

Hardware Processing Platform (HPP): Getting Started Guide

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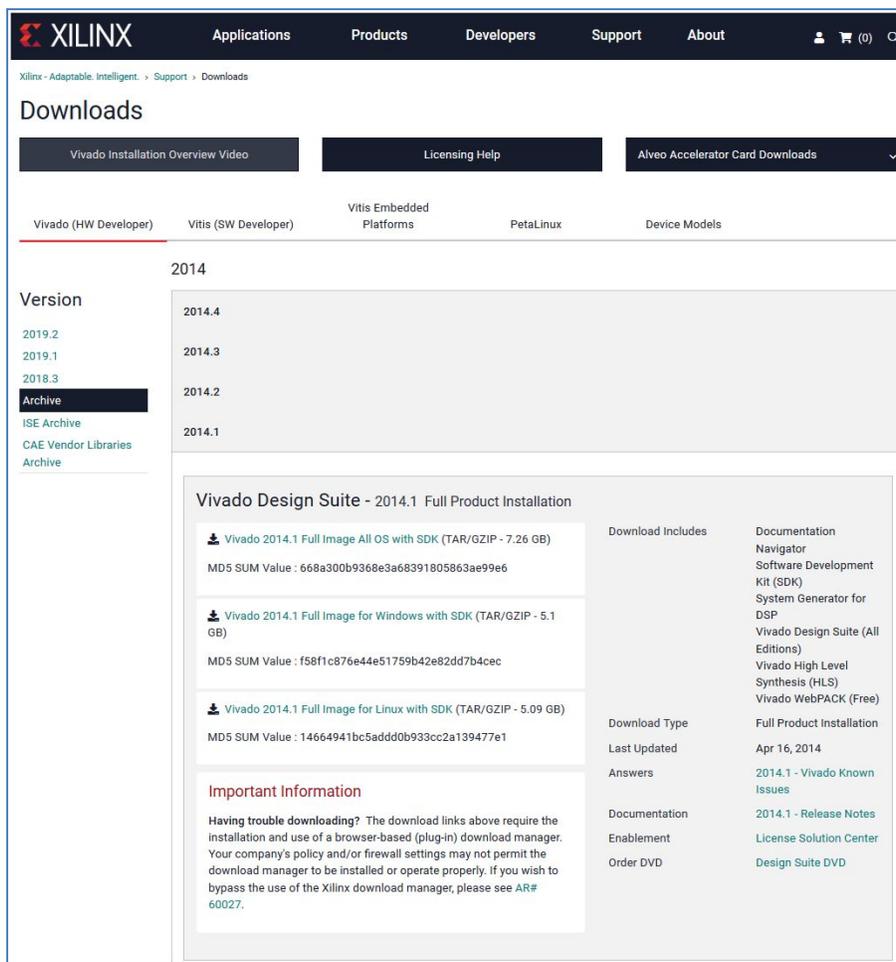
1 Introduction

The Neuralynx Hardware Processing Platform (HPP) runs code developed on a PC and is downloaded through a USB connection. This “Getting Started Guide” walks you through the process of getting the HPP development environment installed and tested.

2 Installing Xilinx Development Software

The development software used with the HPP is the Xilinx Vivado and SDK. The first step is to download this software. Use this link for the download web page:

<https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/vivado-design-tools/archive.html>



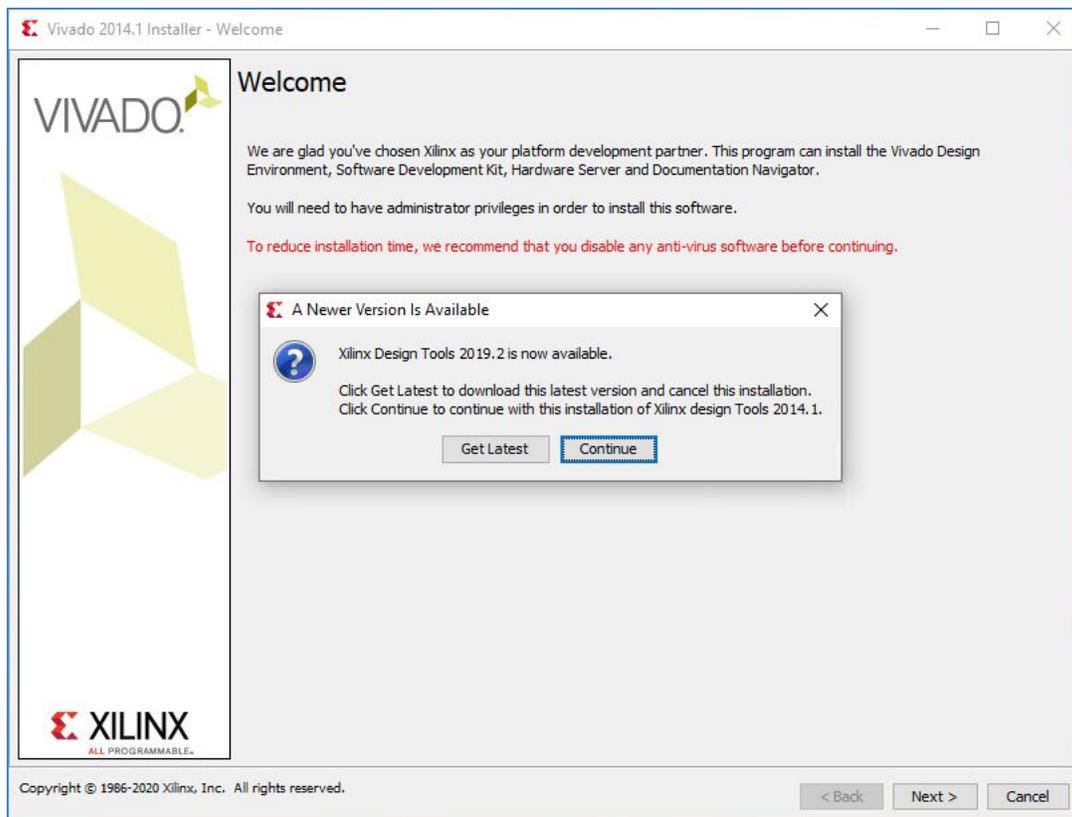
The version to download is “Vivado Design Suite – 2014.1 Full Product Installation”.

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For this guide, we will target a Windows development environment. [Vivado 2014.1 Full Image for Windows with SDK](#) (TAR/GZIP - 5.1 GB). A Xilinx user account will be required for download. If you do not already have one, you can sign up for a free Xilinx account using the “Create your Account” link.

After the file has been downloaded, unzip and untar the compressed files. If you don't have an application installed that can unzip and untar a file, you can download the latest version of 7-zip from www.7-zip.org. Once the installation files have been decompressed, run the xsetup.exe executable located in the extracted Xilinx_Vivado_SDK_Win_2014.1_0405_1 folder.



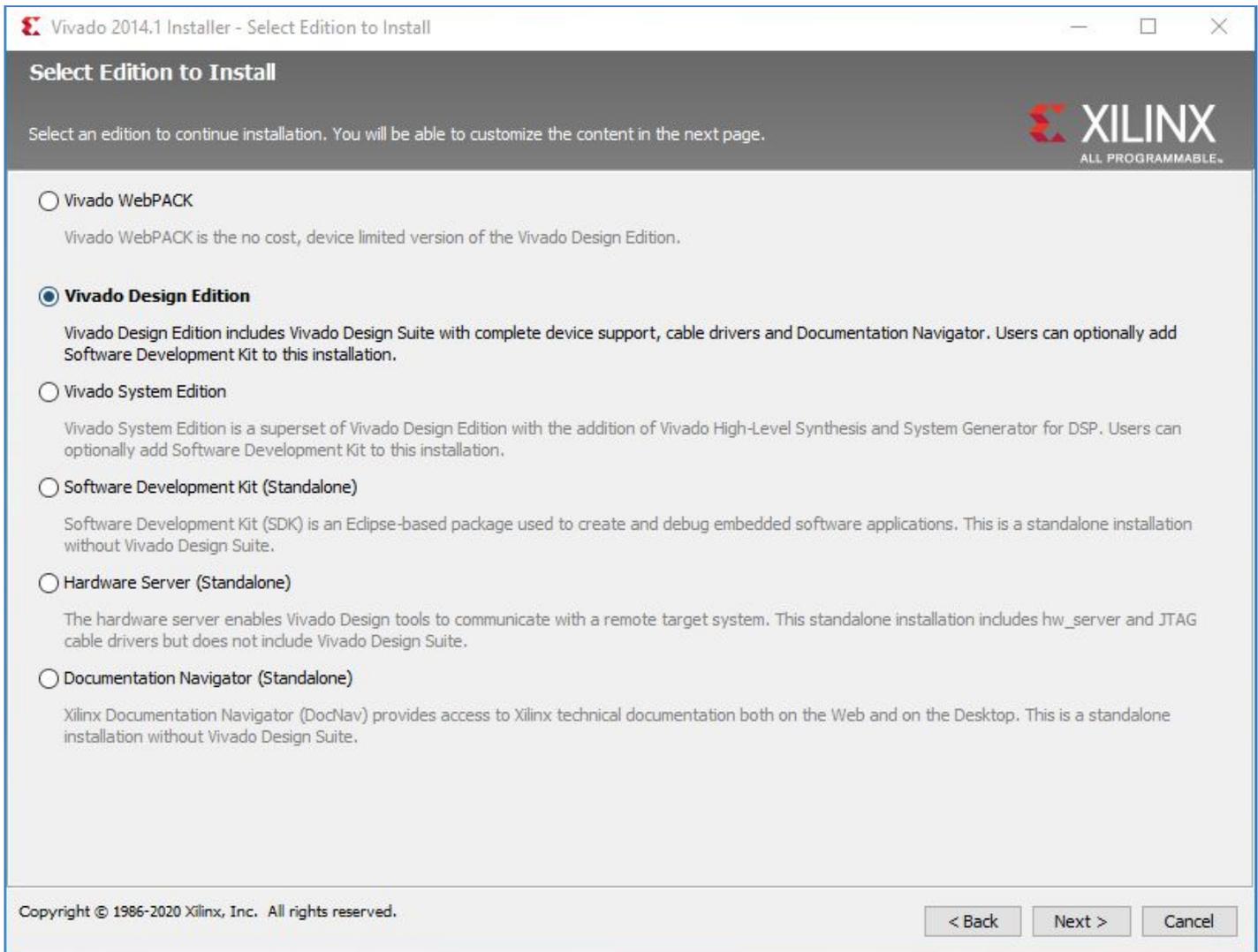
Xilinx Vivado Installation

If the installation prompts to install a newer version, select “Continue” to proceed with installing the 2014.1 version of Xilinx Design Tools. (Neuralynx plans to release an updated HPP platform to support newer versions of Xilinx Development tools in the future).

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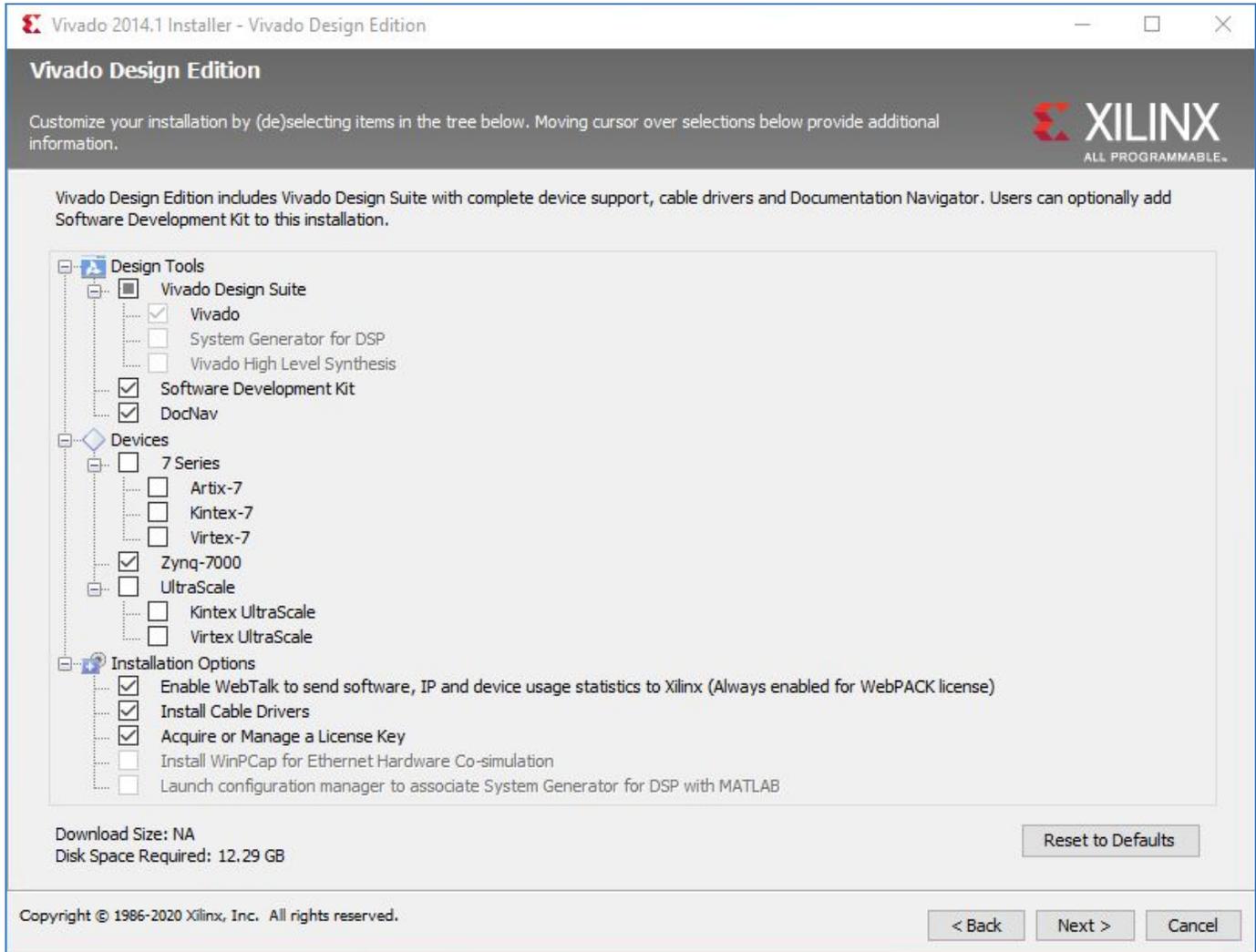
The Complete Solution for Electrophysiology Research

Once the installation process has been started, you will be prompted for the edition to install. You should select the “Vivado Design Edition”.



Edition to Install

Install with the following options selected:

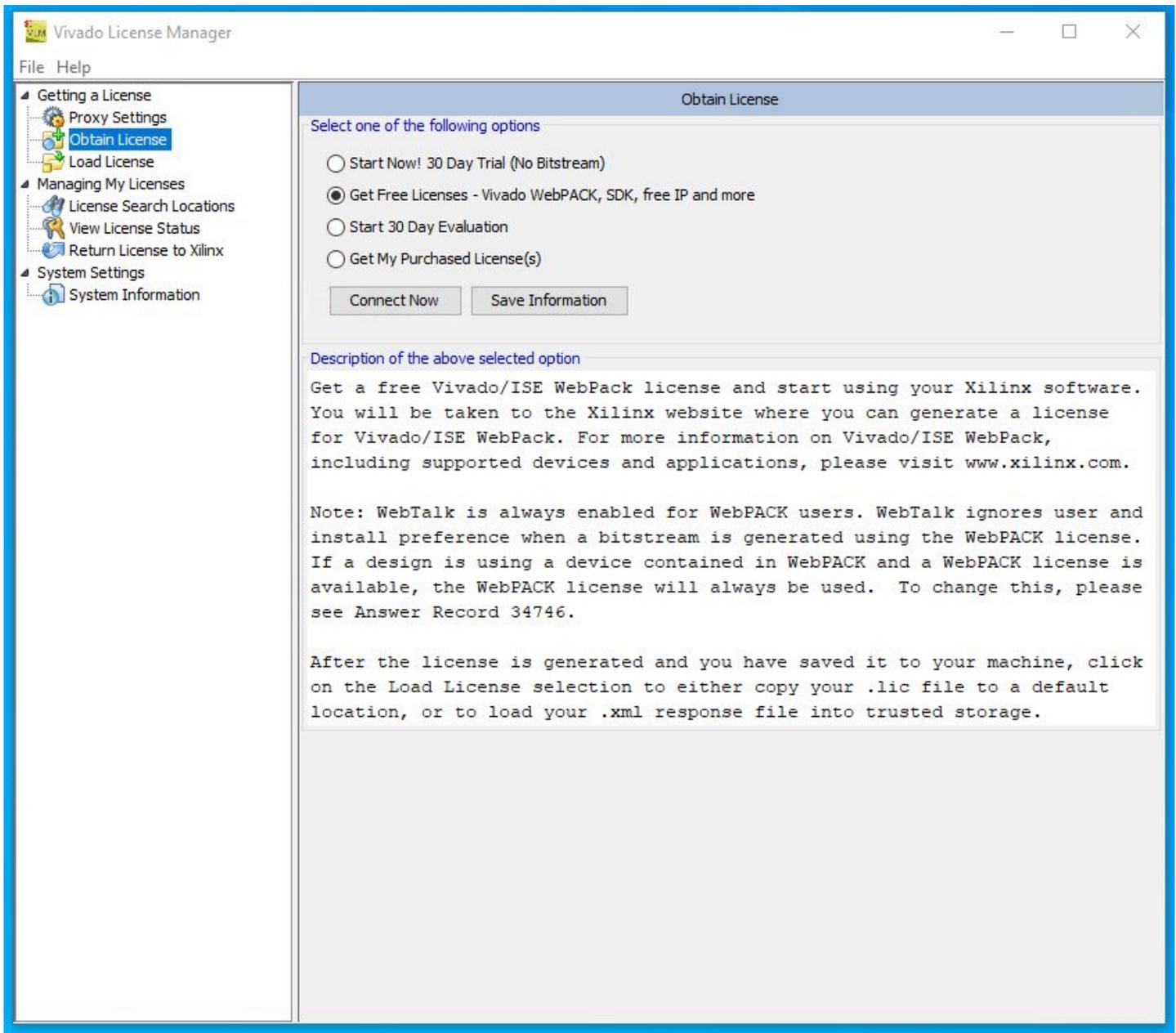


Vivado Design Edition Install Options

At a minimum, ensure that

1. The “Software Development Kit” option is selected under Design Tools,
2. “Zynq-7000” option is selected under Devices, and
3. “Install Cable Drivers” and “Acquire or Manage a License Key” is selected under Installation Options.

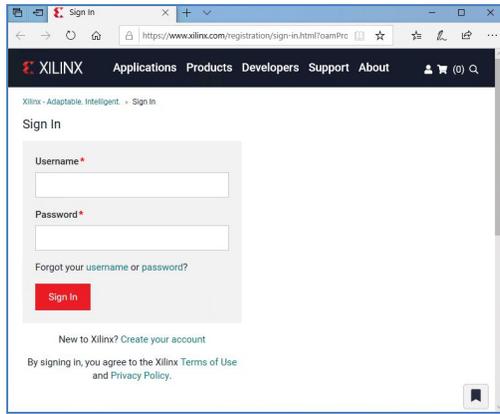
When the installation finishes, the Vivado License Manager will open. Select “Obtain License” under Getting a License.



Vivado License Manager

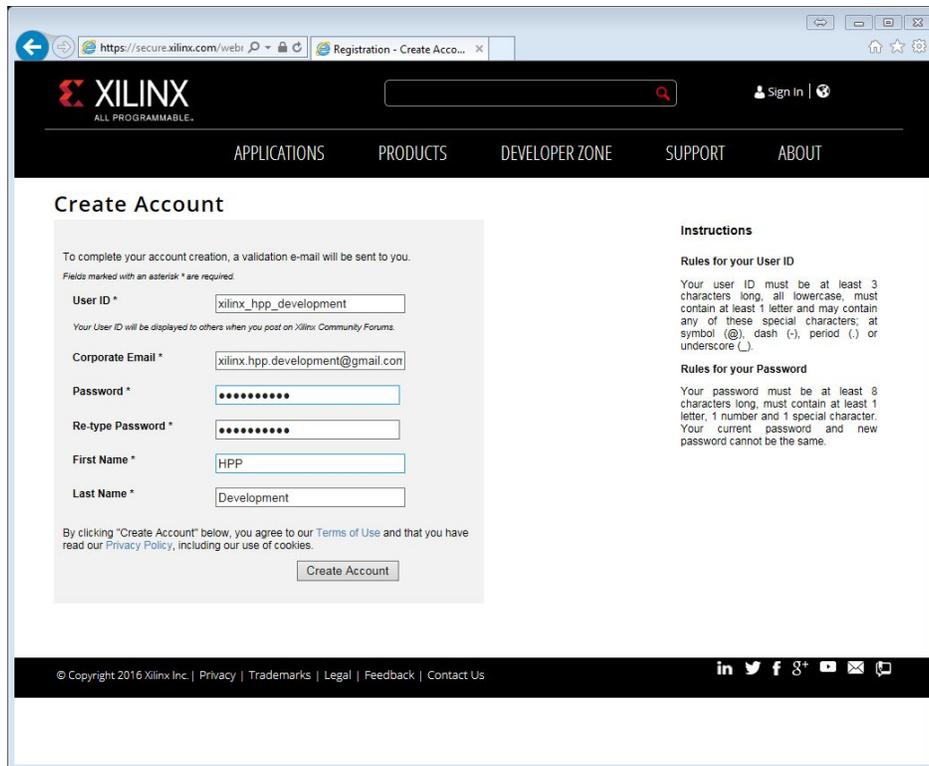
Select “Get Free Licenses – Vivado WebPack, SDK, free IP and more”, then click the “Connect Now” button.

You will need to sign up for a free Xilinx account using the “Create your account” link to get a license for the Xilinx software if you have not already done so.

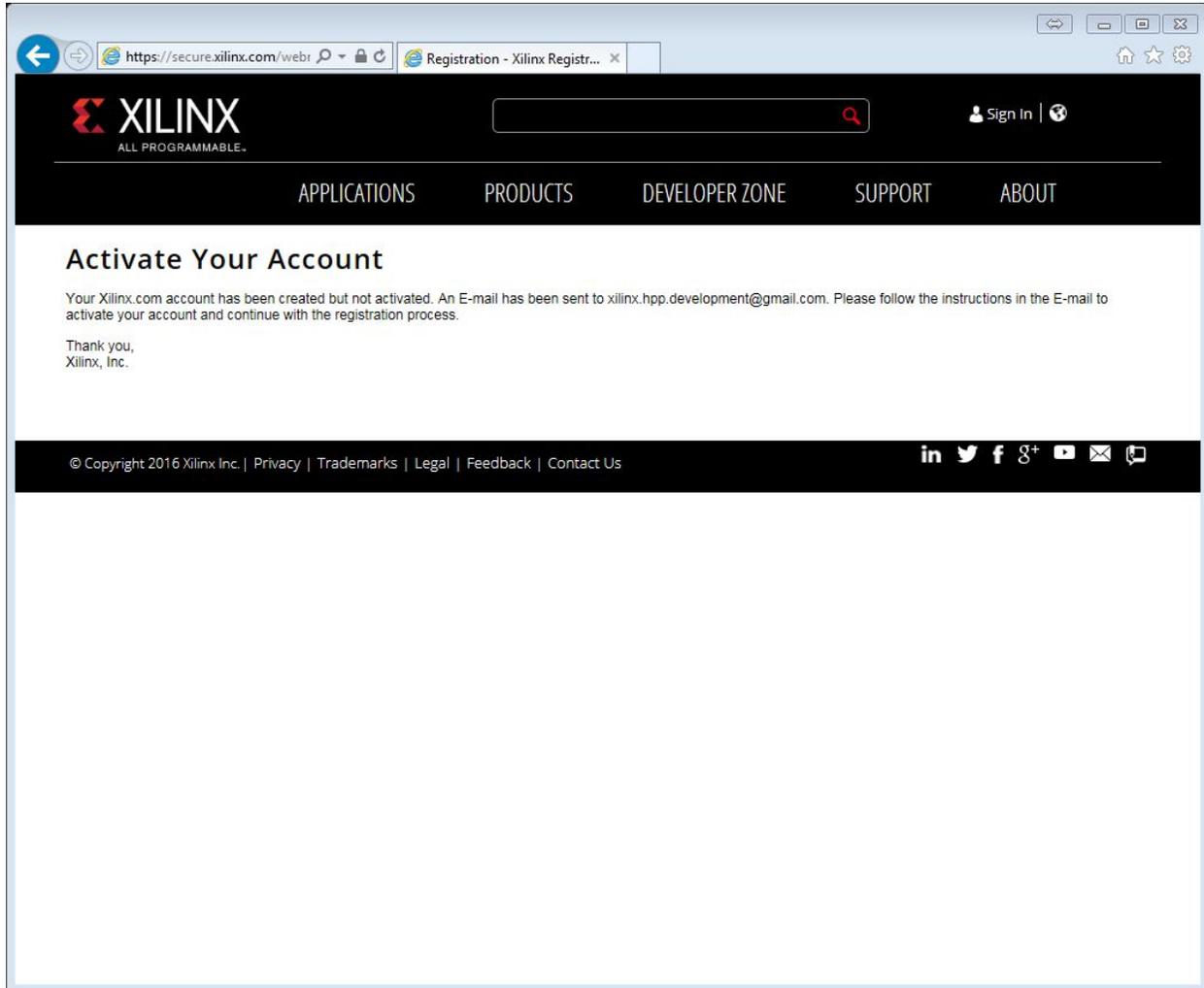


Xilinx Account Sign In Page

Continue to enter your required information:



Account information



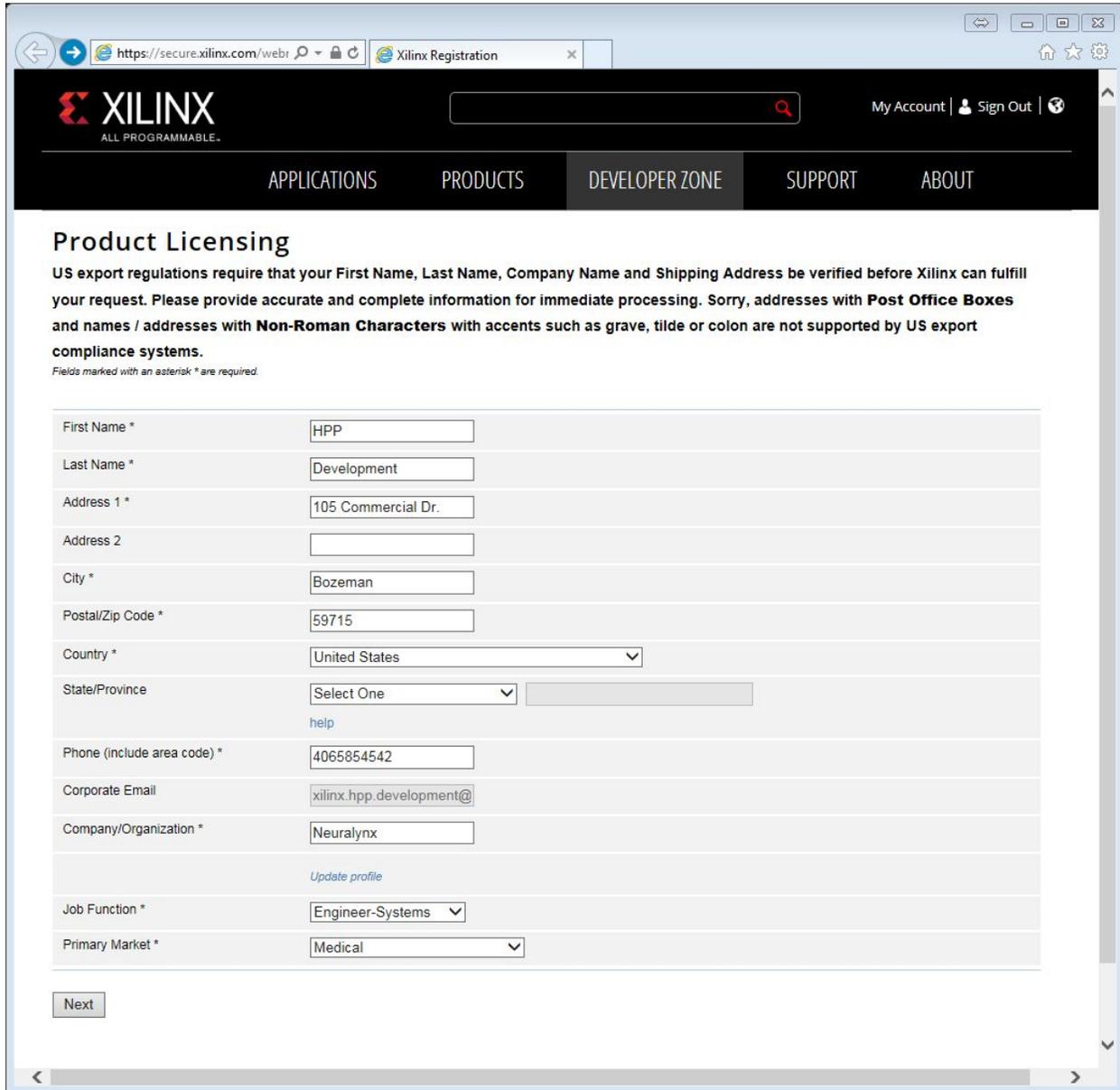
Activate Account

Click on the link in your email to activate your account. This will take you to the Xilinx login webpage. Sign in with your newly created account.

Enter the required profile information (indicated by *) and click "Save Profile."

Return to the Vivado license manager. Click on "Obtain License" and select "Get Free Licenses – Vivado WebPack, SDK, free IP and more." Then click "Connect Now." This will take you back to the licensing web page.

From the Product Licensing web page that opens, verify your user information and click “Next.”



Product Licensing

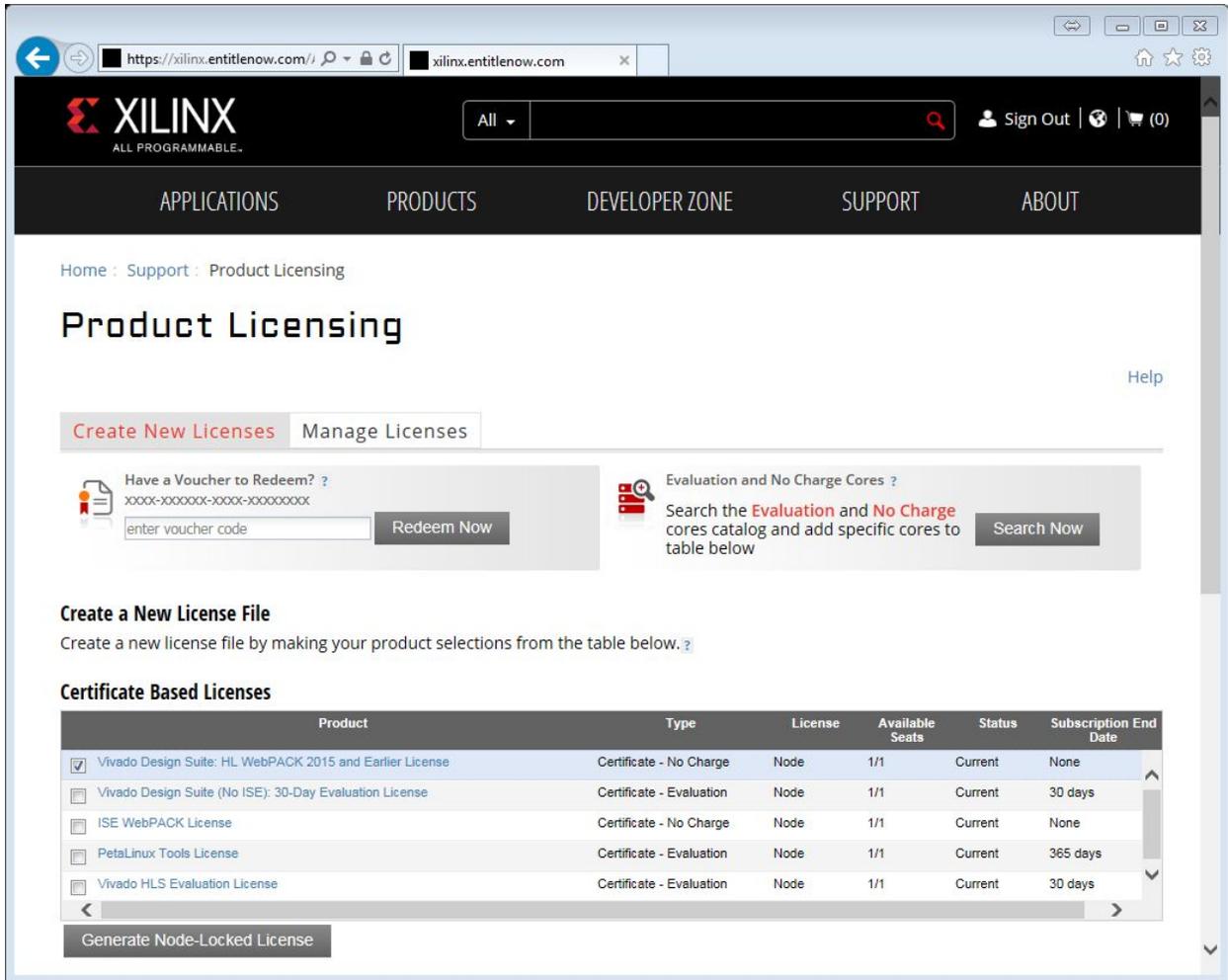
US export regulations require that your **First Name, Last Name, Company Name and Shipping Address** be verified before Xilinx can fulfill your request. Please provide accurate and complete information for immediate processing. Sorry, addresses with **Post Office Boxes** and names / addresses with **Non-Roman Characters** with accents such as grave, tilde or colon are not supported by US export compliance systems.

Fields marked with an asterisk * are required.

First Name *	<input type="text" value="HPP"/>
Last Name *	<input type="text" value="Development"/>
Address 1 *	<input type="text" value="105 Commercial Dr."/>
Address 2	<input type="text"/>
City *	<input type="text" value="Bozeman"/>
Postal/Zip Code *	<input type="text" value="59715"/>
Country *	<input type="text" value="United States"/>
State/Province	<input type="text" value="Select One"/>
	help
Phone (include area code) *	<input type="text" value="4065854542"/>
Corporate Email	<input type="text" value="xilinx.hpp.development@"/>
Company/Organization *	<input type="text" value="Neuralynx"/>
	Update profile
Job Function *	<input type="text" value="Engineer-Systems"/>
Primary Market *	<input type="text" value="Medical"/>

Product Licensing Information

Check the box in “Certificate Based Licenses” for “Vivado Design Suite: HL WebPACK 2015 and Earlier License” and click “Generate Node-Locked License.”



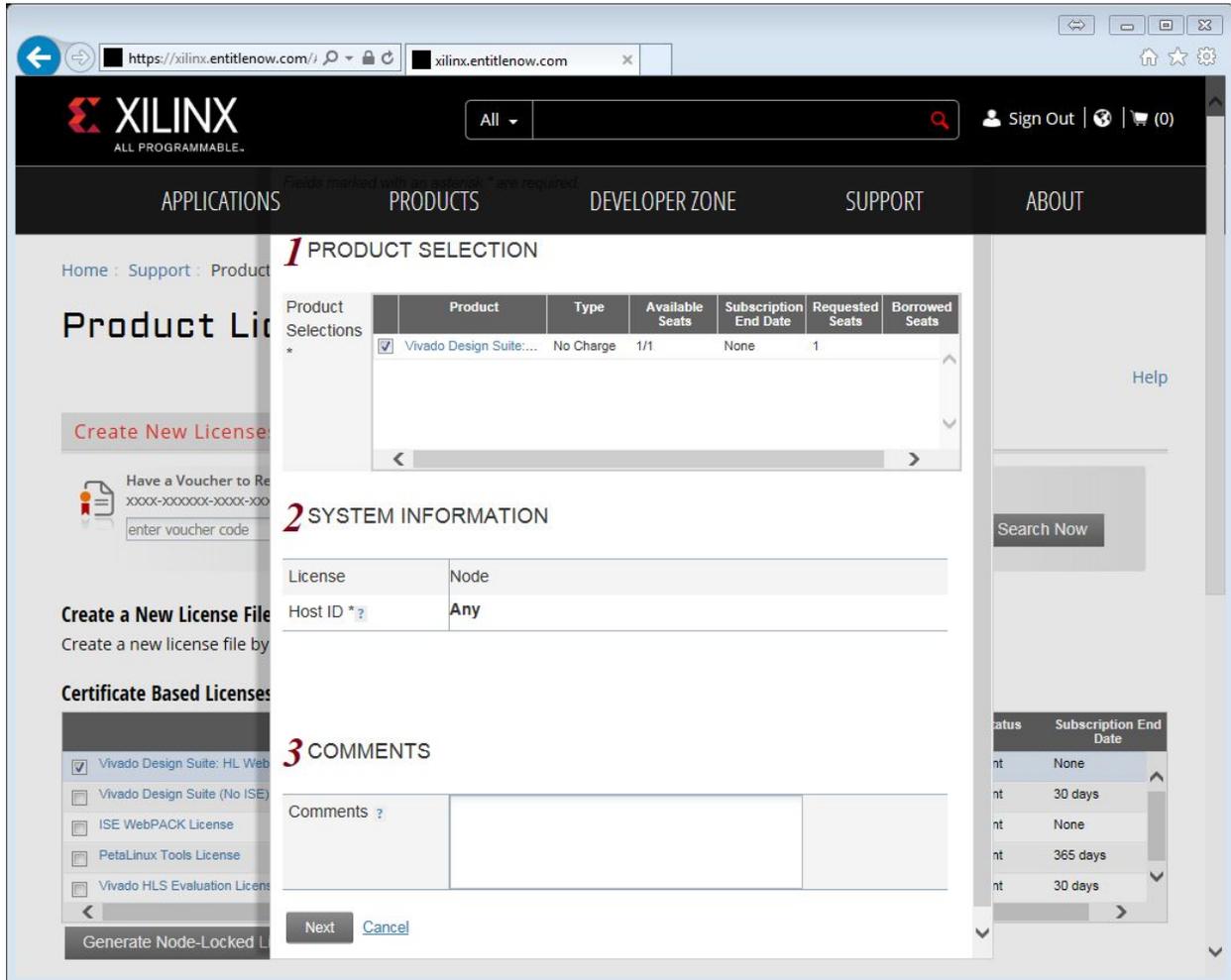
The screenshot shows the Xilinx Product Licensing page. At the top, there is a navigation bar with 'APPLICATIONS', 'PRODUCTS', 'DEVELOPER ZONE', 'SUPPORT', and 'ABOUT'. Below this, the breadcrumb path is 'Home : Support : Product Licensing'. The main heading is 'Product Licensing' with a 'Help' link. There are two tabs: 'Create New Licenses' (active) and 'Manage Licenses'. Below the tabs, there are two promotional boxes: one for redeeming a voucher and another for searching evaluation and no charge cores. The 'Create a New License File' section contains a table of license options under the heading 'Certificate Based Licenses'. The first row in the table is selected.

Product	Type	License	Available Seats	Status	Subscription End Date
<input checked="" type="checkbox"/> Vivado Design Suite: HL WebPACK 2015 and Earlier License	Certificate - No Charge	Node	1/1	Current	None
<input type="checkbox"/> Vivado Design Suite (No ISE): 30-Day Evaluation License	Certificate - Evaluation	Node	1/1	Current	30 days
<input type="checkbox"/> ISE WebPACK License	Certificate - No Charge	Node	1/1	Current	None
<input type="checkbox"/> PetaLinux Tools License	Certificate - Evaluation	Node	1/1	Current	365 days
<input type="checkbox"/> Vivado HLS Evaluation License	Certificate - Evaluation	Node	1/1	Current	30 days

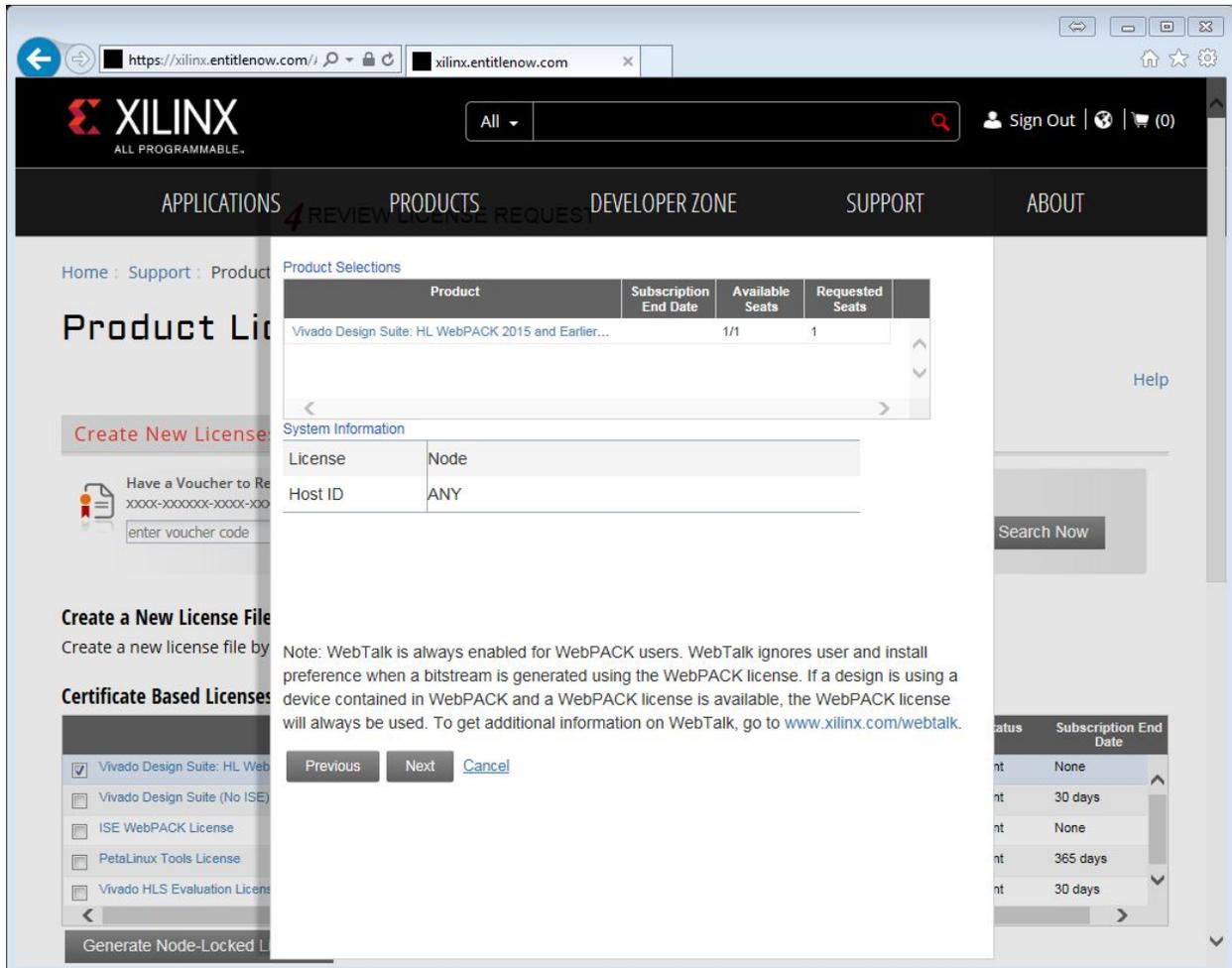
Generate Node-Locked License

[Generate License](#)

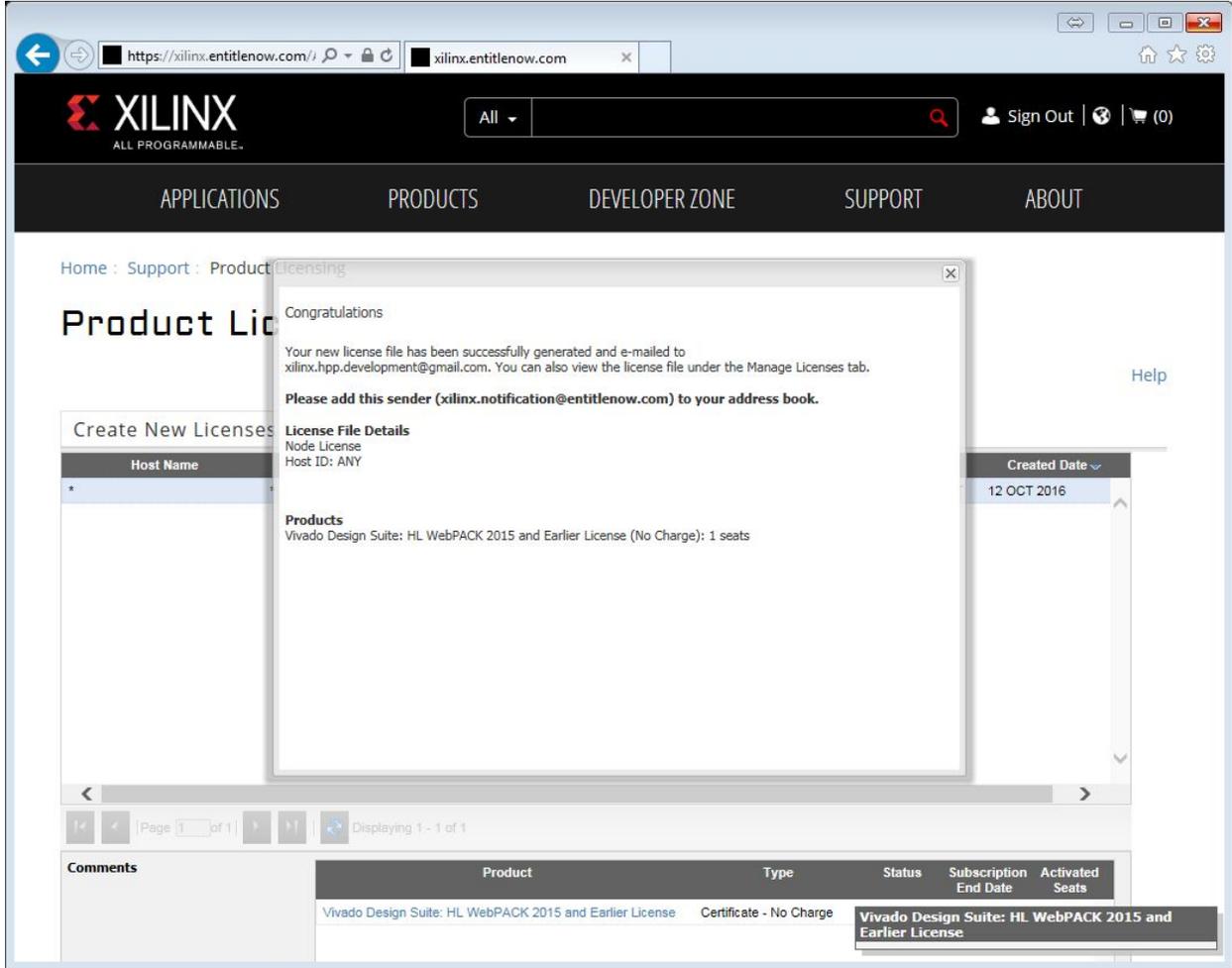
This page will use a host ID from the current PC to license the development software.



Obtain Host ID



License Information Window 1



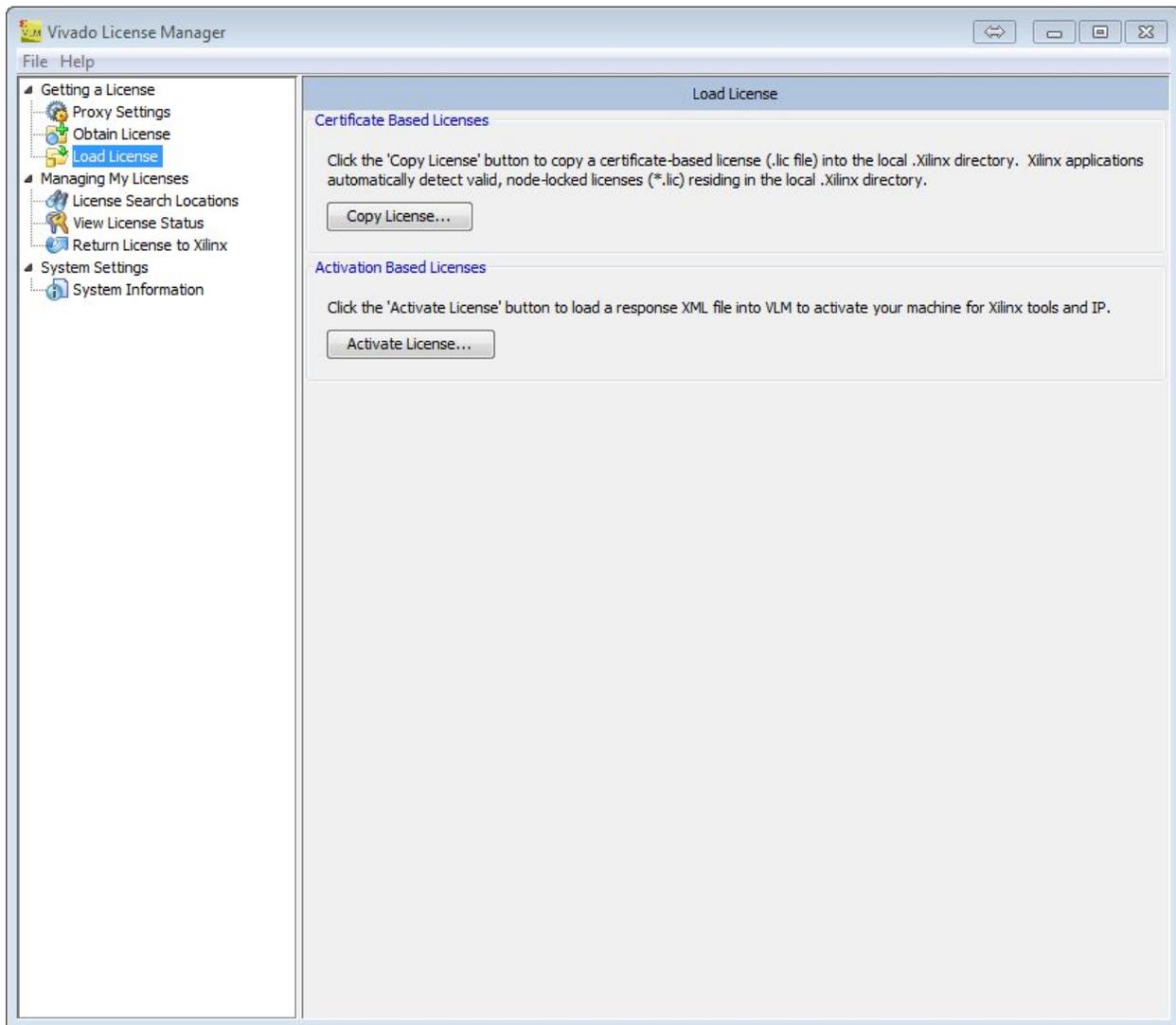
The screenshot shows the Xilinx Entitlement Now web interface. At the top, there is a navigation bar with the Xilinx logo and the text 'ALL PROGRAMMABLE.'. Below this is a menu with 'APPLICATIONS', 'PRODUCTS', 'DEVELOPER ZONE', 'SUPPORT', and 'ABOUT'. The main content area is titled 'Product Licensing' and features a 'Create New Licenses' section with a table for 'Host Name'. A modal window titled 'Licensing' is open, displaying a success message: 'Congratulations. Your new license file has been successfully generated and e-mailed to xilinx.hpp.development@gmail.com. You can also view the license file under the Manage Licenses tab. Please add this sender (xilinx.notification@entitlenow.com) to your address book.' Below the message, the 'License File Details' are shown: 'Node License', 'Host ID: ANY', and 'Products: Vivado Design Suite: HL WebPACK 2015 and Earlier License (No Charge): 1 seats'. The modal also shows a 'Created Date' of '12 OCT 2016'. At the bottom of the modal, a table lists the license details:

Comments	Product	Type	Status	Subscription End Date	Activated Seats
	Vivado Design Suite: HL WebPACK 2015 and Earlier License	Certificate - No Charge			Vivado Design Suite: HL WebPACK 2015 and Earlier License

License Generation Complete

A Xilinx license file will be sent to your provided email address from xilinx.notification. Download the “Xilinx.lic” file to a known location.

Return to the Vivado License Manager. Select on “Load License” under Getting a License and click the “Copy License” button.

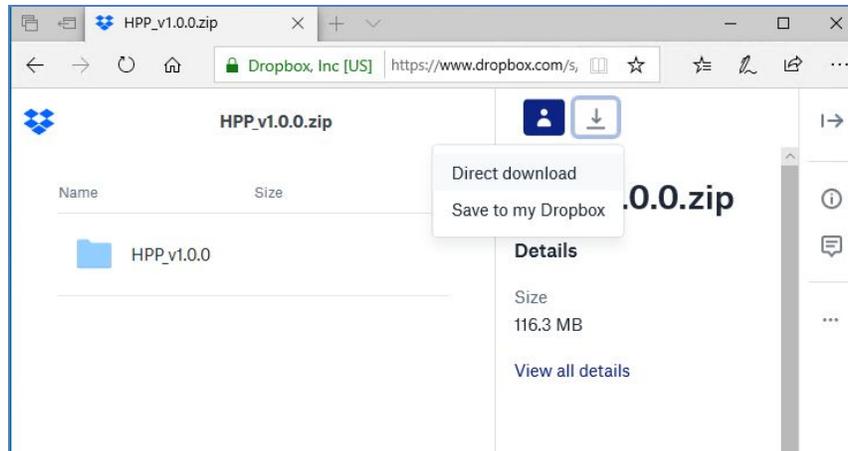


Load License

Browse to your downloaded “Xilinx.lic” license file and click “Open”. Click “Ok” to close the “license installation was successful” message box. Close the Vivado License Manager and complete the Vivado installation.

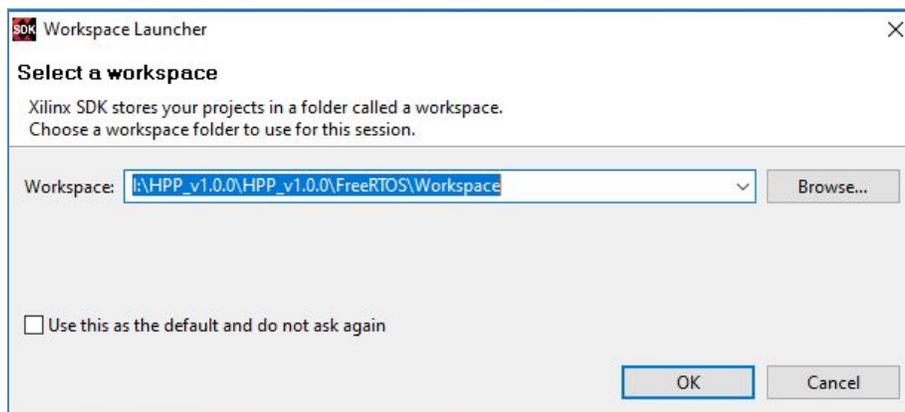
3 Programming a Project on the HPP

Download the provided base example project for the HPP from:
https://www.dropbox.com/s/wyvn19gtwokvc1c/HPP_v1.0.0.zip?dl=0



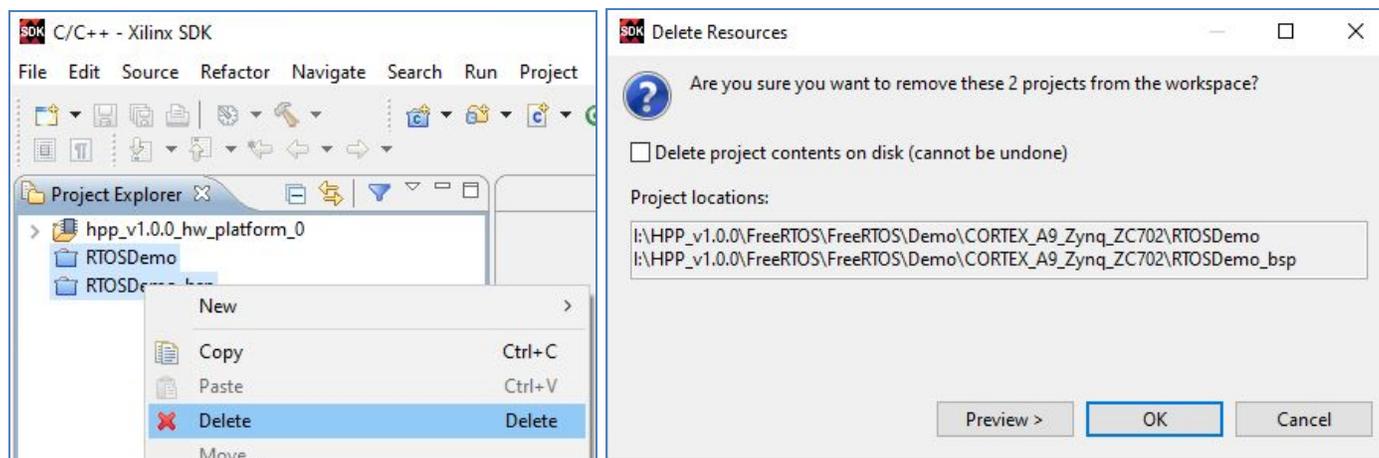
Select “Direct download” to download the compressed HPP_v1.0.0.zip project. Extract the project to a folder onto your development PC.

The generated HPP bitstream and demo ELF files will be programmed through JTAG using the Xilinx SDK 2014.1 software. Open Xilinx SDK 2014.1.



Select the workspace directory of the extracted project located at
<your_proj_dir>\<proj_name>\HPP_v1.0.0\FreeRTOS\Workspace.

In the SDK Project Explorer on the left, right-click on “RTOSDemo” and “RTOSDemo_BSP” folders and select “Delete” from the menu.



Click “OK” to confirm the deletion.

Warning: Do NOT select the “Delete project contents on disk (cannot be undone)” checkbox as this could permanently delete your project folders from a copied location.

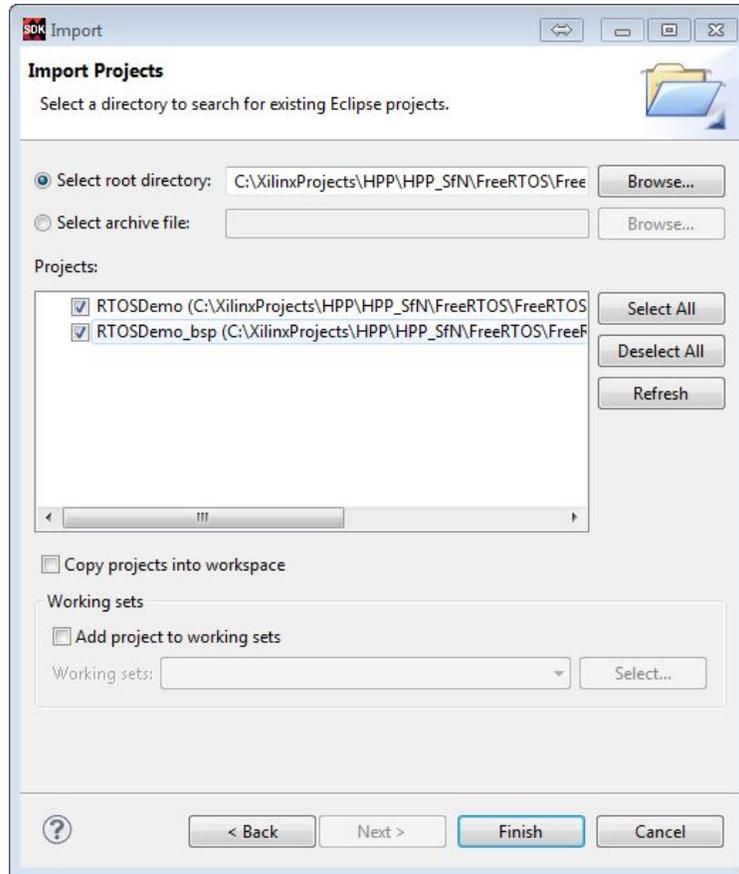
Select menu option “File -> Import...” or right-click in Project Explorer and select “Import ...”, then choose “Existing Projects into Workspace” under “General” and click “Next” to continue.

Click the “Browse” button to the Select root directory:

<your_proj_dir>\<proj_name>\HPP_v1.0.0\FreeRTOS\FreeRTOS\Demo\CORTEX_A9_Zynq_ZC702\

Select “RTOSDemo” and “RTOSDemo_bsp” in Projects.

Warning: Do NOT select “Copy projects into workspace” since this will cause pathing dependency issues when rebuilding the project.



Import Projects

Click “Finish” to complete the import of the project into the active project workspace. Right-click on RTOSDemo in the Project Explorer and select “Clean Project” to clean and rebuild the project contents.

4 Running an Application on the HPP

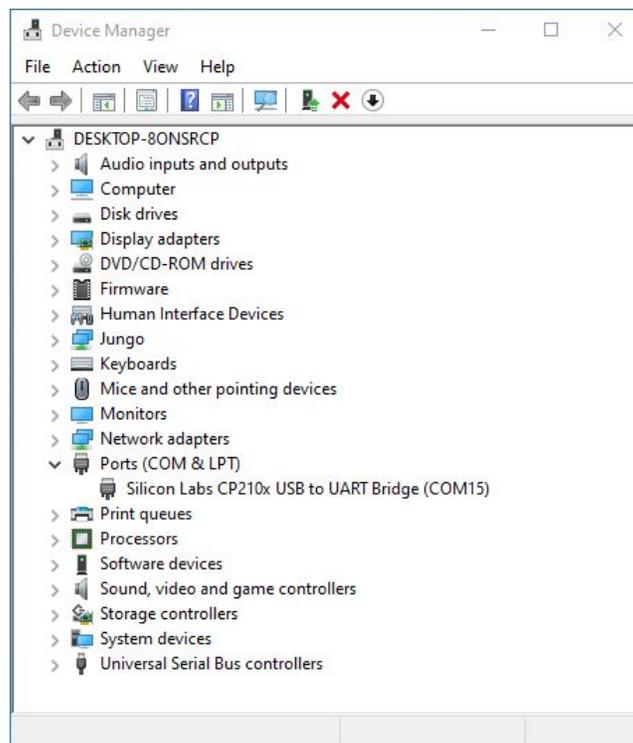
The HPP uses a serial command-line interface (CLI) to interact with the operating system. You must have the required USB to UART Bridge Virtual COM Port (VCP) driver installed on the PC.

Download and install the latest Silicon Labs CP210x Windows VCP driver from <https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>

If you haven't already done so,

- Attach a USB cable from the development PC to Digital Lynx SX port "HPP Terminal"
- Attach a USB cable from the development PC to Digital Lynx SX port "HPP JTAG"

In Windows Device Manager, make a note of the COM port number "Silicon Labs CP210x USB to UART Bridge" connected to your HPP USB Terminal. The baud rate is 115200.



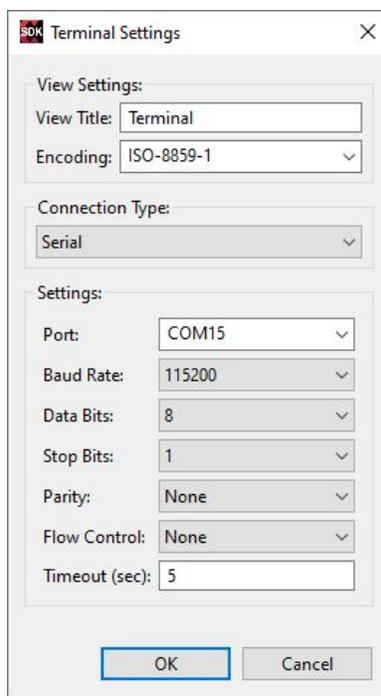
Windows device manager view of COM ports

To connect the PC for terminal access, a terminal program such as Tera Term or PuTTY is required.

If you don't already have a terminal program, you can download the latest version of Tera Term from <https://ttssh2.osdn.jp/index.html.en>

Or PuTTY from <https://www.chiark.greenend.org.uk/~sgtatham/putty/>

The Xilinx SDK 2014.1 also provides a built-in terminal module. If the Terminal module window is not shown, select from the menu "Window -> Show View -> Terminal". In the Terminal module window select the "Settings" icon (third icon from the left that looks like a note sheet ).



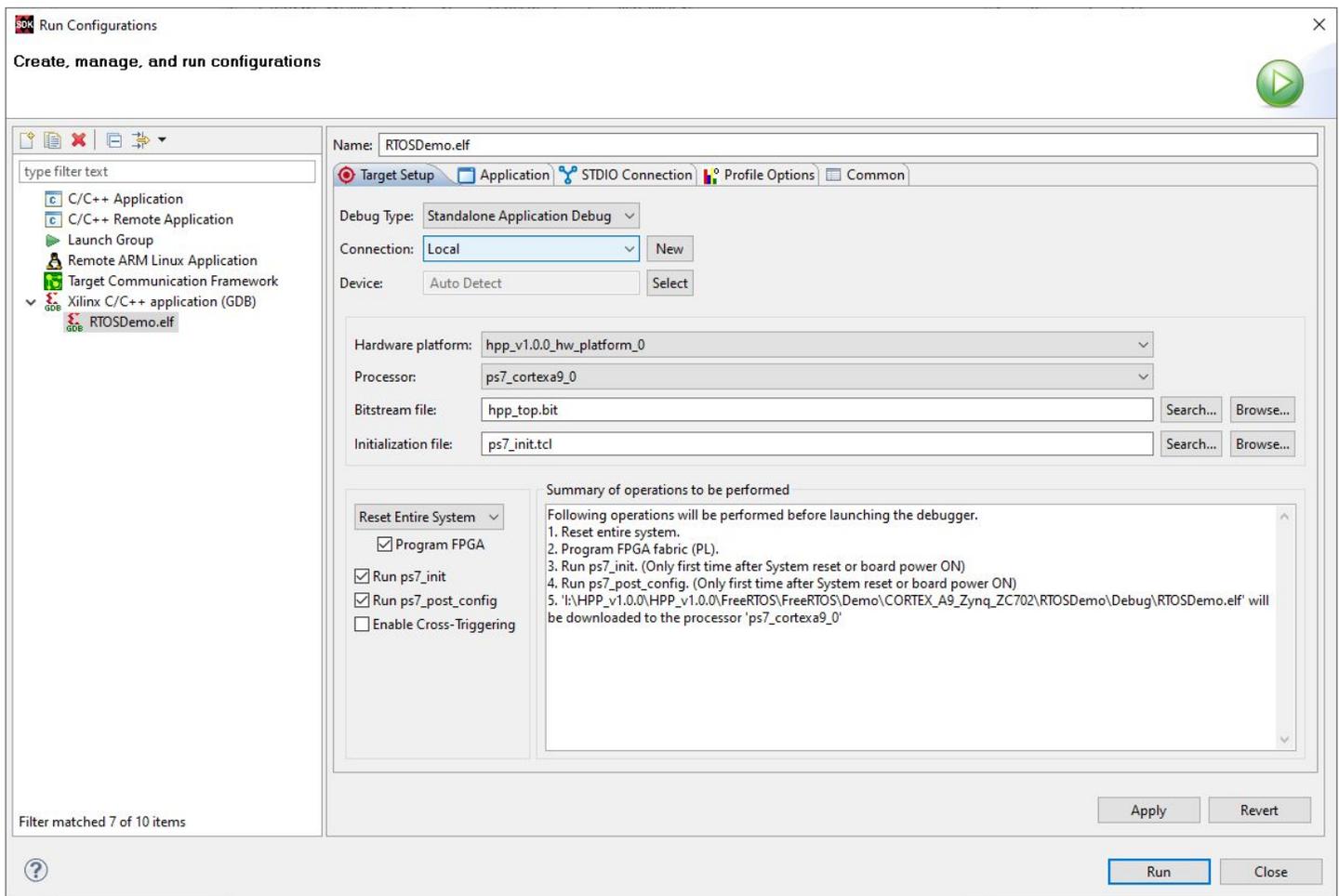
SDK Terminal Settings - serial port setup

In the Terminal Settings dialog, set "Connection Type" to "Serial" from the drop-down menu. In "Settings" choose your COM "Port" number connected to your HPP. Set the "Baud Rate" to 115200.

In the Terminal module window click the "Connect" icon (first icon from the left ) to connect to serial port.

In the SDK Project Explorer, right-click on RTOSDemo and select “Run As -> 1 Launch on Hardware (GDB)”. This will create a default run configuration “RTOSDemo.elf” for this application.

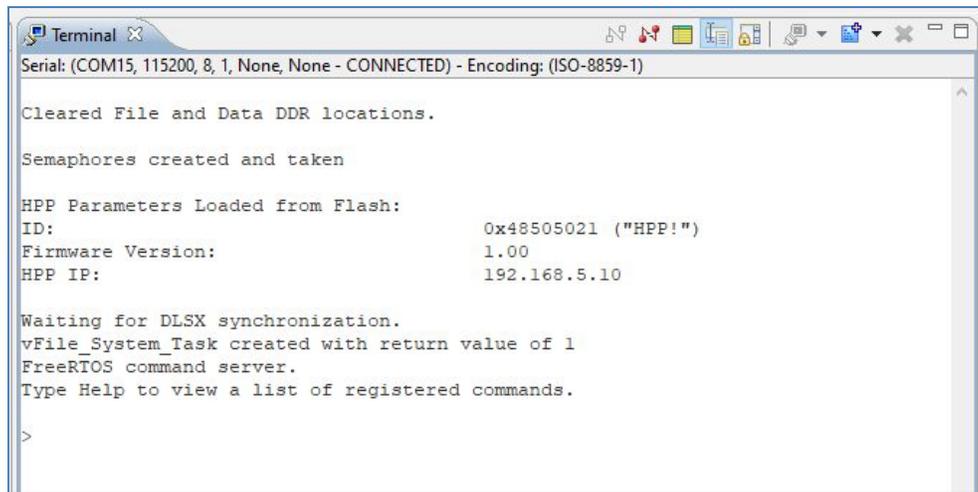
In the SDK menu, select “Run -> Run configurations...” to edit the default run configuration. In the Target Setup tab, select the “Reset Entire System” option from the drop-down list and select the “Program FPGA” checkbox. In the Bitstream file box, click “Search...” and choose hpp_top.bit to select the bitstream file to download to the HPP FPGA. Click the “Apply” button to save and then “Run” to program the HPP over JTAG.



Run Configurations setup

This will begin a programming process visible in the lower right progress bar. This process usually takes approximately 15 seconds as it configures the FPGA, and downloads the bitstream and application.

Verify the following output is received over the serial connection in the Terminal window.



```
Terminal X
Serial: (COM15, 115200, 8, 1, None, None - CONNECTED) - Encoding: (ISO-8859-1)

Cleared File and Data DDR locations.

Semaphores created and taken

HPP Parameters Loaded from Flash:
ID:                                0x48505021 ("HPP!")
Firmware Version:                   1.00
HPP IP:                              192.168.5.10

Waiting for DLSX synchronization.
vFile_System_Task created with return value of 1
FreeRTOS command server.
Type Help to view a list of registered commands.

>
```

Type “help” and press Enter, to output a list of registered commands currently implemented in the HPP.



For more information or questions, please contact:

HPP_Support@neuralynx.com / 406-585-4542