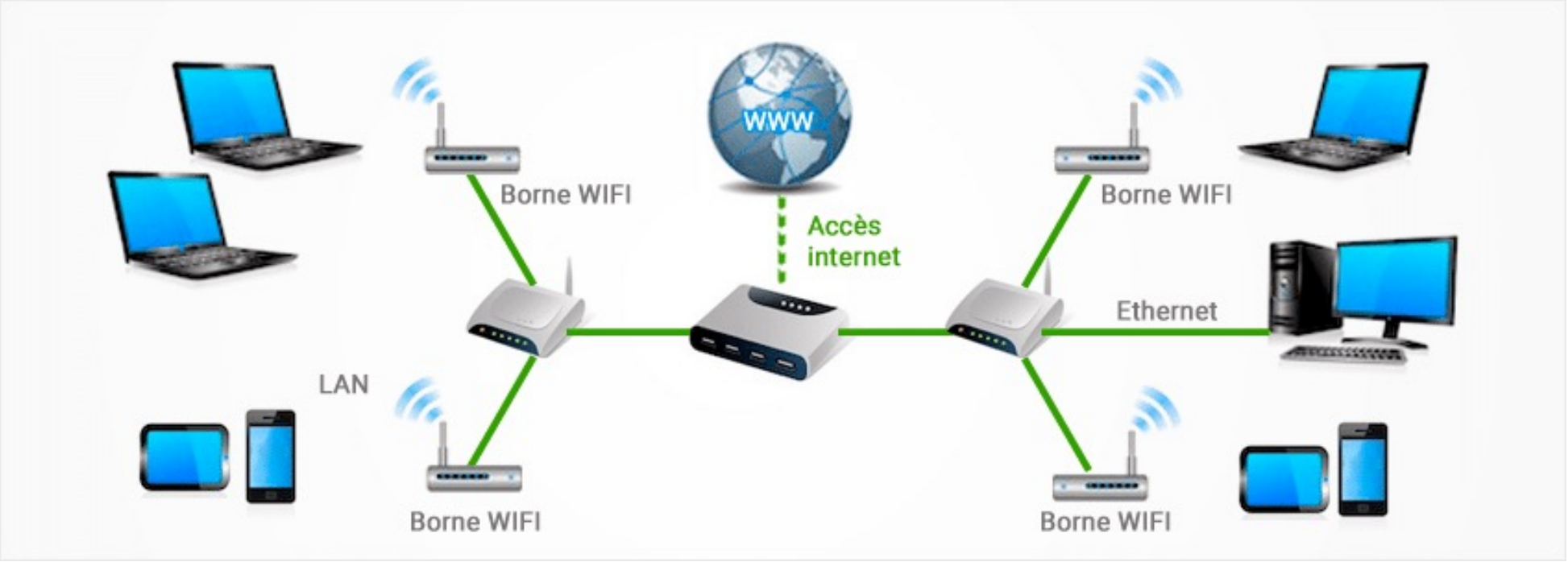
Yann DOUZE
Twitter : @yann_douze
Linkedin :
https://www.linkedin.com/in/yanndouze/

The Internet Of Things
C3 : Wi-Fi

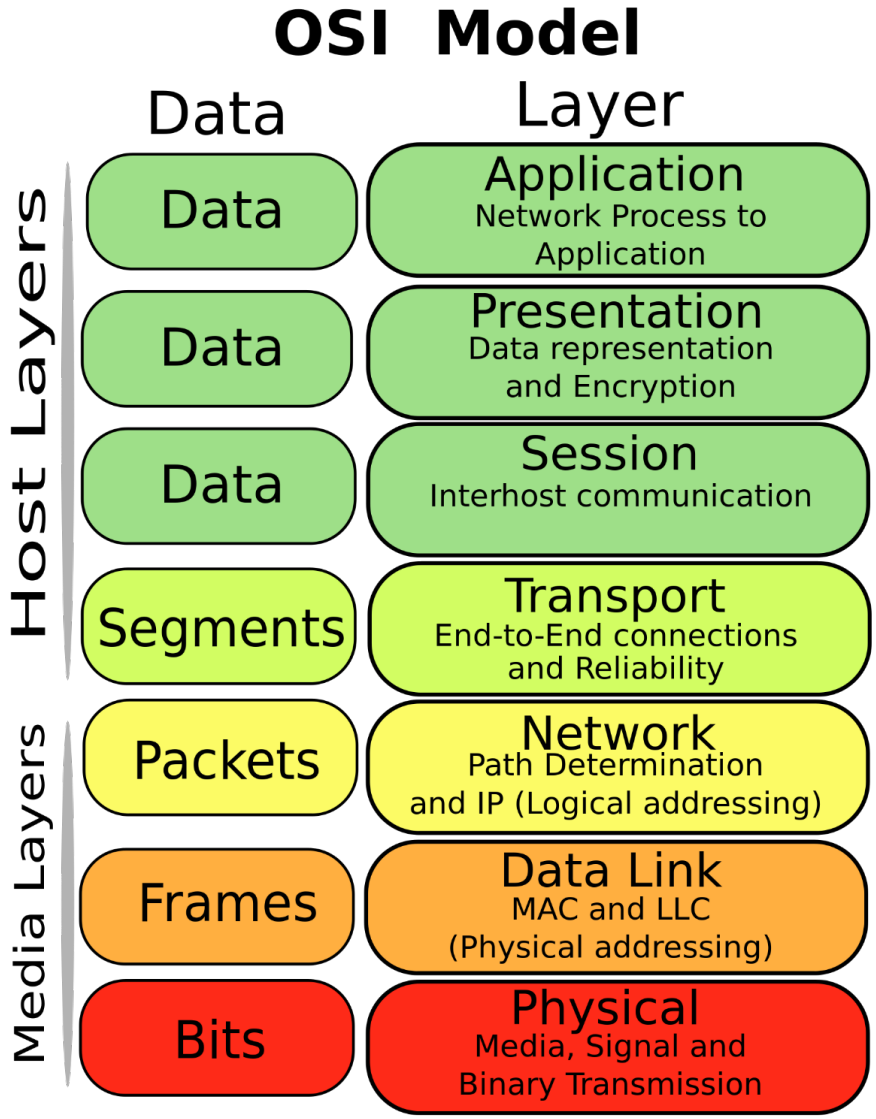
Terminology

- Wi-Fi – sounds cool - means nothing, Wireless Fidelity is a myth
- SSID : name of a Wi-Fi network
- AP : Access Point
- WLAN – “W” or “Wireless” LAN

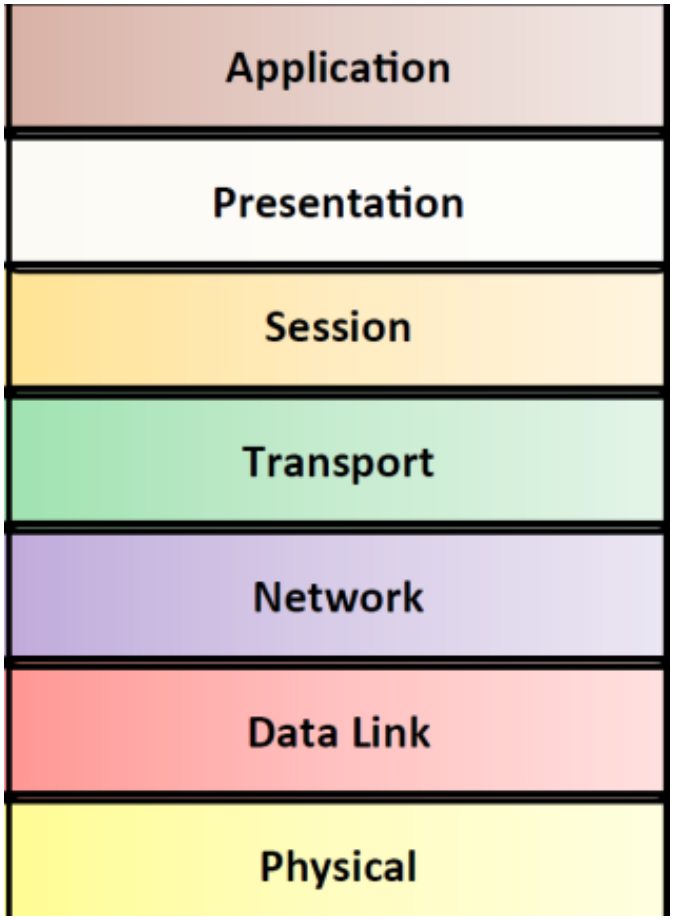
WLAN Architecture



7 layers of the OSI Model



Wi-Fi and the OSI Model



Wi-Fi operates at layers one and two

Wi-Fi versions

STANDARD		DATE	FREQUENCY (GHZ)	MAXIMUM DATA RATE
WiFi 1	802.11b	1999	2.4	11 Mbps
WiFi 2	802.11a	1999	5.0	54 Mbps
WiFi 3	802.11g	2003	2.4	54 Mbps
WiFi 4	802.11n	2009	2.4 / 5.0	600 Mbps
WiFi 5	802.11ac (Wave 1) 802.11ac (Wave 2)	2013 2015	5.0 5.0	1.73 Gbps 3.46 Gbps
WiFi 6	802.11ax	2020	2.4 / 5.0/ 6.0	9.60 Gbps

https://www.nextinpact.com/article/67335/20-ans-dhistoire-wi-fi-11-mbs-802-11b-a-plus-10-gbs-en-wi-fi-6-802-11ax

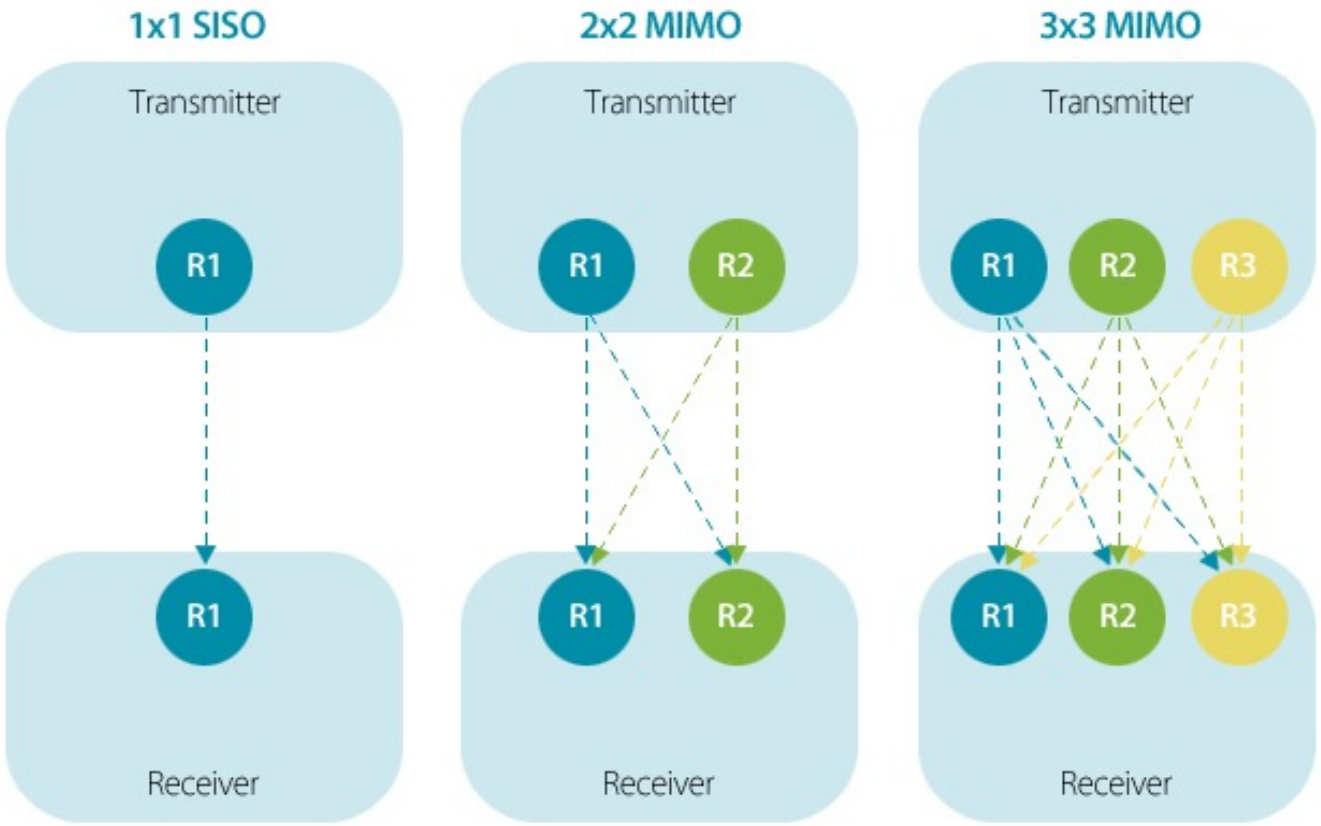
Wi-Fi Standards

Standard	Supported Data Rates	2.4 GHz	5 GHz	RF Technology	Radios
802.11 legacy	1, 2 Mbps	Yes	No	FHSS or DSSS	SISO
802.11b	1, 2, 5.5 and 11 Mbps	Yes	No	HR-DSSS	SISO
802.11a	6 - 54 Mbps	No	Yes	OFDM	SISO
802.11g	6 - 54 Mbps	Yes	No	OFDM	SISO
802.11n	6 - 600 Mbps	Yes	Yes	HT	MIMO
802.11ac	Up to 6.933 Gbps*	No	Yes	VHT	MIMO

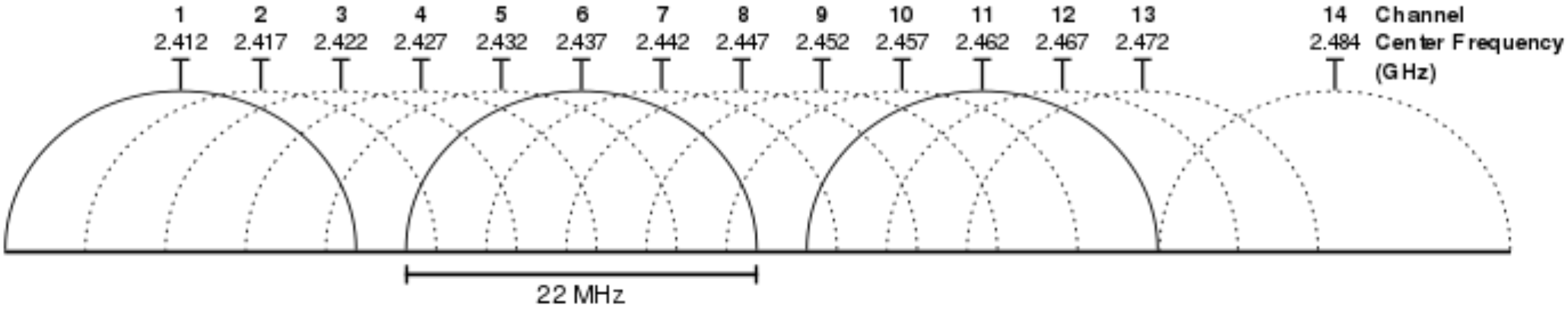
DSSS	**Direct Sequencing Spread Spectrum**
FHSS	**Frequency Hopping Spread Spectrum**
OFDM	**Orthogonal Frequency Division Multiplexing**
HT	**High Throughput**
VHT	**Very High Throughput**
SISO	**Single Input, Single Output**
MIMO	**Multiple Input, Multiple Output**

SISO et MIMO

- SISO : Single Input, Single Output
- MIMO : Multiple Input Multiple Output



Wi-Fi Channel

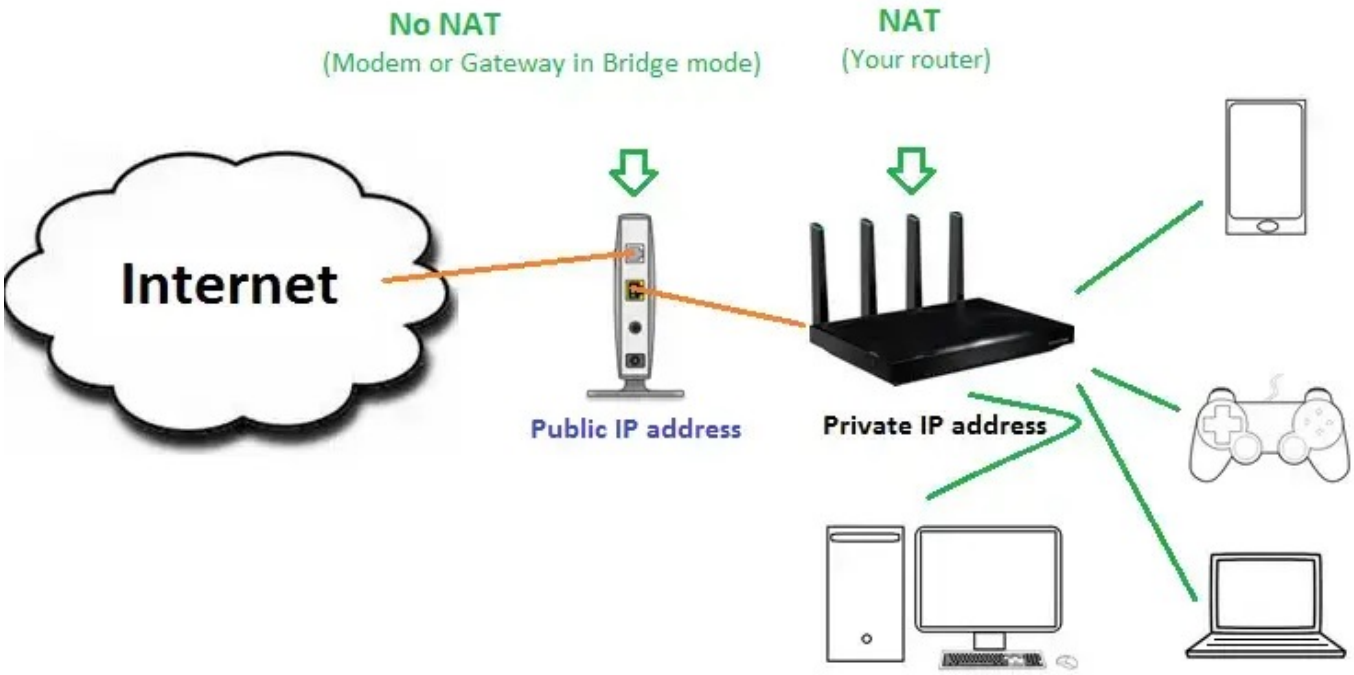


MAC Address, IP Address

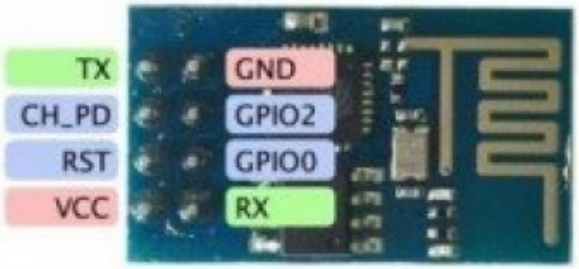
- Each Wi-Fi cheap have is own MAC address
- Each MAC address is unique in the world !
  - How to find it :
  - Windows : type *ipconfig –all* in Powershell
  - Linux : type *ifconfig* in a shell

- The network give the IP Adress
- Each Device on a Wi-Fi Network have a unique IP address

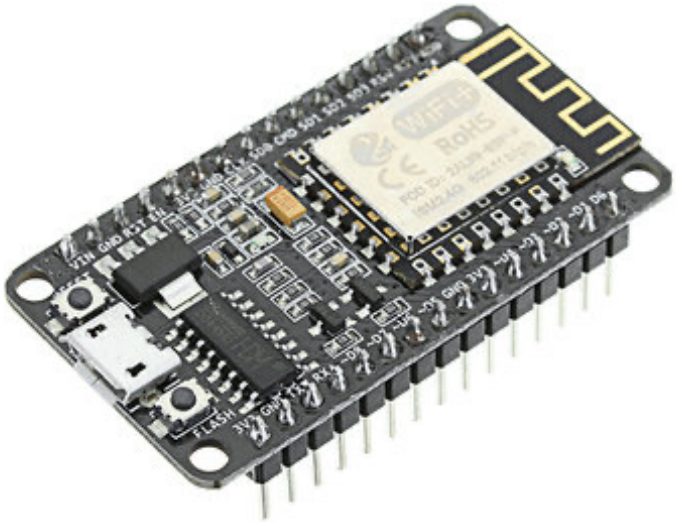
WLAN architecture

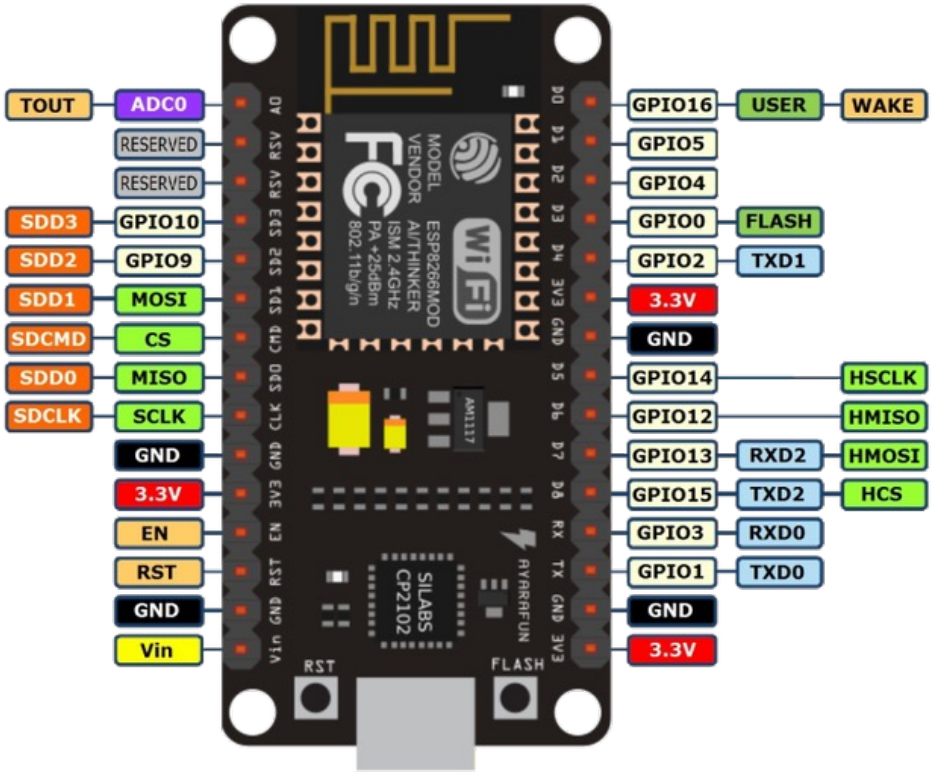


ESP8266 : 2014 First low cost Wi-Fi Chip (2 $)



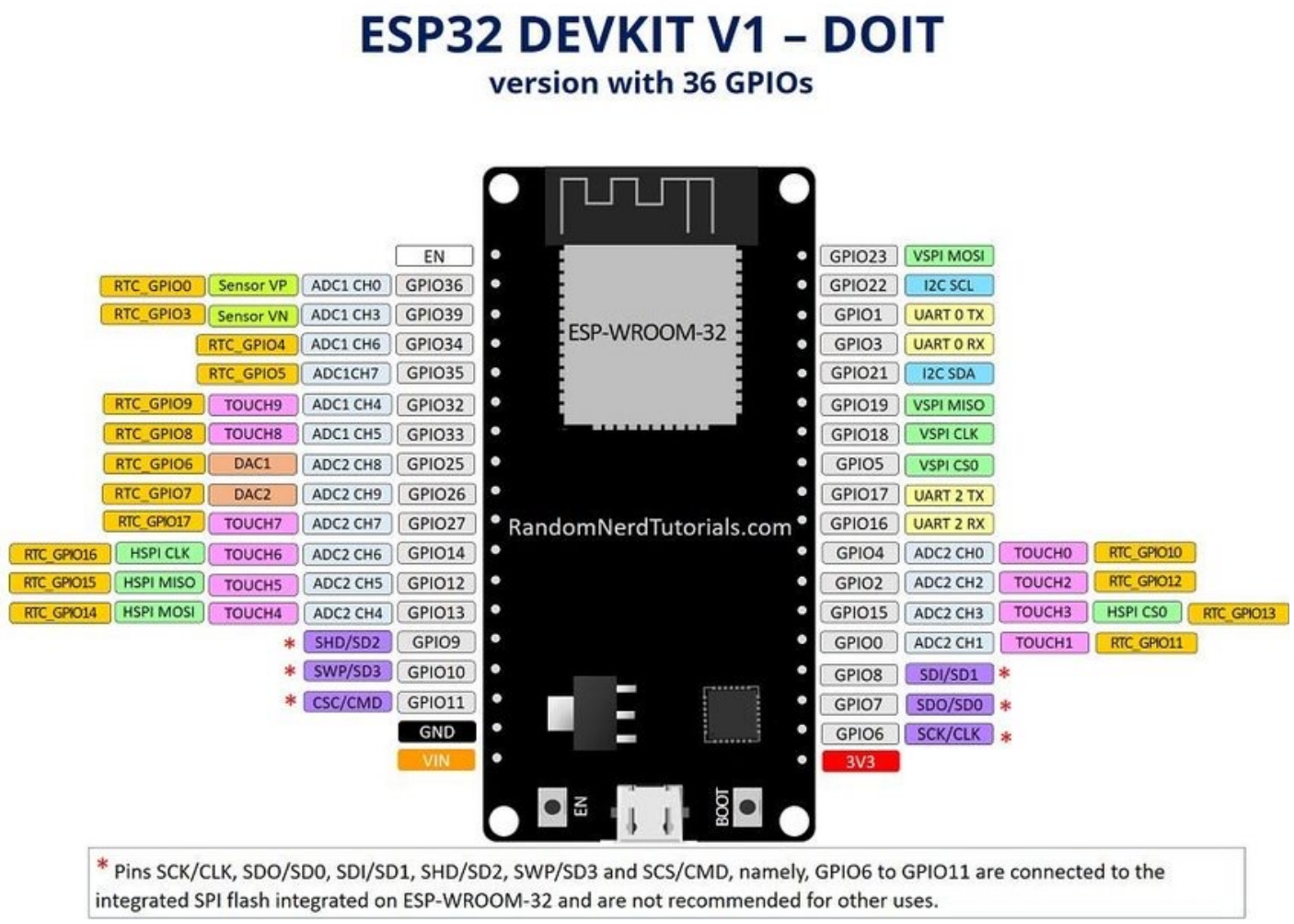
NodeMCU (ESP8266 Chip) : 2015 (5 $)





ESP32 : BLE and Wi-Fi

Since 2017
Around 5$



Arduino WiFi library

- WiFi header for ESP32

```
#include <WiFi.h>
```

- Wifi Network credentials

```
const char* ssid = "yourNetworkName";
const char* password = "yourNetworkPassword";
```

- Connect to a network

```
Serial.begin(115200);
scanNetworks();
connectToNetwork();
```

- Print the IP address ans the MAC address :

```
Serial.println(WiFi.localIP());
Serial.println(WiFi.macAddress());
```

Examples

- Scan the Access Point Gateaways
  - File → Examples → WiFi → WiFiScan

- Basic HTTP Client
  - File → Examples → HTTPClient → BasicHttpClient
  - Change the SSID and PASSWORD to connect with your smartphone credentials.
  - Then change the url you want to access

- Simple WiFi Server
  - File → Examples → WiFi → SimpleWiFiServer