

Setting up a Raspberry Pi's SD Card for BTS 2

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1 Introduction

This document describes how to configure a Raspberry Pi¹ B+ to create a BTS-2 base-station controller.

2 Materials

You will need several items to configure the Raspberry Pi's SD Card. These items also will be used in the base-station controller.

- Raspberry Pi Model B+
- 1-amp or greater USB power supply with Micro-B connector
- 4-GB or greater microSD memory card. Try to get a memory card with Class 6 speed or greater.

These items help with configuring the Raspberry Pi B+, but they are not deployed with the base station.

- USB-to-SD adapter for 4-GB or larger memory cards, or a computer that can write SD Cards
- USB keyboard
- Video monitor for HDMI signals
- Video monitor cable
- Computer with Internet access

3 Creating the SD Card

The setup procedure described here is organized into several sections.

Load GNU/Linux on the SD Memory Card

Some Raspberry Pi vendors will sell you an SD memory card that is preloaded with GNU/Linux. There is nothing wrong with this, and it will save you the steps in this first section, but it also will cost you about \$4 additional (at the time of this writing).

¹Raspberry Pi is a trademark of the Raspberry Pi Foundation

Assuming that you need to load GNU/Linux on a blank SD memory card, follow the instructions on the web page

<http://www.raspberrypi.org/documentation/installation/installing-images/README.md>

For your convenience (actually, for our convenience), we've included steps from that web page below for using an Apple computer. (We used the "Alternative Method" presented on the page.) Check the web page just mentioned for using other computers.

Note: These commands and actions need to be performed as a computer user that has administrator privileges. Even if you don't know what that means, it's quite possible that you already have such privileges, but a web search may help you understand.

1. Download the Raspberry Pi's Raspbian SD-Card image. See the URL

<http://www.raspberrypi.org/downloads>

Get the most recent version of the file.

Some commands below are typed into a Mac's terminal program, but most of the commands are typed into the Raspberry Pi's keyboard. To remind you, the Mac commands are prefixed with `mac$`, while the Raspberry Pi's commands are prefixed with `just $`.

2. Start the Mac OS X Terminal application.
3. Optional. Verify the file that you just downloaded. In the terminal, use the `shasum` command to print the file's Secure Hash Algorithm checksum and compare it to the SHA checksum on the download website. Substitute `_____ .zip` with the name of the file that you downloaded.

```
mac$ shasum ~/Downloads/_____ .zip
```

4. Extract the GNU/Linux image from `_____ .zip`. (Substitute the name of the file that you downloaded.)

```
mac$ unzip ~/Downloads/_____ .zip
```

5. The extracted file should have a `.img` extension. Write it here:

_____ .img

We need to know the name that the operating system uses for the SD Card. We'll determine that by comparing the mounted volumes before and after inserting the card.

6. Ensure that the SD Card reader is disconnected.
7. From the terminal run the Disk Free command.

```
mac$ df -h
```

We'll use the response of the command momentarily.

8. Connect the SD Card reader with the SD Card inside. Wait a moment for the Mac to notice the card.
9. Rerun the Disk Free command.

```
mac$ df -h
```

10. Compare the results of the two `df` commands. Look for the device that appeared after the SD Card reader was inserted. If there is no difference, maybe the operating system didn't notice the SD Card yet, so wait a moment and then run `df` again.
11. Record the device name of the SD Card's partition, e.g. `/dev/disk1s1`.

The SD Card's partition name is `/dev/disk__`

12. Next, you are *not* going to *eject* the card, but you are going to *unmount* it's partition so that you will be allowed to overwrite the SD Card. Leave the card in the card reader after executing this command.

```
mac$ sudo diskutil unmount /dev/disk__
```

13. Starting with the device name of the partition that you recorded in step 11, work out the raw device name for the entire SD Card by omitting the partition name (probably a final `s1`) and replacing `disk` with `rdisk`.

This is very important! You could lose all data on the hard drive of your computer if you accidentally use its name in the steps that follow!

Record the raw device name of the SD Card, e.g. `/dev/rdisk1`.

The SD Card's raw device name is `/dev/rdisk_`

14. Verify that the device name is the name of the whole SD card as described above and not just a partition of it (for example, `rdisk3`, not `disk3s1`). Be sure that you don't have another SD drive like `rdisk2` or `rdisk4`. If you have any doubts, recheck by using the `df-h` command both before and after you insert your SD Card reader into your Mac.
15. Write the GNU/Linux `_____img` file that you obtained in step 4 to the SD Card using the command below. The parameter `if=_____img` specifies the name of the GNU/Linux image file. The parameter `of=/dev/rdisk_` represents the name

of the SD Card's raw device name, which you just recorded and verified in step 13. Substitute the appropriate names in the command. It is very important to use the correct `of=` parameter because it specifies the disk that gets overwritten.

```
mac$ sudo dd bs=1m if=_____.img of=/dev/rdisk_
```

Note that `dd` will print an error if it is unsuccessful, but it will print nothing if it is successful. If you are curious, while `dd` is running, you can instruct the command to report its progress by typing `Ctrl-T`. (This is called sending a `SIGINFO` signal to the process.)

In my laptop, the `dd` command took between four and five minutes to complete.

16. Type this command

```
mac$ sudo diskutil eject /dev/disk_
```

This command doesn't physically eject the card. It just tells Mac OS X that you are about to eject the card.

Note: it is super tempting to take a look at the card's contents before ejecting it. Resist temptation! The Mac OS X operating system will write some hidden files on the drive if you access it using the Finder, and these files can interfere with its intended use under GNU/Linux. Just eject the SD Card immediately using the command above.

17. Remove the card physically from the SD Card reader.

We'll talk about how to transfer other files onto the SD Card later. Next, let's boot the Raspberry Pi and configure it for basic operation.

Basic Configuration

The first time you boot a Raspberry Pi that uses your newly formatted SD Card, it will run a utility called `raspi-config`. Below we tell you how to use this configuration utility.

Note that we do not want to boot the Raspberry Pi with connection to a network yet because its security is fairly low by default. Let's fix that first.

18. Ensure that the Raspberry Pi is unpowered.
19. Insert the SD Card into its SD Card socket, and connect a USB keyboard and a computer monitor.
20. Ensure that the network cable is **unplugged**.

21. Power up the Raspberry Pi by connecting it to the USB power supply using the USB cable (the board has no power switch). The `raspi-config` utility runs.
22. As it is now, the SD Card image is 2 GB. Run the option `1 Expand Filesystem` to expand the GNU/Linux root file system to use the entire card: use the downarrow key to move select the option, and press the Enter key to run it. Press Enter again to close the `<Ok>` screen that follows.

We are going to remove the pi user later, but changing its default password is a good idea anyway.

23. Select the `2 Change User Password` option and enter a new password for the pi user.

By default the Raspberry Pi starts a graphical user interface. I don't use it.

24. Select `3 Enable Boot to Desktop/Scratch`. Select `Console Text console` so that the desktop does not start on boot.

The “locale” of the computer determines its character set. By default, it uses UK English, but we want to use US English. In the steps below, you will add US English, but you will leave UK English selected because it is used by the running `raspi-config` utility.

25. Select `4 Internationalisation Options` and press Enter.
26. Select the `I1 Change Locale` option. (This option takes a moment to respond.)
27. Leave the option `en_GB.UTF-8 UTF-8` selected, and then using the Down Arrow and Space bar select the option `en_US.UTF-8 UTF-8` as well.
28. Tab to `<Ok>` and press Enter.
29. Select `en_US.UTF-8` for the default locale, tab to `<OK>`, and press Enter. This option takes a while to run.

The Raspberry Pi sets its clock from the network every time it boots (it lacks a battery-powered clock), and it needs to know your timezone.

30. Select `4 Internationalisation Options` and press Enter.
31. Select `I2 Change Timezone` and do the steps to set the time zone. There are two Pacific timezones. Select “Pacific-New”.

The GNU/Linux image assumes that you are using a UK-based keyboard. Tell it that you have a US-based keyboard.

32. Select `4 Internationalisation Options` and press Enter.
33. Select the `I3 Change Keyboard Layout` option.

34. Select **Generic 104-key PC** (I'm assuming that that's what you have).
35. For the keyboard layout select **Other**.
36. Select **English (US)**.
37. Select **English (US)** at the top of the next list.
38. Select **The default for the keyboard layout**.
39. Select **No compose key**.
40. Regarding **Ctrl-Alt-Backspace**, select **<No>**. (This will take a few moments.)

Set the network hostname.

41. Select **8 Advanced Options** and press **Enter**.
42. Select the **A2 Hostname** option and set the hostname from among these options:
`bts2baskin`, `bts2college8`, `bts2development`, `bts2earth`, `bts2opers`, `bts2taps`.

I think that SSH already is enabled, but it doesn't hurt to be sure.

43. Select **8 Advanced Options** and press **Enter**.
44. Select the **A4 SSH option** and do the steps to enable SSH.

We are done. Reboot.

45. Exit `raspi-config` and reboot: to do this you will select **<Finish>**, press **Enter**, and select **<Yes>**.

If necessary, you can fix the video display's borders.

46. Edit the boot configuration file.

```
$ sudo vi /boot/config.txt
```

You may not have seen the `sudo` command before. It acts like the root user and runs the rest of the command line, which in this case is the `vi` text editor. The first time you use `sudo`, it will prompt you for your password. It's just verifying that you really want to do this command.

I hope that you already know the basics of the `vi` text editor! If not, then you'll need to learn it. It's used often when administrating a GNU/Linux system.

47. Set the borders for an Adafruit 7" 1280 × 800 HDMI display (Product ID 1033). Uncomment this line by deleting the `#` on its left.

```
hdmi_force_hotplug=1
```

Uncomment these lines and edit them.

```
hdmi_group=2
hdmi_mode=28
```

Uncomment this line and edit it.

```
hdmi_drive=1
```

Save the boot configuration file.

48. Force 25 × 80 character display.

```
$ sudo vi /usr/local/bin/largefont
```

Here is the contents of the file.

```
#!/bin/bash
setfont /usr/share/consolefonts/Lat15-TerminusBold32x16.psf.gz
```

Save the file, and make it executable.

```
$ sudo chmod +x /usr/local/bin/largefont
```

49. Ensure that the script runs when booting. Also, print the MAC address.

```
$ sudo vi /etc/rc.local
```

Put these lines just before `exit 0` at the end of the file.

```
sudo /usr/local/bin/largefont

# Print the MAC address
_MAC=$(cat /sys/class/net/eth0/address) || true
if [ "$_MAC" ]; then
    printf "My MAC address is %s\n" "$_MAC"
fi
```

Next let's turn up the network security before rebooting.

Basic Network Security

The pi user login probably is known by everyone who learns about Raspberry Pi. So for security, let's create a new user, confirm that we can log in as the new user, and then delete the pi user.

50. Create a new user bts2admin with the following command. You can just press the Enter key for most questions, but you must choose a password. Use the standard base-station password.

```
$ sudo adduser bts2admin
```

Accept defaults for all other questions.

51. Give the new user administrative privileges.

```
$ sudo visudo
```

52. Using arrow keys, go to the end of the file and add a line like this for your user.

```
bts2admin ALL=(ALL) ALL
```

Save the file with Ctrl-O followed by Enter, and exit with Ctrl-X.

53. Test the new user by logging out and then logging again as the new user.

```
$ logout
raspberrypi login: bts2admin
```

54. Remove the pi user.

```
$ sudo deluser --remove-home pi
$ sudo visudo
```

55. Using arrow keys and the Delete key, go to the end of the file remove the line

```
pi ALL=(ALL) NOPASSWD: ALL
```

Save the file with Ctrl-O followed by Enter, and exit with Ctrl-X.

Update GNU/Linux

The GNU/Linux image that you downloaded probably does not have all of the security updates. Usually it's best to get the updates.

56. Plug in the network cable.
57. Reboot the Raspberry Pi. This step will take a few minutes as the operating system finalizes the configuration changes. (The `-r` option tells the command to reboot the board instead of just shutting it down.)

```
$ sudo shutdown -r now
```

58. Log in as `bts2admin` .
59. The first step is to “update”:

```
$ sudo apt-get update
```

The update step takes between 1 and 2 minutes.

60. The next step is to “upgrade”. A few seconds after executing the command below, you’ll be asked a question. Answer “Y”.

```
$ sudo apt-get upgrade
Y
```

I’ve seen the upgrade step take between 2 and 3 minutes or as long as 10 minutes.

61. Install four modules. In some cases, you’ll be asked to confirm the installation. Answer “Y”.

```
$ sudo apt-get install libmysqlclient18
$ sudo apt-get install mysql-client
$ sudo apt-get install libmysqlclient-dev
$ sudo apt-get install libcurl4-openssl-dev
```

62. At this point it is prudent to confirm that the Raspberry Pi still can boot. Check that now.

```
$ sudo shutdown -r now
```

Assuming that the board reboots correctly, log in again as `bts2admin` and skip the next step.

63. If there are problems, we know that they were caused by the update, the upgrade, or a module that you installed in the step 61. First, take a look at the log file:

```
$ dmesg | tail
```

If this doesn't help, you could start over with the `dd` command that formatted the SD Card and reboot after each command of step 61 to narrow down the location of the problem, but the operating system has log files that store diagnostic information.

Configure the Serial Port

The Raspberry Pi board has a serial port. We use it to receive data from the 900-MHz radio, and so we should disable its login messages. The steps below are from the URL <http://www.hobbytronics.co.uk/raspberry-pi-serial-port>.

64. To disable the login prompt, edit the `inittab` file:

```
$ sudo vi /etc/inittab
```

65. Search for `ttyAMA0`, and comment out its `getty` line. You will prefix the appropriate line with a `#` character. Probably you will edit the last line of the file. When you are done, the line will start with a `#`.

```
#T0:23:respawn:/sbin/getty -L ttyAMA0 115200 vt100
```

Save the file and exit.

66. To suppress bootup info on the serial port, edit the `cmdline.txt` file:

```
$ sudo vi /boot/cmdline.txt
```

67. Remove all references to `ttyAMA0`. You will delete the portion of the file that looks like this:

```
... console=ttyAMA0,115200 ...
```

Save the file and exit.

68. Ensure that the serial port uses 9600 baud.

```
$ sudo vi /etc/rc.local
```

Put this line just before `exit 0` at the end of the file.

```
sudo stty -F /dev/ttyAMA0 9600
```

Create a `/var/tmp` Directory in RAM

Writing temporary files and log files to the SD card will wear it out. So instead, write them to a RAM-based tmp directory.

69. Edit `/etc/fstab`.

```
$ sudo vi /etc/fstab
```

70. Add this line, and save the file.

```
tmpfs /var/tmp tmpfs defaults,noatime,nodev,nosuid,noexec,mode=1777,size=100m 0 0
```

71. Check the mount.

```
$ sudo mount -a
$ df
```

You should see the `/var/tmp` directory listed as `tmpfs`.

Copying Files Onto Your Raspberry Pi

We need to copy some files onto the Raspberry Pi's SD Card. One way to copy the files is to write the SD Card using another computer. But on a Mac (which I'm using) this is not a good idea. The Mac OS X operating system writes hidden files onto the SD Card for Mac purposes. These files may trouble the GNU/Linux operating system. So instead, it's best to leave the SD Card plugged into the Raspberry Pi and transfer files over the network connection.

72. Display the network IP address of your Raspberry Pi. (Realize that this address is assigned when you reboot the board, and so it may change after rebooting.)

```
$ ifconfig eth0
```

Look through the command's output for a string like this, with digits instead of # characters. The phrase `inet addr` means *internet address*.

```
inet addr:###.###.##.##
```

The string of digits and periods following the colon (for example 128.114.59.59) is the IP address of the board's network connector. Record this address for the following steps.

73. On a Mac, you will use the `scp` program to copy files from your computer to the board. Here are the files that you need to copy along with their descriptions.

- `Makefile` — Makefile for `aerod` and `btsManagerd` daemons
- `aero` — `init.d` script for `aerod` daemon
- `aerod.cpp` — Source code for `aerod` daemon
- `aws.c` — Source code for AWS function
- `aws.h` — Header file for AWS function
- `btsManager` — `init.d` script for `btsManagerd` daemon
- `btsManagerd.c` — Source code for `btsManagerd` daemon
- `strlog.c` — Source code for log-file function
- `strlog.h` — Header file for log-file function
- `unitdir.c` — Source code for UNIT-file functions
- `unitdir.h` — Header file for UNIT-file functions
- `unitdir.h` — Header file for UNIT-file functions
- `wiringPi-df45388.zip` — Library for Wiring Pi library

On your Mac, in the terminal, go to the directory that contains the files. Then to copy the files to the login directory of user `bts2admin`, type these commands into your Mac's terminal, changing `128.114.59.59` into the IP address of your board.

```
mac$ scp Makefile      bts2admin@128.114.59.59:.  
mac$ scp aero         bts2admin@128.114.59.59:.  
mac$ scp aerod.cpp    bts2admin@128.114.59.59:.  
mac$ scp aws.c        bts2admin@128.114.59.59:.  
mac$ scp aws.h        bts2admin@128.114.59.59:.  
mac$ scp basestation.c bts2admin@128.114.59.59:.  
mac$ scp btsManager   bts2admin@128.114.59.59:.  
mac$ scp btsManagerd.c bts2admin@128.114.59.59:.  
mac$ scp const.h      bts2admin@128.114.59.59:.  
mac$ scp strlog.c     bts2admin@128.114.59.59:.  
mac$ scp strlog.h     bts2admin@128.114.59.59:.  
mac$ scp unitdir.c    bts2admin@128.114.59.59:.  
mac$ scp unitdir.h    bts2admin@128.114.59.59:.  
mac$ scp wiringPi-df45388.zip bts2admin@128.114.59.59:.
```

74. Next log into the Raspberry Pi as `bts2admin` .
75. The files that you just copied are in the `login` directory. Move them to their appropriate destinations.

```
$ mkdir basestation
$ mv Makefile aerod.cpp basestation.c btsManagerd.c basestation
$ mv const.h strlog.c strlog.h unitdir.c unitdir.h basestation
$ mv aws.c aws.h basestation
$ sudo mv aero btsManager /etc/init.d
```

76. Install the Wiring Pi library.

```
$ unzip wiringPi-df45388.zip
$ cd wiringPi-df45388
$ ./build
$ cd ..
$ rm wiringPi-df45388.zip
```

77. Each base station has a different name. To change the name of the base station edit this file:

```
$ cd basestation
$ vi const.h
```

78. Change the value of the `BASESTATION` variable to one of these names: `BASKIN`, `COLLEGE 8`, `EARTH & MARINE`, `OPERS`, or `TAPS`.

79. Write the file.

80. Make the daemons `aerod` and `btsManagerd`.

```
$ make
```

81. Add the daemon to the `init` list with

```
$ cd /etc/init.d
$ sudo insserv aero
$ sudo insserv btsManager
```

82. Print base-station information.

```
$ sudo vi /etc/rc.local
```

Put these lines just before `exit 0` at the end of the file.

```
# Print the name of the base station
_BASESTATION=$(/home/bts2admin/basestation/basestation) || true
if [ "$_BASESTATION" ]; then
    printf "My name is %s\n" "$_BASESTATION"
fi
```

83. At this point reboot.

```
$ sudo shutdown -r now
```

84. After the the Raspberry Pi reboots and you log in, check that the daemons are running.

```
$ ps aux | grep basestation
```

You should see processes for aerod and btsManagerd .

85. One final item is to configure the base station to reboot every morning at 3 A.M.

```
$ sudo crontab -e
```

Add this line at the bottom of the file.

```
3 0 * * * /sbin/shutdown -r now
```

Save the file and exit. Configuration is complete.

Turning Off Your Raspberry Pi

You must shut down the Raspberry Pi before removing its power.

86. Here's how to shut down the board, making everything safe for you to remove its power.

```
$ sudo shutdown -h -P now
```

The -h and -P options tell the board to halt and power down. (I believe that actually it enters an infinite do-nothing loop.) Now you can remove the board's power.

The Raspberry Pi is ready for use as the controller of a BTS 2 base station.

4 Other Notes

Here are a few notes on using the Raspberry Pi. These steps do not need to be performed to make the Raspberry Pi function as a BTS 2 base-station controller, but they may be useful if you need to make changes to the Raspberry Pis programming.

4.1 Creating init.d Scripts for Daemons

The version of Debian GNU/Linux that we are using supports LSB (Linux Standards Base) init.d scripts. Here is how to create and install a daemon and its init.d script.

1. If necessary, create a directory for the daemon. It really can be anywhere, but one location is in a subdirectory of your new users login directory. For example, we used the directory name `basestation` .

```
$ mkdir ~/basestation
```

The next few steps explain how to create init.d scripts.

2. Go to the `/etc/init.d` directory, and make a copy of the skeleton script.

```
$ cd /etc/init.d
$ sudo cp skeleton mydaemon
$ sudo vi mydaemon
```

3. For information on editing the script can be found at this URL, see

```
http://wiki.debian.org/LSBInitScripts
```

The comments at the top of the daemon script actually are configuration lines. We need to edit several of them.

4. This is the file name of the script. Be sure to change `mydaemon` into the name of your script.

```
# Provides:          mydaemon
```

5. List the daemons that need to be running before this one starts. Putting `$all` at the end is easiest; your daemons will be started last and stopped first.

```
# Required-Start:   $remote_fs $syslog $all
# Required-Stop:    $remote_fs $syslog $all
```

6. These lines give the run levels for your daemon. You probably can leave them unchanged. (Run level 2 is normal operation.)

```
# Default-Start:  2 3 4 5
# Default-Stop:   0 1 6
```

7. The descriptions are printed in some log files, and so making them descriptive will help with diagnosing any future problems. Change `short description` and `Longer description` as necessary.

```
# Short-Description:  short description
# Description:        Longer description
#                    possibly with multiple lines.
```

8. Might as well claim authorship. The skeleton uses a name and an email address.

```
# Author:  First Last <abc@def.edu>
```

9. Change the values of several variables.

```
DESC="useful description of daemon"
NAME=mydaemon
NAMED=mydaemond
DAEMON=/home/testbed/basestation/$NAMED
DAEMON_ARGS=""
PIDFILE=/var/run/NAMED.pid
```

10. If your daemon is written to run forever, and it does *not* create its own background process, then add a `--background` option to the lines in the script that begin like this.

```
start-stop-daemon --start --background --quiet ...
```

11. Find all lines that begin with `start-stop-daemon` and end with `--name $NAME`. Change `$NAME` into `$NAMED`.

```
start-stop-daemon ... --name $NAMED
```

12. Find all lines that contain `log_daemon_msg`. Change `"$NAME"` into `"$NAMED"`.

```
... log_daemon_msg ... "$NAMED"
```

13. Find all lines that start with `status_of_proc`. Change `"$NAME"` into `"$NAMED"`

```
status_of_proc ... --name $NAMED
```

If you need to change the daemon's name, you can edit the values of the `$NAME` and `$NAMED` variables in step 9.

4.2 SSH Keys

Remove the old SSH keys. On the Mac, type

```
vi ~/.ssh/known_hosts
```

Remove `bts2development` lines.

4.3 Creating a Base-Station Image File from an SD Card

To create an Image file of SD Card #1, perform these steps.

1. Ensure that the SD Card reader is disconnected.
2. From the terminal run the Disk Free command.

```
mac$ df -h
```

We'll use the response of the command momentarily.

3. Connect the SD Card reader with SD Card #1 inside. Wait a moment for the Mac to notice the card.
4. Rerun the Disk Free command.

```
mac$ df -h
```

5. Compare the results of the two `df` commands. Look for the device that appeared after SD Card #1 was inserted. If there is no difference, maybe the operating system didn't notice the SD Card yet, so wait a moment and then run `df` again.
6. Record the device name of SD Card #1's partition, e.g. `/dev/disk1s1` .

```
SD Card #1's partition name is /dev/disk___
```

7. Starting with this device name, work out the raw device name for the entire SD Card by omitting the partition name (probably a final s1) and replacing disk with rdisk .

Record the raw device name of SD Card #1, e.g. /dev/rdisk1 .

```
SD Card #1's raw device name is /dev/rdisk_
```

8. Verify that the device name is the name of the whole SD card as described above and not just a partition of it (for example, rdisk3, not disk3s1). Be sure that you don't have another SD drive like rdisk2 or rdisk4. If you have any doubts, recheck by using the `df -h` command both before and after you inserted SD Card #1 into your Mac.
9. Create a GNU/Linux *.img file from SD Card #1 using the command below. The parameter `if=/dev/rdisk_` represents the name of the SD Card's raw device name, which you just recorded and verified in step 7. The parameter `of=filename.img` represents the name of the GNU/Linux image file that will be created. Substitute the appropriate names in the command.

```
mac$ sudo dd bs=1m if=/dev/rdisk_ of=filename.img
```

Note that `dd` will print an error if it is unsuccessful, but it will print nothing if it is successful. If you are curious, while `dd` is running, you can instruct the command to report its progress by typing `Ctrl-T`. (This is called sending a `SIGINFO` signal to the process.)

In my laptop, the `dd` command took between four and five minutes to complete.

10. Type this command

```
mac$ sudo diskutil eject /dev/disk_
```

This command doesn't physically eject the card. It just tells Mac OS X that you are about to eject the card.

11. Physically remove SD Card #1.

4.4 Copying a Base-Station Image File to an SD Card

Here's how to copy a Base-Station Image file to SD Card #2.

1. From the terminal run the Disk Free command.

```
mac$ df -h
```

2. Insert the SD Card reader with SD Card #2 inside. Wait a moment for the Mac to notice the card.
3. Rerun the Disk Free command.

```
mac$ df -h
```

4. Compare the results of the two df commands. Look for the device that appeared after SD Card #2 was inserted. If there is no difference, maybe the operating system didn't notice the SD Card yet, so wait a moment and then run df again.
5. Record the device name of SD Card #2's partition, e.g. /dev/disk1s1 .

```
SD Card #2's partition name is /dev/disk___
```

6. Starting with the device name of the partition that you recorded in step 5, work out the raw device name for the entire SD Card by omitting the partition name (probably a final s1) and replacing disk with rdisk .

This is very important! You could lose all data on the hard drive of your computer if you accidentally use its name in the steps that follow!

Record the raw device name of the SD Card, e.g. /dev/rdisk1 .

```
SD Card #2's raw device name is /dev/rdisk_
```

7. Verify that the device name is the name of the whole SD card as described above and not just a partition of it (for example, rdisk3, not disk3s1). Be sure that you don't have another SD drive like rdisk2 or rdisk4. If you have any doubts, recheck by using the df-h command both before and after you insert your SD Card reader into your Mac.
8. Write the GNU/Linux filename.img file to the SD Card using the commands below. The parameter if=filename.img represents the name of the GNU/Linux image file that you created earlier in step 9. The parameter of=/dev/rdisk_ represents the name of the SD Card's raw device name, which you just recorded and verified in step 6. Substitute the appropriate names in the command. It is very important to use the correct of= parameter because it specifies the disk that gets overwritten.

```
mac$ sudo diskutil unmount /dev/disk___
mac$ sudo dd bs=1m if=filename.img of=/dev/rdisk_
mac$ sudo diskutil eject /dev/disk___
\end{\begin{Verbatim}[frame=single]
erbatim}
```

```
\item Remove the SD Card physically from the SD Card reader.

\item Insert the SD Card Boot into a Raspberry Pi and apply power.

\item Log in as \verb#bts2admin#.

\item Edit \verb#~/basestation/const.h#.

\begin{Verbatim}[frame=single]
$ cd basestation
```

9. Change the value of the BASESTATION variable to one of these names: BASKIN, COLLEGE 8, DEVELOPMENT, EARTH & MARINE, OPERS, or TAPS.

```
$ vi const.h
```

10. Remake the daemons, and run rasp-config.

```
$ make
$ sudo rasp-config
```

11. Select 8 Advanced Options and press Enter.
12. Select the A2 Hostname option and set the hostname from among these options: bts2baskin, bts2college8, bts2development, bts2earth, bts2opers, bts2taps.
13. Tab to <Finish>, press Enter, and reboot.
14. Log in as bts2admin. Confirm that the console shows desired information.
15. All look good?

```
My name is _____
Raspbian GNU/Linux 7 _____ tty1
_____ login:
```

Then power down.

```
$ sudo shutdown -h -P now
```