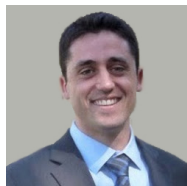


# Setup BBB and Run the QuickBot

## *Control of Mobile Robots: Hardware Lecture #4*



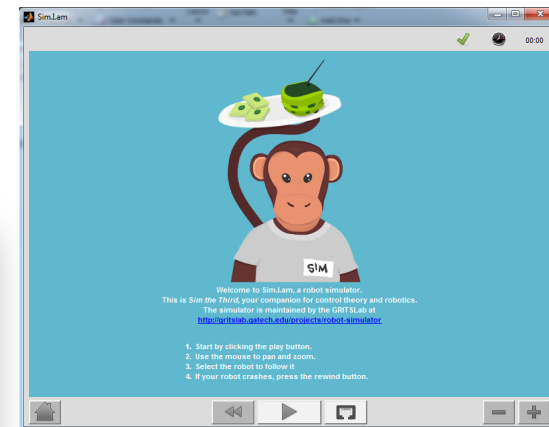
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# Overview Of Steps to Run the QuickBot

1. SSH into BBB
2. Launch QuickBot code on the BBB
3. Launch Sim.I.Am simulator in Matlab

```
rowland — ssh — 70x10
Last login: Mon Jan 27 22:30:07 on ttys001
[rowland@Bender ~]> ssh root@192.168.7.2
root@192.168.7.2's password:
[root@beaglebone ~]>
```

```
rowland — ssh — 70x10
[root@beaglebone ~]> cd quickbot_bbb/
[root@beaglebone quickbot_bbb]> ./QuickBotRun.py
Running QuickBot
Running QuickBot Program
Base IP: 192.168.7.1
Robot IP: 192.168.7.2
Setting motor PWMs to: left = 0 and right = 0
```



# SSH into BBB

- Adafruit has a great tutorial: “SSH to BeagleBone Black over USB”  
<http://learn.adafruit.com/ssh-to-beaglebone-black-over-usb/overview>

The screenshot shows a web browser displaying the Adafruit Learning System page for the tutorial "SSH to BeagleBone Black over USB". The page is titled "SSH to BeagleBone Black over USB" and is created by Simon Monk. It includes a table of contents with links to Overview, You Will Need, Preparation, Installing Drivers (Windows), Installing Drivers (Mac), Installing Drivers (Linux), Browsing Your BeagleBone, SSH with Windows and Putty, SSH on Mac and Linux, and Next Steps. There is also a link to Download PDF. The main content area shows a terminal window with the command "ssh root@192.168.1.2" and the output "root@192.168.1.2:~#". Below the terminal window is a photo of a BeagleBone Black board with a USB cable connected. To the right of the main content is a section titled "Featured in this Guide" which shows a BeagleBone Black board with a price of \$45.00 and a button to "Add all to Cart".

# Using the Linux Terminal I O I

Task	Command	Examples
Get current directory	<code>pwd</code>	<pre>&gt;&gt; pwd /home/root</pre>
Make new directory	<code>mkdir</code>	<pre>&gt;&gt; mkdir temp</pre>
List contents of directory	<code>ls</code>	<pre>&gt;&gt; ls Desktop temp</pre>
Change to a different directory	<code>cd</code>	<pre>&gt;&gt; cd .. &gt;&gt; cd /home/root/temp</pre>
Create a new file	<code>touch</code>	<pre>&gt;&gt; touch aFile</pre>
Copy a file or folder	<code>cp</code>	<pre>&gt;&gt; cp aFile aNewFile</pre>
Remove a file	<code>rm</code>	<pre>&gt;&gt; rm aNewFile</pre>
Display Manual	<code>man</code>	<pre>&gt;&gt; man ls</pre>

Google is your friend here!!!

# Connect to BBB via Ethernet

- Plug Ethernet cable into BBB and router
- Power BBB with either USB cable or 5V power supply
- SSH with:  

```
>> ssh root@beaglebone.local or ssh root@192.168.1.###
```

No password needed (just hit [enter])
- Check internet connectivity:  

```
>> ping -o www.google.com
```

  - If output says “ping: cannot resolve www.google.com: Unknown host”  
then internet is not working

Note: Windows users may be able to get internet connectivity through USB connection.

# Setup Wifi

- Execute the following commands in the terminal:

```
>> opkg update
>> ln -sf /usr/share/zoneinfo/America/New_York /etc/localtime
>> ntpdate -b -s -u pool.ntp.org
>> /usr/lib/connman/test/set-global-timeservers pool.ntp.org
>> date
```

(Confirm that the date and time are correct)

(Change to your respected time zone.  
Use TAB completion to get list of time zones)

- Plug in Wifi adapter into BBB and restart BBB

```
>> shutdown -r now
```

(Might have to open a new terminal window )

# Setup Wifi

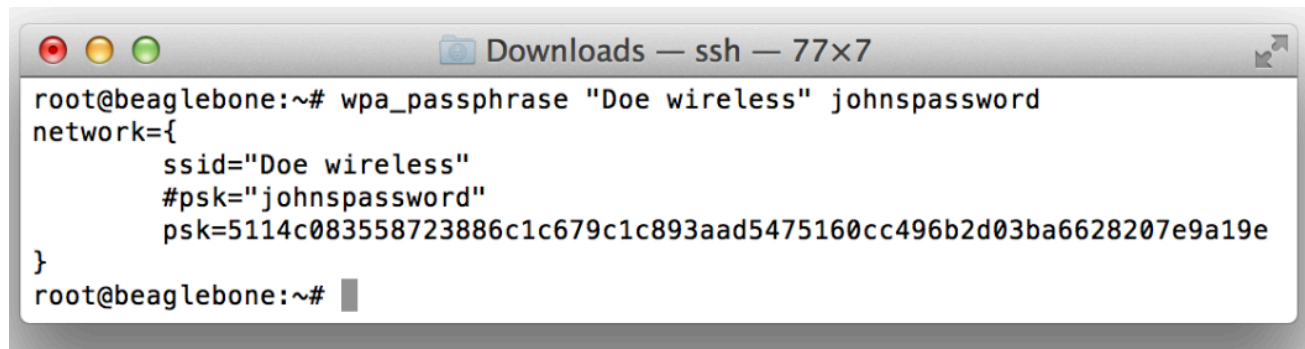
- SSH back into BBB and check that the wireless is working

```
>> ifconfig ra0
```

(If you get an error then it is not working)

- Configure network settings to connect to WPA protected network

```
>> wpa_passphrase "Your Network Name Here" 'Your password here'
```

A terminal window titled "Downloads — ssh — 77x7" showing the execution of the wpa\_passphrase command. The output displays the configuration for a WPA network named "Doe wireless" with the password "johnspassword".

```
root@beaglebone:~# wpa_passphrase "Doe wireless" johnspassword
network={
    ssid="Doe wireless"
    #psk="johnspassword"
    psk=5114c083558723886c1c679c1c893aad5475160cc496b2d03ba6628207e9a19e
}
root@beaglebone:~#
```

# Setup Wifi

- Edit the wifi configuration file

```
>> nano /var/lib/connman/wifi.config
```

- Type out the following in the editor:

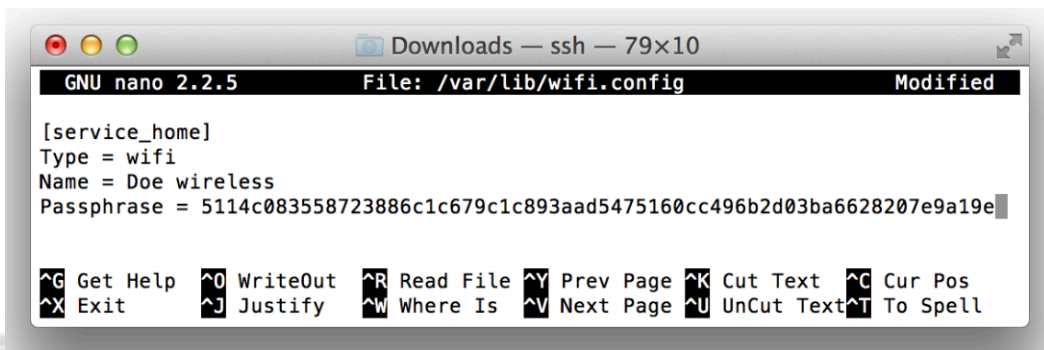
```
[service_home]
```

```
Type = wifi
```

```
Name = Network Name
```

```
Passphrase = psk_encrypted_passphrase
```

(Press Ctrl-x, y, enter to save and exit editor)



The screenshot shows a terminal window titled "Downloads — ssh — 79x10". Inside the terminal, the GNU nano 2.2.5 editor is open, editing the file /var/lib/wifi.config. The editor's status bar at the top indicates "Modified". The content of the file is as follows:

```
[service_home]
Type = wifi
Name = Doe wireless
Passphrase = 5114c083558723886c1c679c1c893aad5475160cc496b2d03ba6628207e9a19e
```

At the bottom of the editor, a list of keyboard shortcuts is displayed:

<b>^G</b> Get Help	<b>^O</b> WriteOut	<b>^R</b> Read File	<b>^Y</b> Prev Page	<b>^K</b> Cut Text	<b>^C</b> Cur Pos
<b>^X</b> Exit	<b>^J</b> Justify	<b>^W</b> Where Is	<b>^V</b> Next Page	<b>^U</b> UnCut Text	<b>^T</b> To Spell



# Setup Wifi

- Restart BBB (unplug ethernet before BBB re-boots)

```
>> shutdown -r now
```

- SSH with:

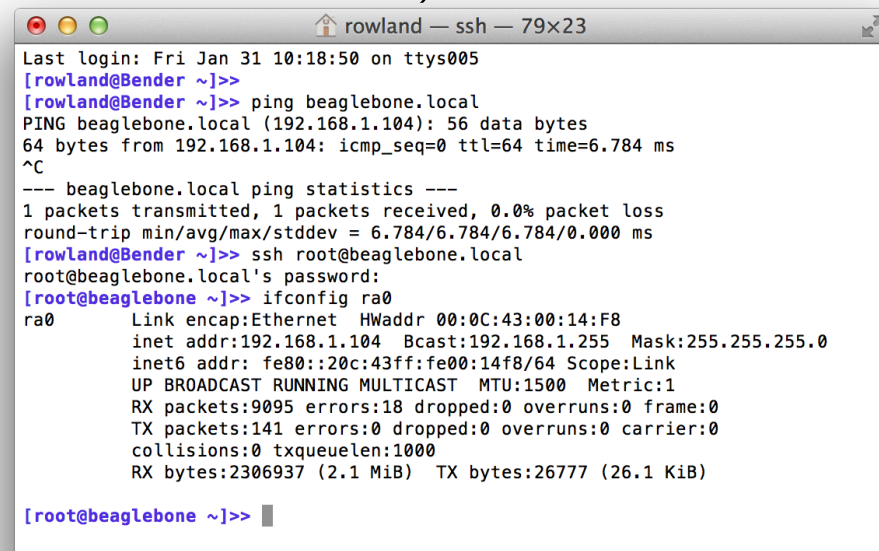
```
>> ssh root@beaglebone.local
```

- Check IP address:

```
>> ifconfig ra0
```

- Check internet connectivity:

```
>> ping -o www.google.com
```



The screenshot shows a terminal window titled 'rowland — ssh — 79x23'. The session starts with a login from 'rowland@Bender' to 'root@beaglebone.local'. The user runs 'ping beaglebone.local', which shows a successful connection with 56 data bytes and a 6.784 ms round-trip time. Then, the user runs 'ifconfig ra0', displaying the network configuration for the 'ra0' interface, including the IP address 192.168.1.104, broadcast address 192.168.1.255, and other network statistics.

```
rowland — ssh — 79x23
Last login: Fri Jan 31 10:18:50 on ttys005
[rowland@Bender ~]>>
[rowland@Bender ~]>> ping beaglebone.local
PING beaglebone.local (192.168.1.104): 56 data bytes
64 bytes from 192.168.1.104: icmp_seq=0 ttl=64 time=6.784 ms
^C
--- beaglebone.local ping statistics ---
1 packets transmitted, 1 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.784/6.784/6.784/0.000 ms
[rowland@Bender ~]>> ssh root@beaglebone.local
root@beaglebone.local's password:
[root@beaglebone ~]>> ifconfig ra0
ra0      Link encap:Ethernet HWaddr 00:0C:43:00:14:F8
         inet addr:192.168.1.104 Bcast:192.168.1.255 Mask:255.255.255.0
         inet6 addr: fe80::20c:43ff:fe00:14f8/64 Scope:Link
         UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
         RX packets:9095 errors:18 dropped:0 overruns:0 frame:0
         TX packets:141 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:2306937 (2.1 MiB) TX bytes:26777 (26.1 KiB)

[root@beaglebone ~]>>
```

# Get Python Libraries Onto BBB

- A few python libraries are needed:

```
>> opkg update
```

```
>> opkg install python-pip python-setuptools
```

```
>> pip install Adafruit_BBIO
```

# Clone QuickBot Repo

- Execute the following command to download the QuickBot code:  

```
>> git clone https://bitbucket.org/rowoflo/quickbot_bbb.git
```

Task	Command	Examples
Clone new repository	<code>git clone</code>	<pre>&gt;&gt; git clone https://.../quickbot_bbb.git</pre>
Get latest updates	<code>git pull</code>	<pre>&gt;&gt; git pull</pre>
Get status of local files	<code>git status</code>	<pre>&gt;&gt; git status</pre>
Commit changes to repo	<code>git commit</code>	<pre>&gt;&gt; git -a -m "Commit message"</pre>
Send changes to remote	<code>git push</code>	<pre>&gt;&gt; git push</pre>

<https://confluence.atlassian.com/display/STASH/Basic+Git+commands>

Google is your friend here!!!

# Get IP Addresses

- Check IP address:

```
>> ifconfig
```

Check Both Your PC's IP and BBB's IP

```
rowland — bash — 79x23
ssh      bash

[rowland@Bender ~]>> ifconfig
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    options=3<RXCSUM,TXCSUM>
    inet6 ::1 prefixlen 128
    inet 127.0.0.1 netmask 0xff000000
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x1
    nd6 options=1<PERFORMNUD>
gif0: flags=8010<POINTOPOINT,MULTICAST> mtu 1280
stf0: flags=0<> mtu 1280
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether 20:c9:d0:42:ea:6d
    inet6 fe80::22c9:d042:ea6d%en0 prefixlen 64 scopeid 0x4
    inet 192.168.1.100 netmask 0xfffff00 broadcast 192.168.1.255
    nd6 options=1<PERFORMNUD>
    media: autoselect
    status: active
en3: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=60<TS04,TS06>
    ether 32:00:13:ea:c5:00
    media: autoselect <full-duplex>
    status: inactive
en4: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=60<TS04,TS06>
```

```
rowland — ssh — 79x23

Last login: Fri Jan 31 10:18:50 on ttys005
[rowland@Bender ~]>>
[rowland@Bender ~]>> ping beaglebone.local
PING beaglebone.local (192.168.1.104): 56 data bytes
64 bytes from 192.168.1.104: icmp_seq=0 ttl=64 time=6.784 ms
^C
--- beaglebone.local ping statistics ---
1 packets transmitted, 1 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 6.784/6.784/6.784/0.000 ms
[rowland@Bender ~]>> ssh root@beaglebone.local
root@beaglebone.local's password:
[root@beaglebone ~]>> ifconfig ra0
ra0
    Link encap:Ethernet HWaddr 00:0C:43:00:14:F8
    inet addr:192.168.1.104 Bcast:192.168.1.255 Mask:255.255.255.0
    inet6 addr: fe80::20c:4300:14f8:fe00:14f8/64 Scope:Link
    UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
    RX packets:9095 errors:18 dropped:0 overruns:0 frame:0
    TX packets:141 errors:0 dropped:0 overruns:0 carrier:0
    collisions:0 txqueuelen:1000
    RX bytes:2306937 (2.1 MiB) TX bytes:26777 (26.1 KiB)

[root@beaglebone ~]>>
```

# Run QuickBot Code On BBB

- Change into QuickBot repo directory

```
>> cd ~/quickbot_bbb
```

- Check file permissions

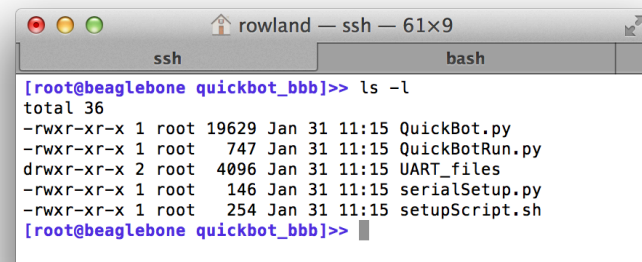
```
>> ls -l
```

- Change file permissions if necessary

```
>> chmod u+x QuickBotRun.py
```

- Run QuickBot code

```
>> ./QuickBotRun.py Your_PC_IP BBB_IP
```



A terminal window titled 'rowland - ssh - 61x9' with tabs for 'ssh' and 'bash'. The prompt is '[root@beaglebone quickbot\_bbb]>'. The command 'ls -l' has been executed, showing the following output:

```
total 36
-rwxr-xr-x 1 root 19629 Jan 31 11:15 QuickBot.py
-rwxr-xr-x 1 root 747 Jan 31 11:15 QuickBotRun.py
drwxr-xr-x 2 root 4096 Jan 31 11:15 UART_files
-rwxr-xr-x 1 root 146 Jan 31 11:15 serialSetup.py
-rwxr-xr-x 1 root 254 Jan 31 11:15 setupScript.sh
[root@beaglebone quickbot_bbb]>
```

# Start Matlab and Sim.I.Am Simulator

- Launch Matlab
- Startup Sim.I.Am
- Connect to QuickBot
- Press Play



# Shutting Down

- Close Sim.I.Am
- Ctrl-C in BBB terminal to end QuickBotRun program
- Shutdown BBB  
`>> shutdown -H now`
- Turn off QuickBot



# Demo