Welcome To:
Module 8

Disk Management and
Run Levels

System Run Level

- System Run Levels

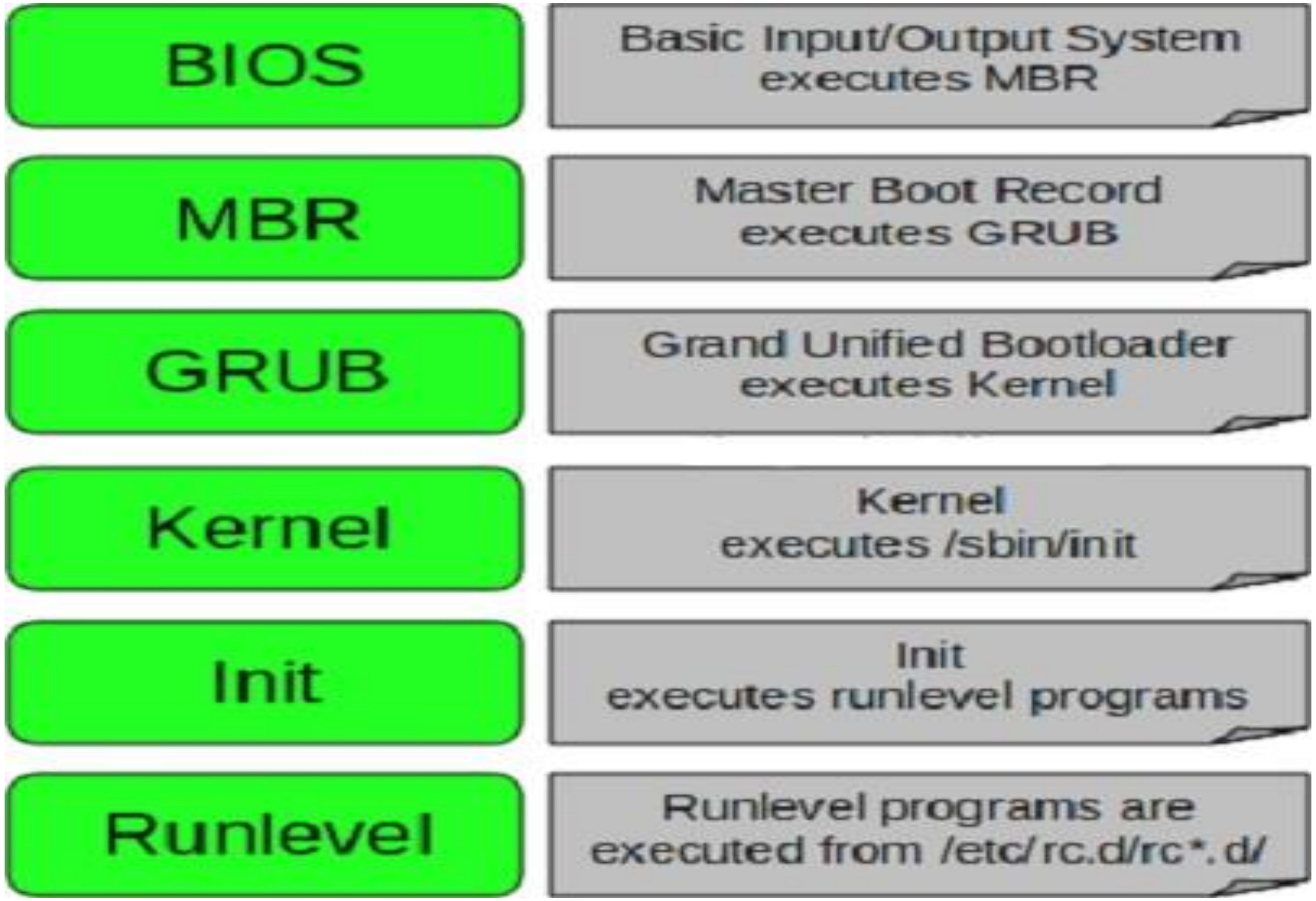
Main Run level

- 0 Shut down (or halt) the system
- 1 Single-user mode; usually aliased as s or S
- 6 Reboot the system

Other Run levels

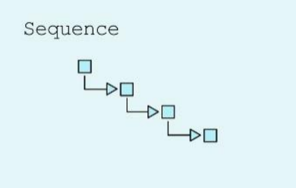
- 2 Multiuser mode without networking
- 3 Multiuser mode with networking
- 5 Multiuser mode with networking and GUI.

Linux Boot Process



BIOS	Basic Input/Output System executes MBR
MBR	Master Boot Record executes GRUB
GRUB	Grand Unified Bootloader executes Kernel
Kernel	Kernel executes /sbin/init
Init	Init executes runlevel programs
Runlevel	Runlevel programs are executed from /etc/rc.d/rc*.d/

Linux Boot Process (Newer Versions)



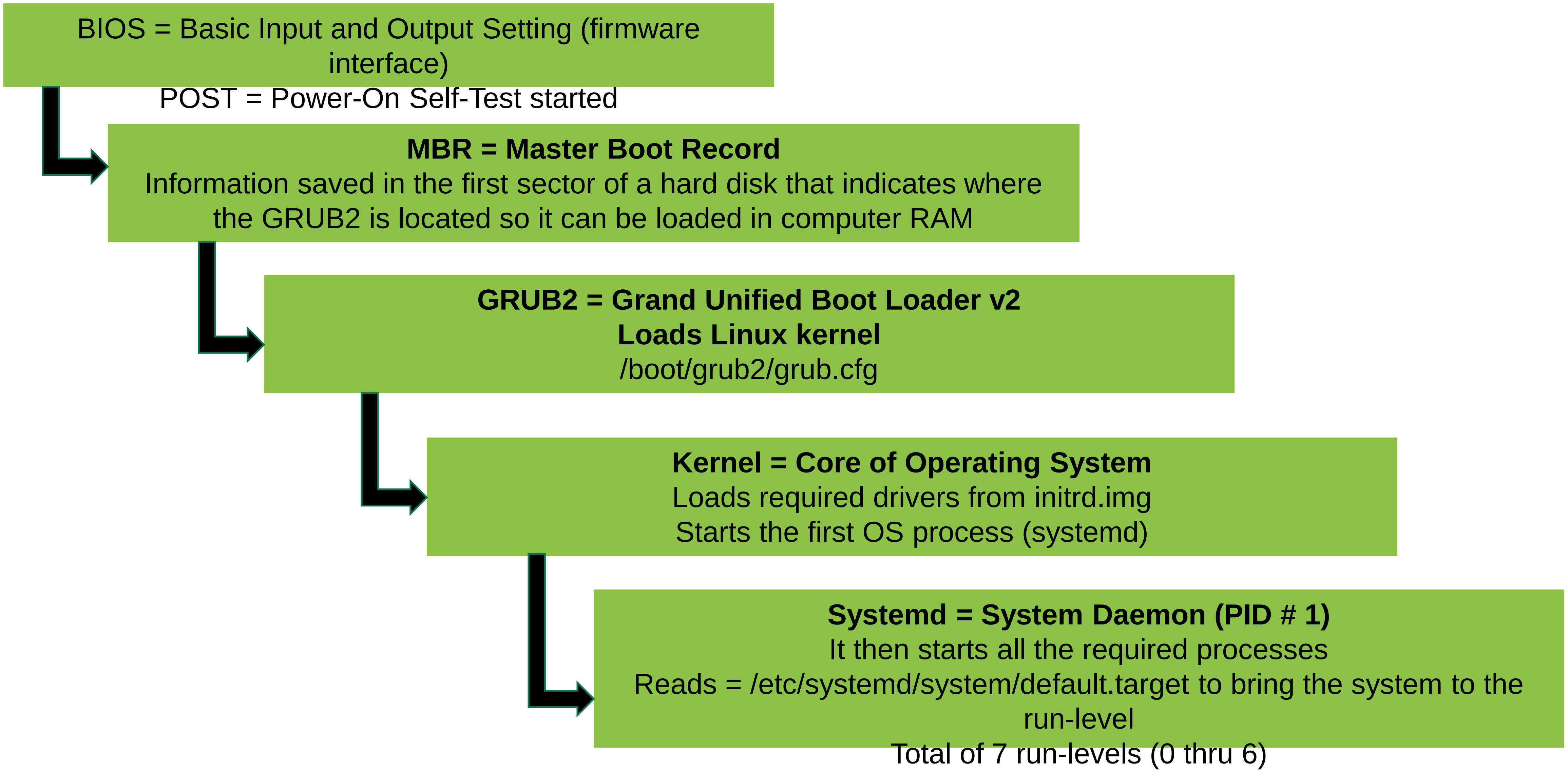
- The boot sequence changes in CentOS/Redhat 7 and above

- **systemd** is the new service manager in CentOS/RHEL 7 that manages the boot sequence

- It is backward compatible with SysV init scripts used by previous versions of RedHat Linux including RHEL 6

- Every system administrator needs to understand the boot process of an OS in order to troubleshoot effectively

Linux Boot Process (Newer Versions)



BIOS = Basic Input and Output Setting (firmware interface)

POST = Power-On Self-Test started

MBR = Master Boot Record

Information saved in the first sector of a hard disk that indicates where the GRUB2 is located so it can be loaded in computer RAM

GRUB2 = Grand Unified Boot Loader v2

Loads Linux kernel

/boot/grub2/grub.cfg

Kernel = Core of Operating System

Loads required drivers from initrd.img

Starts the first OS process (systemd)

Systemd = System Daemon (PID # 1)

It then starts all the required processes

Reads = /etc/systemd/system/default.target to bring the system to the run-level

Total of 7 run-levels (0 thru 6)

Message of the Day

- Message of the day file location
  - **`/etc/motd`**

Customize Message of the Day

- Once again, message of the day is the first message users will see when they login to the Linux machine

- Steps:
  - Create a new file in `/etc/profile.d/motd.sh`
  - Add desired commands in motd.sh file
  - Modify the `/etc/ssh/sshd_config` file to edit `#PrintMotd yes` to `PrintMotd no`
  - Restart sshd service
    - `systemctl restart sshd.service`

Disk Partition

- Commands for disk partition
  - **`df`**
  - **`fdisk`**

Adding Disk and Creating Partition

- Purpose? = Out of Space, Additional Apps etc.

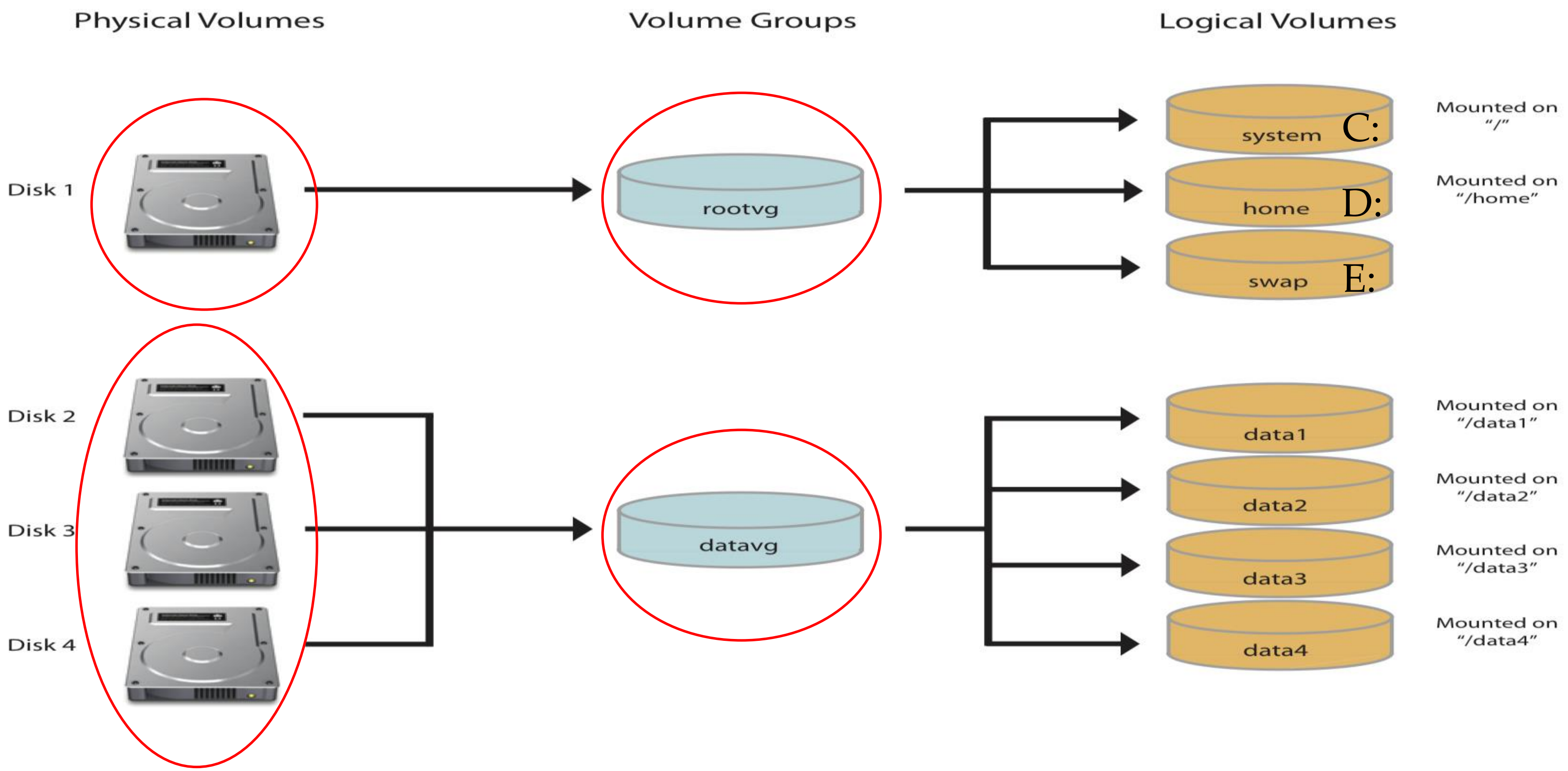
- Commands for disk partition
  - **`df`**
  - **`fdisk`**

Storage

- Local Storage
- SAN (Storage Area Network)
- NAS (Network Attached Storage)

Logical Volume Management (LVM)

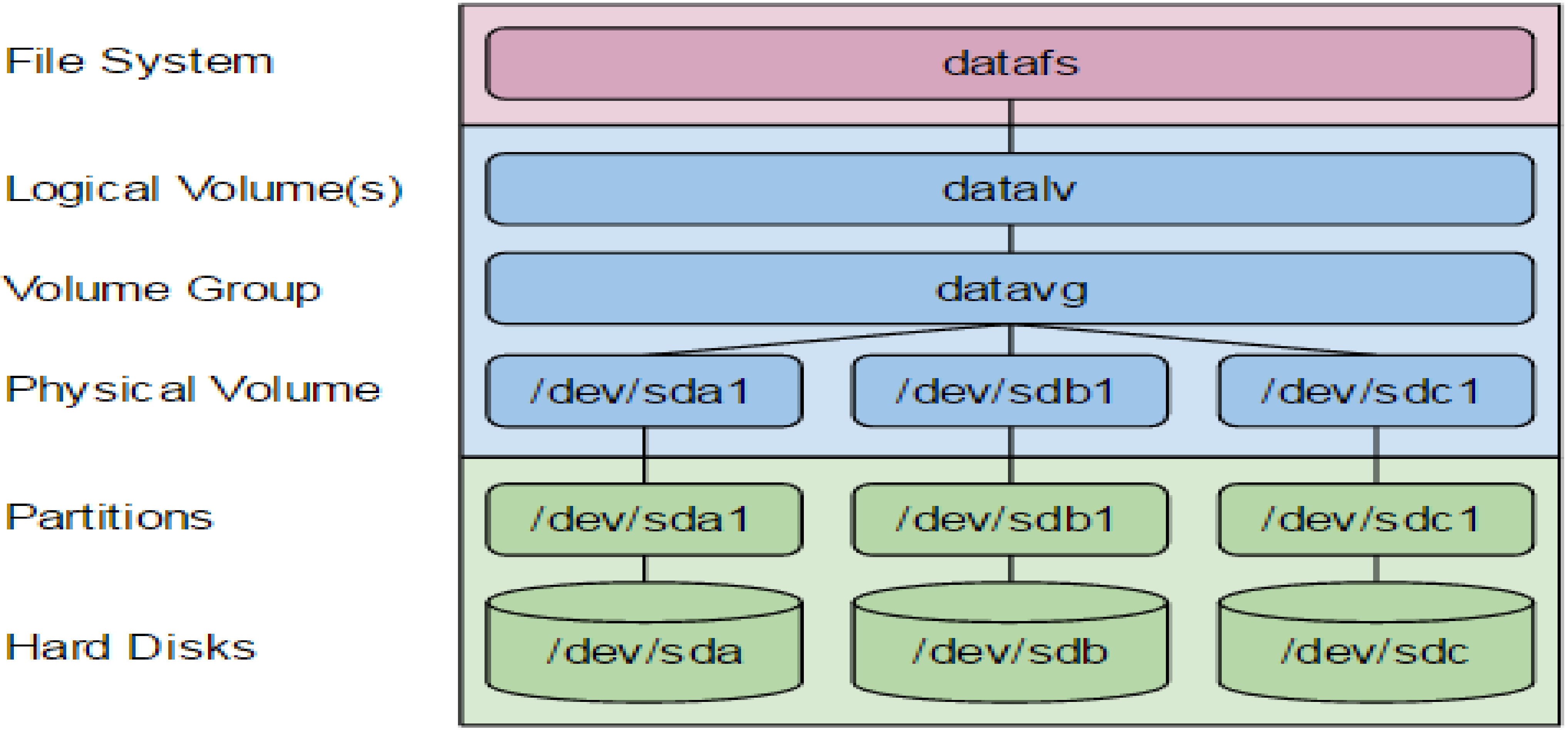
- LVM allows disks to be combined together



LVM Configuration During Install

- Install Linux CentOS with LVM configuration

Add Disk and Create LVM Partition



File System

datafs

Logical Volume(s)

datalv

Volume Group

datavg

Physical Volume

/dev/sda1 /dev/sdb1 /dev/sdc1

Partitions

/dev/sda1 /dev/sdb1 /dev/sdc1

Hard Disks

/dev/sda /dev/sdb /dev/sdc

By: Imran Afzal

Add and Extend Disk using LVM

/oracle = 1.0G
/oracle = Full

Few Options:

- Delete older files to free up disk space
- Add new physical disk mount to /oracle2
- Create a new virtual disk and mount to /oracle2
- Or extend /oracle through LVM.

Add/Extend Swap Space

- What is swap? – CentOS.org

  Swap space in Linux is used when the amount of physical memory (RAM) is full. If the system needs more memory resources and the RAM is full, inactive pages in memory are moved to the swap space. While swap space can help machines with a small amount of RAM, it should not be considered a replacement for more RAM. Swap space is located on hard drives, which have a slower access time than physical memory

- Recommended swap size = Twice the size of RAM

  M = Amount of RAM in GB, and S = Amount of swap in GB, then

  ```
  If M < 2
  then      S = M *2
  Else      S = M + 2
  ```

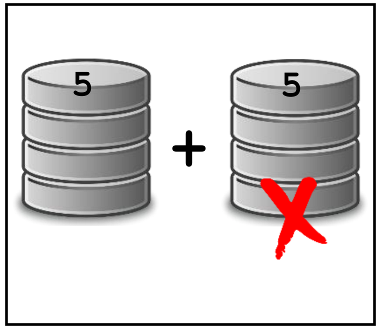
- Commands
  - dd
  - mkswap
  - swapon or swapoff

By: Imran Afzal

RAID

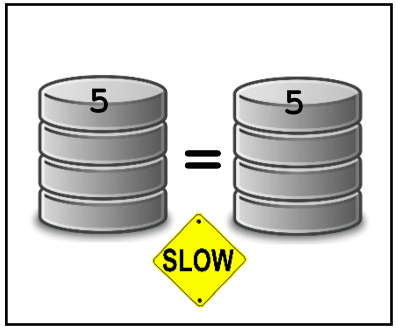
- RAID (Redundant Array of Independent Disks)

- Type of RAID
  - **RAID0**
  - **RAID1**
  - **RAID5**



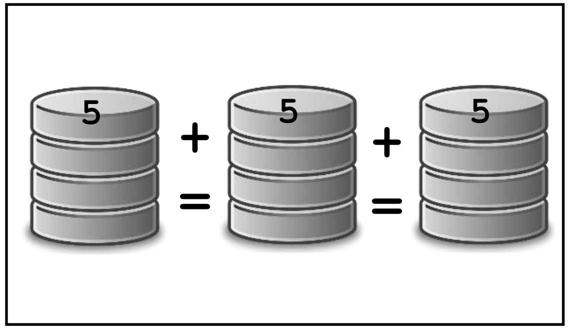
5+5=10G

RAID0



5,5=5G

RAID1



5+5+5=12G

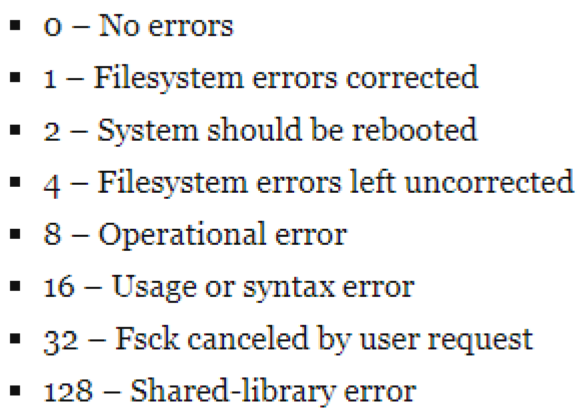
RAID5

File System Check (fsck and xfs_repair)

- Linux fsck utility is used to check and repair Linux filesystems (**`ext2`**, **`ext3`**, **`ext4`**, **`etc.`**)
- Linux xfs_repair utility is used to check and repair Linux filesystems for **`xfs`** filesystem type
- Depending on when was the last time a file system was checked, the system runs the fsck during boot time to check whether the filesystem is in consistent state
- System administrator could also run it manually when there is a problem with the filesystems
- Make sure to execute the fsck on an **unmounted** file systems to avoid any data corruption issues.

File System Check (fsck and xfs_repair)…

- Force a filesystem check even if it’s clean using option –f
- Attempt to fix detected problems automatically using option -y
- The xfs_repair utility is highly scalable and is designed to repair even very large file systems with many inodes efficiently. Unlike other Linux file systems, xfs_repair does not run at boot time
- The following are the possible <u>**exit codes**</u> for fsck command



- 0 – No errors
- 1 – Filesystem errors corrected
- 2 – System should be rebooted
- 4 – Filesystem errors left uncorrected
- 8 – Operational error
- 16 – Usage or syntax error
- 32 – Fsck canceled by user request
- 128 – Shared-library error

System Backup (dd Command)

5 Different Types of Backups

1. System backup (entire image using tools such as acronis, Veeam, Commvault etc.)
2. Application backup (3rd party application backup solution)
3. Database backup (Oracle dataguard, SQL backup etc.)
4. Filesystem backup (tar, gzip directoris etc.)
5. Disk backup or disk cloning (dd command)

- dd is a command-line utility for Unix and Unix-like operating systems whose primary purpose is to convert and copy files
- As a result, dd can be used for tasks such as backing up the boot sector of a hard drive, and obtaining a fixed amount of random data
- Please note the source and destination disk should be the same size

System Backup (dd Command)…

- To backup or clone an entire hard disk to another hard disk connected to the same system, execute the dd command as shown

```
# dd if=<source file name> of=<target file name> [Options]
# dd if=/dev/sda of=/dev/sdb
```

- To backup/copy the disk partition

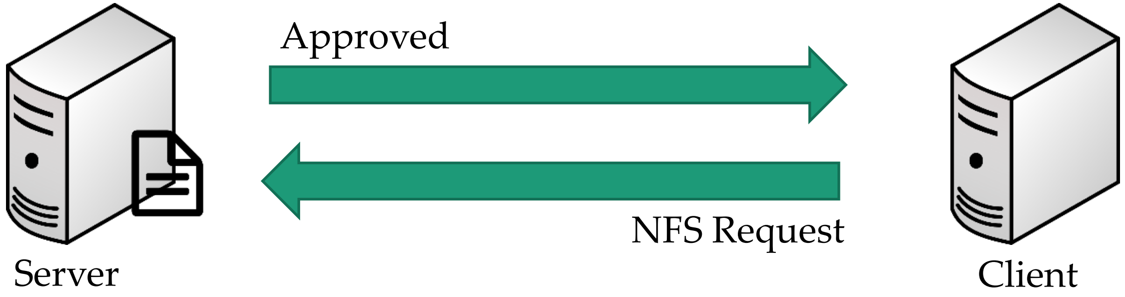
```
# dd if =/dev/sda1 of=/root/sda1.img
```

- Restoring this image file to other machine after copying the .img

```
# dd if=/root/sda1.img of=/dev/sdb3
```

Network File System (NFS)

- NFS stands for Network File System, a file system developed by Sun Microsystems, Inc.
- It is a client/server system that allows users to access files across a network and treat them as if they resided in a local file directory
- For example, if you were using a computer linked to a second computer via NFS, you could access files on the second computer as if they resided in a directory on the first computer. This is accomplished through the processes of exporting (the process by which an NFS server provides remote clients with access to its files) and mounting (the process by which client map NFS shared filesystem)



Network File System (NFS)…

Steps for NFS Server Configuration

- Install NFS packages

```
# yum install nfs-utils libnfsidmap   (most likely they are installed)
```

- Once the packages are installed, enable and start NFS services

```
# systemctl enable rpcbind
# systemctl enable nfs-server
# systemctl start rpcbind, nfs-server, rpc-statd, nfs-idmapd
```

- Create NFS share directory and assign permissions

```
# mkdir /mypretzels
# chmod a+rwx /mypretzels
```

- Modify `/etc/exports` file to add new shared filesystem

```
#   /mypretzels 192.168.12.7(rw,sync,no_root_squash) = for only 1 host

# /mypretzels *(rw,sync,no_root_squash) = for everyone
```

NFS share

IP address of client machine

Read/write

all changes to the according filesystem are immediately flushed to disk; the respective write operations are being waited for

root on the client machine will have the same level of access to the files on the system as root on the server.

- Export the NFS filesystem

```
# exportfs -rv
```

Network File System (NFS)…

Steps for NFS Client Configuration

- Install NFS packages

```
# yum install nfs-utils rpcbind
```

- Once the packages are installed enable and start rpcbind service

```
# systemctl rpcbind start
```

- Make sure firewalld or iptables stopped (if running)

```
# ps –ef | egrep “firewall|iptable”
```

- Show mount from the NFS server

```
# showmount -e 192.168.1.5 (NFS Server IP)
```

- Create a mount point

```
# mkdir /mnt/kramer
```

- Mount the NFS filesystem

```
# mount 192.168.1.5:/mypretzels /mnt/kramer
```

- Verify mounted filesystem

```
# df –h
```

- To unmount

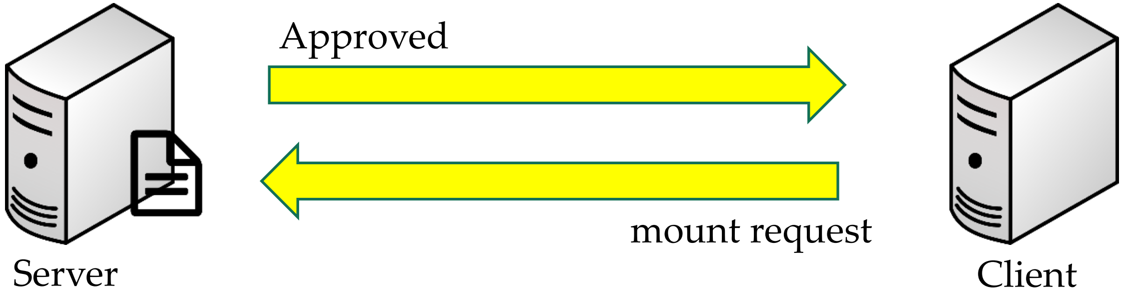
```
# umount /mnt/kramer
```

Samba

- Samba is a Linux tool or utility that allows sharing for Linux resources such as files and printers to with other operating systems

- It works exactly like NFS but the difference is NFS shares within Linux or Unix like system whereas Samba shares with other OS (e.g. Windows, MAC etc.)

- For example, computer “A” shares its filesystem with computer “B” using Samba then computer “B” will see that shared filesystem as if it is mounted as the local filesystem



Samba (smb vs. CIFS)

- Samba shares its filesystem through a protocol called **SMB** (Server Message Block) which was invented by IBM

- Another protocol used to share Samba is through **CIFS** (Common Internet File System) invented by Microsoft and NMB (NetBios Named Server)

- **CIFS** became the extension of **SMB** and now Microsoft has introduced newer version of SMB v2 and v3 that are mostly used in the industry

- In simple term, most people, when they use either SMB or CIFS, are talking about the same exact thing

Samba Installation and Configuration

- Take snapshot of your VM
- Install samba packages
- Enable samba to be allowed through firewall (Only if you have firewall running)
- Disable firewall
- Create Samba share directory and assign permissions
- Also change the SELinux security context for the samba shared directory
- Or disable SELinux
- Modify **`/etc/samba/smb.conf`** file to add new shared filesystem
- Verify the setting
- Once the packages are installed, enable and start **Samba** services (smb and nmb)
- Mount Samba share on Windows client
- Mount Samba share on Linux client
- Additional instructions on creating secure Samba share.

Difference Between CentOS/RHEL 7 and 8

- Red Hat Enterprise Linux 8 (RHEL 8) is now available for production use with lots of developer-friendly capabilities
- RHEL 8 official release by Red Hat Inc, was announced on **May 7, 2019**
- I will cover only what is changed and what you should in terms of my Linux course

	RHEL 8	**RHEL 7**
General Availability Date	14-Nov-18	10-Jun-14
Code Name	Ootpa	Maipo
Kernel Version	4.18	3.10.0-123
End of Support	May-2029	30-Jun-2024
Last Minor Release	8.x	7.7
Network Time Synchronization	Only Chrony	Chrony and ntpd
GUI Interface (Desktop)	Gnome 3.28	Gnome 3
Default Database	MySQL 8.0, MariaDB 10.3, PostgreSQL 10 and 9.6, and Redis 5.0	MariaDB

Difference Between CentOS/RHEL 7 and 8

	RHEL 8	RHEL 7
Default Firewall	Firewalld, it uses nftables framework in the backend	Firewalld, it uses Iptables framework in the backend
Max Supported (Individual) File & Filesystem Size	XFS= 1024TB	XFS= 500TB
Package Management	By default both are installed, YUM symbolic link to DNF	By default only YUM and DNF can be installed from the Extra repo
Max. RAM Supported	24 TB on x86_64 architecture	12 TB on x86_64 architecture