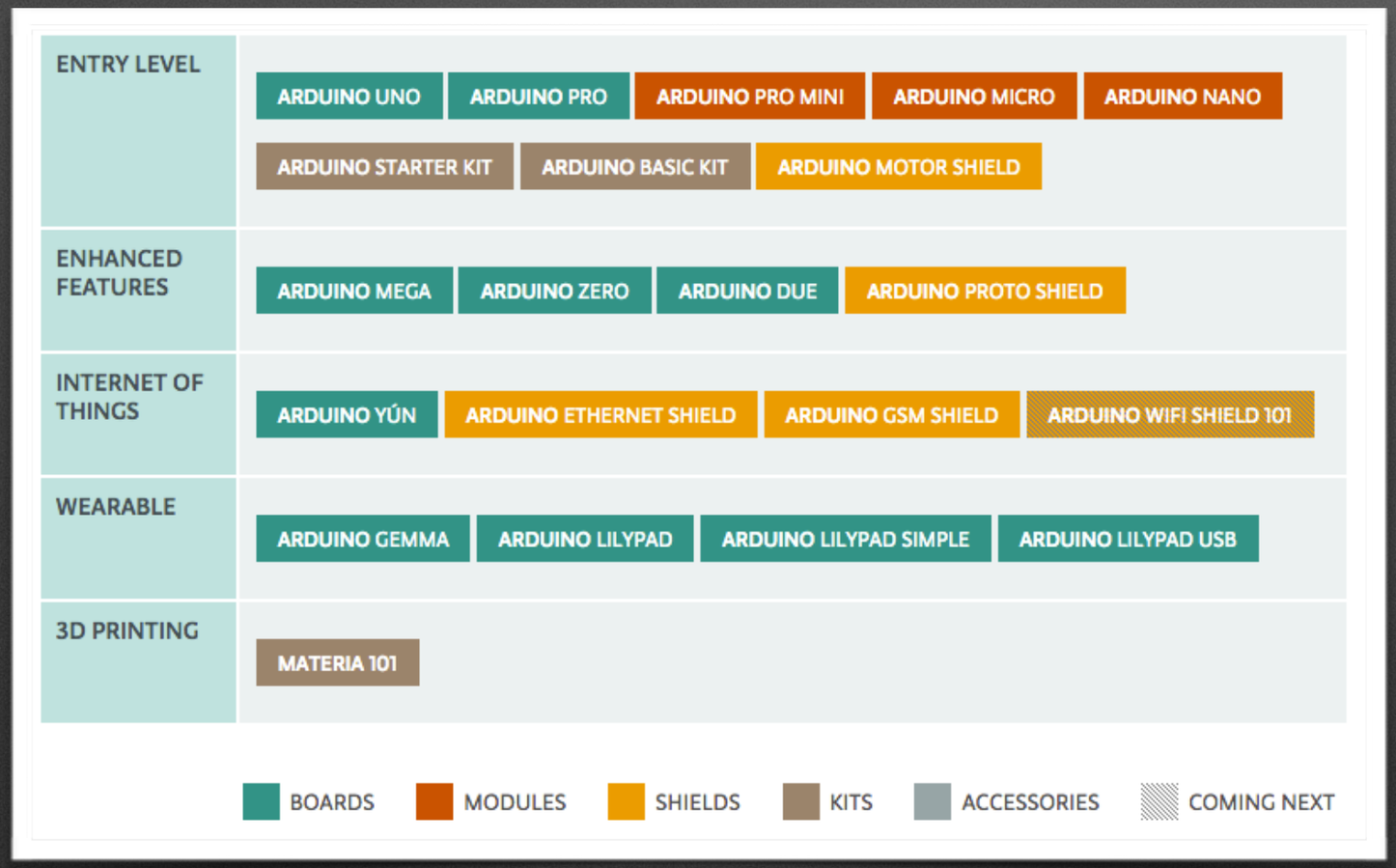
Arduino

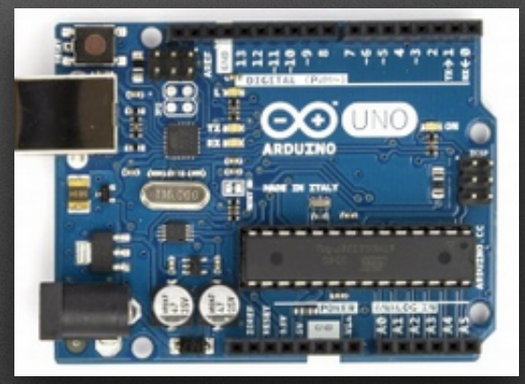
For Beginners

by Rick Suel

What is Arduino?

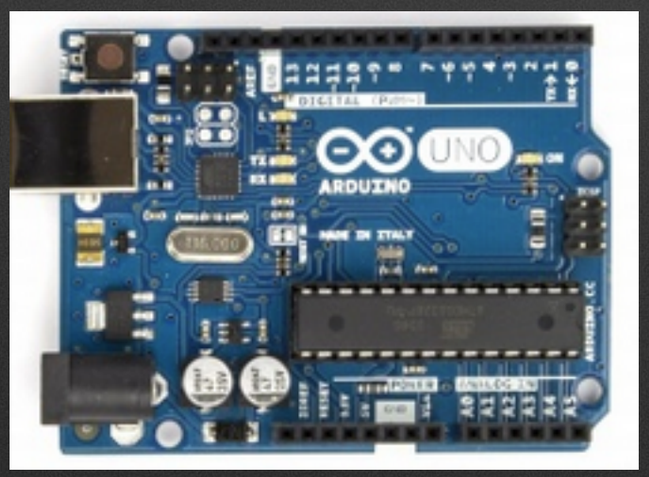
Arduino is an open source hardware and software platform that makes it very simple to experiment with interactive electronics. Hardware is expandable using “shields”.





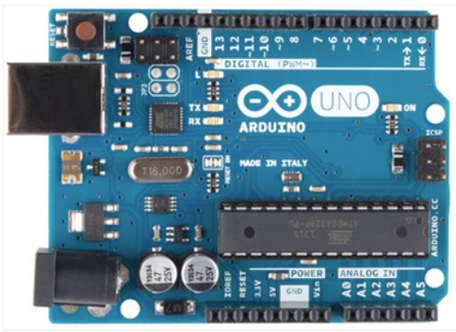
Arduino vs Raspberry Pi

- Arduino runs on a 16MHz micro controller ($10 - $25)
- Runs user-written C programs
- Great for interfacing with sensors
- Very simple to get started



- Pi 2 runs on a 900MHz quad-core CPU ($35)
- Runs Linux OS (or Windows 10)
- Great for multi-media projects but can also interface with sensors
- Harder to get started

The Arduino Uno



ATMEL

8-bit AVR® Microcontroller with 4/8/16/32K Bytes In-System Programmable Flash

ATmega48PA
ATmega88PA
ATmega168PA
ATmega328P

Technical specs

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25 g

The Tools

www.arduino.cc/en/Main/Software

Download the Arduino Software

ARDUINO 1.6.5

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.
This software can be used with any Arduino board.
Refer to the Getting Started page for Installation instructions.

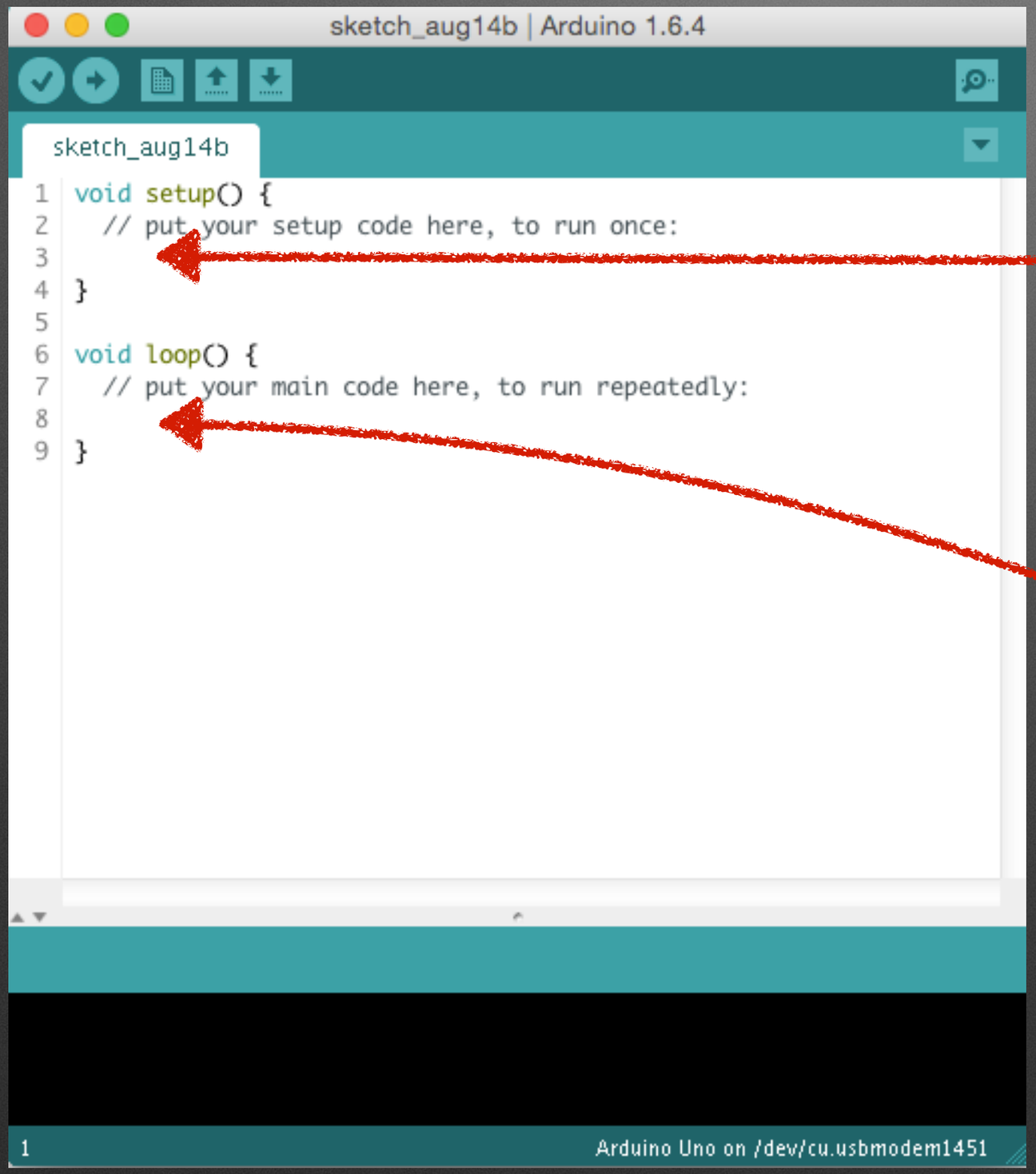
Windows Installer
Windows ZIP file for non admin install

Mac OS X 10.7 Lion or newer

Linux 32 bits
Linux 64 bits

Release Notes
Source Code
Checksums

The ‘Sketch’



Executed 1st:

- Initialization Code
- Runs once

Executed 2nd:

- Application code
- Runs “forever”

Language Reference

https://www.arduino.cc/en/Reference/HomePage

Language Reference

Arduino programs can be divided in three main parts: *structure*, *values* (variables and constants), and *functions*.

Structure

- setup()
- loop()

Control Structures

- if
- if...else
- for
- switch case
- while
- do... while
- break
- continue
- return
- goto

Variables

Constants

- HIGH | LOW
- INPUT | OUTPUT | INPUT_PULLUP
- LED_BUILTIN
- true | false
- integer constants
- floating point constants

Data Types

- void
- boolean
- char
- unsigned char
- byte

Functions

Digital I/O

- pinMode()
- digitalWrite()
- digitalRead()

Analog I/O

- analogReference()
- analogRead()
- analogWrite() - *PWM*

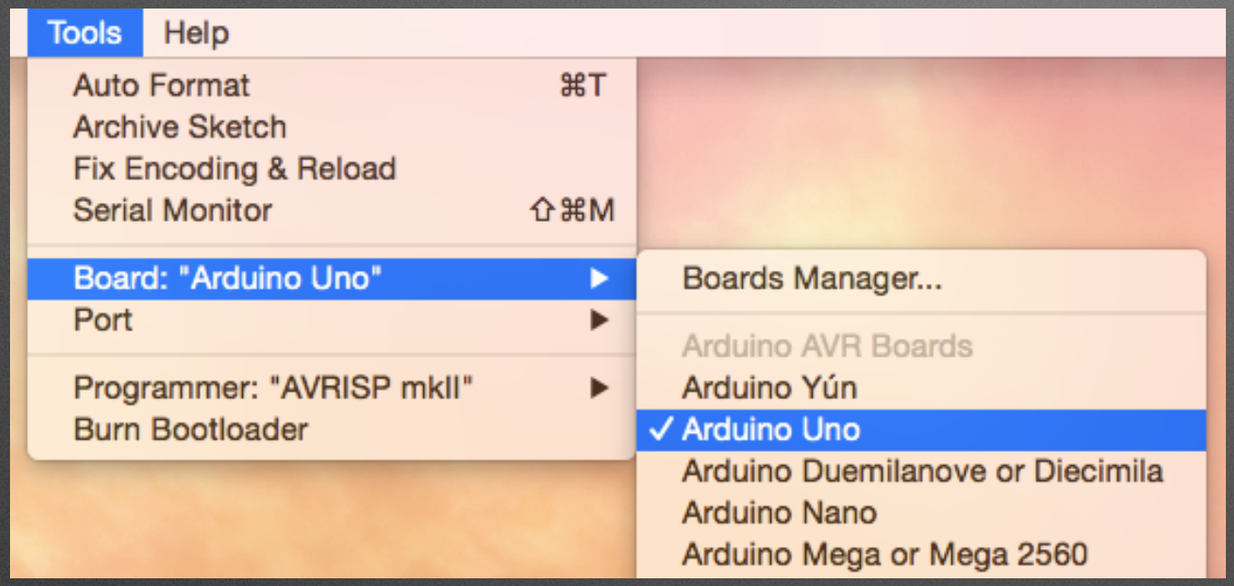
Due & Zero only

- analogReadResolution()
- analogWriteResolution()

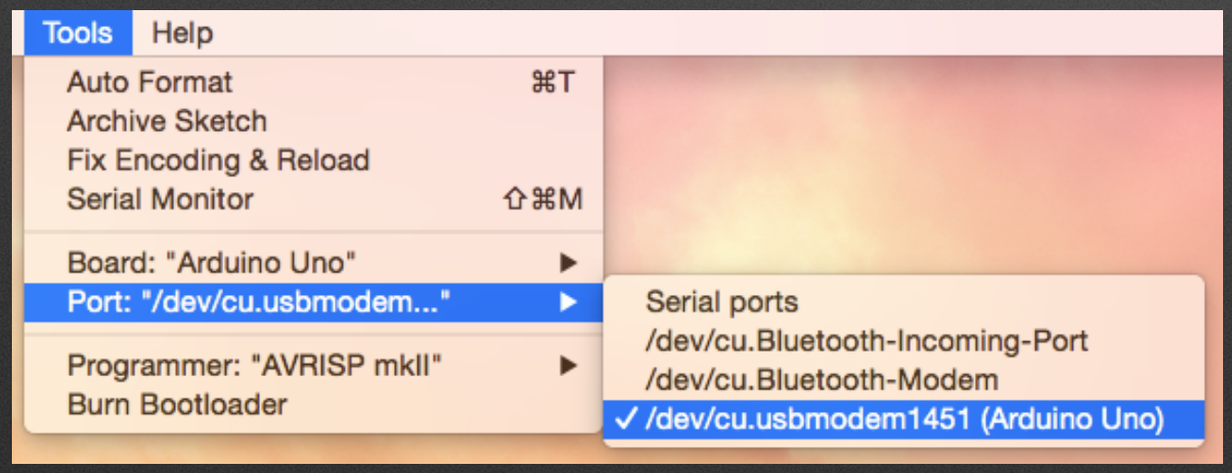
Advanced I/O

Connecting the Arduino

1. Connect the USB cable from the Arduino to your PC
2. Select Tools->Board->Arduino Uno



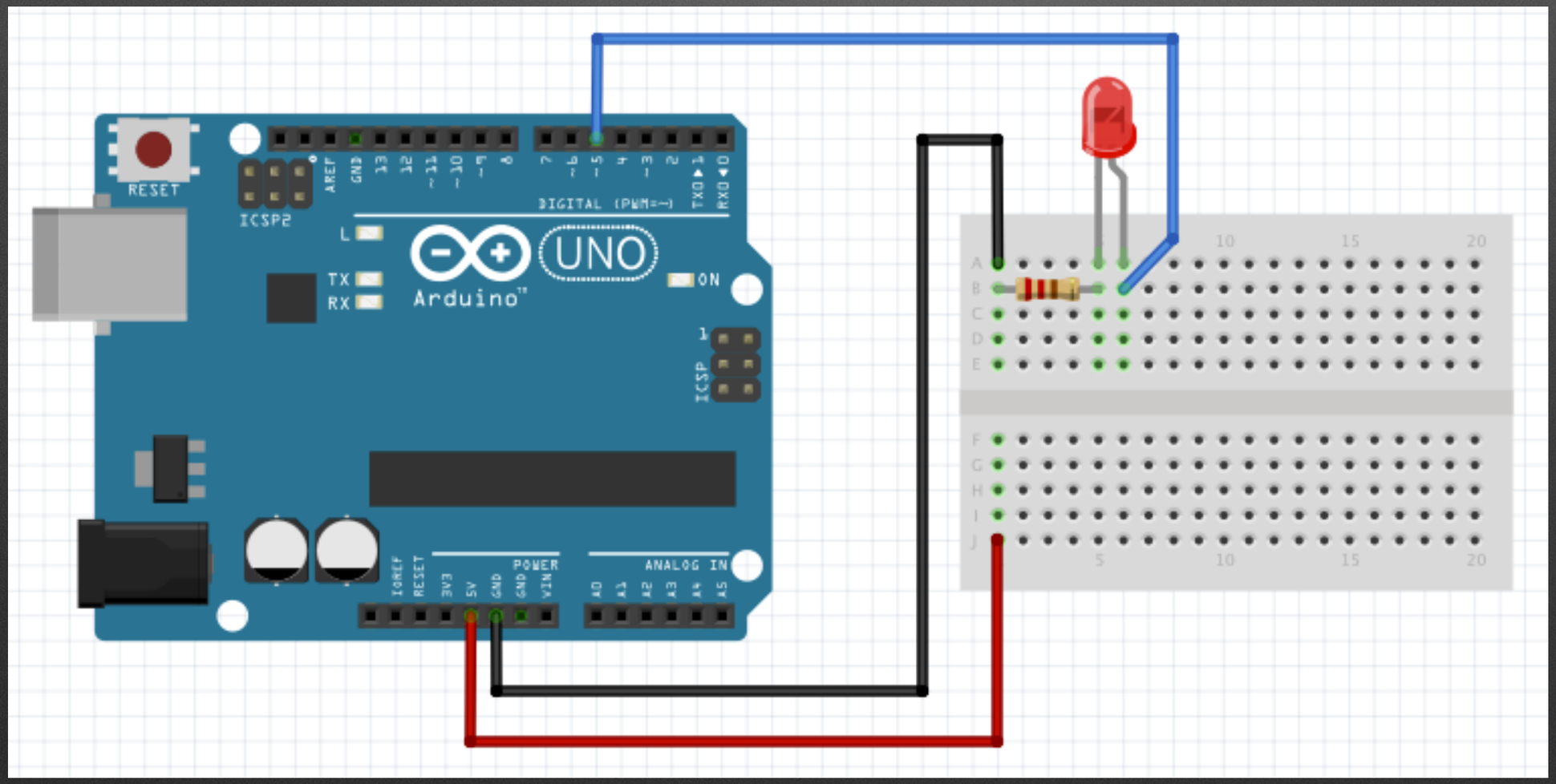
3. Select Tools->Port->….(Arduino Uno)

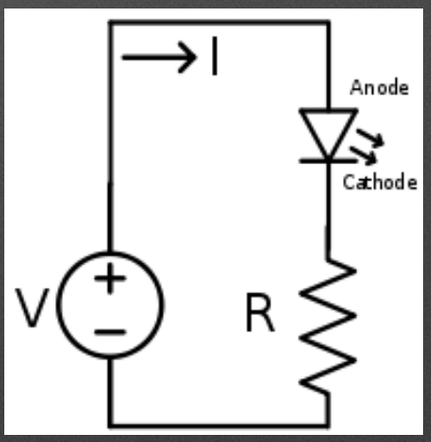


Ex 1: Blink an LED

Requirements:

- Connect anode (+) of LED to pin 5 of Arduino
- Connect cathode (-) of LED through 200 Ohm (blue) resistor to ground
- Blink the LED at 1Hz (500ms on, 500ms off)

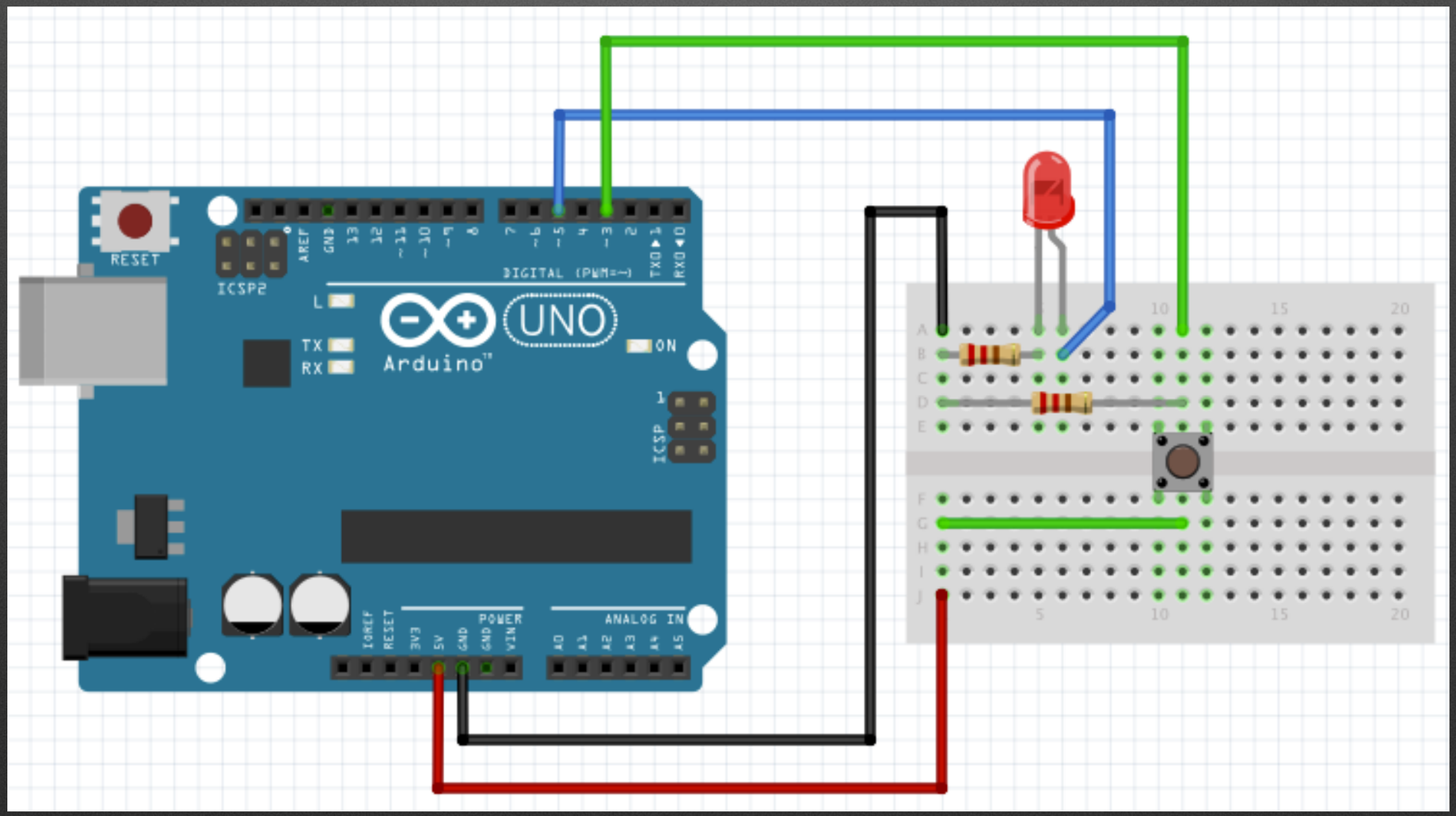




Ex 2: Add a button

Requirements:

- Connect one pin of push button to pin 3 or Arduino.
- Connect other pin of push button to ground through 10K “pulldown” resistor.
- When button is pressed, turn LED on and print “press” in serial window.
- When button is released, turn LED off and print “release” in serial window.



Ex 3: External Interrupts

Requirements:

- Keep the same circuit from example 3.
- Use Interrupt 1 (pin 3) to achieve the same button/LED functionality.
- Simplifies the loop function!

attachInterrupt()

Description

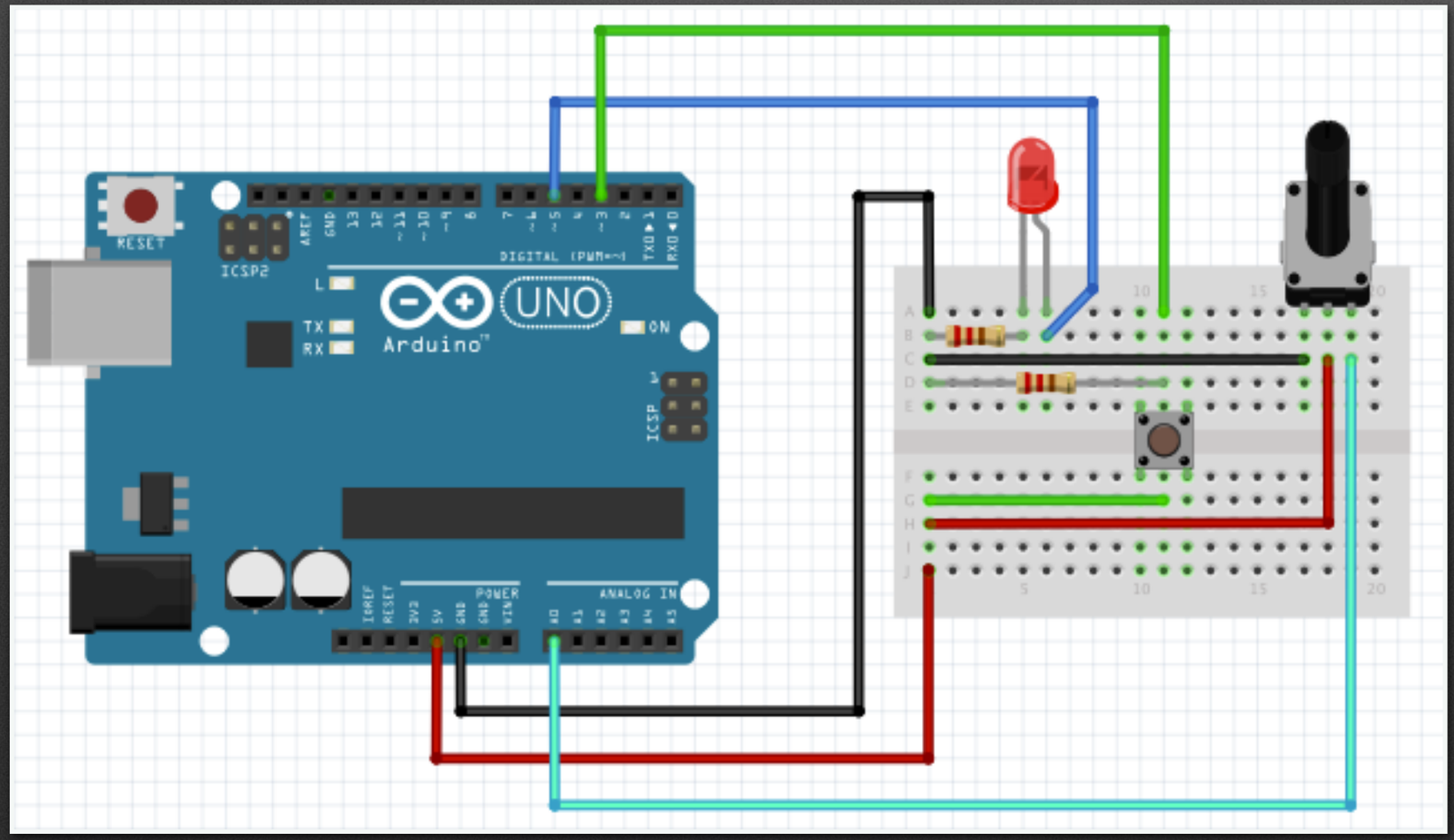
Specifies a named Interrupt Service Routine (ISR) to call when an interrupt occurs. Replaces any previous function that was attached to the interrupt. Most Arduino boards have two external interrupts: numbers 0 (on digital pin 2) and 1 (on digital pin 3). The table below shows the available interrupt pins on various boards.

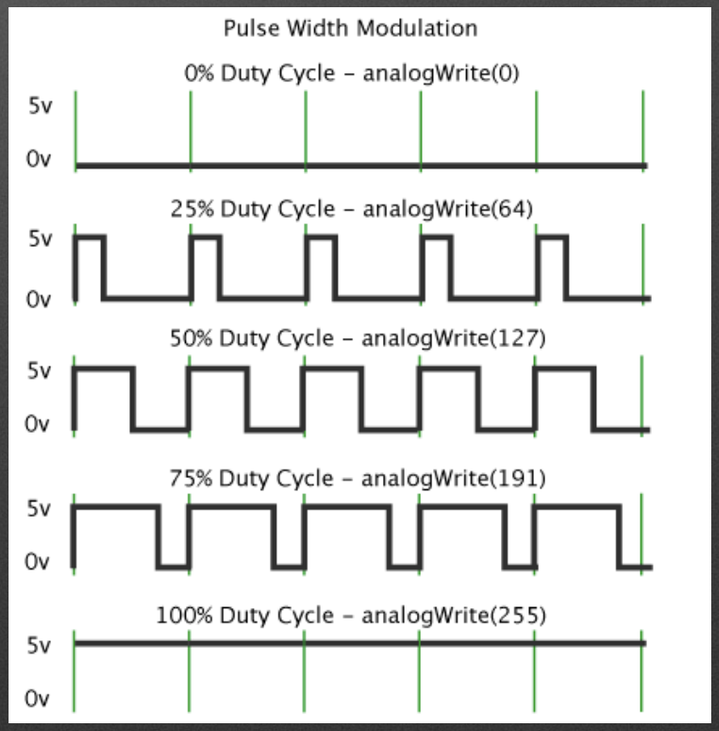
Board	int.0	int.1	int.2	int.3	int.4	int.5
Uno, Ethernet	2	3				
Mega2560	2	3	21	20	19	18
Leonardo	3	2	0	1	7	
Due			(see below)			

Ex 4: Analog In / PWM Out

Requirements:

- Connect the potentiometer to pin A0 as shown below.
- Drive the LED as a PWM output using the analog input to adjust brightness.
- Press/hold the button and you should be able to adjust the brightness.
- Print brightness to the serial window.

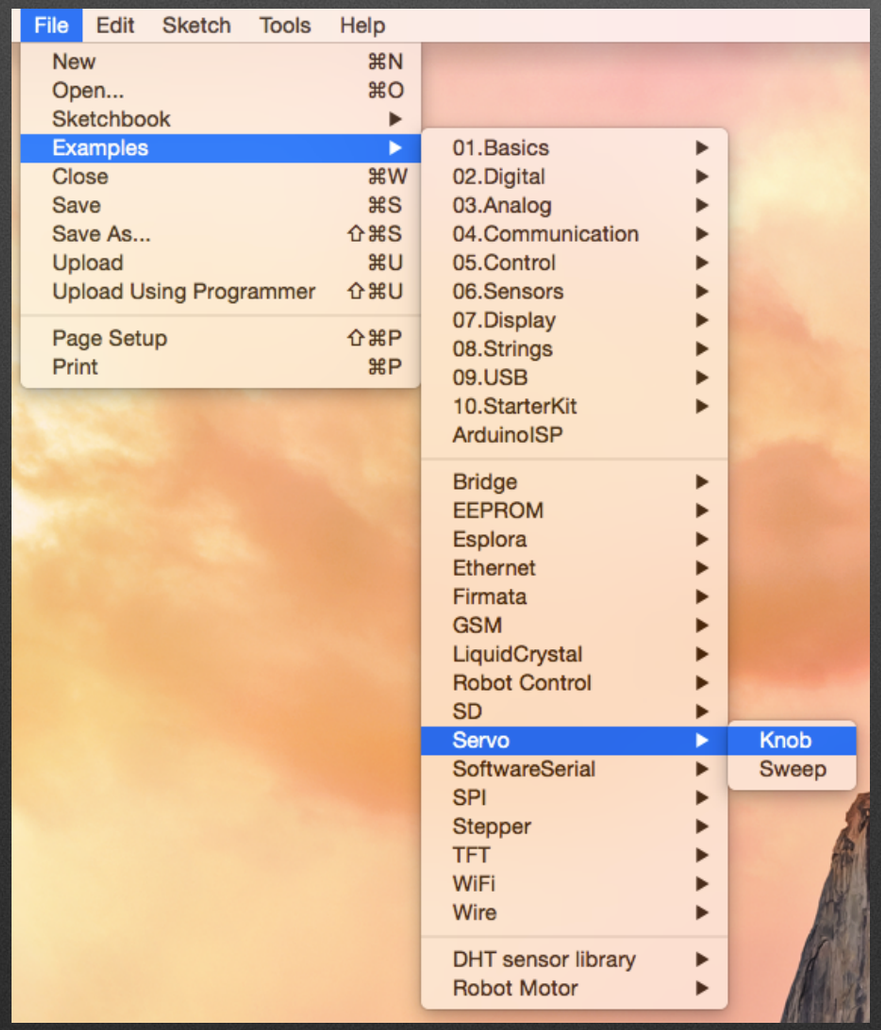


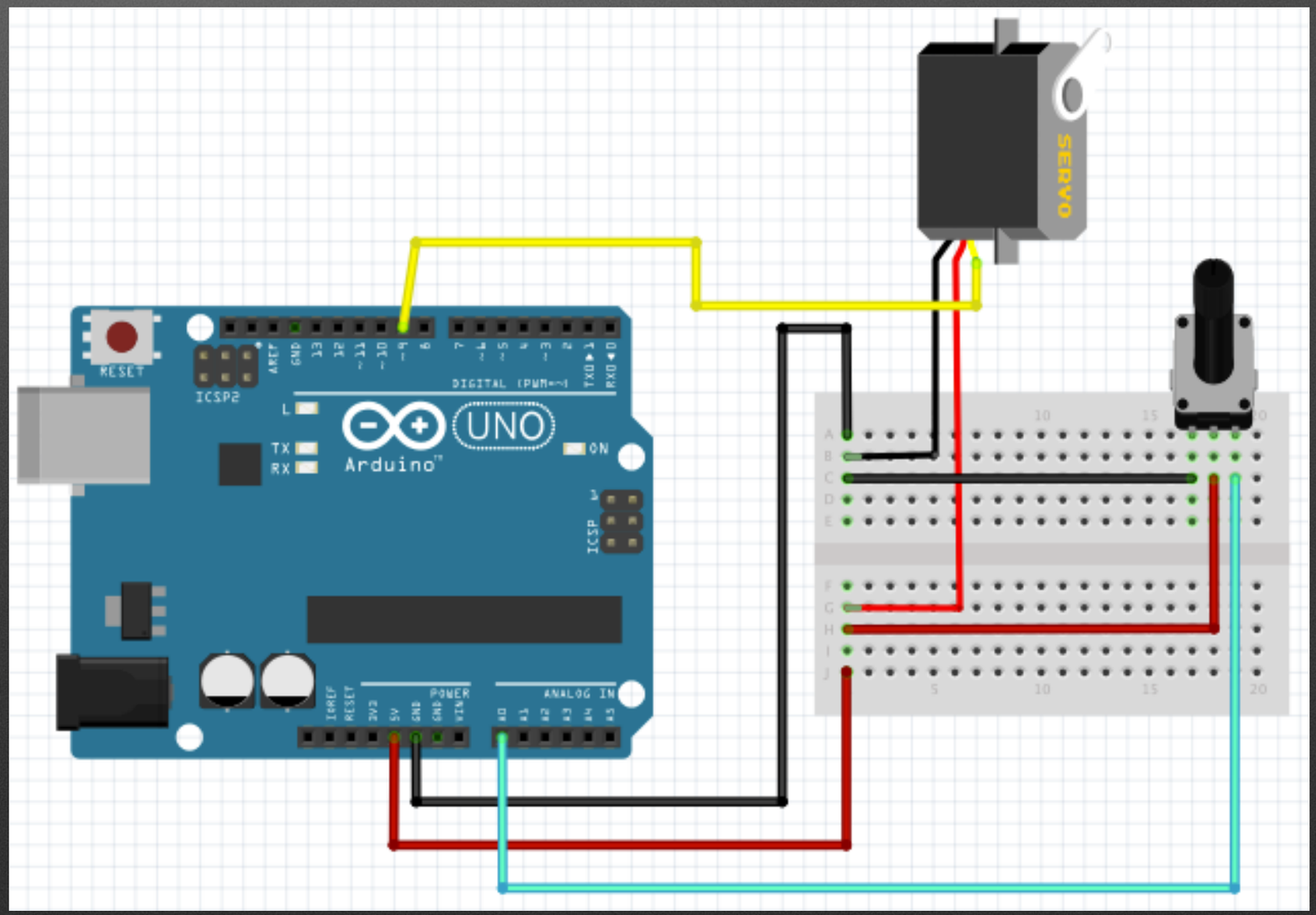


Ex. 5: Drive a Servo (Library)

Requirements:

- Connect the servo and potentiometer as shown below (Brn=Gnd, Red=5V, Org=Sig)
- Launch the built in servo example
- Download and run!

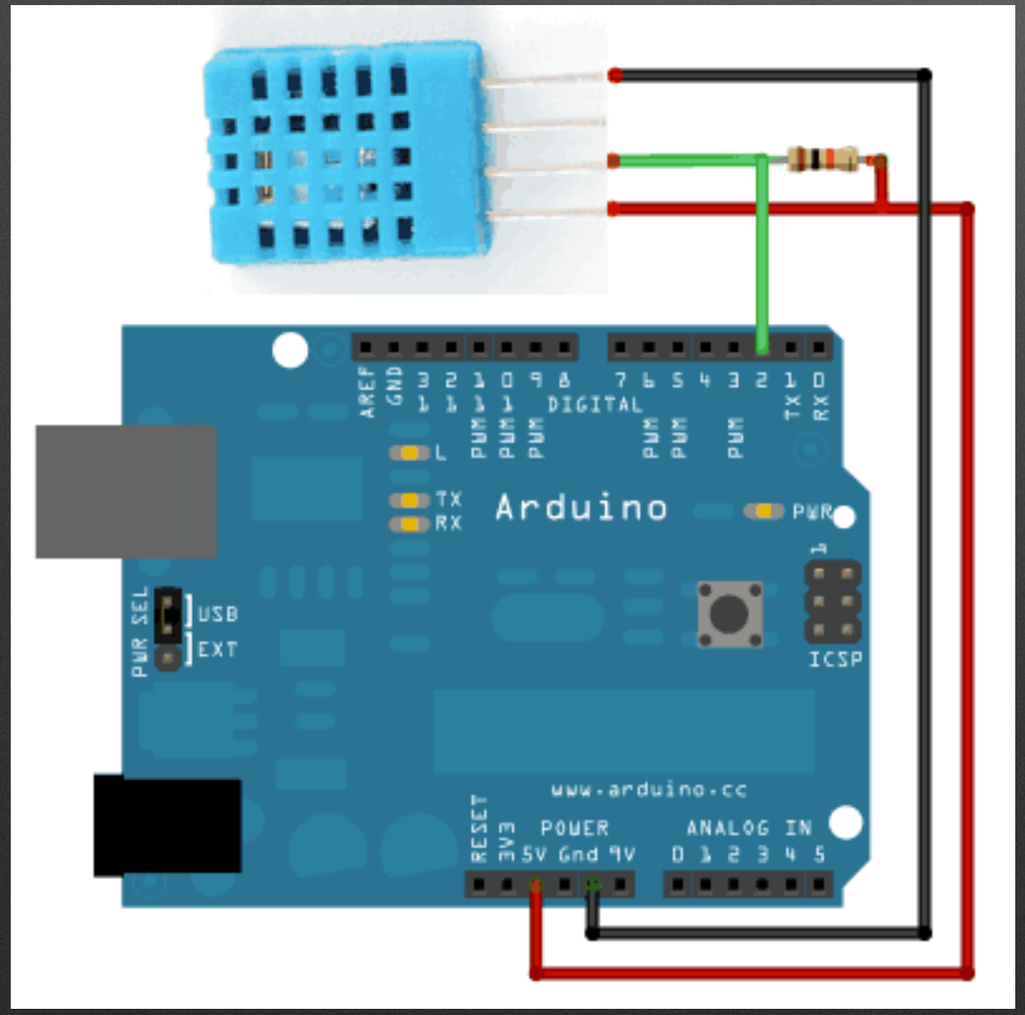


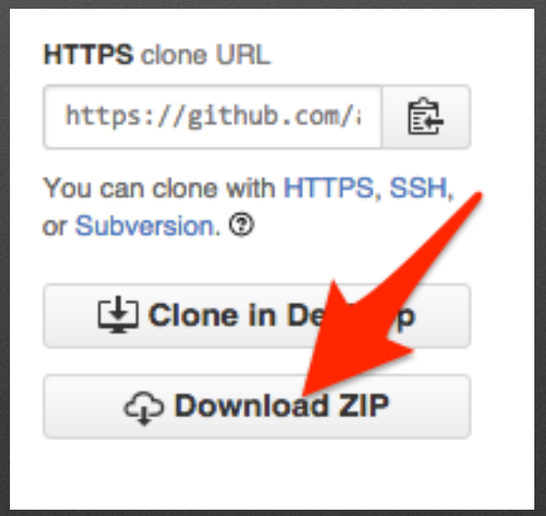


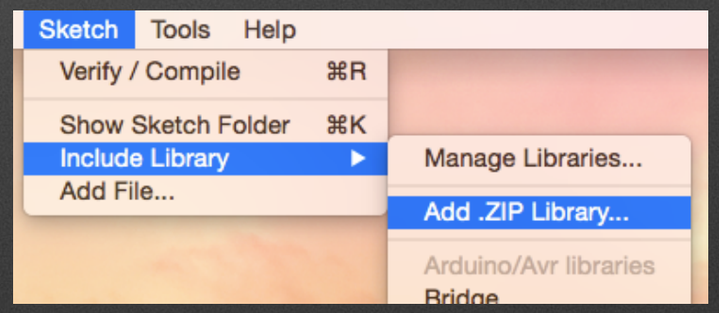
Ex. 6: Temp Sensor (Library)

Requirements:

- Follow this tutorial: https://learn.adafruit.com/dht/connecting-to-a-dhtxx-sensor
- Download the library zip from here: https://github.com/adafruit/DHT-sensor-library
- Import the library as a zip file
- Launch the example, configure as DHT



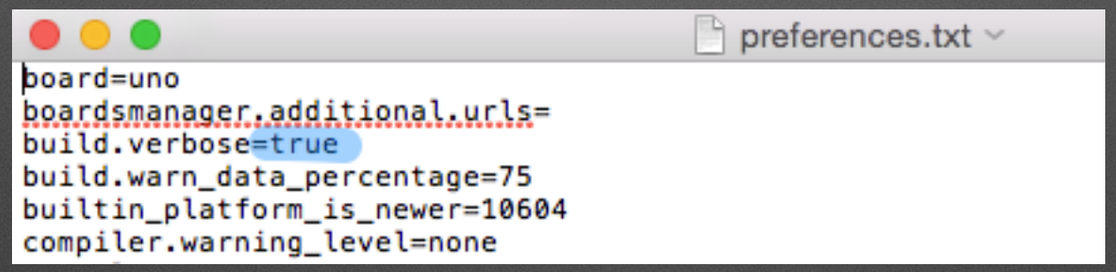




Advanced: Verbose Build

Turn On Verbose Build:

- Arduino->Preferences - then click the link to the preferences near the bottom
- Close Arduino software
- Open the preferences.txt file and change the following option to “true”

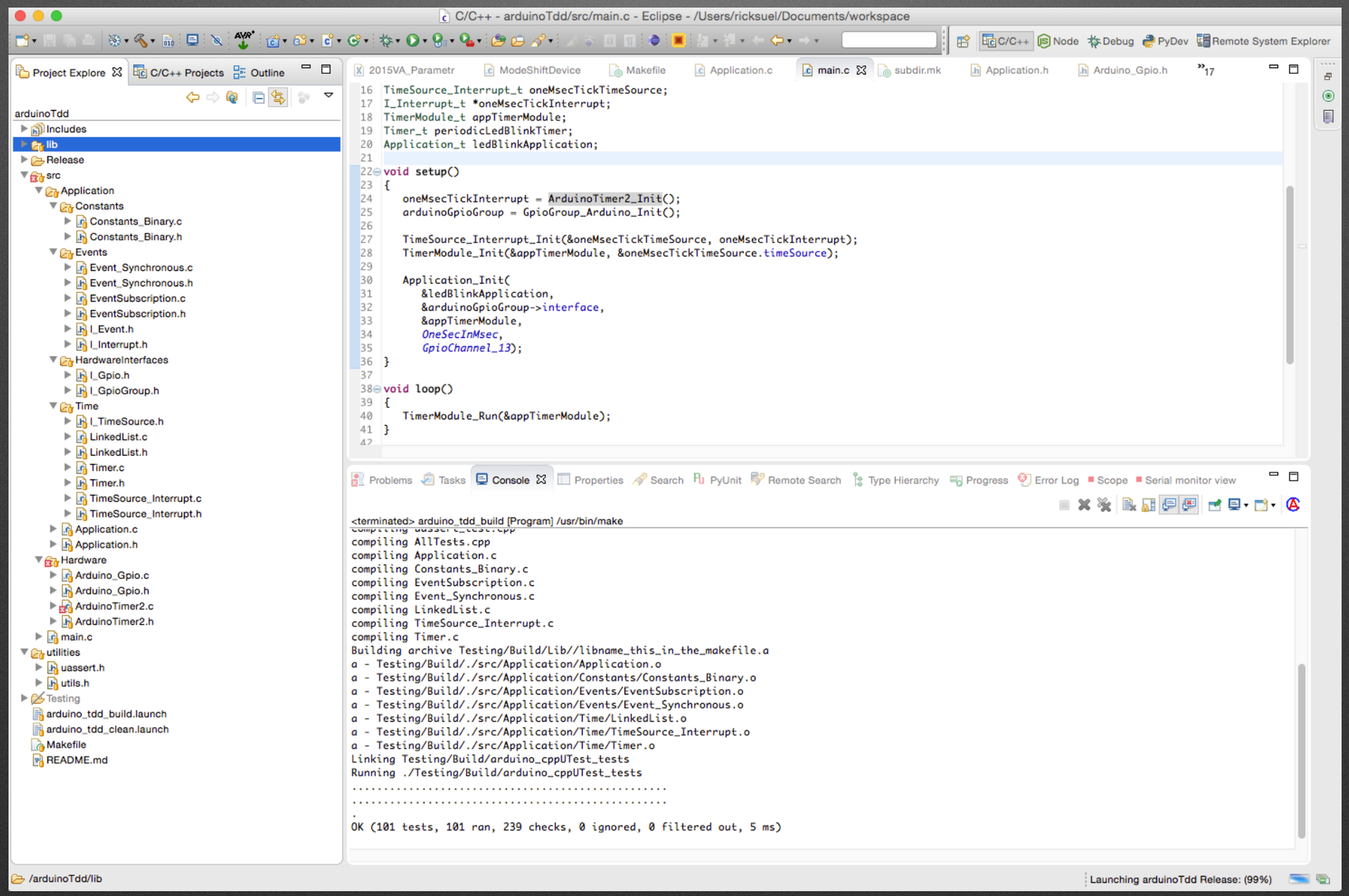


- Restart the Arduino software and build your project.
- Now you can see everything that goes into building that sketch!

Advanced: Eclipse IDE/TDD

Github Project

- https://github.appl.ge.com/NelsonTanquero/arduino_tdd



Go Make Something!