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ADM-PCIE-7V3
SDAccel Board Installation

Introduction

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

support@alpha-data.com 🖂

Supported SDAccel Releases

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

Hardware Requirements

1) An **ADM-PCIE-7V3** accelerator card.

2) A **Host Machine**. This will host the ADM-PCIE-7V3 accelerator card.

3) 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

1) 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.

3) 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 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™ installation directory.

1) Power-on the Host Machine, boot into your chosen Linux distribution then open a command prompt.

2) Download the ADM-PCIE-7V3 SDAccel™ platform package that matches your installed SDAccel™ 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™ 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 create the following directory:

   ```
   /opt/Xilinx/SDx/2017.4/platforms/xilinx_adm-pcie-7v3_lddr_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_lddr_3_0 -d 7v3_dsa
   ```

   The expected output is of the form:

   ```
   ****** xbinst v2017.4 (64-bit)
     **** SW Build 2086221 on Fri Dec 15 20:54:30 MST 2017
       ** Copyright 1986-2017 Xilinx, Inc. All Rights Reserved.

   INFO: [XBINST 60-895]   Target platform: /opt/Xilinx/SDx/2017.4/platforms/
   xilinx_adm-pcie-7v3_lddr_3_0/xilinx_adm-pcie-7v3_lddr_3_0.xpfm
   INFO: [XBINST 60-267] Packaging for PCIe...
   WARNING: [XBINST 60-947] No image(s) discovered to be inserted into the
   '.dsabin' file. File not created.
   INFO: [XBINST 60-268] Packaging for PCIe...COMPLETE
   INFO: [XBINST 60-667] xbinst has successfully created a board installation
   directory at /opt/Xilinx/SDx/2017.4/7v3_dsa.
   ```

> **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:

i)   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™ applications:

   /opt/Xilinx/SDx/2017.4/7v3_dsa/xbinst/install.sh

iii) 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.

ALPHA DATA

Step 2 - Setting Up the Hardware

1) Remove all power from the Host Machine.

2) 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.
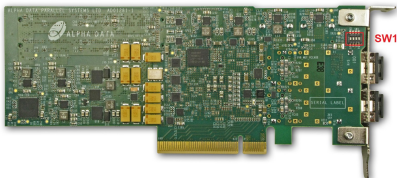

Figure 1 : The bottom face of the ADM-PCIE-7V3

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.

4) 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.
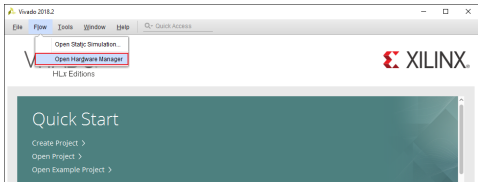2) Power-on the Programming Machine, launch Vivado® in GUI mode then select **Flow -> Open Hardware Manager**.

Figure 3 : Opening Vivado Hardware Manager

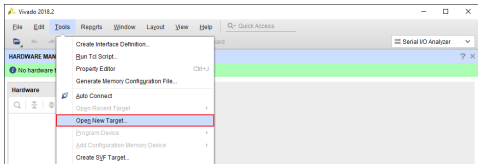3) Select **Tools -> Open New Target**.

Figure 4 : Opening a New Target

ALPHA DATA

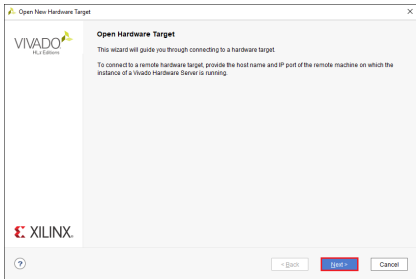4) From the **Open Hardware Target** window, click **Next**.

Figure 5 : The Open Hardware Target window

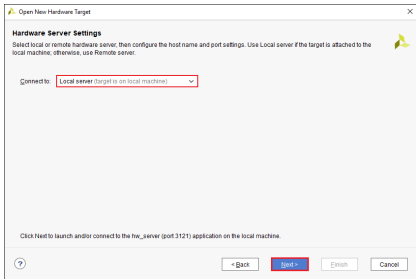5) From the **Hardware Server Settings** window, select **Local server** then click **Next**.

Figure 6 : The Hardware Server Settings window

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6) From the **Select Hardware Target** window, select the **xilinx_tcf** target then click **Next**.
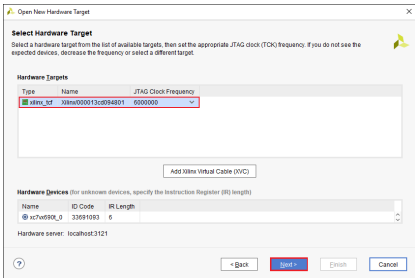

Figure 7 : The Select Hardware Target window

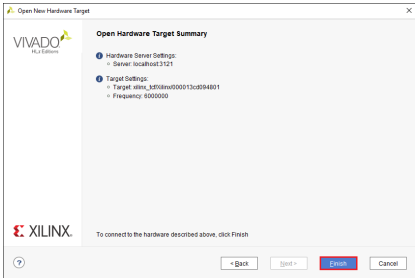7) From the **Open Hardware Target Summary** window, click **Finish**.

Figure 8 : The Open Hardware Target Summary window

8) Within the **Hardware** sub-window of Vivado® Hardware Manager, right-click on the **xc7vx690t_0** part and select **Add Configuration Memory Device**.
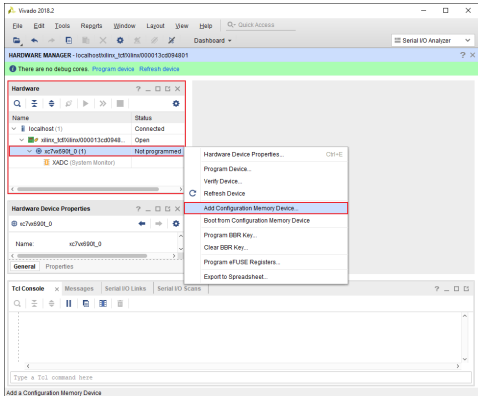

Figure 9 : Opening the Configuration Memory Device settings

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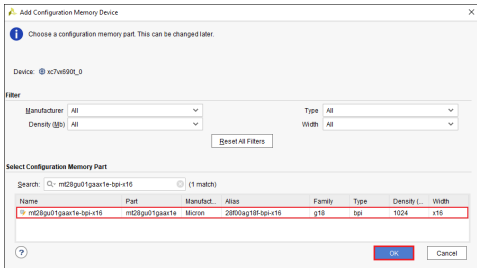

Figure 10 : The Add Configuration Memory Device window

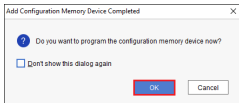10) If prompted, click **OK** to program the configuration memory device.

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.
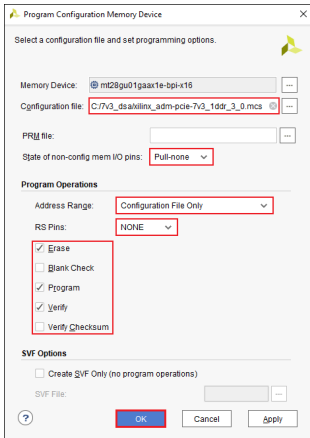

Figure 12 : The Program Configuration Memory Device window

12) Within the **Hardware** sub-window of Vivado® Hardware Manager, right-click on the **xc7vx690t_0** part and select **Boot from Configuration Memory Device**.

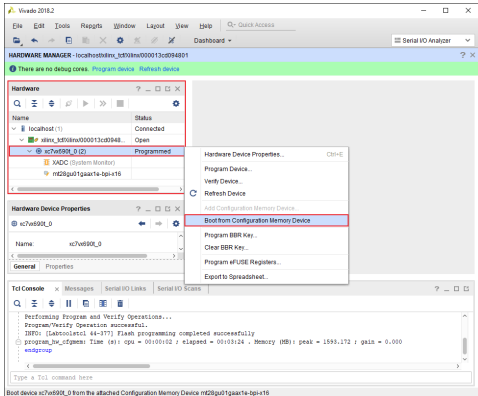**Figure 13 : Booting from the ADM-PCIE-7V3 Configuration Memory Device**

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.
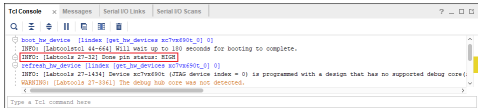

Figure 14 : Tcl Console log showing the 'Done pin status: HIGH' message

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.

2) 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:

```
INFO: Creating ICD entry for Xilinx Platform
INFO: Installing firmware for FPGA devices
/tmp/12750/0
Archive:  xcldma.zip
  inflating: driver/include/xclbin.h
  inflating: driver/include/xclfeatures.h
  inflating: driver/xcldma/kernel/xdma-bit.c
  inflating: driver/xcldma/kernel/xdma-core.c
  inflating: driver/xcldma/kernel/xdma-ioctl.c

...

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

> **Note:**
> The **install.sh** script is used to perform a number of tasks:
>
> i) Builds, installs and loads the **xcldma** kernel module, required by the ADM-PCIE-7V3 when used within SDAccel™ 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.
>
> iv) Generates a **setup.sh** script within the same directory. This script can be used to setup the runtime environment of an SDAccel™ 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:

1) 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
    ```

4) 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_1ddr_3_0
    Max work-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: ADM-PCIE-7V3 board installation OK.
    ```

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

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

i) The SDAccel™ 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 -lstdc++
  ```

- The Xilinx® OpenCL runtime found within the ADM-PCIE-7V3 board installation directory,
  /opt/Xilinx/SDx/2017.4/7v3_dsa/xbinst/runtime/lib/x86_64/libxilinxopencl.so

  ```
  -L/opt/Xilinx/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 -lOpenCL
  ```

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

ii) The **setup.sh** script within the ADM-PCIE-7V3 board installation directory is sourced before running the SDAccel™ host application:

```
source /opt/Xilinx/SDx/2017.4/7v3_dsa/xbinst/setup.sh
```

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Document Revision History

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