# FPGA set up for NVMeTCP10G-IP

Rev1.1 29-Jun-23

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## 1 Introduction

This document describes how to setup FPGA board and test environment for running NVMeTCP10G-IP demo. The user can setup the test environment for accessing target NVMe SSD on Test PC across 10Gb Ethernet as shown in Figure 1-1.

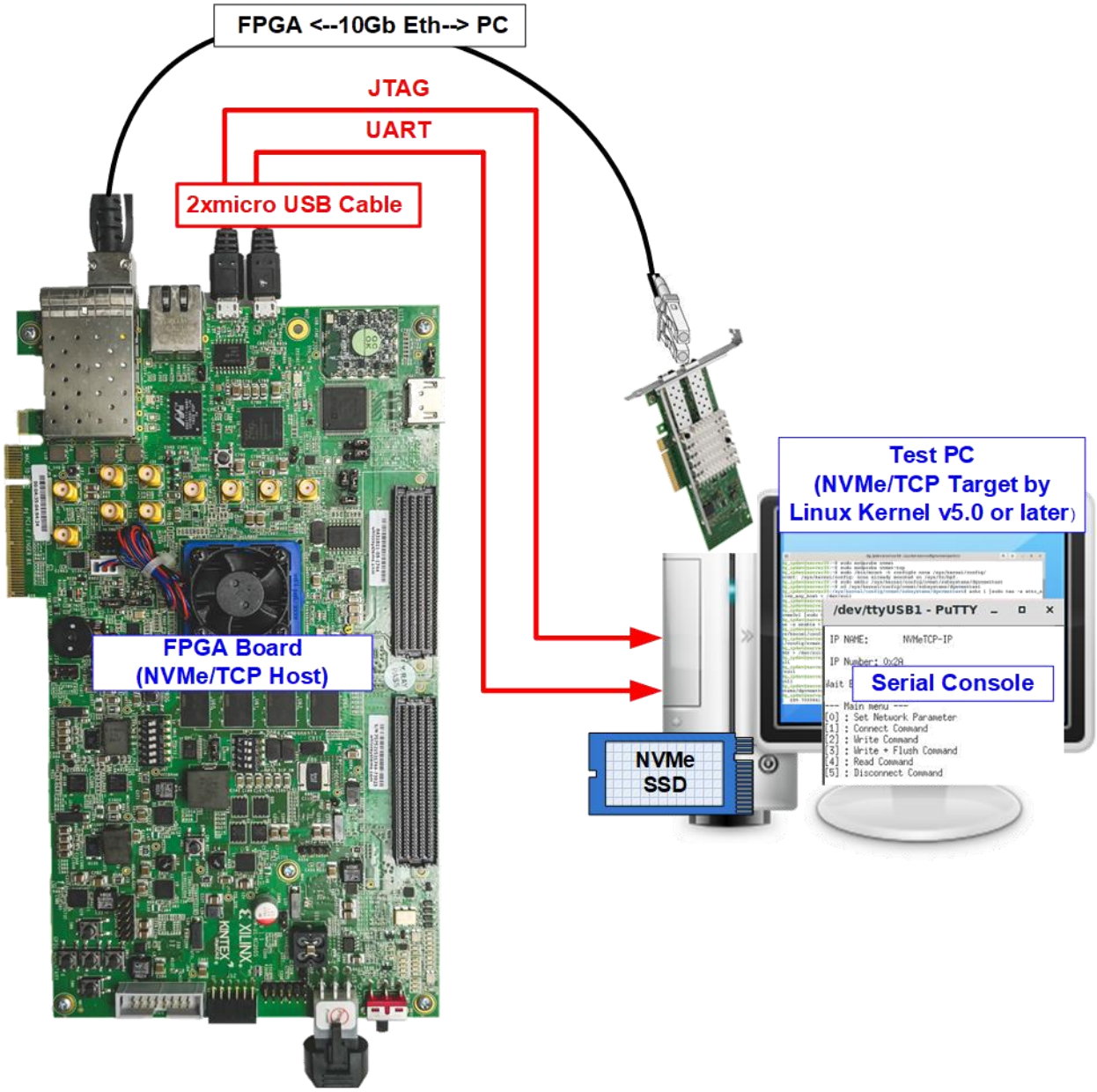


Figure 1-1 Test environment for running the demo

FPGA board runs NVMeTCP10G-IP for the host operation while Test PC integrates 10Gb Ethernet card and one NVMe SSD to be NVMe/TCP target. Test PC installs LinuxOS with the kernel version 5.0 or later to support NVMe/TCP protocol. Also, Serial console is run on Test PC to be user interface console.

Before running the test, please prepare following test environment.

- FPGA development boards: ZCU106, ZCU102, or KCU105
- Test PC
  i) Install Linux kernel version 5.0 or later,
  ii) Plug in with one NVMe SSD
  iii) Plug in with 10 Gigabit Ethernet card
- 10 Gb Ethernet cable: 10 Gb SFP+ Active Optical Cable (AOC) or 10Gb SFP+ transceivers (10G BASE-R) with optical cable (LC to LC, Multimode)
- micro USB cable for programming FPGA connecting between FPGA board and PC
- micro USB cable connecting between FPGA board and PC for Serial console.
- Serial console software such as Putty installed on PC. The setting on the console is Baudrate=115,200, Data=8-bit, Non-parity, and Stop=1-bit.
- Vivado tool for programming FPGA, installed on PC

*Note: Example hardware for running the demo is listed as follows.*
*[1] 10G Network Adapter: Intel X710-DA2*
*https://ark.intel.com/content/www/us/en/ark/products/83964/intel-ethernet-converged-network-adapter-x710da2.html*
*[2] 10-Gigabit SFP+ AOC cable (AOC-S1S1-001)*
*https://www.10gtek.com/10gsfp+aoc*
*[3] PC: Motherboard ASUS Z170-K, 64 GB RAM, and LinuxOS* with kernel version 5.4.0-81
*[4] Target NVMe SSD in PC: 512 GB Samsung 960 Pro*

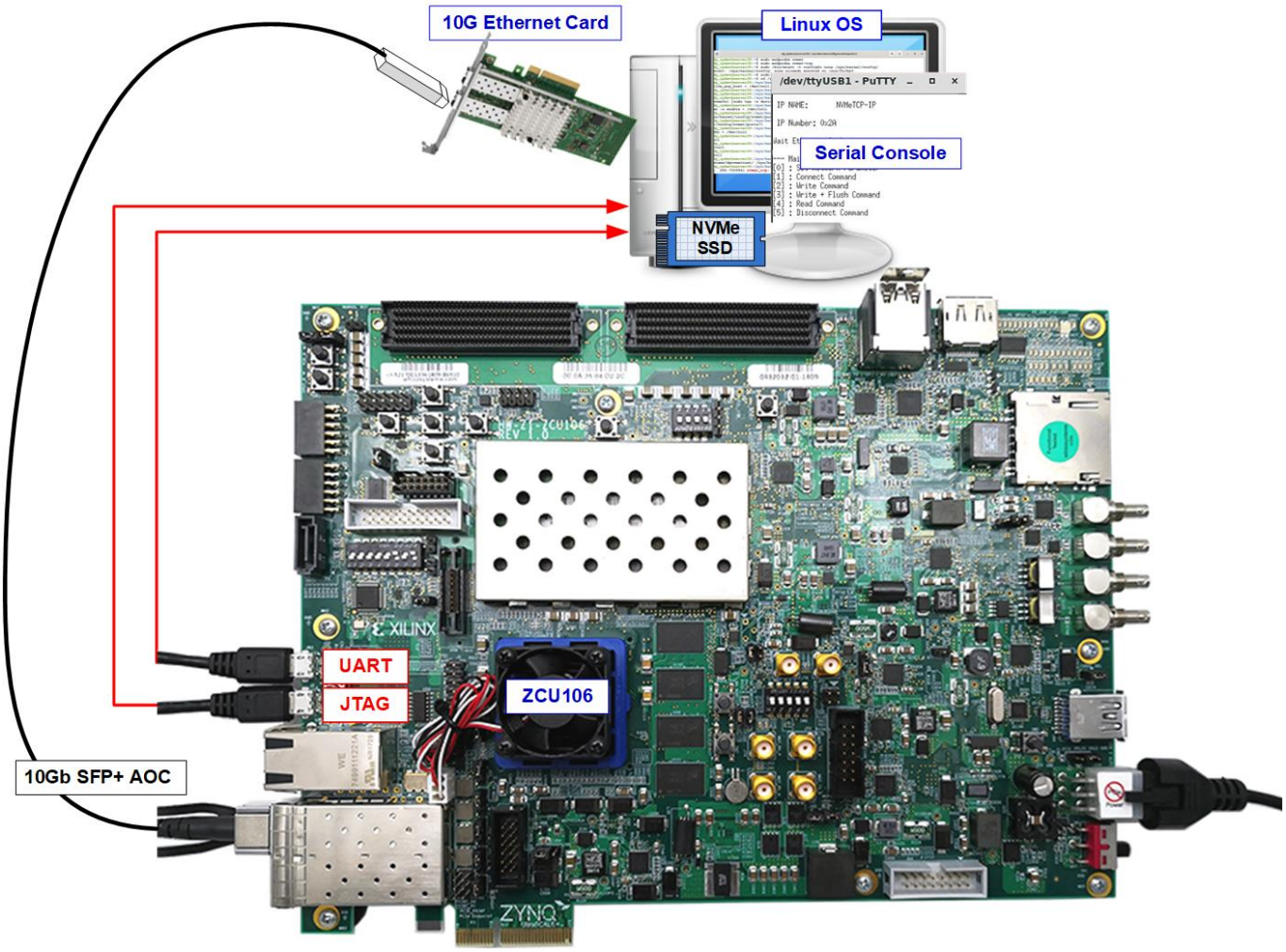


Figure 1-2 NVMeTCP10G-IP demo on ZCU106

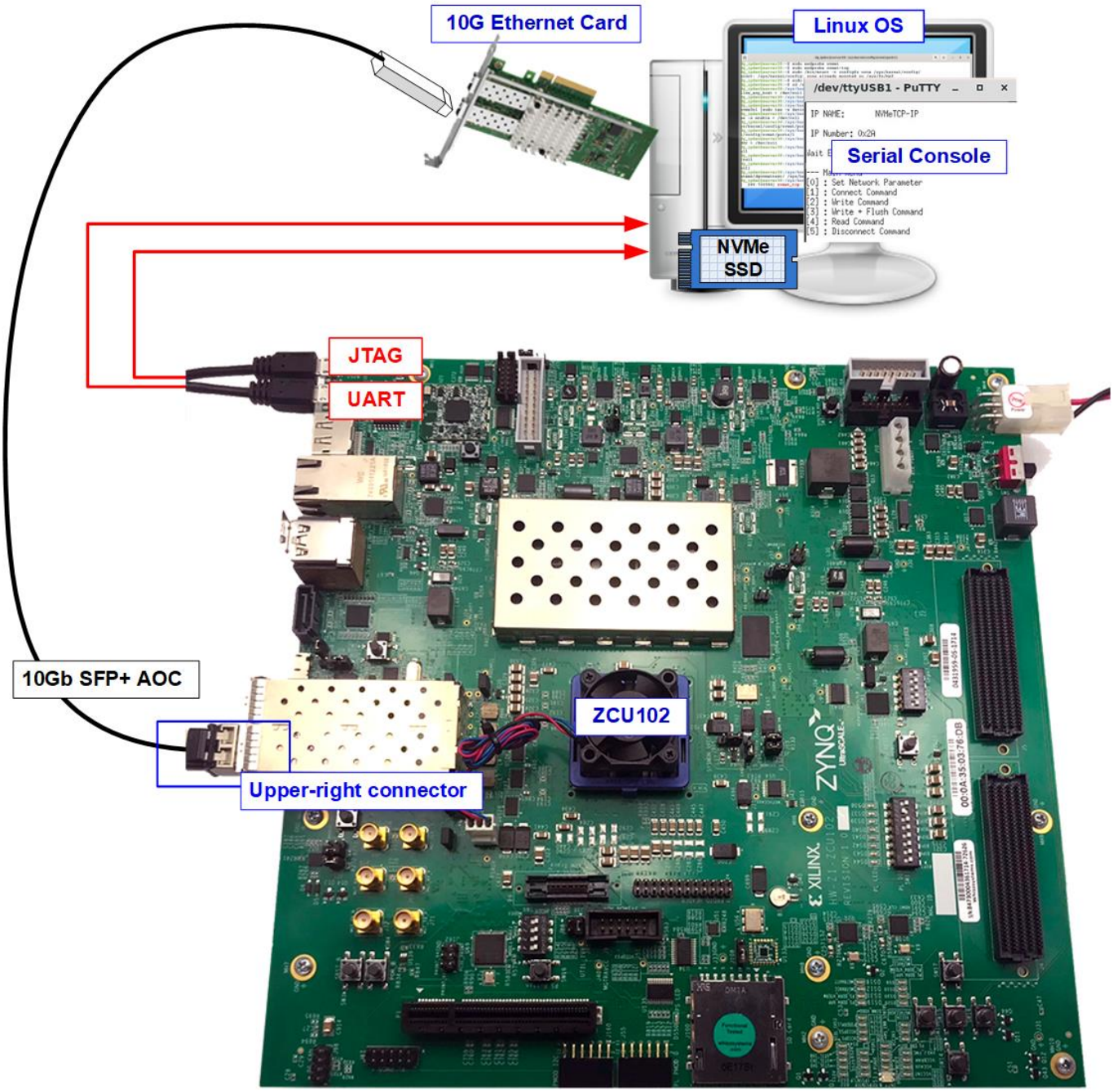


Figure 1-3 NVMeTCP10G-IP demo on ZCU102

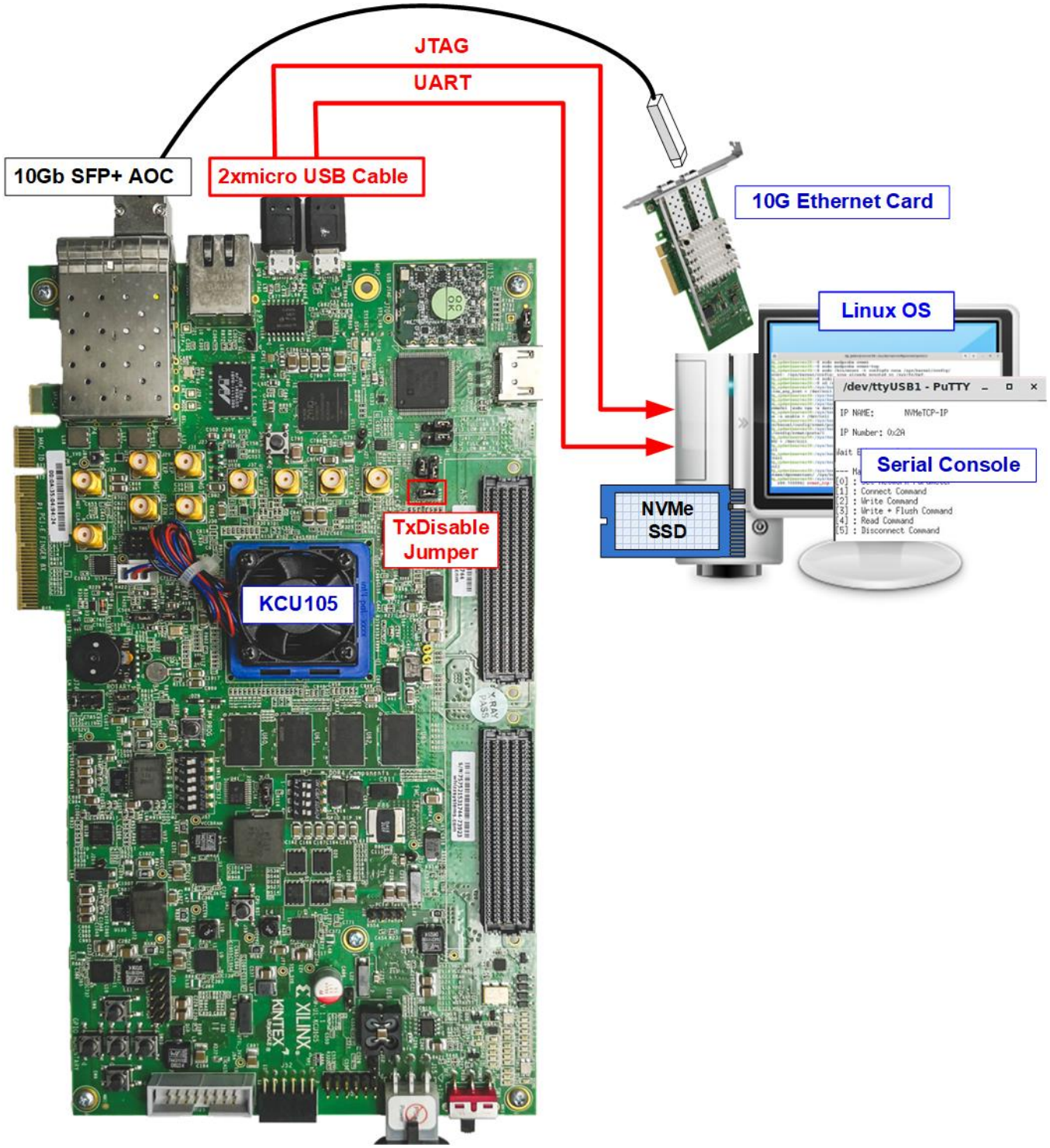


Figure 1-4 NVMeTCP10G-IP demo on KCU105

# 2 FPGA setup

This topic describes the details to set up FPGA board for running the demo.

1) Check DIPSW and jumper setting on FPGA board.
   a) Board setting on ZCU102/ZCU106 board is shown in Figure 2-1.
      - Set SW6=all ONs to use USB-JTAG
      - Only ZCU102, insert jumper to J16 to enable Tx SFP+

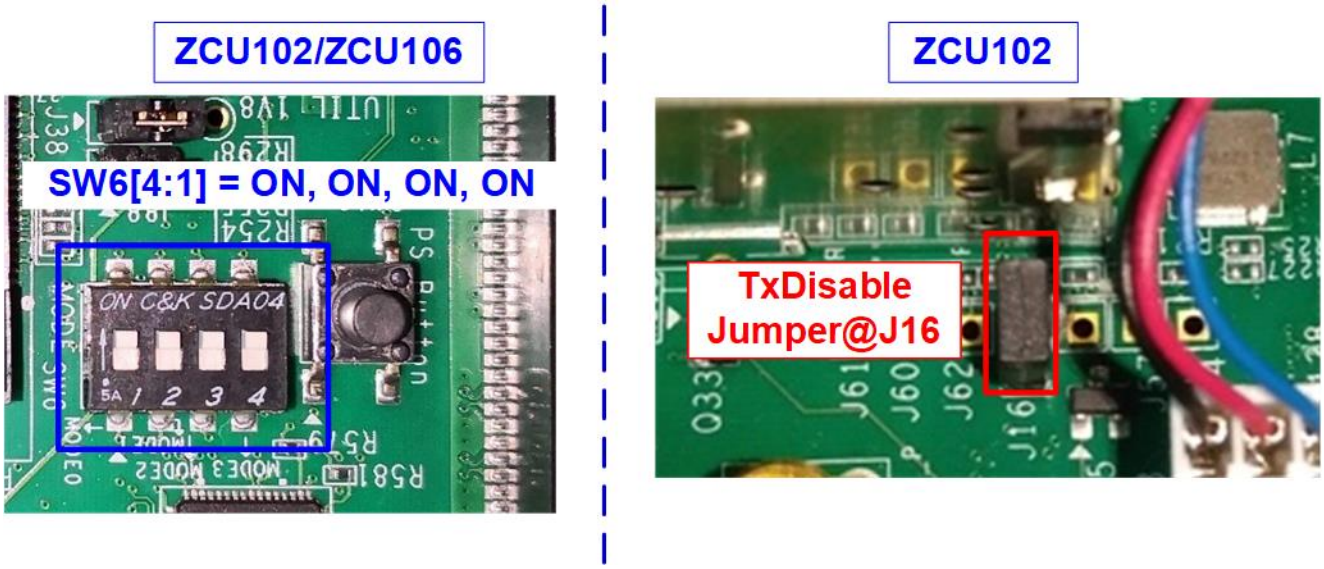


Figure 2-1 ZCU102/ZCU106 board setting

   b) Board setting on KCU105 board is shown in Figure 2-2. Insert jumper to J6 to enable Tx SFP+.

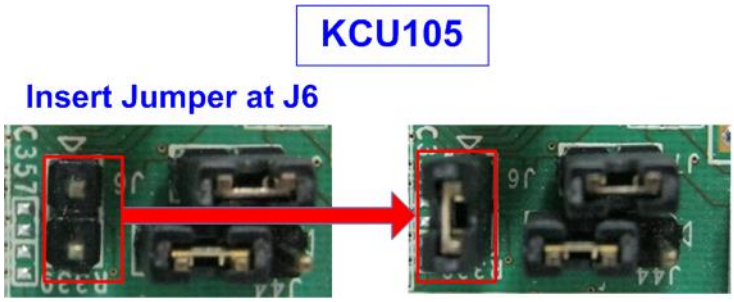


Figure 2-2 Insert jumper to enable SFP+ on KCU105

2) Connect micro USB cable from FPGA board to PC for JTAG programming.
3) Connect micro USB cable from FPGA board to PC for USB UART.
4) Connect power supply to FPGA development board.
5) Connect 10Gb Ethernet cable between FPGA board and PC by inserting 10 Gb SFP+ AOC. Some boards have many SFP connectors, use the channel as shown in Figure 2-3.

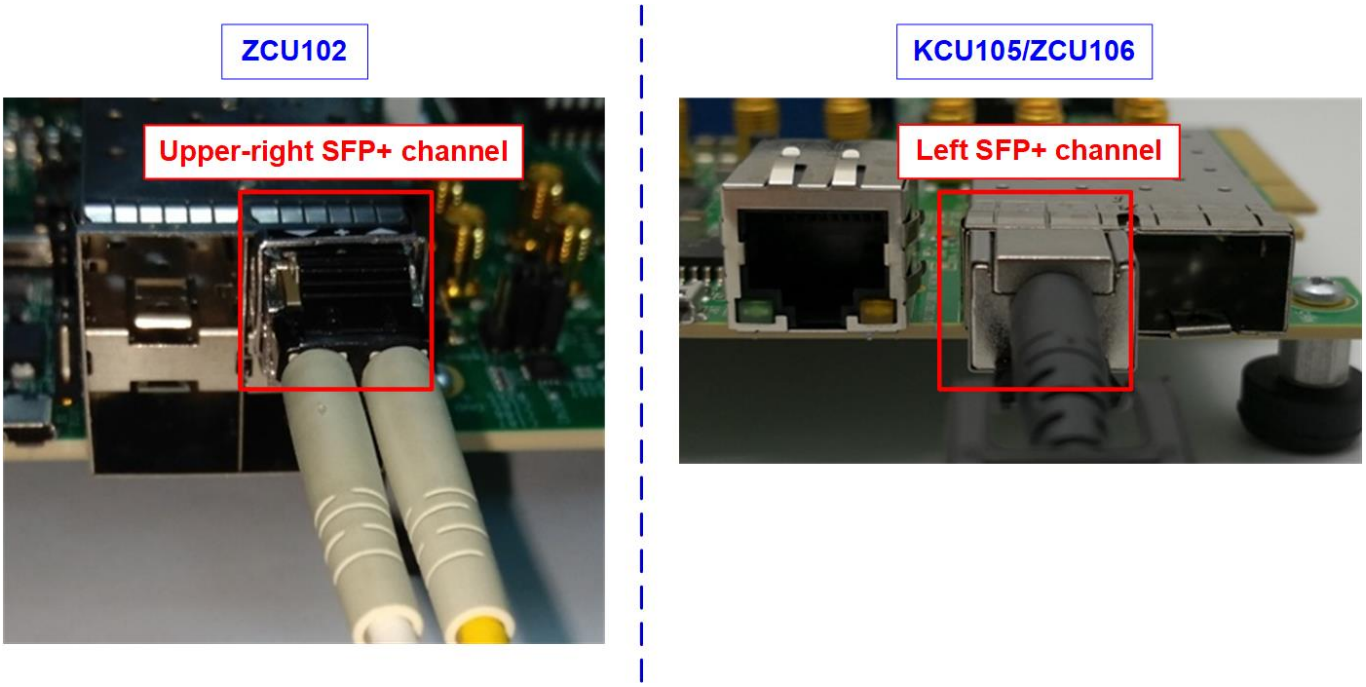


Figure 2-3 SFP+ channel using on ZCU106/KCU105 board

6) Power on FPGA board.

# 3 PC setup

The step describes Serial console setting and FPGA programmer tools on PC for running the demo. Both Windows OS and Linux OS are displayed.

## 3.1 Serial console

When connecting FPGA board to PC, many COM ports from FPGA connection are detected and displayed. Please select the correct COM port for running the demo.

Serial console setting: Baud rate=115,200, Data=8-bit, Non-Parity and Stop = 1-bit.

Windows OS

Select Standard COM port for KCU105 while select COM port number of Interface0 for ZCU102/ZCU106 board.

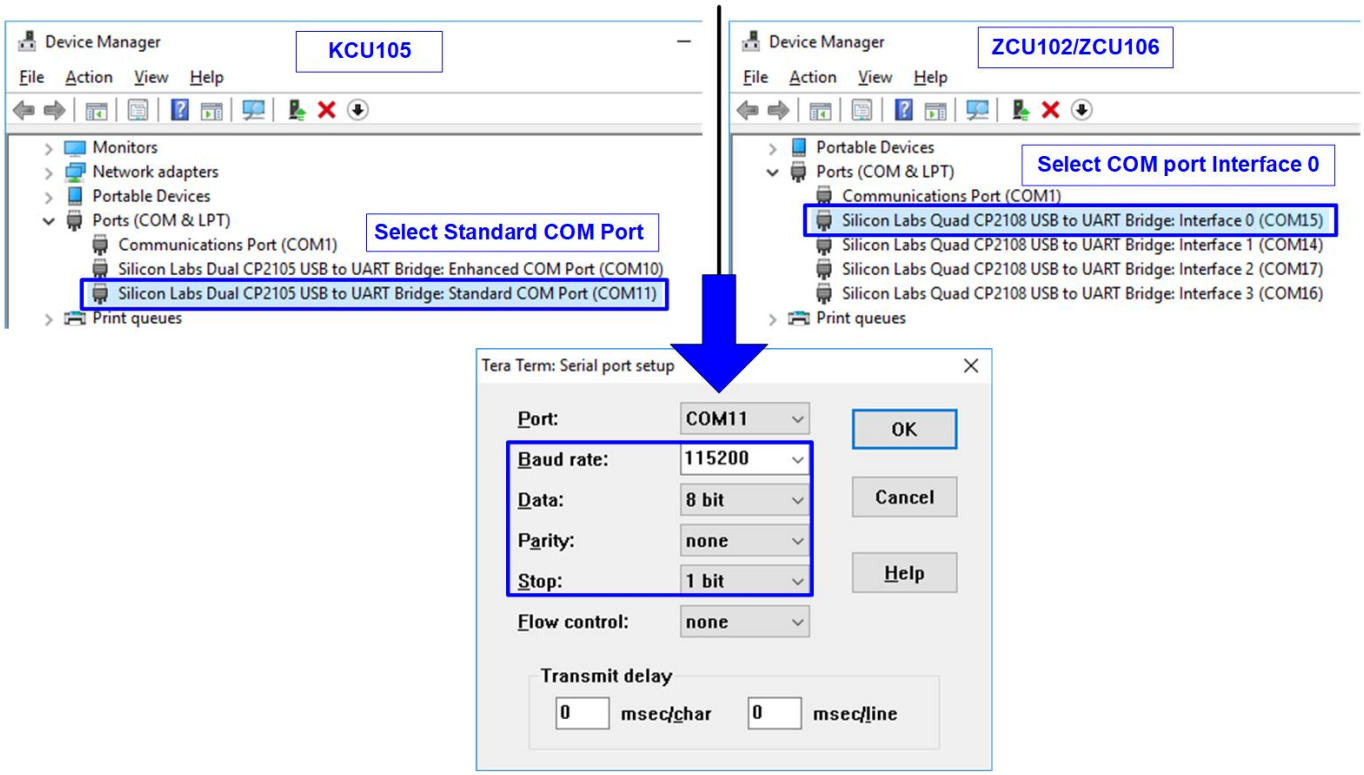


Figure 3-1 COM port number for Serial console on Windows OS

Linux OS

When connecting FPGA board to PC, many USB Serial ports from FPGA connection are detected and displayed, as shown in Figure 3-2.

Use following command to list USB Serial ports.
>> dmesg | grep ttyUSB

When running on KCU105, select the second port.
When running on ZCU102/ZCU106, select the first port.

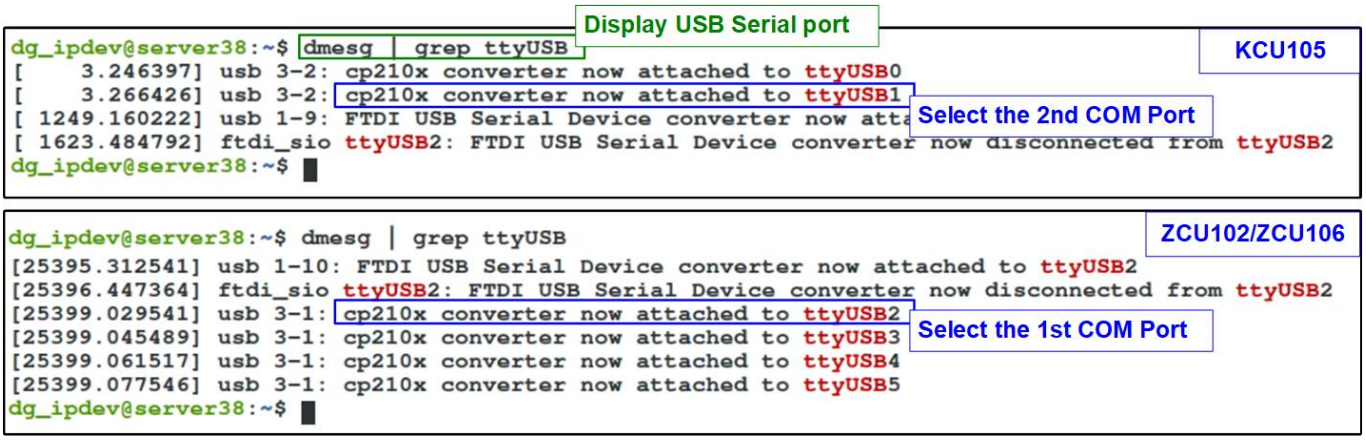


Figure 3-2 Command to scan USB Serial ports on Linux OS

Figure 3-3 shows the example to configure Serial by using Putty application. Serial console setting: Baud rate=115,200, Data=8-bit, Non-Parity and Stop = 1.

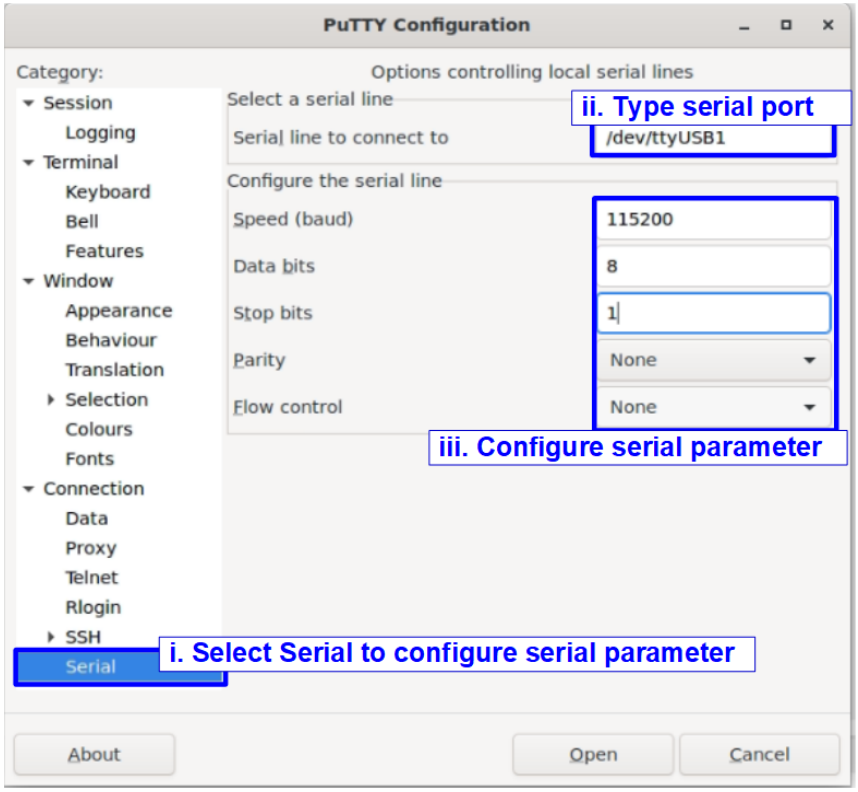


Figure 3-3 Serial console setting on Linux OS

## 3.2 FPGA configuration

This topic shows how to load configuration file and the firmware of the demo to FPGA board. Two methods are applied – programming tools when using KCU105 board and script file when using ZCU102 or ZCU106 board.

When running KCU105 board, open Vivado tools and program bit file by using Hardware manager, as shown in Figure 3-4.

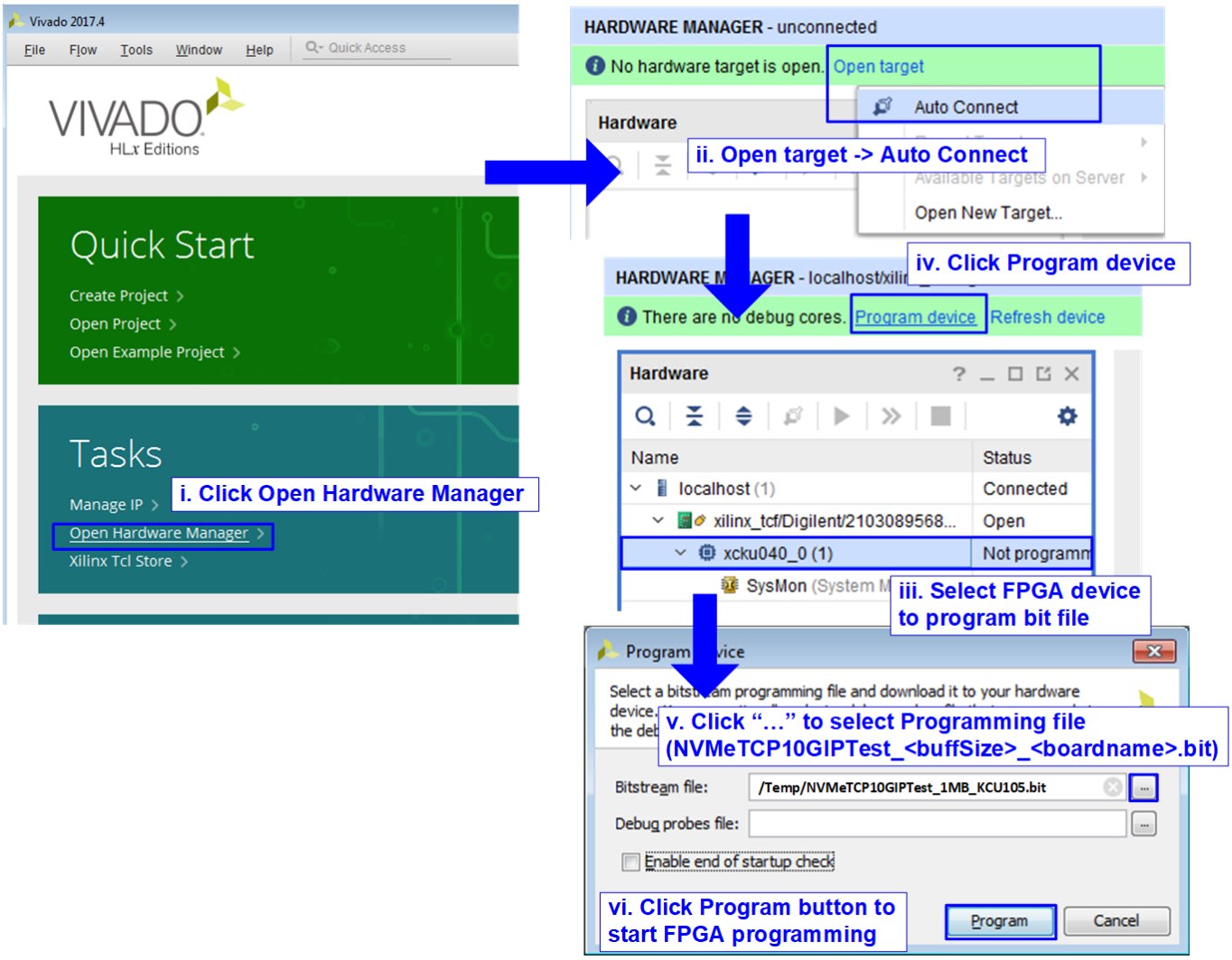


Figure 3-4 KCU105 Configuration

When running ZCU102/ZCU106 board, run script file on TCL shell to load bit file and elf file.

Windows OS

Script file for loading on Windows OS is bat file. Run the following commands.
>> cd <directory that stores bat file?
>> nvmetcp10giptest_<buffsize>_<boardname>.bat.

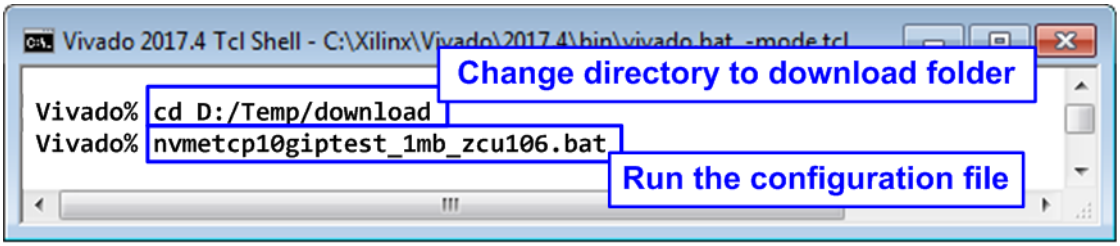


Figure 3-5 ZCU102/ZCU106 Configuration on Windows OS

Linux OS

Script file for loading on Linux OS is tcl file. Run the following commands.
>> cd <directory that stores tcl file>
>> exec xsdb nvmetcp10giptest_<buffsize>_<boardname>.tcl.

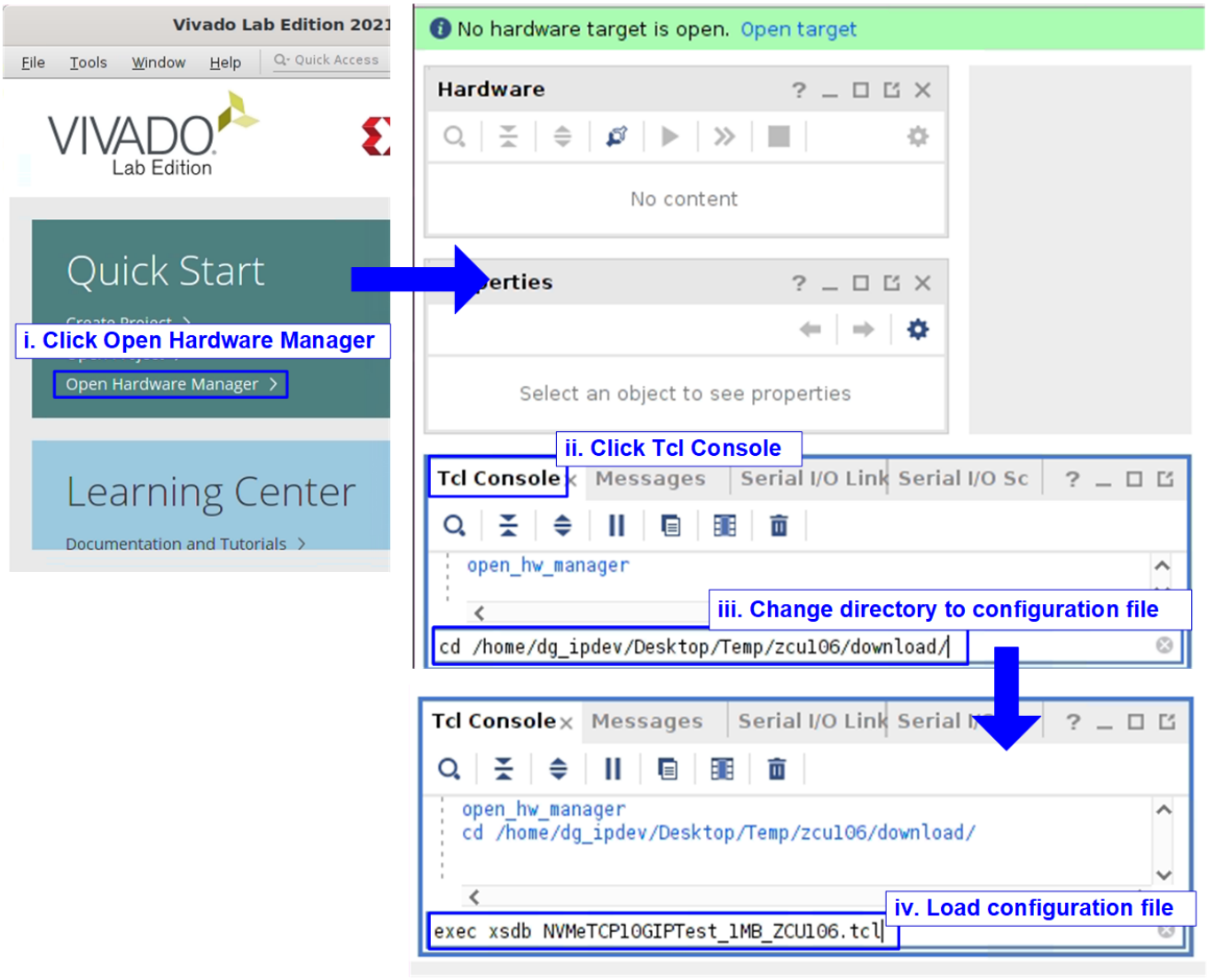


Figure 3-6 ZCU102/ZCU106 Configuration on Linux OS

After finishing FPGA configuration, welcome message is displayed on the console as shown in Figure 3-7.

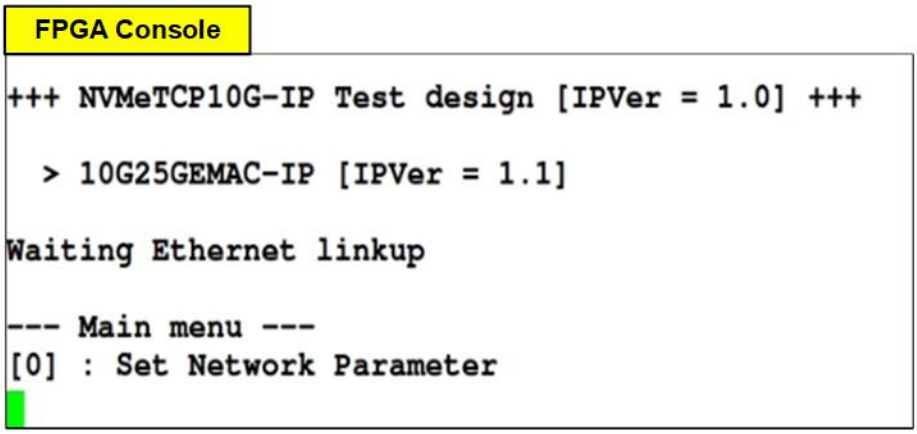


Figure 3-7 Welcome screen

# 4 Revision History

| Revision | Date | Description |
|---|---|---|
| 1.0 | 3-Nov-21 | Initial version release |
| 1.1 | 24-Mar-22 | Correct the information |