CSE 391

Users, Groups, Permissions, and more!

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Users

Linux and unix are multi-user operating systems

- Ever program/process is run by a user
- Every file is owned by a user
- Every user has a unique integer ID number (UID)

Different users have different access permissions, allowing them to

- Read or write to a given file
- Browse the contents of a directory
- Execute a particular program
- Install new software on the system
- Change global system settings
- And more!

Users

Command	Description
`whoami`	Print your username
`id`	Print user ID and group membership
`users`	List logged-in users (short)
`who`	List logged-in users (long)
`finger`	Print information about users

Groups

A group is a collection of users

- Groups can be assigned access to files or resources
- A single user may belong to multiple groups
- Check group membership with `grep <groupname> /etc/group`
- Every file has an associated group
- Every group has a unique integer ID (GID)

Groups

Command	Description
`groups`	Print group membership
`groupadd`	Create a group
`groupdel`	Delete a group
`groupmod`	Modify a group

To add users to a group, you must edit `/etc/group` as *root*. We will talk more about the *root* user later in these slides.

root

Every system contains a special user known as the *superuser* or *root*.

- Normal users are restricted in what they can read, write, execute, and install.
- The superuser has unrestricted access to the machine

There are a number of different ways to *BECOME THE SUPERUSER*

- Most systems have the *sudo* command installed, which stands for **su**per user **do**. For example, to add someone to a group, you would run `sudo vim /etc/groups`
- Additionally, you can run a superuser shell with `su`

Processes

Every user on a system has processes associated with them.

- Running a command in the shell launches a process for that command
- Process management is a major component of any operating system

Command	Description
`ps`	List processes being run
`ps -u <user>`	List processes being run by <user>
`top`	Show process statistics
`kill`	Terminate process by PID
`killall`	Terminate process by name

aliases

- Programmers are notoriously lazy, and many of the commands you use on a day to day basis tend to be verbose.
- To remedy this, you can use aliases to assign a pseudonym to a command.

Command	Description
`alias`	Assigns a pseudonym to a command

- To create an alias for a command, use the following syntax

```
alias name=command
```

- For example, to quit a shell by typing q

```
alias q=exit
```

- WARNING: DO NOT PUT SPACES ON EITHER SIDE OF THE =

.bash_profile

- Everytime you **log in** to a shell (i.e. by ssh-ing into attu or logging into your computer), the commands in `~/.bash_profile` are run.
  - It is often useful to put common startup commands (i.e. commands that you want to be run whenever you login.
- *Note*: The dot (.) that precedes the filename means the file is *hidden*. To view the file, you must run `ls -a`

.bashrc

- Everytime you launch a **non-login** shell (i.e. by launching a new terminal) the commands in `~/.bashrc` are run.
  - This is useful for setting up persistent commands.
  - In practice, your `.bash_profile` is often configured to run your `.bashrc`

$PATH

Have you ever wondered what happens when you type a command like `ls` ? How does the system know what program to run?

- Your shell looks through the $PATH variable, using the following algorithm:

```
execute(command)
    for each entry in $PATH separated by “:”
        if directory contains command
            run command
            exit
    print “command not found”
```

$PATH

- A common use case for your `.bashrc` or `.bash_profile` is adding directories to your path.
- To *prepend* a directory to your `$PATH`

```
export PATH=/your/new/directory:$PATH
```

- To *append* a directory to your `$PATH`

```
export PATH=$PATH:/your/new/directory
```

Think

Suppose we have the following executable files and `$PATH` variable

```
PATH=/usr/home:/usr/bin:/usr/sbin
```

`/usr/bin/hello.sh`

```
echo “howdy partner”
```

`/usr/sbin/hello.sh`

```
echo “yeehaw”
```

What would be the output of the following command?

```
> hello.sh
```

Changing File Group

To assign a file to a new group, use chgrp

```
chgrp GROUP filename
```

- For example, to change the file run.sh to be owned by the group ugrad_uw,

  ```
  chgrp ugrad_uw run.sh
  ```

- Use the -R flag to apply this recursively. To change all files, starting in the current directory, to be owned by ugrad_uw

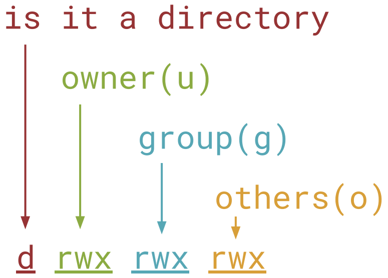
  ```
  chgrp ugrad_uw -R .
  ```

File Permissions

Since multiple users share the same system, files and directories are protected by certain permissions.

- Permissions for each file are defined by the type of person trying to do something and the operation that they are trying to run.
- The types of people are: owner(u), group(g), and others(o)
- The types of operations are: read(r), write(w) and execute(x)

Permissions are shown by typing `ls -l`



is it a directory

owner(u)

group(g)

others(o)

d rwx rwx rwx

File Permissions

People: each user fits into exactly one of the following categories:

- `owner(u)` - the person who created the file. This can be changed using chown
- `group(g)` - the group associated with each file
- `others(o)` - people who are neither the owner of the file nor a member of the group associated with the file

Permissions:

- `read(r)` - allows files to be open and read
- `write(w)` - allows contents of a file to be modified
- `execute(x)` - allows the file to be run

Changing File Permissions

The first method of changing file permissions is using letter codes. It uses the following general syntax:

```
chmod who(+-)what filename
```

- allow group members to execute:

  ```
  chmod g+x file.txt
  ```

- allow everyone to execute:

  ```
  chmod +x file.sh
  ```

- owners/group read/write, others nothing:

  ```
  chmod ug+rw,o-rwx file.sh
  ```

- NOTE: THERE IS NO SPACE AFTER THE COMMA

Changing File Permissions

The second method of changing file permissions is using octal. It uses the following general syntax (N is 0-7):

```
chmod NNN filename
```

- Each digit corresponds to owner(u), group(g), and others(o) in that order.
- Each gets +4 for read, +2 for write, and +1 for execute
- Owners can read/write, everyone else gets nothing

```
chmod 600 file.txt
```

- Everyone can read, write, and execute

```
chmod 777 file.txt
```

Think

Using letter codes, (i.e. rwx) what would be the command to allow the owner and group to read, write, and execute and others to read the file run.sh?

u	owner
g	group
o	other
r	read
w	write
x	execute

Think

Using octal codes (i.e. 1-8), what would be the command to allow the owner and group to read, write, and execute and others to read the file run.sh?

1	execute
2	write
4	read

Default File Permissions

Finally, there is a program called umask which sets the default permissions for newly created files. The syntax is as follows:

```
umask [options] [mask]
```

- Calling umask without any arguments will print out the current mask.
- Calling umask similarly to chmod with octal will *remove* those permissions for newly created files.
- The following will give the owner full privileges and all others read/execute privileges only.

```
umask 0022
```

- Note that the leading zero for umask is intended to signify that it is an octal number (base 8).

Directory Permissions

We noted earlier that the first digit of a file’s permissions determines whether or not that file is a directory. Directories have the same permissions as files, although the behavior is a little different:

- Read - determines whether or not the user can view the contents of the directory (i.e. can they run `ls` on that directory)
- Write - determines whether the the user can add or delete files or directories.
- Execute - determines whether the user can enter into that directory.