



## ADM-PCIE-7V3 SDAccel Board Installation

# Introduction

This application note provides details on the hardware and software setup required to begin development with the XIIInx⊗ SDAccel™ Development Environment, using the Alpha Data ADM-PCIE-7V3 accelerator card. For support, please e-mait:

support@alpha-data.com (\$)

# Supported SDAccel Releases

For a list of supported SDAccel<sup>™</sup> releases, along with a list of ADM-PCIE-7V3 SDAccel<sup>™</sup> platform releases, please refer to Alpha Data RN0149.

## Hardware Requirements

- An ADM-PCIE-7V3 accelerator card.
- 2) A Host Machine. This will host the ADM-PCIE-7V3 accelerator card.
- A Programming Machine. This will be used to program the ADM-PCIE-7V3 with the ADM-PCIE-7V3 Device Support Archive (DSA).
- 4) A Xilinx® Platform Cable USB II, or similar JTAG programming box.

# Software Requirements

- The Host Machine must be running the CentOS Linux distribution, capable of performing tasks with root privileges.
- 2) The Host Machine must have one of the Supported SDAccel Releases installed.
- The Programming Machine may be running either Linux or Windows and must have the Vivado® Design Suite installed, which may be a Lab Tools version if necessary.

### Note:

For a list of CentOS versions that your particular SDAccel<sup>™</sup> installation supports, along with a list of Linux packages to install, please refer to Xilinx® UG1238.



# Installing the ADM-PCIE-7V3

This section describes each of the steps involved in performing the ADM-PCIE-7V3 SDAccel™ board installation.

## Step 1 - Preparing the Board Installation Files

#### Note:

Within the remainder of this application note, /opt/Xilinx/SDx/2017.4 is referred to as the SDAccel<sup>™</sup> installation directory.

- 1) Power-on the Host Machine, boot into your chosen Linux distribution then open a command prompt.
- Download the ADM-PCIE-7V3 SDAccel<sup>™</sup> platform package that matches your installed SDAccel<sup>™</sup> release from the following link:

ftp://ftp.alpha-data.com/pub/sdaccel/platform/adm-pcie-7v3/ (\$)

It is assumed that the path to the downloaded platform package is:

~/Downloads/xilinx\_adm-pcie-7v3\_1ddr\_3\_0-2017\_4-1.0.0.zip

3) Navigate to the SDAccel<sup>™</sup> installation directory:

\$ cd /opt/Xilinx/SDx/2017.4

- 4) Unzip the downloaded ADM-PCIE-7V3 platform package into the platforms directory:
  - \$ sudo unzip ~/Downloads/xilinx\_adm-pcie-7v3\_lddr\_3\_0-2017\_4-1.0.0.zip -d platforms/.

This will generate the following directory:

/opt/Xilinx/SDx/2017.4/platforms/xilinx adm-pcie-7v3 1ddr 3 0

5) Source the settings64.sh script within the SDAccel™ installation directory:

\$ source settings64.sh

6) Generate the ADM-PCIE-7V3 board installation directory using the xbinst utility:

\$ sudo bin/xbinst -f xilinx adm-pcie-7v3 1ddr 3 0 -d 7v3 dsa

The expected output is of the form:

```
***** skinst v2017.4 (64-bit)
***** SW Build 206621 on Fri Dec 15 20:54:30 MST 2017
** Copyright 1966-2017 Xilnn, Inc. All Rights Reserved.
NFO: UKINST 60-851 Target platform: /opt/Xilinx/Dbc/2017.4/platforms/
xilinx_dm-pcie-703 lddr_3_0/xilinx_dm-pcie-703 lddr_3_0.spfm
MANING: [XENST 60-847] No image(s) discovered to be inserted into the
'dashir'flic File not created.
NFO: [XENST 60-647] Pointering. / decovered to be inserted into the
'dashir'flic File not created.
NFO: [XENST 60-647] Pointering as moresefully created a board installation
directory at /opt/Xilinx/B02017.4/704 das.
```

Note:

The warning generated by the xbinst utility regarding an undiscovered 'dsabin' file can be safely ignored.



#### Note:

Within the remainder of this application note, /opt/Xilinx/SDx/2017.4/7v3\_dsa is referred to as the ADM-PCIE-7V3 board installation directory.

#### Note:

The ADM-PCIE-7V3 board installation directory will contain a number of significant items:

 An MCS file, used to program a region of the ADM-PCIE-7V3 configuration memory with the ADM-PCIE-7V3 DSA:

### /opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/firmware/xilinx\_adm-pcie-7v3\_1ddr\_3\_0.mcs

ii) A shell script, used to build and install the driver needed by the ADM-PCIE-7V3 when accelerating SDAccel<sup>TM</sup> applications:

#### /opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/install.sh

 A test directory, containing a simple, pre-built executable and kernel which can be used to verify the ADM-PCIE-7V3 board installation:

### /opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/test/verify.exe

/opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/test/verify.xclbin

8) Copy the newly-generated MCS file,

/opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/firmware/xilinx\_adm-pcie-7v3\_1ddr\_3\_0.mcs,

into the Programming Machine.



## Step 2 - Setting Up the Hardware

- 1) Remove all power from the Host Machine.
- On the ADM-PCIE-7V3, locate the DIP quad-switch SW1 on the bottom face of the card (the face opposite the FPGA), then set each switch to match the configuration given in Table 1.



Figure 1 : The bottom face of the ADM-PCIE-7V3

Switch	SW1-1	SW1-2	SW1-3	SW1-4
Position	ON	ON	ON	OFF

Table 1 : ADM-PCIE-7V3 Switch Configuration

- 3) Install the ADM-PCIE-7V3 into an available PCI Express slot within the Host Machine.
- On the ADM-PCIE-7V3, locate the JTAG connector J1 on the front face of the card, then establish a JTAG connection between the JTAG programming box and the ADM-PCIE-7V3.



Figure 2 : The front face of the ADM-PCIE-7V3

5) Establish a USB connection between the JTAG programming box and the Programming Machine.



## Step 3 - Programming the ADM-PCIE-7V3

### Note:

The Host Machine is required only to supply power to the ADM-PCIE-7V3 in this step.

- 1) Power-on the Host Machine.
- Power-on the Programming Machine, launch Vivado® in GUI mode then select Flow -> Open Hardware Manager.



Figure 3 : Opening Vivado Hardware Manager

3) Select Tools -> Open New Target.



Figure 4 : Opening a New Target



4) From the Open Hardware Target window, click Next.

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Figure 5 : The Open Hardware Target window

5) From the Hardware Server Settings window, select Local server then click Next.

🍌 Open New H	landware Tanget	×
Hardware S Select local or local machine	erver Settings remich handware server, then configure the host name and pirt settings. Use Local server if the target is attached to the otherwise Juse Remittor Server.	A
<u>Connect</u> to:	Local server (target is on local machine) 🗸	
Click Next to	b launch and/or connect to the hw_server (port 3121) application on the local machine.	
•	< <b>Back</b> Brish C	Cancel

Figure 6 : The Hardware Server Settings window



6) From the Select Hardware Target window, select the xilinx\_tcf target then click Next.

	mare mayer			
Hect Hardware lect a hardware pected devices, Hardware Tarp	target from the li decrease the fre	ist of avails iquency or	ble targets, then set the appropriate JTAG clock (TCK) trequency. If you do not see the select a different target	•
Туре	Name		JTAG Clock Frequency	
🖬 xilinx_tof	XIIIna/000013cd	094801	6000000 V	
			And Wiley Metral Cable (2007)	
Hardware Devi	<b>tes</b> (for unknow	n devices,	specify the Instruction Register (R) length)	
tardware <u>D</u> evi	ces (for unknow ID Code	n devices, IR Lengt	Paid Anime initial caule (APC) specify the Instruction Register (IR) length)	
Name © xc7xx590t_	ID Code 33691093	R Lengt	Au Jame made Care (VK) specify the Instruction Register (R) length)	
Name ® xc7xx690t_ Hardware serve	ID Code 0 33691093 rr: localhost312	n devices, IR Lengt 6	And series while dealer (sec)	

Figure 7 : The Select Hardware Target window

7) From the Open Hardware Target Summary window, click Finish.

🍌 Open New Hardware Tan	set	×
VIVADO <sup>A</sup>	Open Hardware Target Summary	
E XILINX.	To connect to the hardware described above, click Firish	
•	<back next=""> Enich Cancel</back>	

Figure 8 : The Open Hardware Target Summary window



 Within the Hardware sub-window of Vivado® Hardware Manager, right-click on the xc7vx690t\_0 part and select Add Configuration Memory Device.

A Vivado 2018.2				-		×
Eile Edit Icols Reports Windo	w Lagout View	w	Help Q- Cuick Access			
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T XADC (System Monitor)			Province Device			
			Program Device			
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Hardware Device Properties	? _ 🗆 🗆 X		Add Configuration Memory Device			
ec7w690t_0	+ - 0		Boot from Configuration Memory Device			
	^		Program BBR Key			
Name: xc7vd90t_0	~		Clear BBR Key			
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						~
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Type a Tol command here						
Add a Configuration Memory Device						

Figure 9 : Opening the Configuration Memory Device settings



 From the Add Configuration Memory Device window, choose the mt28gu01gaax1e-bpi-x16 memory part then click OK.

	on Memory Devic	e							
Choose a co	nfiguration mem	ory part. This can be ch	anged later.						
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Figure 10 : The Add Configuration Memory Device window

10) If prompted, click OK to program the configuration memory device.



Figure 11 : The Memory Device Programming prompt



11) From the Program Configuration Memory Device window, fill the Configuration file field with the path to the ADM-PCIE-7V3 DSA MCS file that was copied over from the Host Machine then make sure that the settings match those seen in Figure 12.

Once these settings have been confirmed, click **OK** then wait for the configuration memory programming procedure to finish.

▶ Program Configuration Memory Device ×							
Select a configuration file and set programming options.							
Memory Device:   ml28gu01gaax1e-bpi-x16  Cgnfiguration file:   C/7V3_dsa/xilinx_adm-pcie-7V3_1ddr_3_0.mcs							
PRM file:	]						
State of non-config mem I/O pins: Pull-none V							
Program Operations							
Address Range: Configuration File Only ~							
RS Pins: NONE V							
✓ Erase							
Blank Check							
✓ Program							
✓ ⊻enty							
Verify Checksum							
SVF Options	SVF Options						
Create SVF Only (no program operations)							
SVF File:							
OK         Cancel         Apply							

Figure 12 : The Program Configuration Memory Device window



 Within the Hardware sub-window of Vivado® Hardware Manager, right-click on the xc7vx690t\_0 part and select Boot from Configuration Memory Device.



Figure 13 : Booting from the ADM-PCIE-7V3 Configuration Memory Device

13) Within the Tcl Console sub-window of Vivado® Hardware Manager, check the log output and verify that the Done pin status: HIGH message can be seen.



Figure 14 : Tcl Console log showing the 'Done pin status: HIGH' message

14) Disconnect the JTAG programming box from the ADM-PCIE-7V3, then reboot the Host Machine.



## Step 4 - Installing the Linux Driver

- 1) Boot the Host Machine into your chosen Linux distribution, then open a command prompt.
- Navigate to the ADM-PCIE-7V3 board installation directory, which was created in Step 1 Preparing the Board Installation Files.

\$ cd /opt/Xilinx/SDx/2017.4/7v3 dsa/xbinst

3) Run the install.sh script with the following flags:

\$ sudo ./install.sh -f yes -k yes

### The expected output is of the form:

```
NMPO: Creating ICD entry for Xilinx Platform
INPO: Installing firmware for FPGA devices
/tmp/12750/0
Archiver xeldscipul
first dever/include/xellent.
inflating: driver/include/xellentures.
inflating: driver/xeldma/kernel/xdma-bit.c
inflating: driver/xeldma/kernel/xdma-bit.c
inflating: driver/xeldma/kernel/xdma-bit.c
inflating: driver/xeldma/kernel/xdma-bit.c
```

. . .

```
rmmod -s xcldma || true
modprobe xcldma
Found hal iru, ignoring
Generating SDAccel runtime environment setup script, setup.sh for bash
Generating SDAccel runtime environment setup script, setup.ch for (t)csh
```

### Note:

The install.sh script is used to perform a number of tasks:

- Builds, installs and loads the xcldma kernel module, required by the ADM-PCIE-7V3 when used within SDAccel<sup>™</sup> applications.
- ii) Installs a copy of the ADM-PCIE-7V3 DSA firmware into /lib/firmware/xilinx.
- iii) Creates a Xilinx® OpenCL Installable Client Driver (ICD) at /etc/OpenCL/vendors. This can be used to allow multiple implementations of OpenCL to co-exist within the same system, which in turn lets the developer pick between a list of available platforms at runtime.
- Generates a setup.sh script within the same directory. This script can be used to setup the runtime environment of an SDAccel<sup>TM</sup> application that targets the ADM-PCIE-7V3.



## Step 5 - Verifying the ADM-PCIE-7V3 Board Installation

The verify.exe and verify.xclbin files, included within ADM-PCIE-7V3 platform package, can be used to verify the ADM-PCIE-7V3 SDAccel™ board installation:

 Copy the test directory within the ADM-PCIE-7V3 board installation directory into a directory which is not write-protected:

\$ cp -r /opt/Xilinx/SDx/2017.4/7v3 dsa/xbinst/test /tmp/.

2) Navigate to the newly-created test directory:

```
$ cd /tmp/test
```

3) Source the setup.sh script within the ADM-PCIE-7V3 board installation directory:

\$ source /opt/Xilinx/SDx/2017.4/7v3 dsa/xbinst/setup.sh

Add the 'execute' permission to the verify.exe file:

\$ chmod +x verify.exe

5) Run the verify.exe executable:

\$ ./verify.exe

#### The expected output is of the form:

Platform[0] name: Xilinx. Device 0 Device name: xilinx\_adm-pcie-7v3\_lddr\_3\_0 Max vork-group size: 4096 Max clock frequency (MHz): 200

INFO: Accelerating a simple 'squaring' kernel on hardware to verify ADM-PCIE-7V3 board installation. INFO: Input data: 001, 002, 003, 004, 005, 006, 007, 008, 009, 010 INFO: Output data: 001, 004, 009, 016, 025, 036, 049, 064, 081, 100 INFO: AMM-PCIE-7V3 board installation OK.



## Building and Running SDAccel Applications for the ADM-PCIE-7V3

In order to successfully build and run an SDAccel<sup>TM</sup> host application that targets the ADM-PCIE-7V3, make sure of the following:

- The SDAccel<sup>™</sup> host application is linked with the following runtime libraries:
  - The GNU C++ runtime found within the ADM-PCIE-7V3 board installation directory, /opt/Xilinx/SDx/2017.4/7V3\_dsa/xbinst/runtime/lib/x86\_64/libstdc++.so.6
     -L/opt/Xilinx/SDx/2017.4/7v3\_dsa/xbinst/runtime/lib/x86\_64
  - The Xilmx8 OpenCL runnine found within the ADM-PCIE-YV3 board installation directory. /optXillinx/SDx2017.4/7v3\_dsa/xbinst/mnlmAlb/x86\_64/libxillixxopencl.so -L/optY/Xillinx/SDx/2017.4/7v3\_dsa/xbinst/runtime/lib/x86\_64 -lxilinxopencl or

-L/opt/Xilinx/SDx/2017.4/7v3 dsa/xbinst/runtime/lib/x86 64 -10penCL

with the Xilinx® OpenCL ICD installed (see Step 4 - Installing the Linux Drivers).

The setup.sh script within the ADM-PCIE-7V3 board installation directory is sourced before running the SDAccel<sup>™</sup> host application:

source /opt/Xilinx/SDx/2017.4/7v3 dsa/xbinst/setup.sh



# **Document Revision History**

Date	Revision	Nature of change
Sep 18, 2018	1.0	Initial version.

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