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Assignment No. 2

Title: Shell Scripting

Theory:

Initially, Linux was created for personal computers and gradually it was used in other machines like servers, mainframe computers, supercomputers, etc. Nowadays, Linux is also used in embedded systems like routers, automation controls, televisions, digital video recorders, video game consoles, smartwatches, etc. The biggest success of Linux is Android(operating system) . It is based on the Linux kernel that is running on smartphones and tablets. Due to android Linux has the largest installed base of all general-purpose operating systems. Linux is generally packaged in a Linux distribution.

Linux Distribution

Linux distribution is an operating system that is made up of a collection of software based on Linux kernel or you can say distribution contains the Linux kernel and supporting libraries and software. And you can get Linux based operating system by downloading one of the Linux distributions and these distributions are available for different types of devices like embedded devices, personal computers, etc. Around **600 + Linux Distributions** are available and some of the popular Linux distributions are:

- MX Linux
- Manjaro
- Linux Mint
- elementary
- Ubuntu
- Debian
- Solus
- Fedora
- openSUSE

- Deepin

Linux Operating System Features

- **Portable:** Linux OS can perform different types of hardware and the kernel of Linux supports the installation of any type of hardware environment.
- **Open source:** Linux operating system source code is available freely and for enhancing the capability of the Linux OS, several teams are performing in collaboration.
- **Multiprogramming:** Linux OS can be defined as a multiprogramming system. It means more than one application can be executed at the same time.
- **Multi-user:** Linux OS can also be defined as a multi-user system. It means more than one user can use the resources of the system such as **application programs, memory,** or **RAM** at the same time.

Drawbacks of Linux

- **Hardware drivers:** Most of the users of Linux face an issue while using Linux. Various companies of hardware prefer to build drivers for Mac or Windows due to they contain several users rather than Linux. Linux has smaller drivers for peripheral hardware than windows.
- **Software alternative:** Let's take the Photoshop example which is a famous tool for graphic editing. Photoshop exists for Windows; however, it is not available in Linux.
- **Learning curve:** Linux isn't a very user-friendly operating system. Hence, it might be confusing for many beginners. Getting begun with Windows is efficient and easy for many beginners; however, understanding Linux working is complex.
- **Games:** Several games are developed for Windows but unfortunately not for Linux. Because the platform of Windows is used widely. So, the developers of the games are more interested in windows.

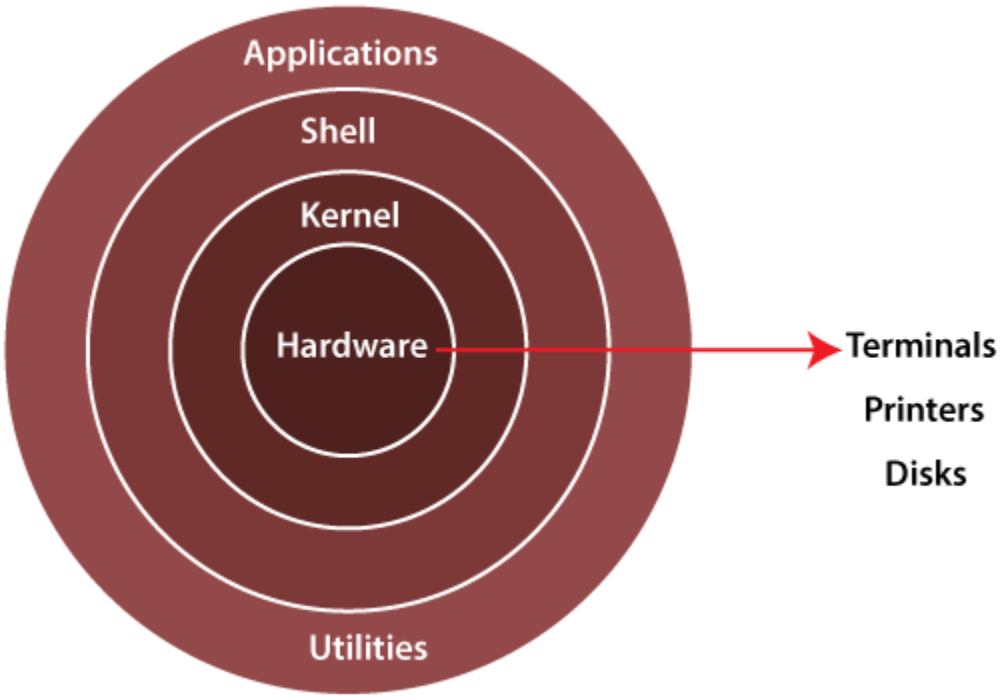
❖ What is Shell (Linux kernel architecture diagram)?

Ans.: It is an interface among the kernel and user. It can afford the services of the kernel. It can take commands through the user and runs the functions of the kernel. The shell is available in distinct types of OSes. These operating systems are categorized into two different types, which are the **graphical shells** and **command-line shells**.
The graphical line shells facilitate the graphical user interface, while the command line shells facilitate the command line interface. Thus, both of these shells implement operations. However, the graphical user interface shells work slower as compared to the command-line interface shells.

There are a few types of these shells which are categorized as follows:

- Korn shell
- Bourne shell
- C shell
- Z shell

Architecture of Linux system



The Linux operating system's architecture mainly contains some of the components: **the Kernel, System Library, Hardware layer, System,** and **Shell utility**.

1. Kernel:- The kernel is one of the core section of an operating system. It is responsible for each of the major actions of the Linux OS. This operating system contains distinct types of modules and cooperates with underlying hardware directly. The kernel facilitates required abstraction for hiding details of low-level hardware or application programs to the system. There are some of the important kernel types which are mentioned below:

- Monolithic Kernel
- Micro kernels
- Exo kernels
- Hybrid kernels

2. System Libraries:- These libraries can be specified as some special functions. These are applied for implementing the operating system's functionality and don't need code access rights of the modules of the kernel.

3. System Utility Programs:- It is responsible for doing specialized level and individual activities.

4. Hardware layer:- Linux operating system contains a hardware layer that consists of several peripheral devices like CPU, HDD, and RAM.

5. Shell:- It is an interface among the kernel and user.

❖ **Different types of shells**

Each of these shells has properties that make them highly efficient for a specific type of use over other shells. So let us discuss the different types of shells in Linux along with their properties and features.

1. The Bourne Shell (sh)

Developed at AT&T Bell Labs by Steve Bourne, the Bourne shell is regarded as the first UNIX shell ever. It is denoted as sh. It gained popularity due to its compact nature and high speeds of operation.

This is what made it the default shell for Solaris OS. It is also used as the default shell for all Solaris system administration scripts. Start reading about shell scripting here.

However, the Bourne shell has some major drawbacks.

- It doesn't have in-built functionality to handle logical and arithmetic operations.
- Also, unlike most different types of shells in Linux, the Bourne shell cannot recall previously used commands.
- It also lacks comprehensive features to offer a proper interactive use.

The complete path-name for the Bourne shell is /bin/sh and /sbin/sh. By default, it uses the prompt # for the root user and *$* for the non-root users.

2. The GNU Bourne-Again Shell (bash)

More popularly known as the Bash shell, the GNU Bourne-Again shell was designed to be compatible with the Bourne shell. It incorporates useful features from different types of shells in Linux such as Korn shell and C shell.

It allows us to automatically recall previously used commands and edit them with the help of arrow keys, unlike the Bourne shell.

The complete path-name for the GNU Bourne-Again shell is /bin/bash. By default, it uses the prompt *bash-VersionNumber#* for the root user and *bash-VersionNumber for* the non-root users.

3. The C Shell (csh)

The C shell was created at the University of California by Bill Joy. It is denoted as csh. It was developed to include useful programming features like in-built support for arithmetic operations and a syntax similar to the C programming language.

Further, it incorporated command history which was missing in different types of shells in Linux like the Bourne shell. Another prominent feature of a C shell is "aliases".

The complete path-name for the C shell is /bin/csh. By default, it uses the prompt *hostname#* for the root user and *hostname%* for the non-root users.

4. The Korn Shell (ksh)

The Korn shell was developed at AT&T Bell Labs by David Korn, to improve the Bourne shell. It is denoted as ksh. The Korn shell is essentially a superset of the Bourne shell.

Besides supporting everything that would be supported by the Bourne shell, it provides users with new functionalities. It allows in-built support for arithmetic operations while offering interactive features which are similar to the C shell.

The Korn shell runs scripts made for the Bourne shell, while offering string, array and function manipulation similar to the C programming language. It also supports scripts which were written for the C shell. Further, it is faster than most different types of shells in Linux, including the C shell.

The complete path-name for the Korn shell is /bin/ksh. By default, it uses the prompt # for the root user and *$* for the non-root users.

5. The Z Shell (zsh)

The Z Shell or zsh is a sh shell extension with tons of improvements for customization. If you want a modern shell that has all the features and much more, the zsh shell is what you're looking for.

Some noteworthy features of the z shell include:

- Generate filenames based on given conditions
- Plugins and theming support
- Index of built-in functions
- Command completion
- and many more…

Problem statements for shell scripting:

a) Write a shell script to check if the user is a root user or not.

Ans.:

```
#!/bin/bash
if [ "$(id -u)" == "0" ]
then
        echo "you are a root user."
else
        echo "you are not a root user."
fi
```

Output: -

```
student@student-Vostro-3470:~/Documents/Ruthik$ chmod +x test.sh
student@student-Vostro-3470:~/Documents/Ruthik$ ./test.sh
you are not a root user.
student@student-Vostro-3470:~/Documents/Ruthik$
```

```
student@student-Vostro-3470:~/Documents/Ruthik$ sudo cp /home/student/Documents/Ruthik/test.sh /root
student@student-Vostro-3470:~/Documents/Ruthik$ sudo -i
root@student-Vostro-3470:~# chmod +x test.sh
root@student-Vostro-3470:~# ./test.sh
you are a root user.
root@student-Vostro-3470:~#
```

b) Write a shell script to install any particular software (ex: java or python).

Ans.:

```
#!/bin/bash
read software
sudo apt-get install $software
```

Output: -

```
student@student-Vostro-3470:~/Documents/Ruthik$ chmod +x software.sh
student@student-Vostro-3470:~/Documents/Ruthik$ ./software.sh
mongodb
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  mongodb
0 upgraded, 1 newly installed, 0 to remove and 94 not upgraded.
Need to get 0 B/9,640 B of archives.
After this operation, 45.1 kB of additional disk space will be used.
Selecting previously unselected package mongodb.
(Reading database ... 179004 files and directories currently installed.)
Preparing to unpack .../mongodb_1%3a3.6.9+really3.6.8+90~g8e540c0b6d-0ubuntu5.3_amd64.deb ...
Unpacking mongodb (1:3.6.9+really3.6.8+90~g8e540c0b6d-0ubuntu5.3) ...
Setting up mongodb (1:3.6.9+really3.6.8+90~g8e540c0b6d-0ubuntu5.3) ...
student@student-Vostro-3470:~/Documents/Ruthik$
```

c) Write a shell script to check disk usage of the system and if disk usage is more than 90% it should send an email to system admin. This script should run everyday at 8:00 AM.

Ans.:

```
df -Ph | grep -vE '/Filesystem|tmpfs|cdrom' | awk '{ print $5,$1 }' |
while read output;
do
echo $output
used=$(echo $output | awk '{print $1}' | sed s/%//g)
partition=$(echo $output | awk '{print $2}')
if [ $used -gt 90 ]; then
echo "The partition \"$partition\" on $(hostname) has used $used%at $(date)" |
mail -s "Disk Space Alert: $used% Used On $(hostname)"
root@student-HP-280-G3-SFF-Business-PC
echo "Email sent regarding $partition"
else
echo "Disk space usage is in under control"
fi
done
```

```
root@student-HP-280-G3-SFF-Business-PC: ~
(base) student@student-HP-280-G3-SFF-Business-PC:~/Documents/Ruthik$ sudo cp /home/student/Documents/Ruthik/admin.sh /root
(base) student@student-HP-280-G3-SFF-Business-PC:~/Documents/Ruthik$ sudo -i
root@student-HP-280-G3-SFF-Business-PC:~# chmod +x admin.sh
root@student-HP-280-G3-SFF-Business-PC:~# ./admin.sh
Use% Filesystem
./admin.sh: line 7: [: Use: integer expression expected
Disk space usage is in under control
0% udev
Disk space usage is in under control
3% /dev/sda5
Disk space usage is in under control
100% /dev/loop1
Email sent regarding /dev/loop1
100% /dev/loop3
Email sent regarding /dev/loop3
100% /dev/loop5
Email sent regarding /dev/loop5
100% /dev/loop0
Email sent regarding /dev/loop0
100% /dev/loop2
Email sent regarding /dev/loop2
100% /dev/loop7
Email sent regarding /dev/loop7
100% /dev/loop6
Email sent regarding /dev/loop6
100% /dev/loop10
Email sent regarding /dev/loop10
100% /dev/loop14
Email sent regarding /dev/loop14
100% /dev/loop11
Email sent regarding /dev/loop11
100% /dev/loop12
Email sent regarding /dev/loop12
100% /dev/loop9
Email sent regarding /dev/loop9
100% /dev/loop13
Email sent regarding /dev/loop13
100% /dev/loop8
Email sent regarding /dev/loop8
100% /dev/loop4
Email sent regarding /dev/loop4
100% /dev/loop17
Email sent regarding /dev/loop17
100% /dev/loop16
Email sent regarding /dev/loop16
100% /dev/loop15
```

```
Email sent regarding /dev/loop15
100% /dev/loop18
Email sent regarding /dev/loop18
1% /dev/sda1
Disk space usage is in under control
root@student-HP-280-G3-SFF-Business-PC:~# mail
"/var/mail/root": 19 messages 19 new
>N   1 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   2 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   3 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   4 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   5 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   6 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   7 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   8 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N   9 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  10 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  11 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  12 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  13 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  14 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  15 root              Tue Jan 31 16:27  13/736   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  16 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  17 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  18 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
 N  19 root              Tue Jan 31 16:27  13/737   Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
? 1
Return-Path: <root@student-HP-280-G3-SFF-Business-PC>
X-Original-To: root@student-HP-280-G3-SFF-Business-PC
Delivered-To: root@student-HP-280-G3-SFF-Business-PC
Received: by student-HP-280-G3-SFF-Business-PC (Postfix, from userid 0)
        id 953EA1C80454; Tue, 31 Jan 2023 16:27:36 +0530 (IST)
Subject: Disk Space Alert: 100% Used On student-HP-280-G3-SFF-Business-PC
To: <root@student-HP-280-G3-SFF-Business-PC>
X-Mailer: mail (GNU Mailutils 3.7)
Message-Id: <20230131105736.953EA1C80454@student-HP-280-G3-SFF-Business-PC>
Date: Tue, 31 Jan 2023 16:27:36 +0530 (IST)
From: root <root@student-HP-280-G3-SFF-Business-PC>

The partition "/dev/loop1" on student-HP-280-G3-SFF-Business-PC has used 100%at Tuesday 31 January 2023 04:27:36 PM IST
?
```

d) write a shell script to take mysql database server backup. This script should run weekly on every sunday at 11:00 PM.

Ans.:

```
echo "starting database backup"
db_backup="mydb.gz"
sudo mysqldump -uroot -p test | gzip -c > ./${db_backup}
if [ "$?" -eq 0 ]; then
echo "db backup complete"
else
echo "db backup failed"
fi
```

```
(base) student@student-HP-280-G3-SFF-Business-PC:~$ sudo cp /home/student/Documents/Ruthik/backup.sh /root
(base) student@student-HP-280-G3-SFF-Business-PC:~$ sudo -i
root@student-HP-280-G3-SFF-Business-PC:~# chmod +x backup.sh
root@student-HP-280-G3-SFF-Business-PC:~# ./backup.sh
starting database backup
Enter password:
db backup complete
```