TrustFLEX Step by Step Guide AWS IoT with Custom PKI

Table of Contents

1 Introduction

This document gives a detailed walk through of the custom public key infrastructure use case implementation. If familiar with Jupyter Notebook, can skip this section and move to Section 2.

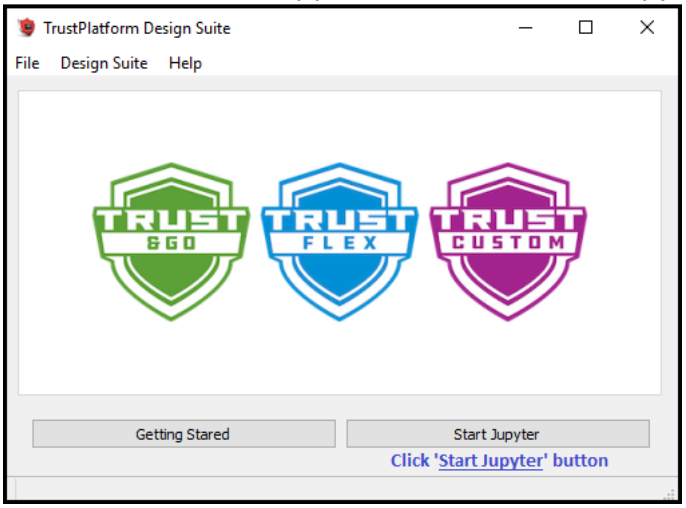
1.1 Getting started with Jupyter Notebook Tutorials

Jupyter Notebook is open source web application which allows you to create documents that contain code that you can execute in place as well as narrative text. It provides GUI elements, ability to execute code in place, ability to add images and gives it the look and feel that normal code files lack.

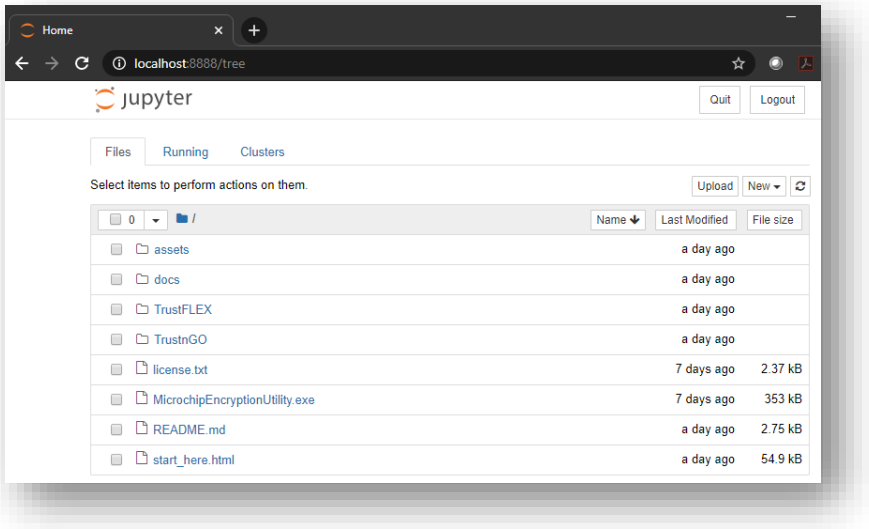
Jupyter notebooks are mainly used to explain/evaluate code in an interactive way.

1.1.1 Starting Jupyter Notebook

Jupyter notebook can be launched from Trust Platform GUI Main window. Run START -> Trust Platform x.x.x icon. Click on 'Start Jupyter' button to launch Jupyter local server.



Clicking on Start Jupyter should be web browser tab like below,



1.2 Jupyter Notebook Basics

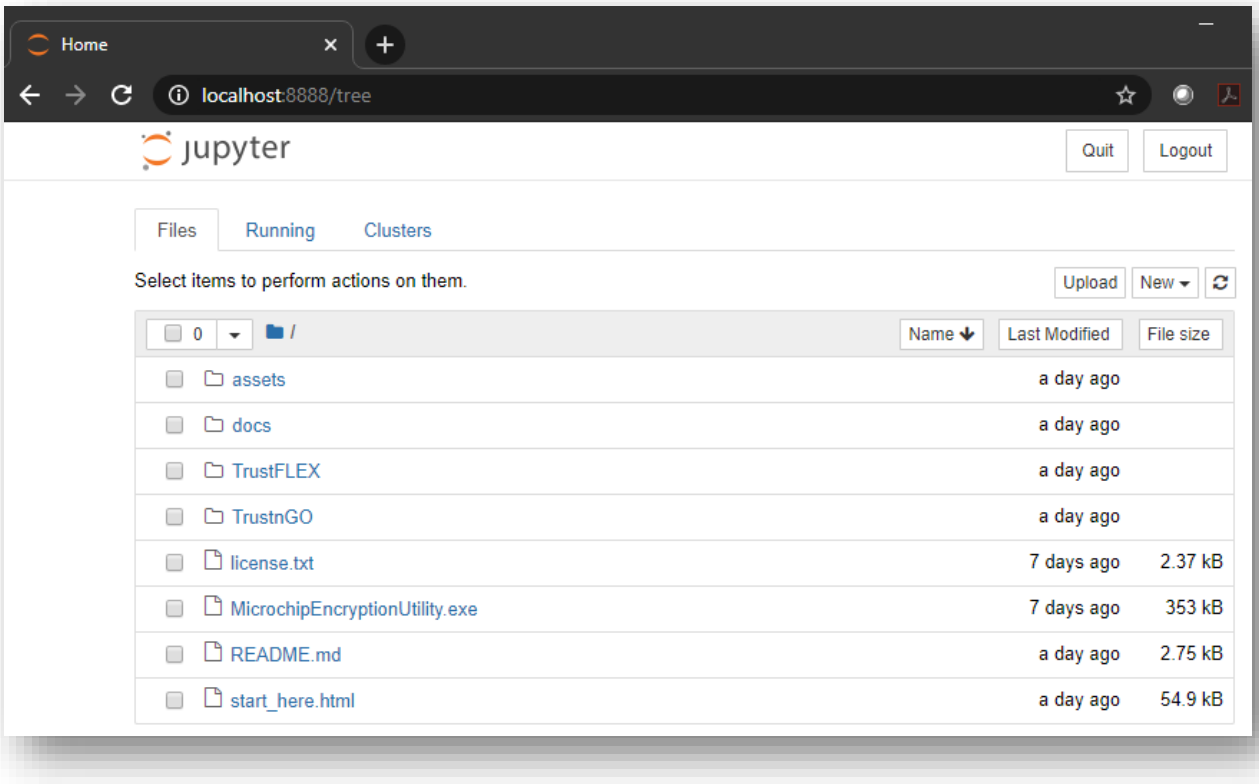
It is recommended to become familiar with Jupyter basic concepts with the online documentation, https://jupyter-notebook.readthedocs.io/en/stable/examples/Notebook/Notebook%20Basics.html

Some of the content is duplicated here for convenience. The online documentation should always be used as a reference.

1.2.1 The Notebook dashboard

When you first start the notebook server, your browser will open Notebook dashboard. The dashboard serves as a home page for the notebook. Its main purpose is to display the notebooks and files in the current directory.

For example, here is a screenshot of the Jupyter dashboard. The top of the notebook list displays clickable breadcrumbs of the current directory. By clicking on these breadcrumbs or sub-directories in the notebook list, you can navigate your file system.

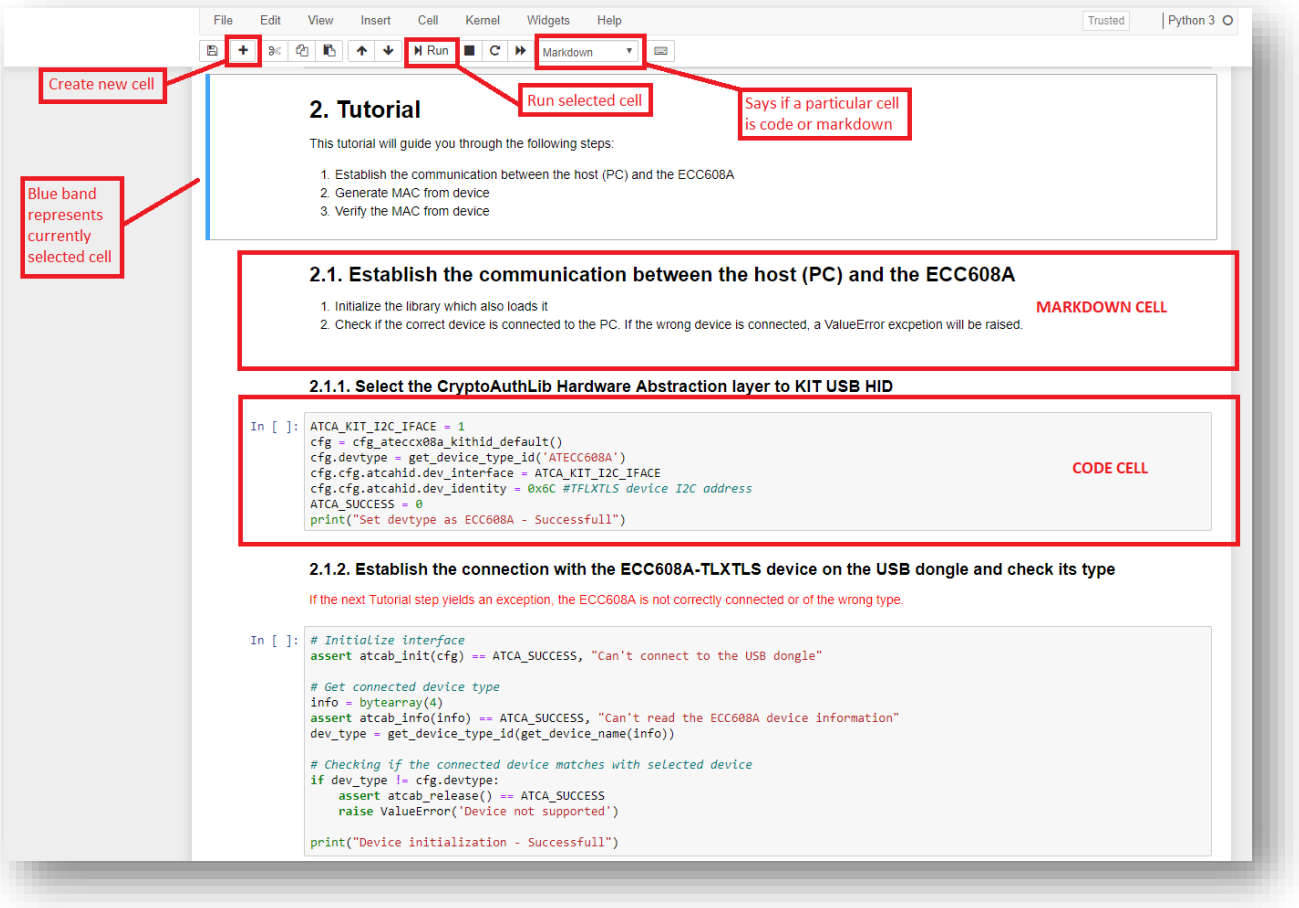


1.3 Introduction to Jupyter Notebook GUI.

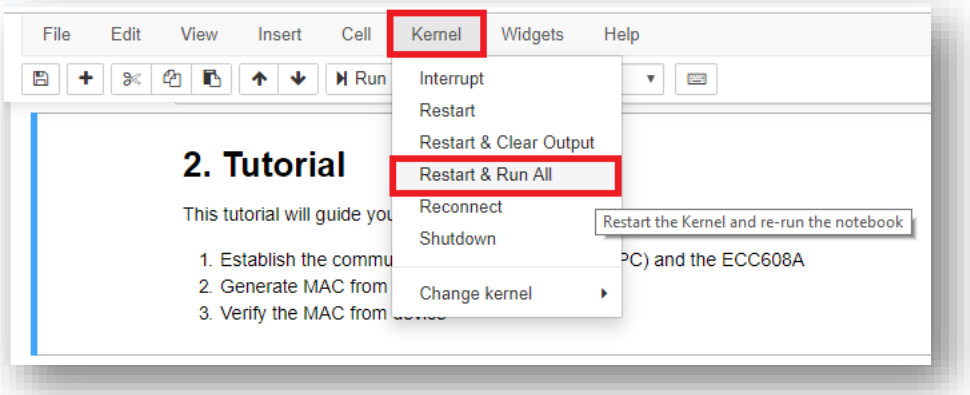
Jupyter Notebooks contain cells where you can either write code or markdown text. Notebooks contain multiple cells, some set as code and others markdown. Code cells contain code that can be executed live, and markdown contains text and images that explains the code.

Below image shows some options in a typical Jupyter Notebook. Individual cells can be executed by pressing on the RUN button as shown in the below image.

All cells in the Notebook can be executed in order by **Kernel->Restart & Run All**.



To run all cells in sequence.



2 Jupyter Notebook Tutorials

The TrustPlatform Design Suite comes with a number of Notebook Tutorials to easily prototype popular use cases for TrustFLEX and Trust&Go devices. Here is the list of Jupyter Notebook Tutorials.

Jupyter Notebook Tutorials	**Relative Path**	**Applicable Devices**
Manifest Generation	TrustnGO\00_resource_generation\TNGTLS_manifest_file_generation.ipynb	TrustnGO
Resource Generation	TrustFLEX\00_resource_generation\TFLXTLS_resource_generator.ipynb	TrustFLEX
Accessory Authentication	TrustFLEX\01_accessory_authentication\notebook\ TFLXTLS_accessory_authentication.ipynb	TrustFLEX
Firmware Validation	TrustFLEX\02_firmware_validation\notebook\ TFLXTLS_firmware_validation.ipynb	TrustFLEX
GCP Connect	TrustFLEX\03_gcp_connect\notebook\TFLXTLS_GCP_connect.ipynb	TrustFLEX
IP Protection	TrustFLEX\04_ip_protection\notebook\ TFLXTLS_IP_protection.ipynb	TrustFLEX
Secure Public Key Rotation	TrustFLEX\05_public_key_rotation\notebook\ TFLXTLS_public_key_rotation.ipynb	TrustFLEX
AWS Custom PKI	TrustFLEX\06_custom_pki_aws\notebook\ TFLXTLS_aws_connect.ipynb	TrustFLEX
Azure Connect	TrustFLEX\07_custom_pki_azure\notebook\ TLFXTLS_azure_connect.ipynb	TrustFLEX

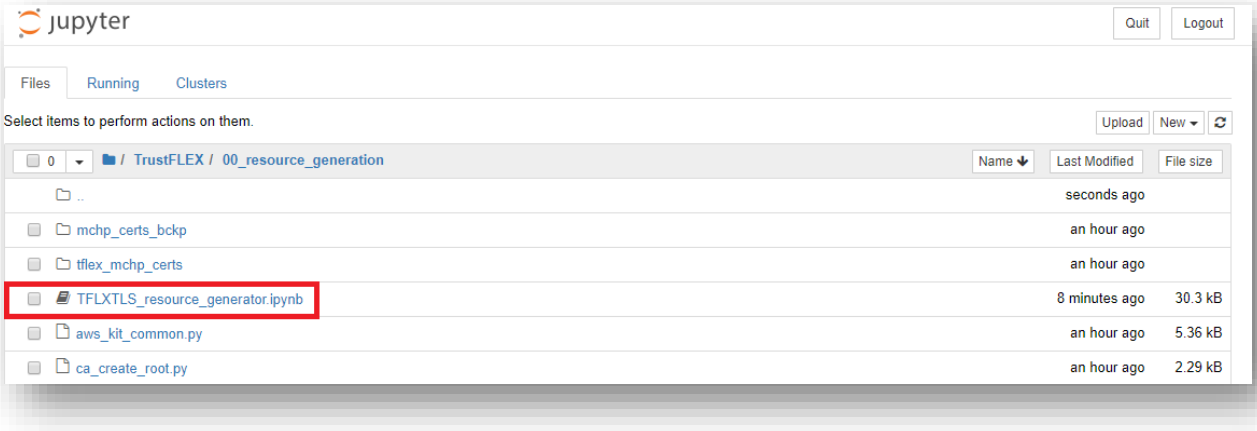
3 Resource Generation Notebook

TFLXTLS device is one of the three devices available in the Trust Platform USB Dongle Board.

TrustFLEX devices come pre-programmed with certificates in slots 10, 11 and 12, also slots 0-4 have pre-generated private keys, other than the mentioned slots all the other slots have no meaningful data in them.

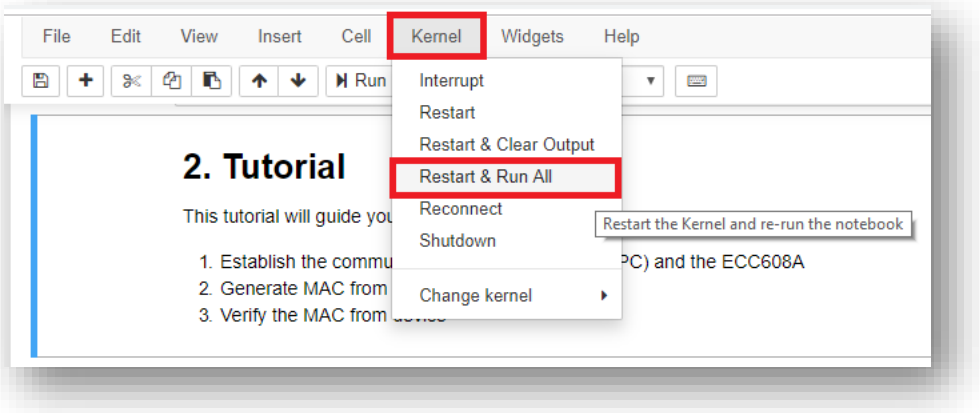
The Resource Generator Notebook will create development keys and certificates for all slots that can be further customized. Keys and Certificate chains are stored in the PC filesystem. These keys should never be used for production purposes as their generation is not handled in a secure environment. These development keys will be later used by the other notebooks to implement the various pre-defined use cases.

Within the Jupyter Dashboard, navigate **TrustFLEX\00_resource_generation** folder to open **TFLXTLS_resource_generator.ipynb** notebook

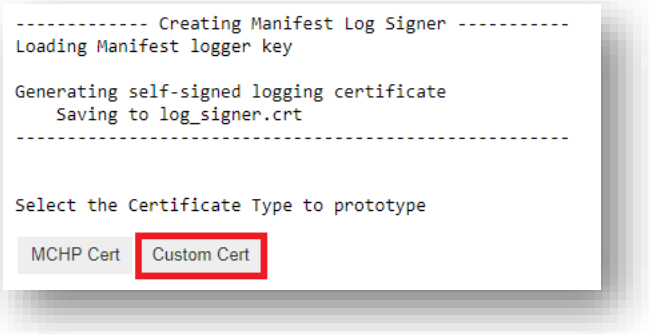


Run all cells of the Crypto Resource Generator Notebook: Kernel->Restart & Run All

Note: Before executing the cells on Crypto Trust Platform, its required to have factory default program running on SAMD21 of Trust Platform. Refer to 4.3 CryptoAuth TrustPlatform Factory reset section for reloading default program.



It will execute and prompt you to choose between MCHP certificate and a custom certificate chain, press "Custom Cert" option for this use case.



Now it prompts you to enter the organization name, enter the name that will be used as an Organization Name in the certificate template. The name length is limited to 24 characters.

The Notebook will generate a number of keys and certificates. Make sure you have an error free output before continuing to the next steps of the training.

The output log should resemble this:

Loading root CA key

Generating self-signed root CA certificate

```
   Saving to root-ca.crt

Loading signer CA key

Generating signer CA CSR
   Saving to signer-ca.csr

Loading signer CA CSR
   Loading from signer-ca.csr

Loading root CA key
   Loading from root-ca.pem

Loading root CA certificate
   Loading from root-ca.crt

Generating signer CA certificate from CSR
   Saving to signer-ca.crt

-------------------------------------------

Signer Certificate written successfully to device
Device Certificate written successfully to device
Thing ID c162f7cedb44317696f7fcf7c80c43cbee4a6c97

-------------------------------------------

Generating signer certificate definition header file - cust_def_1_signer.h
Generating device certificate definition header file - cust_def_2_device.h
Generating signer certificate definition source file - cust_def_1_signer.c
Generating device certificate definition source file - cust_def_2_device.c

-------------------------------------------

Custom certificate generation and provisioning - SUCCESS

-------------------------------------------

Root Certificate loading from: root-ca.crt
Certificate:
   Data:
      Version: 3 (0x2)
      Serial Number:
         46:ae:32:e9:71:02:da:03:24:27:f0:1c:0b:b9:84:9d
```

```
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: O = "custom_org            ", CN = Crypto Authentication Root CA 000
        Validity
            Not Before: Nov 19 06:38:32 2019 GMT
            Not After : Nov 12 06:38:32 2044 GMT
        Subject: O = "custom_org            ", CN = Crypto Authentication Root CA 000
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:f5:9b:35:8c:c5:5b:e8:30:94:ab:c0:d1:5a:0c:
                    40:45:7f:2b:21:a6:05:53:61:a9:d4:7e:fb:b9:7b:
                    a8:e6:7b:d8:ca:82:60:c3:57:f1:f8:a0:cf:f3:df:
                    39:d7:83:ba:d4:78:9f:7d:9b:6b:d3:99:e6:3a:57:
                    2e:9f:cd:c9:78
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        X509v3 extensions:
            X509v3 Subject Key Identifier:
                8F:28:E9:74:55:D1:49:52:9D:09:3C:70:00:9F:BB:11:79:9B:FB:3B
            X509v3 Basic Constraints: critical
                CA:TRUE
    Signature Algorithm: ecdsa-with-SHA256
         30:45:02:21:00:d9:9c:f1:01:7e:39:09:43:63:e8:8a:62:3b:
         e8:91:4a:b8:28:0e:92:4f:74:e6:f3:fb:42:ff:a2:0f:de:35:
         6d:02:20:01:e4:10:ee:7d:b5:64:ee:ba:18:6a:9d:16:0a:03:
         c8:9a:25:c3:f6:e1:8e:c7:8a:bf:f5:06:d7:90:8b:fc:5a
-----BEGIN CERTIFICATE-----
MIIBzjCCAXSgAwIBAgIQRq4y6XEC2gMkJ/AcC7mEnTAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhjdXN0b21fb3JnICAgICAgICAgICAgICAxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMDAeFw0xOTExMTkwNjM4MzJaFw00
NDExMTIwNjM4MzJaME8xITAfBgNVBAoMGGN1c3RvbV9vcmcgICAgICAgICAgICAg
IDEqMCgGA1UEAwwhQ3J5cHRvIEF1dGhlbnRpY2F0aW9uIFJvb3QgQ0EgMDAwMFkw
EwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAE9Zs1jMVb6DCUq8DRWgxARX8rIaYFU2Gp
1H77uXuo5nvYyoJgw1fx+KDP898514O61HiffZtr05nmOlcun83JeKMyMDAwHQYD
VR0OBBYEFI8o6XRV0UlSnQk8cACfuxF5m/s7MA8GA1UdEwEB/wQFMAMBAf8wCgYI
KoZIzj0EAwIDSAAwRQIhANmc8QF+OQlDY+iKYjvokUq4KA6ST3Tm8/tC/6IP3jVt
AiAB5BDufbVk7roYap0WCgPImiXD9uGOx4q/9QbXkIv8Wg==
-----END CERTIFICATE-----

Validate Root Certificate:
OK

Signer Certificate loading from: signer-ca.crt
```

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            67:f4:54:1e:c6:7b:9c:53:1a:eb:6c:71:c6:53:7e:11
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: O = "custom_org             ", CN = Crypto Authentication Root CA 000
        Validity
            Not Before: Nov 19 06:00:00 2019 GMT
            Not After : Nov 19 06:00:00 2029 GMT
        Subject: O = "custom_org             ", CN = Crypto Authentication Signer FFFF
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:79:5c:1d:e1:c4:42:9c:fd:a4:25:26:92:a8:1c:
                    a5:bb:a5:e2:f4:00:24:b9:a9:93:45:44:45:94:d1:
                    61:5f:89:73:92:9d:f5:7d:90:6c:c0:be:93:89:ef:
                    69:cc:ce:80:b7:03:c6:2e:9e:b1:01:de:be:b0:4d:
                    20:26:33:b4:f9
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        X509v3 extensions:
            X509v3 Key Usage: critical
                Digital Signature, Certificate Sign, CRL Sign
            X509v3 Basic Constraints: critical
                CA:TRUE, pathlen:0
            X509v3 Subject Key Identifier:
                1C:27:0D:E4:22:01:30:6A:37:0F:F9:68:E4:D8:91:04:C9:37:D5:82
            X509v3 Authority Key Identifier:
                keyid:8F:28:E9:74:55:D1:49:52:9D:09:3C:70:00:9F:BB:11:79:9B:FB:3B

    Signature Algorithm: ecdsa-with-SHA256
         30:45:02:21:00:c6:8d:c9:fd:a0:07:6f:6d:ab:c3:4e:cd:bf:
         d1:eb:61:a1:80:1b:fd:b0:6f:b3:6e:eb:fe:2c:ef:4b:f7:2d:
         6f:02:20:66:ed:8f:4a:60:1a:34:56:e3:6d:2b:e9:01:ba:3b:
         5b:37:b2:b7:7b:bf:a5:58:d7:37:cd:55:9b:a8:e4:15:eb
-----BEGIN CERTIFICATE-----
MIICAjCCAaigAwIBAgIQZ/RUHsZ7nFMa62xxxlN+ETAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhjdXN0b21fb3JnICAgICAgICAgICAgICAxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMDAeFw0xOTExMTkwNjAwMDBaFw0y
OTExMTkwNjAwMDBaME8xITAfBgNVBAoMGGN1c3RvbV9vcmcgICAgICAgICAgICAg
IDEqMCgGA1UEAwwhQ3J5cHRvIEF1dGhlbnRpY2F0aW9uIFNpZ25lciBGRkZGMFkw
EwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAEeVwd4cRCnP2kJSaSqBylu6Xi9AAkuamT
```

```
RURFlNFhX4lzkp31fZBswL6Tie9pzM6AtwPGLp6xAd6+sE0gJjO0+aNmMGQwDgYD
VR0PAQH/BAQDAgGGMBIGA1UdEwEB/wQIMAYBAf8CAQAwHQYDVR0OBBYEFBwnDeQi
ATBqNw/5aOTYkQTJN9WCMB8GA1UdIwQYMBaAFI8o6XRV0UlSnQk8cACfuxF5m/s7
MAoGCCqGSM49BAMCA0gAMEUCIQDGjcn9oAdvbavDTs2/0ethoYAb/bBvs27r/izv
S/ctbwIgZu2PSmAaNFbjbSvpAbo7Wzeyt3u/pVjXN81Vm6jkFes=
-----END CERTIFICATE-----

Validate Signer Certificate:
OK

Device Certificate loading from: device_cert.crt
Certificate:
   Data:
      Version: 3 (0x2)
      Serial Number:
         4b:58:a6:d8:9c:be:92:41:bc:f8:57:54:df:02:2b:3e
      Signature Algorithm: ecdsa-with-SHA256
      Issuer: O = "custom_org            ", CN = Crypto Authentication Signer FFFF
      Validity
         Not Before: Nov 19 06:00:00 2019 GMT
         Not After : Nov 19 06:00:00 2029 GMT
      Subject: O = "custom_org            ", CN = 01239E0A9490433401_ATECC
      Subject Public Key Info:
         Public Key Algorithm: id-ecPublicKey
            Public-Key: (256 bit)
            pub:
               04:0f:eb:6a:61:45:3e:f7:97:58:f9:dc:98:13:98:
               e0:20:10:99:7a:49:3e:c8:ab:29:01:79:bc:4e:13:
               7a:1e:cf:c3:e3:2e:89:66:7b:6e:cf:9c:0f:c3:10:
               15:c0:35:64:ac:28:b8:9f:8e:f4:68:d5:f3:d9:a2:
               4f:17:28:a9:0d
            ASN1 OID: prime256v1
            NIST CURVE: P-256
      X509v3 extensions:
         X509v3 Basic Constraints: critical
            CA:FALSE
         X509v3 Key Usage: critical
            Digital Signature, Certificate Sign, CRL Sign
         X509v3 Subject Key Identifier:
            C1:62:F7:CE:DB:44:31:76:96:F7:FC:F7:C8:0C:43:CB:EE:4A:6C:97
         X509v3 Authority Key Identifier:
            keyid:1C:27:0D:E4:22:01:30:6A:37:0F:F9:68:E4:D8:91:04:C9:37:D5:82

   Signature Algorithm: ecdsa-with-SHA256
```

```
        30:45:02:20:3f:e6:c7:a5:17:80:57:d6:69:04:36:01:34:5e:
        0e:c2:f3:8a:17:2f:a5:6b:41:ca:9e:79:23:42:1d:60:1e:6e:
        02:21:00:bb:d6:59:98:a0:a1:34:4e:81:b8:c9:1d:ae:54:18:
        7f:f2:57:46:34:5e:e9:03:ff:7f:39:4e:eb:d2:a3:72:8d
-----BEGIN CERTIFICATE-----
MIIB8zCCAZmgAwIBAgIQS1im2Jy+kkG8+FdU3wIrPjAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhjdXN0b21fb3JnICAgICAgICAgICAgICAxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBTaWduZXIgRkZGRjAeFw0xOTExMTkwNjAwMDBaFw0y
OTExMTkwNjAwMDBaMEYxITAfBgNVBAoMGGN1c3RvbV9vcmcgICAgICAgICAgICAg
IDEhMB8GA1UEAwwYMDEyMzlFMEE5NDkwNDMzNDAxX0FURUNDMFkwEwYHKoZIzj0C
AQYIKoZIzj0DAQcDQgAED+tqYUU+95dY+dyYE5jgIBCZekk+yKspAXm8ThN6Hs/D
4y6JZntuz5wPwxAVwDVkrCi4n470aNXz2aJPFyipDaNgMF4wDAYDVR0TAQH/BAIw
ADAOBgNVHQ8BAf8EBAMCAYYwHQYDVR0OBBYEFMFi987bRDF2lvf898gMQ8vuSmyX
MB8GA1UdIwQYMBaAFBwnDeQiATBqNw/5aOTYkQTJN9WCMAoGCCqGSM49BAMCA0gA
MEUCID/mx6UXgFfWaQQ2ATReDsLzihcvpWtByp55I0IdYB5uAiEAu9ZZmKChNE6B
uMkdrlQYf/JXRjRe6QP/fzlO69Kjco0=
-----END CERTIFICATE-----

Validate Device Certificate:
OK

Generated the manifest file 01239e0a9490433401_manifest.json
Custom Certificate processing completed successfully

-------------------------------------------
```

At the end of the execution, a Custom PKI chain will be generated on your PC and TrustFLEX device specific slots (10 through 12) will be overwritten with the custom certificates.

The Notebook has also generated a manifest file to be uploaded into the public cloud of your choice (Google GCP, AWS IoT and Microsoft Azure).

4 Use Case Prototyping

This hands-on lab is intended to demonstrate the usage of TrustFLEX to secure an AWS IoT connection based on a custom PKI.

The AWS IoT device reference implementation is provided as an MPLAB X project and the generation of a custom PKI is achieved through the execution of Jupyter Notebook Tutorials.

Here are the steps that will be required to complete this Tutorial:

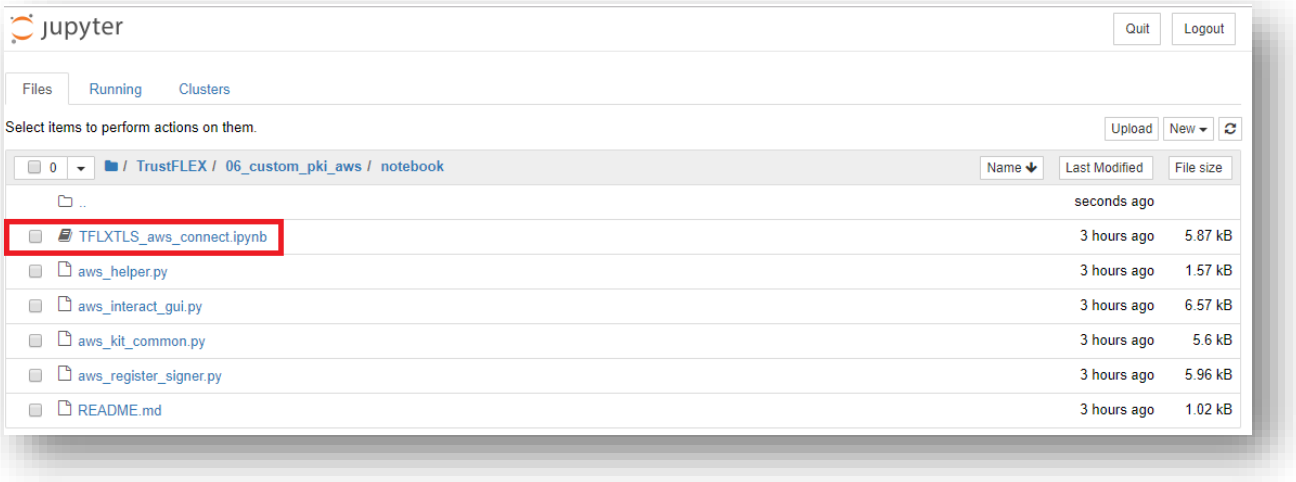
- Configure AWS CLI
- Register Custom PKI signer
- Build the AWS IoT device source code and flash it to the USB Dongle Board

Note: It is required to have an AWS IoT test account setup. Instruction to setup the account quickly is provided in **docs\TrustFLEX AWS demo account setup instructions.pdf**.

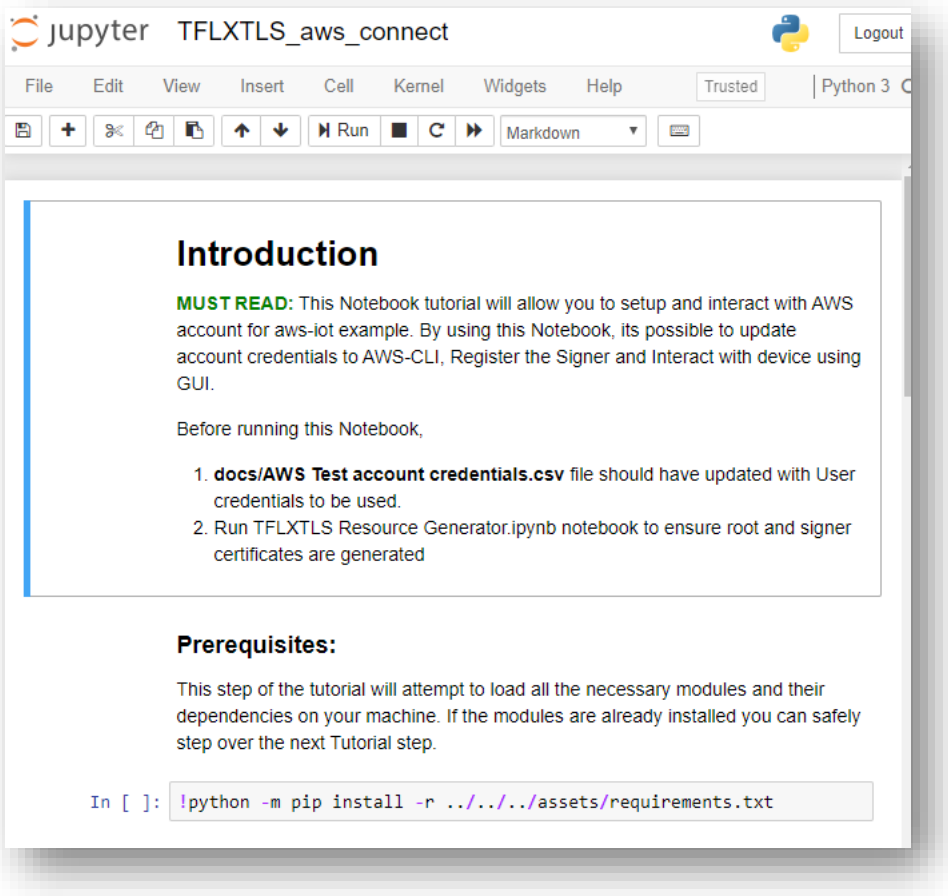
4.1 Running Custom PKI example on Jupyter Notebook

By running this following step, we can configure the AWS command line with AWS credentials, register the signer certificate to AWS IoT and get AWS host endpoint to which device should connect.

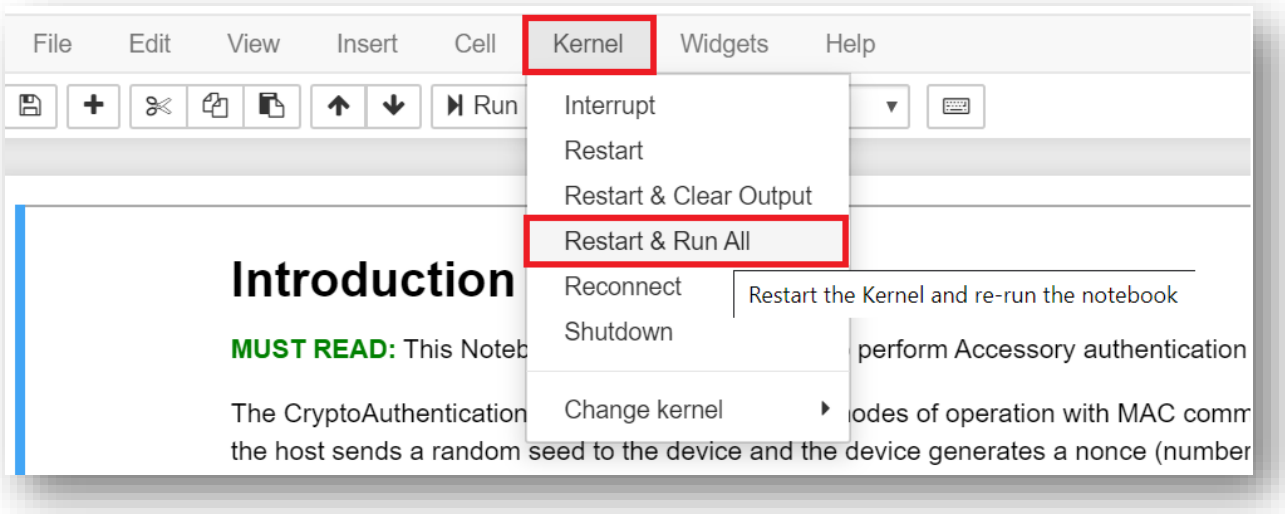
1. From the Jupyter Home page, navigate to **TrustFLEX\06_custom_pki_aws\notebook\TFLXTLS_aws_connect.ipynb** notebook file and open it.



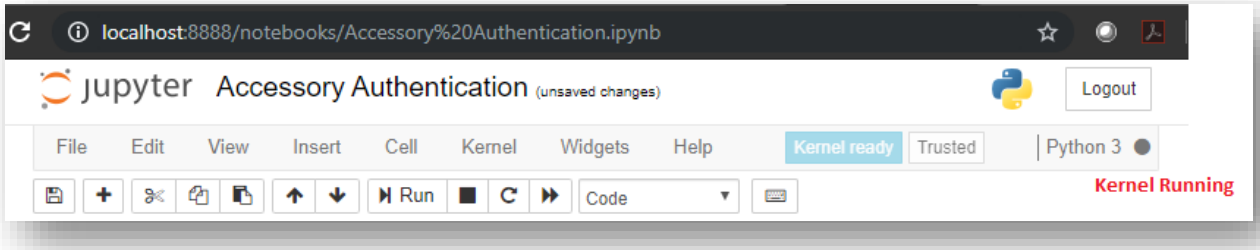
Opening the Jupyter notebook example should load the following on the browser.

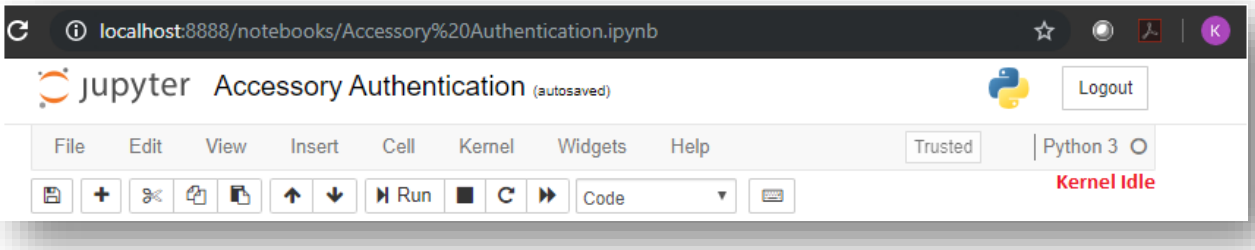


2. Run All Cells by using Kernel -> Restart & Run All



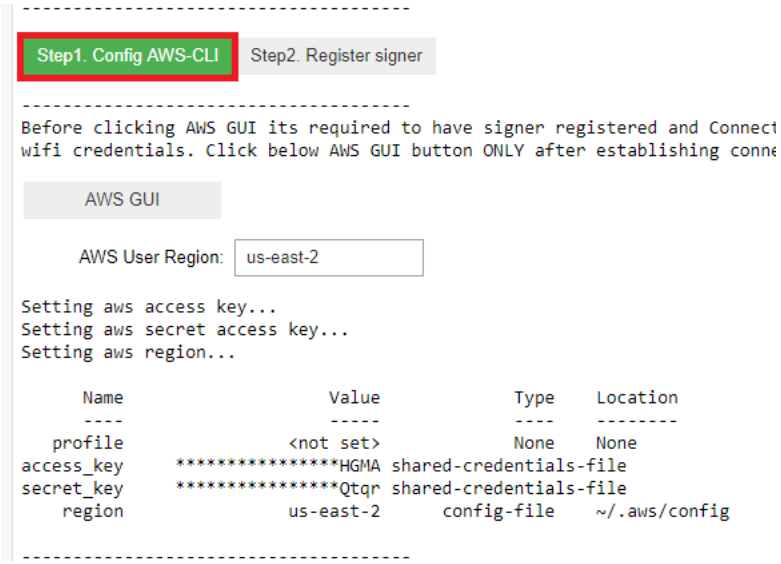
It may take a while to complete, wait for the kernel to complete all processing i.e. from Kernel Running to Kernel Idle state (Check circle above **RED** text)





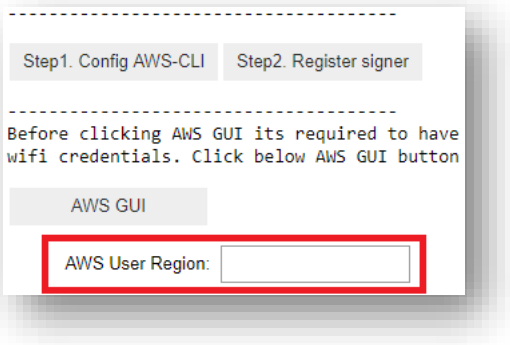
3. Navigate through different cells output for the description of the step and result from the execution.

4. There are 4 major steps:
   Configure AWS command line interface:
   Before we can interact with AWS, we need to configure the tools with the appropriate AWS credentials. These credentials are composed of the **Access Key ID** and the **Secret Access Key**. Outside of the classroom, they will be generated when creating the IAM user.
   Below screenshot display the configured AWS credentials



   Enter your region:

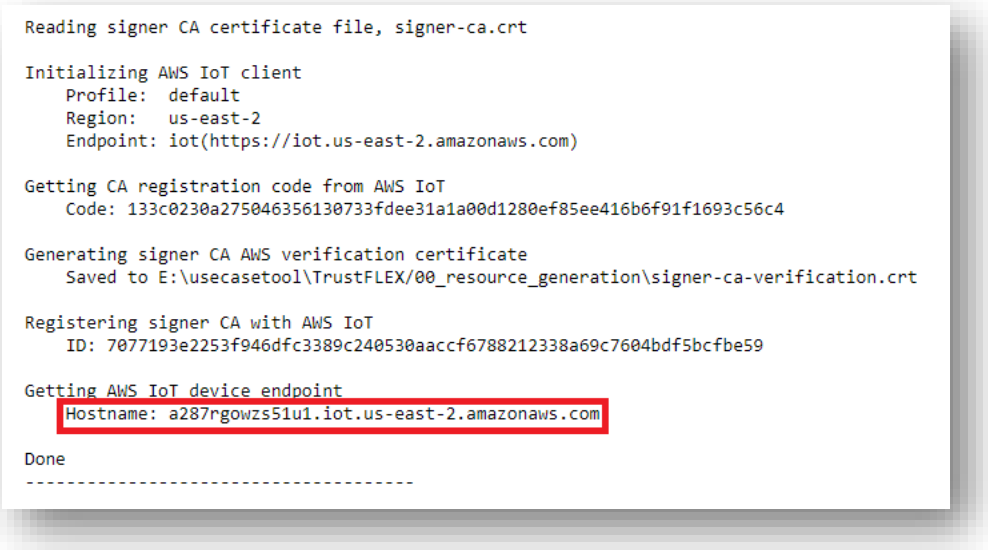
Below screenshot display the option to enter your region



Register Signer Module:

Code block of this step generates "**Register signer**" button. Clicking the button, it registers the custom PKI signer module to the AWS account, and gives an AWS host endpoint. To establish a secure communication with AWS IoT, we need to register the Custom PKI signer certificate to AWS IoT.

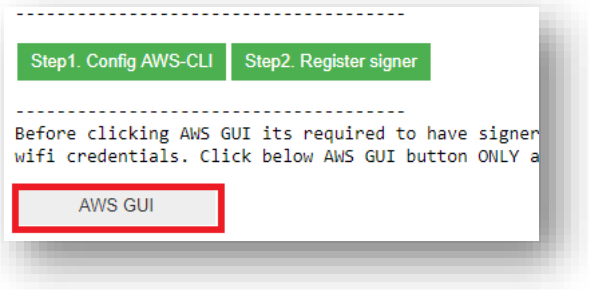
Upon successful execution, the log should look like this. The marked URL is the endpoint to which the device must connect. It will be added to the device firmware in the next section



Once this step is completed, signer module is successfully registered to AWS IoT. Before running the last cell, we need to program the Crypto Trust Platform. So next step is to program the Crypto Trust Platform.

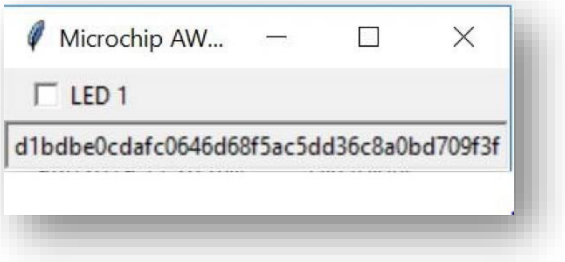
NOTE: Make sure that you executed C project successfully before executing the next step in the Jupyter notebook. To execute C project, refer "Running AWS IoT example on Embedded platform" next section.

AWS GUI:
Code block of this step generates "**AWS GUI**" button.



Clicking the button, it will create a very basic graphical interface that will display the device ID and will allow to switch the board LED status.

Below screenshot display the graphical interface



Using this interface, Custom PKI CryptoAuth Trust Platform can able to communicate with AWS IoT. Upon successful communication, you have now a device connected to AWS IoT through a secure TLS session with a custom PKI using a Crypto Trust Platform.

4.2 Running Custom PKI example on Embedded platform

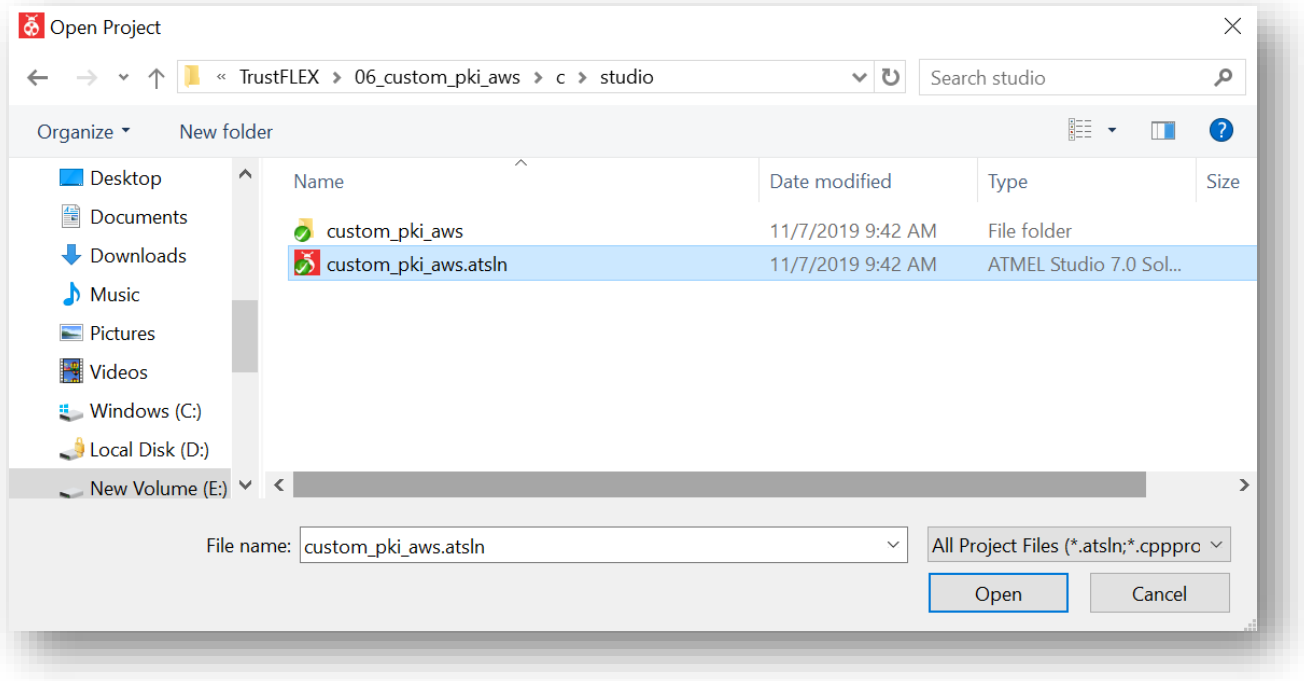
Once the resources are generated both Atmel Studio and MPLAB projects provided can be used to run the use case on CryptoAuth Trust Platform.

This project can configure the Wi-Fi credentials, establish a TLS connection, subscribe to MQTT and register device certificate but not register the signer module to AWS IoT. It is required to use the AWS IoT Jupyter notebook to register the signer module and get the AWS endpoint to which device must connect.

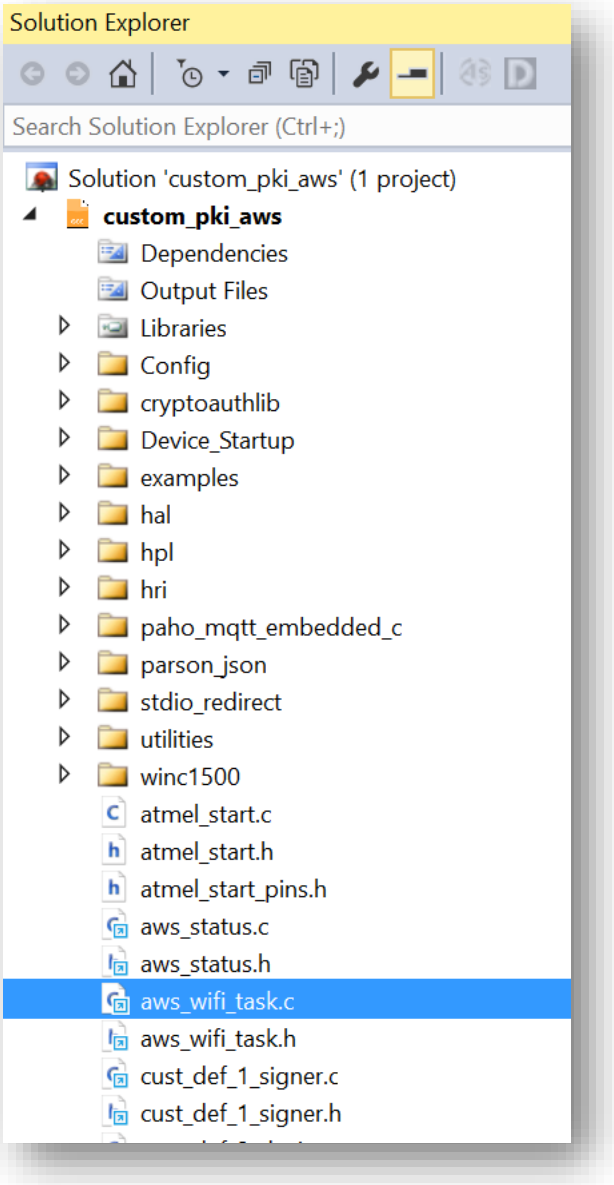
Once the signer module is registered and AWS endpoint is available then these embedded projects can be executed.

4.2.1 Atmel Studio:

1. Open **custom_pki_aws.atsln** project by navigating **TrustFLEX\06_custom_pki_aws\c\studio\custom_pki_aws.atsln**



2. In the project navigate to **custom_pki_aws -> aws_wifi_task.c** file



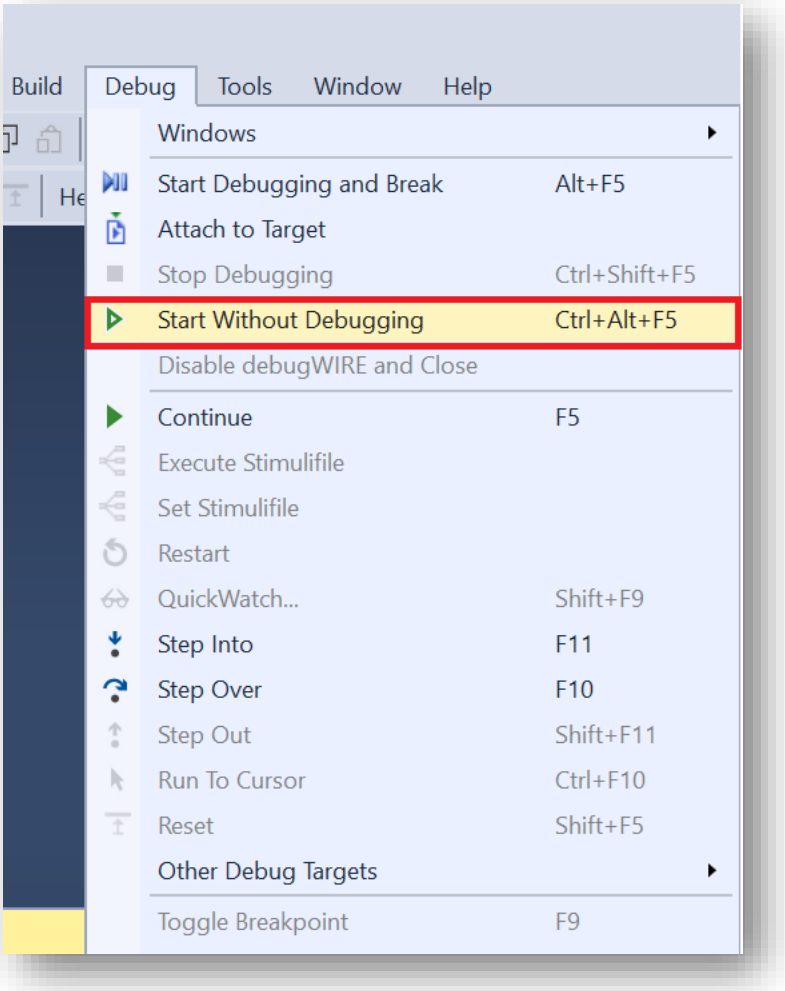
update the following constants before building the project:

- MAIN_WLAN_SSID
- MAIN_WLAN_PSK
- AWS_HOST_ENDPOINT

The AWS_HOST_ENDPOINT string should be set to the value reported by the Jupyter Notebook of the section 4.3 (field Hostname)

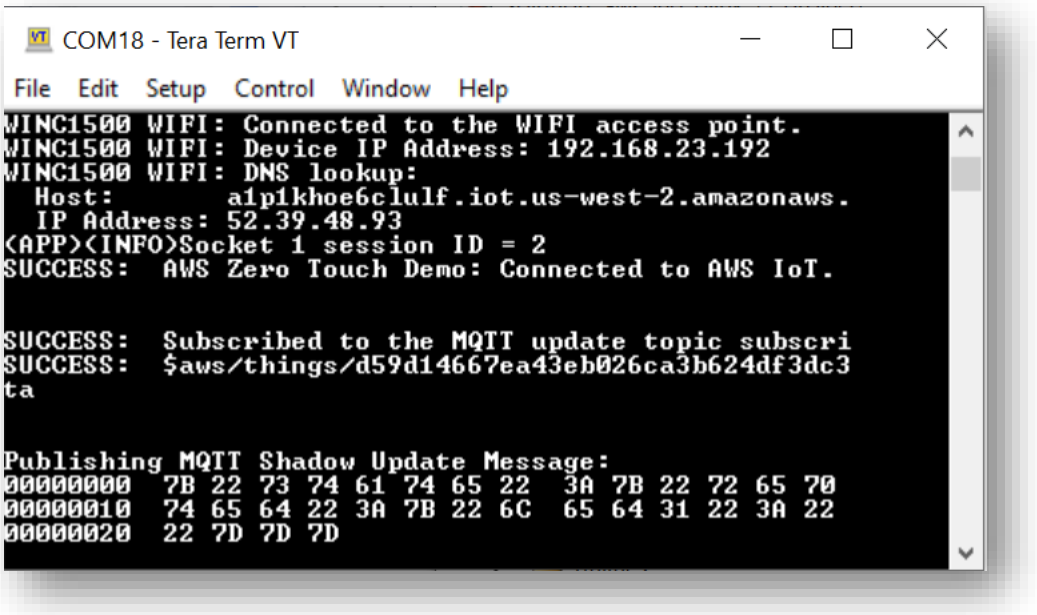
```
#define MAIN_WLAN_SSID       "xxxxxx"
#define MAIN_WLAN_AUTH       M2M_WIFI_SEC_WPA_PSK
#define MAIN_WLAN_PSK        "xxxxxxxxxx"

#define AWS_HOST_ENDPOINT    "xxxxxxx.iot.us-west-2.amazonaws.com"
```

3. Program the CryptoAuth Trust Platform by navigating to **Debug -> Start Without Debugging**



This step may take some time, wait for Atmel Studio to compile and program the device.

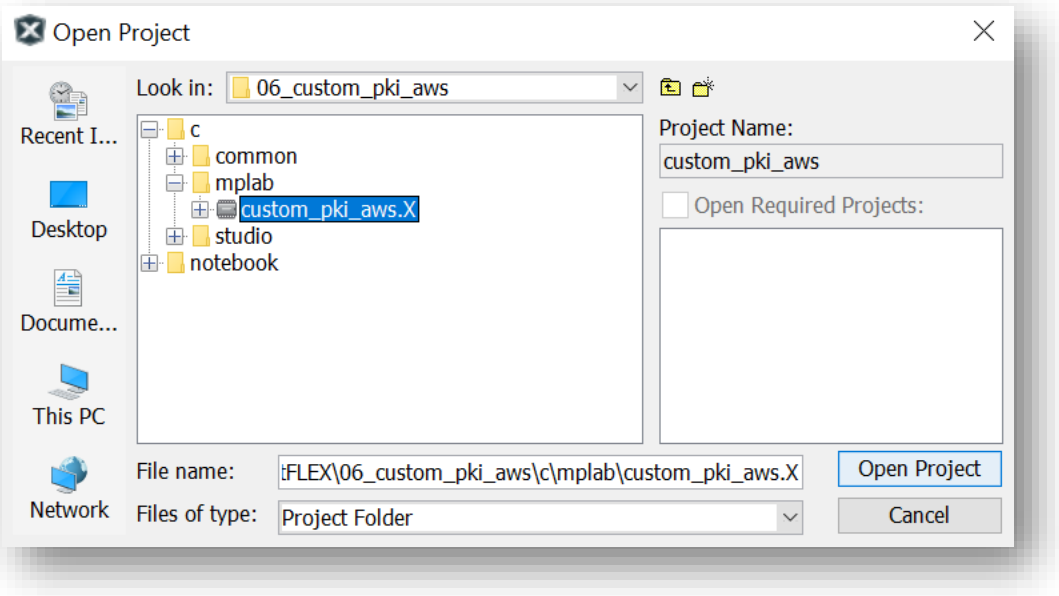
Once the programming is done, reset the hardware (press the reset button) and view the Console messages by using applications like 'Tera Term'. Open the application with the COM related to CryptoAuth Trust Platform with 115200-8-N-1 settings.



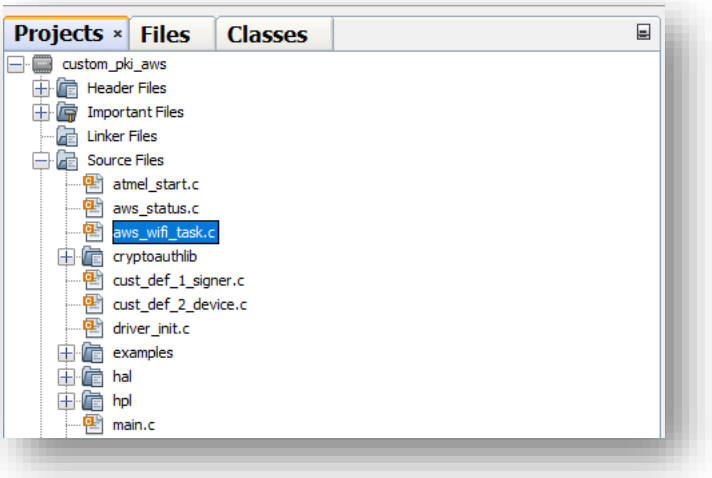
Once successfully programmed the CryptoAuth Trust Platform, now we can run the last step in the Jupyter Notebook. Just navigate to previous section 4.3 to run the last step (AWS GUI) in the Jupyter Notebook.

4.2.2 MPLAB:

1. Open **custom_pki_aws.X** project by navigating to MPLAB -> File -> Open Project -> **TrustFLEX\06_custom_pki_aws\c\mplab\custom_pki_aws.X**



2. Open **aws_wifi_task.c file** by navigating to **custom_pki_aws -> Source Files -> aws_wifi_task.c**



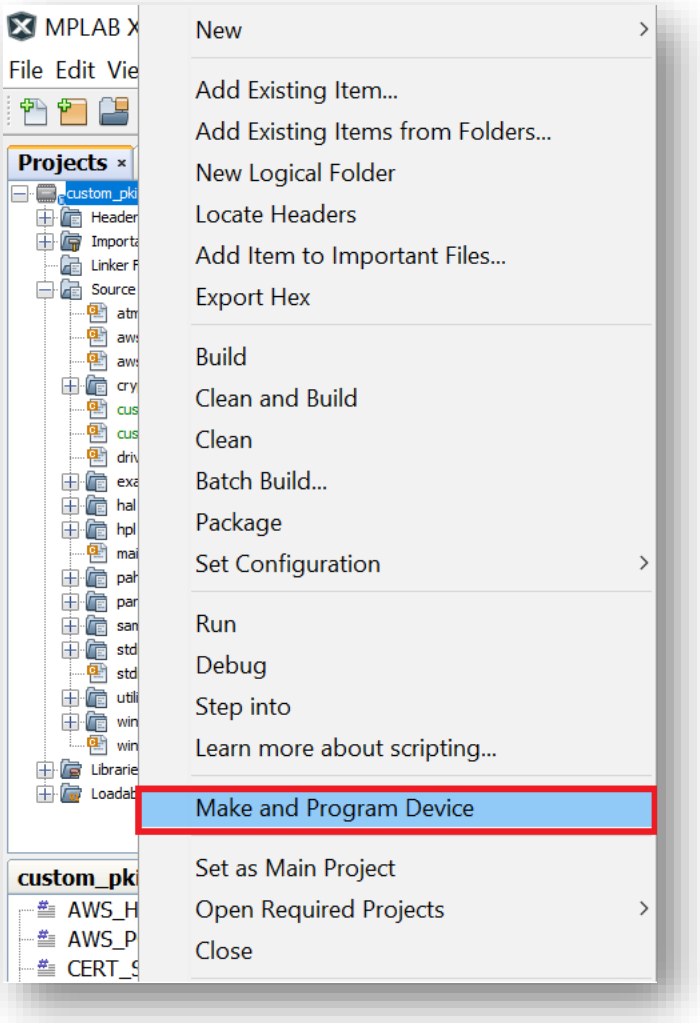
update the following constants before building the project:

- MAIN_WLAN_SSID
- MAIN_WLAN_PSK
- AWS_HOST_ENDPOINT

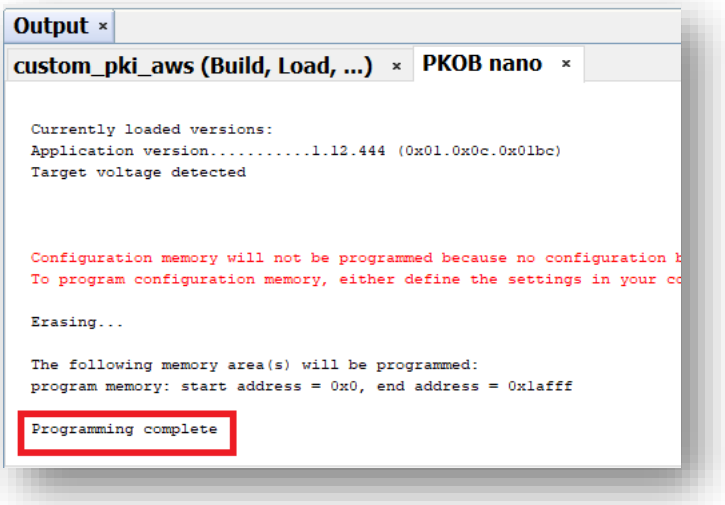
The AWS_HOST_ENDPOINT string should be set to the value reported by the Notebook of the section 4.3 (field Hostname)

```
49
50  #define MAIN_WLAN_SSID       "XXXXXXX"
51  #define MAIN_WLAN_AUTH       M2M_WIFI_SEC_WPA_PSK
52  #define MAIN_WLAN_PSK        "XXXXXXX"
53
54  #define AWS_HOST_ENDPOINT    "XXXXXXXXX.iot.us-west-2.amazonaws.com"
55
```

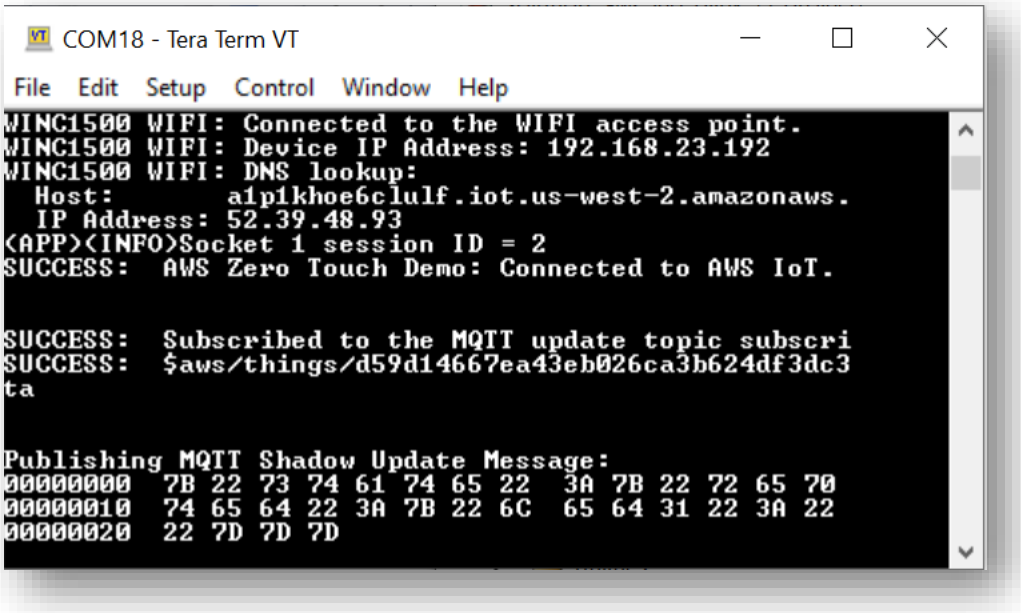
3. Program the CryptoAuth Trust platform by navigating to **custom_pki_aws -> Make and Program Device**



This step may take some time, wait for MPLAB to program the device. Once it is done programming you will see "**Programming complete**" message in Output Window.



Once the programming is done, reset the hardware (press the reset button) and view the Console messages by using applications like 'Tera Term'. Open the application with the COM related to CryptoAuth Trust Platform with 115200-8-N-1 settings.



Once successfully programmed the CryptoAuth Trust Platform, now we can run the last step in the Jupyter Notebook. Just navigate to previous section 4.3 to run the last step (AWS GUI) in the Jupyter Notebook

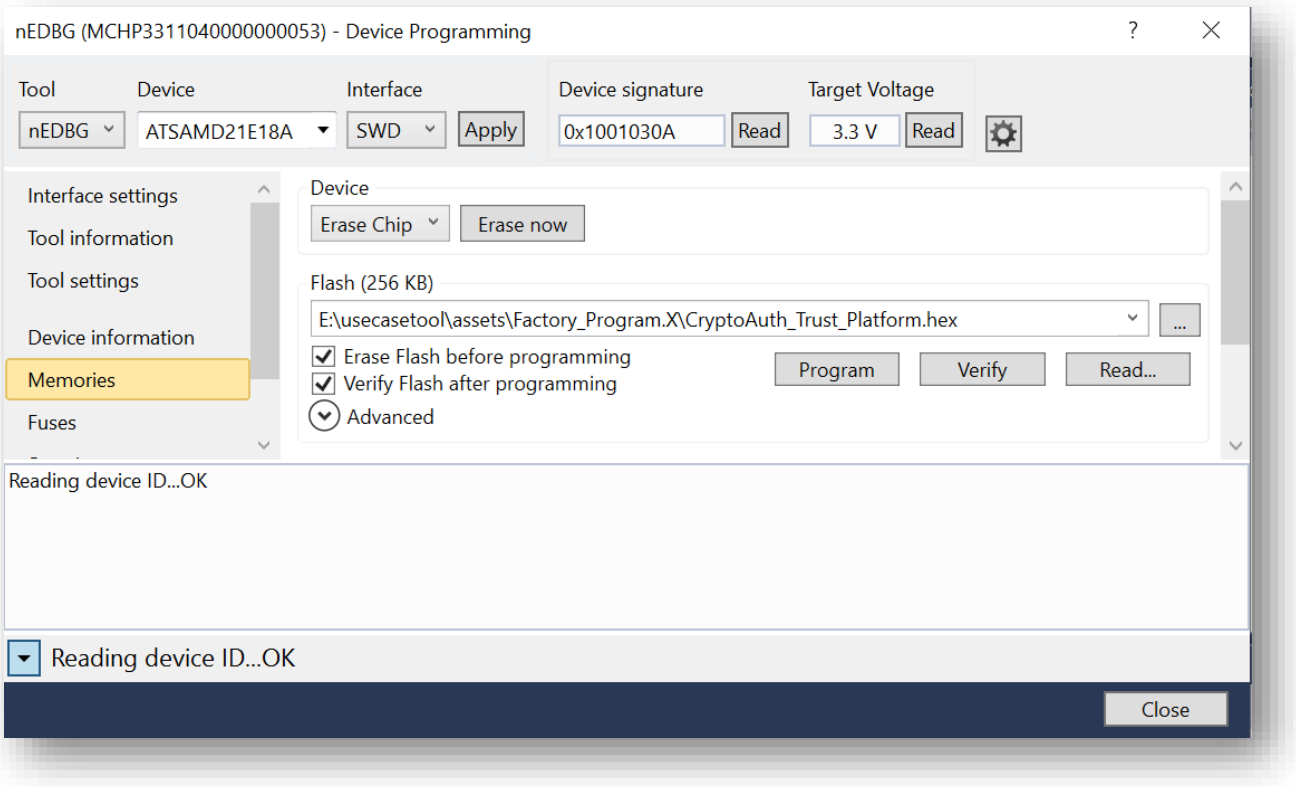
4.3 CryptoAuth Trust Platform Factory reset

If any embedded project is loaded to CryptoAuth Trust Platform, the default program that enables interaction with CryptoAuth Trust Platform tools will be erased.

Before using the CryptoAuth Trust Platform with any other notebook or tools on PC, its required to reprogram the default firmware. Default hex file is available at **assets\Factory_Program.X\CryptoAuth_Trust_Platform.hex**

To reprogram using Atmel Studio:

1. Navigate to AtmelStudio -> Tools -> Device Programming
2. Select Tool as nEDBG and Apply
3. Go to Memories and navigate to above path under Flash dropdown
4. Check both Erase Flash and Verify Flash
5. Click on Program



To reprogram using MPLAB:

1. Open **assets\Factory_Program.X** project in MPLAB IDE
2. Program the Crypto Trust platform by navigating to **CryptoAuth_Trust_Platform_Factory_Program -> Make and Program Device**

Now, CryptoAuth Trust Platform contains factory application that enables interactions with Notebooks and/or PC tools.

5 FAQ

1. **What are the reasons for "AssertionError: Can't connect to the USB dongle" error?**
   There are many possibilities like,
   1. Crypto Trust Platform is having different application than factory reset firmware. Refer to "CryptoAuth TrustPlatform Factory reset" section any usecase TrustFLEX Guide for reloading it
   2. Check the switch positions on Crypto Trust Platform and/or ATECC608A Trust board
      a. Correct Trust device should be connected and only one device of that type is allowed on the I2C bus. Multiple devices with same address results in error
   3. Check USB connections to Crypto Trust Platform

2. **How to reload factory default application to Crypto Trust Platform?**
   Refer to "CryptoAuth TrustPlatform Factory reset" section any usecase TrustFLEX Guide for reloading it.

3. **Why does my C projects generates No such file or directory with ../../../ TFLXTLS_resource_generation/?**
   C project generates this error when the resources are not generated prior to using embedded projects. Running the resource generation notebook ensures these files and secrets are generated.

4. **Before running any use case notebook and/or C project, why is it mandate to execute resource generation?**
   When resource generation notebook is executed, it generates and programs the required resources like secrets, keys and certificates. These are only prototyping keys and cannot be used for production. These keys will be used part of Usecase notebooks and C projects

5. **How to know the resources being used in a use case?**
   Refer to individual Usecase description html for details on transaction diagrams, resources being used and other details. The resources required for given use case is mentioned in INFER CRYPTOGRAPHIC ASSETS section.

6. **When should I select Custom certificates while doing resource generation?**
   Custom certificates are required when user wants to have their own root, signer instead of MCHP provided. The difference would be organization name, common name and validity are configurable

7. **How to know whether C project is executing on Trust Platform or not after programming?**
   Once the programming is done, the firmware will do use case operation. Depending on the use case operation's output, the Crypto Trust Platform board's status LED will blink at different rates.
   If use case operation succeeds, LED blinks once every second. If it fails, LED blinks five times every second.

It is also possible to view the Console messages by using applications like TeraTerm. Open the application with the COM related to Crypto Trust Platform with 115200-8-N-1 settings

8. **Why AWS demo application is not getting connected to cloud?**

   There are many possibilities like,

   a. Signer registration is not done to the right account
   b. aws client region is select incorrectly
   c. WiFi credentials are not populated or in correct in C project
   d. aws-iot endpoint is not populated or in-correct in C project

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