#### Bonus EV3 Programming Lessons



#### Introduction to ev3dev: Setup





#### Objectives

- Learn how to install ev3dev on an EV3
- Learn to setup networking on ev3dev and connect to the ev3 using ssh

Prerequisites: none

#### Materials

- EV3 brick
- USB WIFI (Optional)
- Micro SD card (2gb+ but smaller than 32gb)

#### What is ev3dev?

- ev3dev is a <u>Debian Linux</u>-based operating system that runs on the LEGO<sup>®</sup> MINDSTORMS EV3
- ev3dev allows you to program in different languages (eg. Python, c++)
- ev3dev supports many USB and Bluetooth devices, like Wi-Fi dongles, keyboards, keypads, joysticks and cameras work too.

# Step 1: Download ev3dev

- Download the latest version of EV3dev for EV3 <u>here</u> (https://github.com/ev3dev/ev3dev/releases)
- Unzip the file
- Remember where you put the .img file

# Step 2: Write Image (Windows)

- Download <u>win32diskimager</u>
- Insert the Micro SD card into the computer
- Browse for the .img file you downloaded in win32diskimager
- Write to the drive letter of your SD card (in device dropdown)
- Accept all warnings

| 😒 Win32      | 2 Disk Imager |      | -     |    | ×     |
|--------------|---------------|------|-------|----|-------|
| – Image File |               |      |       | D( | evice |
| LOCATION_    | OF_EV3DEV_IM  | IG   |       |    | -     |
| Copy N       | 1D5 Hash:     |      |       |    |       |
| Version: 0.9 | Cancel        | Read | Write |    | Exit  |
|              |               |      |       |    |       |

# Step 2: Write Image (Mac OS X)

- Open terminal from Application  $\rightarrow$  Utilities
- Run diskutil list
- Now insert you SD card and run diskutil list again. The new entry (/dev/ID\_OF\_CARD) is your SD card. Remember the ID\_OF\_CARD
- Run diskutil unmountDisk /dev/ID\_OF\_CARDs1
- Unmount your SD card. If it has more than one partition, you will need to do this for each partition. (Listed as identifier when running diskutil list)
- This is the dangerous part. If you pick the wrong device, you could wipe out your hard drive, so BE CAREFUL!.
- Run sudo dd if=Location\_OF\_EV3DEV\_IMG of=/dev/rID\_OF\_CARD bs=4m
- REPLACE EVERY ID\_OF\_CARD WITH THE ACTUAL DISK ENTRY FOUND IN DISKUTIL LIST (EG. DISK1)

# Step 2: Write Image (Linux)

- Run df -h
- Now insert you SD card and run df -h again.
- See the a new entry eg.(/dev/sdb1)? That is your SD card. sdb is the actual device name and 1 is the partition number. Your actual device may be named something different.
- Run sudo umount /dev/sdb1
- You may have to run this more than once with a different number at the end if you have more than one partition
- IMPORTANT: Note sdb is just an example id. Your actual device may be named something different.
- Run sudo dd if=Location\_OF\_EV3DEV\_IMG bs=4M of=/dev/sdb

# Step 2: Write Image (Ubuntu Linux)

Download the ev3dev image file ending with .xz instead of .zip (do not extract)

|                           |                              | Restore Disk In  | nage  |
|---------------------------|------------------------------|------------------|---|
|                           |                              | Image to Restore | -/Desktop/ev3-ev3dev-jessie-2015-12-30.img.xz   |
| ev3-ev3dev<br>2015-12-30. | Open With Disk Image Writer  | Destination      | (None)  |
|                           | Open With 🕨 🕨                |                  | 🖾 64 GB Hard Disk — VMware, VMware Virtual S (/dev/sda)   |
|                           | Cut                          |                  | Eloppy Drive — Floppy Drive (/dev/fd0)  |
|                           | Coor                         | _                | CD/DVD/Blu-Ray Drive — VMware Virtual SATA CDRW Drive (/dev/sr0)                                |
|                           | Сору                         |                  | O CD/DVD Drive — VMware Virtual SATA CDRW Drive (/dev/sr1)                                      |
|                           | Move To                      | F                | Drive — Generic Flash HS-CE (/dev/sdb)         2.0 GB Drive — Generic Flash HS-COMBO (/dev/sdc) |
|                           | Copy 10                      | This i           | s our micro SD card. (Yours will probably be differen   |
|                           | Make Link                    | 11151            | s our micro SD card. (Tours will probably be differen   |
|                           | Rename                       |                  |   |
|                           | Move to Trash                | 😣 Restore D      | isk Image   |
|                           | Resize Icon                  |                  |   |
|                           | Restore Icon's Original Size | 👔 The disk i     | mage is 113 MB smaller than the target device   |
|                           | Email                        | Image to Rest    | ore ~/Desktop/ev3-ev3dev-jessie-2015-12-30.img.xz   |
|                           | Extract Here                 | Image S          | ize 1.9 GB (1,887,436,800 bytes) when decompressed  |
|                           | Compress                     |                  |   |
|                           | Devert to Dravious Version   | Destinat         | ion 2.0 GB Drive — Generic Flash HS-COMBO (/dev/sdc)  |
|                           | Revert to Previous version   |                  |   |
|                           | Properties                   |                  | Cancel Start Restoring  |
|                           |                              |                  |   |

#### Step 3: Boot ev3dev

- Put the SD Card in your EV3 and power it on.
- At first, you will see the MINDSTORMS boot splash and the red LEDs will be on. This is immediately followed by the ev3dev boot splash and the LEDs changing to orange.
- The button lights on the EV3 brick (LEDs) indicate SD card activity.

## Step 4: Connect to the Internet

- Insert the USB Wi-Fi dongle
- Note that more than the standard LEGO specified Wi-Fi dongles should work
- Navigate to Wireless and Networks using arrow keys on robot
- Find Wi-Fi
- Select Powered
- Press Start Scan
- Select a network that you recognize
- Press connect
- When you are prompted with a dialogue press the middle button
- Type in the passcode
- Select Accept then Accept on the other remaining dialogue
- To connect to the Internet in another way (USB or Bluetooth) visit <u>here</u>

# Step 5: SSH on Linux/Mac OS X

- Launch terminal
- Find the IP Address of your EV3 (On the top left of the EV3 screen)
- In Terminal type *ssh IP\_Address\_EV3 -1 root*
- **Replace** *IP\_Address\_EV3* with the value you found in step 2
- The password is rootme
- root is the username
- To change the password run sudo passwd
- To make a new user run useradd NAME OF USER
- Replace NAME OF USER with the username you want

# Step 5: SSH on Windows

- Install <u>Putty</u>
- Find the IP Address of your EV3 (On the top left of the EV3 screen)
- Connect to the EV3:
- Press open
- root is the username
- The password is rootme

| Category:   |  |  |  |  |
|---|--|--|--|--|
| _ategory:<br>Session<br>Logging<br>Terminal<br>Keyboard<br>Bell<br>Features<br>Window<br>Appearance<br>Behaviour<br>Translation<br>Selection<br>Colours | Basic options for your PuTTY session         Specify the destination you want to connect to         Host Name (or IP address)       Port         YOUR_IP_ADDRESS_HERE       [22]         Connection type:       Raw         Raw       Telnet       Rlogin         Load, save or delete a stored session       Saved Sessions |  |  |  |
| Connection<br>Data<br>Proxy<br>Telnet<br>Rlogin<br>SSH<br>Serial  | Default Settings Load Save Delete  |  |  |  |
|   | Close window on exit<br>Always Never Only on clean exit  |  |  |  |
| About   | Open Cancel  |  |  |  |

- To change the password run sudo passwd
- To make a new user run useradd NAME\_OF\_USER
- Replace NAME\_OF\_USER with the username you want

#### CREDITS

- This tutorial was created by Sanjay Seshan and Arvind Seshan from Droids Robotics.
- More lessons are available at www.ev3lessons.com
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- Credits: <u>ev3dev.org</u>



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