Trust&GO Step by Step Guide Accessory Asymmetric Authentication

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1 Introduction

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

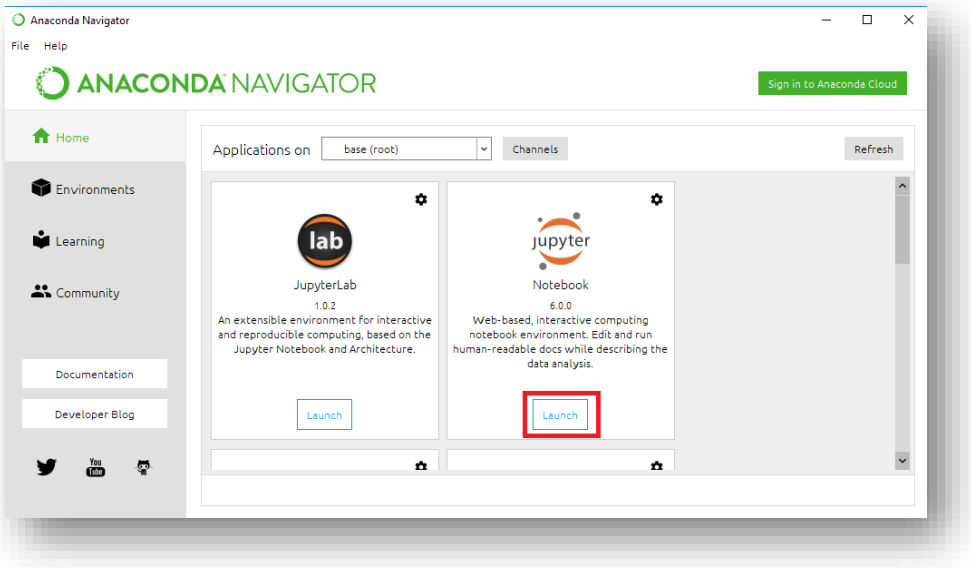
1.1 Getting started with Jupyter Notebook Tutorials

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 the Anaconda Navigator main window.



1.2 Jupyter Notebook Basics

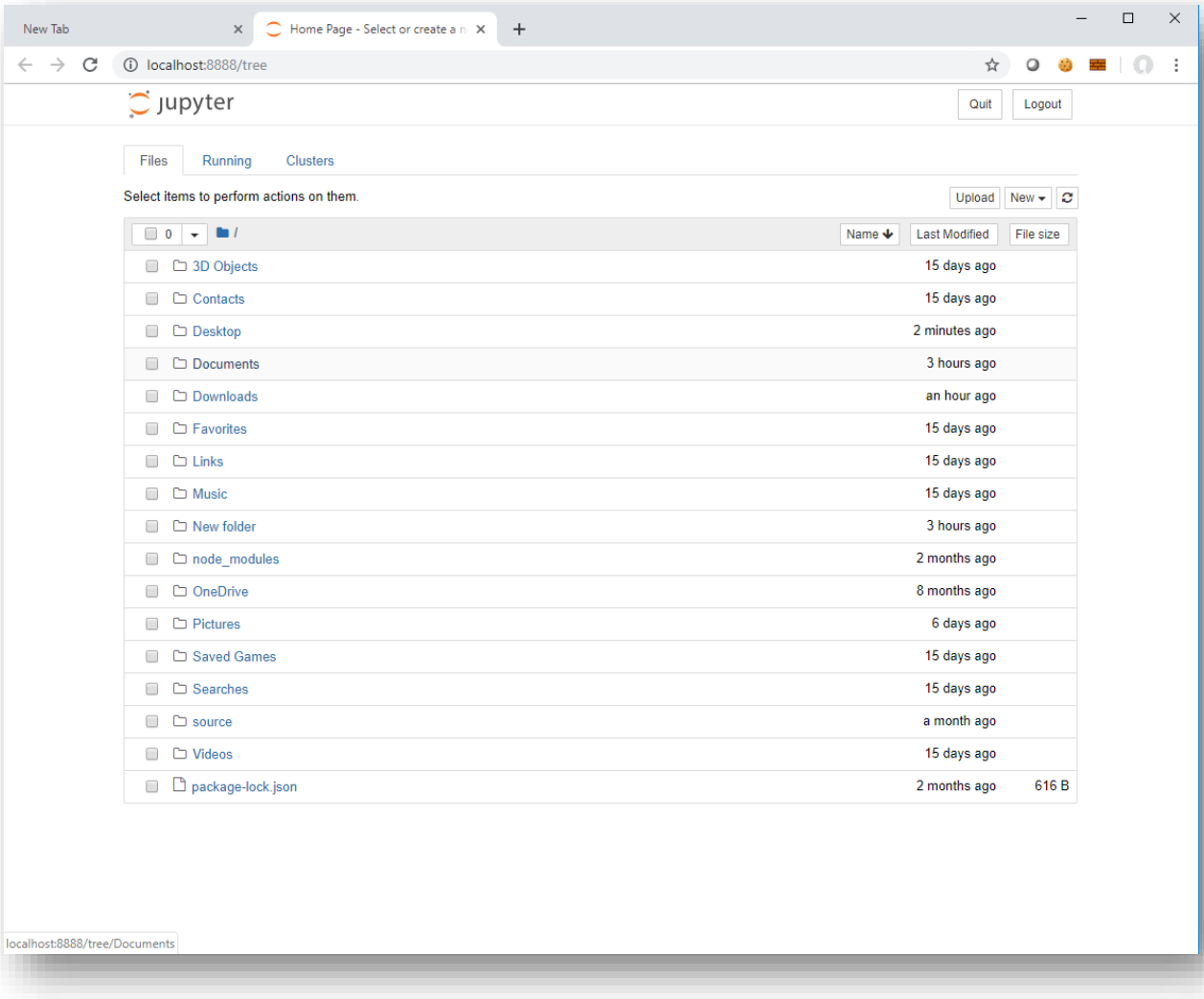
It is recommended to become familiar with Jupyter basic concepts with the online documentation, https://jupyter-notebook.readthedocs.io/en/stable/examples/Notebook/Notebook%20Basics.html

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 to the 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 on sub-directories in the notebook list, you can navigate your file system.

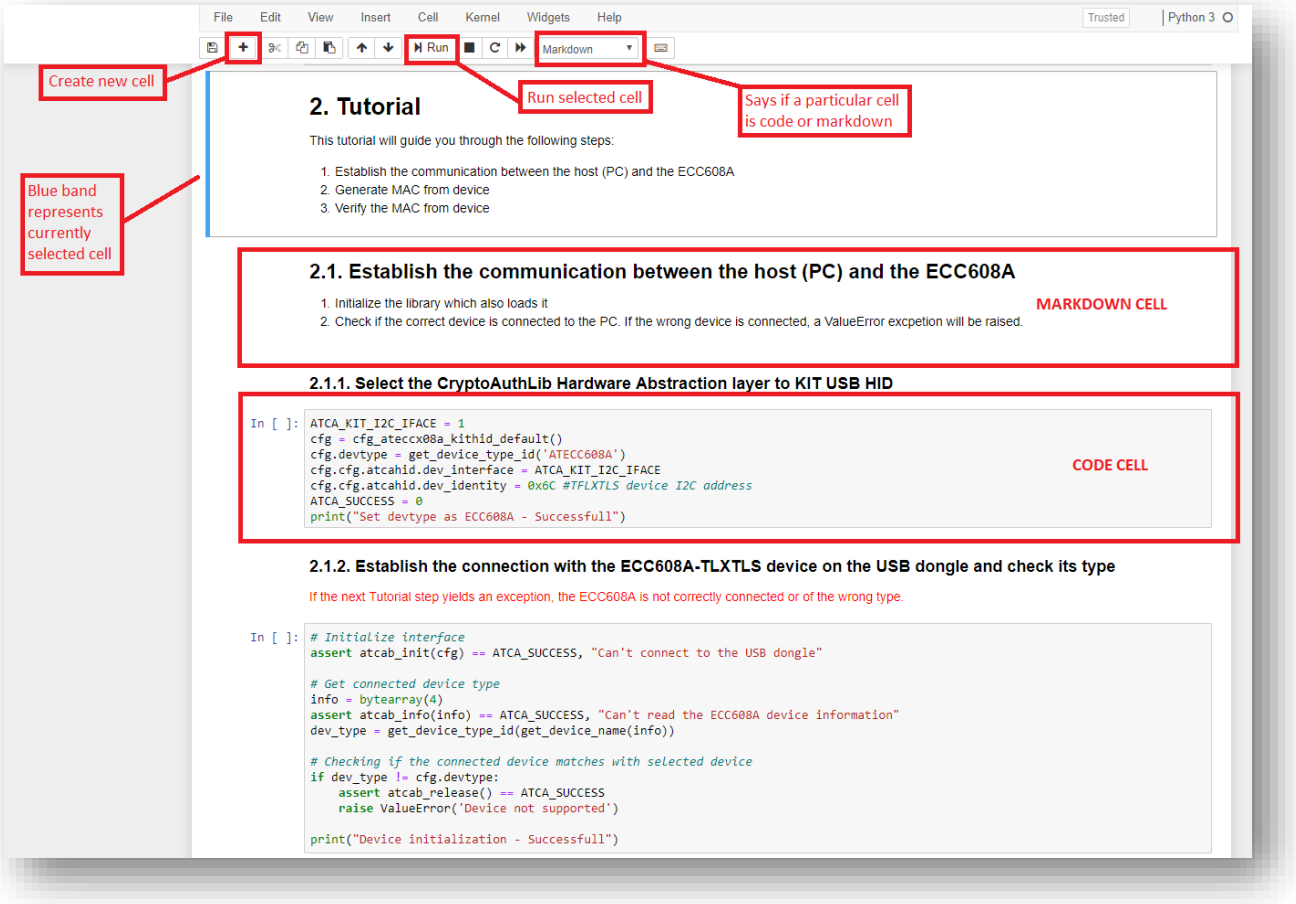


1.3 Introduction to Jupyter Notebook GUI.

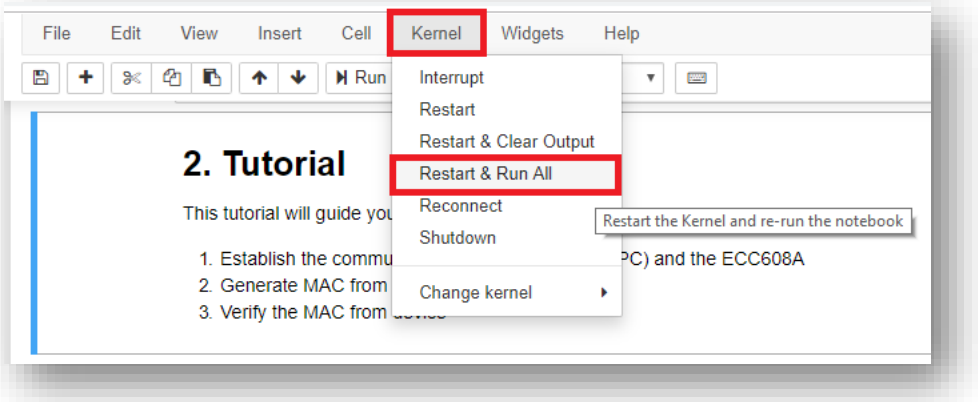
Jupyter Notebooks contain cells where you can either write code or markdown text. Notebooks contain multiple cells, some set as code and others markdown. Code cells contain code that can be executed live, and markdown contains text and images to explain the code.

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 Trust Platform Design Suite comes with Notebook Tutorials to easily prototype popular use cases for TrustFLEX. 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	Trust&GO
AWS Connect	TrustnGO\01_aws_connect\notebook\TNGTLS_aws_connect.ipynb	
GCP Connect	TrustnGO\02_gcp_connect\notebook\TNGTLS_GCP_connect.ipynb	
Accessory Asymmetric Authentication	TrustnGO\03_asymmetric_authentication\notebook\ TNGTLS_asymmetric_authentication.ipynb	

3 Generate Manifest files

In the real scenarios, the Manifest files for Trust&GO and TrustFLEX should be downloaded from microchipDirect. Once devices have shipped, you will be able to download the Manifest file from your Microchip Purchasing & Client Services Account. The file can then be uploaded into your cloud service account.

Kits, demonstration boards do not ship with a Manifest file.

The following sections provide steps to generate manifest files for Trust&GO and TrustFLEX devices during prototyping the Usecases.

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.

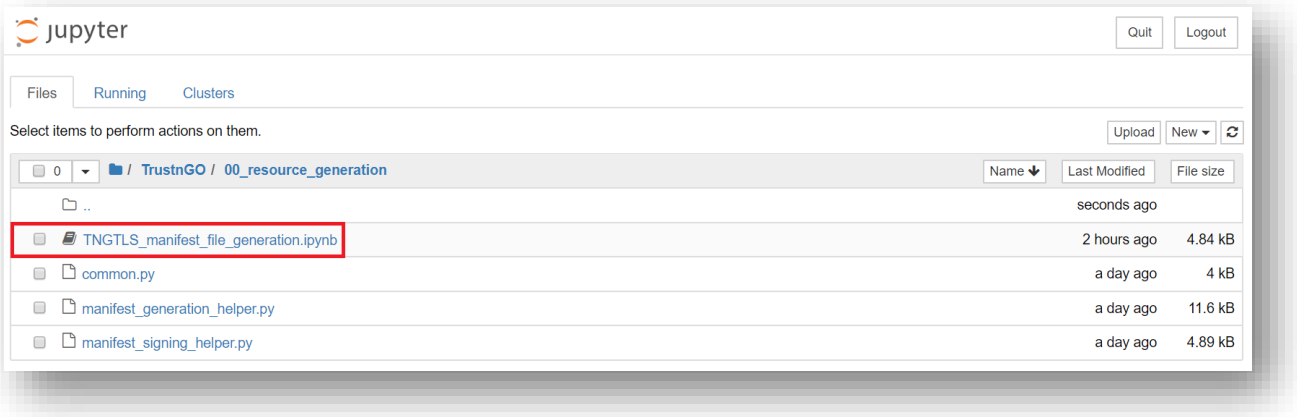
3.1 Trust&GO – Manifest file generation

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

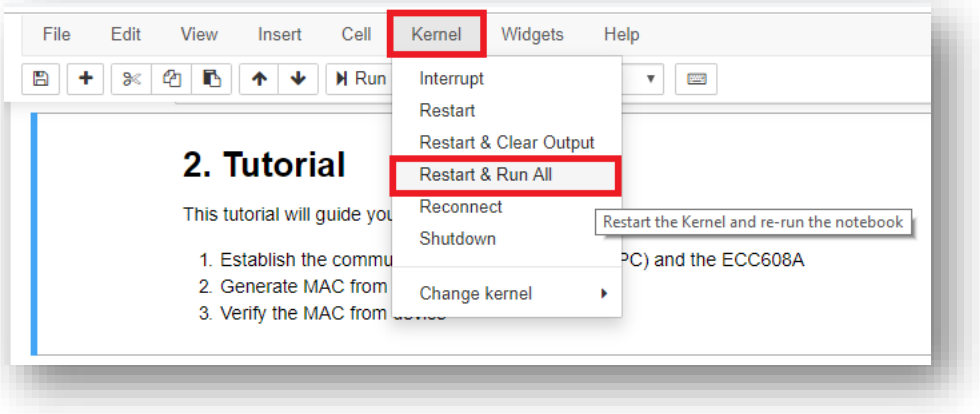
Trust&GO devices come with pre-programmed certificates in slots 10, 11 and 12, also slots 0-4 have pre-generated private keys, other than the previously mentioned slots all the other slots are locked.

The secure element manifest format is designed to convey the unique information about a device including its unique ID (e.g. serial number), public keys, and certificates. The manifest file generated can be used to register the device to cloud providers.

Within the Jupyter Dashboard, navigate **TrustnGO\00_resource_generation** folder to open **TNGTLS_manifest_file_generation.ipynb**



Run all cells of the **TNGTLS_manifest_file_generation** Notebook: Kernel->Restart & Run All



If all the steps ran without errors, you will see result as shown below.
Loading logger key

```
Generating self-signed logging certificate
   Saving to log_signer.crt
-----------------------------------------
TNG Root Certificate:
Certificate:
   Data:
      Version: 3 (0x2)
      Serial Number:
         77:d3:6d:95:6e:c8:ae:62:05:e5:8e:3a:cb:98:5a:81
      Signature Algorithm: ecdsa-with-SHA256
      Issuer: O = Microchip Technology Inc, CN = Crypto Authentication Root CA 002
      Validity
         Not Before: Nov  8 19:12:19 2018 GMT
         Not After : Nov  8 19:12:19 2058 GMT
      Subject: O = Microchip Technology Inc, CN = Crypto Authentication Root CA 002
      Subject Public Key Info:
         Public Key Algorithm: id-ecPublicKey
            Public-Key: (256 bit)
            pub:
               04:bd:54:e6:6d:e3:87:54:84:00:6b:53:ae:15:80:
               d5:0a:a0:69:e7:8a:df:55:78:d8:5c:e2:d5:4d:d5:
               b8:30:29:6b:ff:dd:6e:6f:72:56:fb:d9:9e:f1:a1:
               16:b1:1d:33:ad:49:10:3a:a1:85:87:39:dc:fa:e4:
               37:e1:9d:63:4e
            ASN1 OID: prime256v1
            NIST CURVE: P-256
      X509v3 extensions:
         X509v3 Subject Key Identifier:
            7A:ED:7D:6D:C6:B7:78:9D:B2:38:01:A5:E8:4A:8C:B0:A4:0E:2A:8C
         X509v3 Authority Key Identifier:
            keyid:7A:ED:7D:6D:C6:B7:78:9D:B2:38:01:A5:E8:4A:8C:B0:A4:0E:2A:8C
```

```
            X509v3 Basic Constraints: critical
                CA:TRUE
    Signature Algorithm: ecdsa-with-SHA256
         30:45:02:21:00:a1:dc:63:45:90:ec:81:9e:e1:de:5b:81:12:
         65:51:ad:d4:c2:c4:f8:e5:95:28:2e:e0:4b:e7:68:ec:7c:02:
         73:02:20:3e:6b:a7:4e:9e:4c:0a:d6:8c:24:b0:fb:2e:e7:93:
         d2:e6:be:94:65:ca:15:d0:ea:5b:c8:7f:55:79:99:5c:ad
-----BEGIN CERTIFICATE-----
MIIB8TCCAZegAwIBAgIQd9NtlW7IrmIF5Y46y5hagTAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMjAgFw0xODExMDgxOTEyMTlaGA8y
MDU4MTEwODE5MTIxOVowTzEhMB8GA1UECgwYTWljcm9jaGlwIFRlY2hub2xvZ3kg
SW5jMSowKAYDVQQDDCFDcnlwdG8gQXV0aGVudGljYXRpb24gUm9vdCBDQSAwMDIw
WTATBgcqhkjOPQIBBggqhkjOPQMBBwNCAAS9VOZt44dUhABrU64VgNUKoGnnit9V
eNhc4tVN1bgwKWv/3W5vclb72Z7xoRaxHTOtSRA6oYWHOdz65DfhnWNOo1MwUTAd
BgNVHQ4EFgQUeu19bca3eJ2yOAGl6EqMsKQOKowwHwYDVR0jBBgwFoAUeu19bca3
eJ2yOAGl6EqMsKQOKowwDwYDVR0TAQH/BAUwAwEB/zAKBggqhkjOPQQDAgNIADBF
AiEAodxjRZDsgZ7h3luBEmVRrdTCxPjllSgu4EvnaOx8AnMCID5rp06eTArWjCSw
+y7nk9LmvpRlyhXQ6lvIf1V5mVyt
-----END CERTIFICATE-----

Validate Root Certificate:
OK

TNG Signer Certificate:
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            7c:31:16:e0:34:06:5b:25:e0:53:bf:b0:9e:26:1a:66
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: O = Microchip Technology Inc, CN = Crypto Authentication Root CA 002
        Validity
            Not Before: Dec 14 19:00:00 2018 GMT
            Not After : Dec 14 19:00:00 2049 GMT
        Subject: O = Microchip Technology Inc, CN = Crypto Authentication Signer F640
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:0e:7f:32:95:f2:eb:46:40:f4:aa:39:4c:e5:e5:
                    20:d7:d9:b5:0b:b9:54:f5:c3:f8:bb:6f:3f:2c:18:
                    5a:4d:b9:90:91:bc:af:49:ea:06:fc:4b:cc:5c:2a:
                    27:c8:d0:02:2b:1a:9b:f0:1b:f4:46:dd:9a:c5:62:
                    30:4c:7a:38:76
                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:
                EB:62:03:2B:8C:81:58:16:42:9A:1C:AB:F1:BE:8C:22:1E:B7:A6:C9
            X509v3 Authority Key Identifier:
                keyid:7A:ED:7D:6D:C6:B7:78:9D:B2:38:01:A5:E8:4A:8C:B0:A4:0E:2A:8C

    Signature Algorithm: ecdsa-with-SHA256
         30:46:02:21:00:e0:78:ed:06:27:15:f0:31:32:f0:ef:31:97:
         22:a5:49:e2:e1:86:28:73:b5:f2:b7:5f:28:3e:e3:7d:13:6e:
         bc:02:21:00:df:68:76:be:05:22:ae:7f:e9:15:84:82:fa:08:
         45:8d:da:9c:f3:08:17:2f:d6:60:74:fc:11:90:7a:30:47:7b
-----BEGIN CERTIFICATE-----
MIICBTCCAaqgAwIBAgIQfDEW4DQGWyXgU7+wniYaZjAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMjAgFw0xODEyMTQxOTAwMDBaGA8y
MDQ5MTIxNDE5MDAwMFowTzEhMB8GA1UECgwYTWljcm9jaGlwIFRlY2hub2xvZ3kg
SW5jMSowKAYDVQQDDCFDcnlwdG8gQXV0aGVudGljYXRpb24gU2lnbmVyIEY2NDAw
WTATBgcqhkjOPQIBBggqhkjOPQMBBwNCAAQOfzKV8utGQPSqOUzl5SDX2bULuVT1
w/i7bz8sGFpNuZCRvK9J6gb8S8xcKifI0AIrGpvwG/RG3ZrFYjBMejh2o2YwZDAO
BgNVHQ8BAf8EBAMCAYYwEgYDVR0TAQH/BAgwBgEB/wIBADAdBgNVHQ4EFgQU62ID
K4yBWBZCmhyr8b6MIh63pskwHwYDVR0jBBgwFoAUeu19bca3eJ2yOAGl6EqMsKQO
KowwCgYIKoZIzj0EAwIDSQAwRgIhAOB47QYnFfAxMvDvMZcipUni4YYoc7Xyt18o
PuN9E268AiEA32h2vgUirn/pFYSC+ghFjdqc8wgXL9ZgdPwRkHowR3s=
-----END CERTIFICATE-----

Validate Signer Certificate:
OK

TNG Device Certificate:
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number:
            71:4f:f4:a3:24:1b:e8:18:dc:6d:8b:b0:c5:53:aa:6f
        Signature Algorithm: ecdsa-with-SHA256
        Issuer: O = Microchip Technology Inc, CN = Crypto Authentication Signer F640
        Validity
            Not Before: Aug  1 00:00:00 2019 GMT
            Not After : Aug  1 00:00:00 2047 GMT
        Subject: O = Microchip Technology Inc, CN = 0123CEDC3CD337AA01 ATECC
        Subject Public Key Info:
            Public Key Algorithm: id-ecPublicKey
                Public-Key: (256 bit)
                pub:
                    04:97:24:09:48:8c:20:89:19:6f:24:47:b0:8a:4d:
                    90:cc:74:d6:cc:14:37:60:b0:aa:b5:76:4d:cd:bf:
                    03:f6:06:e9:46:80:18:e5:2c:9f:75:4a:3b:c8:3f:
                    17:2d:b5:24:d7:5b:c4:ba:f7:34:92:f3:a3:45:58:
                    c2:eb:ae:69:34
                ASN1 OID: prime256v1
                NIST CURVE: P-256
        X509v3 extensions:
            X509v3 Basic Constraints: critical
                CA:FALSE
```

```
            X509v3 Key Usage: critical
                Digital Signature, Key Agreement
            X509v3 Subject Key Identifier:
                09:61:2F:3F:E6:E6:AE:20:35:71:7D:CB:C7:A7:49:AC:63:E5:FC:66
            X509v3 Authority Key Identifier:
                keyid:EB:62:03:2B:8C:81:58:16:42:9A:1C:AB:F1:BE:8C:22:1E:B7:A6:C9

    Signature Algorithm: ecdsa-with-SHA256
         30:46:02:21:00:a1:52:e2:bb:be:01:1d:91:8e:12:0c:9b:a6:
         67:67:6a:55:78:e9:66:6a:72:84:ba:17:2f:ce:9b:72:f7:6c:
         3b:02:21:00:c7:29:b1:2c:5d:43:cb:7c:f2:67:7d:12:c8:59:
         82:eb:4f:78:0e:49:8a:16:11:62:55:2a:15:45:f8:2a:f4:a5
-----BEGIN CERTIFICATE-----
MIIB9jCCAZugAwIBAgIQcU/0oyQb6BjcbYuwxVOqbzAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBTaWduZXIgRjY0MDAgFw0xOTA4MDEwMDAwMDBaGA8y
MDQ3MDgwMTAwMDAwMFowRjEhMB8GA1UECgwYTWljcm9jaGlwIFRlY2hub2xvZ3kg
SW5jMSEwHwYDVQQDDBgwMTIzQ0VEQzNDRDMzN0FBMDEgQVRFQ0MwWTATBgcqhkjO
PQIBBggqhkjOPQMBBwNCAASXJAlIjCCJGW8kR7CKTZDMdNbMFDdgsKq1dk3NvwP2
BulGgBjlLJ91SjvIPxcttSTXW8S69zSS86NFWMLrrmk0o2AwXjAMBgNVHRMBAf8E
AjAAMA4GA1UdDwEB/wQEAwIDiDAdBgNVHQ4EFgQUCWEvP+bmriA1cX3Lx6dJrGPl
/GYwHwYDVR0jBBgwFoAU62IDK4yBWBZCmhyr8b6MIh63pskwCgYIKoZIzj0EAwID
SQAwRgIhAKFS4ru+AR2RjhIMm6ZnZ2pVeOlmanKEuhcvzpty92w7AiEAxymxLF1D
y3zyZ30SyFmC6094DkmKFhFiVSoVRfgq9KU=
-----END CERTIFICATE-----

Validate Device Certificate:
OK

------------------------------------------------------
Generated the manifest file 0123cedc3cd337aa01_manifest.json
```

The Notebook will be used to generate a manifest file which can be uploaded into the public cloud provider of your choice (Google GCP, AWS IoT and soon to be supported Microsoft Azure).). TNGTLS Manifest Generation notebook needs to be run for all Trust&Go example Notebooks that require a Manifest file.

4 Use Case Prototyping

This hands-on lab is intended to demonstrate the usage of host to authenticate Accessory device. It uses asymmetric authentication where host reads certificates from accessory to validate chain of trust, followed by device private key.

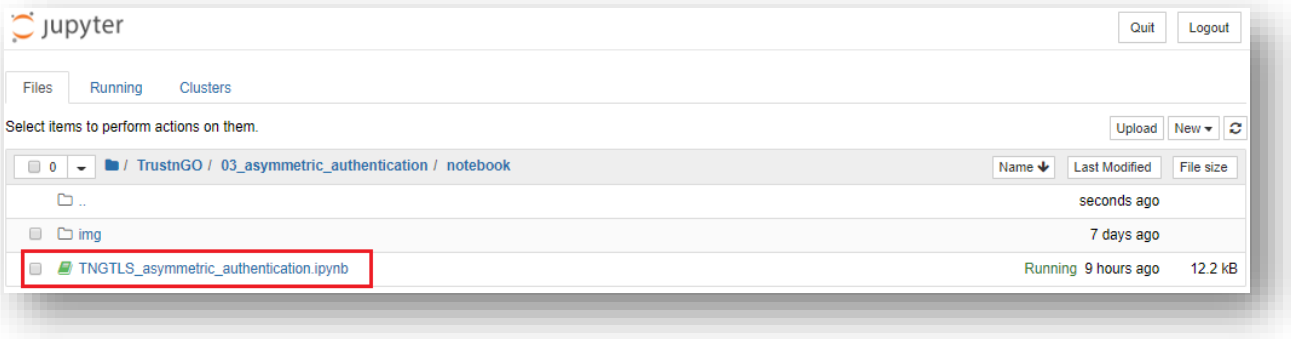
This process uses a challenge-response model. In this model, host authenticates the accessory device based on response. Response (Signature) is calculated on the accessory device to prove that it holds the private key associated to its certificate shared to the host. Then the response will be verified by the host using Public key in Device certificate to authenticate the accessory.

This lab is developed by simulating Trust&GO device as Accessory and host to authenticate the accessory.

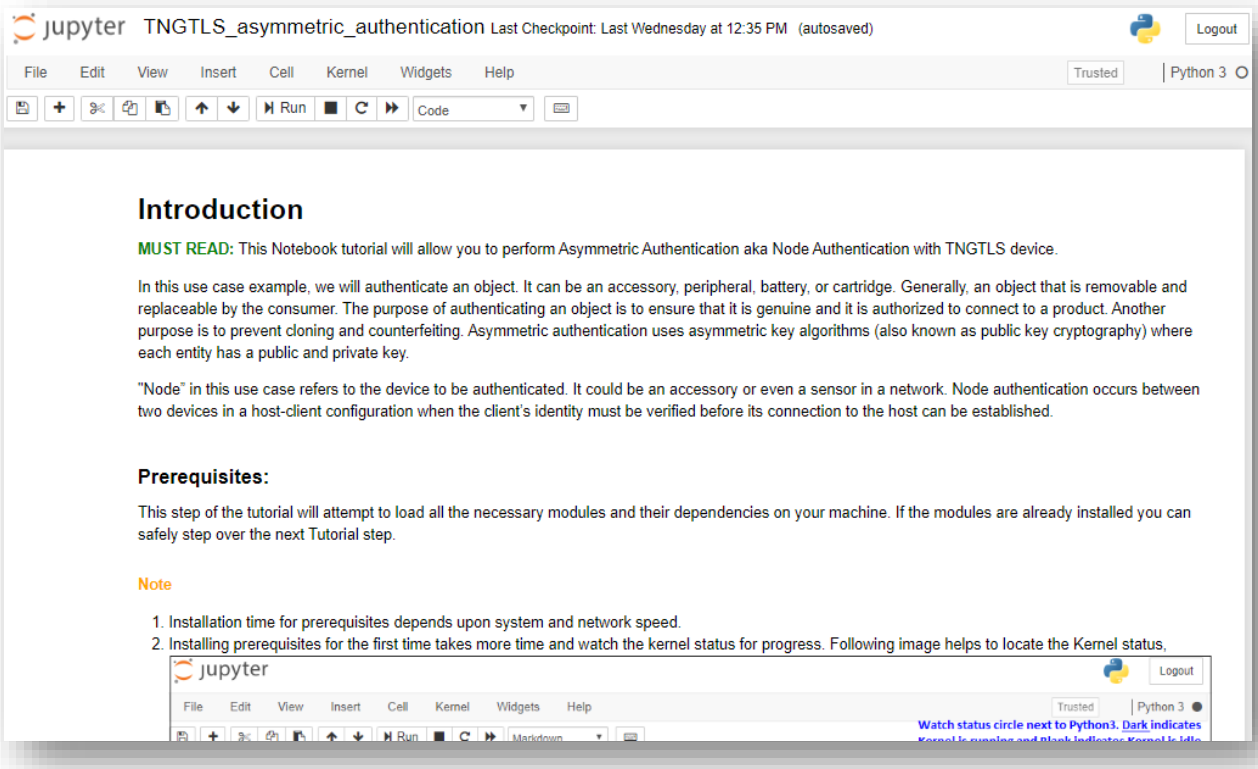
Following sections provides detail steps to execute the usecase both on Jupyter Notebook and on Embedded project

4.1 Running Accessory Asymmetric Authentication example on Jupyter Notebook:

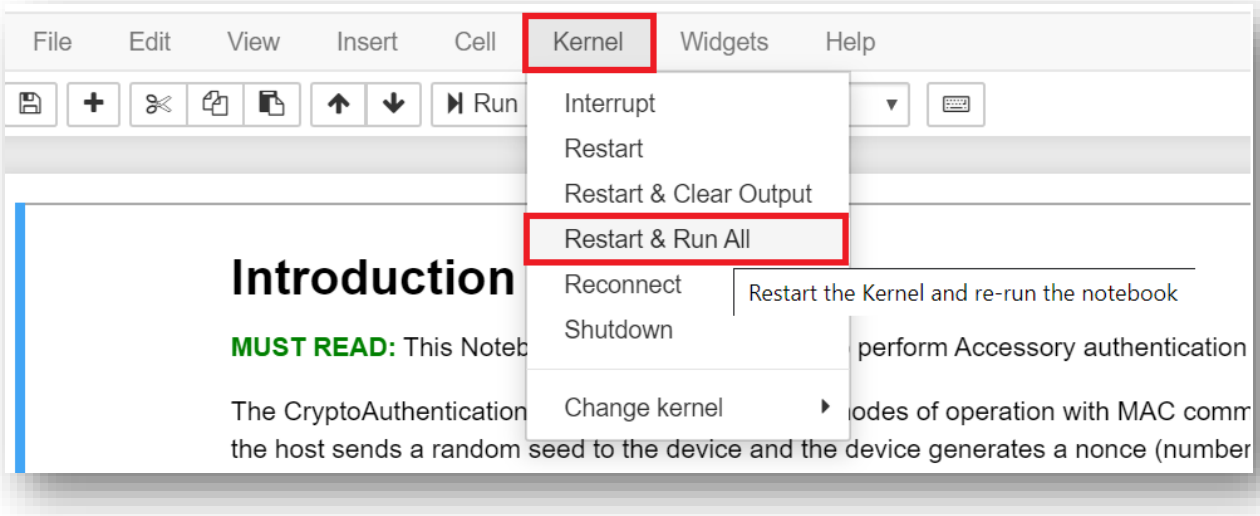
1. From the Jupyter Home page, navigate to **TrustnGO\03_asymmetric_authentication\notebook\TNGTLS_asymmetric_authentication.ipynb** notebook file and open it.



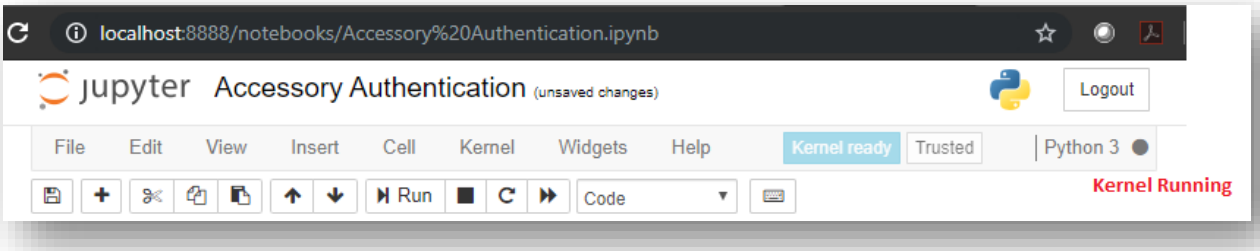
Opening the notebook from Jupyter home page should load the following on the browser,

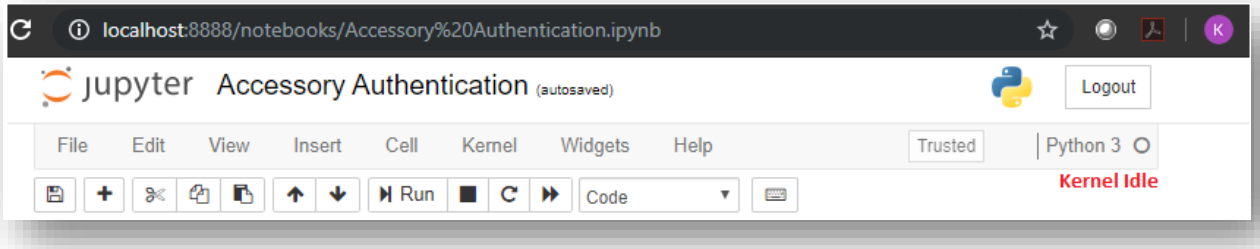


2. Run All Cells by using Kernel -> Restart & Run All



3. 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)





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

5. There are 2 major steps in this lab
   Verify Certificate Chain
   The certificate chain verification process includes reading the certificates from device, validating its signatures using CA's Public Key.

   The host MCU contains the Root's Public Key stored on it. Certificate chain verification process starts by reading both Signer and Device certificates. CryptoAuthLibrary provides the apis to read the certificates directly from device. Since this is TNG device, the certificate templates are fixed and signed by MCHP root and signers.

   Authenticate Accessory/Node
   On clicking 'Authenticate Node' button, the process of rebuilding certificates, validation and Accessory authentication gets triggered.

Client Rebuild Certificates:
In this step host triggers set of commands to know the max size of the certificate and read the actual certificates from secure element. One can see root, signer and device certificates in the log.

Host to verify certificate chain:
On reading the certificates, host starts certificate chain verification. This step is currently limited to signature verification only.

Signer certificate is validated using MCHP root public key and device certificate is validated using Signer public key provided in the signer certificate.

Challenge-Response-Verify:
Once the certificates are validated, its important to check the accessory holds the original private key used to generate device certificate signing request. This will be done through a challenge response method.

Host generates as random challenge and sends to accessory for signing. Accessory would sign the challenge using the private key used for Device CSR. Once, host receives the signature from accessory, it verifies the same using public key provided in the Device certificate.

The result will be success only if the private and public key corresponds to each other, this indicates the connected accessory is authentic.

In case if private key is not associated to public key in the device certificate, this verification step would fail, this indicates the connected accessory is not authentic.

Pressing the button, turns it Green or Red. Green indicates that the device is authenticated by host and Red indicates the authentication is failed.

4.2 Running Accessory Asymmetric Authentication example on Embedded platform

This usecase can also be executed on Embedded platform. Once the resources are generated, both Atmel Studio and MPLAB projects provided can be used to run the application on CryptoAuth Trust Platform.

Note: This usecase requires resource generation notebook executed prior to using embedded projects.

4.2.1 Atmel Studio

1. Open **asymmetric_auth.atsln** project by navigating to Atmel Studio -> File -> open -> **TrustnGO\03_asymmetric_authentication\c\studio\asymmetric_auth.atsln**

2. The application source code **asymmetric_auth.c** is available at **TrustnGO\03_asymmetric_authentication\c\asymmetric_auth.c.** Other supporting files can be found under **assets\dependencies**

3. Program the Crypto 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, the firmware will do Accessory Asymmetric Authentication operation. Depending on the result, the CryptoAuth Trust Platform board's status LED will blink at different rates.

   If succeeds, LED blinks once every second.
   If 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 CryptoAuth TrustPlatform with 115200-8-N-1 settings


COM32 - Tera Term VT
File Edit Setup Control Window Help
Device revision: 00 00 60 02
Device serial number: 01 23 29 79 CB 29 3B A5 01
CLIENT: Rebuilt Signer Certificate:
-----BEGIN CERTIFICATE-----
MIICBTCCAaqgAwIBAgIQeQqn1X1z3OltZdtmi3ayXjAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMjAgFw0xODEyMTQxOTAwMDBaGA8y
MDQ5MTIxNDE5MDAwMFowTzEhMB8GA1UECgwYTWljcm9jaGlwIFR1Y2hub2xvZ3kg
SW5jMSowKAYDVQQDDCFDcnlwdG8gQXV0aGVudGljYXRpb24gU2lnbmVyIEY2MDAw
WTATBgcqhkjOPQIBBggqhkjOPQMBBwNCAAR2R0FwsmPnmVS8hbsS6f5wDFuN1NaT
RZjCKadoAg5OC21IddDtoe72X5FfxrEWRsWhymMfY1VodEdpxd6DtY1qo2YwZDAO
BgNVHQ8BAf8EBAMCAYYwEgYDVR0TAQH/BAgwBgEB/wIBADAdBgNVHQ4EFgQU+9yq
Eor6wbWSj82rEdsJPs9NvvYwHwYDVR0jBBgwFoAUeu19bca3eJ2yOAG16EqMsKQO
KowwCgYIKoZIzj0EAwIDSQAwRgIhAMYwMempizBOaH4GxTl5KsV6XAFNMBfe3NJ9
1R3Nhjf/AiEAxqIsbrGuX4WRSctd53eLo/ML6T2bgG+Uvz2QpYR4Ydw=
-----END CERTIFICATE-----
CLIENT: Rebuilt Device Certificate:
-----BEGIN CERTIFICATE-----
MIIB9TCCAZugAwIBAgIQYlvNgfJuMqdIpWEADSpuWzAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBTaWduZXIgRjYwMDAgFw0xOTA3MzEyMTAwMDBaGA8y
MDQ3MDczMTIxMDAwMFowRjEhMB8GA1UECgwYTWljcm9jaGlwIFR1Y2hub2xvZ3kg
SW5jMSEwHwYDVQQDDBgwMTIzMjk3OUNCMjkzQkE1MDEgQURFQ0MwWTATBgcqhkjO
PQIBBggqhkjOPQMBBwNCAASZ2Oqd0R6AEDuObwxdFLwJjT16yq7HGqThiaLpkN0K
eG5qZOJl0HCPdBoWplEsDcw26q0X6uIMuqyrRTL883Reo2AwXjAMBgNVHRMBAf8E
AjAAMA4GA1UdDwEB/wQEAwIDiDAdBgNVHQ4EFgQUCwT6mxFlijOMO0UmHxvIo1ox
k8EwHwYDVR0jBBgwFoAU+9yqEor6wbWSj82rEdsJPs9NvvYwCgYIKoZIzj0EAwID
SAAwRQIgGnifKevE7ZIp2mpAQIW6OWHfitgH4uJlCof1DWkGb18CIQDii8oVy/HU
aLN9cpDc2FfRDRGf5UdU1ZR35Jv/I6VChw==
-----END CERTIFICATE-----
HOST: Signer certificate verified against root public key!
HOST: Device certificate verified against signer public key!
HOST: Generated challenge:
06 E6 31 DB 55 4B B3 62 3A 37 71 5F 21 19 2B F7
B5 B2 92 E3 2C 95 FB BB 77 FB 63 29 70 5C 2A 5F
CLIENT: Calculated response to host challenge:
4F DB B1 06 07 FC 6B 2B 7B 37 4E 00 99 03 19 B1
83 9E 41 D3 AE F1 86 14 E7 1A F6 6C 48 0E 8A 20
C2 CF 48 44 53 1E 35 90 0A 9C 58 93 55 D1 08 B1
95 93 4A 12 69 EC 04 63 CE 61 8A 15 58 13 01 D4
HOST: Device public key from certificate:
99 D8 EA 9D D1 1E 80 10 3B 8E 6F 0C 5D 14 BC 09
8D 3D 7A CA AE C7 1A A4 E1 89 A2 E9 90 DD 0A 78
6E 6A 64 E2 65 D0 70 8F 74 1A 16 A6 51 2C 0D CC
36 EA AD 17 EA E2 0C BA AC AB 45 32 FC F3 74 5E
HOST: Device response to challenge verified!
Accessory device authenticated successfully
Execution completed with status 00

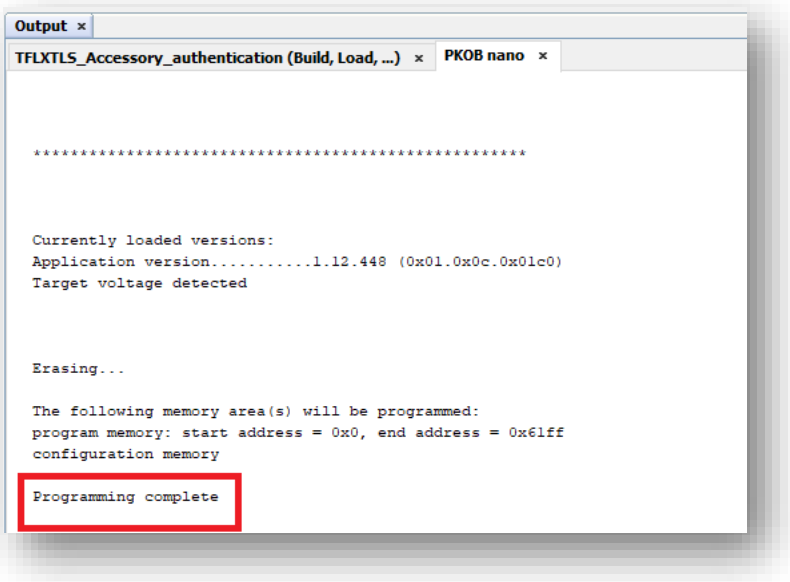
4.2.2 MPLAB:

1. Open **asymmetric_auth.X** project by navigating to MPLAB -> File -> Open Project -> **TrustnGO\03_asymmetric_authentication\c\mplab\asymmetric_auth.X**

2. The application source code asymmetric_auth.c is available at **TrustnGO\03_asymmetric_authentication\c\asymmetric_auth.c.** Other supporting files can be found under **assets\dependencies**

3. Program the Crypto Trust platform by navigating to **asymmetric_auth -> 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, the firmware will do Accessory Asymmetric Authentication operation. Depending on the output, the Cryptoauth Trust Platform board's status LED will blink at different rates.

If succeeds, LED blinks once every second.
If 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 CryptoAuth TrustPlatform with 115200-8-N-1 settings


COM32 - Tera Term VT
File Edit Setup Control Window Help
Device revision: 00 00 60 02
Device serial number: 01 23 29 79 CB 29 3B A5 01
CLIENT: Rebuilt Signer Certificate:
-----BEGIN CERTIFICATE-----
MIICBTCCAaqgAwIBAgIQeQqn1X1z3OltZdtmi3ayXjAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBSb290IENBIDAwMjAgFw0xODEyMTQxOTAwMDBaGA8y
MDQ5MTIxNDE5MDAwMFowTzEhMB8GA1UECgwYTWljcm9jaGlwIFR1Y2hub2xvZ3kg
SW5jMSowKAYDVQQDDCFDcnlwdG8gQXV0aGVudGljYXRpb24gU2lnbmVyIEY2MDAw
WTATBgcqhkjOPQIBBggqhkjOPQMBBwNCAAR2R0FwsmPnmVS8hbsS6f5wDFuN1NaT
RZjCKadoAg5OC21IddDtoe72X5FfxrEWRsWhymMfY1VodEdpxd6DtY1qo2YwZDAO
BgNVHQ8BAf8EBAMCAYYwEgYDVR0TAQH/BAgwBgEB/wIBADAdBgNVHQ4EFgQU+9yq
Eor6wbWSj82rEdsJPs9NvvYwHwYDVR0jBBgwFoAUeu19bca3eJ2yOAG16EqMsKQO
KowwCgYIKoZIzj0EAwIDSQAwRgIhAMYwMempizBOaH4GxTl5KsV6XAFNMBfe3NJ9
1R3Nhjf/AiEAxqIsbrGuX4WRSctd53eLo/ML6T2bgG+Uvz2QpYR4Ydw=
-----END CERTIFICATE-----
CLIENT: Rebuilt Device Certificate:
-----BEGIN CERTIFICATE-----
MIIB9TCCAZugAwIBAgIQYlvNgfJuMqdIpWEADSpuWzAKBggqhkjOPQQDAjBPMSEw
HwYDVQQKDBhNaWNyb2NoaXAgVGVjaG5vbG9neSBJbmMxKjAoBgNVBAMMIUNyeXB0
byBBdXRoZW50aWNhdGlvbiBTaWduZXIgRjYwMDAgFw0xOTA3MzEyMTAwMDBaGA8y
MDQ3MDczMTIxMDAwMFowRjEhMB8GA1UECgwYTWljcm9jaGlwIFR1Y2hub2xvZ3kg
SW5jMSEwHwYDVQQDDBgwMTIzMjk3OUNCMjkzQkE1MDEgQURFQ0MwWTATBgcqhkjO
PQIBBggqhkjOPQMBBwNCAASZ2Oqd0R6AEDuObwxdFLwJjT16yq7HGqThiaLpkN0K
eG5qZOJl0HCPdBoWplEsDcw26q0X6uIMuqyrRTL883Reo2AwXjAMBgNVHRMBAf8E
AjAAMA4GA1UdDwEB/wQEAwIDiDAdBgNVHQ4EFgQUCwT6mxFlijOMO0UmHxvIo1ox
k8EwHwYDVR0jBBgwFoAU+9yqEor6wbWSj82rEdsJPs9NvvYwCgYIKoZIzj0EAwID
SAAwRQIgGnifKevE7ZIp2mpAQIW6OWHfitgH4uJlCof1DWkGb18CIQDii8oVy/HU
aLN9cpDc2FfRDRGf5UdU1ZR35Jv/I6VChw==
-----END CERTIFICATE-----
HOST: Signer certificate verified against root public key!
HOST: Device certificate verified against signer public key!
HOST: Generated challenge:
06 E6 31 DB 55 4B B3 62 3A 37 71 5F 21 19 2B F7
B5 B2 92 E3 2C 95 FB BB 77 FB 63 29 70 5C 2A 5F
CLIENT: Calculated response to host challenge:
4F DB B1 06 07 FC 6B 2B 7B 37 4E 00 99 03 19 B1
83 9E 41 D3 AE F1 86 14 E7 1A F6 6C 48 0E 8A 20
C2 CF 48 44 53 1E 35 90 0A 9C 58 93 55 D1 08 B1
95 93 4A 12 69 EC 04 63 CE 61 8A 15 58 13 01 D4
HOST: Device public key from certificate:
99 D8 EA 9D D1 1E 80 10 3B 8E 6F 0C 5D 14 BC 09
8D 3D 7A CA AE C7 1A A4 E1 89 A2 E9 90 DD 0A 78
6E 6A 64 E2 65 D0 70 8F 74 1A 16 A6 51 2C 0D CC
36 EA AD 17 EA E2 0C BA AC AB 45 32 FC F3 74 5E
HOST: Device response to challenge verified!
Accessory device authenticated successfully
Execution completed with status 00

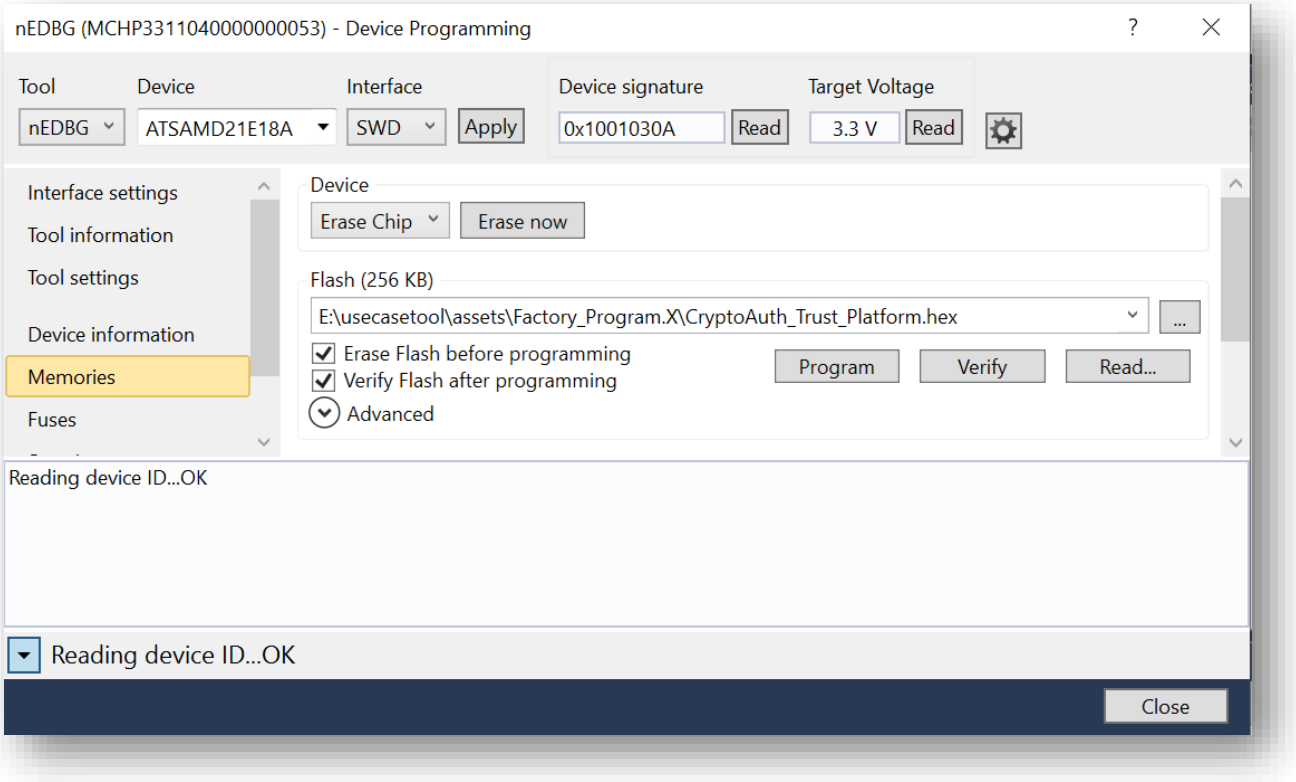
4.3 CryptoAuth TrustPlatform Factory reset

Once any of the embedded project is loaded to CrytoAuth TrustPlatform, the default program that enables interaction with TrustPlatform tools will be erased.

Before using the Platform with any other notebook or tools on PC, its required to reprogram the default .hex file. 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 programmed 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

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