



DesignNews

BeagleBone Black Primer

Day 5: BeagleBone Black Wireless

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Fred Eady

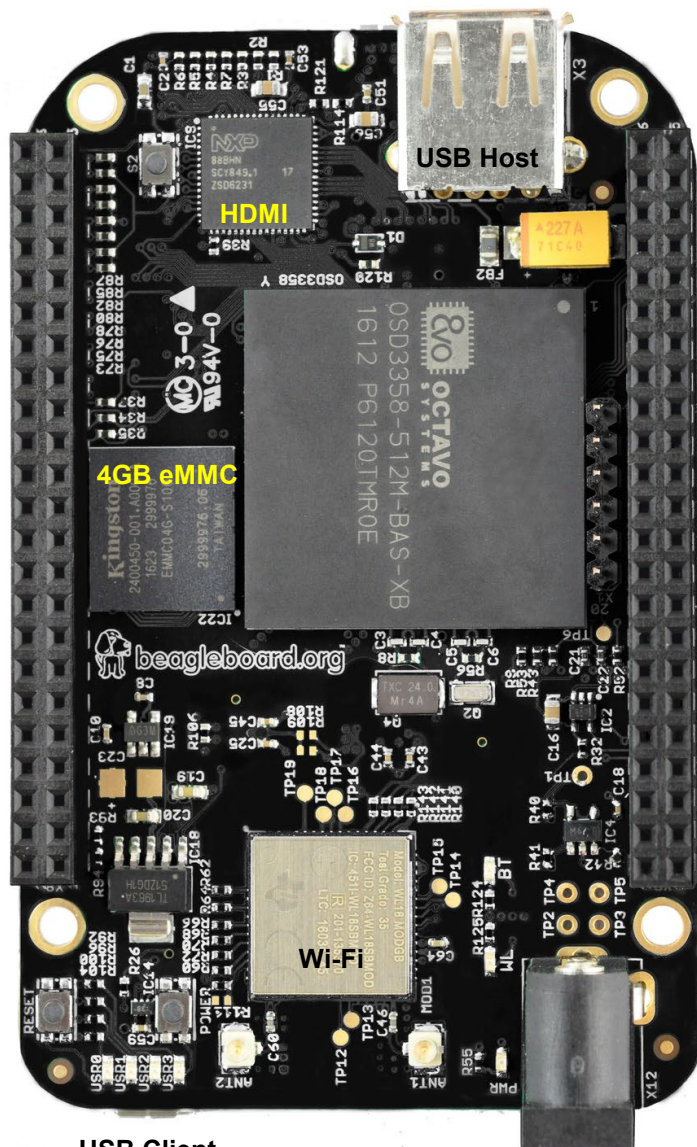
Visit 'Lecturer Profile' in your console for more details.

AGENDA

- **BeagleBone Black Wireless Physicals**
- **BeagleBone Black Wireless Networking**
- **Coding a BBBW TCP/IP Client Application**
- **Coding a BBBW TCP/IP Server Application**
- **Changing the BBBW Username and Hostname**



BeagleBone Black Wireless Physicals



USB Client

TPS65217C

Power
Management
IC

TL5209 LDO

Up to
1GB DDR3
512MBPassive
ComponentsARM Cortex-A8
Up to 1 GHz32K L1 Icache + SED
32K L1 Dcache + SED

256K L2 + ECC

176K ROM

64K RAM

Graphic
PowerVR
SGX
3D GFX

Crypto

64K
shared
RAM

Display

24-bit LCD controller

Touch screen controller

PRU-ICSS

EtherCAT, PROFINET,
EtherNet/IP and
more

L3 and L4 interconnect

System

ADC (8 channel)
12-bit SAR

WDT

JTAG

Crystal
Oscillator x2

eDMA

RTC

Timers x8

eHRPWM x3

eQEP x3
eCAP x3

Serial

UART x6

SPI x2

I²C x3

CAN x2

McASP x2
(4 channel)

USB 2.0 HS OTG + PHY x2

EMAC (2-port) 10/100/1000
IEEE 1588v2, and switch

Parallel

MMC, SD and
SDIO x3

GPIO x114

Memory Interface

NAND and NOR (16-bit ECC)

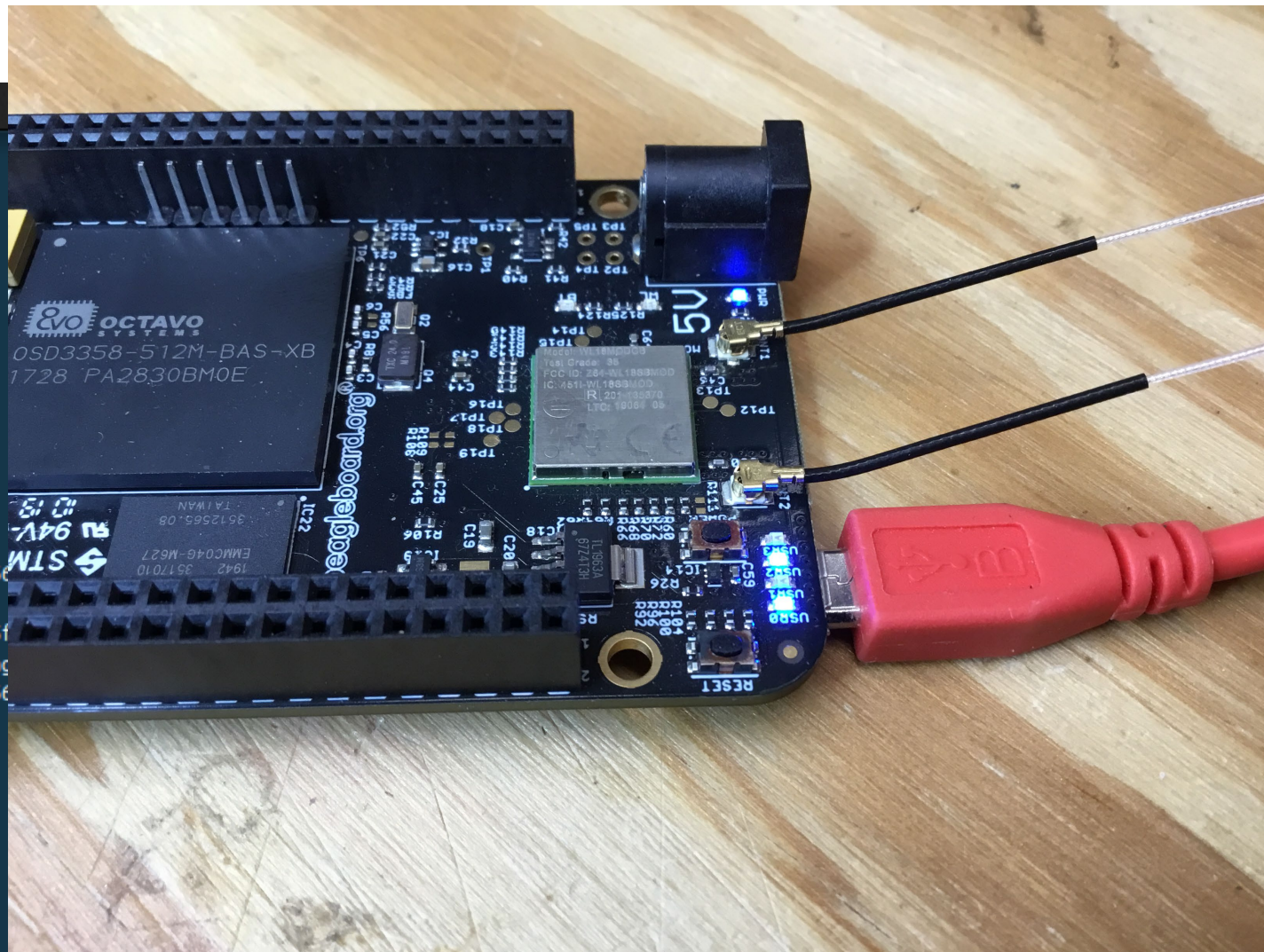
BeagleBone Black Wireless Networking Getting on the LAN

```
sudo - "debian@bea x +
debian@beaglebone:/var/lib/cloud9$ sudo connmanctl

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

#1) Respect the privacy of others.
#2) Think before you type.
#3) With great power comes great responsibility.

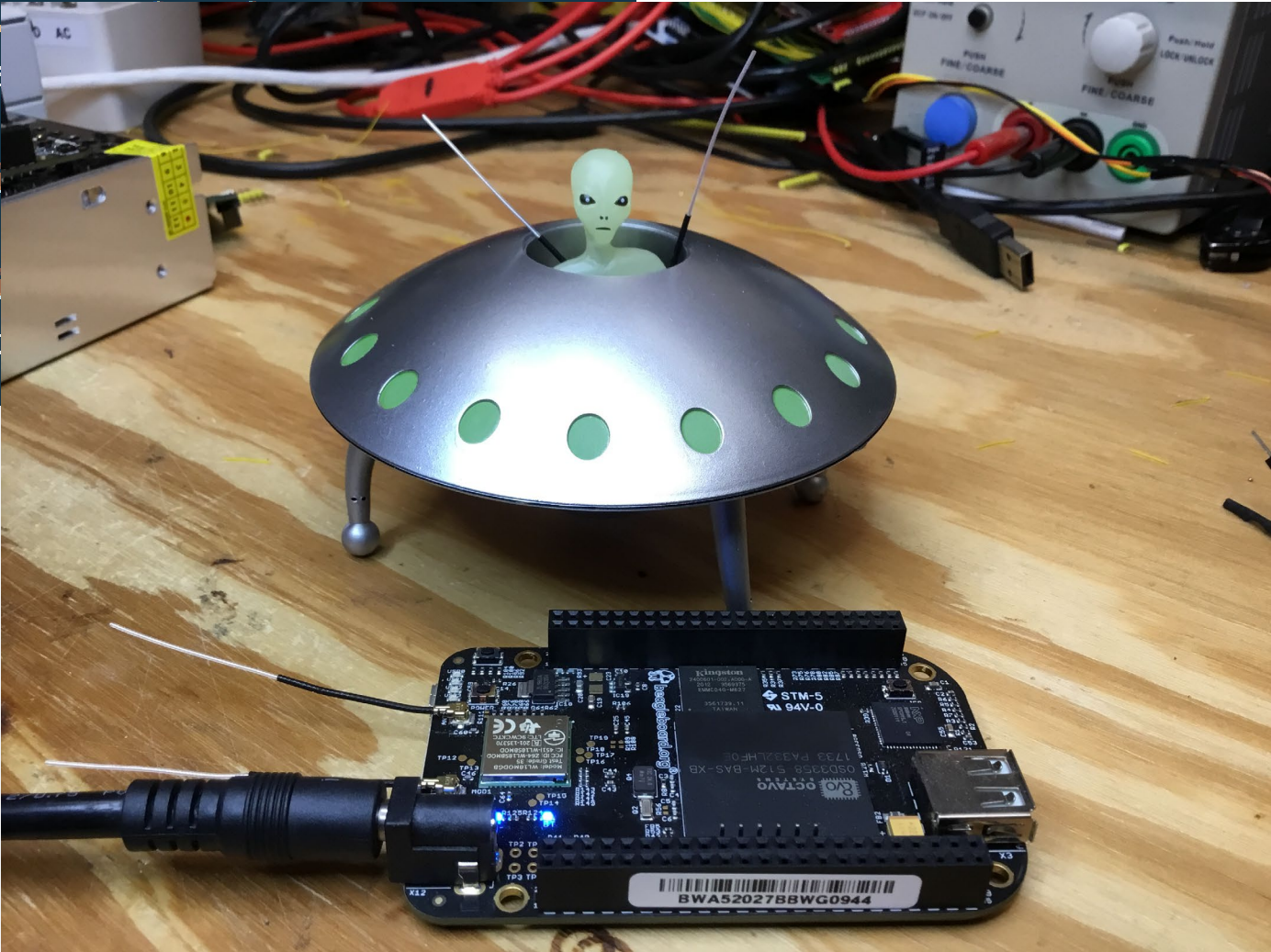
[sudo] password for debian:
connmanctl> scan wifi
Scan completed for wifi
connmanctl> services
➔ edtpnet2      wifi_2cab339dd70d_656474706e657432_managed_psk
DIRECT-6F-HP OfficeJet Pro 6970 wifi_2cab339dd70d_4449524543542d36462d4850204f666
edtpnet        wifi_2cab339dd70d_656474706e6574_managed_psk
MyCharterWiFi89-2G_2GEXT wifi_2cab339dd70d_4d79436861727465725769466938392d32475f
MyCharterWiFi89-2G      wifi_2cab339dd70d_4d79436861727465725769466938392d3247_manag
DIRECT-8A-HP OfficeJet Pro 6970 wifi_2cab339dd70d_4449524543542d38412d4850204f666
connmanctl> agent on
Agent registered
connmanctl> connect wifi_2cab339dd70d_656474706e657432_managed_psk
Agent RequestInput wifi_2cab339dd70d_656474706e657432_managed_psk
  Passphrase = [ Type=psk, Requirement=mandatory ]
Passphrase: ██████████
Connected wifi_2cab339dd70d_656474706e657432_managed_psk
connmanctl> quit
```



BeagleBone Black Wireless Networking Getting on the LAN

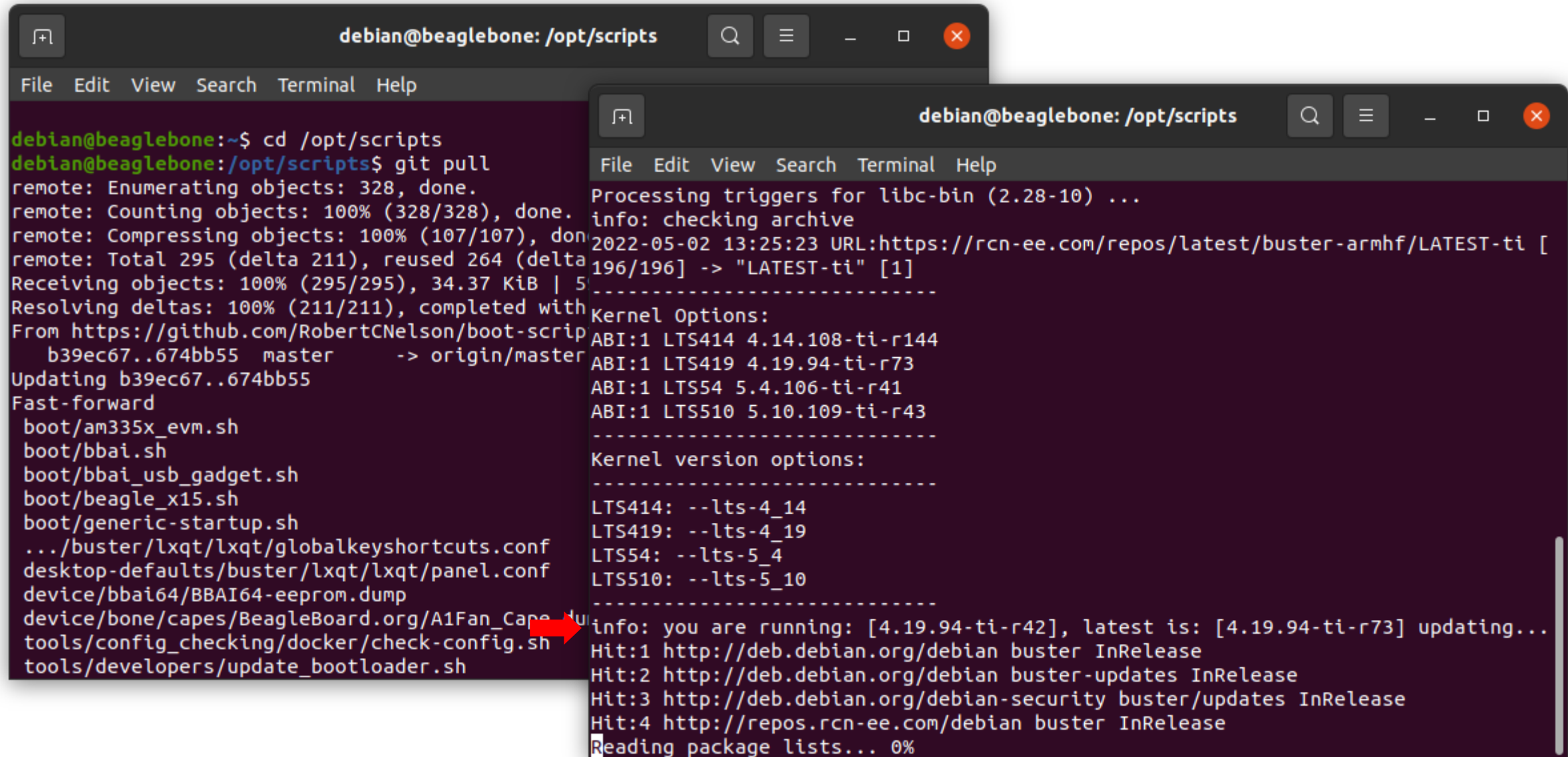
```
debian@beaglebone:/var/lib/cloud9$ ifconfig  
wlan0: flags=-28605<UP,BROADCAST,RUNNING,MULTICAST,DYNAMIC> mtu 1500  
→ inet 192.168.1.242 netmask 255.255.255.0  
inet6 fe80::2eab:33ff:fe9d:d70d prefixlen 64  
ether 2c:ab:33:9d:d7:0d txqueuelen 1000  
RX packets 493 bytes 63454 (61.9 KiB)  
RX errors 0 dropped 0 overruns 0  
TX packets 371 bytes 81669 (79.7 KiB)  
TX errors 0 dropped 0 overruns 0
```

```
File Edit View Search Terminal Help  
E: Couldn't find any package by regex 'seed-modules-4.19.94-ti-r73'  
update-initramfs: Generating /boot/initrd.img-4.19.94-ti-r73  
debian@beaglebone:/opt/scripts$ sudo shutdown -r now  
debian@beaglebone:/opt/scripts$ Connection to 192.168.1.242 closed by remote host  
t.  
Connection to 192.168.1.242 closed.  
fred@shopUbuntu885:~$ ssh debian@192.168.1.242  
ssh: connect to host 192.168.1.242 port 22: No route to host  
fred@shopUbuntu885:~$ ssh debian@192.168.1.242  
Debian GNU/Linux 10  
  
BeagleBoard.org Debian Buster IoT Image 2020-04-06  
Support: http://elinux.org/Beagleboard:BeagleBoneBlack_Debian  
  
default username:password is [debian:temppwd]  
  
debian@192.168.1.242's password:  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
```



BeagleBone Black Wireless Networking

Update the Linux Image



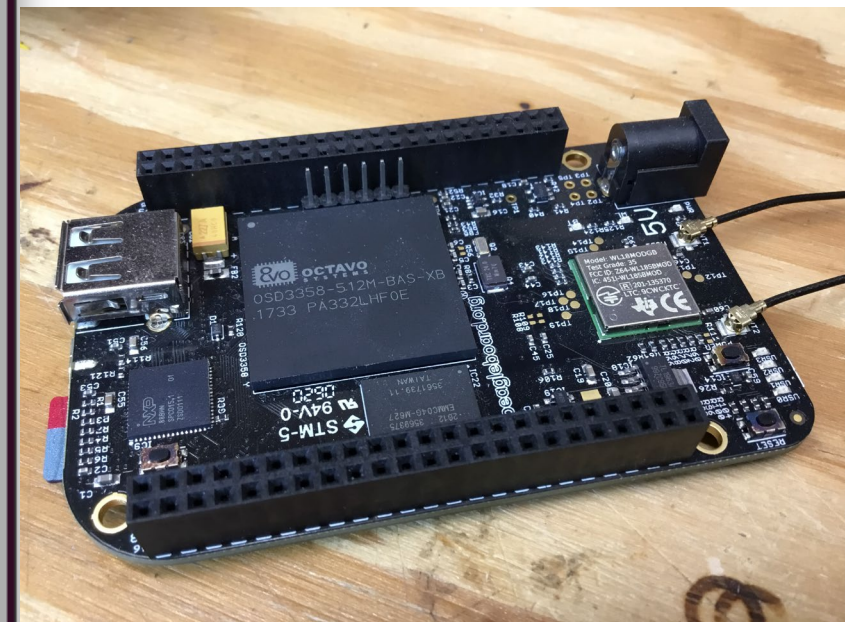
```
debian@beaglebone:~/opt/scripts$ cd /opt/scripts
debian@beaglebone:/opt/scripts$ git pull
remote: Enumerating objects: 328, done.
remote: Counting objects: 100% (328/328), done.
remote: Compressing objects: 100% (107/107), done.
remote: Total 295 (delta 211), reused 264 (delta 196/196) -> "LATEST-ti" [1]
Receiving objects: 100% (295/295), 34.37 KiB | 5
Resolving deltas: 100% (211/211), completed with
From https://github.com/RobertCNelson/boot-scripts
   b39ec67..674bb55  master    -> origin/master
Updating b39ec67..674bb55
Fast-forward
 boot/am335x_evm.sh
 boot/bbai.sh
 boot/bbai_usb_gadget.sh
 boot/beagle_x15.sh
 boot/generic-startup.sh
 .../buster/lxqt/lxqt/globalkeyshortcuts.conf
 desktop-defaults/buster/lxqt/lxqt/panel.conf
 device/bbai64/BBAI64-eeeprom.dump
 device/bone/capes/BeagleBoard.org/A1Fan_Cape_tu
 tools/config_checking/docker/check-config.sh
 tools/developers/update_bootloader.sh

Processing triggers for libc-bin (2.28-10) ...
info: checking archive
2022-05-02 13:25:23 URL:https://rcn-ee.com/repos/latest/buster-armhf/LATEST-ti [
196/196] -> "LATEST-ti" [1]
-----
Kernel Options:
ABI:1 LTS414 4.14.108-ti-r144
ABI:1 LTS419 4.19.94-ti-r73
ABI:1 LTS54 5.4.106-ti-r41
ABI:1 LTS510 5.10.109-ti-r43
-----
Kernel version options:
-----
LTS414: --lts-4_14
LTS419: --lts-4_19
LTS54: --lts-5_4
LTS510: --lts-5_10
-----
info: you are running: [4.19.94-ti-r42], latest is: [4.19.94-ti-r73] updating...
Hit:1 http://deb.debian.org/debian buster InRelease
Hit:2 http://deb.debian.org/debian buster-updates InRelease
Hit:3 http://deb.debian.org/debian-security buster/updates InRelease
Hit:4 http://repos.rcn-ee.com/debian buster InRelease
Reading package lists... 0%
```

BeagleBone Black Wireless Networking

Assign a Static IP Address

```
debian@beaglebone: ~  
File Edit View Search Terminal Help  
  
debian@beaglebone:~$ sudo connmanctl  
[sudo] password for debian:  
Error getting VPN connections: The name net.connman.vpn was not provided by any  
connmanctl> scan wifi  
Scan completed for wifi  
connmanctl> services  
*AR edtpnet2          wifi_2cab339dd70d_656474706e657432_managed_psk  
    DIRECT-6F-HP OfficeJet Pro 6970 wifi_2cab339dd70d_4449524543542d36462d485020  
4f66666963654a65742050726f2036393730_managed_psk  
connmanctl> quit  
debian@beaglebone:~$ sudo connmanctl config wifi_2cab339dd70d_656474706e657432_m  
anaged_psk --ipv4 manual 192.168.1.10 255.255.255.0 192.168.1.1 --nameservers 8.  
8.8.8
```



BeagleBone Black Wireless Networking

Copy SSH Key to the BBBW

```
fred@shopUbuntu885: /
File Edit View Search Terminal Help
fred@shopUbuntu885:/$ ssh debian@192.168.1.10
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@    WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!    @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
Someone could be eavesdropping on you right now (man-in-the-middle attack)!
It is also possible that a host key has just been changed.
The fingerprint for the RSA key sent by the remote host is
SHA256:v+H6cUGk8A5qKB3U1jNqNRkoBYdYbIqrmVrAXub6eKQ.
Please contact your system administrator.
Add correct host key in /home/fred/.ssh/known_hosts to get rid of this message.
Offending RSA key in /home/fred/.ssh/known_hosts:9
    remove with:
    ssh-keygen -f "/home/fred/.ssh/known_hosts" -R "192.168.1.10"
RSA host key for 192.168.1.10 has changed and you have requested strict checking
.
Host key verification failed.
fred@shopUbuntu885:/$ ssh-keygen -f "/home/fred/.ssh/known_hosts" -R "192.168.1.10"
# Host 192.168.1.10 found: line 9
/home/fred/.ssh/known_hosts updated.
Original contents retained as /home/fred/.ssh/known_hosts.old
fred@shopUbuntu885:/$
```

Coding a BBBW TCP/IP Client Application
Code and Compile the Client App

```

int main(int argc, char const* argv[])
{
    int sock = 0;
    struct sockaddr_in serv_sockaddr;
    char* msg = "Message from BeagleBone Black Wireless.";
    char buffer[1024] = { 0 };

    if ((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0)
    {
        printf("Socket creation error \r\n");
        return -1;
    }
    else
    {
        printf("Socket created successfully!\r\n");
    }
    serv_sockaddr.sin_family = AF_INET;
    serv_sockaddr.sin_port = htons(PORT);

    // Convert IPv4 and IPv6 addresses from text to binary form
    if (inet_pton(AF_INET, "192.168.1.73", &serv_sockaddr.sin_addr)<= 0)
    {
        printf("Invalid address\r\n");
        return -1;
    }

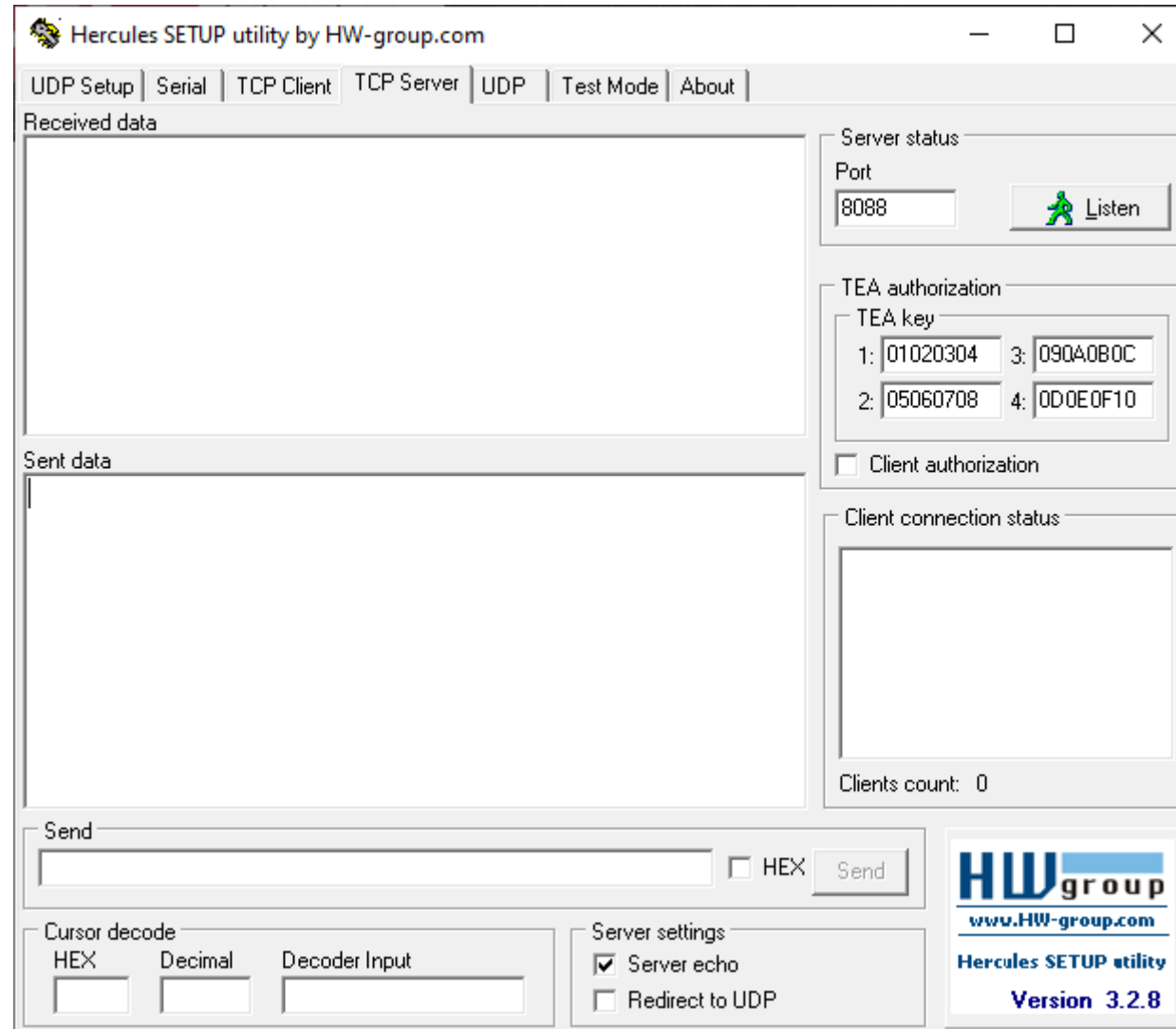
    if (connect(sock, (struct sockaddr*)&serv_sockaddr, sizeof(serv_sockaddr))< 0)
    {
        printf("Connection Failed \r\n");
        return -1;
    }
    send(sock, msg, strlen(msg), 0);
    printf("Message sent!\r\n");
    read(sock, buffer, 1024);
    printf("%s\r\n", buffer);
    return 0;
}

```



Coding a BBBW TCP/IP Client Application

Prepare the Server

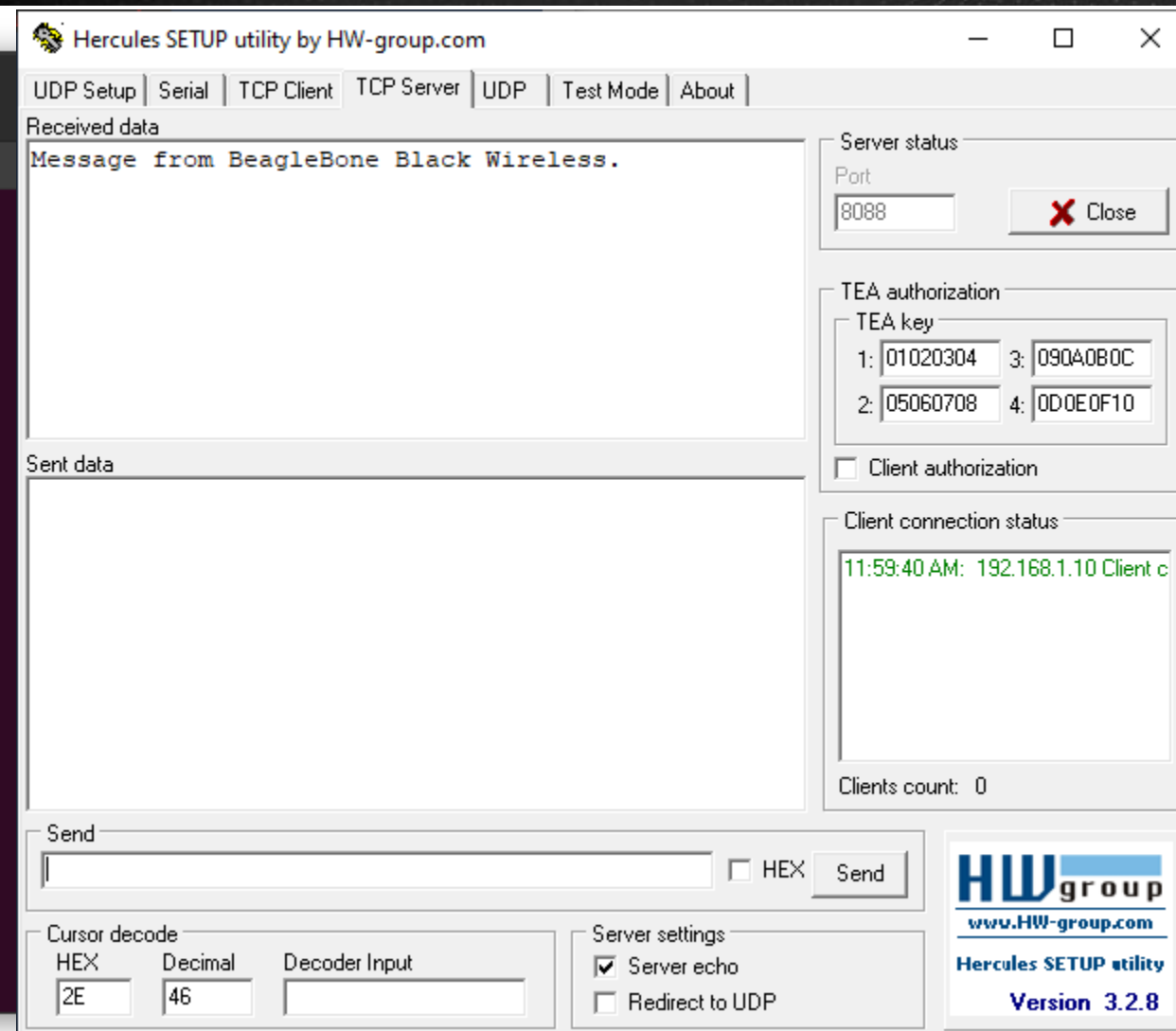


Coding a BBBW TCP/IP Client Application

Run the BBBW Client App

```
debian@beaglebone: ~/bbProjects
File Edit View Search Terminal Help

debian@beaglebone:~$ mkdir bbProjects
debian@beaglebone:~$ cd bbProjects
debian@beaglebone:~/bbProjects$ ls -la
total 84
drwxr-xr-x 2 debian debian 4096 May  2 15:58 .
drwxr-xr-x 6 debian debian 4096 May  2 15:58 ..
-rwxr-xr-x 1 debian debian 76560 May  2 15:58 bbb_tcp_client
debian@beaglebone:~/bbProjects$ ./bbb_tcp_client
Socket created successfully!
Message sent!
Message from BeagleBone Black Wireless.
debian@beaglebone:~/bbProjects$
```



Coding a BBBW TCP/IP Server Application

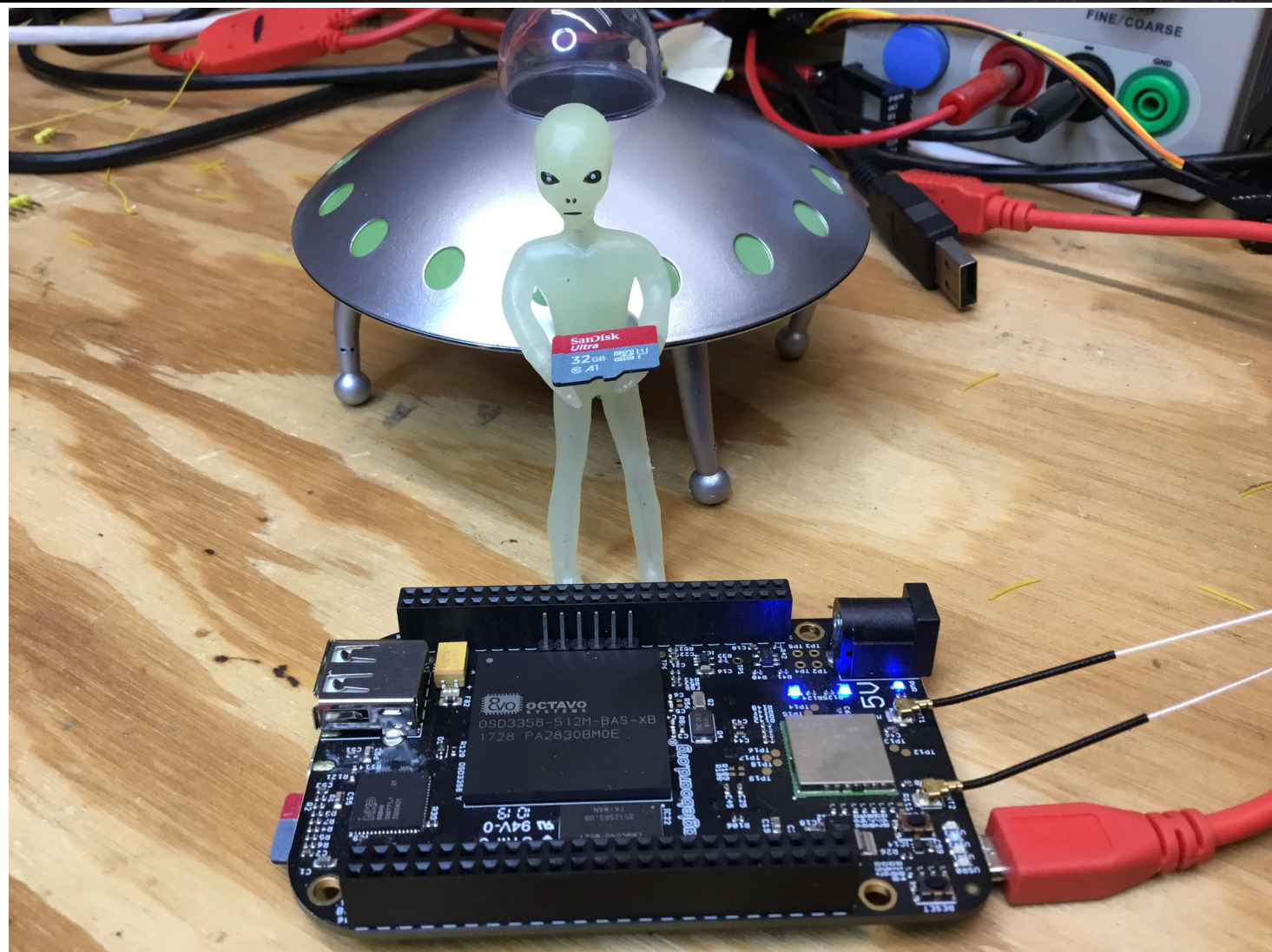
Code and Compile the BBBW Server App

```
int main(int argc, char const* argv[])
{
    int tcpServer_fd, newSocket;
    struct sockaddr_in address;
    int opt = 1;
    int addrlen = sizeof(address);
    char buffer[1024] = { 0 };
    char* msg = "\r\nMessage from TCP server!";

    // Creating socket file descriptor
    if ((tcpServer_fd = socket(AF_INET, SOCK_STREAM, 0)) == 0)
    {
        printf("Socket failed!\r\n");
        return -1;
    }
    else
    {
        printf("Socket file descriptor created successfully!\r\n");
    }

    // attaching socket to port 8088
    if (setsockopt(tcpServer_fd, SOL_SOCKET, SO_REUSEADDR | SO_REUSEPORT, &opt, sizeof(opt)))
    {
        printf("Setsockopt failed!\r\n");
        return -1;
    }
    else
    {
        printf("Socket attached to port 8088!\r\n");
    }
    address.sin_family = AF_INET;
    address.sin_addr.s_addr = INADDR_ANY;
    address.sin_port = htons(PORT);

    // binding socket to port 8088
    if (bind(tcpServer_fd, (struct sockaddr*)&address, sizeof(address)) < 0)
    {
        printf("Bind failed!\r\n");
        return -1;
    }
    else
    {
        printf("Bind to port 8088 successful!\r\n");
    }
}
```

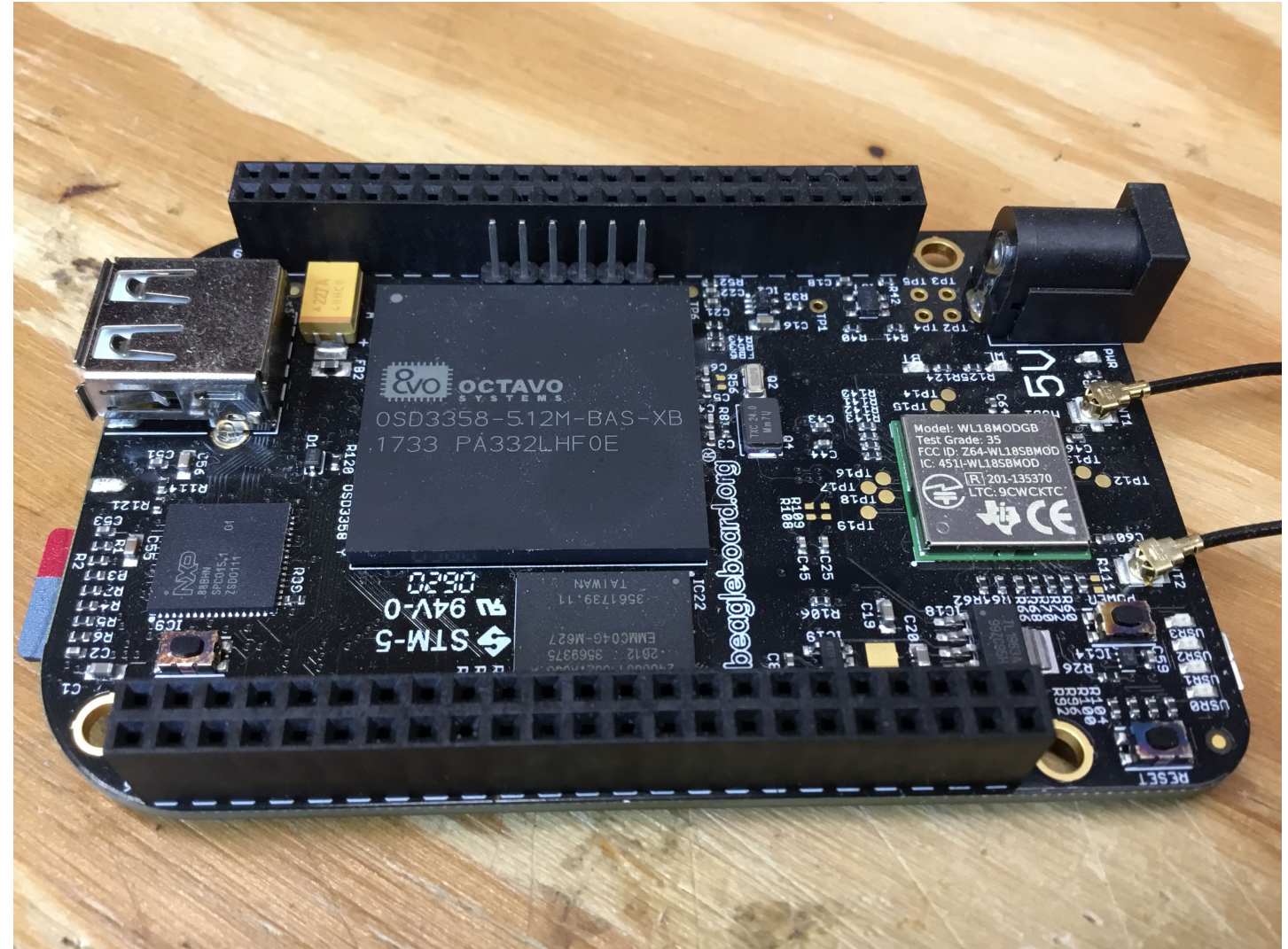


Coding a BBBW TCP/IP Server Application
Code and Compile the BBBW Server App

```

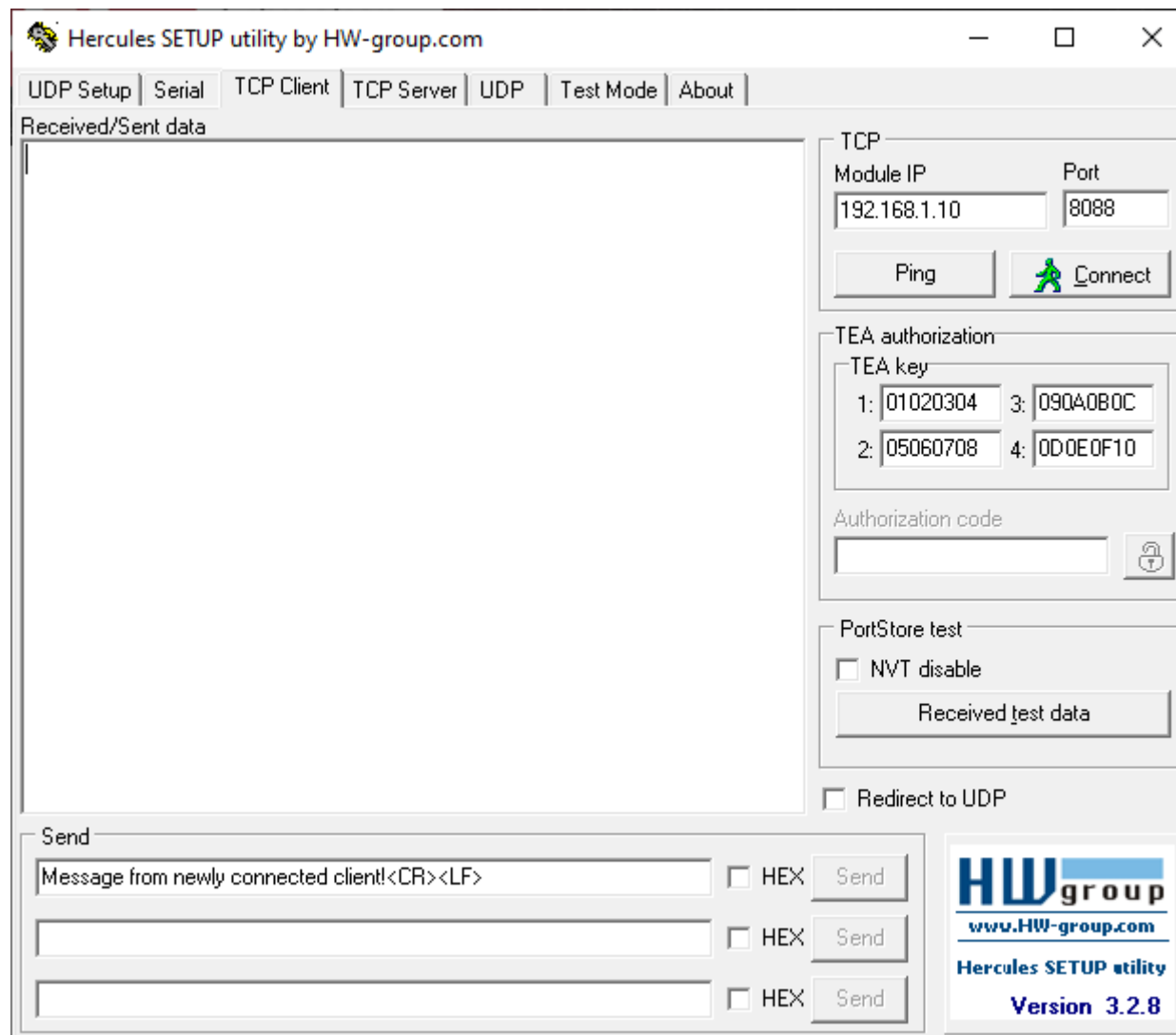
if (listen(tcpServer_fd, 3) < 0)
{
    printf("listen failed!\r\n");
    return -1;
}
else
{
    printf("Listening on Port 8088!\r\n");
}
if ((newSocket= accept(tcpServer_fd,(struct
sockaddr*)&address,(socklen_t*)&addrlen))< 0)
{
    printf("accept failed!\r\n");
    return -1;
}
else
{
    printf("New connection accepted!\r\n");
}
read(newSocket, buffer, 1024);
printf("%s\r\n", buffer);
send(newSocket, msg, strlen(msg), 0);
printf("Message sent!\r\n");
return 0;
}

```



Coding a BBBW TCP/IP Server Application

Prepare the Client



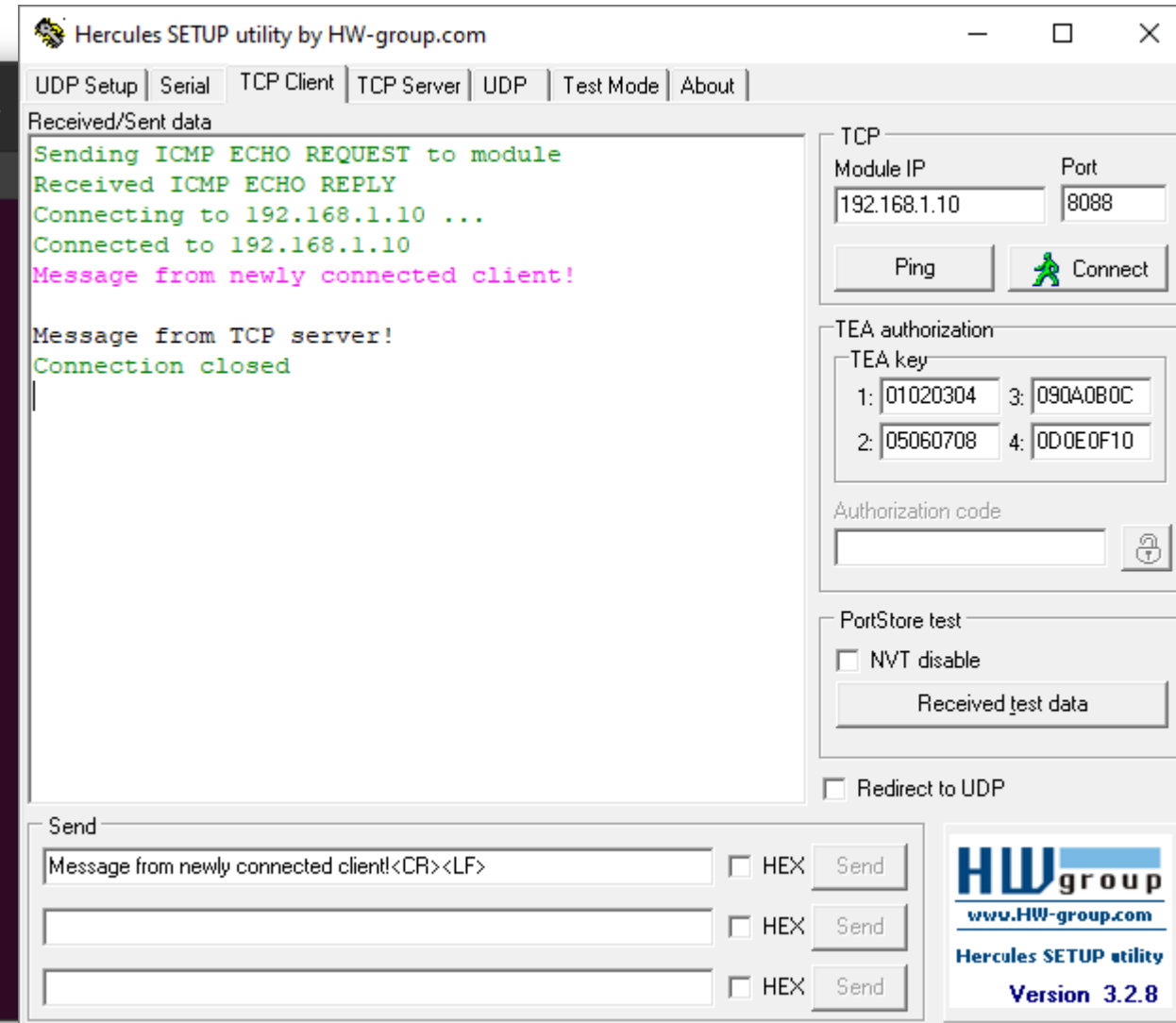
Coding a BBBW TCP/IP Server Application

Run the Server App

```
debian@beaglebone: ~/bbProjects
File Edit View Search Terminal Help

debian@beaglebone:~$ cd bbProjects
debian@beaglebone:~/bbProjects$ ls -la
total 164
drwxr-xr-x 2 debian debian 4096 May  2 16:30 .
drwxr-xr-x 6 debian debian 4096 May  2 15:58 ..
-rwxr-xr-x 1 debian debian 76532 May  2 16:11 bbb_tcp_client
-rwxr-xr-x 1 debian debian 79600 May  2 16:40 bbb_tcp_server
debian@beaglebone:~/bbProjects$ ./bbb_tcp_server
Socket file descriptor created successfully!
Socket attached to port 8088!
Bind to port 8088 successful!
Listening on Port 8088!
New connection accepted!
Message from newly connected client!

Message sent!
debian@beaglebone:~/bbProjects$
```



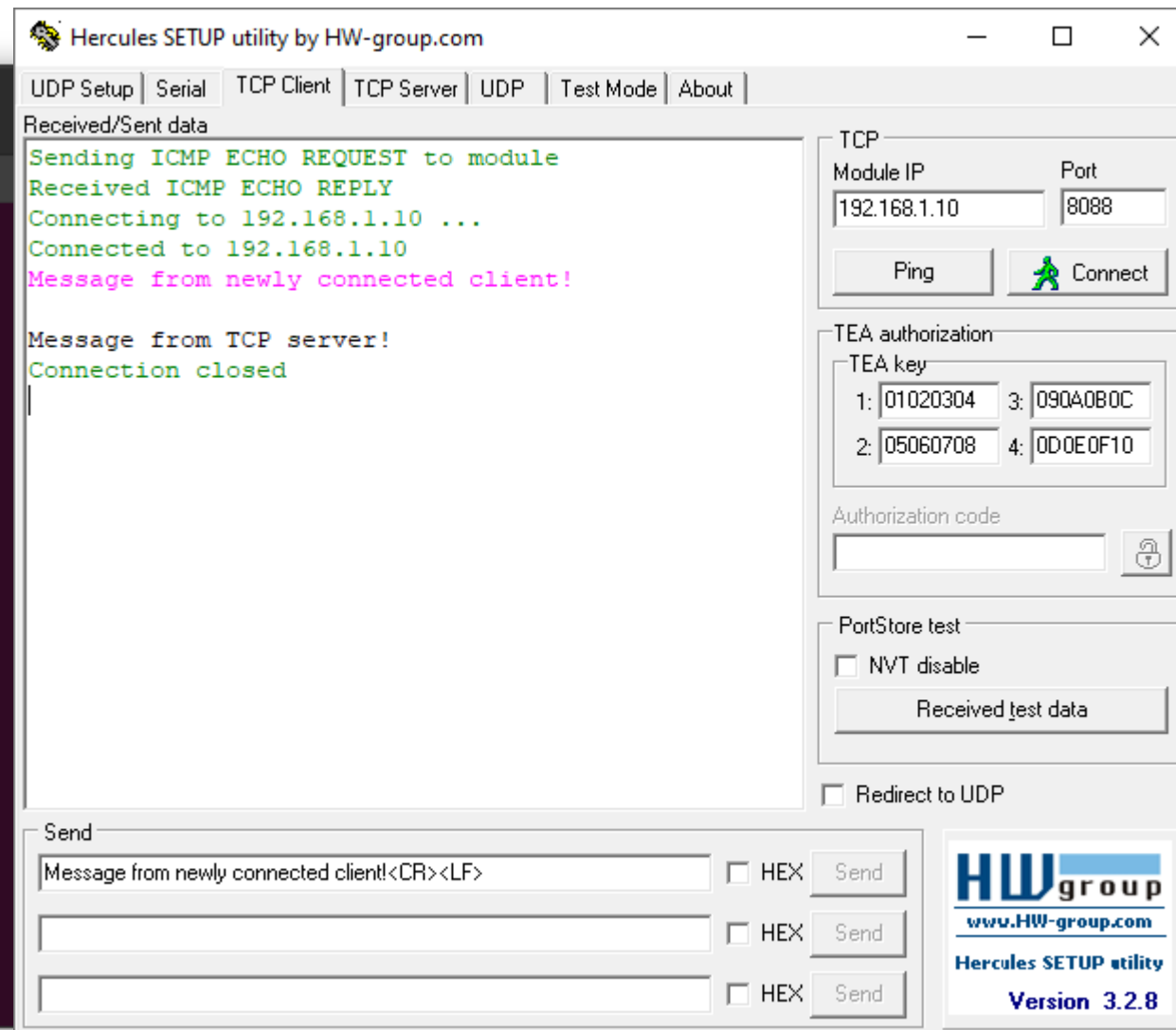
Coding a BBBW TCP/IP Server Application

Run the Server App

```
debian@beaglebone: ~/bbProjects
File Edit View Search Terminal Help

debian@beaglebone:~$ cd bbProjects
debian@beaglebone:~/bbProjects$ ls -la
total 164
drwxr-xr-x 2 debian debian 4096 May  2 16:30 .
drwxr-xr-x 6 debian debian 4096 May  2 15:58 ..
-rwxr-xr-x 1 debian debian 76532 May  2 16:11 bbb_tcp_client
-rwxr-xr-x 1 debian debian 79600 May  2 16:40 bbb_tcp_server
debian@beaglebone:~/bbProjects$ ./bbb_tcp_server
Socket file descriptor created successfully!
Socket attached to port 8088!
Bind to port 8088 successful!
Listening on Port 8088!
New connection accepted!
Message from newly connected client!

Message sent!
debian@beaglebone:~/bbProjects$
```



Changing the BBBW Username and Hostname Target Host Files

```
debian@beaglebone: /etc
File Edit View Search Terminal Help

debian@beaglebone:~$ cd /etc
debian@beaglebone:/etc$ ls -la host*
-rw-r--r-- 1 root root  9 Aug  7 2006 host.conf
-rw-r--r-- 1 root root 11 Apr  6 2020 hostname ←
-rw-r--r-- 1 root root 213 Apr  6 2020 hosts ←
-rw-r--r-- 1 root root 411 Apr  6 2020 hosts.allow
-rw-r--r-- 1 root root 711 Apr  6 2020 hosts.deny

hostapd:
total 12
drwxr-xr-x  2 root root 4096 May  2 13:50 .
drwxr-xr-x 84 root root 4096 May  2 13:55 ..
-rwxr-xr-x  1 root root 3129 Sep 17 2019 ifupdown.sh
debian@beaglebone:/etc$
```

Changing the BBBW Username and Hostname

Change the Hostname

`sudo nano hostname`

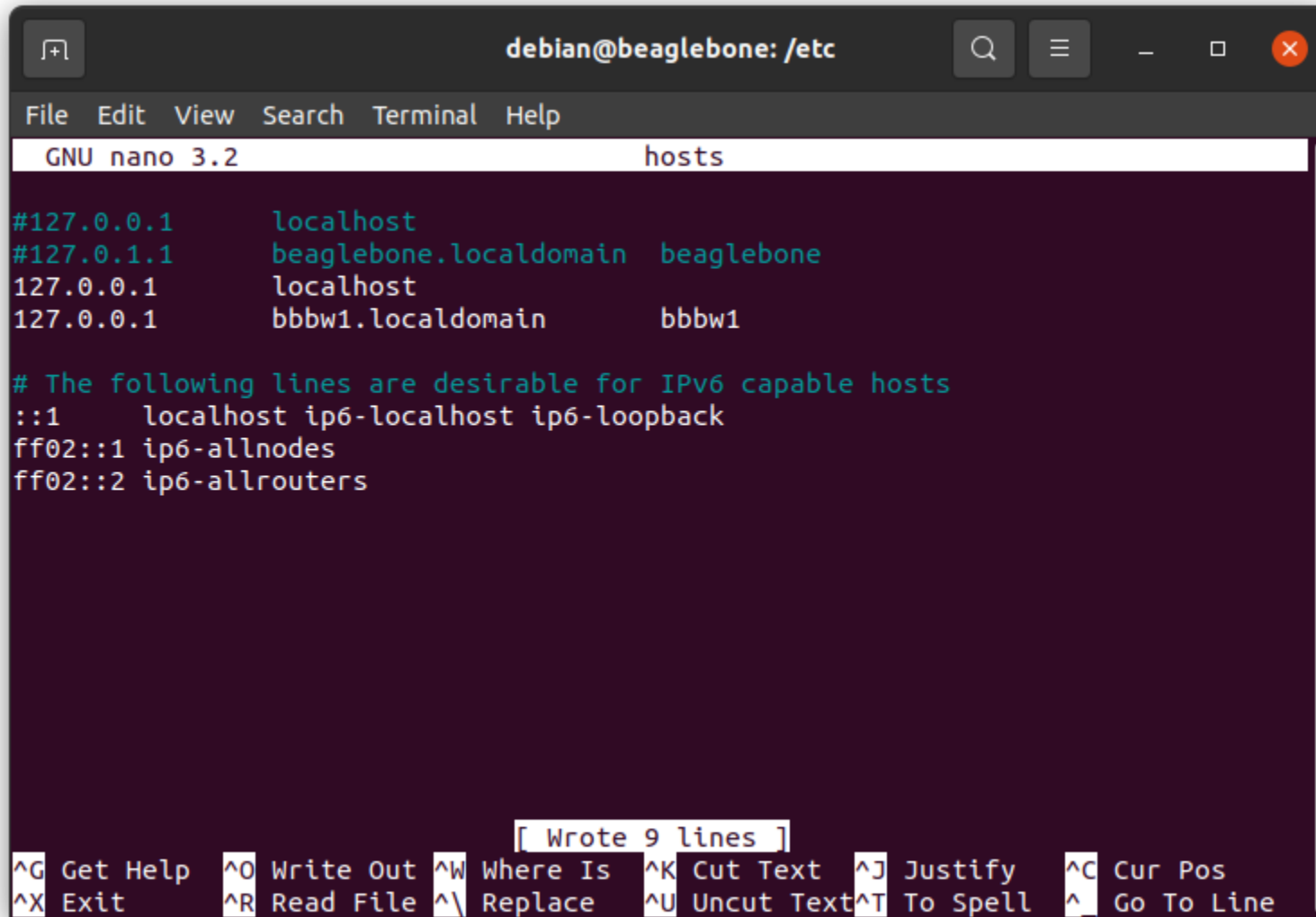
```
debian@beaglebone: /etc
File Edit View Search Terminal Help
GNU nano 3.2 hostname
#beaglebone
bbbw1

[ Read 2 lines ]
^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Uncut Text ^T To Spell  ^_ Go To Line
```

Changing the BBBW Username and Hostname

Change the Hostname

`sudo nano host`



```
debian@beaglebone: /etc
GNU nano 3.2 hosts

#127.0.0.1    localhost
#127.0.1.1    beaglebone.localdomain  beaglebone
127.0.0.1     localhost
127.0.0.1     bbbw1.localdomain      bbbw1

# The following lines are desirable for IPv6 capable hosts
::1          localhost ip6-localhost ip6-loopback
ff02::1      ip6-allnodes
ff02::2      ip6-allrouters

[ Wrote 9 lines ]
^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Uncut Text ^T To Spell  ^_ Go To Line
```

Changing the BBBW Username and Hostname

Change the Username (and Password)

```
debian@bbbw1: ~  
File Edit View Search Terminal Help  
  
debian@bbbw1:~$ sudo adduser cec  
[sudo] password for debian:  
Adding user `cec' ...  
Adding new group `cec' (1001) ...  
Adding new user `cec' (1001) with group `cec' ...  
Creating home directory `/home/cec' ...  
Copying files from `/etc/skel' ...  
New password:  
Retype new password:  
passwd: password updated successfully  
Changing the user information for cec  
Enter the new value, or press ENTER for the default  
    Full Name []:  
    Room Number []:  
    Work Phone []:  
    Home Phone []:  
    Other []:  
Is the information correct? [Y/n] Y  
Adding new user `cec' to extra groups ...  
Adding user `cec' to group `dialout' ...  
Adding user `cec' to group `i2c' ...  
Adding user `cec' to group `spi' ...  
Adding user `cec' to group `cdrom' ...  
Adding user `cec' to group `floppy' ...  
Adding user `cec' to group `audio' ...  
Adding user `cec' to group `video' ...  
Adding user `cec' to group `plugdev' ...  
Adding user `cec' to group `users' ...  
debian@bbbw1:~$
```

Changing the BBBW Username and Hostname

Change the Username

```
debian@bbbw1: ~  
File Edit View Search Terminal Help  
  
debian@bbbw1:~$ sudo adduser cec sudo  
Adding user `cec' to group `sudo' ...  
Adding user cec to group sudo  
Done.  
debian@bbbw1:~$ sudo passwd -l debian  
passwd: password expiry information changed.  
debian@bbbw1:~$ sudo reboot now
```

Changing the BBBW Username and Hostname

Change the Username

```
cec@bbbw1: ~  
File Edit View Search Terminal Help  
  
debian@bbbw1:~$ sudo adduser cec sudo  
Adding user `cec' to group `sudo' ...  
Adding user cec to group sudo  
Done.  
debian@bbbw1:~$ sudo passwd -l debian  
passwd: password expiry information changed.  
debian@bbbw1:~$ sudo reboot now  
Connection to 192.168.1.10 closed by remote host.  
Connection to 192.168.1.10 closed.  
fred@shopUbuntu885:~$ ssh cec@192.168.1.10  
ssh: connect to host 192.168.1.10 port 22: No route to host  
fred@shopUbuntu885:~$ ssh cec@192.168.1.10  
Debian GNU/Linux 10  
  
BeagleBoard.org Debian Buster IoT Image 2020-04-06  
  
Support: http://elinux.org/Beagleboard:BeagleBoneBlack\_Debian  
  
default username:password is [debian:tempwd]  
  
cec@192.168.1.10's password:  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
cec@bbbw1:~$
```

Gotta Go! See You Next Time!!

Thank you for attending!!!

Please consider the resources below:

- [BeagleBone Black How-To PDF](#)
- [BeagleBone.org](#)



Today's download package is available at:
www.edtp.com/bbb/day5.zip



DesignNews

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