Instruction – using user PC

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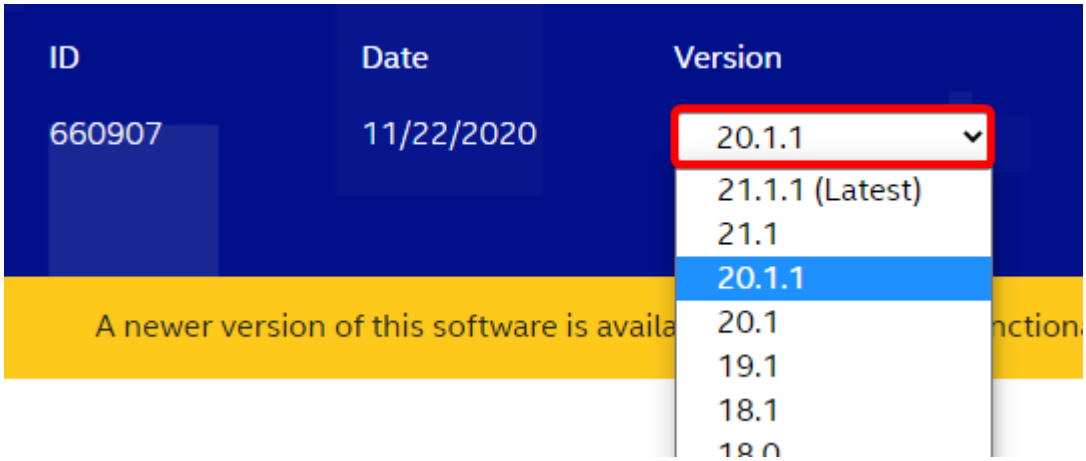
1. Quartus installation

1.1. Links to download

- Quartus (windows_link) (linux_link)

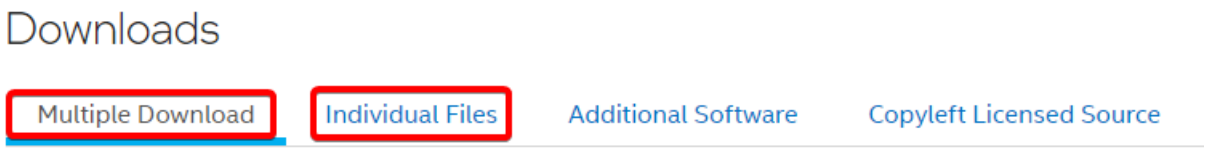
1.2. Files to download

Select version of quartus you want:



You can use latest version, but we prefer version 20.1.1 – it is last version with ModelSim inside.

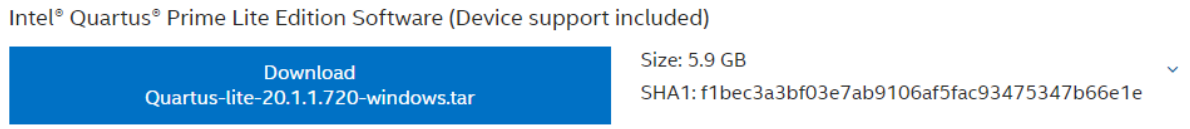
There are 2 options of downloading installation files: “Multiple Download” and “Individual Files”:



“Multiple Download” is full quartus installation pack and “Individual Files” are separate files which can be selected if needed. “Individual Files” also takes less disk space.

1.2.1. Multiple Download

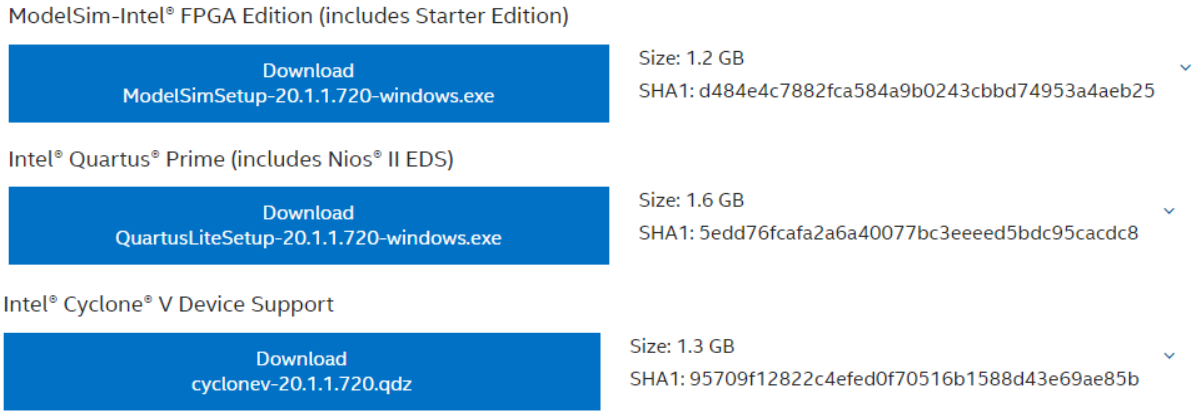
All You need to download is single tar:



When this file is downloaded you need to unpack and run “setup.bat” file.

1.2.2. Individual Files

Files required to download:



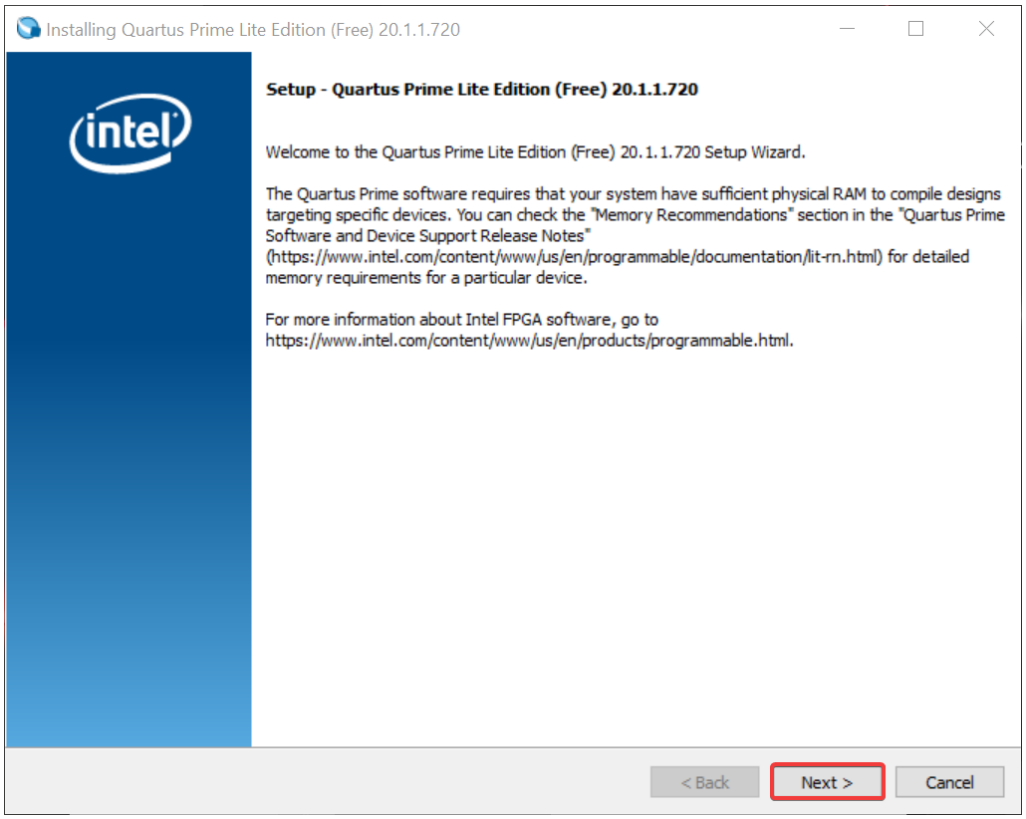
After download place all files in same directory and run QuartusLiteSetup-20.1.1.720-windows.exe on windows or QuartusLiteSetup-20.1.1.720-linux.run on linux.

If using Linux there is need to have proper access rights, therefore it is required to run chmod u+x on all downloaded files:

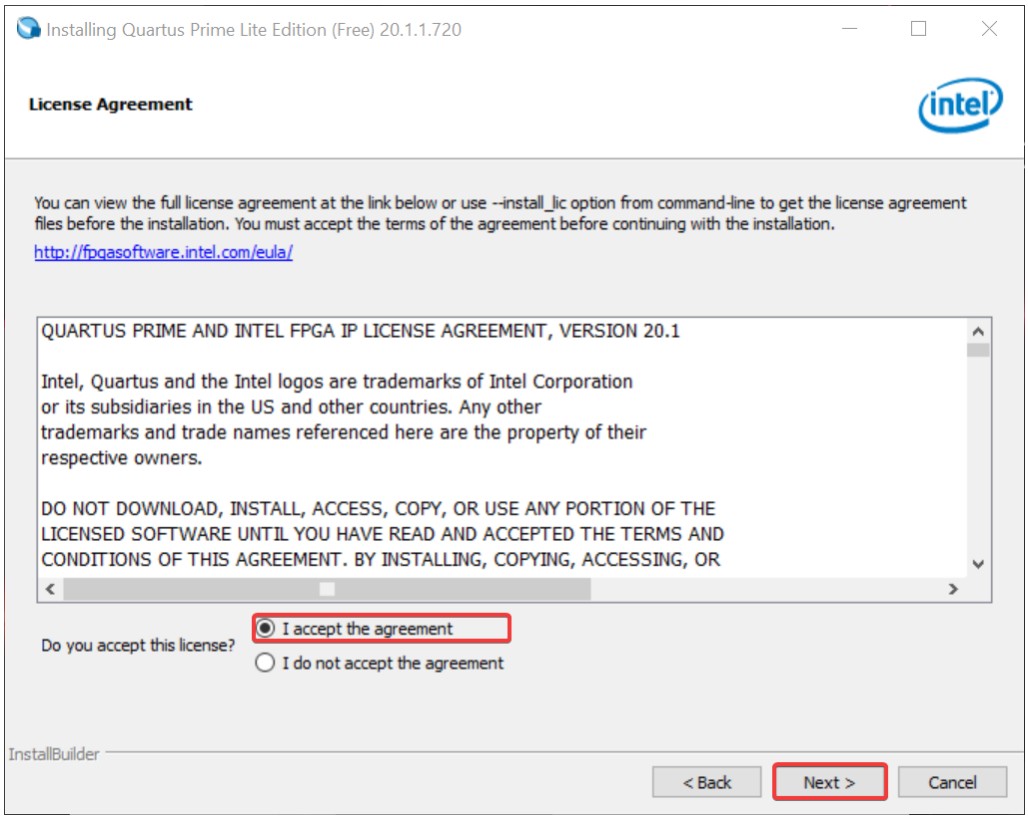
```
chmod u+x QuartusLiteSetup-20.1.1.720-linux.run
chmod u+x ModelSimSetup-20.1.1.720-linux.run
chmod u+x cyclonev-20.1.1.720.qdz
```

1.3. Installation

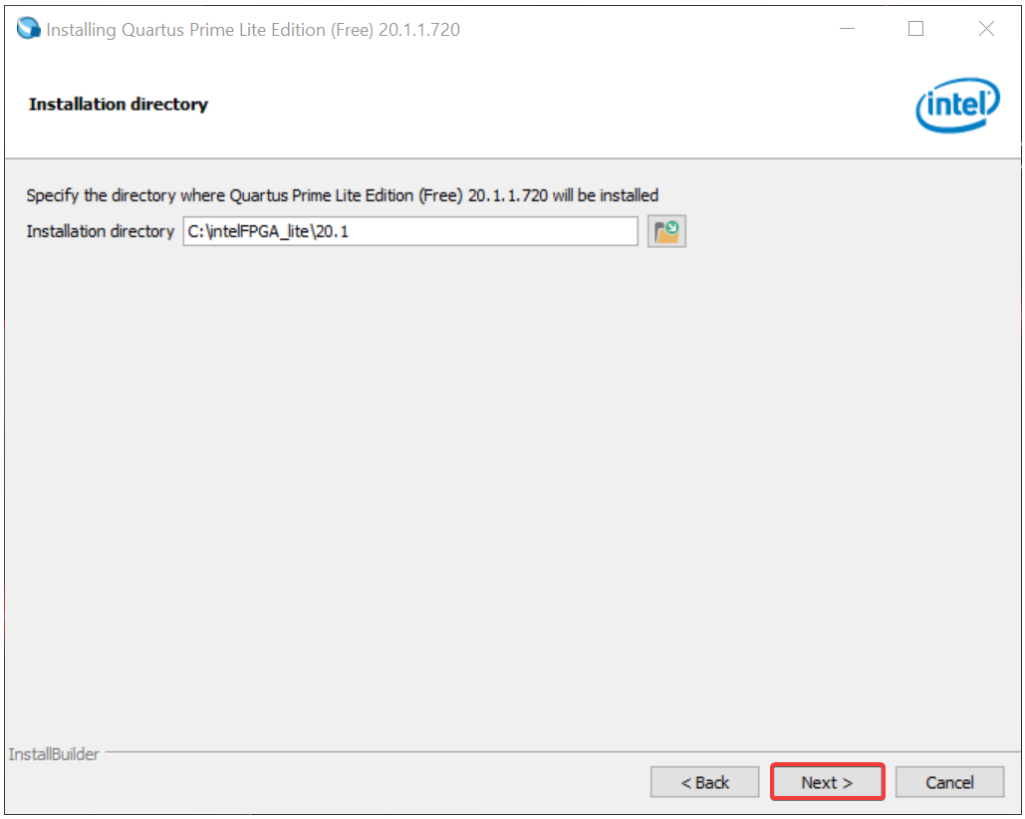
Installation process looks the same on windows and linux. Select “next”



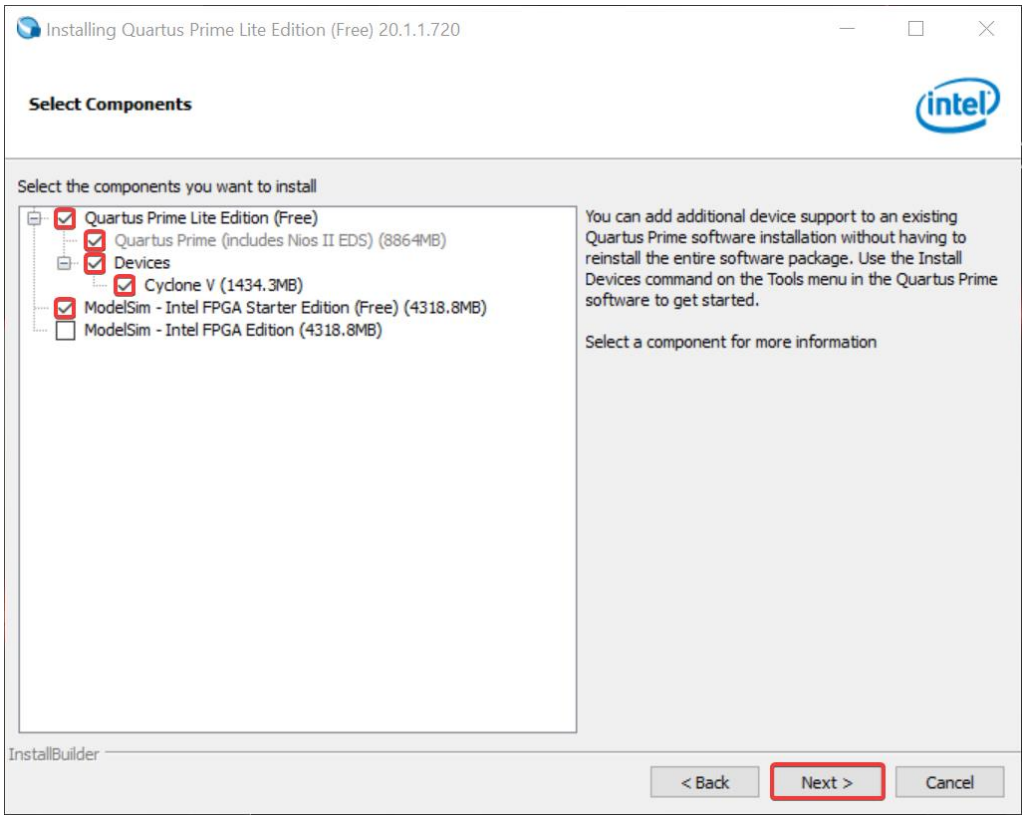
Accept the Agreement



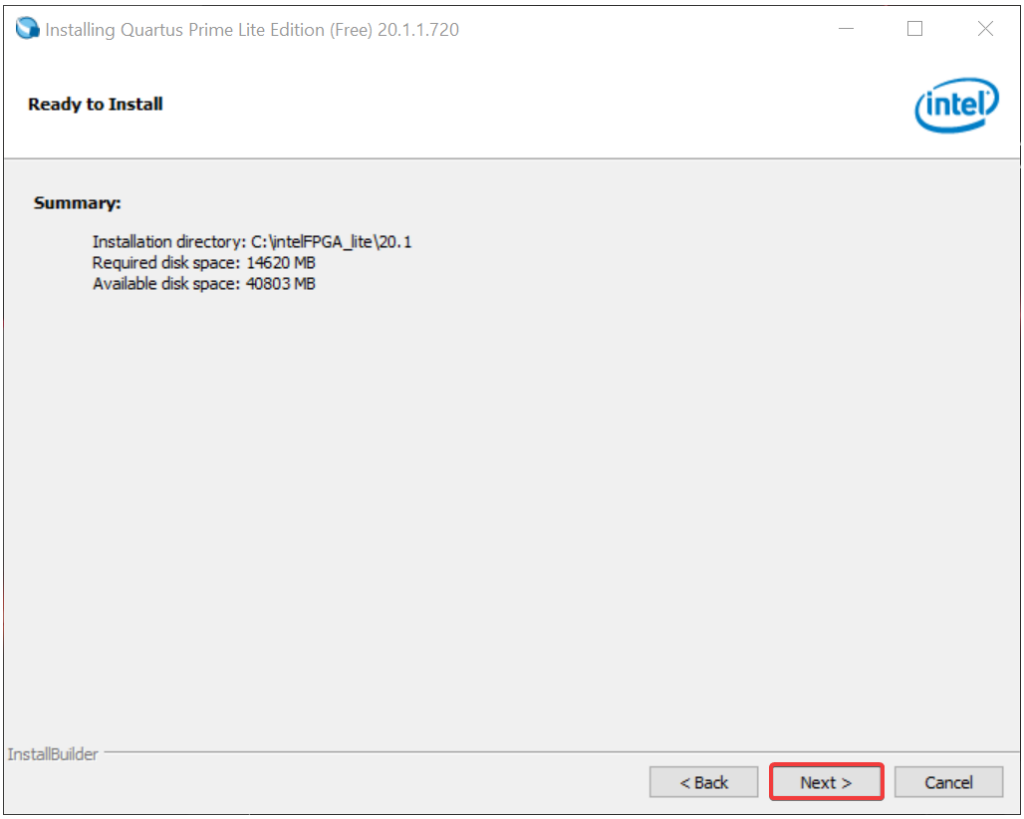
Choose path of installation



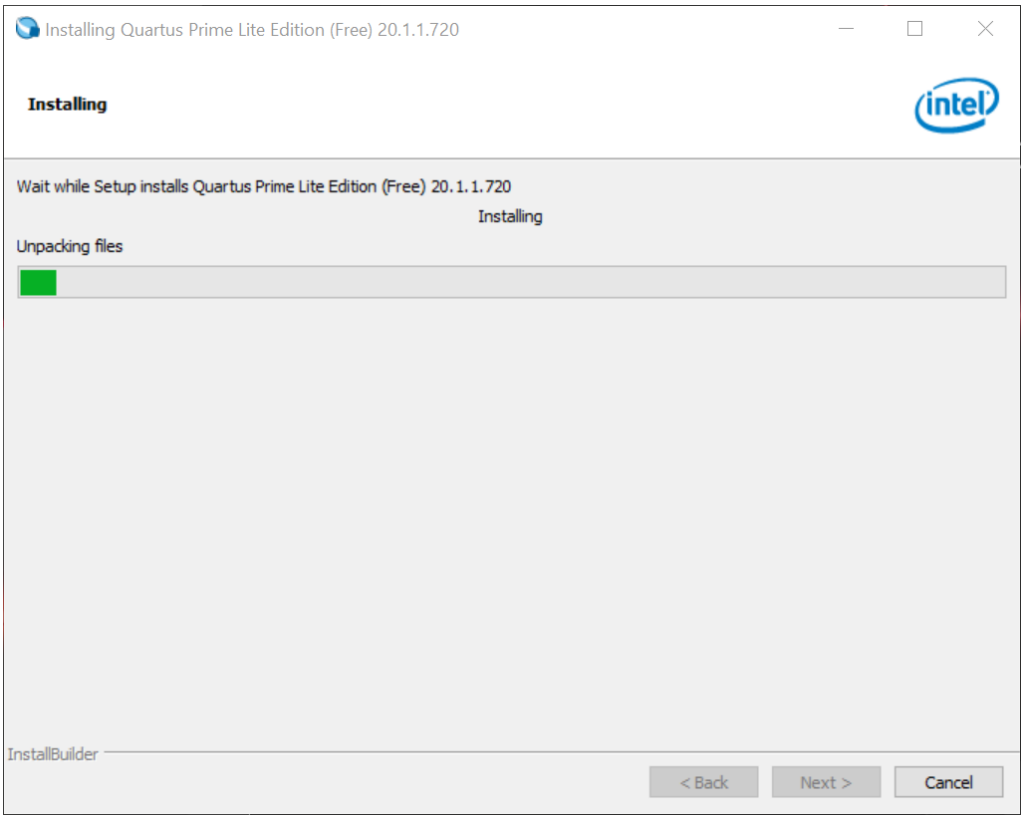
Select all highlighted components



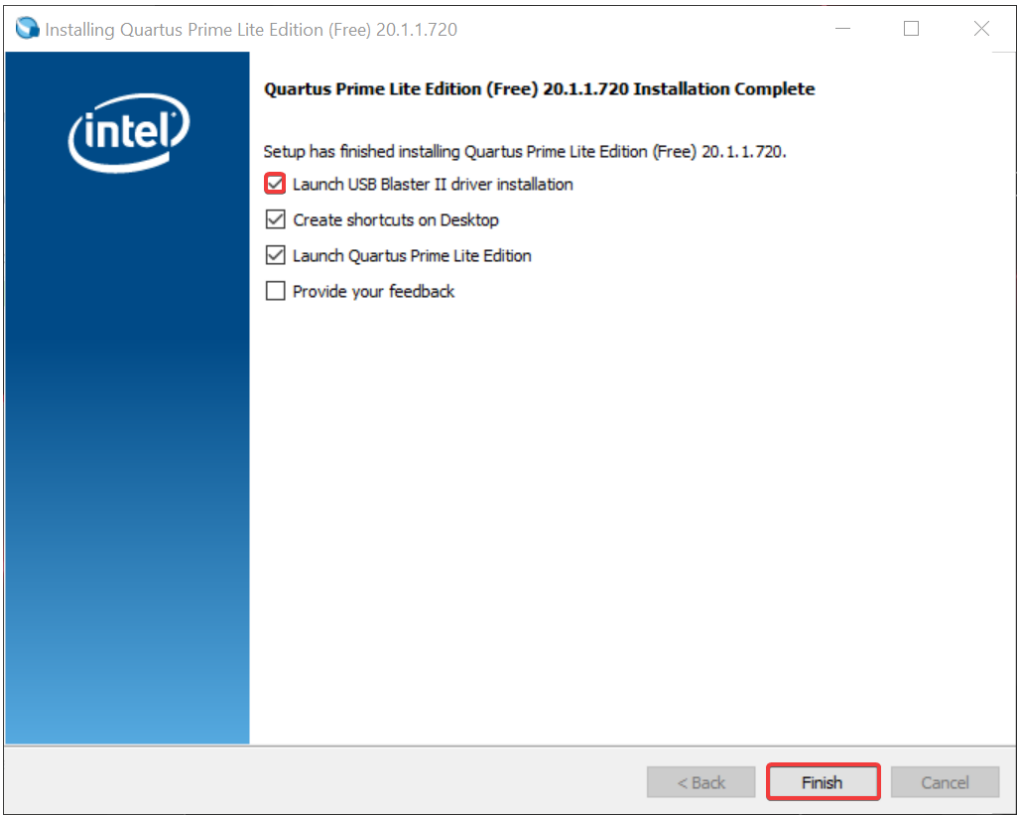
Start installation



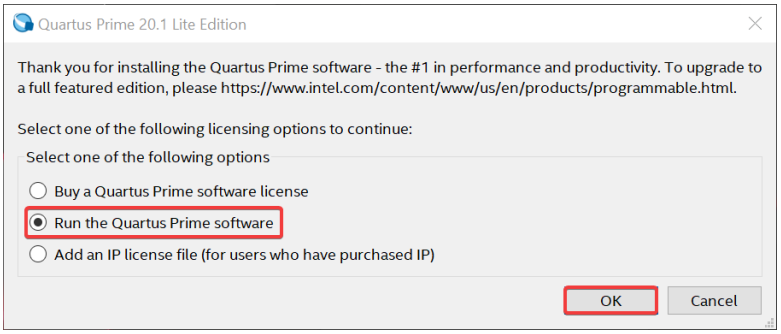
Wait until the installation is complete



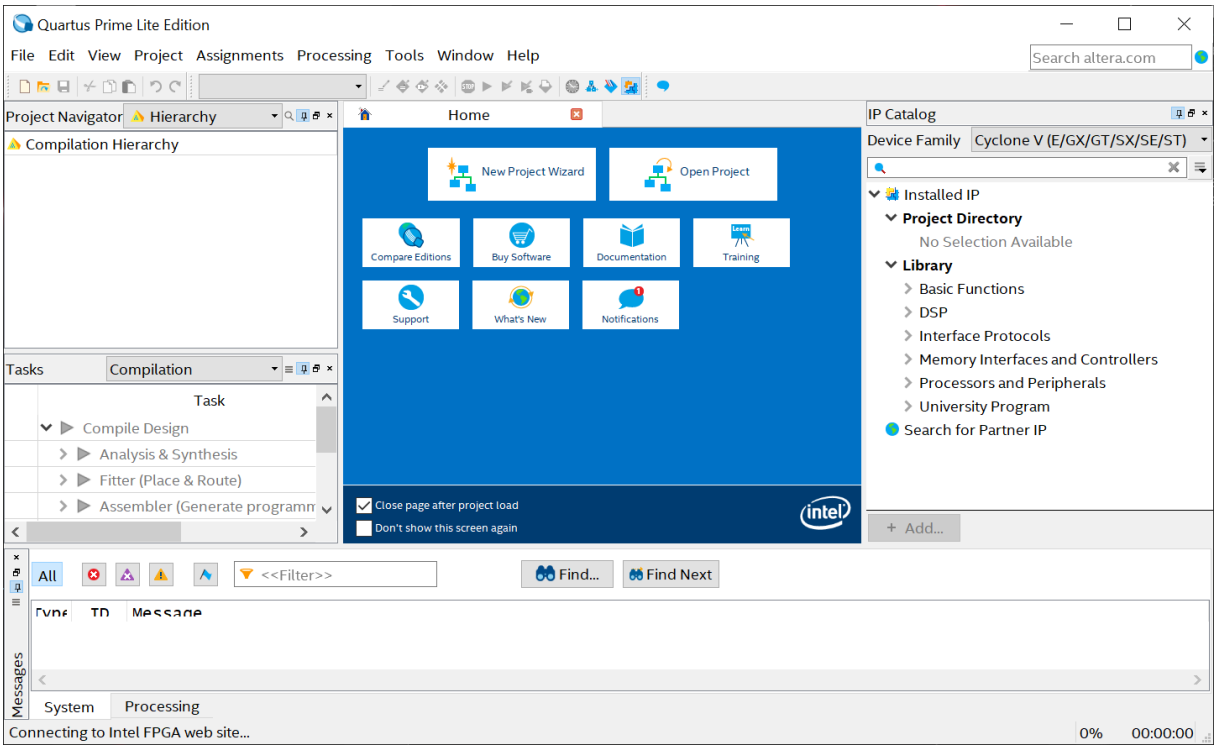
After installation select highlighted option (if it appears) and finish installation



Run quartus. While first run select highlighted option



Quartus is running



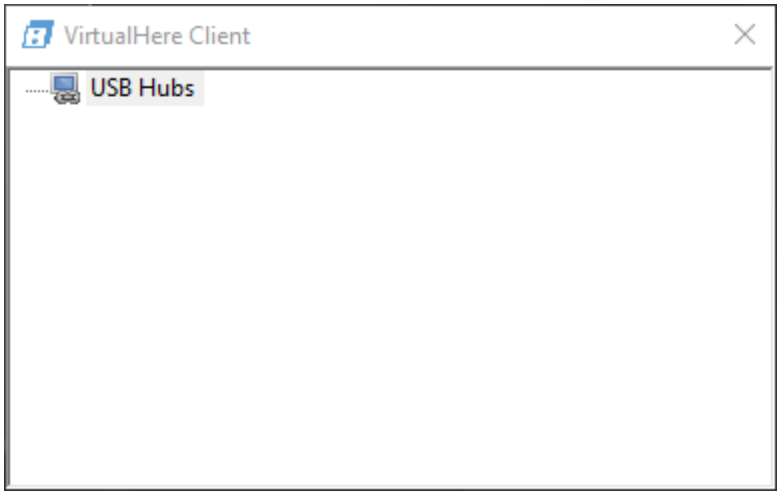
2. Connection with board

2.1. Files to download

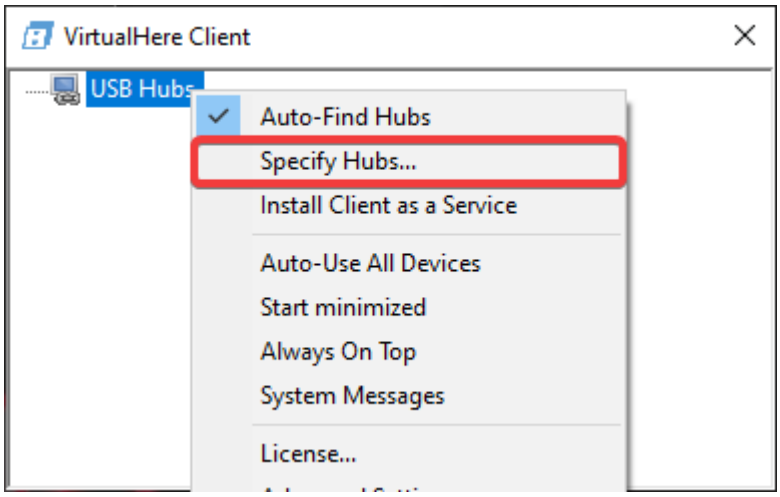
- VirtualHere Client (link)
- JTAG driver (Windows only) (link)

2.3. VirtualHere Client configuration

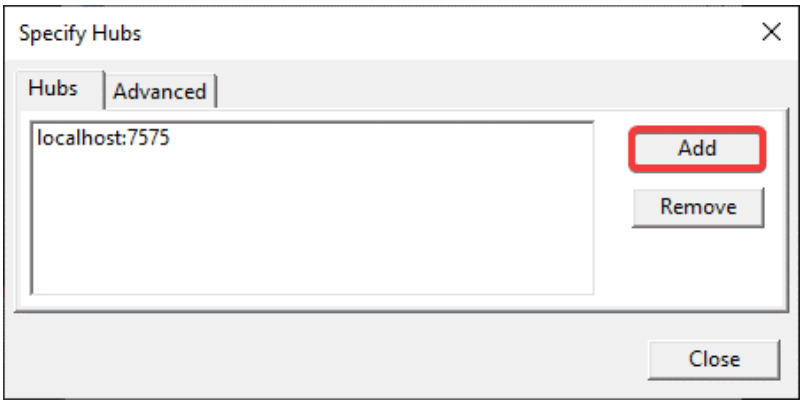
Open VirtualHere Client



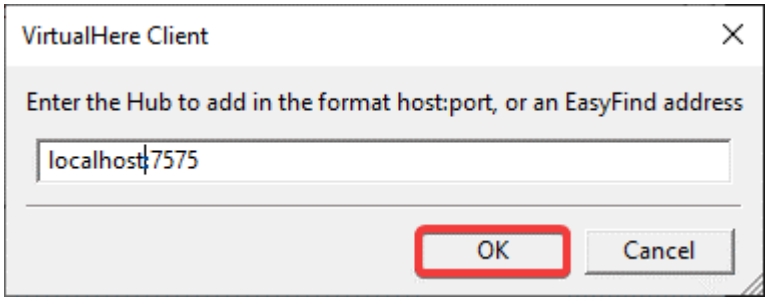
Click right mouse button on USB Hubs, than select “Specify Hubs” option



Select “Add” option



And type “localhost:7575”



After “OK” VirtualHere Client is configured. To see all devices there is need to create tunnel

2.4. Enable ssh tunnel

Open command prompt (on Windows) or terminal (on Linux), change directory to directory with ssh key and run command:

```
ssh -N -L 7575:localhost:7575 hackaton_user@31.172.183.106 -i <SSH_KEY_PATH>
```

SSH_KEY_PATH is path to ssk key received in the email, for example “SSH_Key_Team_A1”. Path can be relative or absolute.

Console must be open all time while using connected usb devices.

*If there is problem with key permissions on Windows - open cmd and use commands:

```
icacls <SSH_KEY_PATH> /inhritance:r
icacls <SSH_KEY_PATH> /grant:r "%username%":"(R)"
```

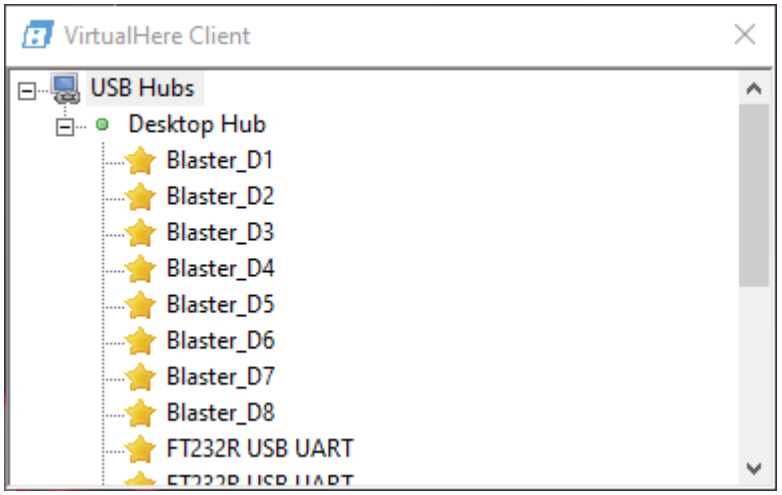
*If there is problem with key permissions on Linux - open terminal and use command:

```
chmod 600 <SSH_KEY_PATH>
```

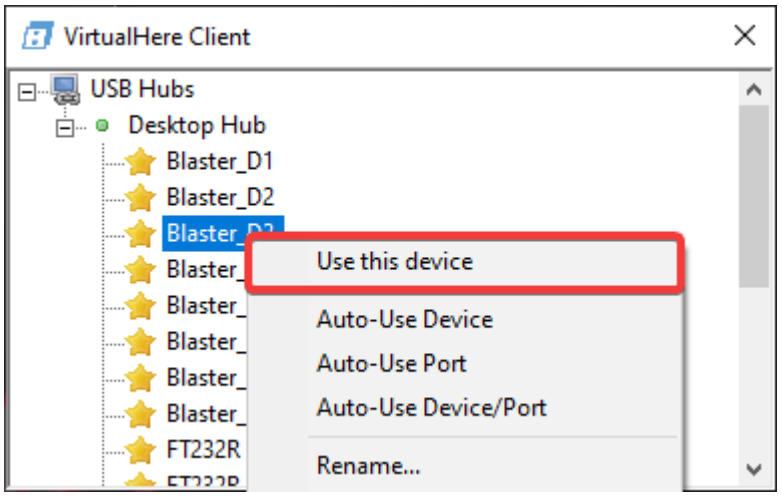
2.5. Connection with USB device

To obtain list of USB devices there is needed to open ssh tunnel.

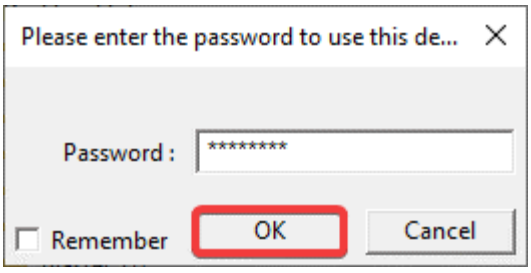
With configured VirtualHere Client and ssh tunnel opened Client automatically finds all shared USB devices



To connect use right mouse button on selected device and choose “Use this device option”

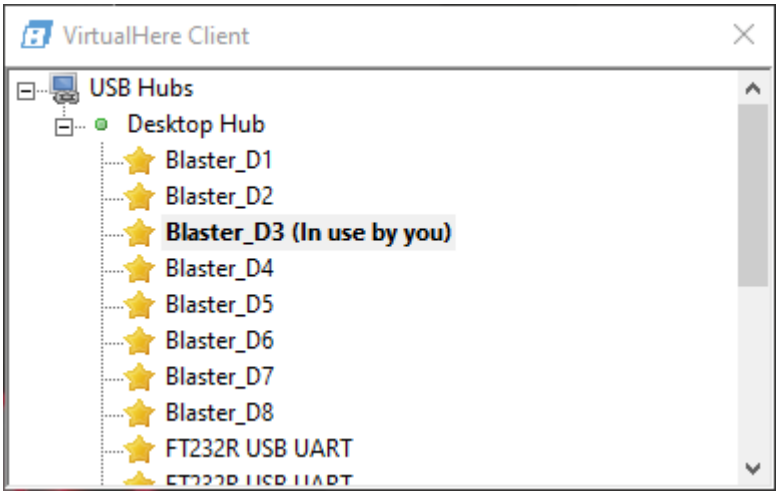


Enter the password which is 12 first characters of the 5th line in the team ssh private key file.



It is possible to use option “Remember”. If the remembered password was entered incorrectly, it can be canceled by selecting device and using shortcut Shift+F9.

If password for device is correct connection will be enabled



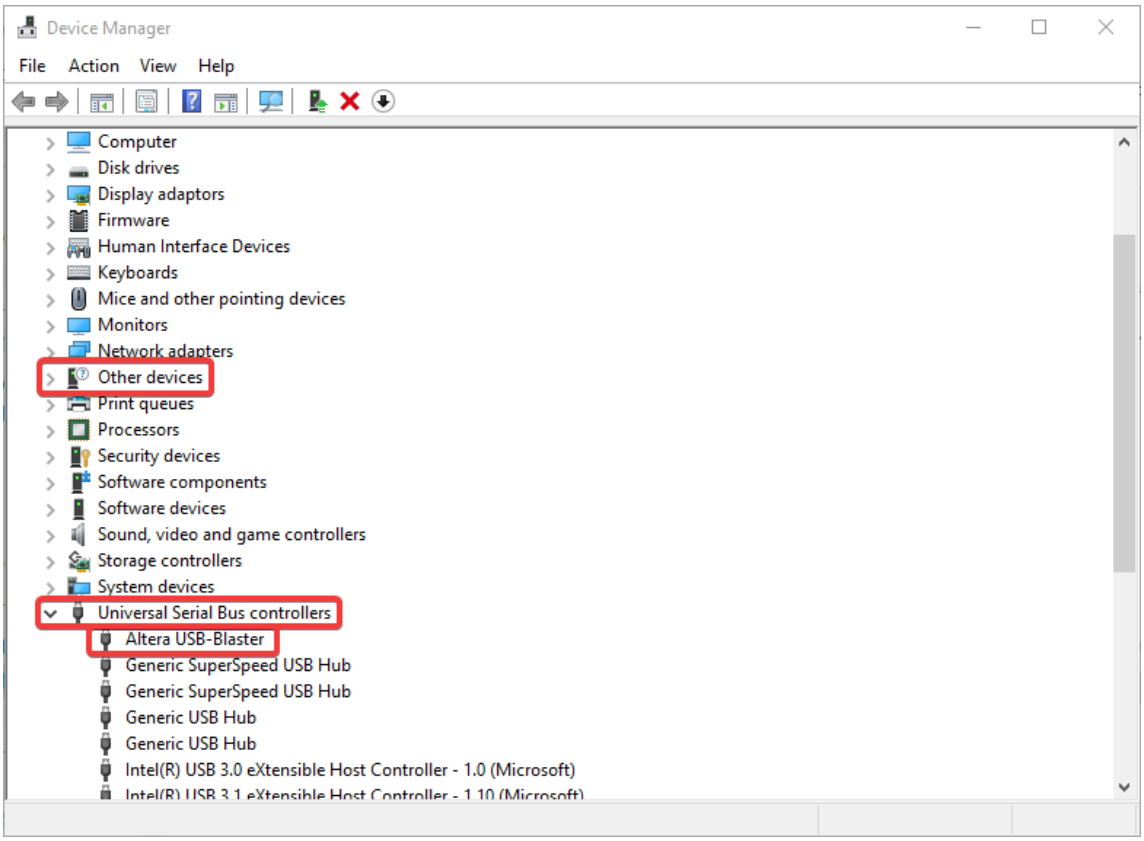
It is not possible to connect with usb device which is in being used by other user.

2.6. Install JTAG Driver

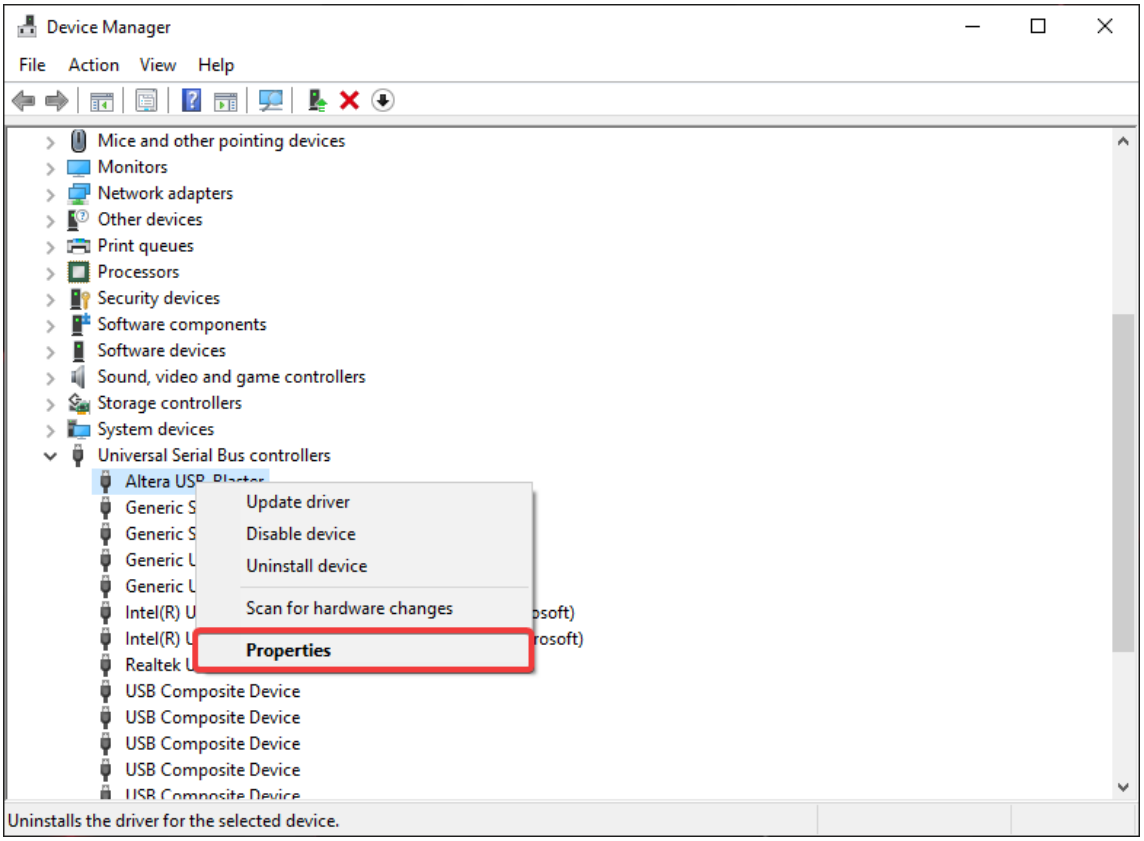
This part is needed only for windows users.

Unpack JTAG driver (Usb_blaster_q16.1.zip) downloaded from link in chapter 2.1, and open Device Manager from Control Panel.

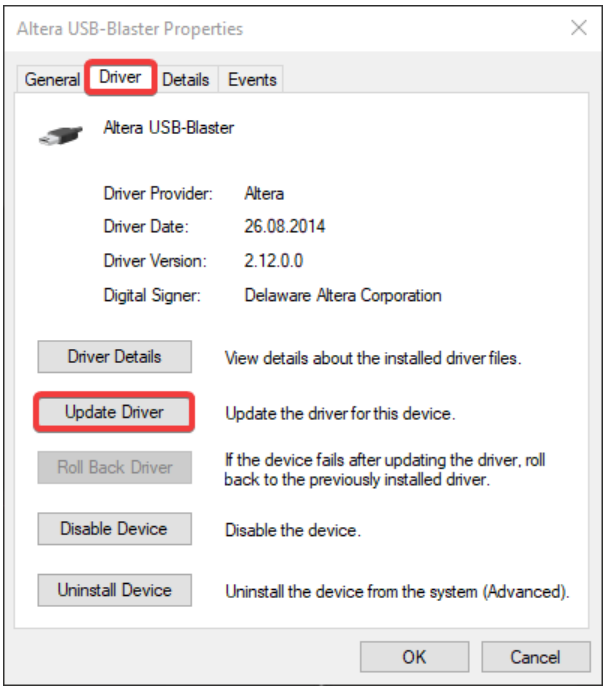
Expand list of “Other devices” or “Universal Serial Bus controllers” and find “Altera USB-Blaster” or “USB-Blaster” device.



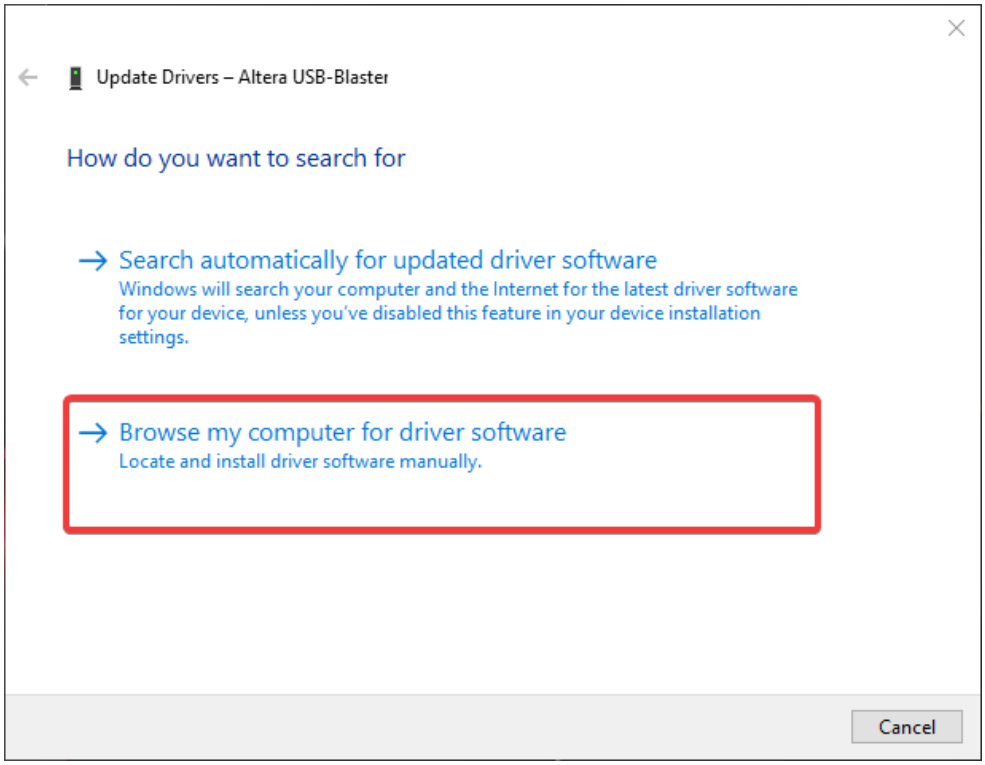
Click right mouse button on “Altera USB-Blaster” and select Properties



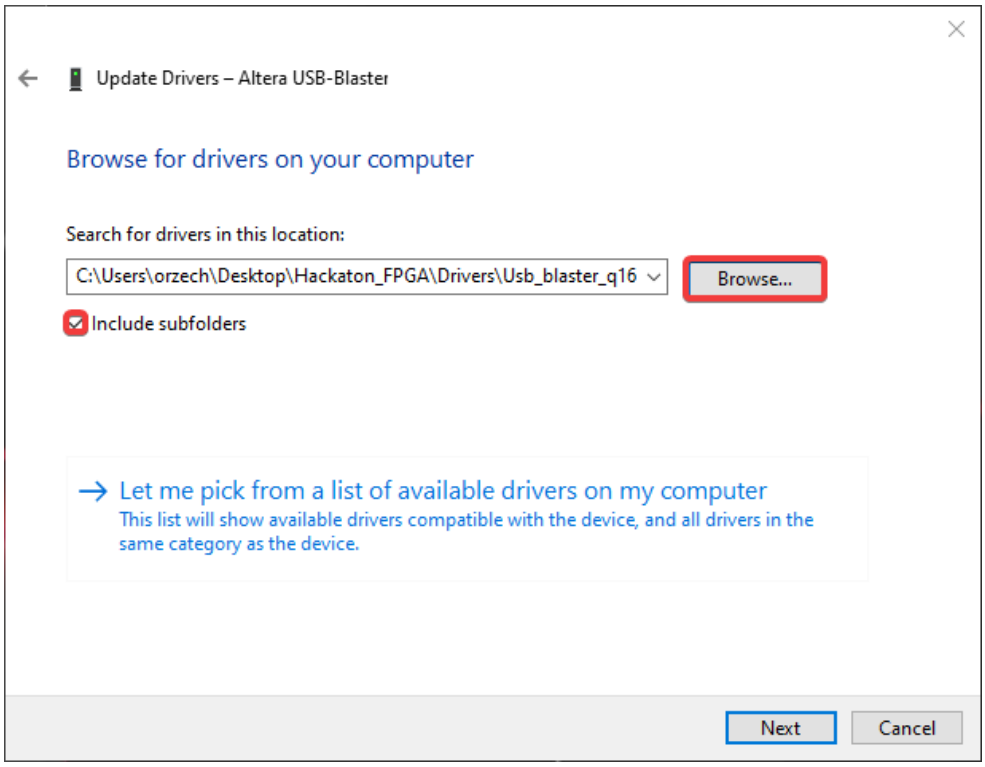
Choose “Driver” from top bar and select “Update Driver”



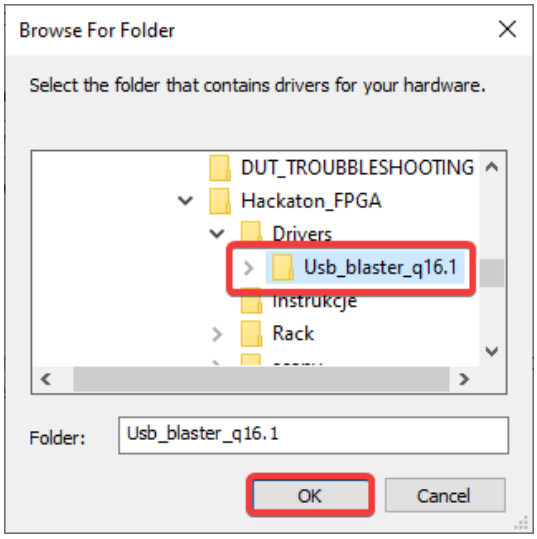
Select “Browse my computer for driver software”



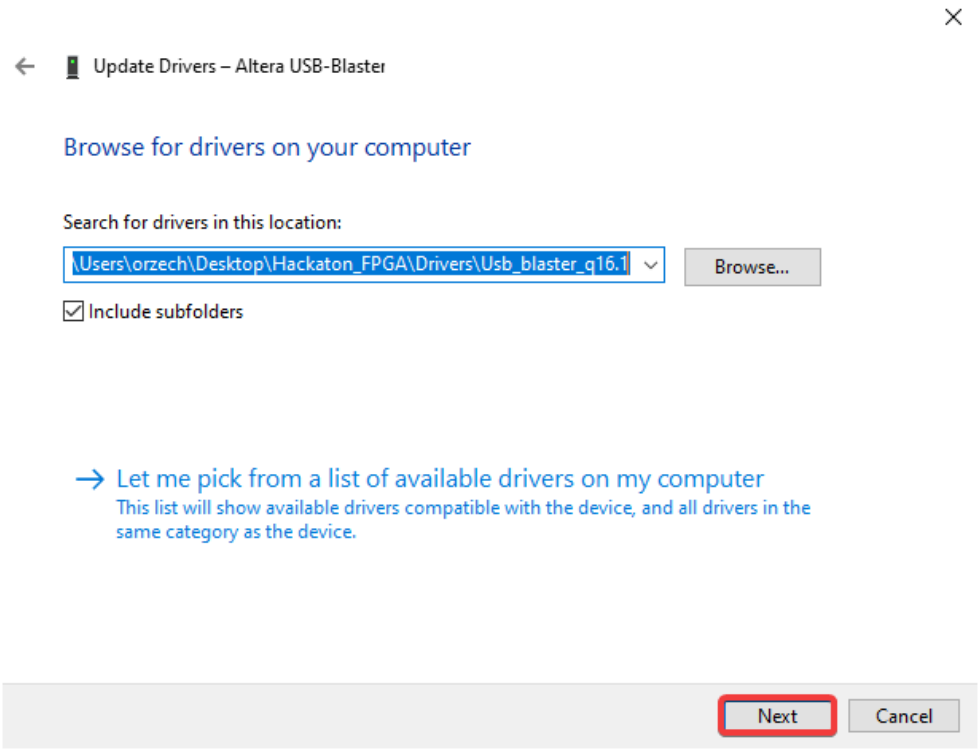
Mark “Include subfolders” and select “Browse” button



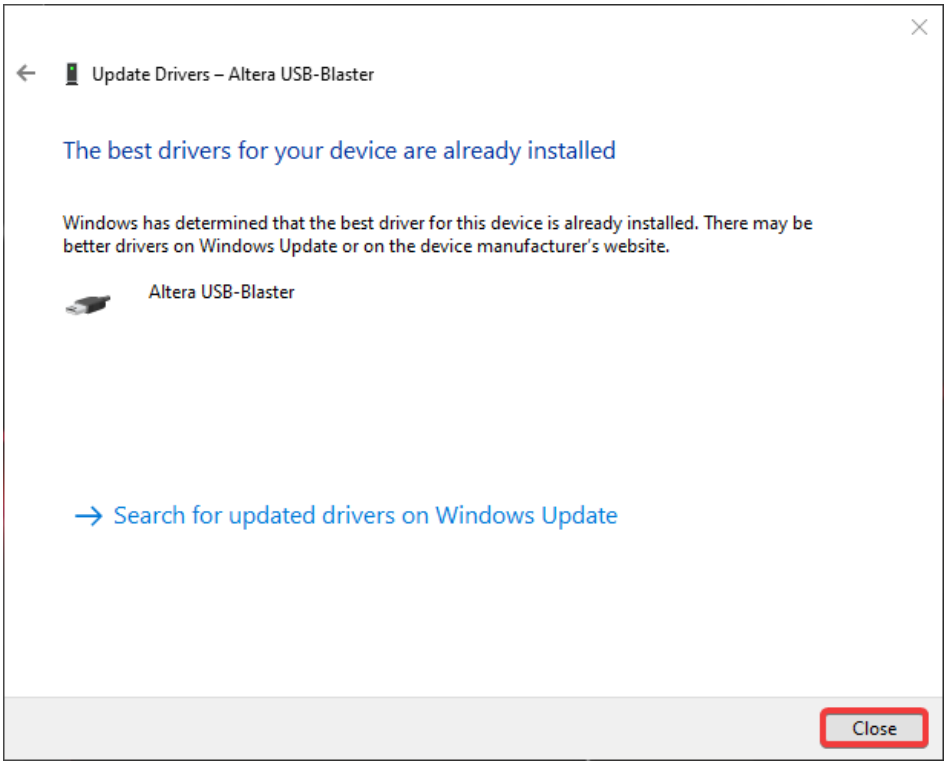
Choose path to unpacked driver. Select Usb_blaster_q16.1 directory (not x32 or x64 inside)



Select “Next”



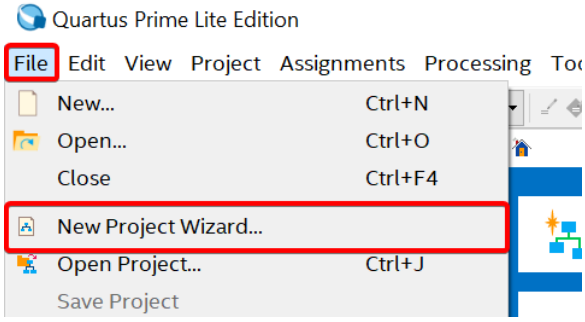
Drivers will be installed



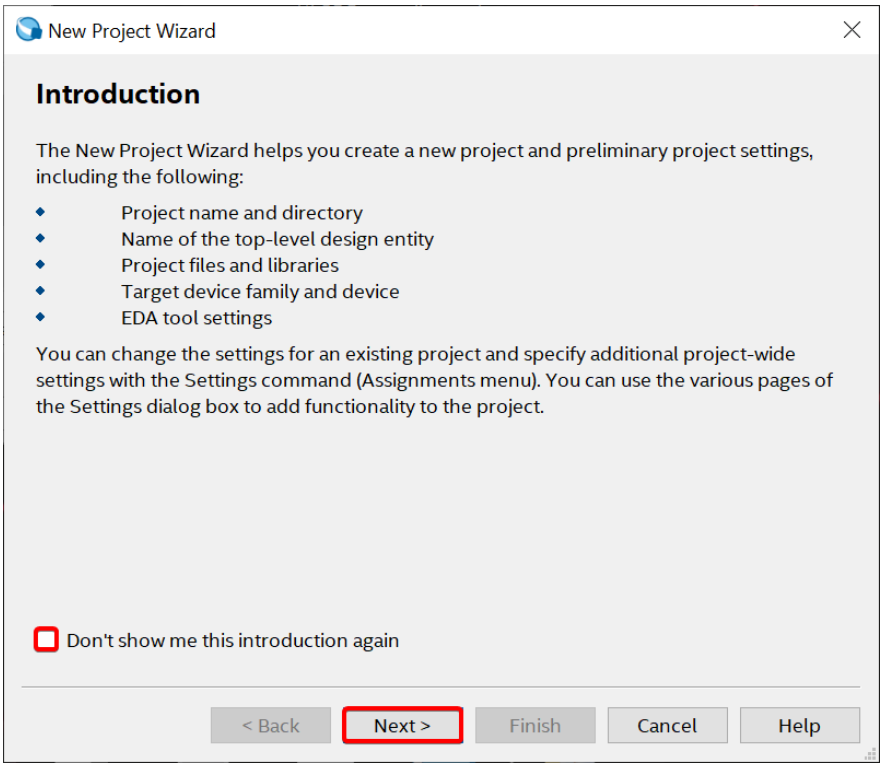
3. Upload bitfile

3.1. Create empty project *(for connection test)*

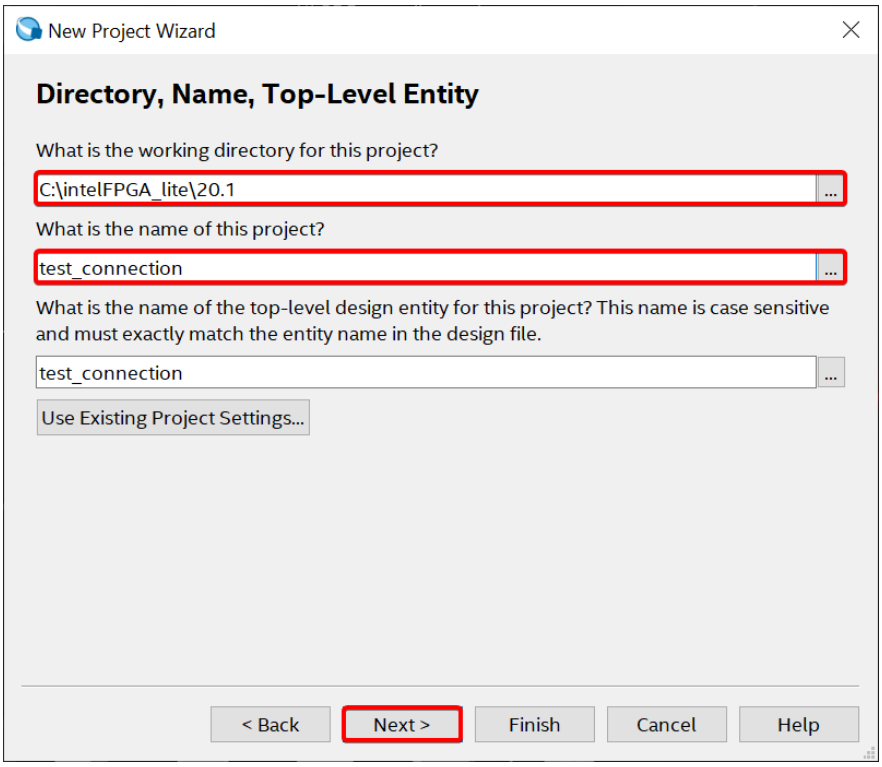
Select “New Project Wizard…” from “File” tab



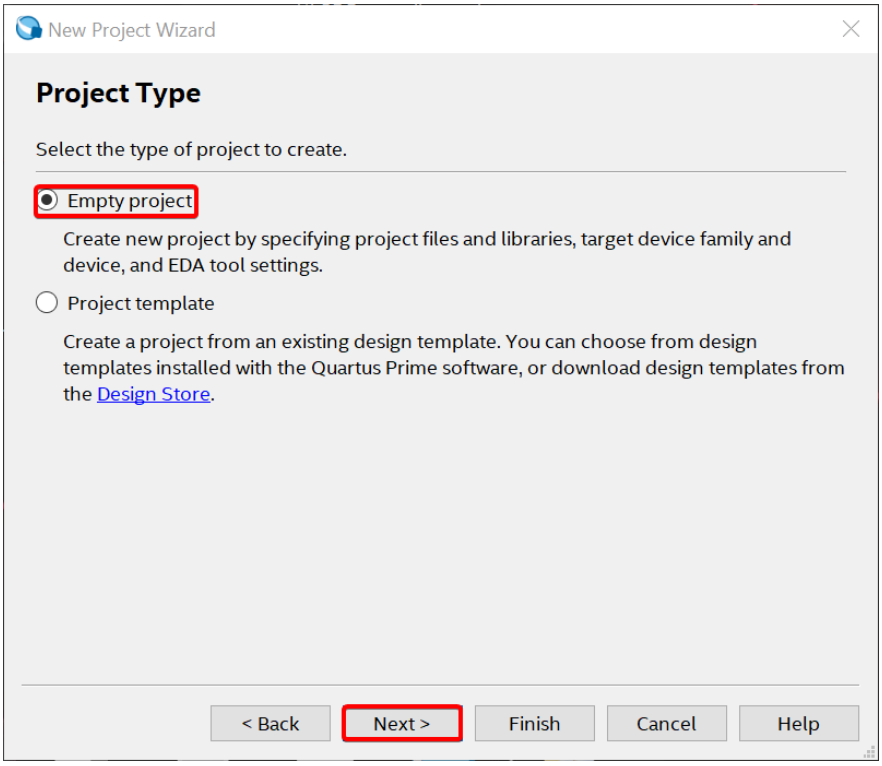
Select “Next” and check “Don’t show me this introduction again” if you don’t want to see this Introduction again



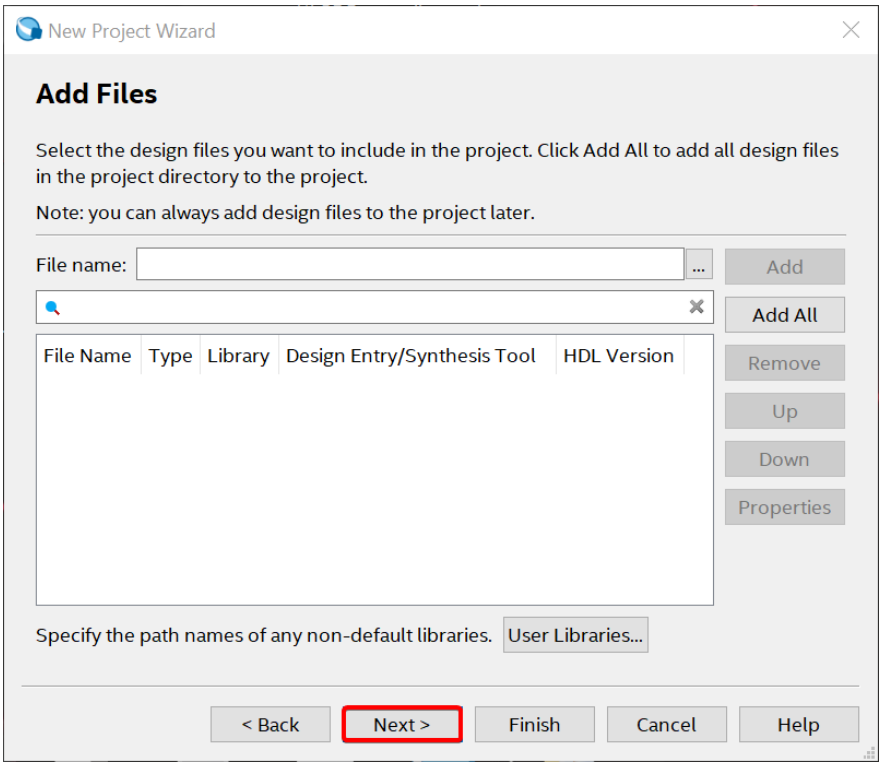
Enter correct project path and name



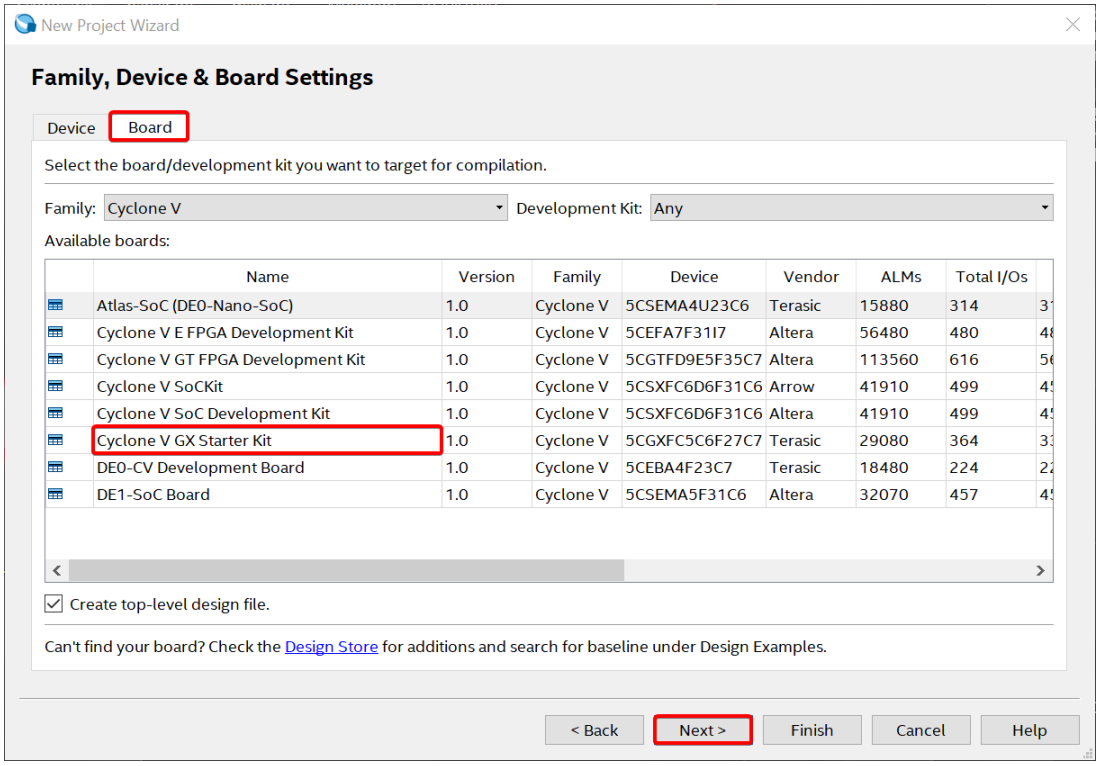
Select “Empty project”



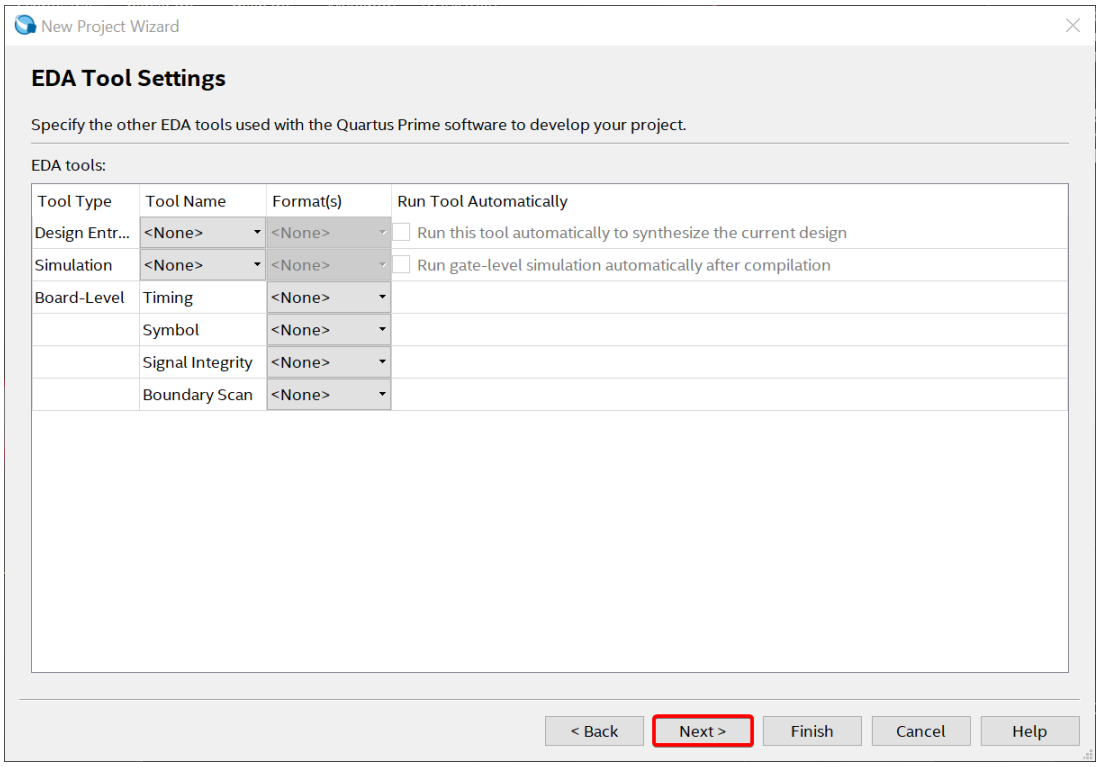
Additional files are not needed



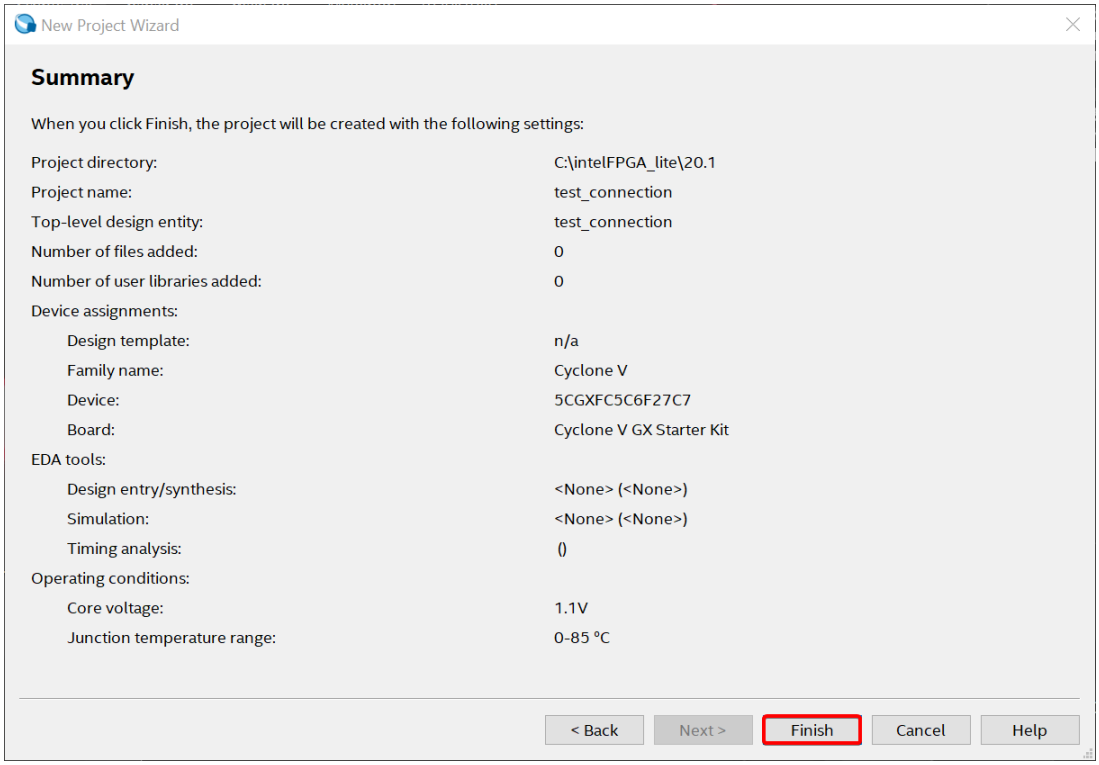
Select “Board” and “Cyclone V GX Starter Kit”



For empty project nothing is needed here

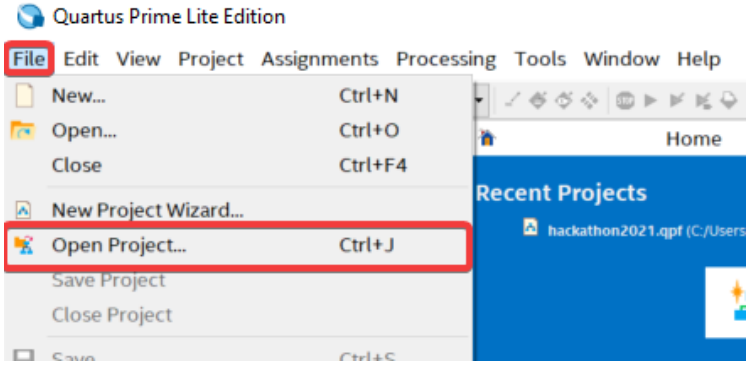


Select “Finish” to create empty project

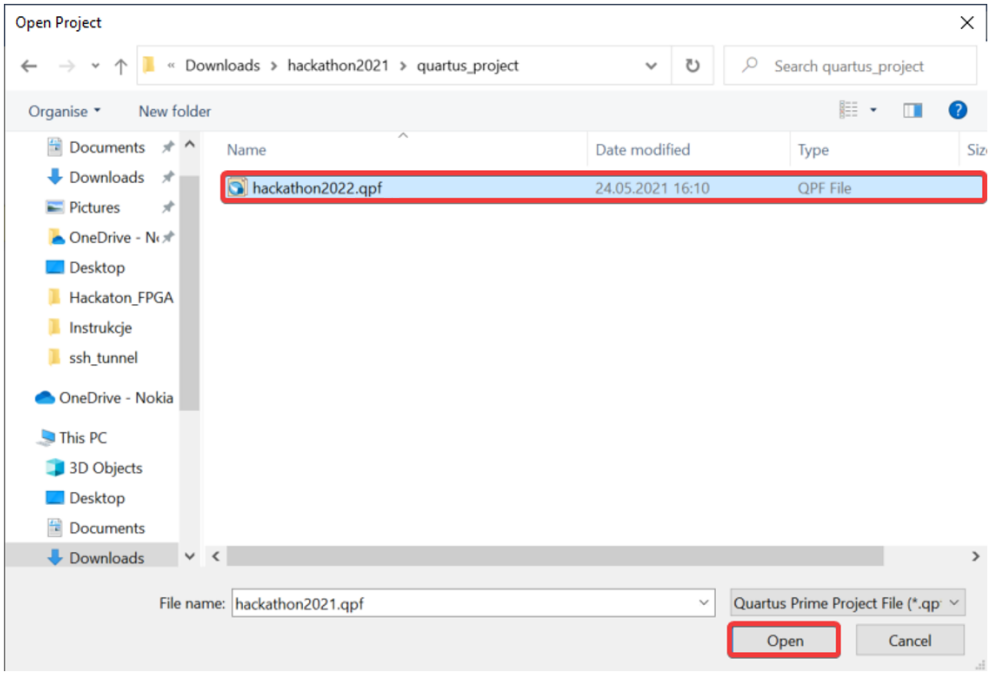


3.2. Import project

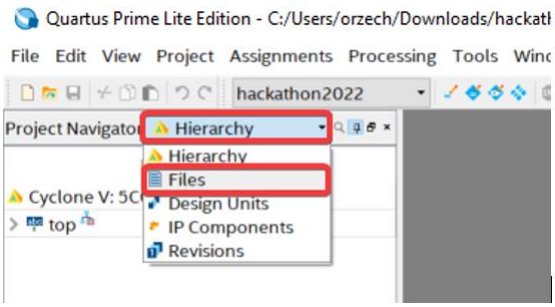
Select “Open Project” from “File” tab



Enter the path to project (*.qpf file from “quartus_project” directory)

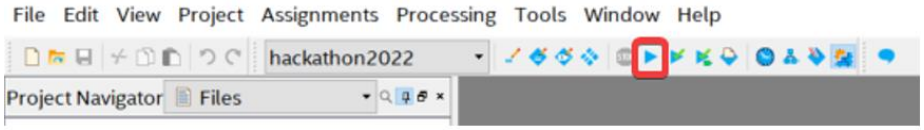


To see all files from project change view from “Hierarchy” to “Files”

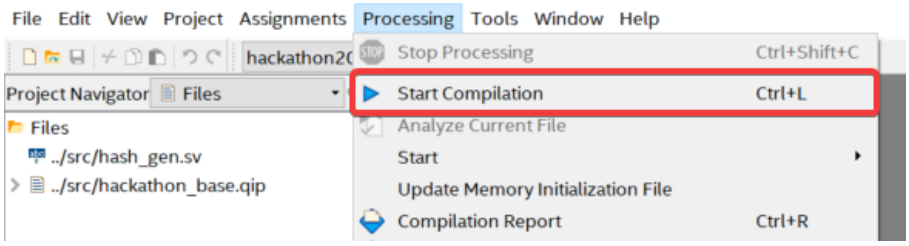


3.3. Compilation

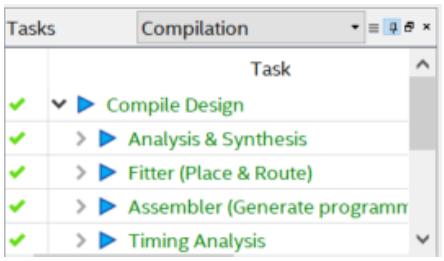
To compile project use button with triangle from tool bar



Or select “Start Compilation” from Processing tab



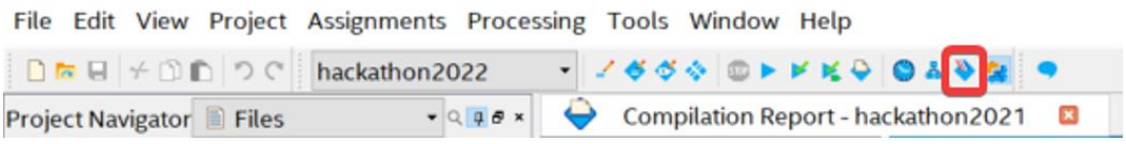
If compilation was successful all compilation phases should have green color



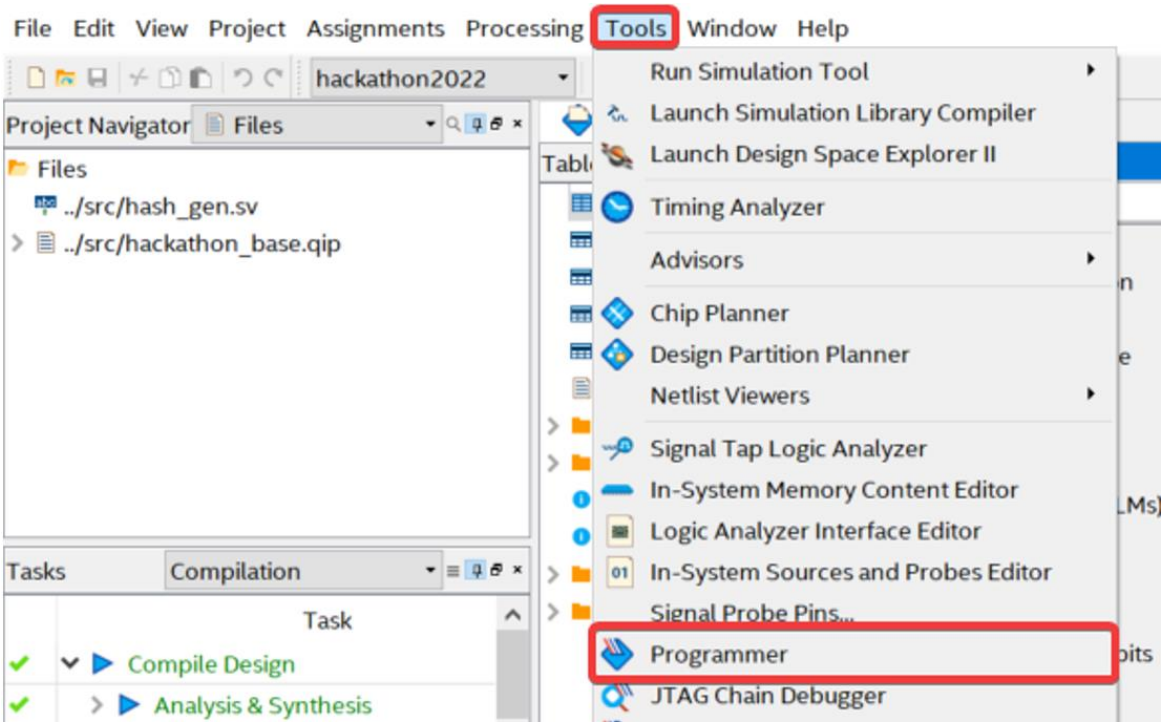
3.4. Uploading bitfile

To upload bitfile right usb device should be connected via virtualhere through the ssh tunnel.

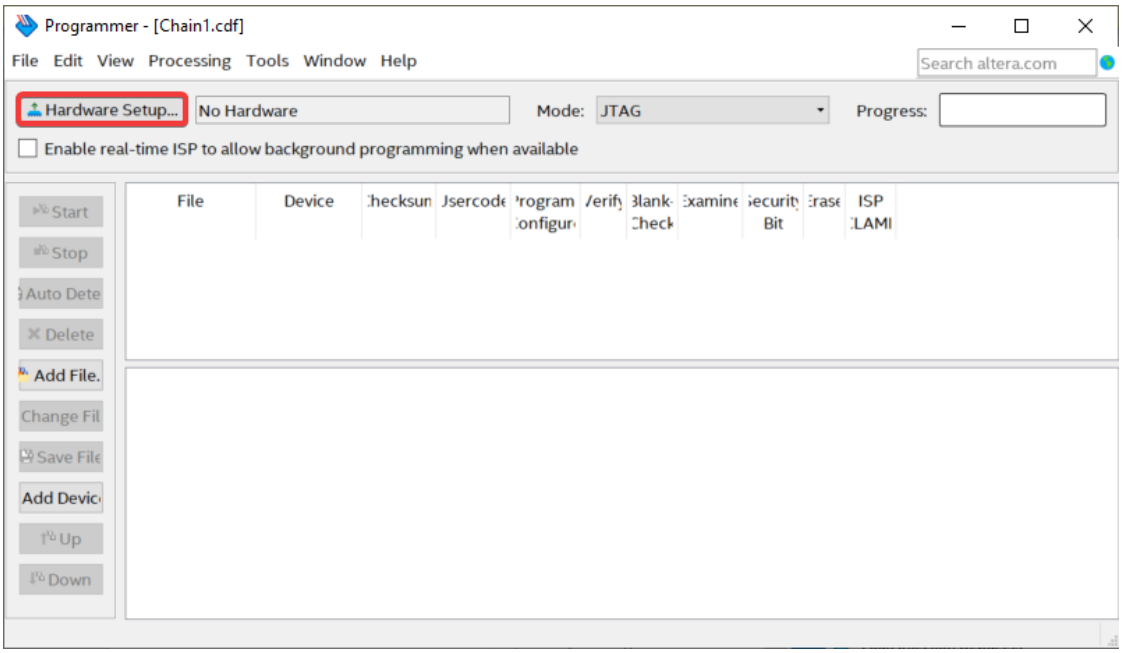
Run Programmer using symbol shown on picture below



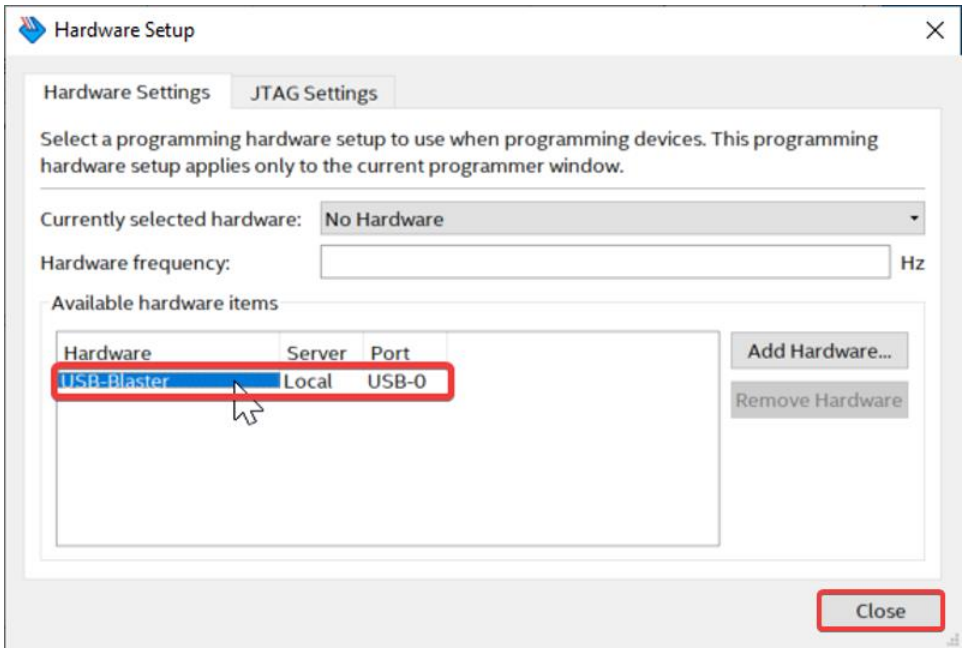
Or select “Programmer” option from “Tools” tab.



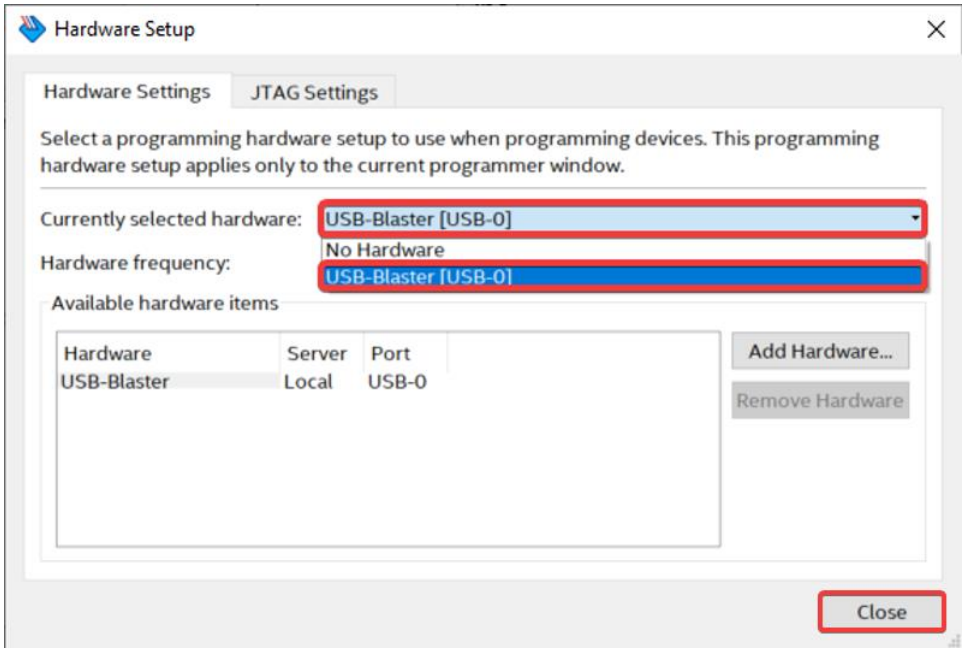
If “USB-Blaster” is not connected select “Hardware Setup”



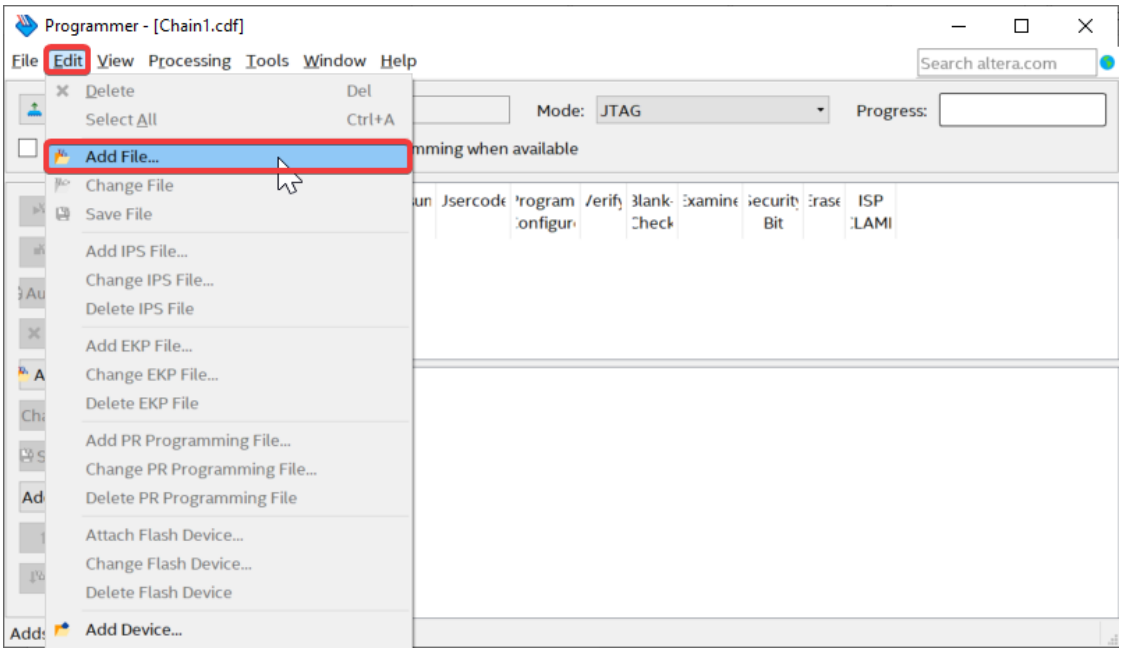
Double click on USB-Blaster connected



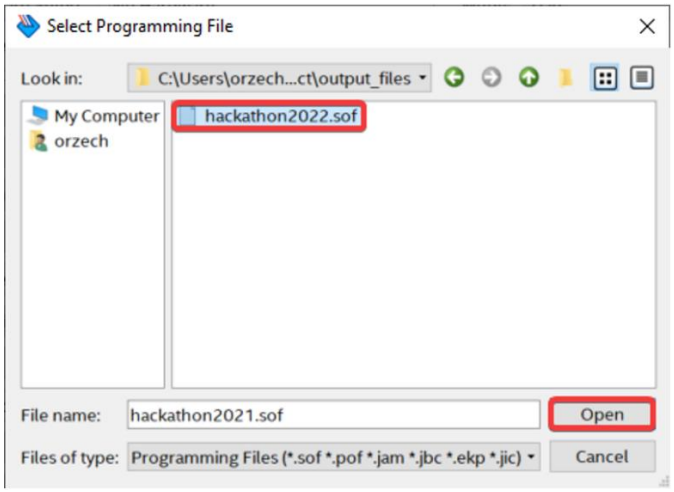
Or select USB-Blaster from drop-down list



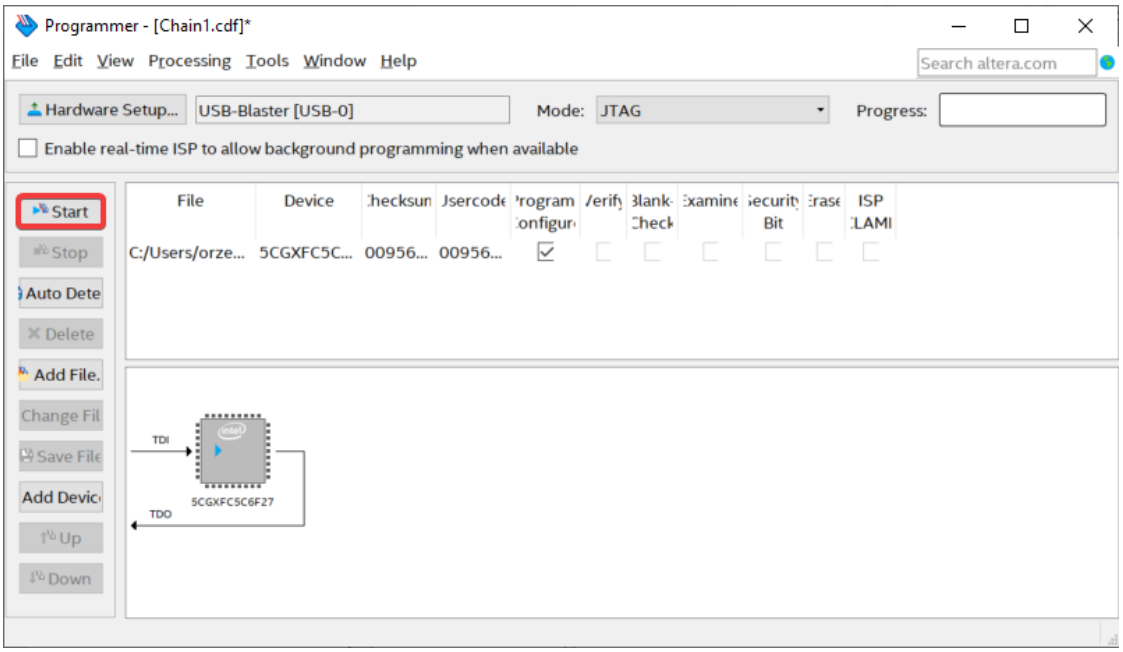
If there is need to choose bitfile expand “Edit” from toolbar and select “Add File”



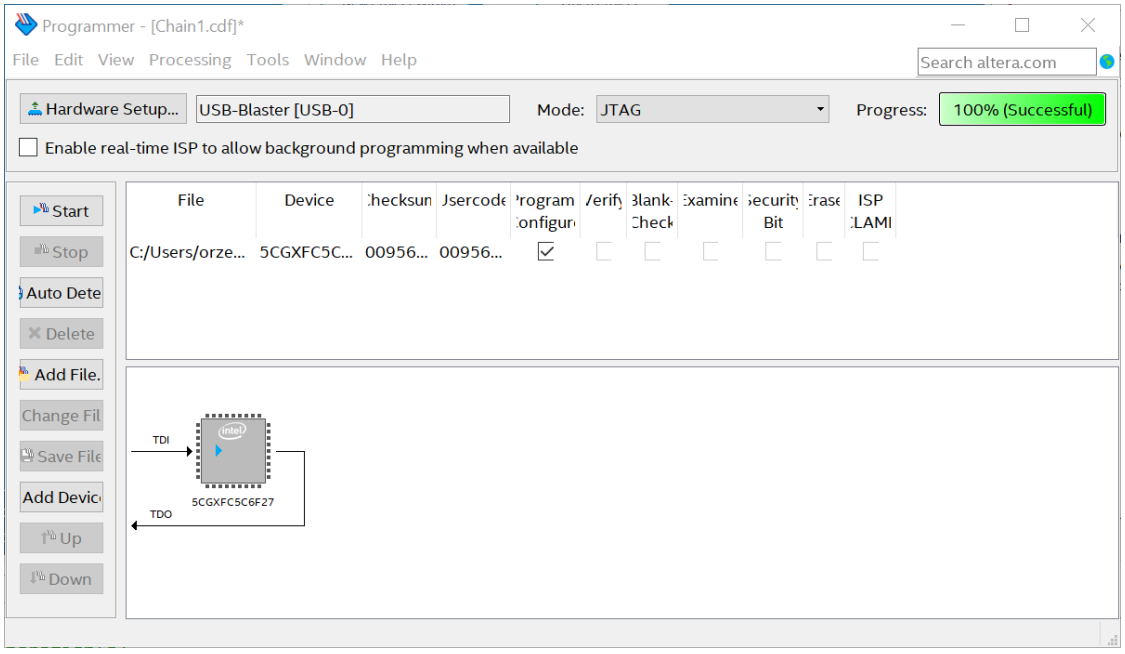
And select bitfile (file *.sof from “output_files” directory)



Use “Start” button to upload bitfile



If everything works bitfile will be uploaded with 100% Success



Sometimes it takes a while, so if “Progress” bar looks stuck - be patient.

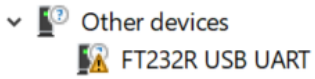
4. Additional actions

4.1. Files to download

- UART Driver (link) (For Windows users if needed)

4.2. UART Driver installation

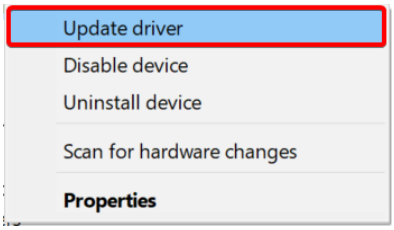
If using UART will be helpful and driver is not installed than in device manager you will see FT232R USB UART in Other devices.



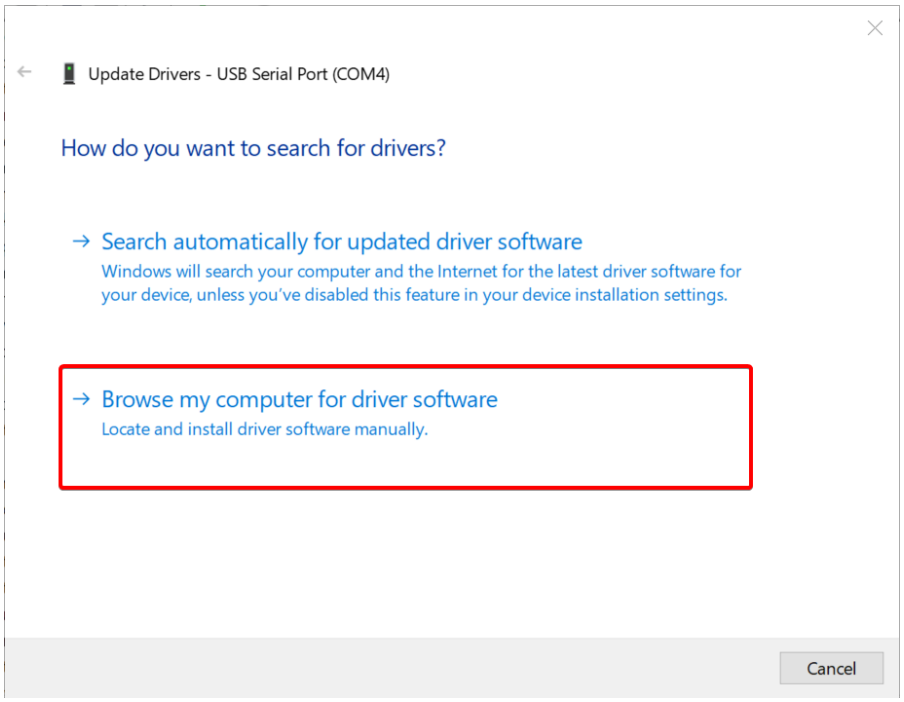
Download driver (link in 4.1). Choose the correct version for Your PC

		Processor Architecture						
Operating System	Release Date	x86 (32-bit)	x64 (64-bit)	PPC	ARM	MIPSII	MIPSIV	SH4
Windows*	2017-08-30	2.12.28	2.12.28	-	-	-	-	-

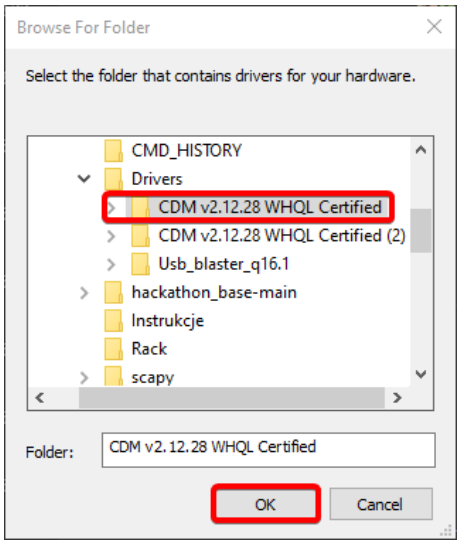
Unpack driver and right click on FT232R USB UART in device manager, select “Update driver” option.



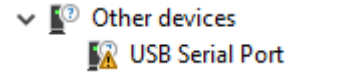
Select “Browse my computer for driver software”



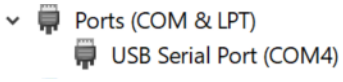
Select “Browse..” and find unpacked driver “CDM v2.12.28 WHQL Certified”



Select “Next”, driver should be installed and USB Serial Port should appear in Other devices.



Repeat all procedure for this device using same driver. Now USB Serial Port should appear and UART should work.



5. Extras

Additional actions that could be useful, but are not required to complete task

5.1. Free Active-HDL Student Edition (external simulation tool)

There is possibility to test Active-HDL from ALDEC - if needed to test software before using Riviera-PRO, which will be delivered on virtual machine

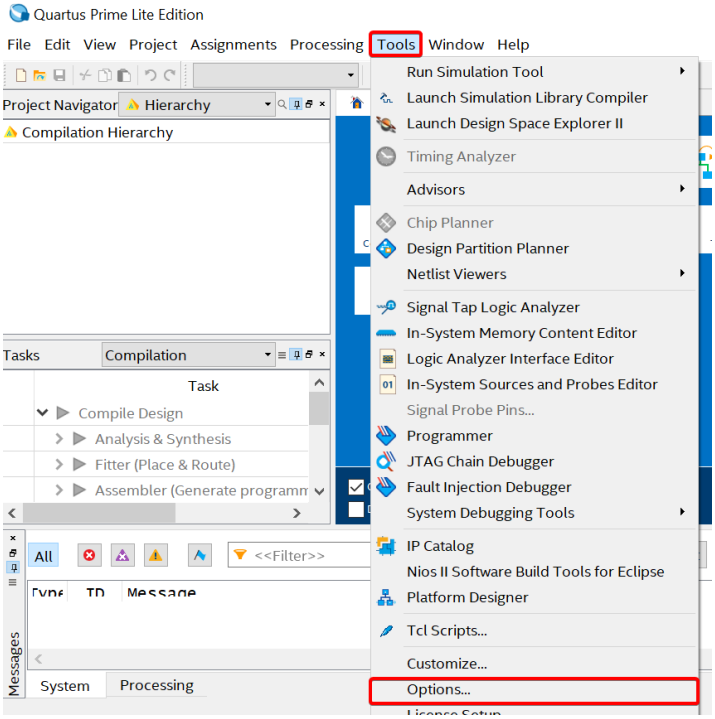
Link to download: https://www.aldec.com/en/products/fpga_simulation/active_hdl_student

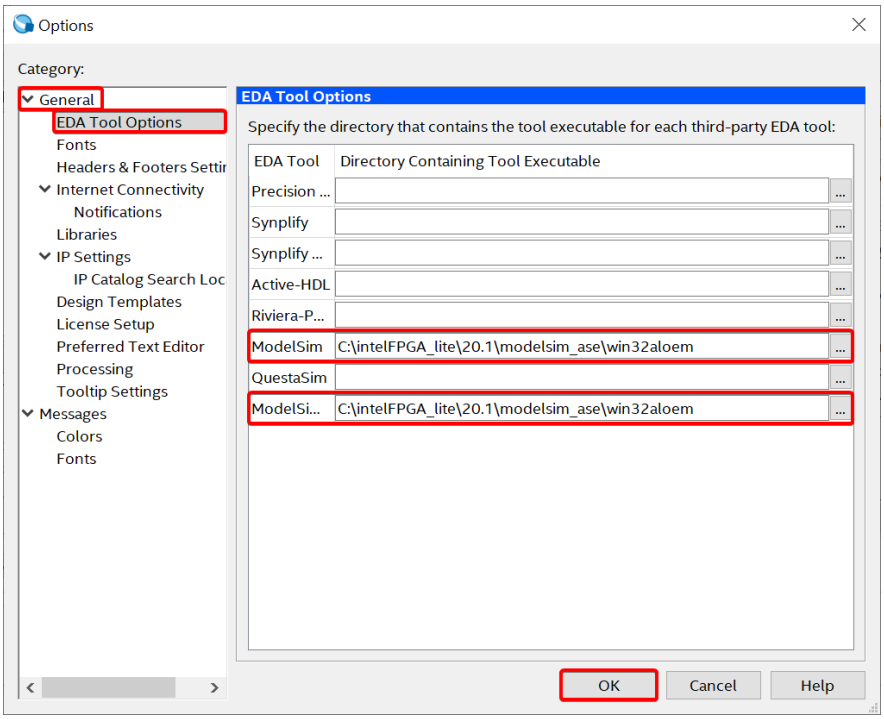
5.2. Modelsim (simulation tool integrated with this Quartus version)

5.2.1. Linking modelsim to quartus

Open **Tools** -> **Options**, go to section **General** -> **EDA Tool Options**, then enter valid paths under ***ModelSim-Altera*** (you can also fill ***ModelSim*** field) in Quartus installation directory – the path should end with:

\modelsim_ase\win32aloem



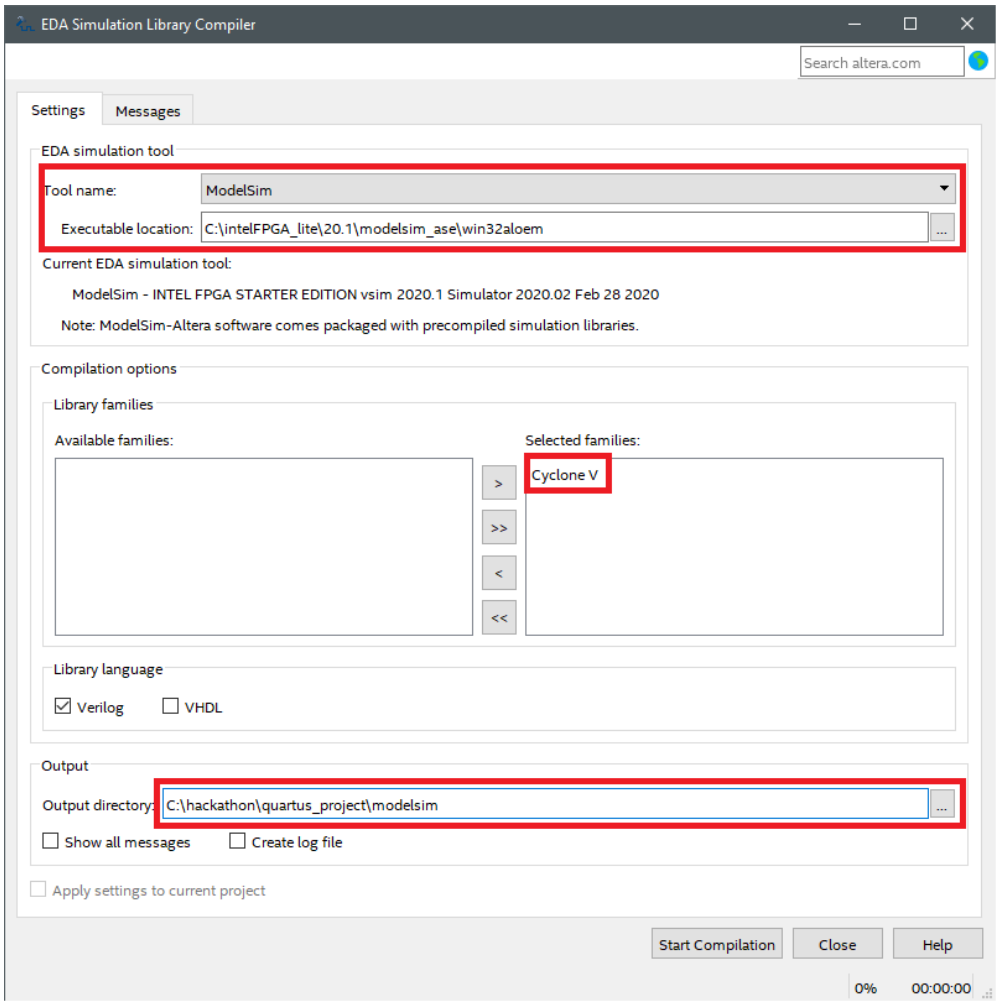


5.2.2. ModelSim Intel/Altera library compilatin

Before running simulation, we need to compile Intel/Altera libraries.

Select **Tools** -> **Launch Simulation Library Compiler**. Make sure that selected tool and path matches with those entered in 5.2.1 and that ***Cyclone V*** is in selected families

Change output directory to your project directory with name ***modelsim*** – this directory will be created before compilation.



5.2.3 Running simulation

To run simulation using scripts delivered with base project select

Tools -> **Run Simulation Tool** -> **RTL Simulation**

This should open ModelSim, in ModelSim's transcript window use following commands to compile the design and run simulation

`do ../../../sim/comp.do` (to start compilation)

`do ../../../sim/sim.do` (to run simulation)