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**OS LAB 1**

**RA1911003010865**

**CSE-E2**

1. **What is meant by booting? Explain Bios, MBR, GRUB, INIT, Run level programs.**

**BIOS**:

BIOS stands for Basic Input/Output System. It performs some system integrity checks. It searches, loads, and executes the boot loader program.

**MBR:**

MBR stands for Master Boot Record.

It is located in the 1st sector of the bootable disk. Typically, /dev/hda, or /dev/sda

MBR is less than 512 bytes in size. This has three components 1) primary boot loader info in 1st 446 bytes 2) partition table info in next 64 bytes 3) mbr validation check in last 2 bytes.

It contains information about GRUB.

**GRUB:**

GRUB stands for Grand Unified Bootloader.

If we have multiple kernel images installed on our system, we can choose which one to be executed.

GRUB displays a splash screen, waits for few seconds, if you don’t enter anything, it loads the default kernel image as specified in the grub configuration file.

GRUB has the knowledge of the filesystem.

**INIT:**

Looks at the /etc/inittab file to decide the Linux run level.

Following are the available run levels

0– halt

1 – Single user mode

2 – Multiuser, without NFS

3 – Full multiuser mode

4 – unused

5 – X11

6 – reboot

**Runlevel programs:**

When the Linux system is booting up, you might see various services getting started. For example, it might say “starting Sendmail …. OK”. Those are the runlevel programs, executed from the run level directory as defined by your run level.

1. **What is initrd image and its functions in linux booting?**

The initrd image contains the necessary executables and system files to support the second-stage boot of a Linux system.

Depending on which version of Linux you're running, the method for creating the initial RAM disk can vary.

The initrd (initial ramdisk) plays a very significant role in [booting up](https://linoxide.com/booting/boot-process-of-linux-in-detail/) the system. This tutorial discusses initrd ramdisk and how we can create it if it needs to be recreated.

**The Linux** initial RAM disk (**initrd**) is a temporary root file system that is mounted during system **boot** to support **the** two-state **boot** process. **The initrd** contains various executables and drivers that permit **the** real root file system to be mounted, after which **the initrd** RAM disk is unmounted and **its** memory freed

1. **What are the run levels in linux and how to change them? How to check the run level of your computer? To which value it is set by default**

A runlevel is a mode of operation in the computer operating systems that implement Unix System V-style initialization. Conventionally, seven runlevels exist, numbered from zero to six. S is sometimes used as a synonym for one of the levels.

Use the init command to change it temporarily. Modify or set up /etc/inittab to make a permanent change.

To check the runlevel of you computer use the runlevel command.

To find default run level Check /etc/inittab if it exists. If not, just ask runlevel. You’re likely already in that run level.

1. **Explain suid, sgid, and sticky bit.**

There are 3 special permission that are available for executable files and directories. These are :

1. SUID permission 2. SGID permission 3. Sticky bit

## **Set-user Identification (SUID)**

Have you ever thought, how a non-root user can change his own password when he does not have write permission to the /etc/shadow file. hmmm… interesting isn’t it? Well to understand the trick check for the permission of /usr/bin/passwd command :

# ls -lrt/ur/bin/passwd

-r sr-sr-x 1 root sys 31396Jan 20 2021/usr/bin/passwd

# ls -lrt /usr/bin/passwd

– If you check carefully, you would find the 2 S’s in the permission field. The first s stands for the SUID and the second one stands for SGID.

– When a command or script with SUID bit set is run, its effective UID becomes that of the owner of the file, rather than of the user who is running it.

– Another good example of SUID is the su command :

# ls -l /bin/su

-rw**s**r-xr-x-x 1 root user 16384 Jan 12 2014 /bin/su

– The setuid permission displayed as an “s” in the owner’s execute field.

### How to set SUID on a file?

# chmod 4555 [path\_to\_file]

Note :

If a capital “S” appears in the owner’s execute field, it indicates that the setuid bit is on, and the execute bit “x” for the owner of the file is off or denied.

## **Set-group identification (SGID)**

### SGID permission on executable file

– SGID permission is similar to the SUID permission, only difference is – when the script or command with SGID on is run, it runs as if it were a member of the same group in which the file is a member.

# ls -l /usr/bin/write

-r-xr-sr-x 1 root tty 11484 Jan 15 17:55 /usr/bin/write

– The setgid permission displays as an “s” in the group’s execute field.

Note :

– If a lowercase letter “l” appears in the group’s execute field, it indicates that the setgid bit is on, and the execute bit for the group is off or denied.

### How to set GUID on a file?

# chmod 2555 [path\_to\_file]

### SGID on a directory

– When SGID permission is set on a directory, files created in the directory belong to the group of which the directory is a member.

– For example if a user having write permission in the directory creates a file there, that file is a member of the same group as the directory and not the user’s group.

– This is very useful in creating shared directories.

### How to set SGID on a directory

# chmod g+s [path\_to\_directory]

## **Sticky Bit:**

– The sticky bit is primarily used on shared directories.

– It is useful for shared directories such as **/var/tmp** and **/tmp** because users can create files, read and execute files owned by other users, but are not allowed to remove files owned by other users.

– For example if user bob creates a file named /tmp/bob, other user tom can not delete this file even when the /tmp directory has permission of 777. If sticky bit is not set then tom can delete /tmp/bob, as the /tmp/bob file inherits the parent directory permissions.

– root user (Off course!) and owner of the files can remove their own files.

### Example of sticky bit :

# ls -ld /var/tmp

drwxrwxrw**t** 2 sys sys 512 Jan 26 11:02 /var/tmp

- T refers to when the execute permissions are off.

- t refers to when the execute permissions are on.

### How to set sticky bit permission?

# chmod +t [path\_to\_directory]

or

# chmod 1777 [path\_to\_directory]

1. **Rescue mode, emergency mode, single user mode.**

* Booting into rescue mode:

To boot into rescue mode, you must be able to boot the system using one of the following methods:

By booting the system from a boot CD-ROM or DVD.

By booting the system from other installation boot media, such as USB flash devices.

Once you have booted using one of the described methods, add the keyword rescue as a kernel parameter.

* Booting into single user mode:

On an x86 system using GRUB, use the following steps to boot into single-user mode:

At the GRUB splash screen at boot time, press any key to enter the GRUB interactive menu.

Select Linux with the version of the kernel that you wish to boot and type a to append the line.

Go to the end of the line and type single as a separate word (press the Spacebar and then type single). Press Enter to exit edit mode.

* Booting into emergency mode:

To boot into emergency mode, use the same method as described for single-user mode in single user mode with one exception, replace the keyword single with the keyword emergency.

1. **Explain briefly the procedure for reinstalling GRUB.**

Reinstall the GRUB boot loader by following these steps:

1. Place your SLED 10 CD 1 or DVD in the drive and boot up to the CD or DVD. On the resulting menu select "Rescue System". This will boot you up to a text based terminal with a "Login" prompt. Enter"root" for the user name. You will be brought to a command prompt.

2. Enter the command "fdisk -l". This will display the partitions on your drives that may look something similar to the following:

Disk /dev/sda: 160.0 GB, 160041885696 bytes

255 heads, 63 sectors/track, 19457 cylinders

Units = cylinders of 16065 \* 512 = 8225280 bytes

Device Boot Start End Blocks Id System

/dev/sda1 1 262 2104483+ 82 Linux swap / Solaris

/dev/sda2 \* 263 3449 25599577+ 83 Linux

/dev/sda3 3450 19456 128576227+ f W95 Ext'd (LBA)

/dev/sda5 3450 6060 20972826 83 Linux

/dev/sda6 6061 19456 107603338+ 83 Linux

This is an example from a SATA drive. IDE drives will have a device name of /dev/hda.

You need to know which of the partitions displayed is your root partition for the Linux system. If you took the default during installation it is typically the Linux partition just after the Linux swap partition.

3. Enter the command "mount /dev/sda2 /mnt". Be sure to replace /dev/sda2 with the appropriate device for your root partition.

\*\*\* Note: With this partition mounted you can verify that it is the "/" (or root) partition by viewing the contents of the /mnt/etc/fstab file. Run this command to display the file.

cat /mnt/etc/fstab

You should see this same partition being mounted to "/" in a line similar to this:

/dev/sda2 / reiserfs acl,user\_xattr 1 1

If the file is not found then this is most likely not the root partition. You can unmount the partition and try one of the others if needed. Use the following commands as an example. Just replace the device names with those on your system:

umount /mnt

mount /dev/sda3 /mnt

Remember that you will not be able to do the umount command if you have used the cd command to change directories into the /mnt directory. If you get an error run the command "cd /" and try again.

4. Enter the command "grub-install --root-directory=/mnt /dev/sda". Be sure to replace /dev/sda with the correct device for your hard drive where the root partition exists (usually /dev/hda for IDE drives). The "sda" without the number on the end represents the drive where the 2 in "sda2" represents the partition number on the drive.

5. Once this command completes successfully reboot your system by entering the command "reboot". Your system will reboot and hopefully you will see the GRUB menu again.nstall the GRUB boot loader by following these steps:

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