Raspberry Pis
Computational Thinking and Cyberscience

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U.S. DEPARTMENT OF ENERGY

Argonne NATIONAL LABORATORY

Choose your own adventure

Introduction - Computational Thinking and Raspberry Pi ---------- 3 – 21

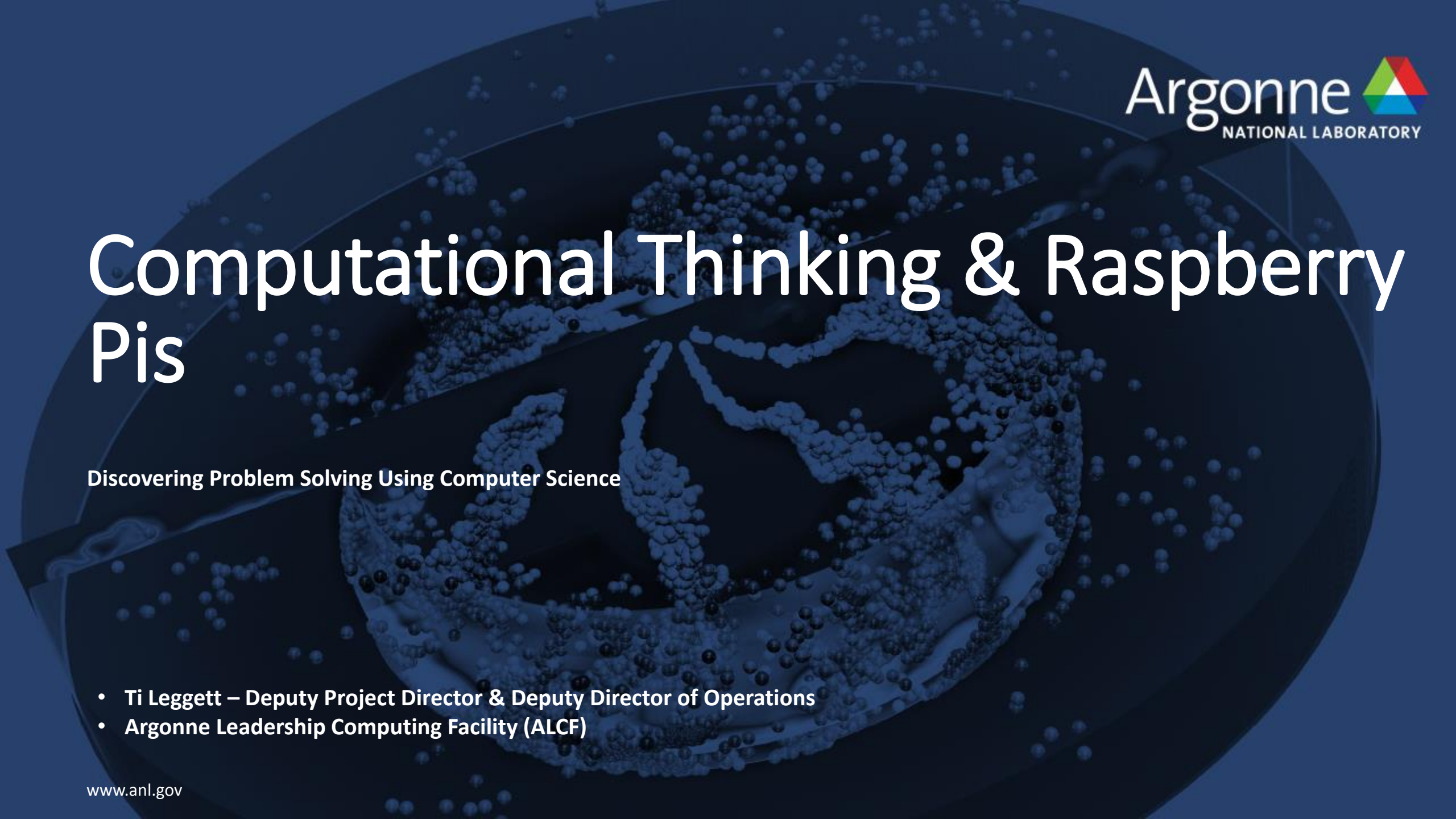
- Continuation of Introduction

Computing Tracks

- Demo - Tiny Titan Supercomputing Demo
- Talk - History and Future of Supercomputing
- Demo – Machine Learning on an Rpi

Cyberscience

- Hacking Demo 1 - DDOS demo
- Hacking Demo 2 - ARP Poisoning
- Alt – practice run for middle schoolers



Computational Thinking & Raspberry Pis

Discovering Problem Solving Using Computer Science

- **Ti Leggett – Deputy Project Director & Deputy Director of Operations**
- **Argonne Leadership Computing Facility (ALCF)**

Why computational thinking?

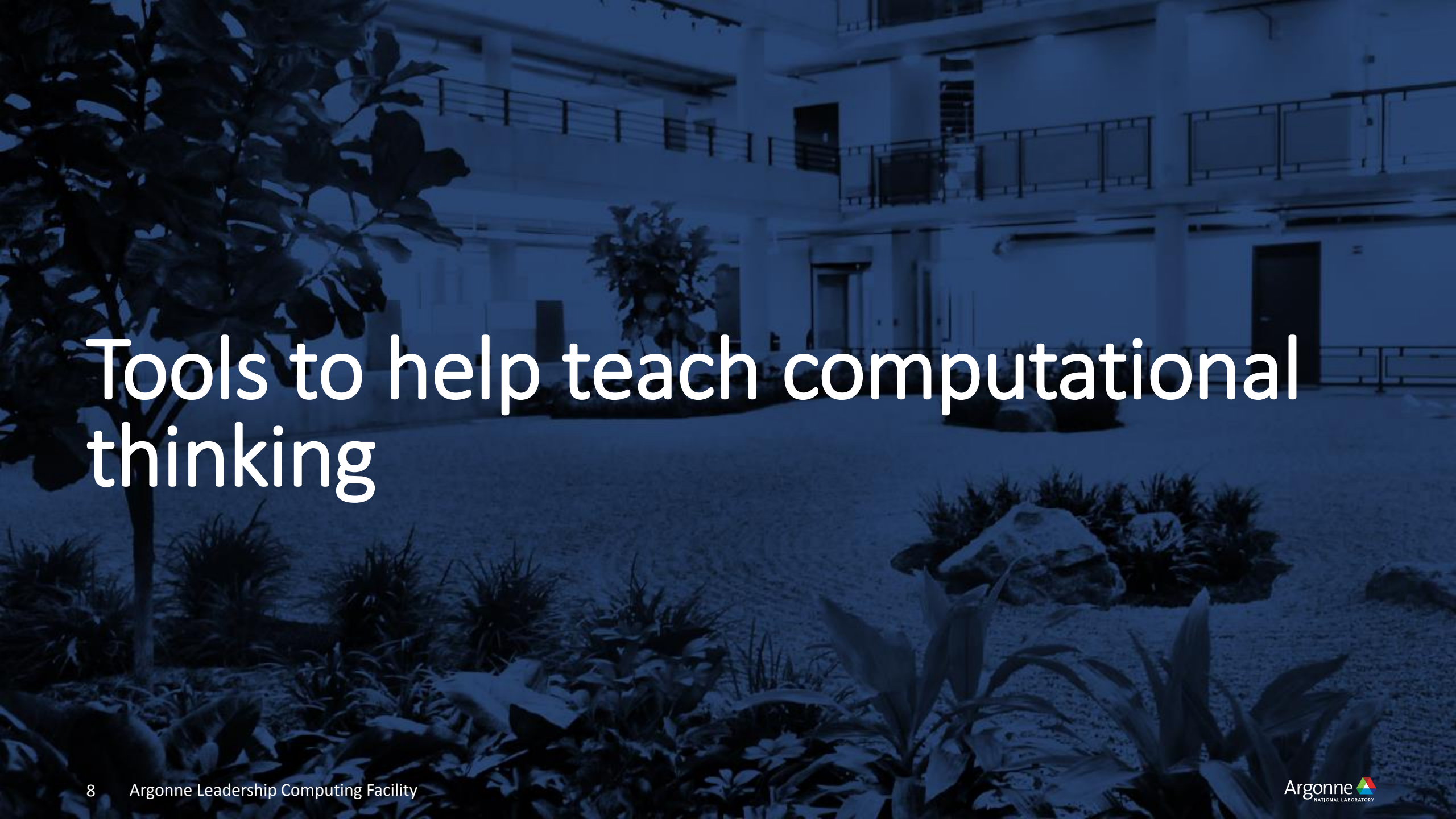
Problem Solving by Pattern Matching

- Critical skill, not just in computer science
- Break the problem down
  - What are you trying to solve?
  - What do you know/have?
  - Do you know what you don’t know?
    - How do you find out what you don’t know?
  - Do you notice any patterns?
    - After solution, can you simplify/optimize the solution further?

Examples

- Helping my son with math homework
- Assembling a wheelbarrow
- Building a house in Minecraft

My Story



Tools to help teach computational thinking

Software Resources

- **MIT Scratch**
  - http://scratch.mit.edu

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- **Code.org**
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- **Alice**
  - https://www.alice.org

What’s the difference?

- MIT Scratch
  - More open ended
  - Community based
- Code.org
  - Aligned with Common Core
  - Step by Step
  - Hour of Code
- Alice
  - Focuses more on visual and interactive
  - Not as widely used as other two

Hardware Resources

- **Lab computers, laptops, & tablets**

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- **PINE64**
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- **Raspberry Pi**
  - https://www.raspberrypi.org

What's the difference?

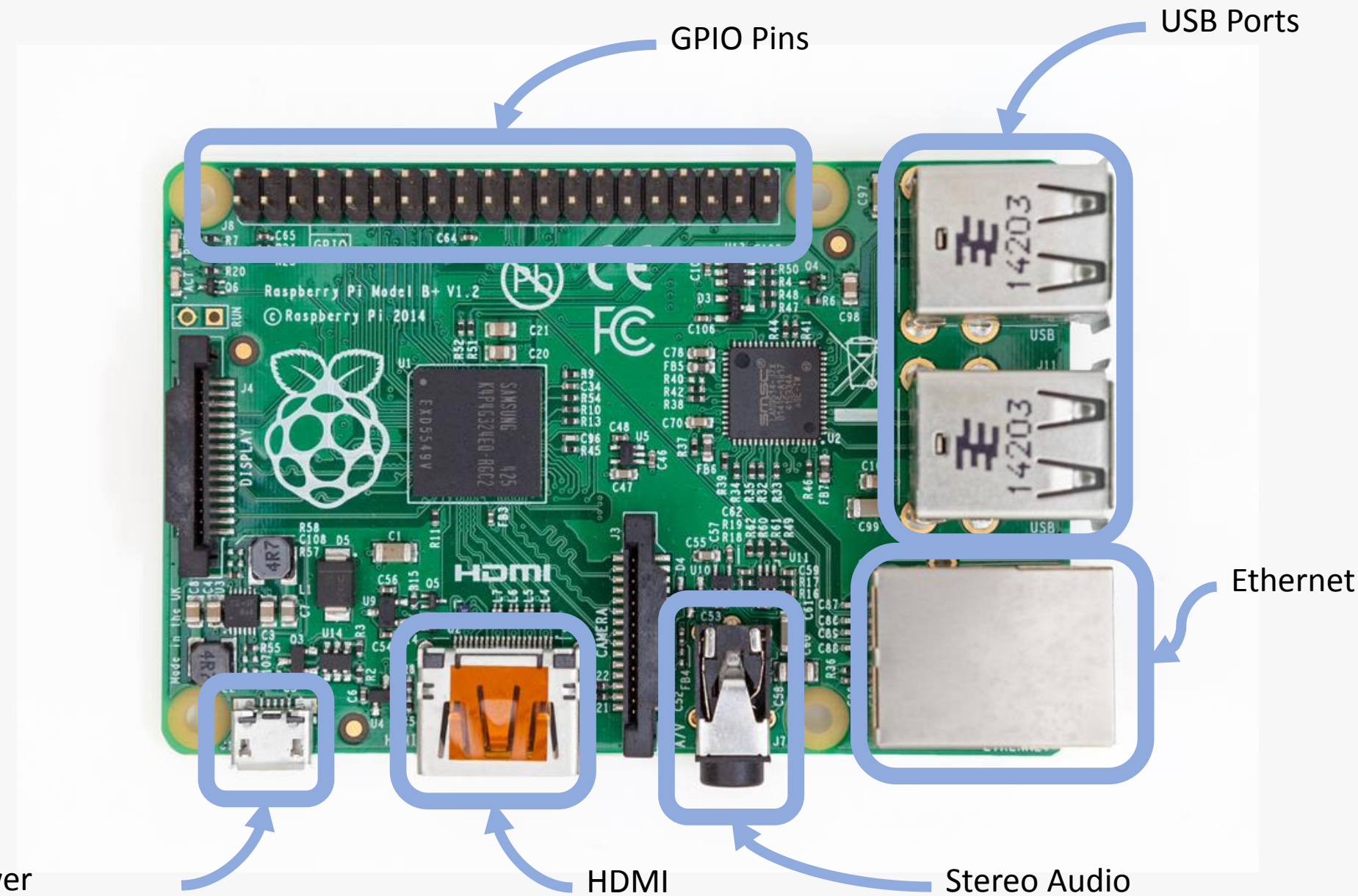
- **BeagleBone, PINE64, & Raspberry Pi**
  - Full fledged computers
  - Run an OS
  - Programmed with many different languages
  - More general purpose
  - More easily use networks
  - Large amount of RAM
- **Arduino**
  - Microcontroller
  - No OS, what you "flash" on it is the only thing that runs
  - Great for "real time" applications
  - Low power & can be tiny
- **All have General Purpose I/O (GPIO)**
  - Sensors, motors, relays

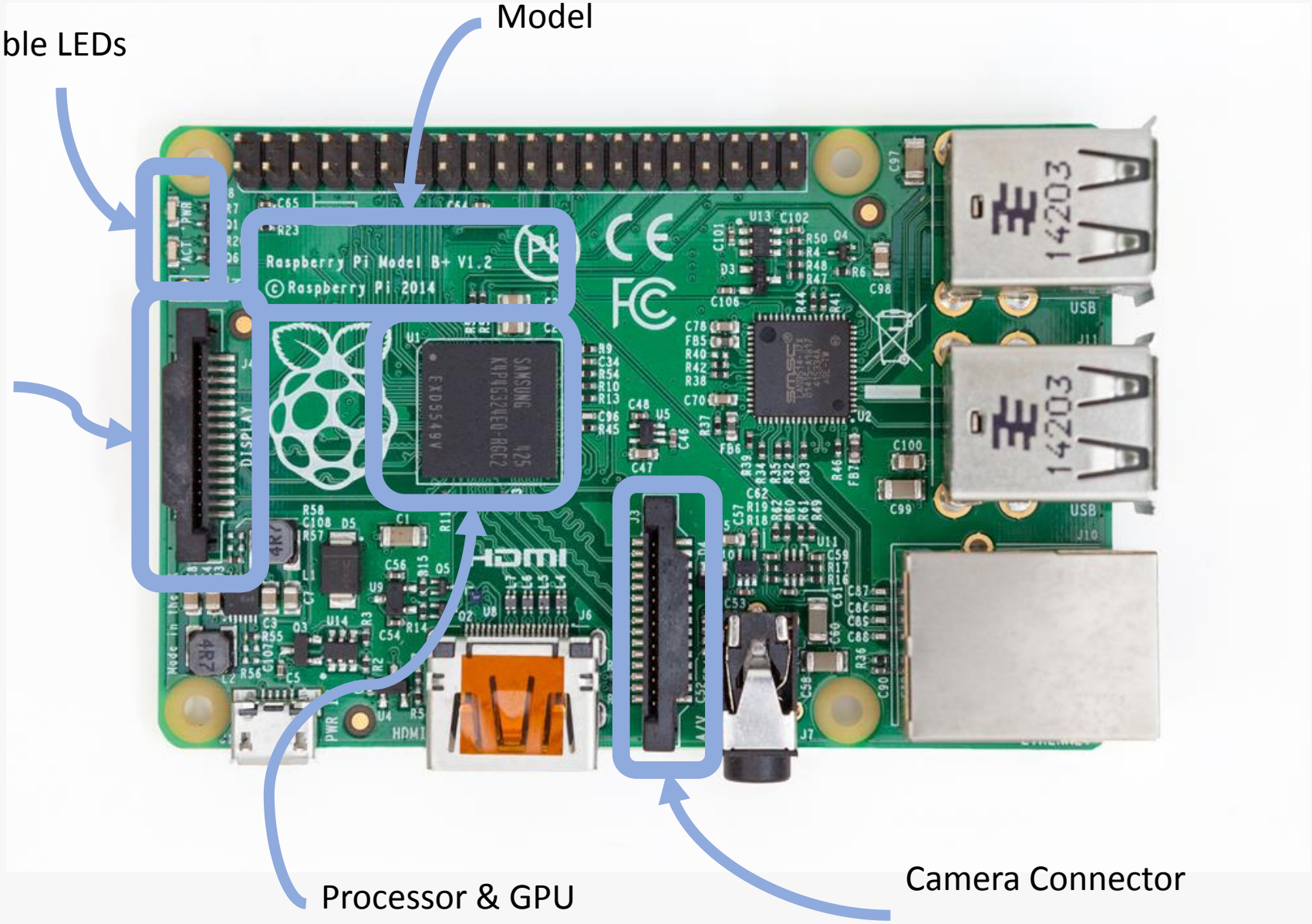
Why the Raspberry Pi?

- **It's cheap: $35**
- **Works with common components**
  - TV, keyboard, mouse, wireless, Bluetooth
- **Updated versions regularly**
  - Faster, more RAM, better I/O, etc.
- **Flexible**
  - Runs Windows & Linux
- **Huge user community**
  - Many existing projects and examples
- **MagPi**
  - Free to download monthly magazine
- **Lots of accessories**
  - Cameras, LCDs, sensors, cases

Introduction to the Raspberry Pi


GPIO
DISPLAY
HDMI
15262
15262


GPIO Pins
USB Ports
Ethernet
Micro USB Power
HDMI
Stereo Audio
Raspberry Pi Model B+ V1.2
© Raspberry Pi 2014
DISPLAY
CAMERA
HDMI
USB
14203


Programmable LEDs
Model
External Display Connector
Processor & GPU
Camera Connector

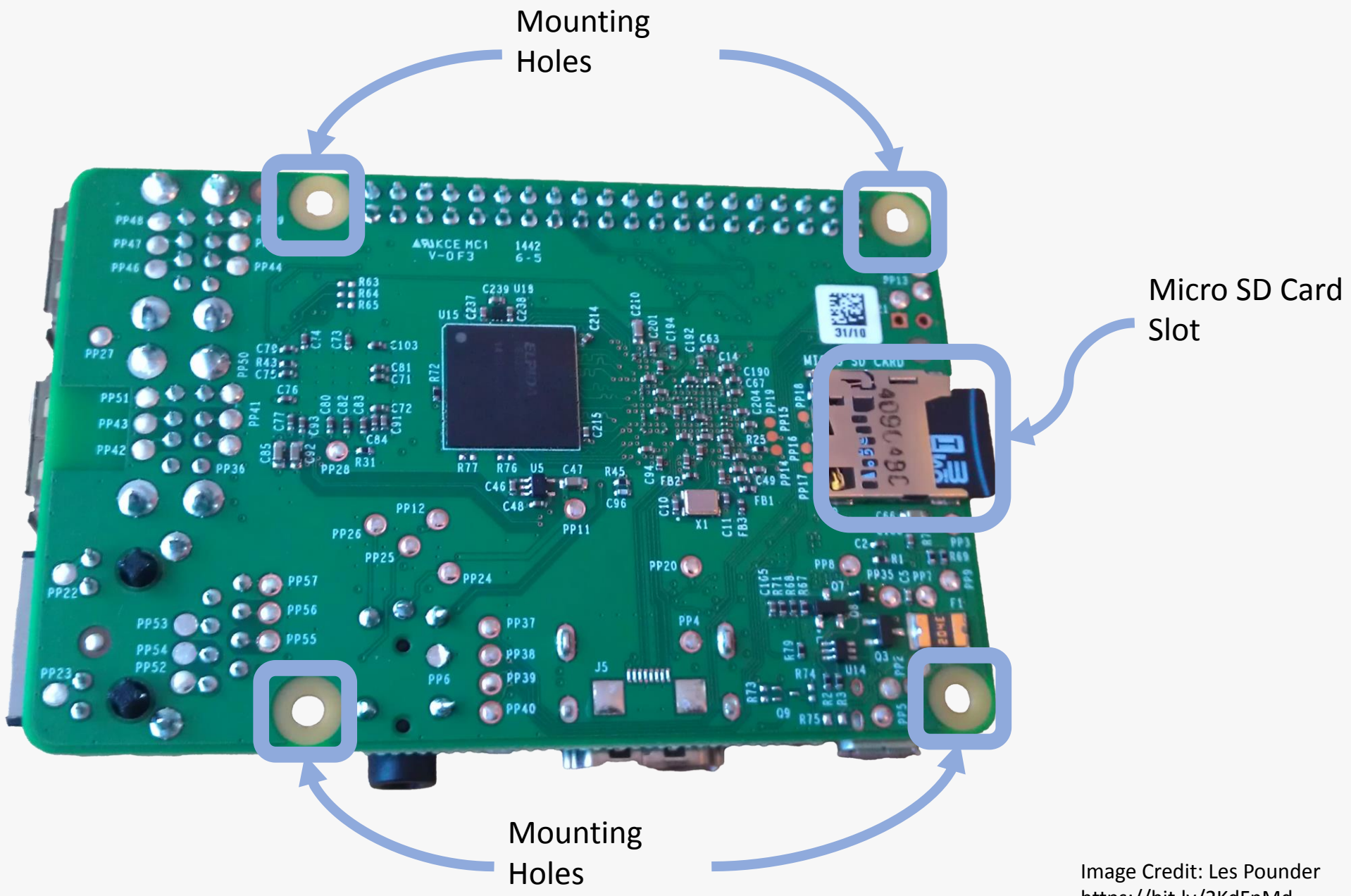


Image Credit: Les Pounder
https://bit.ly/2KdFnMd

What do you need to get started?

- **HDMI monitor or TV**
- **HDMI cable**
- **USB keyboard and mouse**
- **8GB+ micro SD card**
- **SD card reader (your laptop may have one built in)**
- **OS image**
  - Raspbian: https://www.raspberrypi.org/downloads/raspbian/
- **Software to write to the SD card**
  - https://etcher.io/
- **Micro USB power adapter**
  - Many cell phone chargers will work
  - Make sure it is at least rated for 2.5A output
  - If in doubt, buy a UL rated one for a Raspberry Pi 3

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INTRO END

Acknowledgement

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