Module 4 – Linux Fundamentals

Command Syntax

- **Commands typically have the syntax:**

  command option(s) argument(s)

- **Options:**
  - Modify the way that a command works
  - Usually consist of a hyphen or dash followed by a single letter
  - Some commands accept multiple options which can usually be grouped together after a single hyphen
- **Arguments:**
  - Most commands are used together with one or more arguments
  - Some commands assume a default argument if none is supplied
  - Arguments are optional for some commands and required by others

File Permissions

Every **file** and **directory** in your account can be **protected** from or made **accessible** to other **users** by changing its access **permissions**. Every user has responsibility for controlling access to their files.

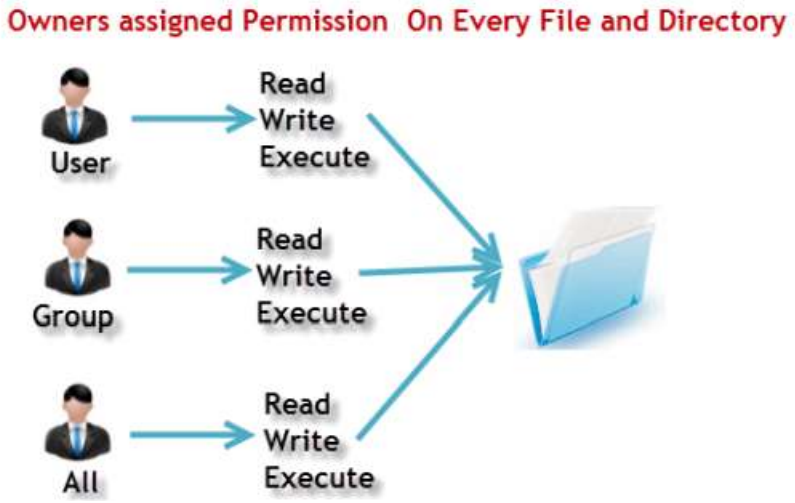
- There are 3 type of permissions
  - r -**read**
  - w -**write**
  - x -**execute** = running a program
- Each permission (rwx) can be controlled at three levels:
  - u -**user** = yourself
  - g -**group** = can be people in the same project
  - o -**other** = everyone on the system
- File or Directory permission can be displayed by running ls –l command
    - -rwxrwxrwx
- Command to change permission - **chmod**

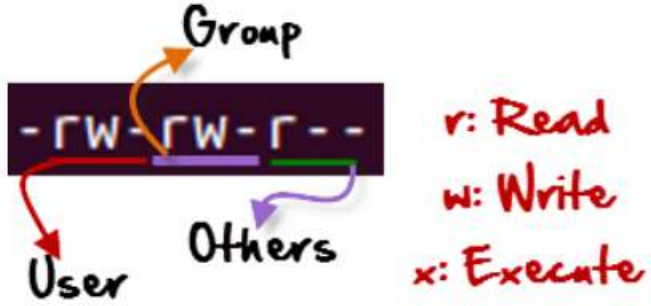
Permissions using Numeric mode

- Permission to a file and directory can also be assigned numerically

chmod ugo+r File or chmod 444 File

```
-r--r--r--
```





Permissions using Numeric mode

The table below assigns numbers to permissions types

Number	Permission Type	Symbol
0	No Permission	---
1	Execute	--x
2	Write	-w-
3	Execute + Write	-wx
4	Read	r--
5	Read + Execute	r-x
6	Read +Write	rw-
7	Read + Write +Execute	rwx

chmod 764 File

File Permissions - umask

- When creating a file or directory, a set of default permissions are applied.
- These **default** permissions are determined by the **umask**.
- The umask specifies permissions that you do not want set on by default.
- You can display the umask with the **umask** command, umask -S

```
[root@MyFirstLinux permission]# umask
0022
```

- Full permission of File – 666 , Default permission of file = 666-022 →644
- Full permission of Dir – 777 , Default permission of Dir = 777 -022 →755
- You can set temporary umask value→ umask 034 (all files/dir will be created with this new default permission).it holds good until a session ends.

File Ownership

- There are 2 owners of a file or directory
  - **User** and **group**
  - The users and groups of a system can be locally managed in **/etc/passwd** and **/etc/group**
- Command to change file ownership – Only root user can perform
  - **chown** changes the ownership of a file
    - chown user Filename
    - chown user:group filename
  - **chgrp** changes the group ownership of a file
    - Chgrp grpname filename
  - **Recursive** ownership change option (Cascade) **–R**
    - chown –R user:grp dirname
    - chgrp –R grp dirname

Adding text to Files

3 Simple ways to **add text** to a file

- **vi**
- **Redirect command output > or >>**
- **echo > or >>**

Input and output redirects

- There are 3 redirects in Linux
  - Standard input (**stdin**) and it has file descriptor number as 0
  - Standard output (**stdout**) and it has file descriptor number as 1
  - Standard error (**stderr**) and it has file descriptor number as 2
- By default when running a command its output goes to the terminal
- The output of a command can be routed to a file using > or >> symbol
  - **ls -l > listings**
  - **Pwd >> findpath**

input redirection

- Redirecting stdin is done with < (short for 0<)
  - cat < text.txt
- **<< here document**
- The here document (sometimes called here-is-document) is a way to append input until a certain sequence (usually EOF) is encountered.
- The EOF marker can be typed literally or can be called with Ctrl-D
  - cat <<EOF > filename or cat <<EOF >>filename

    >Hi

    >Bye

    >EOF

Redirect both stdout and stderr

- To redirect both stdout and stderr to the same file, use 2>&1.
- Note that the order of redirections is significant.
- For example, the command **ls > dirlist 2>&1** directs both standard output (file descriptor 1) and standard error (file descriptor 2) to the file dirlist
- Also **command >& dirlist** directs both std o/p and stderror to file dirlist
- while the command **ls 2>&1 > dirlist** directs only the standard output to file dirlist

Filters or Text Processing commands Tee ,Pipes and wc

- **Tee**
- The **tee** filter puts stdin on stdout and also into a file.
- So tee is almost the same as cat, except that it has two identical outputs.
  - ls -l |**tee** filename
- **Pipes (|)**
- A pipe is used by the shell to connect the output of one command directly to the input of another command. Cmd1 | cmd2
- **wc**
  - Counting words, lines and characters is easy with wc.
    - wc file ,wc –l file ,wc –m file ,wc –w file

Cut

- The cut filter can select columns from files, depending on a delimiter or a count of bytes.
  - cut –c1-3 filename = List range of characters
  - cut –c1-3,6-8 filename = List specific range of character
- The example below shows -cut to filter for the username and userid in the /etc/passwd file.
- It uses the colon as a delimiter, and selects fields 1 and 3.
  - cut -d: -f1,3 /etc/passwd | tail -4

Grep

- The grep command which stands for “global regular expression print,” processes text line by line and prints any lines which match a specified pattern
- grep keyword file = Search for a keyword from a file
- grep –i KEYword file = Search for a keyword ignore case-sensitive
- grep –v keyword file = Display everything but keyword
- cat /etc/passwd | grep “keyword”
- egrep “keyword1 | keyword2” file = search for either keyword

sort,uniq Filter

- The **sort** filter will default to an alphabetical sort
  - sort file
  - sort –r file = Sort in reverse alphabetical order
  - sort –k2 file = Sort by field number (specify –n for numerical sort)
- **Uniq** command filters out the repeated or duplicate lines
  - uniq file = Removes duplicates
  - sort file | uniq = Always sort first before using uniq their line numbers
  - sort file | uniq –c = Sort first then uniq and list count

Access Control Lists (ACLs)

- Access control list (ACL) provides an additional, more flexible permission mechanism for file systems
- Think of a scenario in which a particular user is not a member of group created by you but still you want to give some read or write access, how can you do it without making user a member of group, here comes in picture Access Control Lists.
- **setfacl** and **getfacl** are used for setting up ACL and showing ACL respectively
- View ACL : To show permissions :
  - getfacl filename/dirname
  - getfacl –R dirname – to view the acls recursively
- To set ACL on a file for a specific user
  - setfacl -m u:username:permission filename - setfacl -m 'u:username:7' filename
- To set ACL on a file for a specific group
  - setfacl -m g:groupname: permission filename - setfacl -m g:groupname:7 filename

Access Control Lists (ACLs)

- To remove ACL on a file for a specific user
  - setfacl -x u:username filename
- To remove ACL on a file for a specific group
  - setfacl -x g:username filename
- To remove all ACL
  - setfacl -b file/directory
- To recursively set the ACL use –R option
  - setfacl -R -m g:groupname:permission dirname
- The ACL mask - The acl mask defines the maximum effective permissions for any entry in the acl. This mask is calculated every time you execute the setfacl. You can prevent the calculation by using
    - setfacl --no-mask -m u:uername:permission filename/dirname