Probando la Orange Pi

Un proyecto de BricoLabs

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Probando la Orange Pi y aprendiendo a usarla.

TRABAJO EN CURSO NO TERMINADO

# Empezar rápido desde linux

Para usar la Orange Pi Zero tendremos que crear imágenes arrancables en tarjetas micro SD.

## Crear una SD arrancable

Dependiendo de donde conectemos la tarjeta tendremos que usar diferentes rutas. En el procedimiento descrito a continuación ${card} será la ruta al dispositivo de la tarjeta y ${p} la partición (si la hay).

Si la tarjeta se conecta via adaptador USB, linux la va a asociar a un dispositivo /dev/sdx, por ejemplo en mi portátil el disco duro es /dev/sda las distintas particiones serán /dev/sda1, /devb/sda2, etc.

Si conectamos una memoria con un adaptador USB linux la podría mapear en /dev/sdb por ejemplo.

Si la memoria se conecta mediante una ranura SD, linux la asociará a un dispositivo /dev/mmcblk0 o /dev/mmcblk1, etc. etc. Dependerá de la ranura usada. Las particiones en este tipo de dispositivos tienen rutas como por ejemplo /dev/mmcblk0p1.

Los datos se pueden almacenar directamente en la memoria SD o en una partición creada en la memoria.

Resumiendo:

* ${card} será /dev/sdb o /dev/mmcblk0
* {p} será /dev/sdb1 o /dev/mmcblk0p1

Antes de seguir adelante hay que estar completamente seguro del dispositivo asociado a nuestra memoria SD para no armar ningún estropicio.

Hay varias comprobaciones que se pueden hacer:

dmesg |tail nos permitirá echar un ojo a los últimos mensajes en el log del sistema. Si acabamos de insertar la memoria veremos el dispositivo usado.

sudo fdisk -l nos permite ver las particiones montadas en nuestro linux, por ejemplo con mi SD en la ranura SD de mi portatil la salida es (entre otras cosas, he obviado las particiones de los discos duros):

Disk /dev/mmcblk0: 7.4 GiB, 7948206080 bytes, 15523840 sectors  
Units: sectors of 1 \* 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disklabel type: dos  
Disk identifier: 0x00000000

cat /proc/partitions también nos dará una lista de particiones, en mi portátil las que interesan son:

179 0 7761920 mmcblk0  
 179 1 7757824 mmcblk0p1

Descargamos la imagen de Jessie adaptada a la *Orange Pi Zero* desde la página <https://www.armbian.com/download/>

Descomprimimos la imagen y la grabamos en la tarjeta SD con el comando:

sudo dd if=./Armbian\_5.24\_Orangepizero\_Debian\_jessie\_3.4.113.img of=/dev/mmcblk0

Insertamos la tarjeta en la *Orange Pi* y le damos alimentación. El primer arranque llevará alrededor de tres minutos, y tras ese tiempo aun hará falta un minuto más para poder hacer login. Este retardo es debido a que el sistema intentará actualizar la lista de paquetes y creará un area de swap de emergencia en la SD, y además cambiará el tamaño de la partición que hemos creado para ocupar todo el espacio libre en la SD.

De momento solo la he arrancado y efectivamente las particiones han cambiado tras el arranque así que tiene buena pinta.

Volvemos a insertar la SD en la *Orange Pi* y la conectamos con un cable ethernet al router de casa. El Armbian viene configurado por defecto para obtener su IP desde un servidor DHCP.

Como mi cutre-router no me da información de las IP asignadas usamos *nmap*:

nmap -sP 192.168.0.0/24

Con eso averiguamos la IP asignada a la *Orange Pi Zero* y ya podemos hacer login con el siguiente comando [[1]](#footnote-26):

ssh root@192.168.0.109

¡Y ya estamos!



Primer login en *Orange Pi*

Lo primero es poner al dia el sistema:

apt-get update  
apt-get upgrade

Si quieres puedes reconfigurar el *time zone*:

dpkg-reconfigure tzdata

## Conexión WIFI

Vamos a comprobar que todo va bien:

root@orangepizero:~# iwconfig  
lo no wireless extensions.  
  
tunl0 no wireless extensions.  
  
wlan0 IEEE 802.11bgn ESSID:off/any  
 Mode:Managed Access Point: Not-Associated Tx-Power=20 dBm  
 Retry long limit:7 RTS thr:off Fragment thr:off  
 Encryption key:off  
 Power Management:on  
  
eth0 no wireless extensions.

Todo tiene buena pinta, vamos a ver si detecta WIFIs:

root@orangepizero:~# iwlist wlan0 scan |grep ESSID  
 ESSID:"wificlientesR"  
 ESSID:"casa\_de\_verano"  
 ESSID:"MOVISTAR\_BEEF"  
 ESSID:"wificlientesR"  
 ESSID:"R-wlan90"  
 ESSID:"MOVISTAR\_BAAF"  
 ESSID:"ababab"  
 ESSID:"WLAN 77"  
 ESSID:"castillo"  
 ESSID:"unaWifi"  
 ESSID:""  
 ESSID:"mikasa"

Para configurar el wifi echamos un ojo al fichero /etc/network/interfaces pero en ese mismo fichero encontramos el aviso:

# Armbian ships with network-manager installed by default. To save you time  
# and hassles consider using 'sudo nmtui' instead of configuring Wi-Fi settings  
# manually.

Así que basta con ejecutar sudo nmtui y ya podemos dar de alta nuestra wifi (yo la prefiero con IP estática).



Configuración WIFI

Ejecutamos ifconfig y ya vemos nuestro nuevo interface configurado:

ifconfig  
  
wlan0 Link encap:Ethernet HWaddr a4:7c:f2:9a:97:7c  
 inet addr:192.168.0.120 Bcast:192.168.0.255 Mask:255.255.255.0  
 inet6 addr: fe80::a67c:f2ff:fe9a:977c/64 Scope:Link  
 UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1  
 RX packets:2 errors:0 dropped:0 overruns:0 frame:0  
 TX packets:8 errors:0 dropped:0 overruns:0 carrier:0  
 collisions:0 txqueuelen:1000  
 RX bytes:328 (328.0 B) TX bytes:852 (852.0 B)

# Orange Pi Zero, características técnicas

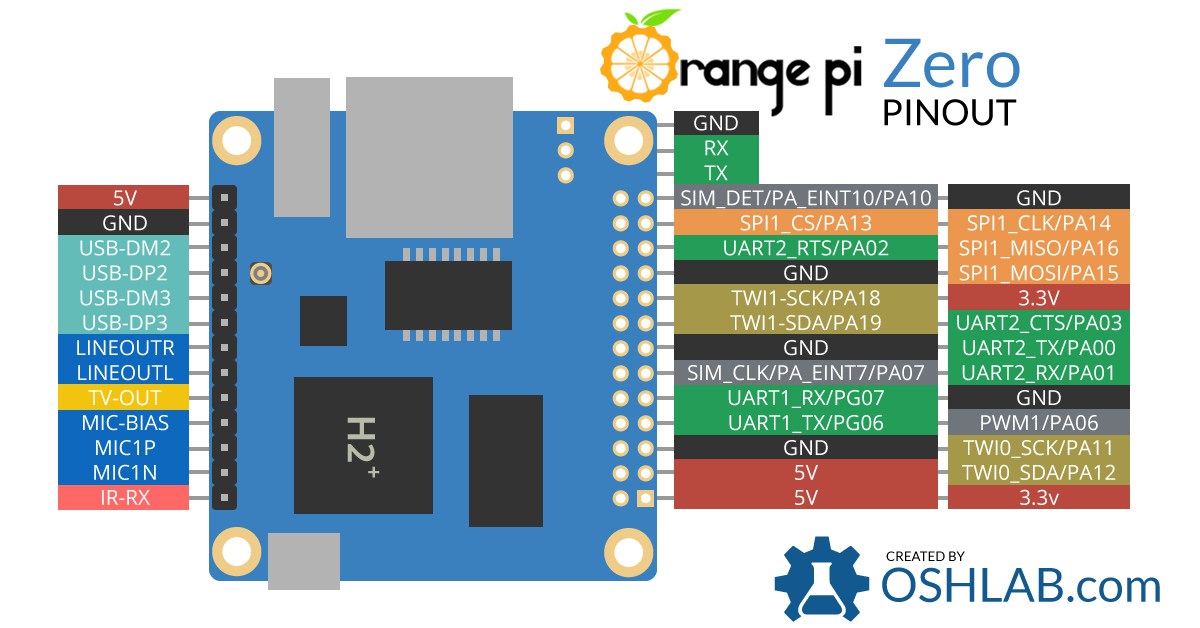
La tarjeta de desarrollo Orange Pi Zero viene equipada con un procesador Cortex A7 Allwinner H2+ quad core, con 256 o 512MB RAM, Ethernet, y puertos USB. Disponible en Aliexpress (tienda oficial) por 6.99 dolares, mas 3.39 dolares como gastos de envío.

## Especificaciones

* SoC – Allwinner H2(+) quad core Cortex A7 processor @ 1.2 GHz with Mali-400MP2 GPU @ 600 MHz
* System Memory – 256 to 512 MB DDR3-1866 SDRAM
* Storage – micro SD card slot
* Connectivity – 10/100M Ethernet + 802.11 b/g/n WiFi (Allwinner XR819 WiFi module) with u.FL antenna connector and external antenna
* USB – 1x USB 2.0 host ports, 1x micro USB OTG port
* Expansion headers – Unpopulated 26-pin “Raspberry Pi B+” header + 13-pin header with headphone, 2x USB 2.0, TV out, microphone and IR receiver signals
* Debugging – Unpopulated 3-pin header for serial console
* Misc – 2x LEDs
* Power Supply – 5V via micro USB port or optional PoE
* Dimensions – 52 x 46 mm
* Weight – 26 grams

## Esquema de pines

Un excelente esquema de pines puede conseguirse en [OSHLab](https://oshlab.com/orange-pi-zero-pinout/)



Pineado Orange Pi

El mapeado de los pines de la Orange (de los micros Allwinner en realidad) en el kernel de Linux viene dado por la formula:

(Position of letter in alphabet - 1) \* 32 + Pin number

Para todos los pines PA de nuestra Orange Pi Zero, el número del kernel coincide con el del pin. Pero para los pines *PG06* y *PG07* se corresponden con los códigos *198* y *199*.

## Esquemas eléctricos

Pueden bajarse de [aquí](http://harald.studiokubota.com/wordpress/wp-content/uploads/2016/11/Orange-Pi-Zero-Schanetics-v1_11.pdf)

# Accediendo al hardware desde linea de comandos

La memoria es más que suficiente para correr programas. El Armbian consume únicamente 40Mb en funcionamiento.

root@orangepizero:~# free  
 total used free shared buffers cached  
Mem: 247068 122300 124768 4620 7908 69548  
-/+ buffers/cache: 44844 202224  
Swap: 131068 0 131068

Vamos a hacer algunas pruebas con el hardware. En Armbian, como todo Unix que se precie, todo es un fichero.

En el directorio /sys/class encontraremos cosas interesantes:

root@orangepizero:~# ls /sys/class  
backlight cuse graphics i2c-dev mdio\_bus power\_supply script spidev thermal video4linux  
bdi devfreq hdmi ieee80211 mem ppp scsi\_device spi\_master tty vtconsole  
block disp hidraw input misc rc scsi\_disk sunxi\_cma\_test udc  
bsg dma hwmon leds mmc\_host rfkill scsi\_host sunxi\_dump usb\_device  
cedar\_dev gpio i2c-adapter lirc net rtc sound sunxi\_info vc

## LEDs

Si miramos dentro del directorio leds veremos que hay un directorio que representa cada uno de los leds de la placa:

root@orangepizero:~# cd /sys/class/leds/  
root@orangepizero:/sys/class/leds# ls  
green\_led red\_led

Podemos ver, por ejemplo, a que evento está asociado cada led ejecutando cat green\_led/trigger (tiene el valor default\_on) o cat red\_led/trigger (tiene el valor none).

root@orangepizero:/sys/class/leds# cat green\_led/trigger   
none mmc0 mmc1 timer heartbeat backlight [default-on] rfkill0 phy1rx phy1tx phy1assoc phy1radio   
root@orangepizero:/sys/class/leds# cat red\_led/trigger   
[none] mmc0 mmc1 timer heartbeat backlight default-on rfkill0 phy1rx phy1tx phy1assoc phy1radio

O podemos encender el led rojo ejecutando echo 1 > red\_led/brightness, y para apagarlo ya os podéis imaginar que es echo 0 > red\_led/brightness.

## GPIO

Podemos ver los GPIO disponibles ejecutando:

root@orangepizero:~# cat /sys/kernel/debug/gpio  
GPIOs 0-383, platform/sunxi-pinctrl, sunxi-pinctrl:  
 gpio-10 (? ) out hi  
 gpio-17 (red\_led ) out lo  
 gpio-202 (xradio\_irq ) in lo  
 gpio-354 (? ) out hi  
 gpio-362 (green\_led ) out hi

Podemos activar un nuevo puerto GPIO, digamos el 15:

root@orangepizero:~# echo 15 >/sys/class/gpio/export

Ahora veremos el puerto activo:

root@orangepizero:~# cat /sys/kernel/debug/gpio   
GPIOs 0-383, platform/sunxi-pinctrl, sunxi-pinctrl:  
 gpio-10 (? ) out hi  
 gpio-15 (sysfs ) in lo  
 gpio-17 (red\_led ) out lo  
 gpio-202 (xradio\_irq ) in lo  
 gpio-354 (? ) out hi  
 gpio-362 (green\_led ) out hi

En el directorio /sys/class/gpio/gpio15/ tendremos los interfaces usuales para puertos gpio definidos en el kernel de linux.

# Bibliotecas útiles

## Python

### Instalación de virtualenv

Para probar bibliotecas de Python instalamos:

sudo aptitude install python-pip  
sudo aptitude install python-virtualenv  
sudo aptitude install python-dev

El caso es que el *virtualenv* no me funciona después de ejecutar estos pasos. Finalmente he tenido que ejecutar, como *root*, los siguientes comandos:

pip install --upgrade pip  
pip install --upgrade virtualenv

Despues de eso ya he podido usar *virtualenv* sin problemas.

### orangepi\_PC\_gpio\_pyH3

Tenemos dos repos disponibles:

El repositorio original con las librerías *gpio* para H3:

git clone https://github.com/duxingkei33/orangepi\_PC\_gpio\_pyH3

Y un fork del repositorio original **ya adaptado** a la Orange Pi Zero (que es el que usaremos):

git clone https://github.com/nvl1109/orangepi\_PC\_gpio\_pyH3

**IMPORTANTE:** Si usamos el repositorio original tenemos que revisar el fichero orangepi\_PC\_gpio\_pyH3/pyA20/gpio/mapping.h

Por ejemplo: la definicion de *STATUS\_LED* debe quedar en el *GPA17* en lugar de *GPA15*:

{ "STATUS\_LED", SUNXI\_GPA(17), 2 },

Nos clonamos el repo. Vamos a hacer todas las pruebas desde la cuenta de **root**.

Creamos un entorno para pruebas y lo activamos:

virtualenv test\_pyH3\_zero  
source test\_pyH3\_zero/bin/activate

Compilamos la biblioteca:

cd orangepi\_PC\_gpio\_pyH3  
python setup.py install

Y ya podemos probar los ficheros de ejemplo:

examples/blink\_led.py  
examples/blink\_POWER\_STATUS\_PL10.py

El resto de ejemplos no van a funcionar, están escritos para la *A20-OLinuXino-MICRO*

## Acceso desde C

### pyA20

La biblioteca de Python *orangepi\_PC\_gpio\_pyH3*, en realidad se basa en bibliotecas escritas en C que tenemos disponibles dentro del repo en el directorio *pyA20*

cd pyA20  
ls  
gpio/ i2c/ \_\_init\_\_.py spi/ utilities/

Nos interesa probar las bibliotecas en los directorios *gpio* e *i2c*, al menos de momento. Serían *gpio\_lib* e *i2c\_lib* respectivamente.

Probamos el acceso al *gpio* desde C con un programa sencillo que nos haga encender y apagar el led de la OPI.

#include <gpio\_lib.h>  
sunxi\_gpio\_init();  
sunxi\_gpio\_set\_cfgpin(SUNXI\_GPA(17), SUNXI\_GPIO\_OUTPUT);  
while(1) {  
 sunxi\_gpio\_output(SUNXI\_GPA(17), 1);  
 sleep(1);  
 sunxi\_gpio\_output(SUNXI\_GPA(17), 0);  
 sleep(1);  
}

### WiringOP-Zero

Esta biblioteca imita a la *WiringPI* que se usa con *Raspberry Pi*.

Tenemos un fork que viene preparado para la Orange Pi Zero disponible aquí:

https://github.com/xpertsavenue/WiringOP-Zero

GPIO funciona completamente y al parecer aun no han testeado el i2c (tiene mala pinta)

Para compilarla seguimos las instrucciones:

git clone https://github.com/xpertsavenue/WiringOP-Zero  
cd WiringOP-Zero  
chmod +x ./build  
sudo ./build

Podemos comprobar que todo se ha instalado correctamente:

gpio readall  
 +-----+-----+----------+------+--Orange Pi Zero--+---+------+---------+-----+--+  
 | H2+ | wPi | Name | Mode | V | Physical | V | Mode | Name | wPi | H2+ |  
 +-----+-----+----------+------+---+----++----+---+------+----------+-----+-----+  
 | | | 3.3v | | | 1 || 2 | | | 5v | | |  
 | 12 | 8 | SDA.0 | ALT5 | 0 | 3 || 4 | | | 5V | | |  
 | 11 | 9 | SCL.0 | ALT5 | 0 | 5 || 6 | | | 0v | | |  
 | 6 | 7 | GPIO.7 | ALT3 | 0 | 7 || 8 | 1 | OUT | TxD3 | 15 | 198 |  
 | | | 0v | | | 9 || 10 | 0 | ALT5 | RxD3 | 16 | 199 |  
 | 1 | 0 | RxD2 | ALT5 | 0 | 11 || 12 | 0 | ALT3 | GPIO.1 | 1 | 7 |  
 | 0 | 2 | TxD2 | ALT5 | 0 | 13 || 14 | | | 0v | | |  
 | 3 | 3 | CTS2 | ALT3 | 0 | 15 || 16 | 0 | ALT4 | GPIO.4 | 4 | 19 |  
 | | | 3.3v | | | 17 || 18 | 0 | ALT4 | GPIO.5 | 5 | 18 |  
 | 15 | 12 | MOSI | ALT5 | 0 | 19 || 20 | | | 0v | | |  
 | 16 | 13 | MISO | ALT5 | 0 | 21 || 22 | 0 | ALT3 | RTS2 | 6 | 2 |  
 | 14 | 14 | SCLK | ALT5 | 0 | 23 || 24 | 0 | ALT5 | CE0 | 10 | 13 |  
 | | | 0v | | | 25 || 26 | 0 | ALT3 | GPIO.11 | 11 | 10 |  
 +-----+-----+----------+------+---+---LEDs---+---+------+----------+-----+-----+  
 | 17 | 30 | STAT-LED | OUT | 1 | 27 || 28 | | | PWR-LED | | |  
 +-----+-----+----------+------+---+-----+----+---+------+----------+-----+-----+  
 | H2+ | wPi | Name | Mode | V | Physical | V | Mode | Name | wPi | H2+ |  
 +-----+-----+----------+------+--Orange Pi Zero--+---+------+---------+-----+--+

Instalamos las i2c-tools aptitude install i2c-tools, después de eso ya funciona el comando gpio i2cd.

### WiringPI-Python-OP

Una receta para compilar WiringPI-Python-OP

Edited by nopnop2002 at 2017-3-18 22:51

diyer replied at 2017-3-6 06:03 can someone explain how to map wiringPO on zero plaese?

You can update WiringPi-Python-OP to WiringPi-Python-OP-ZERO.

1.Download [WiringOP libary for the Orange Pi Zero] from here.

https://github.com/xpertsavenue/WiringOP-Zero

2.Download [WiringPi-Python-OP](#wiringpi-python-op) from here.(But not Install)

https://github.com/lanefu/WiringPi-Python-OP

3.Replace base library

cd WiringPi-Python-OP rm -R WiringPi cp -R $HOME/WiringOP-Zero ./ mv WiringOP-Zero WiringPi

4.Build WiringPi-Python-OP-ZERO library

sudo apt-get install python-dev python-setuptools swig swig2.0 -python wiringpi.i sudo python setup.py install cd tests sudo python test.py

WiringPi-Python-OP-ZERO have there pin. PysPin PinInLib 1(3.3V) 2(5V) 3 8 4(5V) 5 9 6(GND) 7 7 8 15 9(GND) 10 16 11 0 12 1 13 2 14(GND) 15 3 16 4 17(3.3V) 18 5 19 12 20(GND) 21 13 22 6 23 14 24 10 25(GND) 26 11

This is same as RPI TYPE A or B

## Referencias

* [Probando la Orange Pi Zero](http://harald.studiokubota.com/wordpress/index.php/2016/11/19/orange-pi-zero-neat/)
* [GPIO from commandline](http://falsinsoft.blogspot.com.es/2012/11/access-gpio-from-linux-user-space.html)
* [mas de lo mismo](http://www.emcraft.com/stm32f429discovery/controlling-gpio-from-linux-user-space)
* [hilo GPIO en foro](https://forum.armbian.com/index.php/topic/3084-orange-pi-zero-python-gpio-library/)
* [WiringPi\_OrangePi explicación lanefu](https://gist.github.com/lanefu/f16a67195c9fa35c466c6b50cdaeadea)
* [El repo donde pretende unificar WiringPI](https://github.com/lanefu/WiringOtherPi)
* [Otro Repo mas](https://github.com/lanefu/WiringPi-Python-OP)
* [Otro mas, este tio no para](https://gist.github.com/lanefu/f16a67195c9fa35c466c6b50cdaeadea)
* [Hilo en el foro hablando de unificiación de bibliotecas](https://forum.armbian.com/index.php/topic/2956-559-gpio-support-for-h2h3-boards-with-a-unified-wiringpi-library-in-a-neat-little-package/#entry20311)
* [Otro hilo](https://forum.armbian.com/index.php/topic/3084-orange-pi-zero-python-gpio-library/?hl=%2Bzero+%2Bgpio+%2Blibrary)
* [Otro hilo más con I2C SPI](https://forum.armbian.com/index.php/topic/3084-orange-pi-zero-python-gpio-library/)

# Distribuciones disponibles para Orange Pi Zero

## Armbian oficial

En la página oficial de [Armbian](https://www.armbian.com/orange-pi-zero/) tenemos dos opciones:

### Ubuntu Server (legacy kernel)

Es la versión estable

### Ubuntu Server (mainline kernel)

Es la versión de desarrollo.

## Orange Pi oficial

Tiene [varias distribuciones](http://www.orangepi.org/downloadresources/), parece que no esta puesta al dia o bien las fechas no son consistentes.

## Diet Pi

En [esta página](http://dietpi.com/) parece que hay una versión ultraligera.

# Monitorizar temperatura

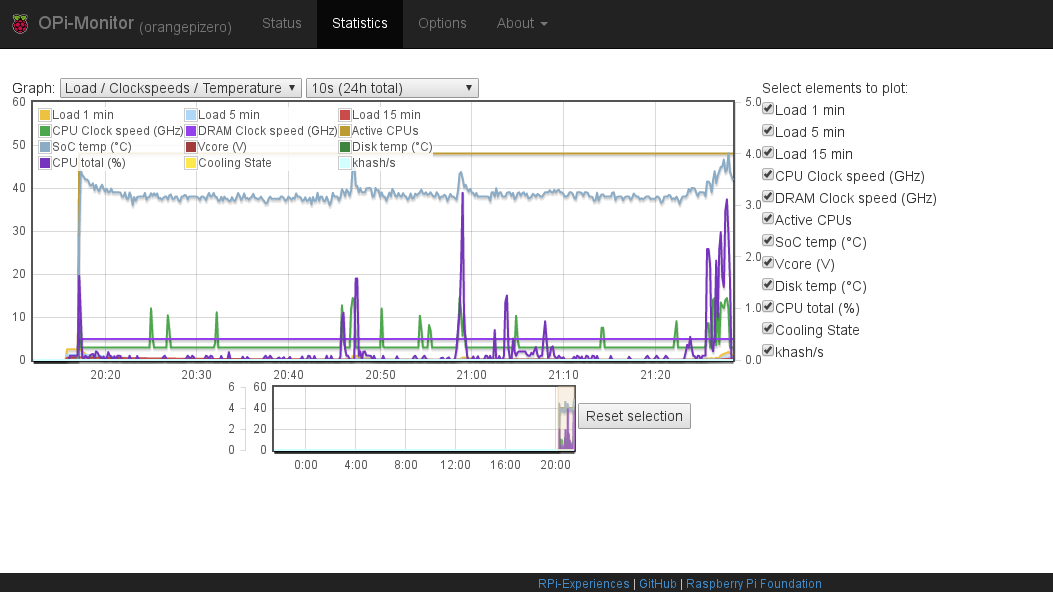
Podemos ver estadísticas de nuestra OPI con:

sudo armbianmonitor -m  
  
Stop monitoring using [ctrl]-[c]  
Time CPU load %cpu %sys %usr %nice %io %irq CPU  
21:04:18: 1152MHz 0.08 0% 0% 0% 0% 0% 0% 40°C  
21:04:23: 240MHz 0.07 0% 0% 0% 0% 0% 0% 39°C  
21:04:28: 240MHz 0.15 6% 1% 0% 0% 4% 0% 40°C  
21:04:33: 240MHz 0.12 6% 1% 0% 0% 4% 0% 38°C  
21:04:38: 240MHz 0.11 2% 1% 0% 0% 0% 0% 39°C  
21:04:43: 240MHz 0.11 1% 0% 0% 0% 0% 0% 39°C  
21:04:49: 240MHz 0.10 1% 0% 0% 0% 0% 0% 38°C  
21:04:54: 240MHz 0.09 1% 0% 0% 0% 0% 0% 39°C  
21:04:59: 240MHz 0.08 2% 1% 0% 0% 0% 0% 38°C  
21:05:04: 240MHz 0.08 2% 1% 0% 0% 0% 0% 38°C  
21:05:10: 240MHz 0.07 2% 1% 0% 0% 0% 0% 40°C  
21:05:15: 240MHz 0.06 2% 1% 0% 0% 0% 0% 37°C  
21:05:20: 240MHz 0.06 2% 1% 0% 0% 0% 0% 39°C  
21:05:25: 240MHz 0.05 2% 1% 0% 0% 0% 0% 37°C  
21:05:30: 240MHz 0.05 2% 1% 0% 0% 0% 0% 39°C

También podemos instalar RPi-Monitor con el comando:

sudo armbianmonitor -r

Una vez instalado podemos visitar desde nuestro navegador la dirección ip de nuestra OPI Zero *http://opi-adress:8888* para ver las estadísticas.



Estadísticas en RPi-Monitor

¡Ojo! Las gráficas no se refrescan automáticamente hay que recargar la página.

Para desinstalar el RPi-Monitor basta con:

sudo aptitude uninstall rpimonitor

# Referencias

* [Página oficial](http://www.orangepi.org/)
* [Recursos oficiales](http://www.orangepi.org/downloadresources/) aquí hay imágenes y los esquemáticos
* [Tienda en Aliexpress](https://www.aliexpress.com/store/1553371?spm=2114.8147860.0.0.F1q43C)
* <http://linux-sunxi.org/Bootable_SD_card>
* <https://www.armbian.com/orange-pi-zero/>
* <https://docs.armbian.com/User-Guide_Getting-Started/>
* <https://docs.armbian.com/Hardware_Allwinner/>
* [GPIO](https://linux-sunxi.org/GPIO) Una explicación de como acceder al gpio desde terminal
* [Info variada](https://linux-sunxi.org/Orange_Pi_Zero) Aquí tenemos el esquema de pines
* [GPIO desde el espacio de usuario](https://forum.armbian.com/index.php/topic/1886-gpio-access-from-user-space/)
* [sunxi-gpio](https://forum.armbian.com/index.php/topic/1471-solved-difficulty-accessing-gpio-via-the-sunxi-gpio-export-interface/)
* [orange pi español](http://orangepiweb.es/index.php)
* [ArchLinux ARM on Orange Pi](https://www.amedeobaragiola.me/blog/2016/06/04/archlinux-arm-on-orange-pi-one/)
* [Lakka Nightly Builds](http://mirror.lakka.tv/nightly/) Lakka is the official Linux distribution of RetroArch and the libretro ecosystem. Each game system is implemented as a libretro core, while the frontend RetroArch takes care of inputs and display. This clear separation ensures modularity and centralized configuration. Also nightly build for H3 is supported

# META

Este documento está escrito en [Markdown-Pandoc](http://pandoc.org/README.html). Pandoc es un sistema muy sencillo de documentación que permite generar múltiples formatos de salida.

Las fuentes del documento están en el directorio **doc/src** dentro del árbol de directorios del proyecto.

Los formatos de salida son el fichero **README.md** en formato *Markdown-Github* y los documentos que puedes encontrar en el directorio **doc/out** incluyendo un fichero en formato *pdf*.

Los documentos en los distintos formatos de salida se generan automáticamente sin mas que ejecutar:

$ cd doc  
$ make

Otras opciones que soporta el **makefile** serían:

reset

para regenerar todos los documentos de salida.

clean

para borrar todos los fichero de salida

pdf, latex, mediawiki, epub, odt, docx

genera el fichero de salida en el formato especificado: pdf, latex, etc. etc.

Ejemplos:

$ make reset  
$ make odt

## Requisitos

Necesitas tener instalaco **Pandoc**, hay [una pequeña introducción](https://github.com/brico-labs/pandoc_basico) en el el github de BricoLabs.

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