

Building
your own
Lightsaber

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TSA

Pro-Tip™



ADAPTER
200002

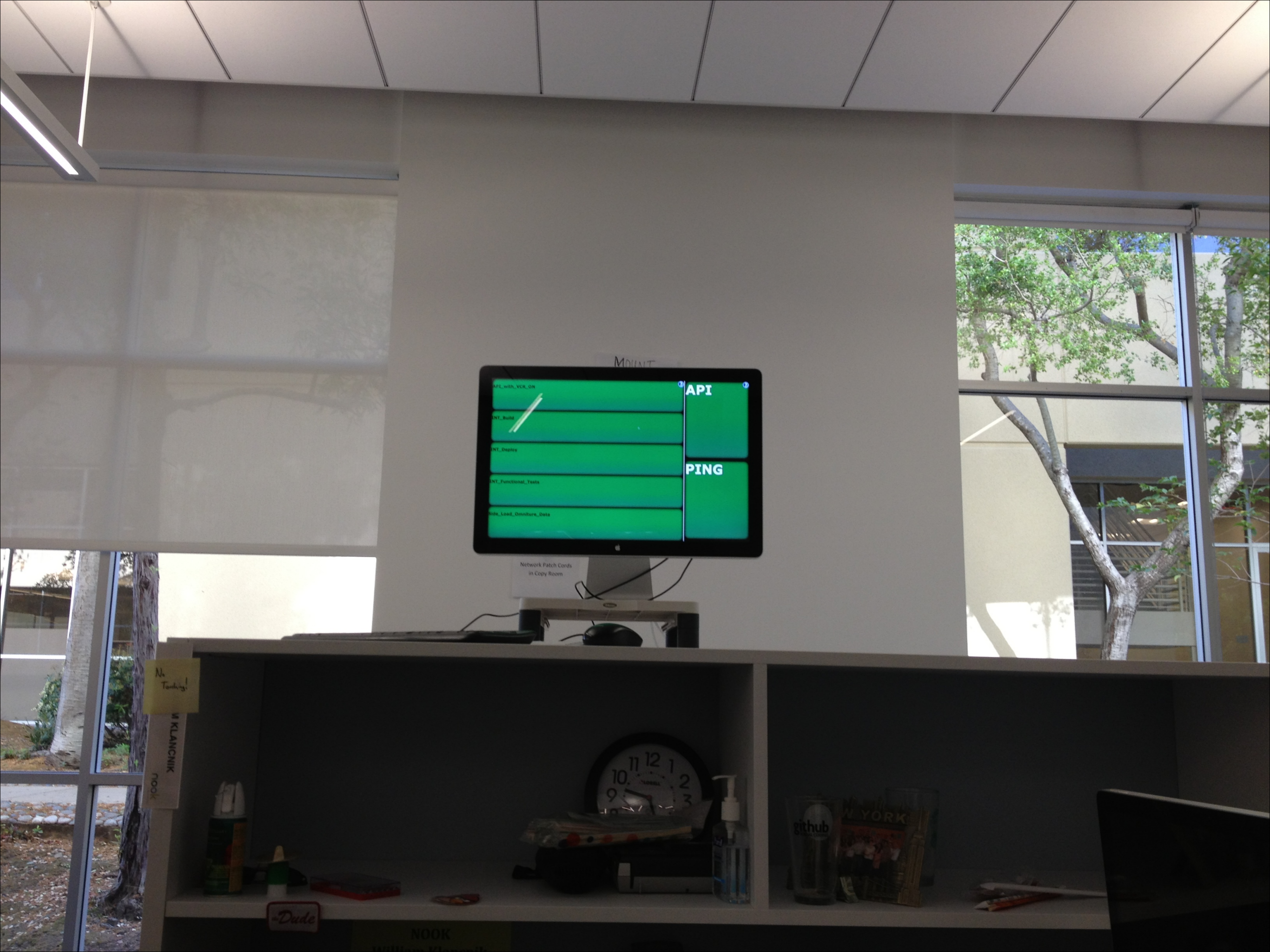




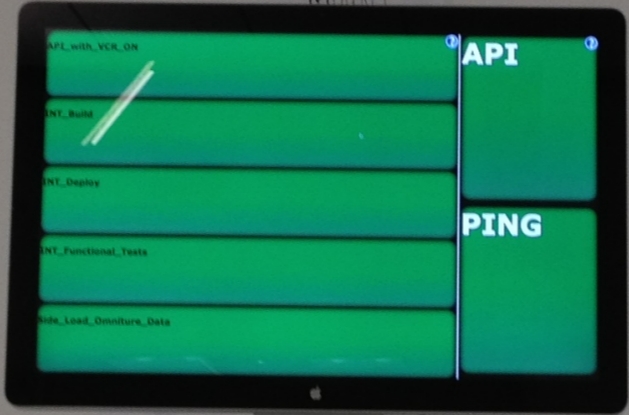
Continuous Integration



Feedback



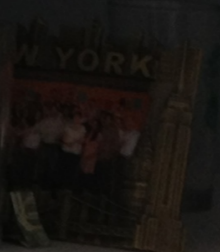
MOUNT



Network Patch Cords
in Copy Room

No
Teaching!

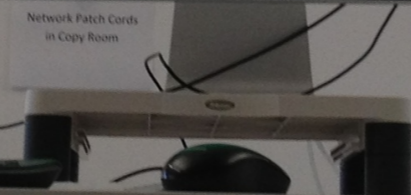
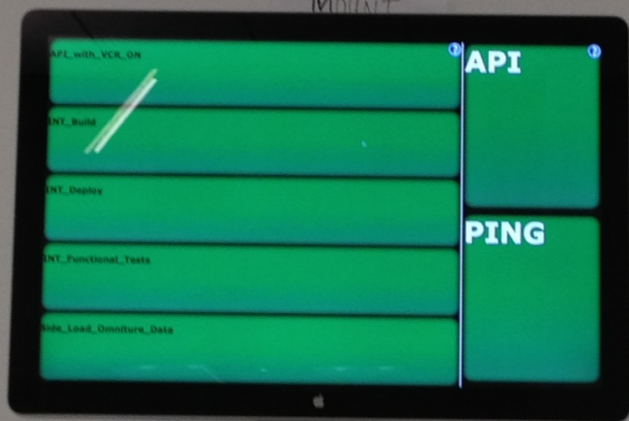
M KLANCNIK
NOOK



-Dude

NOOK

Feedback



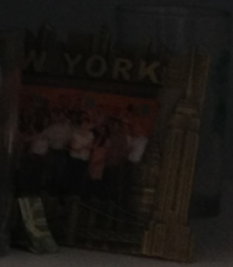
No Teaching!

M KLANCNIK
NOOK



-Dude

NOOK

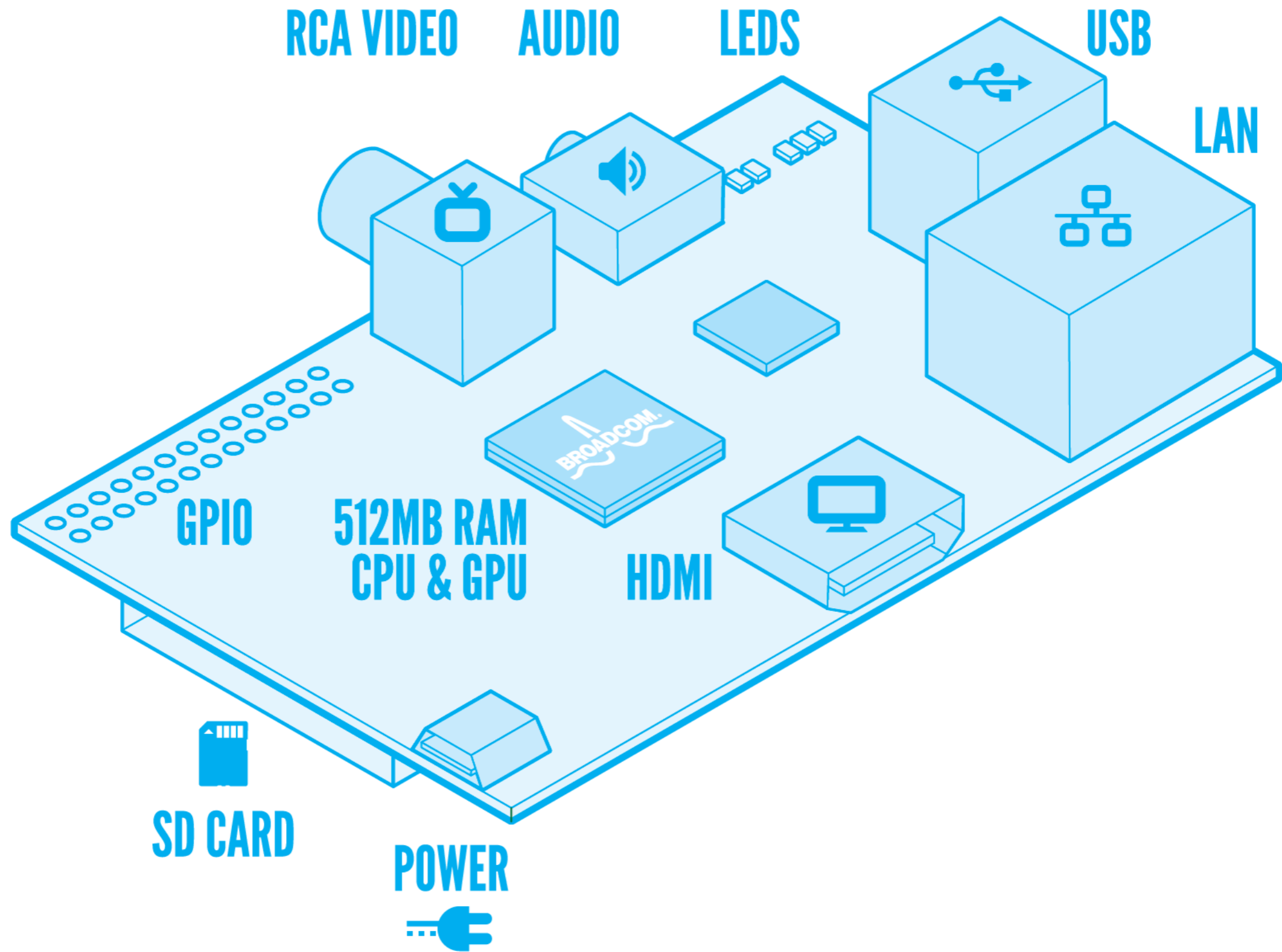


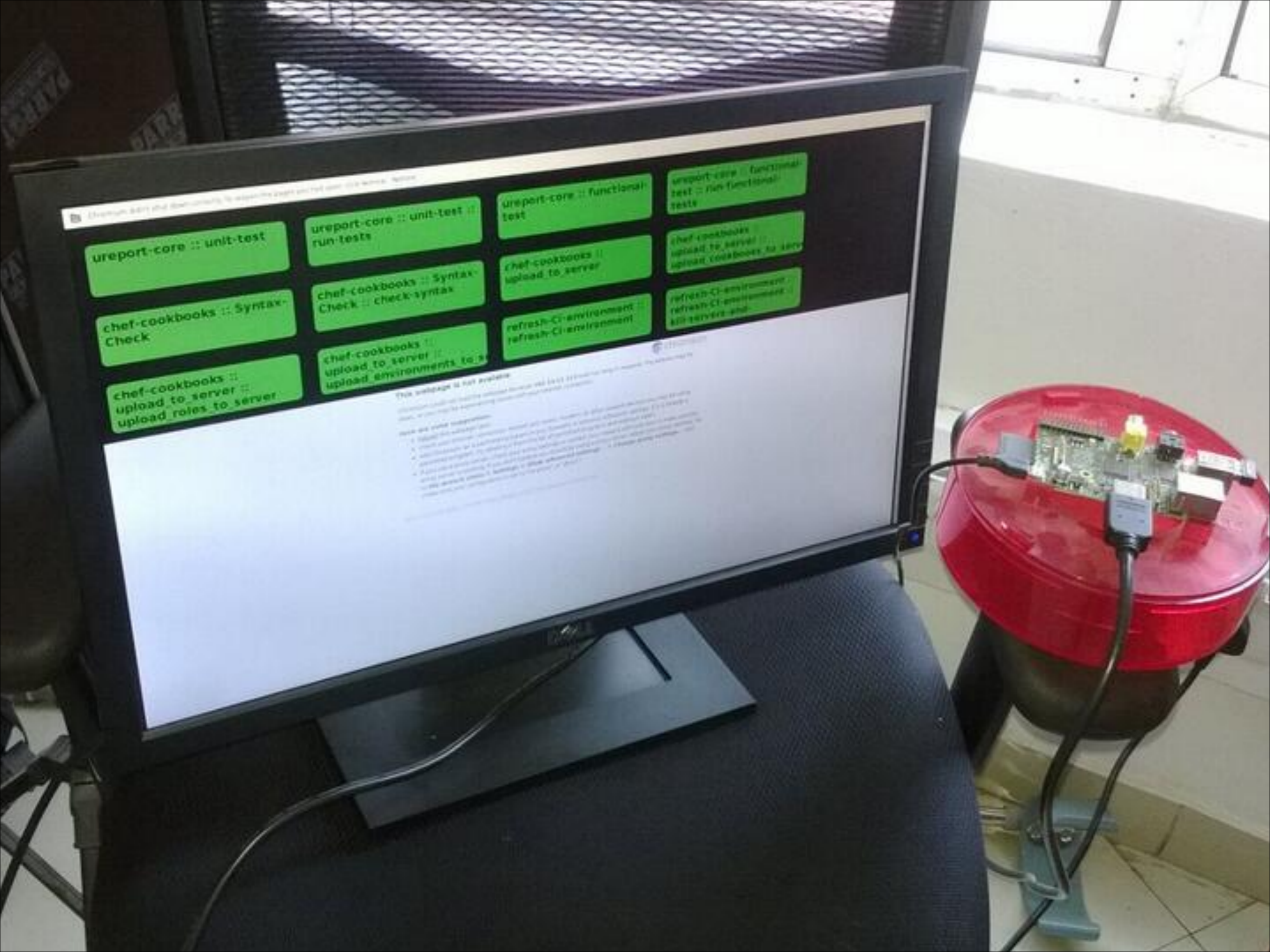


what if you have
no build box?

<http://www.flickr.com/photos/johnmueller/52621490/>

Raspberry Pi





```
ureport-core :: unit-test
```

```
ureport-core :: unit-test  
run-tests
```

```
ureport-core :: functional-  
test
```

```
ureport-core :: functional-  
test  
:: run functional-  
tests
```

```
chef-cookbooks :: Syntax-  
Check
```

```
chef-cookbooks :: Syntax-  
Check  
:: check-syntax
```

```
chef-cookbooks ::  
upload to server
```

```
chef-cookbooks  
upload to server  
:: upload cookbooks to server
```

```
chef-cookbooks ::  
upload to server  
:: upload roles to server
```

```
chef-cookbooks ::  
upload to server  
:: upload environments to server
```

```
refresh-ci-environment  
refresh-ci-environment
```

```
refresh-ci-environment  
refresh-ci-environment  
:: kill servers and  
rebuild
```

This webpage is not available

Information could not be retrieved because the host is unreachable. Please check the address of the host, or you may be experiencing a network-related problem.

Here are some suggestions:

- Check the webpage's URL.
- Check your Internet connection, router, and modem. Turn off your computer and router for a few minutes, then restart them.
- Make sure you're accessing the Internet through an Internet Service Provider (ISP).
- Try using a different browser or device.
- If you're having trouble accessing a specific website, you may need to update your DNS settings or flush your DNS cache.
- If you're having trouble accessing a specific website, you may need to update your DNS settings or flush your DNS cache.



Raspberry Pi



ureport-core :: unit-test

ureport-core :: unit-test
run-tests

ureport-core :: functional-test

ureport-core :: functional-test
run-functional-tests

chef-cookbooks :: Syntax-Check

chef-cookbooks :: Syntax-Check
check-syntax

chef-cookbooks :: upload to server

chef-cookbooks upload to server
upload cookbooks to server

chef-cookbooks :: upload to server
upload roles to server

chef-cookbooks upload to server
upload environments to server

refresh-ci-environment
refresh-ci-environment

refresh-ci-environment
refresh-ci-environment
kill servers and

This webpage is not available
We're sorry the webpage you were trying to visit is not available. It may have been moved, renamed, or deleted. Verify that the address is correct.
More details here: [Google search](#)
You can also search for this page with Google.
If you're having trouble viewing this page, you may have a browser issue. Try updating or deleting your cookies.
If you're still having trouble, you may need to clear your browser's cache.
If you're still having trouble, you may need to clear your browser's cache.
If you're still having trouble, you may need to clear your browser's cache.

visual indicator

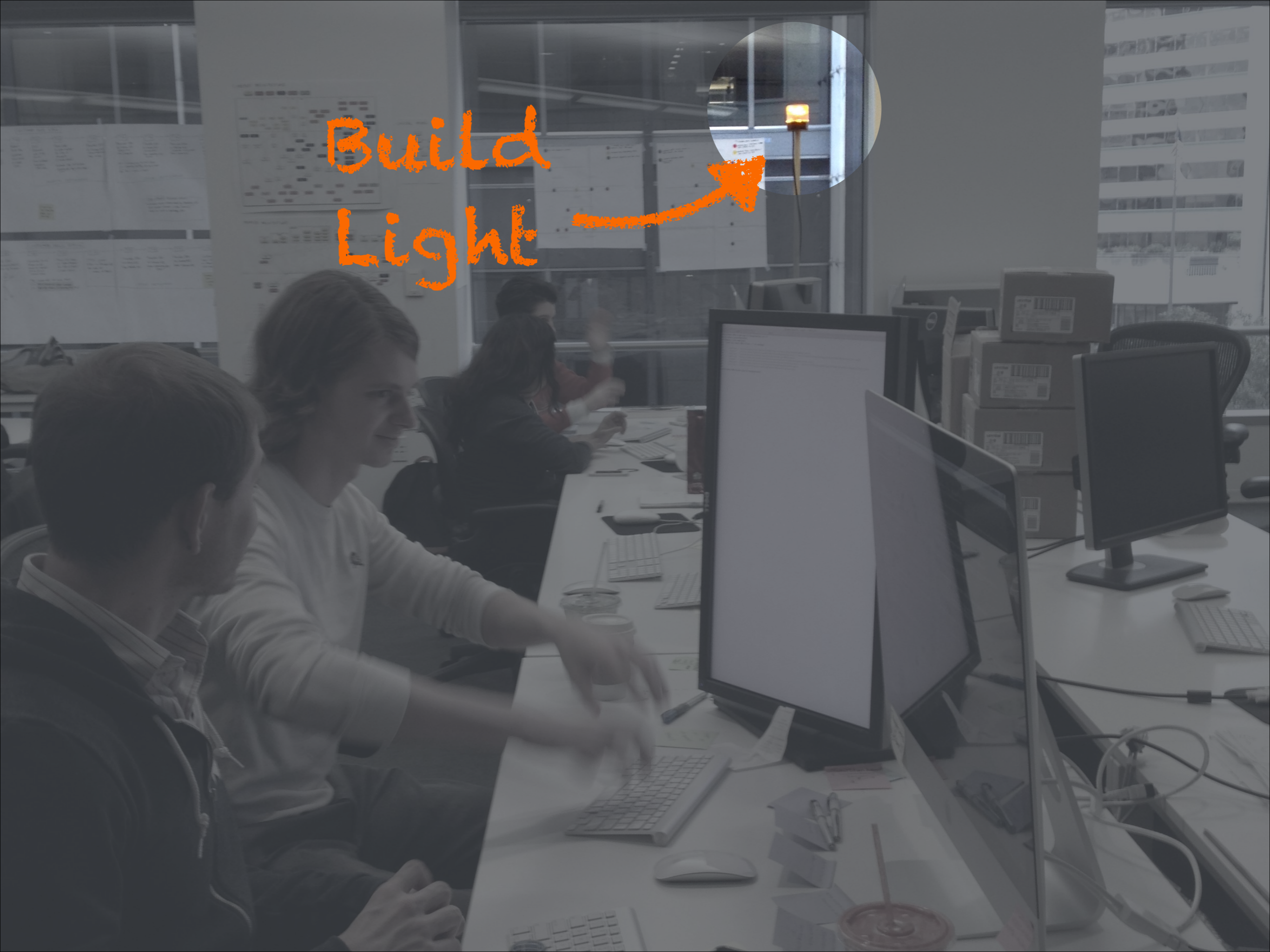
aka

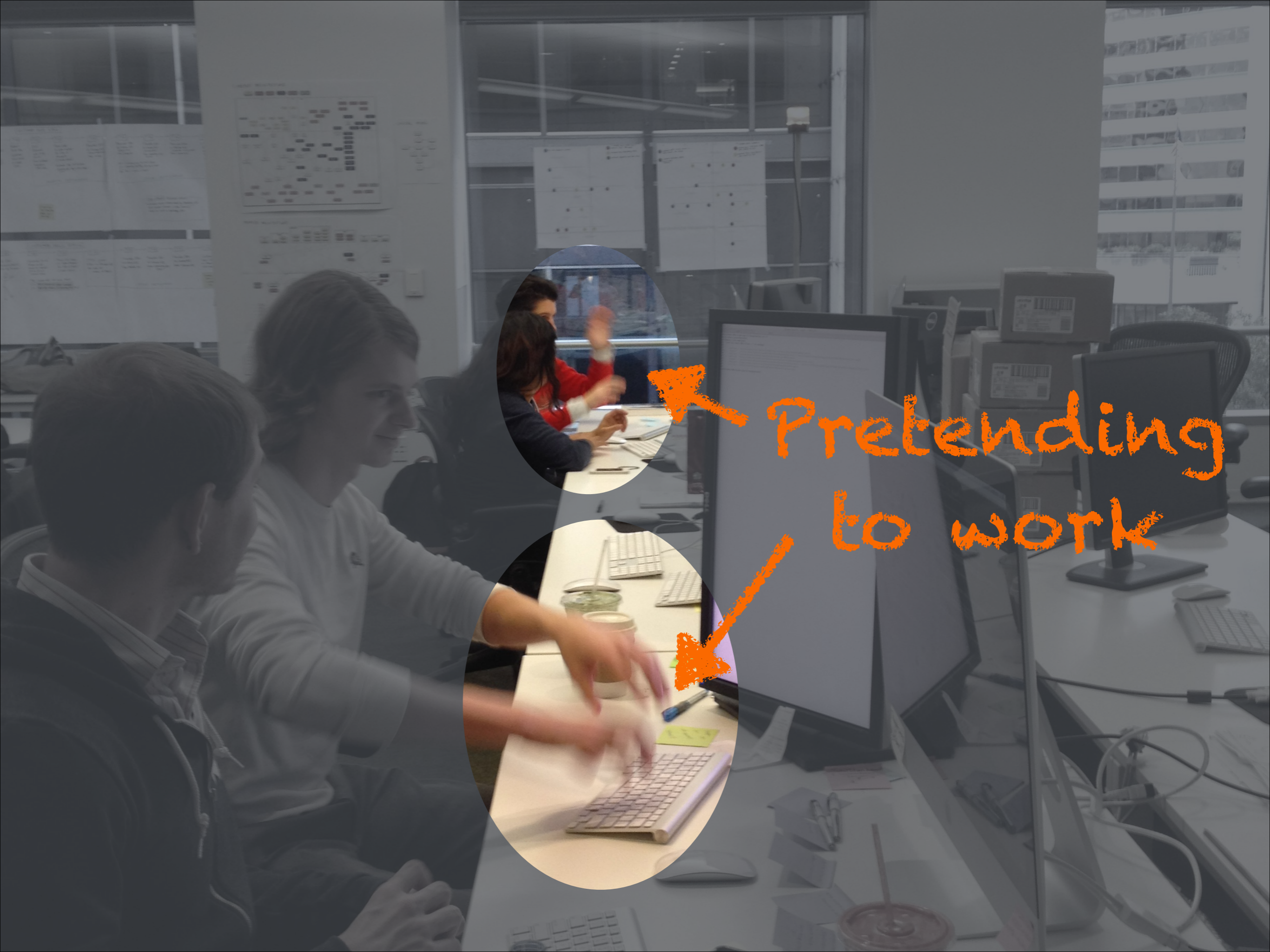
build light





Build
Light





Pretending
to work

raspberrypi

&

build light

done.

done?

build my own
~~lightsaber~~
build light

Learning

by

Doing



Learning By Doing



Choose a
"right-sized"
problem

build my own
~~lightsaber~~
build light

LEDs

low voltage (can be powered via USB)

bright

flexible (*blink!* colors!)

all
the colors

The Dreyfus Model



Beginner

Expert

Beginner

detailed

step-by-step
instructions

no wider

context

Beginner

detailed
step-by-step
instructions

no wider
context

Expert

wider
context
(goal)

no details
(yet)

Know where you
are on the
Dreyfus scale

The
Pragmatic
Programmers

Pragmatic & Thinking & Learning

Refactor
Your Wetware



Andy Hunt

all
the colors

multi-color LEDs

Search

multi-color LEDs

Search

an LED can only be one color...

but LEDs can come in many colors...

solution: combine different colored LEDs

RGB

color mixing

vary LED brightness

Search

vary LED brightness

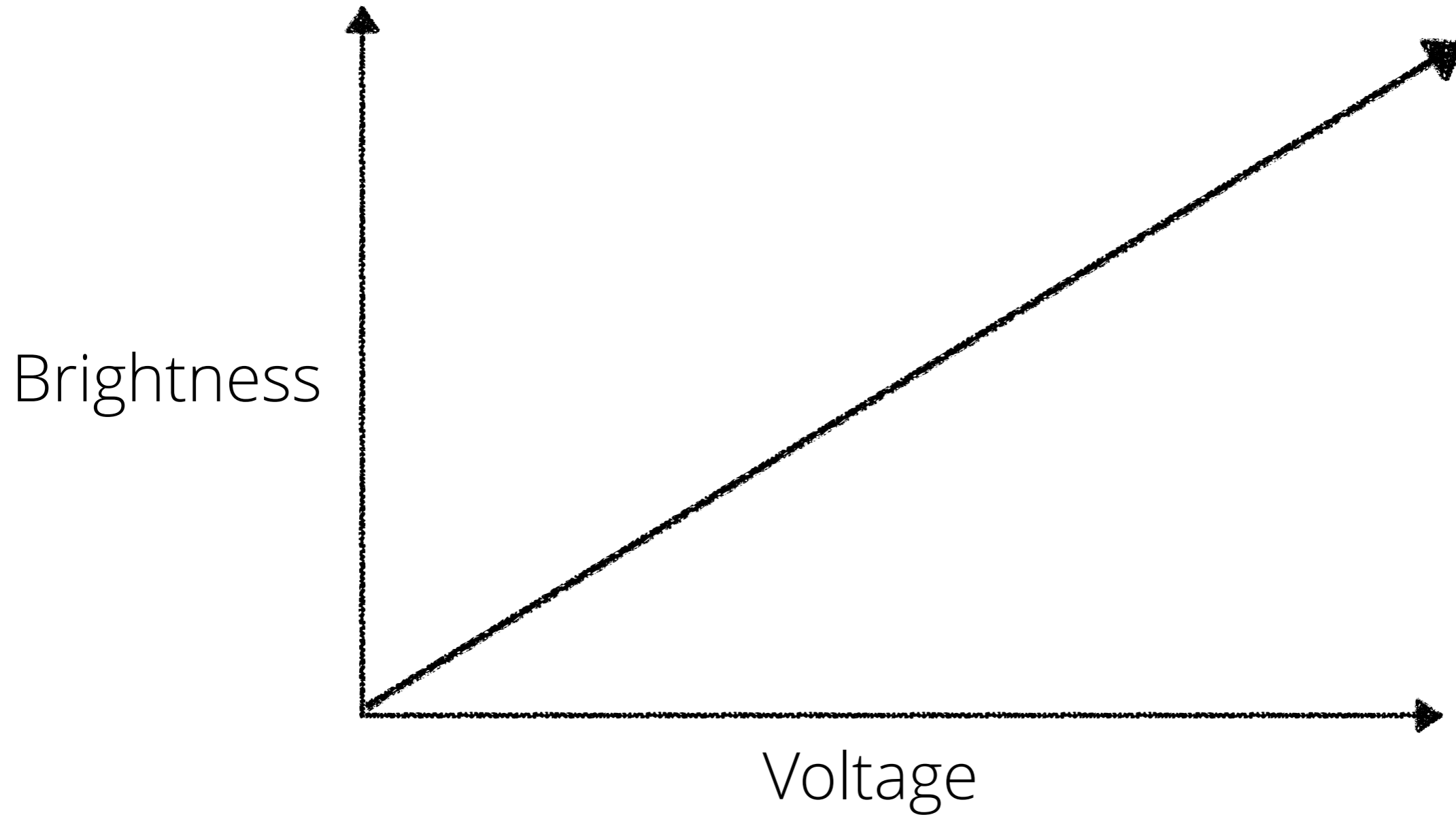
Search

Pulse

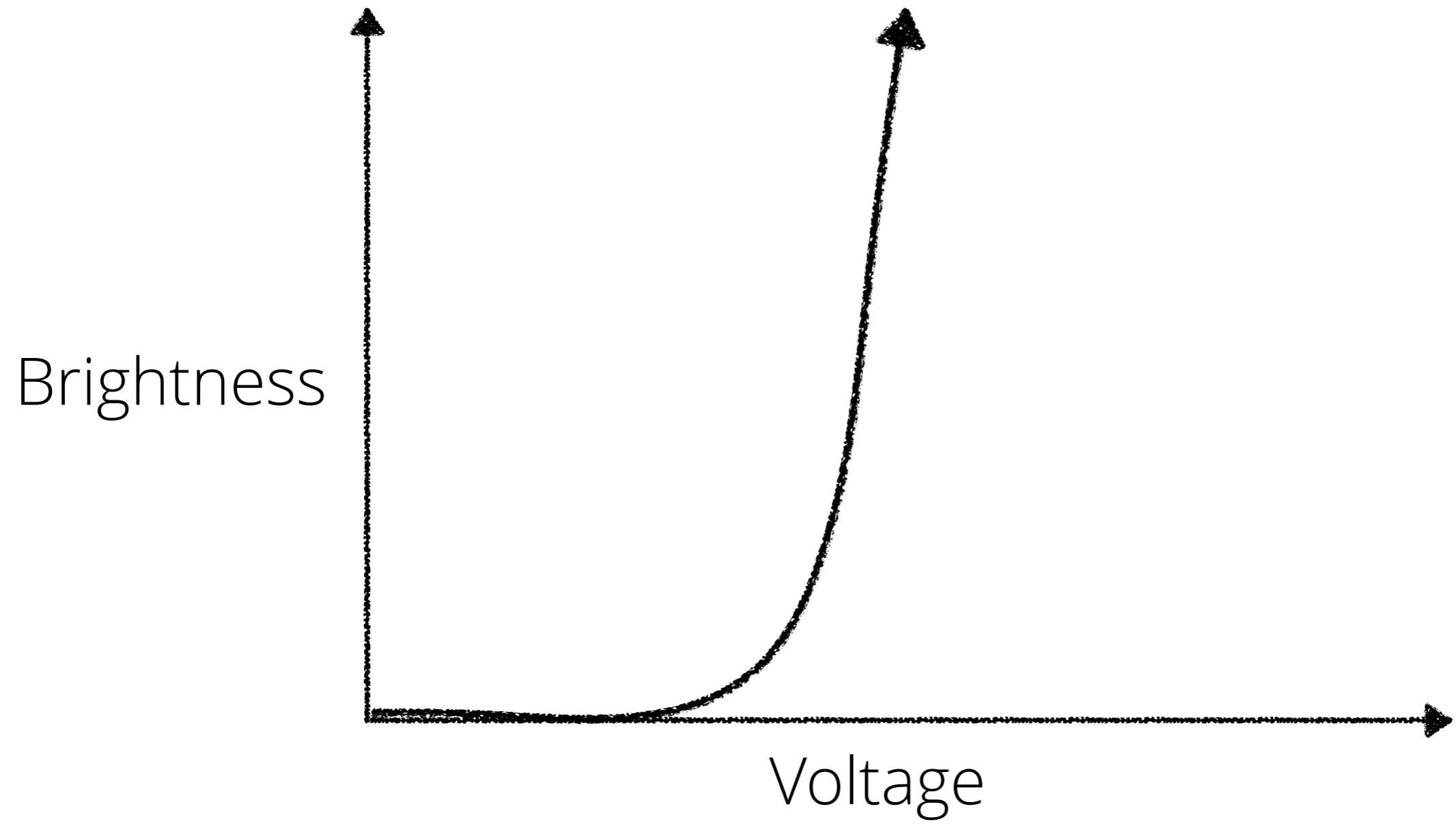
Width

Modulation

Incandescent Bulb

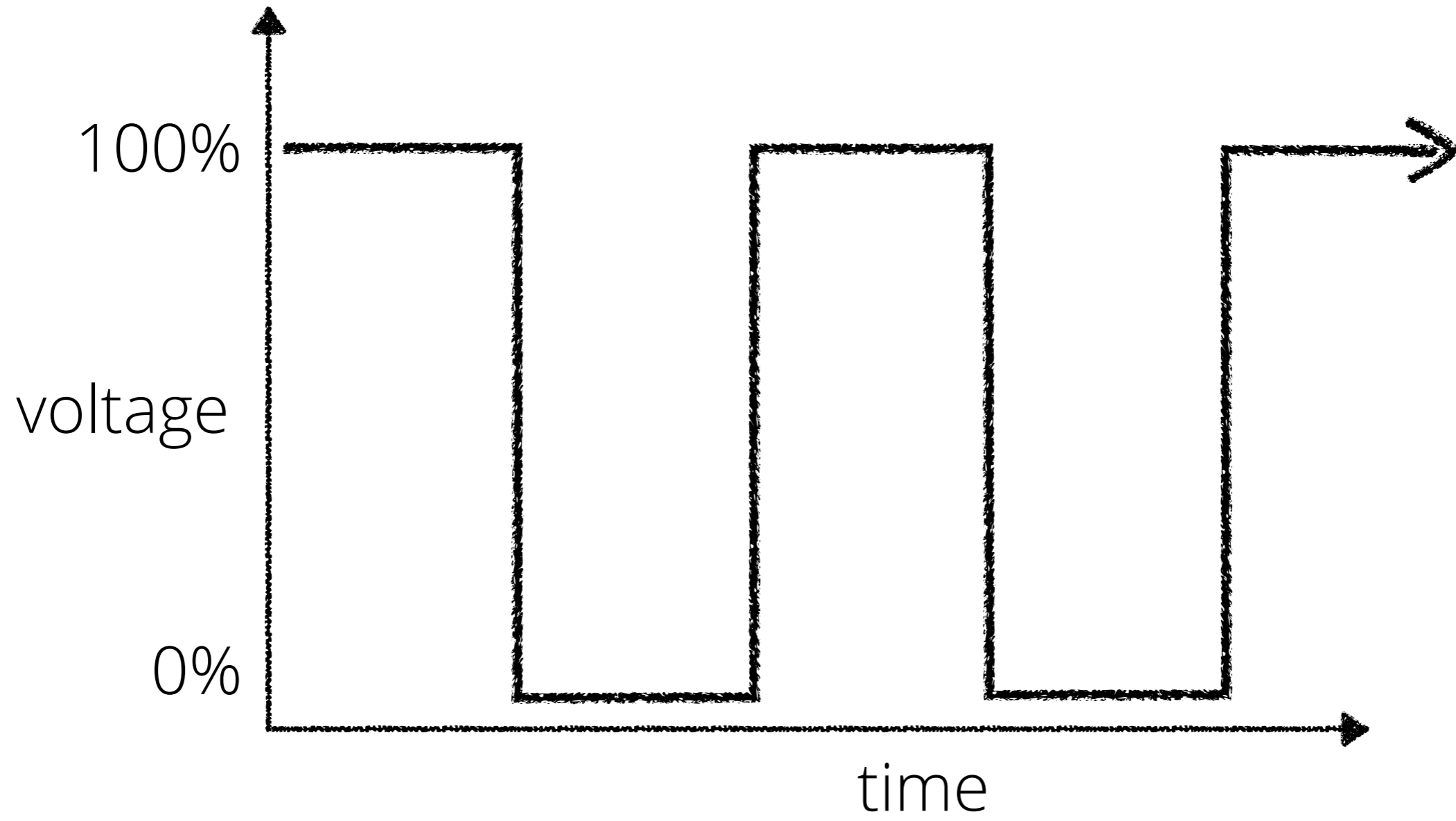


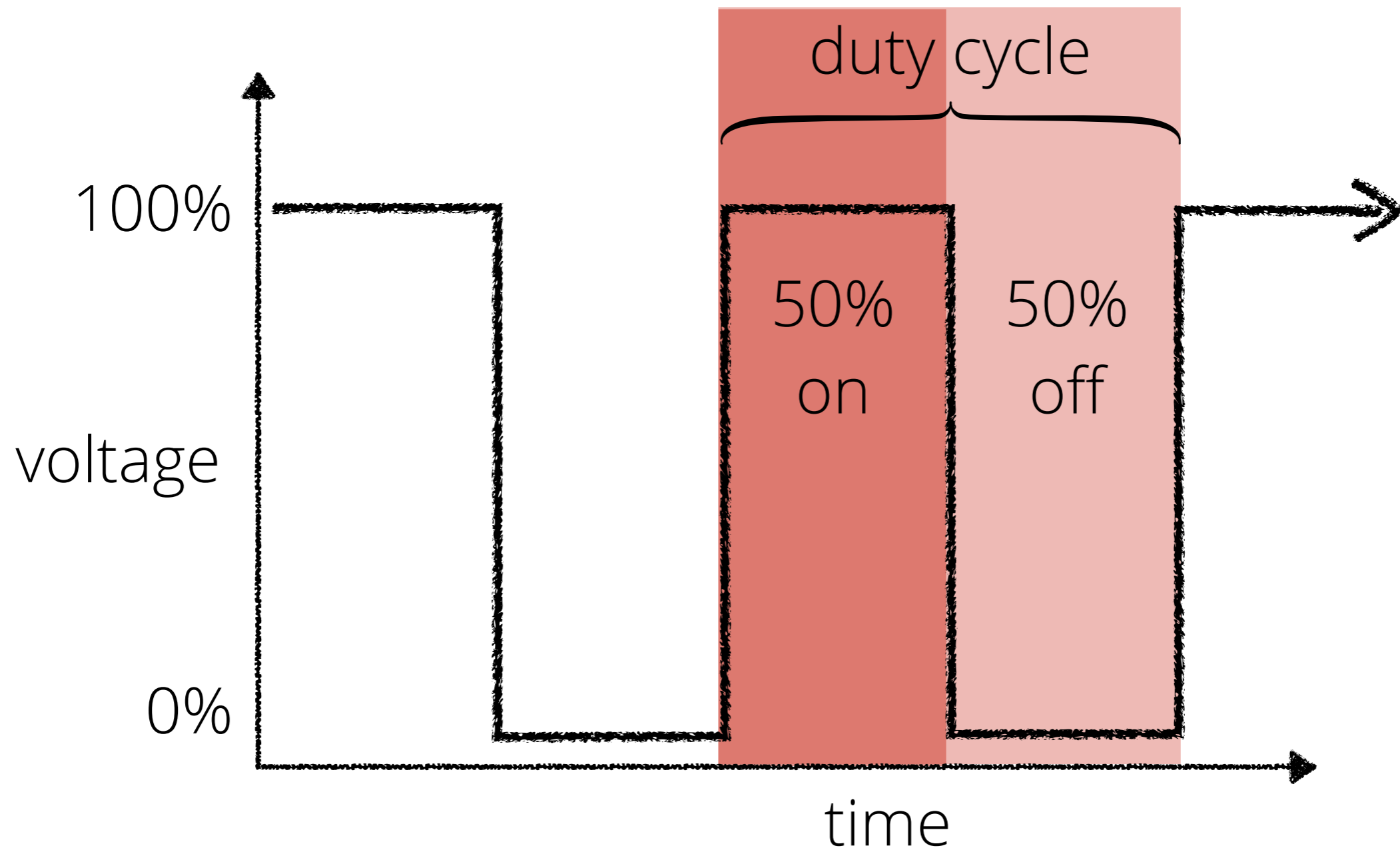
LED



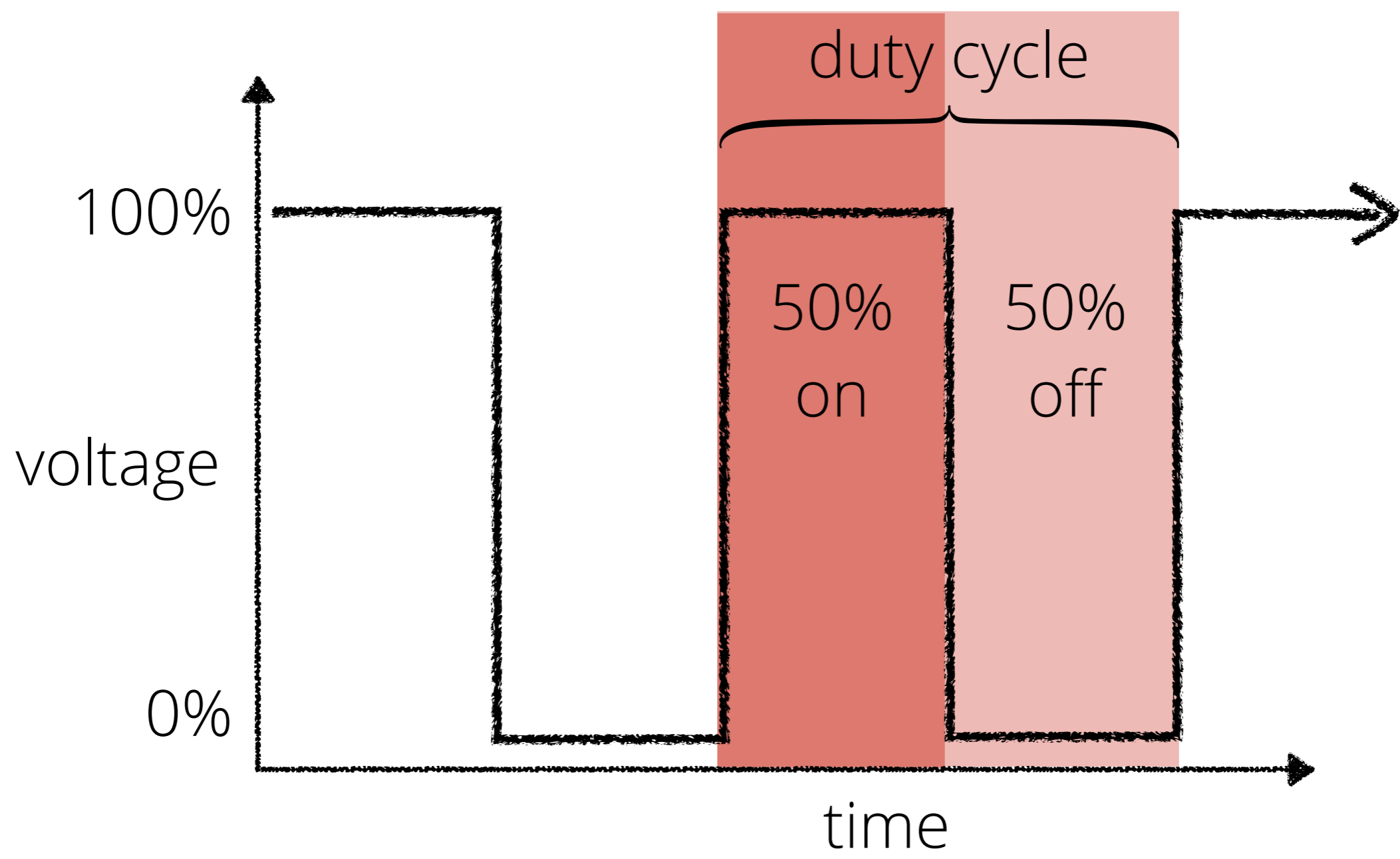
brightness: 100%

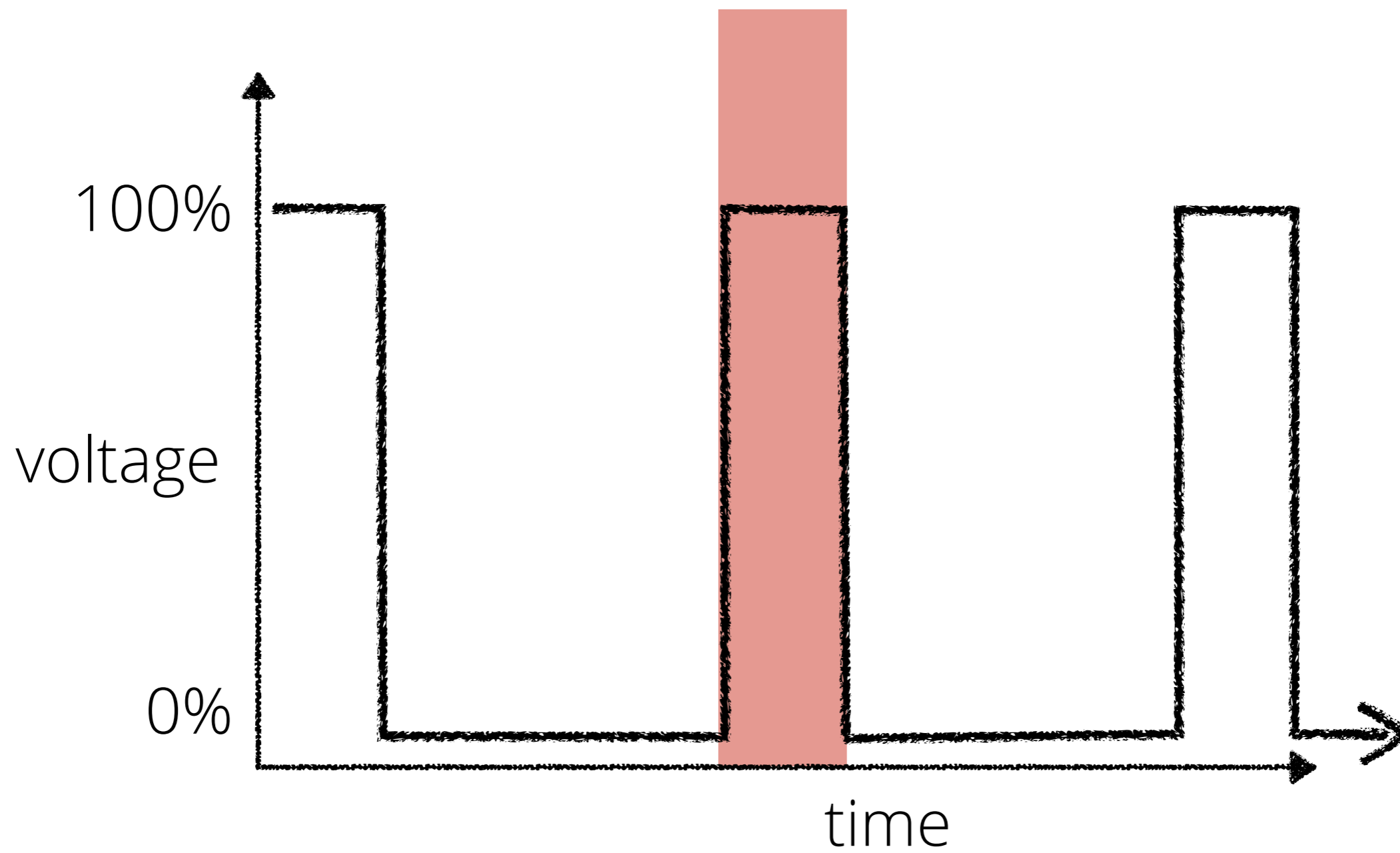


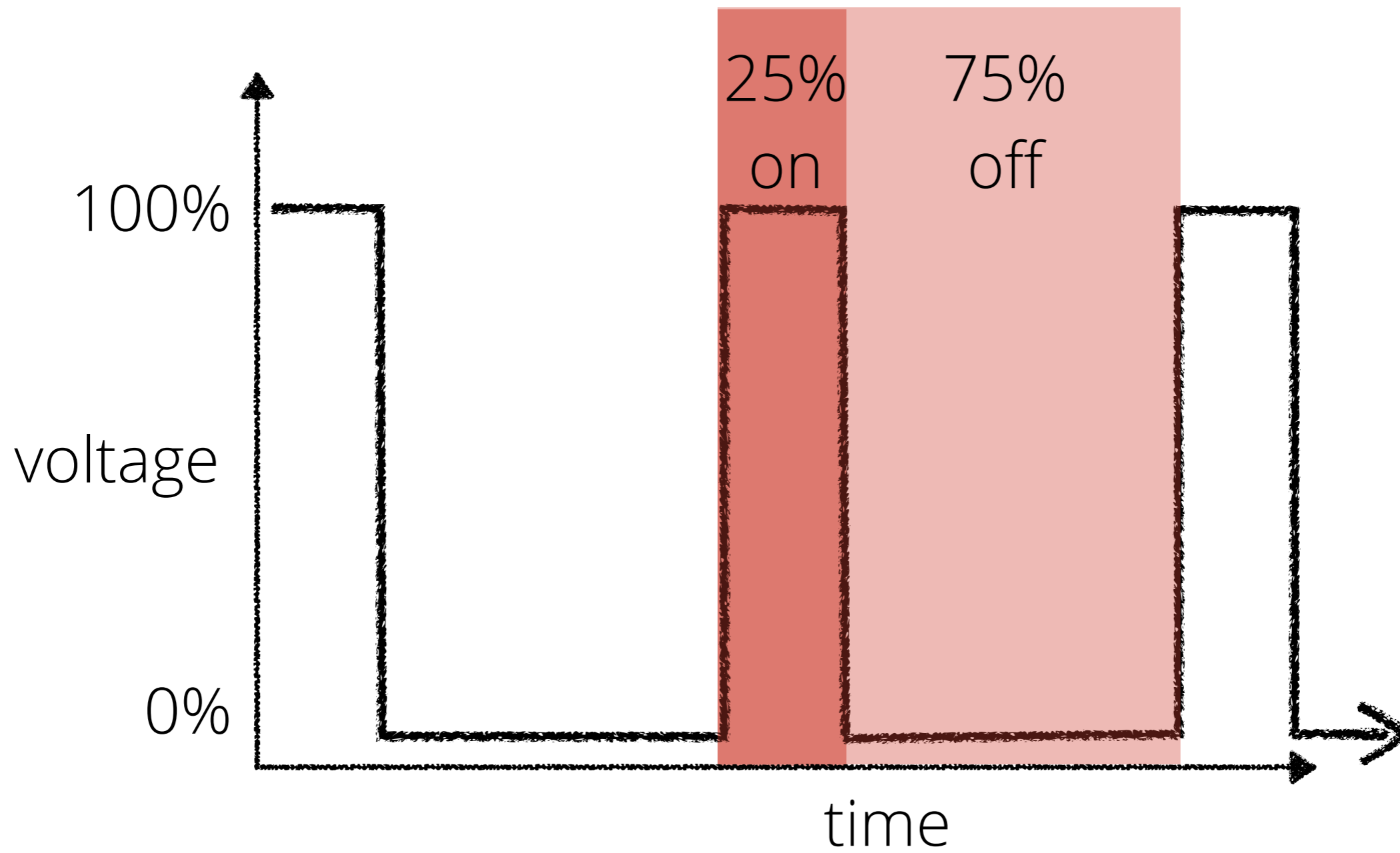




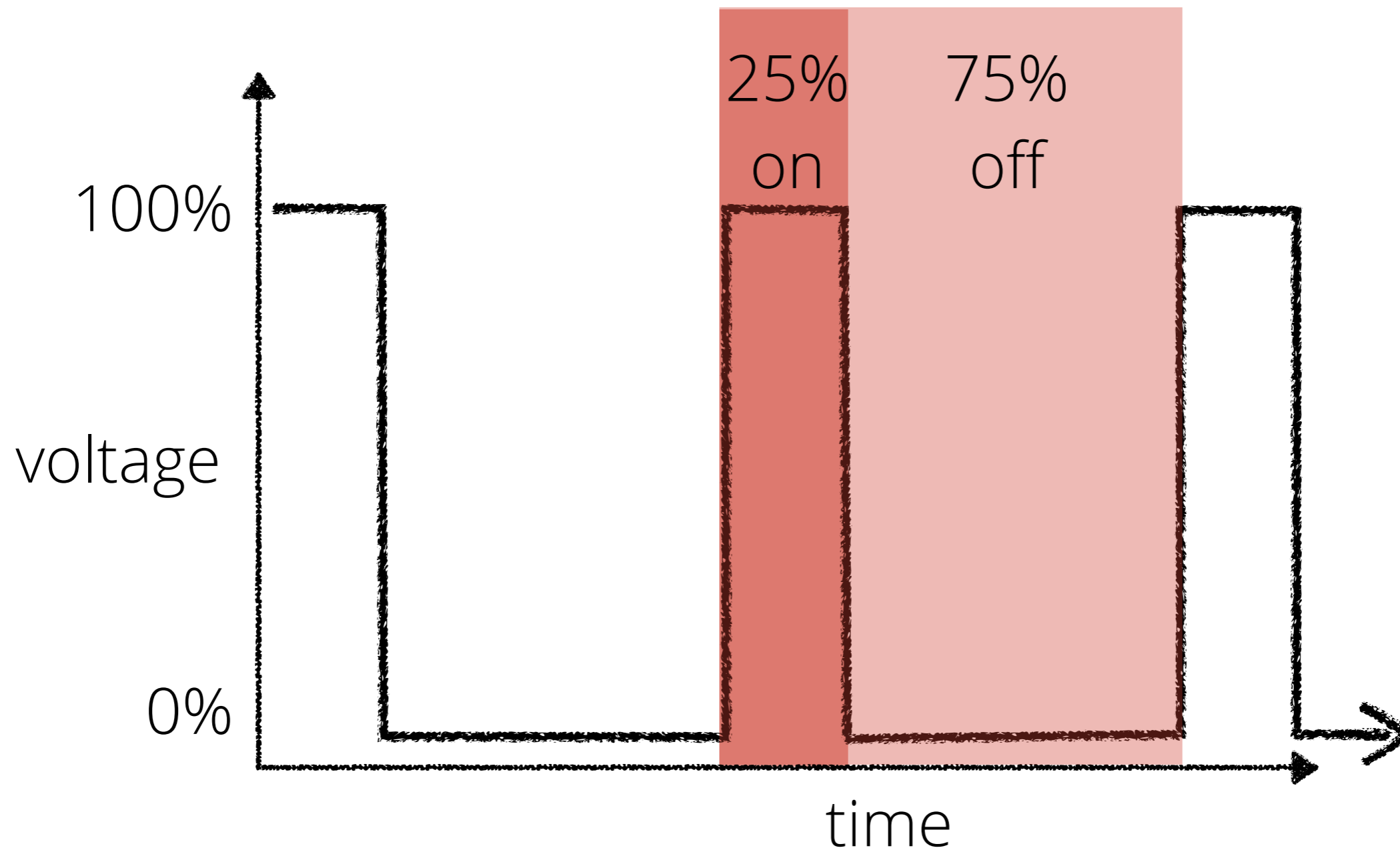
brightness: 50%







brightness: 25%



Don't
trust your
intuition

Red LED

+ Green LED

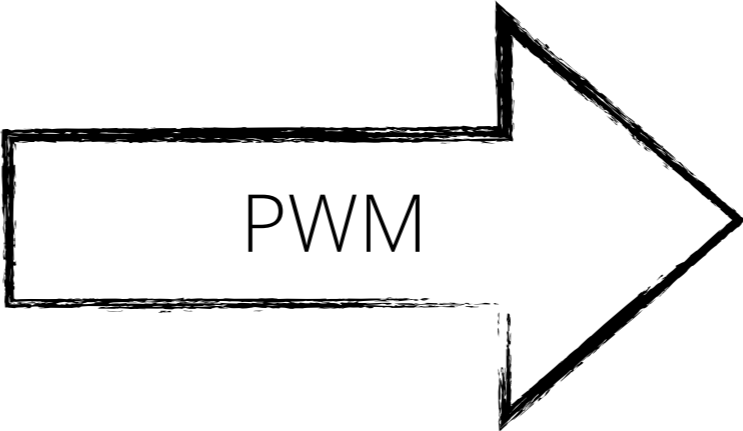
+ Blue LED

+ PWM

= all the colors!



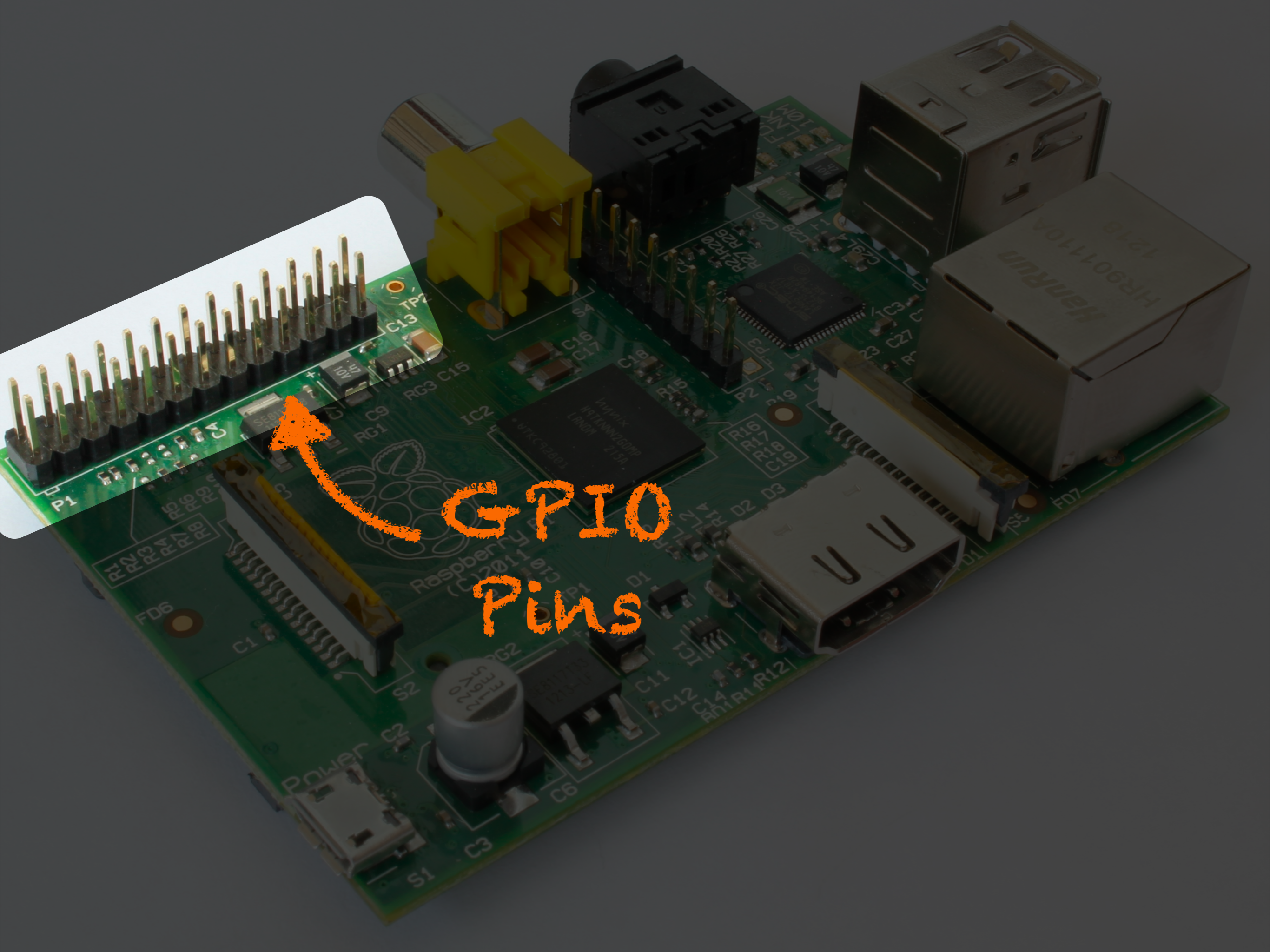
Raspberry
PI



red
LED

green
LED

blue
LED

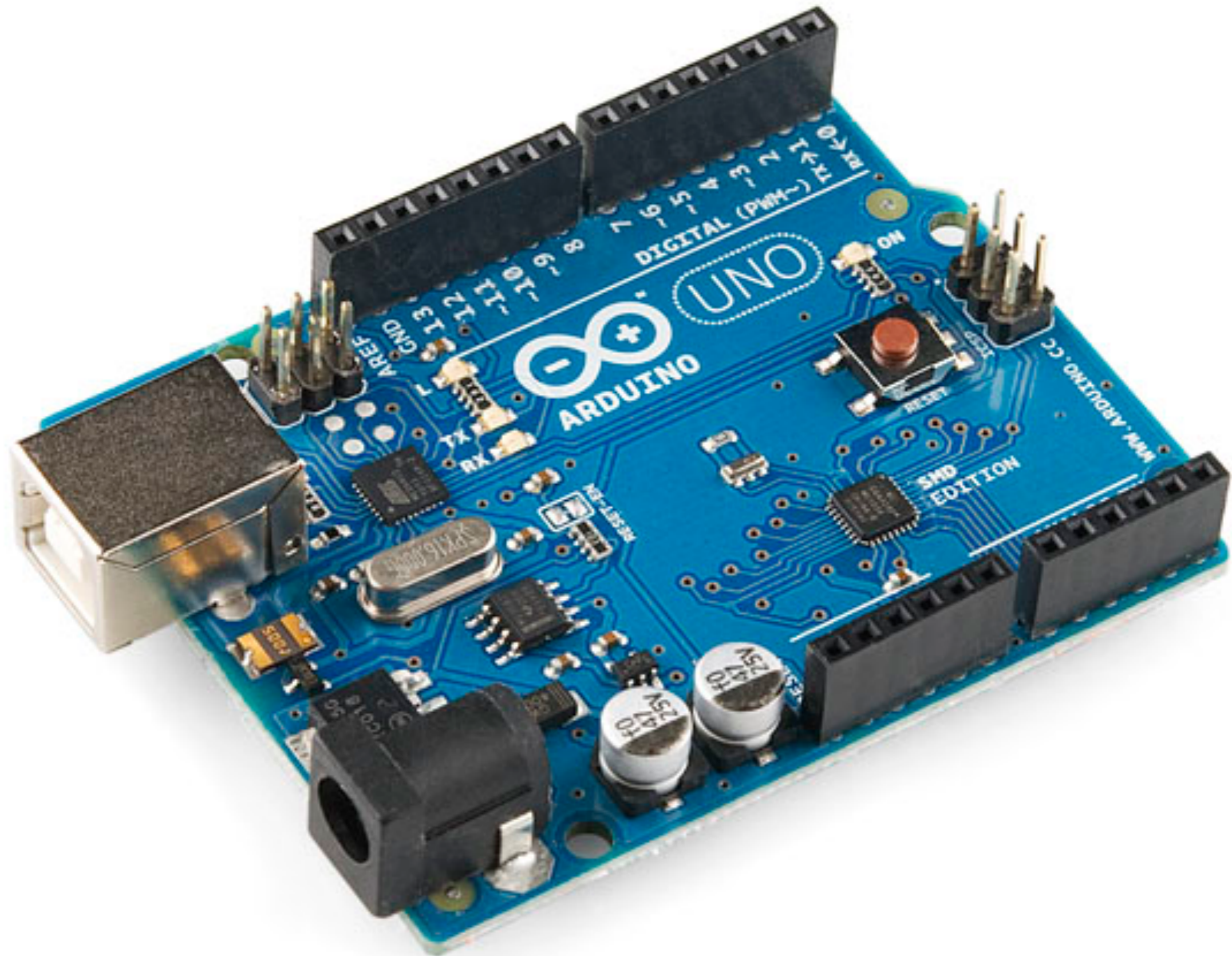


GPIO
Pins

Raspberry Pi has **two**
GPIO pins which capable
of **PWM** output.

Our light needs **three**.

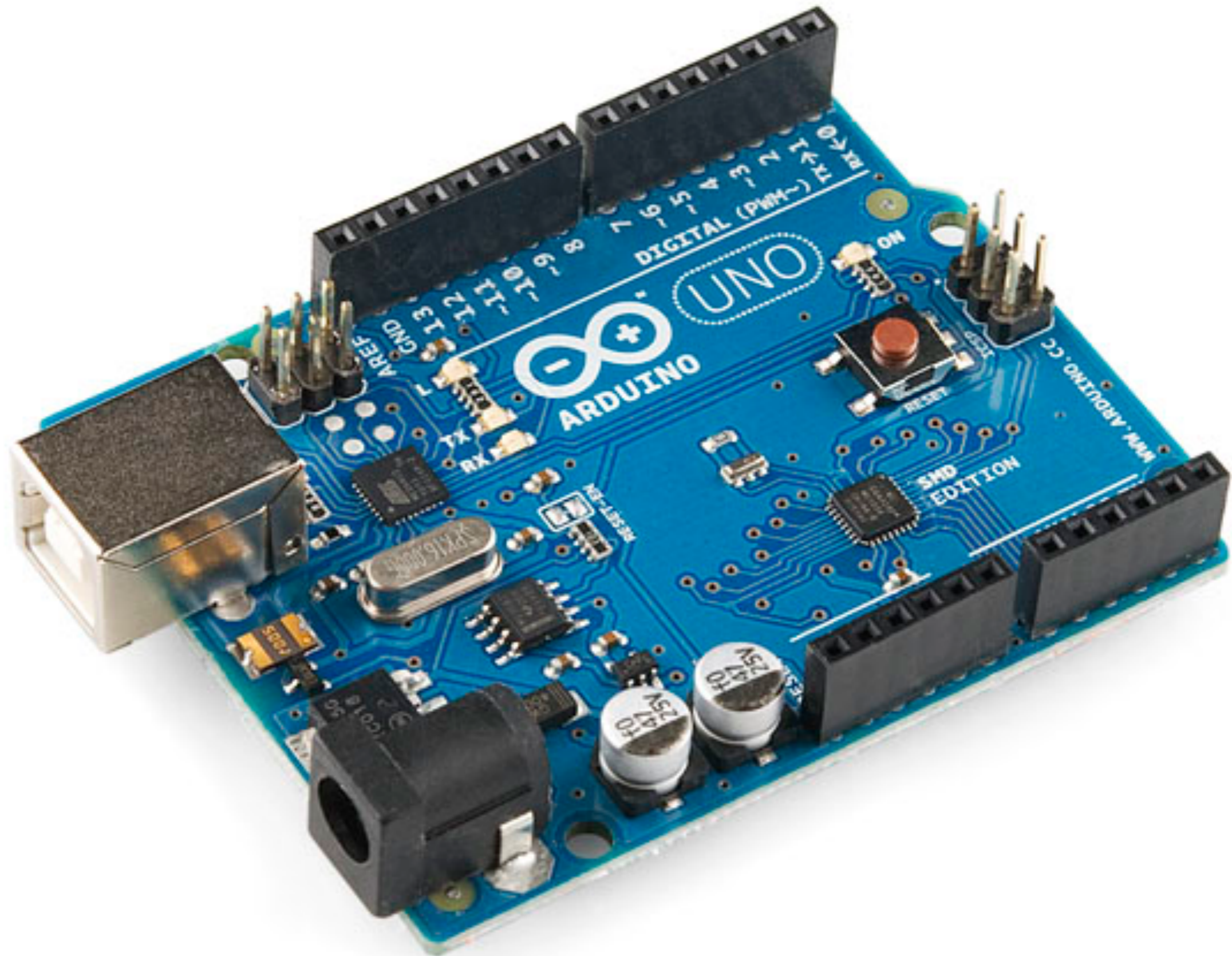
Arduino



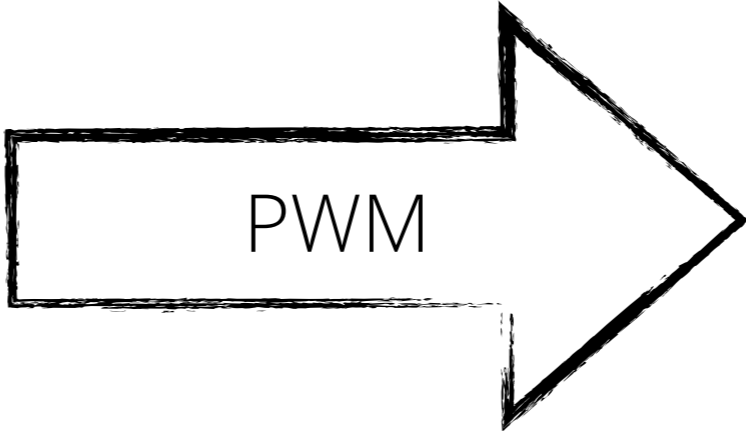
Arduino is an Open-Source electronics prototyping platform based on flexible, ***easy-to-use hardware and software.***

- arduino.cc

Arduino



Raspberry
PI

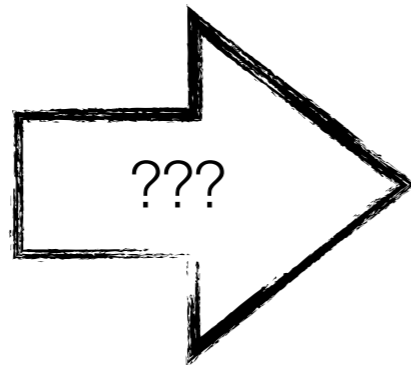


red
LED

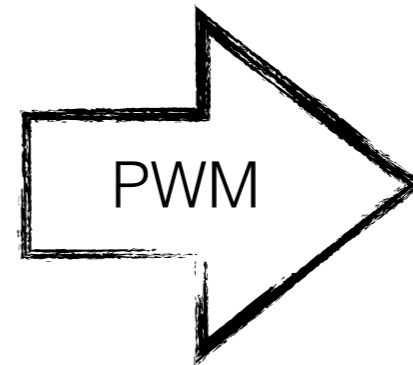
green
LED

blue
LED

Raspberry
PI



Arduino



red
LED

green
LED

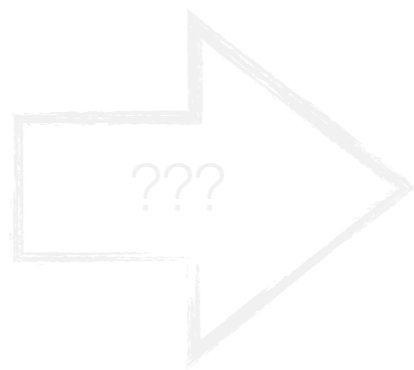
blue
LED

Feature-creep

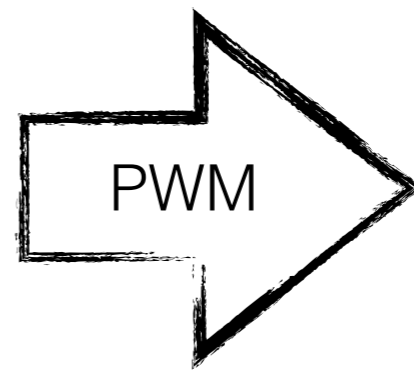
as a

Learning tool

Raspberry
PI



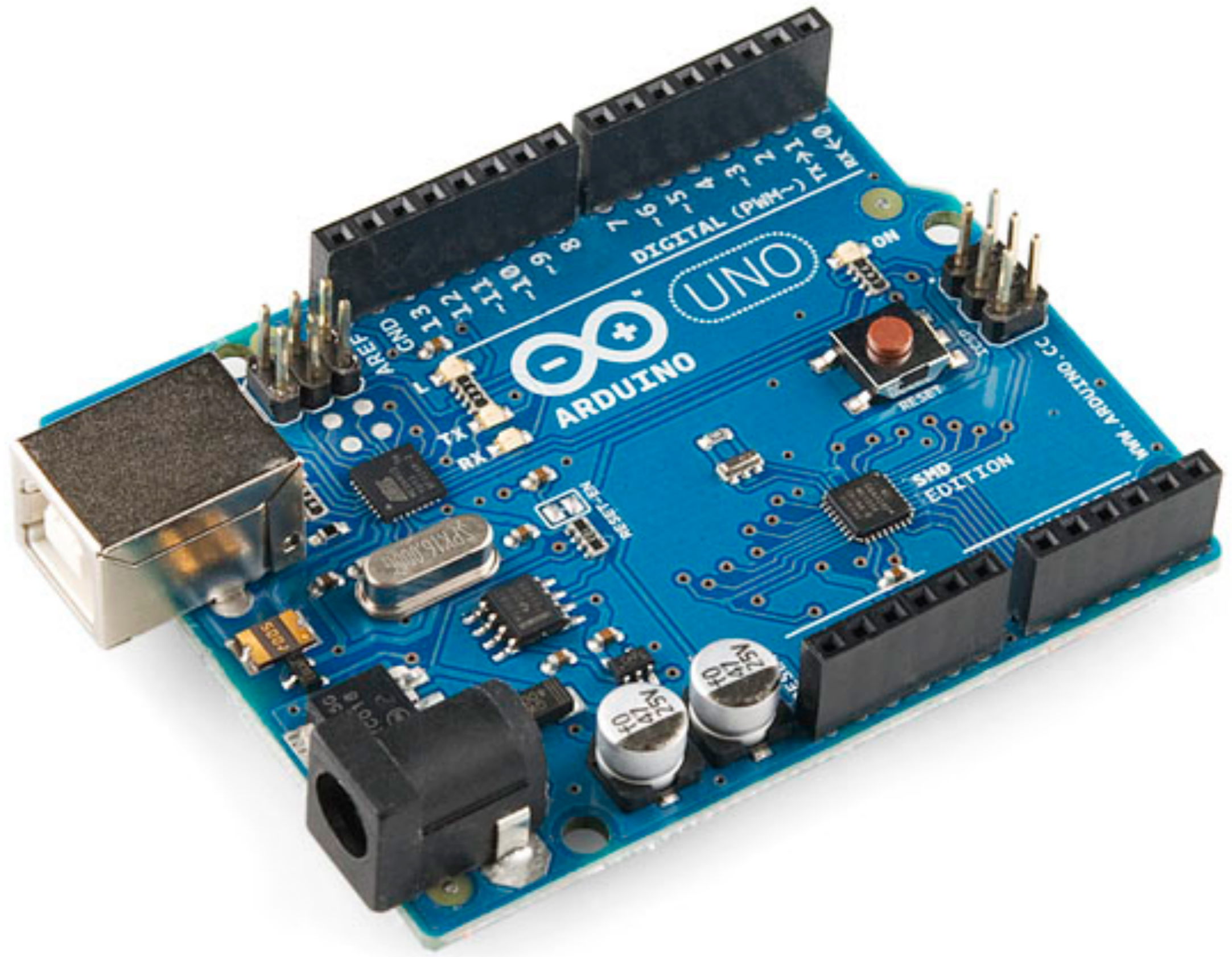
Arduino



red
LED

green
LED

blue
LED

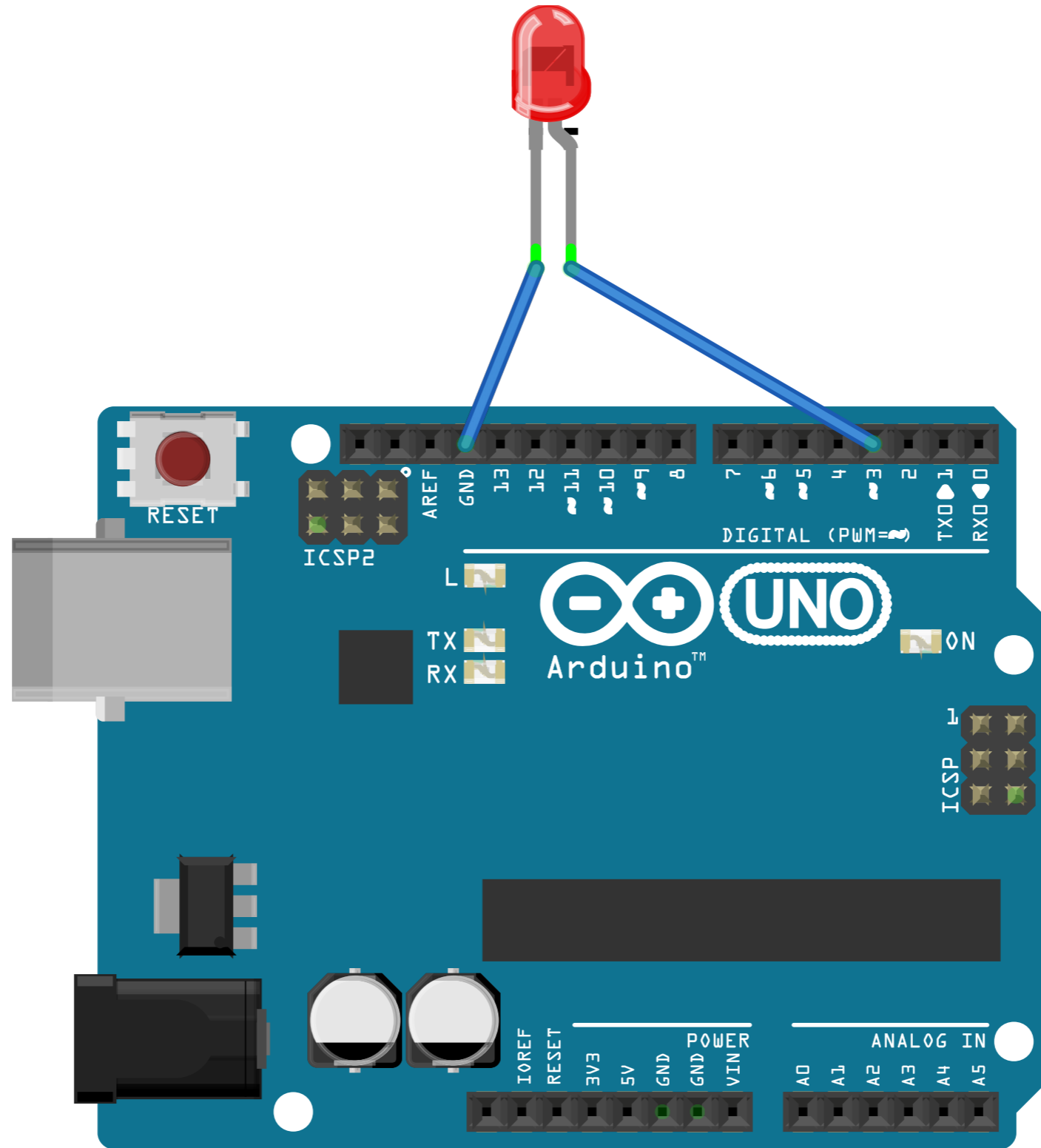


baby steps,
towards an
eventual goal.

sketch 1

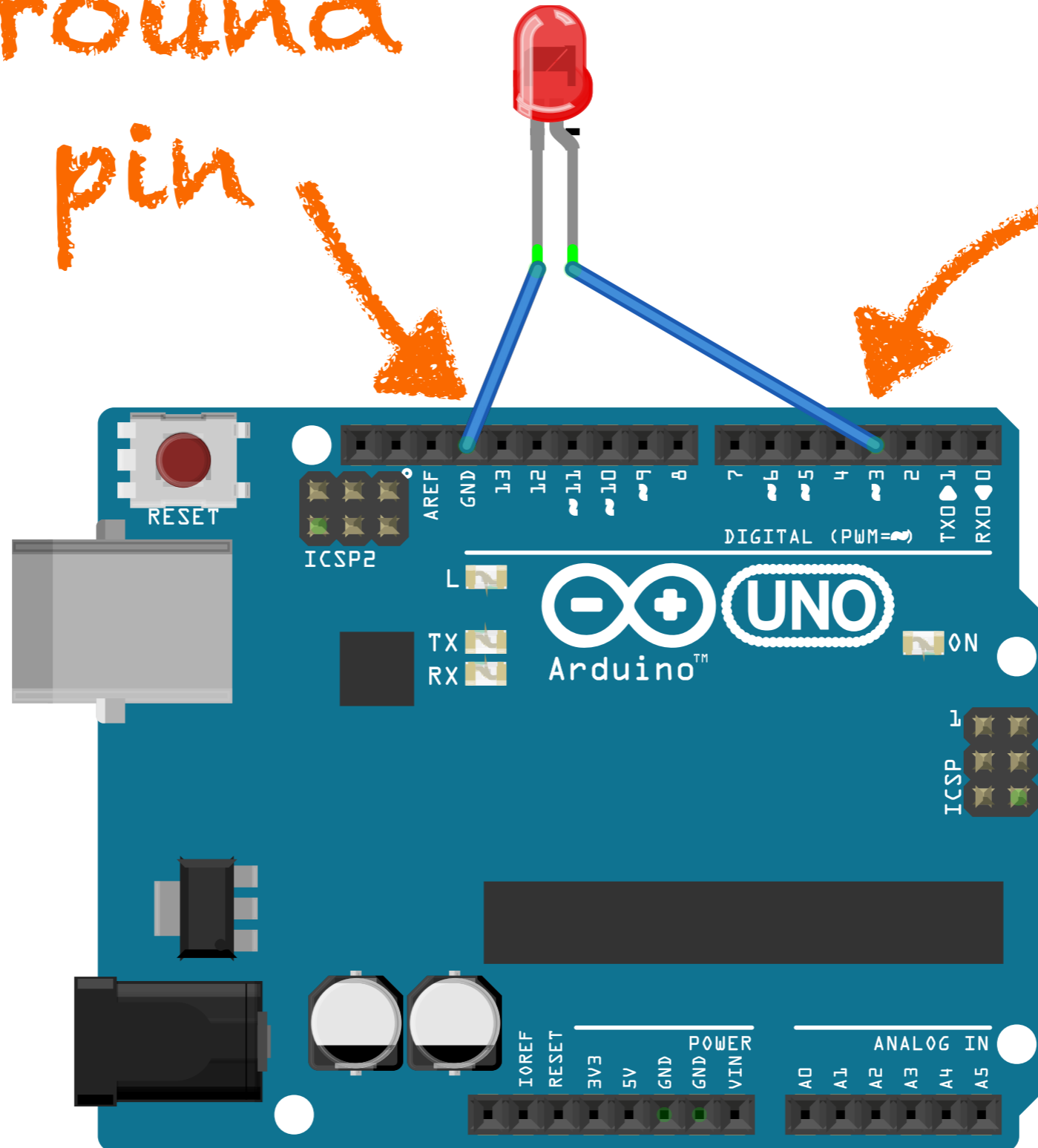
blinking an LED

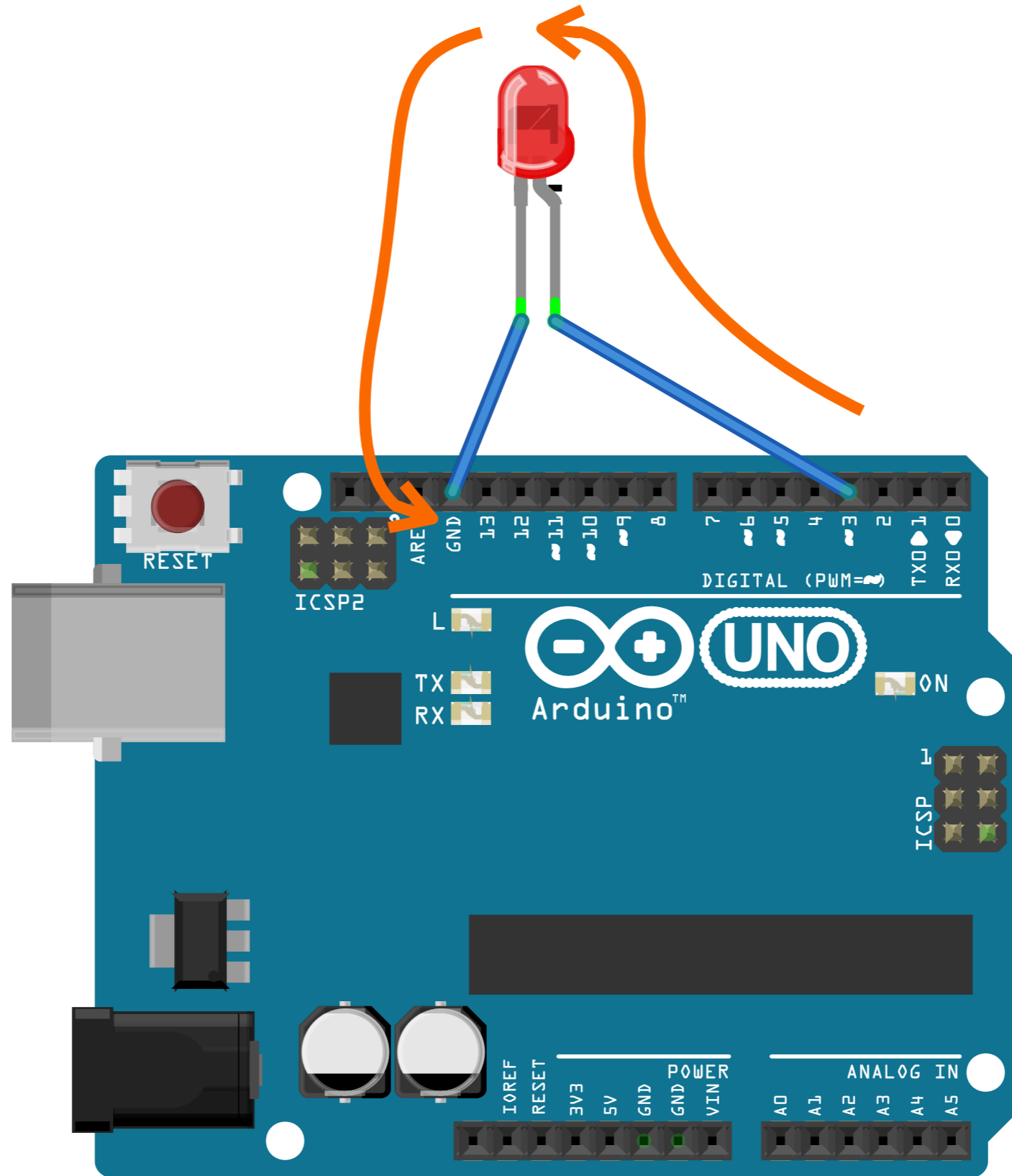
(Hello World of hardware)

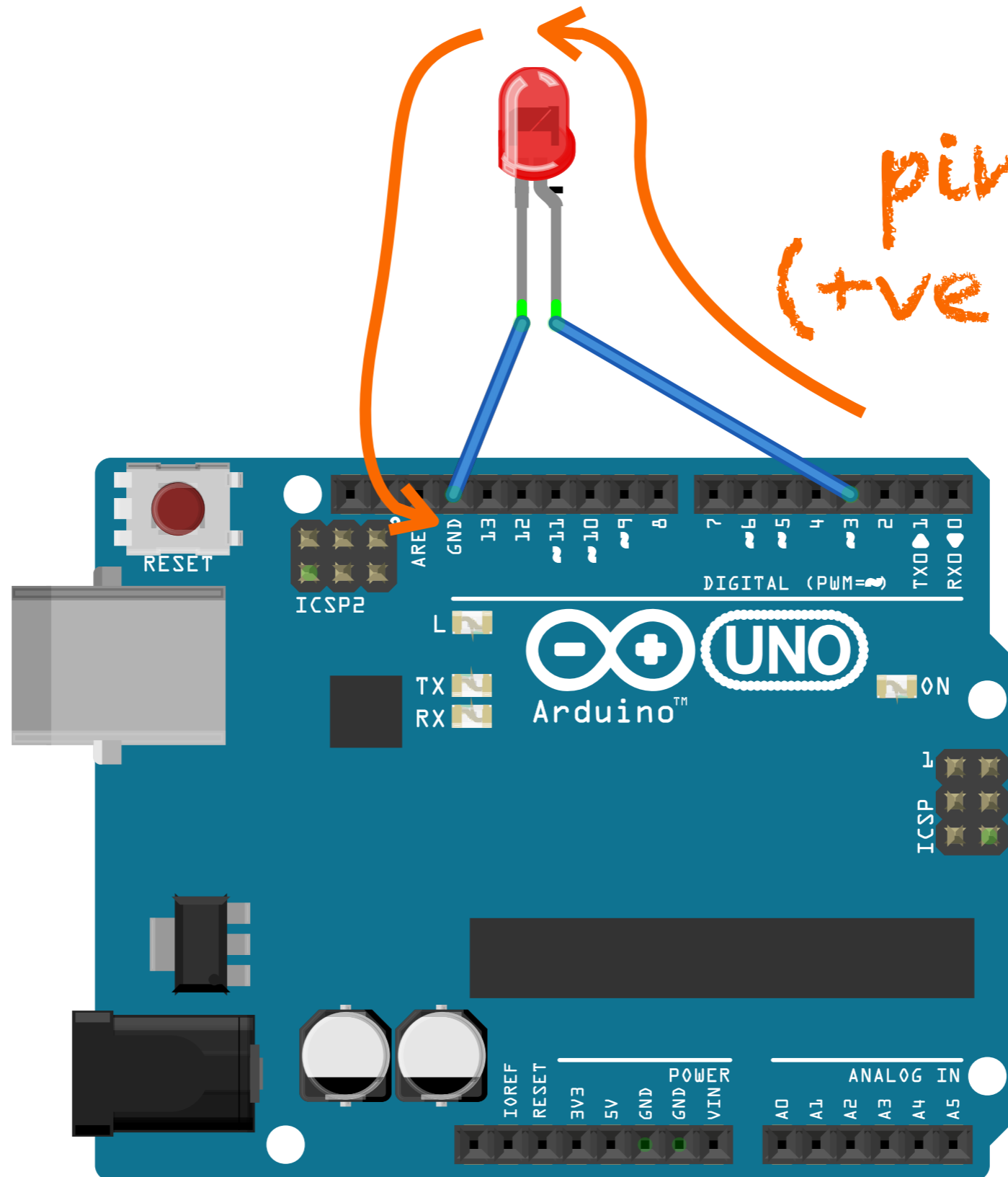


ground
pin

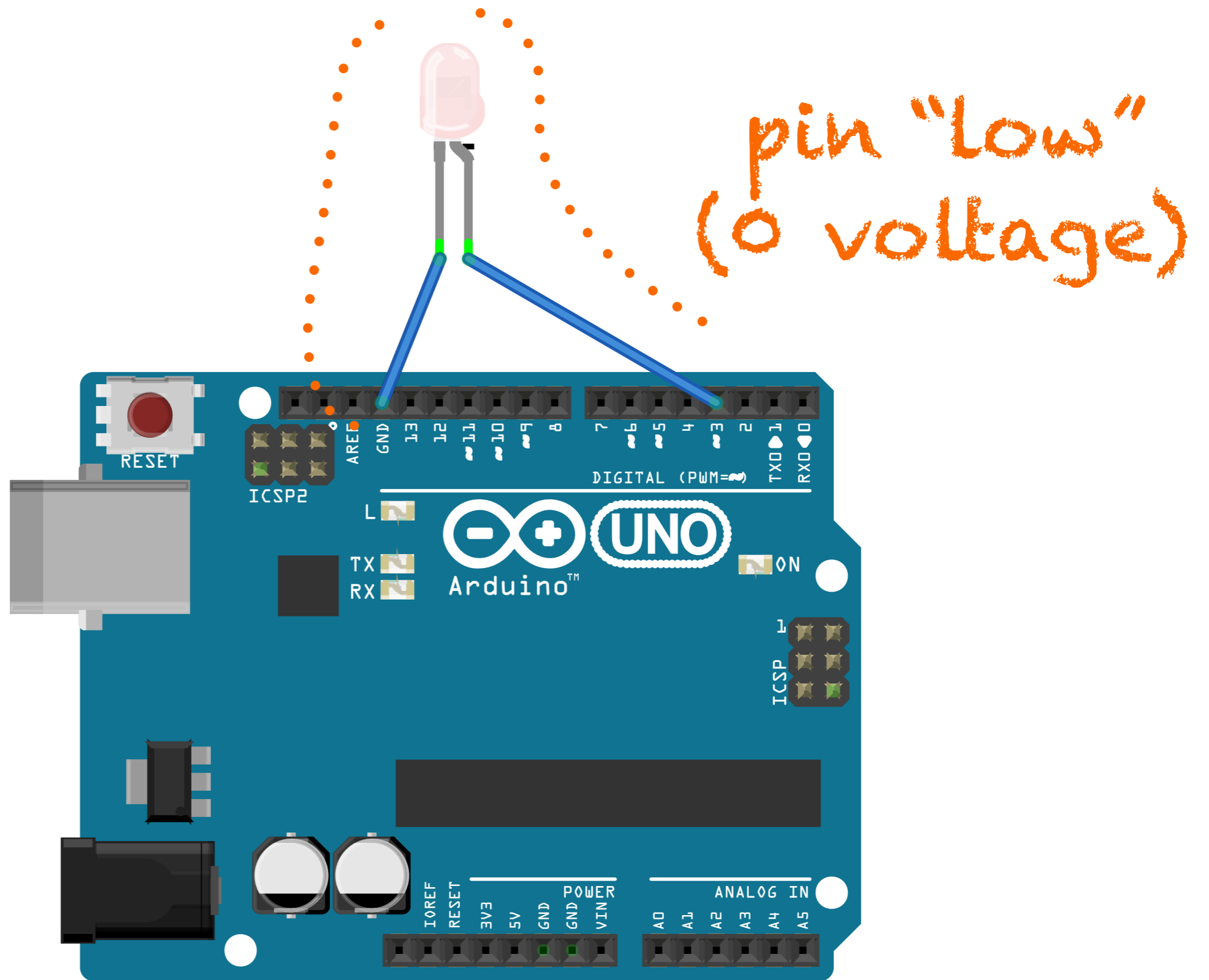
IO
pin







pin "high"
(+ve voltage)



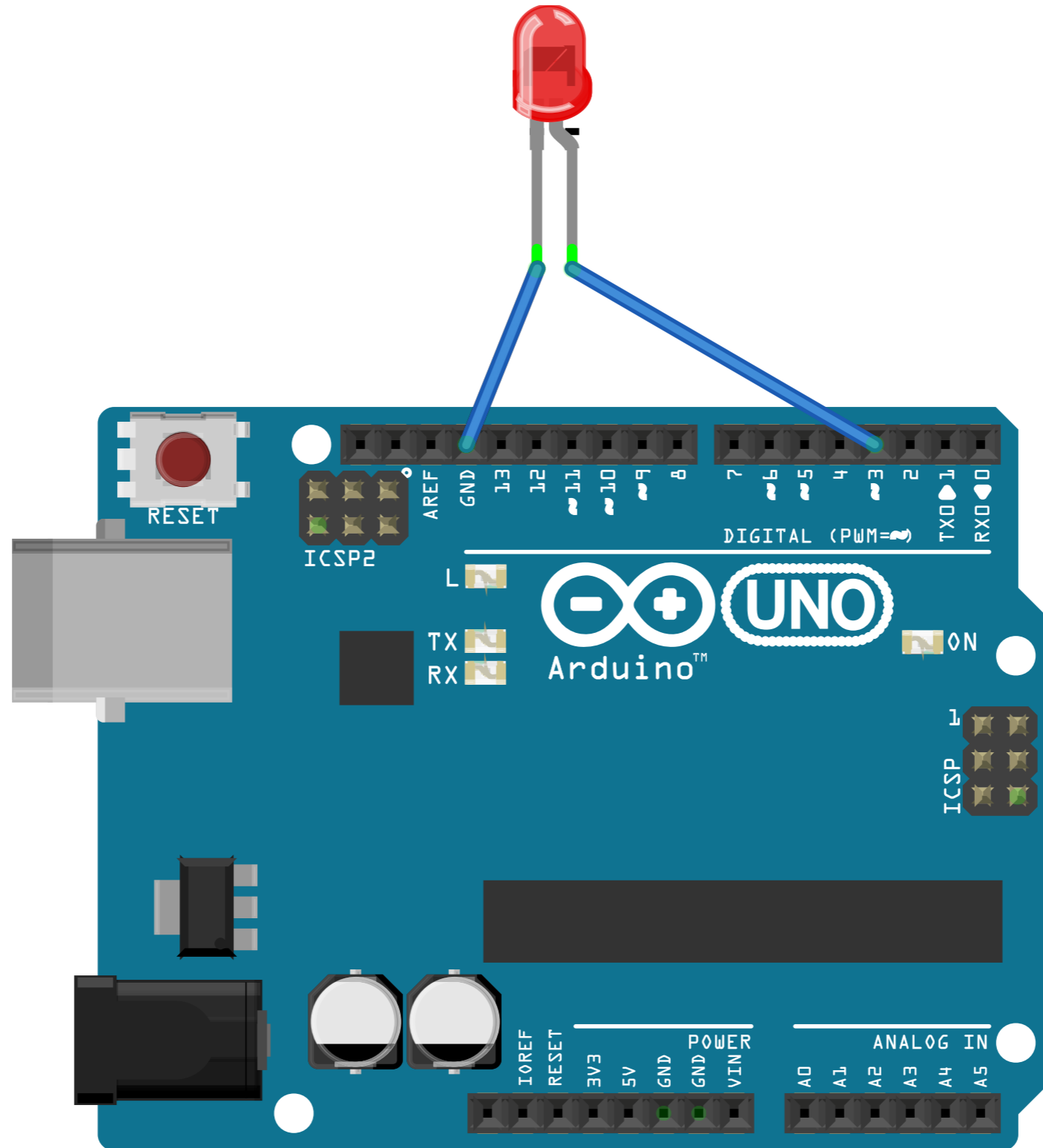
```
int LED_PIN = 6;

void setup() {
    pinMode(LED_PIN, OUTPUT);
}

void loop() {
    digitalWrite(LED_PIN, HIGH);
    delay(1000);
    digitalWrite(LED_PIN, LOW);
    delay(1000);
}
```

sketch 2

fading an LED (PWM)



```
int LED_PIN = 6;
int MAX_BRIGHTNESS = 255;
int brightness = 0;

void setup() {
    pinMode(LED_PIN, OUTPUT);
}

void loop() {
    analogWrite(LED_PIN, brightness);

    brightness = brightness + 5;
    if( brightness > MAX_BRIGHTNESS )
        brightness = 0;

    delay(30);
}
```

```
int LED_PIN = 6;
int MAX_BRIGHTNESS = 255;
int brightness = 0;

void setup() {
    pinMode(LED_PIN, OUTPUT);
}
```

```
void loop() {
    analogWrite(LED_PIN, brightness);

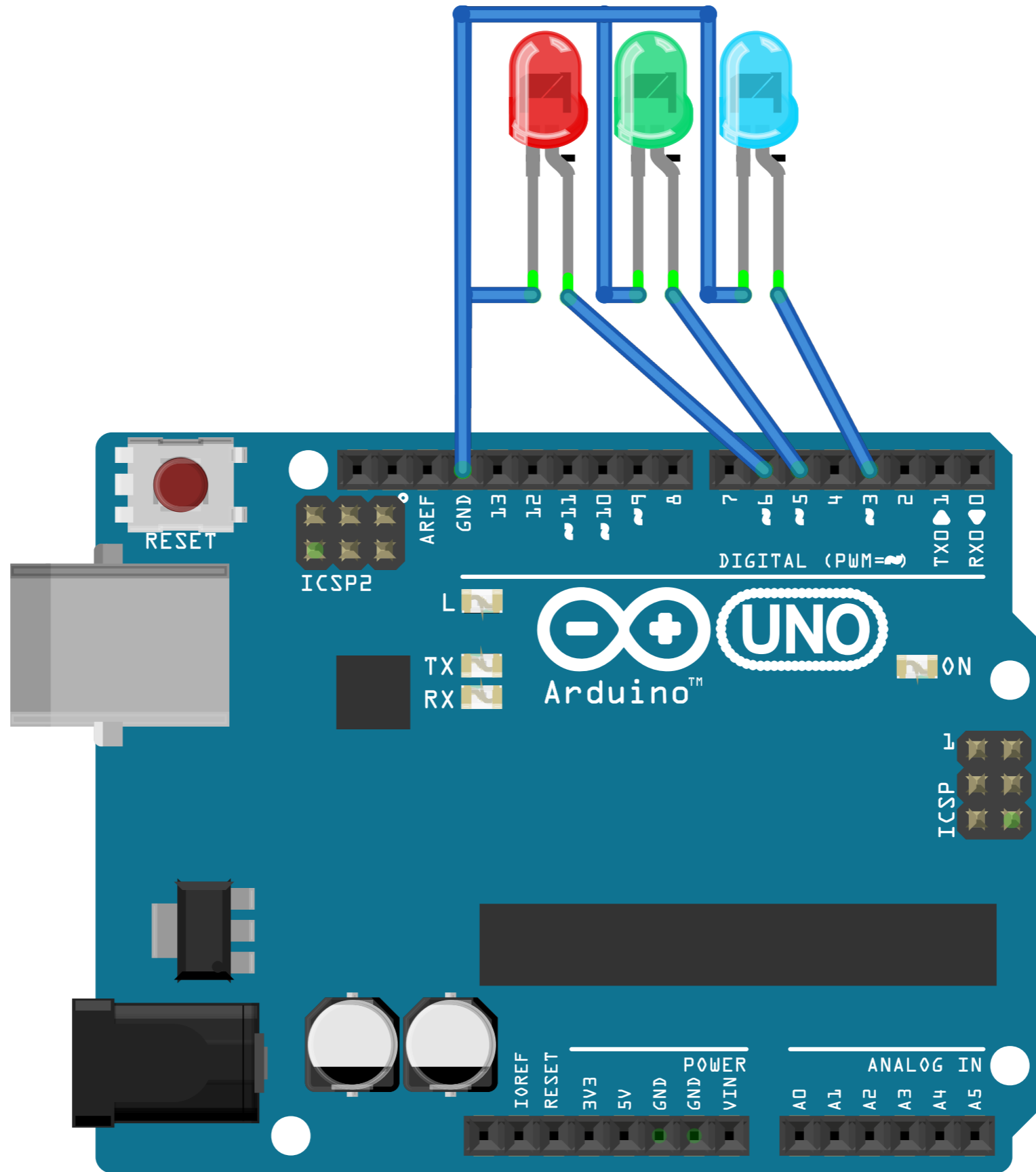
    brightness = brightness + 5;
    if( brightness > MAX_BRIGHTNESS )
        brightness = 0;

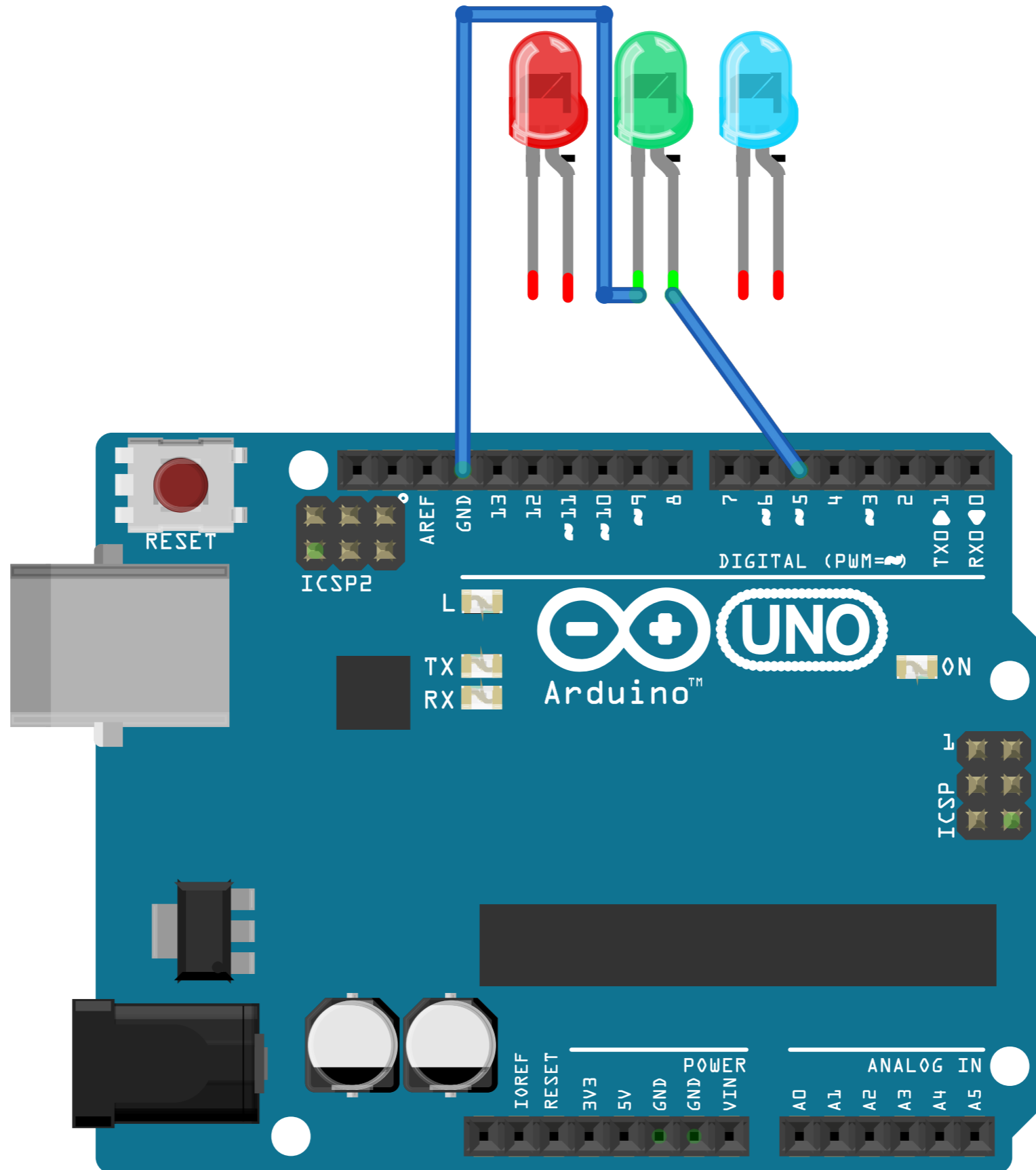
    delay(30);
}
```

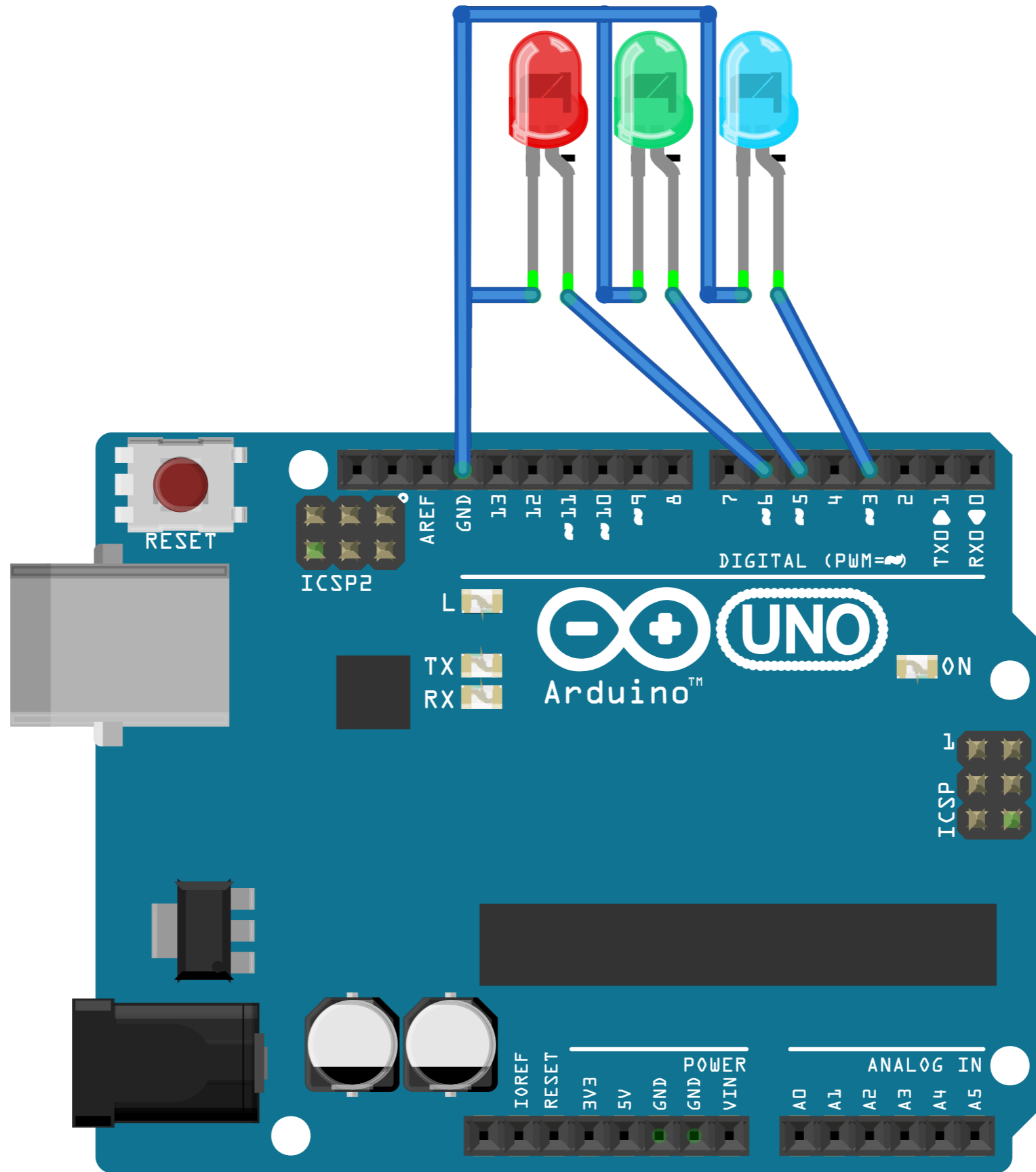
PWM
↓

sketch 3

mixing colors







```
int RED_PIN = 3;  
int GREEN_PIN = 5;  
int BLUE_PIN = 6;  
int MAX_BRIGHTNESS = 255;
```

```
void setup() {  
  pinMode(RED_PIN, OUTPUT );  
  pinMode(GREEN_PIN, OUTPUT );  
  pinMode(BLUE_PIN, OUTPUT );  
}
```

```
void loop() {  
  byte color[3];  
  assignRandomColorTo(color);  
  displayColor(color);  
  delay(1000);  
}
```

```
void assignRandomColorTo(byte colorComponents[]) {  
  colorComponents[0] = random(MAX_BRIGHTNESS);
```

```
int RED_PIN = 3;
int GREEN_PIN = 5;
int BLUE_PIN = 6;
int MAX_BRIGHTNESS = 255;
```

```
void setup() {
  pinMode(RED_PIN, OUTPUT );
  pinMode(GREEN_PIN, OUTPUT );
  pinMode(BLUE_PIN, OUTPUT );
}
```

```
void loop() {
  byte color[3];
  assignRandomColorTo(color);
  displayColor(color);
  delay(1000);
}
```

```
void assignRandomColorTo(byte colorComponents[]) {
  colorComponents[0] = random(MAX_BRIGHTNESS);
```

```
int RED_PIN = 3;  
int GREEN_PIN = 5;  
int BLUE_PIN = 6;  
int MAX_BRIGHTNESS = 255;
```

```
void setup() {  
  pinMode(RED_PIN, OUTPUT );  
  pinMode(GREEN_PIN, OUTPUT );  
  pinMode(BLUE_PIN, OUTPUT );  
}
```

```
void loop() {  
  byte color[3];  
  assignRandomColorTo(color);  
  displayColor(color);  
  delay(1000);  
}
```

```
void assignRandomColorTo(byte colorComponents[]) {  
  colorComponents[0] = random(MAX_BRIGHTNESS);
```

```
void loop() {  
    byte color[3];  
    assignRandomColorTo(color);  
    displayColor(color);  
    delay(1000);  
}
```

```
void assignRandomColorTo(byte colorComponents[]) {  
    colorComponents[0] = random(MAX_BRIGHTNESS);  
    colorComponents[1] = random(MAX_BRIGHTNESS);  
    colorComponents[2] = random(MAX_BRIGHTNESS);  
}
```

```
void displayColor(byte colorComponents[]) {  
    analogWrite( RED_PIN,    colorComponents[0] );  
    analogWrite( GREEN_PIN,  colorComponents[1] );  
    analogWrite( BLUE_PIN,   colorComponents[2] );  
}
```

```
void loop() {  
    byte color[3];  
    assignRandomColorTo(color);  
    displayColor(color);  
    delay(1000);  
}
```

```
void assignRandomColorTo(byte colorComponents[]) {  
    colorComponents[0] = random(MAX_BRIGHTNESS);  
    colorComponents[1] = random(MAX_BRIGHTNESS);  
    colorComponents[2] = random(MAX_BRIGHTNESS);  
}
```

```
void displayColor(byte colorComponents[]) {  
    analogWrite( RED_PIN,    colorComponents[0] );  
    analogWrite( GREEN_PIN,  colorComponents[1] );  
    analogWrite( BLUE_PIN,   colorComponents[2] );  
}
```

```
void loop() {  
  byte color[3];  
  assignRandomColorTo(color);  
  displayColor(color);  
  delay(1000);  
}
```

```
void assignRandomColorTo(byte colorComponents[]) {  
  colorComponents[0] = random(MAX_BRIGHTNESS);  
  colorComponents[1] = random(MAX_BRIGHTNESS);  
  colorComponents[2] = random(MAX_BRIGHTNESS);  
}
```

```
void displayColor(byte colorComponents[]) {  
  analogWrite( RED_PIN,    colorComponents[0] );  
  analogWrite( GREEN_PIN,  colorComponents[1] );  
  analogWrite( BLUE_PIN,   colorComponents[2] );  
}
```

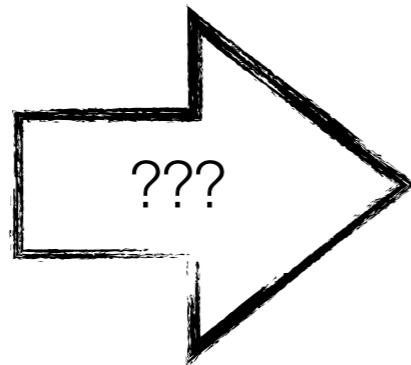


```
void loop() {  
    byte color[3];  
    assignRandomColorTo(color);  
    displayColor(color);  
    delay(1000);  
}
```

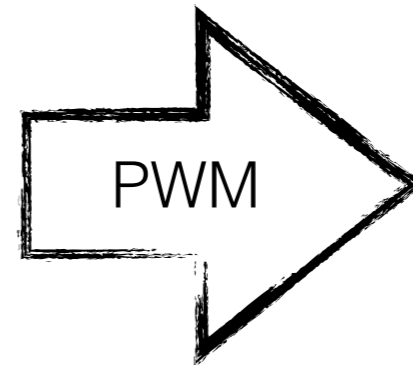
```
void assignRandomColorTo(byte colorComponents[]) {  
    colorComponents[0] = random(MAX_BRIGHTNESS);  
    colorComponents[1] = random(MAX_BRIGHTNESS);  
    colorComponents[2] = random(MAX_BRIGHTNESS);  
}
```

```
void displayColor(byte colorComponents[]) {  
    analogWrite( RED_PIN,    colorComponents[0] );  
    analogWrite( GREEN_PIN, colorComponents[1] );  
    analogWrite( BLUE_PIN,   colorComponents[2] );  
}
```

Raspberry
PI



Arduino

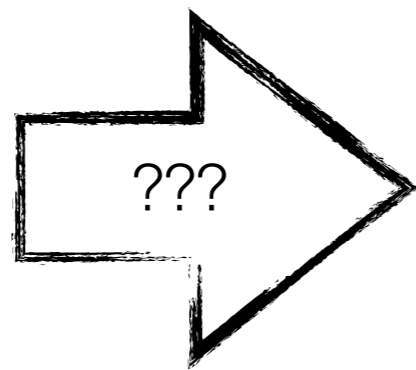


red
LED

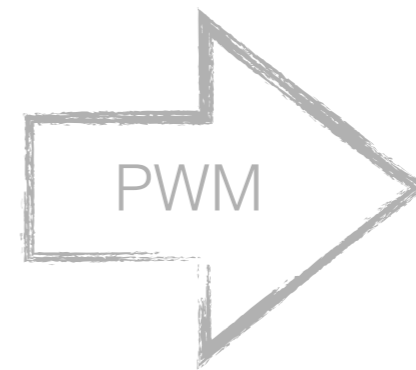
green
LED

blue
LED

Raspberry
PI



Arduino

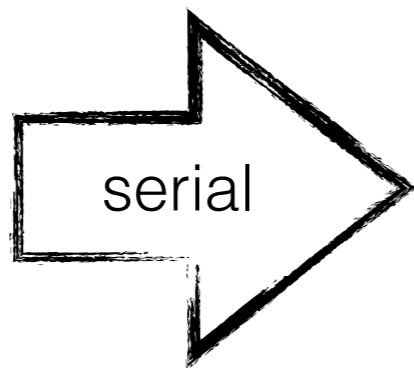


red
LED

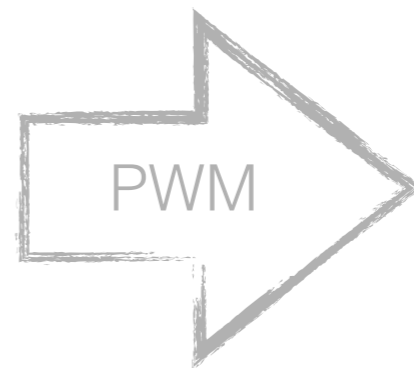
green
LED

blue
LED

Raspberry
PI



Arduino



red
LED

green
LED

blue
LED

sketch 4

an echo server (serial IO)

```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while (Serial.available() <= 0) {
    // busy loop
  }
}
```

```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while (Serial.available() <= 0) {
    // busy loop
  }
}
```

```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while (Serial.available() <= 0) {
    // busy loop
  }
}
```



```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while (Serial.available() <= 0) {
    // busy loop
  }
}
```

```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while (Serial.available() <= 0) {
    // busy loop
  }
}
```

```
void setup()
{
  Serial.begin(57600); // start serial port at 57600 bps
}

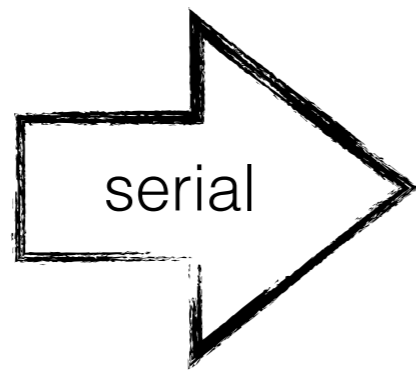
void loop() {
  waitForInput();

  static char input[1025];
  int bytesRead = Serial.readBytesUntil( '\n', input, 1024 );

  if( bytesRead ){
    String str = String(input);
    str.toUpperCase();
    Serial.println(str);
  }
}

void waitForInput() {
  while ( Serial.available() <= 0 ) {
    // busy loop
  }
}
```

Raspberry
PI



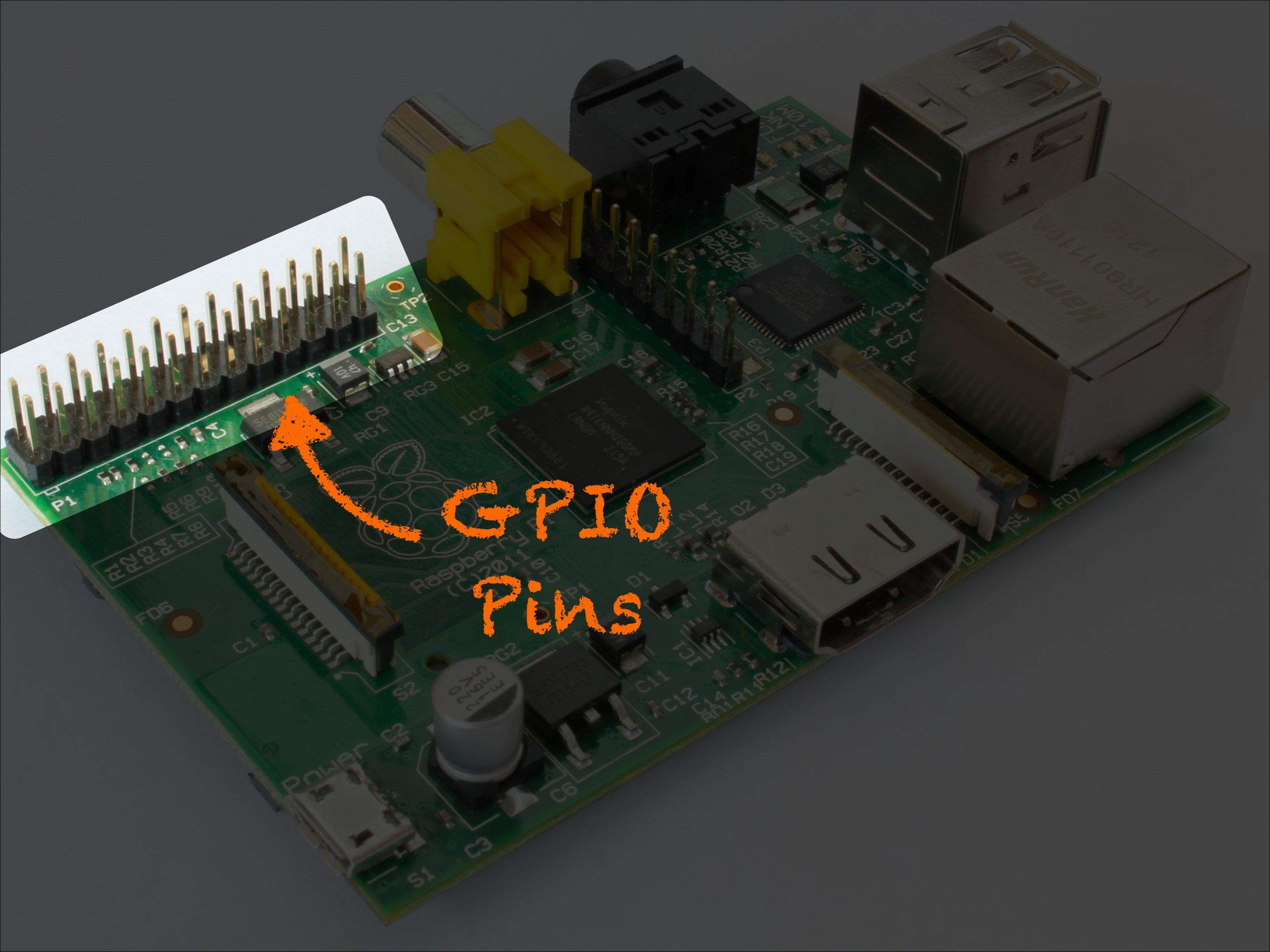
Arduino



red
LED

green
LED

blue
LED



GPIO
Pins

Raspberry
PI

Arduino

red
LED

green
LED

blue
LED

Raspberry
PI

"ffaa11\n"

Arduino

red
LED

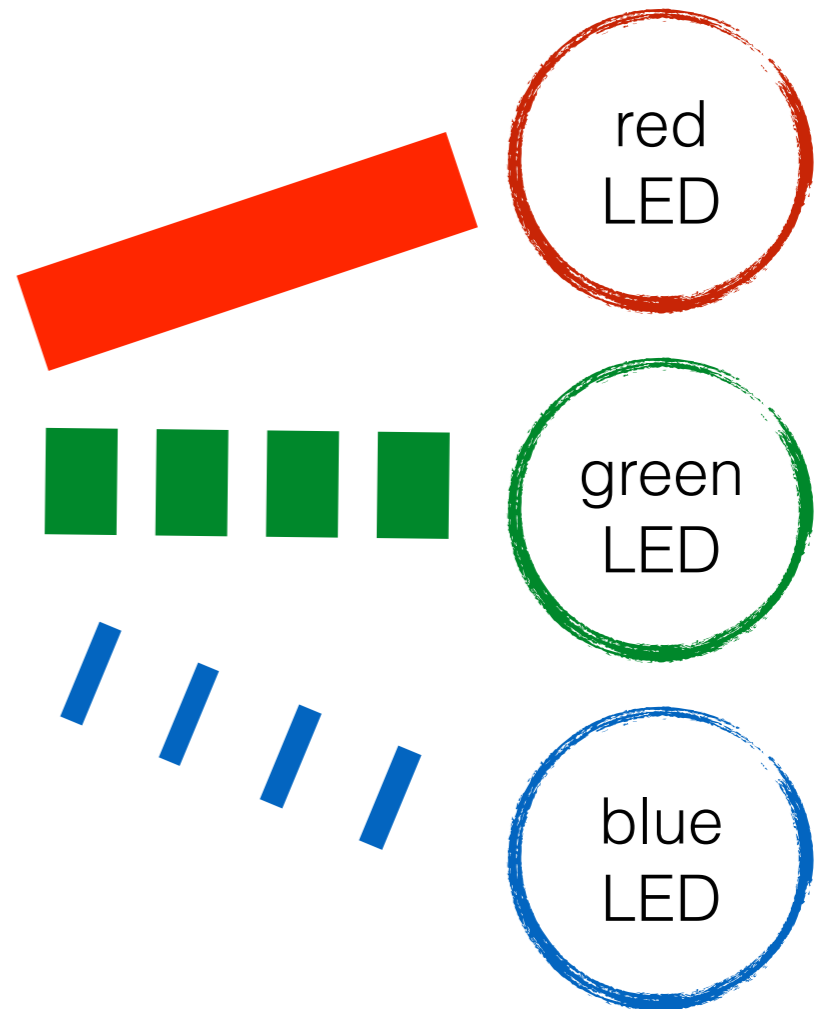
green
LED

blue
LED

Raspberry
PI

"ffaa11\n"

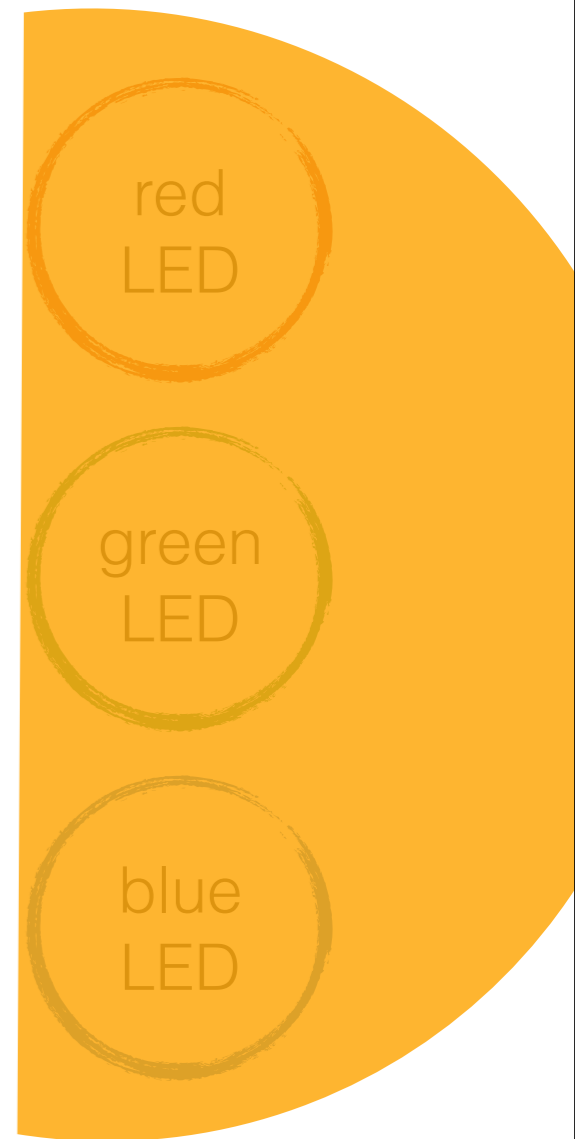
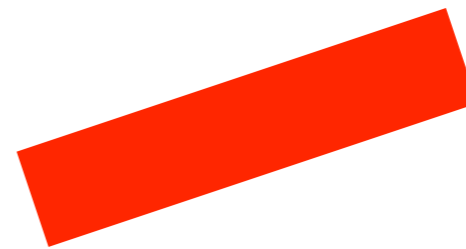
Arduino



Raspberry
PI

"ffaa11\n"

Arduino



Much Learning

Arduino-
compatibles

bareduinos

LPC810

soldering!

transistors

protoboard

fritzing

voltage
regulators

node.js

cctray

line-level
converters

command-line
builds

C++ on Arduino

usb to serial

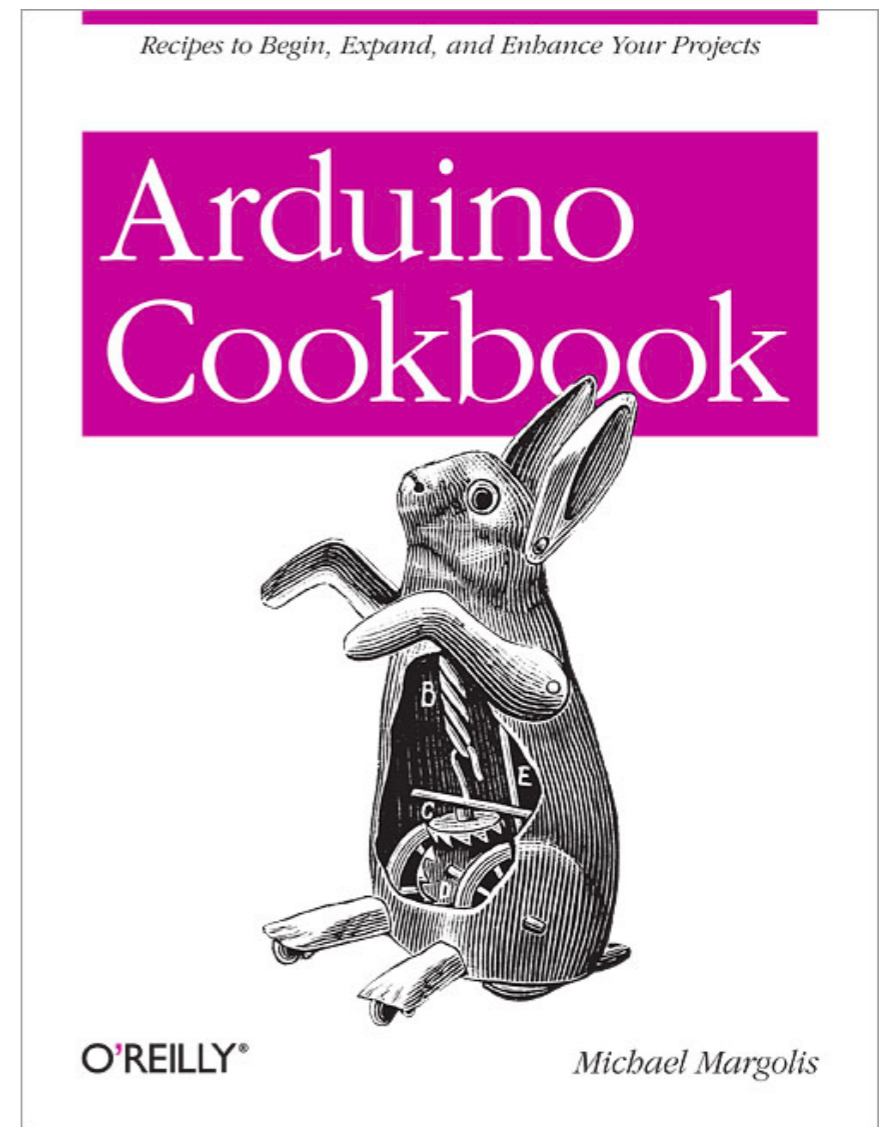
external
programmers

OSS hardware

Resources



Resources



GitHub

more dip/aphex

(work in progress)

Have FUN!

<http://bit.ly/buildlightsaber>



these
slides

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