Getting Started with
Turnkey Accelerator Systems
TKAS-D2101

Design Gateway Co., Ltd.

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1. Introduction

This document provides hardware installation and software validation procedures for the Turnkey Accelerator Systems with Xilinx's Alveo™ accelerator card and applies to Xilinx Machine Learning Suite 2021.1 and greater. Installation and maintenance should be performed by experienced user only.

TKDAS-2101 Specification
1. Intel Gen 11th Core i7 Rocket Lake-s Processor with Deep Learning Boost AI acceleration and AVX-512 instruction set
2. DDR4-3200 MHz Memory up to 128 GB
3. Support up to 1x double slot Xilinx Alveo Accelerator card
   - Standard model Alveo U50
   - Changeable to U25, U30, U200, U250 and U280 as an option
4. PCIe Gen4 support
5. Tower case with Thermaltake CPU cooling system
6. Pre-installed and ready to use
   - Ubuntu 20.04 LTS Server
   - Xilinx Machine Learning Suite
   - Xilinx's Vitis AI Docker container
   - Design Gateway IP core performance evaluation demo

2. System Installation

2.1. Product Registration

Please register your product by sending email with subject "Turnkey Accelerator Systems Product Registration" to ip-sales@design-gateway.com

Please visit Xilinx website to register your Alveo Accelerator card, create account and register your information.
https://www.xilinx.com/myprofile.html

2.2. Safety Instructions

To ensure your personal safety and the safety of your equipment:
- Keep your work area and the computer/server clean and clear of debris
- Before opening the computer/system cover, shut down the computer/system and unplug the power cord.

2.3. Electrostatic Discharge Caution

Electrostatic discharge (ESD) can damage electronic components when they are improperly handled, and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.

To prevent ESD damage:
- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the card against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the card by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the card down only on an antistatic surface such as the bag supplied in your kit.
- If you are returning the card to Xilinx Product Support, place it back in its antistatic bag immediately.

2.4. Terms and conditions of Sales

1. The Turnkey Accelerator System warranty is valid for 1 year under Design Gateway's terms and conditions of Sales as described in the link below
https://dgway.com/terms_conditions_turnkey.html
2. Xilinx's Accelerator Card typical warranty period is 1 year under Xilinx Standard Terms and Conditions below.
https://www.xilinx.com/about/legal.html
3. Warranty of each component such as CPU, DDR Memory, SSD is depended on component's suppliers. Please check the detail in warranty card inside the box.
4. Warranty is void if any modification has been made to this product and any incorrect operation from this manual or warranty sticker is torn or damaged.
5. In order to claim for product exchange or technical support within warranty period, official receipt is required for unregistered customer as evidence of purchasing whereas official receipt is unnecessary for registered customer.

2.5. Customer Support

Customer can contact to ip-sales@design-gateway.com for support of any problem about Turnkey Accelerator Systems or visit our website at www.design-gateway.com.

3. System Validation

Before you begin
- Ensure that appropriate AC Power source for 750 Watts power consumption
- Prepare 100/1000 LAN cable with DHCP network support
- Connect TKDAS-2101 with Display, mouse and keyboard

Figure 3-1

Power on and Login

1. Push power on button to power systems

Figure 3-2 power on button location

2. Login with
   Server's name: tkas-d2101
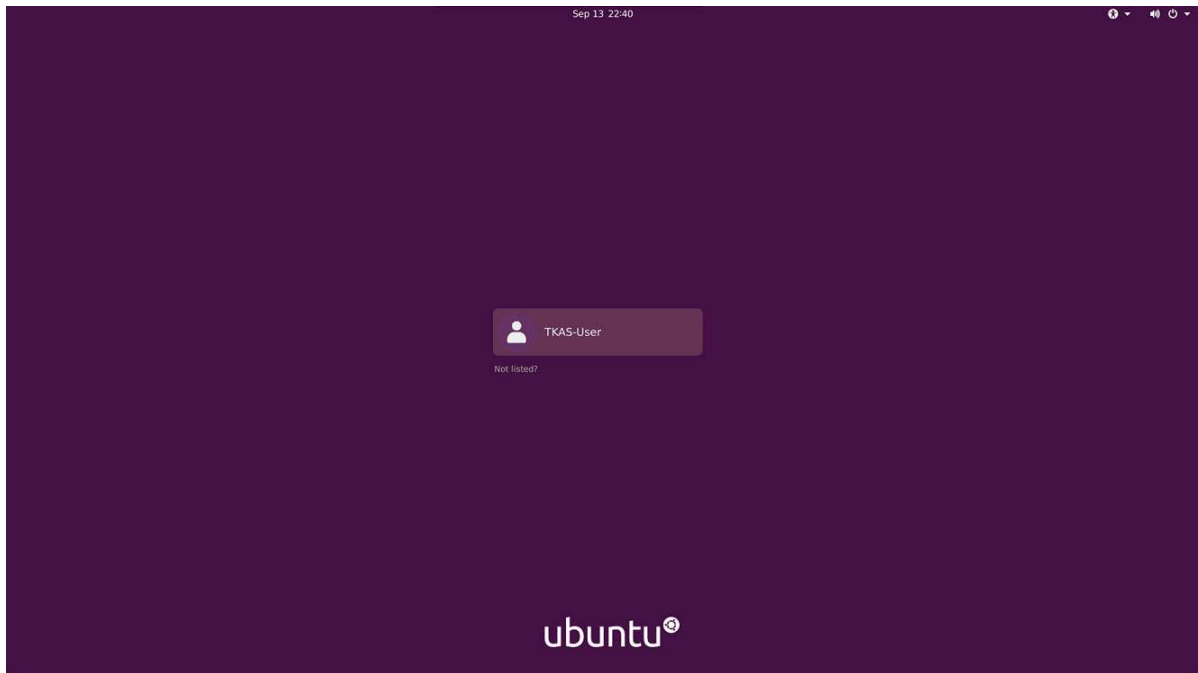   username: tkas-user
   Password: tkas#01

Figure 3-3 Ubuntu login screen

Setup environment
3. Open Terminal
4. Type **"source /opt/xilinx/xrt/setup.sh"** then enter
5. Type **"source /opt/xilinx/xbtest/setup.sh"** then enter

Scan flash on Alveo card
6. Type **"sudo /opt/xilinx/xrt/bin/xbmgmt flash --scan"** then enter

```
tkas-user@tkas-d2101:~$ sudo /opt/xilinx/xrt/bin/xbmgmt flash --scan
-----------------------------------------------------------------
Deprecation Warning:
    The given legacy sub-command and/or option has been deprecated
    to be obsoleted in the next release.

    Further information regarding the legacy deprecated sub-commands
    and options along with their mappings to the next generation
    sub-commands and options can be found on the Xilinx Runtime (XRT)
    documentation page:

    https://xilinx.github.io/XRT/master/html/xbtools_map.html

    Please update your scripts and tools to use the next generation
    sub-commands and options.
-----------------------------------------------------------------
Card [0000:01:00.0]
    Card type:              u250
    Flash type:             SPI
    Flashable partition running on FPGA:
        xilinx_u250_gen3x16_base_3,[ID=0x48810c9d17860ef5],[SC=4.6.11]
    Flashable partitions installed in system:
        xilinx_u250_gen3x16_base_3,[ID=0x48810c9d17860ef5],[SC=4.6.11]

tkas-user@tkas-d2101:~$
```
Figure 3-4 scan flash on Alveo card

Figure 3-4 show Alveo Card found, and Card ID is **"0000:01:00.0"**.

7. Type **"sudo /opt/xilinx/xrt/bin/xbmgmt partition --scan"** then enter

Figure 3-5 scan partition on Alveo card

Figure 3-5 show partition on Alveo card, found that no shell partition is running on Alveo card. It needs to re-program shell partition.

If shell partition is running, skip to step 10

8. Type **"sudo /opt/xilinx/xrt/bin/xbmgmt partition --program --name xilinx_u250_gen3x16_xdma_shell_3_1 --card 0000:01:00.0"** then enter

Figure 3-6 program shell partition successfully

9. Re-scan partition, type **"sudo /opt/xilinx/xrt/bin/xbmgmt partition --scan"** then enter

Figure 3-7 shell partition on FPGA

Figure 3-7 show shell partition is running on Alveo card.

Get board information
10. Type "**xbutil scan**" then enter


```
tkas-user@tkas-d2101:~$ xbutil scan
-----------------------------------------------------------------
Deprecation Warning:
    The given legacy sub-command and/or option has been deprecated
    to be obsoleted in the next release.

    Further information regarding the legacy deprecated sub-commands
    and options along with their mappings to the next generation
    sub-commands and options can be found on the Xilinx Runtime (XRT)
    documentation page:

    https://xilinx.github.io/XRT/master/html/xbtools_map.html

    Please update your scripts and tools to use the next generation
    sub-commands and options.
-----------------------------------------------------------------
INFO: Found total 1 card(s), 1 are usable
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
System Configuration
OS name:        Linux
Release:        5.4.0-84-generic
Version:        #94-Ubuntu SMP Thu Aug 26 20:27:37 UTC 2021
Machine:        x86_64
Model:          System Product Name
CPU cores:      16
Memory:         31874 MB
Glibc:          2.31
Distribution:   Ubuntu 20.04.3 LTS
Now:            Tue Oct  5 02:45:03 2021 GMT
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
XRT Information
Version:        2.11.648
Git Hash:       38a348510a76068a67d988128c3368f554e7b97b
Git Branch:     2021.1
Build Date:     2021-07-02 15:46:58
XOCL:           2.11.648,38a348510a76068a67d988128c3368f554e7b97b
XCLMGMT:        2.11.648,38a348510a76068a67d988128c3368f554e7b97b
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
 [0] 0000:01:00.1 xilinx_u250_gen3x16_xdma_shell_3_1 user(inst=128)
tkas-user@tkas-d2101:~$
```

Figure 3-8 board information

Figure 3-8 show U250 board information and board ID is "**0000:01:00.1**".

Card validation

11. Type "**xbutil validate -d 0000:01:00.1 --verbose**" then enter

```
tkas-user@tkas-d2101:~$ xbutil validate -d 0000:01:00.1 --verbose
Verbose: Enabling Verbosity
Starting validation for 1 devices

Validate Device          : [0000:01:00.1]
    Platform             : xilinx_u250_gen3x16_xdma_shell_3_1
    SC Version           : 4.6.11
    Platform ID          : 0x0
-------------------------------------------------------------------------
Test 1 [0000:01:00.1]    : Aux connection
    Description          : Check if auxiliary power is connected
    Test Status          : [PASSED]
-------------------------------------------------------------------------
Test 2 [0000:01:00.1]    : PCIE link
    Description          : Check if PCIE link is active
    Test Status          : [PASSED]
-------------------------------------------------------------------------
Test 3 [0000:01:00.1]    : SC version
    Description          : Check if SC firmware is up-to-date
    Test Status          : [PASSED]
-------------------------------------------------------------------------
Test 4 [0000:01:00.1]    : Verify kernel
    Description          : Run 'Hello World' kernel test
    Xclbin               : /opt/xilinx/firmware/u250/gen3x16/xdma-shell/test/ve
rify.xclbin
    Testcase             : /opt/xilinx/xrt/test/22_verify.py
    Test Status          : [PASSED]
-------------------------------------------------------------------------
Test 5 [0000:01:00.1]    : DMA
    Description          : Run dma test
    Details              : Host -> PCIe -> FPGA write bandwidth = 8547.561462 N
B/s
                           Host <- PCIe <- FPGA read bandwidth = 11645.660314 N
B/s
    Test Status          : [PASSED]
-------------------------------------------------------------------------
Test 6 [0000:01:00.1]    : iops
    Description          : Run scheduler performance measure test
    Xclbin               : /opt/xilinx/firmware/u250/gen3x16/xdma-shell/test/ve
rify.xclbin
    Testcase             : /opt/xilinx/xrt/test/xcl_iops_test.exe
    Details              : IOPS: 214627 (hello)
    Test Status          : [PASSED]
```

Figure 3-9 card validation

```
-----------------------------------------------------------------------------
Test 7 [0000:01:00.1]        : Bandwidth kernel
    Description              : Run 'bandwidth kernel' and check the throughput
    Xclbin                   : /opt/xilinx/firmware/u250/gen3x16/xdma-shell/test/ba
ndwidth.xclbin
    Testcase                 : /opt/xilinx/xrt/test/23_bandwidth.py
    Details                  : Maximum throughput: 52187 MB/s
    Test Status              : [PASSED]
-----------------------------------------------------------------------------
Test 8 [0000:01:00.1]        : Peer to peer bar

    Description              : Run P2P test
    Details                  : P2P bar is not enabled
    Test Status              : [SKIPPED]
-----------------------------------------------------------------------------
Test 9 [0000:01:00.1]        : Memory to memory DMA
    Description              : Run M2M test
    Details                  : bank0 -> bank1 M2M bandwidth: 12668.58 MB/s
                               bank0 -> bank2 M2M bandwidth: 12691.31 MB/s
                               bank0 -> bank3 M2M bandwidth: 12692.37 MB/s
                               bank1 -> bank2 M2M bandwidth: 12685.81 MB/s
                               bank1 -> bank3 M2M bandwidth: 12685.23 MB/s
                               bank2 -> bank3 M2M bandwidth: 12704.92 MB/s
    Test Status              : [PASSED]
-----------------------------------------------------------------------------
Test 10 [0000:01:00.1]       : Host memory bandwidth test

    Description              : Run 'bandwidth kernel' when host memory is enabled
    Details                  : Host memory is not enabled
    Test Status              : [SKIPPED]
-----------------------------------------------------------------------------
Test 11 [0000:01:00.1]       : vcu
    Description              : Run decoder test
    Details                  : Verify xclbin not available or shell partition is no
t
                               programmed. Skipping validation.
    Test Status              : [SKIPPED]
-----------------------------------------------------------------------------
Validation completed. Please run the command '--verbose' option for more details

Validation Summary
------------------
1  device(s) evaluated
1  device(s) validated successfully
0  device(s) had exceptions during validation

Validated successfully [1 device(s)]
  - [0000:01:00.1] : xilinx_u250_gen3x16_xdma_shell_3_1

Validation Exceptions [0 device(s)]

Warnings produced during test [0 device(s)] (Note: The given test successfully v
alidated)

Unsupported tests [1 device(s)]
  - [0000:01:00.1] : xilinx_u250_gen3x16_xdma_shell_3_1 : Test(s): 'Peer to peer
 bar', 'Host memory bandwidth test', vcu
tkas-user@tkas-d2101:~$
```

Figure 3-9 card validation (continue)

Figure 3-9 show card is evaluated and validated successfully.

Card validation test

12. Type "**xbtest -d 0000:01:00.1 -c verify**" then enter

```
tkas-user@tkas-d2101:~$ xbtest -d 0000:01:00.1 -c verify
INFO     :: GEN_016 :: GENERAL        :: Scanning xbtest libraries...
INFO     :: GEN_016 :: GENERAL        :: Executing: /opt/xilinx/xbtest/5/bin/xbte
st -d 0000:01:00.1 -j /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell-3.1/
test/verify.json -x /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell-3.1/xc
lbin/xbtest_stress.xclbin -e /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-she
ll-3.1/xbtest_pfm_def.json
INFO     :: GEN_039 :: GENERAL        :: ##################################
##########################################################
INFO     :: GEN_039 :: GENERAL        :: Command line: /opt/xilinx/xbtest/5/bin/x
btest -d 0000:01:00.1 -j /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell-3
.1/test/verify.json -x /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell-3.1
/xclbin/xbtest_stress.xclbin -e /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-
shell-3.1/xbtest_pfm_def.json
INFO     :: GEN_039 :: GENERAL        :: XBTEST version: 5.0.0
INFO     :: GEN_016 :: GENERAL        ::           - SW Build    : 3061717 on Fri
13 Nov 15:41:05 GMT 2020
INFO     :: GEN_016 :: GENERAL        ::           - Process ID  : 4221
INFO     :: GEN_016 :: GENERAL        :: ##################################
##########################################################
INFO     :: GEN_016 :: GENERAL        :: System:
INFO     :: GEN_016 :: GENERAL        ::           - User        : tkas-user
INFO     :: GEN_016 :: GENERAL        ::           - Name        : Linux
INFO     :: GEN_016 :: GENERAL        ::           - Node        : tkas-d2101
INFO     :: GEN_016 :: GENERAL        ::           - Release     : 5.4.0-84-gene
ric
INFO     :: GEN_016 :: GENERAL        ::           - Version     : #94-Ubuntu SM
P Thu Aug 26 20:27:37 UTC 2021
INFO     :: GEN_016 :: GENERAL        ::           - Machine     : x86_64
INFO     :: GEN_039 :: GENERAL        :: XRT version: 2.11.648
INFO     :: GEN_016 :: GENERAL        ::           - XRT build date: 2021-07-02 15
:46:58
INFO     :: GEN_016 :: GENERAL        :: ##################################
##########################################################
INFO     :: GEN_039 :: GENERAL        :: Start of session at: Tue Oct 05 10:19:13
 2021 +07
INFO     :: GEN_039 :: GENERAL        :: ##################################
##########################################################
INFO     :: ITF_008 :: DEVICE         :: Device: xilinx_u250_gen3x16_xdma_shell_3
_1 / BDF: 0000:01:00.1
Starting dynamic display mode...
```

Figure 3-10 all tests passed

```
Repeating last content of dynamic display mode:
   INFO     :: GEN_039 :: GENERAL     :: ####################################
####################################################
   INFO     :: GEN_039 :: GENERAL     :: Command line: /opt/xilinx/xbtest/5/bin
/xbtest -d 0000:01:00.1 -j /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell
-3.1/test/verify.json -x /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdma-shell-3
.1/xclbin/xbtest_stress.xclbin -e /opt/xilinx/xbtest/lib/xilinx-u250-gen3x16-xdm
a-shell-3.1/xbtest_pfm_def.json
   INFO     :: GEN_039 :: GENERAL     :: XBTEST version: 5.0.0
   INFO     :: GEN_039 :: GENERAL     :: XRT version: 2.11.648
   INFO     :: GEN_039 :: GENERAL     :: Start of session at: Tue Oct 05 10:19:
13 2021 +07
   INFO     :: GEN_039 :: GENERAL     :: ####################################
####################################################
   INFO     :: ITF_008 :: DEVICE      :: Device: xilinx_u250_gen3x16_xdma_shell
_3_1 / BDF: 0000:01:00.1
   INFO     :: ITF_009 :: DEVICE      :: Loading xclbin. This could take up to
20.000 seconds
   CRIT WARN :: GEN_037 :: XBT_SW_CFG  :: Memory compute unit krnl_memtest_host_
01_00 targeting host memory HOST[0] found in xclbin, but allocated memory is 0.
Compute unit will be ignored
   CRIT WARN :: VER_011 :: VERIFY      :: Test skipped for compute unit krnl_mem
test_host_01_00

   +-----------------------------------------------------------------------
------------------+ +-----------------------------------------------------------
---------+
   | STATUS                            | | ON GOING TESTS
           |
   |                                   | |
           |
   |-----------------------------------| |-----------------------------------
-----------|
   | Testcase           |    Pending | Completed |   Passed |   Failed |   Err
ors |   Warnings | | Remaining time (s) | Parameters
           |
   |-----------------------------------| |-----------------------------------
-----------|
   | Verify             |          0 |         1 |        1 |        0 |
0 |          1 | |               n/a | n/a
           |
   +-----------------------------------------------------------------------
------------------+ +-----------------------------------------------------------
---------+

   Card status: Power: 47 W; Temperature: 50 C; Qty of measurements: 2

   Messages stats: 0 Warnings, 2 Critical Warnings, 20 Passes, 0 Errors, 0 Failur
es encountered

   Elapsed: 3 s

INFO     :: GEN_040 :: GENERAL     :: ####################################
###### SUMMARY ############################################
INFO     :: GEN_040 :: GENERAL     :: End of session at: Tue Oct 05 10:19:16 2
021 +07
INFO     :: GEN_040 :: GENERAL     :: 0 Warnings, 2 Critical Warnings, 19 Pass
es, 0 Errors, 0 Failures encountered
INFO     :: GEN_040 :: GENERAL     :: ####################################
####################################################
PASS     :: GEN_024 :: GENERAL     :: RESULT: ALL TESTS PASSED
tkas-user@tkas-d2101:~$
```

Figure 3-10 all tests passed (continue)

13. Alveo card ready to use

Revision History

Revision	Date	Detail of change
1.0	26 October 2021	Initial Release