Displaying Webpage on a Secondary Beaglebone

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This document guides the user through

1. Setting up the secondary BBG to successfully run the HDMI cape
2. Change the ip address of the secondary BBG to run two distinct BBG on the same project

Table of Contents

Formatting

1. Commands for the host Linux's console are shown as:
   `(host) $ echo "Hello PC world!"`
2. Commands for the target (BeagleBone) Linux's console are shown as:
   `(bbg) $ echo "Hello embedded world!"`
3. Almost all commands are case sensitive

1. Setup HDMI cape on the BBG

1.1. Download and burn the compatible version of debian to run the HDMI cape

- First check the debian version on your beaglebone by checking the issue file:
  `(bbg) $ cat /etc/issue`
  - If the debian image is **older** than 2018-02-01, please go ahead and download a version of debian that is 2018-02-01 or newer from the link provided below.
  - https://debian.beagleboard.org/images/bone-debian-8.10-seeed-iot-armhf-2018-02-01-4gb.img.xz
- Once you've downloaded the Debian Image, go ahead and download Etcher from the link provided, to help you burn the ios image to a bootable SD card.
  - https://etcher.io/
- Unplug your secondary beaglebone and insert the SD into the BBG's SD card slot located on the opposite side of the microUSB port and boot your BBG.
- Inserting a HDMI cable into the cape will display the Linux command line on the screen.

1.2. Setting up Beaglebone to use the GUI

- To use the GUI, we will go ahead and install lxde on our secondary BBG, run the following commands to install lxde:
  - `(bbg) $ sudo apt-get update`
  - `(bbg) $ sudo apt-get install lxde lxde-core lxde-icon-theme` **(all in one line)**
- Lucky for us, there is already firefox installed when we switch to a graphical UI.

1.3. Logging in to GUI

- Plug in keyboard to enter username and password (debian, temppwd)
- Use mouse to navigate to Firefox in menu (bottom right corner)

1.4. Troubleshooting

- If your display screen is blank, check if you have downloaded the correct version of debian:
  - `(bbg) $ cat /etc/issue/`
    - The debian version should be anything after **2018-02-01**
- If network connectivity issues, see troubleshooting guide for configuring the network and interacting with the wicd graphic tool.
  - https://wiki.seeedstudio.com/BeagleBone_Green_HDMI_Cape/

2. Change Secondary BBG's IP Address

2.1 Setup the Secondary BBG

- Go to /etc/network and edit the interface's file to make the following changes at the end of the file:
  - `(bbg) $ sudo nano /etc/network/interfaces`
  - Make the three following changes to the appropriate fields listed in quotes:
    - "Address" from **192.168.7.2** to **192.168.8.2**
    - "Network" from **192.168.7.0** to **192.168.8.0**
    - "Gateway" from **192.168.7.2** to **192.168.8.2**

- In the am335x_evm.sh script file located in /opt/scripts/boot/ make the following changes:
  - `(bbg) $ sudo nano /opt/script/boot/am335x_evm.sh`
  - Press **Ctrl + W** and search for the first instance of 192.168.7.2, it should look something like:

```
      echo "cache-size=2048" >> ${wfile}
  ->  echo "dhcp-range=usb0,192.168.7.1,192.168.7.1,2m" >>
${wfile}
      echo "dhcp-range=usb1,192.168.6.1,192.168.6.1,2m" >>
${wfile}
      echo "listen-address=127.0.0.1" >> ${wfile}
  ->  echo "listen-address=192.168.7.2" >> ${wfile}
      echo "listen-address=192.168.6.2" >> ${wfile
```

  - Go ahead and change 7.1 to 8.1 and 7.2 to 8.2

- We will have to make a few changes to the host inorder to be able to mount the secondary BBG, so before we run the mount script on the BBG, let's make a change to the script since we have updated the IP address of the BBG.
  - Go to your **mountNFS.sh** script and make the following change.
    - `(bbg) $ sudo nano mountNFS.sh`
      - **Make sure you are in the directory containing the mounting script before you run the command above**
    - It should look something like: **`busybox mount -o tcp -t nfs -o nolock 192.168.7.1:/home/user/cmpt433/public /mnt/remote.`**
      - Change the NFS server IP address from 192.168.7.1 to 192.168.8.1
      - Change "user" in path to be the username on your host pc

2.2 Setup the Host to make changes to the NFS server

- Configure the server by editing the `/etc/exports` file:
  - `(host) $` **`sudo nano /etc/exports`**

- Add the following line to the end of the `/etc/exports` file:
  - `/home/user/cmpt433/public 192.168.8.0/255.255.255.0(rw,sync,no_subtree_check)`
  - You must replace the user with your username shown on your host pc

- Anytime you change the `/etc/exports/` file, you must restart the NFS server on the host. This has to be done only once when you make a change to the file as the next time your computer restarts it will automatically load whatever is in your exports file.
  - Restart the server by running the following command on your host:
    - `(host) $` **`sudo exportfs -rav`**
    - `(host) $` **`sudo /etc/init.d/nfs-kernel-server-restart`**

- View the mount and check if the correct directory is exported using:
  - `(host) $` **`showmount -e`**
  - Expected output:

```
Export list for ubuntu:
/home/manavp980/cmpt433/public
192.168.7.0/255.255.255.252,192.168.8.0/255.255.255.0
```

- To test if the IP address has updated, run:
  - From host:
    - `(host) $` **`ping 192.168.8.2`**
  - From BBG:
    - `(bbg) $` **`ping 192.168.8.1`**

- After completing the steps you are ready to run the update mounting script. You can run it without rebooting your bbg, but it might be a good idea to reboot it so the exports file is automatically loaded with the new IP address and runs the mounting script.

2.3 Troubleshooting

- While running the mount script from the Beaglebone, if you encounter an error such as:

```
Mount: 192.168.8.1:/home/user/cmpt433/public failed, reason given by server:
Permission denied Mount: mounting 192.168.8.1:/home/user/cmpt433/public on /mnt/remote
failed: Bad file descriptor
```

  - You might want to check the line added to the exports file.

    - `(host) $ showmount -e`
- It should read exactly:
    - `/home/manavp980/cmpt433/public 192.168.7.0/255.255.255.252,192.168.8.0/255.255.255.0`
    - **Where manavp980 should be the username on your host**

3. Proceed to Running Firefox and Displaying the webpage

- Open the browser and put in the IP and port setup for the primary BBG as the url, e.g
    - (**HDMI bbg firefox**) - `192.168.7.2:8108`
        - Where 192.168.7.2 is the IP address of the primary beaglebone running the node server and 8108 is the assigned port listening to.
        - Change the IP address and port number according to your setup.
    -

- Unfortunately for now, we cannot run the node server on this particular version of the Linux Kernel and as a result, we cannot get the full potential of what is being achieved with this guide.But we now have two Beaglebones that can distribute a tiny amount of processing power in two ways:
    - The primary beaglebone can run the server and udp server while the secondary beaglebone with the HDMI cape can display the webpage.
    - **This means you can run a separate display(monitor/TV) without needing your laptop and using systemd completely removes the need to use a laptop.**