

# Python on Microcontrollers



ESP8266



ESP32



micro:bit



Adafruit ARM based boards



PyBoard

# Python on Microcontrollers

- Higher productivity than C
- Shorter iterations
- Faster to learn than C/C++



# Python on Microcontrollers

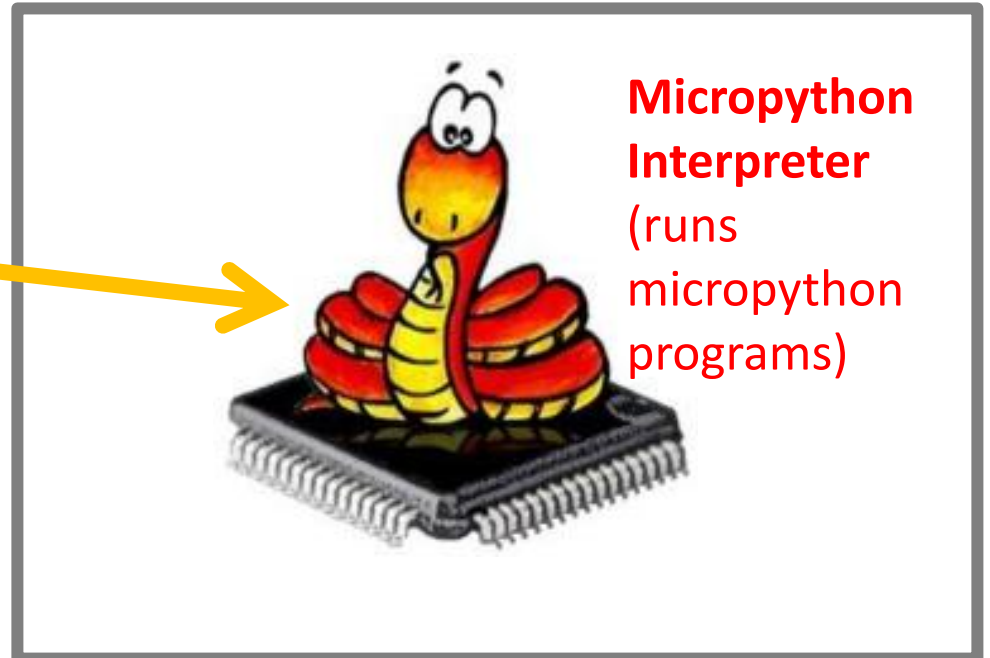
- Less efficient use of RAM, ROM, CPU
- Fewer drivers than Arduino C



# Demo: Using the Python REPL



Putty talks directly to micropython REPL  
• **manually** run a program



# Demo 1: “hello world”



```
COM12 - PuTTY
1 #4 ets_task(40100130, 3, 3fff837c, 4)
OSError: [Errno 2] ENOENT

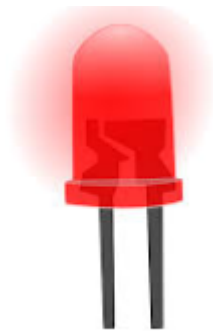
MicroPython v1.9.3-8-g638
Type "help()" for more in
>>> print('hello world')
hello world
>>> █
```

# Demo 2: Control a LED

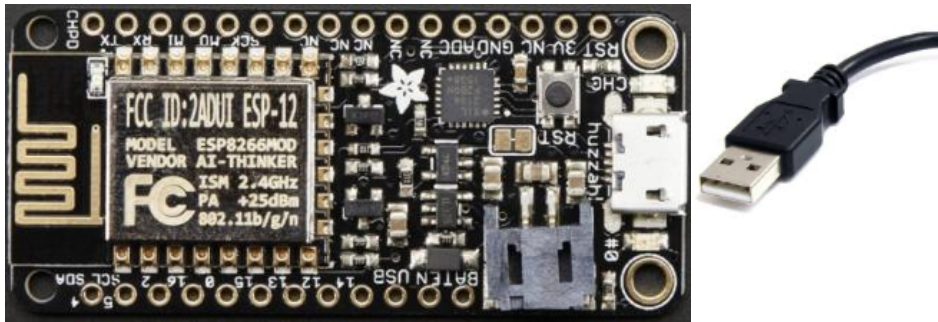


```
COM12 - PuTTY
1 #4 ets_task(40100130, 3, 3fff837c, 4)
OSError: [Errno 2] ENOENT

MicroPython v1.9.3-8-g63826ac5c on 2017-11-01; ESP module with ESP8266
Type "help()" for more information.
>>> print('hello world')
hello world
>>>
```



# More REPL fun



```
COM12 - PuTTY
1 #4 ets_task(40100130, 3, 3fff837c, 4)
OSError: [Errno 2] ENOENT

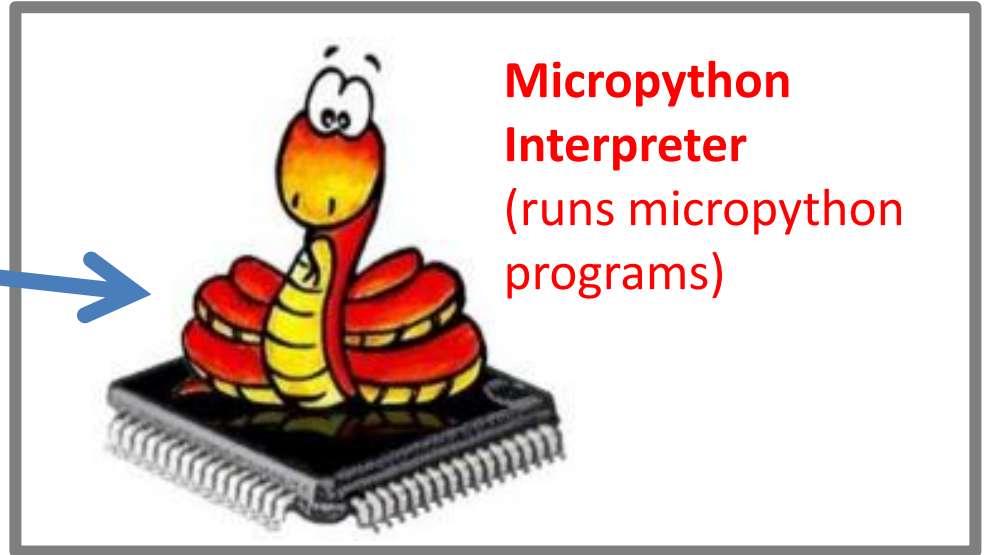
MicroPython v1.9.3-8-g63826ac5c on 2017-11-01; ESP module with ESP8266
Type "help()" for more information.
>>> print('hello world')
hello world
>>>
```

- List capabilities: `help('modules')`
- history
- completion with TAB

# Run programs



run

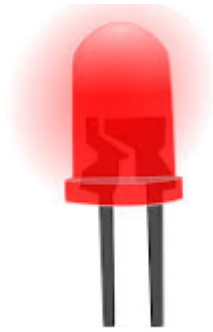


**Micropython  
Interpreter**  
(runs micropython  
programs)

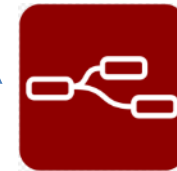
```
ampy -pCOMx -d1 run <python file>
```



# Demo 3: Flash the LED



# Build an IOT Application



Node-RED

Dashboard



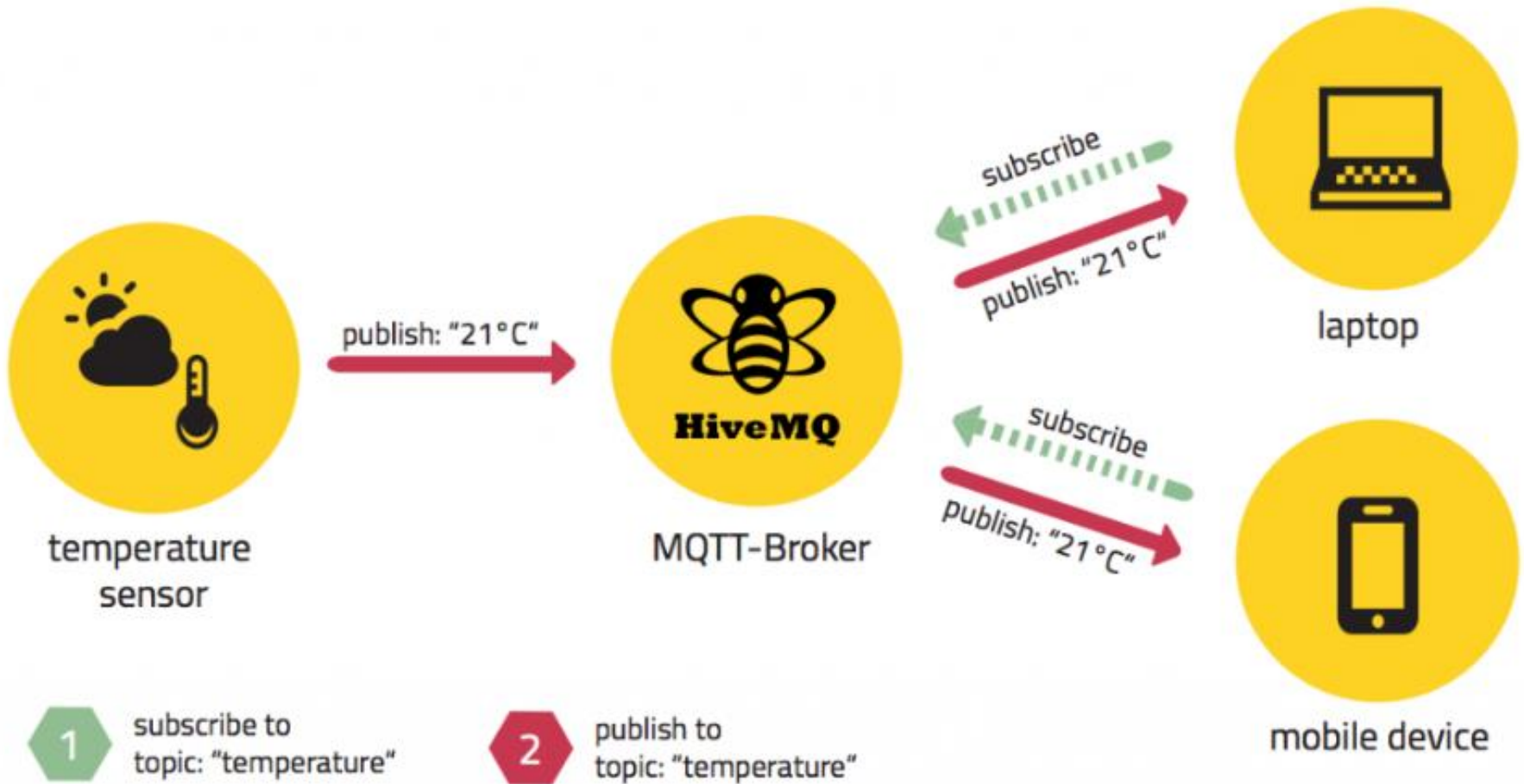
Sensor Data



Light Sensor

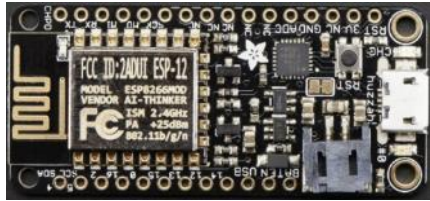
ESP8266 running Micropython

# MQTT

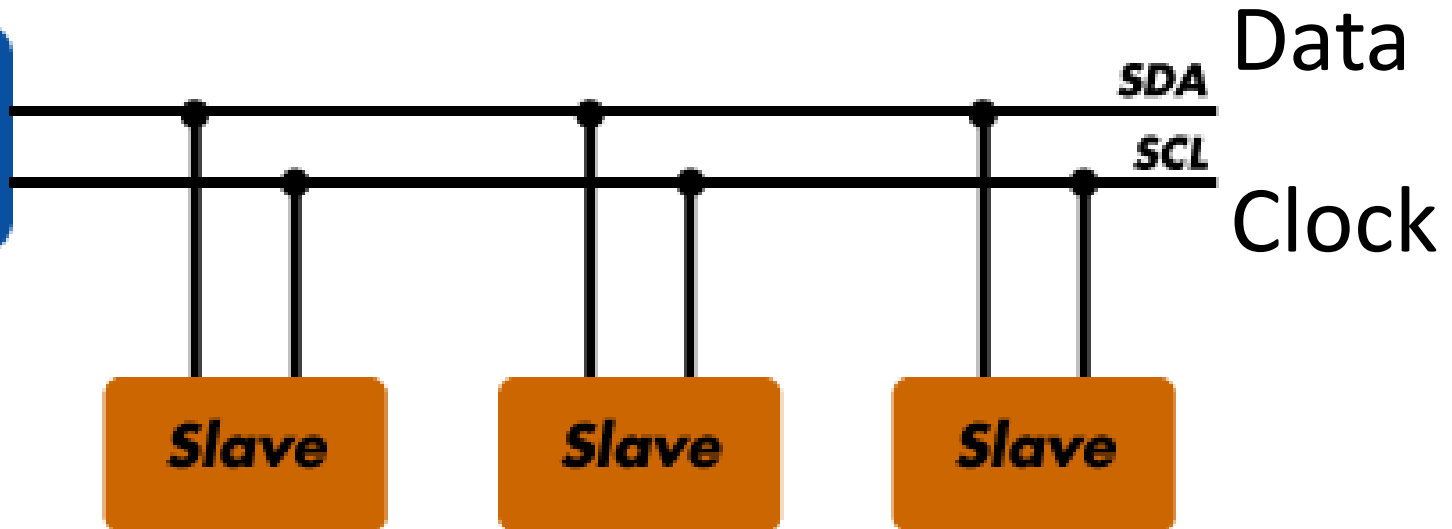


MQTT = Message Queueing Telemetry Transport

# I2C



**Master**

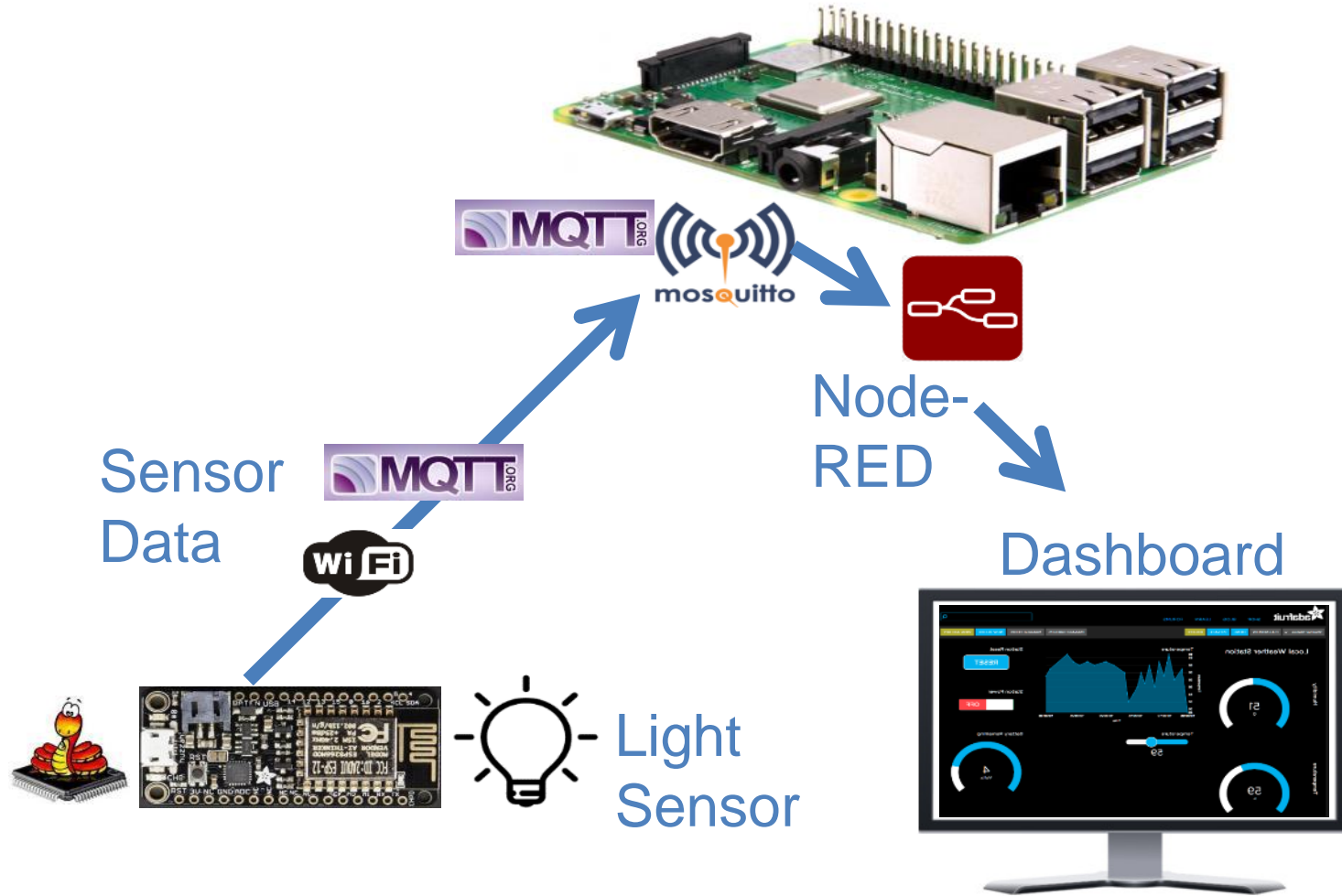


I2C = Inter-Integrated Circuit

# Python Code for IOT Application



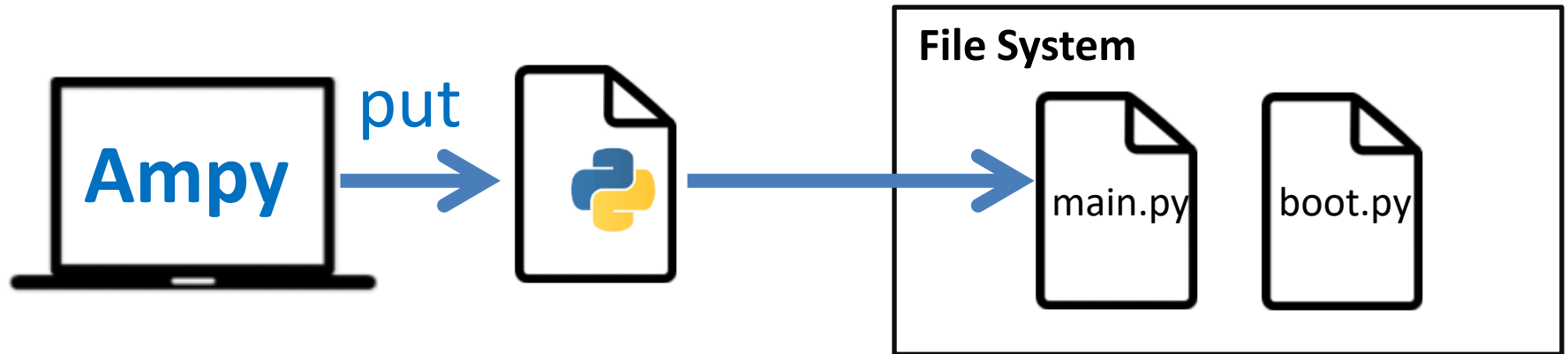
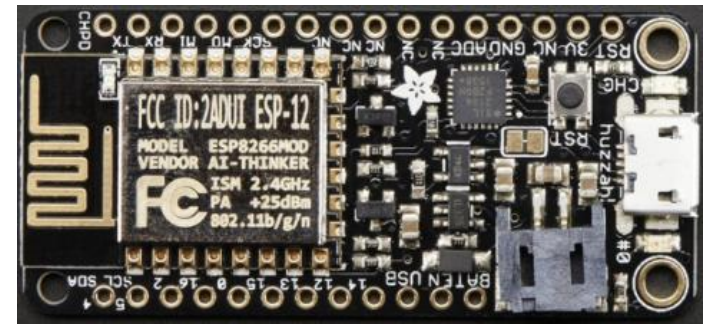
# Demo 4: IOT Application



ESP8266 running Micropython

# Autonomous Operation

- Copy program to file system
- “main.py” runs at startup



`ampy -pCOMx -d1 put <python file> main.py`

# CircuitPython



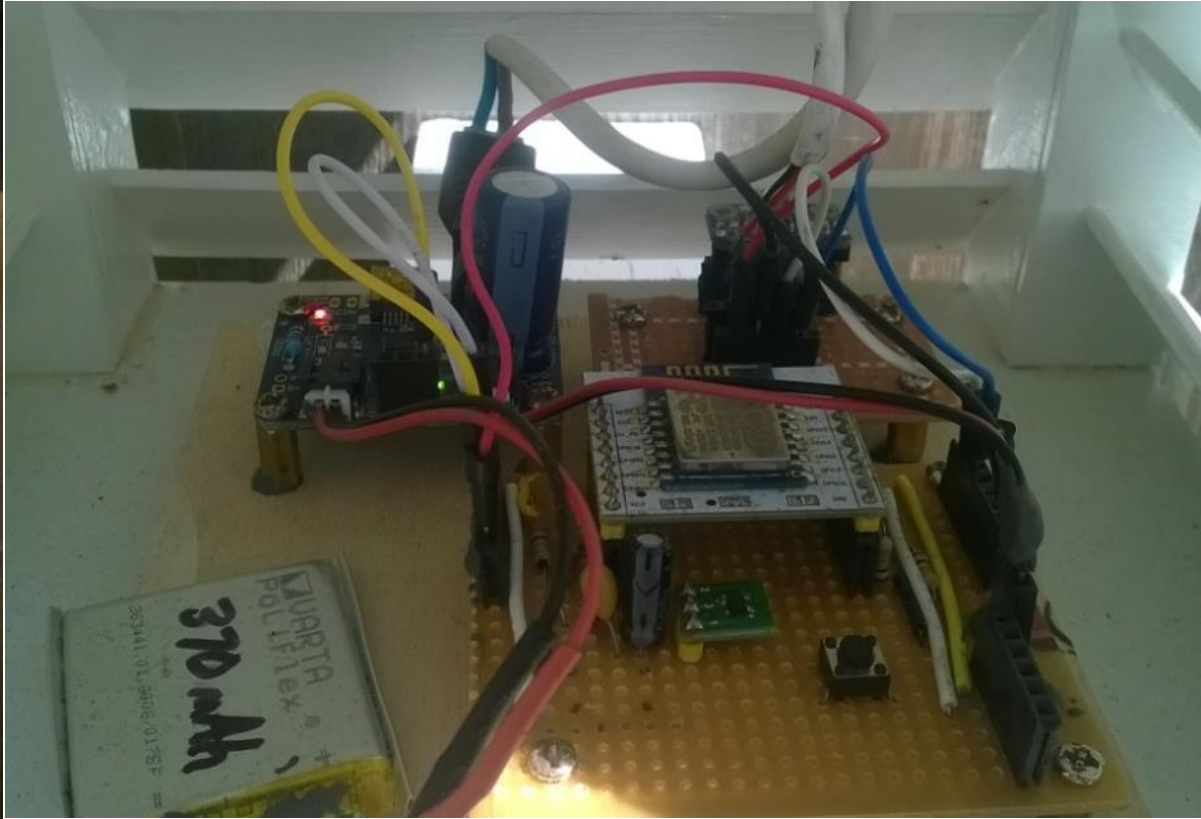
- Adafruit's version of Micropython
- Excellent documentation
- Very active development
- Today: Support for ESP8266 and ESP32 is lacking
- Future: CircuitPython will likely be the preferred version
- <https://learn.adafruit.com/welcome-to-circuitpython/what-is-circuitpython>



# Documentation and Downloads

- <http://docs.micropython.org/en/latest/esp8266/>
- <http://micropython.org/download>

# Solar weather station



# Installing Micropython on ESP8266

## Step 1. Install USB-> Serial Driver

- Install USB driver for board (WEMOS D1 mini) :
  - <https://wiki.wemos.cc/downloads>
- Install USB driver for board (adafruit) :
  - <https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>

Note: Python 3 needs to be installed

# Installing Micropython on ESP8266

## Step 2. Install micropython firmware

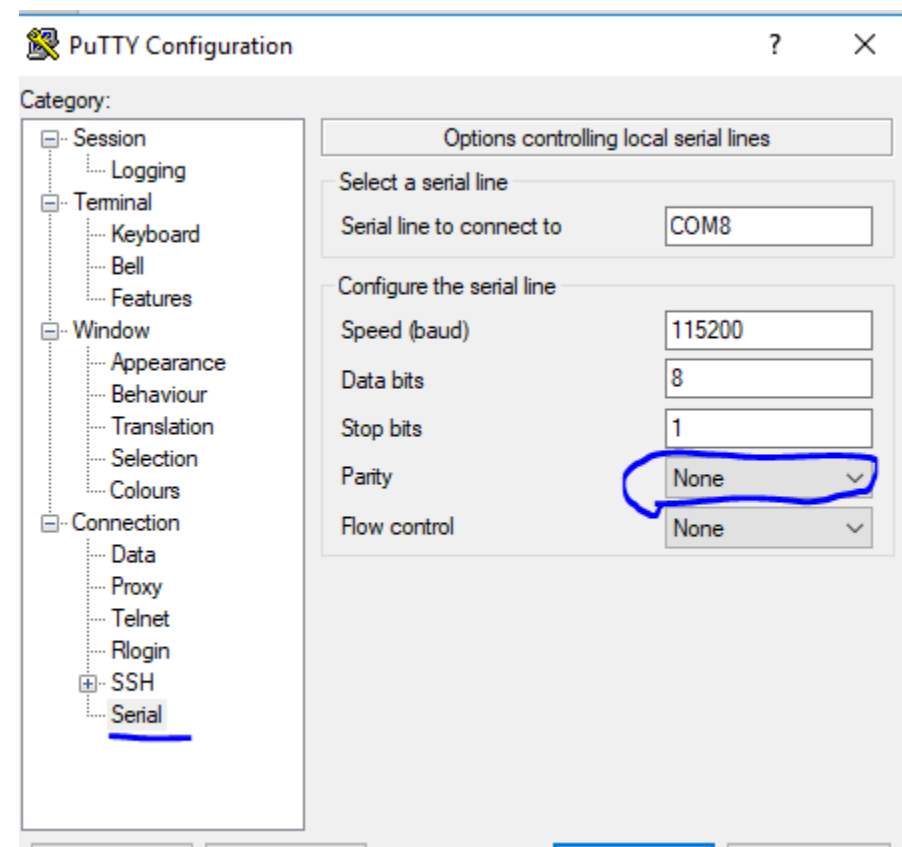
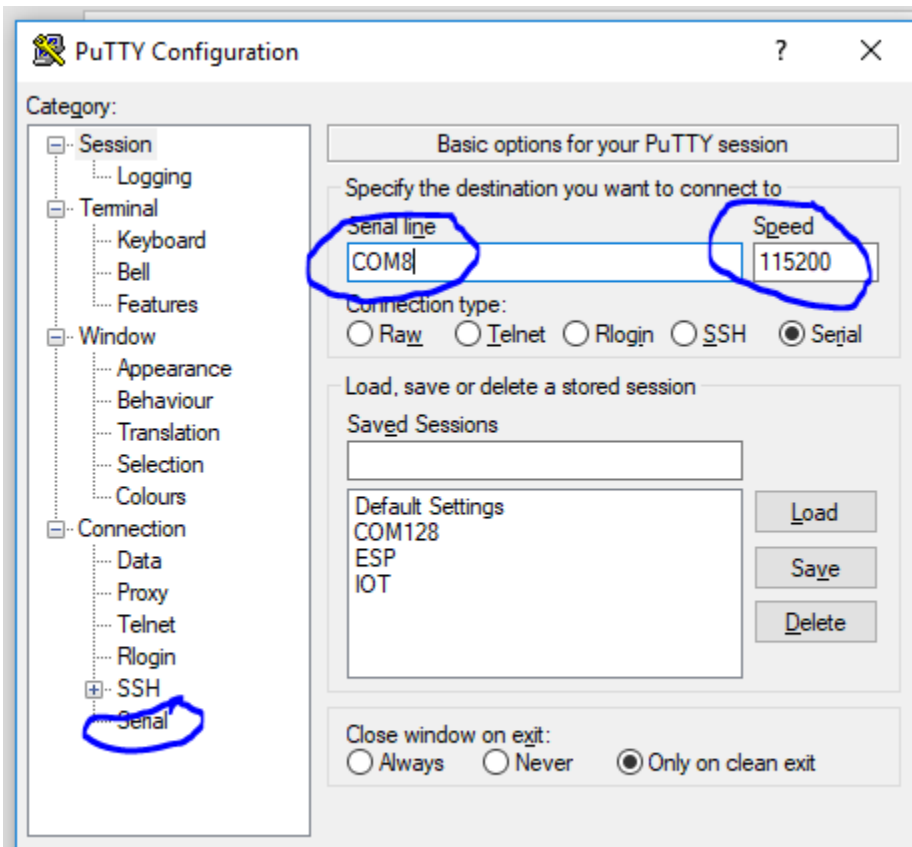
- open CMD shell
- Install Esptool: “pip install esptool”
- Plug in ESP8266 to USB:
- Determine virtual COMxx port:
  - Use **Device Manager** on Windows
- Erase flash: “esptool.py --port COMxx erase\_flash”
- Download latest stable version of Micropython binary
  - <http://micropython.org/download>
- Install Micropython binary:
  - Adafruit:
    - “esptool.py --port COMxx --baud 115200 write\_flash 0 esp8266-20171101-v1.9.3.bin”
  - WEMOS mini:
    - “esptool.py --port COMxx --baud 115200 write\_flash **-fm dout** 0 esp8266-20171101-v1.9.3.bin”

<https://docs.micropython.org/en/latest/esp8266/esp8266/tutorial/intro.html>

# Installing Micropython on ESP8266

## Step 3. Install and Configure Putty

- Install Putty from
  - <https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>
- Configure Putty:



# Installing Micropython on ESP8266

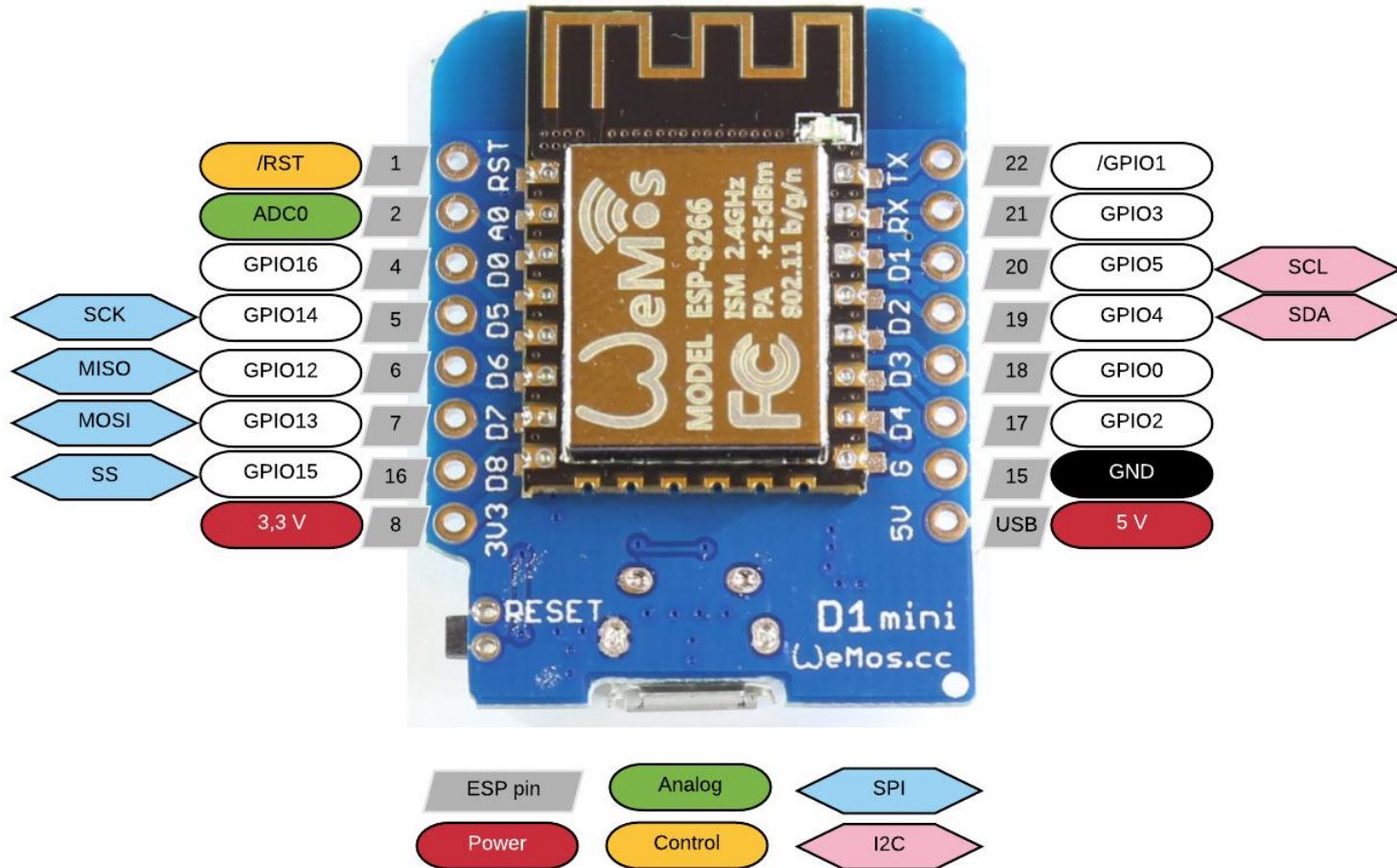
## Step 4. Install Ampy

- Tutorial
  - <https://github.com/adafruit/ampy>
- Run Ampy:
  - `Ampy -pCOMx -d1 ls`
  - `Ampy -pCOMx -d1 run <python file>`
- Where COMx is USB comm port ... e.g COM4. See Windows Device Manager, in the Ports topic

**Troubles?:** see file in package:

“Preparing for Makerspace IoT Class - Nov 2017.pdf”

# WeMos D1 mini



# Adafruit Feather HUZAZH ESP8266

