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Network Startup Resource Center

PacNOG 6: Nadi, Fiji

UNIX™/Linux Permissions

Goal

Understand the following:

- The Unix security model
- How a program is allowed to run
- Where user and group information is stored
- Details of file permissions

Users and Groups

- Unix understands Users and Groups
- A user can belong to several groups
- A file can belong to only one user and one group at a time
- A particular user, the superuser *“root”* has extra privileges (uid = “0” in /etc/passwd)
- Only root can change the ownership of a file

Users and Groups cont.

User information in `/etc/passwd`
Password info is in `/etc/shadow`
Group information is in `/etc/group`

`/etc/passwd` and `/etc/group` divide data fields using a colon ":"

Example /etc/passwd:

```
auser:x:1000:1000:A. User:/home/user:/bin/bash
```

Example /etc/group:

```
users:x:99:auser
```

When a Program Runs…

A program may be run by a user, when the system starts or by another process.

Before the program can execute the kernel inspects several things:

- Is the file containing the program accessible to the user or group of the process that wants to run it?
- Does the file containing the program permit execution by that user or group (or anybody)?
- In most cases, while executing, a program inherits the privileges of the user/process who started it.

Program Details

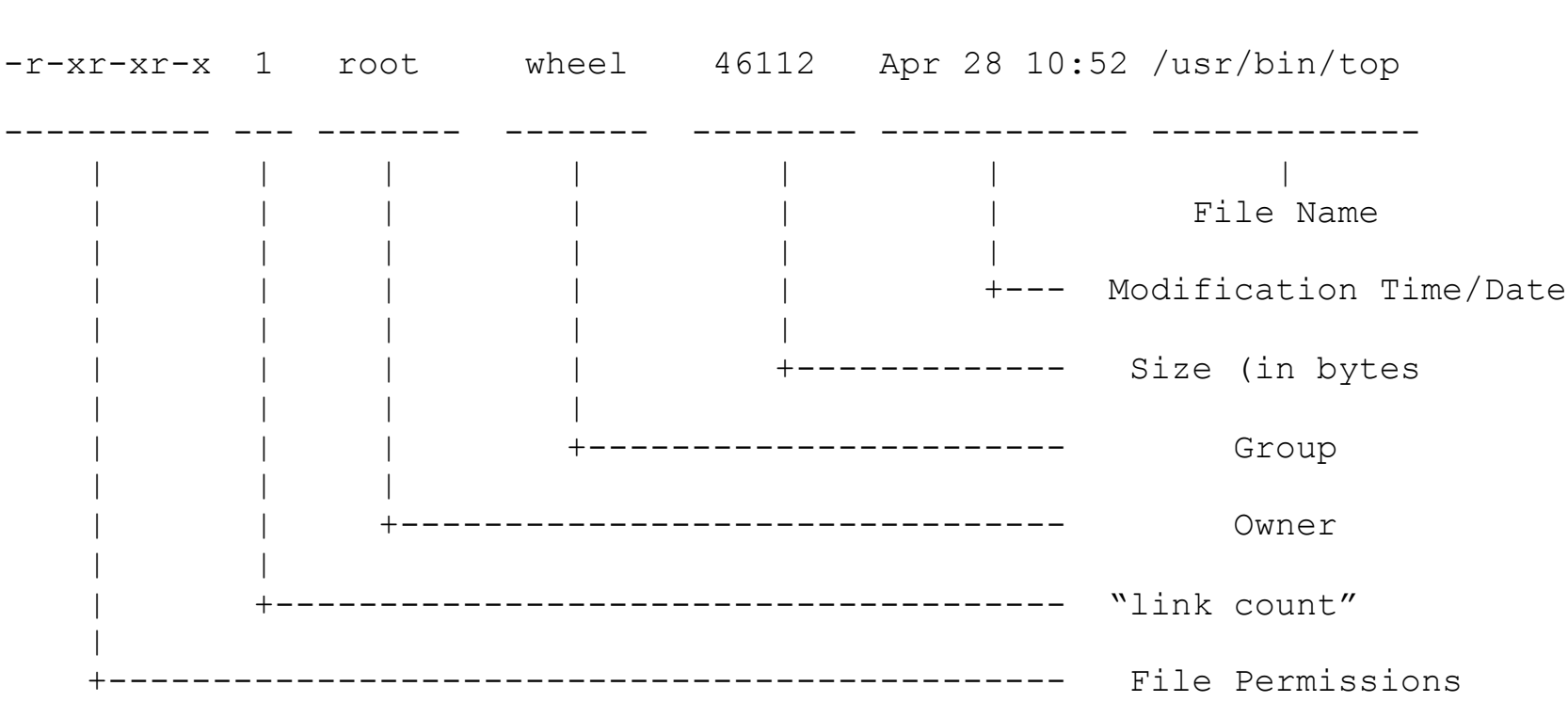
When we type:

```
ls -l /usr/bin/top
```

We'll see:

```
-r-xr-xr-x  1 root  wheel  46112 Apr 28 10:52 /usr/bin/top
```

What does all this mean?



Group
The name of the group that has permissions in addition to the file's owner.

Owner
The name of the user who owns the file.

File Permissions
A representation of the file's access permissions. The first character is the type of file. A "-" indicates a regular (ordinary) file. A "d" would indicate a directory. The second set of three characters represent the read, write, and execution rights of the file's owner. The next three represent the rights of the file's group, and the final three represent the rights granted to everybody else.

(Example modified from **http://www.linuxcommand.org/lts0030.php**)

Access Rights

- Files are owned by a *user* and a *group* (ownership)
- Files have permissions for the user, the group, and *other*
- "*other*" permission is often referred to as "world"
- The permissions are *Read, Write* and *Execute* (R, W, X)
- The user who owns a file is always allowed to change its permissions

Some Special Cases

When looking at the output from "`ls -l`" in the first column you might see:

```
d = directory
- = regular file
l = symbolic link
s = Unix domain socket
p = named pipe
c = character device file
b = block device file
```

Some Special Cases cont.

In the Owner, Group and other columns you might see:

`s = setuid`	[when in Owner column]
`s = setgid`	[when in Group column]
`t = sticky bit`	[when at end]

Some References

http://www.tuxfiles.org/linuxhelp/filepermissions.html

http://www.cs.uregina.ca/Links/class-info/330/Linux/linux.html

http://www.onlamp.com/pub/a/bsd/2000/09/06/FreeBSD_Basics.html

File Permissions

There are two ways to set permissions when using the `chmod` command:

Symbolic mode:

testfile has permissions of `-r--r--r--`

```
                                U   G   O*
$ chmod g+x testfile     ==>    -r--r-xr--
$ chmod u+wx testfile       ==>    -rwxr-xr--
$ chmod ug-x testfile       ==>    -rw--r--r--
U=user, G=group, O=other (world)
```

File Permissions cont.

Absolute mode:

We use octal (base eight) values represented like this:

Letter	Permission	Value
R	read	4
W	write	2
X	execute	1
-	none	0

For each column, User, Group or Other you can set values from 0 to 7. Here is what each means:

0= `---`	1= `--x`	2= `-w-`	3= `-wx`
4= `r--`	5= `r-x`	6= `rw-`	7= `rwx`

File Permissions cont.

Numeric mode cont:

Example index.html file with typical permission values:

```
$ chmod 755 index.html
$ ls -l index.html
-rwxr-xr-x  1 root  wheel  0 May 24 06:20 index.html

$ chmod 644 index.html
$ ls -l index.html
-rw-r--r--  1 root  wheel  0 May 24 06:20 index.html
```

Inherited Permissions

Two critical points:

1. The permissions of a directory affect whether someone can see its contents or add or remove files in it.
2. The permissions on a file determine what a user can do to the data in the file.

Example:

If you don't have write permission for a directory, then you can't delete a file in the directory. If you have write access to the file you can update the data in the file.

Conclusion

To reinforce these concepts let's do some exercises.

In addition, a very nice reference on using the `chmod` command is:

An Introduction to Unix Permissions -- Part Two

By Dru Lavigne

http://www.onlamp.com/pub/a/bsd/2000/09/13/FreeBSD_Basics.html