What is UNIX?

A Little Bit about UNIX and User Interfaces

What is UNIX?

▉ It is a ***multi-user, multi-tasking*** operating system.

✳ An ***operating system*** is a program or collection of programs that manage the computer's hardware and software resources and provide an interface so that people can use the computer.

Operating systems do things like managing memory, managing I/O devices, deciding which programs should run, and protecting users' data from each other.

What does "multi-user" mean?

- *Multi-user*: when two or more people can work on the same computer at the same time, using different *terminals*.

- A *terminal* is a device with a monitor and a keyboard. (The concept is more complex than this, but for now think of it this way. There are also special windows called *pseudo-terminals*.)

What about multi-tasking?

- ***Multi-tasking***: when two or more programs can be running on the computer at the same time.
- This does not imply that there has to be more than one processor; they can "time-share" the processor in the same way that people time-share a vacation house.
- Even modern Windows and Macintosh operating systems support multi-tasking. (Take a look at the list of applications and processes in the Windows "Task Manager".)

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Why all the fuss about UNIX?

- UNIX is a professional operating system that lets you do sophisticated tasks easily.
- It lets you customize your work environment and create new commands.
- It is inherently very secure because of the way it was designed (***but it is not immune to attacks***).
- There are free versions of it that are easily obtained. ***Linux*** is one of the most popular versions of UNIX that can be obtained for free, ***but not the only one!***

Why did UNIX become popular?

- UNIX was unique in that it was:
  - *Portable*: It was easily modified to work on new types of computers as they came into existence (because it was written in C, a novel idea back then.)
  - *Very Small*: The original version of Unix was about 10,000 lines of C, and about 1,000 lines of assembler. (Windows Vista had about 50,000,000 lines of code.)
  - *Free*: It was distributed to universities and research laboratories for free by AT&T.
  - *Innovative*: It had many features that were not part of any other operating systems.

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User interfaces: The UNIX advantage

- Every computer operating system provides one or more *user interfaces*.

- A *user interface* is the part of the operating system that allows the user to *direct* the operating system, i.e., to tell it what to do.

- The primary user interface of the Mac OS and Windows is a *graphical user interface* (*GUI*), in which you use a point-and-click device (e.g., mouse) and keyboard to direct the operating system.

The UNIX user interface

- In contrast, you tell UNIX what to do by typing *commands* in a command window, like the DOS `cmd.exe` window. There is no need for a mouse.

- This type of user interface is called a *command-line interpreter* or *interface* (*CLI*).

- *Commands* are essentially imperative verbs, *always in lowercase letters*, like "`logout`", "`sort`" or "`date`". You can sometimes figure out what they do by their names.

UNIX, in a nutshell

The main component of any operating system is the part that controls the hardware and software resources of the computer. In UNIX, it is called the *kernel*, because like the kernel of a nut, it is hidden away.
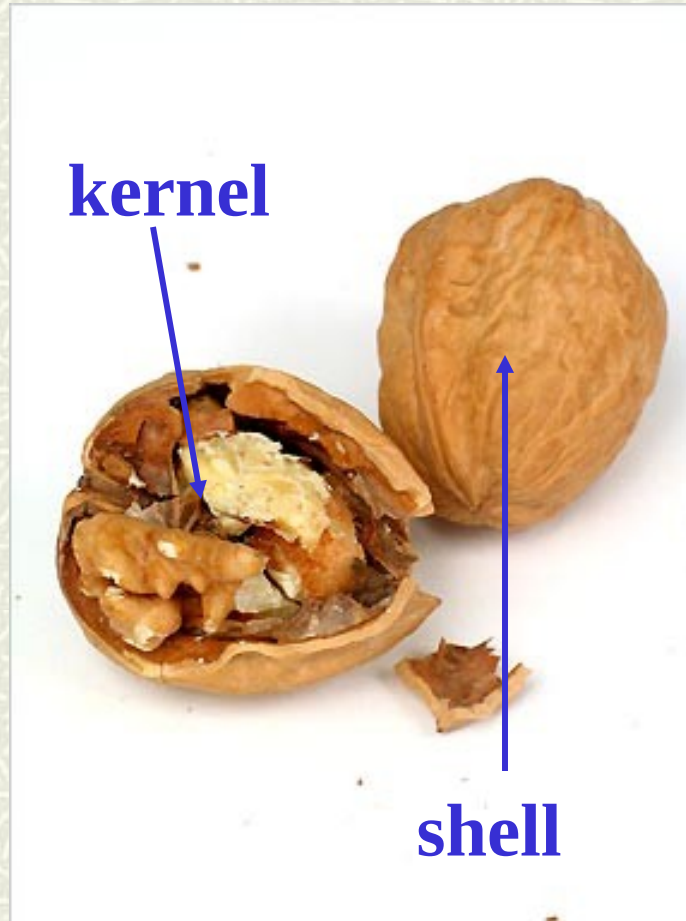
kernel

shell

The command-line interface is the visible part, but it hides the inner workings of the kernel. It is called a *shell* in UNIX.

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Shells

- There are many different shells in UNIX, such as:
    - the Bourne shell (**sh**),
    - the C-shell (**csh**),
    - the Korn shell (**ksh**),
    - the T C-Shell (**tcsh**),
    - the Z shell (**zsh**), and
    - the Bourne-Again Shell (**bash**)
- **bash** is a very popular shell among UNIX users.

What the shell looks like

All shells work in the same way, displaying a prompt, waiting for you to type, and responding:

```
$ ls my_directory
analysis    rawdata    trials
$ date
Mon Jul 14 21:02:36 EDT 2014
$ whoami
sweiss
```

(What you type is colored red ONLY IN THE SLIDES in order to distinguish between entered commands and UNIX's response.)

You'd rather use a GUI?

- You may think that having to type on the keyboard is a minus, not a plus. It is not.

- For one, UNIX has ***hundreds of commands***. They are much more powerful than those you find in a system such as Windows.

- Suppose `files_to_copy` is the name of a file that has the names of files that you want to back up. Try doing this in a GUI:

  `cp `cat files_to_copy` backupdir`

  which copies all files whose names are in `files_to_copy` into the directory `backupdir`.

Composing commands (1)

■ UNIX also lets you *compose commands* and create your own commands by writing shell scripts, because the shells are also programming language interpreters!

■ UNIX shells let you *pipe* the output of one command into another, as in this example:

```
who | awk '{print $1}'| sort | uniq
```

which prints a sorted list of names of users currently logged into the computer, and as in

```
cat f1 f2 f3 | sort -u
```

which sorts files `f1`, `f2`, and `f3` and removes duplicate lines.

Shell Scripts

- The previous examples used a simple but powerful command composition operator called a ***pipe***. Later you will learn more about pipes and other means of altering the flow of inputs and outputs in ***shell scripts***.

- Scripts are lists of shell commands that are executed all at once, like batch files in DOS. Scripts can be extremely powerful, as you will discover.

UNIX Graphical User Interfaces

- Modern UNIX systems for desktop computers, such as Linux, also come bundled with one or more desktop environments with windows, menus, and a GUI.
- *GNOME* and *KDE* were the most prevalent desktops for Linux. There are many others now.
- Within the desktop, UNIX looks like a typical Windows or Macintosh machine, but this is just appearance. *It is still UNIX underneath*.

Linux Desktop Environments

This is one of my desktops, with a VMD window on display. It has the "look and feel" of a Mac or Windows computer.

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