01-Initializing BeagleBone Black for use with KHAN

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1 Requirements

These instructions will initialize the BeagleBone Black (BBB) for use on KHAN, including imaging an SD card with the proper installer for Ubuntu 14.04.3, flashing the BBB with Ubuntu, and changing your username, hostname, and password through SSH. This will require the following:

1. BeagleBone Black
2. Computer with Windows (Verified on Windows 7 and 8.1)
3. Micro SD card - 2GB or larger
4. Micro SD card reader for computer
5. USB to Mini USB Cable

2 Imaging the Micro SD Card

2.1 Downloading and installing necessary software and files

1. Plug the MicroSD card into the computer.
2. Download the most up-to-date image of Ubuntu 14.04 for the BBB. At time of writing, this image is located here[1].
3. Extract the Ubuntu image, using a compression tool such as WinRAR[2] or 7-Zip[3]. Make note of the destination for the extracted files.
4. Install DiskImager[4] to burn the extracted files onto the Micro SD card.

2.2 Write Ubuntu image to SD card

CAUTION!!! DiskImager is generally a very safe piece of software, and attempts to only write to removable devices. Proceed with caution - the tool flashes an entire drive in a single attempt. If the C: drive is selected for flashing, this will erase the computer's hard drive. Do not do this.

1. Run DiskImager as Administrator by right clicking it in the start menu and choosing Run as Administrator.
2. Select the extracted BBB Ubunutu 14.04 file to use as the image file, and the Micro SD card as the device, and write the image file to the card. This should take a few minutes.
3. Eject the card from Windows and physically remove the card.

[1] https://rcn-ee.com/rootfs/2015-09-11/flasher/BBB-eMMC-flasher-ubuntu-14.04.3-console-armhf-2015-09-11-2gb.img.xz
[2] http://www.rarlab.com/download.htm
[3] http://www.7-zip.org/
[4] http://skylineservers.dl.sourceforge.net/project/win32diskimager/Archive/Win32DiskImager-0.9.5-install.exe

4. Reinsert the card into the computer. If Ubuntu was successfully installed, the computer should not recognize it as a disk (Windows may prompt to format your disk, which should not be done. This is simply verifying that Ubuntu is properly installed).
5. Eject the card from Windows and physically remove the card again.

3 Flashing your BeagleBone Black

1. Insert micro SD card into the appropriate slot on the underside of the BBB.
2. There are three buttons on the BBB with text labels. Two buttons labeled reset and power are near the Ethernet port, while the other is on the opposite side of the board, and is unlabeled. This is the boot select button. While holding the boot select button down, connect the power supply to the BBB. Once the power lights turn on, release the power button. The BBB will power on into boot installation mode, initiating the installation of Ubuntu onto the eMMC. The four LEDS next to the ethernet port will flash in a cylon pattern (back and forth) during installation, changing to all solid on once installation has completed.
3. Disconnect power once installation is complete.
4. Remove Micro SD card.

Note: On future boots, do not hold the boot select button, to allow the BBB to boot off the eMMC.

4 Prepping your BeagleBone Black

By default the BeagleBone Black does not provide a graphical user interface. A remote connection to the BBB can be made using the Secure Shell (SSH) protocol. This can be done through any network connection, including the USB connection the BBB provides.

4.1 SSH into BeagleBone Black

This section overviews how to establish an SSH connection with your BeagleBone, using either Ubuntu/Linux or Windows. Before making the SSH connection, plug the BBB's mini-USB into the computer. This provides both power and connectivity to the computer.The default SSH login information for the BBB is as follows:

```
$default_ip_address: 192.168.7.2
$default_username: ubuntu
$default_password: temppwd
```

Note: SSH is used for almost all remote directions in Linux. The general login command structure is useful for future reference, when logging in with other account names or computers. The general command structure is generally:

```
ssh $username@$hostname
```

4.1.1 SSH using Ubuntu

1. Open a terminal in Ubuntu.
2. Verify that Ubuntu has a valid network connection to the BBB. This can be done by executing:

   ```
   ifconfig
   ```

   and verifying that one of the connections has the IP address 192.168.7.1, with a netmask of 255.255.255.0.
3. Enter the SSH login command:

   ssh ubuntu@192.168.7.2

   and type in the password temppwd when prompted.

4.1.2 SSH using Windows

1. Since Windows does not provide a default SSH command, so this guide uses PuTTY. Download putty.exe from the PuTTY download site[5].
2. Run putty.exe, set up a new connection using port 22, and the IP address 192.168.7.2.
3. Open the connection. This should should open a command line terminal.
4. Accept the warning mentioning an RSA key and SSH keys and Putty.
5. Enter ubuntu as the username, and temppwd as the password when prompted.

Issues with PuTTY? If the PuTTY connection times out, power cycle the BeagleBone (remove and re-enter the usb cable) and try again. It has taken some users numerous power cycles before PuTTY works.

If you are still not able to connect after a few power cycles, it may be because certain versions of Windows require specific BeagleBone drivers.

1. Visit the BeagleBone getting started page[6] and install drivers (step 2).
2. It may be necessary to disable signed drivers:
   (a) Search for Advanced Startup
   (b) Click the Restart now button under the Advanced startup section.
   (c) This will momentarily display the startup screen, then switching to a blue screen titled "Choose an option"
   (d) Click the Troubleshoot button.
   (e) Click Advanced options.
   (f) Click Startup Settings
   (g) Click Restart
   (h) After the computer reboots, it will display a Startup Settings screen.
   (i) Press 7 or F7 on your keyboard to Disable driver signature enforcement
   (j) Now Windows 8 will continue starting up.
   (k) Log-in as normal, and then run BONE_D64.exe again
   (l) Clock OK on all warnings about an unsigned driver installation.

4.2 Updating Login Information for the Beaglebone Black

For every computer, there exists a hostname, which indicates the name the computer uses as part of network communication. The default hostname for a BBB is "arm", which lacks character and provides little value in identifying the computer in the presence of other computers (e.g. the class.) In addition, the default password is weak and publicly known, allowing people to easily access the BBB remotely by trying to default login information. Finally, users may wish to use a login name other than ubuntu. The following sections will go through fixing these issues - note that the default password **must* be changed, while the other two are highgly encouraged, but not strictly required.

4.2.1 Changing the Default Password

1. SSH into the BBB using the instructions listed earlier.
2. Once logged into the BBB, enter the command `passwd`
3. Type in the original password, then type in a new password twice, as prompted.

[5] http://www.chiark.greenend.org.uk/∼sgtatham/putty/download.html
[6] http://beagleboard.org/getting-started

4.2.2 Changing the Hostname

For these instruction, you need to choose a good hostname. Consider reading the official internet standard for naming computers, RFC 1178[7]. For these instructions, the name you select will be referred to as `$new_hostname`

1. Change the hostname in general by executing `sudo hostname $new_hostname`
2. Modify the `/etc/hosts` file to fix host lookups by executing:

```
sed -i "s/arm/$new_hostname/g" /etc/hosts
```

   or you can use nano to edit the files in `/etc/hostname` and `/etc/hosts` manually. edit the line that says:

```
127.0.1.1      your-old-hostname
```

   to state:

```
127.0.1.1      your-new-hostname
```

3. The computer must be rebooted before the hostname change will take effect.

4.2.3 Adding a New User

1. Detailed instructions arehere[8]. Type:

   ```
   sudo adduser <new_username>
   ```

   Feel free to leave the options like name and room number blank.

2. To be able to modify the installed packages and control the hardware IO, the new user account must be given super user access. These[9] instructions list how to elevate the new account without issue.

   ```
   sudo adduser <username> sudo
   ```

3. Reboot by executing:

   ```
   sudo reboot
   ```

[7] http://tools.ietf.org/html/rfc1178
[8] https://help.ubuntu.com/community/AddUsersHowto
[9] http://askubuntu.com/questions/7477/how-can-i-add-a-new-user-as-sudoer-using-the-command-line