

*forensic-proof.com*

# Logical Volume Manager

- Software RAID



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# Outline

1. *Background*
2. *LVM Basics*
3. *LVM Structure*
4. *LVM Advantage & Disadvantage*



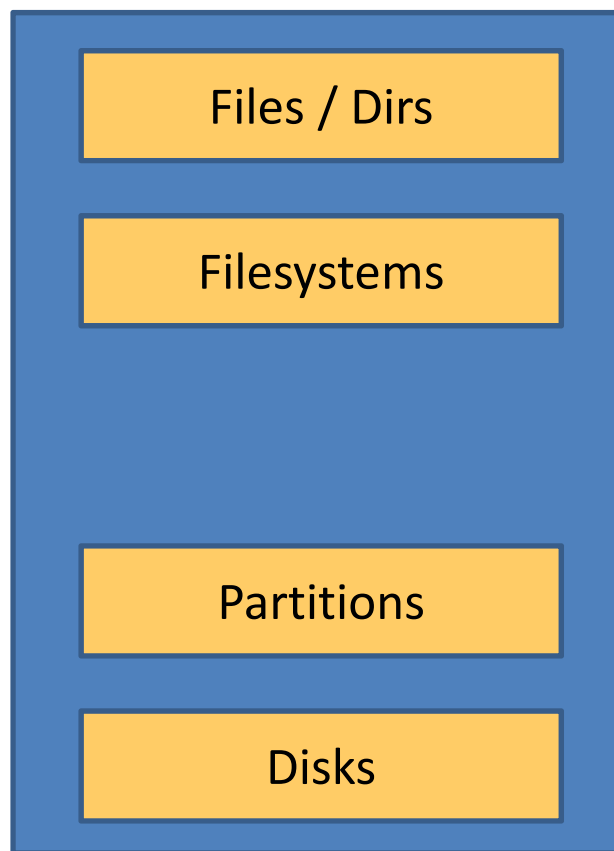
# ***Background***



# Background

## *Layers to make it easier*

- Layers in a typical system (before LVM)

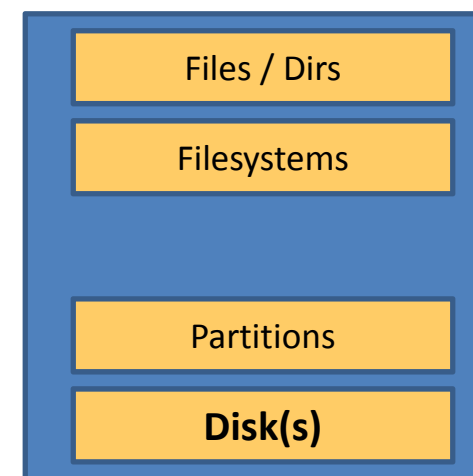


<http://home.techwiz.ca/~peters/presentations/lvm/oclug-lvm.pdf>

# Background

## *What is a Disk?*

- Lets look at some terms first, starting from the bottom
- It has various techie things in it:
  - Cylinders, Heads, Sectors, mbr, partitions
  - It's own cpu, cache, firmware etc
- Linux : `/dev/hda`, `/dev/sda`
- Windows : `\\PhysicalDrive0`, `\\PhysicalDrive1`

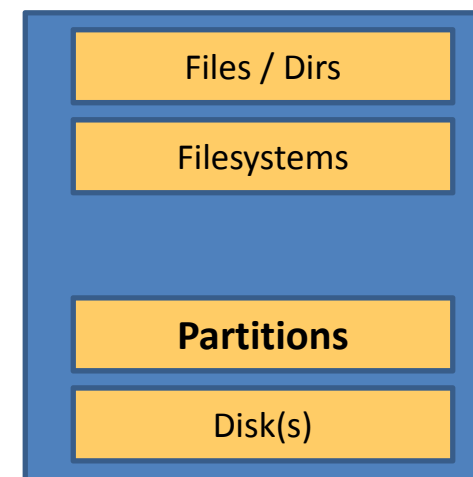


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# Background

## *Partitions*

- *One partition must be a continuous chunk of blocks*
- The original IBM PC from 1981 only had 4 primary partitions
- On a typical linux system you have something like
  - hda1 /
  - hda2 swap
  - hda3 /home
- Or for a dual boot
  - hda1 M\$ Windows C:
  - hda2 swap
  - hda3 /

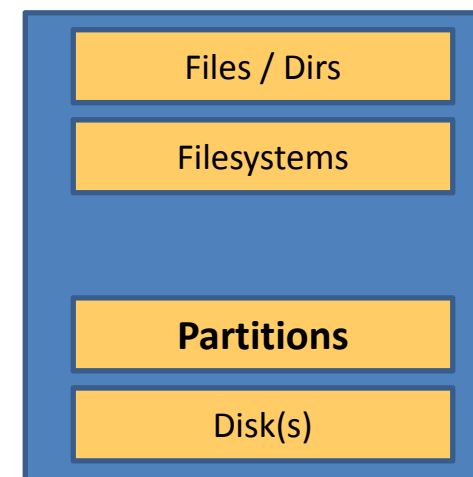


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# Background

## *Partition tools*

- Partition tools can change the existing partition *without loosing existing data*
  - I never tried this tools
  - *They are all very risky*
- *Parted*
  - A free tool that can handle ext2 and vfat but not NTFS
- *Acronis Disk Director & Partition magic*
  - Commercial tool that can do more including NTFS

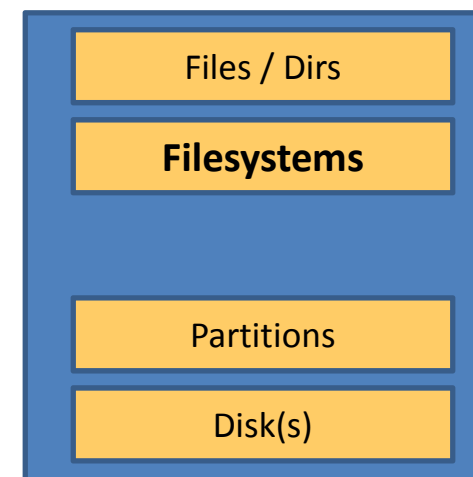


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# Background

## *Filesystems*

- Filesystem are a fancy way to hold together a group of files and directories
- Without LVM *one filesystem = one partition*
- Common File Systems:
  - In the Windows World :
    - FAT12/16/32, exFAT
    - NTFS
  - In Linux
    - Ext2/3/4, Reiserfs, jfs, xfs
    - FAT/NTFS
    - And many many more

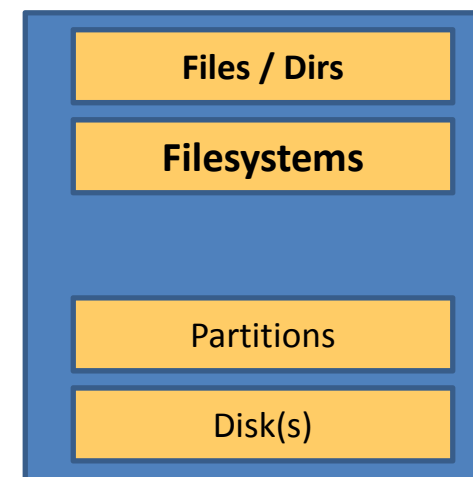


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# Background

## *Files on a linux (and unix) system*

- Within User Level we have
  - Files
  - Directories
  - Filesystems
- Files Hold Data
- Directories hold files and directories
- Filesystems holds directories and files
- Mount points hold Filesystems



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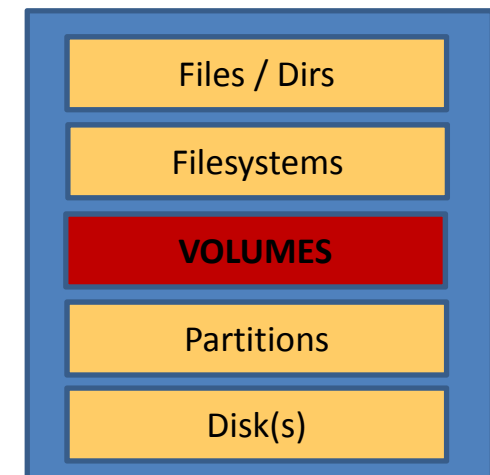
# ***Logical Volume Manager Basics***



# LVM Basics

## *Why Volume Management?*

- To make your life as System Administrator easier
- To give you a bigger Sandbox to play in
- *One Filesystem = One Volume*
- *One Volume = more than One Partition*
- This has many advantages
  - Can carve out non-continuous filesystems
  - Can add disk partitions together so they look like one BIG

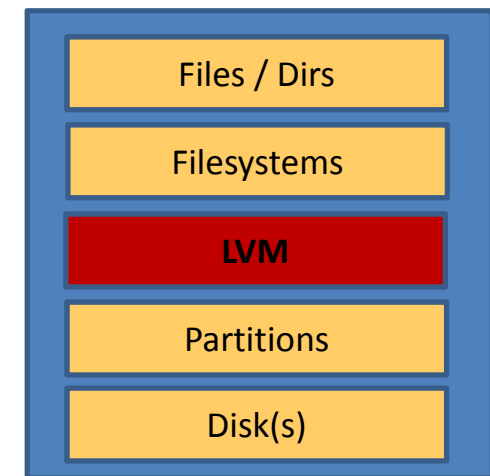


<http://home.techwiz.ca/~peters/presentations/lvm/oclug-lvm.pdf>

# LVM Basics

## *What is LVM?*

- Stands for Logical Volume Management
- It manages disk drives and *similar mass-storage devices*, in particular large ones
- *available in Linux* (Arch Linux, Debian, Fedora, Gentoo, MontaVista Linux, openSUSE, SLED, Slackware, SLES and Ubuntu)
- *as well as HP-UX, IBM AIX, Solaris, OS/2 and Windows*
- It is placed between the filesystems and disk partitions



<http://home.techwiz.ca/~peters/presentations/lvm/oclug-lvm.pdf>

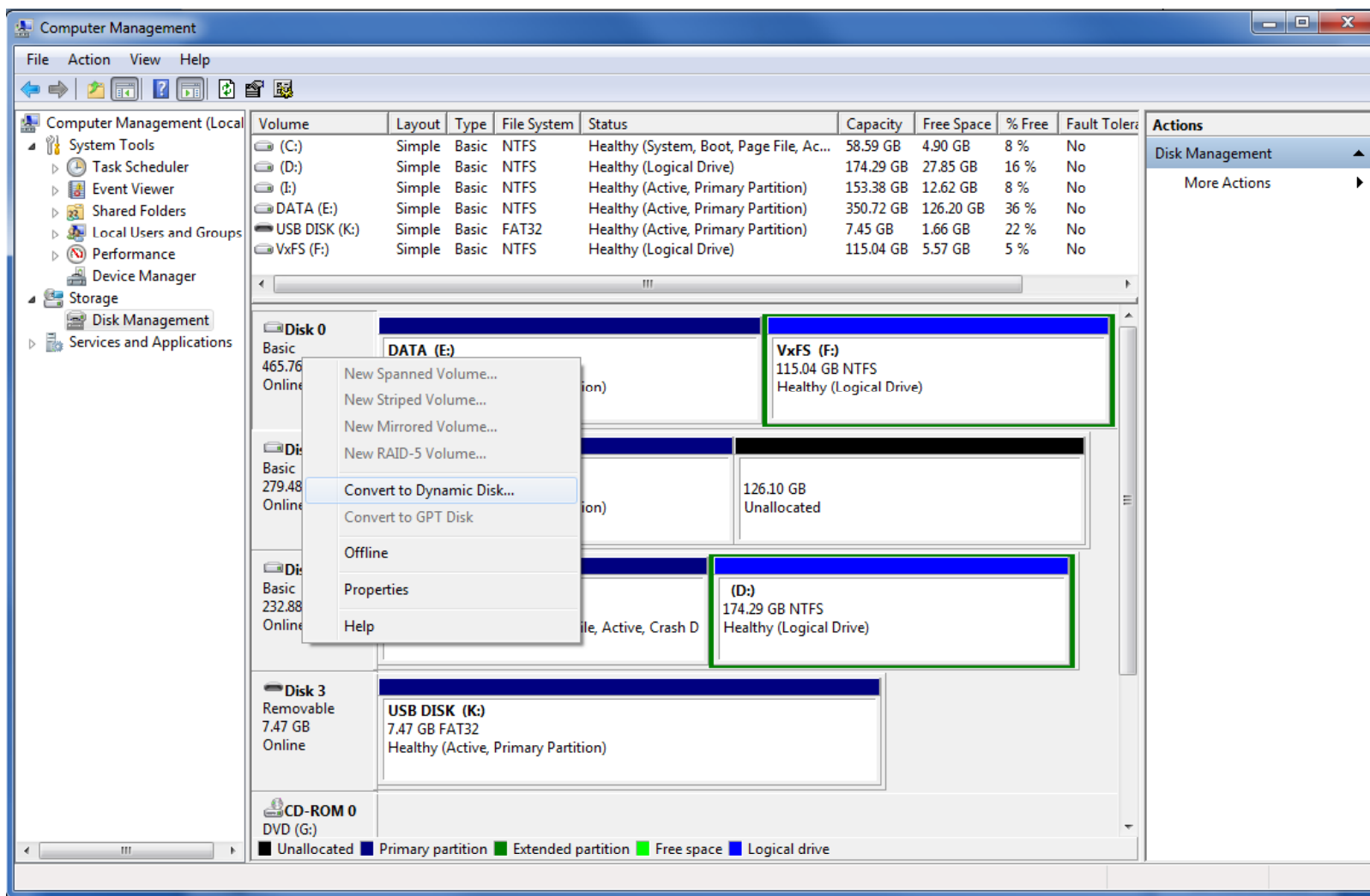
# LVM Basics

## Implementations each OS

Vendor	Introduced in	Volume manager	Allocate anywhere	Snapshots	RAID 0	RAID 1	RAID 5	RAID 10
IBM	AIX 3.0	Logical Volume Manager	YES	NO	YES	YES	NO	YES
Hewlett-Packard	HP-UX 9.0	HP Logical Volume Manager	YES	YES	YES	YES	NO	YES
	FreeBSD	Vinum Volume Manager	YES	NO	YES	YES	YES	
	NetBSD	Logical Volume Manager	YES	NO	YES	YES	NO	NO
	Linux 2.2	Logical Volume Manager	YES	YES	YES	YES	NO	
	Linux 2.4	Enterprise Volume Management System	YES	YES	YES	YES	YES	
	Linux 2.6	Logical Volume Manager	YES	YES	YES	YES	YES	
Silicon Graphics	IRIX or Linux	XVM Volume Manager	YES	YES	YES	YES	YES	
Sun Microsystems	SunOS	Solaris Volume Manager	NO	NO	YES	YES	YES	YES
Sun Microsystems	Solaris 10	ZFS	YES	YES	YES	YES	YES	YES
Veritas	Cross-OS	Veritas Volume Manager	YES	YES	YES	YES	YES	YES
Microsoft	Later NT-based	Logical Disk Manager	YES	YES	YES	YES	YES	

# LVM Basics

## Windows Dynamic Disk – *required 8MB area*



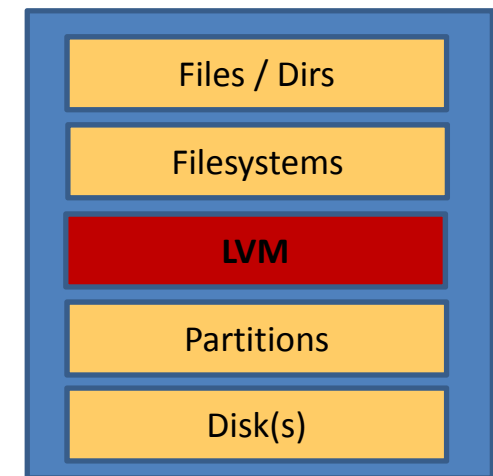
# ***Logical Volume Manager Structure***



# LVM Structure

## *What is LVM? cont.*

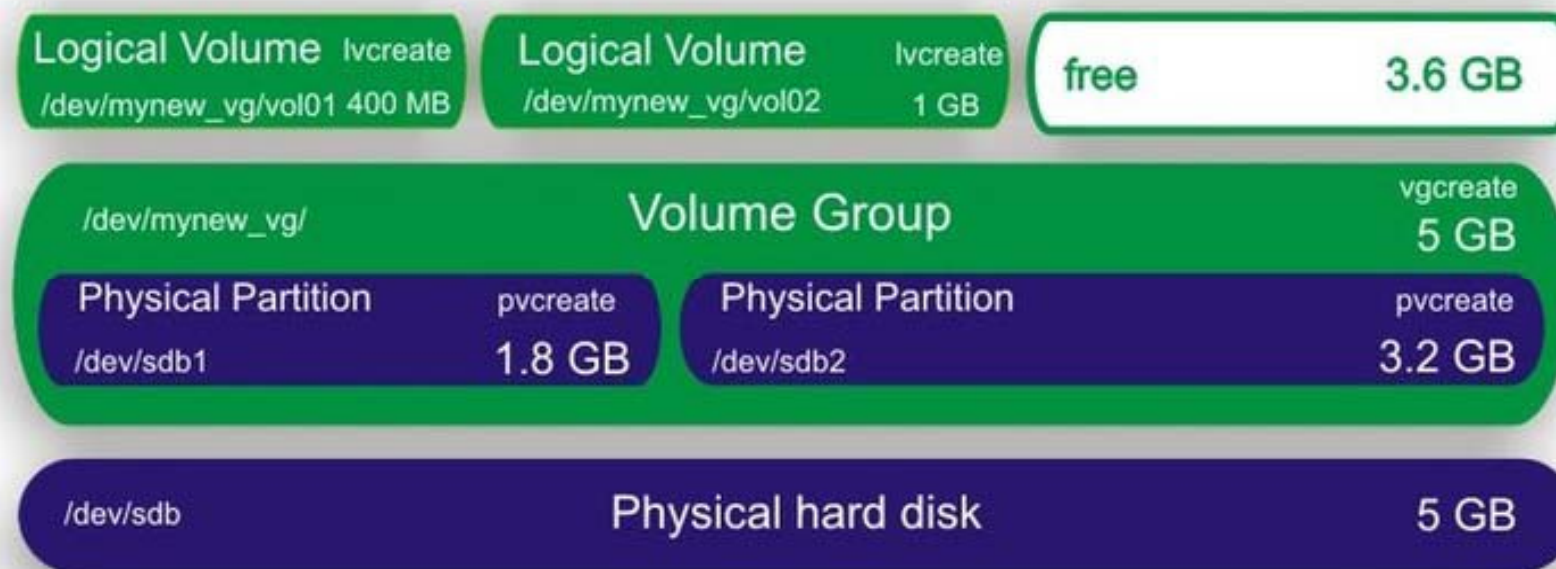
- The appearance of New Terms
- *Physical Volumes PVs*
  - collects all disk partitions
- *Volume Group VGs*
  - creates one big virtual disk
- *Logical Volumes LVs*
  - From the VG you can then create filesystem within LVs
- *Extents*
  - Physical & Logical Extents



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# LVM Structure

## LVM Structure

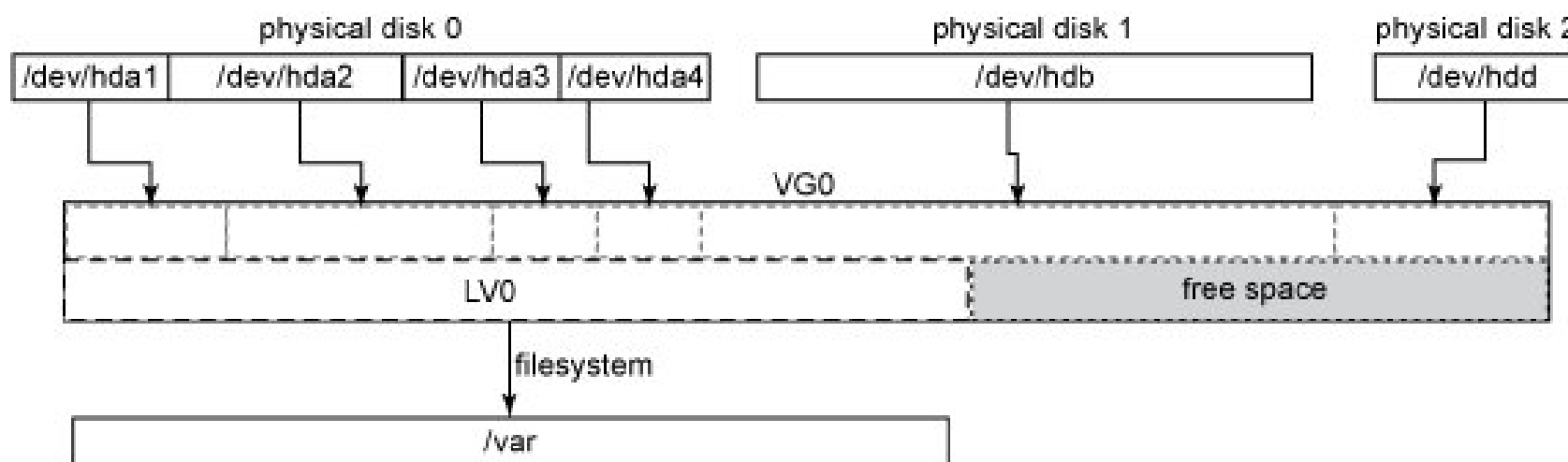


linuxconfig.org

[http://www.linuxconfig.org/Linux\\_lvm\\_-\\_Logical\\_Volume\\_Manager](http://www.linuxconfig.org/Linux_lvm_-_Logical_Volume_Manager)

# LVM Structure

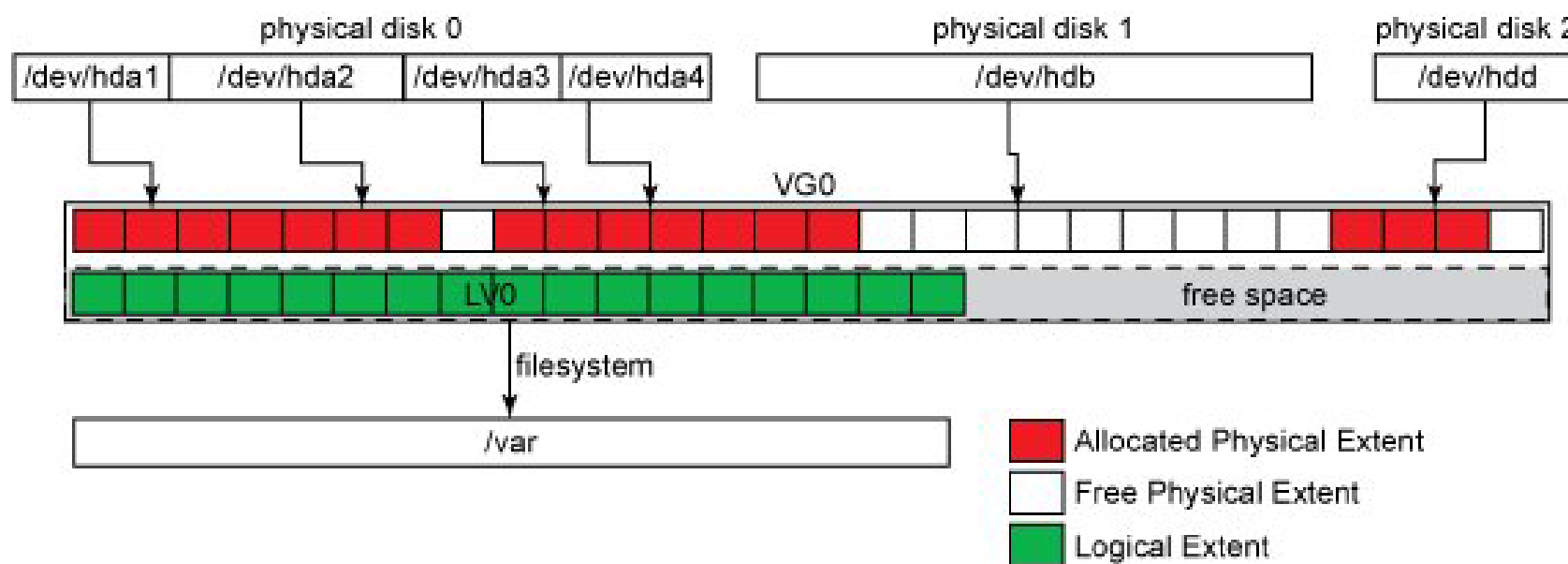
## *LVM Structure cont.*



[http://sunoano.name/ws/public\\_xhtml/lvm.html](http://sunoano.name/ws/public_xhtml/lvm.html)

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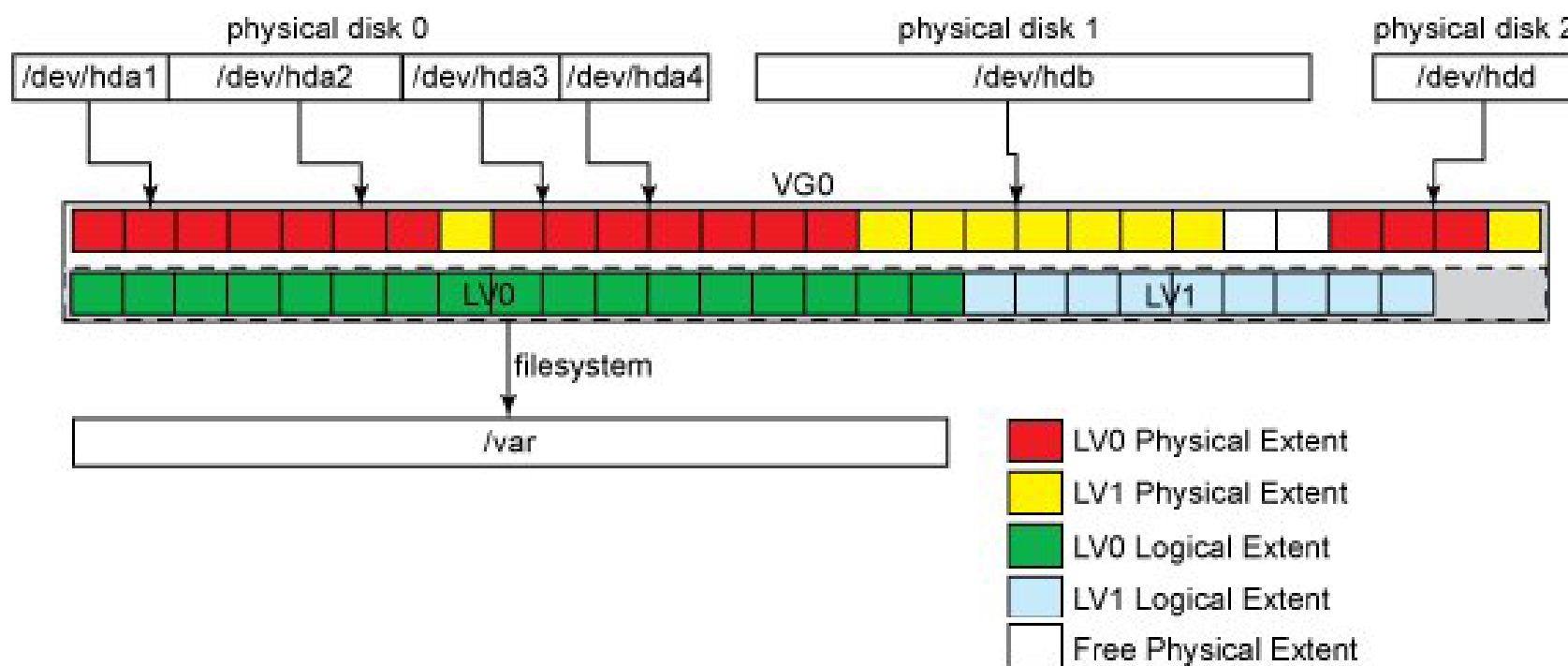
## LVM Structure cont.



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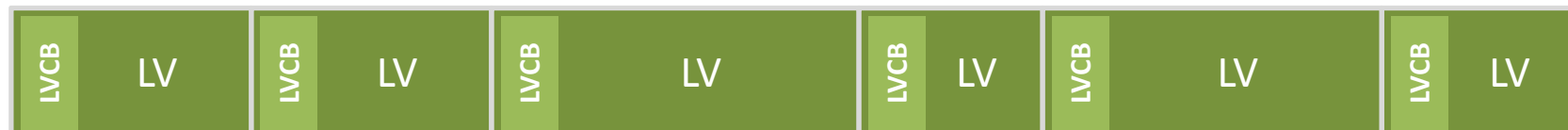
## LVM Structure cont.



[http://sunoano.name/ws/public\\_xhtml/lvm.html](http://sunoano.name/ws/public_xhtml/lvm.html)

# LVM Advantage & Disadvantage

## Lowest Level of LVM



Volume Group



Physical HDD 500GB

Physical HDD 500GB

- VGDA (Volume Group Descriptor Area)
- VGSA (Volume Group Status Area)
- LVCB (Logical Volume Control Block)



# ***Logical Volume Manager Advantage & Disadvantage***



# LVM Advantage & Disadvantage

## Advantages



*/boot, /dev, /etc, /lib ...*



# LVM Advantage & Disadvantage

## *Advantages*

- *Resizing*
  - Resize volume groups online by absorbing new physical volumes(PV) or ejecting existing ones
  - Resize logical volumes (LV) online by concatenating extents onto them or truncating extents from them
- *Snapshot*
  - Create read-only snapshots of logical volumes (LVM1)
  - Create read-write snapshots of logical volumes (LVM2)



# LVM Advantage & Disadvantage

## *Advantages*

- *Similar to RAID 0*
  - Stripe whole or parts of logical volumes across multiple PVs
- *Similar to RAID 1*
  - Mirror whole or parts of logical volumes
- *Move online*
  - Move online logical volumes between PVs



# LVM Advantage & Disadvantage

## *Disadvantages*

- The volume managers *can complicate the boot process* and *make disaster recovery difficult*
- Logical volumes can *suffer from external fragmentation* when the *underlying storage devices do not allocate their PEs contiguously*



# Question & Answer

