u-connectXpress

Azure Connectivity

Application note

Abstract

This Application note provides information on how to configure and setup the connection for the Azure cloud services, using u-connectXpress software.

UBX-22039667 - R01

C1-Public

www.u-blox.com

Document information

Title	**u-connectXpress**	
Subtitle	Azure Connectivity	
Document type	Application note	
Document number	UBX-22039667	
Revision and date	R01	24-Mar-2023
Disclosure restriction	C1-Public	

This document applies to the following products:

Product name	Software version
NINA-W131	2.1.x onwards
NINA-W132	2.1.x onwards
NINA-W151	All
NINA-W152	All
NINA-W156	3.1.x onwards
ODIN-W260	7.0.x onwards
ODIN-W262	7.0.x onwards
ODIN-W263	7.0.x onwards

Contents

1 Configuring Azure IoT Hub

☞ Due to limitations in the maximum length of an AT command for NINA-W13 and NINA-W15 in u-connectXpress software prior to version 3.0, keep all names and identifiers as short as possible.

Identifiers and names for an IoT Hub should typically include:

- The name of the IoT Hub
- The Device Id of the devices
- The names of the certificates (CA and CC) as well as the client private key (PK).

1.1 Create a new IoT Hub

Unless one already exists, create a new IoT Hub.

1. Navigate to portal.azure.com and select **More Services**.
2. Search for IoT Hub and select **Create** in the pop-up window.
3. Create new or select an existing Resource group.
4. Choose your IoT hub name, such as “iot-uconnectxpress-dev”. Microsoft suggest the naming convention “iot-<App Name>-<Environment>”. The given name is publicly visible, so private metadata should not be included. Keep the IoT hub name as short as possible.
5. Step through the configuration wizard. Tags are optional private metadata which you may want or need to manage your hub – especially as your company and your Azure cloud grows. If you are unsure, just add the tag “MyTag”, and value “MyValue”.
6. Once created, go to your IoT Hub (which Microsoft refer to in more general terms as a resource) and check that it is available under “All resources” from the home screen.

1.2 Configure a module with a X.509 CA Signed certificate

1.2.1 Obtain the CA certificate

Create a CA certificate to use when signing the certificates for each module. The procedures for generating a CA certificate using OpenSSL are described in u-connectXpress Wi-Fi security application note [4].

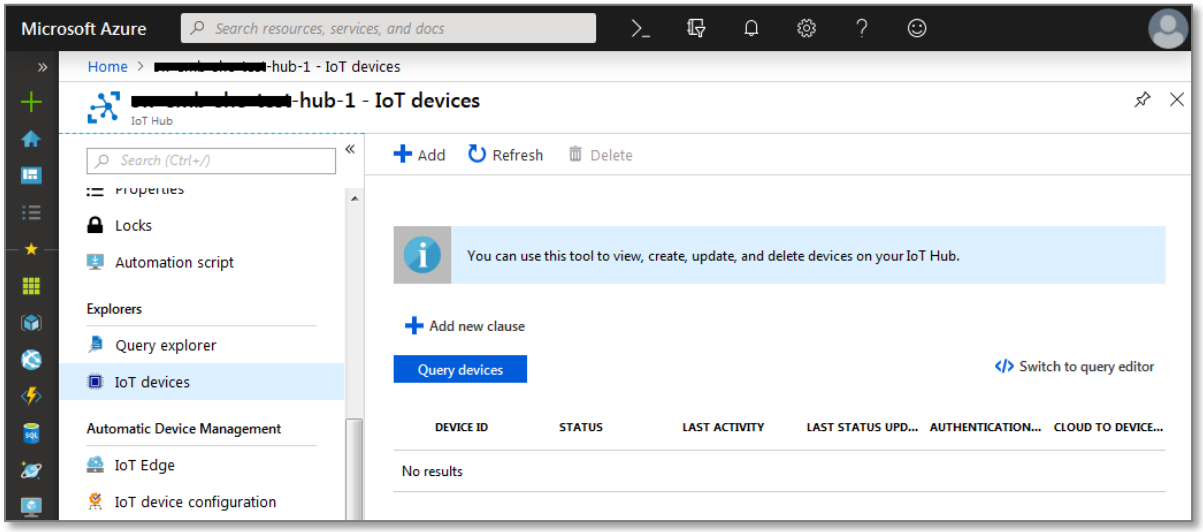
1.2.2 Configure cloud server

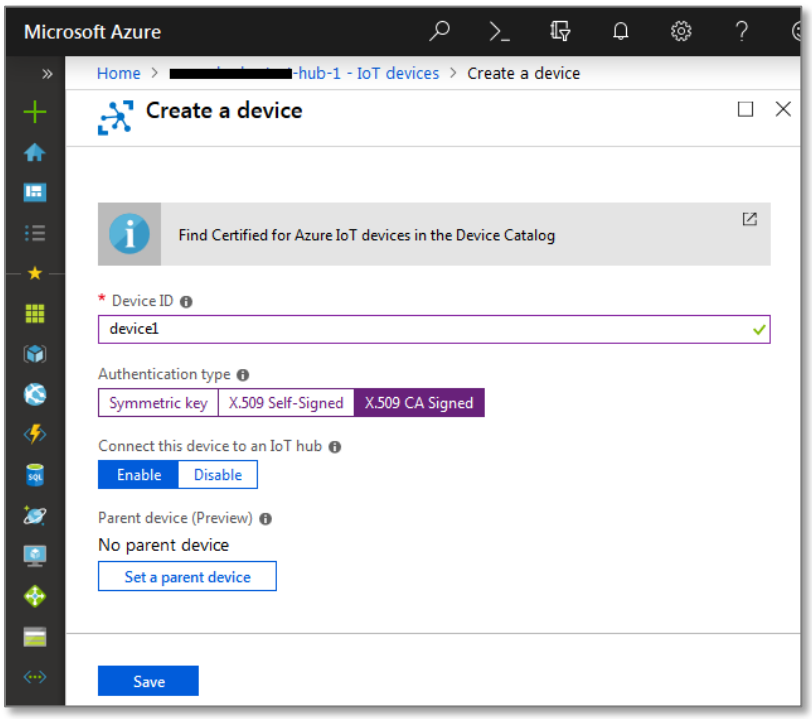
In the IoT Hub resource, you are required to verify that you have the necessary permissions to generate and sign certificates. To configure the cloud server, you must:

- Create the first device
- Sign a client side-certificate for the device
- Upload the CA used to sign the client-side certificate
- Verify the certificate used to sign the client-side certificate

1.2.2.1 Create the first device

1. Go to the IoT Devices tool in the IoT hub Explorer section. Select **New** or **Add** to register a new device.
2. Enter a unique Device ID. For example, enter the serial number of the device as “device1”, or enter the module response to the `AT+UMLA=2` command. If the NINA-W13/W15 module is configured with u-connectXpress software version 3.0 or earlier, keep the device ID as short as possible.
3. Set the Authentication type to “X.509 CA Signed”.





4. Select **Save** to add your new device to the displayed list of IoT devices

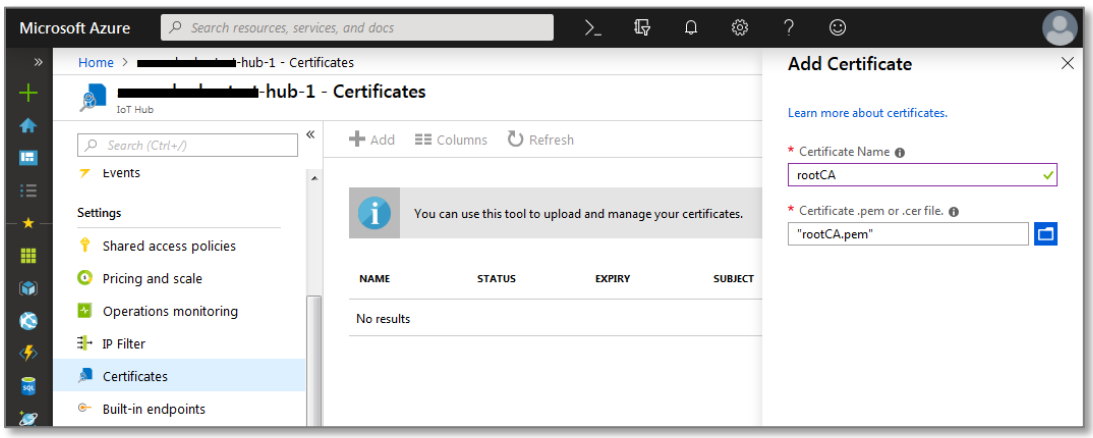
1.2.2.2 Sign a client-side certificate for the module

Generate a client-side certificate for your module. See also the u-connectXpress Wi-Fi security application note [4]), where Common Name (CN) is set to the Device ID of the device.

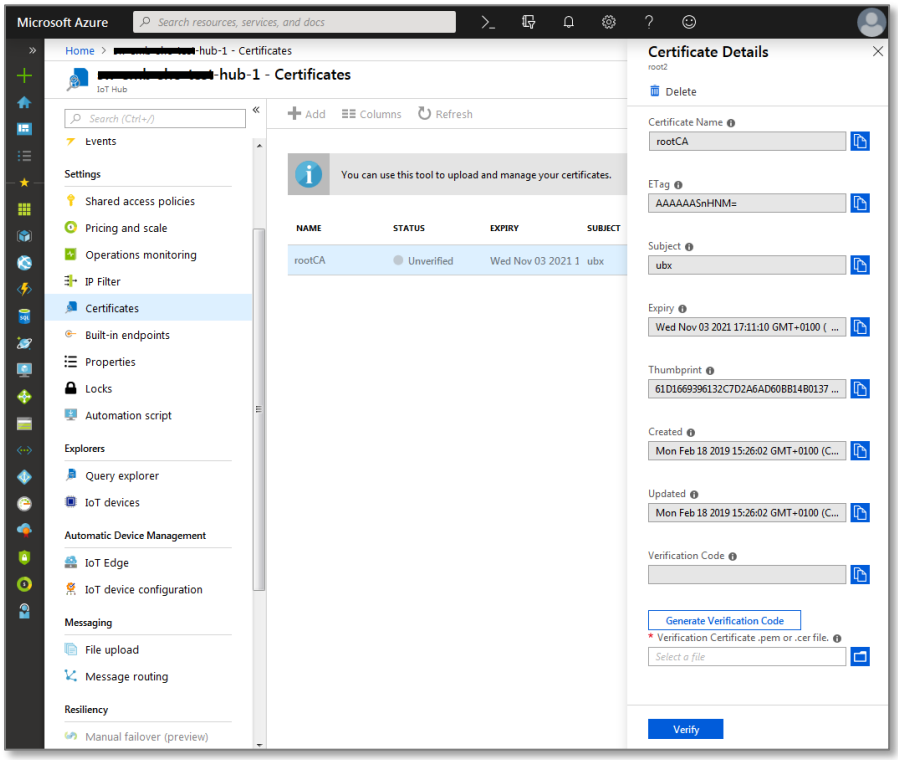
☞ This client-side certificate (CC) and its corresponding private key (PK) are also used later in the configuration.

1.2.2.3 Upload and verify the CA used to sign the client-side certificate

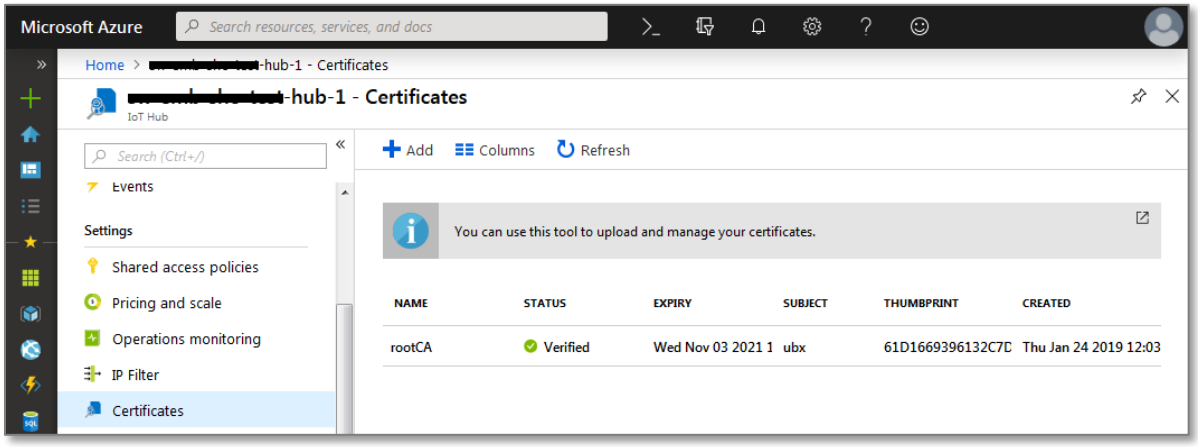
1. To upload the CA certificate created in Obtain the CA certificate, go to “Certificates” and select **Add**.



2. Select the certificate added in the previous step. To generate the verification code needed to generate a new certificate, select **Generate Verification Code** in the “Certificate Details” pane.
3. Generate the new client-side certificate using the same CA used in Obtain the CA certificate, but this time use the Verification Code as the Common Name (CN). To generate a client-side certificate, see the u-connectXpress Wi-Fi security application note, reference [4].

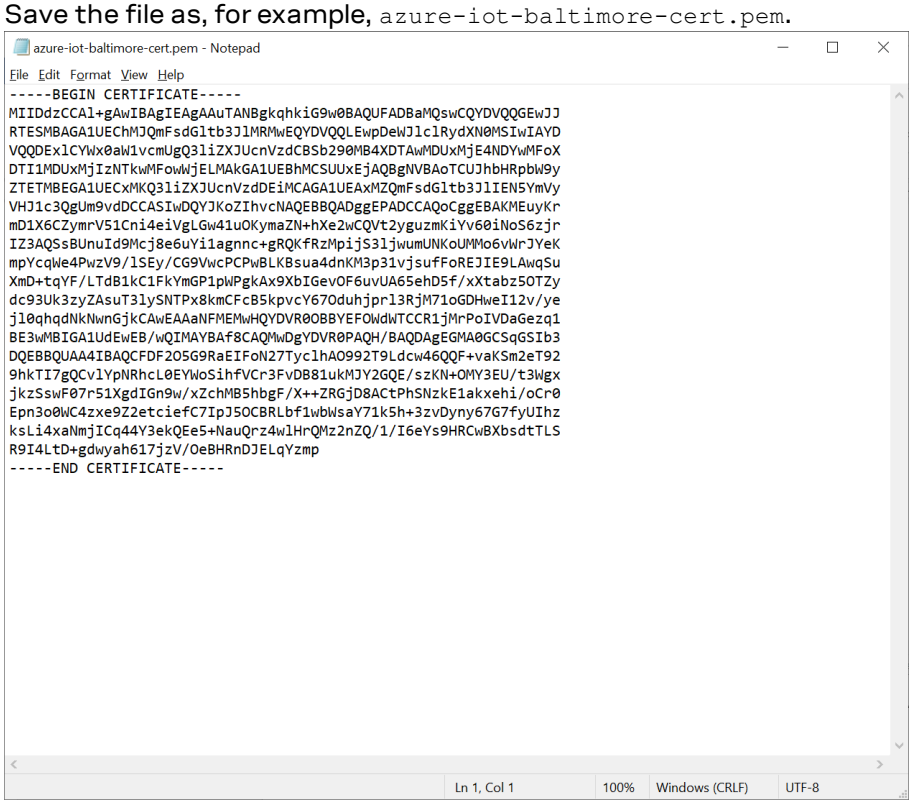


4. Upload the certificate generated in the previous step to the Verification Certificate in the Certificate Details pane and select “Verify”. The STATUS of the CA certificate changes to Verified.



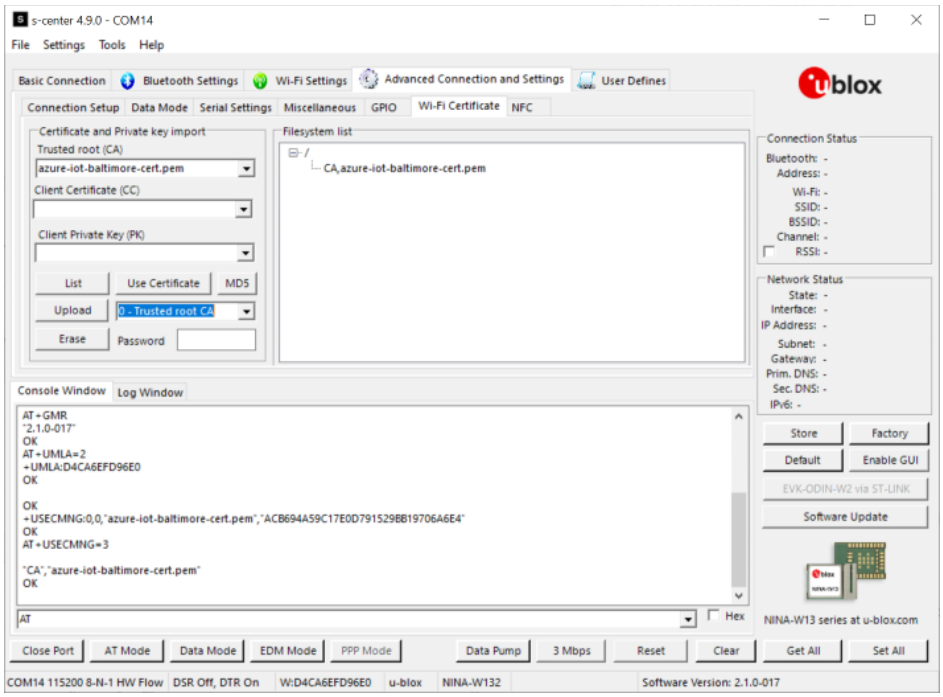
1.2.3 Prepare module certificates

1. Obtain the latest Azure IoT Hub server certificate. The certificate can be found in a `.c-file` in the `certs` directory of the `Azure-iot-sdk-c` repository: https://github.com/Azure/azure-iot-sdk-c/blob/master/certs/certs.c
2. Convert the c-file to a local Azure certificate file containing the DigiCert Baltimore Root certificate by copying the certificate information from `certs.c` to a text editor. Include the lines: `----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----` and then remove the quotation marks (") at the beginning and end of every line. Also remove the `\r\n` characters at the end of every line.
3. Save the file as, for example, `azure-iot-baltimore-cert.pem`.



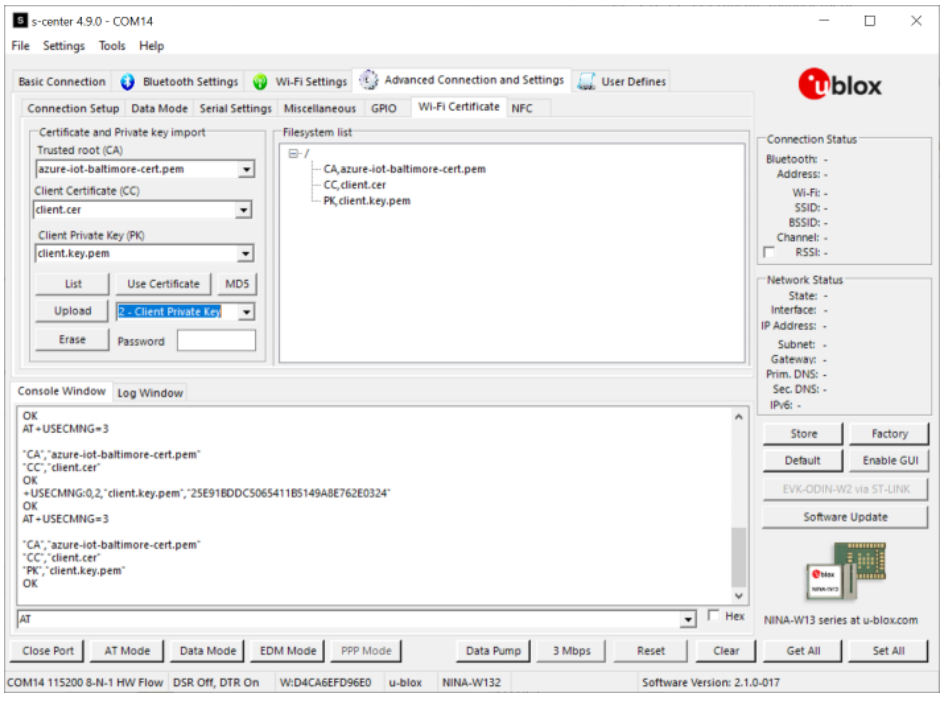
1.2.4 Install certificates on the module

1. Upload the local Azure certificate file to the module as a trusted root (CA) certificate using s-center, or the command `AT+USECMNG=0,0`.



☞ For further information about `AT+USECMNG`, see the u-connect AT commands manual [1] and u-connectXpress user guide [3].

2. Upload the client certificate (CC) and the client private key (PK) generated in Sign a client-side certificate for the module using either:
   - AT commands `AT+USECMNG=0,1` (client certificate) and `AT+USECMNG=0,2` (private key)
   - s-center



☞ As s-center requires a file suffix `.crt`, `.cer`, or `.pem`, the files might need to be renamed.

1.2.5 Connect to the cloud

1. Use s-center or the command AT+UWSC and AT+UWSCA to set up a network connection to the internet on the module. See the u-connectXpress user guide [3] for details.
2. To publish and subscribe to events, connect to Azure IoT Hub using the commands AT+UDCP and MQTT. For further information about the mqtt scheme, see the u-connectXpress MQTT Application With reference to the u-connectXpress MQTT application note [2], the format of the AT+UDCP command for Azure is as follows:

```
AT+UDCP=mqtt://iothubhostname:8883/?client=device_id&user=iothubhostname/device_id
&ca=server_cert_name&cert=device_cert_name&privKey=device_key_name
&pt=devices/device_id/messages/events/
&st=devices/device_id/messages/devicebound/#
```

☞ In the URL, replace the *marked* sections above, as shown below:

Item	Description
iothubhostname	From the Hostname section in the Overview page in Azure IoT Hub
device_id	The Device ID set to the device in Azure IoT Hub
server_cert_name	The internal name given to the Azure IoT Hub server certificate when uploaded to the module
device_cert_name	The internal name given to the client certificate when uploaded to the module
device_key_name	The internal name given to the client private key when uploaded to the module

Example

```
at+udcp=mqtt://iot-xxxx-test-hub-1.azure-devices.net:8883/?client=device1
&user=iot-xxxx-test-hub-1.azure-devices.net/device1
&ca=azure-iot-baltimore-cert.pem&cert=client.cer&privKey=client.key.pem
&pt=devices/device1/messages/events/
&st=devices/device1/messages/devicebound/#
```

3. Switch to Data mode and send data to/from the Azure IoT server; monitor the transferred data as described in Appendix B.1.

☞ The #wildcard is not supported by ODIN-W26-7.0.0, or NINA-W13/NINAW15 prior to v3.0.

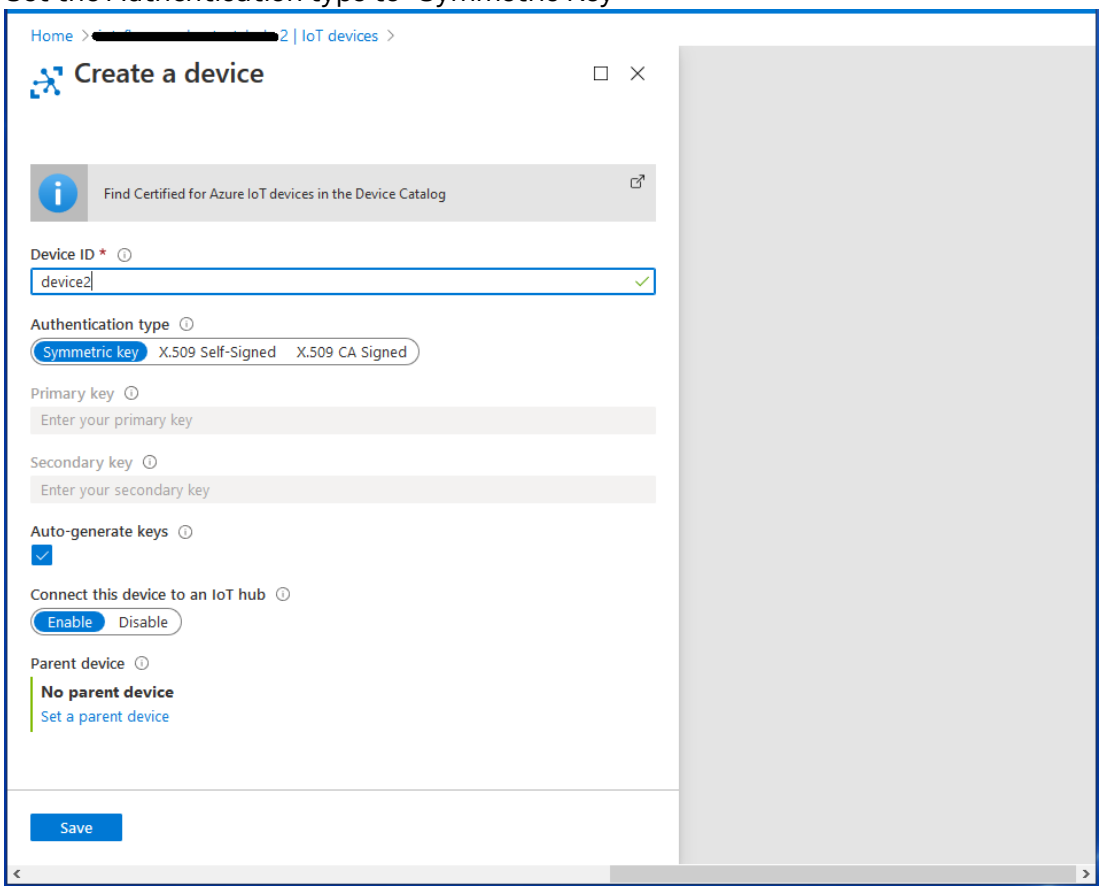
1.3 Configure a module with a Symmetric Key/SAS Token

☞ SAS Tokens are supported from on NINA-W13 and NINA-W15 starting with version 3.0.

If you have not earlier, Create a new IoT Hub.

1.3.1 Create the first device

1. Go to the IoT Devices tool in the IoT hub Explorer section and select **New** or **Add** to register a new device.
2. Enter a unique Device ID, for example “device2”, the device’s serial number, or the result of `AT+UMLA=2` for your module.
3. Set the Authentication type to “Symmetric Key”



4. Select **Save** to include your new device in the list of IoT devices.

The device page on IoT Hub now contains the auto-generated primary and secondary keys, including the connection strings to use.

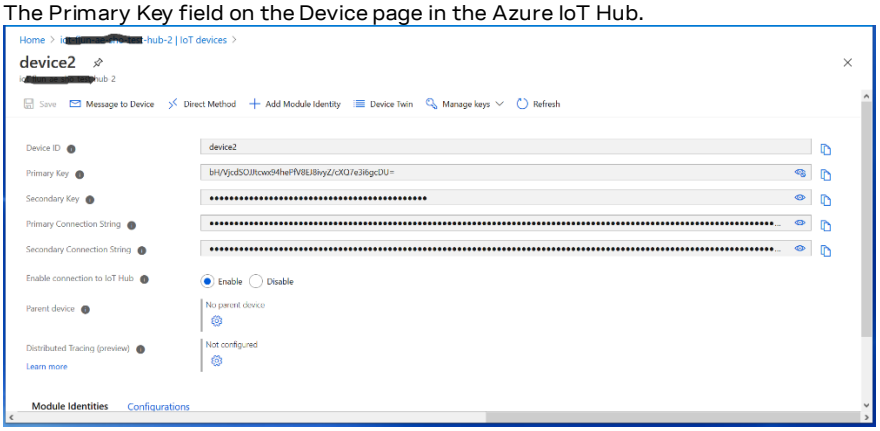
1.3.2 Connect to the cloud

1. Generate a SAS token using the algorithm defined by the code snippets included in the Microsoft Azure documentation at: https://docs.microsoft.com/en-us/azure/iot-hub/iot-hub-devguide-security#security-tokens. The returned string is the complete SAS Token.

   A python program which generates a SAS Token could be written as:

```
from base64 import b64encode, b64decode
from hashlib import sha256
from time import time
from urllib import parse
from hmac import HMAC

IOTHUBHOSTNAME = "iothubhostname"
PRIMARY_KEY    = "primary_key"

def generate_sas_token(uri, key, policy_name, expiry=3600):
    ttl = time() + expiry
    sign_key   = "%s\n%d" % ((parse.quote_plus(uri)), int(ttl))
    signature          =     b64encode(HMAC(b64decode(key),     sign_key.encode('utf-8'),
                 sha256).digest())

    rawtoken    = {
        'sr'    :  uri,
        'sig'   : signature,
        'se'    : str(int(ttl))
    }

    if policy_name is not None:
        rawtoken['skn'] = policy_name

    return 'SharedAccessSignature ' + parse.urlencode(rawtoken)

res = generate_sas_token(IOTHUBHOSTNAME, PRIMARY_KEY, "")
print(res)
```

   In the above program, replace the *marked* items as follows:

Item	Description
iothubhostname	From the Hostname section in the Overview page in Azure IoT Hub.
primary_key	The Primary Key field on the Device page in the Azure IoT Hub. 

Example

Invocation of:

```
generate_sas_token("iot-xxxx-test-hub-2.azure-devices.net",
"bH/VjcdSOJJtcwx94hePfV8EJ8ivyZ/cXQ7e3i6gcDU=", "")
```

Returns the SAS Token:

```
SharedAccessSignature sr=iot-xxxx-test-hub-2.azure-devices.net
&sig=ix4nP1LaU%2FZq2Nk3OaBwJ0MikCPIxGxz2uiZ3KUxecM%3D&se=1591876214&skn=
```

The SAS Token contains both spaces, ampersands, equals, and percent signs.

2. Use s-center or the commands `AT+UWSC` and `AT+UWSCA` to set up a network connection to the internet on the module. For further information, see the u-connectXpress user guide [3].
3. Use the command `AT+UDUV` to set an URL Value to the SAS Token:

```
AT+UDUV=0,"SharedAccessSignature sr=iot-xxxx-test-hub-2.azure-devices.net
&sig=ix4nP1LaU%2FZq2Nk3OaBwJ0MikCPIxGxz2uiZ3KUxecM%3D&se=1591876214&skn="
```

4. Enable Wi-Fi and connect to an internet-connected AP.
5. Use the command `AT+UDCP` command and MQTT to connect to Azure IoT Hub, publish and subscribe to events. For further information about the `mqtt:` scheme, see the u-connectXpress MQTT application note [2]. The format of the `AT+UDCP` command for Azure using a SAS Token is as follows:

```
AT+UDCP="mqtt://iothubhostname:8883/?ca=<ca certificate>
&client=device_id
&user=iothubhostname/device_id
&passwd=%%url_value_index
&pt=devices/device_id/messages/events/
&st=devices/device_id/messages/devicebound/#"
```

☞ In the URL, replace the *marked* sections above as follows:

Item	Description
iothubhostname	From the Hostname section in the Overview page in Azure IoT Hub.
device_id	The Device ID set to the device in Azure IoT Hub.
url_value_index	The URL Value index given as parameter to `AT+UDUV`.

Example

```
at+udcp="mqtt://iot-xxxx-test-hub-2.azure-devices.net:8883/
?ca=<ca certificate>
&client=device2
&user=iot-xxxx-test-hub-2.azure-devices.net/device2
&passwd=%%0
&pt=devices/device2/messages/events/
&st=devices/device2/messages/devicebound/#"
```

6. Switch to Data mode and send data to/from the Azure IoT server. Monitor the transferred data as described in Appendix B.1.

1.4 Device Provisioning Service (DPS)

To get started with the Azure IoT service, it is possible to use the IoT Hub device provisioning service (DPS) that enables zero-touch provisioning and configures the device connection to the cloud without requiring human intervention, allowing customers to configure multiple devices in a secure and scalable manner.

1.4.1 Create and Prepare the Azure IoT Hub Device Provisioning Services

When connected to the Azure DPS, the device is assigned to the IoT Hub created in Create a new IoT Hub. To create a new IoT Hub Device Provisioning Service using the Azure Portal:

1. In the Azure portal, select **+ Create a resource**.
2. From the **Categories** menu, select **Internet of Things** then **IoT Hub Device Provisioning Service**.
3. Select **Create** and fill the required information accordingly to your Azure plan and resources.
4. Select **Review + Create** to validate your provisioning service.
5. Select **Create**.

To Link the IoT hub and your Device Provisioning Service:

1. In the **Settings** menu, select **Linked IoT hubs**.
2. Select **+ Add**.
3. On the **Add link to IoT hub** panel, provide the following information:
4. **Access Policy:** Select **iothubowner** as the credentials for establishing the link with the IoT hub.
5. Select **Save**.

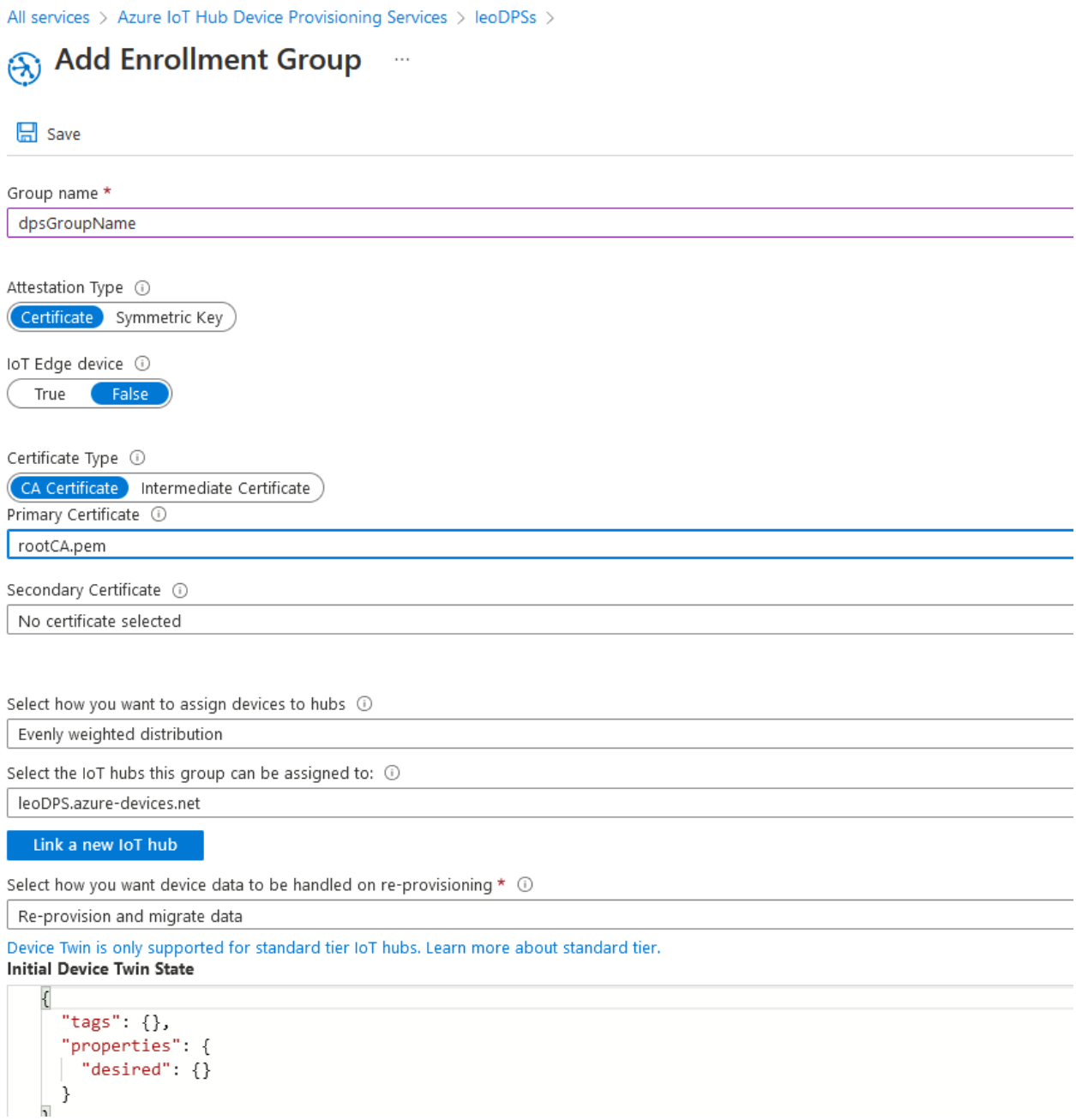
For mor information please visit Azure Quick Start [6].

1.4.2 Configure enrollment group

An enrollment group is a group of devices that share a specific attestation mechanism. Enrollment groups support X.509 certificate or symmetric key attestation. Devices in an X.509 enrollment group present X.509 certificates that have been signed by the same root or intermediate Certificate Authority (CA). The common name (CN) of each device, end-entity (leaf) certificate becomes the registration ID for that device.

The registration ID is used to uniquely identify a device registration with the Device Provisioning Service. The registration ID must be unique in the provisioning service ID scope. Each device must have a registration ID. The registration ID is a case-insensitive string (up to 128 characters long) of alphanumeric characters plus the special characters: '-', '.', '_', ':'. The last character must be alphanumeric or dash ('-').

1. From your DPS in Azure portal, select the “Manage enrollments” tab, and then select “Add enrolment group” at the top.
2. Enter the following information in the “Add Enrolment Group” panel, and then select **Save**. The device certificate can be signed with the root CA or an intermediate CA, as shown below.



See also “Create an enrolment group” in the Provision multiple X.509 devices tutorial [5].

1.4.3 Configure IoT device connection to Device Provisioning Service (DPS)

For X.509-based attestation, the registration ID is set to the common name (CN) of the device certificate. For this reason, the common name must adhere to the registration ID string format.

1. Create client private key and CSR:

```
$ openssl req -newkey rsa:2048 -nodes -keyout nina.key.pem -out nina.csr
```

☞ The common name (CN) of each device's end-entity (leaf) certificate becomes the registration ID for that device.

2. Sign the CSR with the client root CA registered on Azure as described in Upload and verify the CA used to sign the client-side certificate, for example:

```
$ openssl x509 -req -in nina.csr -CA rootCA.pem -CAkey rootCA.key -CAcreateserial -out
nina.pem -days 500 -sha256
```

3. Upload the client Private Key and the client certificate created above to the module as described in section Install certificates on the module.
4. Use the command AT+UDCP command and MQTT to connect to Azure IoT Hub Device Provisioning Service (DPS), publish and subscribe to events.

For further information about the mqtt: scheme, see the u-connectXpress MQTT application note [2]. The format of the AT+UDCP command for Azure using a SAS Token is as follows:

```
AT+UDCP="mqtt://iothubhostname:8883/?
client=registration_id
&user=idScope/registrations/registration_id/api-version=2019-03-31
&pt=$dps/registrations/PUT/iotdps-register/?$rid={request_id}
&st=$dps/registrations/res/#”
&encr=3
&ca=<ca certificate>
&cert=<device certificate>
&privKey=<device private key>
```

In the URL, replace the *marked* sections above as follows:

Item	Description
iothubhostname	From the Hostname section in the Overview page in Azure IoT Hub.
registration_id	The Device ID set to the device in Azure IoT Hub.
idScope	is the ID Scope from the Azure IoT Hub Device Provisioning Service.

Example

The example pseudo-code below shows the DPS flow using u-blox u-connectXpress. It is assumed that the module is provisioned with the certificates and is already connected to the Wi-Fi with internet connection:

```
AT+UDCP=mqtt://global.azure-devices-provisioning.net:8883/?
client=ninadps
&user=0ne0067E45C/registrations/ninadps/api-version=2019-03-31
&pt=$dps/registrations/PUT/iotdps-register/?$rid={request_id}
&st=$dps/registrations/res/#
&keepAlive=60
&encr=3
&ca=ca.pem
&cert=ninadps.pem
&privKey=ninadps.key.pem

+UDCP:1
OK

+UUDPC:1,2,6,0.0.0.0,0,40.113.176.170,8883
ATO1
OK


// Publish the following message
"{\"payload\":\"\",\"registrationId\":\"registration_id\"}"


{"operationId":"5.b084dab098f0a900.5f5b44b2-ae20-4957-bd06-
40f9e8dcec3f","status":"assigning"}
```

1.4.4 Monitoring DPS status

To poll the DPS status, it is possible to publish to the following topic, where `operationId` is returned on the previous message. For example:

```
$dps/registrations/GET/iotdps-get-
operationstatus/?$rid={request_id}&operationId=5.b084dab098f0a900.5f5b44b2-ae20-4957-bd06-
40f9e8dcec3f
```

This example demonstrates the process using u-connectXpress Data Mode. Since it is not possible to start a new peer while in Data Mode, it is necessary to change to Command mode by sending the escape sequence, +++, and create a new peer. Because the topic has an escape character “&”, the url needs to be used with a placeholder:

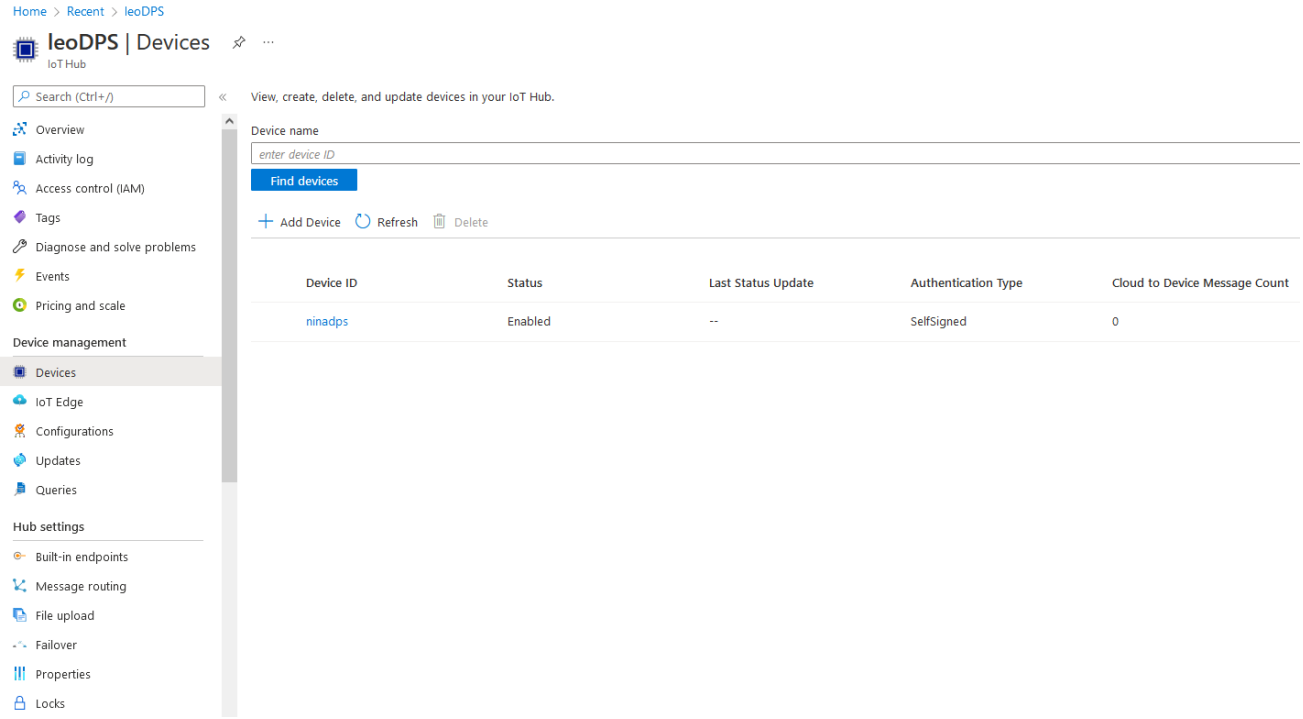
```
AT+UDUV=0,"$dps/registrations/GET/iotdps-get-
operationstatus/?$rid={request_id}&operationId=5.b084dab098f0a900.5f5b44b2-ae20-4957-bd06-
40f9e8dcec3f”

AT+UDCP=mqtt://global.azure-devices-
provisioning.net:8883/?client=ninadps&user=0ne0067E45C/registrations/ninadps/api-
version=2019-03-
31&pt=%%0&st=$dps/registrations/res/#&keepAlive=60&encr=3&ca=ca.pem&cert=ninadps.pem&privK
ey=ninadps.key.pem

+UUDPC:1,2,6,0.0.0.0,0,40.113.176.170,8883
ATO1
OK
```

1. Publish the following message “get operationstatus” to the status topic.

```
{\"operationId\":\"5.54dcdee4e6de2c9a.26a7ed00-28fd-4e98-bb5c-
b464a00262fd\",\"status\":\"assigned\",\"registrationState\":{\"x509\":{\"enrollmentGr
oupId\":\"enrolGroup\"},\"registrationId\":\"dpsdev\",\"createdDateTimeUtc\":\"2022-
07-01T16:46:50.830016Z\",\"assignedHub\":\"leoDPS.azure-
devices.net\",\"deviceId\":\"dpsdev\",\"status\":\"assigned\",\"substatus\":\"initialA
ssignment\",\"lastUpdatedDateTimeUtc\":\"2022-07-
01T16:46:51.0919787Z\",\"etag\":\"IjhkMGJlMTE3LTAwMDAtMDEwMC0wMDAwLTYyYmYyNGZiMDAwMCI=
\"}}
```

2. When the message “status”: “assigned” is received, check that the device has been transferred to the configured IoT Hub in **Devices** under the **Azure IoT Hub.**

In this example, “assignedHub": "**leoDPS.azure-devices.net**":



The following example includes the log from the DPS process, using NINA-W15 and the python script example found at https://github.com/u-blox/u-connectXpress_azure_device_provisioning_services.

```
$ python .\azure_dps.py COM44

com44 open
 18ms -> AT+UFACTORY
 400ms <- AT+UFACTORY
OK
 401ms -> AT+CPWROFF
 416ms <- AT+CPWROFF
OK
 2804ms -> AT+USECMNG=0,0,ca.pem,1261
 3836ms <- AT+USECMNG=0,0,ca.pem,1261
>
 3836ms -> -----BEGIN CERTIFICATE-----
...
-----END CERTIFICATE-----
 5859ms <- +USECMNG:0,0,"ca.pem","ACB694A59C17E0D791529BB19706A6E4"
OK
 5860ms -> AT+USECMNG=0,1,cert.pem,1224
 6923ms <- AT+USECMNG=0,1,cert.pem,1224
>
 6923ms -> -----BEGIN CERTIFICATE-----
...
-----END CERTIFICATE-----
 8938ms <- +USECMNG:0,1,"cert.pem","9A1F95B8D512FA0ED075DD2B794ECB2A"
OK
 8941ms -> AT+USECMNG=0,2,key.pem,1704
 10033ms <- AT+USECMNG=0,2,key.pem,1704
>
 10034ms -> -----BEGIN PRIVATE KEY-----
...
-----END PRIVATE KEY-----
 12057ms <- +USECMNG:0,2,"key.pem","695D5D1EBB1DDBD0C6F2C128BAEB7F34"
OK
 12057ms -> ATO2
 12067ms <- ATO2
```

```
OK
 14076ms -> 0xAA00120044 'AT+UWSC=0,2,SSID\r' 0x55
 14089ms AT response: OK
 14091ms -> 0xAA00100044 'AT+UWSC=0,5,2\r' 0x55
 14105ms AT response: OK
 14106ms -> 0xAA001F0044 'AT+UWSC=0,8,PASSWORD\r' 0x55
 14121ms AT response: OK
 14122ms -> 0xAA000F0044 'AT+UWSCA=0,3\r' 0x55
 14153ms AT response: OK
 17017ms AT event: +UUWLE:0,802AA8035ADE,11
 17065ms AT event: +UUNU:0
 19092ms AT event: +UUNU:0
 22100ms -> 0xAA011F0044 'AT+UDCP=mqtt://global.azure-devices-
provisioning.net:8883/?client=ninadps&user=0ne0067E45C/registrations/ninadps/api-
version=2019-03-31&pt=$dps/registrations/PUT/iotdps-
register/?$rid={request_id}&st=$dps/registrations/res/#&encr=3&keepAlive=60&ca=ca.pem&cert
=cert.pem&privKey=key.pem\r' 0x55
 22440ms AT response: +UDCP:2
OK
 24712ms Connect event IPv4
        Channel id: 0
 25726ms AT event: +UUDPC:2,2,6,0.0.0.0,0,20.43.44.164,8883
 25726ms -> 0xAA002C0036 '\x00{"payload":"","registrationId":"ninadps"}' 0x55
 26168ms Data event:
        Channel id: 0
        Data: {"operationId":"5.b084dab098f0a900.076859d0-7180-40b8-9d06-
bf611e398ec0","status":"assigning"}

 26169ms -> 0xAA00950044 'AT+UDUV=0,$dps/registrations/GET/iotdps-get-
operationstatus/?$rid={request_id}&operationId=5.b084dab098f0a900.076859d0-7180-40b8-9d06-
bf611e398ec0\r' 0x55
 26197ms AT response: OK
 26197ms -> 0xAA00CD0044 'AT+UDCP=mqtt://global.azure-devices-
provisioning.net:8883/?client=ninadps&user=0ne0067E45C/registrations/ninadps/api-
version=2019-03-31&pt=%%0&encr=3&keepAlive=60&ca=ca.pem&cert=cert.pem&privKey=key.pem\r'
0x55
 26234ms AT response: +UDCP:4
OK
 26235ms Connect event IPv4
        Channel id: 1
 27245ms AT event: +UUDPC:4,2,6,0.0.0.0,0,20.43.44.164,8883
 27245ms -> 0xAA00160036 '\x01get operationstatus' 0x55
 27466ms Data event:
        Channel id: 0
        Data: {"operationId":"5.b084dab098f0a900.076859d0-7180-40b8-9d06-
bf611e398ec0","status":"assigned","registrationState":{"x509":{"enrollmentGroupId":"enrolG
roup"},"registrationId":"ninadps","createdDateTimeUtc":"2022-07-
04T08:28:35.8694014Z","assignedHub":"leoDPS.azure-
devices.net","deviceId":"ninadps","status":"assigned","substatus":"initialAssignment","las
tUpdatedDateTimeUtc":"2022-07-
04T08:28:36.154464Z","etag":"IjYwMDA4OTJjLTAwMDAtMDEwMC0wMDAwLTYyYzJhNGI0MDAwMCI="}}

Successfully Assigned
 27468ms -> 0xAA000D0044 'AT+CPWROFF\r' 0x55
 27482ms AT response: OK
```

1.5 Integration with Azure IoT Explorer

IoT Explorer is a tool provided by Azure to set up the connection and monitoring of the module to Azure Cloud applications. The software is provided as a free download and is available at https://github.com/Azure/azure-iot-explorer/releases.

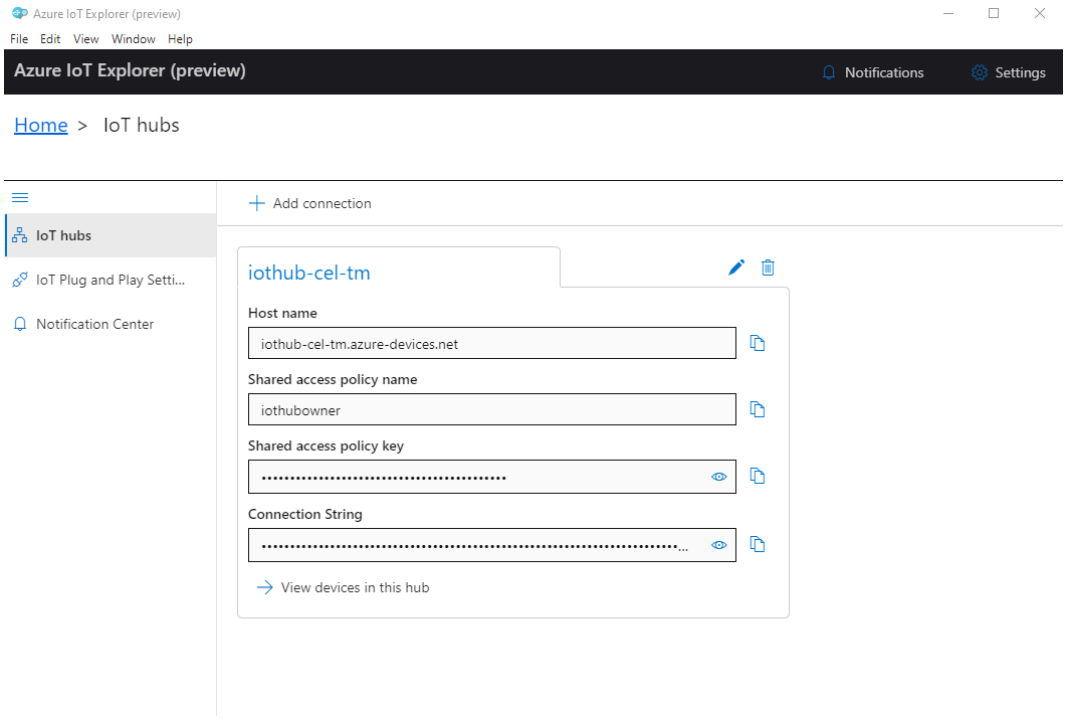
The main features of the Azure IoT Explorer include:

- Simple Azure connection configuration
- Device twin and direct method functions
- Real-time Azure monitoring and alarm management
- Advanced diagnostics tools

For more information about IoT Explorer functions, see the official Azure IoT Explorer page.

1.5.1 IoT Hub connection

1. The first time that Azure IoT Explorer is executed, the application is prompted for the user's IoT hub connection string. Provide the connection string.



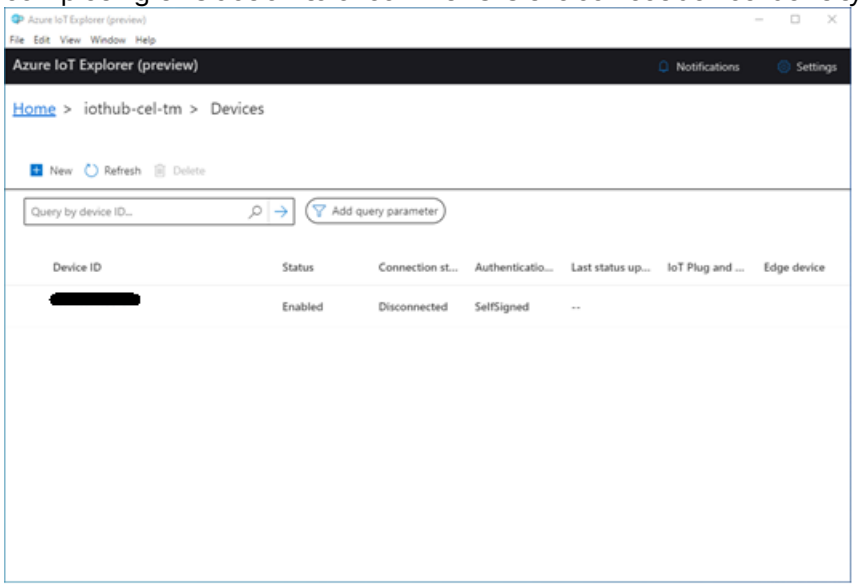
2. Select **Connect**.

1.5.2 View Devices

After the tool connects to the IoT hub, it displays the **Devices** list page that lists the device identities registered with the IoT hub. The user can select any entry in the list to see more information.

To view devices from the Devices list page:

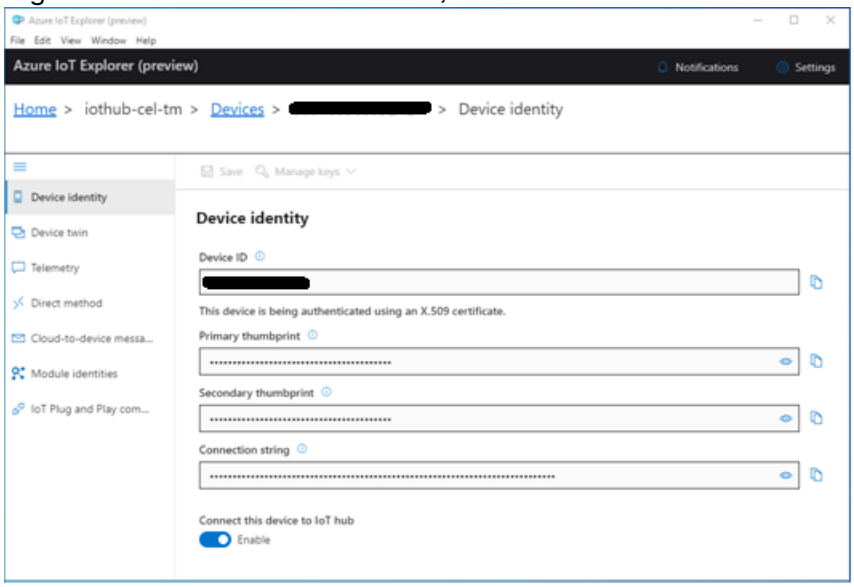
1. Select **New** to register a new device with the Azure IoT hub. Then enter a **Device ID**. Use the default settings to automatically generate authentication keys and enable the connection to the IoT hub.
2. Select a device and then select **Delete** to delete a device identity. Review the device details before completing this action to check if this is the correct device identity to delete.



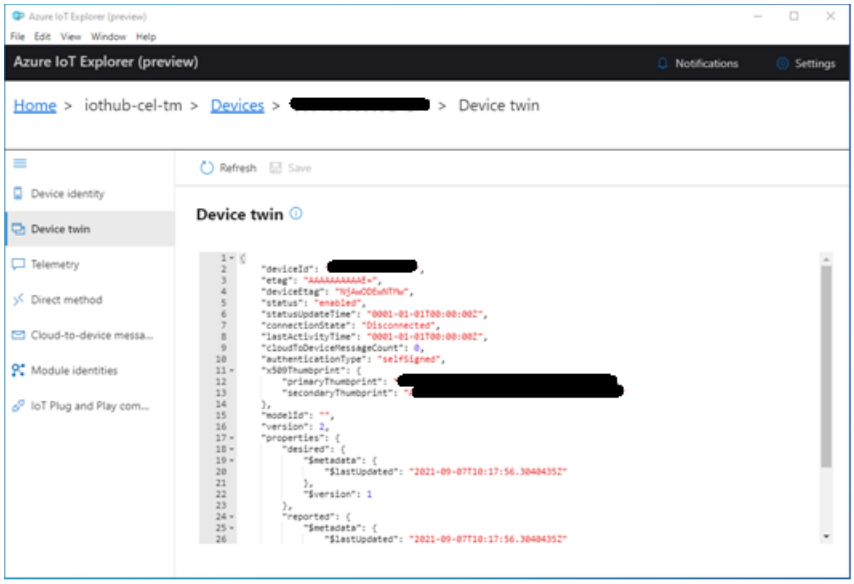
1.5.3 Interact with a device

To interact with a device:

1. On the **Devices** list page, select a value in the **Device ID** column to view the detail page for the registered device. For each device, there are two main sections: **Device** and **Digital Twin**.



2. The user can access the device twin information on the Device twin tab



Appendix

A Glossary

Abbreviation	Definition
API	Application Programming Interface
CA	Certificate Authority
CN	Common Name
CSR	Certificate Signing Request
IoT	Internet of Things
MQTT	Message Queuing Telemetry Transport
TLS	Transport Layer Security

Table 1: Explanation of the abbreviations and terms used

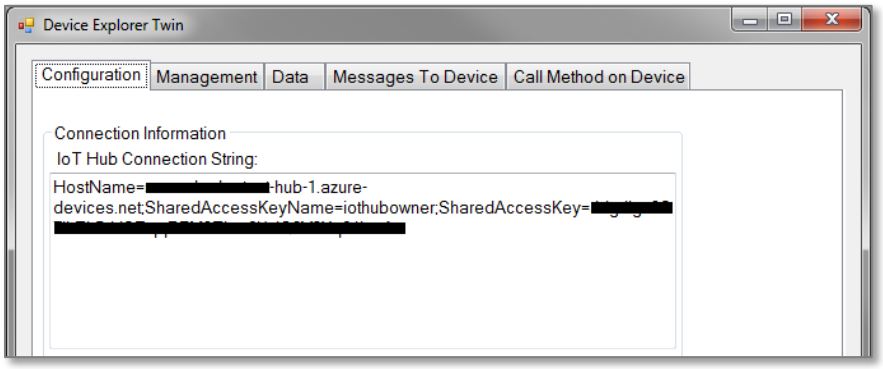
B Monitoring messages to/from the cloud

B.1 In Azure IoT Hub

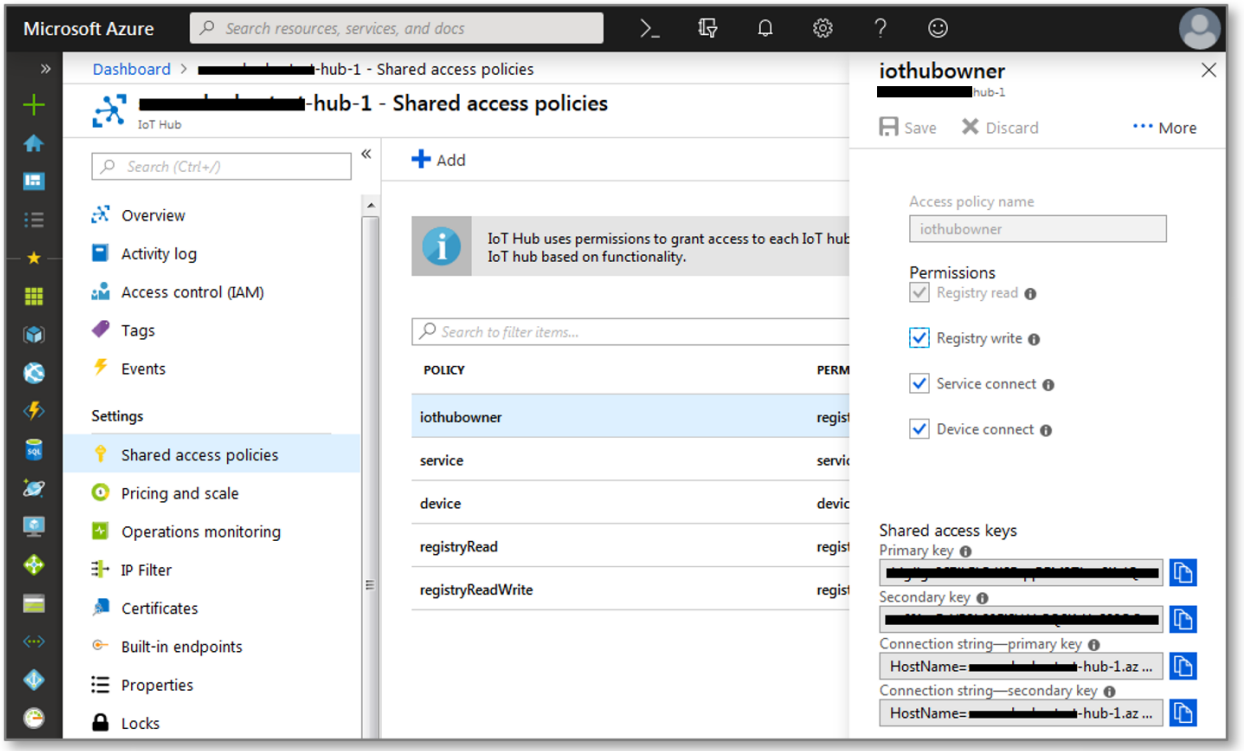
The Device Explorer tool is used to monitor messages between the device and the Azure IoT Hub. A pre-built version of the Device Explorer for Windows can be downloaded from: https://github.com/Azure/azure-iot-sdk-csharp/releases/tag/2019-9-11.

In this URL, scroll down for the SetupDeviceExplorer.msi

1. In the Device Explorer tool, go to the **Configuration** tab and add the Connection String for your Hub. The Connection String can be found in the IoT Hub.

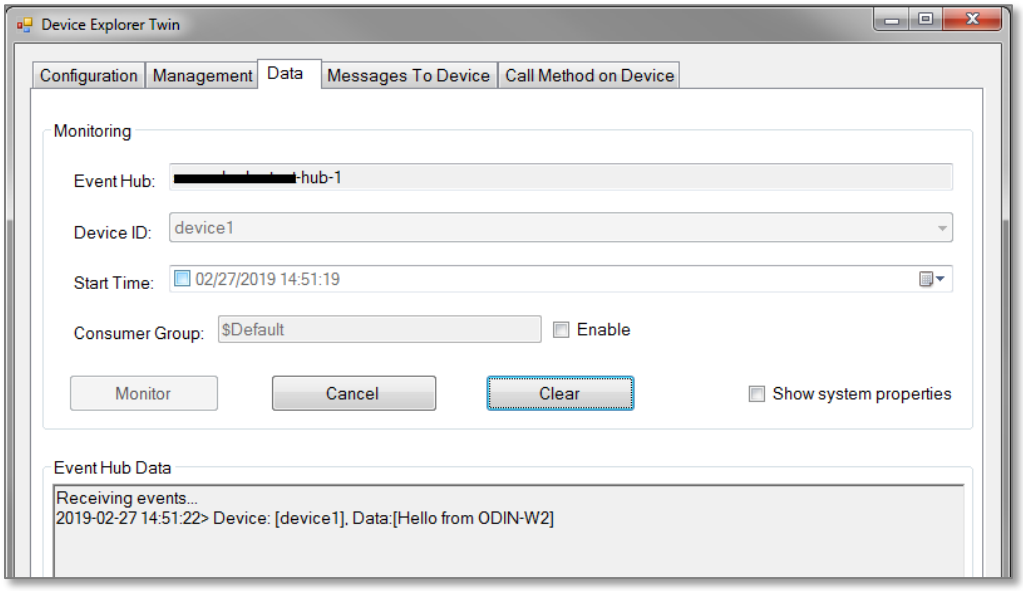


2. Go to Settings / Shared access policies and select the Policy “iothubowner”.



B.1.1 Device-to-cloud

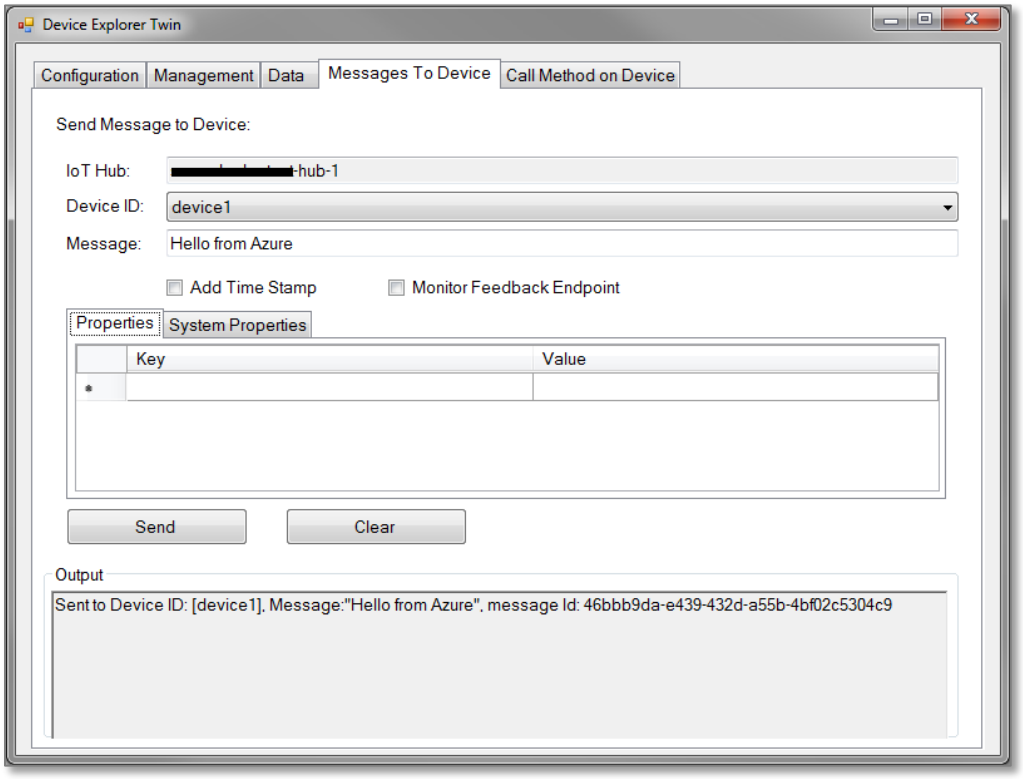
1. In the Device Explorer tool, go to the Data tab and select the Device ID of the device to monitor (for example “device1”)



2. Select **Monitor**.

B.1.2 Cloud-to-device

1. In the Device Explorer tool, go to the “Message to Device” tab and select the Device ID of the device to send message to (for example “device1”).
2. Type a message in the Message text box and select **Send**.



3. Monitor the Cloud-to-Device messages.

Related documents

[1] u-connectXpress AT commands manual, UBX-14044127
[2] u-connectXpress MQTT application note, UBX-19005066
[3] u-connectXpress user guide, UBX-16024251
[4] u-connectXpress Wi-Fi security application note, UBX-20012830
[5] Tutorial: Provision multiple X.509 devices using enrollment groups
[6] Quickstart: Set up the IoT Hub Device Provisioning Service with the Azure portal

Revision history

Revision	Date	Name	Comments
R01	24-Mar-2023	ldas	Initial release.

For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Contact

For further support and contact information, visit us at www.u-blox.com/support.