Programming uBlaze over USB

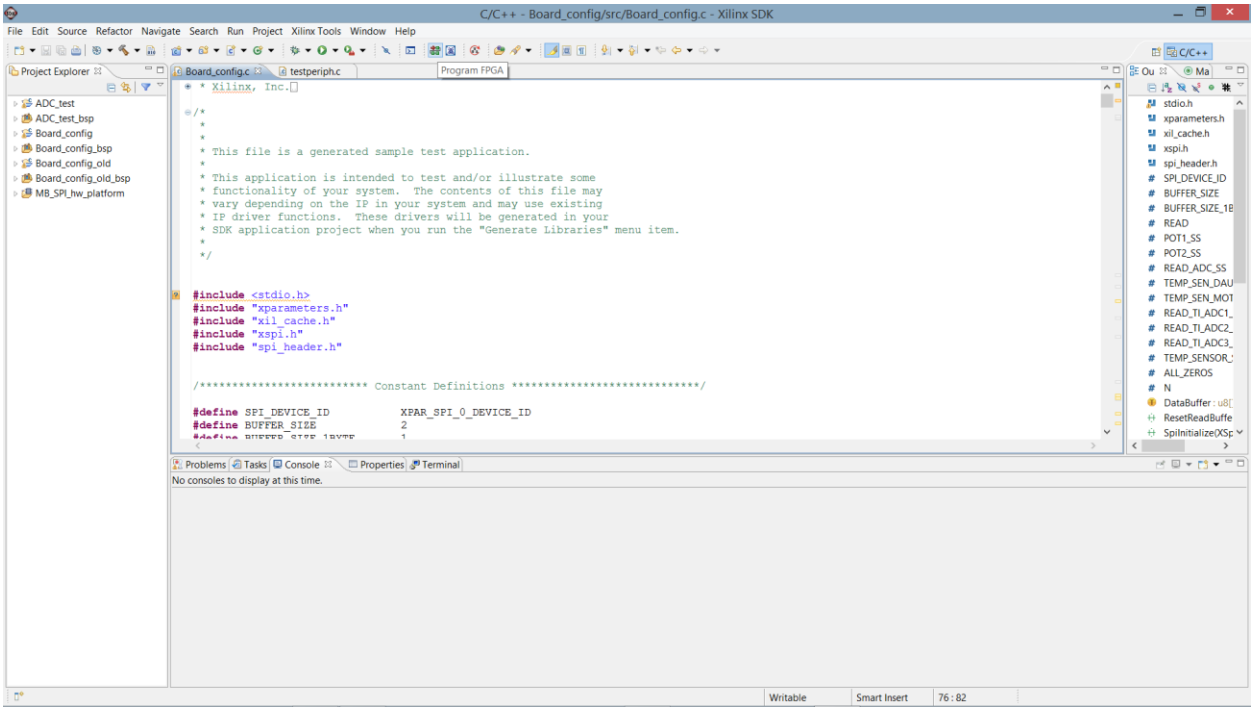
This guide will walk you through programming a uBlaze soft processor over USB, and, for applicable boards, setting the program to run on start-up.

What you will need:

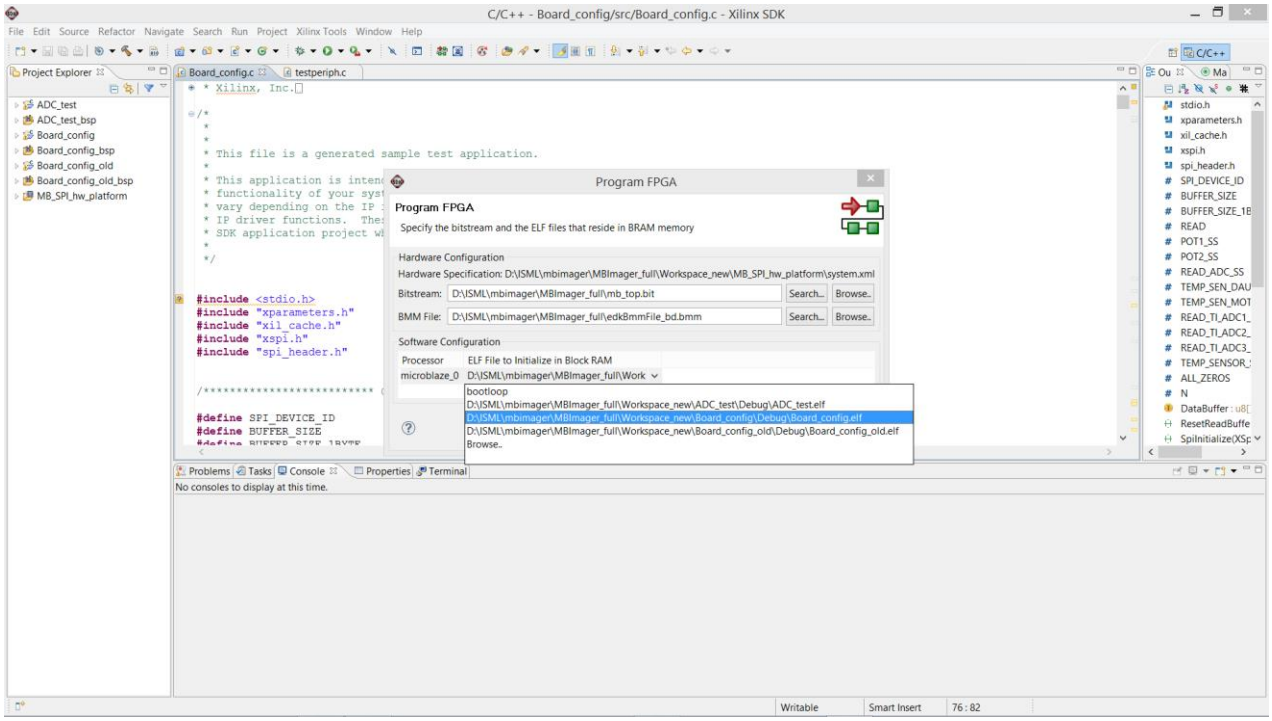
- Opal Kelly Frontpanel installation
- Xilinx SDK
- *system*.bit (*system* is whichever hardware design contains the ublaze)
- edkBmmFile_bd.bmm (this file was generated along with system.bit by Xilinx tools, make sure it refers to the same project as your *system*.bit)
- *yourProgram*.elf (this is the binary generated when you build your project using Xilinx SDK)

Step 1: Generate download.bit

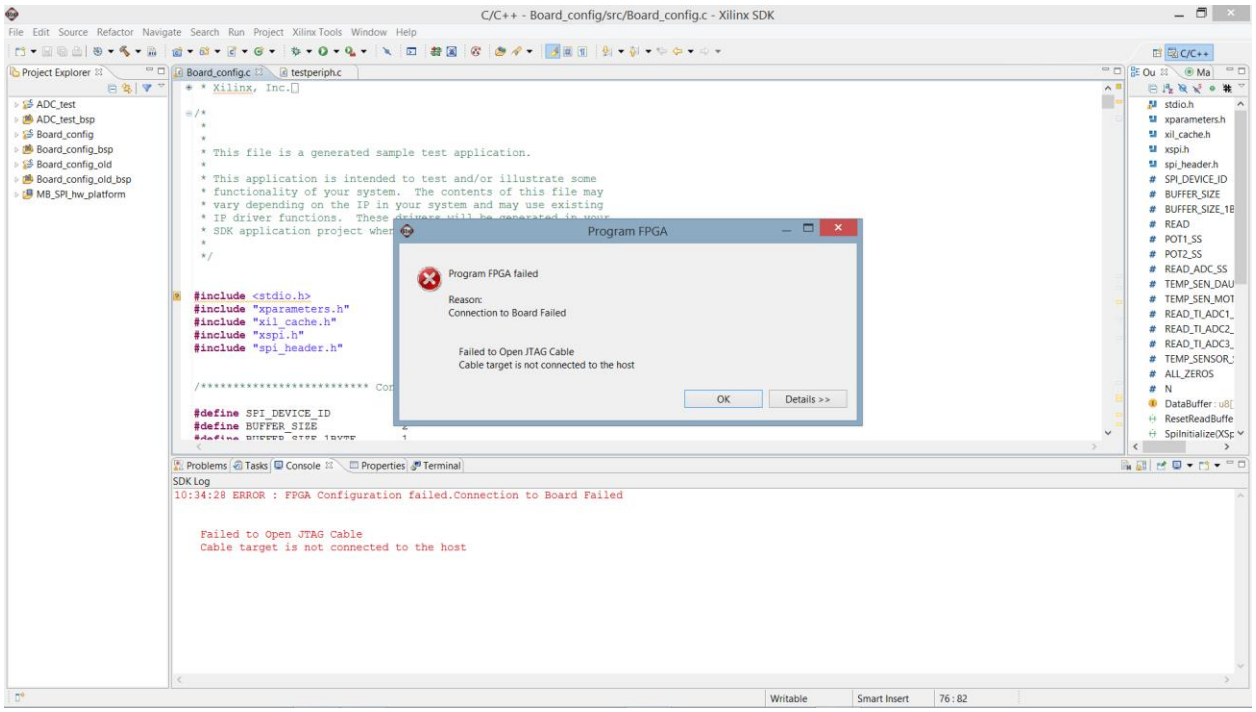
Open your project in Xilinx SDK and make sure it builds correctly. Then, select the **Program FPGA** option from the menu bar:



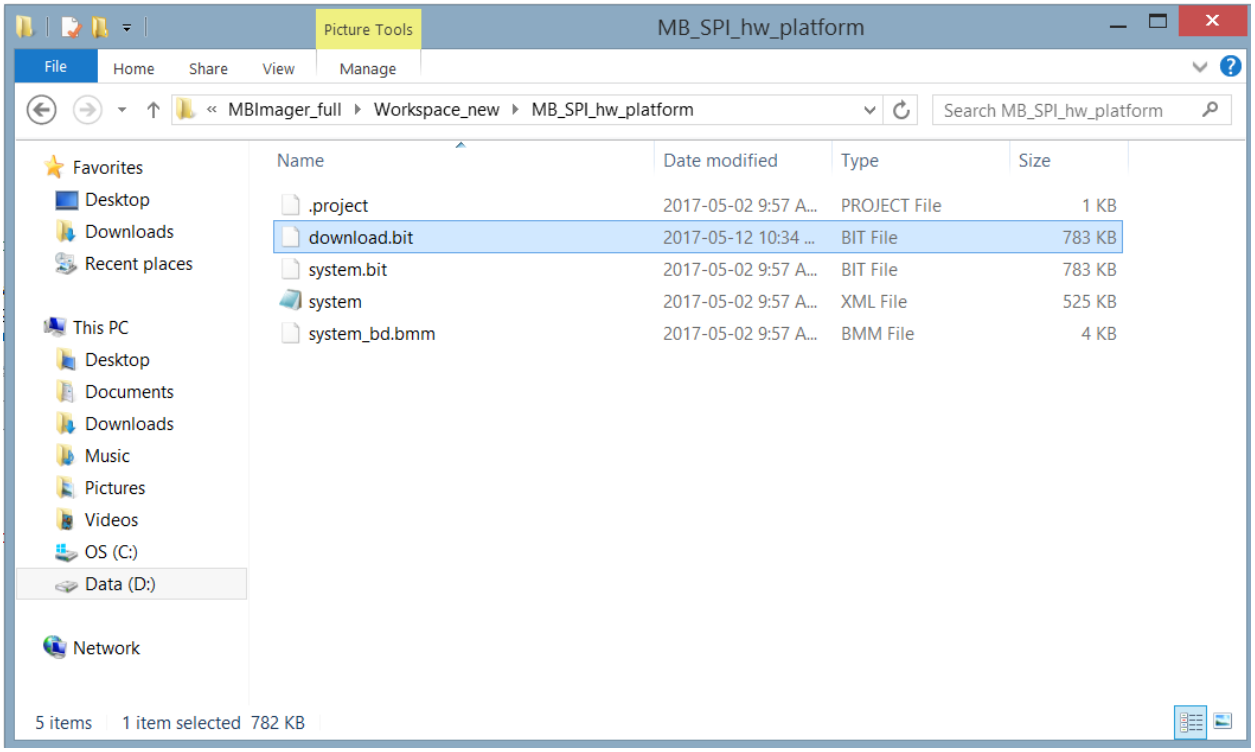
A pop-up will appear. Select your *system.bit* and edbBmmFile_bd.bmm files in the appropriate spaces. Select *yourProject*.elf from the drop-down menu.



Click on the **Program** button. You will receive an error message telling you that the FPGA could not be programmed due to the lack of a JTAG connection. This is normal.



Open file explorer and navigate to your hw_platform folder in your workspace directory. Sort contents by date modified, and you will find a recently created file named download.bit.



This is the file you will use to program the FPGA. It contains your program loaded into the uBlaze's block RAM.

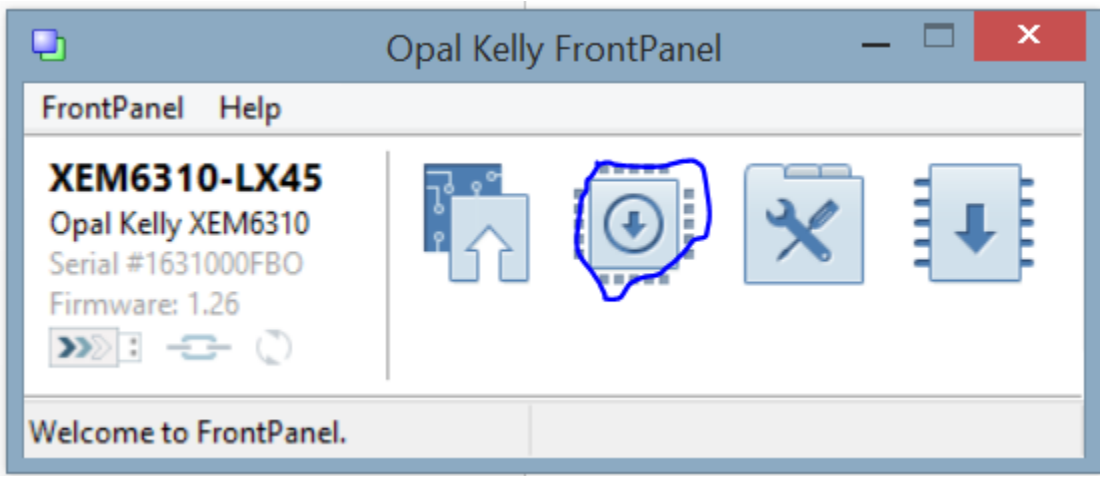
IMPORTANT: Block memory in the uBlaze soft processor is limited. If your program is particularly large (>64 kB) it will not fit into a bram block. If this is causing an issue for you, you have 3 options:

1. Load large data such as masks from a computer over USB link into DDR memory instead of hard-coding them (you should be doing this anyways)
2. Talk to your hardware designer about increasing the size of the bram block (if less than the maximum size) or adding additional bram blocks.
3. Talk to your hardware designer about having some values/code stored in non-volatile memory on the board, and modify your program to load the values/code from non-volatile memory when needed.

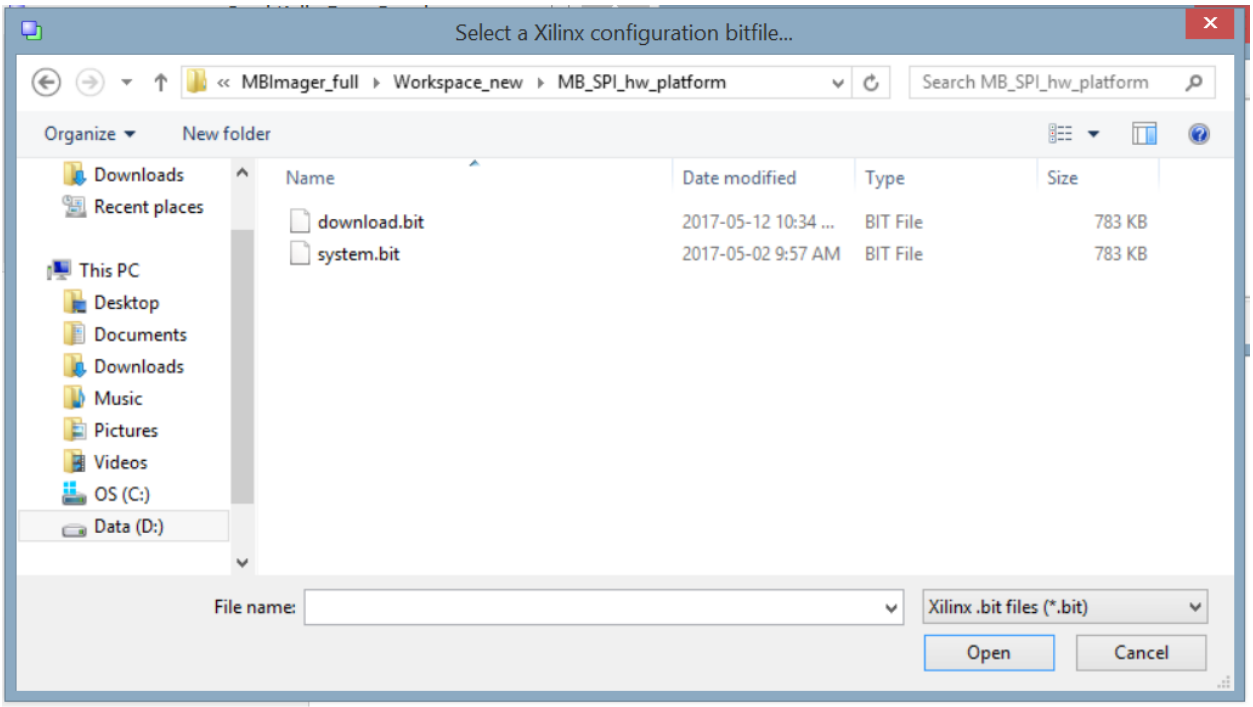
Step 2: Program Your Board

First, connect you board to your computer with the provided USB cable, and make sure you have the appropriate drivers (these should have been included with the Opal Kelly Frontpanel installation). Plug in an appropriate power cable to your board as well.

Open Frontpanel, your board should appear as a connected device. If it doesn't, try reseating the USB cable and waiting a few seconds.



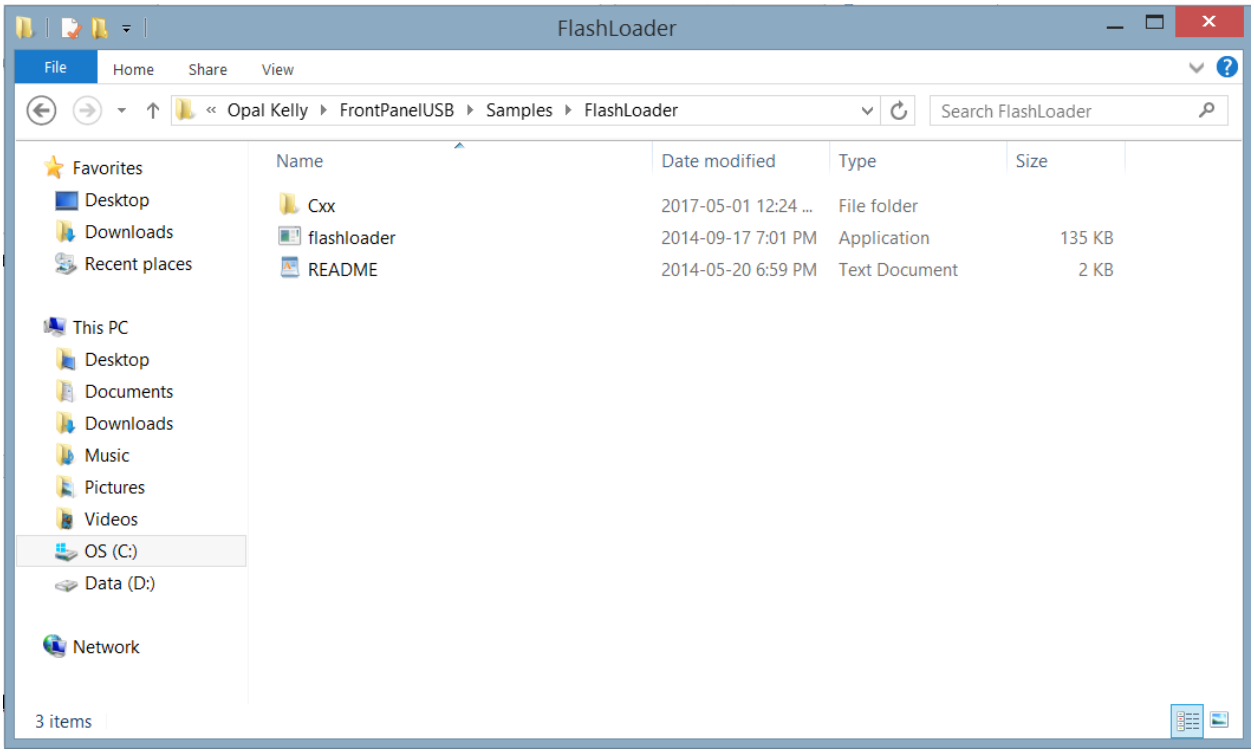
Click the **Download Configuration File** option and browse to the download.bit file you generated in step 1, or drag the file to the option from file explorer.

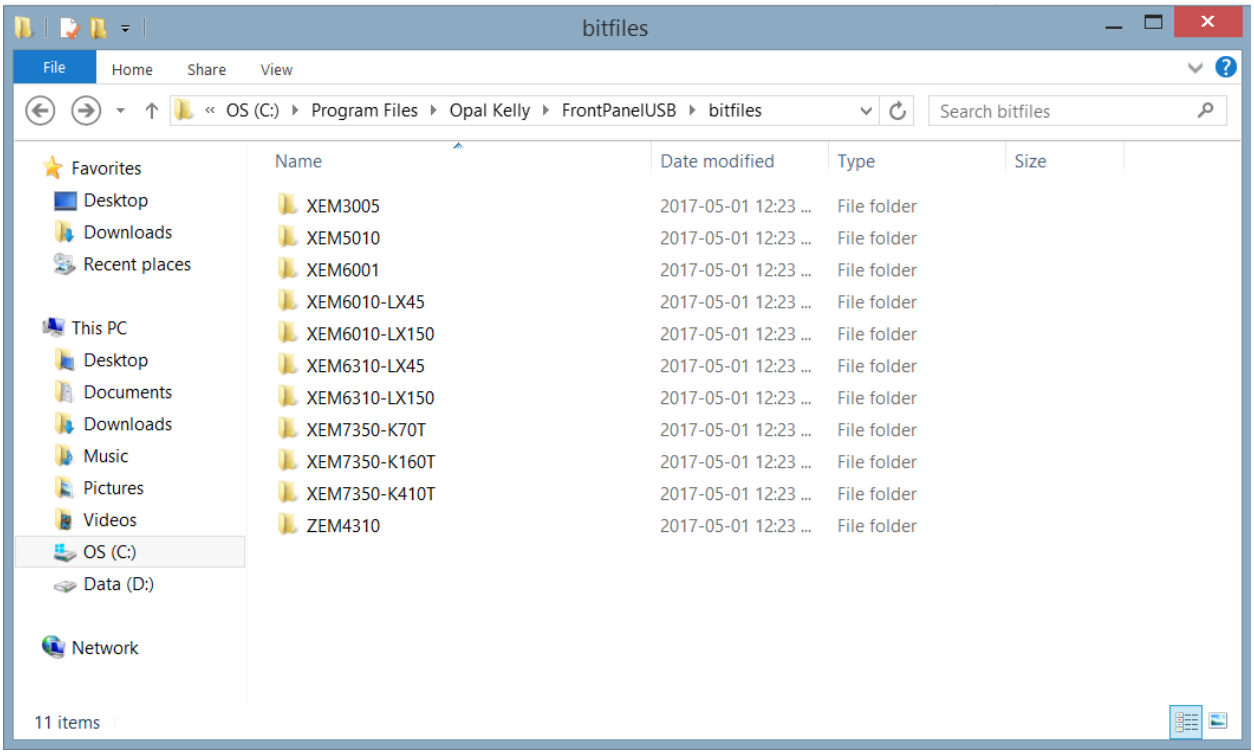


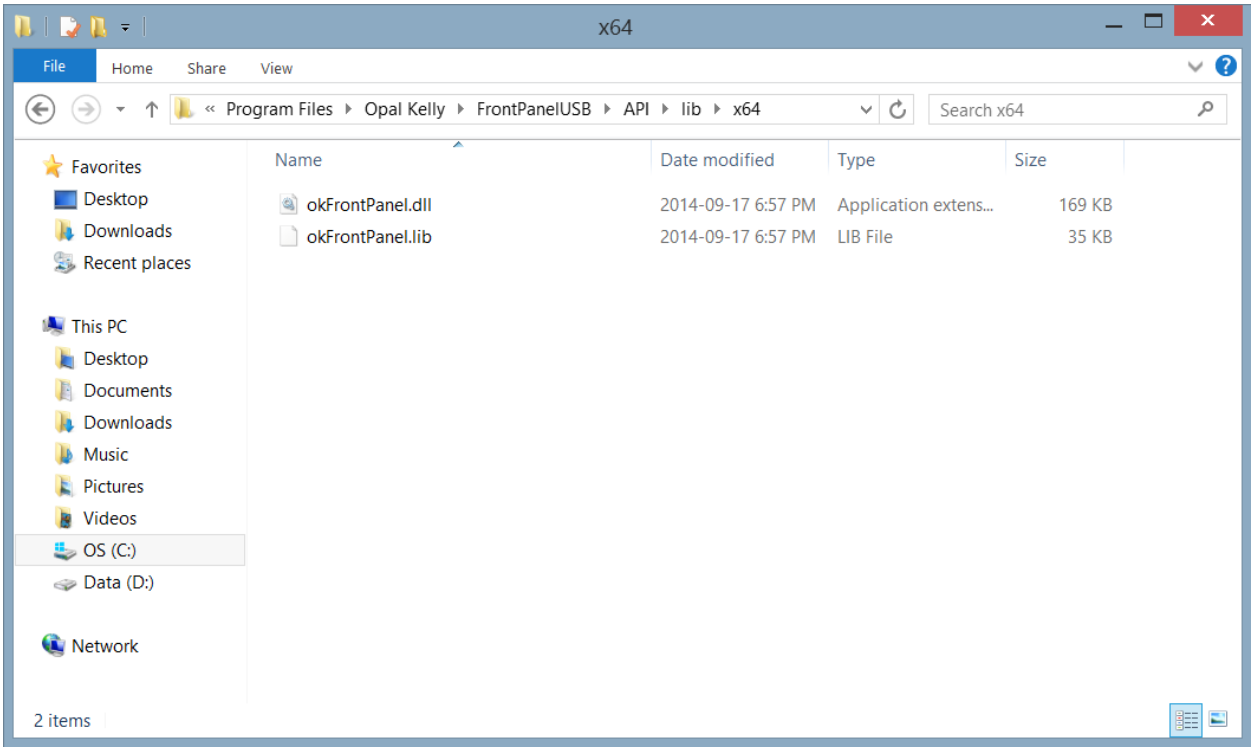
Your FPGA is now programmed with the complete system, including a uBlaze soft processor running your program. However, the settings will be lost if your FPGA ever gets power cycled. For Opal Kelly Boards, there is a way to save the configuration to non-volatile configuration memory, where it will program the board on power-on.

Programming configuration memory

Browse to your FrontPanel Samples directory (located in the installation directory), and open the **flashloader** folder. Copy the flashloader.exe application to a directory of your choice. You will also need download.bit, the flashloader.bit from bitfiles/*yourBoardModel* in the FrontPanel installation directory, and okFrontpanel.dll and okFrontPanel.lib for your system from the api/lib folder.

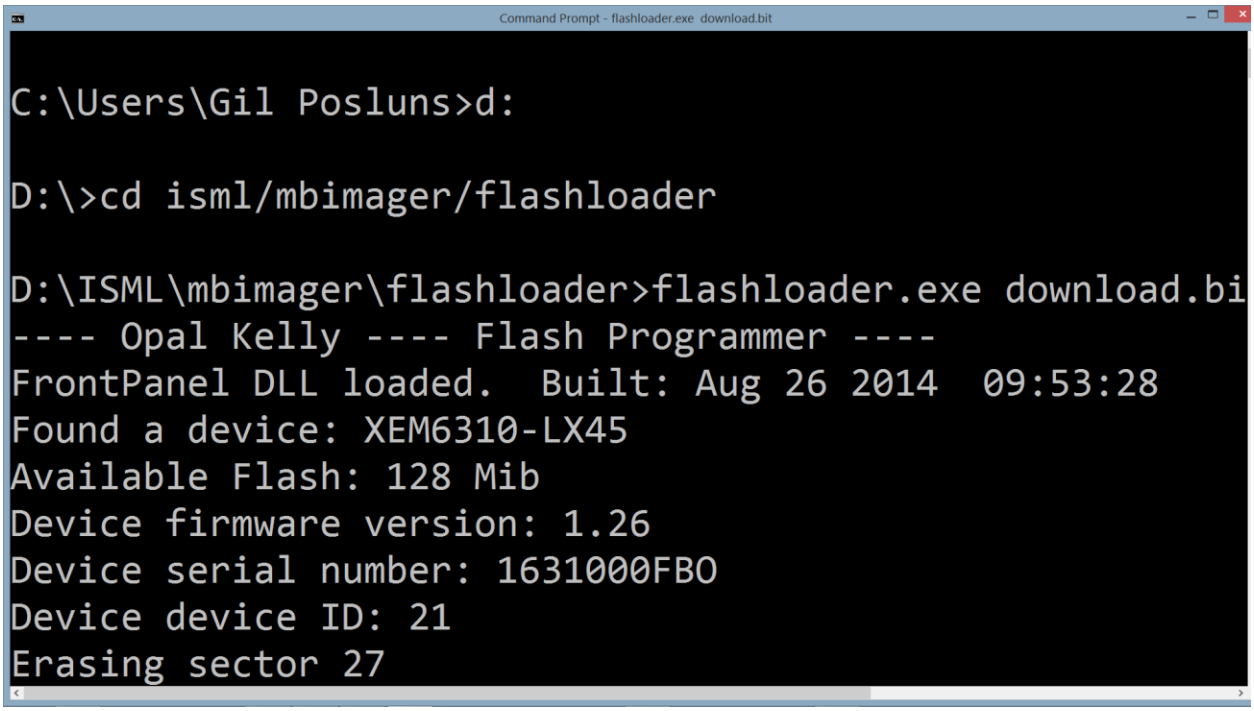






Once all these files are in the same folder, open command prompt/terminal and navigate to that folder. Run the command

flashloader.exe download.bit



At this point, the board will configure itself and run your program every time it is powered on. You can repeat this as many times as you want, overwriting the configuration memory is not harmful. If you want to erase the configuration memory without overwriting, run

flashloader.exe

with no arguments.