

All The Raspberry Pi You Want Guilt Free

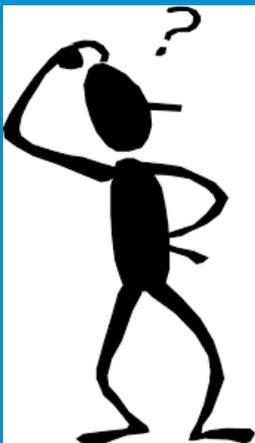
John Roach

KE0AHD
john80132@gmail

March 19, 2018

My First Raspberry Pi 2012

- a gift
- put OS on flash disk and powered up
- Impressive and a novel toy
- But what could I do with it?



A Solution
looking for
a problem

Problems To Solve, Applications

Soon a problem/application showed up
then another
and another
and another....



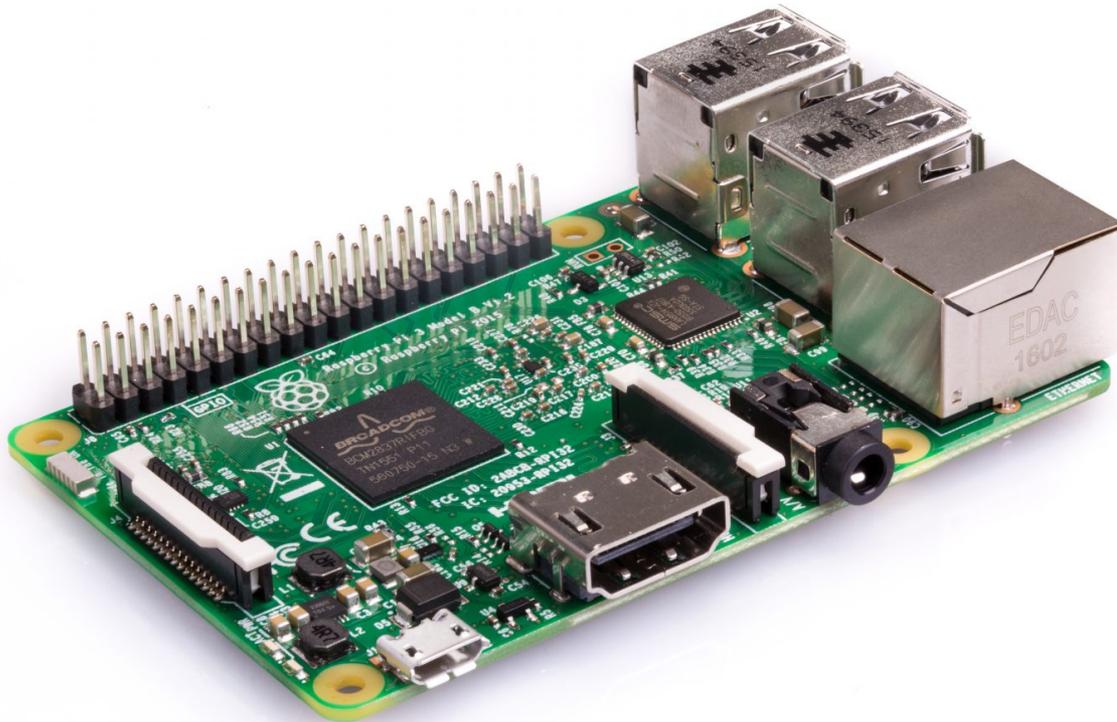
Five Raspberry Pi's deployed
Needed to buy another one for this talk

Raspberry Pi

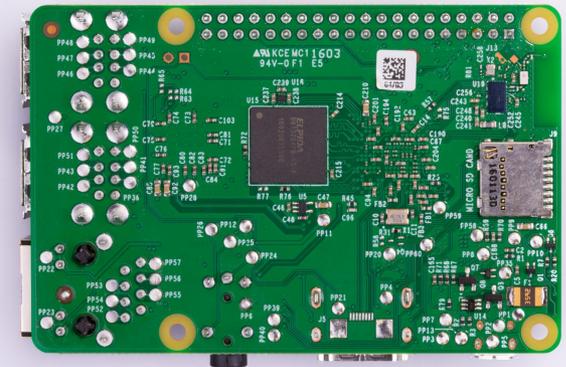
Background & Introduction

- The Raspberry Pi Foundation is a registered educational charity based in the UK.
- Roots go back to University of Cambridge's Computer Laboratory in 2006
- Raspberry Pi 3 Model B+
(release date 3/14/18)
- www.raspberrypi.org

Hardware Highlights



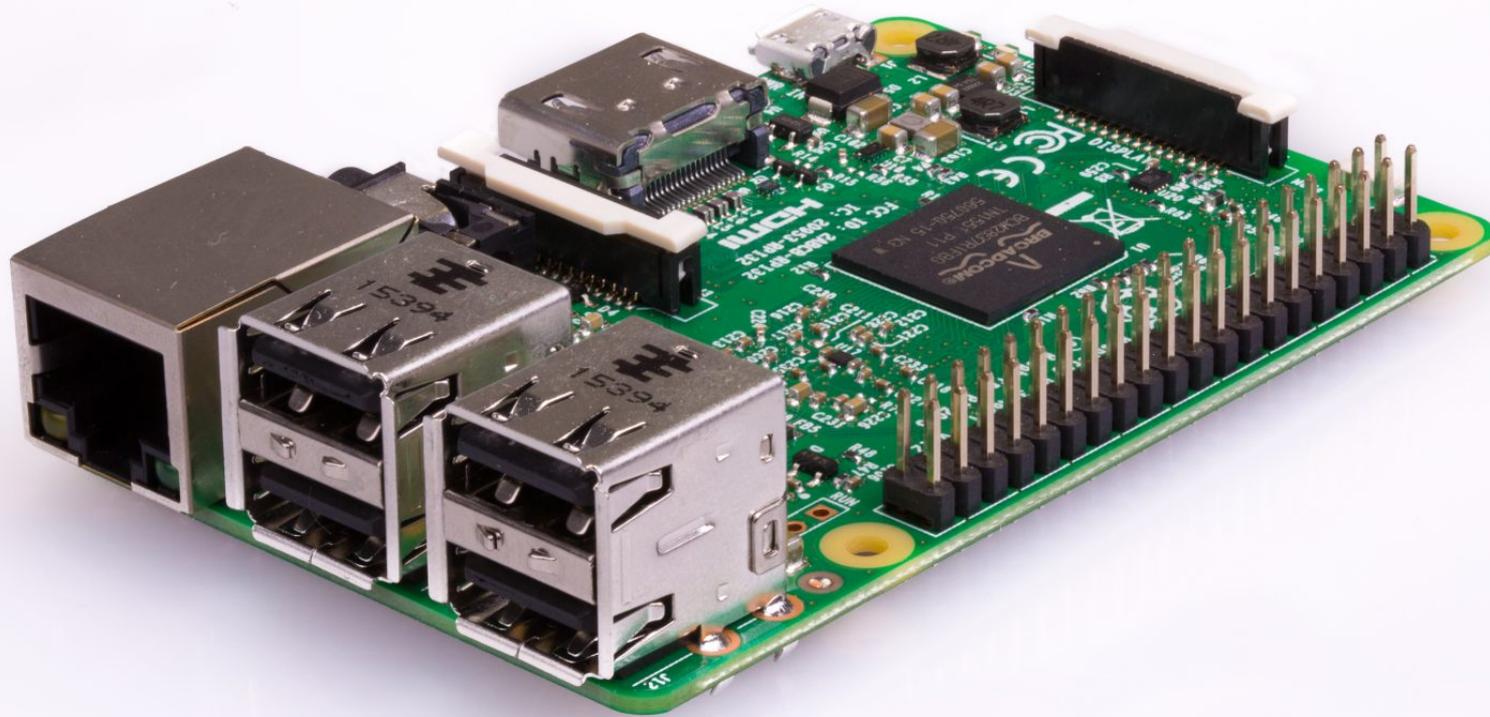
HDMI
Ethernet
WIFI
Audio out
USB power



Broadcom BCM2837

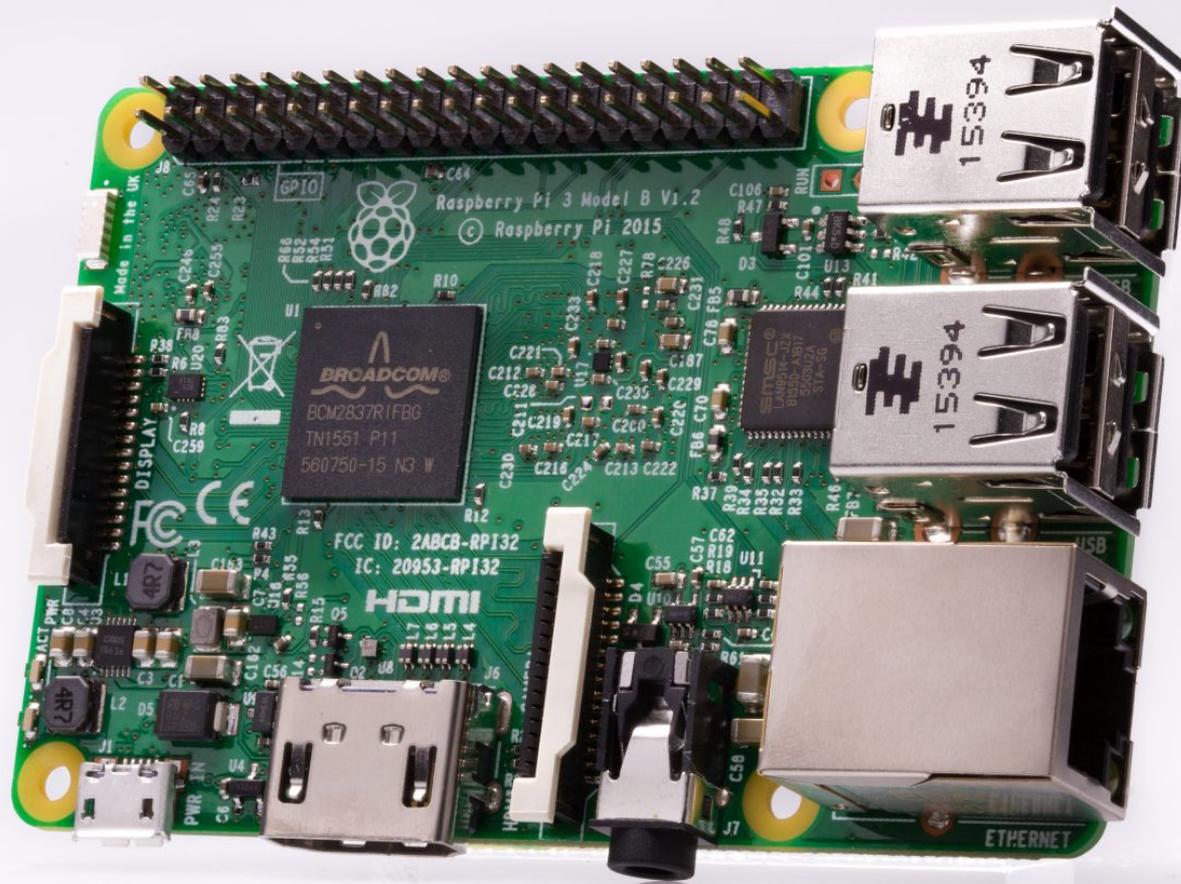
1.2 GHz 64/32-bit quad-core *ARM* Cortex-A53 1GB RAM

Ethernet 4 USB



TOP VIEW OF HARDWARE

NOTE GPIO PINS (General Purpose IO)



Actual Device Boot Demonstration

- Model 3B components and price
- Connect display to pi HDMI
- Raspberry Logo upper left menu
- Thumb drive to USB
- Could connect external USB disk
Western Digital 4 TB external drive

Raspberry Pi Zero

- Raspberry pi ZERO
show actual device \$5
- Single-core CPU
- HAT - Hardware Attached on Top
- IOT

Broadcom / Arm CPU

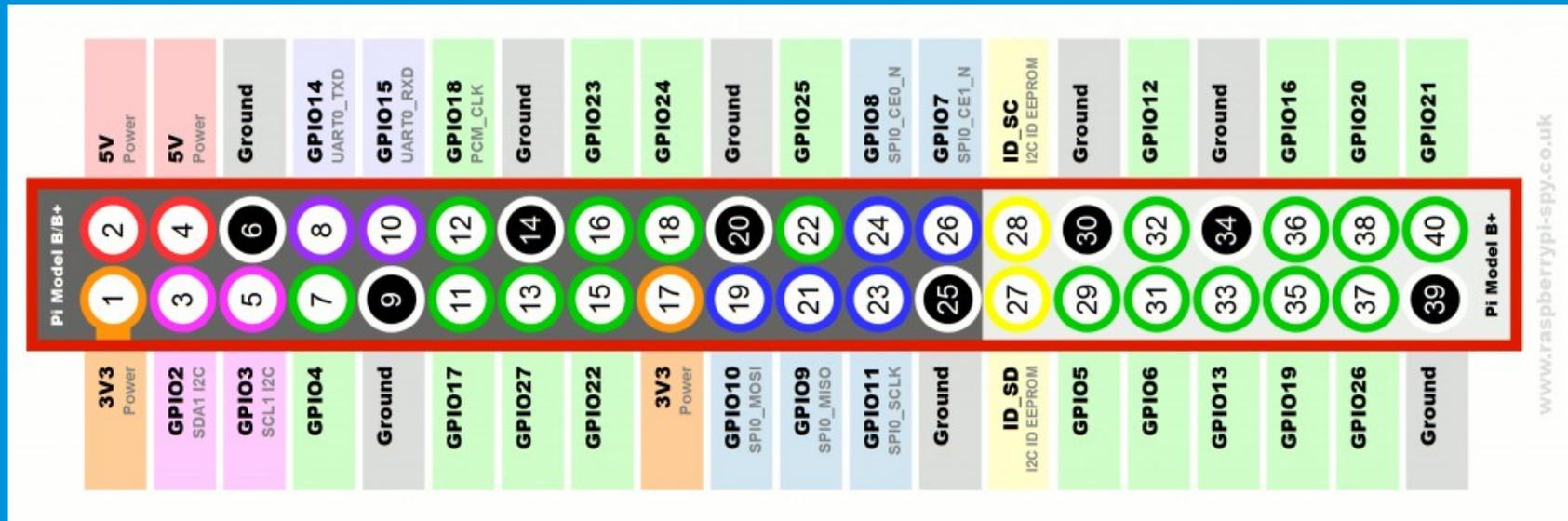
- Broadcom BCM2837 64bit quad core CPU is an ARM processor
- ARM - Advanced **Risc** Machines designs & license but does not manufacture
- A British company was publicly traded
- Was acquired by Soft Bank a Japanese company in 2016 for about 32 Billion Dollars.
- In 2017 they were in the process of selling 25% for \$8 Billion to Vision Fund (Saudi Arabian company)
- In 2015 – 15 Billion arm based processors were sold

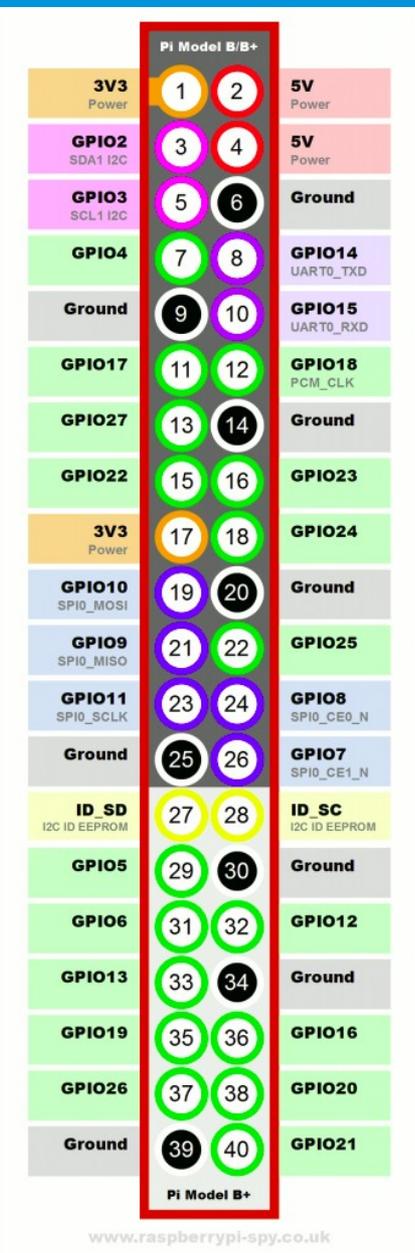
Software

- Linux – Debian + many more distros (Fedora)
(and windows 10 IOT Core)
- Linux – is open source nobody “owns” it
over 2 billion systems world wide
google May 2017 re: Android
- www.raspberrypi.org/downloads/
- NOOBE / NOOBS
- Write to flash Win32DiskImager or dd on linux

GPIO

General Purpose IO Pins





GPIO

General Purpose IO Pins

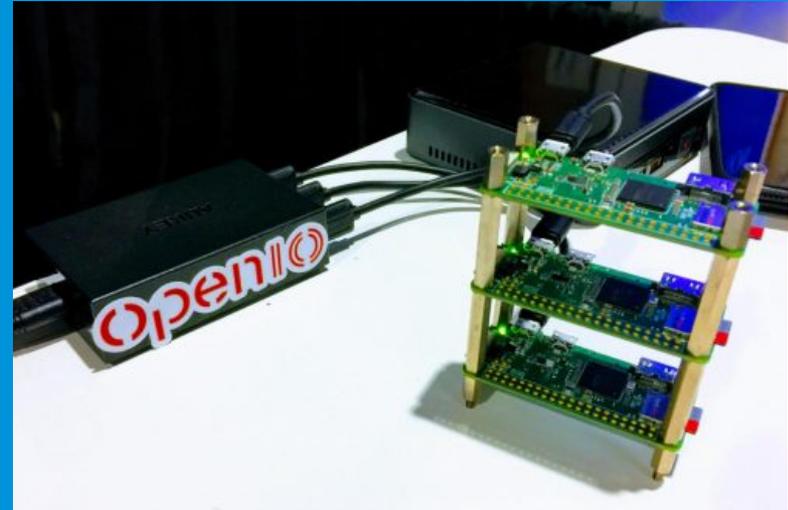
- Most of the pins go directly to the Broadcom chip – be careful to avoid a \$35 learning lesson
- www.raspberrypi.org/documentation/usage/gpio
- Requires privileged permissions
- (sudo or SETUID)

Price/Performance

- \$35 - Raspberry Pi 3 B+ 1.2GHz Broadcom BCM2837 ARM
- \$649 - Laptop 3.3 Ghz Dual Core i7-4600U
- 3.3 Ghz / 1.2 Ghz : 2.75 ratio
- \$649 vs \$35 – 18 Raspberry Pi's
- 18 Rpis at 1.2Gh or 1 @ 3.3Ghz
- Geekbench

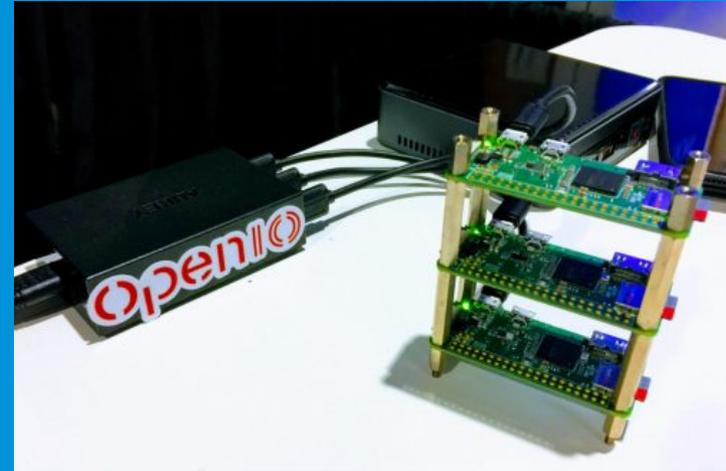
CLUSTERS

- 18 1.2Ghz or 1 3.3Ghz
- 3 Node Rpi Cluster



CLUSTERS

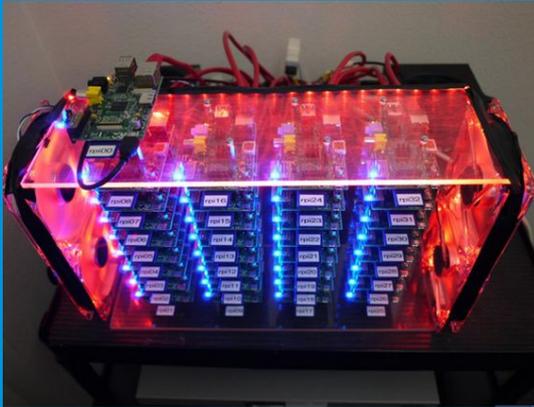
- 18 1.2Ghz or 1 3.3Ghz
- 3 Node Rpi Cluster
- 6 Node Rpi Cluster



MPI – Message Passing Interface

CLUSTERS

- 32 node Beowulf Cluster Boise State

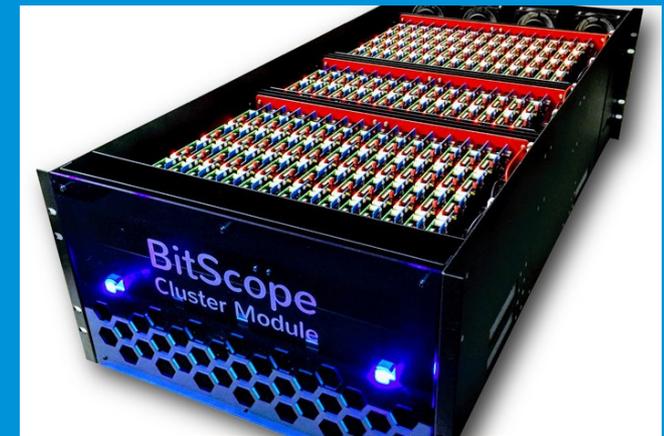


CLUSTERS

- 32 node Beowulf Cluster Boise State



- Los Alamos National Laboratory
750 CPUs or 3,000 cores
- <http://www.lanl.gov/discover/news-release-archive/2017/November/1113-raspberry-pi.php>



Ham Radio Applications

Not unique to Raspberry Pi

- Contact Logging – Xlog (sudo apt-get install xlog)
- CW Decoder - External USB Sound card <\$10
sudo apt-get install fldigi
- NOTE: ARM and INTEL processor instructions are different

Ham Radio Applications Unique to Raspberry Pi

- Control things – Relays
Antenna switching?
- Fox Hunt startup all transmitters
- Monitor things temperature, battery levels,
- FM radio transmitter
1Mhz-250Mhz using Pi's general clock output

More Ham Radio Applications

- WSPR using gpio pins
Raspberry Pi LF/MF/HF/VHF WSPR transmitter
<https://github.com/JamesP6000/WsprryPi>
<https://github.com/JamesP6000/WsprryPi>
- SDR
- google raspberry pi ham radio

DSTAR UHF

- Mounts on GPIO
- <http://www.dvmega.auria.nl/images/DVMEGA%20BlueDV%20manual.pdf>
- <http://maryland-dstar.org/html/raspiberry.html>
- If you want to build the software visit:
- <https://g0wfv.wordpress.com/how-to-mmdvmhost-with-a-dvmega/>

Alarm Monitoring

- Web server on Raspberry pi
- Instant email with pdf on alarm
- Morning health check

Alarm System vacationHome

lower door #1	Door CLOSED	Count = 0
lower windows #2	Windows CLOSED	Count = 0
upper doors #3	Doors CLOSED	Count = 0
upper windows #4	Windows CLOSED	Count = 0
ARM SWITCH	ARMED	Count = 0

Alarm System vacationHome

lower door #1	Door CLOSED	Count = 17
lower windows #2	Windows CLOSED	Count = 0
upper doors #3	OPEN DOOR	Count = 155
upper windows #4	Windows CLOSED	Count = 2
ARM SWITCH	ARMED	Count = 1

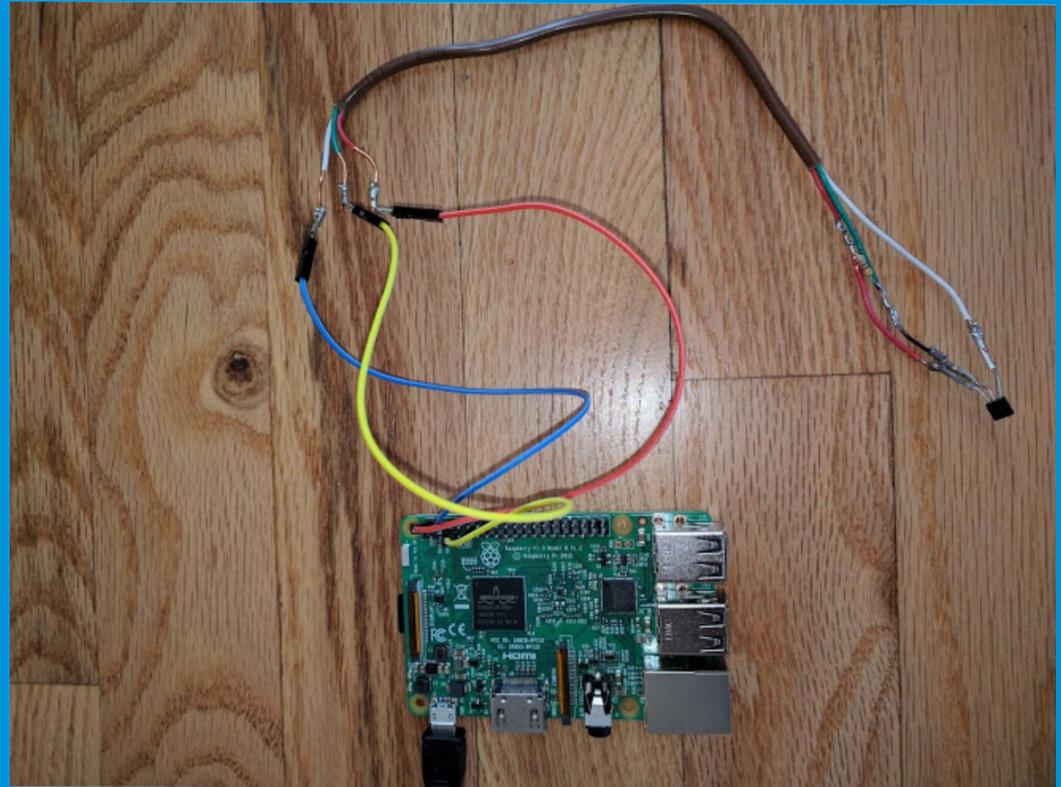
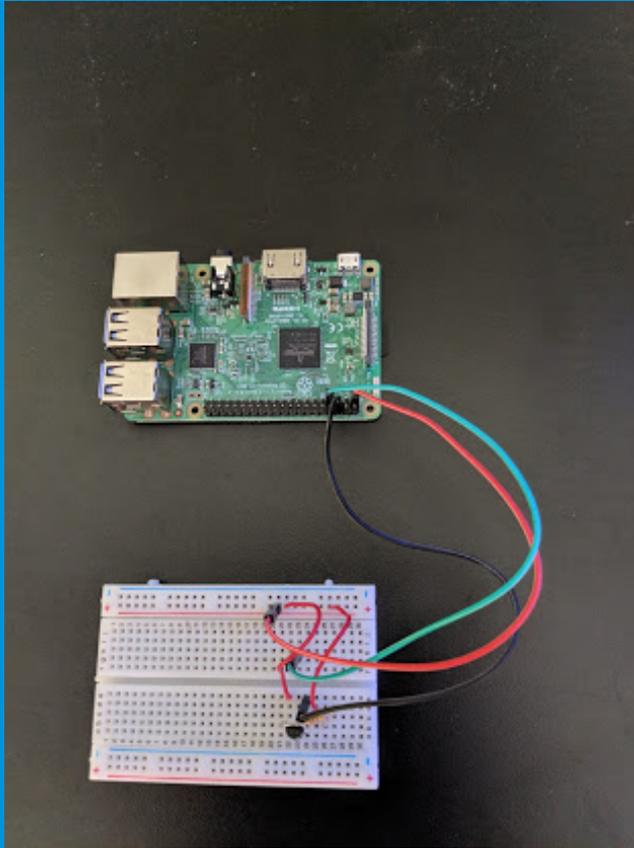
Power Outage Monitoring

Startup at 01:26:59 AM Sun 09/18/16 - after power outage of 0h 01m 37s
Startup at 06:48:24 AM Sun 09/18/16 - after power outage of 0h 01m 43s
Startup at 06:55:22 AM Sun 09/18/16 - after power outage of 0h 01m 40s
Startup at 09:11:34 AM Sun 10/23/16 - after power outage of 0h 01m 40s
....
....
....
Startup at 07:58:52 AM Thu 08/24/17 - after power outage of 0h 01m 41s
Startup at 03:39:50 AM Sat 09/23/17 - after power outage of 2h 28m 00s
Startup at 11:23:36 PM Wed 09/27/17 - after power outage of 0h 04m 15s
Startup at 07:32:31 AM Thu 09/28/17 - after power outage of 0h 21m 50s
Startup at 09:26:52 AM Thu 09/28/17 - after power outage of 1h 52m 05s
Startup at 03:10:14 PM Thu 09/28/17 - after power outage of 5h 30m 47s
Startup at 09:36:39 PM Sun 10/01/17 - after power outage of 0h 01m 38s
Startup at 02:27:36 AM Wed 11/01/17 - after power outage of 0h 01m 37s
Startup at 10:08:38 AM Mon 12/11/17 - after power outage of 1h 54m 01s
Startup at 06:42:11 PM Sat 12/23/17 - after power outage of 0h 01m 40s
Startup at 05:15:21 PM Tue 01/30/18 - after power outage of 0h 01m 46s

One Wire

- a serial protocol using a single data line
- www.maximintegrated.com/en/app-notes/index.mvp/id/1796
- <https://www.modmypi.com/blog/ds18b20-one-wire-digital-temperature-sensor-and-the-raspberry-pi>
- Must enable support on the Pi
- Raspberry logo on upper left of main window
Application Menu -> Preferences->
Raspberry Pi Configuration ->
Interfaces

DS18B20 Connections



One Wire Temperature

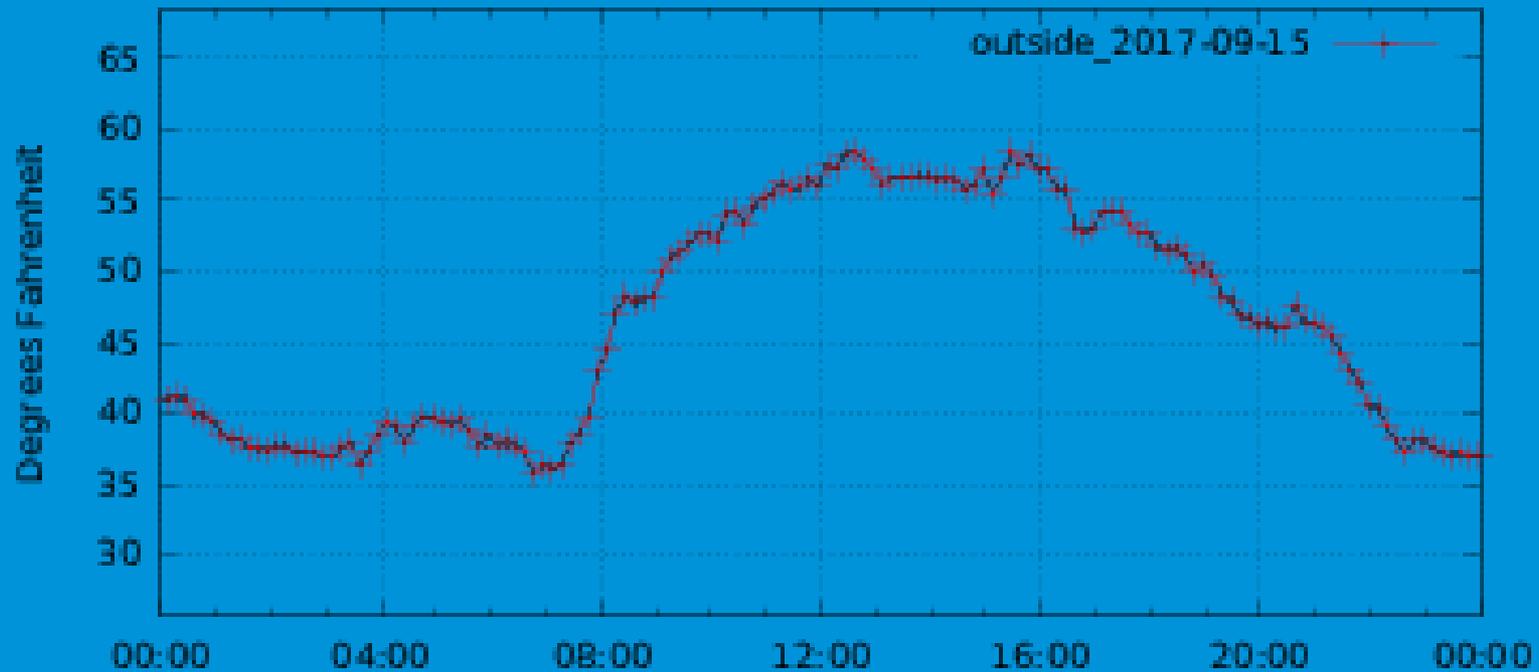
- Pi `sudo modprobe w1-gpio`
- `sudo modprobe w1-therm`
- `DS18B20_DEV=/sys/devices/w1_bus_master1/28-0316740aeeff/w1_slave #soldered wire`
- To read the temperature
- `cat $DS18B20_DEV |`

Daily Temp Report

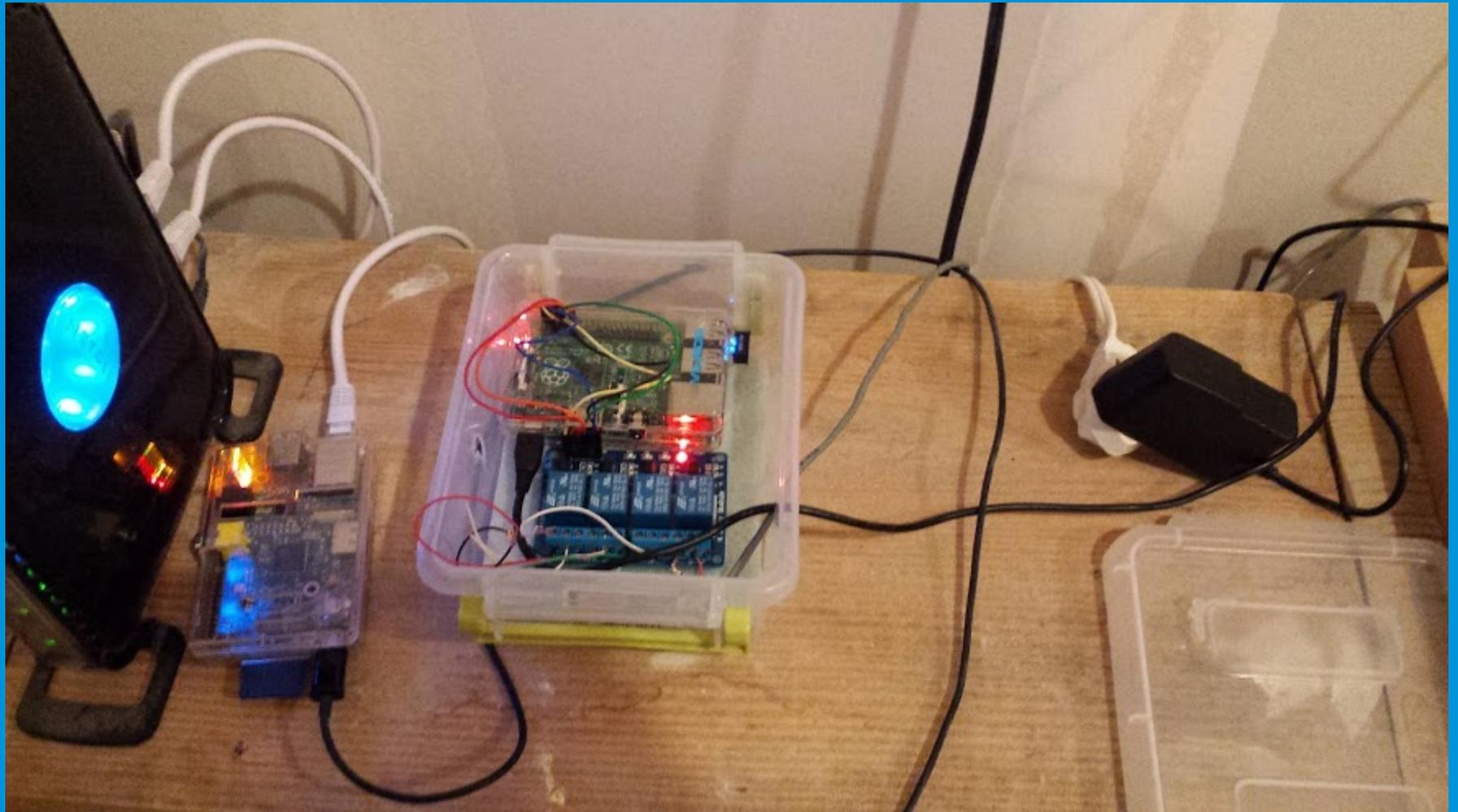
Temperature over last 24 hours

min=35.7116, max=58.4366

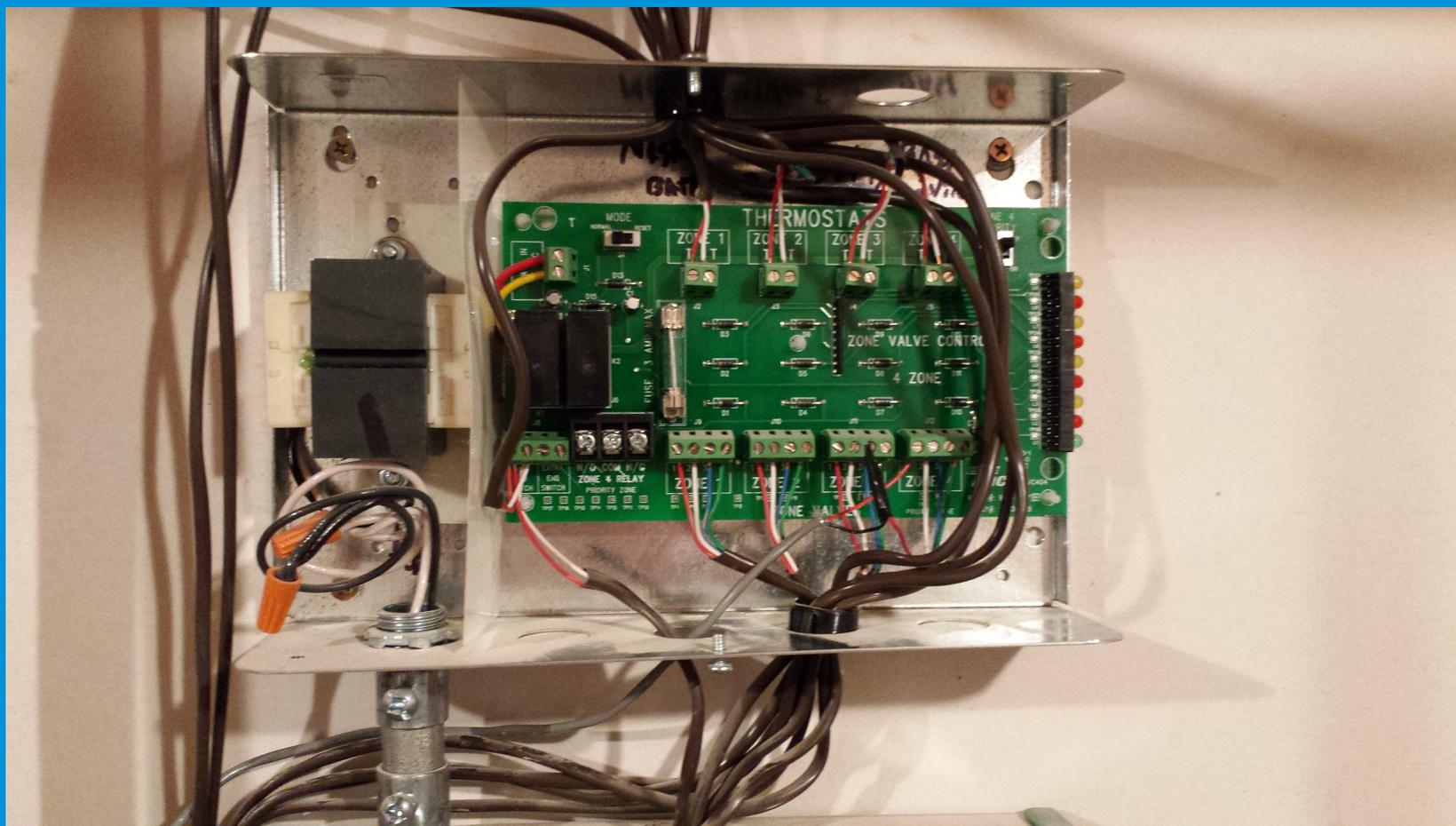
10 minute intervals



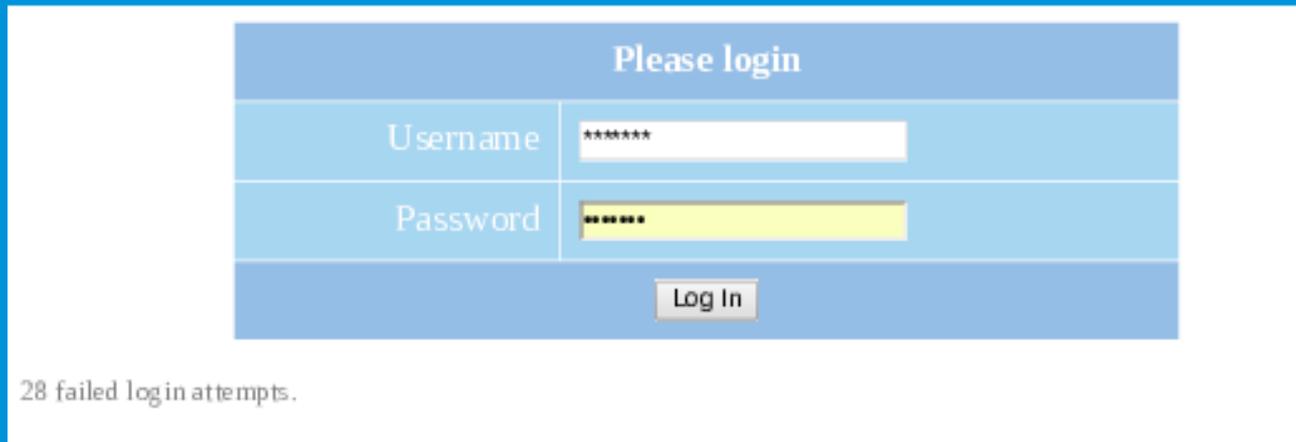
Remote Thermostat Application



Zone Control



Remote Heating Control On Raspberry Pi



The image shows a web-based login interface. At the top, a blue header bar contains the text "Please login". Below this, there are two input fields: "Username" and "Password". The "Username" field contains seven asterisks, and the "Password" field contains six asterisks. A "Log In" button is positioned below the password field. At the bottom left of the form, a message reads "28 failed login attempts."

- Requires an open port on Router
- Change pi default password

Heating zone web control of relays

Heating System

Welcome back **John Roach**. Click here to [Logout](#).



As of: 2/28/2018, 7:57:15 PM

Heating System Supervision and Control

Zone A the lower great-room thermostat is DISABLED to change select here

Zone B the upper master bedroom thermostat is DISABLED to change select here

Zone C the lower south east bedroom thermostat is DISABLED to change select here

Zone D the lower north east bedroom thermostat is DISABLED to change select here

TRD TASKS

“necessity is the mother of invention”



What if we connect a Raspberry Pi to the receiver chime?
What about a water sensor?

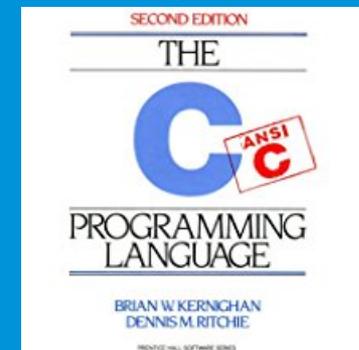
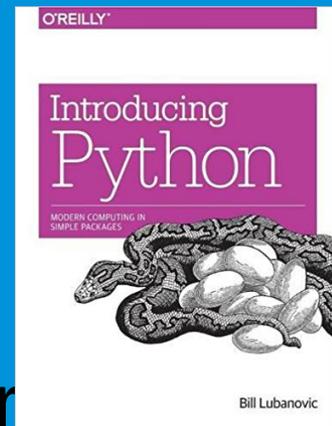
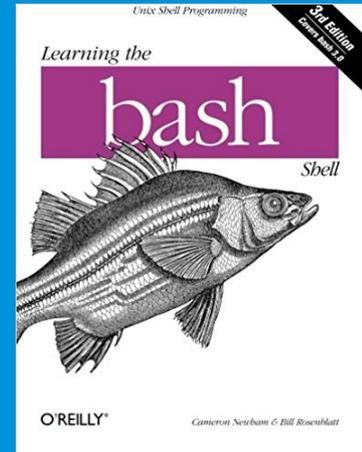


Arduino or Raspberry Pi

- Arduino – microcontroller
a simple computer that can run one program
- Raspberry pi – a general purpose computer running a full operating system
usually Linux
- You can install an sdk on a Raspberry pi
and login to the rpi
- Unlimited enhancements to an existing application /deployment using a Raspberry pi
- Compare a Raspberry Pi Zero for \$5 instead to an Arduino
- Consider which is a better investment of your time in learning and exploring

Where Do You Go From Here

- If you know Linux you will be right at home
- www.raspberrypi.org
- Look at books on LINUX - NOT Raspberry Pi
- "Learning the bash Shell" Oreily book.
- "Introducing Python"
- C Programming
www2.cs.uregina.ca/~hilder/cs430-833/Reference%20Materials/The%20C%20Programmer%20Language.pdf



Last Comments

- If outside access is exposed change the password for the user pi
- SSH client on Android
<https://play.google.com/store/apps/details?id=org.connectbot>
- Google search with keywords **stack overflow**
- **HAVE FUN AND LEARN**