WORKING IN UNIX ENVIRONMENTS: THE SHELL

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Recomendaciones para Clases virtuales

Concentración

Atención es muy importante

Comodidad

Estar muy cómodos NO , lo necesario.

¿Quiénes somos?

A pesar de la distancia, todavía somos personas. No existe manera adecuada de decirlo, pero POR FAVOR PRENDAN LA CÁMARA

Ambientación

Iluminación y sonido adecuados. Evitar el celular y las distracciones innecesarias

Disfrutar

Aprender puede ser frustrante, más si estamos solos. Pero la verdad no estamos solos. Si es necesario, interrumpan y volvemos a comenzar.

the big question

Computation

What is computation?

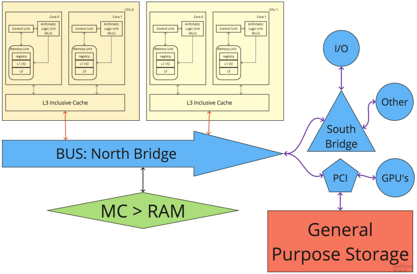
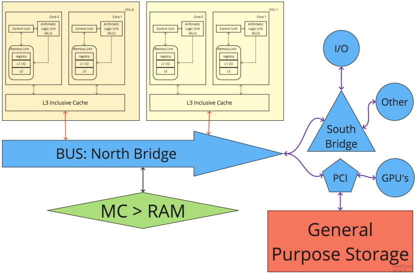


Figure: Von Neumann Architechture

the big question



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Computation

What is computation?

Key infrastructure components

- Storage
- RAM
- Processing block: registries, instruction sets and clock
- FPGA's, GPU's, accelerators and other alternate processing units (RaspBerries, portable devices . . . ARM)
- Compilers - Machine language

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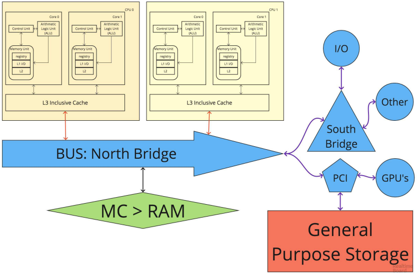

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Limitations & Complications

1. All of the above
2. Education: infrastucture topology, coding strategies, profiling & optimization
3. Interpreted languages
4. Unix like systems
5. Time - accelerating technologies and real-time applications

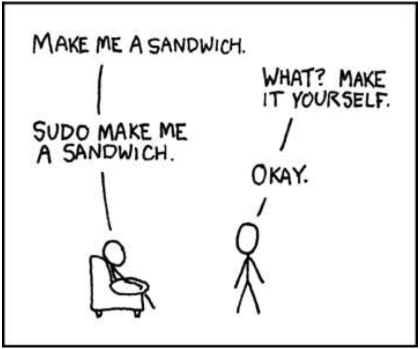

Figure: Not my jokes

Here comes UNIX

the big question

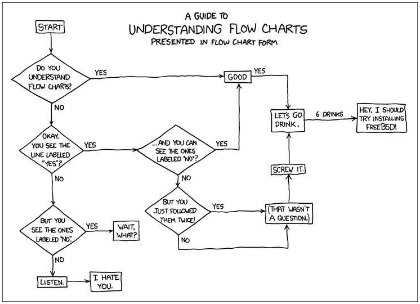

Figure: Not my jokes

Here comes UNIX

Advantages?

- † Uniform access to components
- † Kernel designed for administrating tasks, managing resources: the kernel space
- † Intuitively transparent for the user. Everything is accessible
- ⋆ Security
- † The shell: "One shoe fit for all"
- ‡ Software: C (Dennis Ritchie)
- ‡ Propietary Licensing to "Open Source" (BSD, FreeBSD & Linux)
- △ People, science & culture

⋆'s and △ is HPC

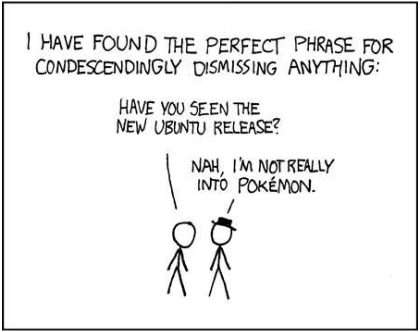

Figure: Not my jokes

Here comes UNIX
Until we have. . . Ubuntu

Why a Linux system?

Advantages of Unix-like systems

- Filesystems (*df -hT*): NFS, Journaled, EXT, XFS, <long filenames>, we hate spaces
- Advanced Kernel
- Everything is a file! Even RAM, procs, eth, CPU, ... (*lscpu, lspci, /dev/*?, /proc/*?*)
- Free / OpenSource software / Package Managers
- one shoe fit for all - terminal concept (Command Line Interpreter or CLI)
- Highly configurable - steep learning curve
- Your best friend: StackOverflow

Enter a terminal: *MyBinder*

Experience the command line

Useful commands

- Help: *man*, *info*, *-h* or *–help*
- Navigation: *ls*, *cd*, *pwd*, *tree*
- Locations: */*, *~*

Enter a terminal: *MyBinder*

Experience the command line

Useful commands

- Display: *echo*, *less*, *more*, *cat*, *head*, *tail*, editors (Nano, Vim, Emacs)!
- File/Directory manipulation: *mkdir*, *tar*, *zip* & *unzip*, *cp*, *scp*, *mv*, *rm*
- Dummy or symbolic files/directories: *touch*, *mktemp*, *ln*
- Testing: *sleep*, *test*

Enter a terminal: *MyBinder*

Experience the command line

Useful commands

- Searching: *locate*, *find*, *grep*, *whereis*
- Computing resources accounting: *top* & *htop*, *ps*, *jobs*
- Storage and devices info: *df*, *du*, *free*, *lsblk*, *lspci*, *lscpu*
- Detailed information on commands: *type* & *which*, *stat*

Enter a terminal: *MyBinder*

Experience the command line

Useful commands

- For loops: *seq*, *{#start..#finish}*
- String manipulation and replacement: *wc*, *cut*, *sed*, *awk*
- Advanced finding: *grep*
- Numerical calculations: *awk*
- Filtering, ordering: *sort*, *uniq*
- Comparing: *diff*, *md5*
- Patching: *patch*

Simple example #1: generating a random number

Source Code 1: Generating multiple random numbers

```
1  #!/bin/bash
2  # -*- coding: utf-8 -*-
3
4  echo "Printing random numbers with /dev/random"
5  stat /dev/random
6  entropy=$(cat /proc/sys/kernel/random/entropy_avail)
7  echo "How much entropy before calling /dev/random? $entropy"
8
9  # Now we create a file where we will store ages of turtles
10 echo "Turtle ages" > test.dat
11 for it in `seq 1000`
12 do
13     num=`od -An -N1 -i /dev/random`
14     if [ $num -gt 150 ]
15     then
16         let num=150+1
17     elif (( $num <= 10 ))
18     then
19         num=$(($num-1))
20     fi
21     echo $num >> test.dat
22 done
23 echo "How much entropy after calling /dev/random? $(cat /proc/sys/kernel/random/entropy_avail)"
```

I can´t remember my code!

1. Design Patterns
2. Refactoring

https://refactoring.guru/

Notice

1. Notice the output of stat is thrown
2. Notice the scope in line 6
3. Notice the syntax for the for loop and conditionals. There are multiple ways of verifying conditions
4. There are also multiple ways of doing math operations
5. Anything else?

Problem

How many turtles have age 63? 10? How many 21?

Environment behavior

- Special instructions: \ ; & && | || > (>&1 >&2 1> 2>) <
- Identifying processes: ($$)
- Environment variables, the *printenv* command
- Programming environment (useful commands: *test*, *seq*): if/elif/else, for loops
- Only for scripting! $@, $#, $<any number>
- Status of a process? $?

the CLI

- Command interpreter: applications and builtin instructions, keywords, . . . [*type, which*]
- Screening and piping processes! [use of |, &, &&]
- Identifying processes: $$, $!, $?, *jobs --help* [type jobs?], *ps aux*
- Logging to stdout and stderr
- Custom outputting [use of > "file", >&1, 2>&1 > file, . . .]
- Environment Variables with scoping [*printenv, env*]
- Important Variables: PATH , LD_LIBRARY_PATH , CPATH , MANPATH , PYTHONPATH [use *echo $VAR*]
- Other Info Variables: HOME , USER , GROUPS , SHELL , HISTSIZE

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- Scriptable and Encodable.
  Comments begin with #
  HEADING (shebang): #!/bin/bash [e.g. for python use #!/usr/bin/env python]
  After HEADING: # -*- coding: utf-8 -*-
- Conditionals, for & while looping, arithmetic and string operations, . . . even obtain random numbers!
- What is EOF?

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- Beautifiers

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Fun Fact

How do i avoid using all CPU's?

```
#  Review /proc/cpuinfo
$   taskset -cpu-list 1,2 command args
```

Instructions

1. Clone the github repo
2. Run the script `app1.sh`

Exercise 1

Run the script `app1.sh` with proper arguments

Exercise 2

Run the script `app1.sh` with proper arguments and store app info into a log file

Exercise 3

Create a text file with inputs for the application and run `./app1.sh < inputs.txt`

Exercise 4

Create a tree structure for multiple experiments

Exercise 5

Create a script that can run x number of experiments (as an input to the script) simultaneously in each of the folders.

Questions on `app1.sh`?

Help another teammate!