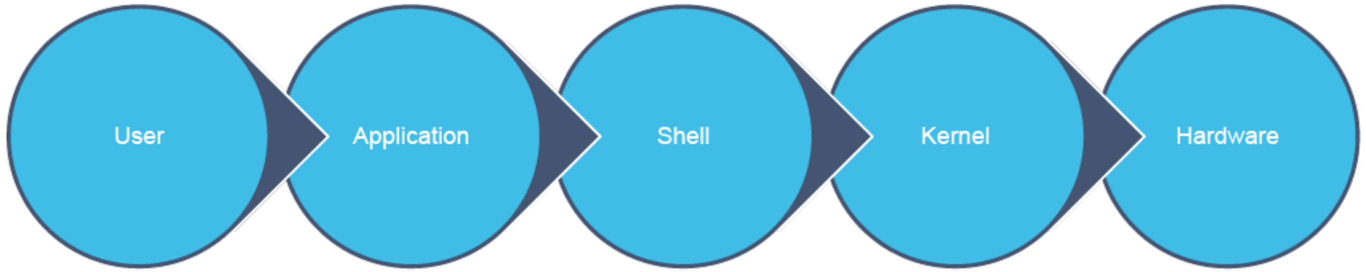
Linux BASH

TRAINOCATE

BASH

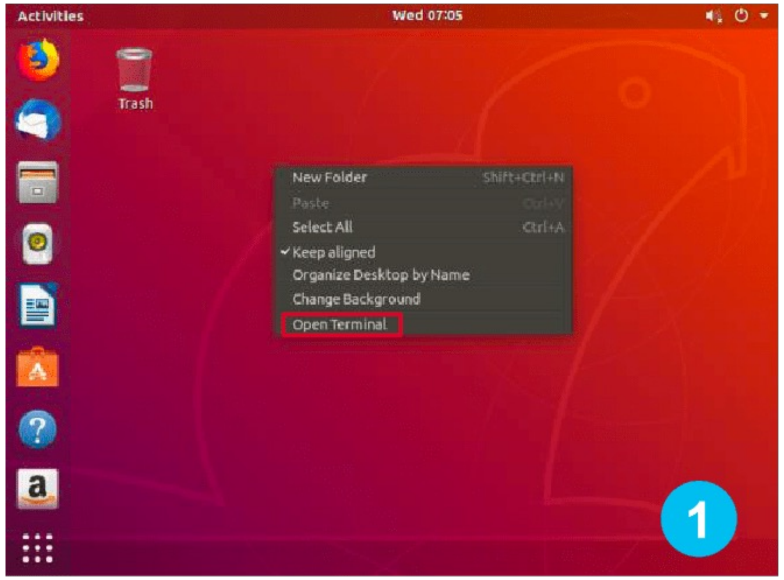
- A Shell is a software layer between you and the operating system (Typically Linux, but now Windows too)
- Bourne Again Shell (Bash) is the default shell for UNIX-like operating systems, such as CentOS and Ubuntu, and conforms to the IEEE Portable Operating System Interface (POSIX) P1003.2/ISO 9954.2 Shell and Tool standard.
- It is command line driven, heavily scriptable, and uses standard commands that are compatible across operating systems

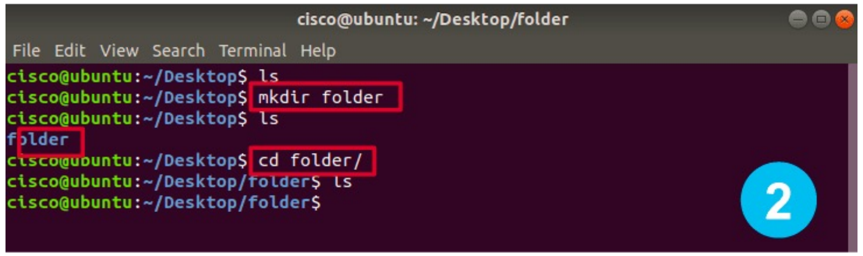


So Many Shells

- There are lots of shells that you can use:
  - **bash**: The Bourne again shell is the default for many Linux distribution
  - **zsh**: the Z Shell is a modern variation of BASH type shells. It is fast, has command spellchecks, auto completion, and over 400 plugins
  - **ksh**: the Korn Shell Know for its very strong scripting language
  - **csh**: C Shell written in the 70s and one of the oldest open-source Unix shells
- Want to know what Shells are available on your system?
  - Type **cat /etc/shells** at the command prompt
- To change your shell to Zshell for example chsh **–s /bin/zsh**

Getting Started with Bash



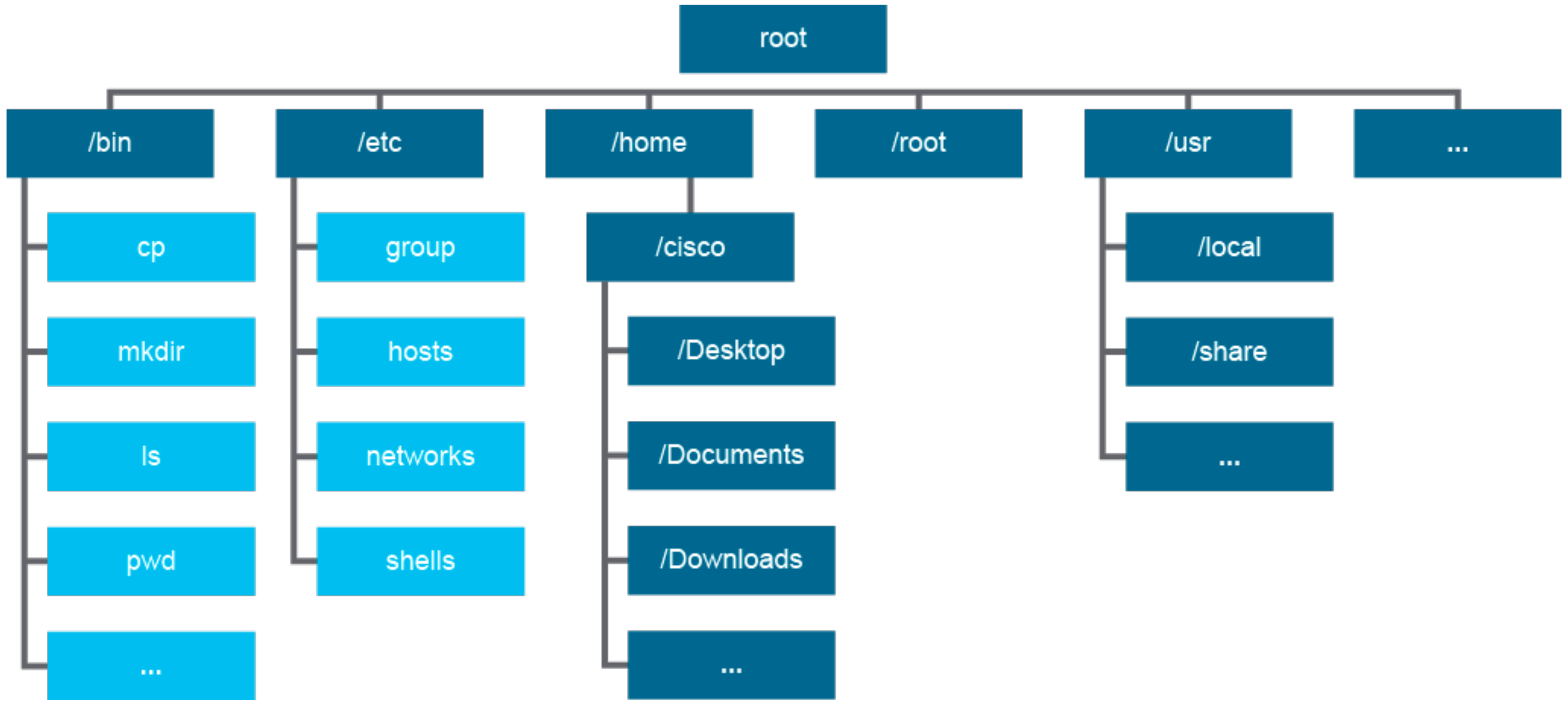

cisco@ubuntu: ~/Desktop/folder
File Edit View Search Terminal Help
2

```
cisco@ubuntu:~/Desktop$ ls
cisco@ubuntu:~/Desktop$ mkdir folder
cisco@ubuntu:~/Desktop$ ls
folder
cisco@ubuntu:~/Desktop$ cd folder/
cisco@ubuntu:~/Desktop/folder$ ls
cisco@ubuntu:~/Desktop/folder$
```

command –flag *argument*

```
student@student-vm:~$ man cp
        <… output omitted …>
        DESCRIPTION
        Copy SOURCE to DEST, or multiple SOURCE(s)
        -a, --archive   same as -dR --preserve=all
        <… output omitted …>
        -b      like --backup but does not accept an argument
        <… output omitted …>
        -f, --force
        Manual page cp(1) line 1 (press h for help or q to      quit)
```

Directory Navigation with Bash



Common Directories

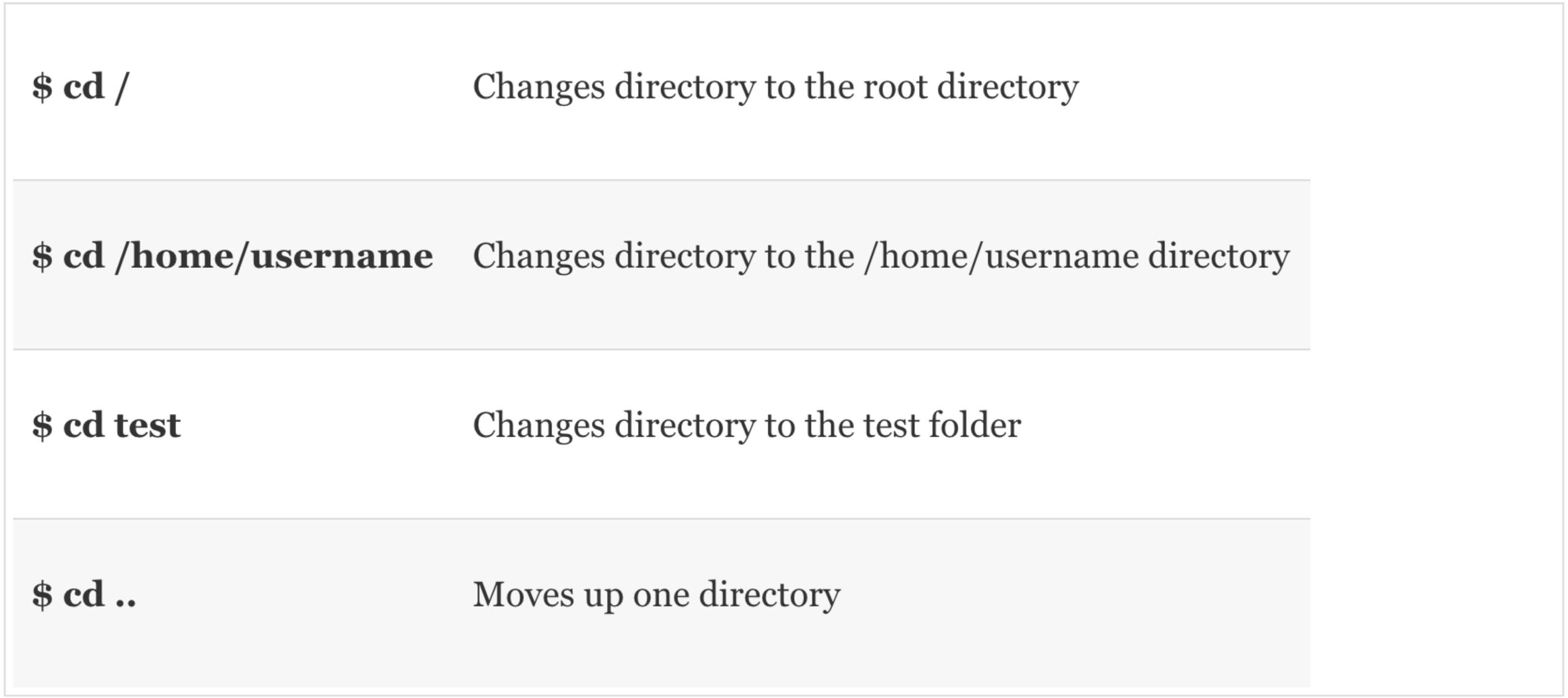
Dir	Description
`/`	The directory called "root." It is the starting point for the file system hierarchy. Note that this is not related to the root, or superuser, account.
`/bin`	Binaries and other executable programs.
`/etc`	System configuration files.
`/home`	Home directories.
`/opt`	Optional or third party software.
`/tmp`	Temporary space, typically cleared on reboot.
`/usr`	User related programs.
`/var`	Variable data, most notably log files.

Pwd command

If you ever get lost while navigating around the file system, you can use the **pwd** command to print out your current working directory path. You can use it as follows:

$ pwd	Print your current working directory

cd command

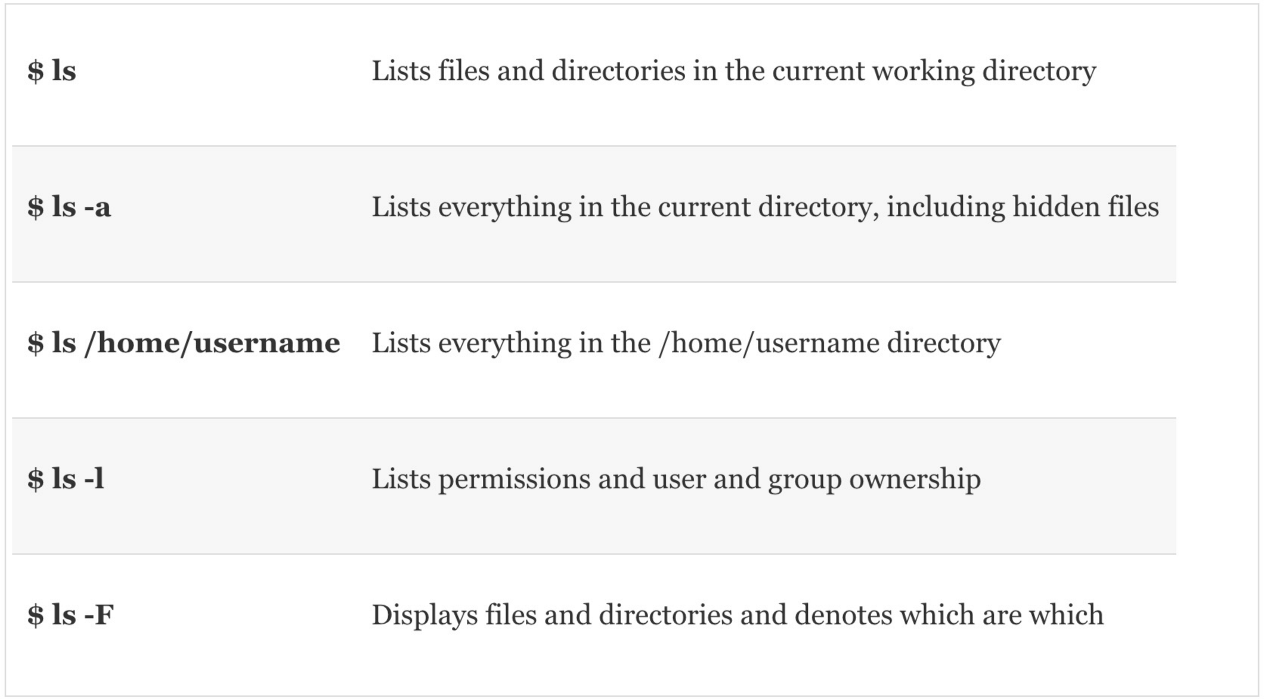


$ cd /	Changes directory to the root directory
$ cd /home/username	Changes directory to the /home/username directory
$ cd test	Changes directory to the test folder
$ cd ..	Moves up one directory

Directory Shortcuts

`.`	This directory
`..`	The parent directory
`cd -`	Change to the previous directory
`~`	home directory
`/`	root directory

ls command



$ ls	Lists files and directories in the current working directory
$ ls -a	Lists everything in the current directory, including hidden files
$ ls /home/username	Lists everything in the /home/username directory
$ ls -l	Lists permissions and user and group ownership
$ ls -F	Displays files and directories and denotes which are which

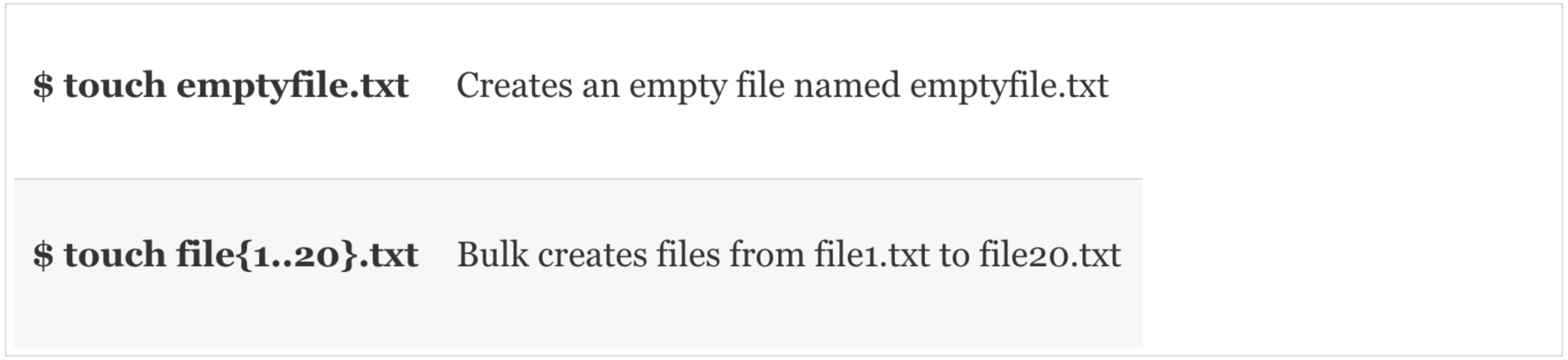
mkdir command

$ mkdir test	Makes a new directory called test in the current working directory if you have permission
$ mkdir /home/username/test	Makes a new directory called test at /home/username/test

File Management with Bash

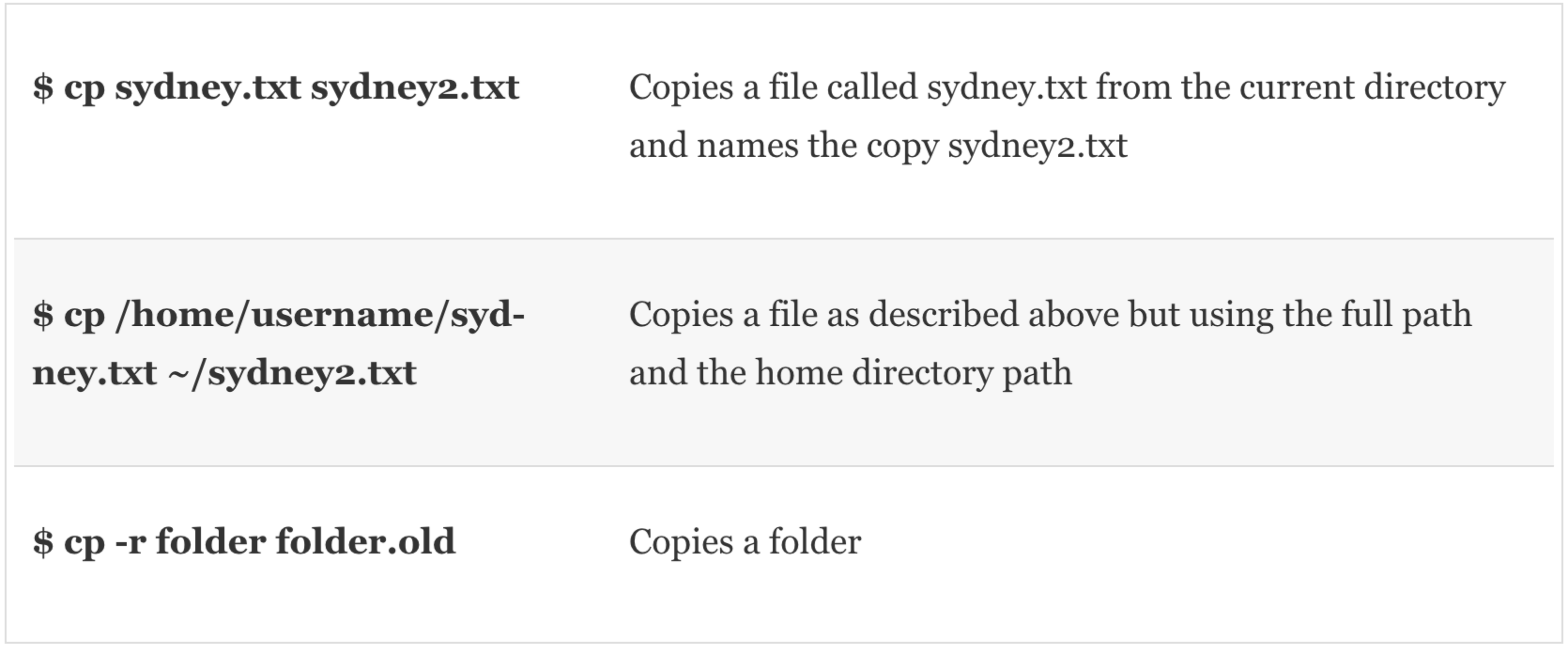
Touch: create/make files
Rm: remove files
Cp: Copy files

Touch command



$ touch emptyfile.txt	Creates an empty file named emptyfile.txt
$ touch file{1..20}.txt	Bulk creates files from file1.txt to file20.txt

cp command

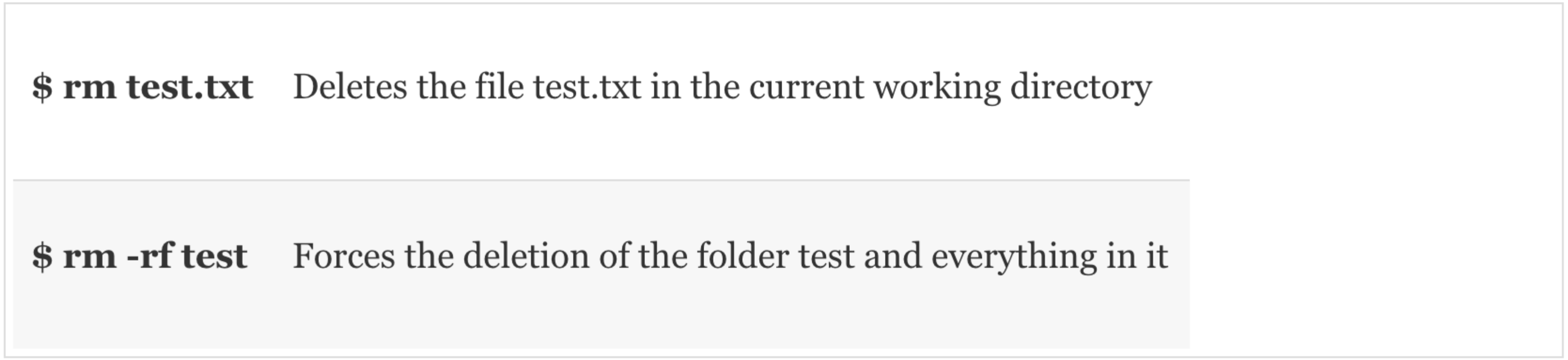


$ cp sydney.txt sydney2.txt	Copies a file called sydney.txt from the current directory and names the copy sydney2.txt
$ cp /home/username/syd-ney.txt ~/sydney2.txt	Copies a file as described above but using the full path and the home directory path
$ cp -r folder folder.old	Copies a folder

mv command

$ mv caleb.txt calebfinal.txt	Renames a file called caleb.txt to calebfinal.txt
$ mv /home/username/caleb.txt ~/calebfinal.txt	Renames a file as described above but using full paths
$ mv -i * /home/username/new/	Moves all files and directories in the current folder to a directory called new

rm command



$ rm test.txt	Deletes the file test.txt in the current working directory
$ rm -rf test	Forces the deletion of the folder test and everything in it

View file content

- First there was **cat**. Output was streamed in an uncontrollable way.
- Then there was **pg**, which may still be found on older UNIXes. This command puts text to the output one page at the time.
- The **more** program was a revised version of **pg**. This command is still available on every Linux system.
- **less** is the GNU version of more and has extra features allowing highlighting of search strings, scrolling back etc. The syntax is very simple:

```
less name_of_file
```

cat command

$cat file1.txt	Displays the contents of file1.txt
$cat file1.txt | more	Displays the contents of file1.txt and pipes the output to **more** to add page breaks
$cat >file2.txt	Sends a user's typed or copied content from the command line to file2.txt

Editing file with Vi

vi [file] : Edit file.

Vi line mode

:w Writes (saves) the file.
:w! Forces the file to be saved. :q Quit.
:q! Quit without saving changes. :wq! Write and quit.
:x Same as :wq

Vi insert mode

i	Insert at the cursor position.
I	Insert at the beginning of the line.
a	Append after the cursor position.
A	Append at the end of the line

Editing file with Vi

- **Vi - Deleting Text**

x	Delete a character.
dw	Delete a word.
dd	Delete a line.
D	Delete from the current position
:[from],[to]d	Delete a Range of Lines
:%d	Delete All Lines

- **Vi Navigation Keys**

^	Go to the beginning of the line
$	Go to the end of the line

Editing file with Nano

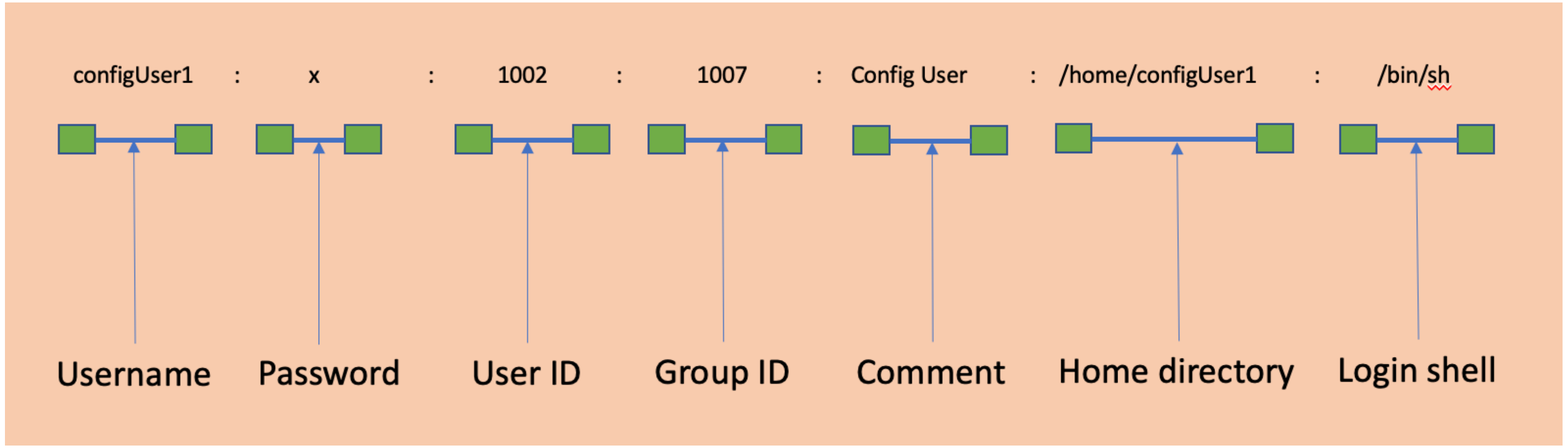
Shortcut	Description
nano filename	Open file for editing in Nano
Arrow keys	Move cursor up, down, left and right
Ctrl+A, Ctrl+E	Move cursor to start and end of the line
Ctrl+Y/Ctrl+V	Move page up and down
Ctrl+_	Move cursor to a certain location
Alt+A and then use arrow key	Set a marker and select text
Alt+6	Copy the selected text
Ctrl+K	Cut the selected text
Ctrl+U	Paste the selected text
Ctrl+6	Cancel the selection
Ctrl+K	Cut/delete entire line
Alt+U	Undo last action
Alt+E	Redo last action
Ctrl+W, Alt+W	Search for text, move to next match
Ctrl+\	Search and replace
Ctrl+O	Save the modification
Ctrl+X	Exit the editor

TRAINOCATE

User and group management

Viewing User Information

```
$ cat /etc/passwd
```



configUser1 : x : 1002 : 1007 : Config User : /home/configUser1 : /bin/sh
Username
Password
User ID
Group ID
Comment
Home directory
Login shell

Adding A User

```
$ useradd [options]  username
```

Option	Meaning
-c "COMMENT"	Comments for the account
-m	Create the home directory
-s /shell/path	The path to the user's shell
-g	Specify the default group
-G	Additional groups

TRAINOCATE

Creating/Changing User Password

```
$ passwd username
```

```
# passwd grant
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated
successfully
#
```

Modifying A User

```
$ usermod [options] username
```

Option	Meaning
-c ”COMMENT”	Comments for the account
-m	Create the home directory
-s /shell/path	The path to the user’s shell
-g	Specify the default group
-G	Additional groups

TRAINOCATE

Viewing User's Groups

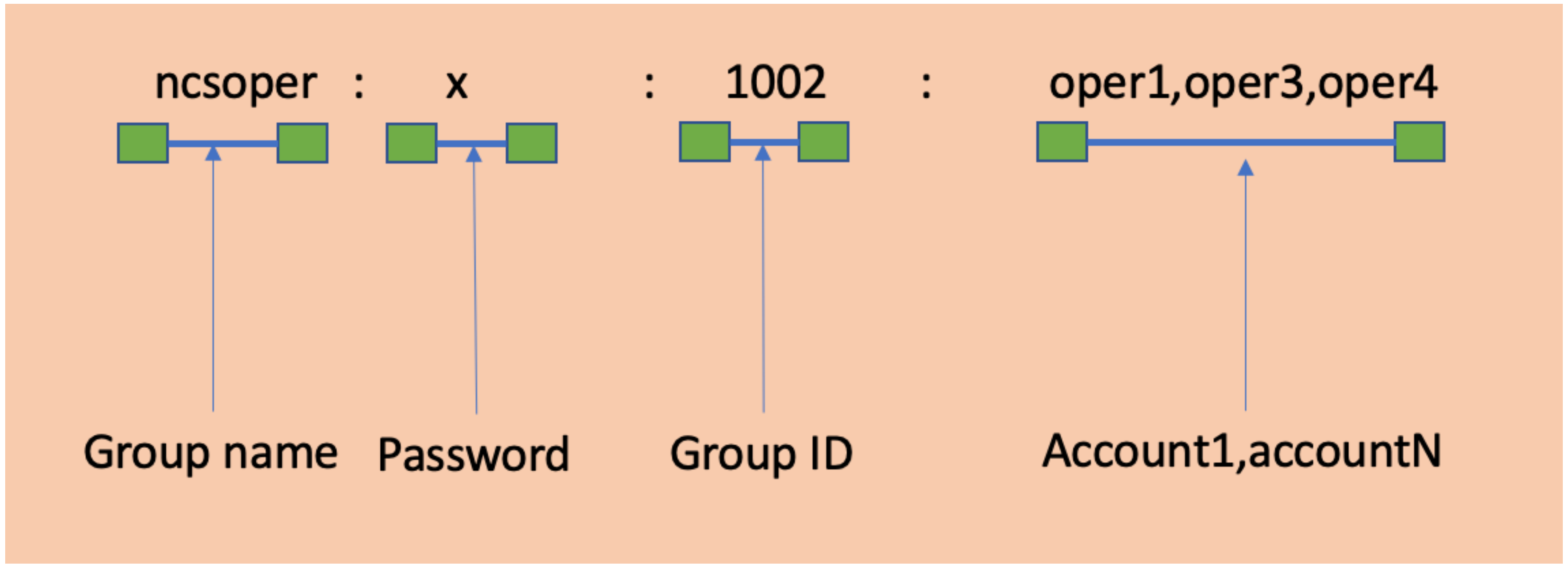
```
$ groups username
```

Deleting A User

```
$ userdel username
```

Viewing Group Information

```
$ cat /etc/group
```



TRAINOCATE

Adding A Group

```
$ groupadd [options]  group_name
```

Option	Meaning
-g, -gid GID	Provide a group id (numeric) to the new group
-r, –system	Create a system group

Modifying A Group

```
$ groupmod [options]  group_name
```

Option	Meaning
-g GID	Change the group ID to GID
-n new_group_name	Rename the group to new_group_name

Deleting A Group

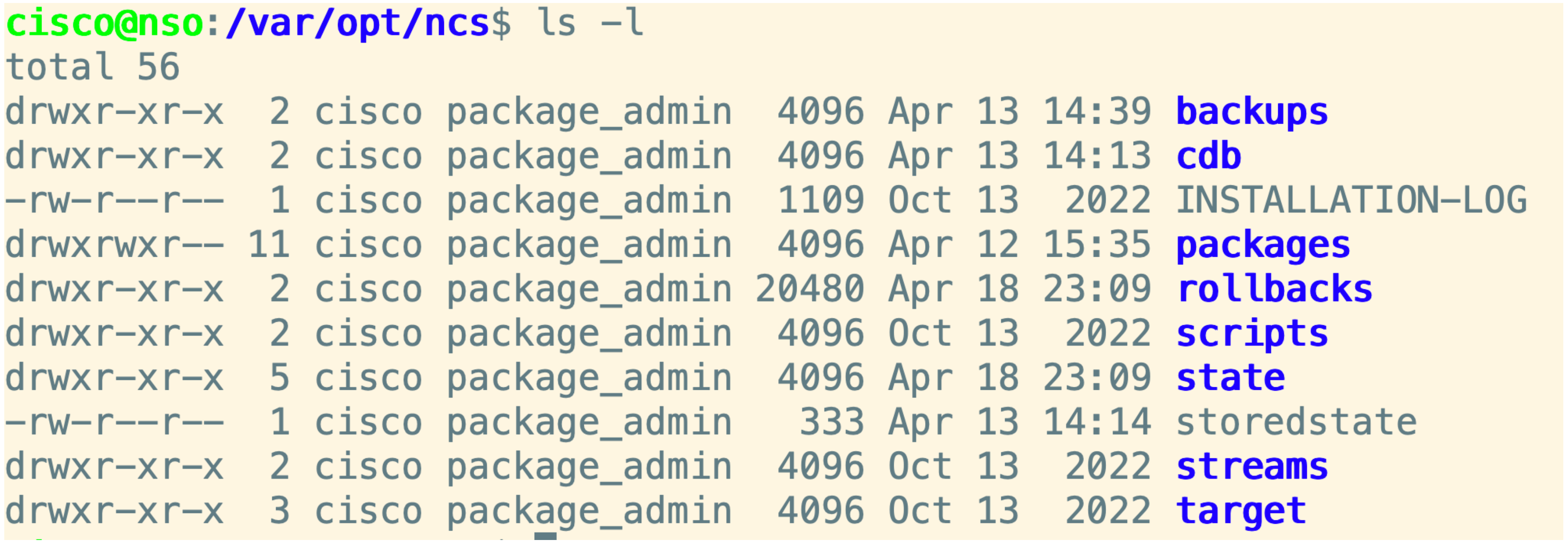
```
$ groupdel group_name
```

It is not possible to remove the primary group of an existing user without removing the user first.

File and directory Permission

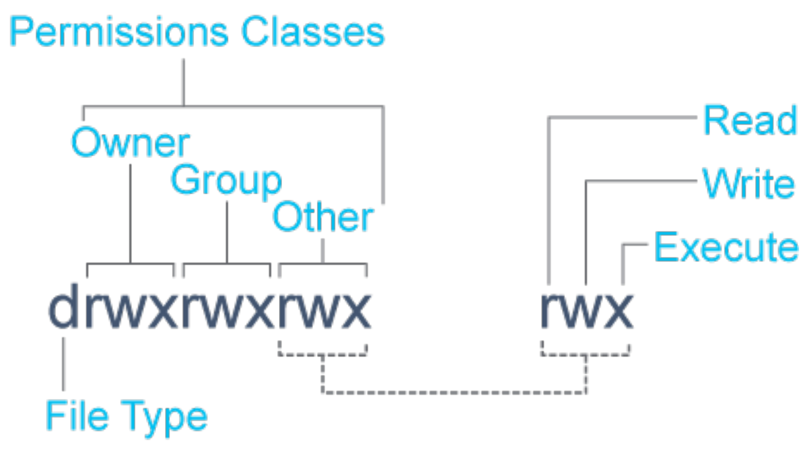
Viewing Permission Of File/Folder

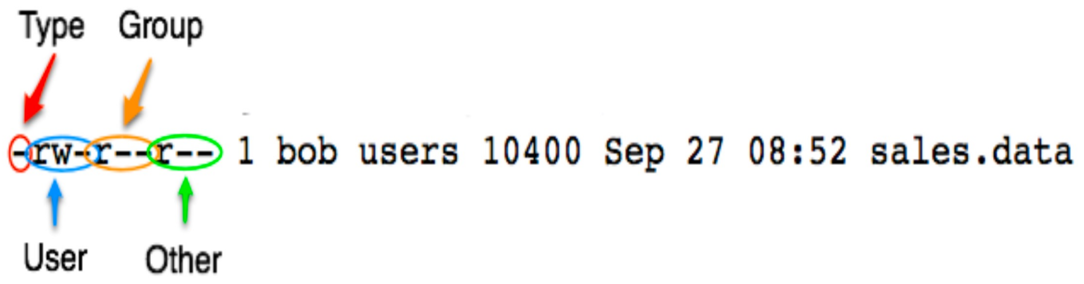
```
$ ls –l
```



```
cisco@nso:/var/opt/ncs$ ls -l
total 56
drwxr-xr-x  2 cisco package_admin  4096 Apr 13 14:39 backups
drwxr-xr-x  2 cisco package_admin  4096 Apr 13 14:13 cdb
-rw-r--r--  1 cisco package_admin  1109 Oct 13  2022 INSTALLATION-LOG
drwxrwxr-- 11 cisco package_admin  4096 Apr 12 15:35 packages
drwxr-xr-x  2 cisco package_admin 20480 Apr 18 23:09 rollbacks
drwxr-xr-x  2 cisco package_admin  4096 Oct 13  2022 scripts
drwxr-xr-x  5 cisco package_admin  4096 Apr 18 23:09 state
-rw-r--r--  1 cisco package_admin   333 Apr 13 14:14 storedstate
drwxr-xr-x  2 cisco package_admin  4096 Oct 13  2022 streams
drwxr-xr-x  3 cisco package_admin  4096 Oct 13  2022 target
```

Secret Decoder Ring





```
-rw-r--r-- 1 bob users 10400 Sep 27 08:52 sales.data
```

Symbol	Category
u	User
g	Group
o	Other
a	All

Symbol	Meaning
-	Regular file
d	Directory
l	Symbolic link
r	Read
w	Write
x	Execute

Permissions - Files vs Directories

Permission	File	Directory
Read (r)	Allows a file to be read.	Allows file names in the directory to be read.
Write (w)	Allows a file to modified.	Allows entries to be modified within the directory.
Execute (x)	Allows the execution of a file.	Allows access to contents and metadata for entries.

TRAINOCATE

Symbolic Based Permissions

```
$ chmod [OPTION]... MODE[,MODE]... FILE...
```

The format of a symbolic mode is
[**ugoa**...][[**-+=**][*perms*...]...]

```
$ chmod a+x new_script.sh
```

Item	Meaning
ugoa	user, group, other, all
+-=	Add, subtract, or set permissions
perms	r: Read w: Write x: Execute

TRAINOCATE

Numeric Based Permissions

```
$ chmod [OPTION]... OCTAL-MODE... FILE...
```

A numeric mode is from one to four octal digits (0-7), derived by adding up the bits with values 4, 2, and 1. Omitted digits are assumed to be leading zeros. The first digit selects the set user ID (4) and set group ID (2) and restricted deletion or sticky (1) attributes. The second digit selects permissions for the user who owns the file: read (4), write (2), and execute (1); the third selects permissions for other users in the file's group, with the same values; and the fourth for other users not in the file's group, with the same values.

```
$ chmod 755 new_script.sh
```

Numeric Based Permissions

r	w	x	
0	0	0	Value for off
1	1	1	Binary value for on
4	2	1	Base 10 value for on

Octal	Binary	String	Description
0	0	---	No permissions
1	1	--x	Execute only
2	10	-w-	Write only
3	11	-wx	Write and execute (2+1)
4	100	r--	Read only
5	101	r-x	Read and execute (4+1)
6	110	rw-	Read and write (4 + 2)
7	111	rwx	Read, write and execute (4+2+1)

Order Has Meaning

	U	G	O
Symbolic	rwx	r-x	r--
Binary	111	101	100
Decimal	7	5	4

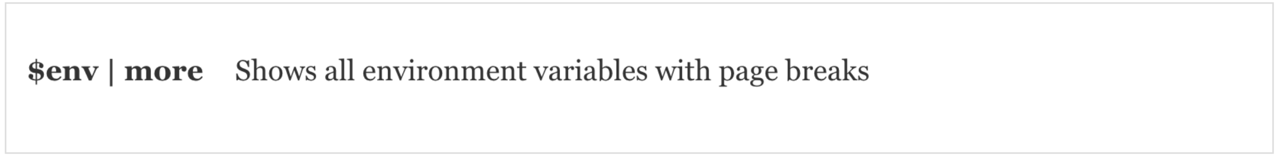
Commonly Used Permissions

Symbolic	Octal
-rwx------	700
-rwxr-xr-x	755
-rw-rw-r--	664
-rw-rw----	660
-rw-r--r--	644

BASH scripting

Environmental Variables with Bash

- **env**: To get to know the current environment, with all its variables



$env | more	Shows all environment variables with page breaks

- Export**:** Set export attribute for shell variables.

  export: export [-fn] [name[=value] ...] or export -p
- unset - delete an environment variable.
- printenv

  Print all or part of environment
- echo $ENV_VAR

  Print the ENV_VAR variable

Common Environment Variables

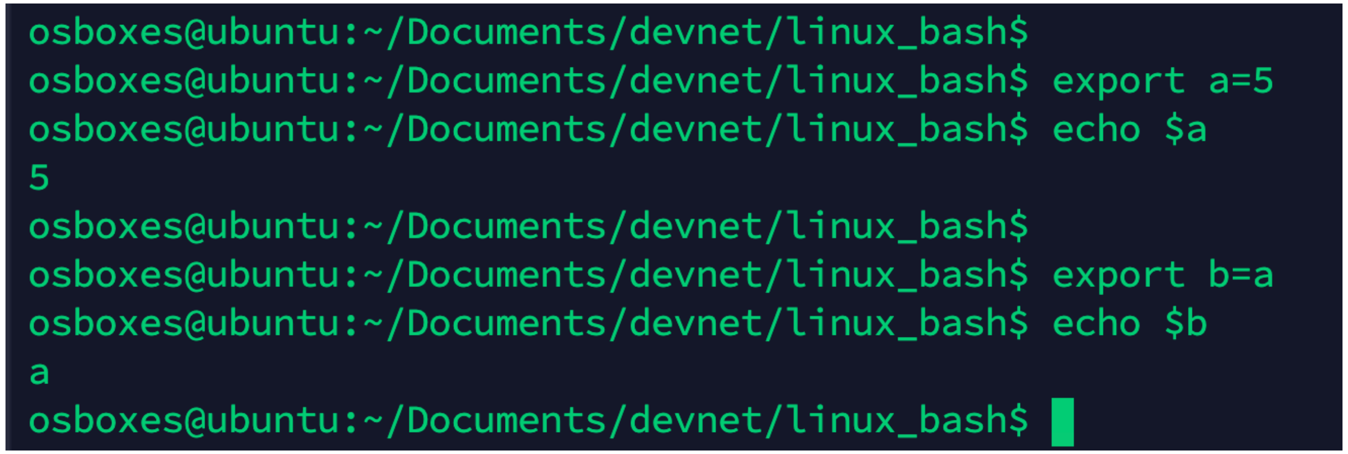
Variable	Description
EDITOR	Program to run to perform edits
HOME	Home directory of the user.
LOGNAME	The login name of the user.
MAIL	The location of the user's local inbox.

Variable	Description
OLDPWD	The previous working directory.
PATH	A list of directions to search for commands.
PAGER	Program used to paginate through files.

Variable	Description
PS1	The primary prompt string.
PWD	Present working directory.
USER	The username of the current user.

Variable Assignment

- VARIABLE_NAME="Value" (*no space before and after*)
- Variables are case sensitive
- By convention variables are uppercase

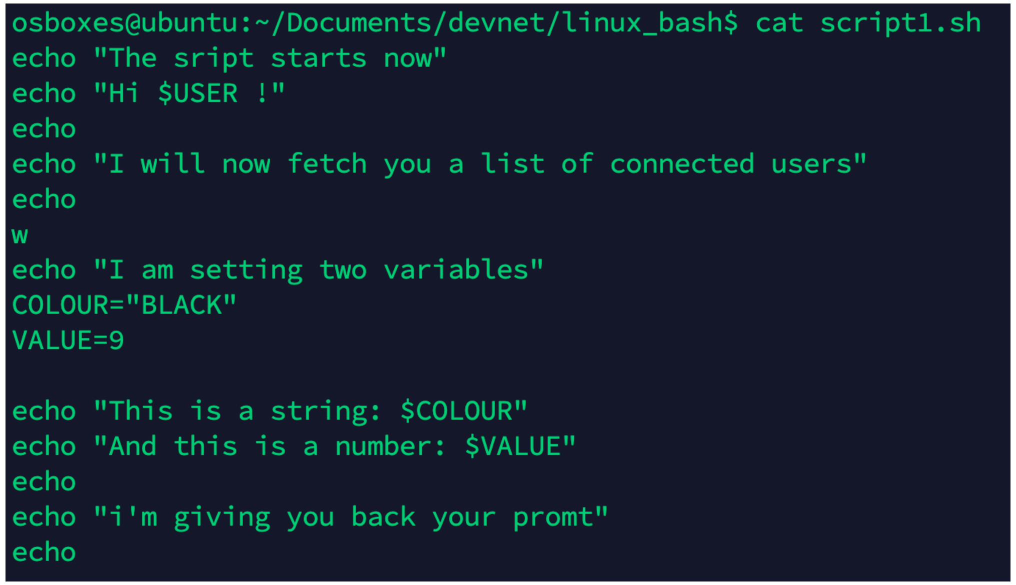


```
osboxes@ubuntu:~/Documents/devnet/linux_bash$
osboxes@ubuntu:~/Documents/devnet/linux_bash$ export a=5
osboxes@ubuntu:~/Documents/devnet/linux_bash$ echo $a
5
osboxes@ubuntu:~/Documents/devnet/linux_bash$
osboxes@ubuntu:~/Documents/devnet/linux_bash$ export b=a
osboxes@ubuntu:~/Documents/devnet/linux_bash$ echo $b
a
osboxes@ubuntu:~/Documents/devnet/linux_bash$ █
```

Variable Assignment

- Contain a series of commands
- An interpreter executes commands in the script
- Anything you can type at the command line, you can put in a script
- Great for automating tasks

Writing The Script

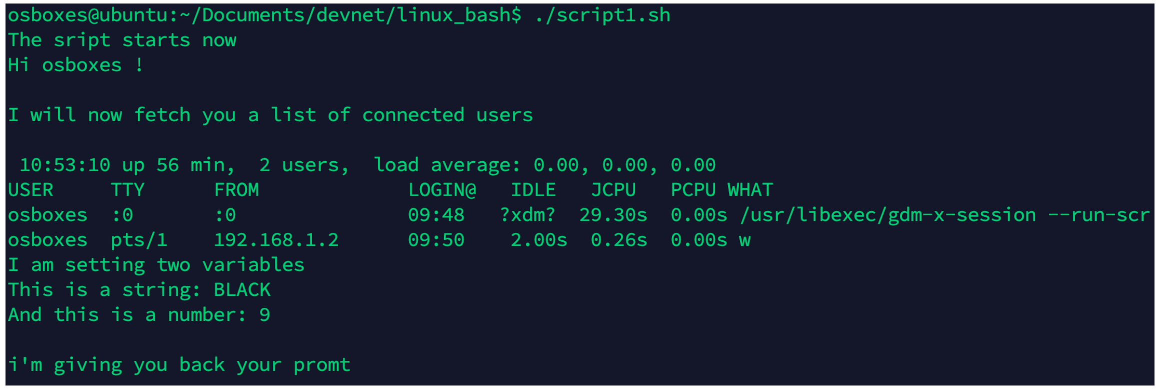


```
osboxes@ubuntu:~/Documents/devnet/linux_bash$ cat script1.sh
echo "The sript starts now"
echo "Hi $USER !"
echo
echo "I will now fetch you a list of connected users"
echo
w
echo "I am setting two variables"
COLOUR="BLACK"
VALUE=9

echo "This is a string: $COLOUR"
echo "And this is a number: $VALUE"
echo
echo "i'm giving you back your promt"
echo
```

```
clear
echo "The sript starts now"
echo "Hi $USER !"
echo
echo "I will now fetch you a list of connected users"
echo
w
echo "I am setting two variables"
COLOUR="BLACK"
VALUE=9

echo "This is a string: $COLOUR"
echo "And this is a number: $VALUE"
echo
echo "i'm giving you back your promt"
echo
```

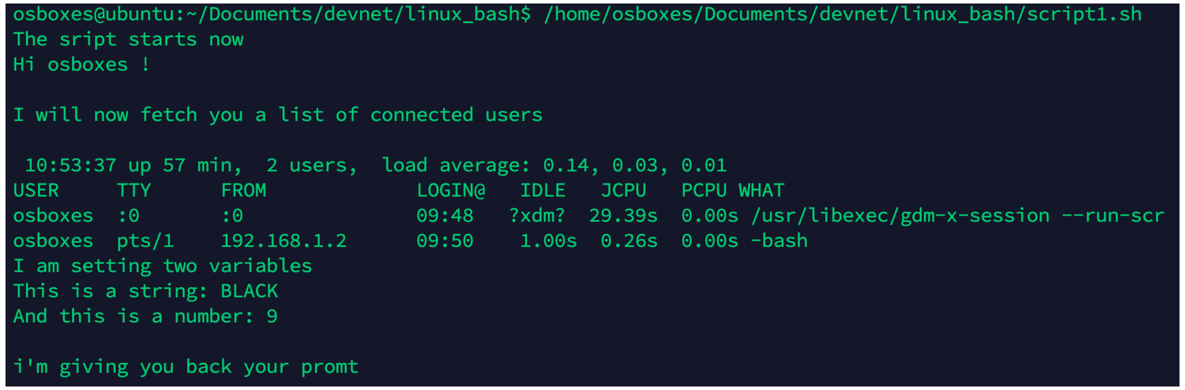
Executing The Script

$ ./ file_name



```
osboxes@ubuntu:~/Documents/devnet/linux_bash$ ./script1.sh
The sript starts now
Hi osboxes !

I will now fetch you a list of connected users

 10:53:10 up 56 min,  2 users,  load average: 0.00, 0.00, 0.00
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
osboxes  :0       :0               09:48   ?xdm?  29.30s  0.00s /usr/libexec/gdm-x-session --run-scr
osboxes  pts/1    192.168.1.2      09:50    2.00s  0.26s  0.00s w
I am setting two variables
This is a string: BLACK
And this is a number: 9

i'm giving you back your promt
```

$ path_to_file



```
osboxes@ubuntu:~/Documents/devnet/linux_bash$ /home/osboxes/Documents/devnet/linux_bash/script1.sh
The sript starts now
Hi osboxes !

I will now fetch you a list of connected users

 10:53:37 up 57 min,  2 users,  load average: 0.14, 0.03, 0.01
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
osboxes  :0       :0               09:48   ?xdm?  29.39s  0.00s /usr/libexec/gdm-x-session --run-scr
osboxes  pts/1    192.168.1.2      09:50    1.00s  0.26s  0.00s -bash
I am setting two variables
This is a string: BLACK
And this is a number: 9

i'm giving you back your promt
```

TRAINOCATE