



Introduction to Arduino

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Agenda

What is Arduino?

- Arduino Architecture

Basic Electronics

- KVL, KCL, Ohm's Law

Programming with Arduino

- Learning the Arduino IDE

Arduino Examples

- Making a small interactive game

What is Arduino?

What is Arduino?

“Arduino is an open-source electronics platform based on **easy-to-use hardware and software.**”

ArduinoCC

What is Arduino?

Arduino Development Board

- Allows you to read inputs, interact with sensors, turn on an LED, activate a motor, connect to the internet and more!
- Provides the perfect hardware for creating DIY electronics projects

Arduino Integrated Development Environment

- Instruct the board by sending a set of instructions to the microcontroller
- Program the board using the Arduino Programming Language based on Wiring (similar to C/C++)
- Provides tools for debugging and library management
- Support for a large variety of Arduino development boards

What is Arduino?

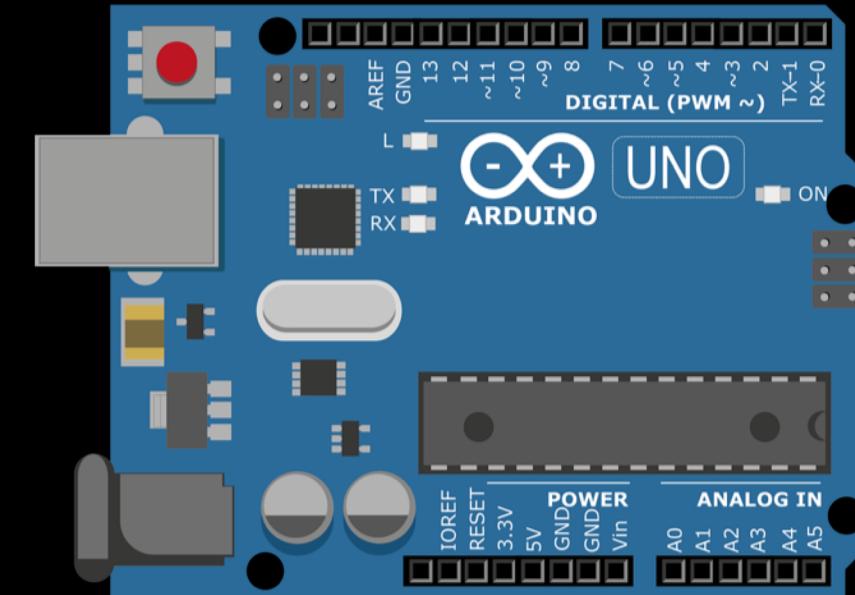
Arduino Architecture

The majority of Arduino boards are based on Atmel's ATMEGA microcontrollers

- The standard Arduino boards provide a respectable amount of performance in a small easy-to-use package.

For example the Arduino UNO has:

- 16 MHz Clock Speed
- 32KB Flash Memory
- 2KB SRAM



Basic Electronics

Basic Electronics

Ohm's Law

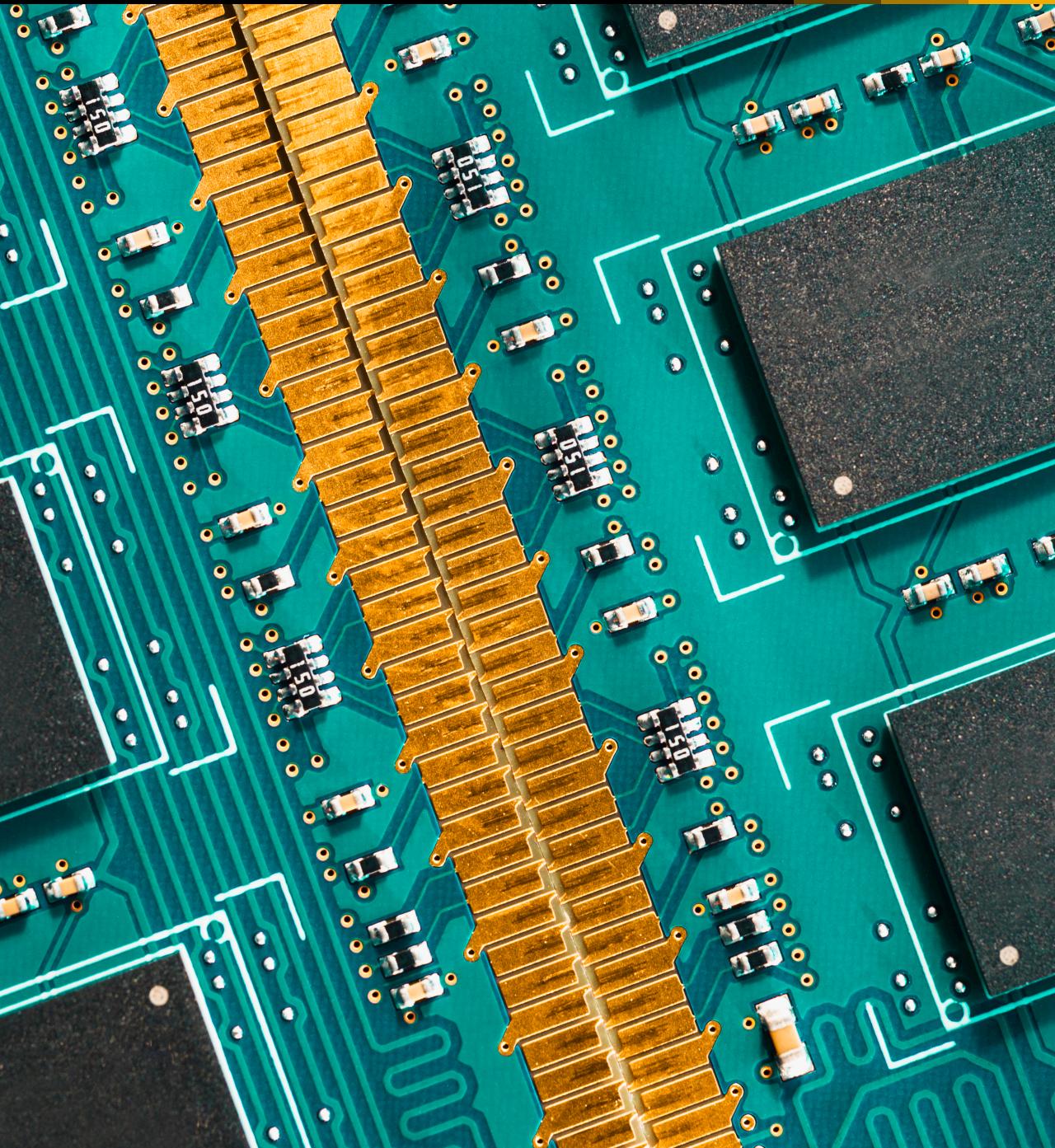
Current through a conductor between two points is proportional to the voltage across the two points.

V: Voltage (V)

I: Current (A)

R: Resistance (R)

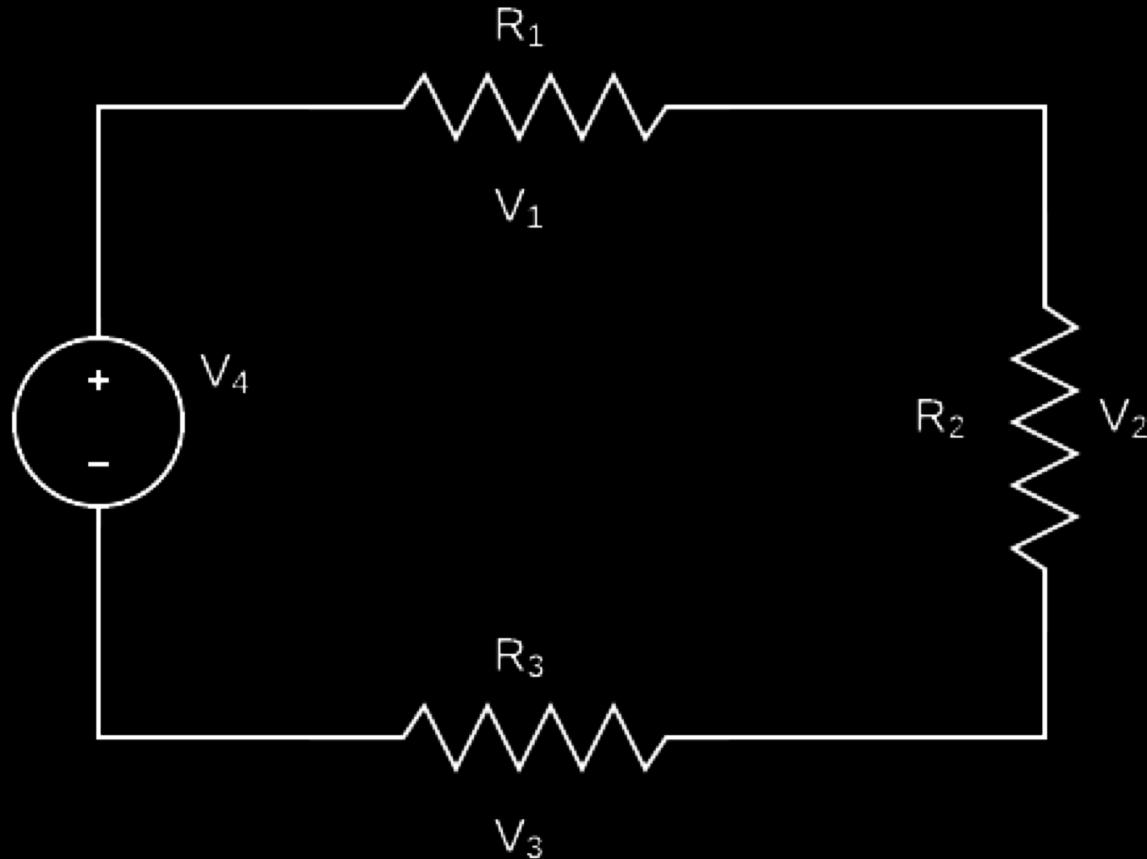
$$V = IR$$



Basic Electronics

Kirchhoff's Voltage Law (KVL)

The sum of electrical voltages around any closed network is zero

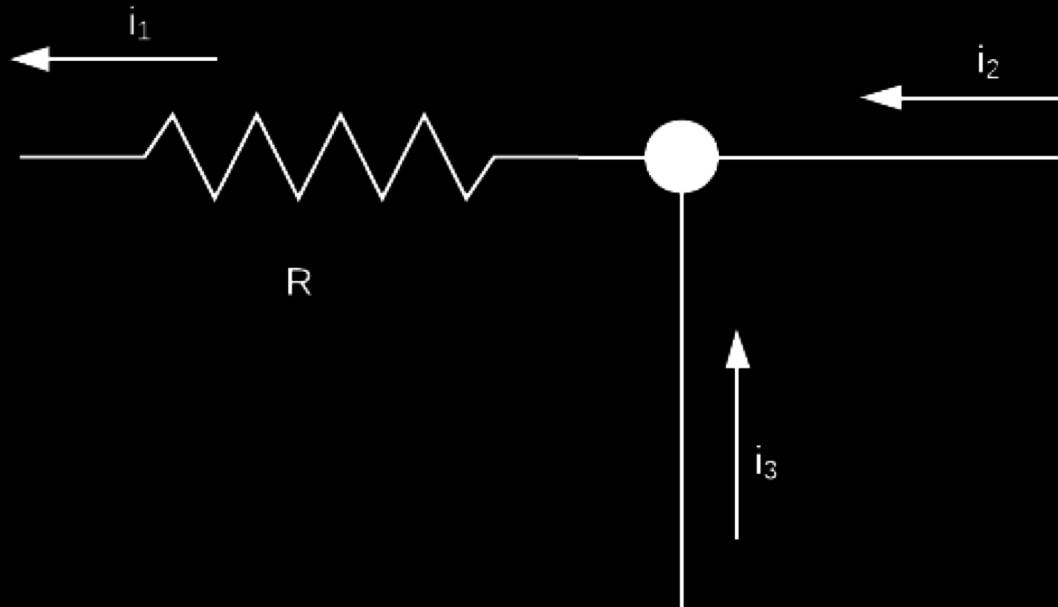


$$V_1 + V_2 + V_3 - V_4 = 0$$

Basic Electronics

Kirchhoff's Current Law (KCL)

At any node in an electrical circuit, the sum of currents flowing into the node is equal to the sum of currents flowing out of the node



$$i_1 - i_2 - i_3 = 0$$

Programming with Arduino

Programming with Arduino

Arduinos can be programmed from a computer with serial communication through a USB cable

- Arduino IDE loads the code onto the microcontroller

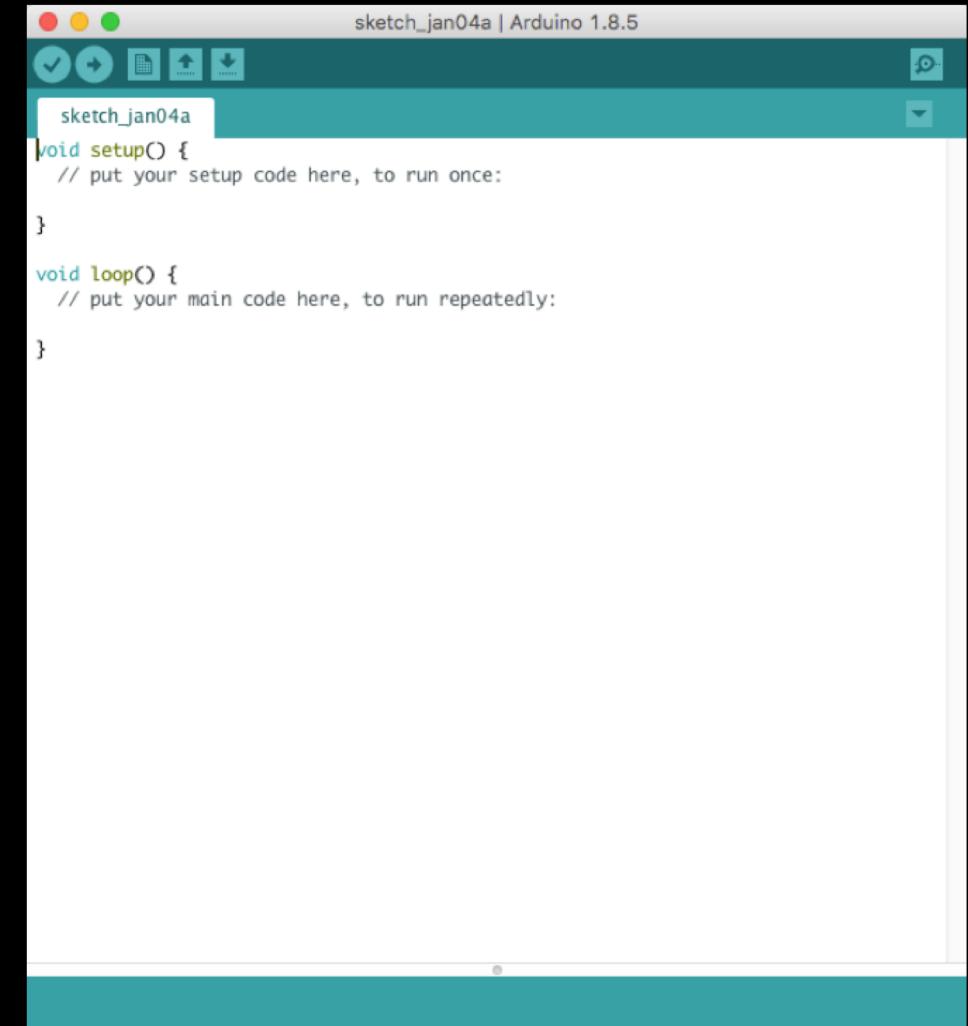
Every Arduino file (known as a sketch) contains two functions `setup()` and `loop()`

- These two functions allow you to easily setup and run the program logic

Programming with Arduino

`setup()` is called once when the program is first run

`loop()` repeats indefinitely once it reaches the end of the function



The screenshot shows the Arduino IDE interface. The title bar reads "sketch_jan04a | Arduino 1.8.5". The main area displays the following code:

```
sketch_jan04a
void setup() {
  // put your setup code here, to run once:
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

Arduino/Genuino Uno on COM1

Programming with Arduino

Uploading the code

Step 1: Write your program

- In the main sketch window create your program by writing code for the setup() and loop() functions

Step 2: Setup your board

- In the toolbar go to Tools > Board > (Select your board here)

Step 3: Select the port

- In the toolbar go to Tools > Port > (Select your port here)

Step 4: Upload the program

- In the toolbar go to Sketch > Upload

Programming with Arduino

Writing your first program

Pin 13 is the built-in LED pin on most Arduinos (check the datasheet to make sure)

The program simply turns the built in LED on and off in a loop

```
int ledPin = 13;

void setup() {
    // initialize digital pin for LED as an output
    pinMode(ledPin, OUTPUT);

}

void loop() {
    // repeatedly turn the led on and off forever
    digitalWrite(ledPin, HIGH);
    delay(1000);
    digitalWrite(ledPin, LOW);
    delay(1000);

}
```

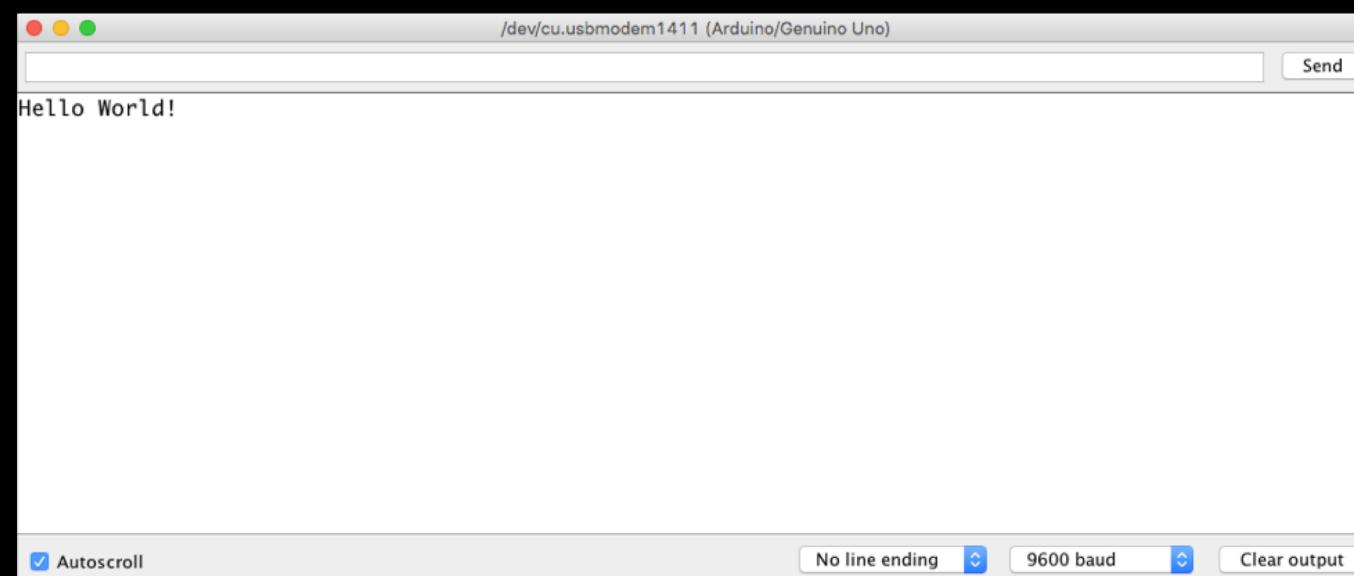
Programming with Arduino

Other Features of Arduino IDE – Serial Monitor

Useful Serial monitor can be used for printing debug messages (Tools > Serial Monitor)

Use the function `Serial.begin(9600)` to initialize the serial data transmission where 9600 is the baud rate (data rate in bits/sec)

Use the function `Serial.print()` to output your message

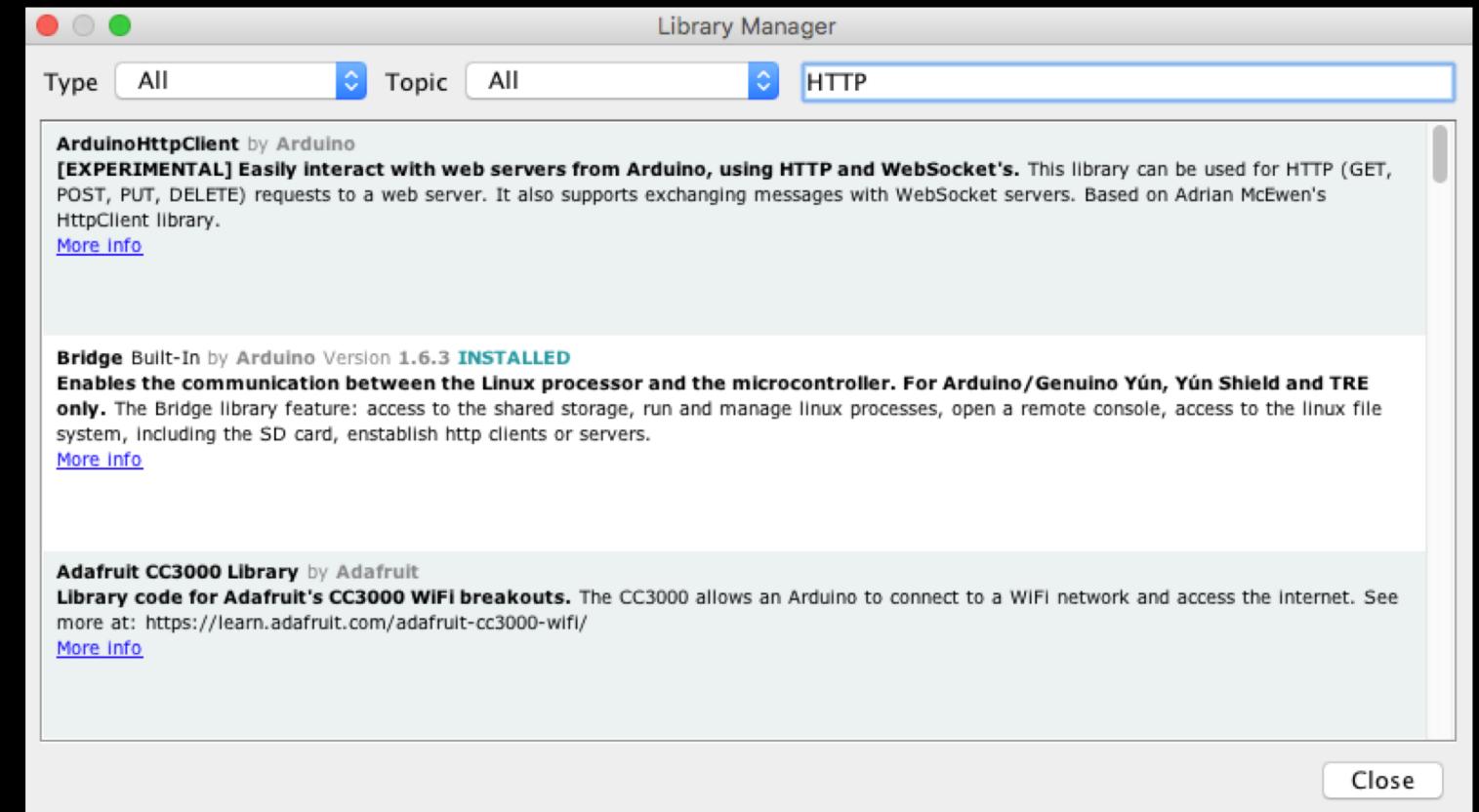


Programming with Arduino

Other Features of Arduino IDE – Package Manager

The Arduino IDE comes with an easy to use package manager for downloading libraries created by other people

Useful for downloading libraries to interface with WiFi or Bluetooth modules and more



Thank you.

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