

Experimentações da Internet das Coisas

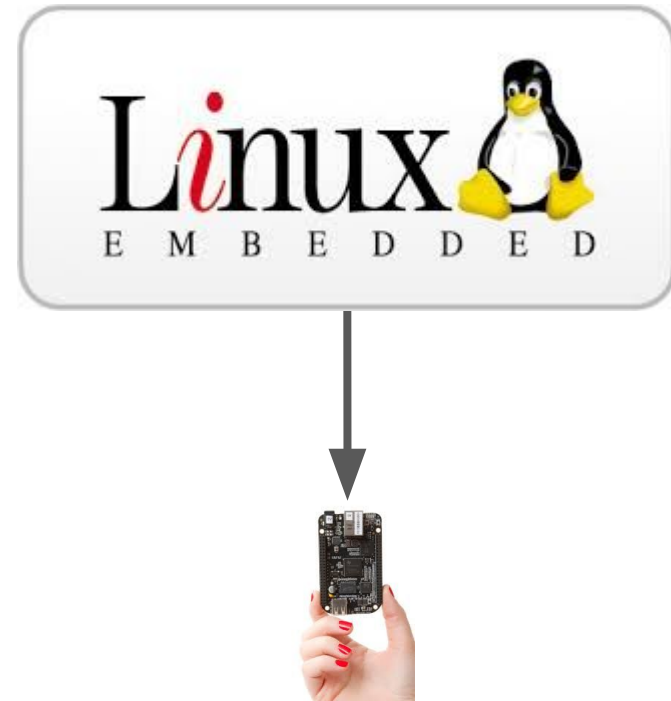
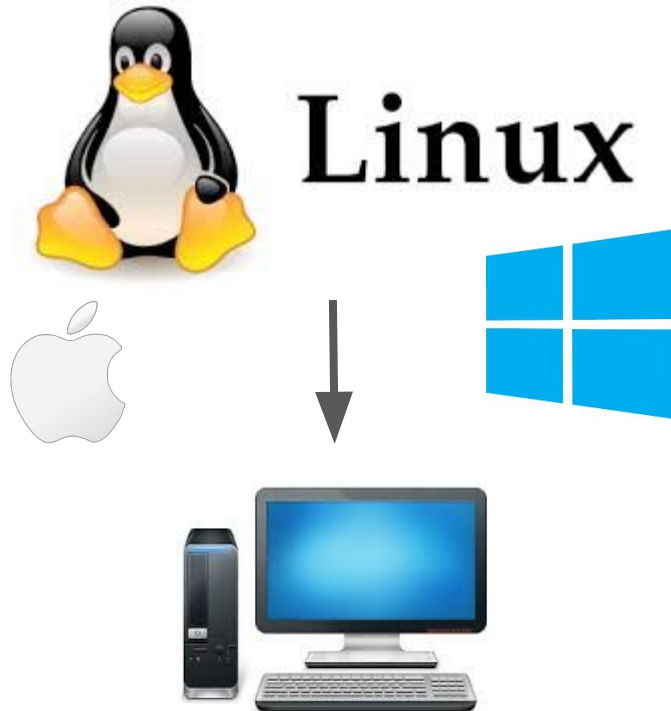
#02 - Ambiente de Desenvolvimento

BeagleBone Black (BBB)

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Agosto, 2017



Sistemas e Arquiteturas Alvo (Motivação)



Principais comandos

<http://beagleboard.org/support/bone101>

- *pwd* - show current directory
- *cd* - change current directory
- *ls* - list directory contents
- *chmod* - change file permissions
- *chown* - change file ownership
- *cp* - copy files
- *mv* - move files
- *rm* - remove files
- *mkdir* - make directory
- *rmdir* - remove directory
- *cat* - dump file contents
- *less* - progressively dump file
- *vi* - edit file (complex)
- *nano* - edit file (simple)
- *head* - trim dump to top
- *tail* - trim dump to bottom

- *echo* - print/dump value
- *env* - dump environment variables
- *export* - set environment variable
- *history* - dump command history
- *grep* - search dump for strings
- *man* - get help on command
- *apropos* - show list of man pages
- *find* - search for files
- *tar* - create/extract file archives
- *gzip* - compress a file
- *gunzip* - decompress a file
- *du* - show disk usage
- *df* - show disk free space
- *mount* - mount disks
- *tee* - write dump to file in parallel
- *hexdump* - readable binary dumps

Por que a BeagleBoneBlack (BBB)?

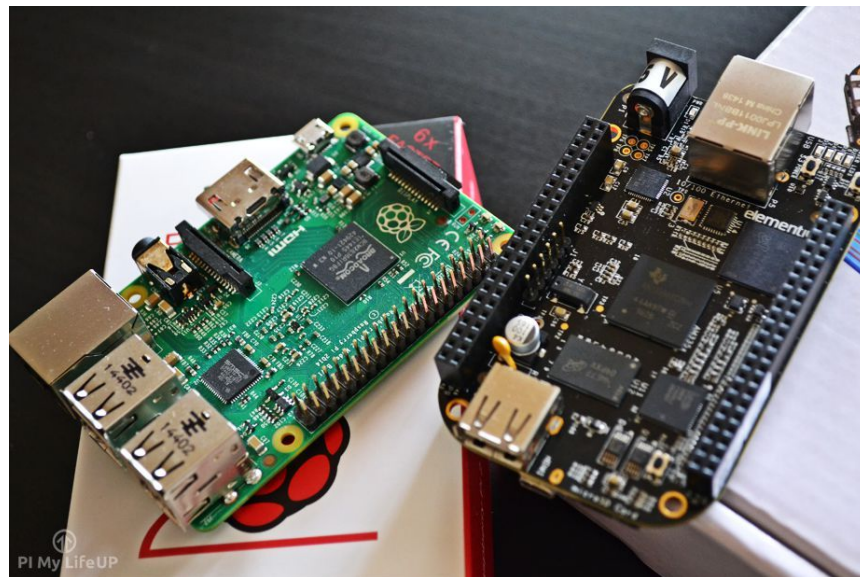
Gráficos, video?
RasPi
Conectar coisas?
BBB

Pros:

- Video
- RAM
- Periféricos

Cons:

- GPIO 26/40
- Power (uUSB)



Pros:

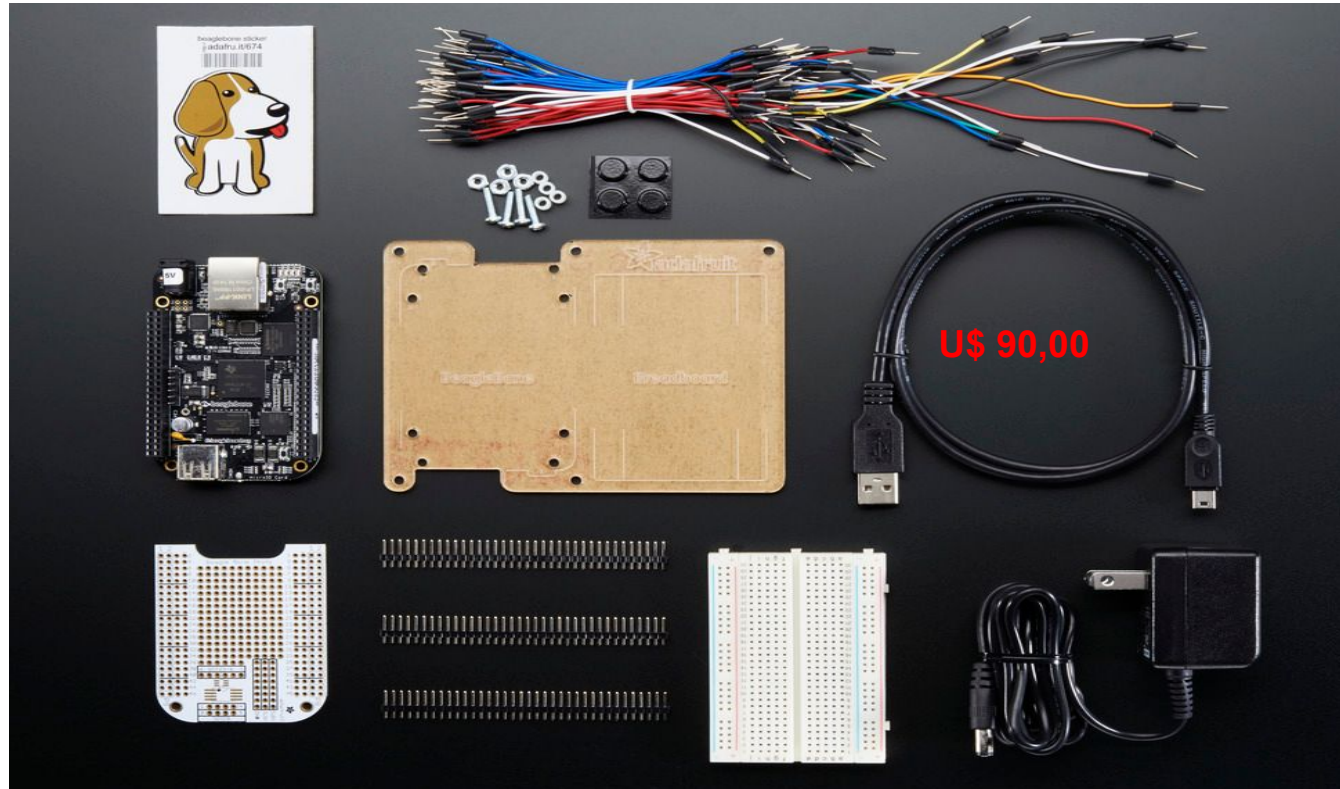
- GPIO 65/92
- Power (uUSB, 5VDC)

Cons:

- Video
- RAM

Kit de desenvolvimento

www.tiny.cc/ebb101



<https://www.adafruit.com/products/703>



Placas de Desenvolvimento, Beaglebone

BeagleBone Black Rev.C



REF: DRE01

Agora você já tem onde comprar sua BeagleBone Black no Brasil a um bom preço, tudo isso ainda com envio em 24h para todo Brasil!



Disponibilidade: **Em**
estoque

R\$399,90

Quantidade:

1 + -

Comprar

Adicionar aos meus
desejos





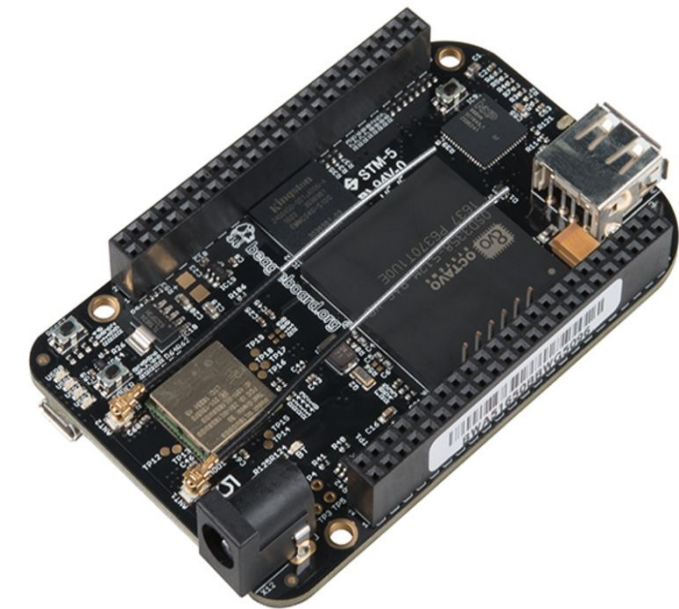
Placas de Desenvolvimento, Beaglebone

BeagleBone Black Wireless



REF: DRE04

A BeagleBone Black Wireless é uma placa de desenvolvimento baseada no processador ARM Cortex-A8, rodando na velocidade de 1GHZ com 512MB de memória RAM, indicada para utilização em sistemas embarcados, suportando aplicações que rodam em Linux (Debian e Ubuntu) e Android, além de outras versões em desenvolvimento.



Disponibilidade: **Apenas**
3 em estoque

R\$599,90

Quantidade:

1 + -

 **Comprar**

 Adicionar aos meus
desejos

Cuidados - Melhores Práticas

1. Não posicionar a BBB em superfícies metálicas
2. Desligar com o comando adequado ou usar os botões. **NUNCA PUXAR O CABO DE FORÇA OU O USB POWER.**
3. Segurar o power button por 8s para um Hard Power Down (HPD)
4. GPIO são 3.3v tolerantes
5. ADC são 1.8v tolerantes
6. Arduino tolera 40mA em cada pino enquanto que a BBB tolera em geral entre 4-6mA. O máximo é 8mA.

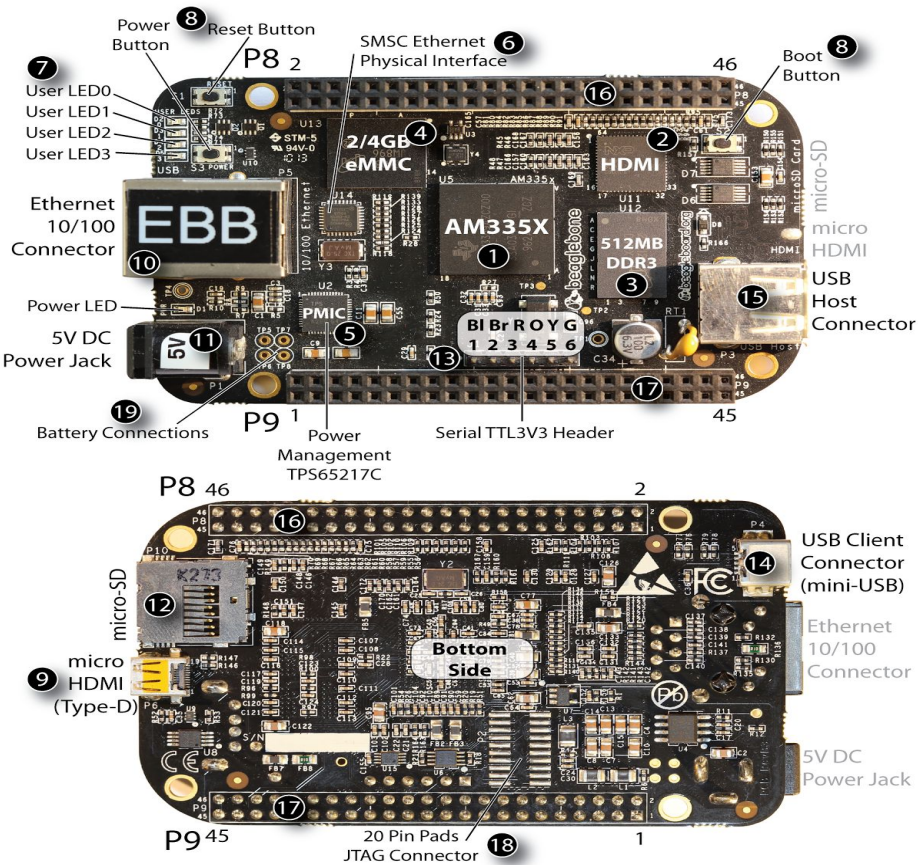
Avisos - Melhores práticas



**Use a fonte de alimentação
para conectar outros
dispositivos**

THE BEAGLEBONE BLACK

Function		Physical	Details
1	Processor	AM335x	A powerful Texas Instruments Sitara 1 GHz ARM-A8 processor that is capable of 2 billion instructions per second. Programmable Real-time Units. Microcontrollers that allow for real-time interfacing. Discussed in Chapter 13. Processor has a 3D graphics engine (SGX530), which is capable of rendering 20 million polygons per second. The framer converts the LCD interface available on the AM335x processor into a HDMI signal (no HDCP). The amount of system memory affects performance and the type of applications that can be run.
		2 x PRUs	
		Graphics Engine	
2	Graphics	HDMI Framer	The framer converts the LCD interface available on the AM335x processor into a HDMI signal (no HDCP).
3	Memory	512MB DDR3	The amount of system memory affects performance and the type of applications that can be run.
4	Storage	eMMC (MMC1)	A 2/4 GB on-board embedded multi-media card (eMMC)—an SD card on a chip. The BBB can boot without an SD card.
5	Power Management	TPS65217C	Power management IC (PMIC). Sophisticated power management IC that has 4 LDO voltage regulators for the power rails. This IC is controlled via I ² C.
6	Ethernet Processor	Ethernet PHY (10/100)	Can be immediately connected to a network (supports DHCP). The physical interface LAN8710A connects the physical RJ45 connector to the ARM microprocessor.
7	LEDs	7 x LEDs	Power LED (blue), 4 user LEDs (blue), and 2 LEDs on the RJ45 Ethernet socket (yellow = 100M link up, green = traffic).
8	Buttons	3 x Buttons	Power button for powering on/off. Reset button for resetting the board and boot switch button for choosing to boot from the eMMC or the SD card.
Connectors			
9	Video Out	micro-HDMI (HDMI-D)	For connecting to monitors and televisions. Supports resolutions up to (1280x1024 at 60 Hz). It can run 1920x1080 but only at 24 Hz. Has HDMI CEC support.
		Audio Out (HDMI-D)	See the Optional Accessories section for details on how to break this out with a regular 3.5 mm audio jack.
10	Network	Ethernet (RJ45)	10/100 Ethernet via a RJ45 connector. No on-board Wi-Fi. See the section on Optional Accessories in this chapter.
11	DC Power	5V DC Supply (5.5 mm)	For connecting 5V mains PSUs to the BBB. See the Highly Recommended Accessories section in this chapter.
12	SD Card	card slot (MMC0) (micro-SD)	3.3V micro-SD card slot. BBB can be booted from this slot, flashed from this slot, or used for additional storage when booting from the eMMC.
13	Serial Debug	6 Pin Connector (6 x 0.1")	(UART0) Used with a serial TTL3V3 cable to connect to the serial console of the BBB (this is not a JTAG connector—see the Highly Recommended Accessories section).
14	USB	1xUSB 2.0 Client (mini-USB)	(USB0) Connects to your desktop computer and can power the BBB directly and/or communicate to it.
15	USB	1xUSB 2.0 Host (USB-A)	(USB1) You can connect USB peripherals (e.g., Wi-Fi, keyboard, webcam) to the BBB with this USB connector. You can use a USB hub to add more than one USB device.
16 17	P8 and P9 Expansion Headers	Two 2x23 pin 0.1" female headers	92 pins in two headers that are multiplexed to provide access to the features in Figure 1-5. Not all functionality is available at the same time. Can be used to connect capes.
18	Other Debug	JTAG	There is space for a JTAG connector on the bottom of the board. JTAG allows you to debug your board, but requires additional hardware and software.
19	Other Power	Battery Connectors	It is possible to solder pins and use these points to connect a battery supply. Read the SRM carefully!



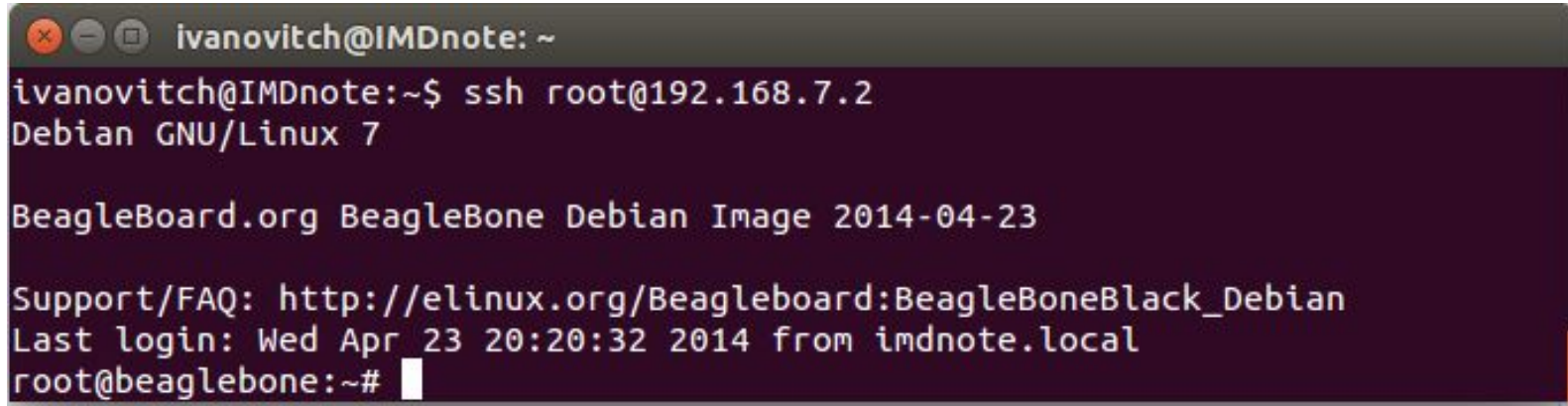
Primeiros passos - acessando a BBB

Instalação de drivers

<http://beagleboard.org/getting-started>

- Mac OS X (liberar permissão em "system preference/security&privacy")
 - <http://beagleboard.org/static/Drivers/MacOSX/RNDIS/HoRNDIS.pkg>
 - <http://beagleboard.org/static/Drivers/MacOSX/FTDI/EnergiaFTDIDrivers2.2.18.pkg>
- Ubuntu
 - Não há necessidade de instalação de drivers
- Windows
 - http://beagleboard.org/static/Drivers/Windows/BONE_D64.exe
 - <http://www.putty.org/>

Acessando a BBB via SSH

A terminal window with a dark background and light text. The window title bar shows standard Linux window controls (close, maximize, minimize) and the text 'ivanovitch@IMDnote: ~'. The terminal content shows a user typing an SSH command to connect to a BeagleBone Black at IP 192.168.7.2. The connection is successful, and the user is prompted with a password. After logging in, the user is at the root prompt of the BeagleBone Black, which is running Debian GNU/Linux 7. The terminal displays a welcome message from BeagleBoard.org, including the date of the image (2014-04-23) and a link to support/FAQ. The last login information is also shown.

```
ivanovitch@IMDnote: ~  
ivanovitch@IMDnote:~$ ssh root@192.168.7.2  
Debian GNU/Linux 7  
  
BeagleBoard.org BeagleBone Debian Image 2014-04-23  
  
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack\_Debian  
Last login: Wed Apr 23 20:20:32 2014 from imdnote.local  
root@beaglebone:~#
```


Interagindo com os LEDS

A BBB possuiu 4 LEDs (reconfiguráveis):

- USR0
 - Pisca em sequência indicando que a BBB está funcionando
- USR1
 - Pisca se o micro-SD card está ativo
- USR2
 - Pisca conforme o nível de uso da CPU
- USR3
 - Pisca se a eMMC está ativa

Interagindo com os LEDs

```
ivanovitch@IMDnote: ~  
root@beaglebone:/sys/class/leds# ls  
beaglebone:green:usr0  beaglebone:green:usr1  beaglebone:green:usr2  beaglebone:green:usr3  
root@beaglebone:/sys/class/leds#
```

```
ivanovitch@IMDnote: ~  
root@beaglebone:/sys/class/leds# cd beaglebone\green\:usr3  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# ls  
brightness device max_brightness power subsystem trigger uevent  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3#
```

Interagindo com os LEDs

```
ivanovitch@IMDnote: ~  
  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# cat trigger  
none nand-disk mmc0 [mmc1] timer oneshot heartbeat backlight gpio cpu0 default-on transi  
ent  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo none > trigger  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3#
```

```
ivanovitch@IMDnote: ~  
  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo 1 > brightness  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo 0 > brightness  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3#
```

Interagindo com os LEDs

```
ivanovitch@IMDnote: ~  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo timer > trigger  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# ls  
brightness delay_on max_brightness subsystem uevent  
delay_off device power trigger  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3#
```

```
ivanovitch@IMDnote: ~  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo 1000 > delay_on  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3# echo 1000 > delay_off  
root@beaglebone:/sys/class/leds/beaglebone:green:usr3#
```

Desligando a BBB

ivanovitch@IMDnote: ~

```
root@beaglebone:/# shutdown -h now
```

```
Broadcast message from root@beaglebone (pts/0) (Wed Apr 23 20:48:23 2014):  
The system is going down for system halt NOW!
```

```
root@beaglebone:/#
```


Instalando o Linux na BBB [*microSD Card*]

BBB tem suporte a várias distribuições:

- Angstrom
- Android
- Ubuntu
- Debian
- FreeBSD
- Nitendo
- Gentoo
- ArchLinux
- Xenomai
- Minix
-



Atualização do Sistema [Debian Jessie IoT]

Passo 1 (download da imagem)

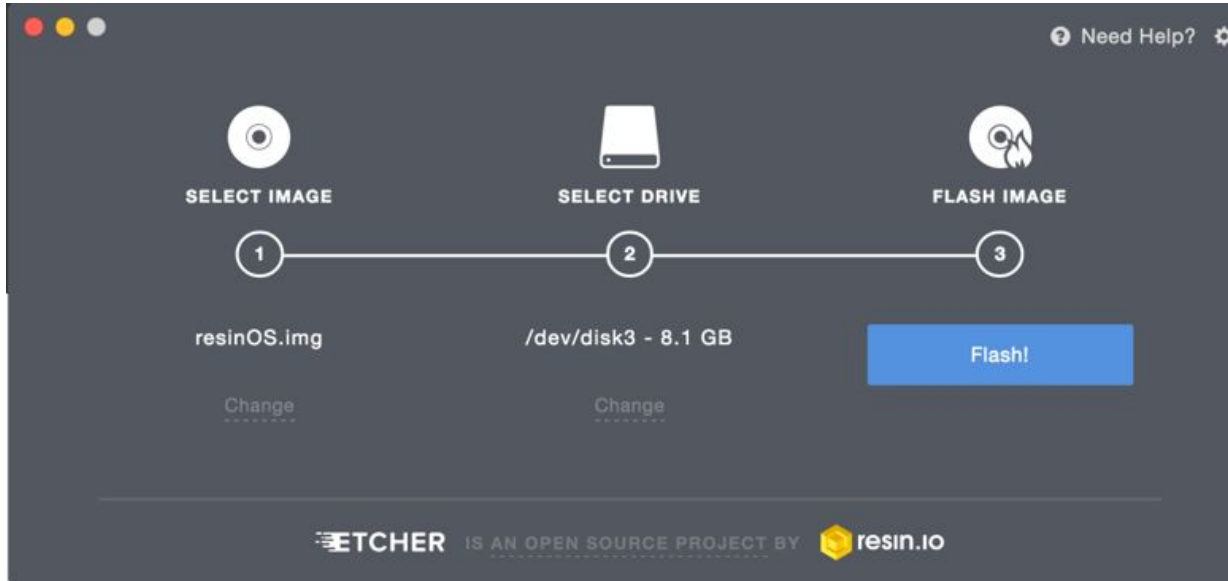
- Fazer o download da versão mais atual da imagem da distribuição (no exemplo estamos usando a distribuição Debian)
 - a. <https://beagleboard.org/latest-images>
 - b. <https://debian.beagleboard.org/images/bone-debian-8.7-iot-armhf-2017-03-19-4gb.img.xz>

Atualização do Sistema [Debian Jessie]

Passo 2 (salvar a imagem no *microSD card*)

- Abrir o Terminal
- Descompactar a imagem
 - `unxz <nomedaimagem>.img.xz`
- Instalar o aplicativo
 - <https://www.etcher.io/>

Atualização do Sistema [Debian Jessie]



8min a 10min

Acessando o sistema

Coloque o *microSD Card* na BBB

Mantenha o “user button” pressionado e ligue a BBB. Todos os LEDs serão ligados. Quando os mesmos começarem a piscar solte o “user button”

Acessando o sistema

Senha: temppwd

```
ssh debian@192.168.7.2
```

```
Debian GNU/Linux 8
```

```
BeagleBoard.org Debian Image 2017-03-19
```

```
Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack\_Debian
```

```
default username:password is [debian:temppwd]
```

```
debian@192.168.7.2's password: 
```

Configurando o Wifi

Identificando e executando os comandos necessários


```
debian@beaglebone:~$ cat /etc/network/interfaces
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
#auto eth0
#iface eth0 inet dhcp
# Example to keep MAC address between reboots
#hwaddress ether DE:AD:BE:EF:CA:FE

##connman: ethX static config
#connmanctl services
#Using the appropriate ethernet service, tell connman to setup a static IP address for that service:
#sudo connmanctl config <service> --ipv4 manual <ip_addr> <netmask> <gateway> --nameservers <dns_server>

##connman: WiFi
#
#connmanctl
#connmanctl> tether wifi off
#connmanctl> enable wifi
#connmanctl> scan wifi
#connmanctl> services
#connmanctl> agent on
#connmanctl> connect wifi_*_managed_psk
#connmanctl> quit
```



Verificando o IP

```
[debian@beaglebone:~]$ ifconfig wlan0
wlan0      Link encap:Ethernet  HWaddr 00:0f:60:04:27:3e
            inet addr:192.168.0.21  Bcast:192.168.0.255  Mask:255.255.255.0
            inet6 addr: fe80::20f:60ff:fe04:273e/64  Scope:Link
            UP BROADCAST RUNNING MULTICAST DYNAMIC MTU:1500  Metric:1
            RX packets:410 errors:0 dropped:0 overruns:0 frame:0
            TX packets:238 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:70033 (68.3 KiB)  TX bytes:39950 (39.0 KiB)
```

Desconecte o cabo usb e faça ssh através do novo IP

Atualizar o sistema

```
sudo apt-get update
```

Aquecimento

Instalando a API



<https://github.com/adafruit/adafruit-beaglebone-io-python>

```
sudo apt-get install build-essential python-dev python-pip -y  
git clone git://github.com/adafruit/adafruit-beaglebone-io-python.git  
cd adafruit-beaglebone-io-python  
sudo python setup.py install  
cd ..  
sudo rm -rf adafruit-beaglebone-io-python
```

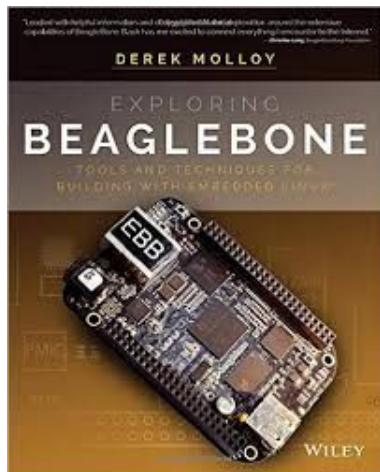
```
import Adafruit_BBIO.GPIO as GPIO
import time

for i in range(4):
    GPIO.setup("USR%d" % i, GPIO.OUT)

while True:
    for i in range(4):
        GPIO.output("USR%d" % i, GPIO.HIGH)
        time.sleep(1)
    for i in range(4):
        GPIO.output("USR%d" % i, GPIO.LOW)
        time.sleep(1)
```

\$sudo python HelloWorld.GPIO.py

Referências



<https://beagleboard.org/>

<http://exploringbeaglebone.com/chapters/>

Referências

- <http://strawsondesign.com/#!/manual-wifi>
- https://wiki.archlinux.org/index.php/Connman#Error_Failed_to_set_hostname.2Fdomainname
- <http://www.welzels.de/blog/en/arm-cross-compiling-with-mac-os-x/>
- <https://github.com/adafruit/adafruit-beaglebone-io-python>