

As Easy As Pie?



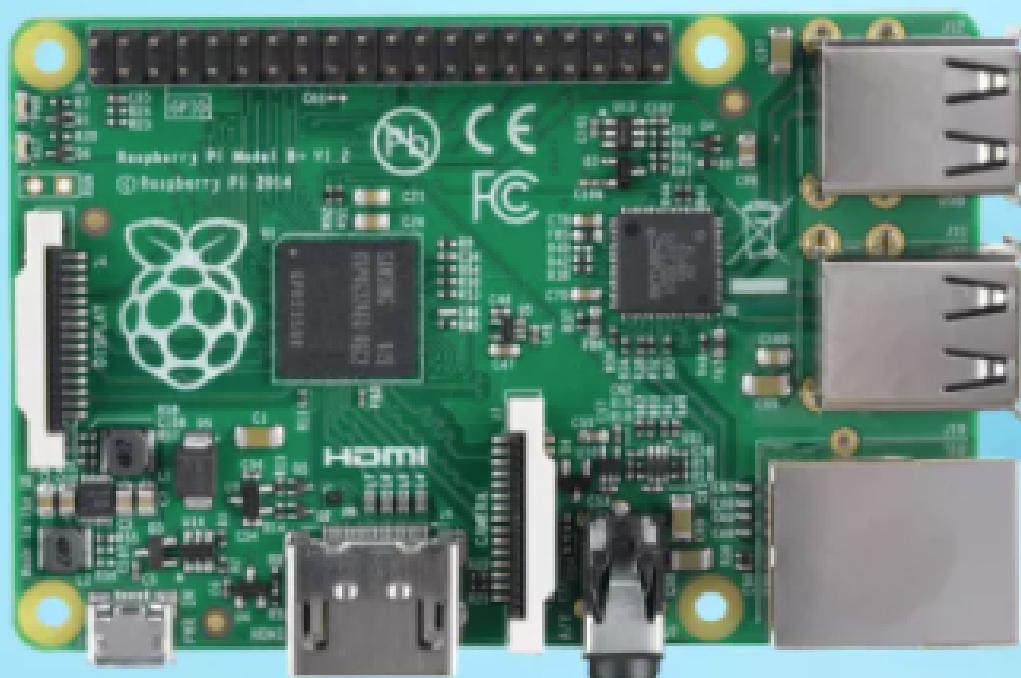
Oops! That's PI not Pie!



So Much Stuff!



Recently Turned 9!



What is a Raspberry PI?

- Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries. The original model became more popular than anyone could have anticipated.
- An initial sales goal of 1,000 units has been exceeded as over 38 million units with 21 models have been delivered.

Some Perspective:

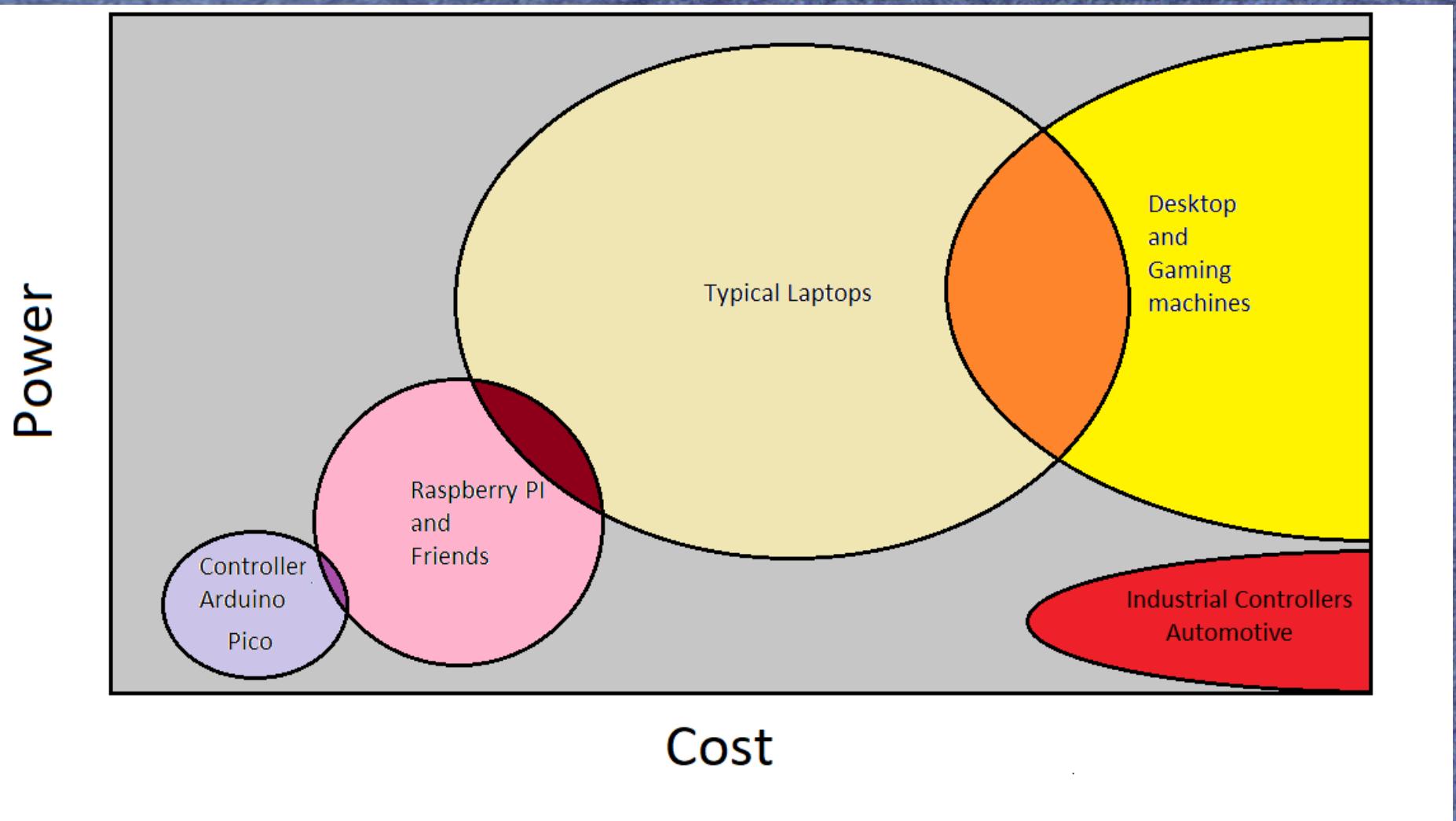
The original vision was that of a small, "hackable", inexpensive computer that could be used by students of computer science. It turned out that this combination of features, enabled many applications.

"We made a toy for children... and people took it to all sorts of exciting places."

Ebon Upton

- Founder of the Raspberry PI Foundation
- CEO of Raspberry PI (Trading) Ltd.

Where does it fit?



The PI has many "Friends"

- The Odyssey X86J4105, The Odroid C4, The Rock Pi 4B, The LattePanda, The Tinker Board, The LattePanda Alpha, The LattePanda Delta, The NVIDIA Jetson Nano, The ODROID N2, The Atomic Pi, The Khadas VIM3, The NanoPi M4, The NanoPi NEO4, The Edge-V, The VIM2, The ROCKPro64, The UDOO x86 Advanced Plus, The ODROID-XU4, The ROCK64, The Banana Pro, The LeMaker Guitar, The Orange Pi 3, etc, etc etc.
- Trade off: Price/Power vs Quality of SW support and a huge, active user community!

The PI Family Tree

Model	Type	RAM	Net	Wireless	GPIO	OS?	Size
Raspberry PI	A/B	256M	B	No*	26	Linux	Std
	A+/B+	512M	B+	No*	40	Linux	Std
Raspberry PI 2	B	1G	Yes	No*	40	Linux	Std
Raspberry PI Zero		512M 1G	No	No*	40	Linux	Small
		512M 1G					Small
Raspberry PI 3	B	1G	Yes	Yes	40	Linux	Std
	A+	512M	No	Yes	40	Linux	Compact
	B	1G	Yes	Yes	40	Linux	Std
Raspberry PI 4	B	1-8G	Yes	Yes	40	Linux	Std
	400	4G	Yes	Yes	40	Linux	Keyboard
Raspberry PI Pico ^μ		264K	No	No	26*	None	Small*
Compute Modules*	*	Varies	*	*	*	Linux	Varies

What makes the PI Special?

- There are four things that separate the Raspberry PI (and it's friends) from typical computers, laptops, and tablets.
 - A) Cost.
 - B) Form Factor.
 - C) Power Consumption.
 - D) Specialized I/O options.

What Does It Cost?

- Prices from Amazon.ca for reference purposes only.
- Note: machines need additional stuff to work.

Unit	Price	Needs this additional stuff:
PI 0/WH	\$40	Not sure. At least (*) but may need more.
PI 3	\$65	(*) Power Supply, Case, Cooling System, SD Card with Operating System, HDMI Cable, Keyboard, Mouse, and Monitor. (?)
PI 3 Starter Kit	\$100	Keyboard, Mouse, and Monitor.
PI 4 4G	\$92	See (*) above.
PI 4 8G	\$125	See (*) above.
PI 4 Starter Kit	\$135	Keyboard, Mouse, and Monitor.
PI 400 "Complete" Kit	\$180	Monitor.

Form Factor

- Most Raspberry PI systems come in the form of a small P.C.B. with no case. This allows integration with an O.T.S. case or a custom packaging solution.

Devices	Dimensions	Notes
Others	85.6 mm × 56.5 mm	Standard Size
Certain Models	65.0 mm × 56.5 mm	Compact
PI Zero	65.0 mm × 30.0 mm	Small
PI 400	Special	Covered Later

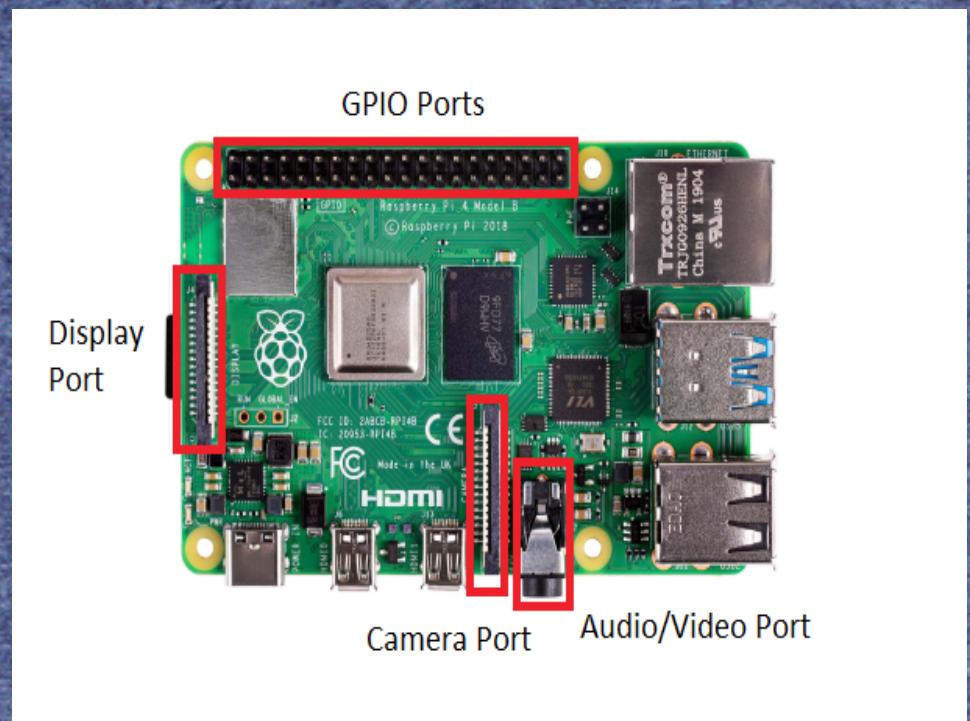
Power Consumption

- The small, simple Raspberry PI with its ARM based SOC processor, is very light on power consumption.

Device	Power Used (Idle)	Power Used (Max)
PI 3	1.5 – 2.3 Watts	6 – 7 Watts
PI 4	3 Watts	6.3 Watts
My Desktop PC	86 Watts (45 Watts Screen)	182 Watts (Fallout 4)
Toshiba Laptop	26 Watts	
2Go Laptop	16 Watts	

Specialized I/O Options

- We use the PI 4 as an example of I/O unique to the Raspberry PI:
 - GPIO Ports
 - Display Port
 - Camera Port
 - A/V Port
- Note: Available ports do vary based on the model of Raspberry PI.



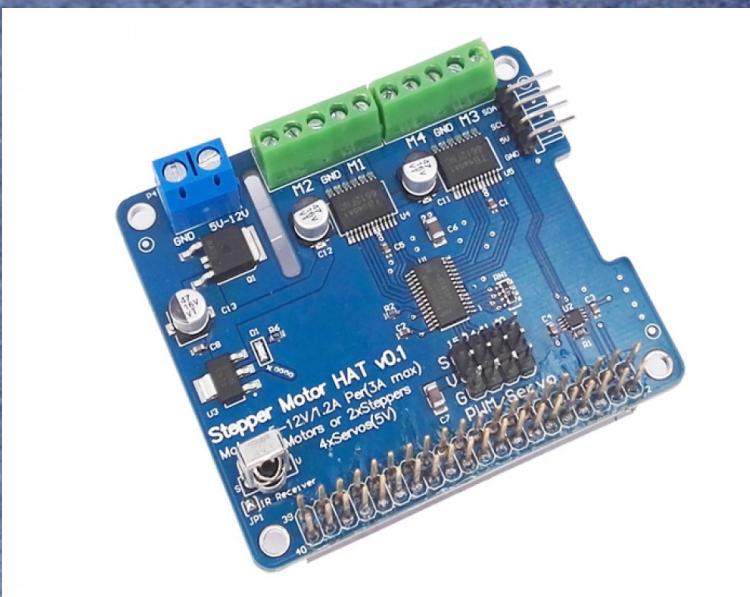
GPIO

- The GPIO has no equivalent in modern consumer computers. It contrasts with USB, WiFi and Bluetooth in terms of complexity.
- It allows easy experimentation with plugin wiring and prototyping boards.
- The configuration of the GPIO connector (header) is a defacto standard. Most SBCs have a PI compatible GPIO 40 pin header.
- Many option boards are available that are plug compatible with the GPIO header.

Example GPIO Devices

- It starts with an LED. The PI can make an LED blink under program control. Instead of an LED, any device could be switched on or off under program control. Unlike store bought items, you get to decide what the program does. If you don't like it, change it! You are not stuck with what's on offer.
- Add on boards are called “hats”.
- Control motors, lighting, and heating, etc. Display data so no monitor needed.
- Sense light, temperature, humidity, position, motion, user input, and much more.

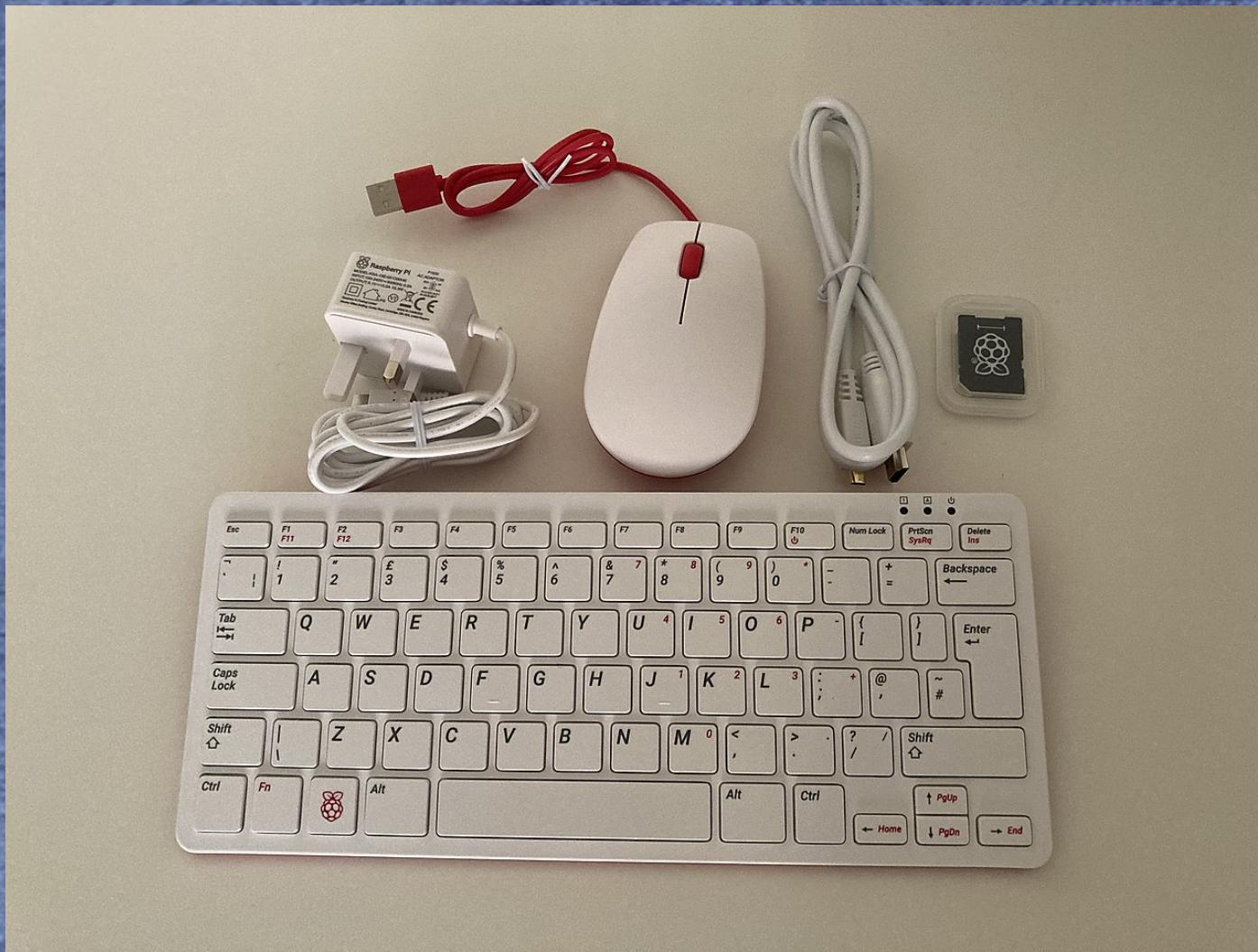
Some examples



Who is the Target User?

- The Raspberry PI was initially developed for students of computer science and engineering.
- While a success there, it has also been embraced by:
 - Student/Hobbyist Engineers
 - Systems Integrators
 - Custom Engineering Companies
 - Makers
- For these groups, the features of the Raspberry PI are especially attractive.

The PI 400 is Unique



Setting up an O/S

- One of the tasks common to all PI systems is the need to create a bootable SD-Card device.
- It is possible to purchase preprogrammed cards.
 - These cards are often included in bundles or "starter" kits.
- You can also use a tool called Raspberry PI Imager.
 - Available for Windows, MAC, and Linux.
- For the more adventurous, a full manual install is also possible. This is more complex, but still relatively safe if you don't use your only SD-Card.

Using Raspberry PI Imager

- Here's what you'll need:
- Visit

<https://www.raspberrypi.org/software/>

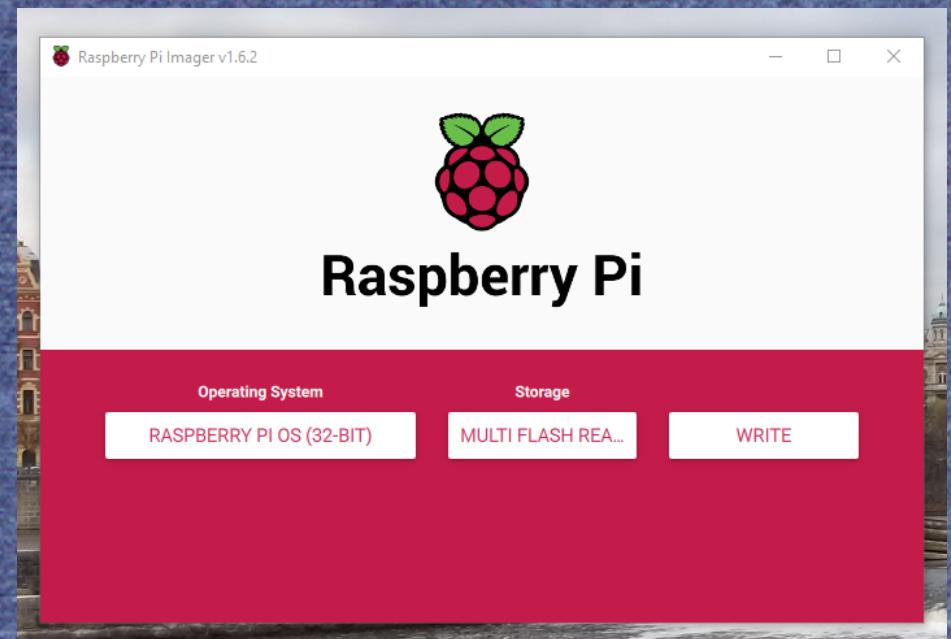
Download and install the
Imager program.

- Run the program
- Plug in the SD-Card



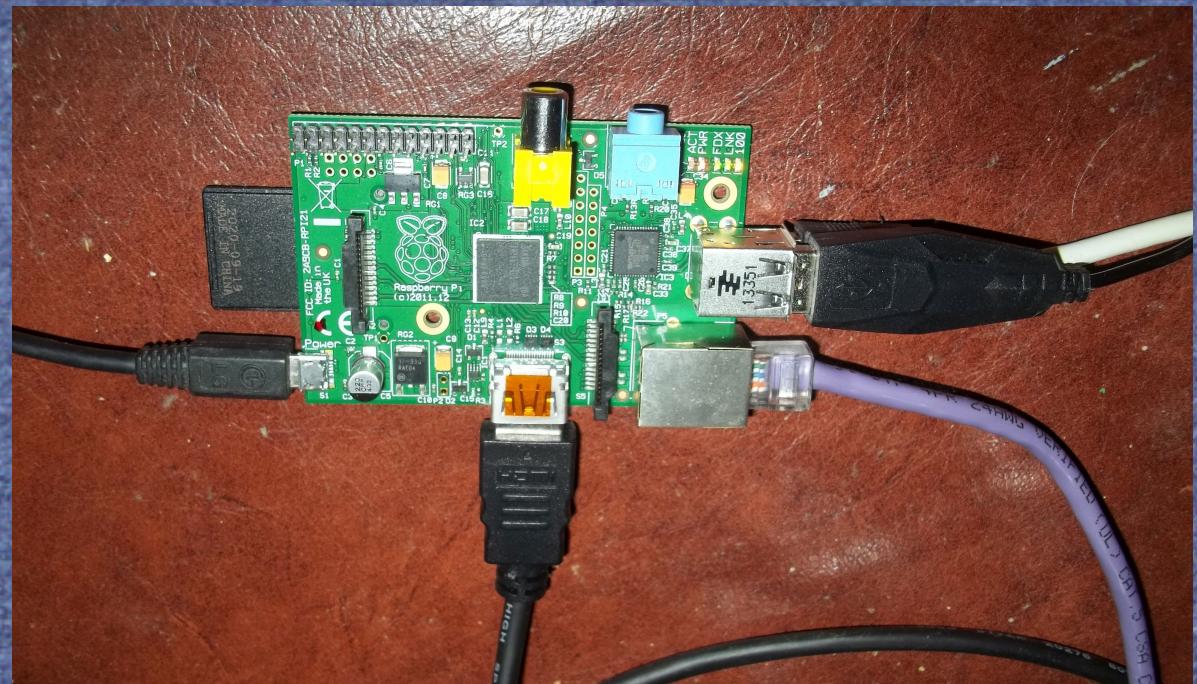
Continued...

- Select an O/S. To start choose Raspberry PI OS (32-BIT)
- Select the SD-Card storage device!
- Click Write. Takes 15 minutes to write and verify (YMMV)!
- It will tell you to remove the card. DO SO AT ONCE!



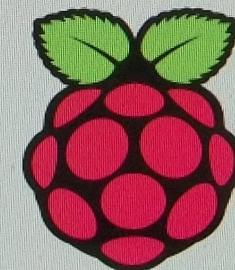
Setting Up

- So here is my Raspberry PI.
- You can see connections for:
 - Power
 - Video
 - Keyboard
 - Mouse
 - Network
 - SD Card



When You Boot You'll See

Welcome to the
Raspberry Pi Desktop



Powered by Raspberry Pi OS (32-bit)

Release 3.6 - January 2022

After setup and updates...



Igor... The Monster Lives!

- Now what?
- To be useful our computer needs an application.
- There are too many to discuss here, so I will give few a samples.



But First...

- Can a Raspberry PI be used as a main PC?
- I have seen several videos where this is done for a week.
- Later PI machines do a better job. The PI 400 is better suited to this.
- But this not really what the Raspberry PI is all about.



The CupCade!

- This is a tiny video game arcade that contains a Raspberry PI running emulations of famous video games.
- The small size, low power use, and powerful CPU make this possible.
- Retro-computing is a major Raspberry PI application area.



PI Hole

- The PI Hole is a great example of the Raspberry PI as an “appliance”. It sits in your home network and directs advertisements into a nice black hole, or /dev/nul for you Linux types.
- It protects all devices you own including smart phones, Chromebooks, tablets, and other devices that don't normally have ad-blockers.
- This normally needs to be on 24/7. The small size and low power use of the Raspberry PI makes it perfect for this task.

How Does It Work?

- The PI Hole sits on your network acting as your personal DNS.
- A DNS translates web names into IP addresses.
- It has lists of known advertising domains. When one of these is encountered, it translates it to a blank address.
- The web site “thinks” it's serving up ads, but it isn't.
- This works even for devices that cannot run ad blocker software.

Find Out More

- I could have tried a deeper explanation of PI Hole but it would not fit, and somebody else is already doing this.
- The CPUsers Group of Pittsburgh is planning a PI Hole Live Install and Setup for June 19.
- See Hugh Crawford for details if you wish to attend this event and see how it is done.
- Hopefully it will be recorded so we can point people to the recording if they miss the live presentation.

Some References

- Wikipedia
- https://en.wikipedia.org/wiki/Raspberry_Pi
- GitHub
- <https://qrgo.page.link/Rzy26>
- <https://github.com/PeterCamilleri/DPCUC>
- References on this page.

