

## Introduction

Welcome and thank-you for evaluating or purchasing the Aupera Facial Recognition Accelerated Application. This document provides the user with the required steps to get started with this application on the Xilinx Kria KV260 Starter Kit.

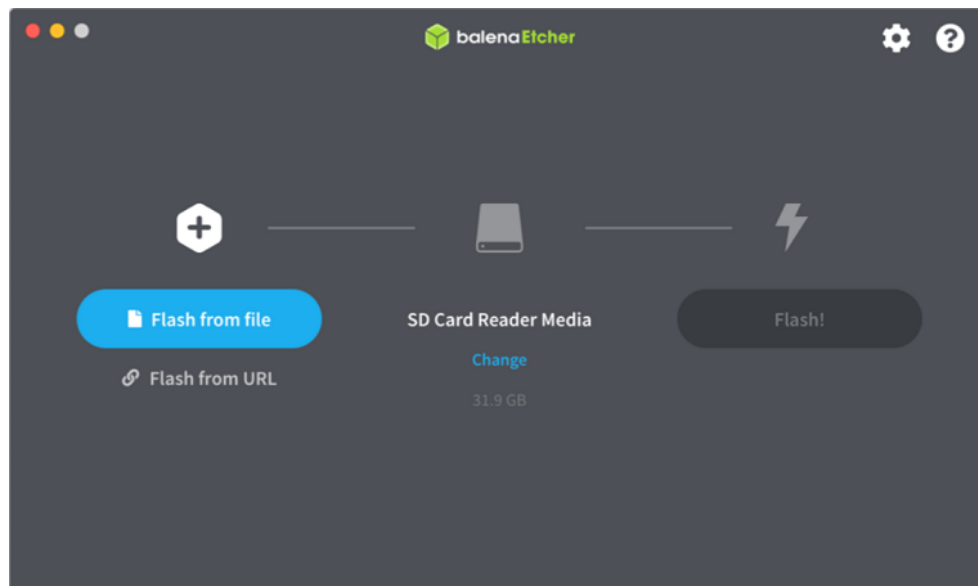
Should you encounter problems or require support for this application, please feel free to contact us via the Xilinx Kria partner application [forums](#). [*Forums -> Hardware Development -> Kria SOMs -> Partner Applications -> Aupera Technologies*]

## Starter Kit microSD Card Preparation

As a first step, we will prepare a microSD for use with the Starter Kit, imaged with the Aupera application image. The Aupera application is provided in the form of a pre-built Linux image which is based on the standard KV260 Starter Kit image from Xilinx, but with some minor modifications required to support the Aupera application. The provided image is fully compatible with the Xilinx released Accelerated Applications and is available for download from the Aupera Technologies website.

Follow the steps below to image a microSD card for use with the KV260 Starter Kit:

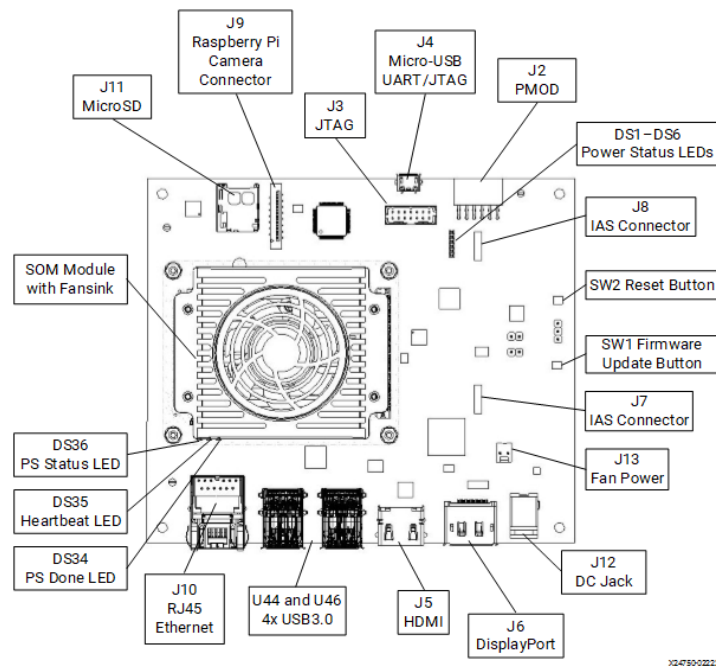
1. Download the SD Card Image, [aupera-kv260-fr-1.1.wic.gz](#), and save it to your computer
2. Insert the microSD card into an available slot on your PC
3. Use your preferred SD card imaging tool to flash a suitable microSD card. We recommend the [Balena Etcher tool](#) which supports Windows, Linux, and macOS. Additional SD card imaging tools are referenced on the [KV260 Getting Started Page](#)
4. Follow the Etcher prompts to select the Aupera .wic image file and flash it to the microSD card as illustrated in the image below. When this process is complete, eject the card from your computer



## Starter Kit Hardware Setup

Next, we will prepare the KV260 Starter Kit to run the application. The basic steps are encapsulated below:

1. Insert the microSD card into the slot on the KV260 carrier card (J11)
2. Connect a micro-USB cable to J4 on the KV260 carrier card. This USB serial interface will be leveraged to interact with the application and view boot time messages
3. Connect an Ethernet cable from J10 on the KV260 carrier card to your local network



## Connecting the KV260

Next, we will connect to the KV260 Starter Kit and bring up the Aupera application.

1. The KV260 Starter Kit uses an FTDI USB to COM port device that requires the FTDI virtual COM (VCOM) port driver be installed on your machine. Set-up your USB-based UART connection via the J4 carrier card interface with the configuration 115200, N, 8, 1, No Flow Control using a terminal program (e.g., TeraTerm, PuTTY, Minicom). The Linux UART is enumerated as the lower of two VCOM ports.
2. After powering on the SOM, it should automatically boot to Linux. You should see the green heartbeat LED flashing, and observe the Linux UART response on the terminal program interface. If you see the heartbeat LED active but no UART response, verify that your machine has the FTDI driver installed and that the terminal program is connected to the correct COM port.

3. At initial log-in, the platform requires you to set a password. The default username is petalinux. Make note of the password for future use. The petalinux user does not have root privileges. Most commands used in subsequent tutorials must be run using sudo and you may be prompted to enter your password.
4. Note: The root user is disabled by default due to security reasons. If you want to login as root user, follow the below steps, else, ignore this step and continue. Use the petalinux user password on the first password prompt, then set a new password for the root user. You can now login as root user using the newly set root user password

```
xilinx-k26-starterkit-2020_2:~$ sudo su -l root

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

Password:
root@xilinx-k26-starterkit-2020_2:~# passwd
New password:
Retype new password:
passwd: password updated successfully
```

If the Kria SOM is connected to a network that supports DHCP, you can determine the local IP address by issuing the command “ifconfig” via your serial terminal application:

```
xilinx-k26-starterkit-2020_2:/D0/aup-pkgs$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0a:35:00:22:01
          inet addr:192.168.1.28  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fd00:fc:8d31:f8e2:20a:35ff:fe00:2201/64  Scope:Global
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1057 errors:0 dropped:0 overruns:0 frame:0
          TX packets:90 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:62512 (61.0 KiB)  TX bytes:11314 (11.0 KiB)
          Interrupt:44

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128  Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:140 (140.0 B)  TX bytes:140 (140.0 B)
```

It is also possible to manually assign an IP address via the command “sudo ifconfig eth0 xxx.xxx.xxx.xxx”, replacing xxx.xxx.xxx.xxx with the target IP address. This will be required if your network does not support DHCP, or if you are using a direct connection from the Kria SOM to your PC.

## Accelize DRM and License Generation

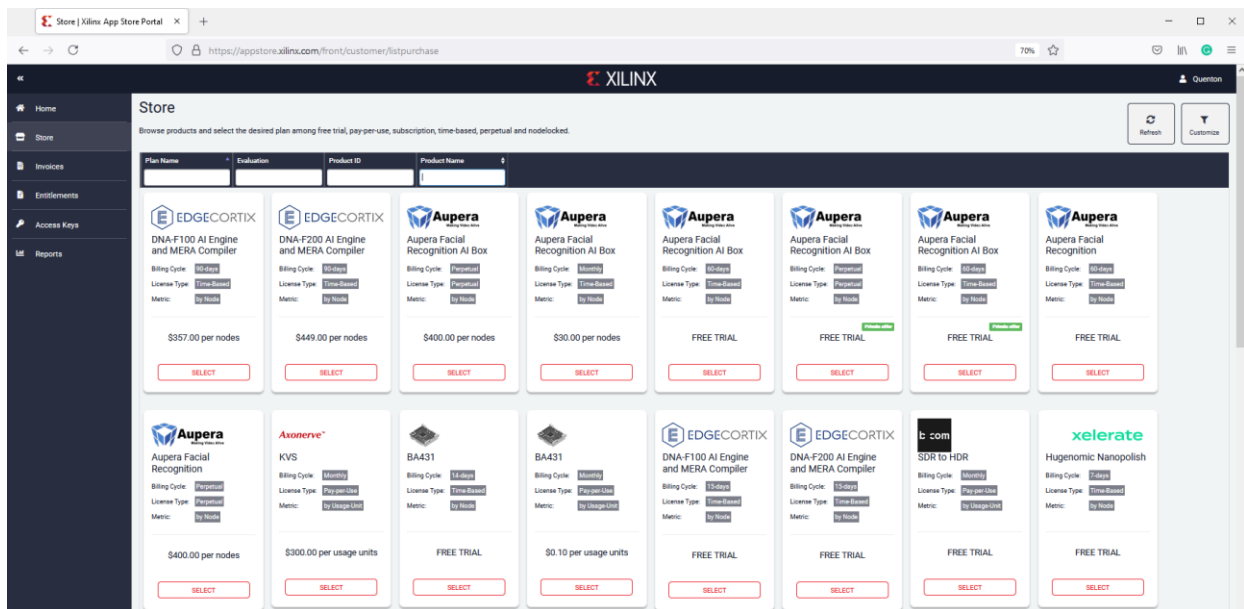
The Aupera Facial Recognition application leverages Accelize Digital Rights Management protection and cannot be used or evaluated without a license. Accelize DRM protection provides significant flexibility to the user, enabling large scale connected deployments with floating licenses, as well as node-locked license types for devices which may not have internet connectivity.

To consume a node-locked license, the KV260 Starter Kit must be connected to the internet one time to generate a license file. Once generated, this license file can unlock the DRM protection while offline but will only work for the specific Kria SOM board that it was generated for and will not work for any other board.

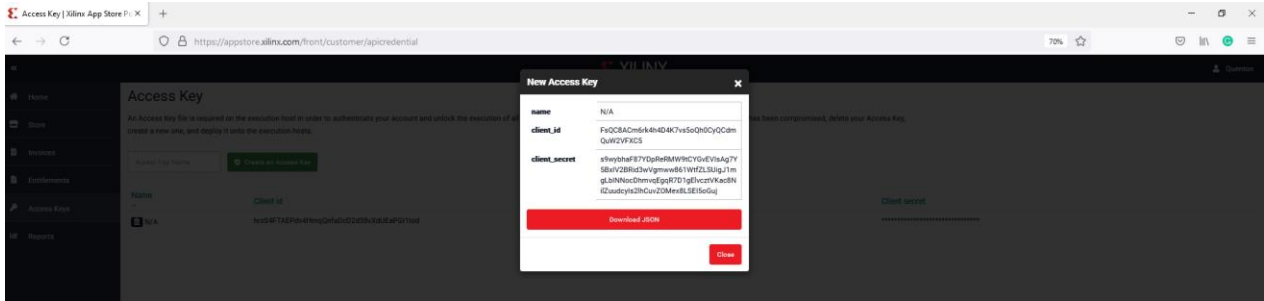
A floating license can be used right away when obtained from the store but requires the KV260 Starter Kit to be constantly connected to the internet.

To obtain a license please follow the steps below:

1. Create a Xilinx Appstore account at <https://appstore.xilinx.com/>
2. From the Appstore homepage, select “Store” from the available menu options. Aupera’s Facial Recognition technology is available for both Alveo and Kria Xilinx platforms. The “Aupera Facial Recognition AI Box” application is specific to the Xilinx Kria KV260 SOM and should be selected in the context of the Kria Starter Kit.



3. Purchase the required nodes via the Appstore or select the free trial (no fee). Complete the checkout process
4. Once the checkout process is complete, you can review the newly generated entitlement in the “Entitlements” section.
5. Create an access key, provided in the form of a cred.json file which can be downloaded from the Appstore



6. Next, the cred.json file needs to be copied to the SOM file system in the directory: /D0/aup-pkgs/cred.json.

You may leverage scp to copy cred.json as shown in the below example (Windows command prompt example shown):

```
C:\Users\username\Downloads>scp cred.json petalinux@192.168.1.28:~/cred.json
The authenticity of host '192.168.1.28 (192.168.1.28)' can't be established.
RSA key fingerprint is SHA256:iNbJtueXCMn0xJq2S6eQVxdwwB2i3STwtRoG79EZTgo.
Are you sure you want to continue connecting (yes/no)?
Warning: Permanently added '192.168.1.28' (RSA) to the list of known hosts.
petalinux@192.168.1.28's password:
cred.json                                     100% 216   105.7KB/s
00:00

C:\Users\username\Downloads>
```

Now, return to the terminal and issue the command to copy cred.json into the aup-pkgs directory:

```
xilinx-k26-starterkit-2020_2:/D0/aup-pkgs$ sudo cp ~/cred.json ./cred.json

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

#1) Respect the privacy of others.
#2) Think before you type.
#3) With great power comes great responsibility.

Password:
xilinx-k26-starterkit-2020_2:/D0/aup-pkgs$ ls
aup_face_recognition_cluster_manager-3.0.1-202107161313-md5-263e17b65ded6302cebce4d64ea27959.pkg  drm-1.0.0-so
m-202107061238-md5-c8ef1a5cc17208b5d9fdaf312e7057e7.pkg
aup_face_recognition_cluster_worker-3.0.1-202107161313-md5-e90a668573374935e2cf1e3dac0ed0d1.pkg  face_detect-
6.0.1-202105211930-md5-d1132a7fffd460b27f191ba657d5b70e.pkg
axstream-2020.2.2-som-4.0.0-202104300056-md5-1e8c5d4b2df394601a182f4837612a24.pkg                person_manag
er-4.0.1-202105212007-md5-2d8e0f33f3be72f39e5069841d22b0fb2.pkg
cred.json
xilinx-k26-starterkit-2020_2:/D0/aup-pkgs$
```

In addition to the cred.json file, the Aupera wic image requires a DRM configuration file. This file, conf.json dictates if the DRM is in node-locked or floating license mode. This file is created automatically when the command “sudo som-start.sh” is executed (described in the Run the Application section of this document). Prior to execution of this script, the DRM subdirectory (/D0/APP/drm) does not exist.

By default, the conf.json is configured to use a floating license. If you are using a free trial, the conf.json does not need to be modified.

To change between floating and node-locked license mode, modify the value of the node-locked field under the licensing entry of the /D0/APP/drm/conf.json file. Example shown below:

```
"licensing": {  
  "url": "https://master.metering.accelize.com",  
  "nodelocked": false,  
  "license_dir": "./"  
}
```

## Starting the FR Application

Now it is time to start the Aupera Facial Recognition Application.

From the KV260 command prompt, execute the following commands. You will notice that the `aupera-kv260-fr` application has been pre-populated in the Aupera `.wic` image.

```
xilinx-k26-starterkit-2020_2:~$ sudo xmutil listapps  
xilinx-k26-starterkit-2020_2:~$ sudo xmutil unloadapp  
xilinx-k26-starterkit-2020_2:~$ sudo xmutil loadapp aupera-kv260-fr
```

The following message confirms that the Aupera Accelerated Application has been successfully loaded. If necessary, press enter to return to the command prompt.

```
...  
[ 8091.009764] OF: graph: no port node found in /amba/zynqmp-display@fd4a0000  
[ 8091.223729] [DPU][3899]Found DPU signature addr = 0x8f000000 in device-tree  
[ 8091.230713] [DPU][3899]Checking DPU signature at addr = 0x8ff00000,  
[ 8091.237102] [DPU][3899]DPU signature checking done!  
[ 8091.244984] xilinx-vcu-core a0040000.vcu: GPIO lookup for consumer reset  
[ 8091.251697] xilinx-vcu-core a0040000.vcu: using device tree for GPIO lookup  
[ 8091.258669] get prop[reset-gpios] idx[0]  
[ 8091.262613] get prop[reset-gpios] idx[0] return of_flags=0x0  
[ 8091.268281] xilinx-vcu-core a0040000.vcu: return lookupflags=0  
[ 8091.274108] gpiod_request ret=0  
[ 8091.277258] xilinx-vcu-core a0040000.vcu: gpiod_configure_flags con_id=reset, ret=0, lookupflags=0, flags=0x3  
DFX-MGRD> Loaded aupera-kv260-fr successfully
```

Next, we will install the Aupera Facial Recognition packages. Execute the following command:

```
xilinx-k26-starterkit-2020_2:~$ sudo som-start.sh
```

At the time of first execution, the script will require access to the internet and may download and upgrade several packages. When prompted, respond “y” to download these additional packages.

The installation should take approximately three minutes. Note that during this installation process you may see several messages that have the format “*diff: <some directory>: No such file or directory*”. Generally, these messages can be safely ignored.

A successful installation will exit after issuing the following messages:

```

===== person_manager =====
diff: /D0/APP/person_manager/person_manager-start.sh: No such file or directory
Stopping person manager
No screen session found.
diff: /usr/bin/person_manager: No such file or directory
diff: /usr/bin/re_encode: No such file or directory
Starting person manager
===== worker =====
diff: /D0/APP/worker/worker-start.sh: No such file or directory
worker change mport to 51997
worker change wport to 51998
diff: /usr/bin/mc_worker: No such file or directory
===== manager =====
diff: /D0/APP/manager/manager-start.sh: No such file or directory
change mport to 51997
change wport to 51998
diff: /usr/bin/mc_manager: No such file or directory
xilinx-k26-starterkit-2020_2:~$

```

We should also confirm that following the successful installation of the application that the necessary processes are now running. To verify this, execute the command “ps -ef”. The following processes should be listed:

```

root      1676      1  0 18:12 ?          00:00:00 SCREEN -S person_manager -dm person_manager
root      1678    1676  1 18:12 pts/0    00:00:02 person_manager
root      1707      1  0 18:12 ?          00:00:00 SCREEN -S aupw -dm mc_worker --manager-port 51997 --worker-port 51998 --engine face_identification_worker
root      1709    1707  2 18:12 pts/1    00:00:04 mc_worker --manager-port 51997 --worker-port 51998 --engine face_identification_worker
root      1718      1  0 18:12 ?          00:00:00 httpd -p 59889 -h /tmp/face_lib_sync/
root      1766      2  0 18:12 ?          00:00:00 [kworker/0:2H]
root      1774      1  0 18:12 ?          00:00:00 SCREEN -S aupm -dm mc_manager --manager-port 51997 --worker-port 51998 --engine face_identification_manager
root      1776    1774  1 18:12 pts/2    00:00:03 mc_manager --manager-port 51997 --worker-port 51998 --engine face_identification_manager
root      1810      2  0 18:13 ?          00:00:00 [kworker/2:2-events]

```

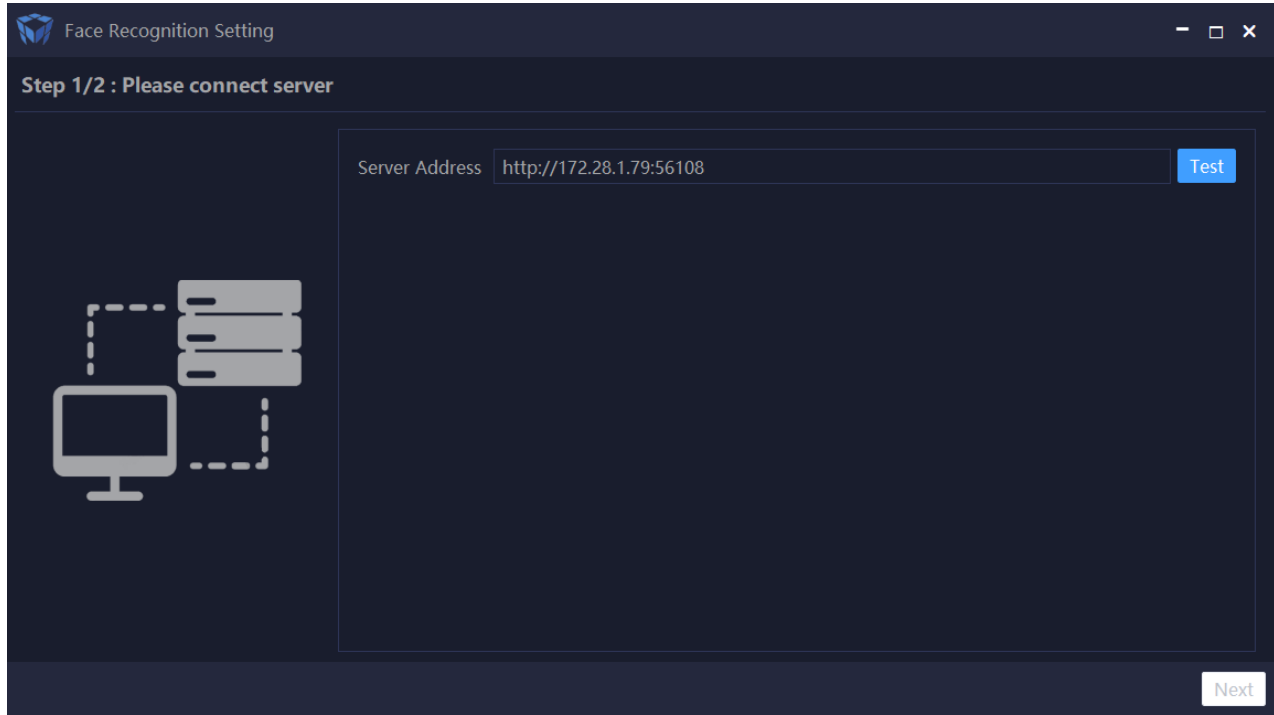
## Connecting Kria SOM to the Aupera AI Client Software

Evaluation of the Kria SOM Accelerated Application is supported by Aupera’s AI Client Software package which is available for Windows platforms. This document does not provide an in-depth perspective on the Aupera AI Client software. Refer to the latest Aupera AI Client User Guide (step 3 below) for additional information.

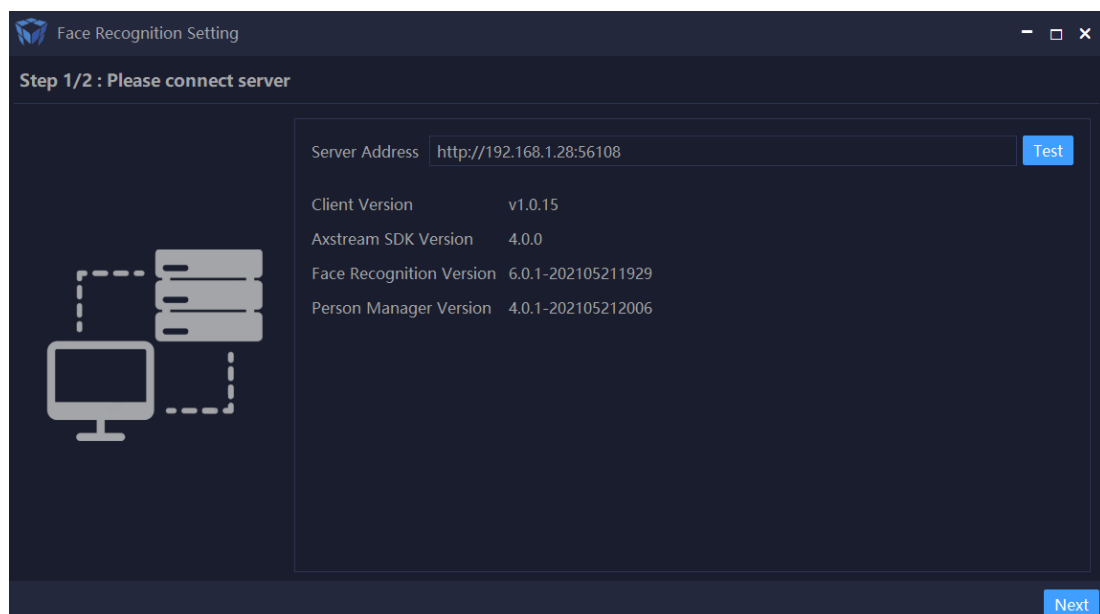
Follow these steps in order to get started with the Aupera Client software:

1. Download the [Aupera AI Client](#) software from the Aupera Technologies downloads page
2. Extract the software package in a convenient directory (ie C:\aupera\_fr\). No installation is necessary.
3. Open the Aupera AI Client User Guide for future reference. It was extracted to <extracted\_path>\dist\client\doc
4. Double-click the extracted executable <extracted\_path>\dist\client\client.exe

- At the time of first execution, the Aupera AI Client needs to be configured with the IP address for the Kria Starter Kit. The following dialog box is used to configure this IP. Replace the default IP address “172.27.1.79” with the IP of your Kria Starter Kit. Note that you must not change the port number or protocol, so the updated field should be populated as [http://<kria\\_IP>:56108](http://<kria_IP>:56108)



- Click the “Test” button to confirm that the Kria SOM is detected and that the Facial Recognition application is running. Your results should appear similar:





7. Click Next to continue, and “No” to the question of Import Data

**IMPORTANT:** *The Client will now close.*

8. You can restart the client with the freshly connected Kria SOM by simply double-clicking again on client.exe. The Client software will default to the “Camera Hub”. It is via this menu that you can add your RTSP or RTMP sources

## Connecting the Kria SOM to RTSP Sources

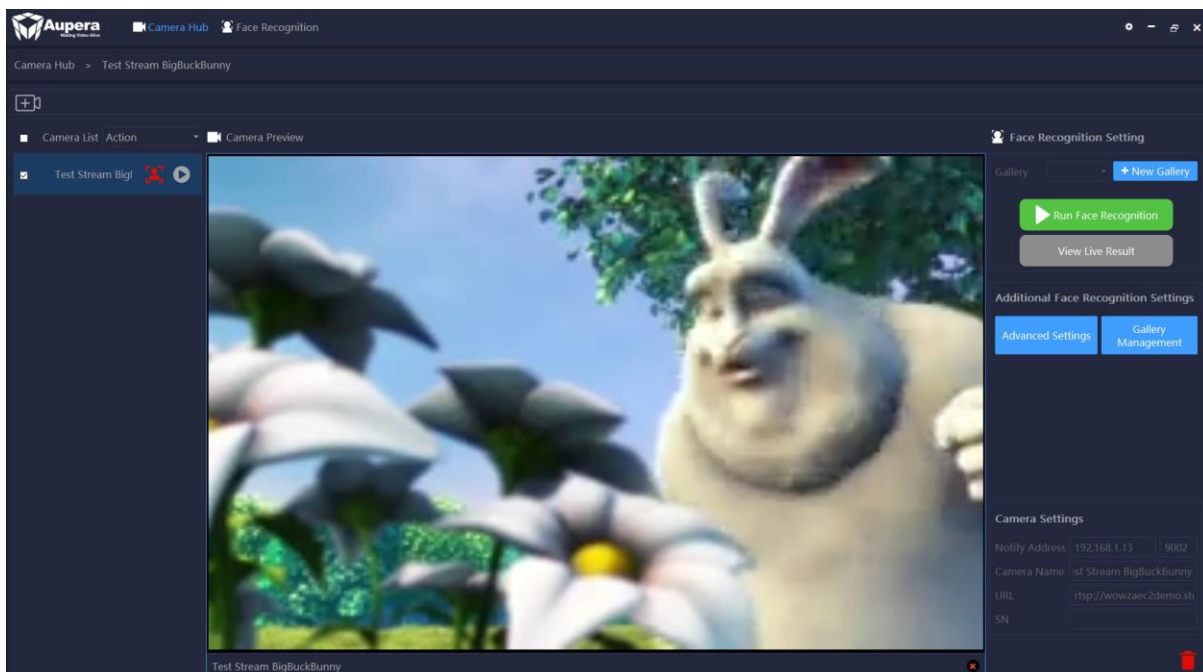
For initial test purposes, we recommend connecting to a “known good” stream. The following two public streams can be used for test purposes. Configure a camera using one of the URLs:

[rtsp://wowzaec2demo.streamlock.net/vod/mp4:BigBuckBunny\\_115k.mov](rtsp://wowzaec2demo.streamlock.net/vod/mp4:BigBuckBunny_115k.mov)

[rtsp://demo:demo@ipvmemo.dyndns.org:5541/onvif-media/media.amp?profile=profile\\_1\\_h264&sessiontimeout=60&streamtype=unicast](rtsp://demo:demo@ipvmemo.dyndns.org:5541/onvif-media/media.amp?profile=profile_1_h264&sessiontimeout=60&streamtype=unicast)

**IMPORTANT:** *You may need to disconnect from your VPN and disable your firewall in order to proceed with next steps*

Click the “Play” button beside the test stream to confirm that the Aupera Client software can receive and decode one or more streams:



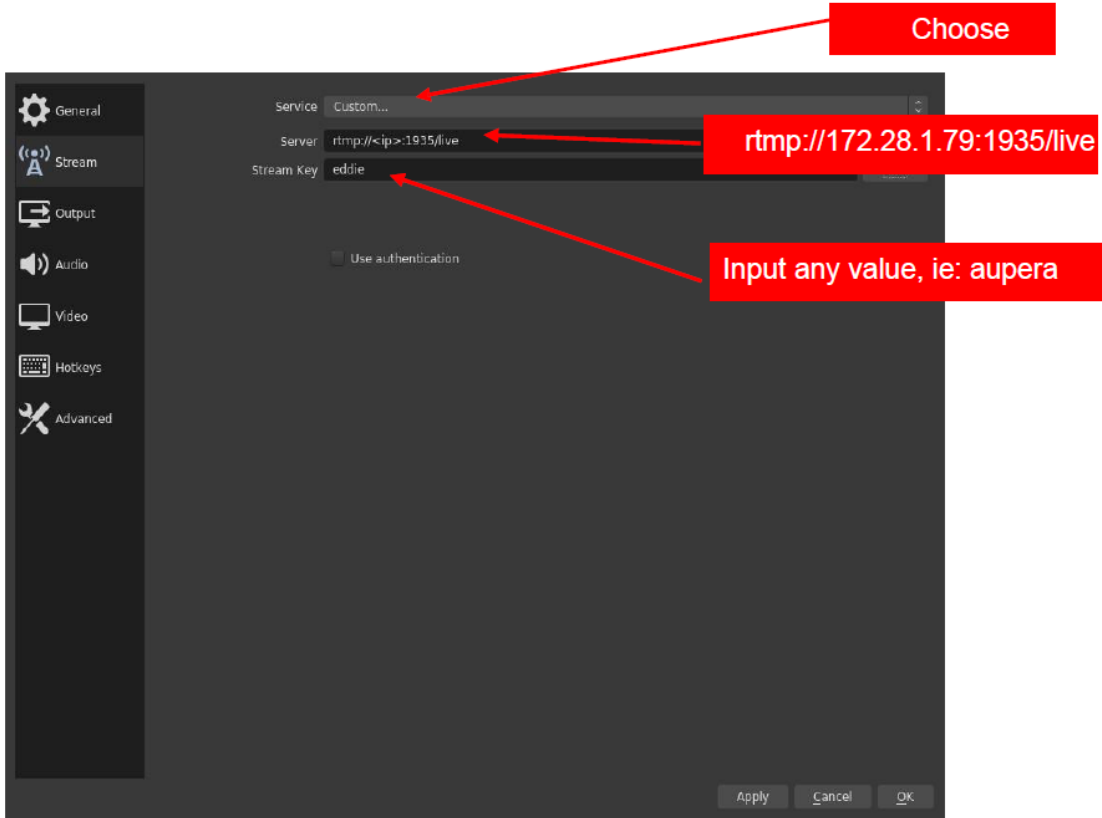
Next, we need to configure streams that will be used as test sources for facial recognition. Suitable sources include RTSP/RTMP streaming servers as well as IP cameras, including the Kria KV260 Starter Kit Smart Cam application! The configuration of all potential sources is beyond the scope of this document, but may include applications for your smart phone, VLC Media Player and many others. If you encounter a stream or source that works well for you, or which appears to have compatibility issues, you may bring this to our attention via the Xilinx Kria forums.

## Kria SOM RTSP / RTMP Source Example

Please refer to <https://obsproject.com/forum/resources/how-to-set-up-your-own-private-rtmp-server-using-nginx.50> for an overview of configuring your own RTMP server using nginx. The basic steps are as follows:

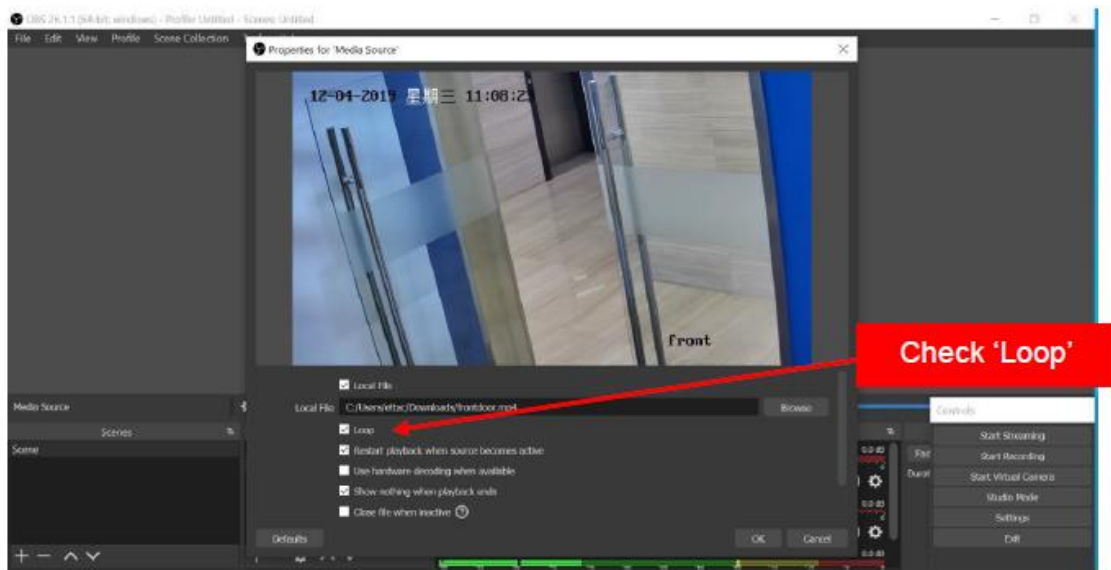
1. Download and install nginx. As necessary, refer to the nginx documentation in order to configure the nginx listen port to an available port on your server PC
2. Download OBS for streaming your own camera or a local video file:  
<https://obsproject.com/download>
  - a. With OBS, you can stream your laptop camera, a USB camera, or use a video file for streaming
  - b. If you want to use your laptop camera as the stream source press, the + button in the Sources box in OBS and Video Capture Device. Create a new capture device and select your camera from the Device drop-down.
  - c. Click the Settings button at the lower right side of the GUI. In the window that appears, select the 'stream' tab on the left-hand side and set your configuration as below:
    - i. Service: select "Custom.."
    - ii. Server: input "rtmp://<cam\_ip>:1935/live" where <cam\_ip> is the address of the rtmp server you setup with nginx
3. Stream key: input any text you like but please do remember it
4. Click "apply", then "ok"
  - a. Click "Start Streaming"

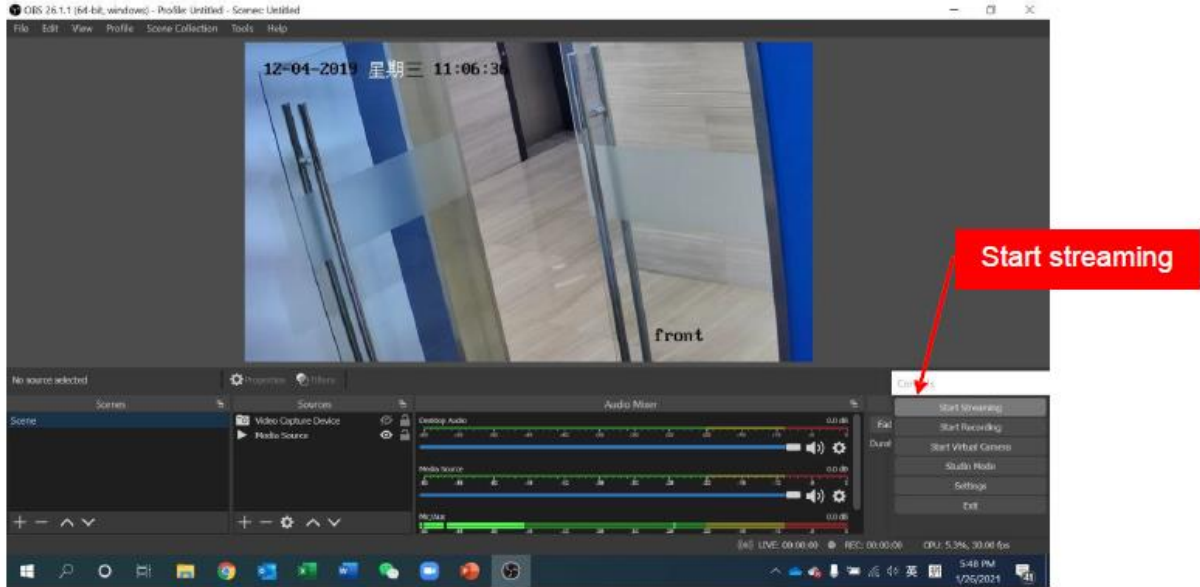
# XILINX KRIA KV260 STARTER KIT FACIAL RECOGNITION



If you want to use a video file to stream, just press, the + button in the Sources box in OBS, choose media file, then choose your local file to start streaming, remember to click 'loop' option after you have selected the file.

Once you set up your video source, save the settings and go to the main OBS UI where you can start streaming.





## Creating a Gallery for Facial Recognition

Prior to attempting to run facial recognition, you must create a gallery of faces. Do not attempt to run facial recognition *without creating at least one suitable gallery containing a minimum of ten faces.*

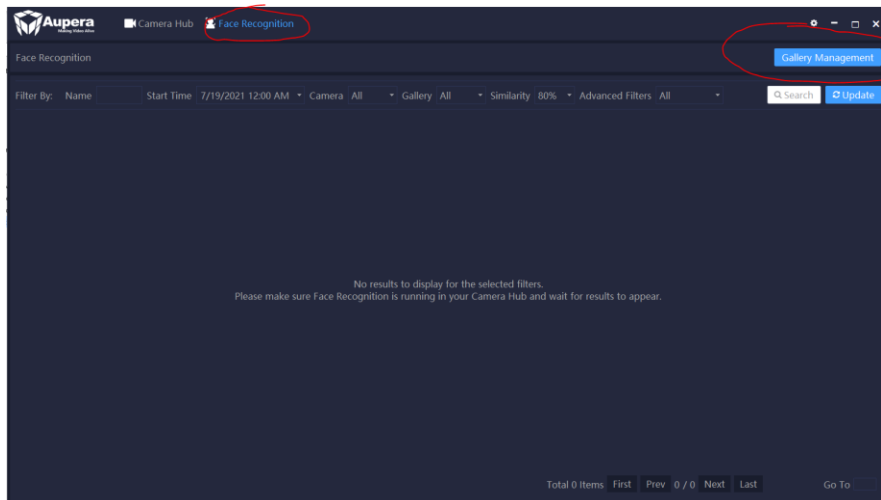
Various open-source facial recognition datasets are available for testing. Should you choose to do so, you can leverage such datasets for testing (however, remember that the input to the Kria SOM is always an RTSP or RTMP stream). Some datasets are available that incorporate video clips, and it may be possible for you to leverage those clips in concert with the related metadata to test the application. Here are a few examples of such datasets:

<https://mmlab.ie.cuhk.edu.hk/projects/CelebA.html>

<https://www.cs.tau.ac.il/~wolf/ytfaces/>

In addition, you can potentially augment your own gallery with faces from online resources such as [Pexels](https://www.pexels.com/).

You can create a Gallery by selecting the Gallery Management button from the Face Recognition hub in the Client application. Various options are available to upload images. For more details, refer to the Aupera AI Client User Guide.



## Running Facial Recognition

Once you have created a Gallery, you may select one or more streams and run the Facial Recognition process on those streams. Select one or more cameras from the Camera List, select your Gallery via the drop-down on the right side of the GUI and then click the “Run Face Recognition” button. You may then select the “View Live Result” button in order to view the similarity predictions.

At this time, the Client informs the application running on the Kria Starter Kit that it should receive the chosen camera stream(s) and begin the process of inferencing. Though the gallery and streams are managed via the Client interface, the similarity predictions and stream processing take place on the SOM. In this fashion, users can potentially craft their own application which manages the FR processes and stream processing of the SOM, leveraging Aupera’s Kria APIs.

**IMPORTANT:** *The Aupera AI Client must be able to receive meta data pushes from the Kria Starter Kit over the local network. These communications may be blocked by the presence of a local firewall. If you are not seeing similarity predictions after refreshing the Live Result view several times, please review the FR app log on the Kria SOM in /var/log/aup\_face\_identification to see whether the predictions have been transmitted from Kria to the Client.*

The expected log looks like:

```
[2021-07-05 21:42:45] - [NO.13]---  
{ "crop": "/tmp/app/face_detect/tasks/51881/0000000829_01_1625546562830_crop.jpg", "extra": { "age": "", "face_name": "VIP3_Dewang", "sex": "", "tel": "" }, "face": { "height": 51, "width": 43, "x": 414, "y": 23 }, "frame": "/tmp/app/face_detect/tasks/51881/0000000829_1_1625546562830.jpg", "gender": true, "glasses": false, "img": "/tmp/app/face_detect/tasks/51881/0000000829_01_1625546562830.png", "input_url": "rtmp://10.53.170.121:1935/live/steven", "mask": false, "person_id": "Face_1625522323866204", "port": 51881, "result": 0, "score": 0.963420569896698, "smile": false, "tags": [ "Lib_1625522301017842" ], "threshold": 0.8500000238418579, "timestamp": 1625546562830, "video": "/tmp/app/face_detect/tasks/51881/852.ts" }
```

```
[2021-07-05 21:42:46] - [NO.13] - post notify to server:http://10.53.170.149:9002 success
```

## Questions / Feedback

We value that you have taken time to evaluate the Aupera Facial Recognition Accelerated Application for the Xilinx KV260 Kria Starter Kit. Please take a moment to share your experiences, questions and feedback with us via the Xilinx Kria Partner forum. Enjoy!