Intel® Edison

Quick Start Guide

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Contents

1 Introduction 6
1.1 References 6
1.2 Terminology 6
1.3 Typographic conventions 6
2 Overview 7
2.1 Before you begin 8
3 Windows Configuration 9
3.1 Connect to Edison through USB/UART serial 9
3.1.1 Downloads 9
3.1.2 Initial setup 9
3.1.3 Connecting to Edison 9
3.2 Connect through RNDIS 10
3.2.1 Downloads 10
3.2.2 Initial setup 10
3.2.3 Connecting to Edison 10
3.3 Flashing an image onto the Edison 10
3.3.1 Downloads 10
3.3.2 Initial setup 11
3.3.3 Flashing an image 12
3.4 Cross-compile “hello world” 13
4 Linux Configuration 14
4.1 Connect through USB/UART 14
4.1.1 Initial setup 14
4.1.2 Connecting to Edison 14
4.2 Connect through RNDIS 14
4.2.1 Initial setup 14
4.2.2 Connecting to Edison 16
4.3 Flash an image onto the Edison 17
4.3.1 Downloads 17
4.3.2 Initial setup 17
4.3.3 Flashing an image 17
4.4 Cross-compile “hello world” 18
5 Mac OS X Configuration 19
5.1 Connect through USB/UART 19
5.2 Connect through RNDIS 19
6 Connecting to the Intel® Edison Board 21
6.1 Wi-Fi 21
6.2 Bluetooth 21
6.3 Changing an Edison board’s static IP address 22
7 7.1 Regulatory Statements 23,24

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Figures

Figure 1 What's included in the box 7
Figure 2 PuTTY configuration 9
Figure 3 Zadig setup 11
Figure 4 Verifying dfu-util installation 12
Figure 5 Windows Device Manager — USB devices 12
Figure 6 Intel® Edison board 13
Figure 7 Linux > Edit connections 15
Figure 8 Linux > Network connections 15
Figure 9 Linux > Editing wired connection 16
Figure 10 Intel® Edison board 18
Figure 11 Mac system preferences 19
Figure 12 Configure RNDIS driver 20

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Revision History

Revision	Description	Date
ww27	Initial release	July 9, 2014
ww29	Overhaul to align documentation with OOBE, follow a linear process, and fix errors.	July 22, 2014

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1 Introduction

This document provides the necessary steps to install the Intel® Edison software and make the initial configurations in the supported environments.

1.1 References

Reference	Name	Number/location
[QSG]	Intel® Edison Quick Start Guide	(This document)
[UG]	Intel® Edison Board Support Package User Guide	
[RN]	Intel® Edison Board Support Package Release Notes	
[HDG]	Intel® Edison Hardware Design Guide	
[GSG]	Intel® Edison Getting Started Guide	
[SDG]	Intel® Edison Software Developer Guide	
[YPQSG]	Yocto Project Quick Start Guide	*http://www.yoctoproject.org/docs/current/yocto-project-qs/yocto-project-qs.html*
[YDM]	Yocto Developer Manual	*http://www.yoctoproject.org/docs/current/dev-manual/dev-manual.html*
[YKDM]	Yocto Kernel Developer Manual	*http://www.yoctoproject.org/docs/latest/kernel-dev/kernel-dev.html*

1.2 Terminology

Term	Definition
SSH	Secure shell host
RNDIS	Remote Network Driver Interface Specification (Microsoft Proprietary protocol used on top of USB)
UART	Universal Asynchronous Receiver/Transmitter
SCP	Secure Copy Command
SFTP	Secure File Transfer Protocol
USB CDC	Universal Serial Bus Communication Device Class

1.3 Typographic conventions

The following conventions are used in this document:

- *Emphasis* - graphical user interface entries and buttons, filenames, directory paths, etc.
- `Courier font` - code examples, command line entries.

Linux terminal inputs follow bold `##` symbols and outputs follow a single `#` symbol as shown below.

```
##echo "a line sample of terminal input and output"
#a line sample of terminal input and output
```

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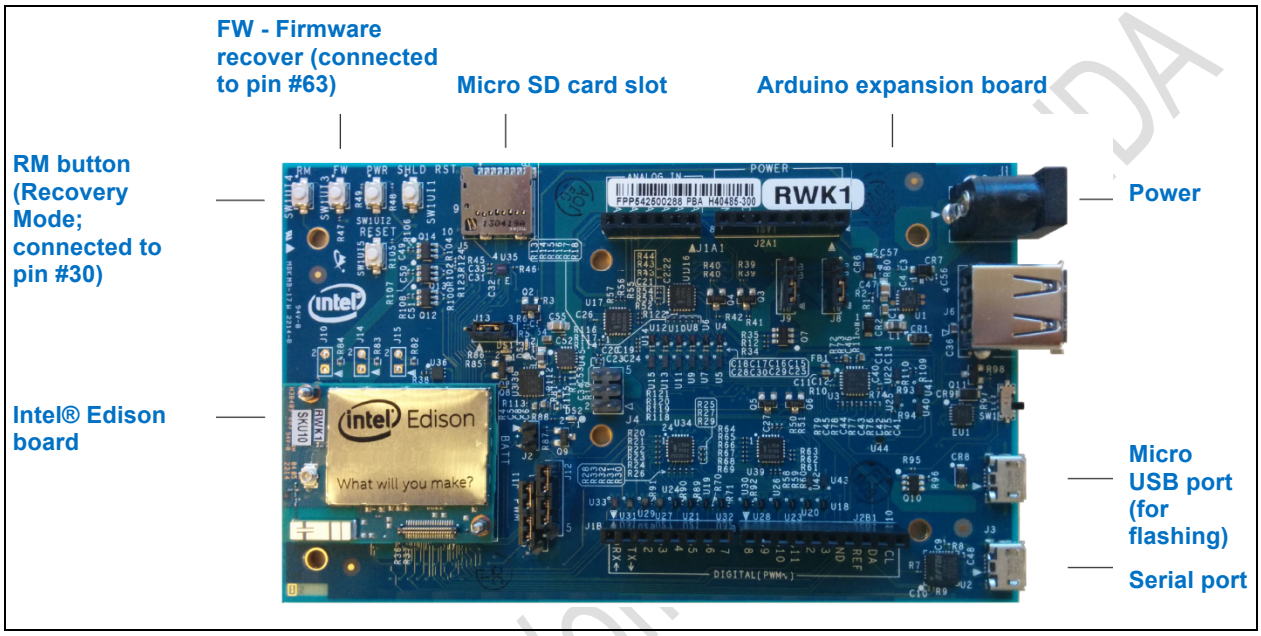
2 Overview

Thank you for participating in the Intel® Edison development program. Your development pacakge includes an Intel® Edison development (daughter) board and an Arduino expansion board (Figure 1). This figure also shows some of the key components on the Intel® Edison development board that you might need to access for the purposes of this document.

Figure 1 What's included in the box



You will also need the following (not included):

- One microUSB cable (two, if you want to use both microUSB ports simultaneously)
- One power supply, with a 2.1 mm center-positive jack, that provides voltage between 7 and 15 V.

The Intel® Edison development board can be powered over USB (max 0.5 A) through the USB multigadget port and by an external power supply that provides between 7 and 15 V.

The UART port is the debug port and provides a serial connection to the Edison board.

The multigadget port is a USB CDC device that does multiple things on the same connection:

- Can power the Edison board.
- Provides a network interface through remote network driver interface specification (RNDIS).
- Provides a serial connection and access for Arduino IDE through ACM serial.
- Grants the host computer access to an 800 MB Edison partition as a USB drive.
- Allows users to flash the Edison device.

The USB 2.0 Host port allows USB devices, such as cameras, to connect to the Edison. This port cannot be used at the same time as the multigadget port; you must use the micro switch to enable one or the other.

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2.1 Before you begin

Release contents are available at *file://aceslab/SLC/NDG-Edison/Software/Release*. To follow this document, download the following:

- Flash image: Edison-image-ww29-14.zip
- Cross-compilation SDK installers (to compile your applications). Download the file for your host OS:
  - Win32: edison-sdk-win32-weekly-19.zip
  - WIn64: edison-sdk-win64-weekly-19.zip
  - Linux32: edison-sdk-linux32-weekly-19.zip
  - Linux64: edison-sdk-linux64-weekly-19.zip
  - Mac OS X: edison-sdk-macosx-weekly-19.zip

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3 Windows Configuration

Complete these one-time instructions to configure your Intel® Edison board for Windows.

3.1 Connect to Edison through USB/UART serial

The easiest way to connect to Edison is to use a terminal emulator through the USB/UART serial debug interface.

3.1.1 Downloads

To connect to the Edison through UART, you need an FTDI UART driver and a terminal emulator such as PuTTY that can connect to a UART interface.

- FTDI Driver: *http://www.ftdichip.com/Drivers/CDM/CDM%20v2.10.00%20WHQL%20Certified.exe*
- PuTTY (or another COM port terminal emulator): *http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe*

3.1.2 Initial setup

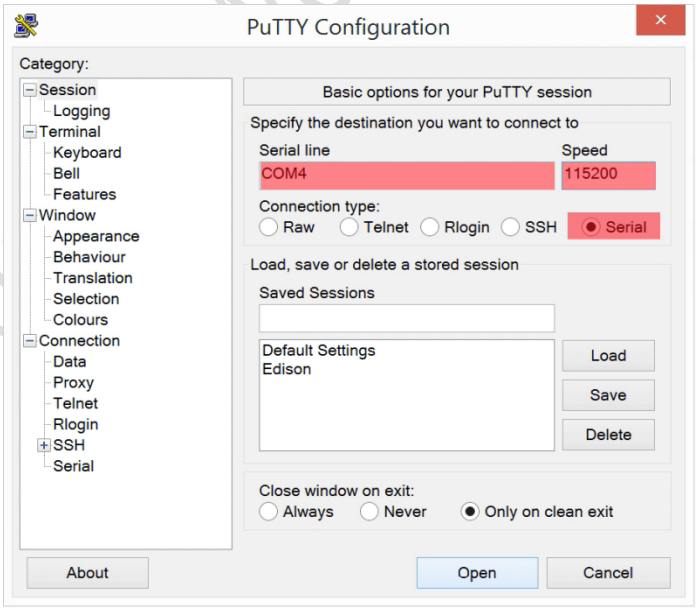
If you have not installed a UART USB driver before, install the FTDI UART driver. To make sure the device has been installed correctly, power on the Edison and connect it to your computer. Then, go to Device Manager and locate the "USB Serial Port" device under Ports. If the device exists, setup succeeded. Afterwards, make sure you have downloaded a terminal emulator, such as PuTTY.

3.1.3 Connecting to Edison

To connect to the USB UART interface, go to Device Manager and make note of the COM port assigned to the USB Serial Port device. Using your terminal emulator, connect to that serial COM port with a baud rate of 115200.

If you are using PuTTY, select *Serial* and enter the COM port and a speed of 115200 (Figure 2).

Figure 2 PuTTY configuration



Note: When the serial console is not used for 5 seconds, it goes to idle. The first character you enter when it is in this state will be lost. This is a hardware issue; there is currently no software workaround.

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3.2 Connect through RNDIS

Setting up RNDIS will allow you to access Edison using an Ethernet over USB connection. This allows SSH, SCP, and SFTP to all occur over a USB cable. This method does not require a driver to be installed.

3.2.1 Downloads

In this case, you'll need to install something with a SSH client such as Cygwin, Git for Windows, or Putty. In our examples, we'll be using Putty.

- PuTTY (or another COM Port terminal emulator): *http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe*

3.2.2 Initial setup

Set up RNDIS/Ethernet gadget

1. Launch the Device Manager (*Start* > *Control Panel* > *Hardware and Sound* and select the Device Manager under *Devices and Printers*) and look under *Network adapters* for *RNDIS/Ethernet Gadget*. If it is not there, right-click *RNDIS/Ethernet Gadget* and select *Update Driver Software*.
2. Choose *Browse my computer for driver software* and *Let me pick from a list of device drivers on my computer*. Select *Network adapters* as the device type and click *Next*.
3. Select network adapters from the dropdown list of manufacturers, select Microsoft Corporation and *Remote NDIS Compatible Device*.
4. Click *Next* and click through the update driver warning. The device should be installed correctly in the network adapters list.

Set the IP address

To set the IP address, do the following:

1. Open *Control Panel* > *Network Internet* > *Network Connections*.
2. Open the properties of the local area network *USB Ethernet/RNDIS Gadget*.
3. Click *Internet Protocol Version 4 (TCP/IPv4)* in the list of items then click *Properties* and change the following:
   a. IP address: 192.168.2.1
   b. Subnet mask: 255.255.255.0
4. Save the settings and exit. This will allow you to connect to the board, which will have the IP address 192.168.2.15.

3.2.3 Connecting to Edison

To connect to the Edison, SSH to 192.168.2.15 with root as the username. If a terminal environment such as Git Bash has SSH, this would create the connection:

```
ssh root@192.168.2.15
```

For Putty, the configuration would be to select the SSH radio button and enter *root@192.168.2.15* as the hostname.

Because this IP address is statically set on the Edison, it will not be possible to have two Edisons connected over RNDIS without changing the static IP on one of the two devices.

3.3 Flashing an image onto the Edison

Follow these instructions to use a prebuilt Edison image that Intel has distributed.

3.3.1 Downloads

Before starting the process, download the following dependencies:

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- Phone Flash Tool: *https://wiki.ith.intel.com/display/DRD/Phone+Flash+Tool*
- dfu-util: *http://dfu-util.gnumonks.org/releases/dfu-util-0.7-binaries.7z*
- Zadig: *http://zadig.akeo.ie/downloads/zadig_2.1.0.exe*

Also, go to *file://aceslab/SLC/NDG-Edison/Software/Release* and download the latest Edison image zip file (*edison-image-wwXX-XX.zip*, where "XX-XX" is the workweek and year), and extract a prebuilt Edison image archive to flash.

3.3.2 Initial setup

For the phone flash tool to work on Windows, the Intel SOC drivers and the Intel Android USB drivers are required. These drivers are included in the Phone Flash Tool package, and they will be installed or updated during PFT installation. Install **Phone Flash Tools**. After doing so, extract the **dfu-util** archive, and store it in a location where it will not be inadvertently disturbed, such as *C:\Program Files (x86).*

You must add the *dfu-util* directory to the path manually. Do the following:

1. Right-click on the Computer icon and select *Properties*.
2. Choose *Advanced system settings* in the left pane.
3. Click *Environment Variables* at the bottom of the *Advanced* tab.
4. Edit the *Path* variable in the system variables list (the lower list). Assuming that *dfu-util* was extracted to *C:\Program Files (x86)*, insert a semicolon and add *C:\Program Files (x86)\dfu-util-0.7-binaries\win32-mingw32* to the path.

You will also need the **Zadig** program to make *dfu-util* work on Windows. Zadig is a utility that aids in installing drivers.

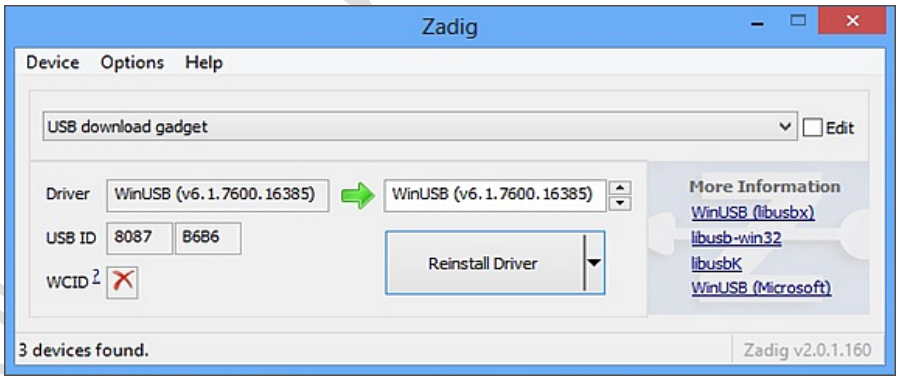
The first time the board is plugged into the PC, you need to install its driver by launching *Zadig.exe*.

Note: If you don't see USB download gadget in the dropdown for Zadig after waiting for about a minute, open a terminal in the extracted folder of the Edison image – which should have a file named flashall.bat – and run the following command:

```
flashall.bat -i
```

After the process is completed, the USB download gadget should show up in Zadig (Figure 3).

Figure 3 Zadig setup



Select *USB download gadget* and install the WinUSB driver, then click *OK* when the verification message states the installation is successful and restart your computer.

To verify *dfu-utils* installation, open a terminal and issue the command:

```
dfu-util -v -l -d 8087:b6b6
```

You should see output similar to Figure 4.

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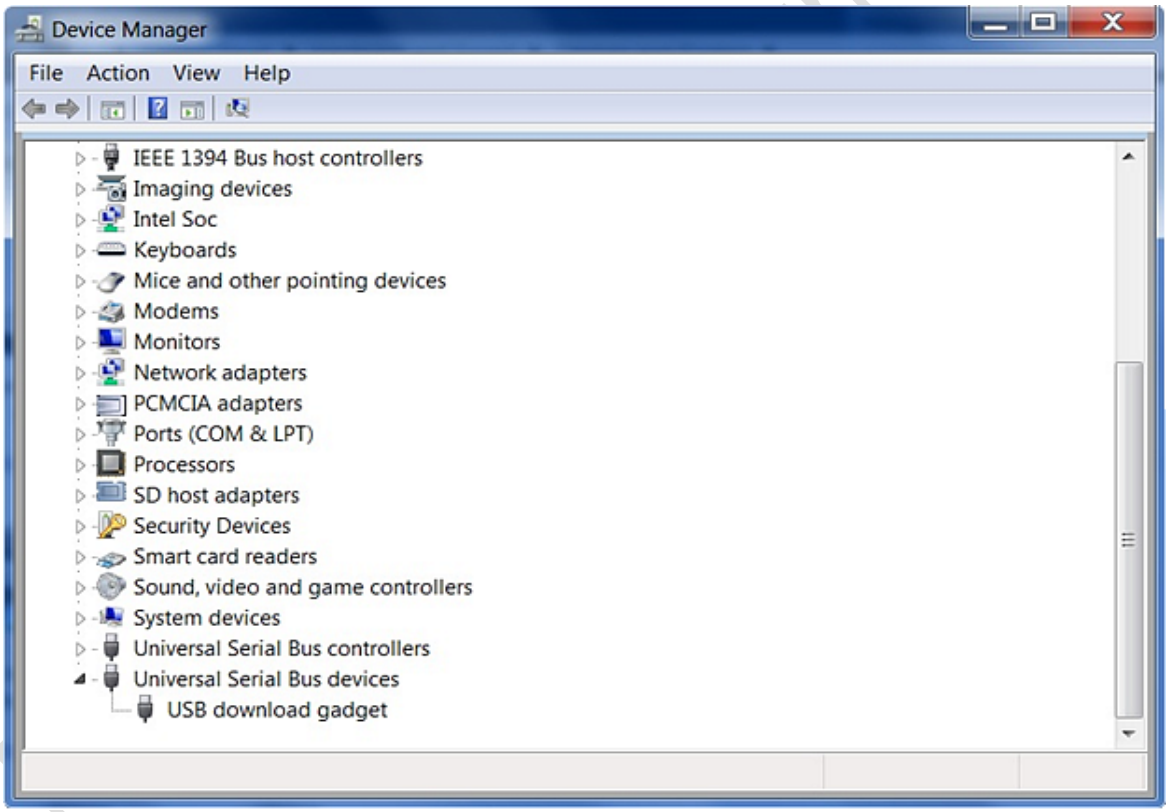
Figure 4 Verifying dfu-util installation

```
Copyright 2005-2008 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010-2012 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY

Filter on vendor = 0x8087 product = 0xb6b6
Found Runtime: [0a5c:21e1] devnum=0, cfg=1, intf=3, alt=0, name="UNDEFINED"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=0, name="u-boot0"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=1, name="u-boot1"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=2, name="u-boot-env0"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=3, name="u-boot-env1"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=4, name="boot"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=5, name="rootfs"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=6, name="log"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=7, name="update"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=8, name="home"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=9, name="vmlinuz"
Found DFU: [8087:b6b6] devnum=0, cfg=1, intf=0, alt=10, name="initrd"
```

You can also verify the availability of the USB download gadget by launching the Device Manager Go to *Start* > *Control Panel* > *Hardware and Sound* and select the Device Manager under *Devices and Printers*. Then look under *Universal Serial Bus devices* (at the bottom of Figure 5).

Figure 5 Windows Device Manager — USB devices



3.3.3 Flashing an image

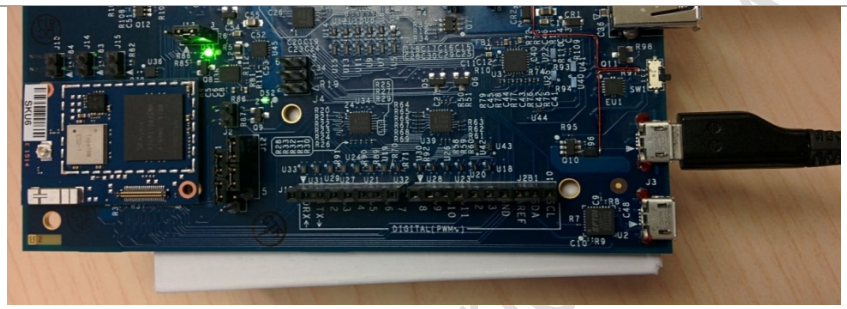
Use a USB 2.0 port for all flashing operations on the Intel® Edison board.

1. Keep the Micro USB cable and the power supply unplugged. Make sure that the position of the tiny switch SW1 is on the side closer to the Micro USB connector.
2. Unzip the prebuilt *edison_image-wwXX-XX.zip* file into a directory of your choice. Then open a Windows command shell, navigate to the directory where you saved the zip files, and enter the following command:

```
.\flashall.bat -b
```

3. When the script starts to search for the Edison, connect the micro USB cable to the inner Micro USB port as shown in Figure 6, and connect the power supply afterwards. If the flashing does not start, unplug both cables, reinsert the microUSB cable, and then reconnect the power supply.
4. After the flashing starts, allow the script to completely run and do not interrupt.
5. After flashing, the board will reboot a couple of times and partition the file system. Do not interrupt this operation, it should last approximately 30 seconds or so.

Figure 6 Intel® Edison board



3.4 Cross-compile "hello world"

To build a native application in a Windows environment, do the following:

1. Unzip the *edison-sdk-win32-weekly-14.zip* file to a directory of your choice.

```
/* Hello World program */
#include<stdio.h>
main()
{
printf("Hello World\n");
}
```

2. If you extracted the zip archive to the C:\ drive, the command to build *helloworld.c* would be this:

```
C:\edison-sdk-win32-weekly-14\poky-edison-eglibc-i686-edison-image-core2-32-
toolchain-1.6\sysroots\i686-pokysdk-mingw32\usr\bin\i586-poky-linux\i586-poky-
linux-gcc.exe --sysroot=C:\edison-sdk-win32-weekly-14\poky-edison-eglibc-i686-
edison-image-core2-32-toolchain-1.6\sysroots\core2-32-poky-linux
c:\test\helloworld.c -o c:\test\helloworld
```

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4 Linux Configuration

Complete these one-time instructions to configure your Intel® Edison board forLinux.

4.1 Connect through USB/UART

4.1.1 Initial setup

If you do not have a terminal program that can connect to a UART interface such as PuTTY, minicom, teraterm, or screen, you will need to install one. For the sake of simplicity, we will be using screen in this guide.

Ubuntu:

```
sudo apt-get install screen
```

4.1.2 Connecting to Edison

Connect a USB cable from your host computer to the Intel® Edison board's micro USB receptacle (J3), in the lower right corner of the board (as shown in Figure 6).

Using a terminal program (such as PuTTY, minicom, teraterm, screen, etc.), enter a command to connect to the board. If multiple UART devices are not connected, the Edison UART interface will be enumerated as /dev/ttyUSB0. Baudrate should be set at 115200.

For example, with screen.

```
sudo screen /dev/ttyUSB0 115200
```

4.2 Connect through RNDIS

4.2.1 Initial setup

Add the following lines to /etc/network/interfaces

```
allow-hotplug usb0
auto usb0
iface usb0 inet static
       address 192.168.2.1
       netmask 255.255.255.0
```

Restart networking service using: */etc/init.d/networking restart*

Note: Modifying this file will have a side-effect that *usb0* network interface will be configured each time for the next PC reboot. If the board is up and running, the USB interface will be found; if the board is not running, it won't. Sometimes this will cause the system to hang for a while as Ubuntu boots, trying to configure the network. After a successful boot, *eth0* might fail to be configured. If this happens, a workaround is to manually start network manager from terminal:

```
$ sudo service network-manager start
```

If this process does not work, there is an alternative (and perhaps easier) method on Ubuntu, using the GUI to edit the network connections. After flashing the device, Ubuntu will automatically register a new wired connection. Network connections can be viewed in the top right of the status bar. Click *Edit Connections* from the dropdown menu, as shown in Figure 7.

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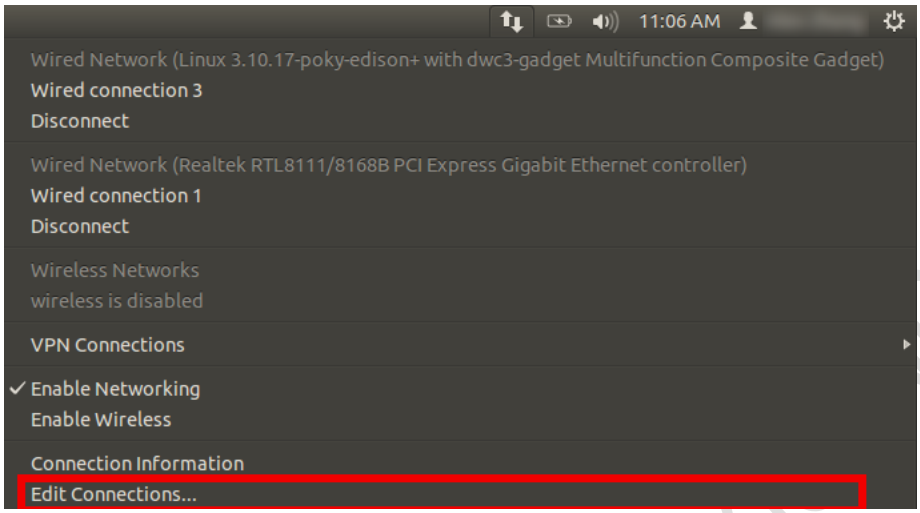
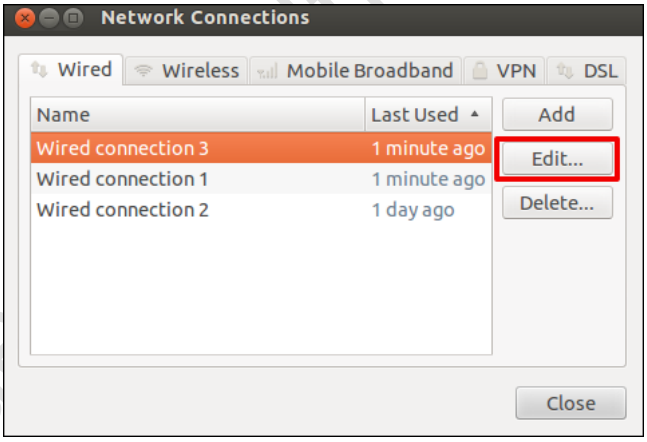
Figure 7 Linux > Edit connections



Depending on how many wired connections you have, the wired connection to the Intel® Edison board will usually be the most recently created one, with the highest identifier. In this case, it is *Wired Connection 3*. You can verify which wired connection is the correct one by going to the dropdown menu shown above, and seeing which connection has "edison" in the name.

After determining which wired connection the Intel® Edison board is connected to, highlight it and click *Edit* (Figure 8).

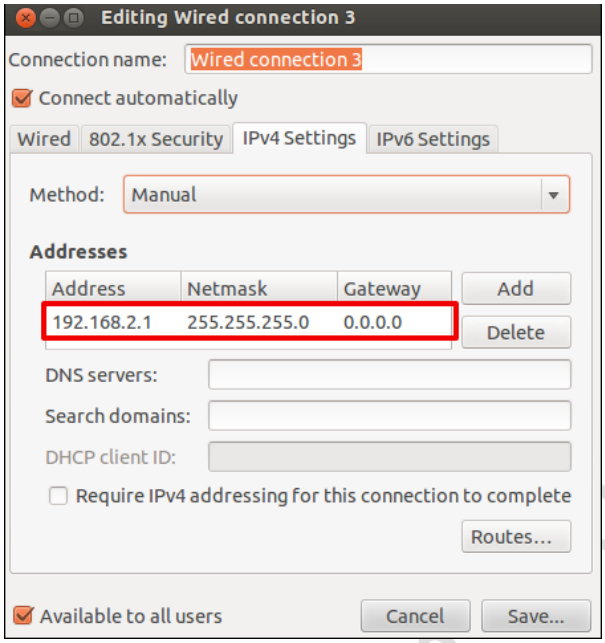
Figure 8 Linux > Network connections



Go to the *IPv4 Settings* tab and click *Add* (Figure 9). Enter the following information:

- IP Address: 192.168.2.1
- Netmask: 255.255.255.0
- Gateway: 0.0.0.0

Figure 9 Linux > Editing wired connection



Click *Save*. You should now be able to network with and connect to the Intel® Edison board without issue.

4.2.2 Connecting to Edison

To connect to the Edison, SSH to 192.168.2.15 with root as the username. For example, from the terminal;

```
ssh root@192.168.2.15
```

Because this IP address is statically set on the Edison, it will not be possible to have two Edisons connected over RNDIS without changing the static IP on one of the two devices.

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4.3 Flash an image onto the Edison

4.3.1 Downloads

Before starting the process, download the following dependencies:

- Phone Flash Tool: *https://wiki.ith.intel.com/display/DRD/Phone+Flash+Tool*

Also, go to *file://aceslab/SLC/NDG-Edison/Software/Release* and download the latest Edison image zip file (*edison-image-wwXX-XX.zip*, where "XX-XX" is the workweek and year), and extract a prebuilt Edison image archive to flash.

4.3.2 Initial setup

For Ubuntu 12.04 environments, do the following:

1. Install Phone Flash Tool (including the SOC and USB drivers):

```
sudo apt-get install gdebi ia32-libs
```

2. Enter the following:

```
sudo gdebi ~/<download_directory>/PhoneFlashTool_4.4.4.0_linux_x86_64.deb
```

3. Enter the following:

```
sudo apt-get install dfu-util
```

Note: **Gnome users:** You must configure the device before connecting it to your computer, to prevent the network manager desktop plugin from creating a profile for the device. If you do not, you will have to remove this profile to avoid losing static IP configuration.

4.3.3 Flashing an image

Note: Use a USB 2.0 port for all flashing operations on the Intel® Edison board.

1. Keep the Micro USB cable and the power supply unplugged. Make sure that the position of the tiny switch SW1 is on the side closer to the Micro USB connector.
2. Unzip the prebuilt *edison_image-wwXX-XX.zip* file. Then open a command shell, navigate to the directory listed below, and enter the following command:

```
./flashall.sh -b
```

3. When the script starts to search for the Edison, connect the micro USB cable to the inner Micro USB port as shown in Figure 6, and connect the power supply afterwards. If the flashing does not start, unplug both cables, reinsert the microUSB cable, and then reconnect the power supply.
4. After the flashing starts, allow the script to completely run and do not interrupt.
5. After flashing, the board will reboot a couple of times and partition the file system. Do not interrupt this operation, it should last approximately 30 seconds or so.

Note: If you have errors flashing, open a UART interface serial connection in order to see what is happening on the Edison.

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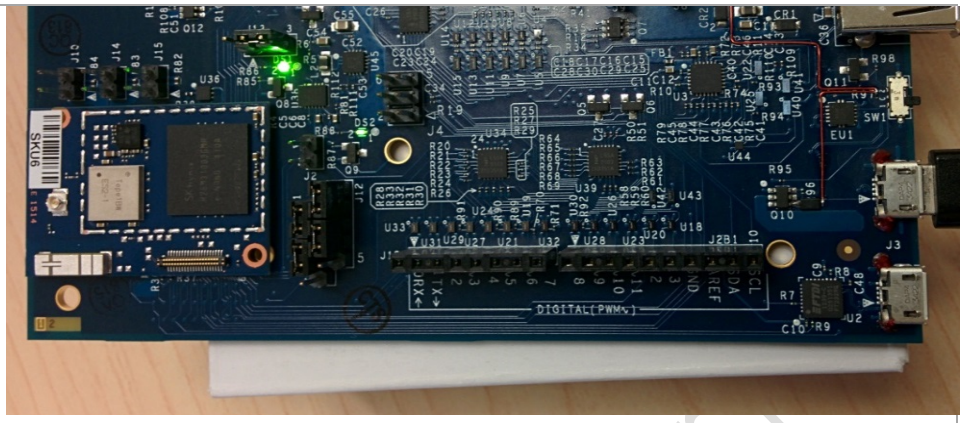
Figure 10 Intel® Edison board



4.4 Cross-compile “hello world”

To build a native application for the target using the cross-compilation toolchain, do the following:

1. Extract the script from the zip, which should be in the format *Edison-sdk-linux-weekly-51.zip*. Run the script with *sudo*, which should prompt for a target install directory. Install the cross-compiler in a directory of your choice, which by default is /opt/poky-edison/1.6.

```
sudo ./poky-edison-eglibc-x86_64-edison-image-core2-32-toolchain-1.6.sh
Enter target directory for SDK (default: /opt/poky-edison/1.6):
```

2. Initialize the environment to use the proper cross-compiler:

```
source /opt/poky-edison/1.6/environment-setup-core2-32-poky-linux
```

3. Build a “helloworld” C program:

```
/* Hello World program */
#include<stdio.h>
main()
{
    printf("Hello World\n");
}
```

4. Save it as *helloworld.c*.
5. Compile the *helloworld.c* program and deploy it on the device. This is an example of how to do so over RNDIS.

```
$CC -o helloworld helloworld.c
scp helloworld root@192.168.2.15:/home/root
```

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5 Mac OS X Configuration

5.1 Connect through USB/UART

Open up a terminal and use the *screen* command to connect to the UART USB interface. The following command will do so as long as there is only one UART interface connected to the Mac.

```
sudo screen /dev/tty.usbserial* 115200
```

5.2 Connect through RNDIS

MacOS X does not come with the needed Remote Network Driver Interface Specification (RNDIS) driver preinstalled. A possible solution is the open-source HoRNDIS driver. (Visit *www.joshuawise.com/horndis*.)

The easiest way to install the necessary software is by using **homebrew**. If you do not have homebrew, you can install it by entering the following on a command line:

```
ruby -e "$(curl -fsSL https://raw.github.com/Homebrew/homebrew/go/install)"
```

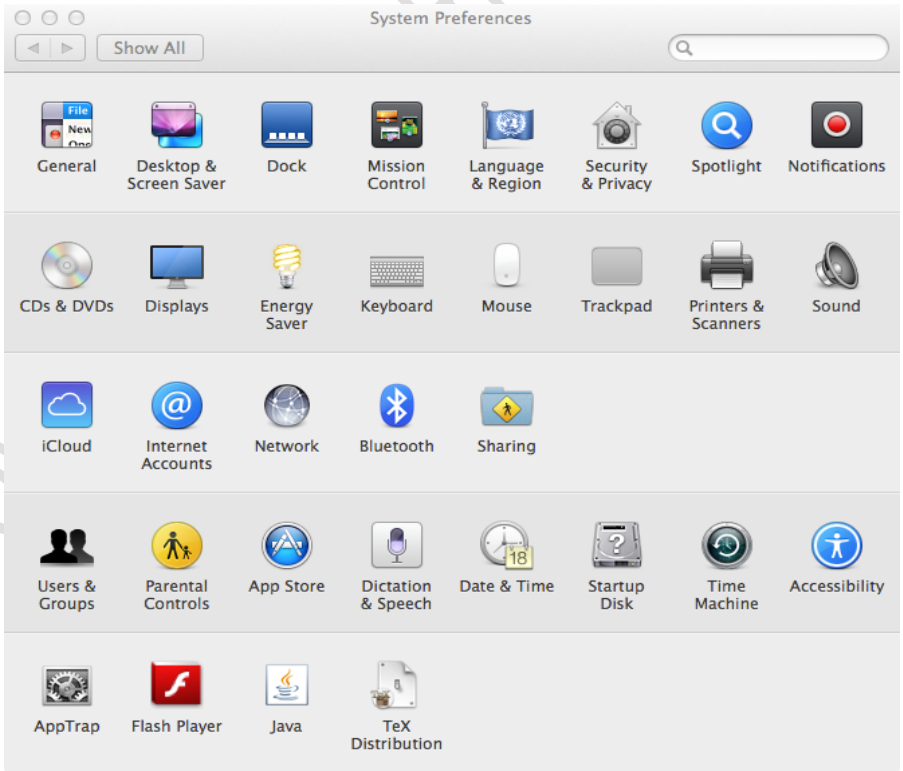
Once you have homebrew installed, use it to install the HoRNDIS driver:

```
brew install horndis
```

If this command fails, install the downloaded horndis file using the Mac package installer.

Configure the RNDIS driver by opening the system preferences and selecting *Network* (Figure 11).

Figure 11 Mac system preferences



In the network window (Figure 12), select *RNDIS driver* from the left column, then set the RNDIS driver to configure IPv4 manually, with an IP address of 192.168.2.1 and a subnet mask of 255.255.255.0. Then click *Apply*.

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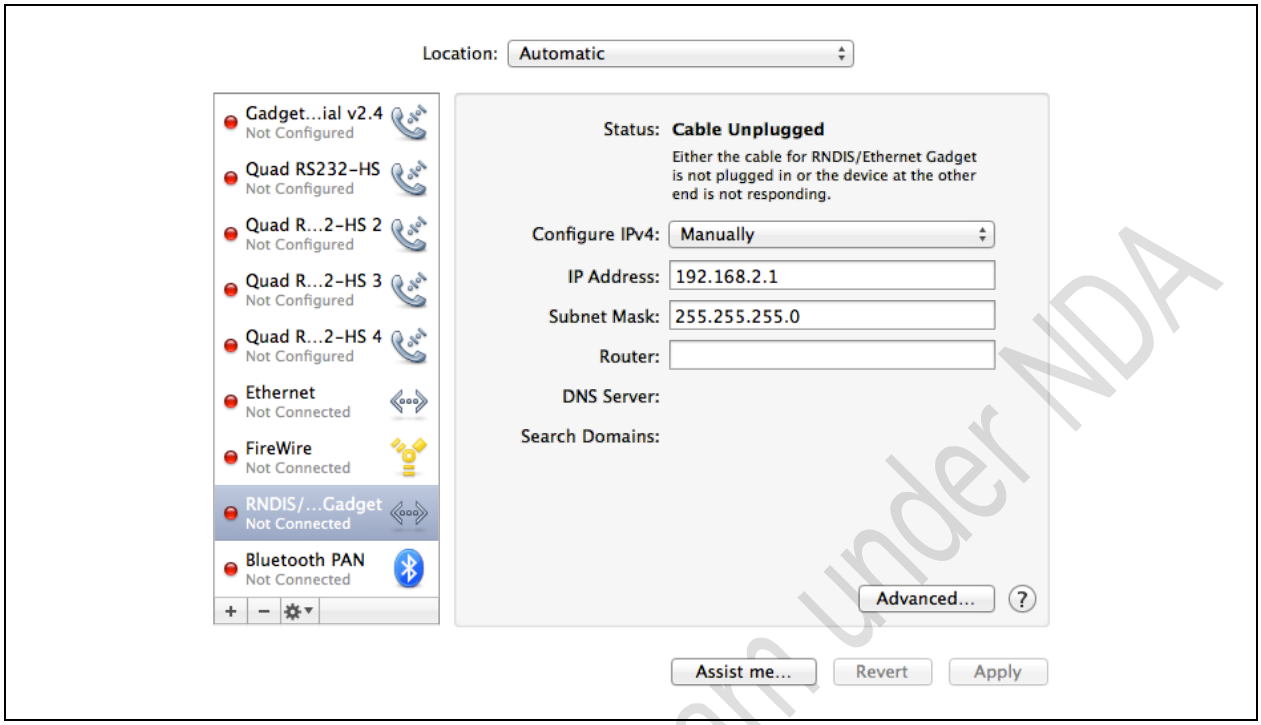
Figure 12 Configure RNDIS driver



To connect to the Edison, SSH to 192.168.2.15 with root as the username. For example, from the terminal:

```
ssh root@192.168.2.15
```

Note: Because this IP address is statically set on the Edison board, it will not be possible to have two Edison boards connected over RNDIS without changing the static IP on at least one of the two devices.

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6 Connecting to the Intel® Edison Board

Make sure your host computer (Linux, Windows, or Mac) has been set up following the steps in the preceding chapters, then connect to the Intel® Edison module using one of the following methods.

6.1 Wi-Fi

To connect your Intel® Edison board to Wi-Fi devices, enter the following on a command line:

```
systemctl start wpa_supplicant
wpa_cli
> add_network
> set_network 0 key_mgmt WPA-PSK
> set_network 0 ssid "Guest"
> set_network 0 psk "xxxxx"
> enable_network 0
> quit
```

Usage example:

```
ping www.intel.com

iperf -c 192.168.2.2 -u -b 20M -I 2 -t 60
```

6.2 Bluetooth

To connect your Intel® Edison board to Bluetooth devices, enter the following on a command line:

```
root@edison:~# rfkill unblock bluetooth
turning Bluetooth ON
Done setting line discipline
root@edison:~#
Now you can verify all RF interface via rfkill
root@edison:~# rfkill list
0: phy0: wlan
    Soft blocked: no
    Hard blocked: no
1: brcmfmac-wifi: wlan
    Soft blocked: no
    Hard blocked: no
2: bcm43xx Bluetooth: bluetooth
    Soft blocked: no
    Hard blocked: no
3: hci0: bluetooth
    Soft blocked: no
    Hard blocked: no
You have done, bluetooth is enabled !!
A basic test is to perform a scan:
root@edison:~# hcitool scan
Scanning ...
    CC:52:AF:03:33:B4    OJABBARX-MOBL2
    70:F3:95:7D:48:EF    MONTEILX-MOBL
    70:F3:95:7D:88:41    n/a
    E0:2A:82:CB:62:9B    FGANAPAX-MOBL
    F4:B7:E2:F7:14:FD    AZOUAOUI-MOBL
    70:F3:95:C7:C7:2D    SCOLLEUX-MOBL
root@edison:~#
```

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6.3 Changing an Edison board's static IP address

If you more than one Intel® Edison device, you will need to change the static IP address of each additional board in the same host via SSH. To change an Edison's IP address, do the following:

1. Log on to the Edison board via SSH.
2. Edit the */lib/systemd/system/network-gadget-init.service* file and change the default IP address listed in following two lines:

```
ExecStart=-/bin/sh -c " ifconfig usb0 192.168.2.15"
ExecReload=-/bin/sh -c " ifconfig usb0 192.168.2.15"
```

3. Next time you og on to this Edison device via SSH, the static IP address will be changed.

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7 Regulatory Statements

Model: Edison

FCC Statement:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

• This device may not cause harmful interference

• This device must accept any interference received including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that

to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help.

WARNING! Exposure to Radio Frequency Radiation The radiated output power of this device is below the FCC and Industry Canada radio frequency exposure limits.
To ensure compliance with FCC, IC and CE SAR limits use in portable hosts is subject to the following limitations:

This module, when configured at the low power setting described in this filing, is approved for use in portable devices operating at a minimum separation distance of 5mm from the body. This module is approved for use at the maximum power setting in portable host devices where the smallest distance between the outer surface of the device and the user is 17mm or the antenna is located at a distance where the SAR characteristics for the host are not influenced by the user. The highest reported SAR value is 0.40 W/Kg for the 5mm separation and 0.37 W/Kg for the 17mm separation distances.

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The modular certification for this device covers installation of the device using only an integral antenna for the configurations described in the installation instructions. Use of an external antenna requires host device certification, which OEM may obtain on their own.

FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Intel, may void the user's authority to use the device.

CAUTION: When using IEEE 802.11a wireless LAN, this product is restricted to indoor use, due to its operation in the 5.15- to 5.25-GHz frequency range. The FCC requires this product to be used indoors for the frequency range of 5.15 GHz to 5.25 GHz to reduce the potential for harmful interference to co-channel mobile satellite systems. High-power radar is allocated as the primary user of the 5.25- to 5.35-GHz and 5.65- to 5.85-GHz bands. These radar stations can cause interference with and/or damage to this device.

Canada IC:

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the interfer- ence-causing equipment standard entitled: "Digital Apparatus," ICES-003 of the Canadian Department of Communications.

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe Bprescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictee par le Ministre Canadian des Communications.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Europe (CE Declaration of Conformity)

This product complies with the Low Voltage Directive 2006/95/EC; EMC Directive 2004/108/EC, EU Directive R&TTE Directive 1999/5/EC, and RoHS Directive 2011/65/EU. Point of contact: Intel Corporation, Attn: Corporate Quality, 200 Mission College Blvd., Santa Clara, CA 05054 USA

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