IBS574 – P45 Grace Crum Rollins Building

Linux shell & shell scripting - I

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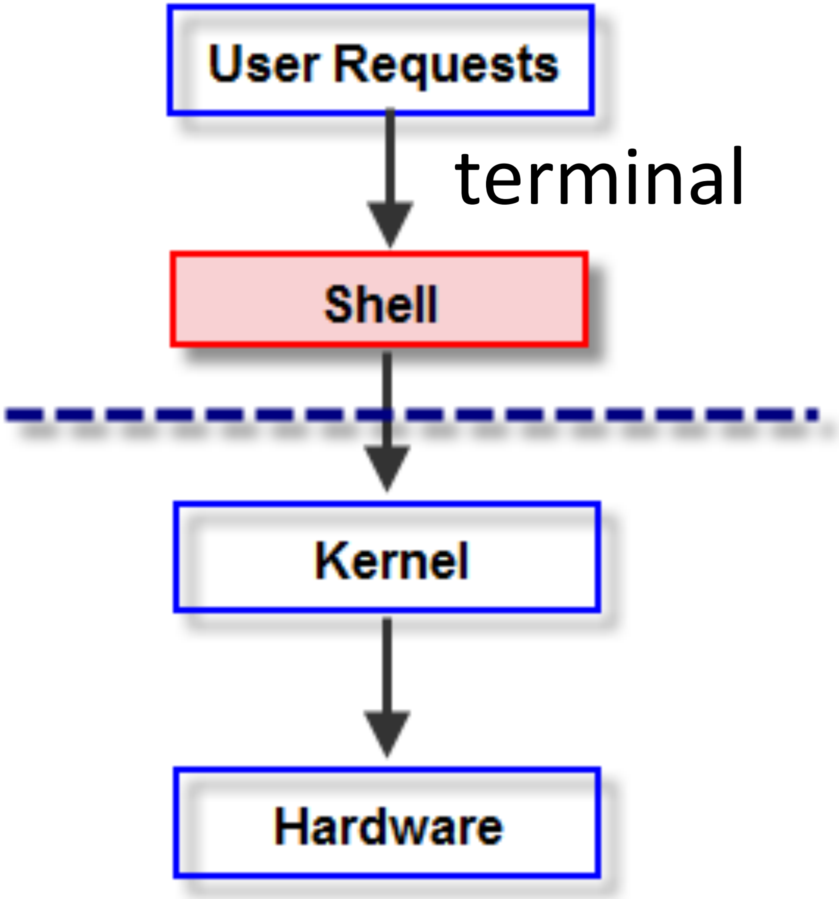
Kernel, Shell & Terminal

frequently used terms in UNIX-like operating systems (OS)

- **Kernel** is the core that provides basic services for all other parts of the OS.
- **Shell** is the outermost part of an OS that interacts with user commands.
    - bash (or bourne again shell), sh
- **Terminal** emulator gives us access to the Shell

Kernel, Shell & Terminal

frequently used terms in UNIX-like operating systems (OS)



terminal

Console/Terminal

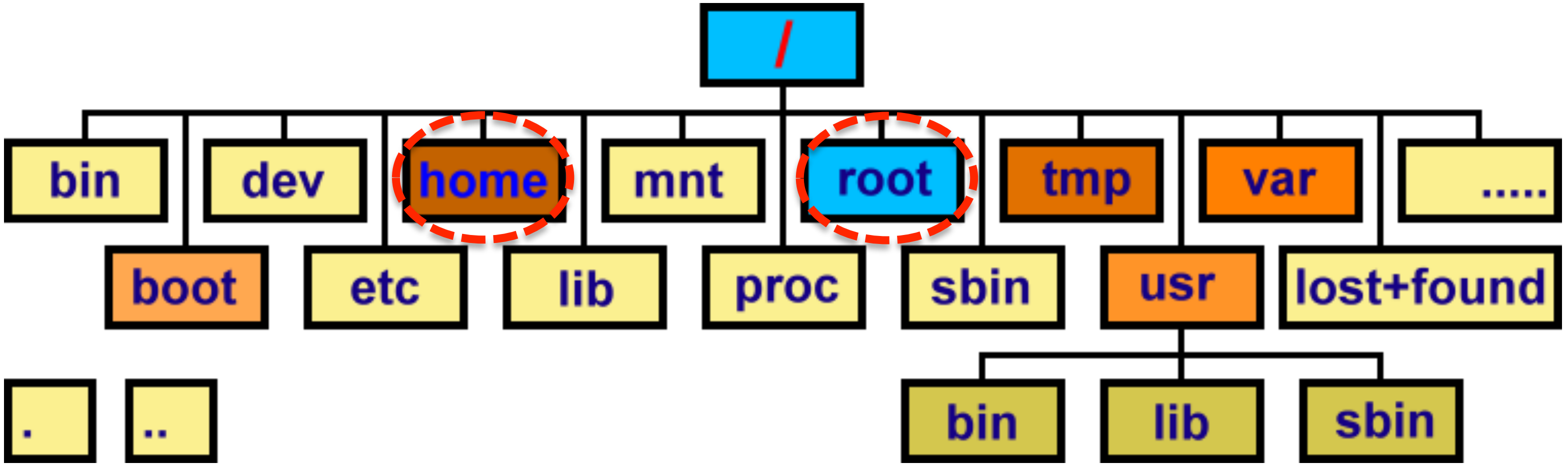
- Shell prompt will usually include

```
[root@machinename ~]#
[user_name@machinename ~]$
```

/root

/home/user_name

- Linux file system hierarchy



Easiest way to do this is …

Let’s start our first lab!

Login at Terminal

```
ssh user_name@blnx1.emory.edu
```

```
user_name@blnx1:~$
```

~ means your home dir, /home/user_name

user_name = your user name

SSH allows you to connect to your server securely and perform Linux command-line operations.

Terminal

- Some simple commands
  - env (current environment)
  - date (for date)
  - cal (for calendar)
  - df or free (disk space or memory)
  - exit (close terminal/session)

Usage: `env` (then press enter key)

Navigation of the file system

Commands: **pwd, ls, cd**

- **pwd** print/current working directory
- **ls** listing directories and files

ls –l (long listing format)
ls –la (with hidden files)

Usage: `pwd` /home/user_name

Usage: `ls -l`

Navigation of the file system

Commands: **pwd, ls, cd**

- **mkdir** make a sub-directory

Usage:

```
mkdir resume
mkdir -p documents/one
mkdir -p documents/{two,three}
```

- **cd** : change directory

Usage:

```
cd documents
cd documents/one
cd ..
```

Navigation of the file system

Commands: **pwd, ls, cd**

cd ~	[change to **home** directory]
cd	[change to **home** directory]
cd /	[change to **root** directory]
cd documents	[relative path]
cd ~/documents	[absolute path]

Usage: cd

*with $HOME environment variable; user_name = your user name

Navigation of the file system

Commands: **pwd, ls, cd**

If a directory name has white space –

```
mkdir ‘My Images’
```

Usage:

```
cd My\ Images
cd "My Images”
cd 'My Images'
```

Create/Edit text files

Choose a text editor: emacs, Vim

Usage: `vi home.txt`

INSERT mode:
press keys like `i` OR `a` & start typing.

"i" will let you insert text just before the cursor.
"I" inserts text at the beginning of the current line.
"a" will let you insert text just after the cursor, and
"A" will let you type at the end of the current line.

Create/Edit text files

Type the following text:

```
Street: 201 Dowman Drive
City: Atlanta
State: Georgia
Country: USA
Zip: 30322
```

Create/Edit text files

SAVE mode:
press esc key AND

q! for not to save OR
x to save all typed content.

Create/Edit text files

Choose a text editor: emacs, Vim

Usage:

```
vi college.txt
```

```
Street: 954 Gatewood Rd
City: Atlanta
State: Georgia
Country: USA
Zip: 30329
```

“ls –R”

- List files recursively

Usage: ls –R

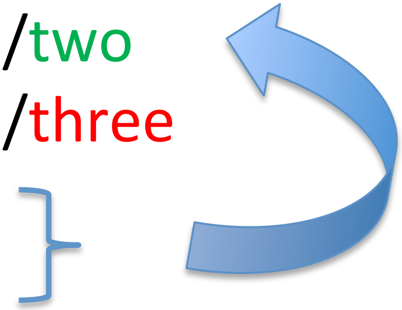
```
resume
My Files
documents/one
documents/two
documents/three
home.txt
college.txt
```

"ls –R"

- List files recursively

Usage: `ls –R`

```
resume
My Files
documents/one
documents/two
documents/three
home.txt
college.txt
```



Copy

Symlink

Move

“cp”

- Copy **one file**

  Usage: `cp home.txt documents/one/`

- Copy **all files**

  Usage: `cp *.txt documents/one/`

CAREFUL! If the destination file already exists, it will be overwritten without a confirmation prompt. Use “cp -i” interactive option for a prompt.

“Symlink”

- Symbolic link can be create by

Usage:

```
ln -s ~/home.txt ~/documents/two/home.txt
```

```
ln -s ~/college.txt ~/documents/two/college.txt
```

source_file target_file

[~ = /home/user_name]

Usage: `cd documents/two` Usage: `ls -l`

“mv”

- Copy **one file**

  Usage:

  ```
  mv home.txt documents/three/
  ```

- Copy **all files**

  Usage:

  ```
  mv *.txt documents/three/
  ```

CAREFUL! If the destination file already exists, it will be overwritten without a confirmation prompt. Use “cp -i” interactive option for a prompt.

“cat”

- **view/read**

  Usage:
  ```
  cat home.txt
  ```

- **concatenate & view**

  Usage:
  ```
  cat home.txt college.txt
  ```

- **concatenate & save**

  Usage:
  ```
  cat home.txt college.txt > add.txt
  ```

WARNING: if add.txt already exists, it will be over-written.
Use >> to append the output to the existing file.

“less & more”

- less (read with cursor)

  Usage:
  ```
  less add.txt
  ```

- more

  Usage:
  ```
  more add.txt
  ```

The program **less** or **more** does not require the whole file to be loaded in memory to view parts of it.

“head & tail”

- **View** the first 5 lines

  Usage:
  ```
  head –n5 add.txt
  ```

- **View** the last 4 lines

  Usage:
  ```
  tail –n4 add.txt
  ```

By **default**, head or tail returns the first or last **10 lines**, respectively of each file that is provided to it.

“pipe & redirect”

- sending data from one program to another

  Usage:
  ```
  cat home.txt | less
  ```

- Redirecting to a file

  Usage:
  ```
  head home.txt > lines.txt
  ```
  ```
  wc -l < home.txt
  ```

“grep”

"global regular expression print"

- **Search a file for keywords**

Usage:
```
grep State add.txt
```

- **ignore case option**

Usage:
```
grep state add.txt
 grep –i state add.txt
```

Regular expressions are used to search and manipulate the text, based on the patterns [Beginning of line (^) ; End of the line ($)]

“join”

- Joins the lines of two files which share a common field of data.

Usage:
```
vi country.txt
```

Usage:
```
vi city.txt
```

```
1    India
2    USA
3    Ireland
4    UK
5    Canada
```

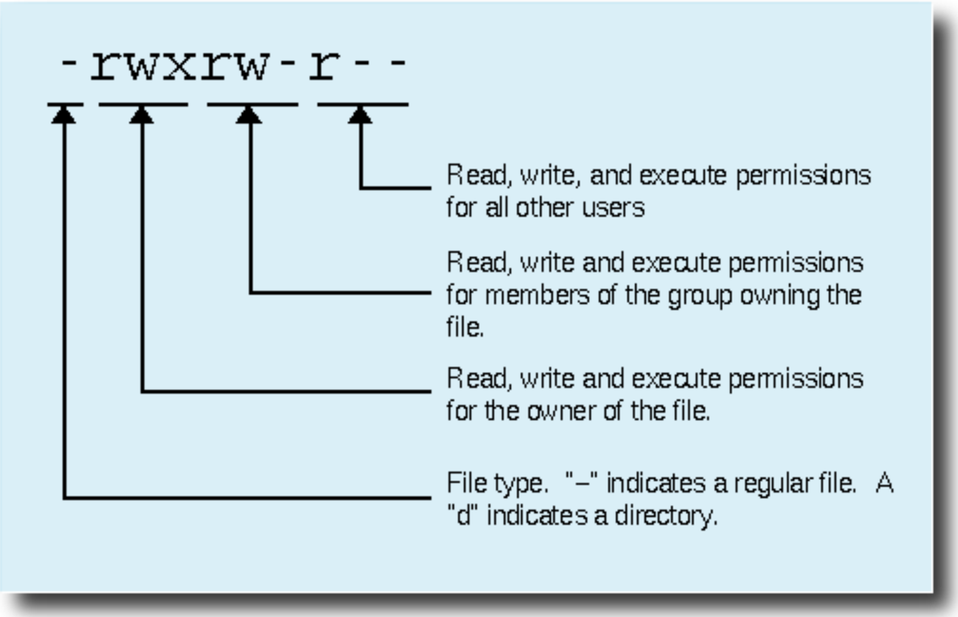
```
1    NewDelhi
2    WashingtonDC
3    Dublin
4    London
5    Toronto
```

Usage:
```
join country.txt capital.txt > file.txt
```

“chmod”

- Change the permissions of files
  - **R**ead (r), **w**rite (w), and e**x**ecute (x)
  - 3 types of users (user, group & other)

Usage: `ls –l`



-rwxrw-r--

Read, write, and execute permissions for all other users

Read, write and execute permissions for members of the group owning the file.

Read, write and execute permissions for the owner of the file.

File type. "–" indicates a regular file. A "d" indicates a directory.

“chmod”

- Change the permissions of files
  - **R**ead (r), **w**rite (w), and e**x**ecute (x)
  - 3 types of users (user, group & other)

Usage:

```
chmod u=rwx,g=rx,o=r home.txt
```

“chmod”

- Change the permissions of files
  - **R**ead (r), **w**rite (w), and e**x**ecute (x)
  - 3 types of users (**u**ser, **g**roup & **o**ther)

Usage: chmod **u**=rwx,**g**=rx,**o**=r home.txt

Usage: chmod 754 home.txt

4 stands for "read",
2 stands for "write”,
1 stands for "execute", & **0** stands for "no permission"

“rm”

- rm removes files blindly, with no concept of 'trash’!!!
- **Remove a file**

  Usage:
  ```
  rm documents/one/add.txt
  ```
- **Remove directory recursively**

  Usage:
  ```
  rm –r documents
  ```

“bashrc”

Usage:
```
vi ~/.bashrc
```

- **Aliases**

  ```
  alias u="cd ..;ls”
  ```

  Usage:
  ```
  vi ~/.bash_profile
  ```

- **Path adjustments**

  ```
  export PATH="$PATH:/<here_new_path>”
  ```

- Reload “.bashrc” or ”.bash_profile”

  ```
  source ~/.bashrc
  ```

Data archiving in Linux

List of archive and/or compresion formats

File extension	Official name	Description
.tar	Tape archive	Archiving
.bz2	bzip2	Compression
.gz	gzip	Compression
.tar.gz (.tgz)	tar with gzip	both
.tar.bz2	tar with bzip2	both
.zip	ZIP	both

Data/File compression

- Compress

Usage:
```
gzip home.txt
```

- Archive & compress

Usage:
```
tar -jcvf home.tar.bz2 home.txt
```

z: use gzip compress;
j: use bzip2 compress
c: compress

Data/File decompression

Download file using wget

```
wget https://github.com/samtools/samtools/releases/download/
1.3.1/samtools-1.3.1.tar.bz2
```

- View the contents of a tar.bz2 file

Usage:

```
tar -jtvf samtools-1.3.1.tar.bz2
```

- Extract the contents

Usage:

```
tar -jxvf samtools-1.3.1.tar.bz2
```

t: list the contents; x: extract the contents of an archive

Practice Makes Perfect

Thank you