirror volume
    - Virtual disk device
    - Contains file system
    - Compare with LVM LV's

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Logical Storage Manager (LSM)

- LSM naming cont.
  - Diskgroup
    - Collection of disks belonging to named group
    - Compare with LVM volume group
  - Disk
    - physical disk
    - Equal to LVM physical volume
  - Private region
    - Contains LSM configuration data, compare with VGRA/PVRA
  - Public region
    - Contains either free space or subdisks

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LVM – LSM Comparison

LSM Term	LVM Term
•Physical Disk	•Physical volume
•Subdisk	•Physical extent
•Volume	•Logical volume
•Disk group	•Volume group
•Private region	•PVRA/BDRA/VGRA
•Free space	•Unused physical extent
•Plexes	•Mirrors
•Dirty Region Logging (DRL)	•Mirror Write Cache (MWC)
•Dynamic multipathing*	•PVlinks

* VxVM term, no need for that within Tru64 UNIX V5.*

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VxVM - LSM Feature Comparison

	HP-UX 11i v2 VxVM 3.5	Tru64 5.1B LSM (VxVM 2.3 Code Base)
Layered Volumes	Yes	No
RAID 5	Yes	Yes
VMSA GUI, VEA GUI	Yes	lsmsa
Online Relayout (vxrelayout)	Yes	No
Dirty Region Logging	Yes	Yes
Disassociating a plex for backup (volpex dis plex)	Yes	Yes
Snapshot volumes (volassist snapshot …)	Yes	Yes
Non-Persistant Fast Resync (Fast Mirror Resynchronization (FMR))	Yes	**No**
Persistant **Fast Resync** (Data Change Object (DCO))	Yes	Wildcat 5.1B (Smash and Resilvering Log (SRL))
SmartSync Recovery Accelerator for Databases	Yes	**No**
Hot Spares / Relocation	Yes	Yes
Dynamic MultiPathing (DMP)	Yes	NA - base OS handles in SCSI/CAM

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VxVM - LSM Feature Comparison

Power Fail Timeout vxpft	Yes	NA - handled in SCSI/CAM
Task Management vxtask	Yes	No
Autoconfig	Yes	Yes
Config load balancing	Yes	Yes
Dynamic IO Sizes	Yes	Yes
Configuration Saving	Yes (dgcfgbackup, dgcfgrestore)	Yes (volsave, volrestore)
Limits: Volume Size	2TB	1TB
Limits: Number of Volumes	None	8189
Limits: Plexes per Volume	32	32
Limits: Plexes	None	8189
Limits: Number of Disks	None	None
Limits: Number of diskgroups	None	None

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File Systems

- Tru64 UNIX supported file systems
  - UFS, AdvFS, NFS, cdfs, dvdfs,
  - mfs, procfs
  - dfs, efs (DCE filesystems)
  - fdfs, ffm (used by streams)
  - pcfs, sysv
- HP-UX supported file systems
  - HFS (UFS), JFS (VxFS), cdfs, NFS

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File Systems

- Large File Support
  - Support for files larger 2^{32}
    - HP-UX 11i V2/VxFS 2TB
    - HP-UX 11i V3/VxFS 16TB
    - Tru64 UNIX AdvFS 16TB
  - AdvFS does not require special flags or options
  - VxFS requires option „largefiles" for files larger 2 GB
    - „mkfs –o largefiles", „mount –o largefiles"
    - „fsadm –o largefiles" converts nolargefiles FS

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File Systems

- Direct I/O
  - HP-UX supports async I/O for raw devices only
    - Sybase/Oracle DB on raw volumes
  - OnlineJFS comes with direct I/O
    - bypass buffer cache on normal file systems
    - controlled through extended mount options
    - no kernel level Oracle asyncronuous I/O
      - Comes with Storage Foundation 4.1
  - No limitations on Tru64 UNIX
    - Either „single server" or direct I/O within cluster
      - Based on drdmgr, default direct I/O
      - Tapes always are „single server"

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File Systems

- Tru64 UNIX
  - different commands for UFS and AdvFS
    - newfs, fsck, dump, rdump, restore ... (UFS)
    - mkfdmn, mkfset, chfset, chfile, rmfdmn, rmfset, showfdmn, ... , vdump, ... , addvol, rmvol, defragment, ... (AdvFS)
    - see „man advfs" for all related commands
- HP-UX
  - single command for specific actions
    - mkfs, newfs, fsck, fsadm (licensed)
    - use option „fstyp" for file system type
    - default file system defined at /etc/default/fs

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File Systems

	Tru64 UNIX® V5.1B (AdvFS)	HP-UX 11iv2 JFS (VxFS)
storage model	multi-volume	single volume (V3) multi-volume (V4)
journals	meta-data optional – user file data, Atomic Data Logging	meta-data
allocation abstraction	extents	extents
Recovery	automatic on mount	external tool fsck, run in bcheckrc
on-line resize	addvol, rmvol, or mount –o expand	(volume mgr cmds), fsadm, VEA
read-only file system copies	clones (clonefset, mount)	Storage chkpts (fsckptadm, mount)
on-line defragmentation	defragment, vfast	fsadm

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File Systems

	AdvFS	VxFS
create a file system	# mkfdmn vol dom # mkfset dom fset # mount dom#fset dir	# mkfs vol # mount vol dir
increase file system size	# addvol vol dom	*increase volume size* # fsadm
list the storage of a file system	# showfdmn dom	# df
list mounted file systems	# mount	# mount
determine unmounted file systems	# more /etc/fstab # ls -R /etc/fdmns	# more /etc/fstab # fsck /…vol…

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File Systems

	AdvFS	VxFS
	Tru64 UNIX	HP-UX
multi-volume model in file system	yes	yes (V4)
	"domain" abstraction representing a pool of volumes to be used for a file system (`mkfdmn`, `addvol`, `rmvol`)	for VxFS 3.5 every file system is associated with a single volume (`mkfs`) with VxVM V4 can use vsets for multi-volume
multiple mountable rooted trees per file system	yes	no
	AdvFS "fileset" abstraction representing an individual mountable tree within a domain (`mkfset`)	every file system has one mountable tree with exception of the special case of a snap shot

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Comparison File Systems and Volume Managers on Tru64 and HP-UX

	Tru64	HP-UX
Base File System	AdvFS Base	JFS
Full Featured File System	AdvFS Utilities	OnlineJFS
Cluster File System	TruCluster CFS	VERITAS CFS
Base Volume Manager	LSM Base	VxVM Base, LVM
Full Featured Volume Manager	LSM Advanced	VxVM, MirrorDisk/UX
Enhanced Volume Manager		CVM, SLVM

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Resources

- HP-UX System and Network Administration
- HP-UX online reference
  - http://docs.hp.com/en/B2355-60103/
- HP-UX LVM online reference
  - http://docs.hp.com/hpux/onlinedocs/B2355-60103/00/42/4255-con.html
- Tru64 UNIX online reference
  - http://h30097.www3.hp.com/docs/pub_page/V51B_DOCS/V51B_DOCLIST.HTM
- Tru64 UNIX Logical Storage Manager
  - http://h30097.www3.hp.com/docs/base_doc/DOCUMENTATION/V51B_HTML/ARH9BDTE/TITLE.HTM