LEGO NXT Tools and Environment Setup

ECE 5780 Real-time Systems
Utah State University

Objective:

The purpose of this document is to help you in setting up your own development environment. Too often in educational career we are given tools that have already been installed on a lab computer. The reality of working with real-time systems, and embedded development in general, is that often you must setup your own environment and it rarely comes with a nice installer.

There are two parts to this tutorial: (1) Installing the tools and (2) Upgrading the NXT firmware. It will take you from a clean computer to compiling, loading and running a test program on the NXT hardware. The default instructions from nxtOSEK are pretty good. I went through the same process and made some notes to clarify points I found lacking in detail. I would suggest the following process:

1. Read through the nxtOSEK instructions completely.
2. Read through the notes below.
3. Then start from the beginning and actually do it.

General Hints:

- If you have access to your own laptop I would suggest using that, for the most part there is nothing special about the lab or its computers. And almost all labs can be done from home. If you do not then the computers in the lab are available for you to use. Just remember they suffer from the "Groundhog Day" syndrome.
- These instructions will work for Win XP or Vista/Win7/Win8/Win10. If installing for Win7 or up I would recommend using "Run as administrator" for everything. Doing so ensures that everything gets installed with the right privileges.
- In general if you get to choose where to install a particular piece of software put it in C:\cygwin. Many of the tools struggle with spaces in the path so it's best to keep it short and this is the location that the tools expect it to be as well.

The Start point:

Start by downloading the LegoPackage.zip file from Canvas.

Supplemental Notes:

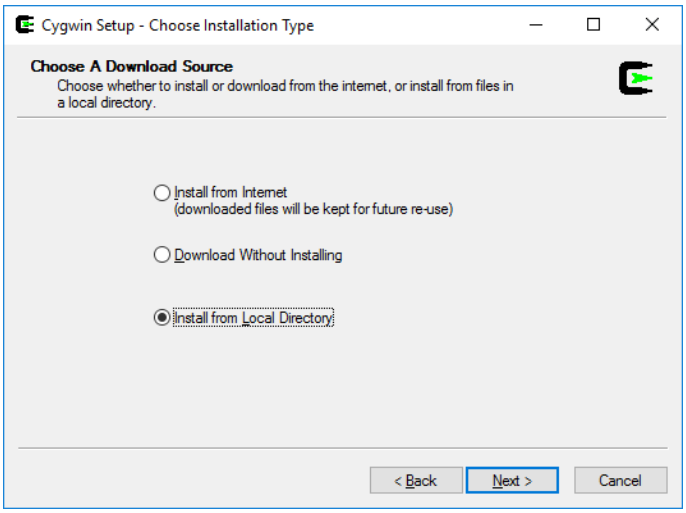
1) Tool Chain Installation
    a) Installing Cygwin:

i. Because the Required Cygwin version is so old it is included as part of the LegoPackage.zip file.

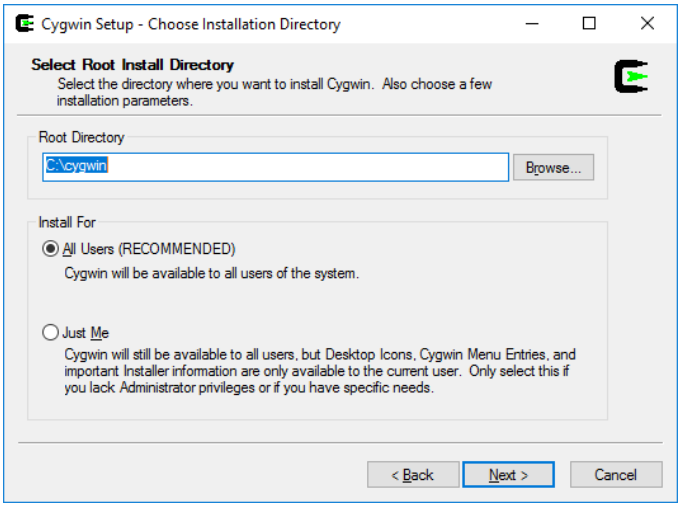
ii. Extract the Cygwin.zip to a temporary location.

iii. Enter the folder and right click on setup.exe and select “Run as Administrator”

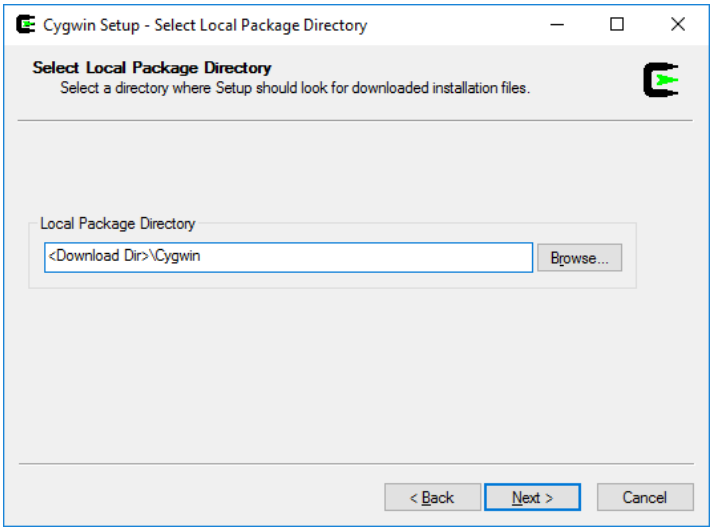
iv. Select Install from Local Directory:



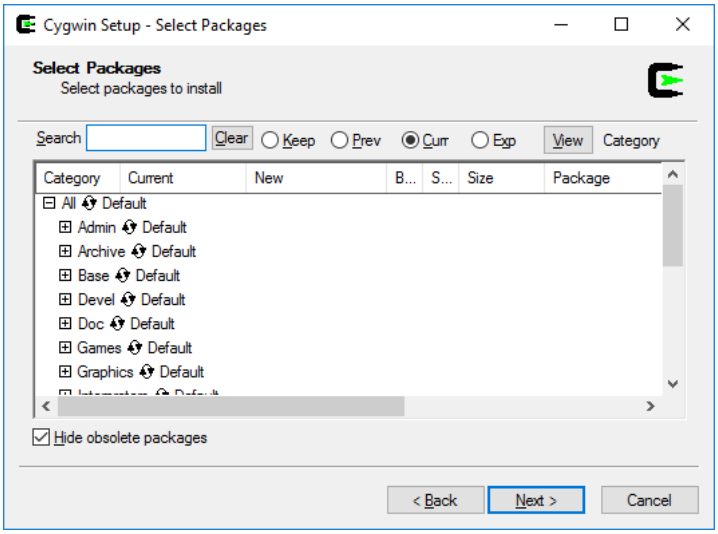
v. Give it a root directory use this default and don’t put any spaces in the directory name.



vi. Select a location to install the packages from. Select the folder that you started “setup.exe” from:

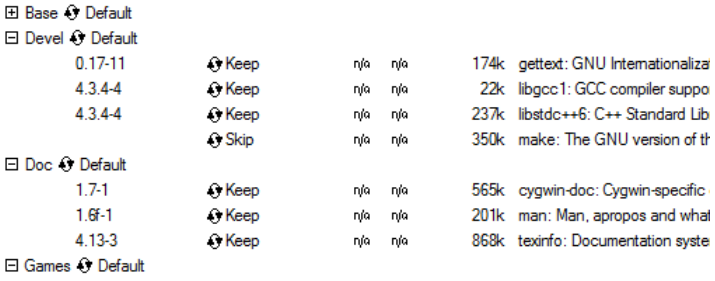


vii. Select packages and just use the defaults the first time click next and then finish.

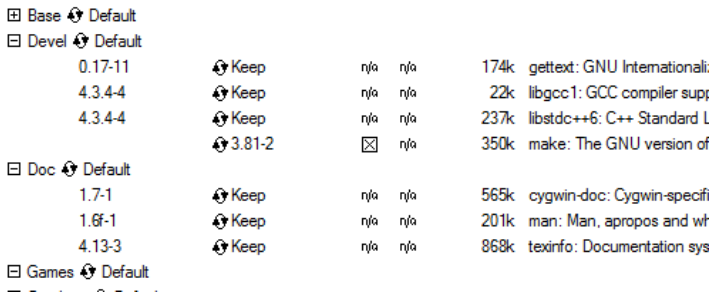


viii. Open “setup.exe” again and follow the same steps to get to the “Select Packages” dialog. The options should default to the settings from the last time.

ix. This time expand each of the categories and click any that say skip



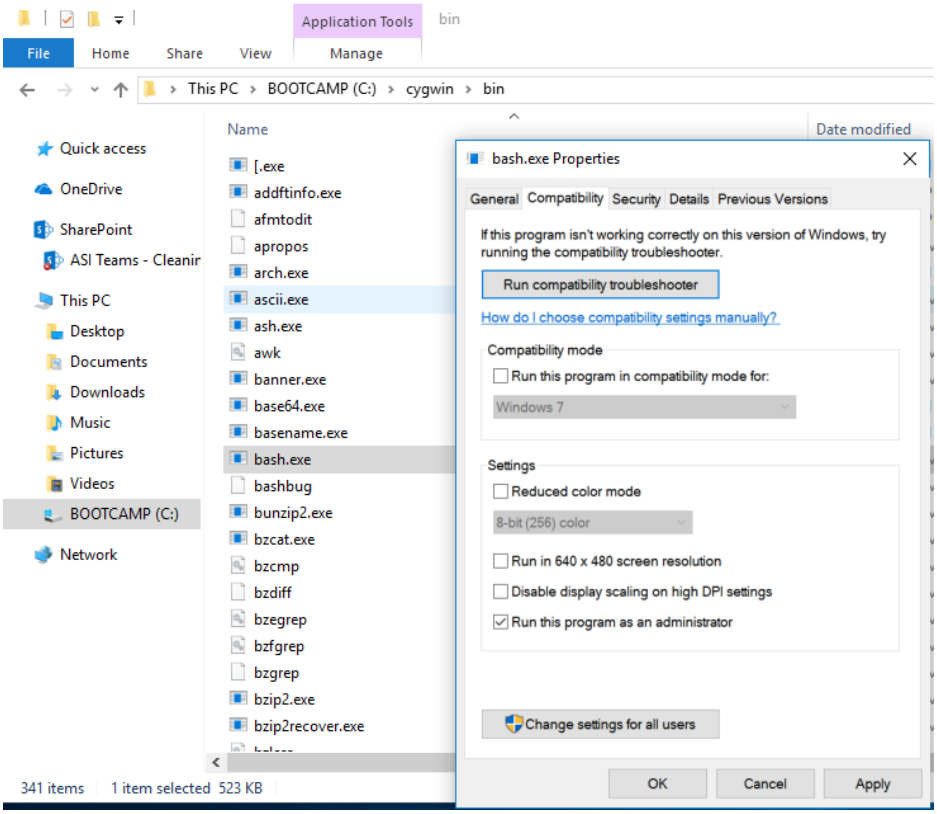
Should no look like:



x. Then click next and finish.

xi. Re-run setup.exe as Admin and follow the previous steps until there are not more packages listed as “skip”.

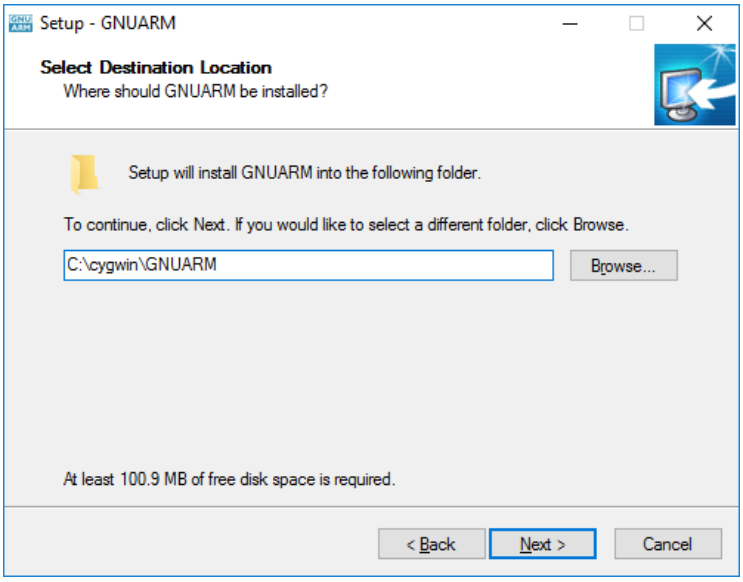
xii. Last you will need to execute Cygwin as “Administrator”. Do this by right clicking on the Cygwin executable “c:\cygwin\bin\bash.exe” and selecting Properties. Under the Compatibilities tab near the bottom check “Run this program as an Administrator”.

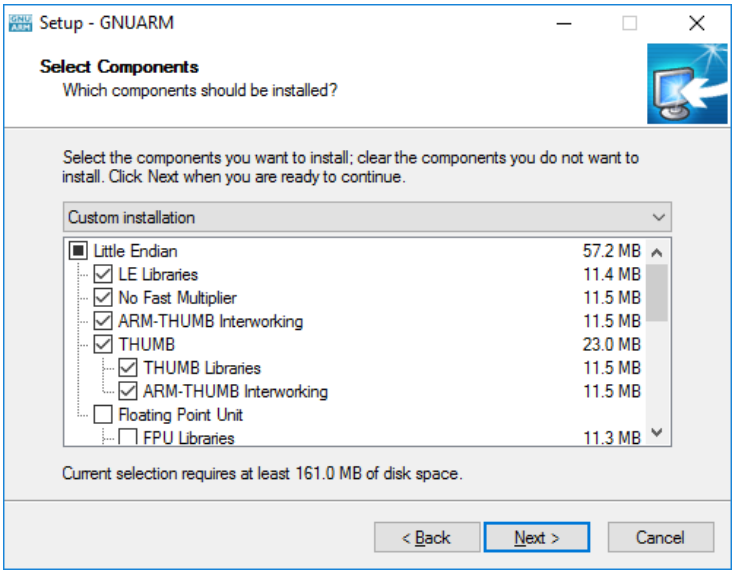


b) Installing GNU Arm

i. Right click on bu-2.16.1_gcc-4.0.2-c-c++_nl-1.14.0_gi-6.4.exe in the Lego Package and select “Run as Administrator”

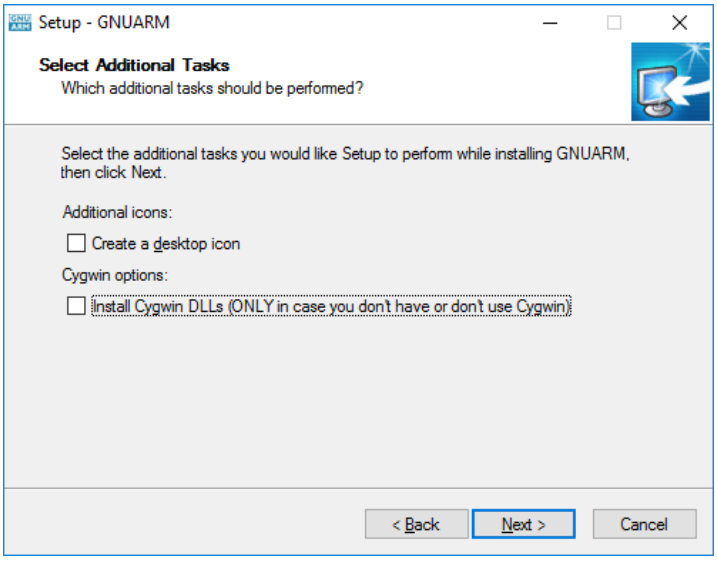
ii. Take the defaults until you get to the “Select Components” dialog. Unselect everything and then only select the options you see below: Install to the Cygwin folder.

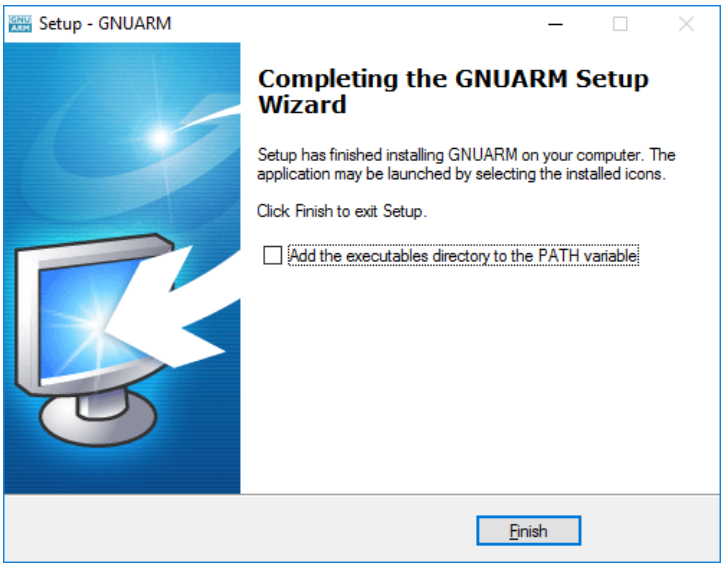




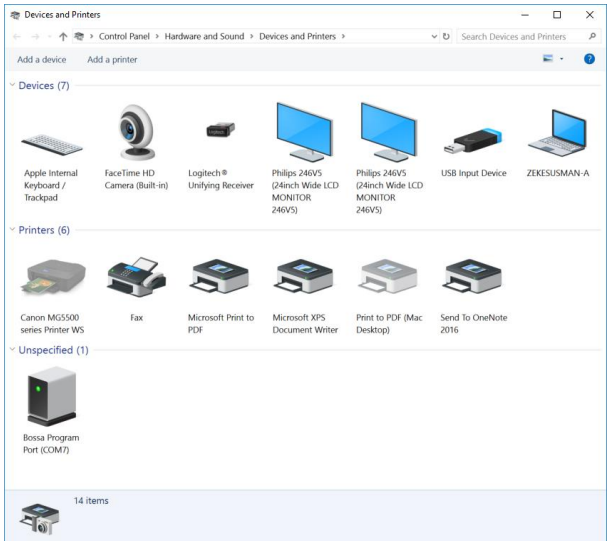
iii. Check the install size in the window it should match (161 MB and no big endian there are more options selected so scroll down).

iv. If you want you can skip the start menu folder addition and the desktop icon as these utilities are driven via command line any way. And don't select the Cygwin DLLs because we already installed them.

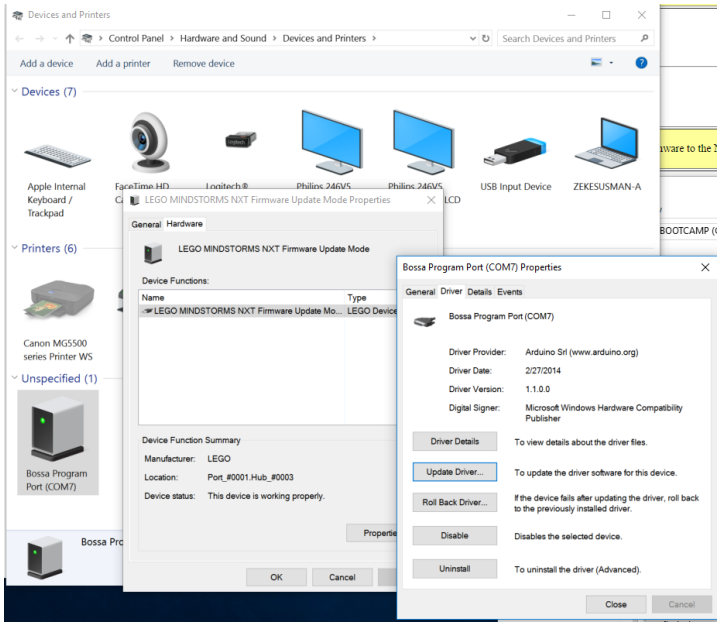




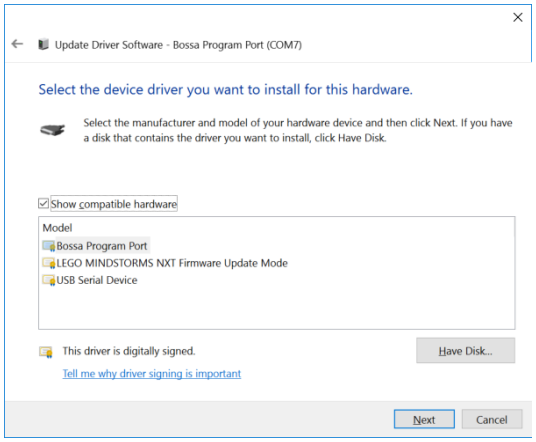
c) Installing the nxtOSEK program upload software (from the LegoPackage.zip file)
    i. Use “John Hansens Enhanced Firmware” option
        i. This part is confusing as it lists the process of installing all three options without a clear delineation between them. There are three pieces of software to install for this step:
            1. The fantom driver from lego
                a. (FantomDriver1.1.3\setup.exe)
                b. Run as admin and take all the defaults
                c. You may need to verify the drive installed correctly by looking at the “Devices and Printers”



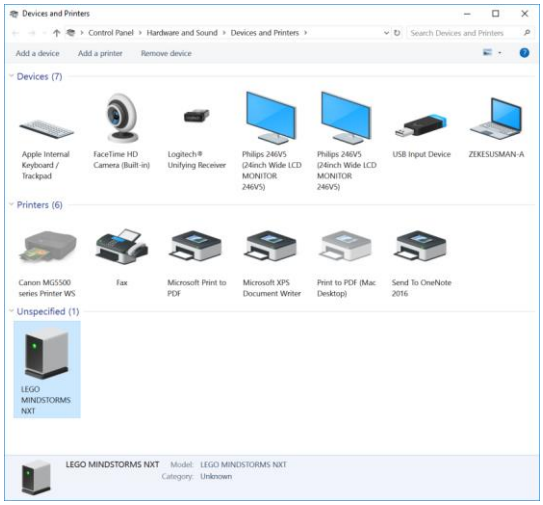
Right click on the Bossa device an pick “Properties”.
Go to the “Hardware” tab at the top of the dialog.
Click “Properties” at the bottom.
From the General Tap choose “Change settings”
Go to the “Driver” tab at the top.
Then pick “Update Driver…”



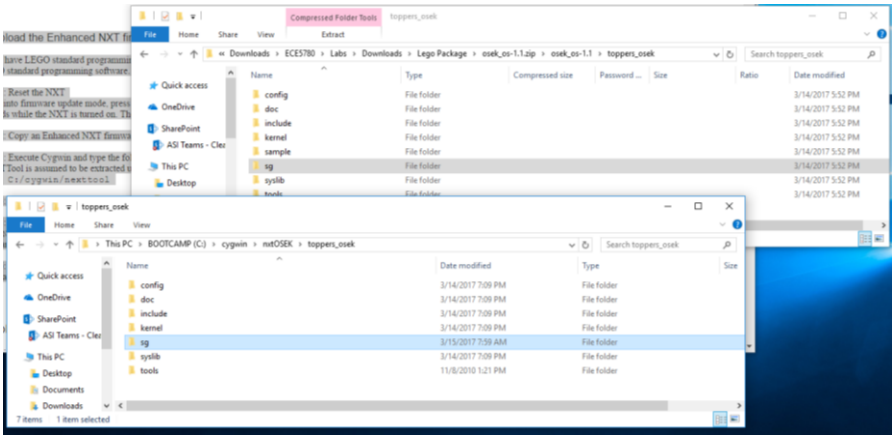
Pick “Browse my computer for driver”
At the bottom pick “Let me pick from a list of device driver…”
And pick “LEGO MINDSTORMS NXT Firmware Update Mode”



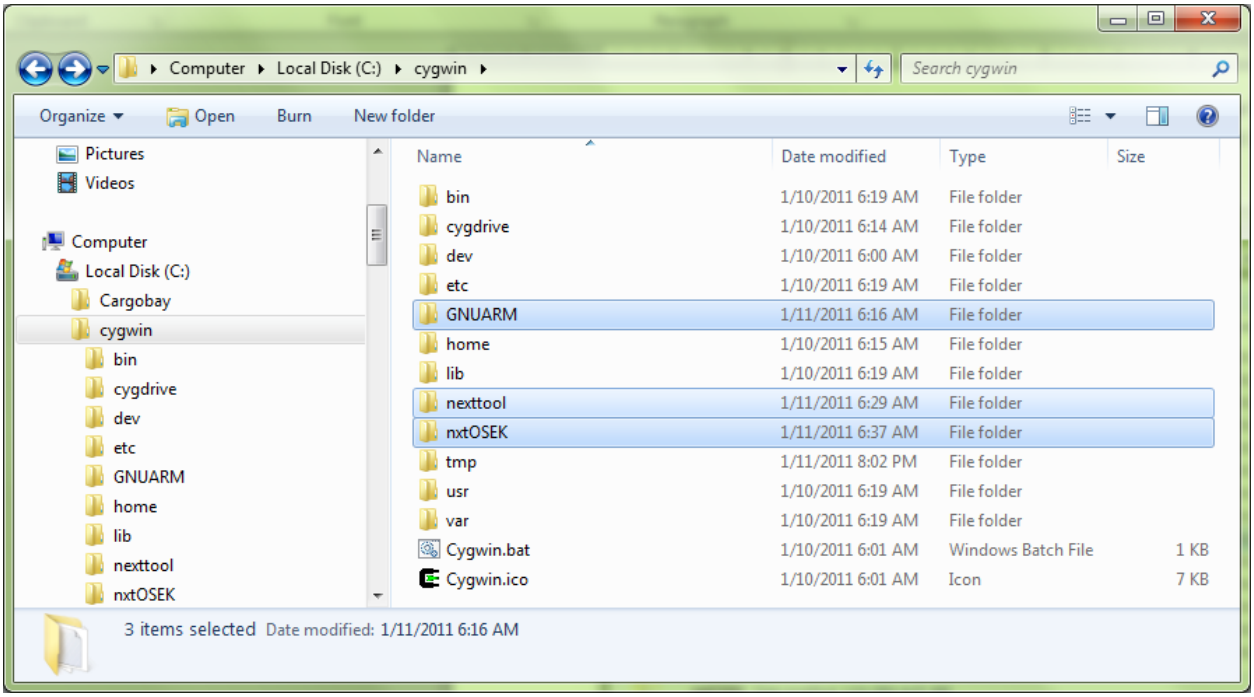
The device should now list as “LEGO MINDSTORMS NXT”



2. The NeXTTool
    a. Get nexttool.zip from the Lego Package and extract it to “C:\cygwin\nexttool” NeXTTool.exe is a PC console command line program and it enables uploading .rxe and .rfw files to the NXT.
3. The Enhanced NXT firmware
4. Extract the contents of lms_arm_jch.zip copy the lms_arm_nbcnxc_128.rfw to “C:\cygwin\nexttool\” folder.
5. Setting up nxtOSEK
    a. extract the contents of nxtOSEK_v214.zip to the Cygwin folder.
    b. Extract osek_os-1.1.zip from the Lego Package and copy the folder “osek_os-1.1\toppers_osek\sg” containing sg.exe to “C:\cygwin\nxtOSEK\toppers_osek\sg” or where you installed nxtOSEK.



ii. If the hello world sample compiles you are good. Below is a screen shot of my installation folder. None should contain the version info that is created when extracting the compressed folders. For example it should be “nxtOSEK” not “nxtOSEK_v214”, look for the folder inside the extracted folder.



2) The next step is to update the firmware on the NXT processor.

a. Upload the Enhanced NXT firmware to the NXT

If you have LEGO standard programming software (i.e. NXT-G), you can upload the Enhanced NXT firmware by using firmware update feature of LEGO standard programming software. Therefore, in this section, an alternative way which uses NeXTTool is instructed.

b. Step 1: Reset the NXT
To go into firmware update mode, press the reset button (at the back of the NXT, upper left corner beneath the USB connector) for more than 5 seconds while the NXT is turned on. The NXT will audibly tick when it is in firmware update mode.

Step 2: Copy an Enhanced NXT firmware (i.e. lms_arm_nbcnxc_106.rfw) to NeXTTool extracted directory.

Step 3: Execute Cygwin and type the following command to change the current directory to the NexTTool extracted directory.
(NeXTTool is assumed to be extracted under C:\cygwin\nexttool directory)
```
$ cd C:/cygwin/nexttool
```

Step 4: Connect PC and the NXT by USB cable.

Step 5: Type the following command in Cygwin to upload the Enhanced NXT firmware to the NXT
```
$ ./NeXTTool.exe /COM=usb –firmware=lms_arm_nbcnxc_1xx.rfw
```
Program upload may take around half minutes and then, NXT LCD is turned to display some chunk from blank.

Step 6: Remove the battery from the NXT and insert it again, and then press orange rectangle button on the NXT to turn on the Enhanced NXT firmware. The Enhanced NXT firmware has same GUI as the LEGO standard firmware.

Note: if the brick just keeps beeping and doesn't change the display then check that windows has assigned the right driver to the NXT Device.

c. Continue on and upload the sample program you compiled earlier. You may have to change permissions on the "rxeflash.sh" file used to upload the example "HelloWorld" program. You should be at: /nxtOSEK/samples_c/helloworld and the '#' is the terminal prompt and not part of the comand.
    i. If Cygwin complains about not having permissions then:
    # ls –l rxeflash.sh
    If you are at the samples folder you will see:
    -rw-r--r-- 1 zekes root 249 Jan 11 20:02 rxeflash.sh
    Then type:
    # chmod 0744 rxeflash.sh
    -rwxr--r-- 1 zekes root 249 Jan 11 20:02 rxeflash.sh
    The x indicates you have execute permissions on the file.
d. A note about executing programs on the NXT.
    i. The orange button powers on the device and executes operations and submenus, the darker gray powers it off and backs out of a submenus.
    ii. The test program will be under the main menu and "My Files" | "Software Files"
    iii. Once selected you will need to run it. This takes more button presses that you would think necessary.