Ex. No. 1a	OPERATING SYSTEM INSTALLATION	Date :

Linux operating system can be installed as either dual OS in your system or you can install through a virtual machine (VM).

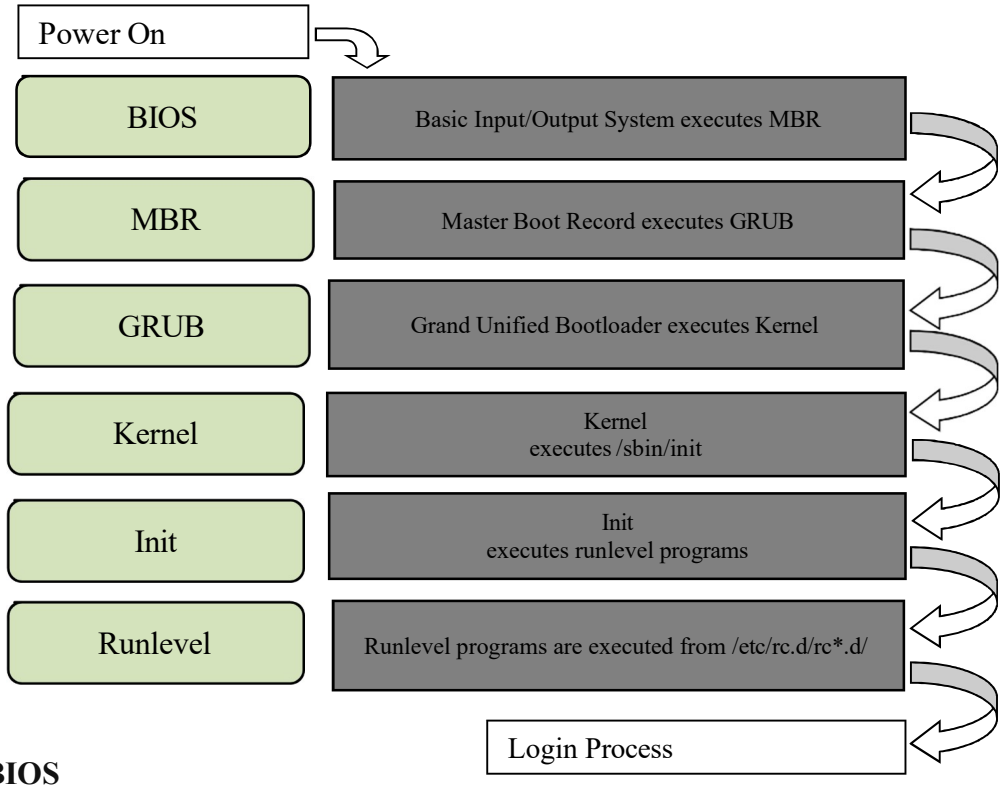
Installation of Ubuntu in your Windows OS through a Virtual machine

Steps

1. Download VMware Player or Workstation recent version.
2. Download Ubuntu LTS recent version.
3. Install VM ware Player in your host machine.
4. Open VMware Workstation and click on "New Virtual Machine".
5. Select "Typical (recommended)" and click "Next".
6. Select "Installer disc image (ISO)", click "Browse" to select the Ubuntu ISO file, click "Open" then "Next".
7. You have to type in "Full name", "User name" that must only consist of lowercase and numbers then you must enter a password. After you finished, click "Next".
8. You can type in a different name in "Virtual machine name" or leave as is and select an appropriate location to store the virtual machine by clicking on "Browse" that is next to "Location" -- you should place it in a drive/partition that has at least 5GB of free space. After you selected the location click "OK" then "Next".
9. In "Maximum disk size" per Ubuntu recommendations you should allocate at least 5GB -- double is recommended to avoid running out of free space.
10. Select "Store virtual disk as a single file" for optimum performance and click "Next".
11. Click on "Customize" and go to "Memory" to allocate more RAM -- 1GB should suffice, but more is always better if you can spare from the installed RAM.
12. Go to "Processors" and select the "Number of processors" that for a normal computer is 1 and "Number of cores per processor" that is 1 for single core, 2 for dual core, 4 for quad core and so on -- this is to insure optimum performance of the virtual machine.
13. Click "Close" then "Finish" to start the Ubuntu install process.
14. On the completion of installation, login to the system

Ex. No. 1b	BOOTING PROCESS OF LINUX	Date :

Press the power button on your system, and after few moments you see the Linux login prompt. From the time you press the power button until the Linux login prompt appears, the following sequence occurs. The following are the 6 high level stages of a typical Linux boot process.



Step 1.BIOS

∑ BIOS stands for Basic Input/Output System
∑ Performs some system integrity checks

∑ Searches, loads, and executes the boot loader program.
∑ It looks for boot loader in floppy, CD-ROMs, or hard drive. You can press a key (typically F12 or F2, but it depends on your system) during the BIOS startup to change the boot sequence.
∑ Once the boot loader program is detected and loaded into the memory, BIOS gives the control to it.
∑ So, in simple terms BIOS loads and executes the MBR boot loader.

Step 2. 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 (or LILO in old systems).
∑ So, in simple terms MBR loads and executes the GRUB boot loader.

Step 3. GRUB

- GRUB stands for Grand Unified Bootloader.
- If you have multiple kernel images installed on your system, you 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 (the older Linux loader LILO didn't understand filesystem).
- Grub configuration file is /boot/grub/grub.conf (/etc/grub.conf is a link to this). The following is sample grub.conf of CentOS.

```
#boot=/dev/sda
default=0
timeout=5
splashimage=(hd0,0)/boot/grub/splash.xpm.gz
hiddenmenu
title CentOS(2.6.18-194.el5PAE)
root(hd0,0)
kernel/boot/vmlinuz-2.6.18-194.el5PAE ro root=LABEL=/
initrd /boot/initrd-2.6.18-194.el5PAE.img
```

- As you notice from the above info, it contains kernel and initrd image.
- So, in simple terms GRUB just loads and executes Kernel and initrd images.

Step 4. Kernel

- Mounts the root file system as specified in the "root=" in grub.conf
- Kernel executes the /sbin/init program
- Since init was the 1st program to be executed by Linux Kernel, it has the process id (PID) of 1. Do a 'ps -ef | grep init' and check the pid.
- initrd stands for Initial RAM Disk.
- initrd is used by kernel as temporary root file system until kernel is booted and the real root file system is mounted. It also contains necessary drivers compiled inside, which helps it to access the hard drive partitions, and other hardware.

Step 5. 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
- Init identifies the default initlevel from /etc/inittab and uses that to load all appropriate program.

- ∑ Execute ‘grep initdefault /etc/inittab’ on your system to identify the default run level
- ∑ If you want to get into trouble, you can set the default run level to 0 or 6. Since you know what 0 and 6 means, probably you might not do that.
- ∑ Typically you would set the default run level to either 3 or 5.

Step 6. 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.
- ∑ Depending on your default init level setting, the system will execute the programs from one of the following directories.
  - Run level 0 – /etc/rc.d/rc0.d/
  - Run level 1 – /etc/rc.d/rc1.d/
  - Run level 2 – /etc/rc.d/rc2.d/
  - Run level 3 – /etc/rc.d/rc3.d/
  - Run level 4 – /etc/rc.d/rc4.d/
  - Run level 5 – /etc/rc.d/rc5.d/
  - Run level 6 – /etc/rc.d/rc6.d/
- ∑ Please note that there are also symbolic links available for these directory under /etc directly. So, /etc/rc0.d is linked to /etc/rc.d/rc0.d.
- ∑ Under the /etc/rc.d/rc*.d/ directories, you would see programs that start with S and K.
- ∑ Programs starts with S are used during startup. S for startup.
- ∑ Programs starts with K are used during shutdown. K for kill.
- ∑ There are numbers right next to S and K in the program names. Those are the sequence number in which the programs should be started or killed.
- ∑ For example, S12syslog is to start the syslog deamon, which has the sequence number of 12. S80sendmail is to start the sendmail daemon, which has the sequence number of 80. So, syslog program will be started before sendmail.

Login Process

1. Users enter their username and password
2. The operating system confirms your name and password.
3. A "shell" is created for you based on your entry in the "/etc/passwd" file
4. You are "placed" in your "home"directory.
5. Start-up information is read from the file named "/etc/profile". This file is known as the system login file. When every user logs in, they read the information in this file.
6. Additional information is read from the file named ".profile" that is located in your "home" directory. This file is known as your personal login file.

Ex. No. 2a	BASIC LINUX COMMANDS	Date :

a) Basics

1. *echo* SRM ➔ to display the string SRM
2. *clear* ➔ to clear the screen
3. *date* ➔ to display the current date and time
4. *cal* 2003 ➔ to display the calendar for the year 2003
   cal 6 2003 ➔ to display the calendar for the June-2003
5. *passwd* ➔ to change password

b) Working with Files

1. *ls* ➔ list files in the present working directory
   ls –l ➔ list files with detailed information (long list)
   ls –a ➔ list all files including the hidden files
2. cat > f1 ➔ to create a file (Press ^d to finish typing)
3. *cat* f1 ➔ display the content of the file f1
4. *wc* f1 ➔ list no. of characters, words & lines of a file f1
   wc –c f1 ➔ list only no. of characters of file f1
   wc –w f1 ➔ list only no. of words of file f1
   wc –l f1 ➔ list only no. of lines of file f1
5. *cp* f1 f2 ➔ copy file f1 into f2
6. *mv* f1 f2 ➔ rename file f1 as f2
7. *rm* f1 ➔ remove the file f1
8. *head* –5 f1 ➔ list first 5 lines of the file f1
   tail –5 f1 ➔ list last 5 lines of the file f1

c) Working with Directories

1. *mkdir* elias ➔ to create the directory elias
2. *cd* elias ➔ to change the directory as elias
3. *rmdir* elias ➔ to remove the directory elias
4. *pwd* ➔ to display the path of the present working directory
5. *cd* ➔ to go to the home directory
   cd .. ➔ to go to the parent directory
   cd - ➔ to go to the previous working directory
   cd / ➔ to go to the root directory

d) File name substitution

1. *ls f?* ➔ list files start with 'f' and followed by any one character
2. *ls* *.c ➔ list files with extension 'c'
3. *ls* [gpy]et ➔ list files whose first letter is any one of the character g, p or y and followed by the word et
4. *ls* [a-d,l-m]ring ➔ list files whose first letter is any one of the character from a to d and l to m and followed by the word ring.

e) I/O Redirection

1. Input redirection

   wc –l < ex1 ➔ To find the number of lines of the file 'ex1'

2. Output redirection

   who > f2 ➔ the output of 'who' will be redirected to file f2

3. *cat* >> f1 ➔ to append more into the file f1

f) Piping

Syntax : Command1 | command2

Output of the command1 is transferred to the command2 as input. Finally output of the command2 will be displayed on the monitor.

ex. *cat* f1 | *more* ➔ list the contents of file f1 screen by screen

head –6 f1 |*tail* –2 ➔ prints the 5th & 6th lines of the file f1.

g) Environment variables

1. *echo $HOME* ➔ display the path of the home directory
2. *echo $PS1* ➔ display the prompt string $
3. *echo $PS2* ➔ display the second prompt string (> symbol by default)
4. *echo $LOGNAME* ➔ login name
5. *echo $PATH* ➔ list of pathname where the OS searches for an executable file