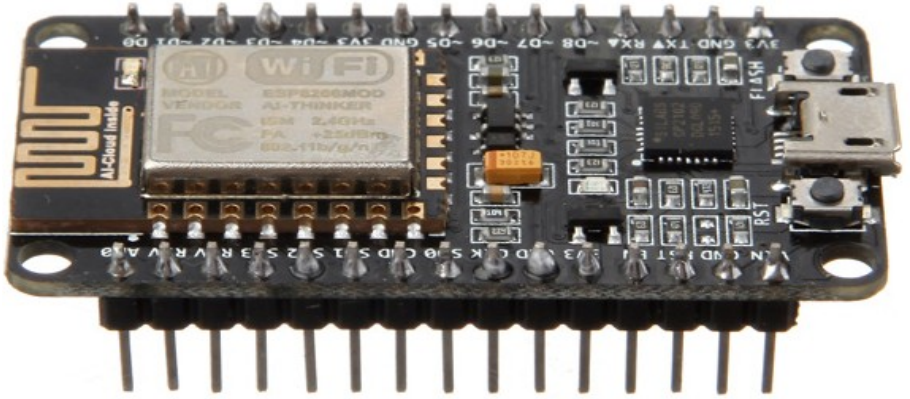
ESP8266

ESP-12E Development Board



Jordi Binefa i Martínez

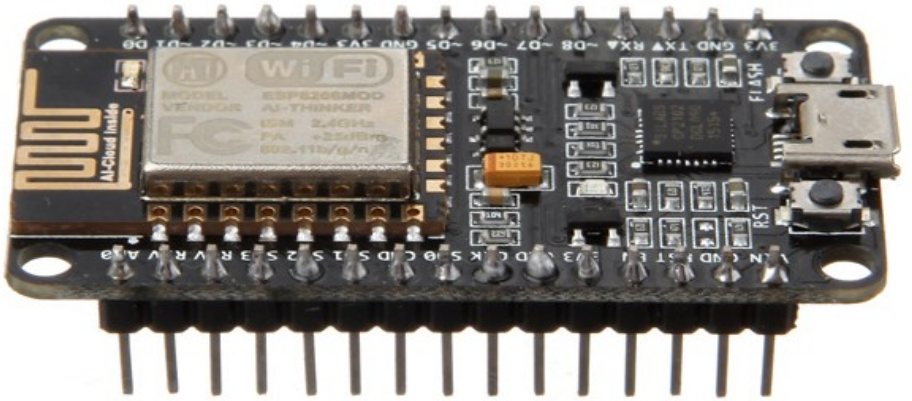
Responsable d'R+D+i a electronics.cat

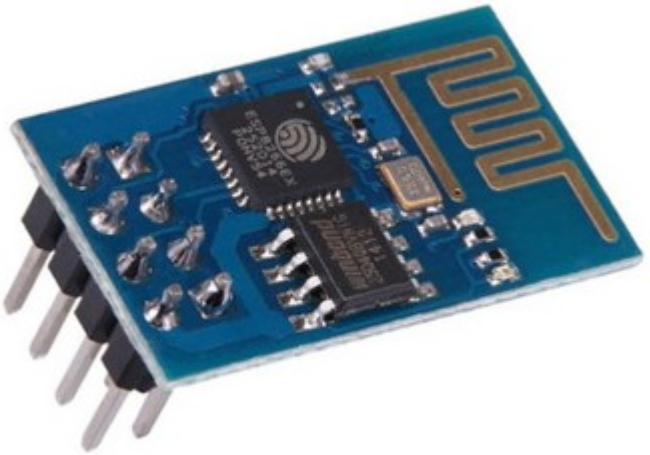
Professor de cicles formatius a JESUÏTES El Clot Escola del Clot

novembre de 2015

ESP-12E Development Board

Algunes plaques amb l'ESP8266





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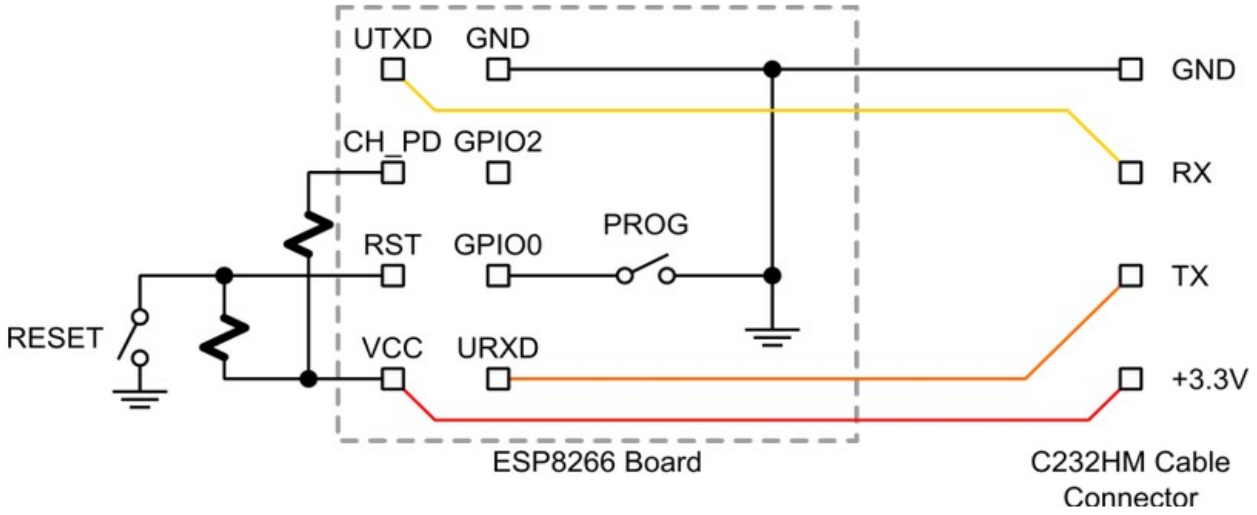
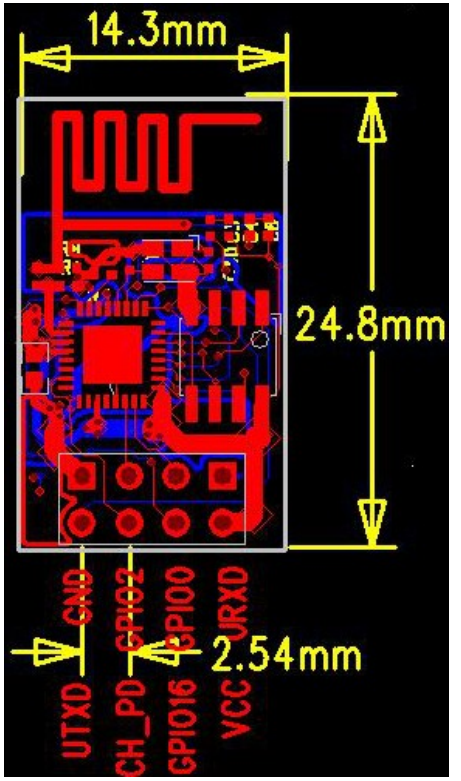
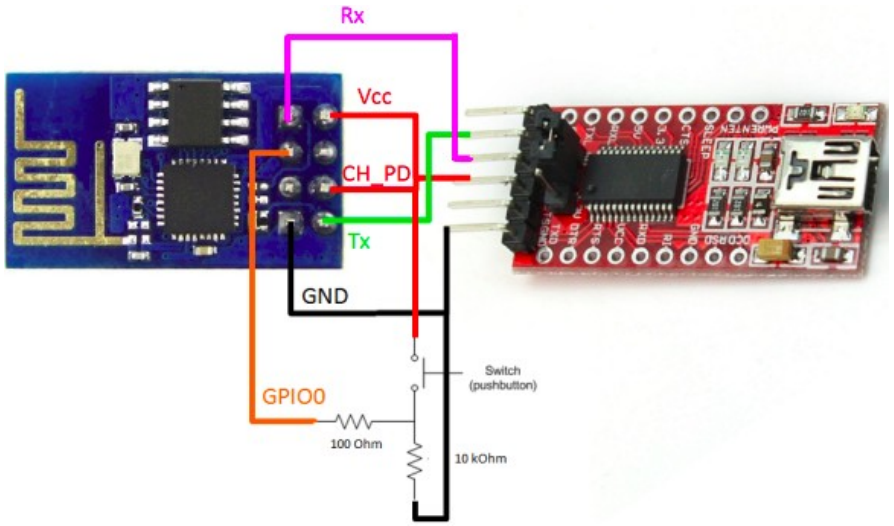
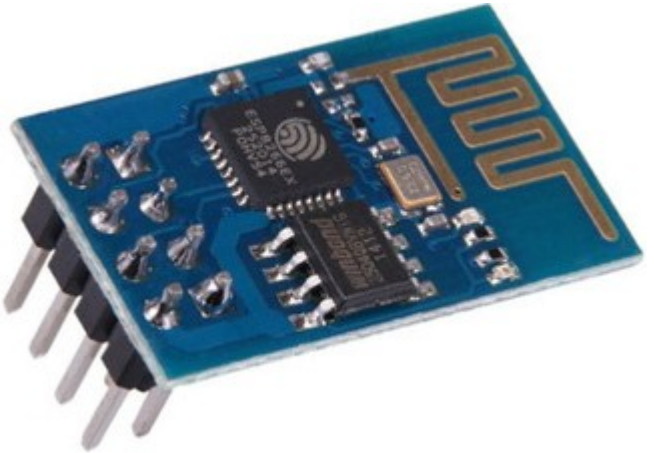
Programant l'ESP8266 - ESP01



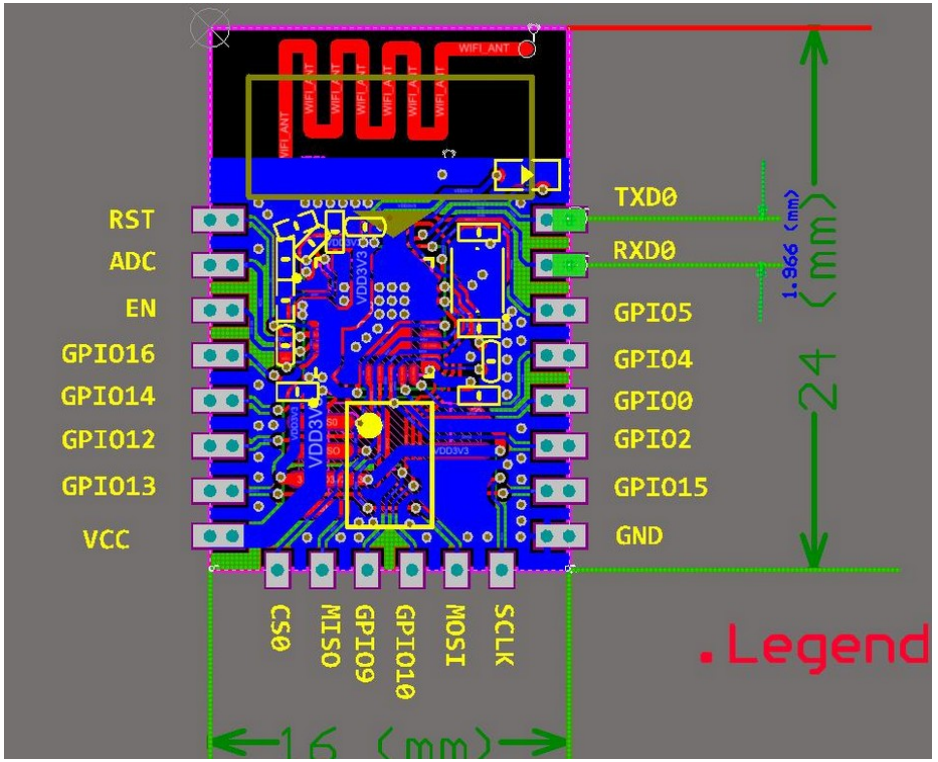






ESP-12E Development Board

Programant l'ESP8266 - ESP12E



ESP-12E Development Board

Fabricant del xip: Espressif

http://espressif.com/en/products/esp8266/

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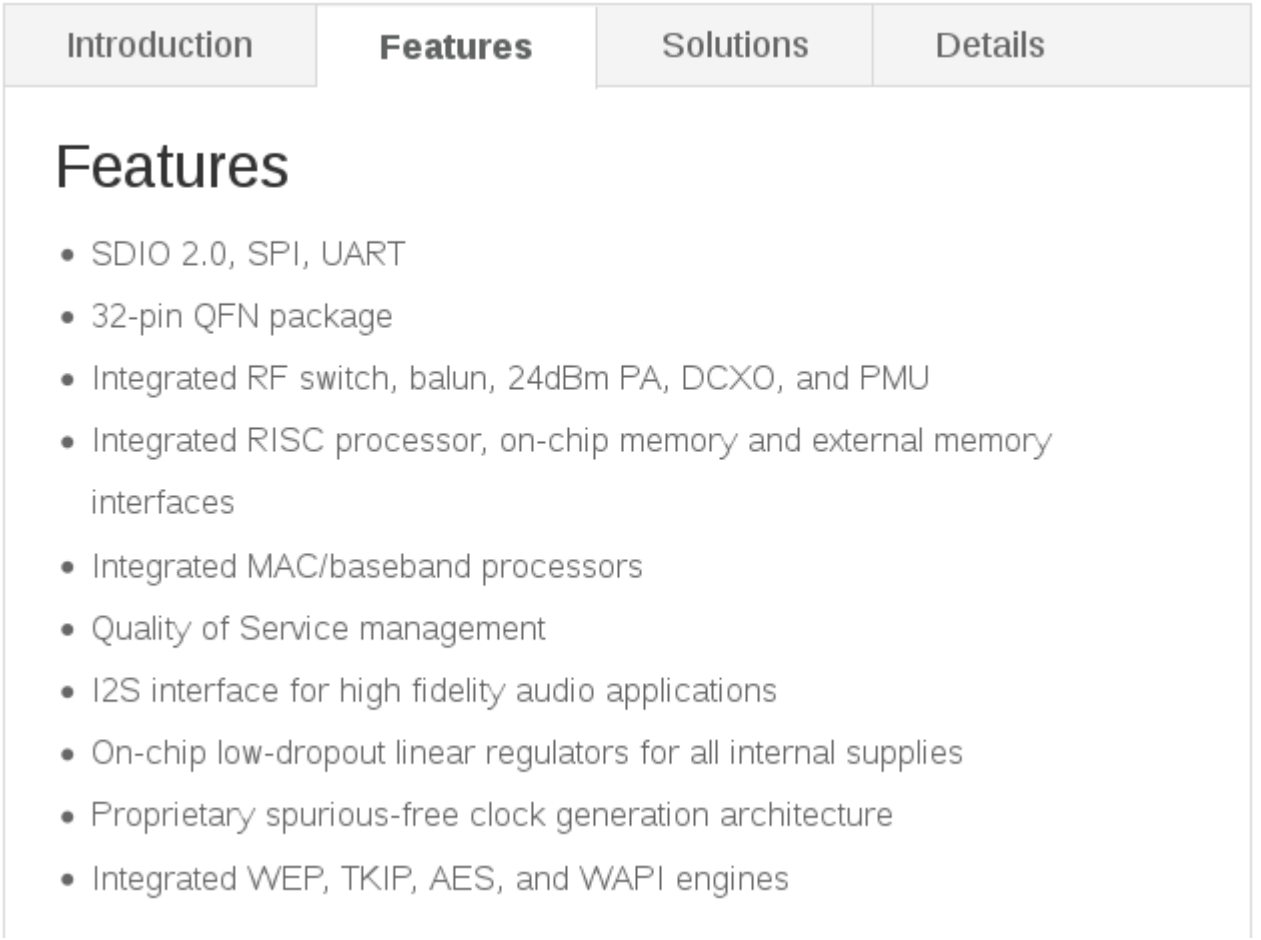
Característiques de l'ESP8266



Introduction | **Features** | Solutions | Details

Features

- SDIO 2.0, SPI, UART
- 32-pin QFN package
- Integrated RF switch, balun, 24dBm PA, DCXO, and PMU
- Integrated RISC processor, on-chip memory and external memory interfaces
- Integrated MAC/baseband processors
- Quality of Service management
- I2S interface for high fidelity audio applications
- On-chip low-dropout linear regulators for all internal supplies
- Proprietary spurious-free clock generation architecture
- Integrated WEP, TKIP, AES, and WAPI engines

http://espressif.com/en/products/esp8266/

ESP-12E Development Board

Especificacions de l'ESP8266

- 802.11 b/g/n
- WiFi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1/2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

http://espressif.com/en/products/esp8266/

ESP-12E Development Board

Datasheet de l'ESP8266

ESP8266EX Datasheet

Version 4.3

Espressif Systems IOT Team

http://bbs.espressif.com/

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ESP8266 Datasheet

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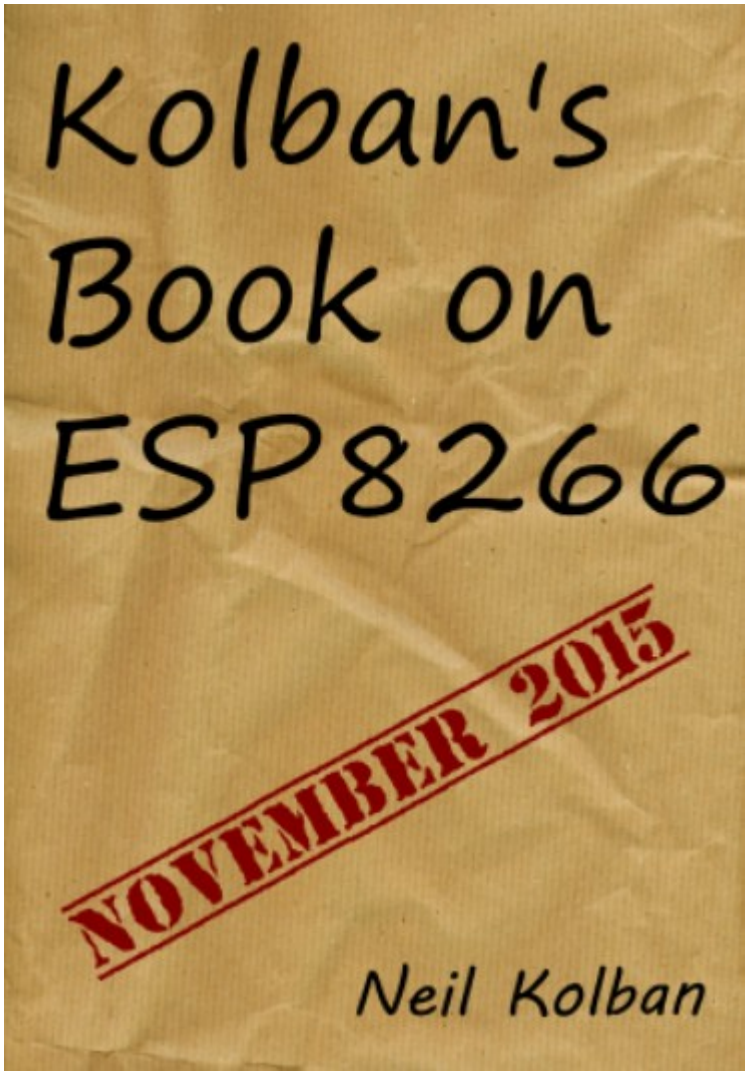
Espressif Systems 2/31 June 1, 2015

Adafruit's link to ESP8266EX Datasheet v4.3

ESP-12E Development Board

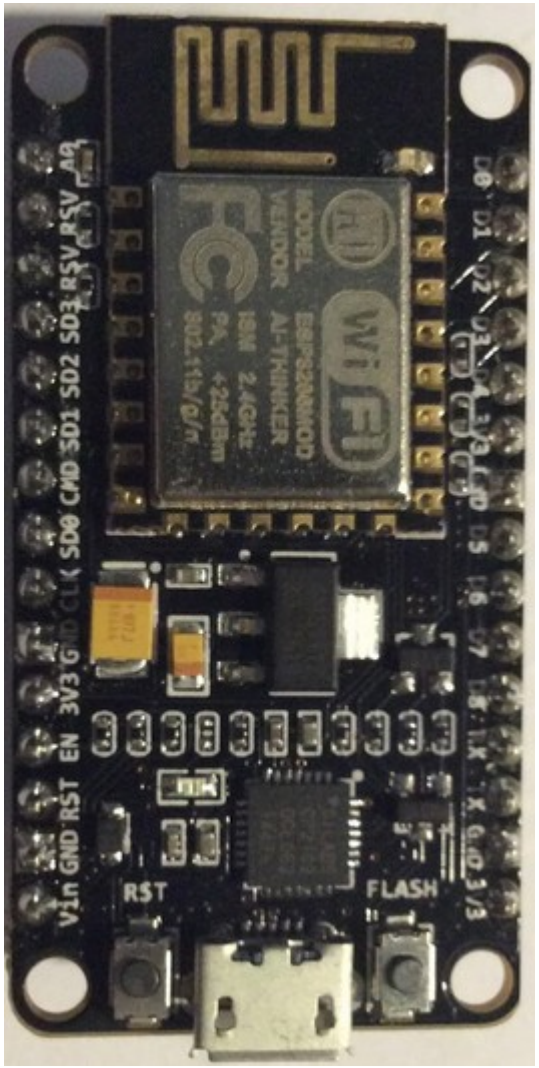
Kolban's Book on ESP8266

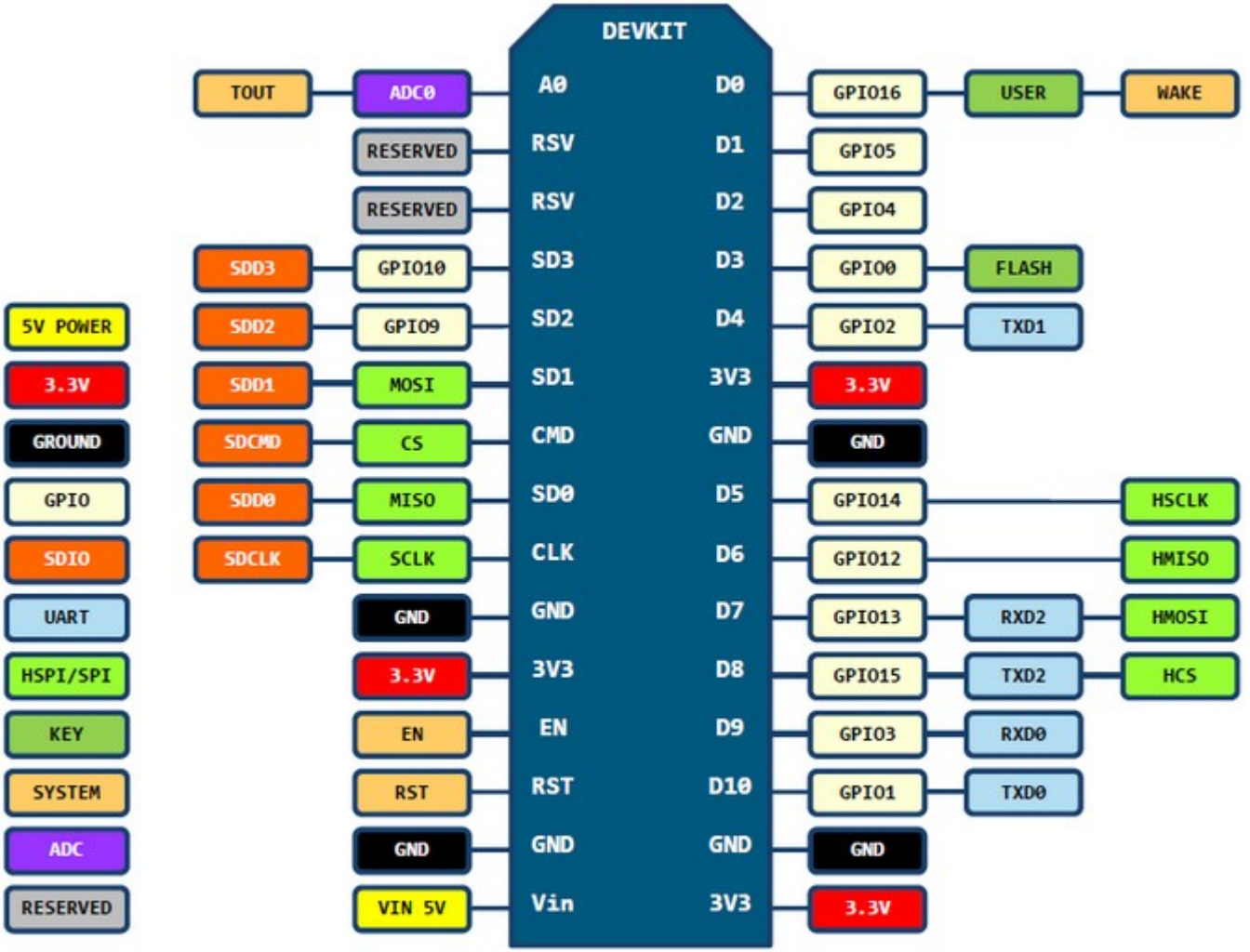


http://neilkolban.com/tech/esp8266/

ESP-12E Development Board

Disposició de pins de l'ESP8266 - NodeMcu





D0(GPIO16) can only be used as gpio read/write, no interrupt supported, no pwm/i2c/ow supported.

ESP-12E Development Board

Programant l'ESP8266 – Ordres AT - Eines

```
# apt-get install python-pip

$ pip install -U setuptools
```

http://binefa.cat/php/esp8266/eines/esptool-master.zip

```
root@debian8:/home/ecat/Documents/dam/uf3/esptool-master# ls -ls
total 64
28 -rwxr-xr-x 1 ecat ecat 27179 set  2 03:03 esptool.py
20 -rw-r--r-- 1 ecat ecat 18092 set  2 03:03 LICENSE
 4 -rw-r--r-- 1 ecat ecat    34 set  2 03:03 MANIFEST.in
 8 -rw-r--r-- 1 ecat ecat  7286 set  2 03:03 README.md
root@debian8:/home/ecat/Documents/dam/uf3/esptool-master# sudo python setup.py install
running install
running bdist_egg
```

Seqüencia prèvia de preparació de l'ESP8266 per a ser programat :

Prémer el botó de RST, sense deixar-ho anar, prémer el botó de FLASH.
I mentre es pressiona el botó de FLASH es deixa anar el botó de RST.
Finalment es deixa de prémer el botó de FLASH

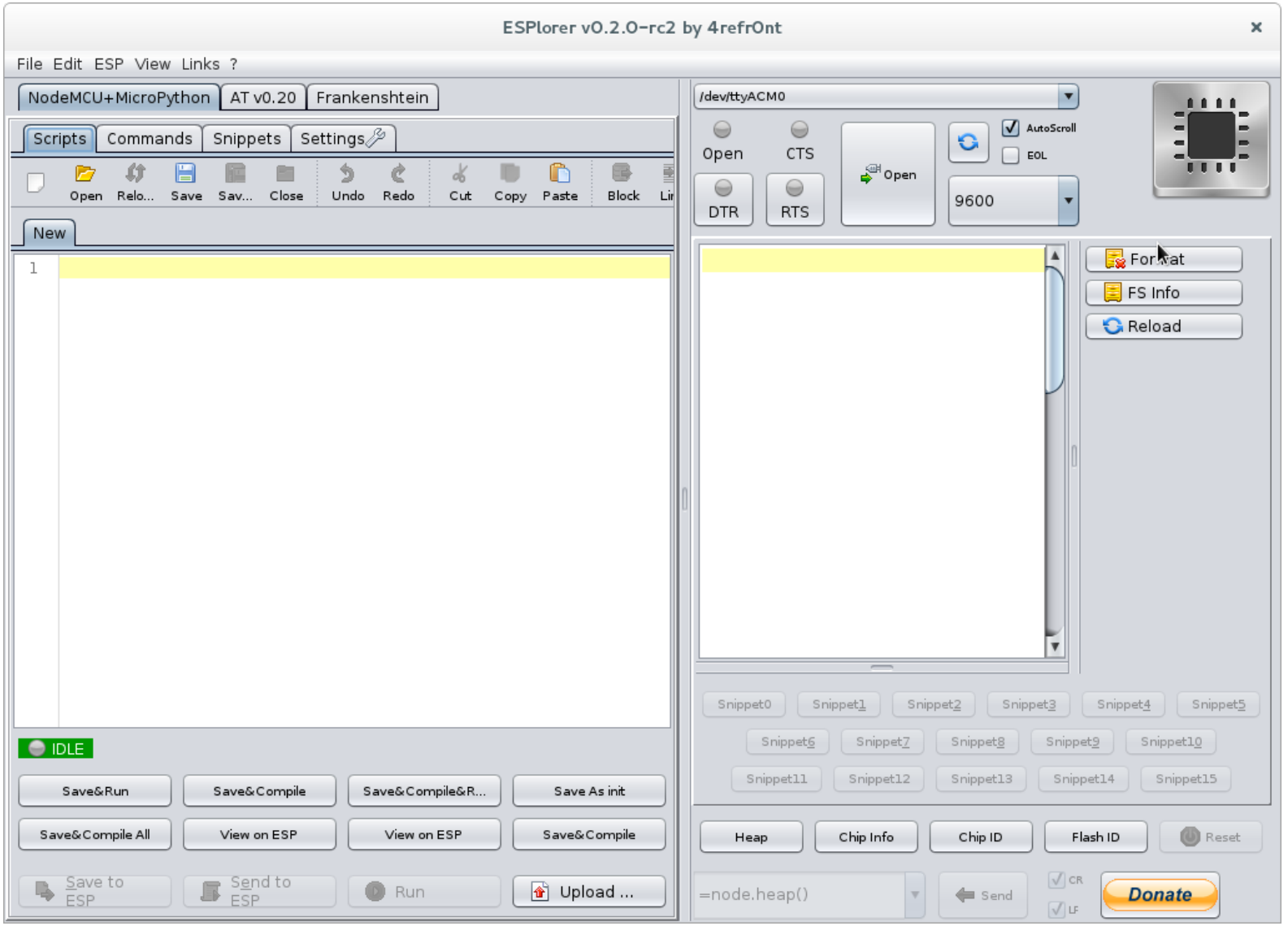
https://github.com/JhonControl/ESP8266-Flasher/tree/master/Firmware%20ESP8266

```
root@debian8:/home/ecat/Documents/dam/uf3/esptool-master# python esptool.py --port
 /dev/ttyUSB0 write_flash 0x00000 v0.9.5.2\ AT\ Firmware.bin
Connecting...
Erasing flash...
Wrote 520192 bytes at 0x00000000 in 49.4 seconds (84.3 kbit/s)...

Leaving...
root@debian8:/home/ecat/Documents/dam/uf3/esptool-master#
```

ESP-12E Development Board

Eines - ESPlorer

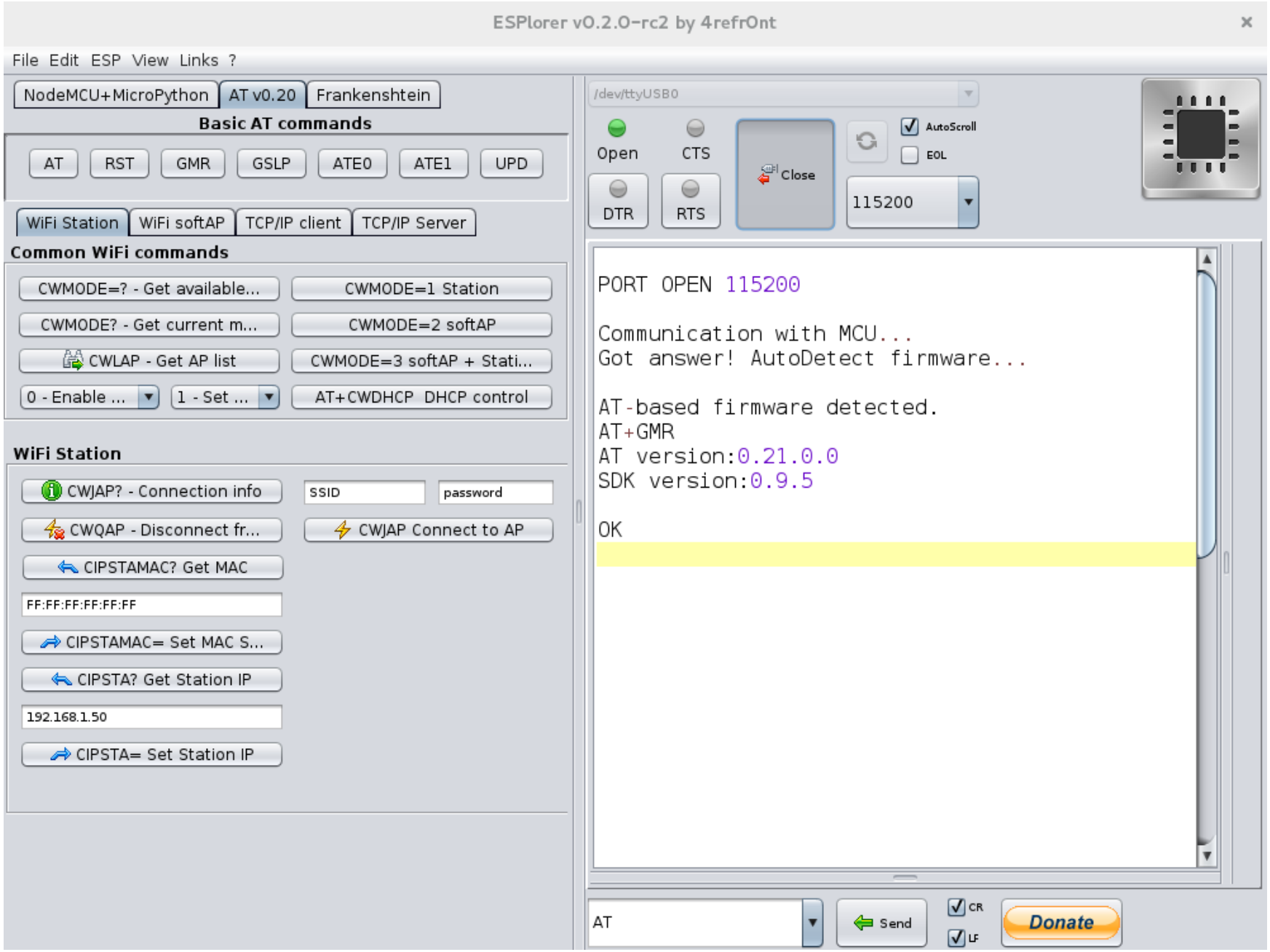
```
ecat@debian8:~/Documents/ESPlorer$ java -jar ESPlorer.jar
```



http://esp8266.ru/esplorer/

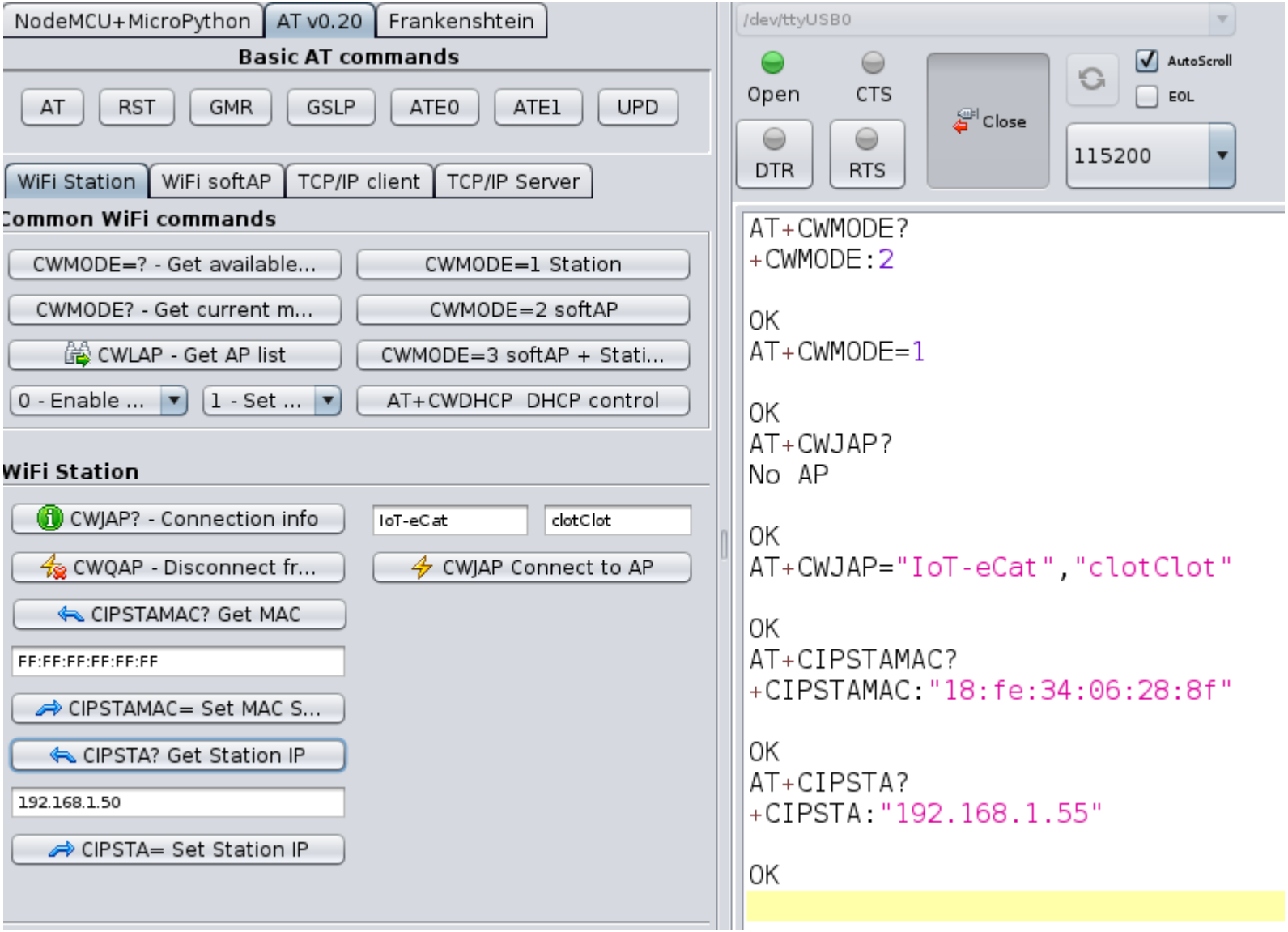
ESP-12E Development Board

Eines - ESPlorer



ESP-12E Development Board

Eines - ESPlorer



ESP-12E Development Board

Programant l'ESP8266 – LUA - Eines

Seqüencia prèvia de preparació de l'ESP8266 per a ser programat :

Verifiqueu que no hi ha cap programa emprant el port sèrie (p.e.: ESPlorer)
Prémer el botó de RST, sense deixar-ho anar, prémer el botó de FLASH.
I mentre es pressiona el botó de FLASH es deixa anar el botó de RST.
Finalment es deixa de prémer el botó de FLASH

https://github.com/nodemcu/nodemcu-devkit-v1.0
https://github.com/nodemcu/nodemcu-firmware
https://github.com/nodemcu/nodemcu-firmware/releases
http://nodemcu-build.com/

Downloads

nodemcu_float_0.9.6-dev_20150704.bin 451 KB

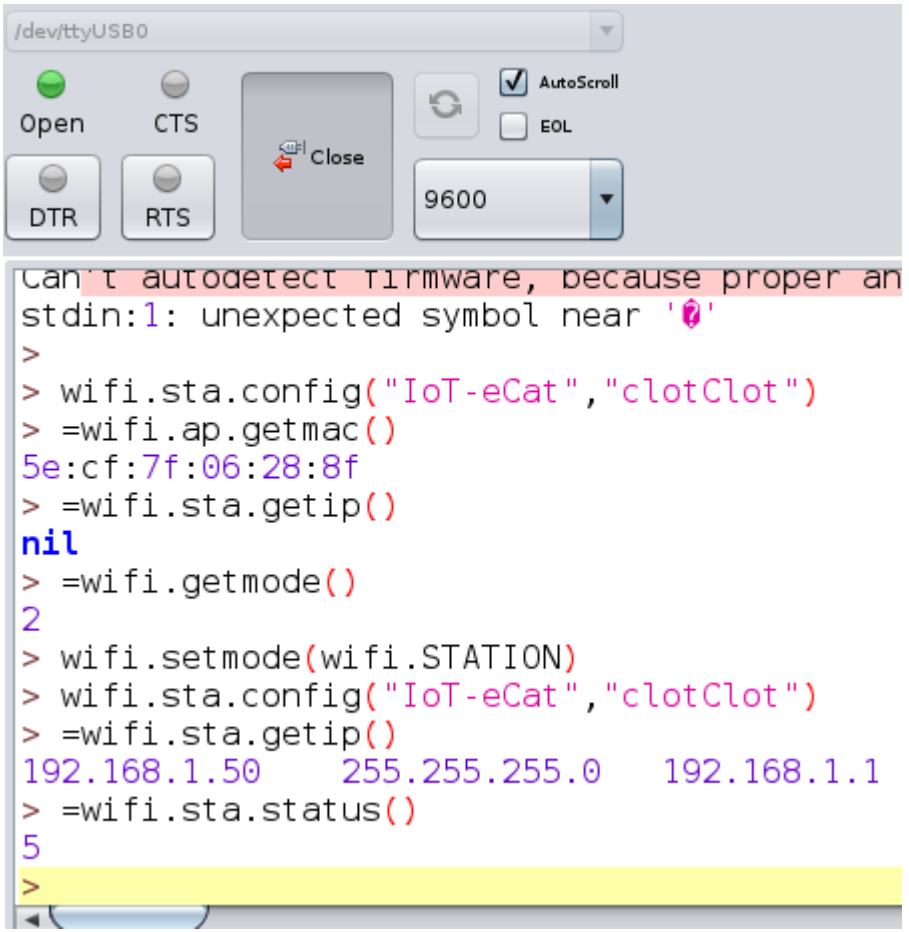
nodemcu_integer_0.9.6-dev_20150704.bin 440 KB

Source code (zip)

```
ecat@debian8:~/Documents/esp8266/lua$ esptool.py --port /dev/ttyUSB0 write_flash 0x00
000 nodemcu_integer_0.9.6-dev_20150704.bin
Connecting...
Erasing flash...
Wrote 450560 bytes at 0x00000000 in 43.3 seconds (83.2 kbit/s)...

Leaving...
ecat@debian8:~/Documents/esp8266/lua$ ls -ls
total 900
456 -rw-r----- 1 ecat ecat 461984 gen 21 13:37 nodemcu_float_0.9.6-dev_20150704.bin
444 -rw-r----- 1 ecat ecat 450072 gen 21 13:37 nodemcu_integer_0.9.6-dev_20150704.bin
ecat@debian8:~/Documents/esp8266/lua$
```

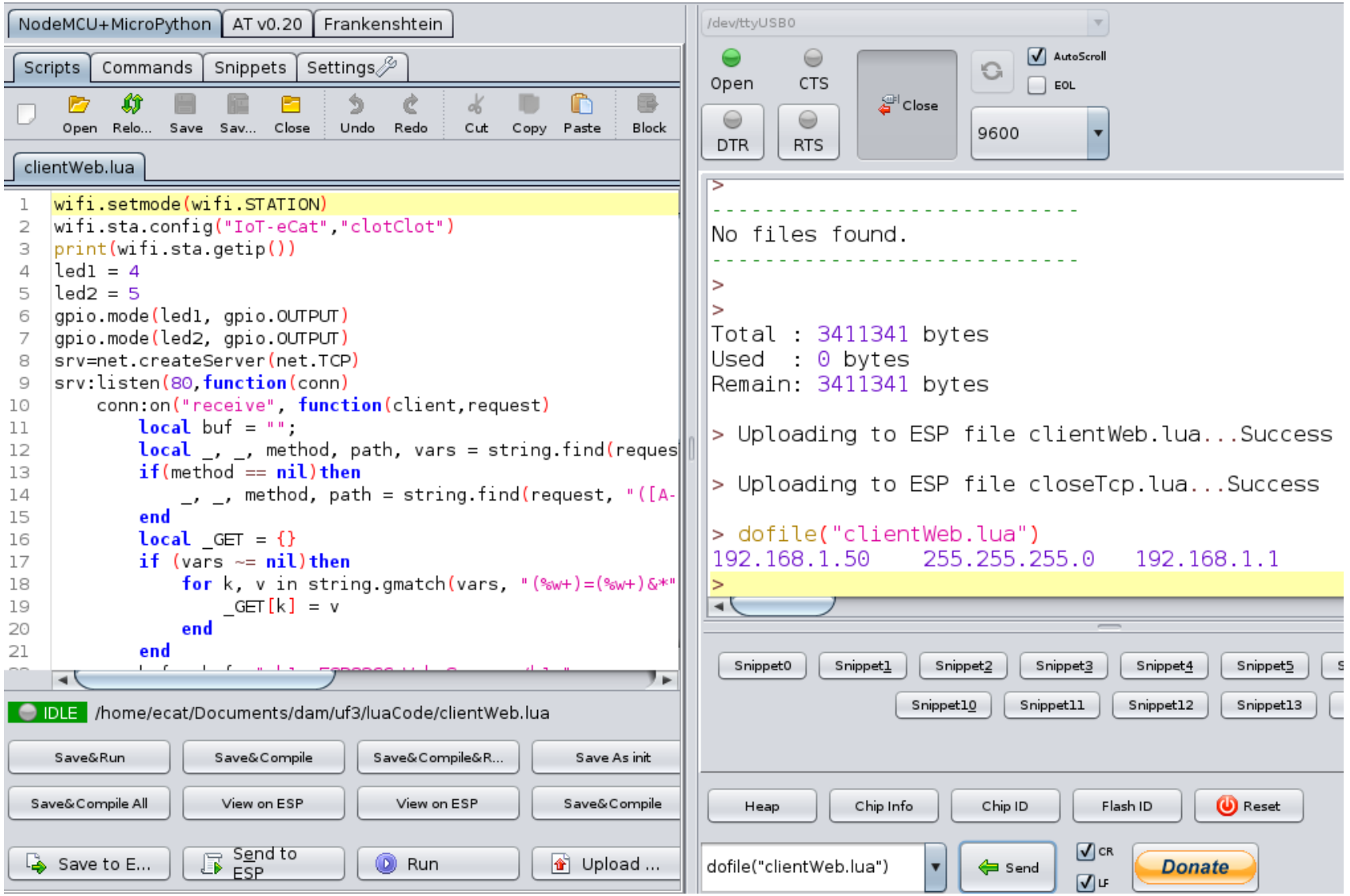
ESP-12E Development Board

Programant l'ESP8266 - LUA



ESP-12E Development Board

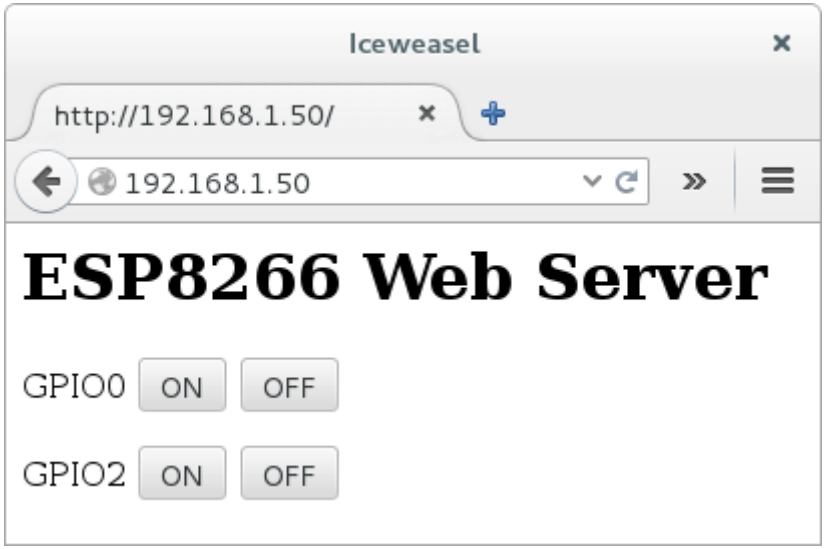
Programant l'ESP8266 - LUA



http://binefa.cat/php/esp8266/codis/lua/clientWeb.lua
http://binefa.cat/php/esp8266/codis/lua/closeTcp.lua

ESP-12E Development Board

Programant l'ESP8266 - LUA



http://binefa.cat/php/esp8266/codis/lua/clientWeb.lua
http://binefa.cat/php/esp8266/codis/lua/closeTcp.lua

ESP-12E Development Board

Programant l'ESP8266 - LUA

Connect to the wireless network

```
print(wifi.sta.getip())
--nil
wifi.setmode(wifi.STATION)
wifi.sta.config("SSID","password")
print(wifi.sta.getip())
--192.168.18.110
```

Blinking Led

```
lighton=0
tmr.alarm(0,1000,1,function()
if lighton==0 then
  lighton=1
  led(512,512,512)
  -- 512/1024, 50% duty cycle
else
  lighton=0
  led(0,0,0)
end
end)
```

A pure lua telnet server

```
-- a simple telnet server
s=net.createServer(net.TCP,180)
s:listen(2323,function(c)
  function s_output(str)
    if(c~=nil)
      then c:send(str)
    end
  end
  node.output(s_output, 0)
  -- re-direct output to function s_ouput.
  c:on("receive",function(c,l)
    node.input(l)
    --like pcall(loadstring(l)), support multiple separate
lines
  end)
  c:on("disconnection",function(c)
    node.output(nil)
    --unregist redirect output function, output goes to
serial
  end)
  print("Welcome to NodeMCU world.")
end)
```

Bootstrap

```
--init.lua will be excuted
file.open("init.lua","w")
file.writeline([[print("Hello World!")]])
file.close()
node.restart()  -- this will restart the module.
```

HTTP Client

```
-- A simple http client
conn=net.createConnection(net.TCP, false)
conn:on("receive", function(conn, pl) print(pl) end)
conn:connect(80,"121.41.33.127")
conn:send("GET / HTTP/1.1\r\nHost:
www.nodemcu.com\r\n"
  .."Connection: keep-alive\r\nAccept: */*\r\n\r\n")
```

HTTP Server

```
-- a simple http server
srv=net.createServer(net.TCP)
srv:listen(80,function(conn)
  conn:on("receive",function(conn,payload)
  print(payload)
  conn:send("<h1> Hello, NodeMCU.</h1>")
  end)
end)
```

Use timer to repeat

```
tmr.alarm(1,5000,1,function() print("alarm 1") end)
tmr.alarm(0,1000,1,function() print("alarm 0") end)
tmr.alarm(2,2000,1,function() print("alarm 2") end)
-- after sometime
tmr.stop(0)
```

http://www.banggood.com/NodeMcu-Lua-WIFI-Development-Board-For-ESP8266-Module-p-976440.html

ESP-12E Development Board

Programant l'ESP8266 – microPython - Eines

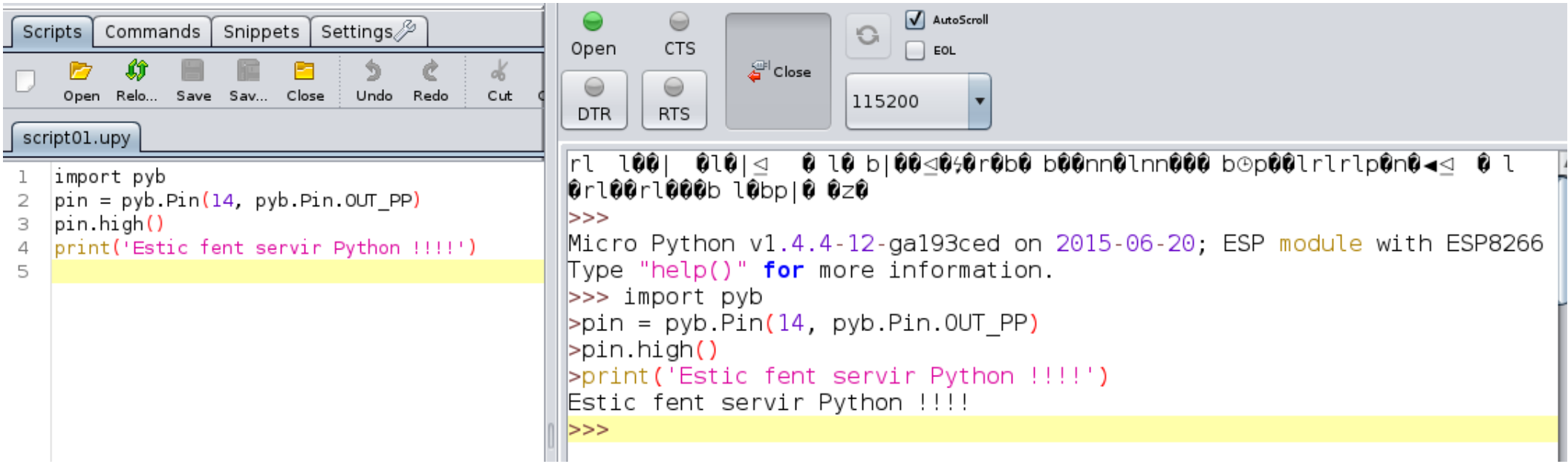
Seqüencia prèvia de preparació de l'ESP8266 per a ser programat :
Verifiqueu que no hi ha cap programa emprant el port sèrie (p.e.: ESPlorer)
Prémer el botó de RST, sense deixar-ho anar, prémer el botó de FLASH.
I mentre es pressiona el botó de FLASH es deixa anar el botó de RST.
Finalment es deixa de prémer el botó de FLASH

https://micropython.org/
https://learn.adafruit.com/building-and-running-micropython-on-the-esp8266
http://www.electrodragon.com/w/MicroPython_ESP8266
http://www.0x43.nl/esp8266-and-micropython/
http://dev.0x43.nl/wp-content/uploads/2015/06/build-MP-esp8266-2015-06-20.tar.gz

```
ecat@debian8:~/Documents/esp8266/flash/build$ esptool.py --port /dev/ttyUSB0 wri
te_flash 0x00000 firmware-combined.bin
Connecting...
Erasing flash...
Wrote 327680 bytes at 0x00000000 in 31.6 seconds (83.0 kbit/s)...

Leaving...
ecat@debian8:~/Documents/esp8266/flash/build$
```

ESP-12E Development Board

Programant l'ESP8266 – microPython - Eines



http://binefa.cat/php/esp8266/codis/micropython/script01.upy

https://learn.adafruit.com/building-and-running-micropython-on-the-esp8266/micropython-usage

ESP-12E Development Board

Programant l'ESP8266 – WiFi a sèrie - Eines

Seqüencia prèvia de preparació de l'ESP8266 per a ser programat :
Verifiqueu que no hi ha cap programa emprant el port sèrie (p.e.: ESPlorer)
Prémer el botó de RST, sense deixar-ho anar, prémer el botó de FLASH.
I mentre es pressiona el botó de FLASH es deixa anar el botó de RST.
Finalment es deixa de prémer el botó de FLASH

http://en.doit.am/doit_esp_wifi_serial.zip

```
ecat@debian8:~/Documents/esp8266/ESP8266 Serial©\to©\WiFi Transmission Firmware$ esptool.py
 --port /dev/ttyUSB0 write_flash 0x00000 ESP8266_Doit_ser2net\(v2.4\).bin
Connecting...
Erasing flash...
Wrote 455680 bytes at 0x00000000 in 43.4 seconds (84.0 kbit/s)...

Leaving...
ecat@debian8:~/Documents/esp8266/ESP8266 Serial©\to©\WiFi Transmission Firmware$
```

ESP-12E Development Board

Programant l'ESP8266 – WiFi a sèrie - Eines

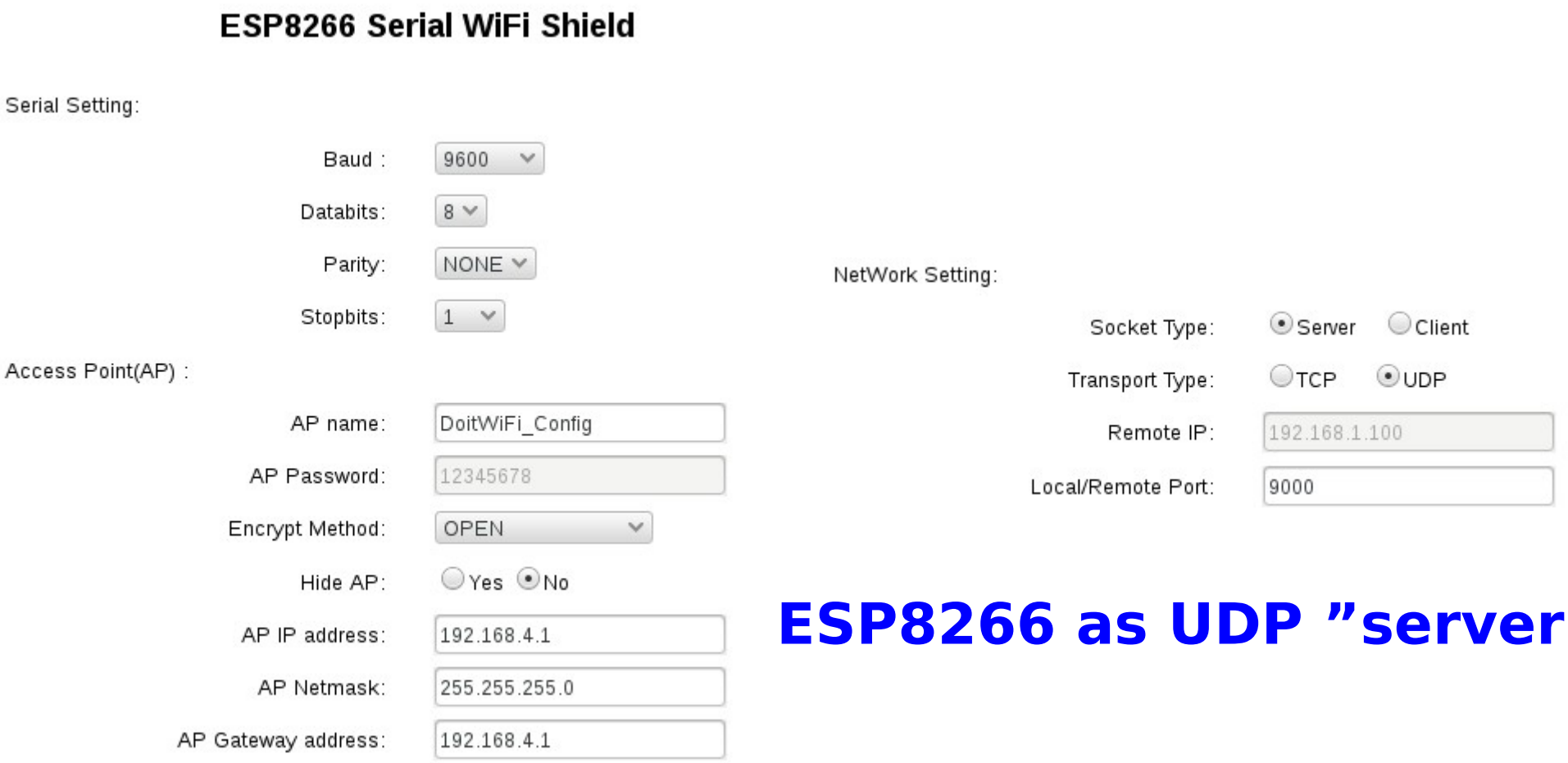
```
root@debian8:~# iwlist wlan0 scanning | grep Doit
                    ESSID:"DoitWiFi_Config"
root@debian8:~#
```

```
root@debian8:~# iwlist wlan0 scanning | grep Doit
                    ESSID:"DoitWiFi_Config"
root@debian8:~# iwconfig
eth0      no wireless extensions.

wlan0     IEEE 802.11bgn  ESSID:"DoitWiFi_Config"
          Mode:Managed  Frequency:2.412 GHz  Access Point: 5E:CF:7F:06:28:8F
          Bit Rate=1 Mb/s   Tx-Power=16 dBm
          Retry short limit:7   RTS thr:off   Fragment thr:off
          Encryption key:off
          Power Management:off
          Link Quality=70/70  Signal level=-23 dBm
          Rx invalid nwid:0  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:1  Invalid misc:63   Missed beacon:0

wwan0     no wireless extensions.

lo        no wireless extensions.

root@debian8:~#
```

http://en.doit.am/doit_esp_wifi_serial.zip

ESP-12E Development Board

Programant l'ESP8266 – WiFi a sèrie - Eines



ESP8266 as UDP ”server”

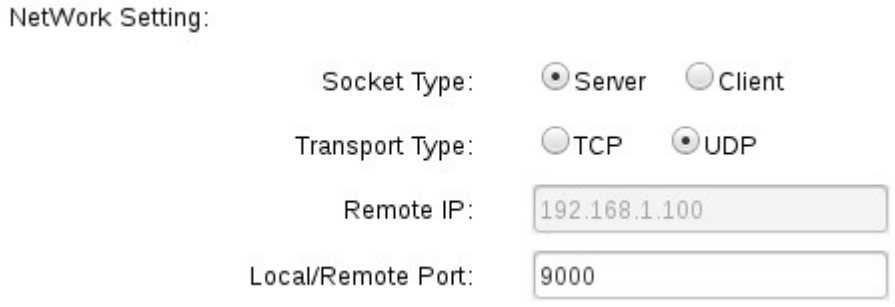
http://en.doit.am/doit_esp_wifi_serial.zip

ESP-12E Development Board

Programant l'ESP8266 – WiFi a sèrie - Eines

```
ecat@debian8:~/Documents/dam/uf3/udp/qtPyUdp$ minicom -b 9600 -o -D /dev/ttyUSB0
```

Obriu el **minicom** i **qtPyUdp.py** a terminals diferents



http://binefa.cat/php/esp8266/codis/Qt_Python/qtPyUdp.tar.gz

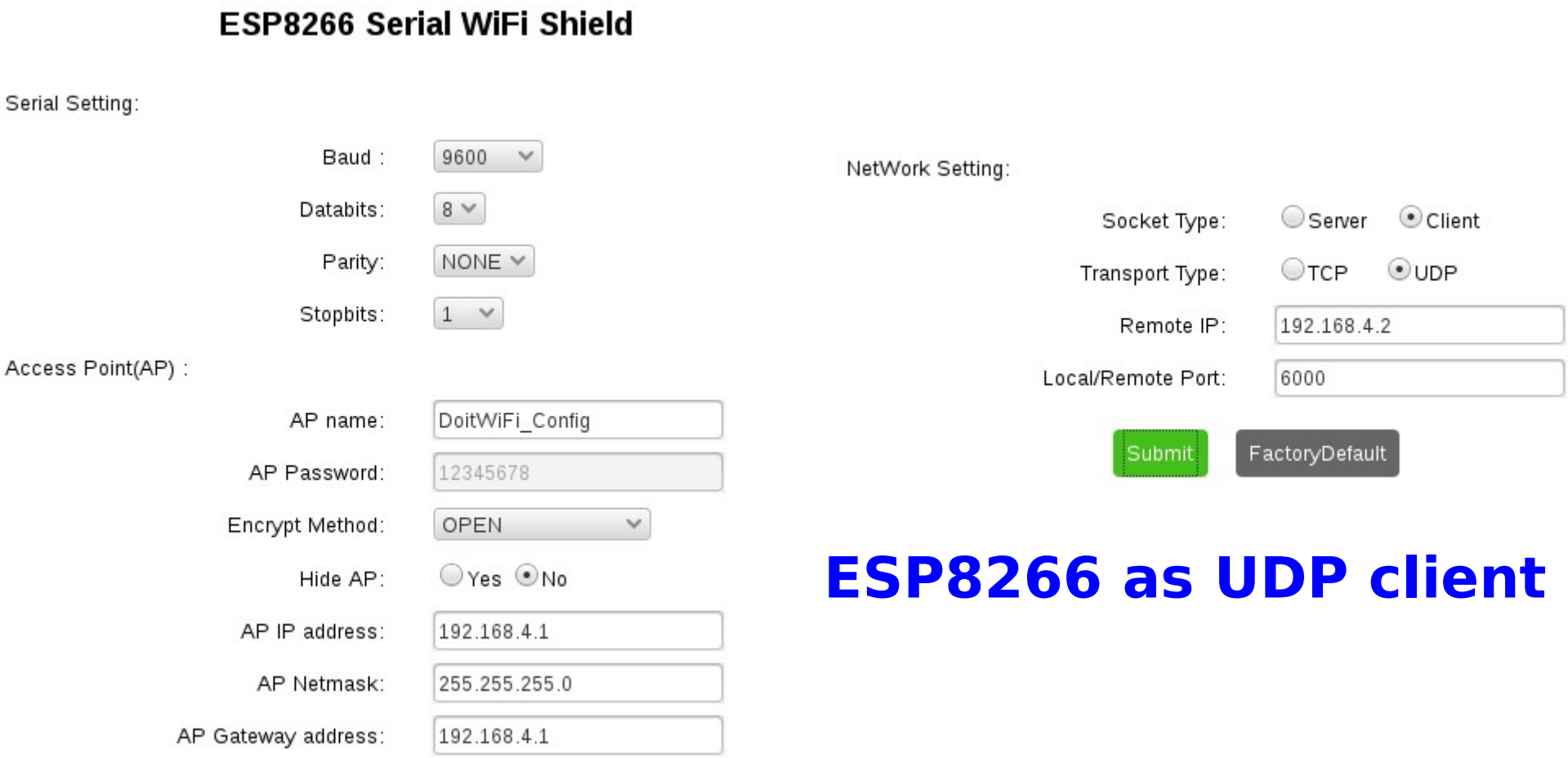
```
ecat@debian8:~/Documents/dam/uf3/udp/qtPyUdp$ ./qtPyUdp.py 6000
```

```
Welcome to minicom 2.7

OPTI+-----------------------------------------
Comp| A -    Serial Device      : /dev/ttyUSB0
Port| B - Lockfile Location     : /var/lock
    | C -   Callin Program      :
Pres| D -  Callout Program      :
    | E -    Bps/Par/Bits       : 9600 8N1
    | F - Hardware Flow Control : No
    | G - Software Flow Control : No
    |
    |    Change which setting? 
    +-----------------------------------------
              | Screen and keyboard      |
              | Save setup as dfl        |
              | Save setup as..          |
              | Exit                     |
              +--------------------------+
```


```
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda

Welcome to minicom 2.7

OPTIONS: I18n
Compiled on Jan  1 2014, 09:30:18.
Port /dev/ttyUSB0, 13:01:03

Press CTRL-A Z for help on special keys

Hola
```

ESP-12E Development Board

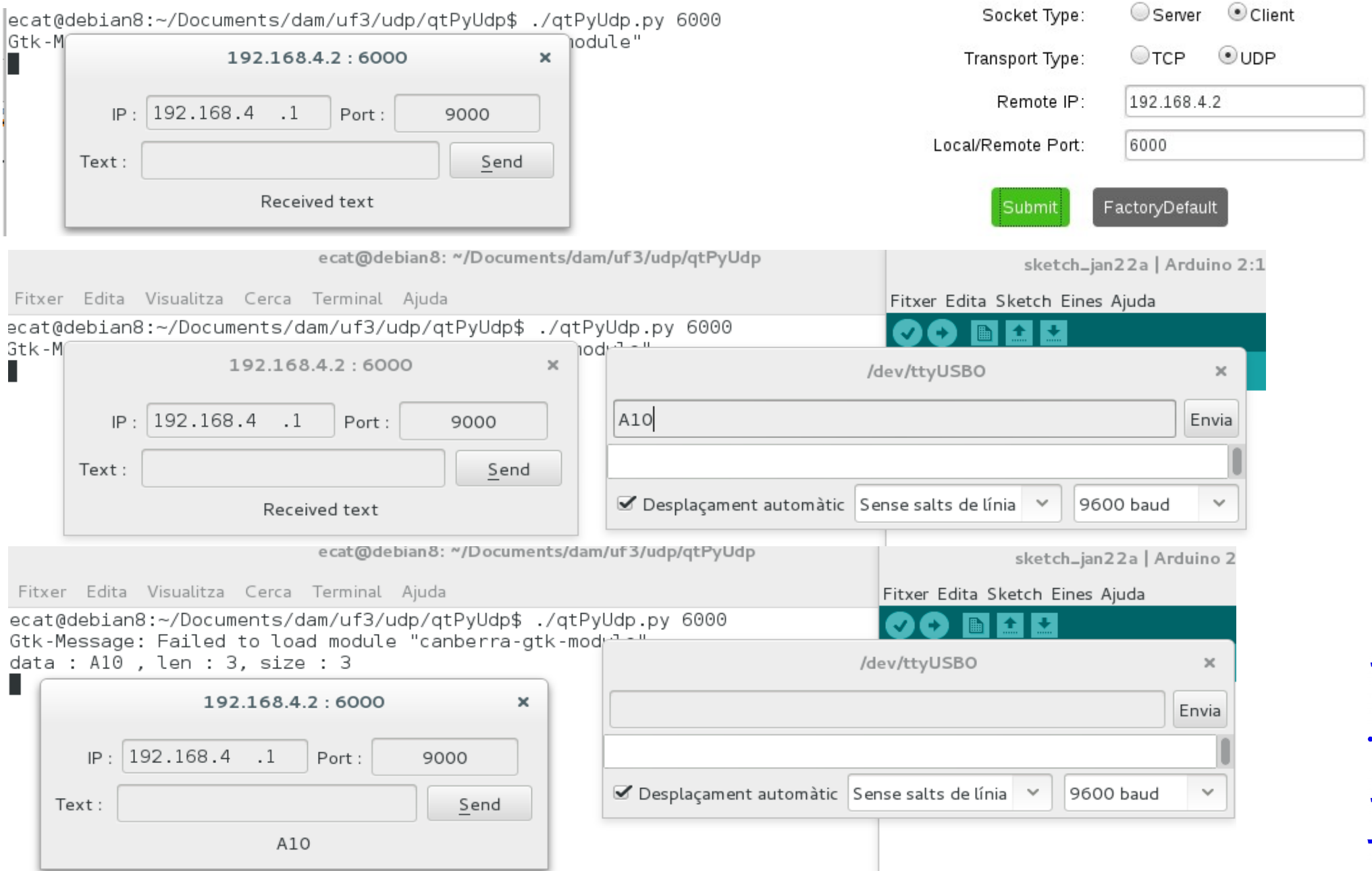
Programant l'ESP8266 – WiFi a sèrie - Eines



ESP8266 as UDP client

ESP-12E Development Board

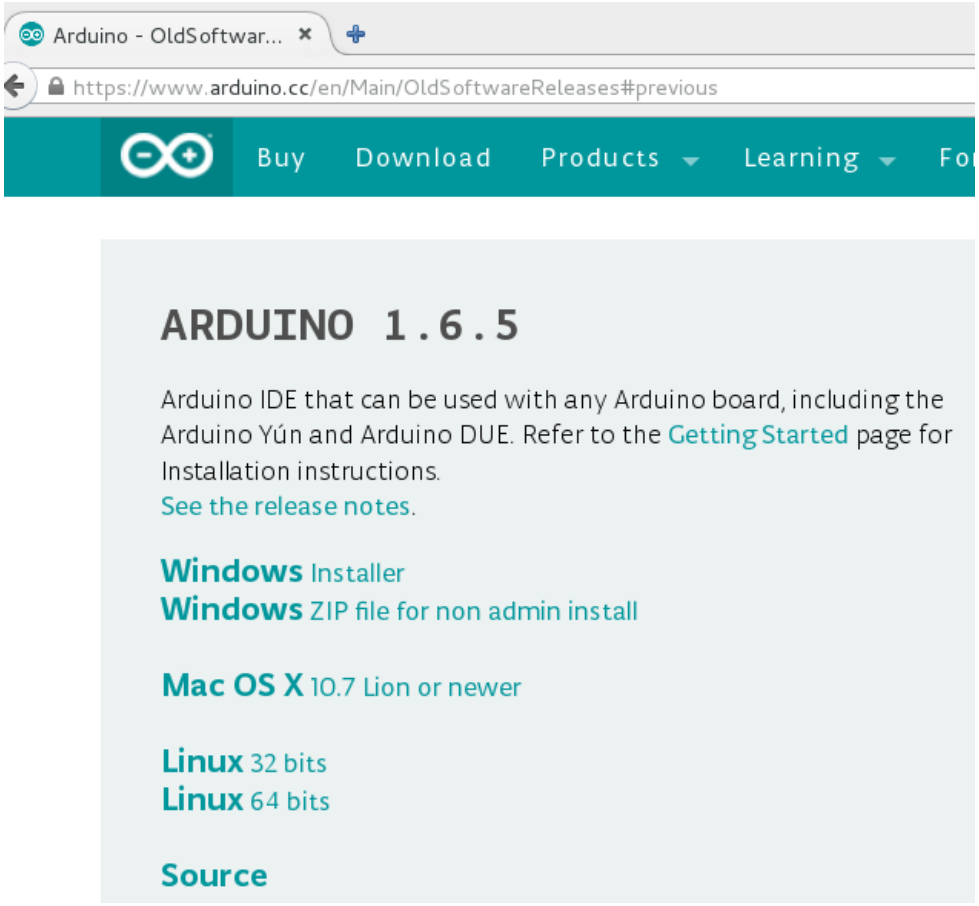
Programant l'ESP8266 – WiFi a sèrie - Eines



ESP-12E Development Board

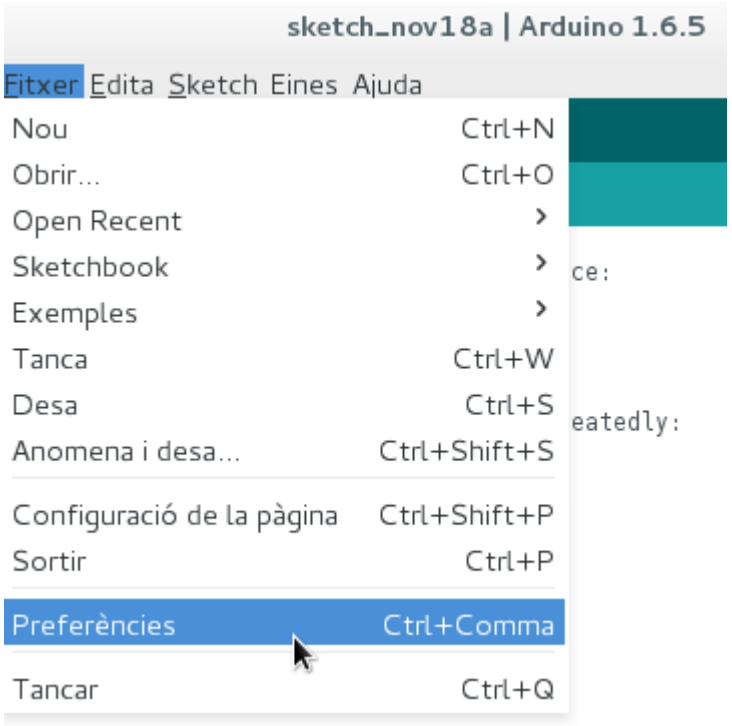
Desenvolupant amb l'ESP8266 sobre l'IDE d'Arduino

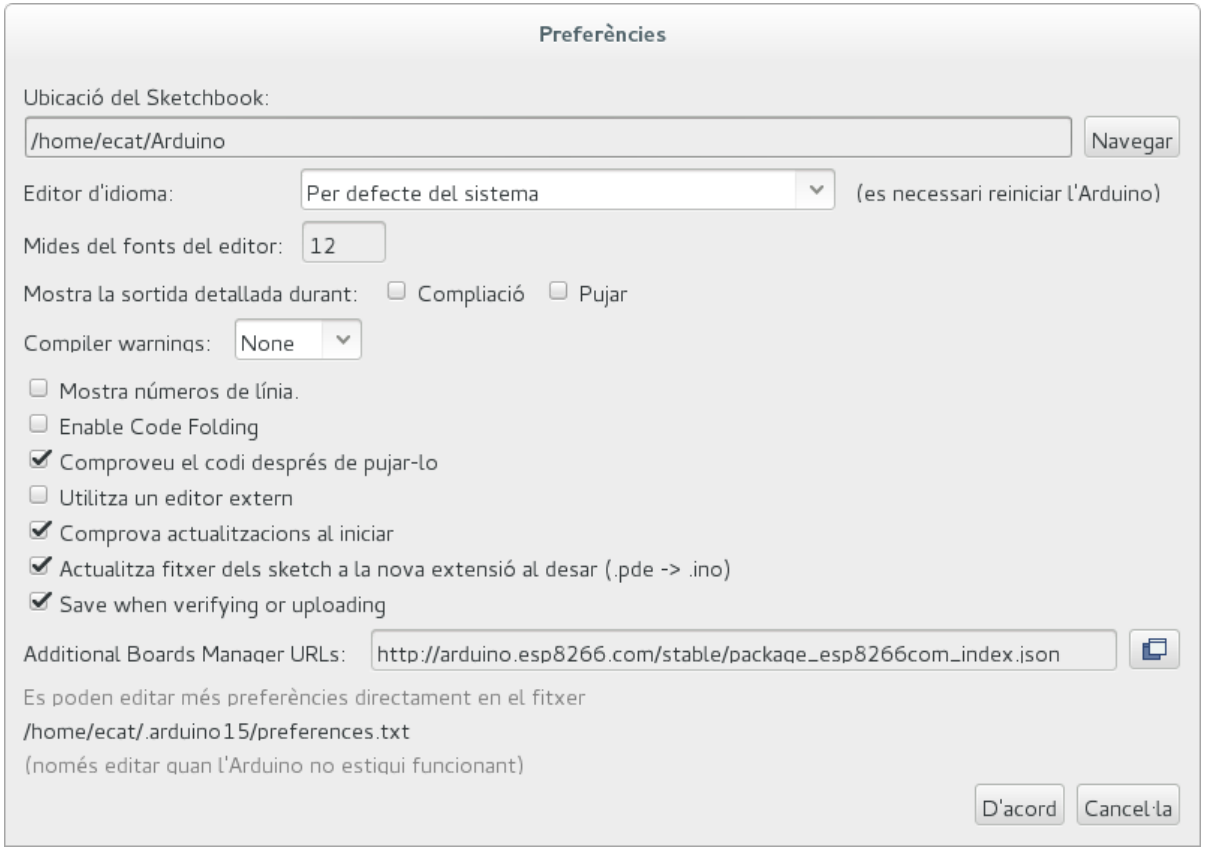
Descarregueu-vos l'instal·lador de l'IDE d'Arduino 1.6.5. des de:
https://www.arduino.cc/en/Main/OldSoftwareReleases



ESP-12E Development Board

Desenvolupant amb l'ESP8266 sobre l'IDE d'Arduino



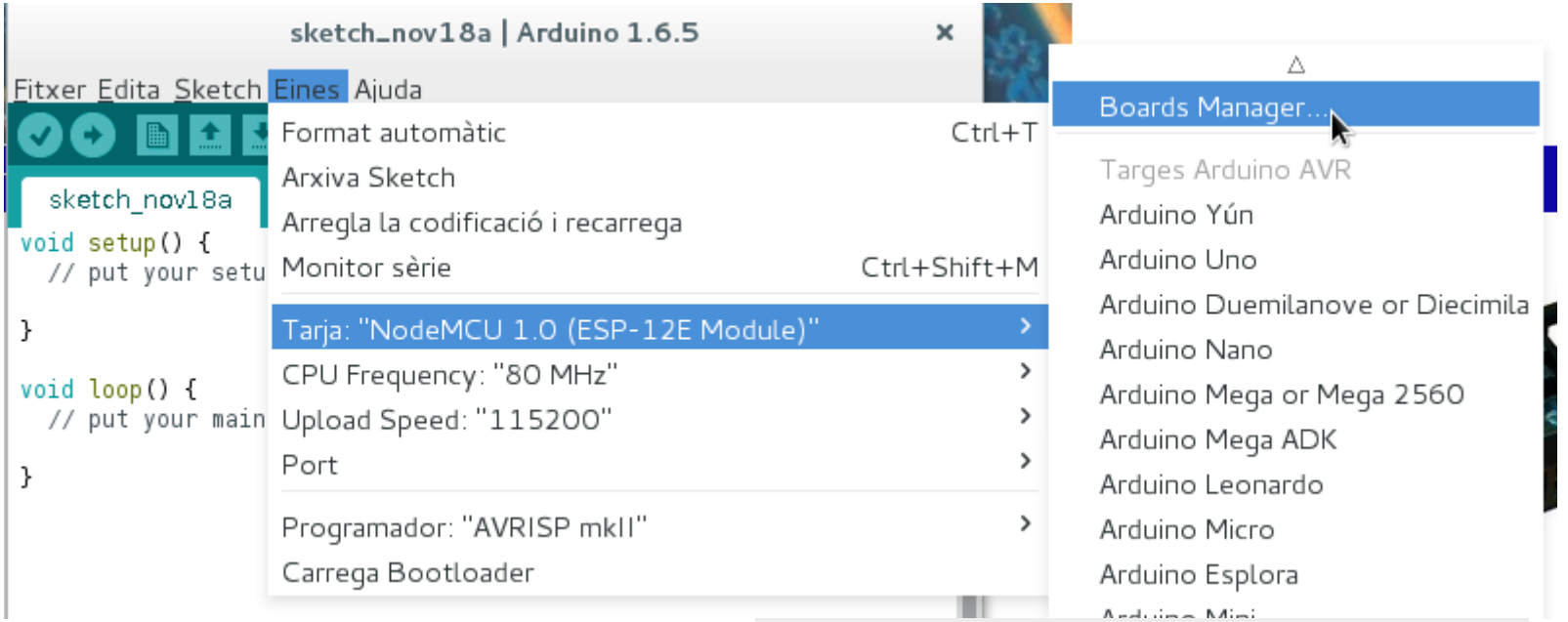


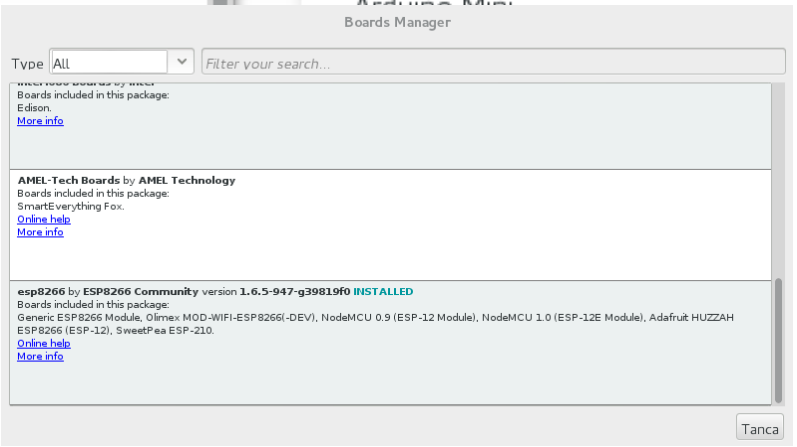
Entreu aquesta adreça a ”Additional Boards Manager URLs”:
http://arduino.esp8266.com/stable/package_esp8266com_index.json

ESP-12E Development Board

Desenvolupant amb l'ESP8266 sobre l'IDE d'Arduino

Tools → Board: “current” → Boards Manager ...





Click install ESP8266
(It is about 450 MB to download) :

Una altra manera de fer la instal·lació de l'IDE d'Arduino per a ESP8266:
https://libraries.io/github/adafruit/ESP8266-Arduino

ESP-12E Development Board

Trametent trames UDP amb l'ESP8266

UDPClientMAC02 | Arduino 1.6.5

Fitxer Edita Sketch Eines Ajuda

UDPClientMAC02

```
#include <ESP8266WiFi.h>
//#include <WiFiUDP.h>
#include <WiFiUdp.h>


#ifdef ESP8266
extern "C" {
#include "user_interface.h"
}
#endif

const char* ssid     = "IoT-eCat";
const char* password = "clotClot";

// A UDP instance to let us send and receive packets over UDP
WiFiUDP Udp;


void setup() {
  Serial.begin(115200);
  delay(10);

  // We start by connecting to a WiFi network
```

NodeMCU 1.0 (ESP-12E Module), 80 MHz, 115200 on /dev/ttyUSB0

```
void loop() {
//  char temp[20];      // buffer for for
  char temp[28];      // buffer for forma

  vGetMac(temp);

  Udp.write(temp);
  Udp.endPacket();

  Serial.print(temp);
  Serial.println(" sent to UDP server");

  delay(5000);
}
```

http://binefa.cat/php/esp8266/codis/arduinoIDE/UDPClientMAC02/UDPClientMAC02.ino

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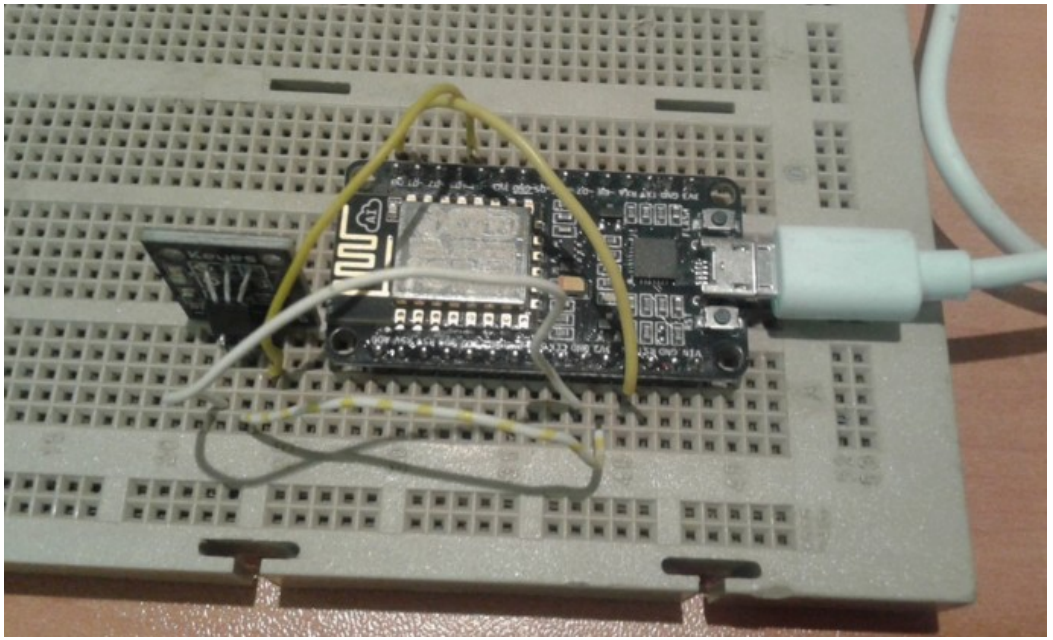
ESP8266 sobre l'IDE d'Arduino - MQTT



```
Fitxer  Edita  Vi
Client mosqsub
Client mosqsub
24.94
Client mosqsub
25.00
Client mosqsub
24.94
Client mosqsub
25.00
Client mosqsub
Client mosqsub
Client mosqsub
25.00
Client mosqsub
25.06
^C
ecat@debian8:~$ mosquitto_sub -d -t sensors/test/temperature
Client mosqsub/15509-debian8 sending CONNECT
Client mosqsub/15509-debian8 received CONNACK
Client mosqsub/15509-debian8 sending SUBSCRIBE (Mid: 1, Topic:
Client mosqsub/15509-debian8 received SUBACK
Subscribed (mid: 1): 0
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.81
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.75
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.69
```

```
Entering deep sleep mode for 3 seconds...
rl  l@@|  @l@|◁   @ l@ b|@@◁@,@r@b@ b@@nn@lnn@@@ b⊙p@@lrlrlp@n
Connecting to IoT-eCat
.............
WiFi connected
IP address:
192.168.1.12
Attempting MQTT connection...connected
Requesting DS18B20 temperature...
Sending temperature: 24.69
Closing MQTT connection...
Closing WiFi connection...
Entering deep sleep mode for 3 seconds...
rl  l@@|  @l@|◁   @ l@ b|@@◁@,@r@b@ b@@nn@lnn@@@ b⊙p@@lrlrlp@n
Connecting to IoT-eCat
....
☑ Desplaçament automàtic
```

http://www.jerome-bernard.com/blog/2015/10/04/wifi-temperature-sensor-with-nodemcu-esp8266/

ESP-12E Development Board

Instal·lació de l'esp-open-sdk

```
root@debian8:~# sudo aptitude install git

ecat@debian8:~/Documents/esp8266$ git clone --recursive https://github.com/pfalcon/esp-open-sdk.git

# apt-get install make unrar autoconf automake libtool gcc g++ gperf flex \
   bison texinfo gawk ncurses-dev libexpat-dev python sed git libtool-bin

$ make STANDALONE=y
```

Configuració del PATH

Per a poder cridar els binaris xtensa-lx106-*generats, podeu afegir la ruta del SDK al PATH. Podeu actualitzar el PATH cada vegada que inicieu una sessió de terminal:

```
export PATH=[your esp-open-sdk directory]/bin:$PATH

Per exemple:
export PATH=/home/ecat/Documents/esp8266/esp-open-sdk/bin:$PATH

Per a fer aquest canvi permanent afegiu-ho a la darrera línia de l'arxiu .profile del vostre directori
d'usuari.
```

```
ecat@debian8:~$ tail .profile
        . "$HOME/.bashrc"
    fi
fi

# set PATH so it includes user's private bin if it exists
if [ -d "$HOME/bin" ] ; then
    PATH="$HOME/bin:$PATH"
fi

export PATH=/home/ecat/Documents/esp8266/esp-open-sdk/bin:$PATH
ecat@debian8:~$
```

http://www.esp8266.com/wiki/doku.php?id=setup-linux-compiler-esp8266

ESP-12E Development Board

Programant l'ESP8266 - microPython

```
root@debian8:~# sudo aptitude install git

ecat@debian8:~/Documents/esp8266$ git clone --recursive https://github.com/pfalcon/esp-open-sdk.git

# apt-get install make unrar autoconf automake libtool gcc g++ gperf flex \
   bison texinfo gawk ncurses-dev libexpat-dev python sed git libtool-bin

$ make STANDALONE=y
```

Torn de preguntes ...

... i sessió pràctica.