Lecture _2

LINUX essentials

Dr .sara mohamed

Command Line Basics

- Modern Linux distributions have a wide range of graphical user interfaces, but an administrator will always need to know how to work with the command line, or shell as it is called. The shell is a program that enables text-based communication between the operating system and the user. It is usually a text mode program that reads the user's input and interprets it as commands to the system.

On Linux the most common one is the Bash shell. This is also the one that will be used in examples or exercises here.

```
username@hostname current_directory shell_type
```

On Ubuntu or Debian GNU/Linux, the prompt for a regular user will likely look like this:

```
carol@mycomputer:~$
```

The superuser's prompt will look like this:

```
root@mycomputer:~#
```

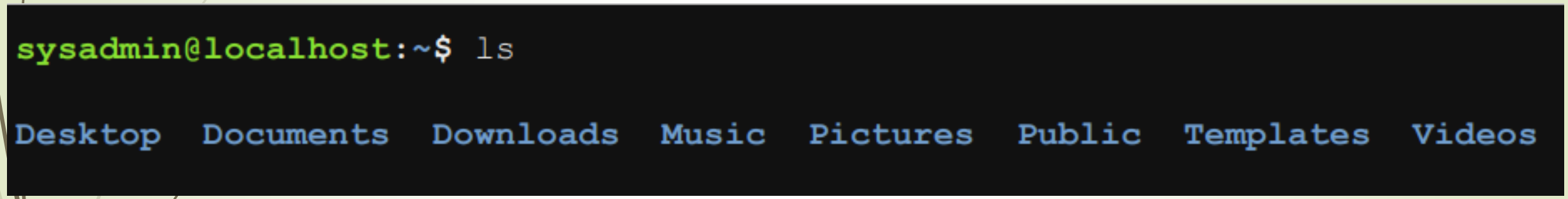
Let's explain each component of the structure

- **Username**: Name of the user that runs the shell
- **Hostname**: Name of the host on which the shell runs.
- **Current directory**: The directory that the shell is currently in.
- A ~ means that the shell is in the current user's home directory.
- **Shell type**:
  - $ indicates the shell is run by a regular user.
  - # indicates the shell is run by the superuser root in Linux this equals **administrator** on windows

Basic Command Syntax

- A command is a software program that when executed on the CLI (command line interface), performs an action on the computer. When you type in a command, a process is run by the operating system that can read input, manipulate data and produce output. A command runs a process on the operating system, which then causes the computer to perform a job. To execute a command, the first step is to type the name of the command.

To execute a command, the first step is to type the name of the command. Click in the terminal on the right. Type ls and hit Enter. The result should resemble the example below



The ls command displays a listing of information about files.

Every part of the command is normally case-sensitive, so LS is incorrect and will fail, but ls is correct and will execute.

```
sysadmin@localhost:~$ LS

-bash: /usr/games/LS: Permission denied
```

Command Line Structure

```
command  [option(s)/parameter(s)...]  [argument(s)...]
```

Most commands follow a simple pattern of syntax:

```
command [options…] [arguments…]
```

Let's explain the purpose of each component

- **Command**: Program that the user will run.
- **Option(s)/Parameter(s):** A "switch" that modifies the behaviour of the command in some way
- **Options** can be accessed in a short and in a long form.
- Multiple options can be combined .
- **Argument(s):** Additional data that is required by the program, like a filename or path. An argument can be used to specify something for the command to act upon.

```bash
ls -a      # short form: show all files, including hidden ones
ls --all   # long form: same option in long form
```

Option example

```
terminal@terminal-temple ~ $ ls
Documents       Downloads       Music           Pictures
terminal@terminal-temple ~ $ ls -l
total 4
drwxr-xr-x  5 terminal  staff  160 Sep 21 06:57 PM Documents
drwxr-xr-x  3 terminal  staff   96 Sep 21 06:57 PM Downloads
drwxr-xr-x  2 terminal  staff   64 Sep 21 06:57 PM Music
drwxr-xr-x  2 terminal  staff   64 Sep 21 06:57 PM Pictures
terminal@terminal-temple ~ $
```

- When this is the case, it's default behaviour is to return a list of files contained within the current directory.
- The ls command, which results in a "long display" output, meaning the output gives more information about each of the files listed as shown in the figure.

```
sysadmin@localhost:~$ ls -l

total 32

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Desktop

drwx------ 4 sysadmin sysadmin 4096 Dec 20  2017 Documents

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Downloads

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Music

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Pictures

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Public

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Templates

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Videos
```

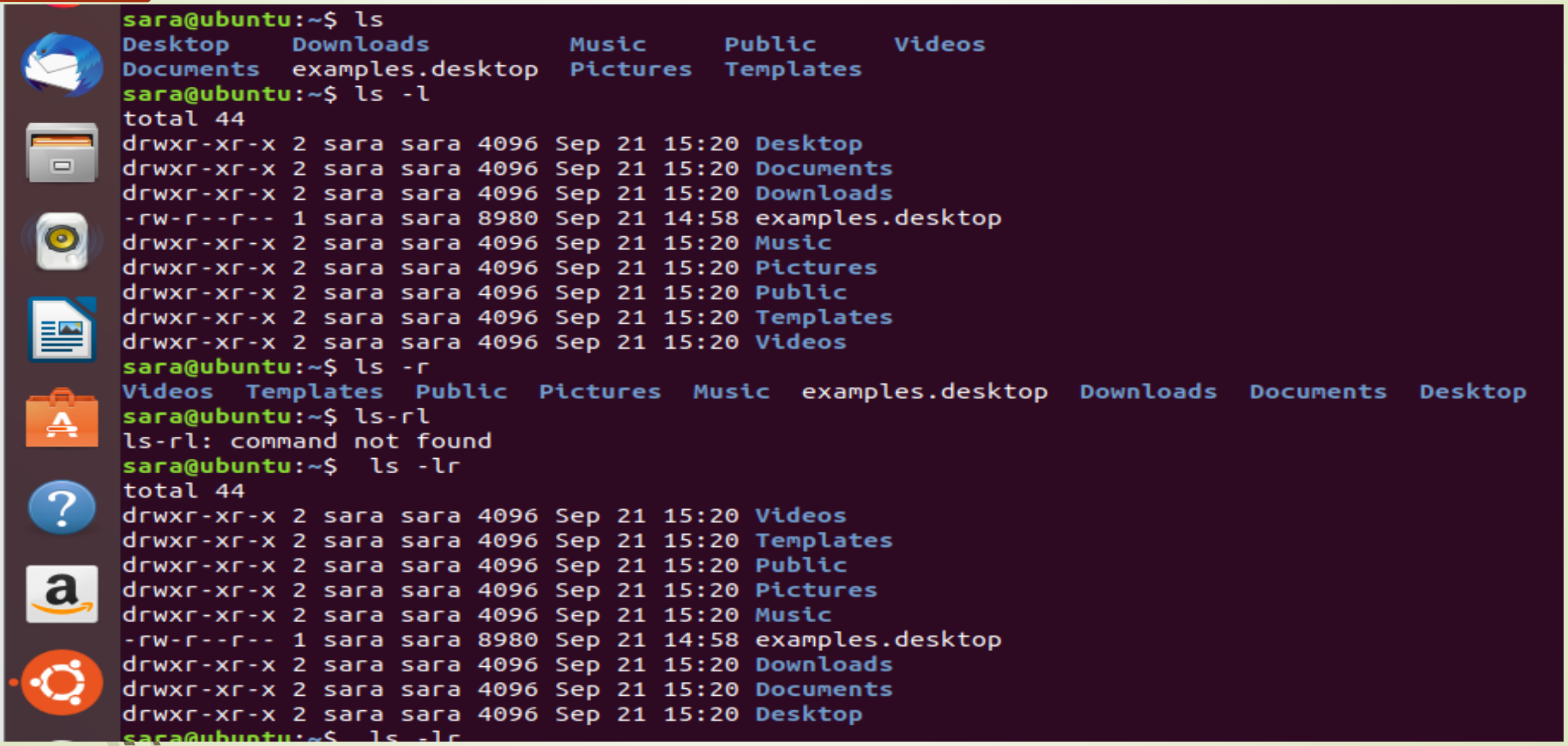
By default, the ls command prints the results in alphabetical order, so adding the -r option will print the results in reverse alphabetical order.

```
sysadmin@localhost:~$ ls -r

Videos  Templates  Public  Pictures  Music  Downloads  Documents  Desktop
```

- **Multiple options** can be used at once, either given as separate options as in -l -r or combined like -lr. The output of all of these examples would be the same:

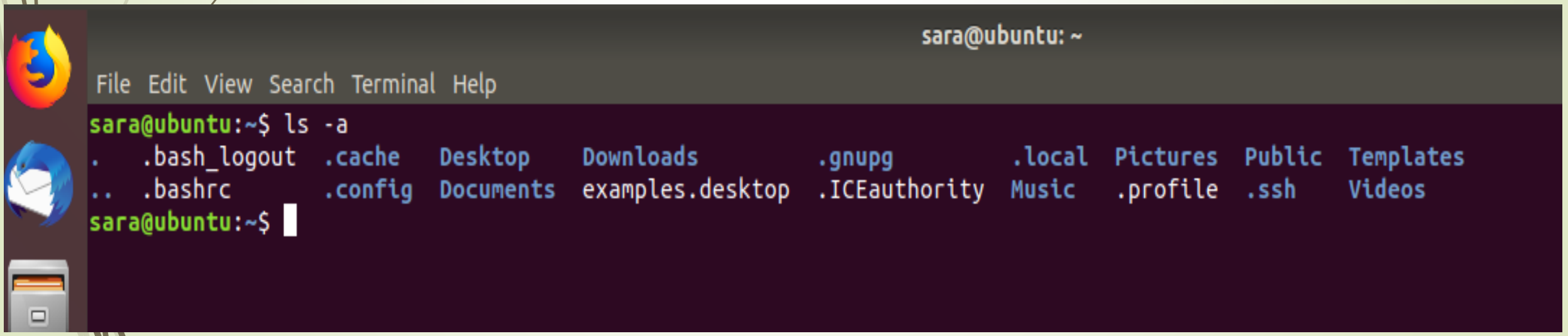
```
ls -l -r

ls -rl

ls -lr
```

As explained above, -l gives a long listing format while -r reverses the listing. The result of using both options is a long listing given in reverse order:



```
sysadmin@localhost:~$ ls -rl

total 32

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Videos

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Templates

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Public

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Pictures

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Music

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Downloads

drwx------ 4 sysadmin sysadmin 4096 Dec 20  2017 Documents

drwx------ 2 sysadmin sysadmin 4096 Dec 20  2017 Desktop
```

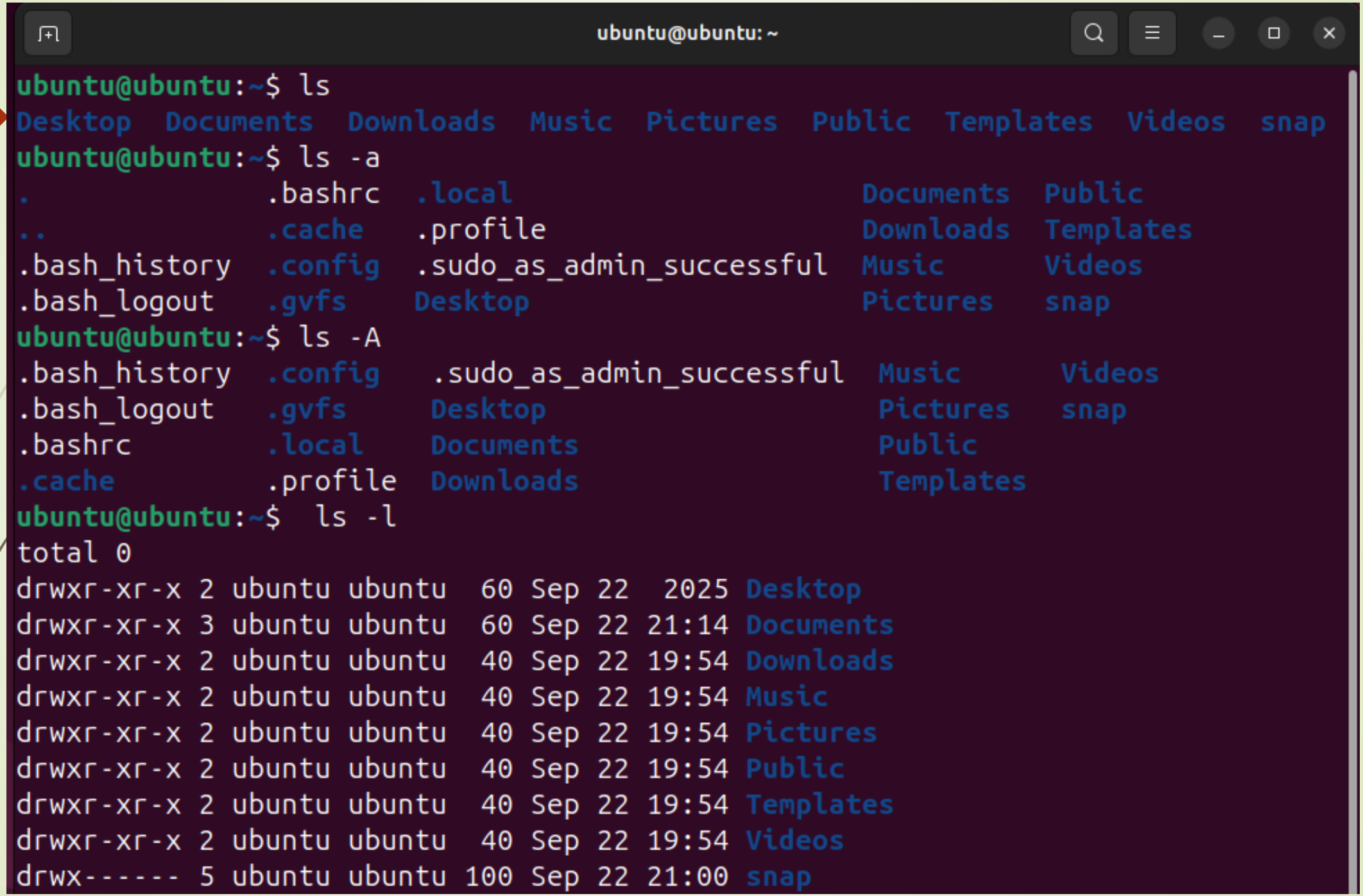
Directory Navigation Commands	Description
`ls`	List files and directories in the current directory.
`ls -a`	List all files and directories in the current directory (shows hidden files).
`ls -l`	List files and directories in long format.
`pwd`	Show the directory you are currently working in.



Common ls Options

Option	Long option	Description
`-a`	`--all`	List all files, even those with names that begin with a period, which are normally not listed (that is, hidden).
`-A`	`--almost-all`	Like the `-a` option except it does not list `.` (current directory) and `..` (parent directory).
`-d`	`--directory`	Ordinarily, if a directory is specified, `ls` will list the contents of the directory, not the directory itself. Use this option in conjunction with the `-l` option to see details about the directory rather than its contents.
`-F`	`--classify`	This option will append an indicator character to the end of each listed name. For example, it will append a forward slash (/) if the name is a directory.
`-h`	`--human-readable`	In long format listings, display file sizes in human-readable format rather than in bytes.
`-l`		Display results in long format.
`-r`	`--reverse`	Display the results in reverse order. Normally, `ls` displays its results in ascending alphabetical order.
`-S`		Sort results by file size.
`-t`		Sort by modification time.

```
ubuntu@ubuntu:~$ ls -a -l -F
total 16
drwxr-x--- 15 ubuntu ubuntu  400 Sep 28 15:58 ./
drwxr-xr-x  1 root   root     80 Sep 28 09:07 ../
-rw-------  1 ubuntu ubuntu  192 Sep 28 17:59 .bash_history
-rw-r--r--  1 ubuntu ubuntu  220 Sep 28 09:04 .bash_logout
-rw-r--r--  1 ubuntu ubuntu 3771 Sep 28 09:04 .bashrc
drwx------ 11 ubuntu ubuntu  240 Sep 28 09:18 .cache/
drwxr-xr-x 13 ubuntu ubuntu  420 Sep 28 09:38 .config/
drwx------  2 ubuntu ubuntu   40 Sep 28 09:05 .gvfs/
drwx------  4 ubuntu ubuntu   80 Sep 28 09:07 .local/
-rw-r--r--  1 ubuntu ubuntu  807 Sep 28 09:04 .profile
-rw-r--r--  1 ubuntu ubuntu    0 Sep 28 09:09 .sudo_as_admin_successful
drwxr-xr-x  2 ubuntu ubuntu   60 Sep 28 09:05 Desktop/
drwxr-xr-x  3 ubuntu ubuntu   60 Sep 28 09:30 Documents/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Downloads/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Music/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Pictures/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Public/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Templates/
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Videos/
drwx------  5 ubuntu ubuntu  100 Sep 28 13:00 snap/
```


ubuntu@ubuntu: ~
ubuntu@ubuntu:~$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos snap
ubuntu@ubuntu:~$ ls -a
. .bashrc .local Documents Public
.. .cache .profile Downloads Templates
.bash_history .config .sudo_as_admin_successful Music Videos
.bash_logout .gvfs Desktop Pictures snap
ubuntu@ubuntu:~$ ls -A
.bash_history .config .sudo_as_admin_successful Music Videos
.bash_logout .gvfs Desktop Pictures snap
.bashrc .local Documents Public
.cache .profile Downloads Templates
ubuntu@ubuntu:~$ ls -l
total 0
drwxr-xr-x 2 ubuntu ubuntu 60 Sep 22 2025 Desktop
drwxr-xr-x 3 ubuntu ubuntu 60 Sep 22 21:14 Documents
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Downloads
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Music
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Pictures
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Public
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Templates
drwxr-xr-x 2 ubuntu ubuntu 40 Sep 22 19:54 Videos
drwx------ 5 ubuntu ubuntu 100 Sep 22 21:00 snap

```
ubuntu@ubuntu:~$ ls --all
.               .bashrc  .local                          Documents  Public
..              .cache   .profile                        Downloads  Templates
.bash_history   .config  .sudo_as_admin_successful       Music      Videos
.bash_logout    .gvfs    Desktop                         Pictures   snap
ubuntu@ubuntu:~$
```

```
ubuntu@ubuntu:~$ ls -F
Desktop/    Downloads/  Pictures/  Templates/  snap/
Documents/  Music/      Public/    Videos/
ubuntu@ubuntu:~$
```

```
ubuntu@ubuntu:~$  ls -l
total 0
drwxr-xr-x 2 ubuntu ubuntu  60 Sep 22  2025 Desktop
drwxr-xr-x 3 ubuntu ubuntu  60 Sep 22 21:14 Documents
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Downloads
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Music
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Pictures
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Public
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Templates
drwxr-xr-x 2 ubuntu ubuntu  40 Sep 22 19:54 Videos
drwx------ 5 ubuntu ubuntu 100 Sep 22 21:00 snap
ubuntu@ubuntu:~$ ls -s
total 0
0 Desktop    0 Downloads  0 Pictures  0 Templates  0 snap
0 Documents  0 Music      0 Public    0 Videos
ubuntu@ubuntu:~$ ls -t
Desktop  Documents  snap  Music  Pictures  Videos  Public  Templates  Downloads
ubuntu@ubuntu:~$ ls -r
snap  Videos  Templates  Public  Pictures  Music  Downloads  Documents  Desktop
```

```
ls -h
```

means **list directory contents in a human-readable format.**

Breakdown:

- `ls` → lists files and directories.
- `-h` → **human-readable sizes** (like KB, MB, GB instead of raw bytes).

⚠ Note: `-h` by itself doesn't change much unless you combine it with `-l` (long listing format).

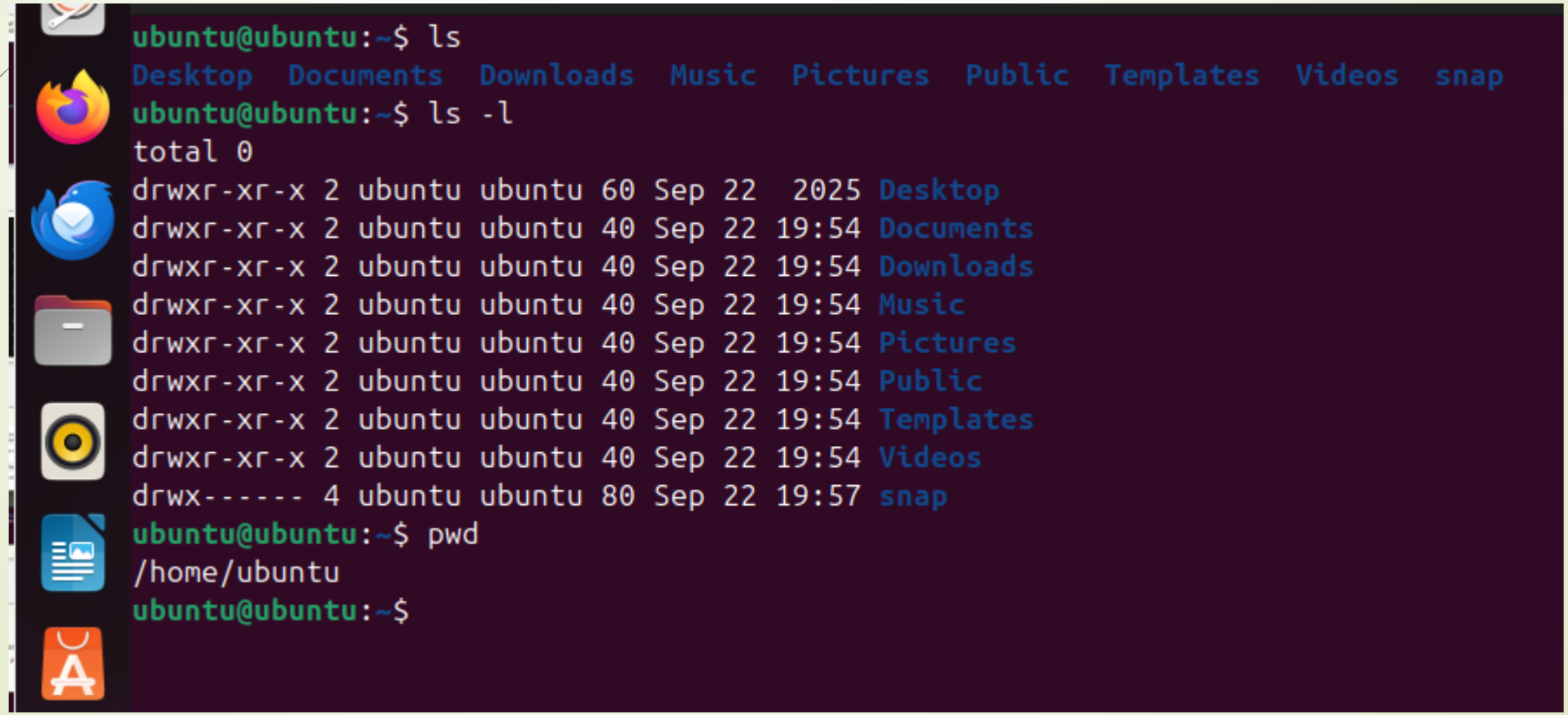
```
ubuntu@ubuntu:~$ ls -l -a  -h
total 16K
drwxr-x--- 15 ubuntu ubuntu  400 Sep 28 15:58 .
drwxr-xr-x  1 root   root     80 Sep 28 09:07 ..
-rw-------  1 ubuntu ubuntu  192 Sep 28 17:59 .bash_history
-rw-r--r--  1 ubuntu ubuntu  220 Sep 28 09:04 .bash_logout
-rw-r--r--  1 ubuntu ubuntu 3.7K Sep 28 09:04 .bashrc
drwx------ 11 ubuntu ubuntu  240 Sep 28 09:18 .cache
drwxr-xr-x 13 ubuntu ubuntu  420 Sep 28 09:38 .config
drwx------  2 ubuntu ubuntu   40 Sep 28 09:05 .gvfs
drwx------  4 ubuntu ubuntu   80 Sep 28 09:07 .local
-rw-r--r--  1 ubuntu ubuntu  807 Sep 28 09:04 .profile
-rw-r--r--  1 ubuntu ubuntu    0 Sep 28 09:09 .sudo_as_admin_successful
drwxr-xr-x  2 ubuntu ubuntu   60 Sep 28 09:05 Desktop
drwxr-xr-x  3 ubuntu ubuntu   60 Sep 28 09:30 Documents
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Downloads
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Music
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Pictures
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Public
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Templates
drwxr-xr-x  2 ubuntu ubuntu   40 Sep 28 09:08 Videos
drwx------  5 ubuntu ubuntu  100 Sep 28 13:00 snap
```

Printing Working Directory

- In order to discover where you are currently located within the filesystem, the pwd command can be used. The pwd command prints the working directory, your current location within the filesystem:

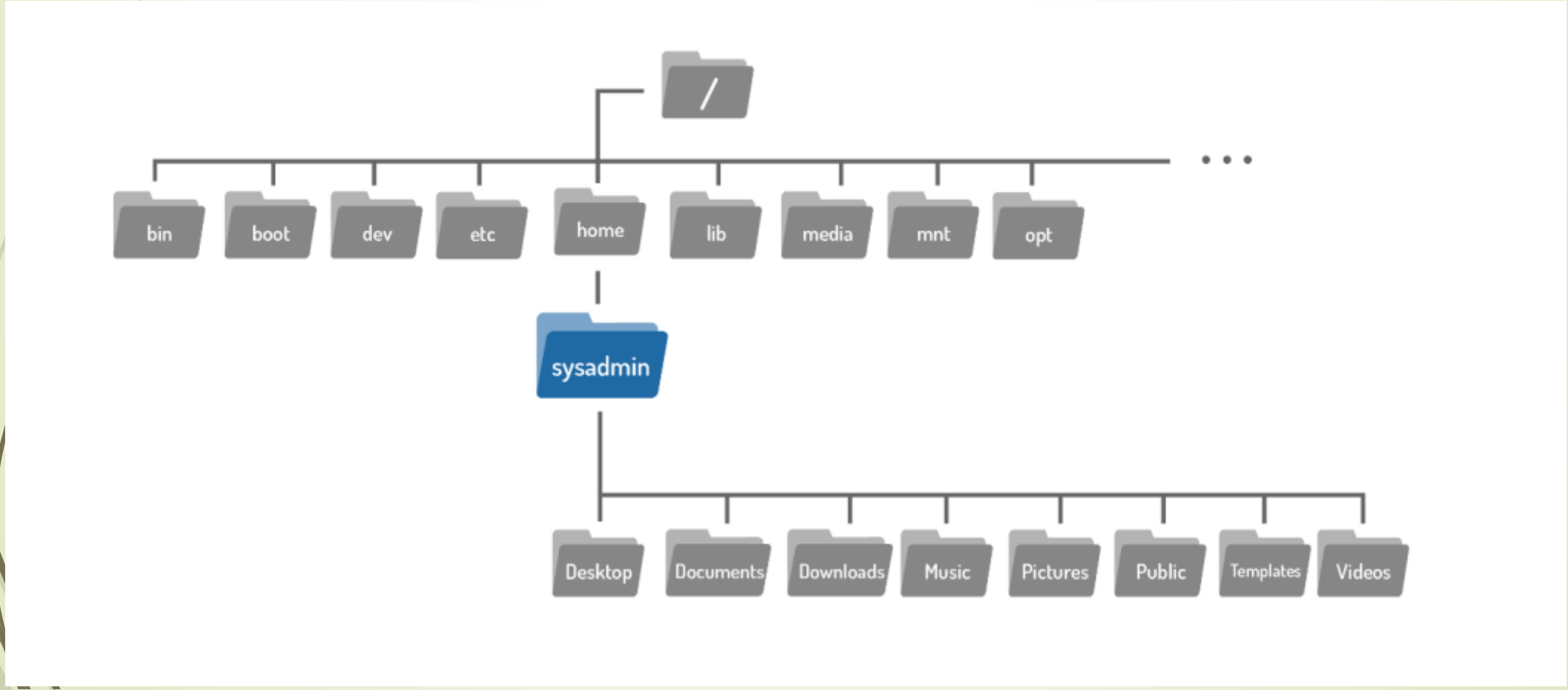
Directories

- Files are used to store data such as text, graphics and programs. Directories are a type of file used to store other files–they provide a hierarchical organizational structure.
- To display the current working directory, we use the pwd (print working directory) command



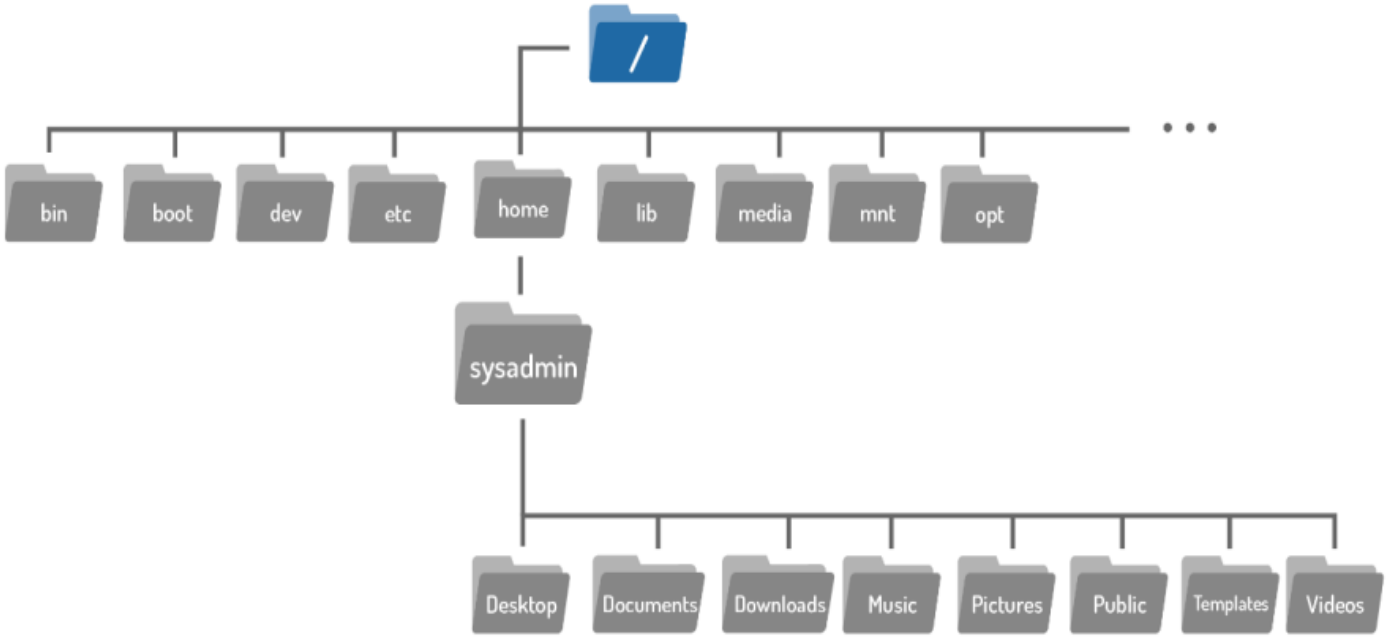
```
/home/sysadmin
```

The output of the above command indicates that the user is currently in their home folder, shown in the filesystem below.



- Directories are equivalent to **folders** on Windows and Mac OS. Like these more popular operating systems, a Linux directory structure has a top level. It is not called "My Computer", but rather the root directory and it is represented by the / character. To move to the root directory, use the **/** character as the **argument** to the cd command.

```
sysadmin@localhost:~/Documents$ cd /

sysadmin@localhost:/$
```



Changing the Current Working Directory

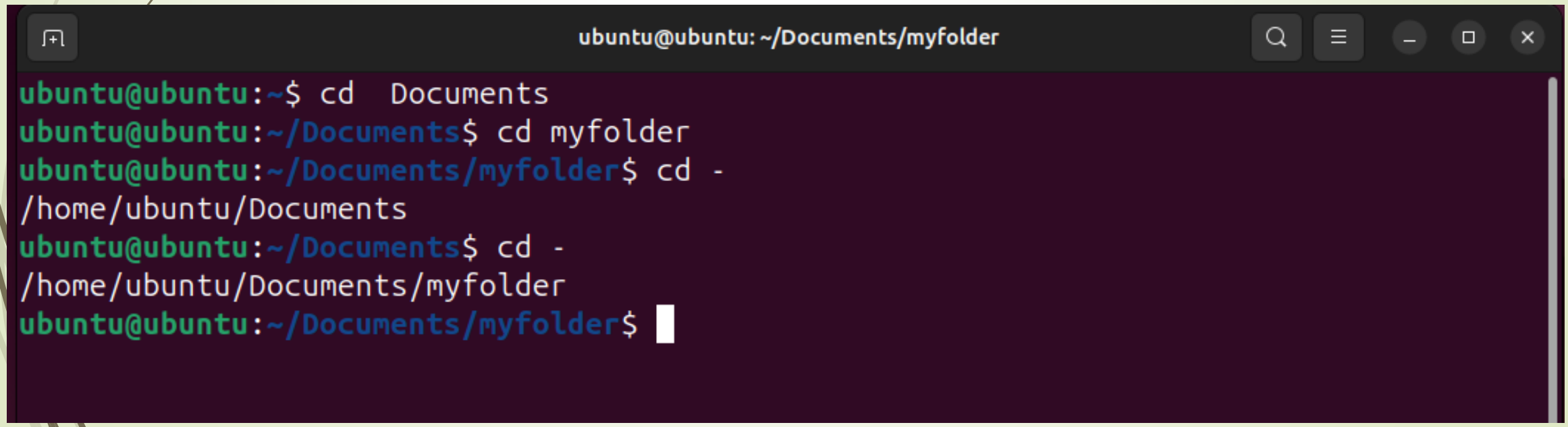
- To change our working directory (where we are standing in the tree-shaped maze), we use the cd command. To do this, type cd followed by the pathname of the desired working directory. A pathname is the route we take along the branches of the tree to get to the directory we want. We can specify pathnames in one of two different ways:

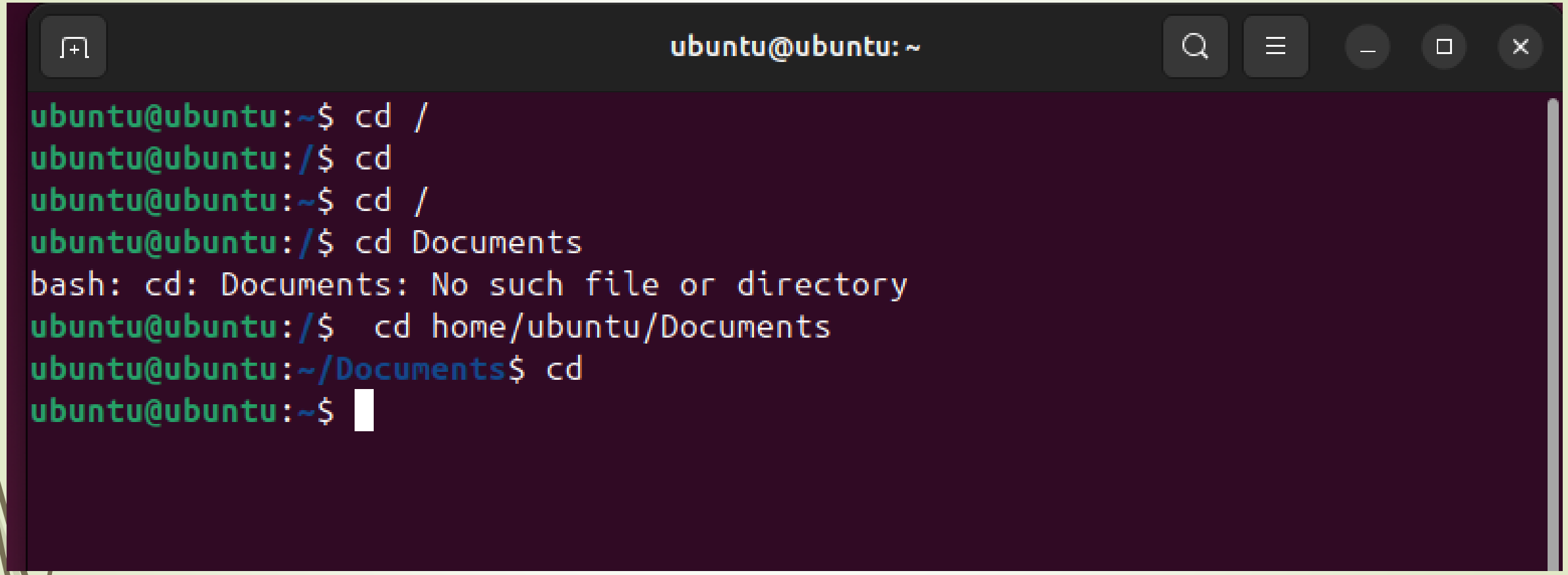
  1. Absolute pathnames
  2. Relative pathnames.

- When we first log in to system (or start a terminal emulator session), our current working directory is set to our home directory. Each user account is given its own home directory, and it is the only place a regular user is allowed to write files. To navigate the filesystem structure, use the cd (change directory) command to change directories.

```
cd [options] [path]
```

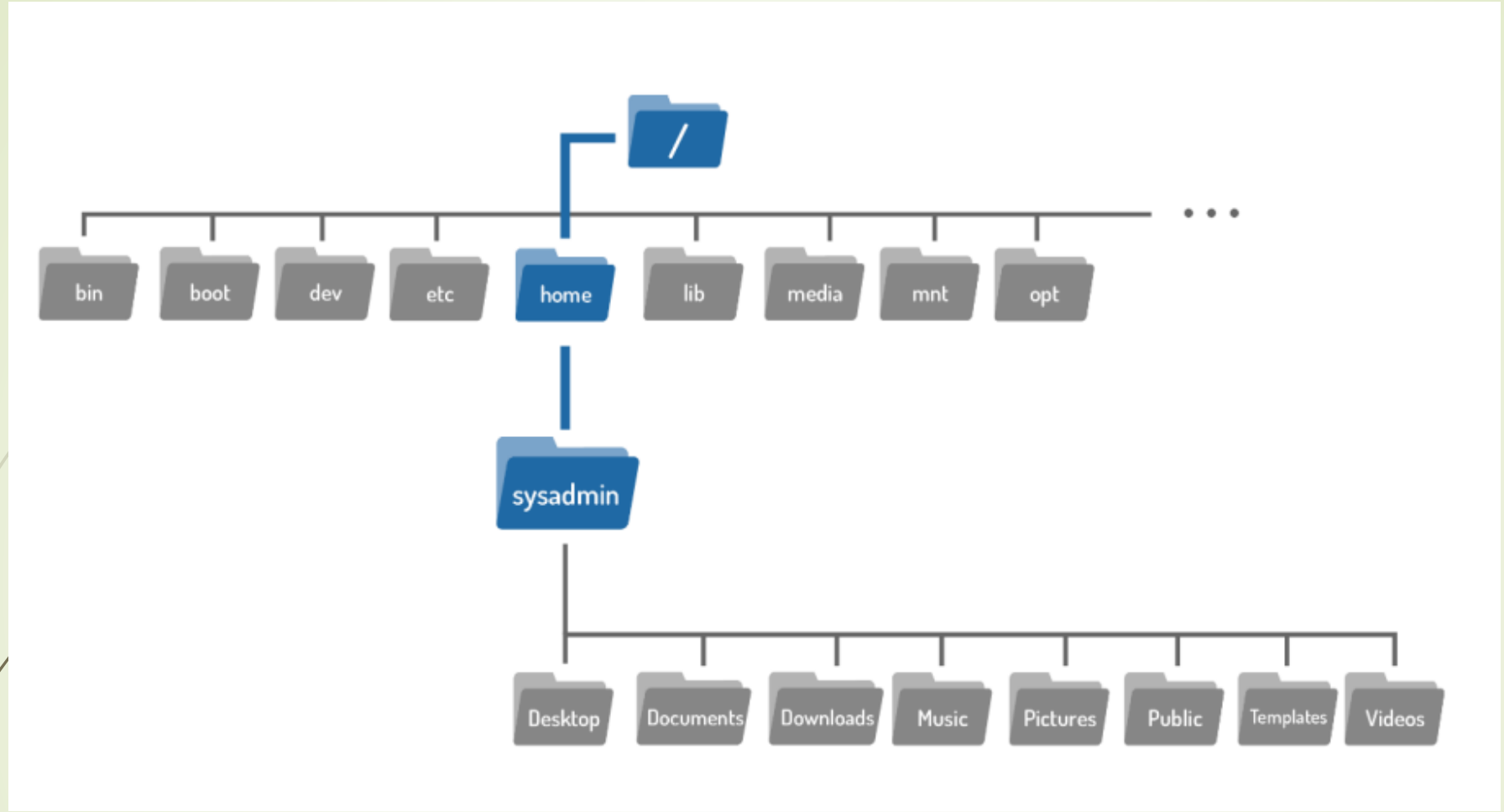
Shortcut	Result
`cd`	Changes the working directory to your home directory.
`cd -`	Changes the working directory to the previous working directory.
`cd ~user_name`	Changes the working directory to the home directory of *user_name*. For example, typing `cd ~bob` will change the directory to the home directory of user "bob."




ubuntu@ubuntu: ~
ubuntu@ubuntu:~$ cd /
ubuntu@ubuntu:/$ cd
ubuntu@ubuntu:~$ cd /
ubuntu@ubuntu:/$ cd Documents
bash: cd: Documents: No such file or directory
ubuntu@ubuntu:/$ cd home/ubuntu/Documents
ubuntu@ubuntu:~/Documents$ cd
ubuntu@ubuntu:~$

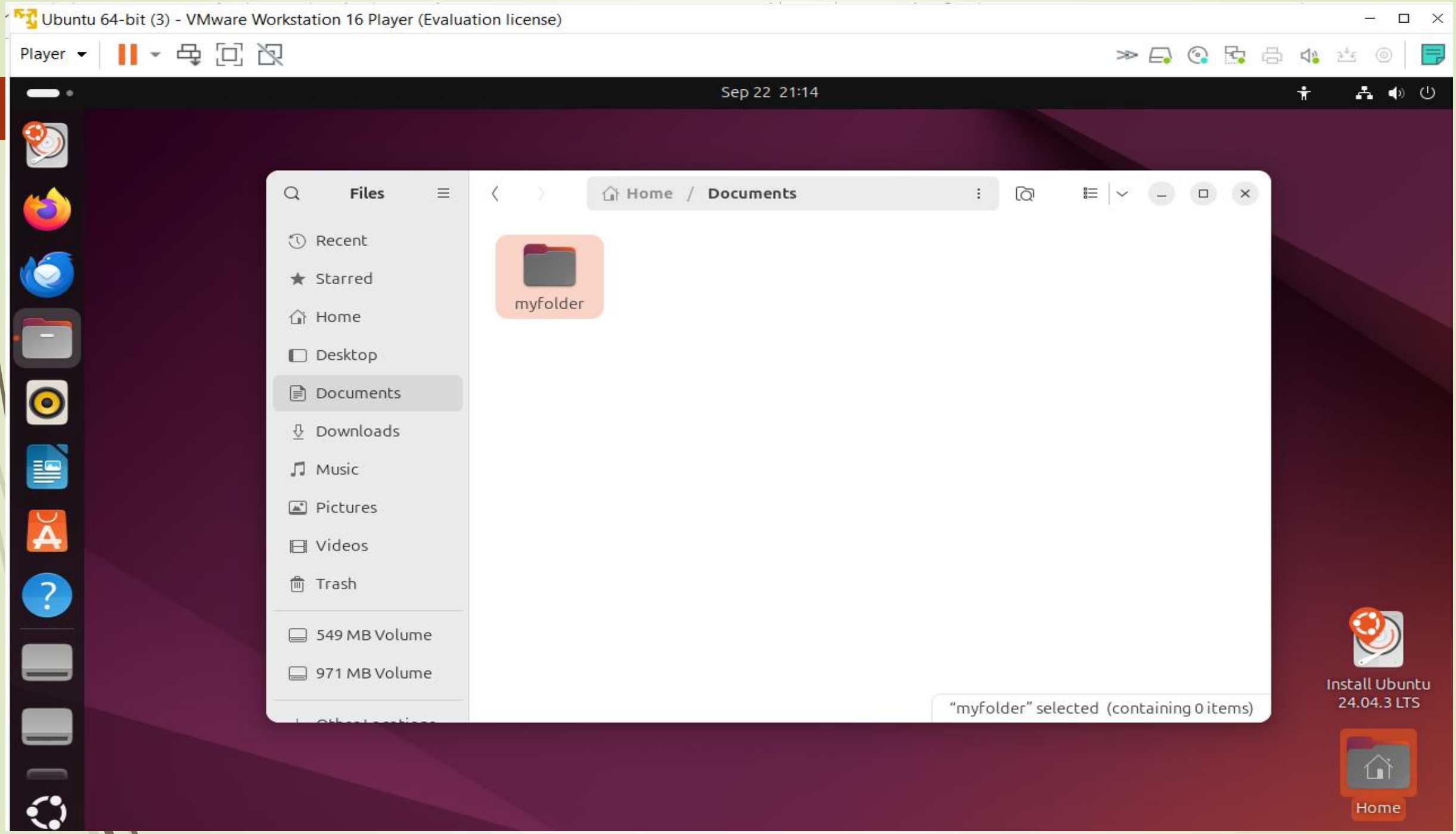
Absolute pathnames

- **An absolute pathname begins with the root directory and follows the tree branch by branch until the path to the desired directory or file is completed.**
- An absolute path allows you to specify the exact location of a directory. It always starts at the root directory; therefore, it always begins with the / character. The path to the home directory /home/sysadminis an absolute path. The path begins at the root / directory, moves into the home directory, and then into the sysadmin directory. Following this path on a graphical user interface (GUI) like your home computer would look something like this:




```
sysadmin@localhost:/$ cd /home/sysadmin

sysadmin@localhost:~$
```

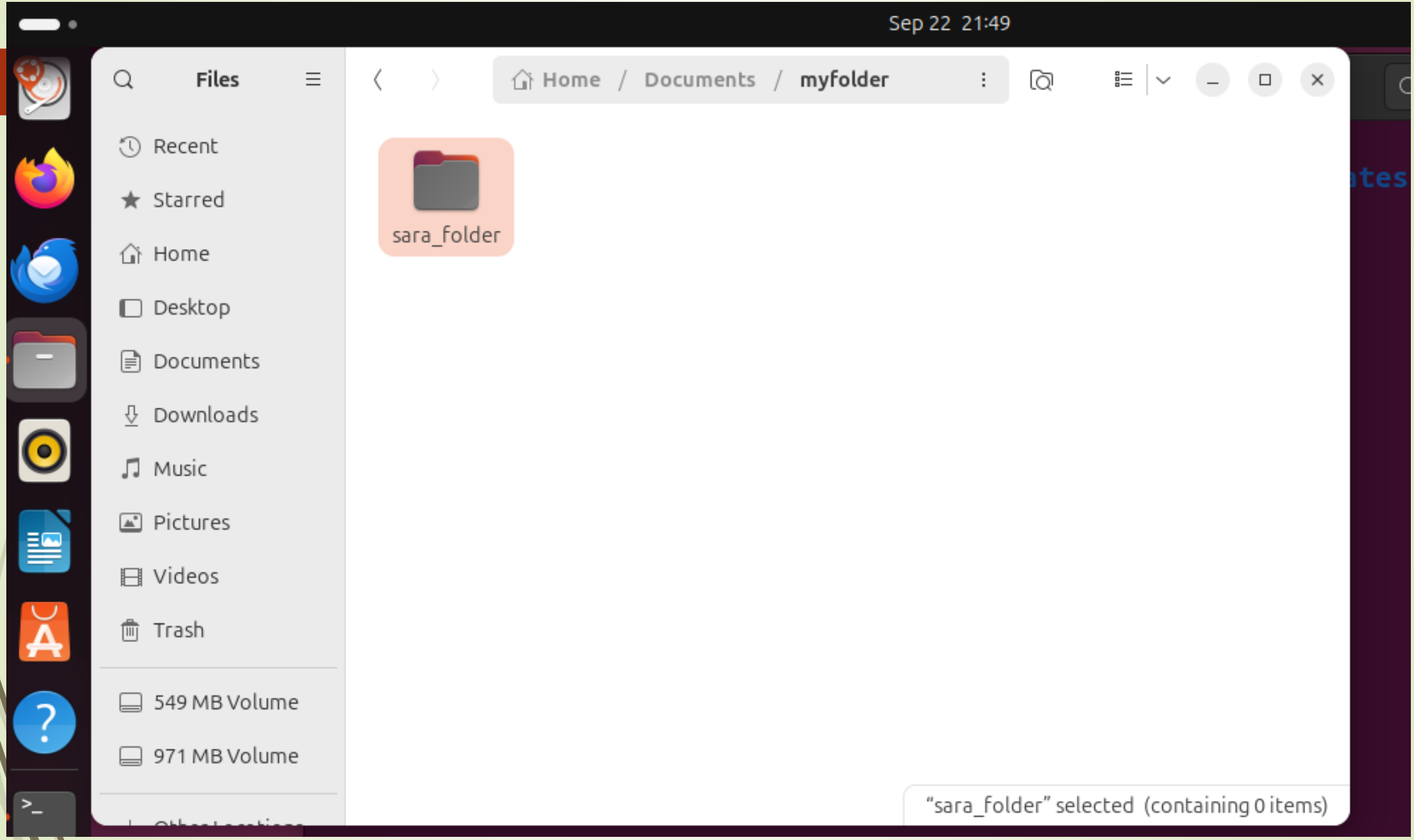
Example1: go to the documents directory which contains another directory named myfolder which contains sara_folder by the **absolute** path:

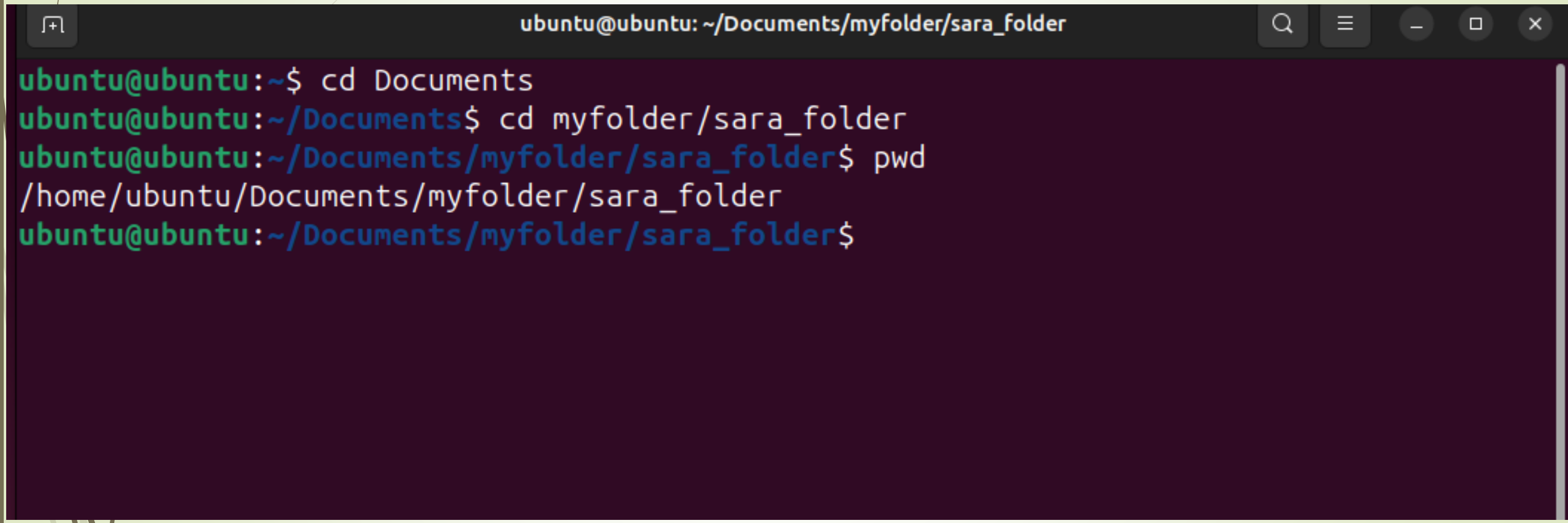

Ubuntu 64-bit (3) - VMware Workstation 16 Player (Evaluation license)
Player
Sep 22 21:14
Files
Recent
Starred
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
Trash
549 MB Volume
971 MB Volume
Home / Documents
myfolder
"myfolder" selected (containing 0 items)
Install Ubuntu 24.04.3 LTS
Home


ubuntu@ubuntu: /
ubuntu@ubuntu:~$ cd /home/ubuntu/Documents
ubuntu@ubuntu:~/Documents$ cd /home/ubuntu/Documents/myfolder
ubuntu@ubuntu:~/Documents/myfolder$ cd /home/ubuntu/Documents/myfolder/sara_folder
ubuntu@ubuntu:~/Documents/myfolder/sara_folder$ cd /
ubuntu@ubuntu:/$

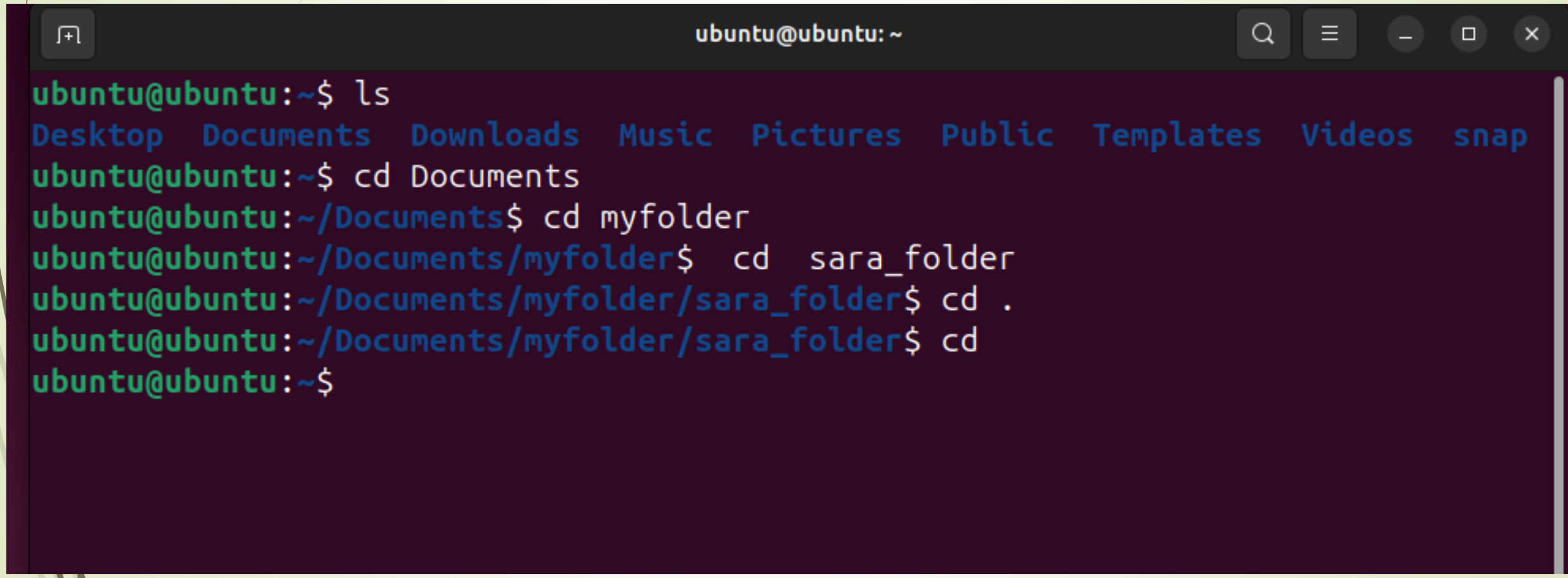
Relative Paths

- A relative path gives directions to a file relative to your current location in the filesystem. Relative paths **do not start with the / character**, they start with the name of a directory. Take another look at the first cd command example. The argument is an example of the simplest relative path: the name of a directory in your current location.


Sep 22 21:49
Files
Recent
Starred
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
Trash
549 MB Volume
971 MB Volume
Home / Documents / myfolder
sara_folder
"sara_folder" selected (containing 0 items)

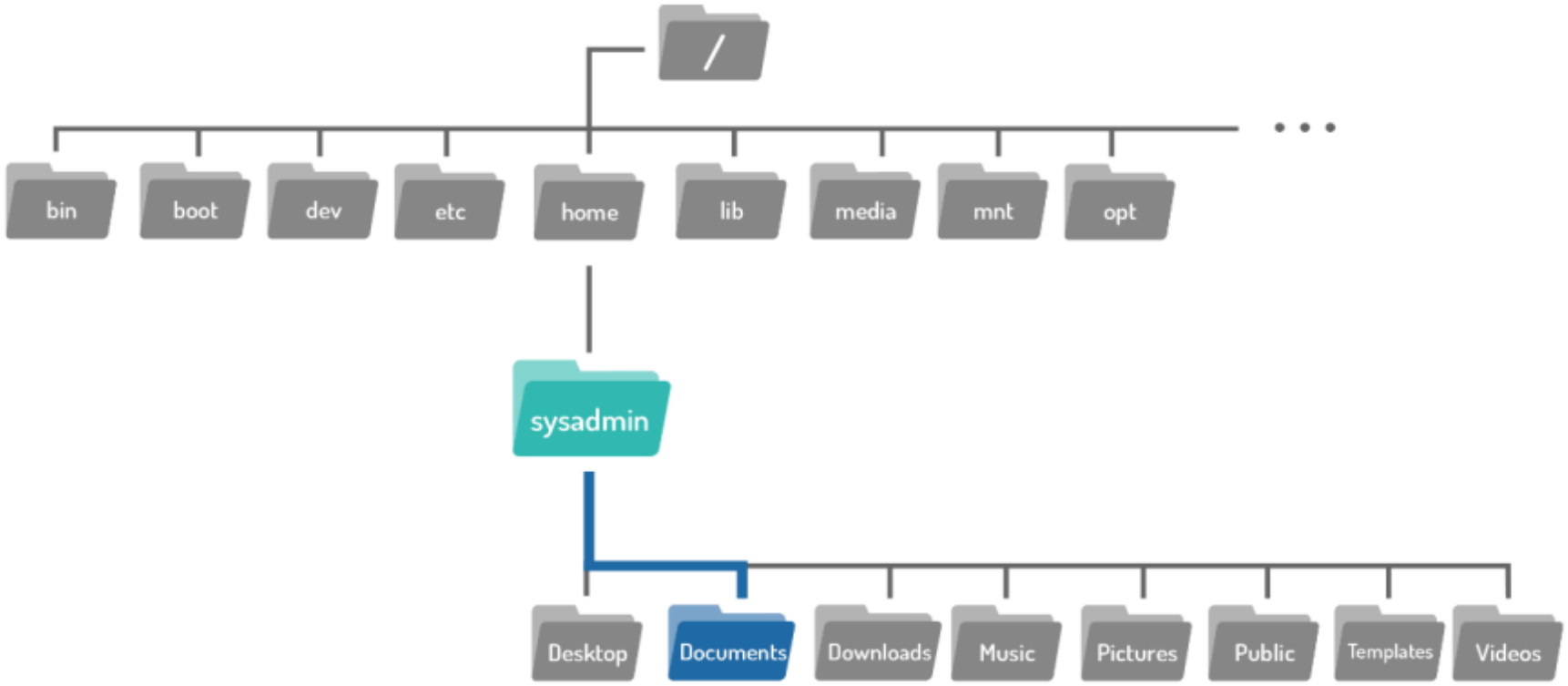

ubuntu@ubuntu: ~/Documents/myfolder/sara_folder
ubuntu@ubuntu:~$ cd Documents
ubuntu@ubuntu:~/Documents$ cd myfolder/sara_folder
ubuntu@ubuntu:~/Documents/myfolder/sara_folder$ pwd
/home/ubuntu/Documents/myfolder/sara_folder
ubuntu@ubuntu:~/Documents/myfolder/sara_folder$

Example:A path can also be broken down into multiple cd commands. The following set of commands would achieve the same results

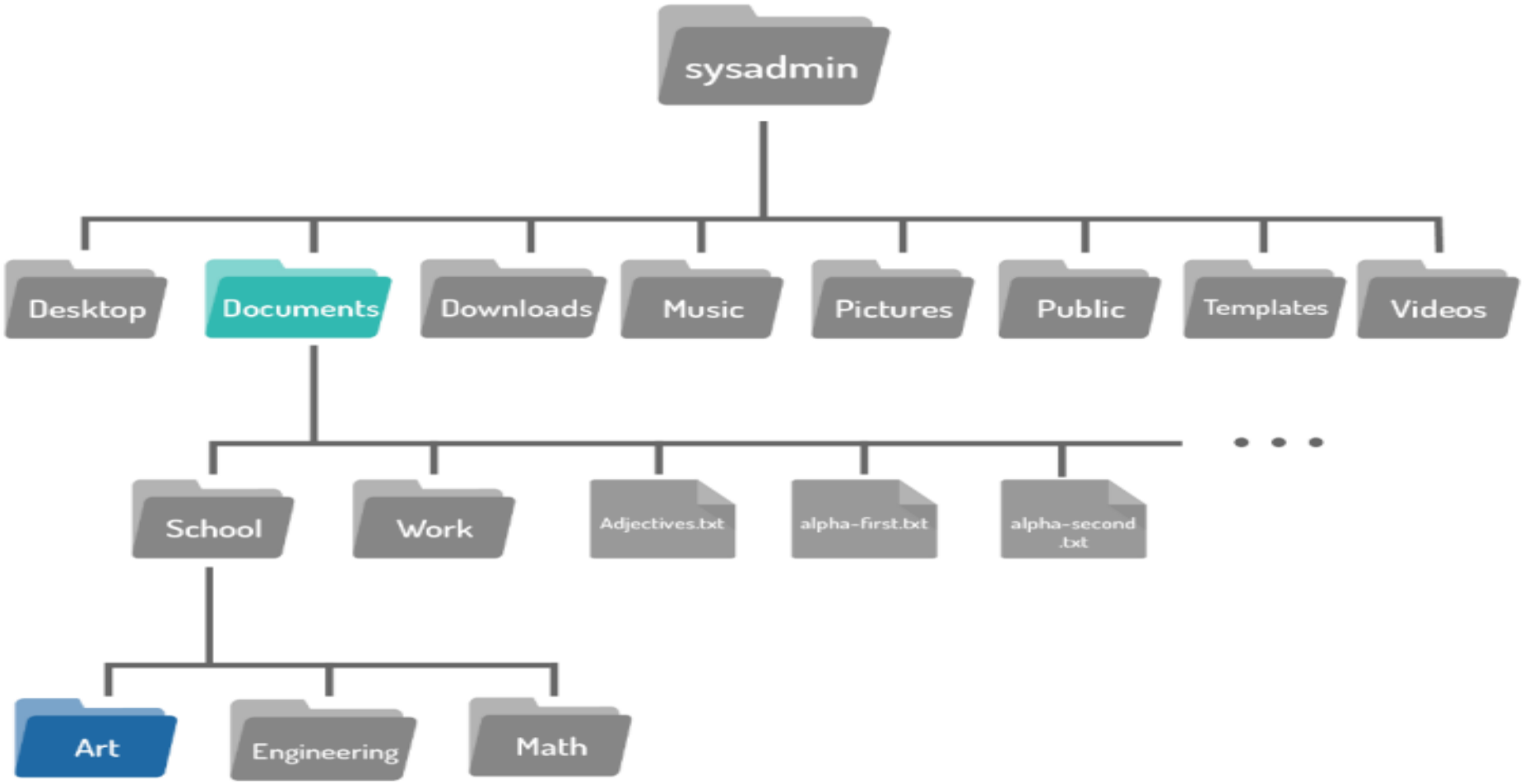

ubuntu@ubuntu: ~
ubuntu@ubuntu:~$ ls
Desktop Documents Downloads Music Pictures Public Templates Videos snap
ubuntu@ubuntu:~$ cd Documents
ubuntu@ubuntu:~/Documents$ cd myfolder
ubuntu@ubuntu:~/Documents/myfolder$ cd sara_folder
ubuntu@ubuntu:~/Documents/myfolder/sara_folder$ cd .
ubuntu@ubuntu:~/Documents/myfolder/sara_folder$ cd
ubuntu@ubuntu:~$

Example3

```
sysadmin@localhost:~$ cd Documents

sysadmin@localhost:~/Documents$
```



The image below shows a map of the files contained within the sysadmin directory. You are currently in the Documents directory and want to move to the Art directory:



Use the relative path as an argument to the cd command to move into the Art directory:

```
sysadmin@localhost:~/Documents/$ cd School/Art

sysadmin@localhost:~/Documents/School/Art$
```

```
sysadmin@localhost:~/Documents/School/Art$ pwd

/home/sysadmin/Documents/School/Art
```

References

- Linux Professional institute, Linux Essentials (Version 1.6) , Linux Evolution and Popular Operating Systems, Version: 2025-07-11 .
- https://phoenixnap.com/kb/linux-commands-cheat-sheet
- William Shotts,” The Linux Command Line”, William Pollock, , 2nd Edition2019.