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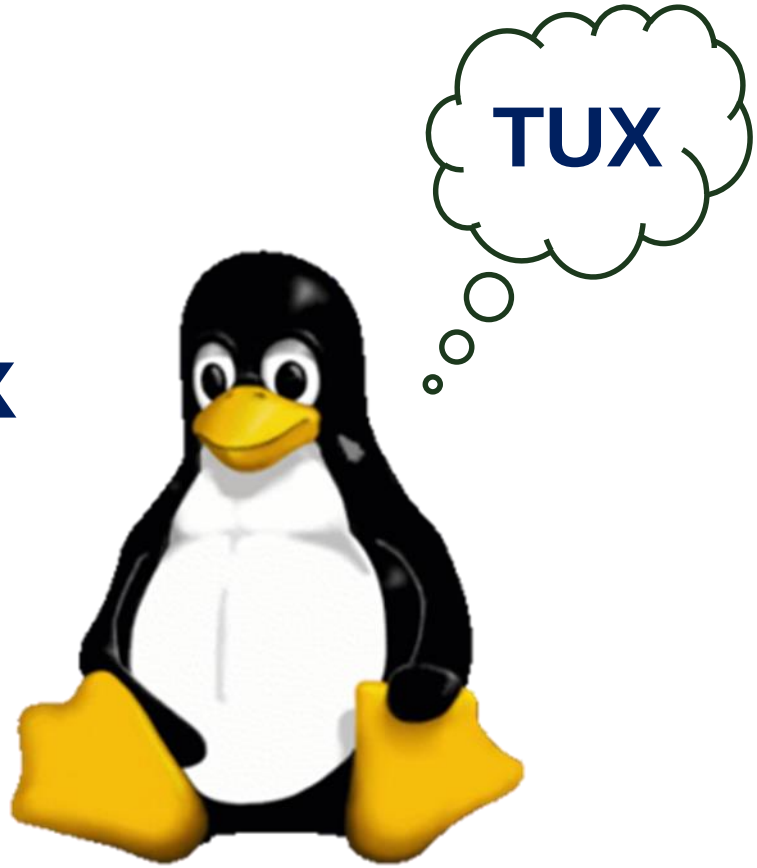
Introduction to Linux



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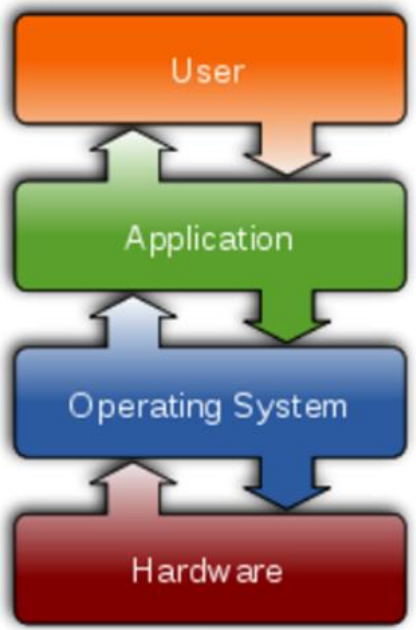
Learning Outcomes

- Understand what a computer operating system is.
- Understand the structure of Linux file system.
- Use basic Linux commands to navigate the file system and examine data.

Operating System

Operating System

- What is Operating System (OS)?
  - A set of software programs that controls the computer.
  - Manages activities and resources of a computer software that acts as an interface between hardware and user.



Linux

- What is Linux?
  - Standard operating system (alternative to Windows OS, Mac OS).
  - Provides a way for you to interact with the computer.
  - An open-sourced **Unix**-clone
  - Around 600+ Linux distributions available currently.

Linux Distributions

Components of Linux System

Hardware	• Consist of all peripheral devices (RAM/ HDD/ CPU etc).
Kernel	• The core component of the OS. Interacts directly with the hardware. It is responsible for all major activities of the OS.
System Library	• Special functions or programs which accesses Kernal features.
System Utility	• Responsible to do specialized, individual level tasks. It provides the user most of the functionalities of an OS.

Brief History

History

- The **UNIX** operating system was developed in the late 1960s.
- It originally began as a one-man project led by Ken Thompson of Bell Labs and has since grown to become the most widely used operating system.
- In the time since UNIX was first developed, it has gone through many different generations and versions.
- An interesting and rather up-to-date timeline of these variations of UNIX can be found at:

  https://www.computerhope.com/history/unix.htm

The Early Years

Ken Thompson (sitting) and Dennis Ritchie, the fathers of Unix. PDP-11 mini computer on which the first edition of Unix (*Credit: Sheila Gibbon/lexleader.net*)

The Rise of Linux

Linus Torvalds the creator of Linux.
Photo Credit: Lf Asia/Lc3 2018

- **Linus Benedict Torvalds**, started developing Linux as a hobby. He wanted to create a system similar to UNIX while still a student at the University of Helsinki.
- In 1991, Torvalds, (at 21 years of age) **released the source code** for Linux 0.0.1 to the world, effectively **introducing a freely available Unix-like operating system kernel**.
- **LINUX** was created and altered UNIX history forever.

Advantages of Linux

Advantages of Linux

- **Why use Linux?**
  - It is an open-source operating system.
  - It is more secure.
  - Availability of Bioinformatics tools.
  - Higher Performance.
  - Software updates.
  - Various Linux distributions.
  - It has large community support.

Freedom to choose any software. The softwares are mostly free!

Source: https://www.stickycomics.com/computer-update/

Shell

Shell

The terms “**terminal**”, **“shell”** and “**command line interface**” are often used interchangeably, but there are subtle differences between them:

A **terminal** is an input and output environment that presents a text-only window running a shell.

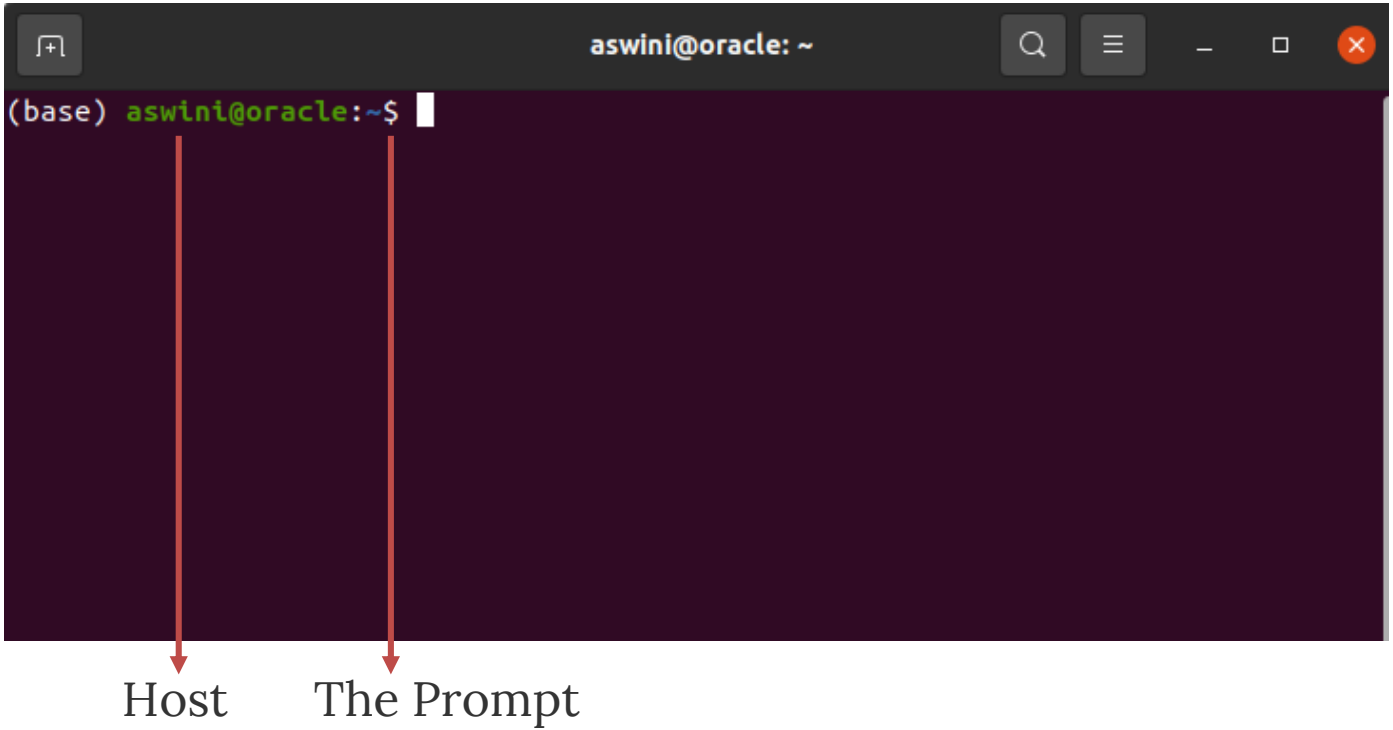
A **shell** is a command line interpreter, used to launch software in Linux.

A **command line interface** is a user interface (managed by a command line interpreter program) that processes commands to a computer program and outputs the results.

Shell

- When someone refers to one of these three terms in the **context of Linux**, they generally mean a **terminal environment**, such as this:

The Terminal



Working with the Terminal

The terminal interprets commands the user types and manages their execution.

Commands are **CASE SENSITIVE!**

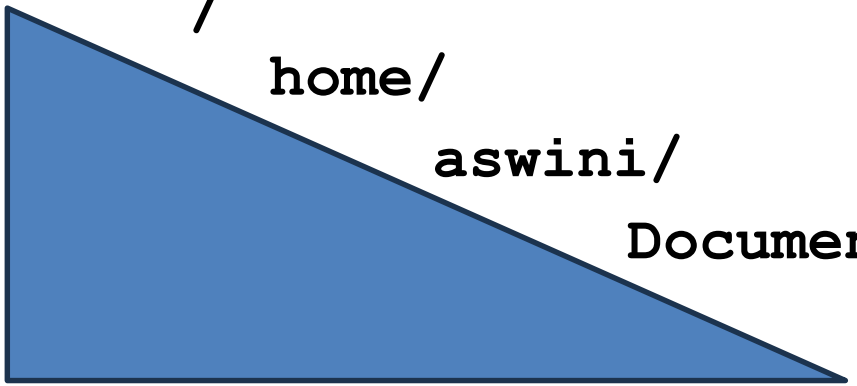
Understanding Linux File Systems

Understanding Linux File System

Consists of a hierarchical set of directories (folders).

Each directory can contain files. Drives can appear at arbitrary points in the file system.

A Simple Linux File System



(Always the top of the file system)

(Directory containing all home directories)

(user)

(A Directory)

(A file we want to work with)

/home/aswini/Documents/test.txt

```
media/
    myusb/
```

(A USB stick added to the system)

/media/aswini/myusb

Specifying File Path

Absolute paths from the top of the file system:

/home/aswini/Documents/Data/some_file.txt

Relative paths from whichever directory you are currently in:

If I'm in /home/aswini/Documents/

Data/some_file.txt

Paths using the home shortcut:

/home/aswini/Documents/Data/some_file.txt

~/Documents/Data/some_file.txt

Mini Practical
(Hands-on using Terminal)

Basic Command Line- System Commands

Commands	Function
pwd	show current directory
ls	show files in current directory
cd	change directory
cp	copy file or directory
mv	move file or directory
rm	remove file or directory
mkdir	create directory
rmdir	remove directory
less, more, cat	display file contents
man	display online manual

Where am I?

pwd

Print name of the “current working directory”

pwd

/home/manager

Linux path begins at the root directory (represented by “ / ”) which is the top level of the file system

“ / ” is used to separate directory and file names

A new beginning…

`mkdir`

Create a new directory

mkdir practical1	- make it
ls	- check it
cd practical1	- go there

Going somewhere else?

cd

Change directory

- pwd

/home/manager/practical1/linux

- cd .. (return to the previous directory)

/home/manager/practical1

- cd (change to user's home directory)

/home/manager/

- cd ~ (change to user's home directory)

/home/manager/

File Path Shortcuts

Shortcut	Description
~ (tilde)	your home directory. ➢ **/home/manager**
. (single dot)	the current directory.
.. (double dot)	the parent of the working directory or the directory immediately above the current directory. ➢ **/home/manager/practical1/linux** ➢ **/home/manager/practical1**

What have we here?

`ls`

List contents of the current working directory

- Command:
  - ls : list content of the current directory
  - ls -l : detailed list

The end?

`rmdir`

Removes a directory

rmdir linux

Provided you are not on that directory.

**Will not prompt for confirmation!*

How do I get help?

`man`

Display the manual for a given program

man ls - see manual for the “ls” command
man bash - learn about that other shell
man man - read the manual for the manual

**to return to the command prompt, type “q”*

Create it!

`touch`

Create a file

touch myfile.txt

Write it!

echo

Command that helps us move some data, usually text into a file

```
echo hello > myfile.txt
```

**Usually use text editors such as nano, gedit or vim*

View it!

cat

Displays the content of a file / concatenate files into single file

cat myfile.txt (display content of file)

cat myfile.txt myfile2.txt > file3.txt (combine 2 files into output file)

Less is More!

`less`

Displays the content of a file

less file.txt - display content of file

**to return to the command prompt, type “q”*

From the top?

head

Browse the content from the beginning of the file

head myfile.txt - display first 10 lines of a file

-n : print n lines in the file (default: 10)

head -2 myfile.txt

From the bottom?

`tail`

Browse the content from the end of the file

tail myfile.txt - display bottom 10 lines of a file

-n : print n lines in the file (default: 10)

tail -2 myfile.txt

Copy it!

Copy a file

(does not delete original)

cp myfile.txt file4.txt

- change name, keep original

Move it!

mv

Move or rename a file

(deletes the original file)

mv file4.txt file5.txt

- change name

Remove it!

`rm`

Remove a file forever

rm file5.txt

**Will not prompt for confirmation!*

Download it!

wget

Download file from website

wget -c https://www.ebi.ac.uk/ena/browser/api/fasta/KX257619.1?lineLimit=1000

Word Count!

wc

Count the words in a file

wc file.txt

Wildcard!

A quick way to be able to specify multiple related file paths in a single operation.

ls *.txt

Command line completion

- A common error while using command line are typing errors in either program names or file paths.
- Shells can help with this by offering to complete path names for you.
- Command line completion is achieved by typing a partial path and then pressing the **TAB** key (to the left of Q).

Command line completion

Actual files in a folder:

```
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
```

If I type the following and press tab:

`De` **[TAB]** will complete to `Desktop` as it is the only option

`T` **[TAB]** will complete to `Templates` as it is the only option

`Do` **[TAB] [TAB]** will show `Documents` and `Downloads` since those are the only options

`Do` **[TAB] [TAB]** `c` **[TAB]** will complete to `Documents`

Command line completion

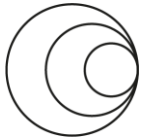
You should ALWAYS use TAB completion to fill in paths for locations which exist so you can't make typing mistakes.

Practical Exercises

Practical Exercises

- The tutorials were created by **Jacqui Keane** and **Martin Hunt.**
- The practical exercises can be found in **/home/manager/course_data/unix**
- There are multiple sections:

(a) Introduction to UNIX	1. Basic Unix
	2. Files
	3. grep
(b) Advanced UNIX for Bioinformatics	4. awk
	5. Bash scripts
	6. Advanced bash



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Thank you!

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