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COMPUTER ENGINEERING DEPARTMENT

Operating systems

LINUX FILE DIRECTORIES

LAB MANUAL 3

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Lab objective

In this lab, you will explore the Linux file system, including the basic concepts of files and directories and their organization in a hierarchical tree structure.

File and Directories

- ✚ A **directory** is a collection of files and/or other directories
 - Because a directory can contain other directories, we get a directory **hierarchy**
- ✚ The 'top level' of the hierarchy is the **root directory**
- ✚ Files and directories can be named by a **path**
 - Shows programs how to find their way to the file
 - The root directory is referred to as /
 - Other directories are referred to by name, and their names are separated by slashes (/)
- ✚ If a path refers to a directory it can end in /
- ✚ Usually an extra slash at the end of a path makes no difference

Linux Files and Directories

Examples of Absolute Paths

- ✚ An **absolute path** starts at the root of the directory hierarchy, and names directories under it:
`/etc/hostname`
 - Meaning the file called *hostname* in the directory *etc* in the root directory
- ✚ We can use `ls` to list files in a specific directory by specifying the absolute path:
`$ ls /usr/share/doc/`

Current Directory

- ✚ Your shell has a **current directory** — the directory in which you are currently working
- ✚ Commands like `ls` use the current directory if none is specified



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- Use the pwd (print working directory) command to see what your current directory is:

```
$ pwd
```

```
/home/fred
```

- Change the current directory with cd:

```
$ cd /mnt/cdrom
```

```
$ pwd
```

```
/mnt/cdrom
```

- Use cd without specifying a path to get back to your home directory

Making and Deleting Directories

- The mkdir command makes new, empty, directories

- For example, to make a directory for storing company accounts:

```
$ mkdir Accounts
```

- To delete an empty directory, use rmdir:

```
$ rmdir OldAccounts
```

- Use rm with the -r (recursive) option to delete directories and all the files they contain:

```
$ rm -r OldAccounts
```

- Be careful — rm can be a dangerous tool if misused

Relative Paths

- Paths don't have to start from the root directory

- A path which doesn't start with / is a **relative path**
- It is relative to some other directory, usually the current directory

- For example, the following sets of directory changes both end up in the same directory:

```
$ cd /usr/share/doc
```



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\$ cd /

\$ cd usr

\$ cd share/doc

Relative paths specify files inside directories in the same way as absolute ones

Special Dot Directories

Every directory contains two special filenames which help making relative paths:

- The directory `..` points to the parent directory
 - `ls ..` will list the files in the parent directory
- For example, if we start from `/home/fred`:

\$ cd ..

\$ pwd

`/home`

\$ cd ..

\$ pwd

`/`

The special directory `.` points to the directory it is in

- So `./foo` is the same file as `foo`

Using Dot Directories in Paths

The special `..` and `.` directories can be used in paths just like any other directory name:

\$ cd ../other-dir/

- Meaning “the directory *other-dir* in the parent directory of the current directory”

It is common to see `..` used to ‘go back’ several directories from the current directory:

\$ ls ../../../../far-away-directory/



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- ✚ The. directory is most commonly used on its own, to mean “the current directory”

Hidden Files

- ✚ The special . and .. directories don't show up when you do ls
 - They are **hidden files**
- ✚ Simple rule: files whose names start with . are considered 'hidden'
- ✚ Make ls display all files, even the hidden ones, by giving it the -a (all) option:
\$ ls -a
.
..
.bashrc
.profile
report.doc
- ✚ Hidden files are often used for configuration files
 - Usually found in a user's home directory
- ✚ You can still read hidden files — they just don't get listed by ls by default

Paths to Home Directories

- ✚ The symbol ~ (tilde) is an abbreviation for your home directory
 - So for user 'fred', the following are equivalent:
\$ cd /home/fred/documents/
\$ cd ~/documents/
- ✚ The ~ is **expanded** by the shell, so programs only see the complete path
- ✚ You can get the paths to other users' home directories using ~, for example:
\$ cat ~alice/notes.txt
- ✚ The following are all the same for user 'fred':
\$ cd
\$ cd ~
\$ cd /home/fred



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Looking for Files in the System

- The command `locate` lists files which contain the text you give
- For example, to find files whose name contains the word 'mkdir':
\$ locate mkdir
`/usr/man/man1/mkdir.1.gz`
`/usr/man/man2/mkdir.2.gz`
`/bin/mkdir`
...
- `locate` is useful for finding files when you don't know exactly what they will be called, or where
- they are stored
- For many users, graphical tools make it easier to navigate the filesystem
 - Also make file management simpler

Running Programs

- Programs under Linux are files, stored in directories like `/bin` and `/usr/bin`
 - Run them from the shell, simply by typing their name
- Many programs take options, which are added after their name and prefixed with -
- For example, the `-l` option to `ls` gives more information, including the size of files and the date they were last modified:
\$ ls -l

<code>drwxrwxr-x</code>	<code>2</code>	<code>fred</code>	<code>users</code>	<code>4096</code>	<code>Mar 01 10:57</code>	<code>Accounts</code>
<code>-rw-rw-r--</code>	<code>1</code>	<code>fred</code>	<code>users</code>	<code>345</code>	<code>Mar 01 10:57</code>	<code>notes.txt</code>
<code>-rw-r--r--</code>	<code>1</code>	<code>fred</code>	<code>users</code>	<code>3255</code>	<code>Mar 01 10:57</code>	<code>report.txt</code>
- Many programs accept filenames after the options
 - Specify multiple files by separating them with spaces



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Specifying Multiple Files

- ✚ Most programs can be given a list of files
 - For example, to delete several files at once:
\$ rm oldnotes.txt tmp.txt stuff.doc
 - To make several directories in one go:
\$ mkdir Accounts Reports
- ✚ The original use of cat was to join multiple files together
 - For example, to list two files, one after another:
\$ cat notes.txt morenotes.txt
- ✚ If a filename contains spaces, or characters which are interpreted by the shell (such as *), put
 - single quotes around them:
\$ rm 'Beatles - Strawberry Fields.mp3'
\$ cat '* important notes.txt *

Finding Documentation for Programs

- ✚ Use the man command to read the manual for a program
- ✚ The manual for a program is called its **man page**
 - Other things, like file formats and library functions also have man pages
- ✚ To read a man page, specify the name of the program to man:
\$ man mkdir
- ✚ To quit from the man page viewer press q
- ✚ Man pages for programs usually have the following information:
 - A description of what it does
 - A list of options it accepts
 - Other information, such as the name of the author



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Specifying Files with Wildcards

- Use the * wildcard to specify multiple filenames to a program:

```
$ ls -l *.txt
```

```
-rw-rw-r-- 1 fred users 108 Nov 16 13:06 report.txt
```

```
-rw-rw-r-- 1 fred users 345 Jan 18 08:56 notes.txt
```

- The shell expands the wildcard, and passes the full list of files to the program

- Just using * on its own will expand to all the files in the current directory:

```
$ rm *
```

- (All the files, that is, except the hidden ones)

- Names with wildcards in are called **globs**, and the process of expanding them is called **globbing**

Chaining Programs Together

- The who command lists the users currently logged in

- The wc command counts bytes, words, and lines in its input

- We combine them to count how many users are logged in:

```
$ who | wc -l
```

- The | symbol makes a **pipe** between the two programs

- The output of who is fed into wc

- The -l option makes wc print only the number of lines

- Another example, to join all the text files together and count the words, lines and characters in

- the result:

```
$ cat *.txt | wc
```




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Graphical and Text Interfaces

- ✚ Most modern desktop Linux systems provide a **graphical user interface** (GUI)
- ✚ Linux systems use the X window system to provide graphics
 - X is just another program, not built into Linux
 - Usually X is started automatically when the computer boots
- ✚ Linux can be used without a GUI, just using a command line
- ✚ Use Ctrl+Alt+F1 to switch to a text console — logging in works as it does in X
 - Use Ctrl+Alt+F2, Ctrl+Alt+F3, etc., to switch between virtual terminals — usually about 6 are provided
 - Use Ctrl+Alt+F7, or whatever is after the virtual terminals, to switch back to X

Text Editors

- ✚ Text editors are for editing plain text files
 - Don't provide advanced formatting like word processors
 - Extremely important — manipulating text is Unix's *raison d'être*
- ✚ The most popular editors are Emacs and Vim, both of which are very sophisticated, but take
 - time to learn
- ✚ Simpler editors include Nano, Pico, Kedit and Gnotepad
- ✚ Some programs run a text editor for you
 - They use the \$EDITOR variable to decide which editor to use
 - Usually it is set to vi, but it can be changed
 - Another example of the component philosophy



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4- Exercises

Q1

- a. Use the `pwd` command to find out what directory you are in.
- b. If you are not in your home directory (*/home/USERNAME*) then use `cd` without any arguments to go there, and do `pwd` again.
- c. Use `cd` to visit the root directory, and list the files there. You should see *home* among the list.
- d. Change into the directory called *home* and again list the files present. There should be one directory for each user, including the user you are logged in as (you can use `whoami` to check that).
- e. Change into your home directory to confirm that you have gotten back to where you started.

Q2

- a. Create a text file in your home directory called *shakespeare*, containing the following text:
Shall I compare thee to a summer's day?
Thou art more lovely and more temperate
- b. Rename it to *sonnet-18.txt*.
- c. Make a new directory in your home directory, called *poetry*.
- d. Move the poem file into the new directory.
- e. Try to find a graphical directory-browsing program, and find your home directory with it. You should also be able to use it to explore some of the system directories.
- f. Find a text editor program and use it to display and edit the sonnet.



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Q3

- From your home directory, list the files in the directory */usr/share*.
- Change to that directory, and use `pwd` to check that you are in the right place. List the files in the current directory again, and then list the files in the directory called *doc*.
- Next list the files in the parent directory, and the directory above that.
- Try the following command, and make sure you understand the result:
\$ echo ~
- Use `cat` to display the contents of a text file which resides in your home directory (create one if you haven't already), using the `~/` syntax to refer to it. It shouldn't matter what your current directory is when you run the command.

Q4

- Use the `hostname` command, with no options, to print the hostname of the machine you are using.
- Use `man` to display some documentation on the `hostname` command. Find out how to make it print the IP address of the machine instead of the hostname. You will need to scroll down the manpage to the 'Options' section.
- Use the `locate` command to find files whose name contains the text 'hostname'. Which of the filenames printed contain the actual `hostname` program itself? Try running it by entering the program's absolute path to check that you really have found it.

Q5

- The `*` wildcard on its own is expanded by the shell to a list of all the files in the current directory. Use the `echo` command to see the result (but make sure you are in a directory with a few files or directories first)



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- b. Use quoting to make echo print out an actual * symbol.
- c. Augment the *poetry* directory you created earlier with another file, *sonnet-29.txt*:
When in disgrace with Fortune and men's eyes,
I all alone beweeep my outcast state,
- d. Use the cat command to display both of the poems, using a wildcard.
- e. Finally, use the rm command to delete the *poetry* directory and the poems in it.