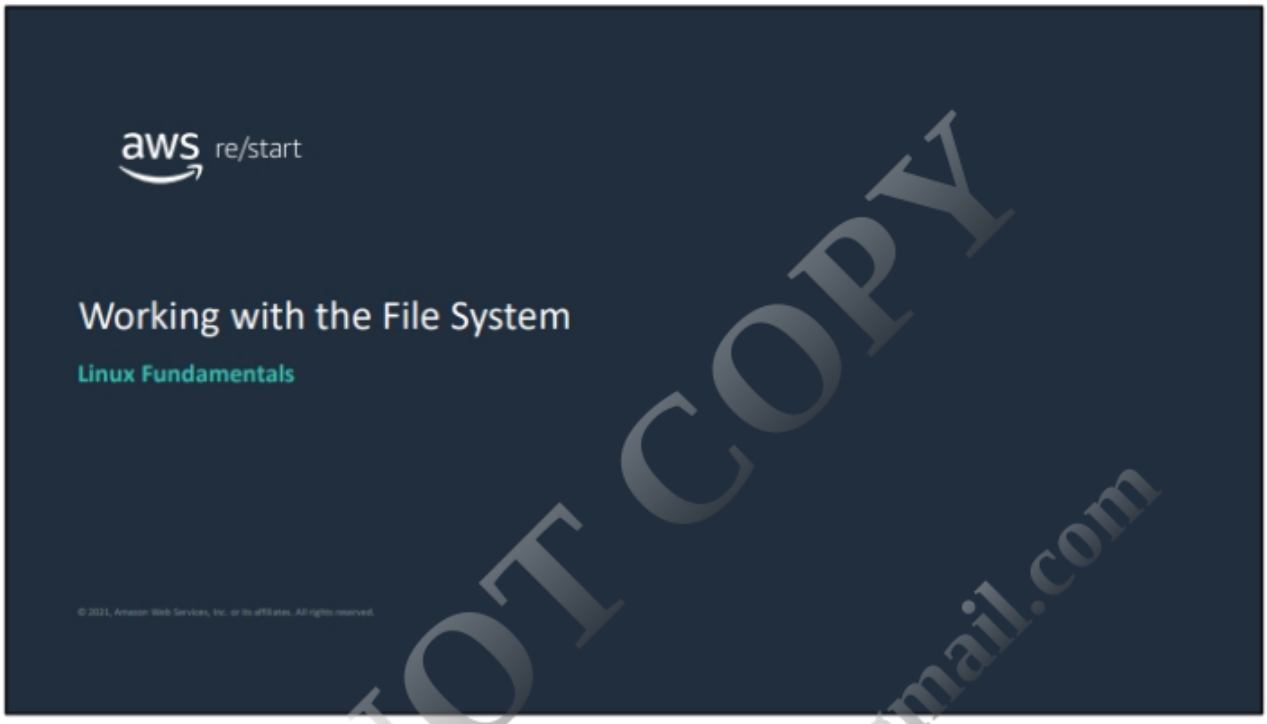

Welcome to Working with the File System.

What you will learn

At the core of the lesson

You will learn how to:

- Navigate files and directories in Linux
- Explain basic commands for managing files and directories
- Compare absolute and relative paths

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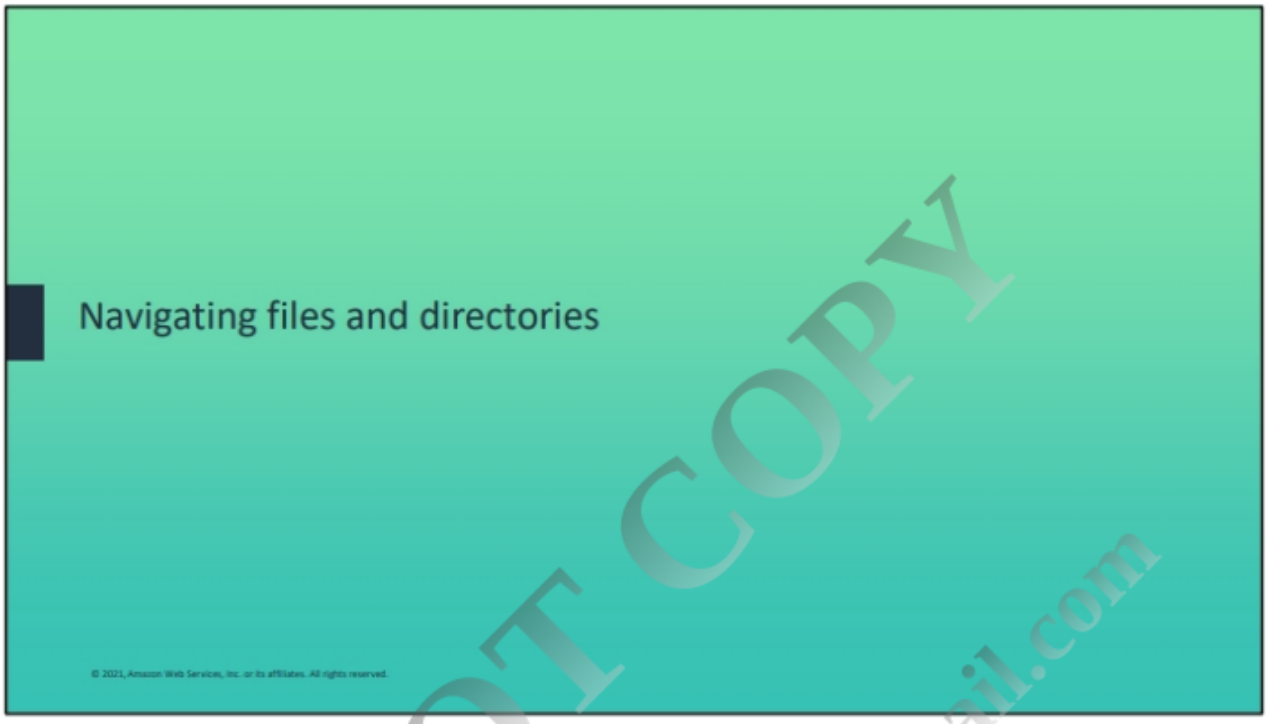
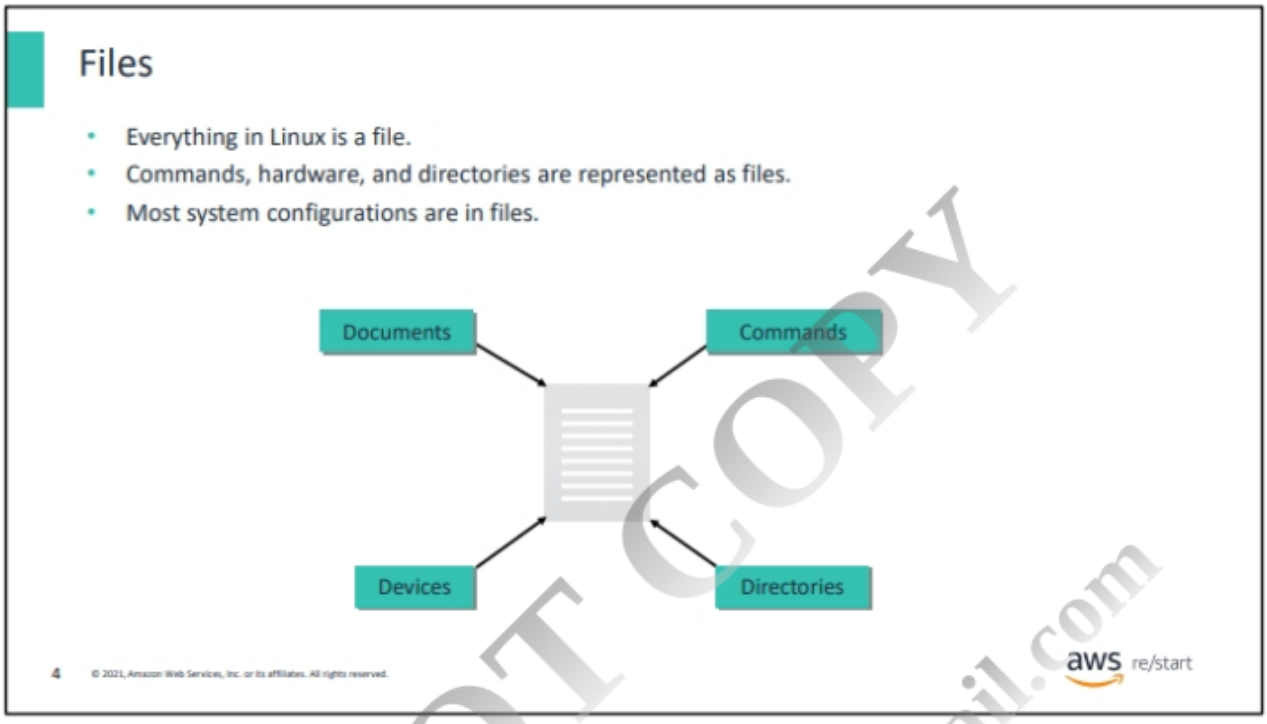
aws re/start

In this lesson, you will learn how to:

- Navigate files and directories in Linux
- Explain basic commands for managing files and directories
- Compare absolute and relative paths

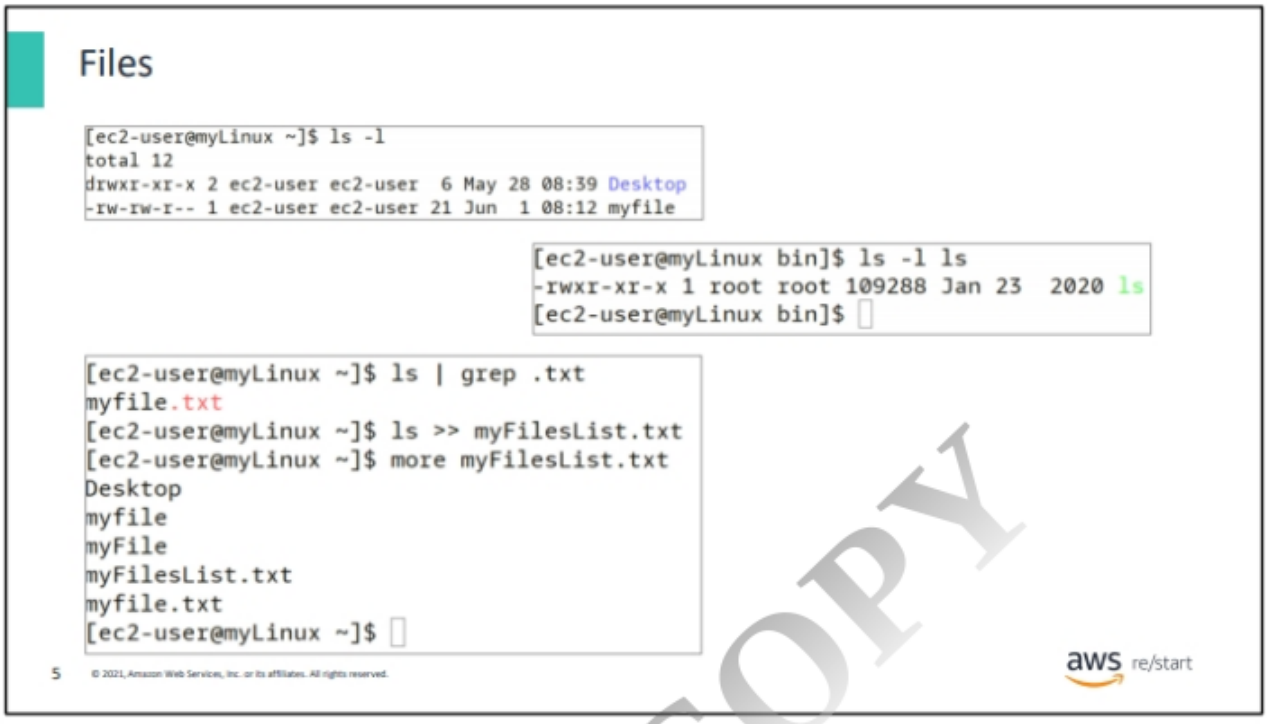


Introducing the Linux file system.

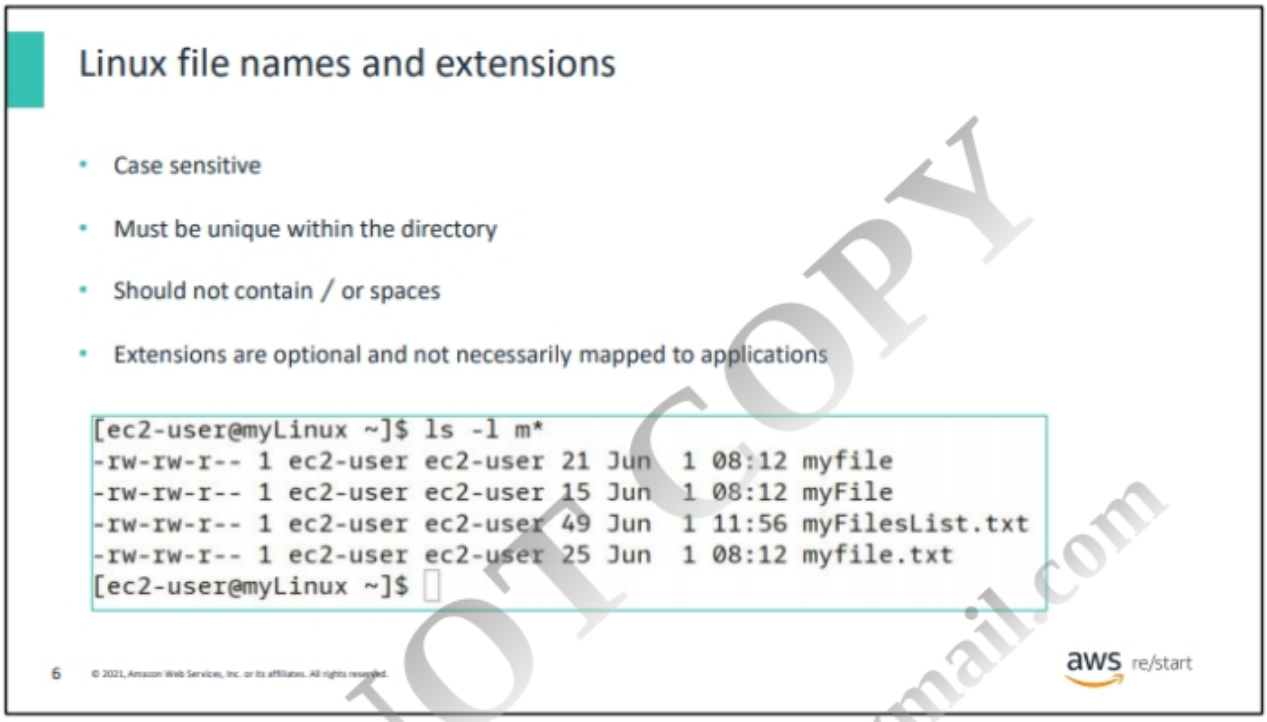


Files allow for transparency: drives, processes, and other elements are all represented as files. They can be browsed and accessed for information (for example, `ls /proc` gives you access to processes).

Files allow for interoperability: the same tools can be used for different types of files and can be combined (for example, `ls -l | grep .txt`).

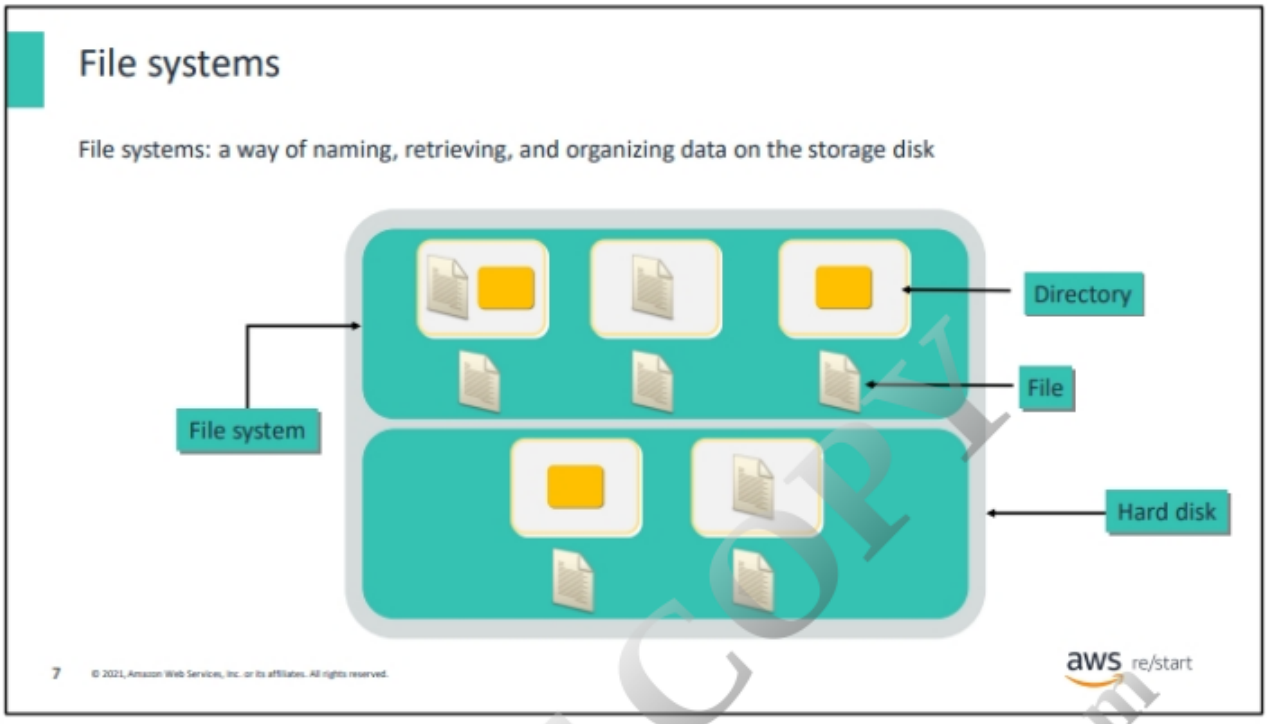


- In the first screenshot, both the directory and the text file are considered as files. The directory is a special kind of file, hence the `d` and the blue color.
- In the second screenshot, you see that you can `list` the `ls` command because it is also a file.
- The third screenshot shows how you can operate between commands.



The screen capture shows three text files: the name is case sensitive and the extension is optional.

You are strongly advised to have consistent extensions. For instance, a .jpg image could be named image.txt even though this extension would not make sense. A user might think that this file is a description file and try to open it with a text editor instead of an image viewer. A better option is to name the image.jpeg or image.jpg.



The file system organizes how files are stored on the hard drive. A file is located inside a directory.

File system hierarchy standard (FHS)

- Standard location and function of directories across Linux distributions
  - Allows software to be compatible with various distributions
  - Allows administrators to predict where certain types of files will be found
- Examples:
  - `/etc` typically contains configuration files
  - `/var/log` typically contains log files

```
[ec2-user@myLinux ~]$ ls /
bin   dev  home  lib64  media  opt   root  sbin  sys  usr
boot  etc  lib   local  mnt    proc  run   srv   tmp  var
[ec2-user@myLinux ~]$
```

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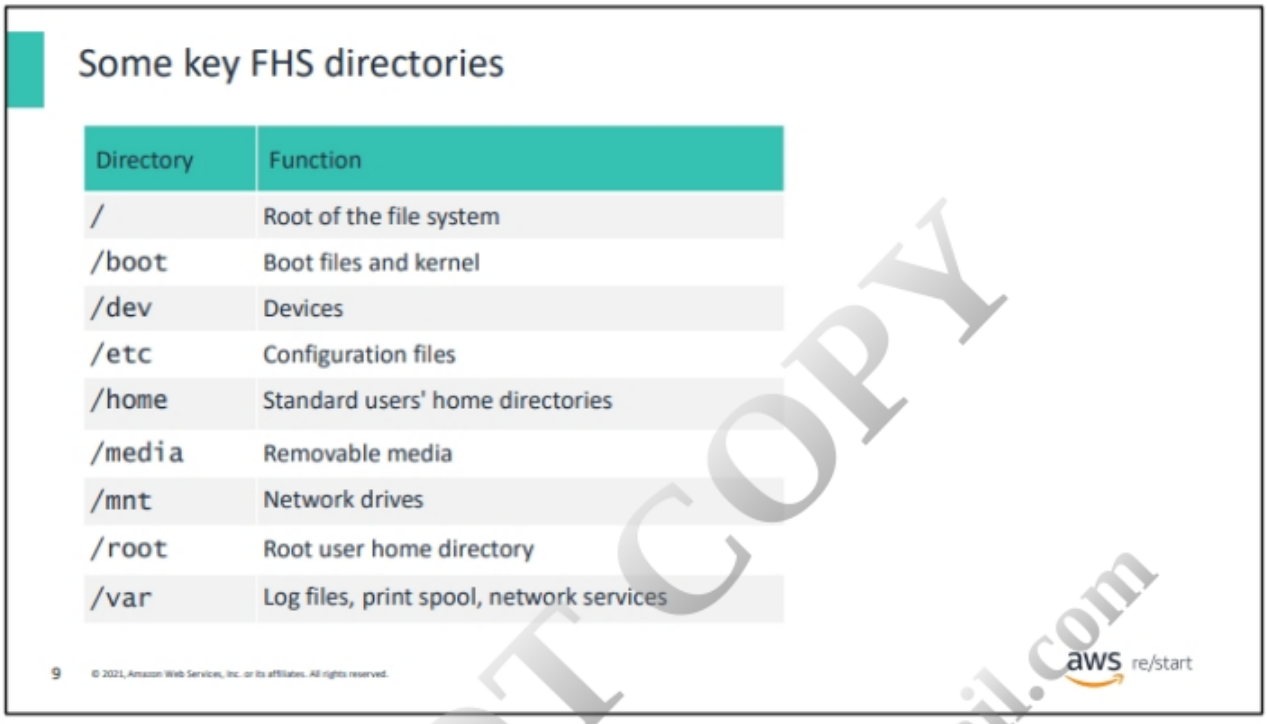
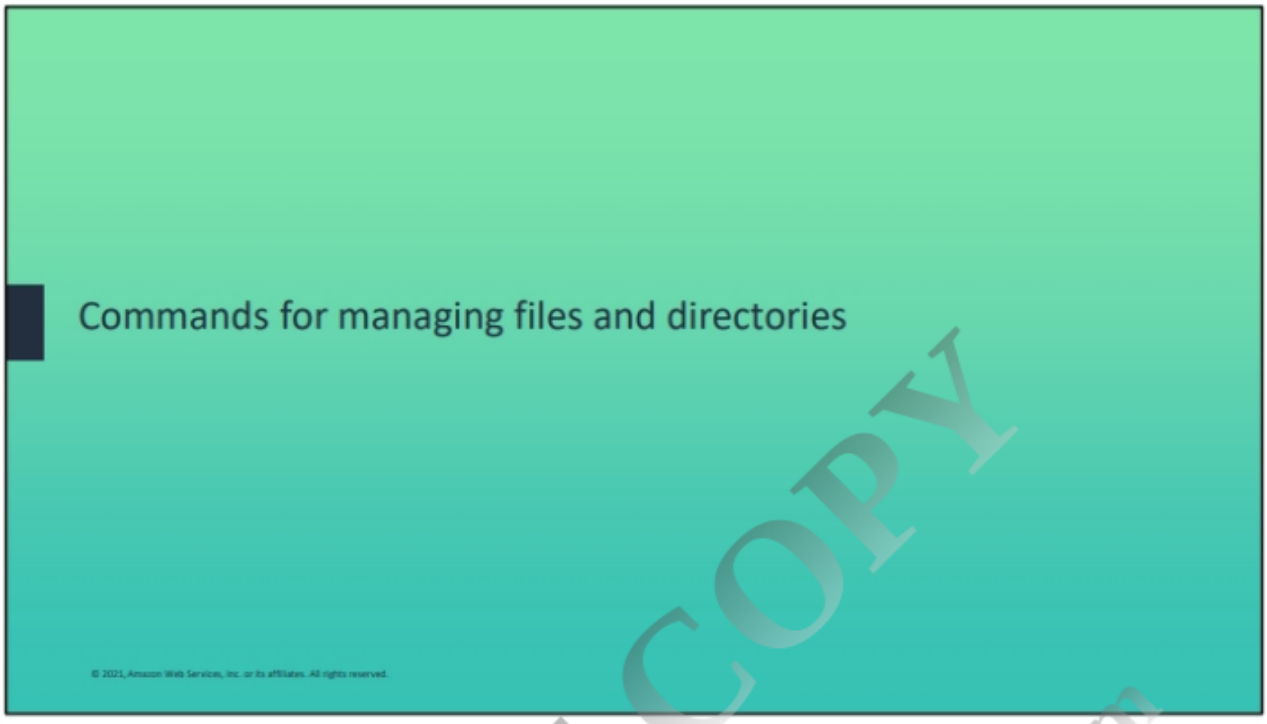
Most Linux distributions use this standard, but some distributions might differ slightly or intentionally use a different file system.



The FHS has many other directories. This list shows a select few.



The following commands are important. They are used to manage files and directories.

Understanding command syntax with the `ls` command

- The `ls` command displays a list of files in a directory.
- Different colors represent different types of files.
- `ls` lists the content of the current directory.
- `ls dir` lists the content of the `dir` directory.

```
[userA@server00 ~]$ ls
backups  Documents  Music     Public     Videos
Desktop  Downloads  Pictures  Templates
[userA@server00 ~]$ ls /var
account  crash     empty   kerberos  lock  nis       run     www
adm      db        games   lib       log   opt       spool   yp
cache    develweb  gopher  local     mail  preserve  tmp
[userA@server00 ~]$
```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Colors are not defined according to a standard. They depend on the configuration of the shell that you are using.

You can list several multiple directories: `ls directory1 directory2`

Useful options for the `ls` command

Option	Description
`-l`	Long format (shows permissions)
`-h`	File sizes reported in a human-friendly format
`-a`	Shows all files, including hidden files
`-R`	Lists subdirectories
`--sort=extension or -X`	Sorts alphabetically by file extension
`--sort=size or -S`	Sorts by file size
`--sort=time or -t`	Sorts by modification time
`--sort=version or -v`	Sorts by version number

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By default, the ls command uses the natural sort order. To get results in the reverse order, add the **–r** option.

You can combine options: `ls -al` displays hidden files and file details.

Examples of the ls command

```
[ec2-user@myLinux ~]$ ls -a
.              .bashrc  .ICEauthority    myfile.txt  .Xauthority
..             .cache   .local           .ssh
.bash_history  .config  myfile           .swp
.bash_logout   .dbus    myFile           .viminfo
.bash_profile  Desktop  myFilesList.txt  .vnc
[ec2-user@myLinux ~]$ ls -al
total 60
drwx------ 9 ec2-user ec2-user   315 Jun  1 11:56 .
drwxr-xr-x 5 root     root        48 May 20 19:30 ..
-rw------- 1 ec2-user ec2-user  3185 Jun  1 10:54 .bash_history
-rw-r--r-- 1 ec2-user ec2-user    18 Jul 15  2020 .bash_logout
-rw-r--r-- 1 ec2-user ec2-user   193 Jul 15  2020 .bash_profile
-rw-r--r-- 1 ec2-user ec2-user   231 Jul 15  2020 .bashrc
drwx------ 3 ec2-user root        25 May 28 08:36 .cache
drwxrwxr-x 7 ec2-user ec2-user    74 May 28 09:15 .config
drwx------ 3 ec2-user ec2-user    25 May 28 08:39 .dbus
drwxr-xr-x 2 ec2-user ec2-user     6 May 28 08:39 Desktop
-rw------- 1 ec2-user ec2-user   624 Jun  1 10:55 .ICEauthority
drwx------ 3 ec2-user ec2-user    19 May 28 08:39 .local
-rw-rw-r-- 1 ec2-user ec2-user    21 Jun  1 08:12 myfile
-rw-rw-r-- 1 ec2-user ec2-user    15 Jun  1 08:12 myFile
-rw-rw-r-- 1 ec2-user ec2-user    49 Jun  1 11:56 myFilesList.txt
```

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- `ls -l`: Lists the contents of the current directory with details. It does not display the hidden files.
- `ls -a`: Displays the hidden files.
- `ls -al`: Displays the hidden files and the file's details (not all of the list is displayed on the screenshot because it would take too much space).

Demonstration: Exploring files and directories

In this demonstration, the instructor will show how to use the `ls` command with various options to view information about files on a Linux system.

```
[labsuser@centos -]$ ls
asnlib  companyA  logins  work
[labsuser@centos -]$ ls -l
total 12
drwxr-x---  3   584731 labsuser 4096 Jan  5 22:37 asnlib
drwxr-xr-x  1 labsuser      1001 4096 Aug 25  2019 companyA
lrwxrwxrwx  1 labsuser labsuser   33 Mar 30 10:02 logins -> companyA/SharedFolders/logins.
csv
drwxrwx---  4 labsuser        48 4096 Mar  5 08:19 work
[labsuser@centos -]$ ls -a
.   asnlib          .bash_logout   .bashrc   logins  .vlog
..  .bash_history   .bash_profile  companyA  .ssh    work
[labsuser@centos -]$ ls -al
total 56
drwxrwx---  1 labsuser        48  4096 Mar 30 10:02 .
drwxr-xr-x  1 root     root      4096 Aug 25  2019 ..
drwxr-x---  3   584731 labsuser  4096 Jan  5 22:37 asnlib
-rw-r--r--  1 labsuser      1001 12438 Aug 25  2019 .bash_history
-rw-r--r--  1 labsuser        48    18 Apr 11  2018 .bash_logout
-rw-r--r--  1 labsuser      1001   199 Aug 25  2019 .bash_profile
-rw-r--r--  1 labsuser        48   246 Aug 21  2019 .bashrc
drwxr-xr-x  1 labsuser      1001  4096 Aug 25  2019 companyA
lrwxrwxrwx  1 labsuser labsuser    33 Mar 30 10:02 logins -> companyA/SharedFolders/logins
.csv
drwx------  1 labsuser        48  4096 Mar 30 09:50 .ssh
-rw-r--r--  1 labsuser      1001   171 Aug 25  2019 .vlog
drwxrwx---  4 labsuser        48  4096 Mar  5 08:19 work
[labsuser@centos -]$
```


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Follow along as the instructor demonstrates the use of the `ls` command.

The more command

- View file contents that don't fit on one screen
- Loads entire contents of files before displaying results
- Can only scroll down
- more can be used in conjunction with other commands:
  cat file.txt | more

```
#       $OpenBSD: sshd_config,v 1.100 2016/08/15 12:32:04 naddy Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/usr/bin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options override the
# default value.

# If you want to change the port on a SELinux system, you have to tell
# SELinux about this change.
# semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
#
#Port 22
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_dsa_key
--More--(19%)
```

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Usage:

```
more [-options] [-num] [+/pattern] [+linenum] [file_name]
```

- Options:
  - -d: Displays information about how to navigate at the bottom of the screen
  - -f: Prevents line wrap
  - -p: Clears the screen before displaying the content
  - -s: Squeezes multiple blank lines into one line
- num: Number of lines to display
- /pattern: String to find in the file
- linenum: Line number where to start displaying the content
- file_name: Name of the file to display the content of

The `less` command

- View file contents that don't fit on one screen
- Can scroll up and down through content
- Loads faster than `more` because `less` doesn't load every page before it displays results
- Mostly used for large files

```
#       $OpenBSD: sshd_config,v 1.100 2016/08/15 12:32:04 naddy Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/usr/bin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options override the
# default value.

# If you want to change the port on a SELinux system, you have to tell
# SELinux about this change.
# semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
#
#Port 22
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_dsa_key
sshd_config
```

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Usage:

```
less [OPTIONS] filename
```

- Use Q to quit
- Options:
  - -N: Shows line numbers
  - -X: Displays the content after the last command and does not clear screen when exiting
  - +F: Watches for file content changes

The head command

- Displays the first 10 lines of a file by default
- With the -n option, you can specify a number of lines to display
- Can display multiple files

```
[ec2-user@myLinux ~]$ head myfile myfile.txt
==> myfile <==
this is another file

==> myfile.txt <==
this is yet another file
[ec2-user@myLinux ~]$
```

```
[ec2-user@myLinux ~]$ sudo head -n 5 /etc/passwd
root:x:0:0:root:/root:/bin/bash
bin:x:1:1:bin:/bin:/sbin/nologin
daemon:x:2:2:daemon:/sbin:/sbin/nologin
adm:x:3:4:adm:/var/adm:/sbin/nologin
lp:x:4:7:lp:/var/spool/lpd:/sbin/nologin
[ec2-user@myLinux ~]$
```

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Usage:

```
head [OPTIONS] filename(s)
```

- Options:
  - -n <number>: First n lines to display
  - -c <number>: First c bytes to display

The `tail` command

- Displays the last 10 lines of a file by default
- With the `-n` option, you can specify a number of lines to display

```
[ec2-user@myLinux ~]$ sudo tail -5 /var/log/boot.log
         Starting Wait for Plymouth Boot Screen to Quit...
[  OK  ] Started Job spooling tools.
         Starting Job spooling tools...
[  OK  ] Started System Logging Service.
[  OK  ] Started Finds and configures elastic network interfaces.
[ec2-user@myLinux ~]$
```

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Usage:

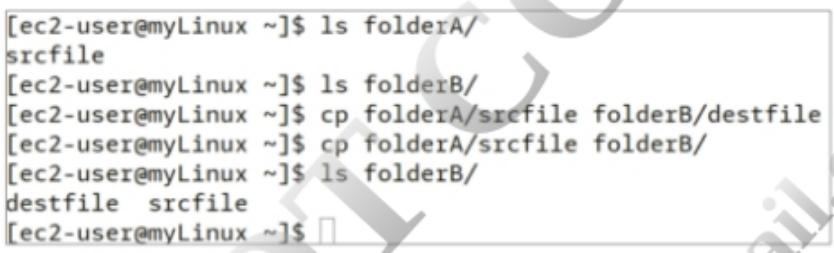
```
tail [OPTIONS] filename(s)
```

- Options:
  - `-n <number>`: Last `n` lines to display
  - `-c <number>`: Last `c` bytes to display
  - `-f`: Monitor for file changes

The `tail -f` command is useful for log files that are regularly updated and where the most recent entries are at the bottom of the file.

The cp command

- The cp command copies files and directories
- By default, the cp command overwrites existing files that have the same name
- Example: cp *<file-name> <destination>*
- For more options, refer to the next slide



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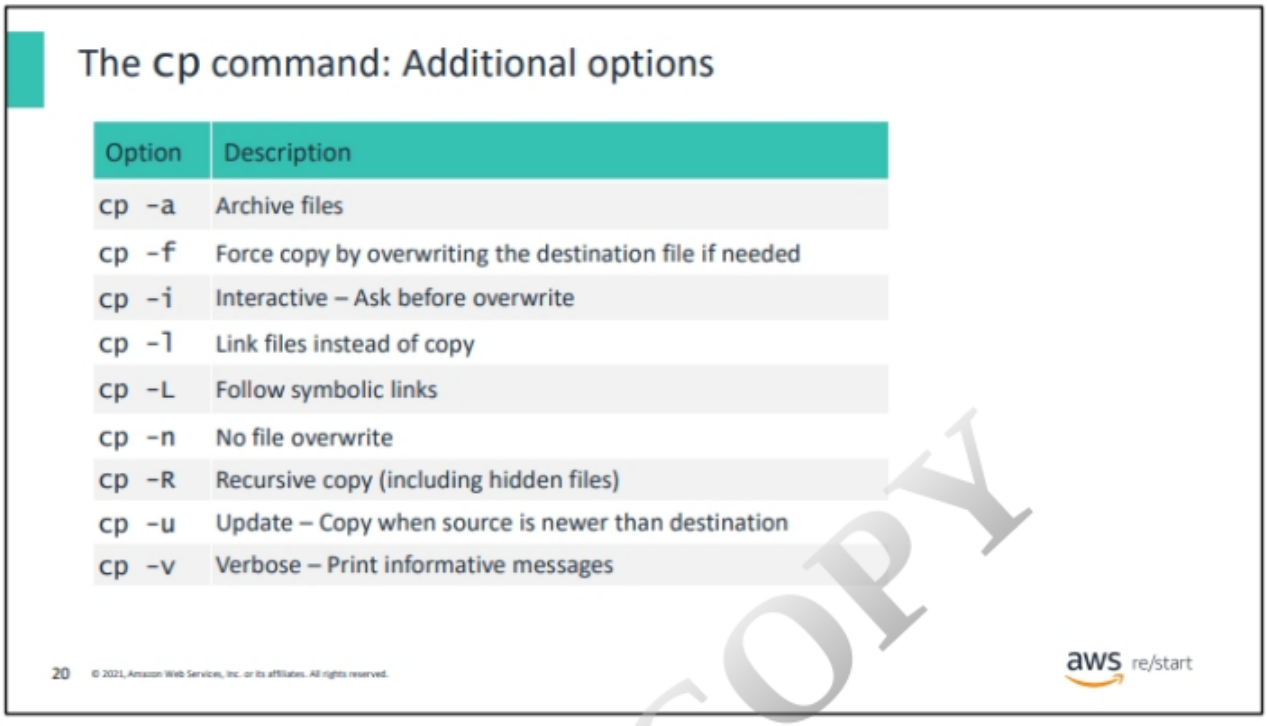
Usage:

`cp folderA/srcfile folderB/destfile`
- Copies the srcfile that is located in folderA to folderB and names it destfile.

`cp folderA/srcfile folderB/`
- Copies the srcfile that is located in folderA to folderB (both files have the same name).

`cp folderA/srcfile folderB/ folderC/destfile`
- Copies the srcfile that is located in folderA to folderB and to folderC with the name destfile.



The slide shows additional options for the cp command that you might use.

The rm command

- Deletes a file
- There is no undelete or Recycle Bin

```
[userA@server00 Documents]$ ls
file1.txt
[userA@server00 Documents]$ rm file1.txt
[userA@server00 Documents]$ ls
[userA@server00 Documents]$
```

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Usage:

```
rm [OPTIONS] filename(s)
```

- Options:
  - `-d`: Removes a directory; the directory must be empty: `rm -d dir`
  - `-r`: Allows you to remove a non-empty directory: `rm -r dir`
  - `-f`: Never prompt user (useful when deleting a directory with many files)
  - `-i`: Prompts the user for confirmation for each file
  - `-v`: Display the names of deleted files

- If a file is write protected, a prompt will ask the user for confirmation.
- Several files can be removed at once.
- If you want to remove a complete directory, use the –r and –f option: `rm -rf dir`
- You can use a regular expression: `rm *.png` removes all files that end with .png.

The mkdir command

Creates new directories

```
[userA@server00 ~]$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
[userA@server00 ~]$ mkdir NewProject
[userA@server00 ~]$ ls
Desktop    Downloads  NewProject  Public     Videos
Documents  Music      Pictures    Templates
[userA@server00 ~]$
```

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Usage:

`mkdir [OPTIONS] filename(s)`

- Options:
  - `-m <mask>`: Sets a permission to the directory
  - `-p`: Creates parent directory
- You can create several directories with one command: mkdir dir1 dir2 dir3
  - mkdir –m 700 dir1: Creates the `dir1` directory with the mask 700 for permissions
  - mkdir –p /home/user/dir1/dir2: If `dir1` does not exist, the creation will fail without the `-p` option

The mv command

- Moves a file from one directory to another
- Renames a file if the source and destination are the same

```
[userA@server00 Documents]$ ls
file1.txt  file1.txt.backup
[userA@server00 Documents]$ mv file1.txt.backup ~/backups/
[userA@server00 Documents]$ ls ~/backups/
file1.txt.backup
[userA@server00 Documents]$
```

Note: By default, the mv command overwrites existing files that have the same name.

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Usage:

```
mv [OPTIONS] source destination
```

- Options:
  - `-i`: Prompts before overwritting a file
  - `-f`: Avoid being prompted
  - `-n`: Do not overwrite existing files
  - `-v`: Verbose option, prints the name of files that are moved or renamed
  - `mv file1 dir1`: Moves file1 to dir1
  - `mv dir1 dir2`: Moves dir1 to dir2
  - `mv file1 file2 dir1 dir2`: Moves file1, file2, and dir1 to dir2; there can only be one target directory here, dir2
  - `mv file1 dir1/file2`: Moves file1 to dir1 and renames it file2
  - `mv file1 file2`: Renames file1 as file2

- You can use a regular expression to move files of the same type:
  - `mv *.png dir1`: Moves all files with extension .png into dir1

The `rmdir` command

- Deletes existing empty directories: `rmdir <DirectoryName>`
- If a directory isn't empty, use `rm -r <DirectoryName>`
  - This command removes a directory and all of its contents.

```
[userA@server00 ~]$ ls
Desktop    Downloads  NewProject  Public     Videos
Documents  Music      Pictures    Templates
[userA@server00 ~]$ rmdir NewProject/
[userA@server00 ~]$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
[userA@server00 ~]$
```


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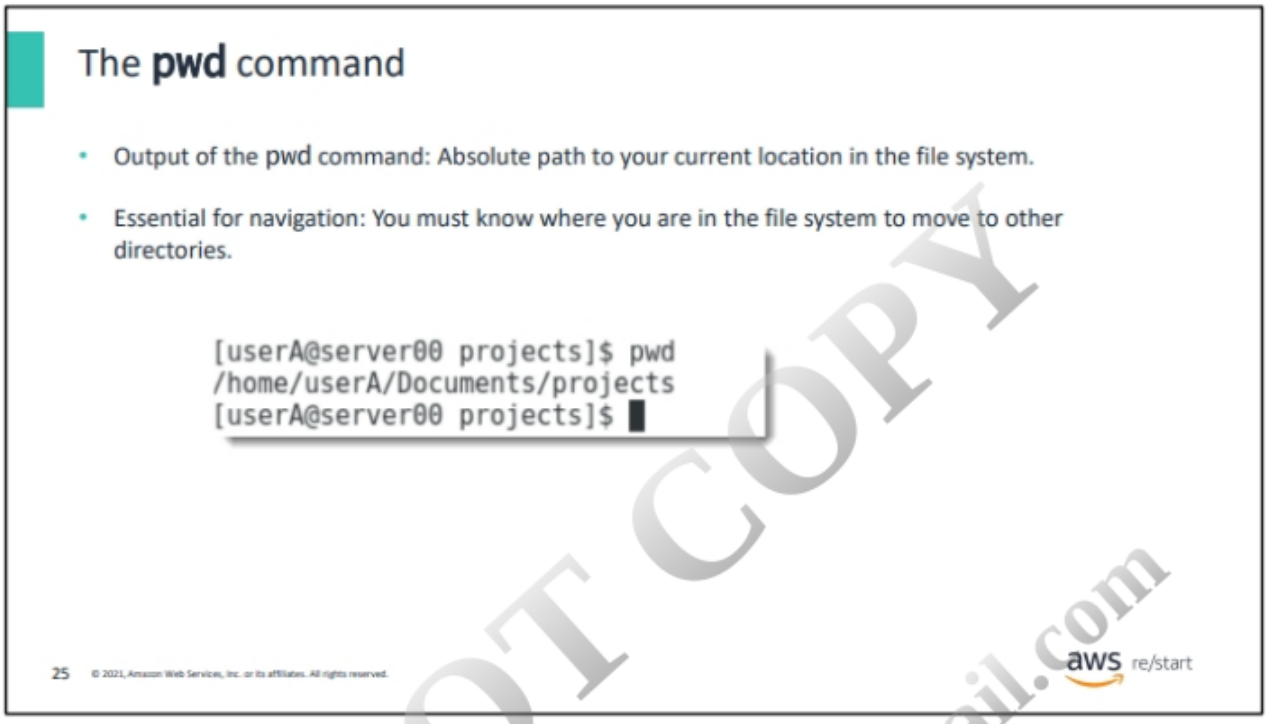
`rmdir` is equivalent to `rm -d`



Use the pwd command to know where you are in the file directory structure.

Demonstration: Managing files and directories

In this demonstration, the instructor will show you how to:

- Create, move, copy, and delete files
- Create and delete directories

```
[labsuser@centos companyA]$ ls
FolderListing.csv  IA          Roster.csv  securecopy.txt  Shipping
HR                 Management  Sales       SharedFolders
[labsuser@centos companyA]$ touch employeeList.csv
[labsuser@centos companyA]$ mkdir Employees
[labsuser@centos companyA]$ mv employeeList.csv  Employees/
[labsuser@centos companyA]$ rm -rf IA
[labsuser@centos companyA]$ ls
Employees          HR          Roster.csv  securecopy.txt  Shipping
FolderListing.csv  Management  Sales       SharedFolders
[labsuser@centos companyA]$ ls Employees/
employeeList.csv
[labsuser@centos companyA]$
```

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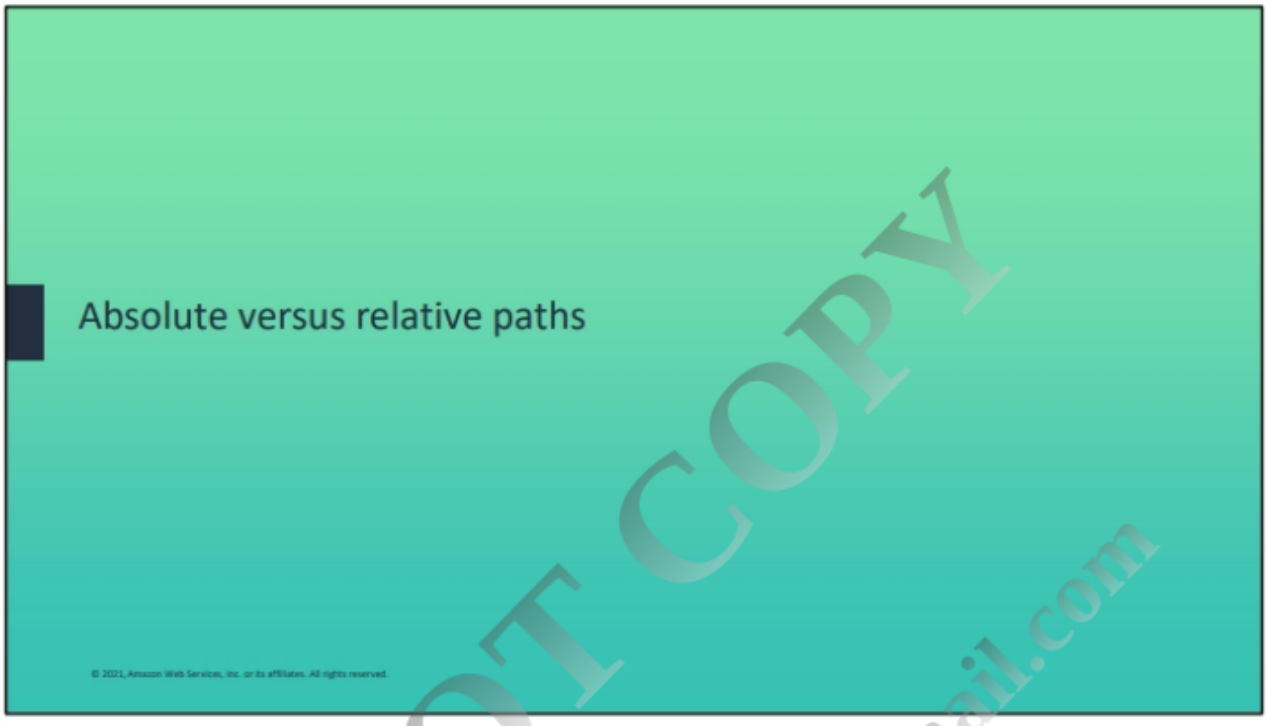
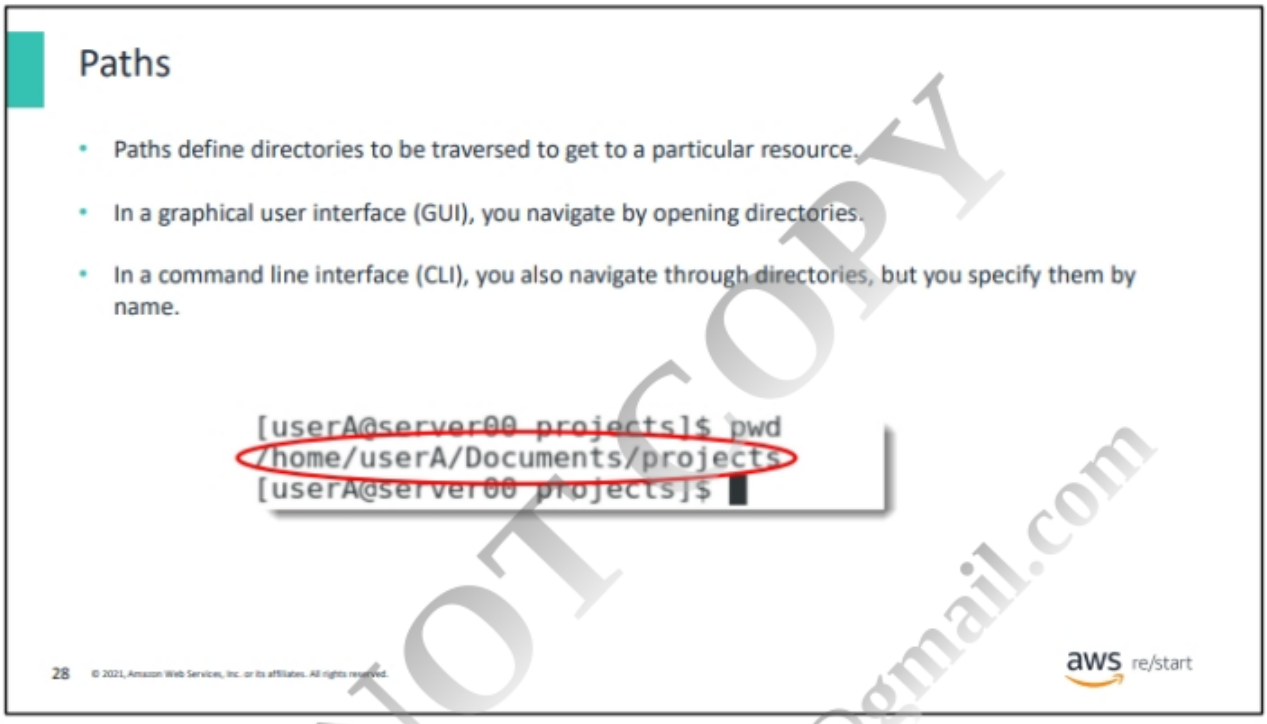
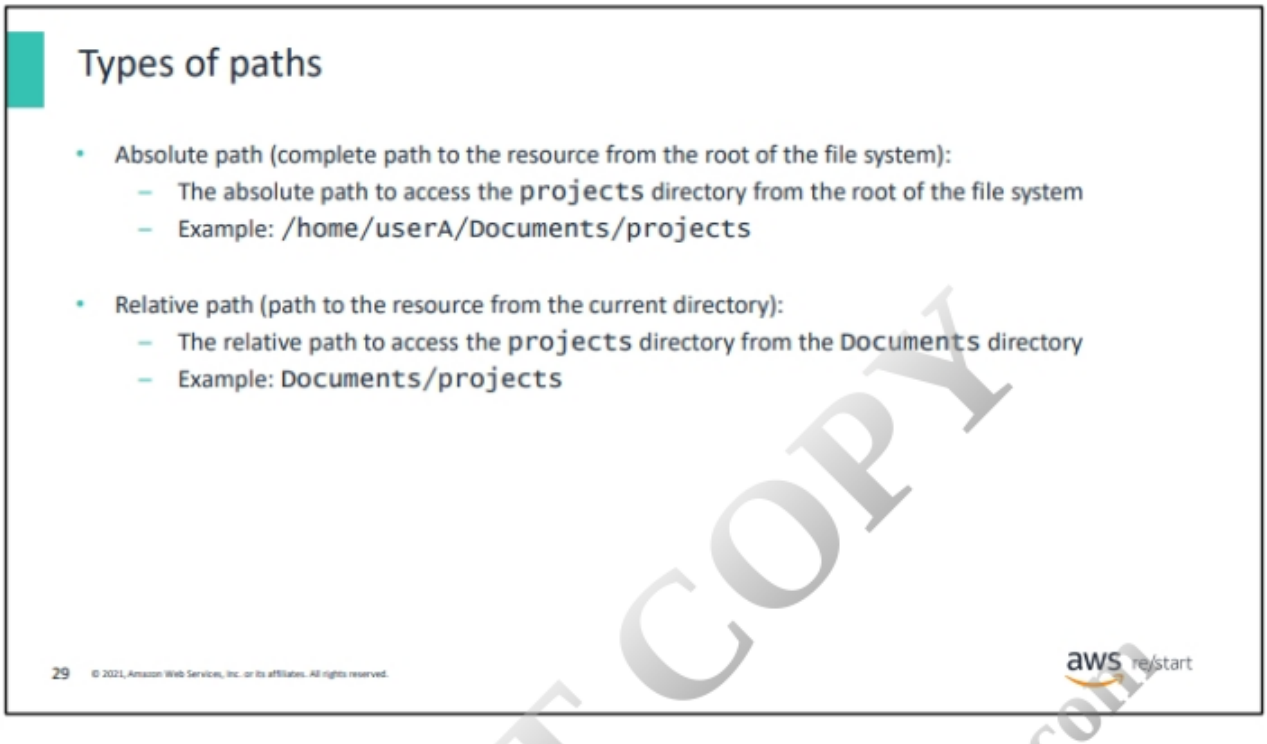
Follow along as the instructor creates, moves, copies, and deletes files and creates and deletes directories.



You must know the difference between absolute and relative paths.



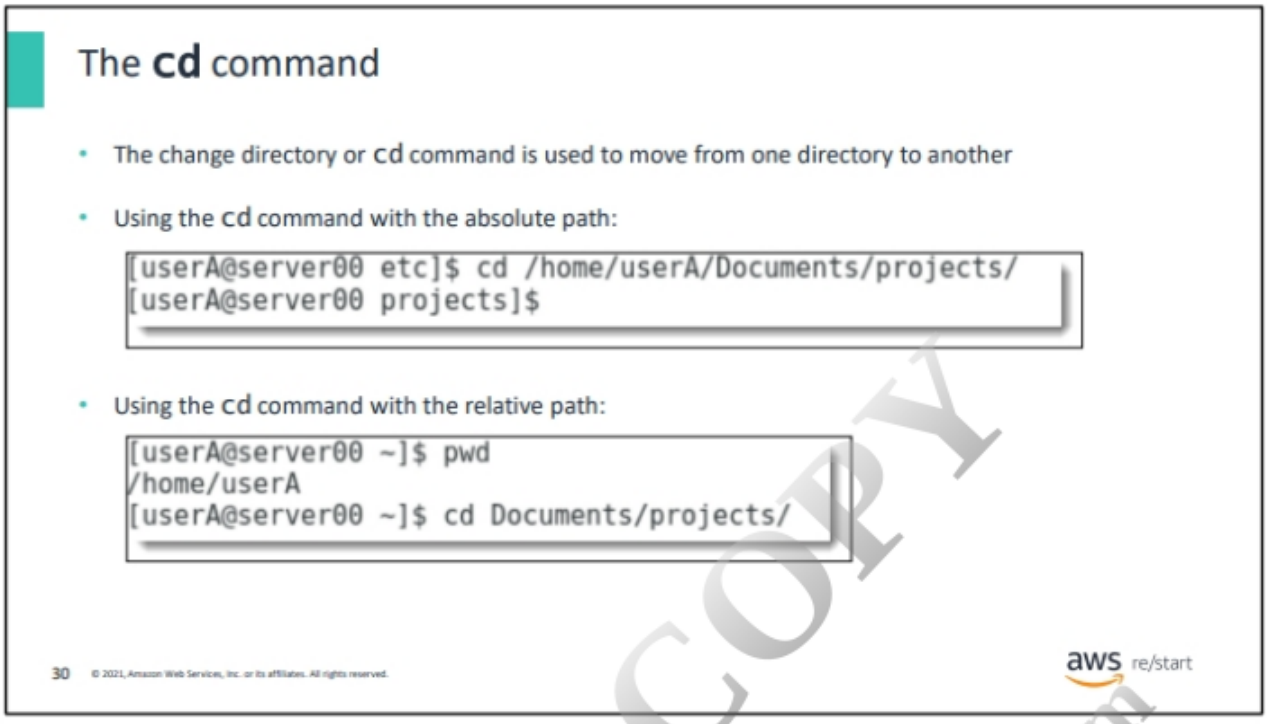
You must know how to navigate directories by both a GUI and a CLI.



Suppose the command `pwd` tells you that you are in the folder `/home/ec2-user`.

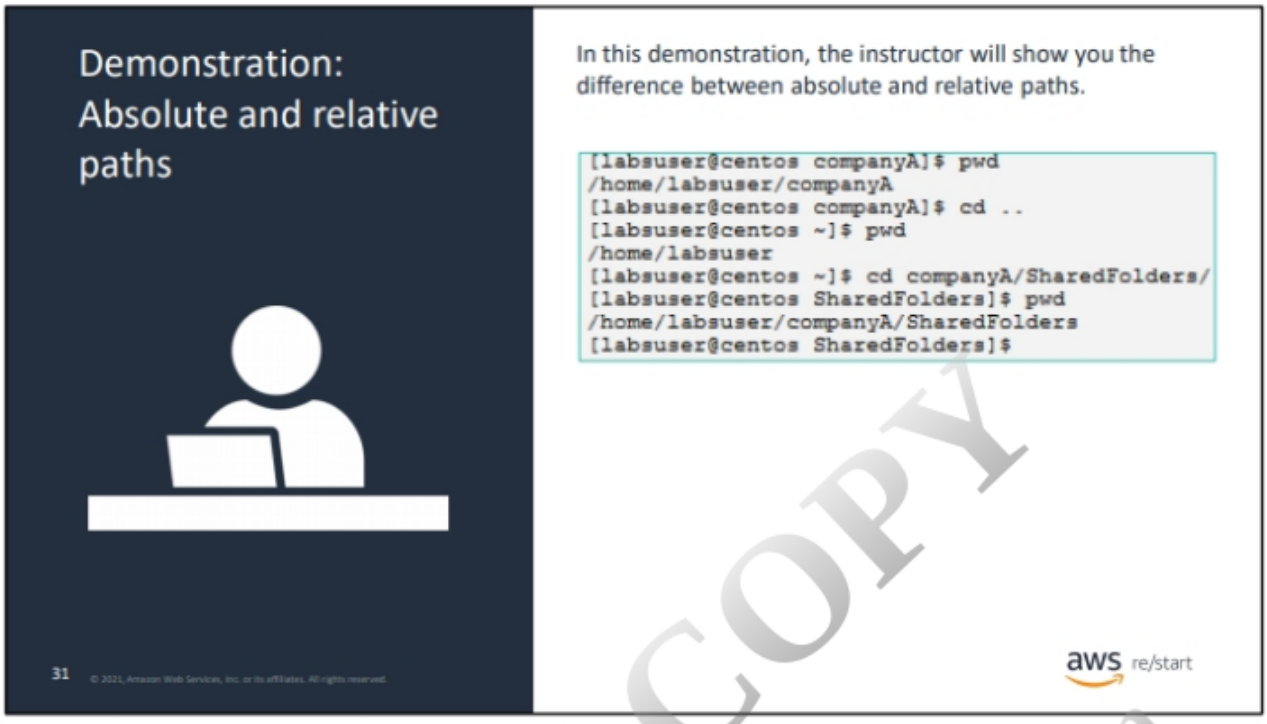
`cd /home/userA/Documents/projects` will navigate to the `/home/userA/Documents/projects` folder.

`cd Documents/projects` will navigate to the `/home/ec2-user/Documents/projects` folder (currentfolder/Document/projects, where current folder is /home/ec2-user).

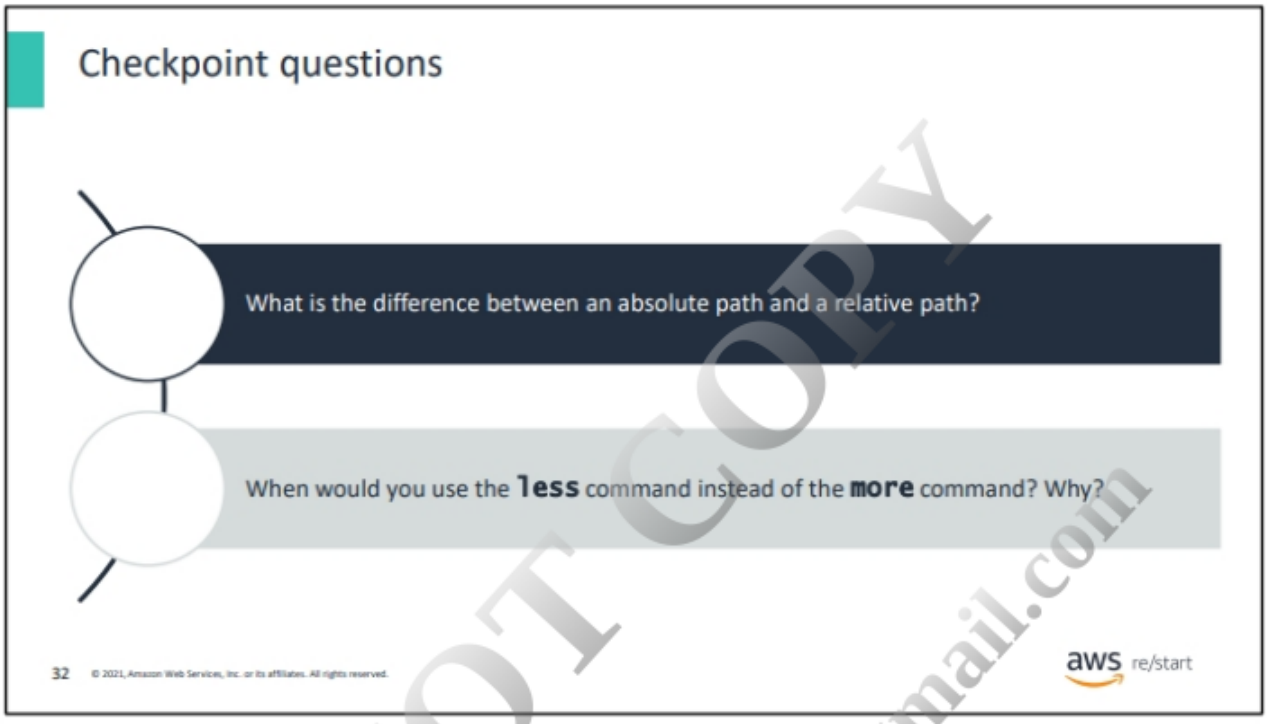


Tip: Use `../` to go up a single directory at a time.

For example, if you are in the /home/userA folder, `cd ../` will navigate to /home.

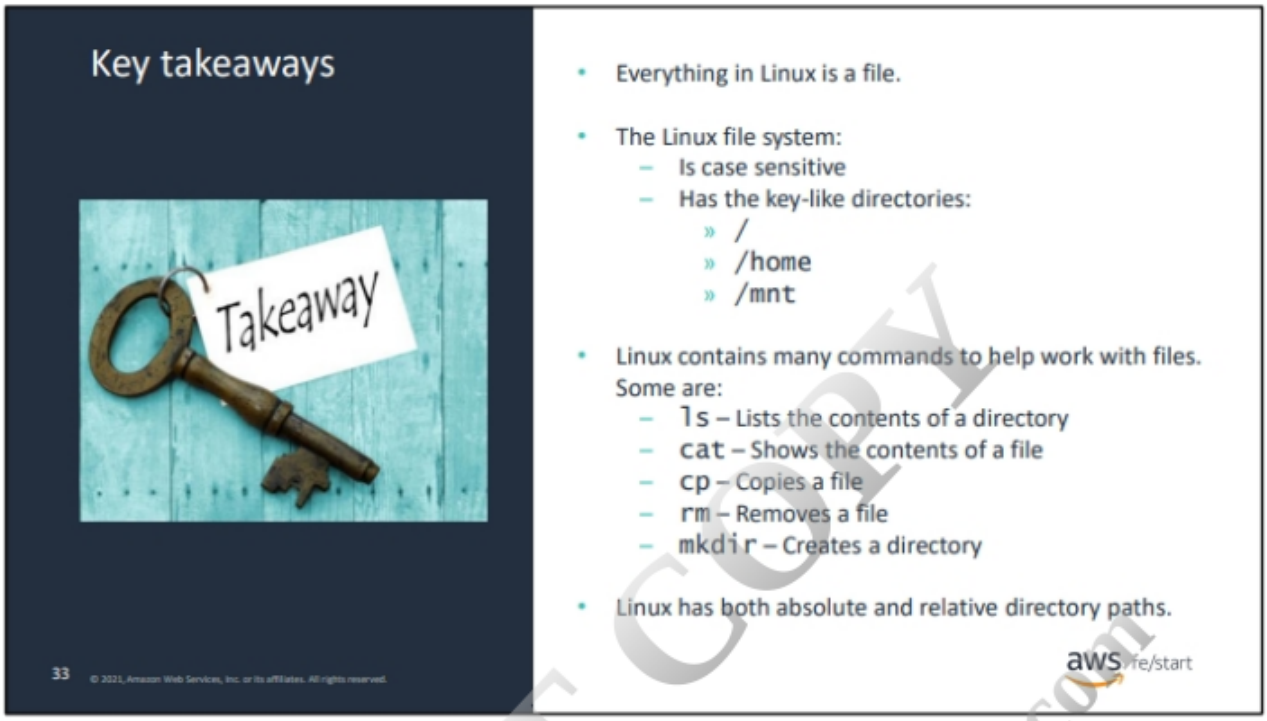


Follow along as the instructor demonstrates the difference between absolute and relative paths.



Answers:

1. The absolute path shows the entire folder structure to the resource that is being used. The absolute path to `my_file.txt` in the `Documents` directory would be something like `/Users/user_name/Documents/Labwork/my_file.txt`.
   The relative path shows only from the current directory to the file that is being used. From the previous example, within the `user_name` directory, the relative path to the file is `/Documents/Labwork/my_file.txt`.
2. You use the `less` command if you want to scroll backward through a file. With the `more` command, you can only scroll forward through a file.



Some key takeaways from this lesson include the following:

- Everything in Linux is a file.
- The Linux file system is case sensitive and has key-like directories.
- Linux contains many commands to help work with files.
- Linux has both absolute and relative directory paths.