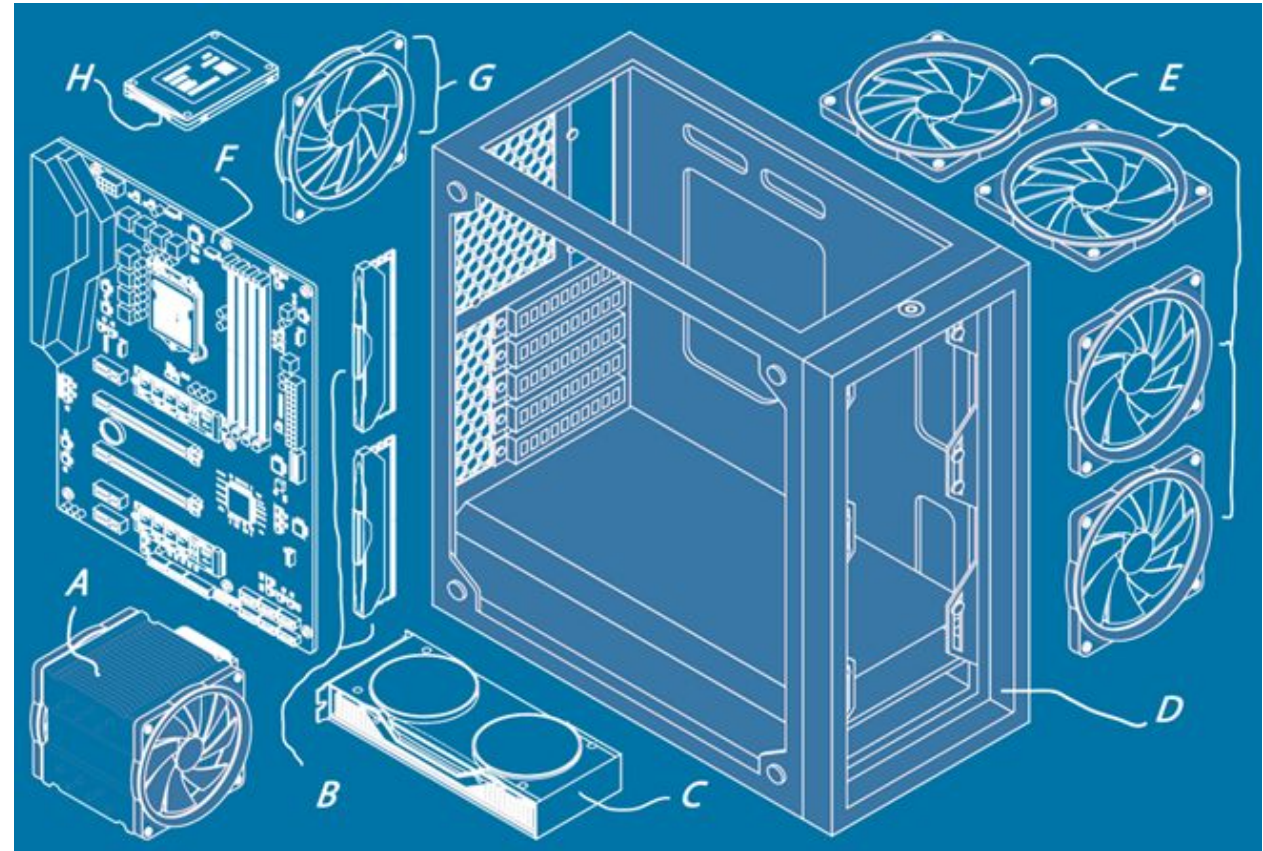# Student Branch Chapter @ USF

Computer Part Picking
Hardware Lead: Liam

Check in! Support Us

Follow Us

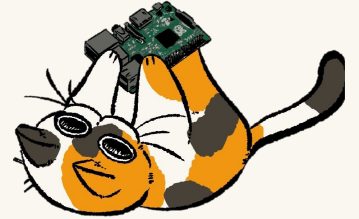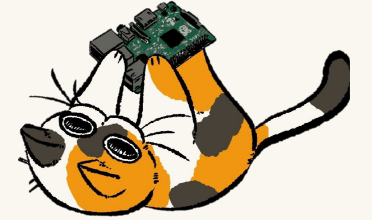

Discord

LinkedIn

Instagram
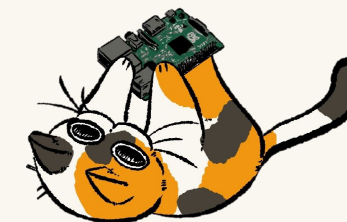
Bulls
Connect

GitHub

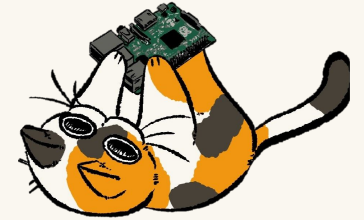# What are we doing today?

- Cases

- Motherboard

- CPU

- RAM

- Storage

- GPU

- Power

- Cooling

Cases

Cases

- **4 main sizes**
  - **EATX**
  - **ATX**
  - **Micro ATX**
  - **Mini ITX**

- **Extension ports for I/O**

- **Controls airflow for PC**
  - **CPU clearance (mm)**
  - **Fan compatibility**

FULL TOWER	MID TOWER	MINI TOWER	SMALL FORM FACTOR
22" - 27"	17" - 21"	14" - 16"	SIZE VARIES
ATX / ~EATX	~ATX	mATX / ITX	MINI-ITX

What Case to Choose?
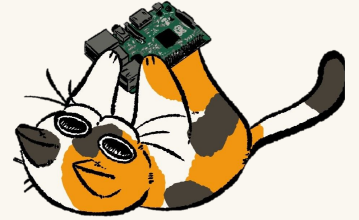
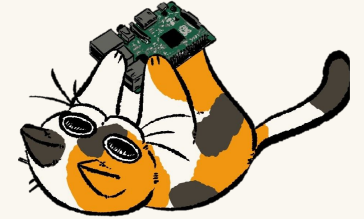**Whatever you want! Just make sure:**

- **CPU clearance exceeds your cooler, or can fit the radiator**

- **Is as big or bigger than the size of your chosen motherboard**

- **I/O has matching sockets to your motherboard connectors if desired**

- **Has good airflow if you need a lot of cooling**
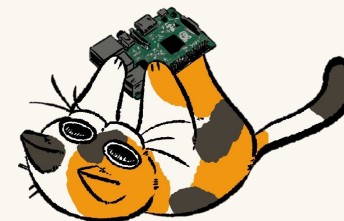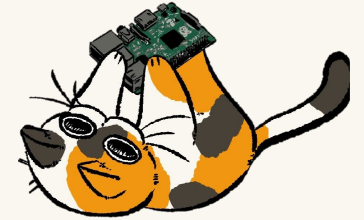
Motherboard

Motherboard Overview

- **The "Skeleton" of the computer**

- **Every component plugs into it**

- **Has Basic Input Output System (BIOS)**

- **Built in components**

  - **Chipset processes I/O and connectivity**

  - **CMOS battery saves time and settings**

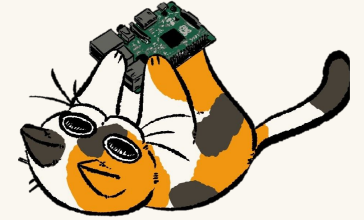 - **Ports on the back of the PC**

Motherboard BIOS

- **If you press f12, f2, delete, etc. on startup, you'll enter BIOS**

- **Every BIOS is unique to motherboard, though are generally similar**

- **BIOS has a mini-system with settings and time stored by CMOS battery**

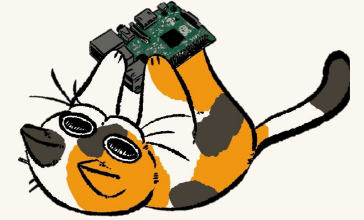- **Firmware on motherboards may need to be updated over time**

What can you do in BIOS?

- **See how your computer is performing and what parts are in it**

- **Choose your boot drive / launch settings or boot manually**

- **Change how fast your fans blow to make them quieter or faster**

- **Sometimes you can update BIOS from within itself**

- **Overclock or underclock performance of parts (but can brick them)**
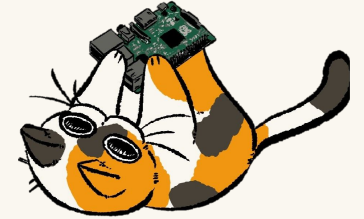
What Motherboard Should I Get?

You just have to make sure it's compatible with everything!

- **Fits into your computer case**

- **Has to have a matching CPU socket and compatible chipset**

- **Has to fit your chosen RAM type (DDR4 or DDR5)**

- **Has the right ports you want for your PC**
  - **Drives**
  - **Video**
  - **USB**
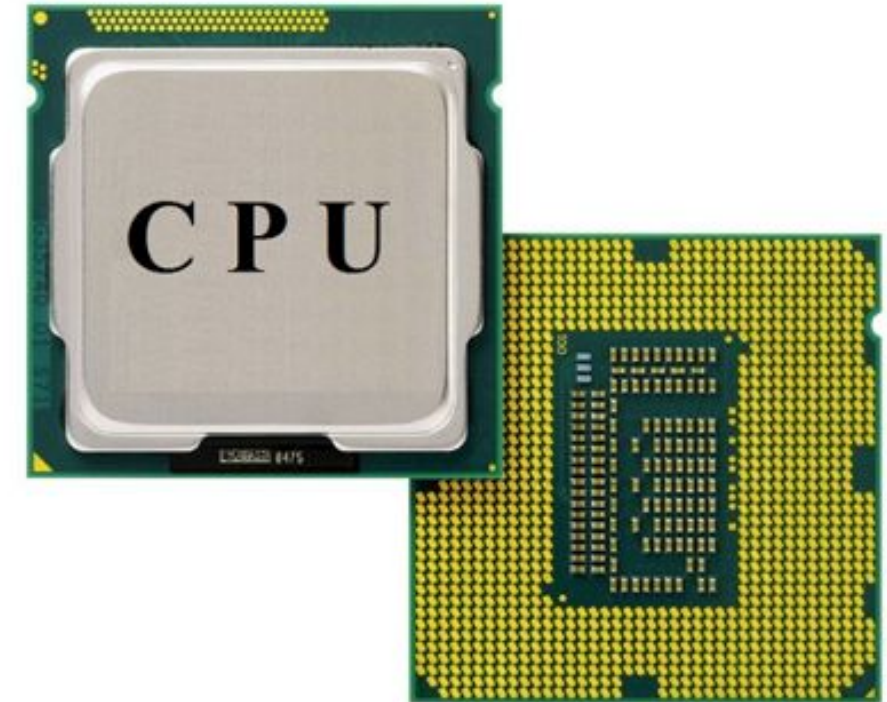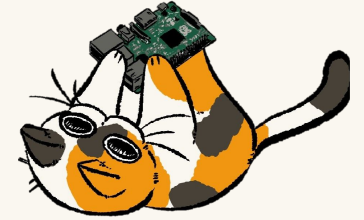 - **PCIe**
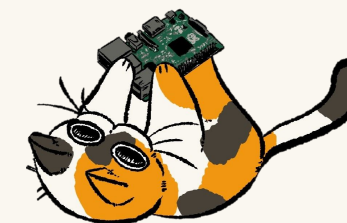
CPU

What Does the CPU Do?

- **The Central Processing Unit performs computations to do most everything for you**

- **Enthusiast desktop processors run the X86 Instruction Set Architecture**
  - **Some laptops or experimental PCs run ARM or other ISAs**

- **Has 60+ billion transistors on a single chip now**

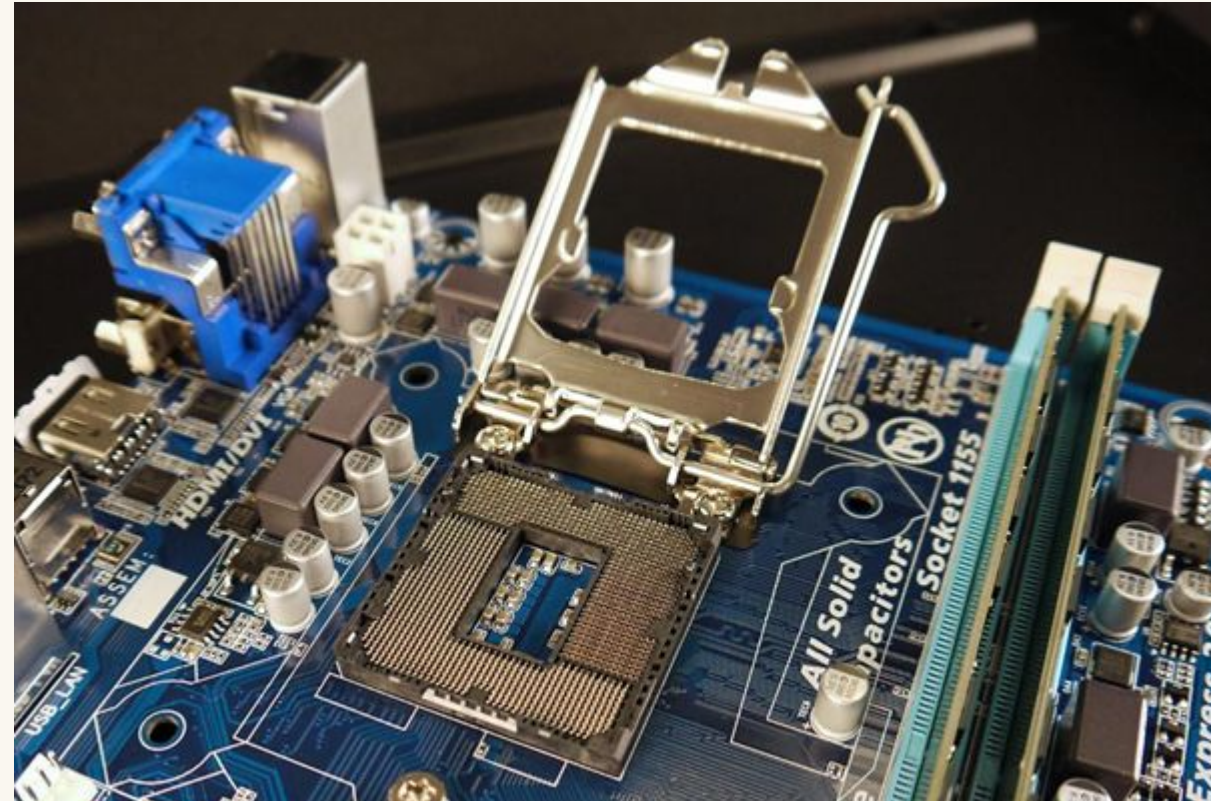- **Circuit cycles billions of time a second to do operations**

Where Does the CPU Go?

- **The CPU socket is a large part in the motherboard which opens and holds the CPU**

- **Many fragile pins and contact pads have to fit precisely here or it will not work**

- **Different CPU generations have sockets**

- **Make sure motherboard can fit your CPU**

What's Inside the CPU?

- **Transistors are made only nanometers apart to fit a massive amount together**

- **Only visible through intense microscopic magnification**

- **Created with very complicated lithography process where multiple layers are combined**
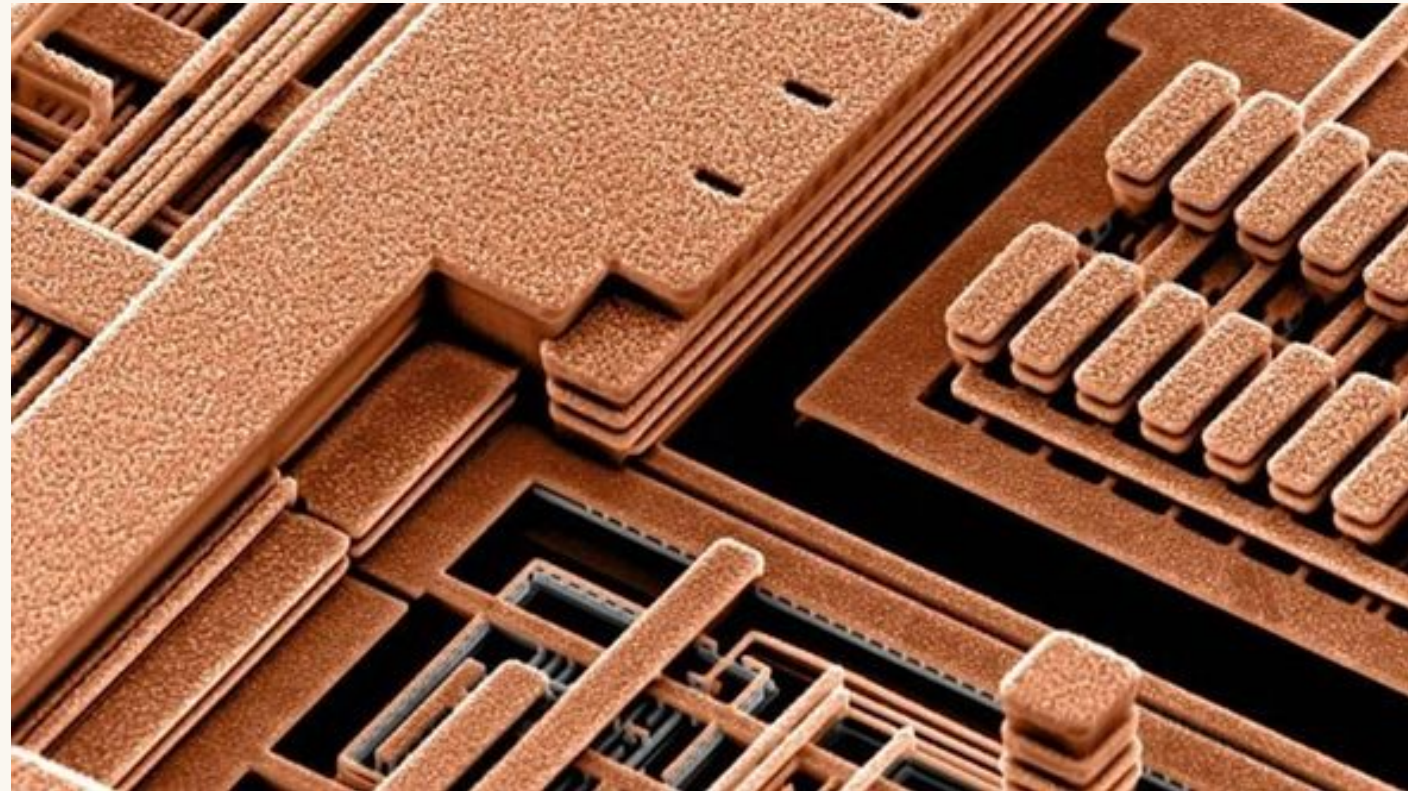
CPU Structure

- **Each part has its own dedicated function which work together**

- **Cores are the main calculators**

- **Cache is low level fast memory**

- **GPU does graphics processing**

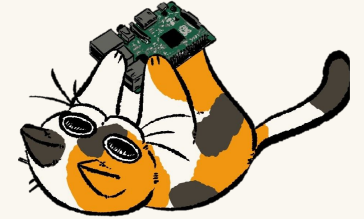- **Memory controller interfaces**

- **Modern CPUs have many cores**

Intel® Core™ M Processor Die Map
14nm 2nd Generation Tri-Gate 3-D Transistors

Processor Graphics

Core   Core

System Agent, Display Engine & Memory Controller

Shared L3 Cache**

Memory Controller I/O

Dual Core Die Shown Above | Transistor Count: 1.3 Billion | Die Size: 82mm²

4th Gen Core Processor (Y series): .96B   4th Gen Core Processor (Y series): 131mm

** Cache is shared across both cores and processor graphics

CPU Multithreading

- **All programs are lists of instructions in order**

- **Computer has hundreds of processes running**

- **Multiple cores allow many processes to run together**

- **If optimized, multiple cores can run programs well**

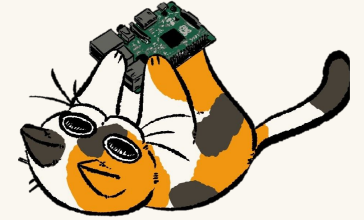- **CPUs have started to add many cores to get faster**

CPU   Intel(R) Core(TM) i7-4810MQ CPU @ 2.80GHz

% Utilization over 60 seconds   100%

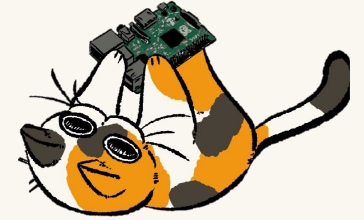| Utilization	Speed		Base speed:	2.79 GHz
4%	1.32 GHz		Sockets:	1
			Cores:	4
Processes	Threads	Handles	Logical processors:	8
327	5033	152064	Virtualization:	Disabled
			Hyper-V support:	Yes
Up time			L1 cache:	256 KB
7:22:08:43			L2 cache:	1.0 MB
			L3 cache:	6.0 MB
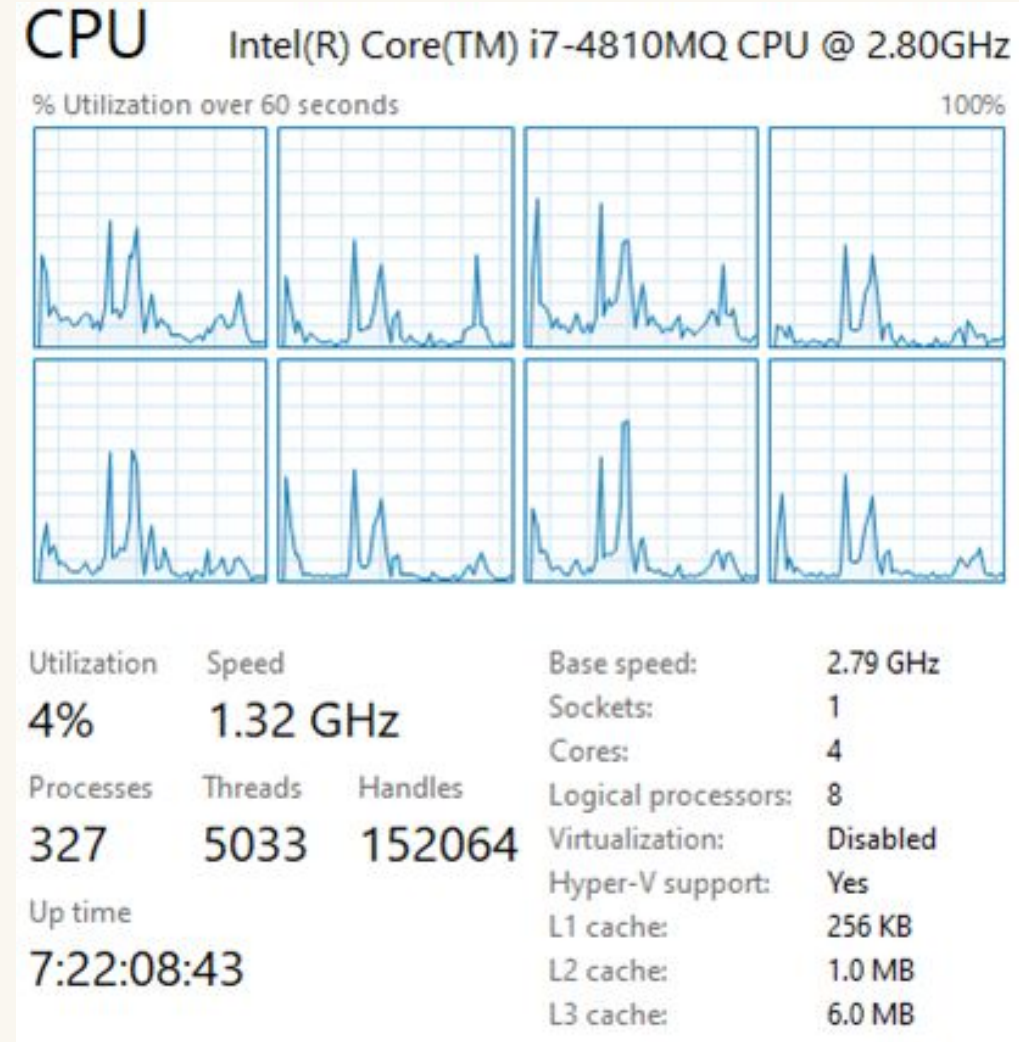
What CPU is Best?

Buy a latest generation CPU with as much money as the budget allows!

- **Your CPU is the main determinant of how fast your computer is**

- **You get what you pay for, but old ones are typically overpriced**

- **If you do a lot of multitasking or thread heavy programs, you want more cores**

- **Top end CPUs have diminishing returns and most people don't need them**

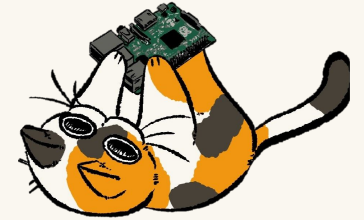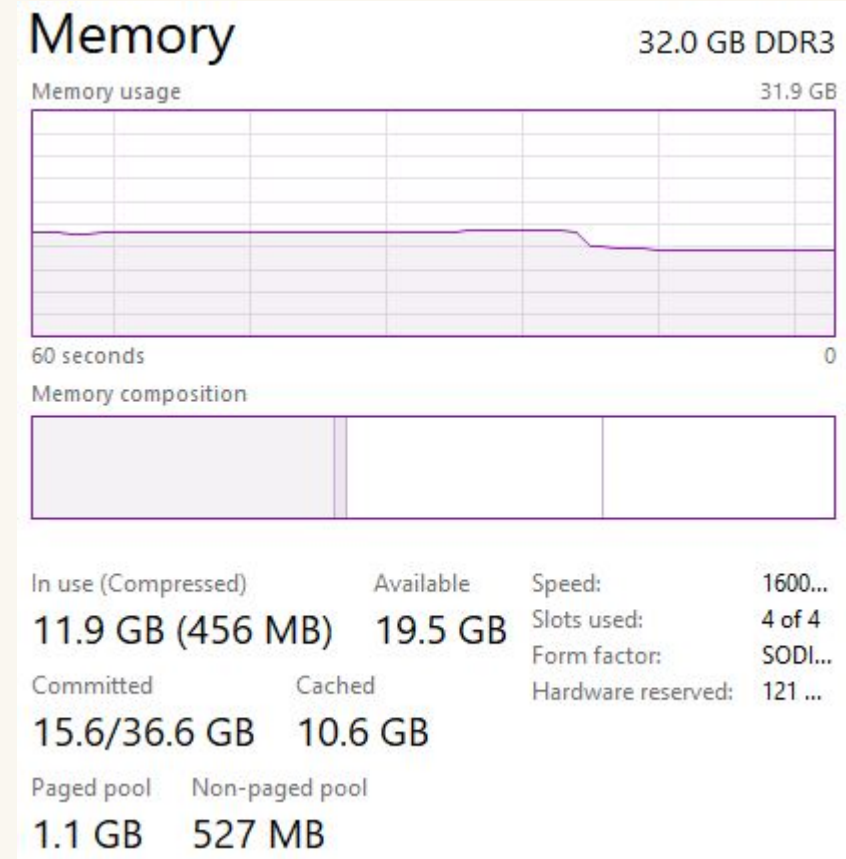- **Make sure it is compatible with your motherboard**
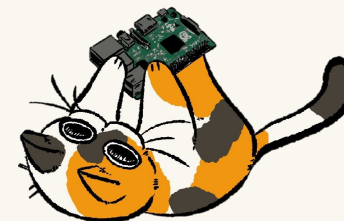
RAM

What is RAM?

- **Random Access Memory is the main memory of your PC.**

- **It stores all working data and things you're looking at**

- **Not to be confused with permanent storage, which will come later**

- **Ram is:**

  - **Volatile (destroyed when it loses power)**

  - **Fast (has to run quickly along the CPU)**

  - **Expensive (made of semiconductors like CPU)**
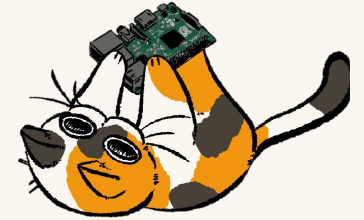
How Does it Help Me?

- **The more RAM you have, the more things you can have open**

- **When you run out of RAM, everything gets VERY slow**

- **Some tasks like video editing and data processing require a lot of RAM to manipulate their contents**
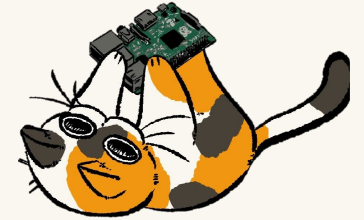
Memory
32.0 GB DDR3

Memory usage
31.9 GB

60 seconds
0

Memory composition

In use (Compressed)	Available	Speed:	1600...
11.9 GB (456 MB)	19.5 GB	Slots used:	4 of 4
		Form factor:	SODI...
Committed	Cached	Hardware reserved:	121 ...
15.6/36.6 GB	10.6 GB		

Paged pool | Non-paged pool
1.1 GB | 527 MB

Ok, But What Does RAM Look Like?

- **RAM comes in small chips attached to a stick shaped circuit**

- **RAM sticks usually have a sticker with their information printed on them**

- **There are several versions of RAM, the newest being DDR5**

Where Does it Go???

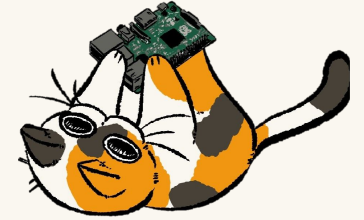RAM sticks go into the large DIMM slots located right next to the CPU socket

For timing purposes which enhance PC performance, RAM should be inserted in a specific pattern of matching the colors

This is related to the Double Data Rate (DDR) part of your DDR ram. The two sticks of RAM will operate synchronously
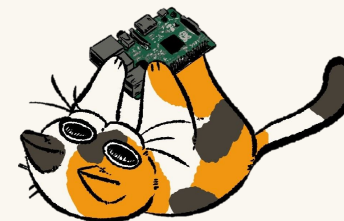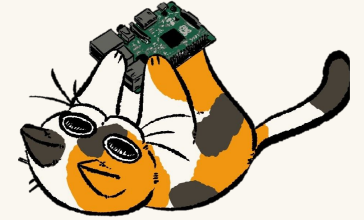
How Much RAM Do I Need?

Most people need 16-32 GB of RAM on a PC nowadays.

- **Make sure it's a version compatible with your motherboard**

- **If you have special tasks that need more RAM like video editing, you may want more**

- **RAM will be marketed with an operating frequency, but don't worry about that much**
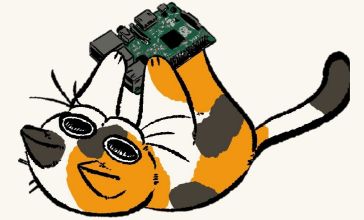
Storage

Storage Overview

- **Storage is what saves all our files in our computers**

- **The computer has to read data off our storage every time we load something new, and write it when we save it**

- **There are 2 common types of drives we use to store data**
  - **Hard Disc Drive (HDD)**
  - **Solid State Drive (SSD)**

Which Drive Is Best?

Hard Disc Drive

- **Data stored on Disks like CD**
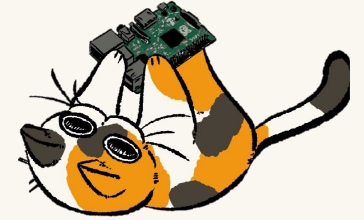- **Very large capacity**
- **Cheaper than SSD**
- **Can recover data if it fails**

Solid State Drive

- **Data stored on flash chips**
- **Faster load times**
- **Makes no noise in use**
- **Much smaller and lighter**

Storage Recommendation

How much storage you need is very much up to your needs, But:

- **You probably want at least one SSD to install your operating system on to go fast**

- **Any software or games you want to load fast also should be on an SSD**

- **If you need a lot of storage for things like (totally legal) video or music collections, make use of HDDs to store a lot of data for relatively cheap**
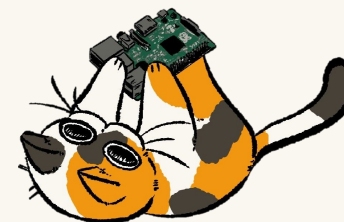
GPU

What's a GPU Really Do?
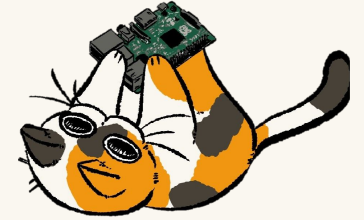
- **A Graphics Processing Unit is a semiconductor chip, like a CPU**

- **Unlike CPU, GPU are significantly limited in scope of purpose**

- **GPUs are designed for one main thing: simple computations**

- **While a CPU has 4-32 compute cores, a GPU could have thousands**

- **Parallelizing all of these cores makes GPUs very fast at what they do**

- **Good at engineering, video rendering for editing and games, and even crypto mining**
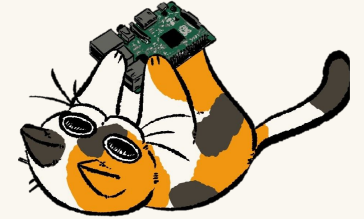
GPU Cards
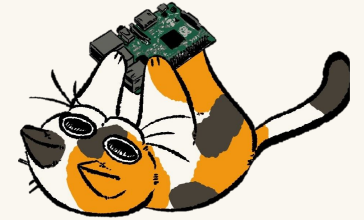
- **GPUs are usually found on large graphics card boards which will go into a PCIe slot**

- **GPU cards usually have large and heavy heatsinks to dissipate heat**

- **These cards also contain other chips for handling video compression and encoding, output ports, and other miscellaneous components**
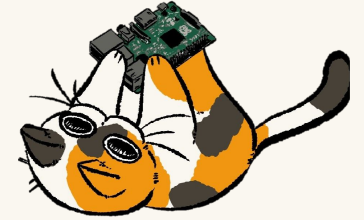
PCIe Slots

- **Peripheral Component Interconnect express slots general purpose to add devices to a PC**

- **PCIe slots are located in a row on a motherboard, near the back of the pc with cover slots**

- **Examples of other external cards added on PCIe slots are sound cards, wireless receivers, extra memory, or even a second graphics card**

- **Large PCIe slots will have a locking connector to help hold in large cards**
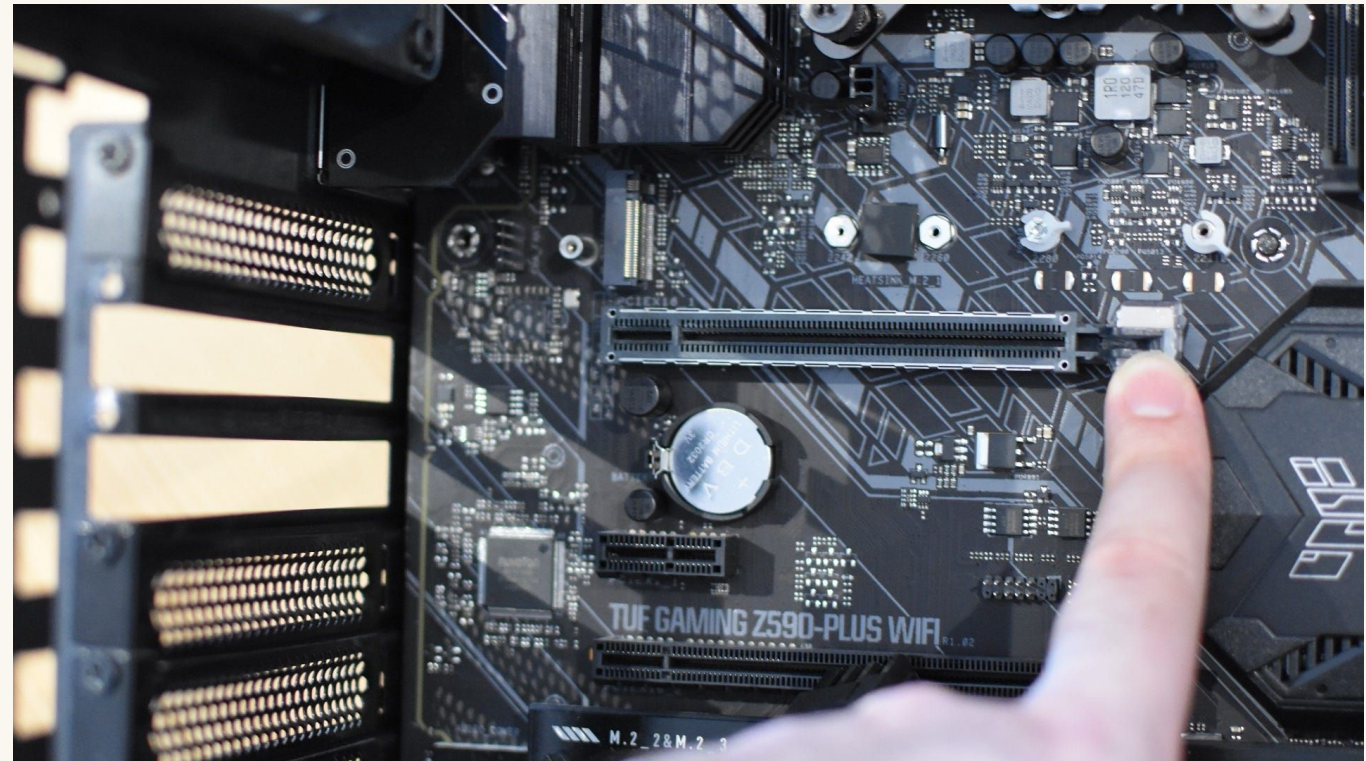
Which GPU Should You Get?

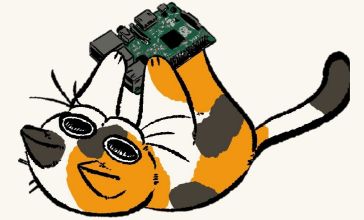**GPUs are very expensive nowadays, but you'll want one if:**

- **You edit a lot of videos or other large data / image sets or 3D modelling**

- **You want to play big games with intensive graphic features or high FPS**

- **Your CPU doesn't have integrated graphics (you need at least one)**

- **You want to mine cryptocurrency (in 2024?) and don't want a dedicated ASIC**

The more expensive your GPU is, the better, but prepare to spend a lot for the best
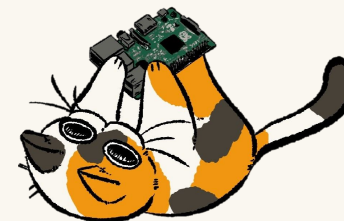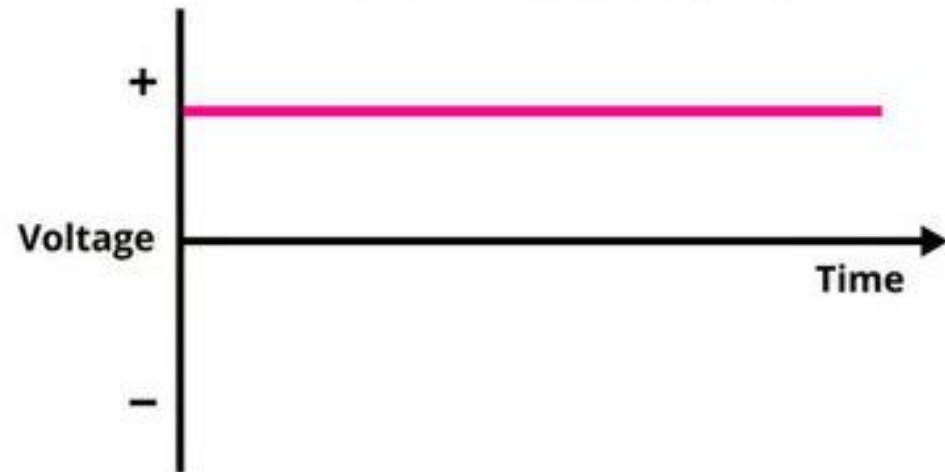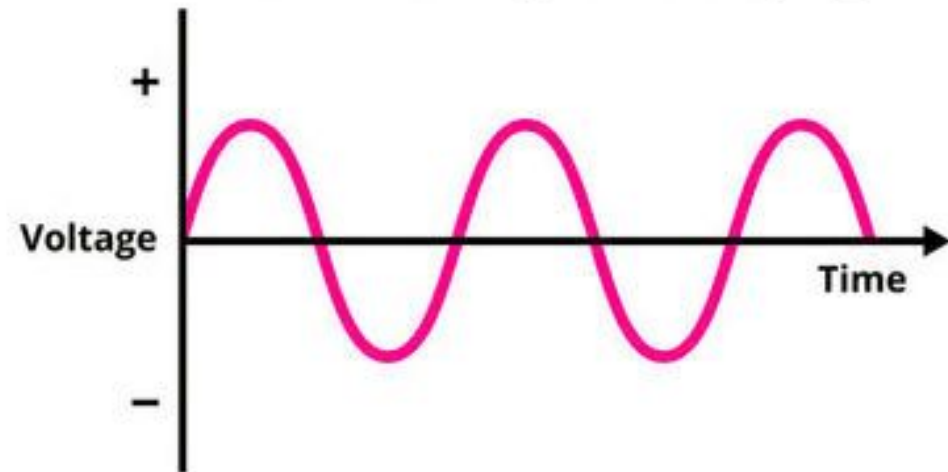
Power

Current
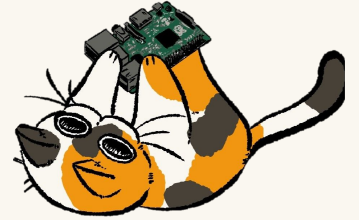

Alternating Current and Direct Current

AC V/S DC

Direct Current (DC)

Voltage / Time

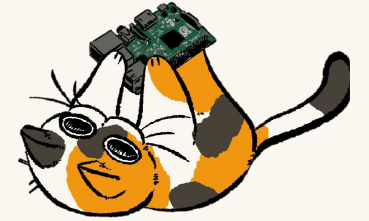**Alternating Current (AC)**
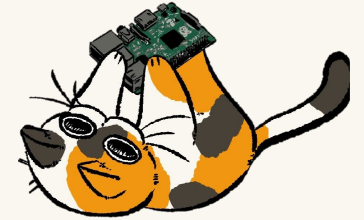
Voltage / Time

AC/DC

- **Your PC needs a Power Supply Unit to power it, just like a phone charger**

- **Converts AC from an electricity outlet into DC for a computer to use**

- **Often times as much as >1000W power output for a PC nowadays**

- **PCs demand high quality and stable DC power to run properly and not crash**
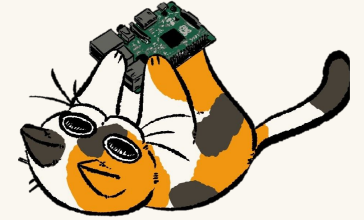
Don't Open a PSU; You Could Die

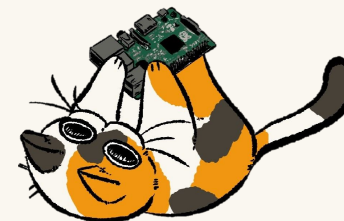# 80+ Performance Enhancements
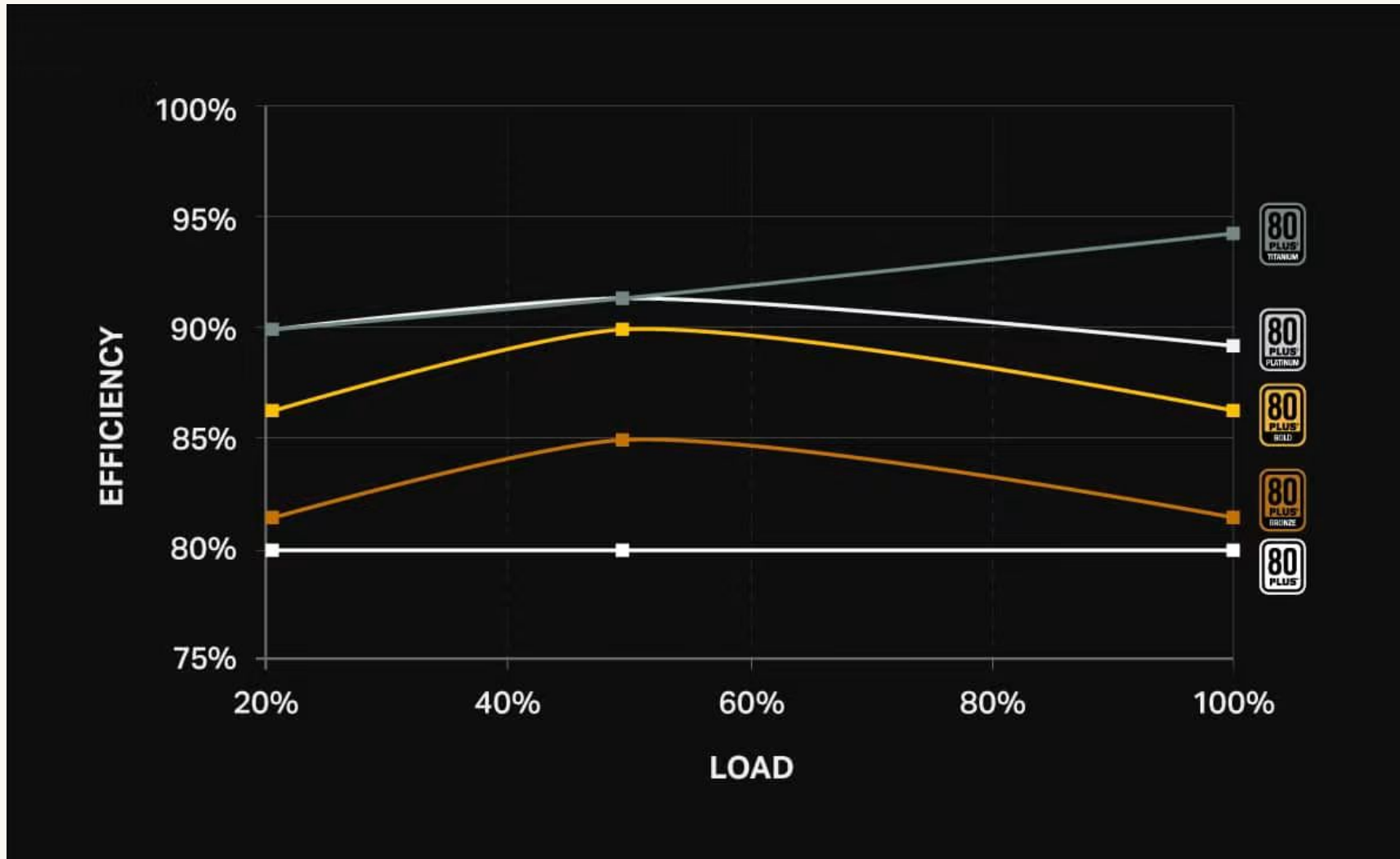
How Big Does My PSU Have to Be?
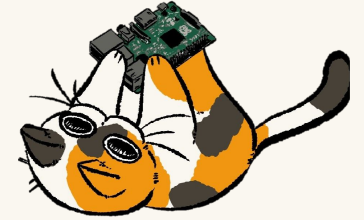
Bigger is better, but not too big

- **Your CPU and GPU power consumption in wattage must be covered**

- **Find the wattage of your CPU and GPU, add together and double it**

- **Try for an 80+ gold or better if you need to save electricity**

- **Some power supplies will have quiet eco modes if you care about noise**

Cooling

Staying Cool

- **Computers are toasters with extra steps**

- **Every watt of energy (almost) you put into your computer will turn into heat at some point, which you need to get rid of**

- **Too much heat in parts will slow them down and degrade them faster, or kill them**

- **Heatsinks and case airflow is how we achieve cooling**

CPU Cooler
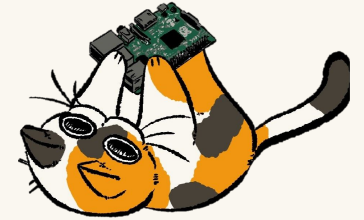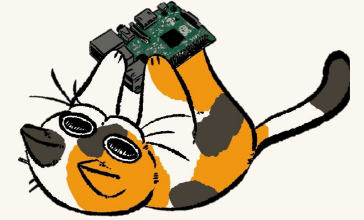
- **Your CPU will need a cooler of its own, if it doesn't come with one**

- **Many smaller parts also have simple heatsinks to radiate heat into the area**

- **Cases need fans attached and plugged into the motherboard to circulate hot air**
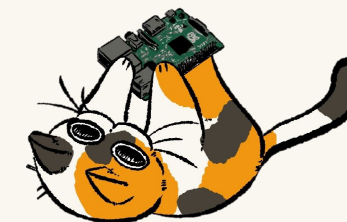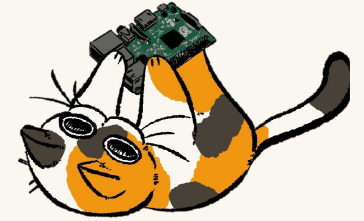
What Cooling Do I Need?

A few fans is all that's typically necessary, but:

- **CPUs can come with their own, so check if you even need one for it**

- **If you need to get a cooler, make sure it's rated for your CPU wattage and case clearance**

- **GPUs usually come with their own cooler on the card**

Conclusion

Next workshops ☺️ !

Resume Critique by CISCO Engineers

Food will be provided!

OCTOBER 18 | 4 - 6:00PM | TBD

- Learn about job opportunities at CISCO

- Get your resume reviewed by CISCO engineers

- Network with CISCO engineers

IEEE COMPUTER SOCIETY
Student Branch Chapter at the University of South Florida

Register here!

Introduction to Python!

Food will be provided!

OCTOBER 21 | 6:30 - 7:30PM |

- Learn basics of Python from scratch
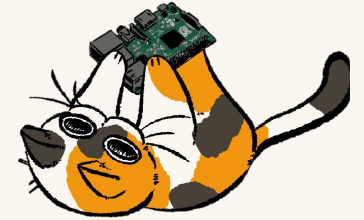- Learn to do Integrals and differentials in Python
- Open to all majors!

IEEE COMPUTER SOCIETY
Student Branch Chapter at the University of South Florida

Register here!

Next workshops 😊 !

Publix chicken & vegetarian wraps provided!

Introduction into Embedded Systems Workshop

OCTOBER 25 | 4 - 5:30PM | TBD

- **Overview of Embedded Applications within today's society**

- **Assembly & Embedded C**

- **Showcase of simple microcontroller project w/ MSP430**

Register here!

IEEE COMPUTER SOCIETY
Student Branch Chapter at the University of South Florida
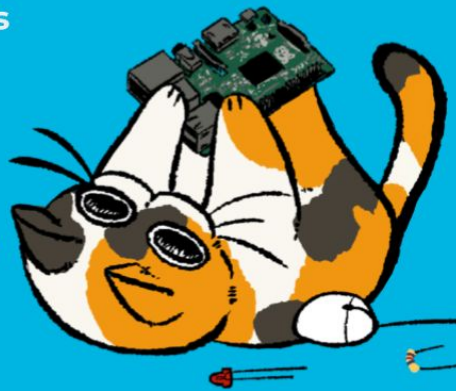
Publix catering will be provided!

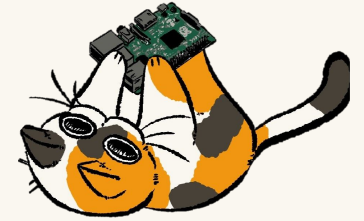## AWS, Microsoft, CompTIA & CISCO Certifications by CISCO Engineers

NOVEMBER 13 | 5 - 6:30 PM | TBD

- Learn about AWS, Azure, CompTIA Net+, & CISCO CCNA certifications

- Learn how they will make you appealing to recruiters

- Learn about Tool Network Academy

CISCO

Register here!

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Next workshops ☺ !

IEEE CS
TECHX Florida

NOVEMBER 23 | TBD

- IEEE-CS Conference about Internet of Things

- Features speakers from Cisco & Particle

- Hands-on workshop with Argon Particle Boards

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