

How Does Computer?

James Hurd

Roadmap



- What *is* a Computer Really?
- Operating Systems !!
- Using Linux

Goal: Build your knowledge of a computer from the ground up

Why should I care?

Do I look like a CS
major to you... 

- Write better code!
- Become a power user 😎
- Understanding these basics are key for HPC
- Flex your knowledge on Dr. Crossfield 💪

We've got a lot to cover!

Click it.  Or ticket.

It's Kansas Law.

PLEASE
Ask Questions!!!

Feel free to raise your hand and interrupt

But first... some housekeeping...



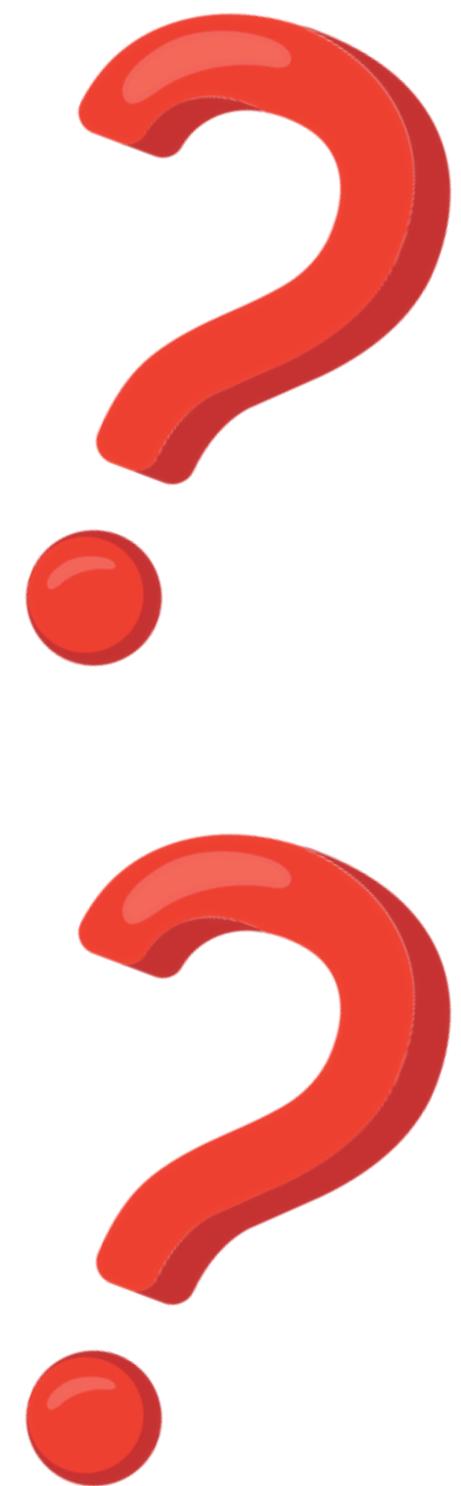
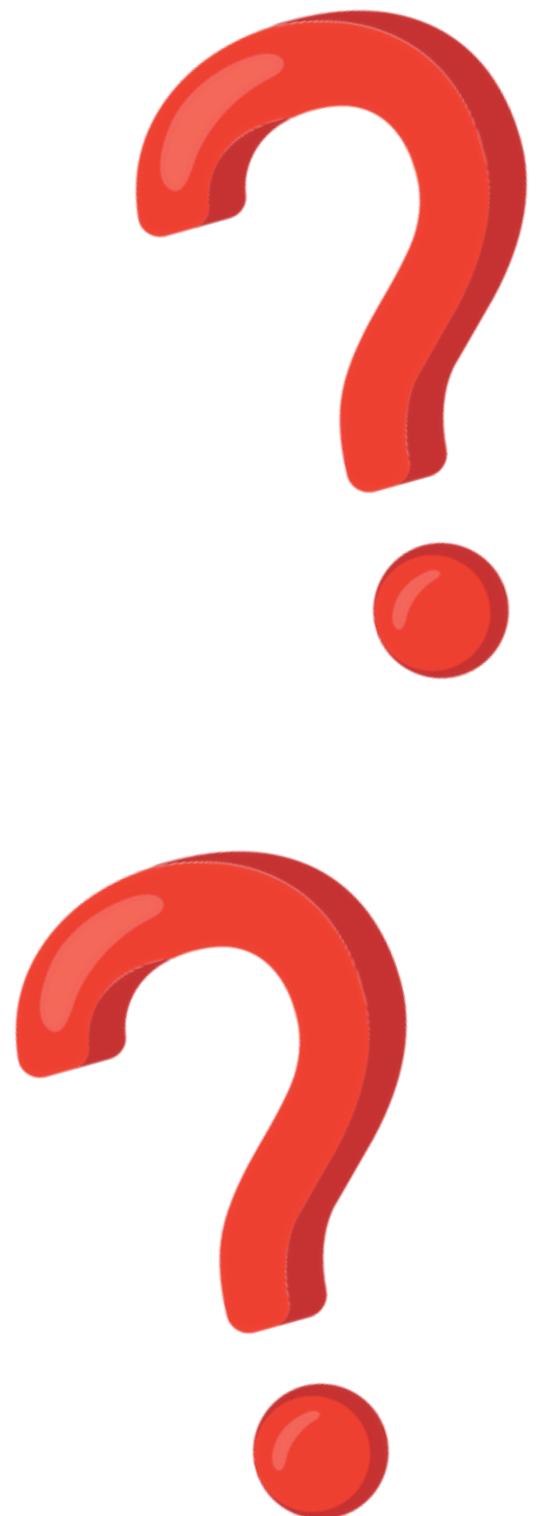
Who am I?

- KU CS '25
- Software Engineer @ Microsoft
- Prev. Los Alamos National Lab (CCS-7)
- Prev. Pinnacle Technology
- Turbo Nerd 😎

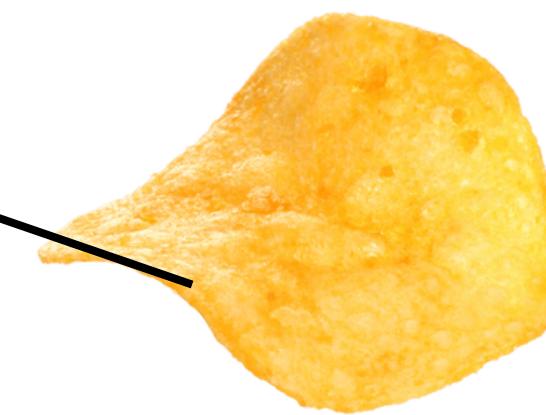
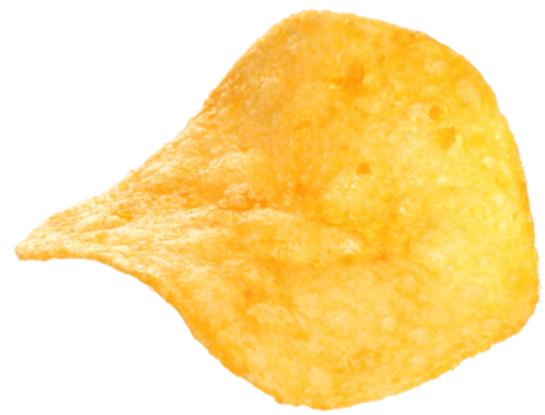
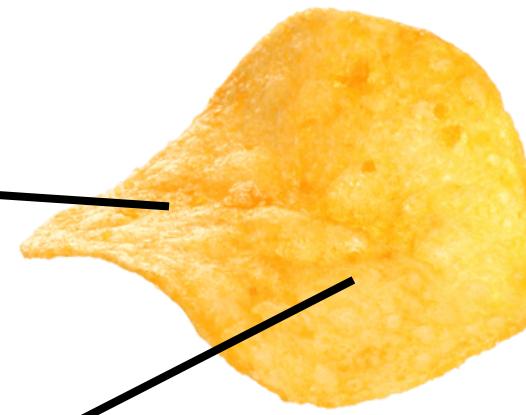
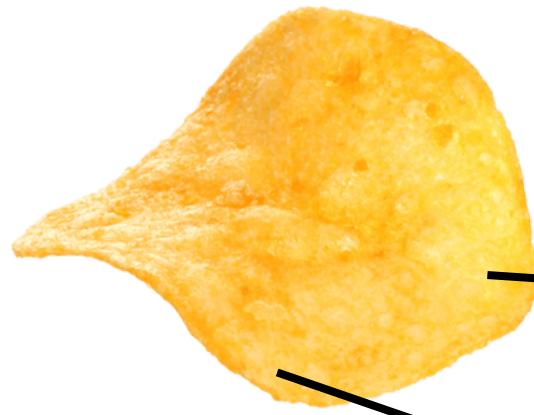


Let's dive in!

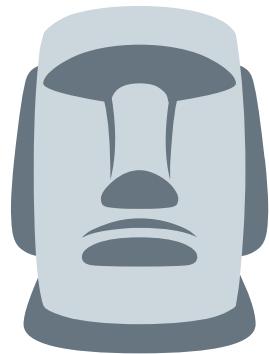




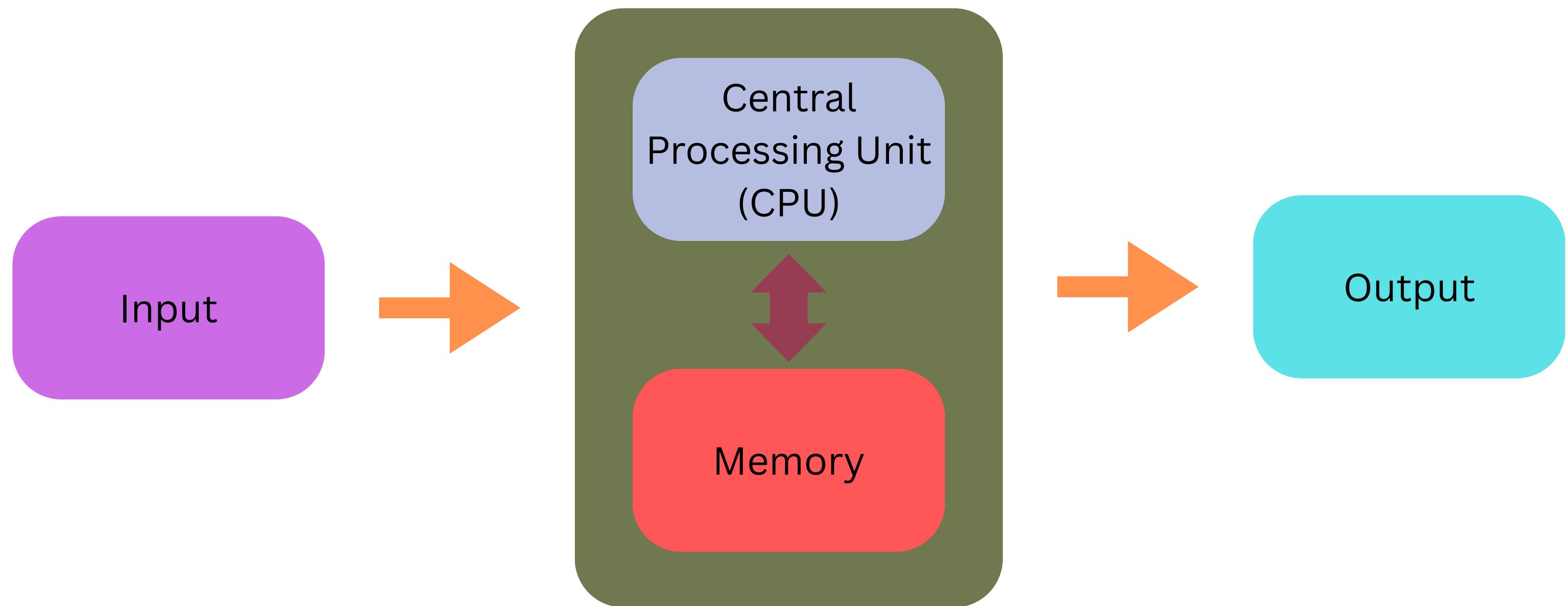
A computer is made up of interconnected components (e.g. chips) each of which serves a specific purpose.



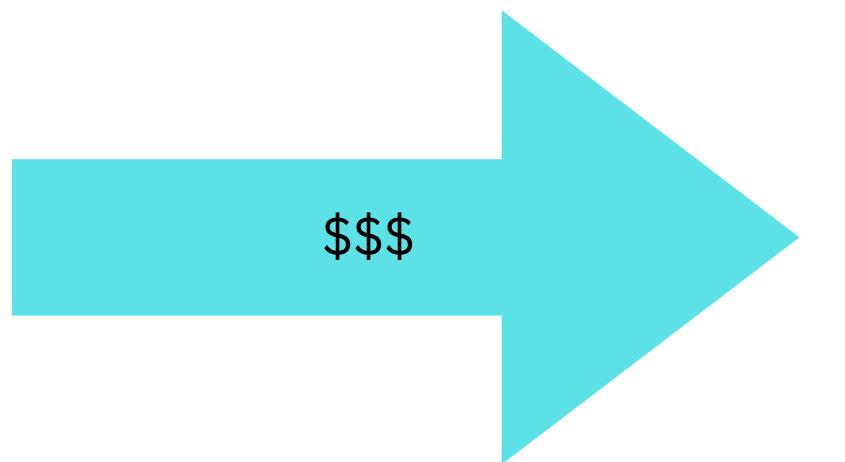
Not quite.....



Von Neumann Architecture



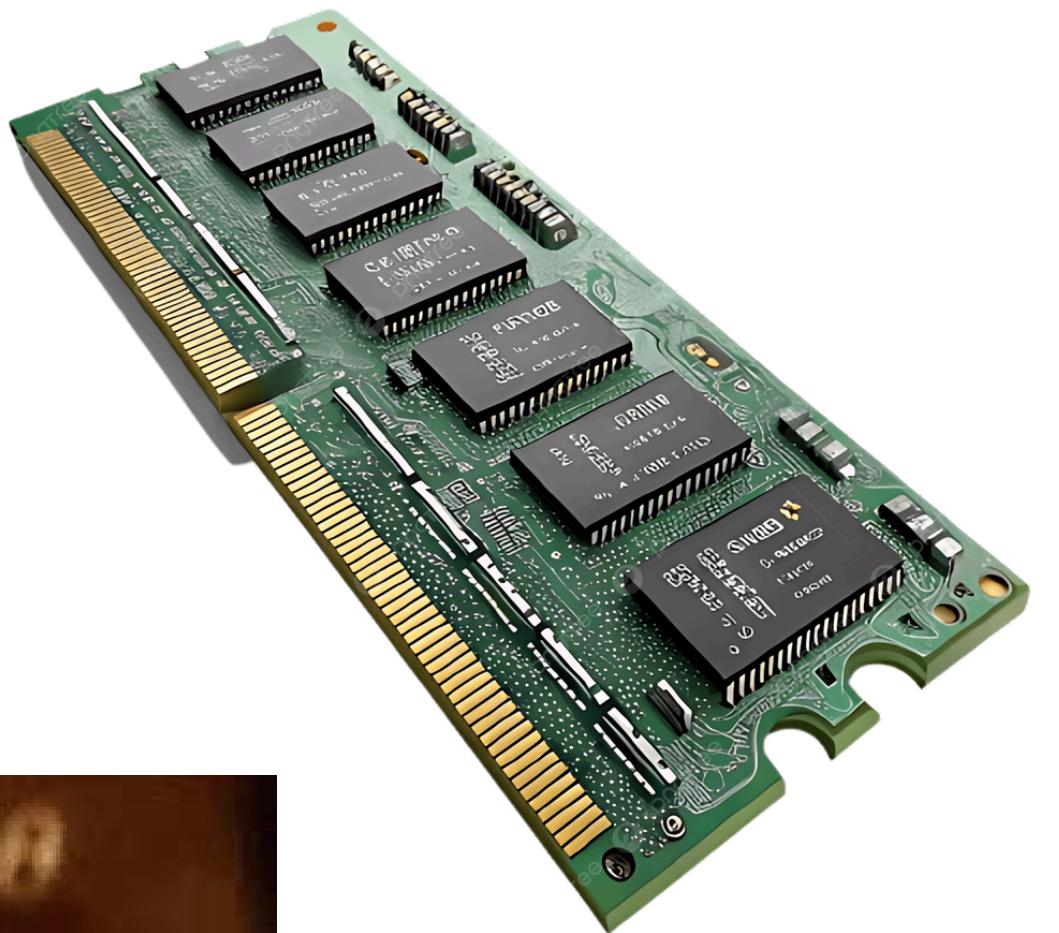
What's a CPU?



“Brain” of Computer

I can't remember... what's memory??

- Short-term storage
- “Scratch paper”
- Variables are stored here!
- RAM



The many forms of input and output

I/O ➔ Input/Output



Input 🖊



Output ⚡♂

```
a = int(input('Input a number: '))
b = int(input('Input another number: '))
c = a + b
print(c)
```

```
a = int(input('Input a number: '))
b = int(input('Input another number: '))
c = a + b
print(c)
```

Input

Memory

CPU

Output

```
a = int(input('Input a number: '))
b = int(input('Input another number: '))
c = a + b
print(c)
```

Input

1

Memory

CPU

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory
a = 1

CPU

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

2

Memory

a = 1

CPU

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory

$a = 1$

$b = 2$

CPU

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory

$a = 1$
 $b = 2$

CPU

$1+2$

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory

a = 1

b = 2

CPU

3

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory

a = 1

b = 2

c = 3

CPU

Output

```
a = int(input('Input a number: '))  
b = int(input('Input another number: '))  
c = a + b  
print(c)
```

Input

Memory

a = 1

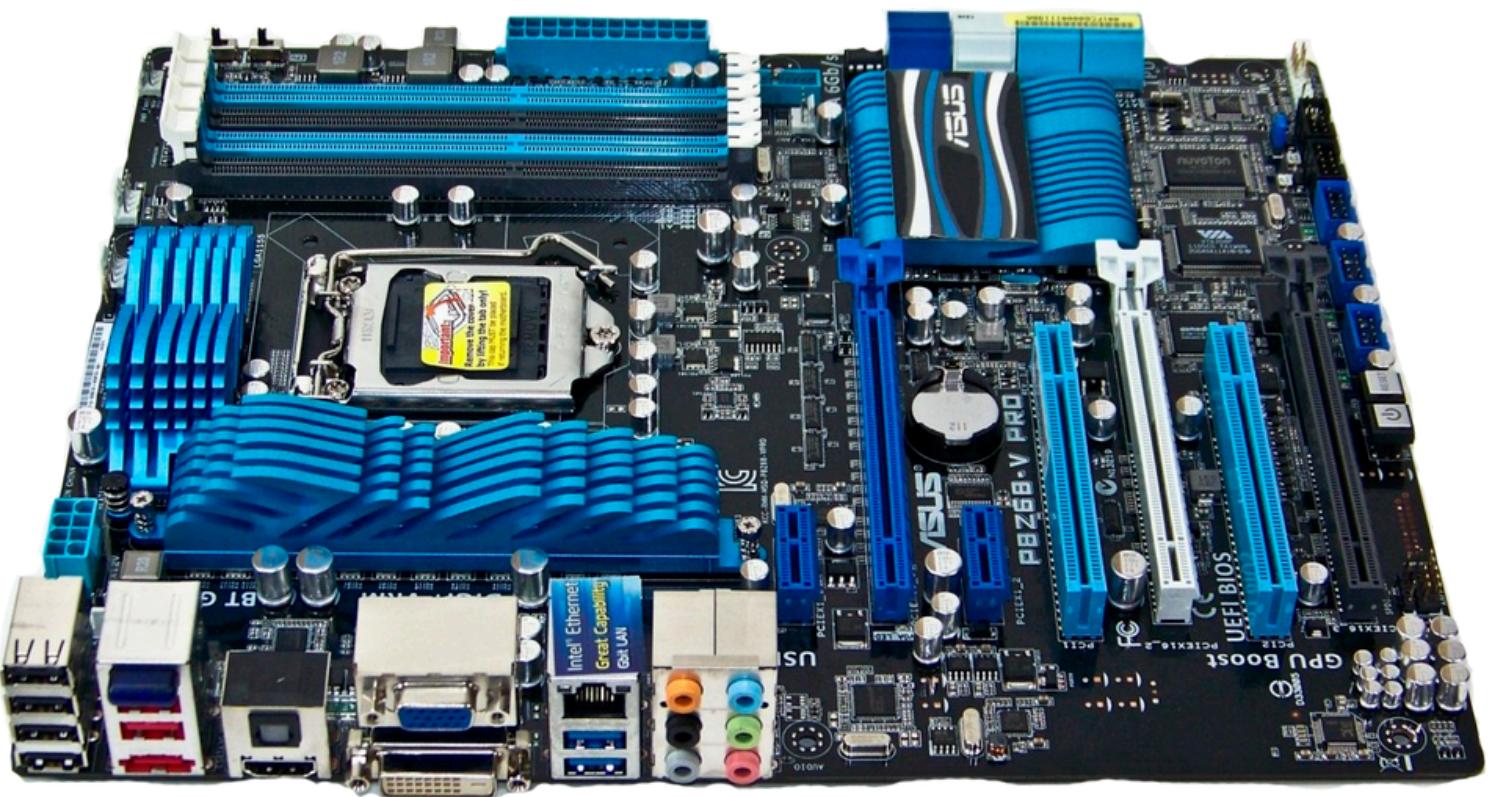
b = 2

c = 3

CPU

Output

3



Enter... Operating Systems!

3 Main Components of an OS

(For our purposes)



Kernel

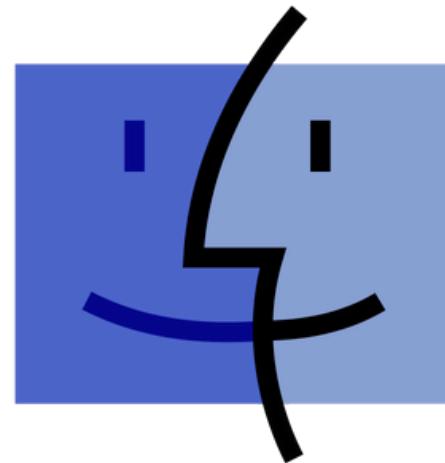


Shell

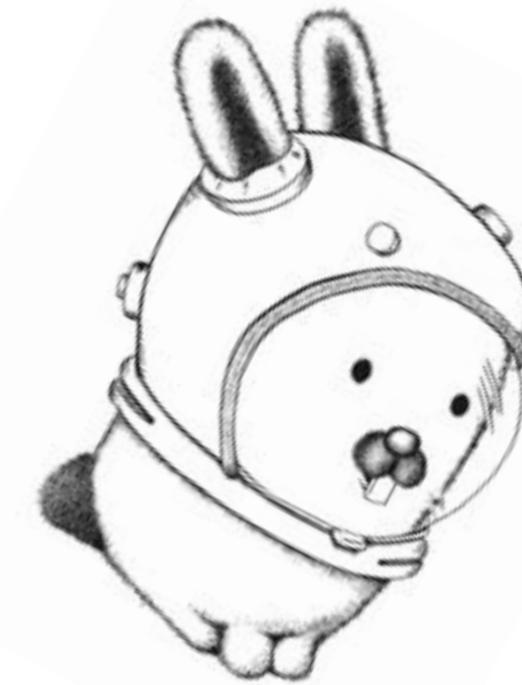
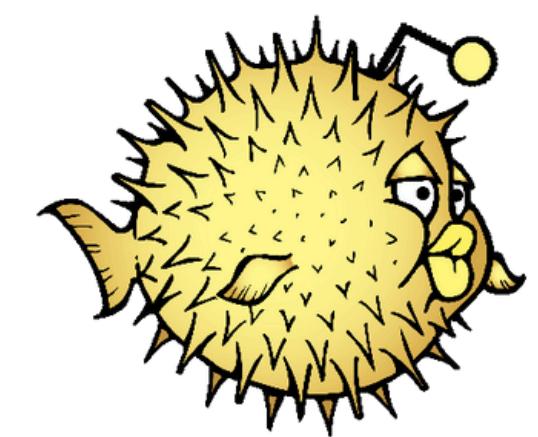
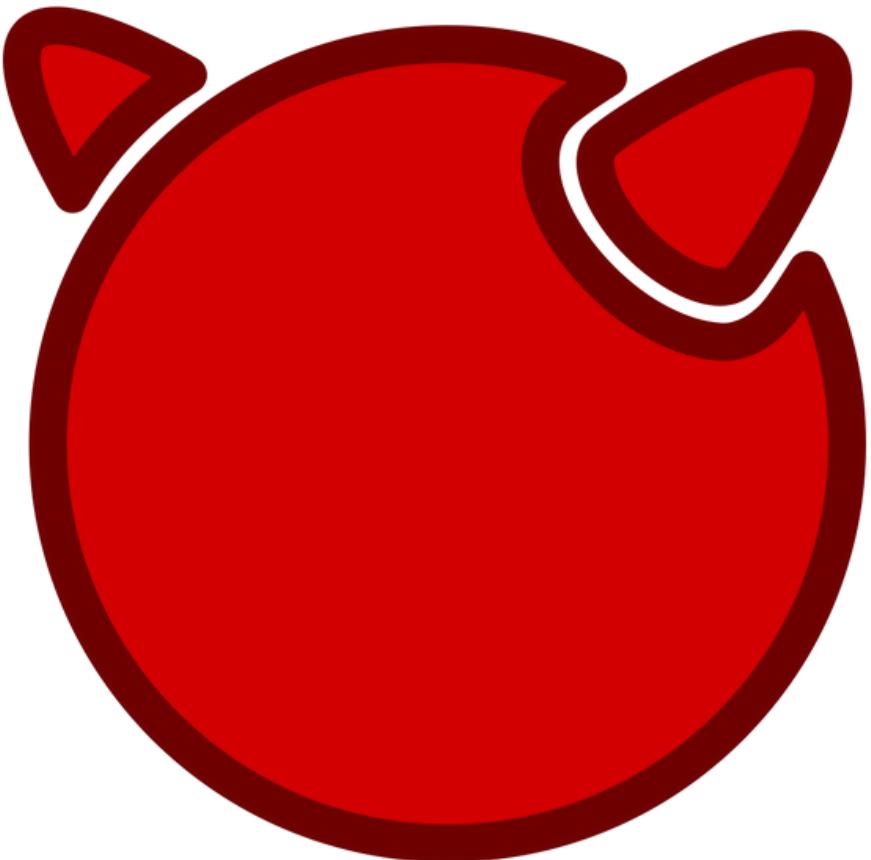


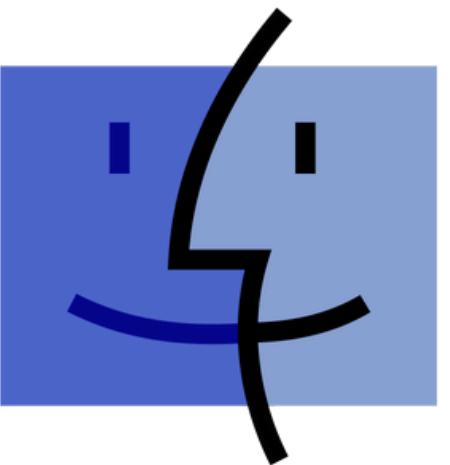
Built-In Core
Utilities

Wait wait wait.... what *is* an OS?

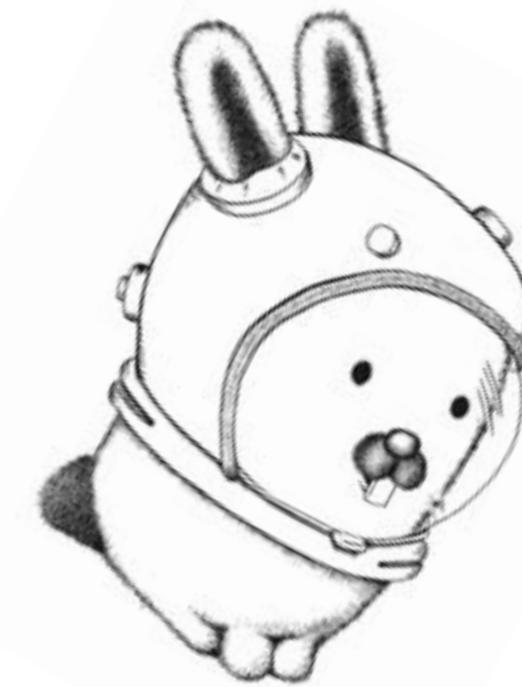
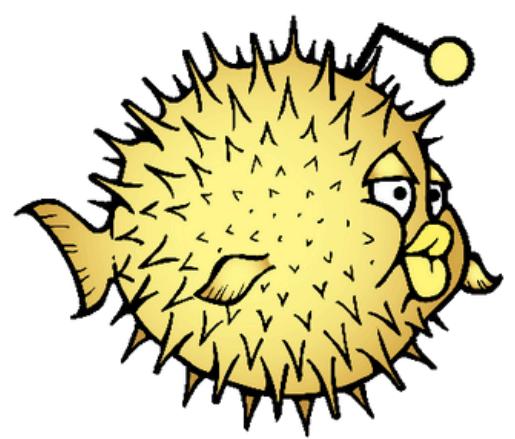
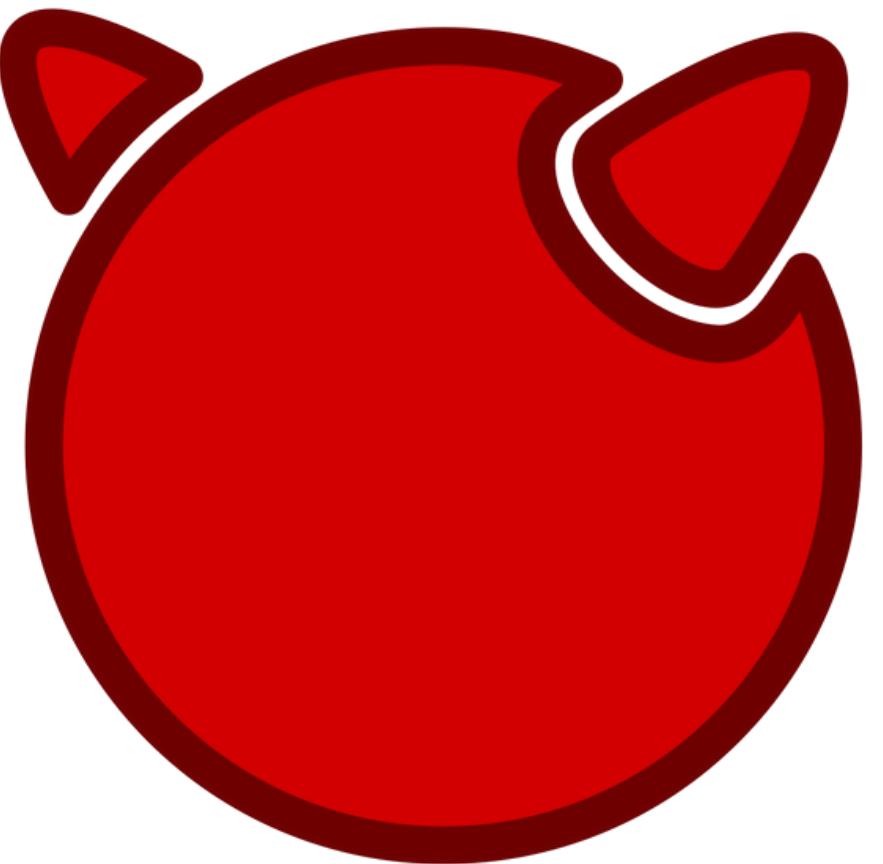


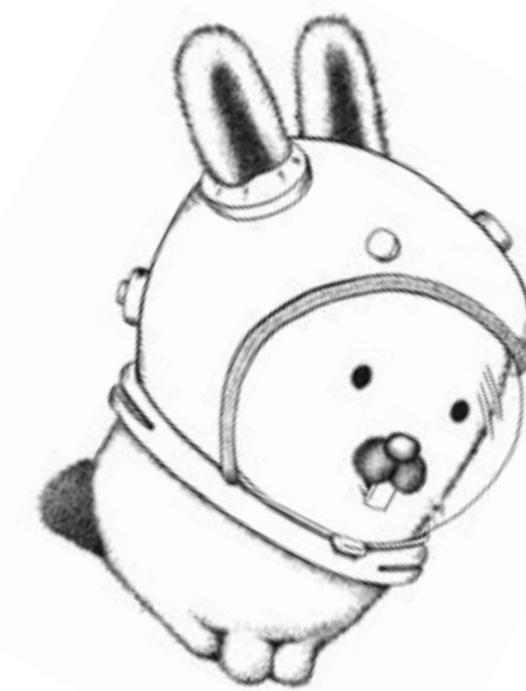
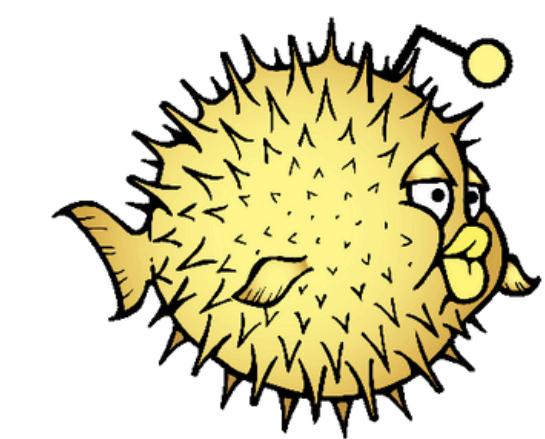
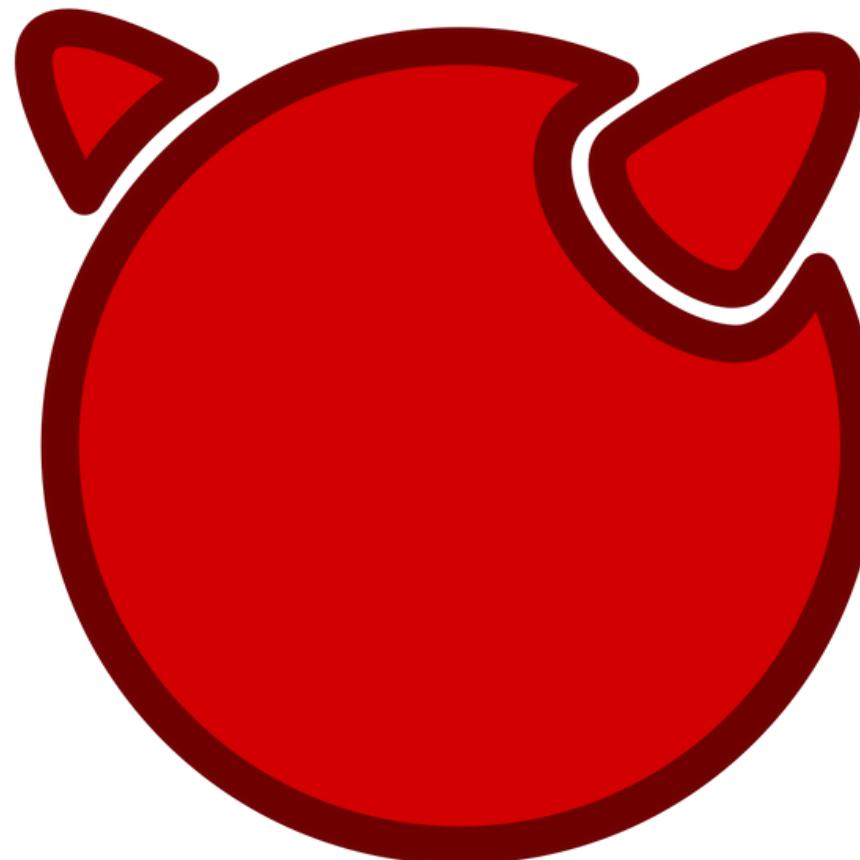
Mac OS

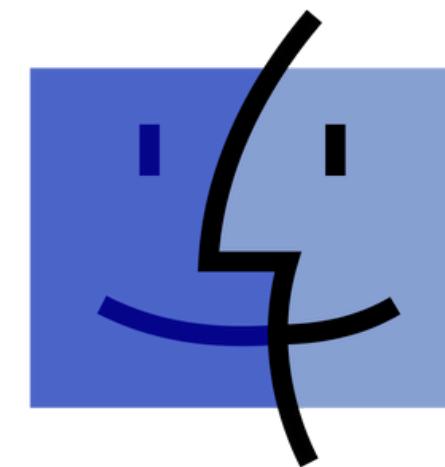




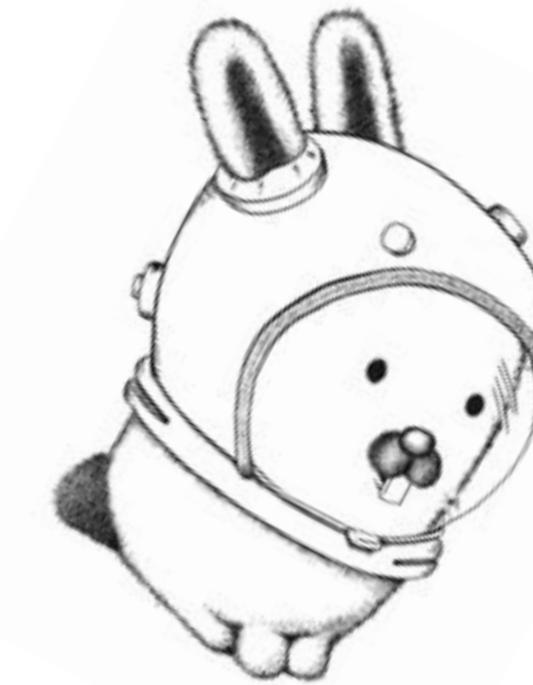
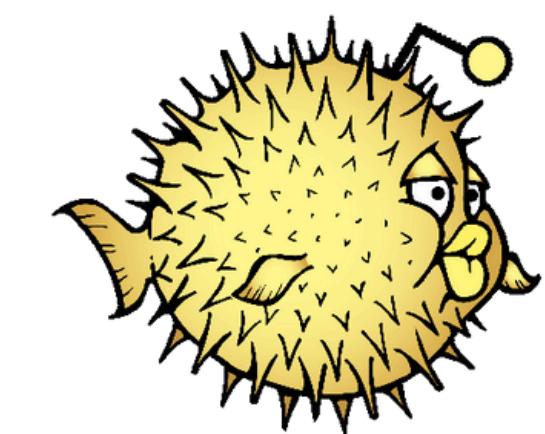
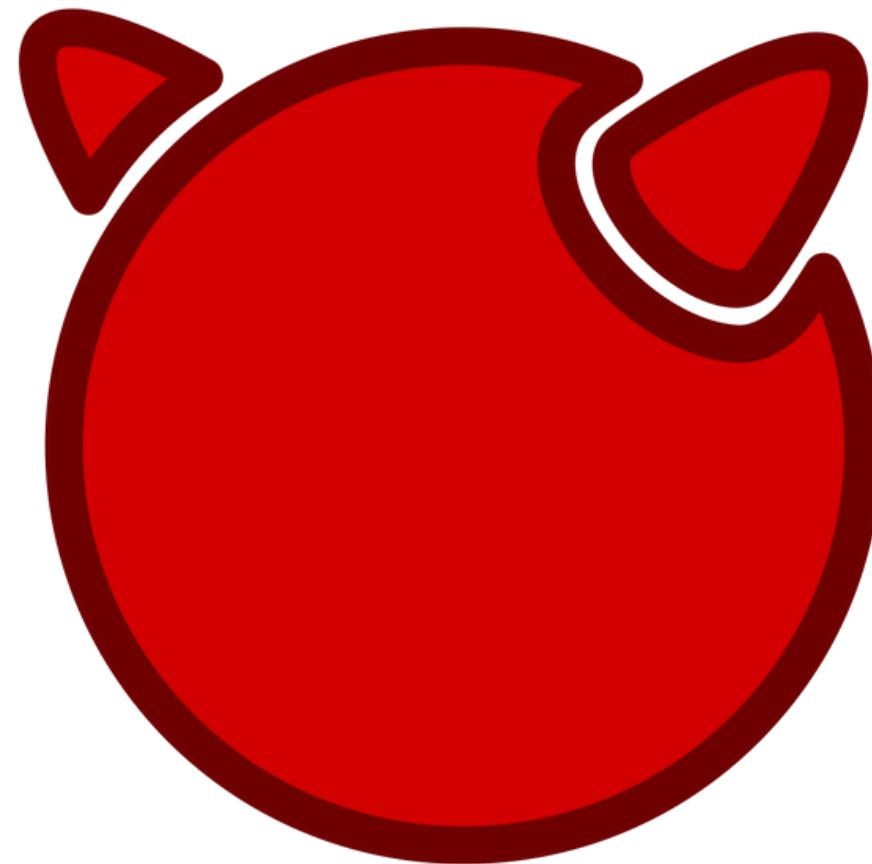
Mac OS







Mac OS



What makes Linux special?

- Widely used
- Free!
- Open Source

github.com/torvalds/linux





erm...
I'd just like to interject for a
moment...

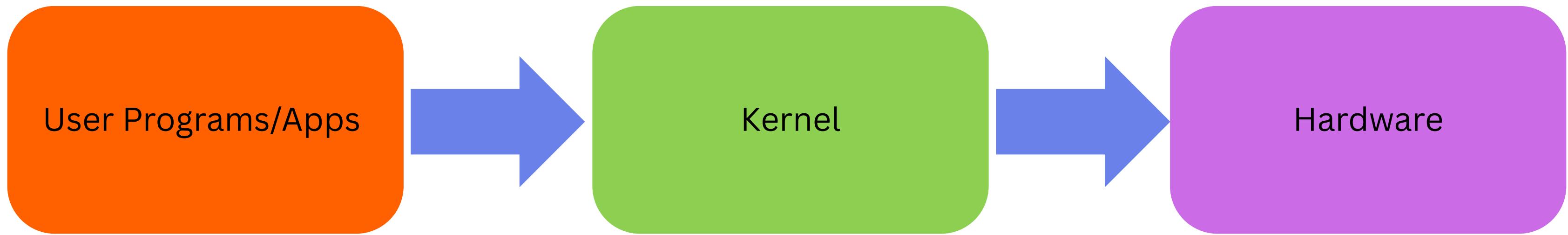


What you're referring to as Linux, is in fact, GNU/Linux, or as I've recently taken to calling it, GNU plus Linux. Linux is not an operating system unto itself, but rather another free component of a fully functioning GNU system made useful by the GNU corelibs, shell utilities and vital system components comprising a full OS as defined by POSIX.

Technically Linux is just the
kernel....

Though if you say “Linux” people know what you
are talking about...

What's a kernel?



But I've never heard of the
kernel... how am I using it?

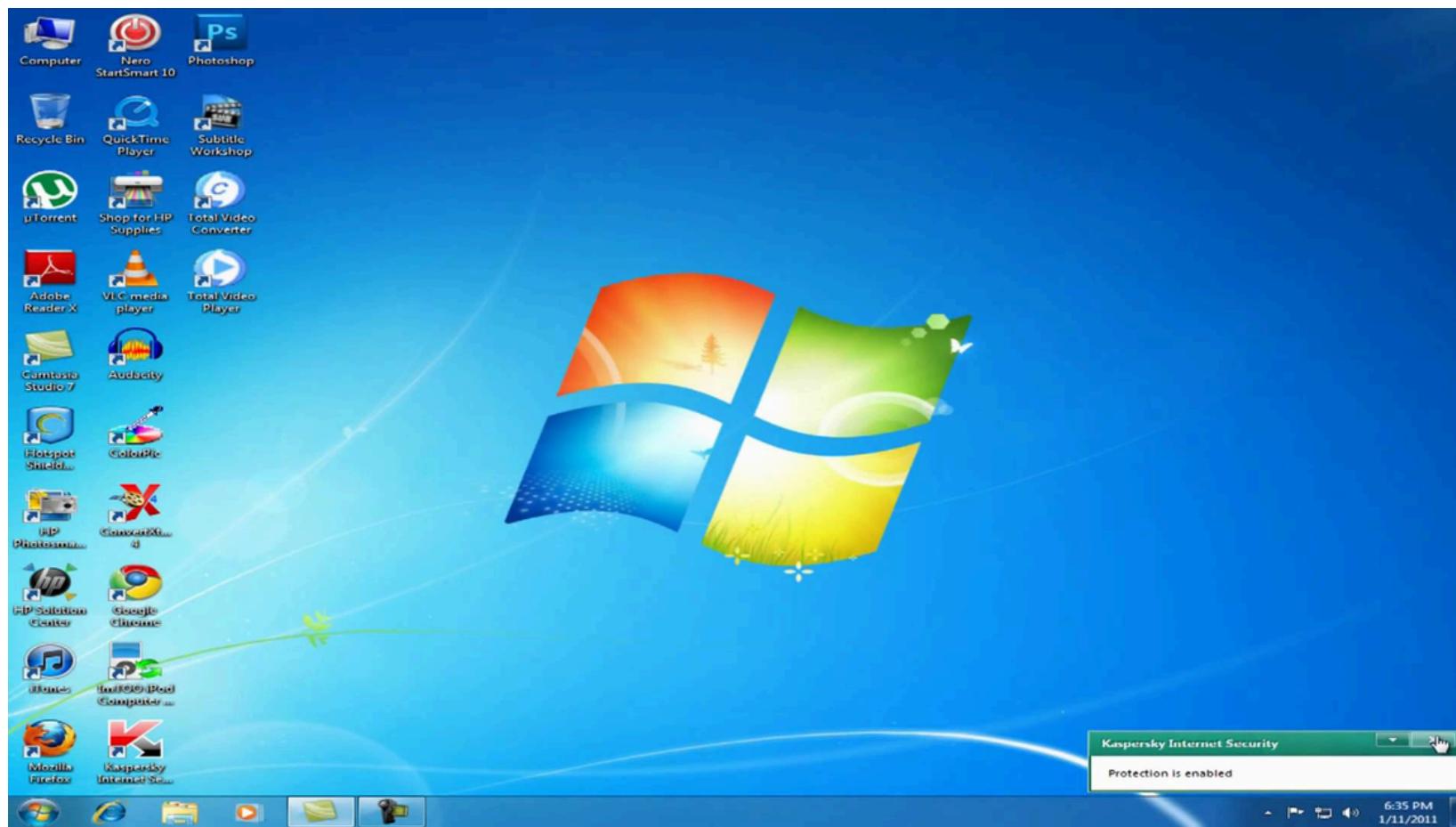
There are ✌ * main ways...

*It's really only ✌, it just seems like ✌ ...

Software interacts with the
kernel behind the scenes



What if I'm not using an app...



```
mark@linux-desktop: /tmp/tutorial
File Edit View Search Terminal Help
Setting up tree (1.7.0-5) ...
Processing triggers for man-db (2.8.3-2) ...
mark@linux-desktop:/tmp/tutorial$ tree
.
├── another
└── combined.txt
dir1
dir2
│   └── dir3
│       ├── test_1.txt
│       ├── test_2.txt
│       └── test_3.txt
dir4
│   └── dir5
│       └── dir6
└── folder
    └── output.txt

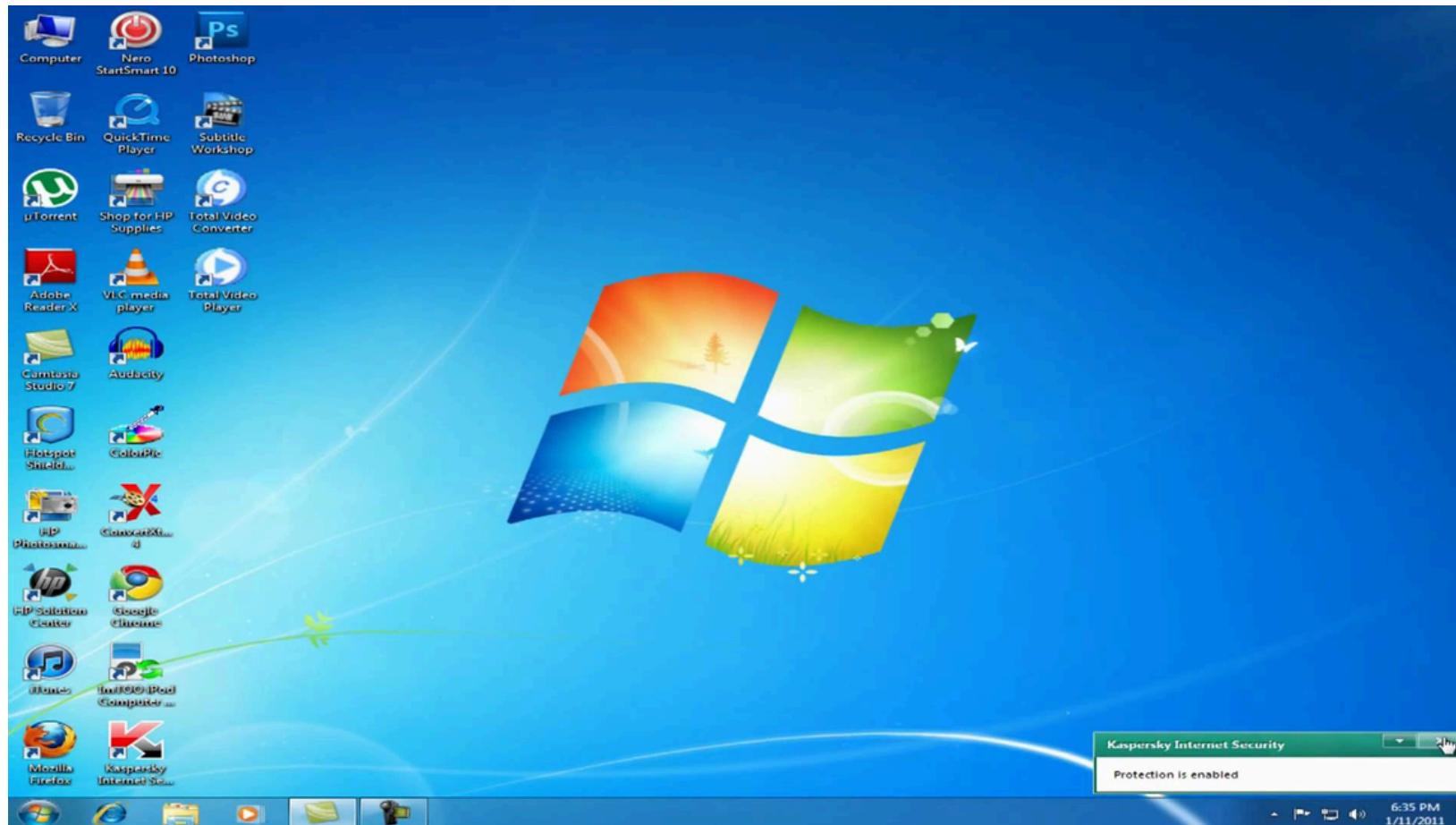
8 directories, 5 files
mark@linux-desktop:/tmp/tutorial$
```

These are apps!!! They have a
special name.....

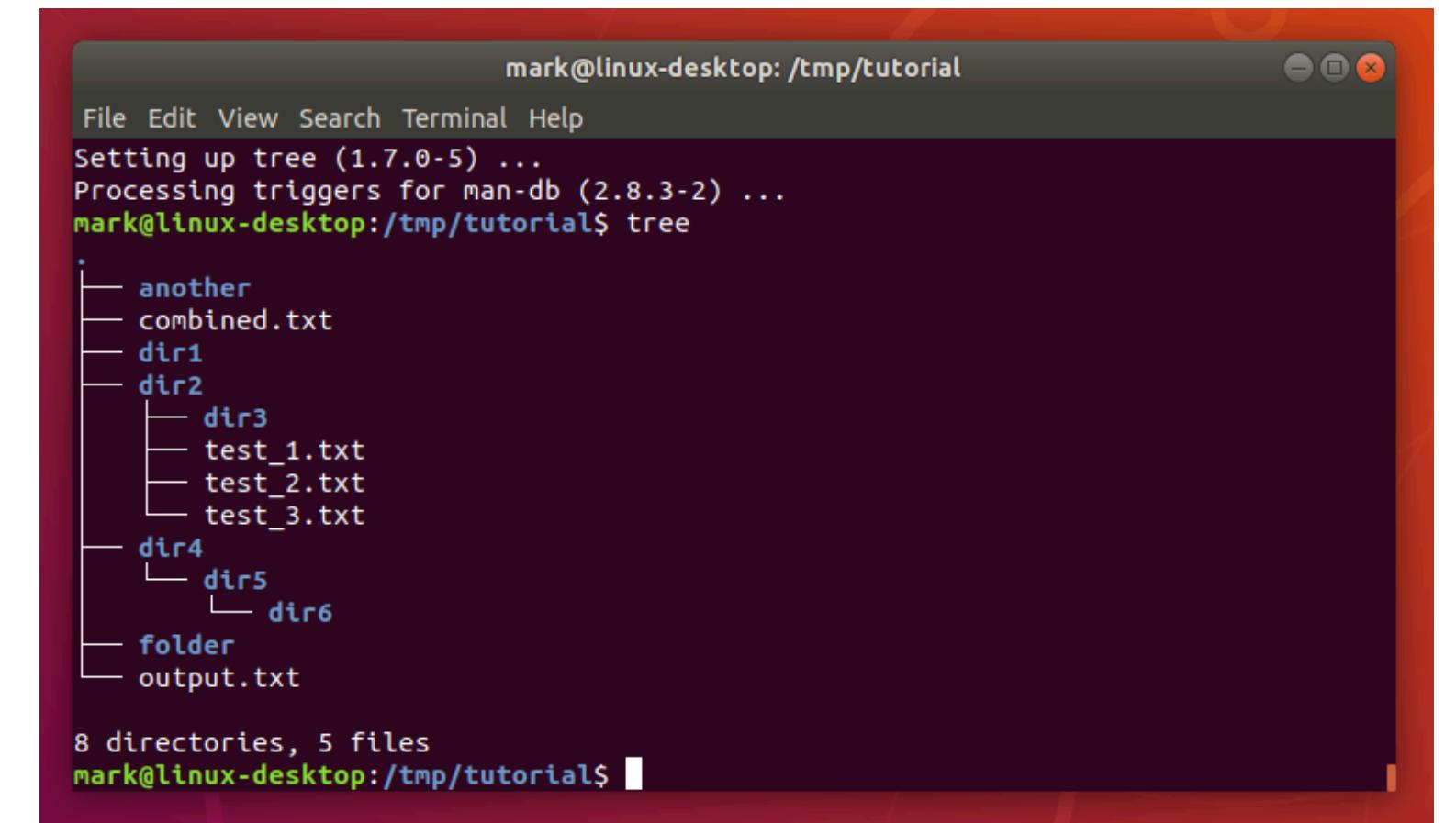
The Shell



The shell allows you to use your computer system



graphical



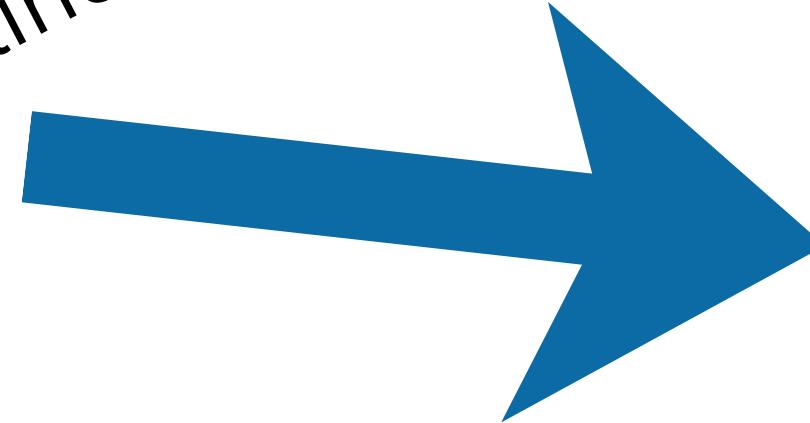
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mark@linux-desktop:/tmp/tutorial$ tree
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├── another
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│   │   ├── test_1.txt
│   │   ├── test_2.txt
│   │   └── test_3.txt
├── dir4
│   └── dir5
│       └── dir6
└── folder
    └── output.txt

8 directories, 5 files
mark@linux-desktop:/tmp/tutorial$
```

A screenshot of a terminal window on a Linux system. The title bar says "mark@linux-desktop: /tmp/tutorial". The window displays the output of the "tree" command, showing a directory structure with several files and nested folders. The terminal has a dark theme with red borders.

text based
“command line”

the most common command
line shell on linux



“Bourne Again Shell”
a.k.a BASH

The main purpose of the shell:

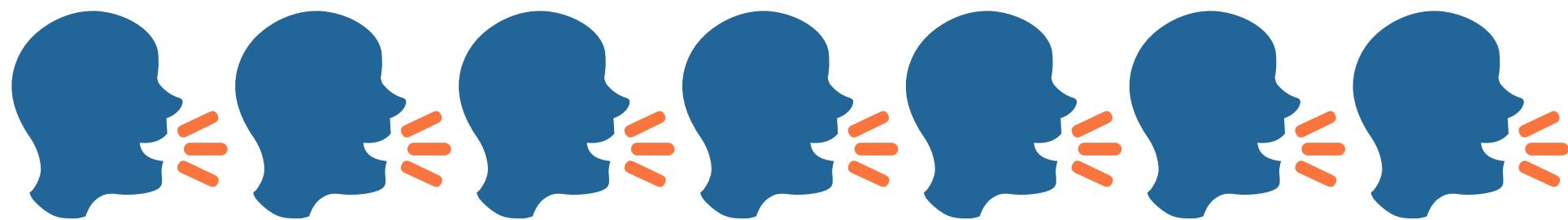
- Allow us to run programs
- Allow us to “string them together”

Sounds like the shell is kind of
useless on it's own....



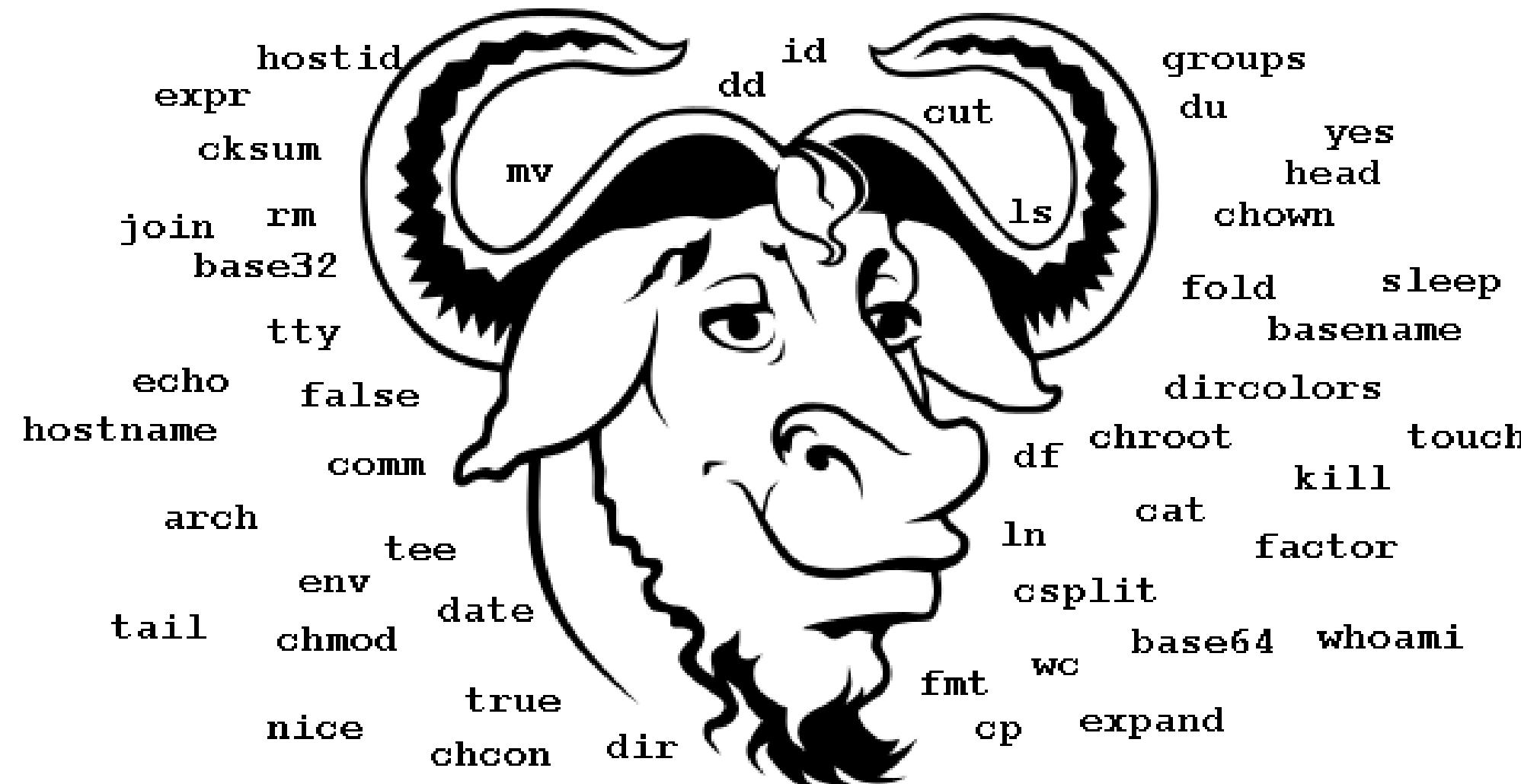
GOOD ANSWER!

GOOD ANSWER!



Core Utilities

- Shipped with OS
- “Shell commands”



Let's see it in action!!



Thank you! ❤



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jameshurd.net/talks/how-computer

fin.