

Installing and Using EDS and Linux

ECE636: Reconfigurable Computing



Electrical and Computer Engineering
University of Massachusetts, Amherst

Overview of Slides

- These slides will provide step-by-step details on downloading, installing and using the Embedded Design Suite. Detailed directions on downloading and installing Linux on a microSD card for the DE1-SOC will also be provided.
- It is assumed that the steps described in the Assignment 3 slides (`pset3-guide.ppt`) have already been taken

- Step 1: Download and install EDS

- Step 2: Download and install microSD card writing software

- Step 3: Download and install Linux for the DE1-SoC on the microSD card

- Step 4: Compile a sample program using EDS

- Step 5: Transfer the compiled binary to the DE1-SOC board using Ethernet and run it

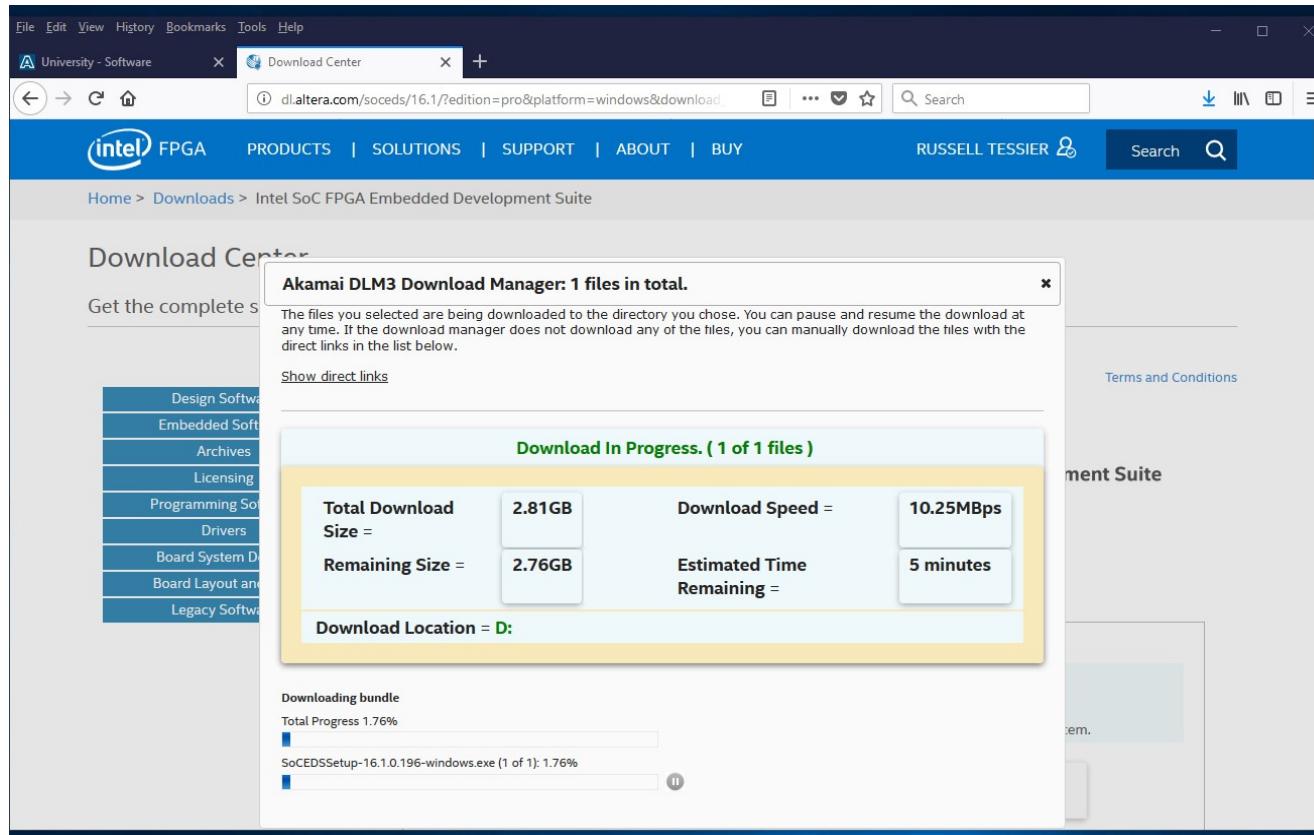
Download and Install EDS

- A detailed discussion of installing EDS can be found in Section 2.3 of the “Getting Started” guide.
- <https://www.altera.com/download/software/soc-eds>

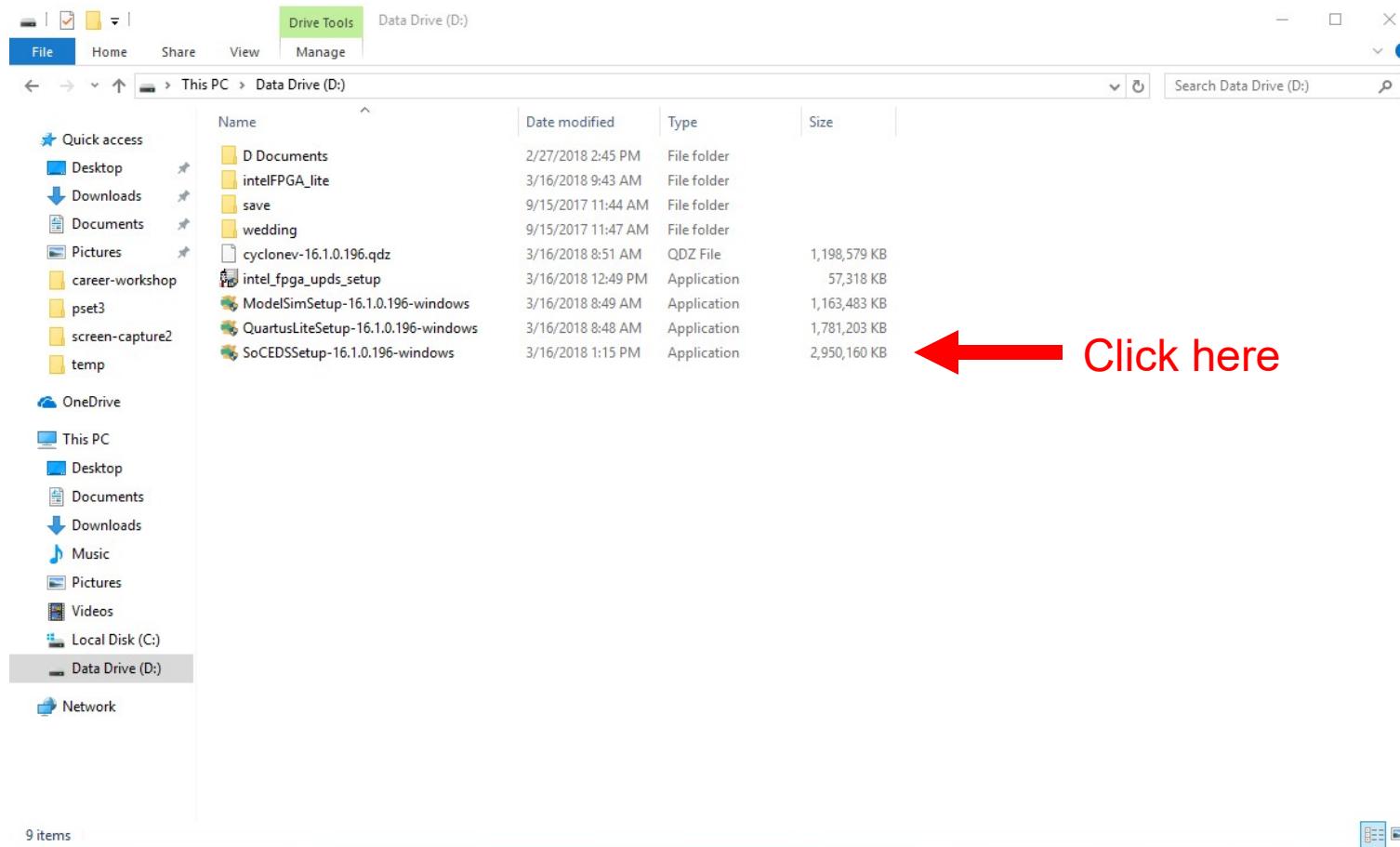
The screenshot shows a web browser displaying the Intel SoC FPGA Embedded Development Suite (EDS) download page. The URL in the address bar is dl.altera.com/soceds/16.1/?edition=pro&platform=windows. The page title is "Intel SoC FPGA Embedded Development Suite". On the left, there's a sidebar with links for Embedded Software, Archives, Licensing, Programming Software, Drivers, Board System Design, Board Layout and Test, and Legacy Software. The main content area displays the "Intel SoC FPGA Embedded Development Suite" logo and the text "Release date: November, 2016" and "Latest Release: v17.1". Below this, there's a dropdown menu labeled "Select release" with "16.1" selected. To the right of the dropdown is a red arrow pointing to it with the text "Version 16.1". Further down, there are sections for "Operating System" (Windows and Linux) and "Download Method" (Akamai DLM3 Download Manager and Direct Download). A large red arrow points to the blue "Download" button. At the bottom of the page, there are links for Licensing, System Requirements, Documentation Links, Software Support, and Legal Notice.

Download EDS

- Note: It is assumed that the Akamai Download Manager is already installed on your computer from the Quartus download**



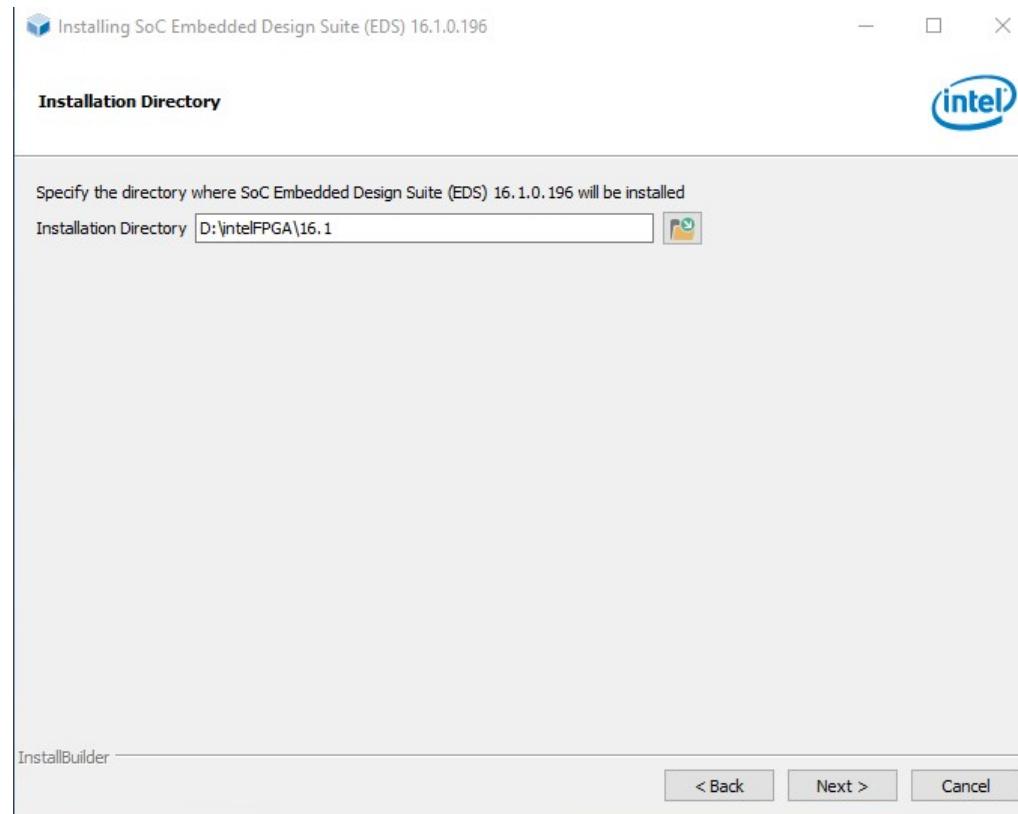
Locating the EDS Files



- Locate downloaded EDS file and click it to start installation

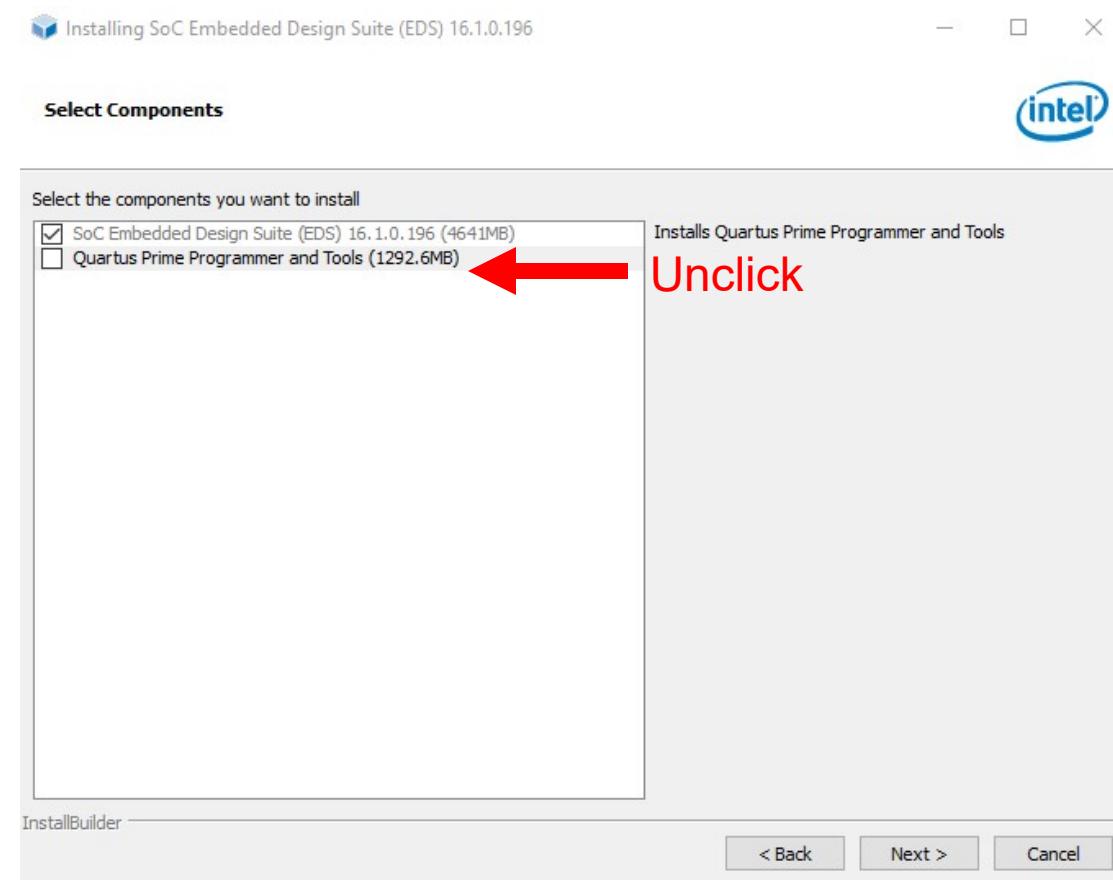
Install EDS

- Select a directory for the EDS software
- I suggest selecting a different directory than the one used for Quartus



Install EDS

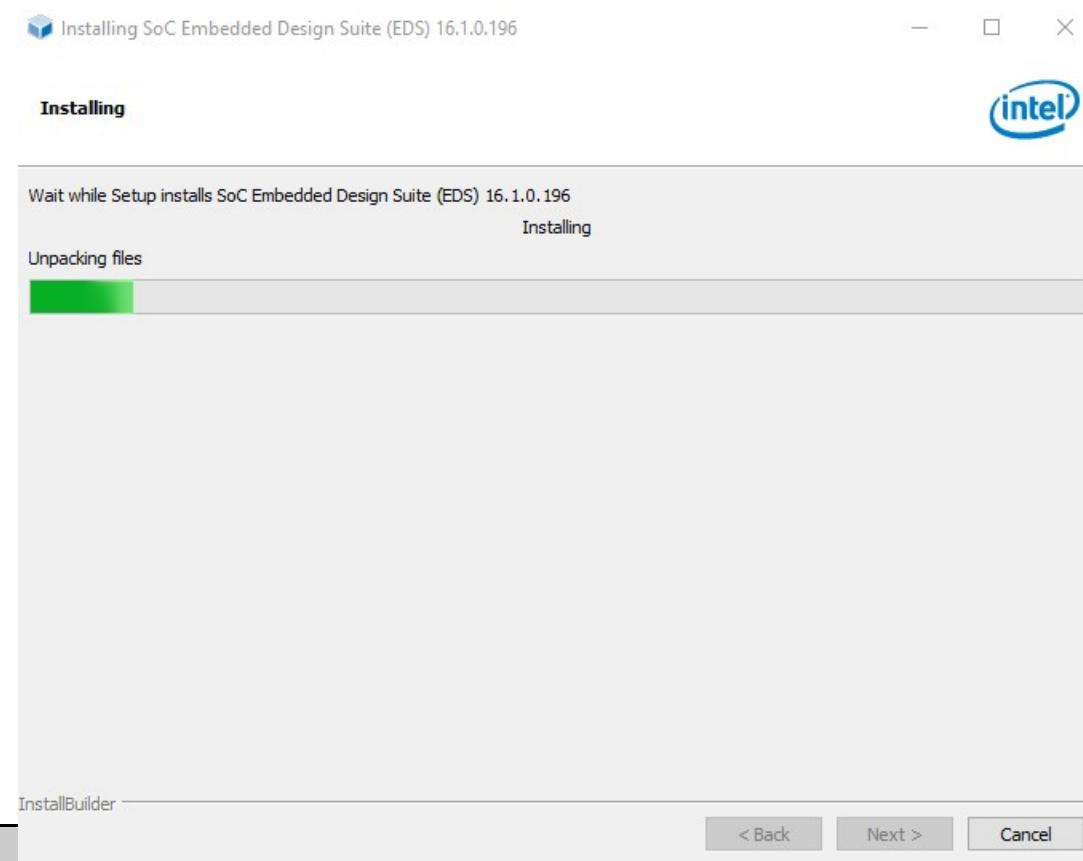
- Do not reinstall the programmer. It was already installed for Quartus



Install EDS

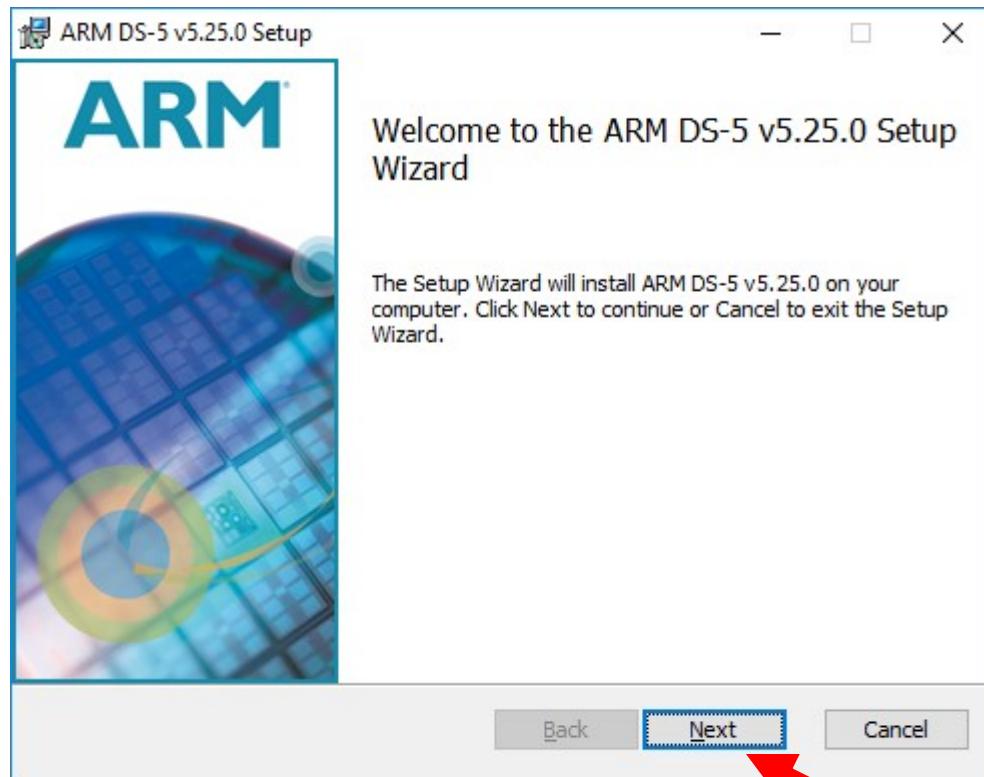
- When the installation finishes you may be prompted to install these two items
 - FTDI drivers – **DO NOT INSTALL THE DRIVERS AT THIS STEP**
 - DS-5 compiler – Do install the DS-5 compiler

Please
note



Install DS-5 Compiler

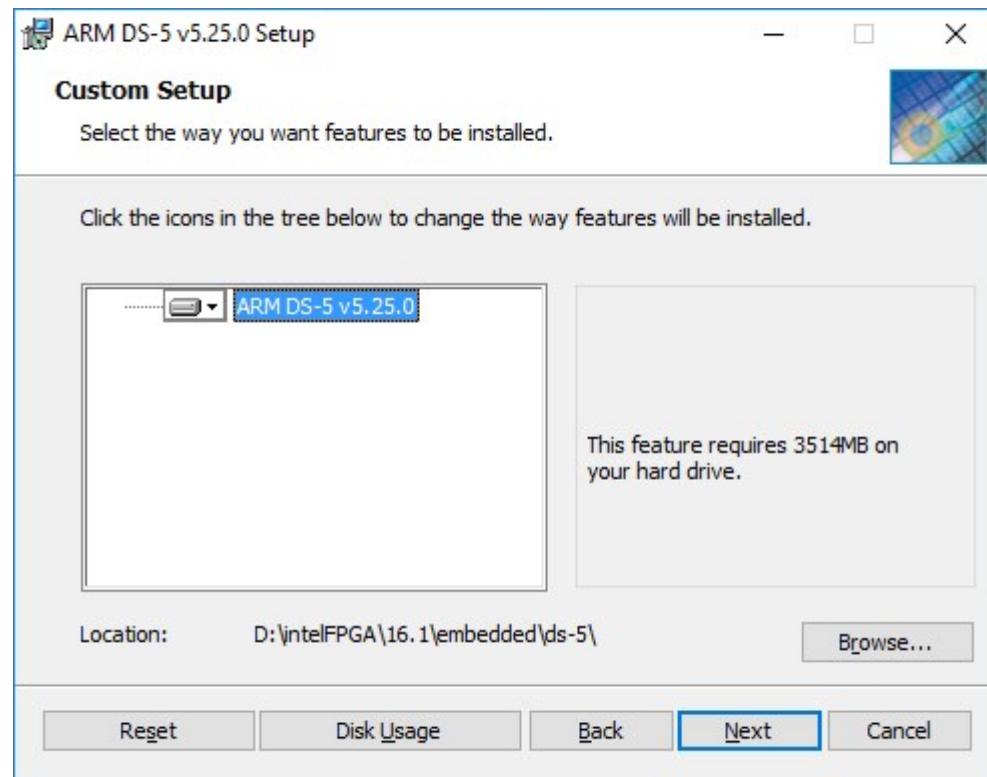
- The DS-5 compiler compiles programs for the ARM C9 processor on the DE1-SOC



Click

Install DS-5 Compiler

- The compiler allows you to compile complex C programs



Downloading and Installing Linux for DE1-SOC

- It is easy to install Linux on a microSD card, insert it into the microSD slot on the board, and then boot up Linux when the on button is pressed on the board.
- In the next few slides, the steps to perform these actions are detailed
- More details on Linux installation can be found in Chapter 5 of the “Getting Started” guide

http://cd_de1-soc.terasic.com/

The screenshot shows a web page with two tables of download links. A red arrow points to the second table, and red text above it says "Click to Download".

Table 1: Quartus Download

Title	Version	Size(KB)	Date Added	Download
Quartus Download			2013-12-26	
DE1-SoC System Builder	1.1.1		2016-09-02	
DE1-SoC CD-ROM (rev.B Board)	1.2.0		2014-03-25	
DE1-SoC CD-ROM (rev.C/rev.D Board)	3.1.3		2015-04-08	
DE1-SoC CD-ROM (rev.E Board)	4.0.3		2015-08-07	
DE1-SoC CD-ROM (rev.F Board)	5.1.1		2016-09-07	

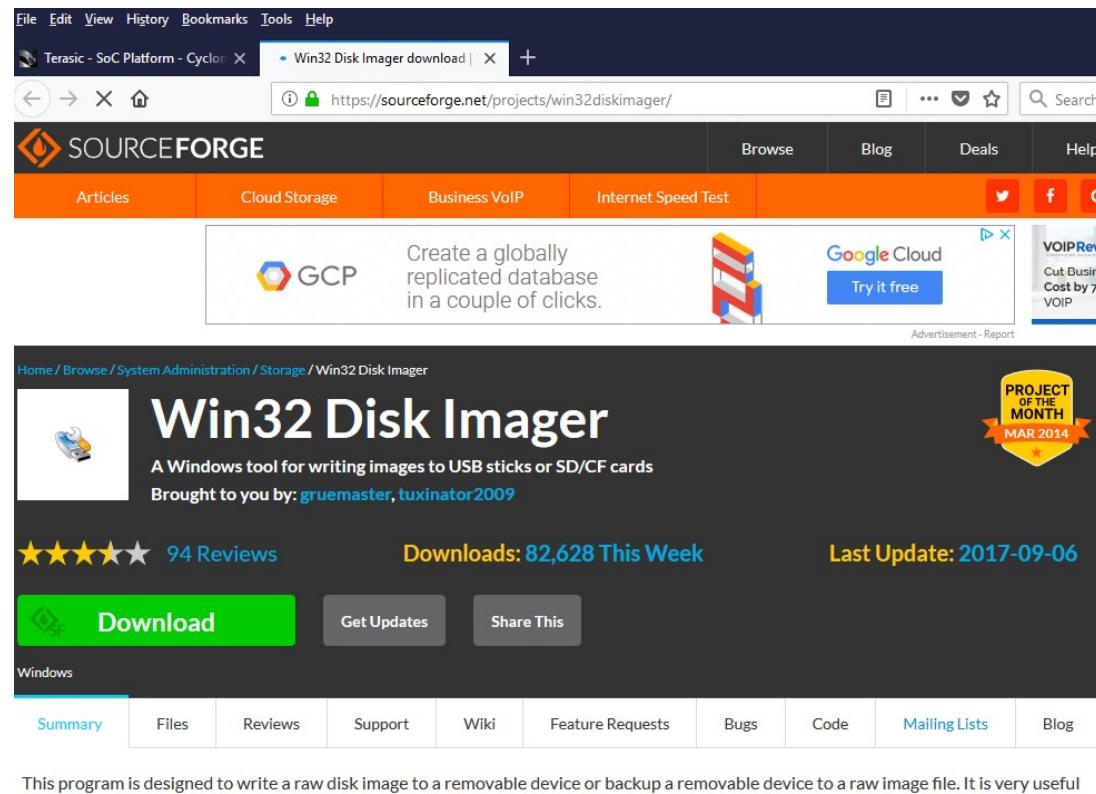
(64-bit OS and Quartus II 64-bit are required to compile projects for DE1-SoC)

Table 2: Linux BSP (Board Support Package): MicroSD Card Image

Title	Linux Kernel	Min. microSD Capacity	Size(KB)	Date Added	Download
Linux Console	3.12	4GB	66495	2014-01-14	
Linux Console with framebuffer	3.12	4GB	328524	2014-03-24	
Linux LXDE Desktop (*)	3.12	8GB	1369526	2014-03-21	
Linux Ubuntu Desktop (*)	3.12	8GB	711995	2015-06-26	
Linux LXDE Desktop	4.5	8GB	1240466	2016-11-14	
Linux Ubuntu Desktop	4.5	8GB	1933049	2016-12-28	

Downloading and Installing Linux for DE1-SOC

- Download Win32 Disk Imager: <http://sourceforge.net/projects/win32diskimager/>
- Unzip DE1_SoC_SD.img



Install the Disk Imager and Burn Image onto microSD card

- Click on win32diskimager-1.0.0-install to install the disk imager software on your PC
- Plug the microSD card into your PC (You may need to use an SD card adapter)
- Follow these directions from Chapter 5 of the “Getting Started” guide

The SD card image file needs to be programmed to a microSD card before it can be used.

The steps below present how to create microSD card on a windows machine using Win32DiskImager.exe.

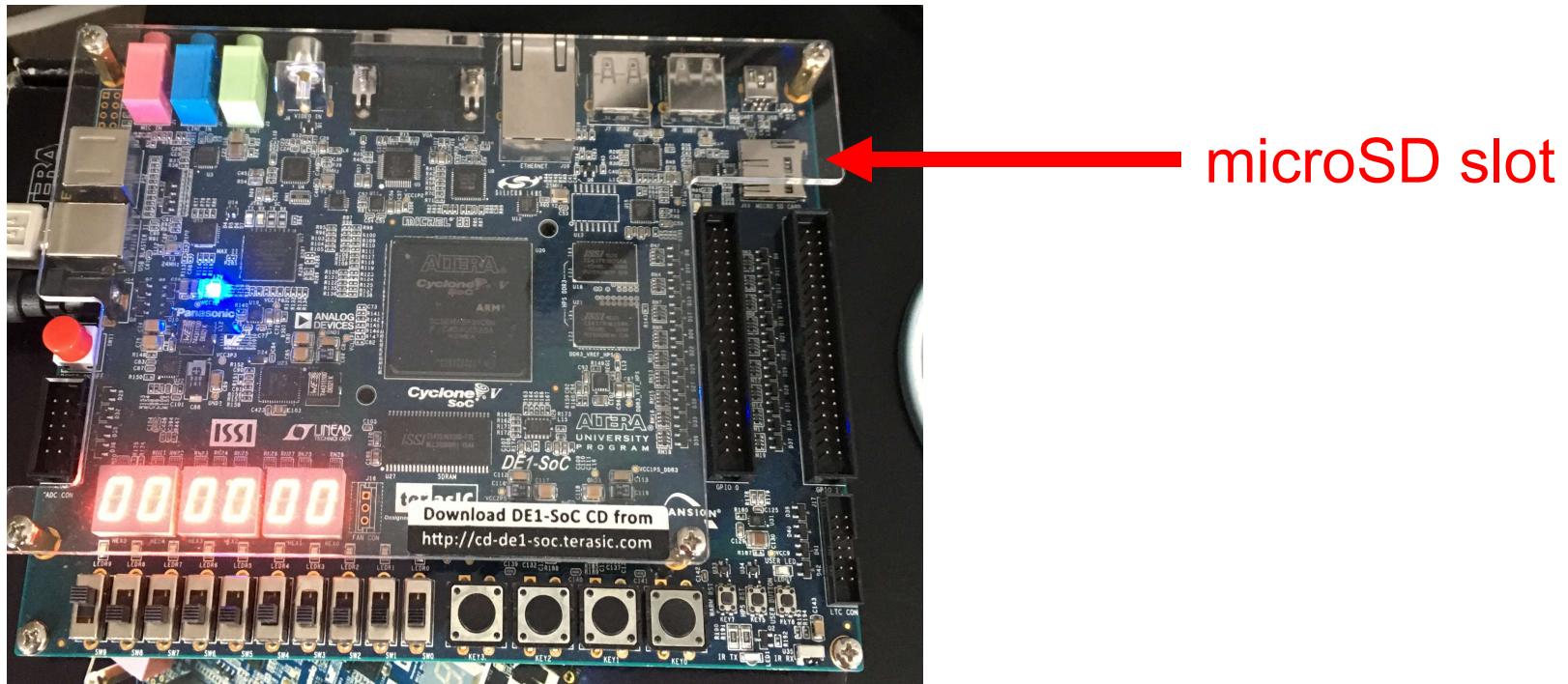
1. Connect the microSD card to a Windows PC
2. Execute Win32DiskImager.exe
3. Select the image file for microSD card
4. Select the microSD card device



5. Click “write” to start writing the image file to the microSD card. Wait until the image is written successfully.

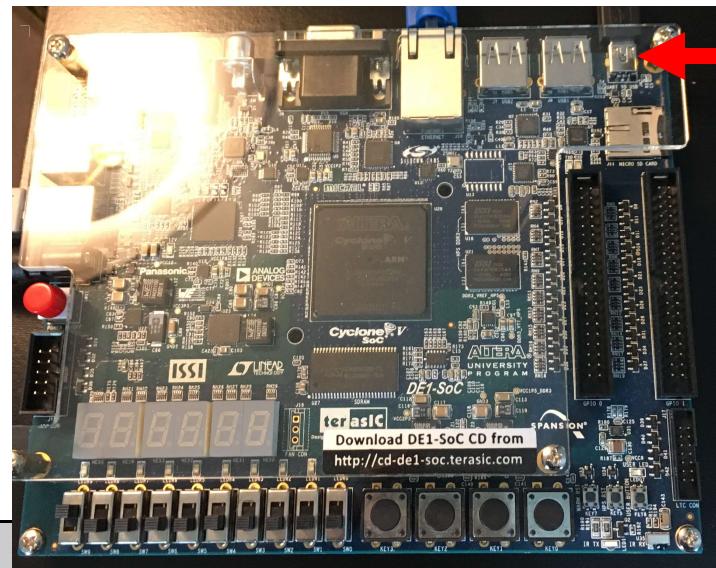
Insert microSD card with Linux into microSD slot

- Insert card into slot when the board is powered down
- Linux will automatically boot up on the ARM C9 processor every time the board is turned on
- Note: Intel Monitor Program will not work if the Linux card is inserted in the board



Setting Up the UART Terminal

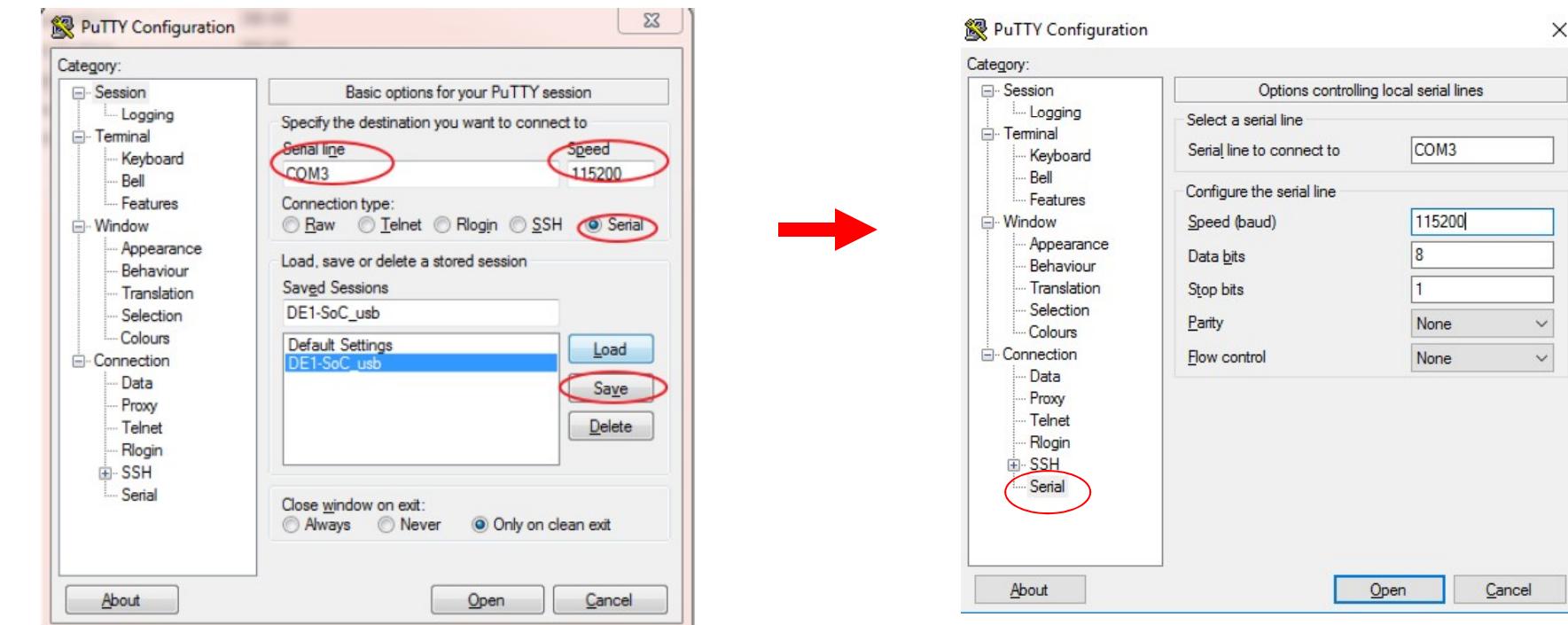
- Connect micro USB cable to PC and DE1-SOC
- If necessary, perform these steps from Section 5.3 of the “Getting Started” guide
 - Power on the board then open the computer device manager in Windows. You will find an unrecognized FT232R USB UART
 - Select the FT232R USB UART to update the driver software. The driver can be downloaded from <http://www.ftdichip.com/Drivers/VCP.htm>
 - After the driver has been installed correctly, the USB Serial Port is recognized as a port such as COM3 (Open the device manager to know which COM port assigned in your computer)



Note: I did not need to install the driver to get the connection working with my PC

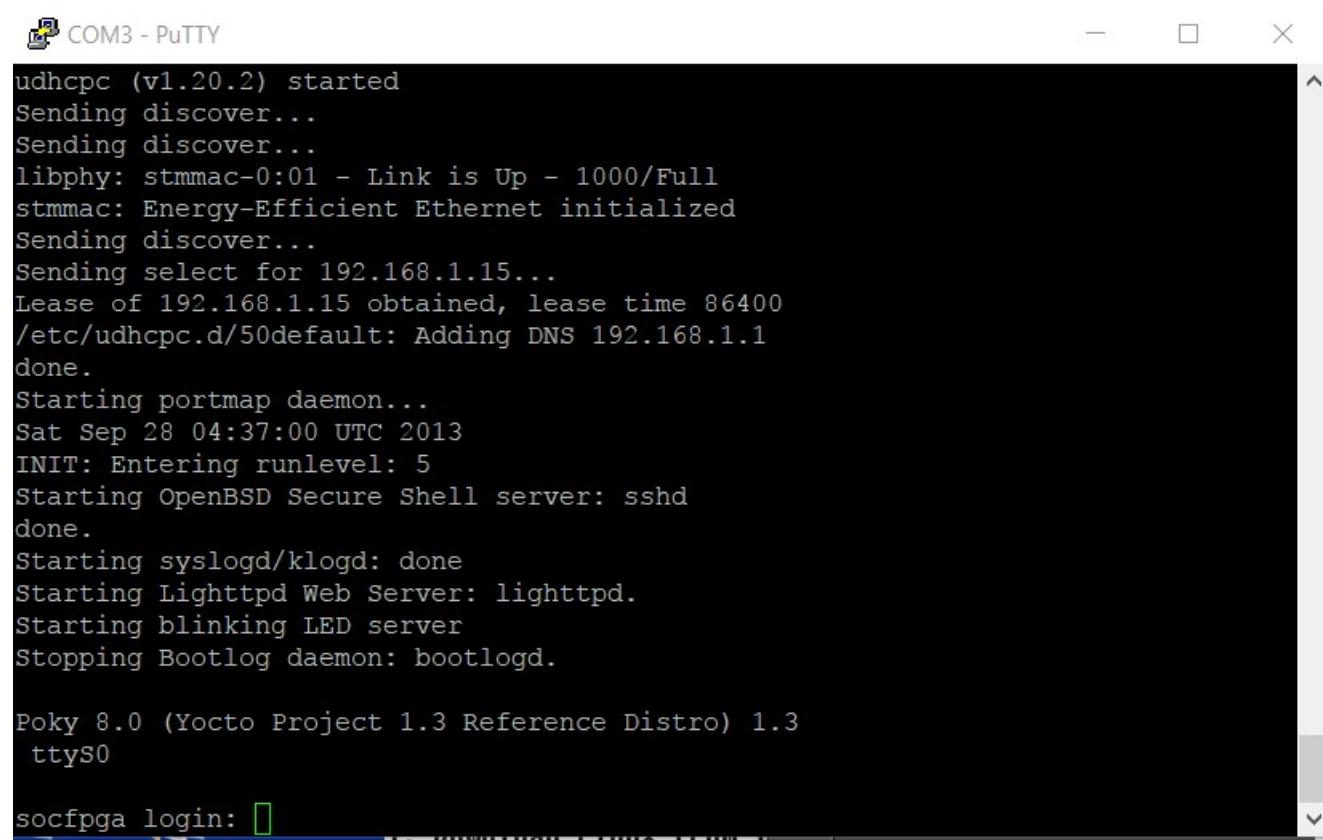
Setting Up the USB Interface

- Download the serial interface (Putty) from the following web site:
<http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe>
- Open putty.exe, click Serial go to a serial configure interface
- Configure the windows like the following pictures and click save button to save the configuration.



Booting Up Linux

- If you did everything correctly, you should see the following messages in the putty terminal on your computer when you turn on the DE1-SOC



A screenshot of a PuTTY terminal window titled "COM3 - PuTTY". The window displays the boot log of a Linux system. The log starts with "udhcpc (v1.20.2) started" and shows the process of obtaining an IP address via DHCP. It then moves on to starting various system services like "portmap", "syslogd/klogd", and "Lighttpd Web Server". Finally, it reaches the "Poky 8.0 (Yocto Project 1.3 Reference Distro) 1.3" prompt, followed by "ttyS0" and "socfpga login: []".

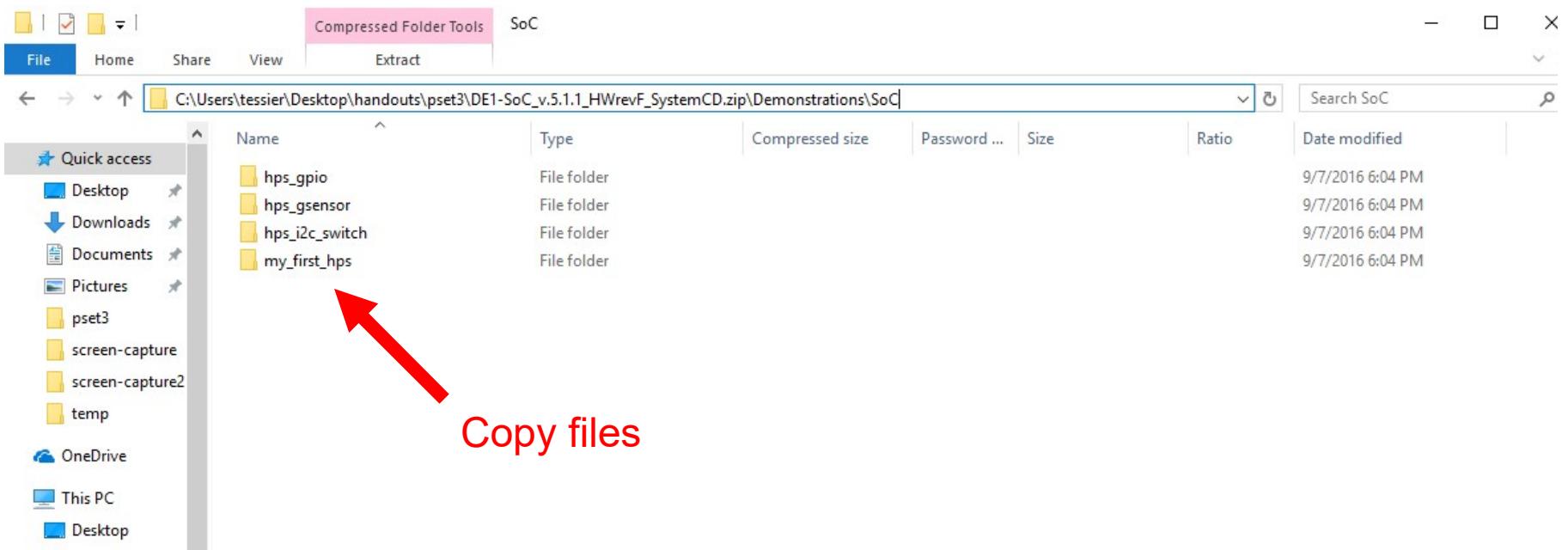
```
udhcpc (v1.20.2) started
Sending discover...
Sending discover...
libphy: stmmac-0:01 - Link is Up - 1000/Full
stmmac: Energy-Efficient Ethernet initialized
Sending discover...
Sending select for 192.168.1.15...
Lease of 192.168.1.15 obtained, lease time 86400
/etc/udhcpc.d/50default: Adding DNS 192.168.1.1
done.
Starting portmap daemon...
Sat Sep 28 04:37:00 UTC 2013
INIT: Entering runlevel: 5
Starting OpenBSD Secure Shell server: sshd
done.
Starting syslogd/klogd: done
Starting Lighttpd Web Server: lighttpd.
Starting blinking LED server
Stopping Bootlog daemon: bootlogd.

Poky 8.0 (Yocto Project 1.3 Reference Distro) 1.3
ttyS0

socfpga login: [ ]
```

Compiling an Application Using EDS

- The next step in this exercise is compiling a program using EDS.
- For this exercise, we use the my_first_hps program located on the DE1-SOC CD-ROM. Make a copy of these files, as shown below
- Additional information about this exercise can be found in Chapter 6 of the DE1-SOC User's Guide Manual

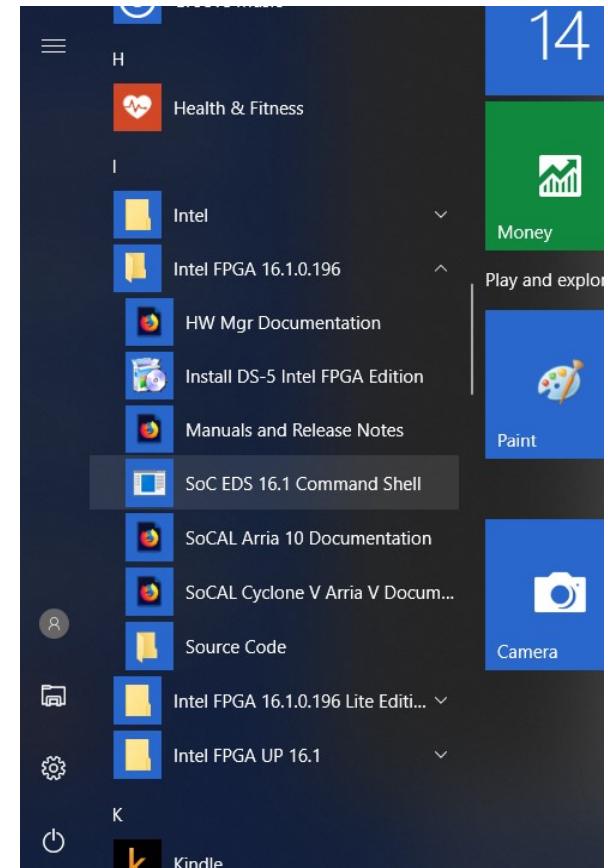


Compiling an Application Using EDS

- Start the compilation process by selecting the SoC EDS 16.1 Command Shell
- This action will open up a text-based command shell

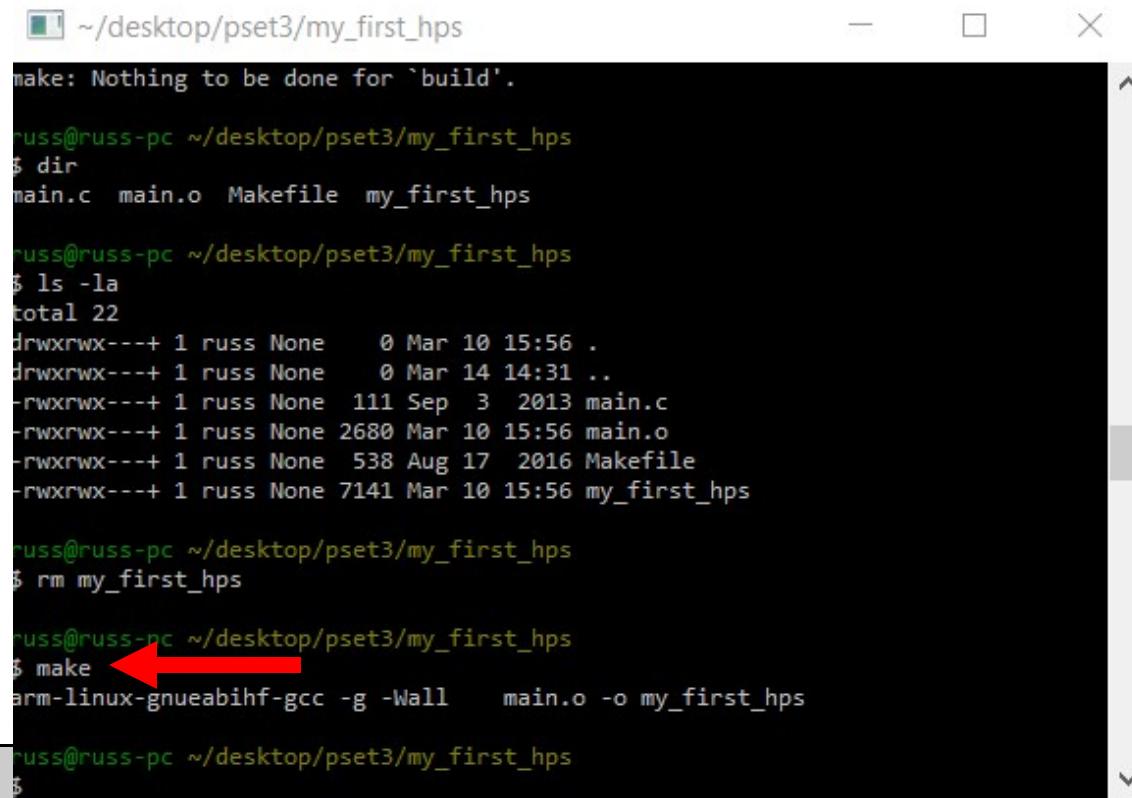


```
WARNING: DS-5 install not detected. SoC EDS may not function correctly without a DS-5 install.  
Altera Embedded Command Shell  
Version 16.1 [Build 196]  
  
tessier@ECS-MST-134-01 ~  
$ pwd  
/cygdrive/c/Users/tessier  
  
tessier@ECS-MST-134-01 ~  
$
```



Compiling an Application Using EDS

- Using the Linux “cd” command, change directories until you reach the `my_first_hps` directory
- Type “make” to create the binary for the “`main.c`” application.



```
~/desktop/pset3/my_first_hps
make: Nothing to be done for 'build'.

russ@russ-pc ~/desktop/pset3/my_first_hps
$ dir
main.c main.o Makefile my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$ ls -la
total 22
drwxrwx---+ 1 russ None    0 Mar 10 15:56 .
drwxrwx---+ 1 russ None    0 Mar 14 14:31 ..
-rwxrwx---+ 1 russ None 111 Sep  3 2013 main.c
-rwxrwx---+ 1 russ None 2680 Mar 10 15:56 main.o
-rwxrwx---+ 1 russ None  538 Aug 17 2016 Makefile
-rwxrwx---+ 1 russ None 7141 Mar 10 15:56 my_first_hps

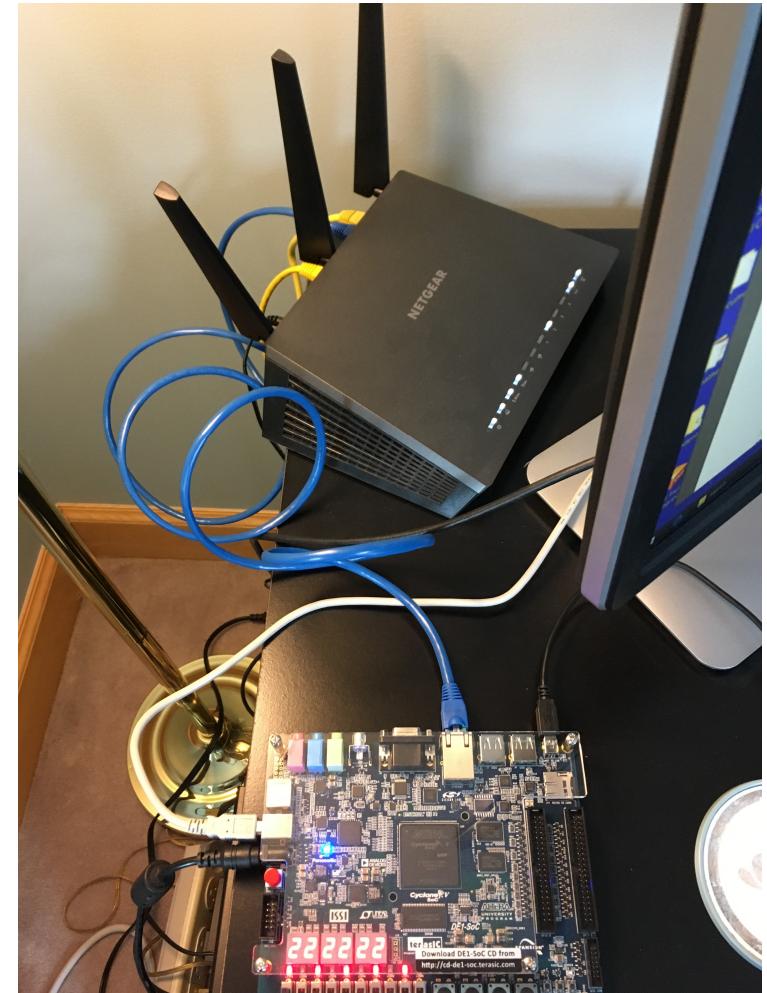
russ@russ-pc ~/desktop/pset3/my_first_hps
$ rm my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$ make ←
arm-linux-gnueabihf-gcc -g -Wall      main.o -o my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$
```

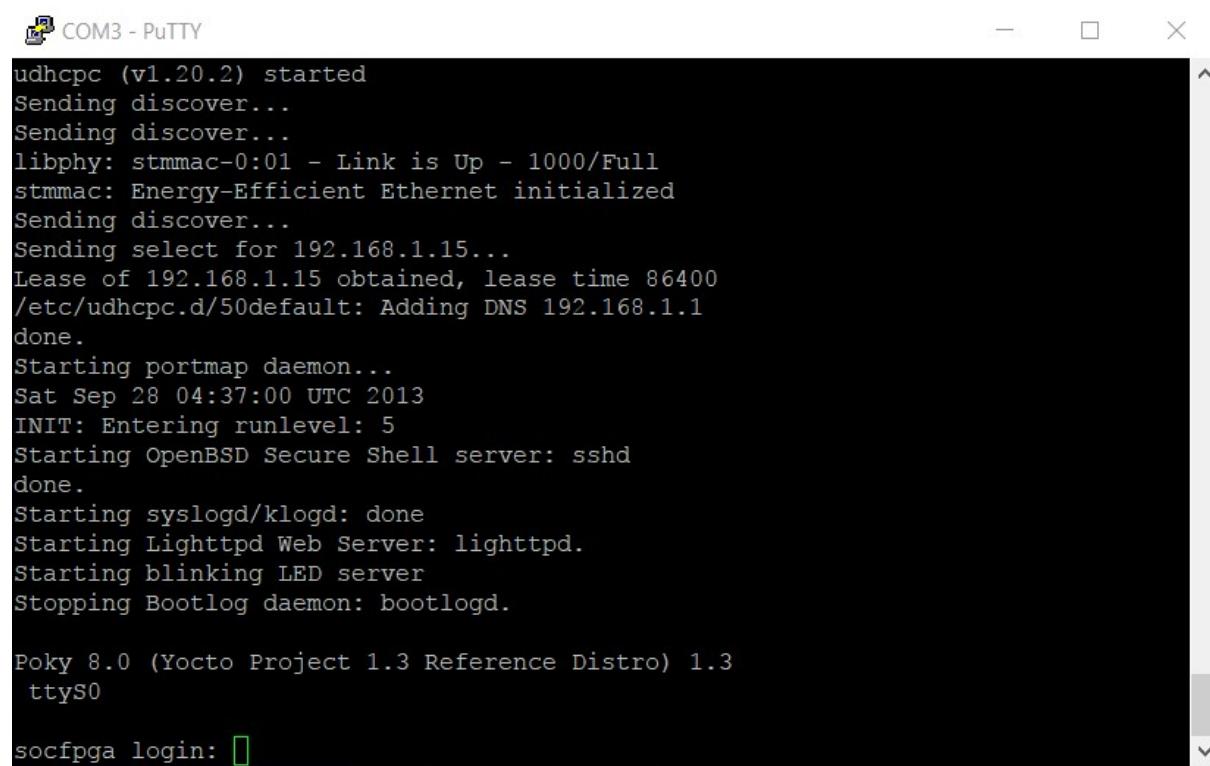
Transferring the Compiled File to the DE1-SoC

- The final step of the exercise is to transfer the compiled binary “my_first_hps” to the DE1-SoC board and to execute it.
- The easiest way to transfer the file is use Ethernet.
- Shut the DE1-SoC board off and connect an Ethernet cable from the board to your home router as shown here



Transferring a File to the DE1-SOC

- At the login prompt in the COM3 window, type “root” and press enter



The screenshot shows a PuTTY terminal window titled "COM3 - PuTTY". The window displays a Linux boot log. The log starts with network initialization (udhcpc), followed by kernel boot messages, and ends with a root login prompt. The text is white on a black background.

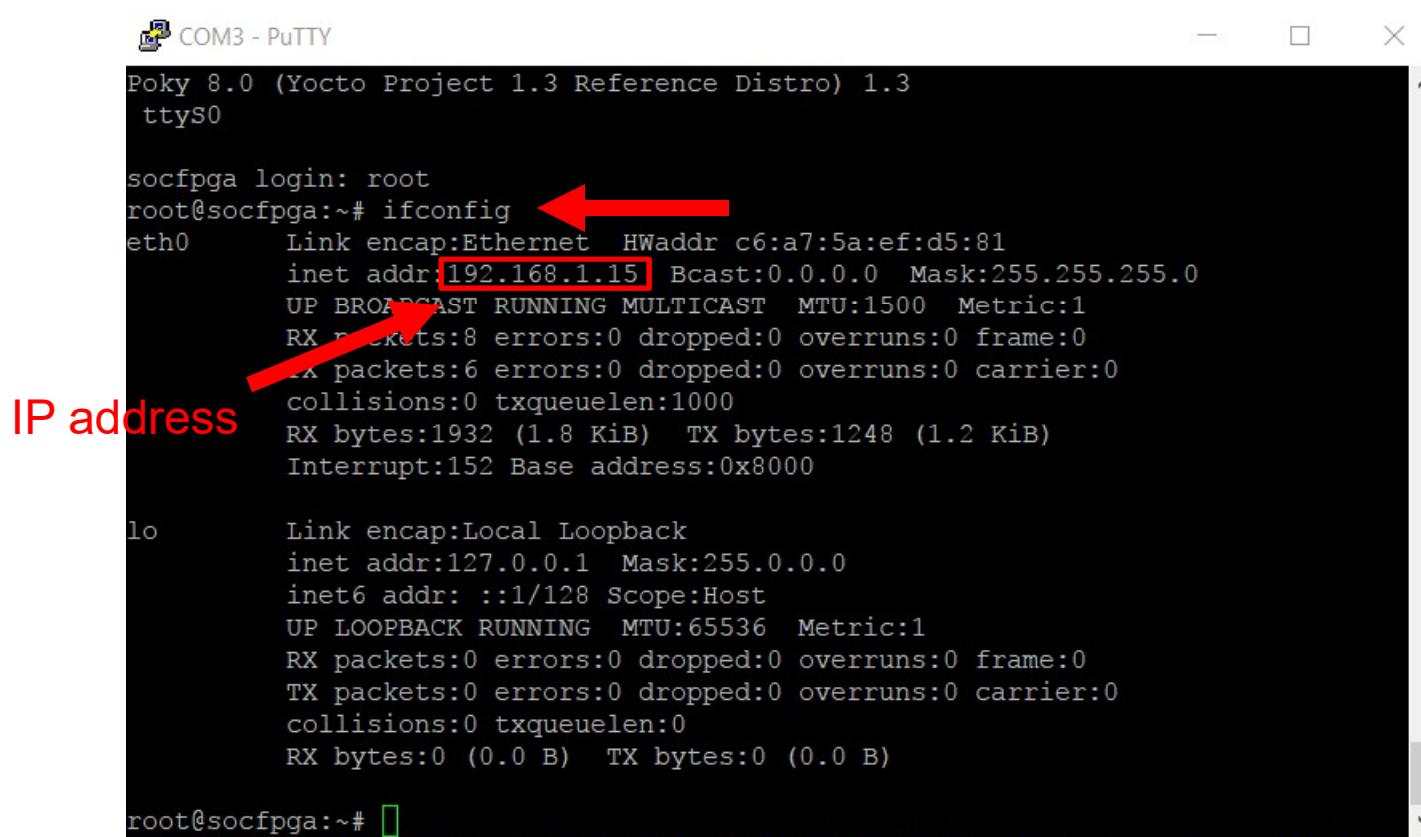
```
udhcpc (v1.20.2) started
Sending discover...
Sending discover...
libphy: stmmac-0:01 - Link is Up - 1000/Full
stmmac: Energy-Efficient Ethernet initialized
Sending discover...
Sending select for 192.168.1.15...
Lease of 192.168.1.15 obtained, lease time 86400
/etc/udhcpc.d/50default: Adding DNS 192.168.1.1
done.
Starting portmap daemon...
Sat Sep 28 04:37:00 UTC 2013
INIT: Entering runlevel: 5
Starting OpenBSD Secure Shell server: sshd
done.
Starting syslogd/klogd: done
Starting Lighttpd Web Server: lighttpd.
Starting blinking LED server
Stopping Bootlog daemon: bootlogd.

Poky 8.0 (Yocto Project 1.3 Reference Distro) 1.3
ttyS0

socfpga login: 
```

Transferring a File to the DE1-SOC

- In the COM3 putty window, type “ifconfig” to determine the IP address of your board. In this case it is 192.168.1.15



Poky 8.0 (Yocto Project 1.3 Reference Distro) 1.3
ttyS0

socfpga login: root
root@socfpga:~# ifconfig

eth0 Link encap:Ethernet HWaddr c6:a7:5a:ef:d5:81
inet addr:192.168.1.15 Bcast:0.0.0.0 Mask:255.255.255.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:8 errors:0 dropped:0 overruns:0 frame:0
TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1932 (1.8 KiB) TX bytes:1248 (1.2 KiB)
Interrupt:152 Base address:0x8000

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root@socfpga:~#

Transferring a File to the DE1-SOC

- In the EDS window (on the right below) type
“`scp my_first_hps root@192.168.1.15:/home/root`”
- This action will copy the file from your PC to the DE1-SoC
- Type “`ls`” in the COM3 window to confirm that the file has been received

```
~/desktop/pset3/my_first_hps
-rwxrwx---+ 1 russ None 111 Sep  3 2013 main.c
-rwxrwx---+ 1 russ None 2680 Mar 10 15:56 main.o
-rwxrwx---+ 1 russ None 538 Aug 17 2016 Makefile
-rwxrwx---+ 1 russ None 7141 Mar 10 15:56 my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$ rm my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$ make
arm-linux-gnueabihf-gcc -g -Wall    main.o -o my_first_hps

russ@russ-pc ~/desktop/pset3/my_first_hps
$ scp my_first_hps root@192.168.1.15:/home/root ←
Could not create directory '/home/russ/.ssh'.
The authenticity of host '192.168.1.15 (192.168.1.15)' can't be established.
ECDSA key fingerprint is SHA256:dwbpG6yAks0iqqLe0QwW4CTuT9HR1Zgkm2NCKdWKwYA.
Are you sure you want to continue connecting (yes/no)? yes
Failed to add the host to the list of known hosts (/home/russ/.ssh/known_hosts).

root@192.168.1.15's password:
my_first_hps                                100% 7141     7.0KB/s   00:00

russ@russ-pc ~/desktop/pset3/my_first_hps
$ pset3

Putty
```

```
COM3 - PuTTY
collisions:0 txqueuelen:1000
RX bytes:1932 (1.8 KiB) TX bytes:1248 (1.2 KiB)
Interrupt:152 Base address:0x8000

lo      Link encap:Local Loopback
        inet addr:127.0.0.1 Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING MTU:65536 Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root@socfpga:~# ls ←
my_first_hps
root@socfpga:~# rm my_first_hps
root@socfpga:~# ls
root@socfpga:~# ls
```

Running my_first_hps

- Type “./my_first_hps in the COM3 window and you should see the “Hello, World” message appear
- Other comments
 - In some cases, installing EDS will cause the USB Blaster II drivers to stop working preventing you from using the Intel Monitor Program.
 - You can reinstall the USB Blaster drivers using the DPInst.exe program

