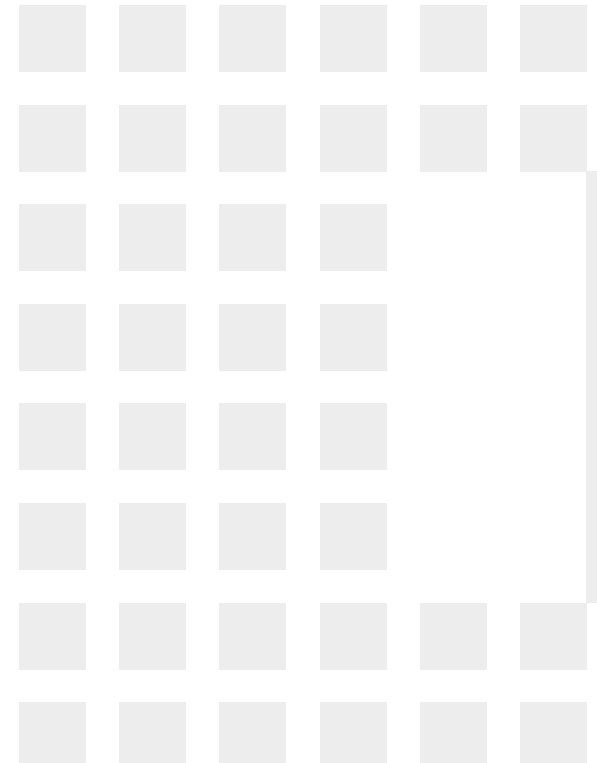




*Think Automation and beyond...*

# FC6A Plus MQTT Microsoft Azure IoT



- WindLDR Version
- What is Microsoft Azure?
  - IoT Services in Azure
    - IoT Hub
    - IoT Device Provisioning Service
    - IoT Central
- Microsoft Azure Configurations
  - IoT Hub (Configurations on both Azure and WindLDR)
  - IoT Device Provisioning Service (Configurations on both Azure & WindLDR)
- Restrictions
- IoT Central Reference

How to connect to cloud services		~FC6A Plus FW V2.10	FC6A Plus FW V2.20~
General Purpose Broker		Supported	Supported
AWS IoT Core			Supported
Azure IoT Hub	Connect using an X.509 certificate *.		Supported
	Connect using SAS	No	Supported
	Connecting via DPS	No	Supported

\*In this case, FC6A Plus uses client certificate for connecting IoT Hub.

# What is Microsoft Azure?

- Microsoft Azure is one of the three major cloud platforms: AWS, Azure, and GCP (Google Cloud Platform)
- These three cloud platforms offer generally similar functionality, and customers choose the platform that is most convenient for them.
  - Azure for easy integration with Office
  - GCP is easy to integrate with Google-based tools
  - AWS has the highest market share
- FC6A Plus support AWS and Azure cloud platforms, as GCP is scheduled to be retired on August 16, 2023



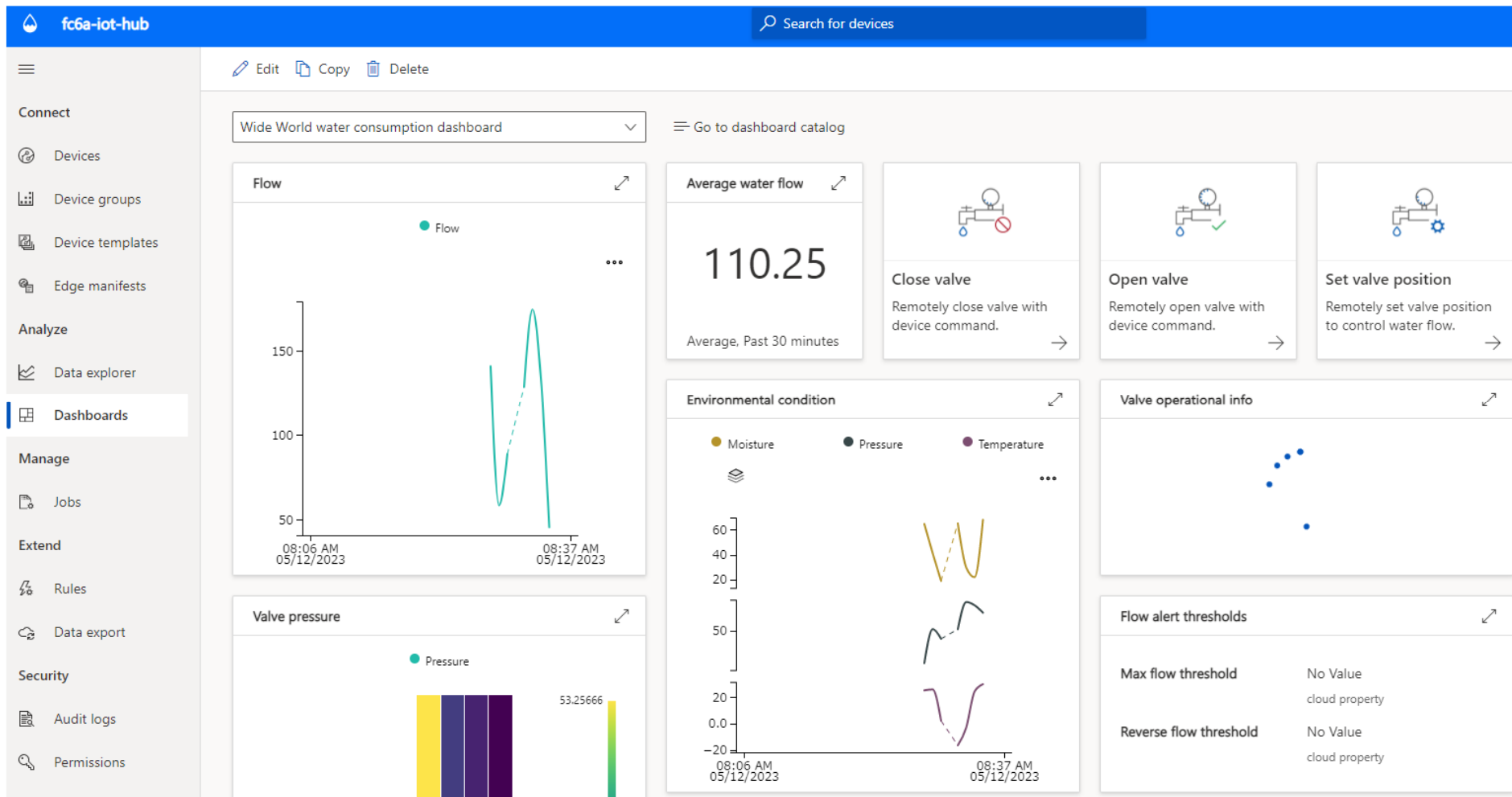
- Microsoft Azure has three major IoT services
- FC6A Plus provides access to these three services.
  - **IoT Hub:**
    - Connect to IoT devices via MQTT similar to the IoT Core in AWS
  - **Azure IoT Hub Device Provisioning Service**
    - This function is designed to efficiently manage a large number of IoT devices
  - **IoT Central Application**
    - Function to create a dashboard that allows you to easily visualize the values of your IoT devices



- **The Azure Device Provisioning Service is called "Azure DPS".**
- Issue of IoT device management
  - If you want to change the host to access after shipping an IoT device, you have to rewrite the program for each individual device, which is time-consuming.
  - It is cumbersome to set up authentication information for each device individually
- **Azure DPS approach (What does Azure DPS do?)**
  - Automatically select the appropriate IoT Hub when a device accesses to the DPS.
  - Each of the large number of IoT devices obtains authentication information semi-automatically, so there is no need to have individual authentication information for each device (the same project can be used in FC6As)

# IoT Central Application

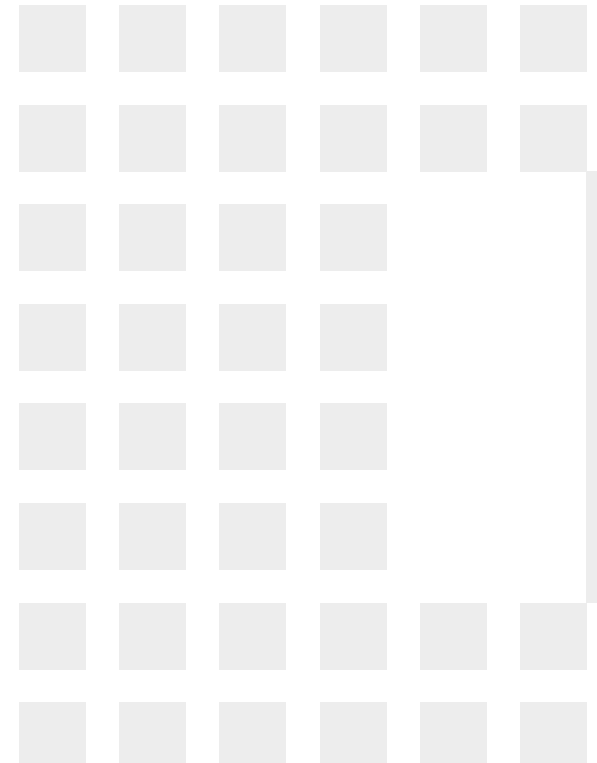
- Function to create dashboards that allow you to easily visualize the values of IoT devices





*Think Automation and beyond...*

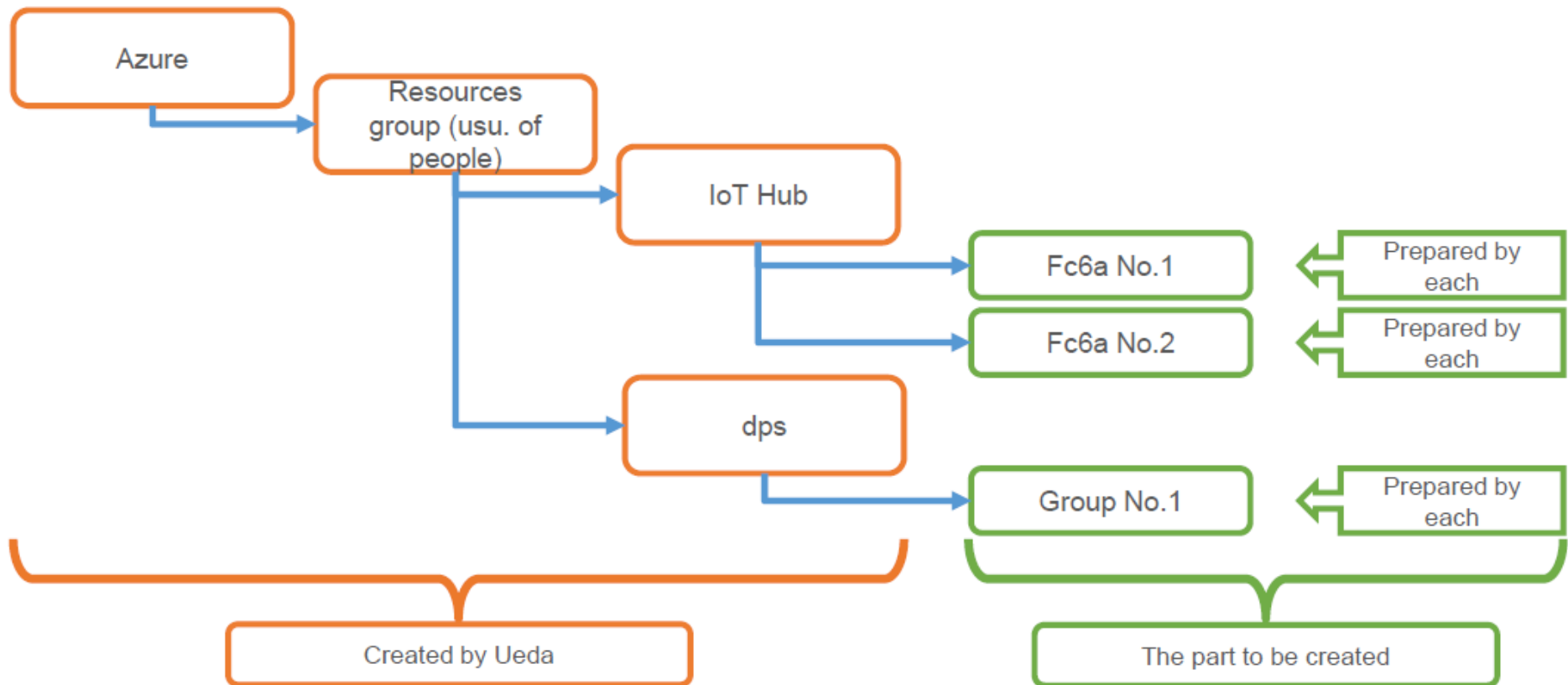
# Microsoft Azure Configurations





# Azure configuration hierarchy

- The Azure configuration has the following hierarchy
- It is possible to create several 'resource groups' in Azure.
- You can create actual service in the resource groups.



- The steps from signing up for Azure to connecting FC6A are as follows.

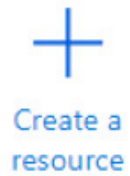
- Connection procedures and testing

- ① Creating Resource Groups
- ② Creating an IoT Hub
- ③ Register device (FC6A) in IoT Hub
- ④ WindLDR settings (connection settings)
- ⑤ connection test
- ⑥ WindLDR settings (Publish)
- ⑦ Publish Test
- ⑧ WindLDR settings (Subscribe)
- ⑨ Subscribe Test

# Creation of Resource Groups

- First, create a Resource groups

## Azure services



Resource groups



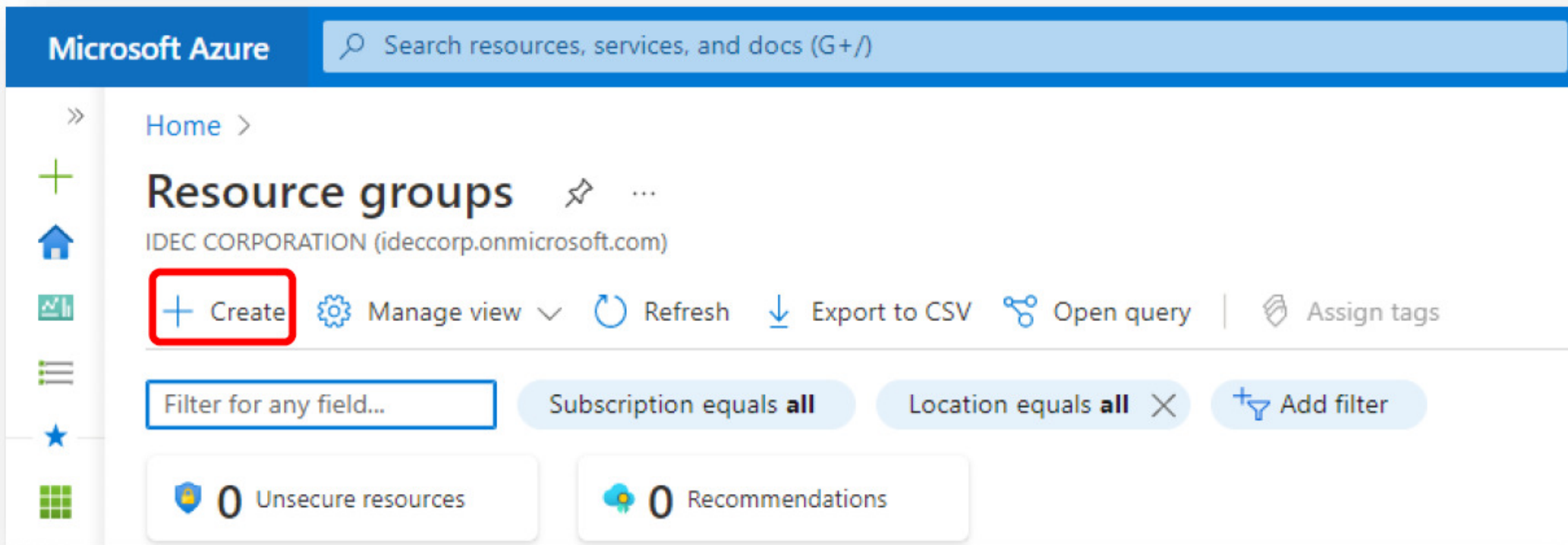
+ Create    View



Resource groups

# Creation of Resource Groups

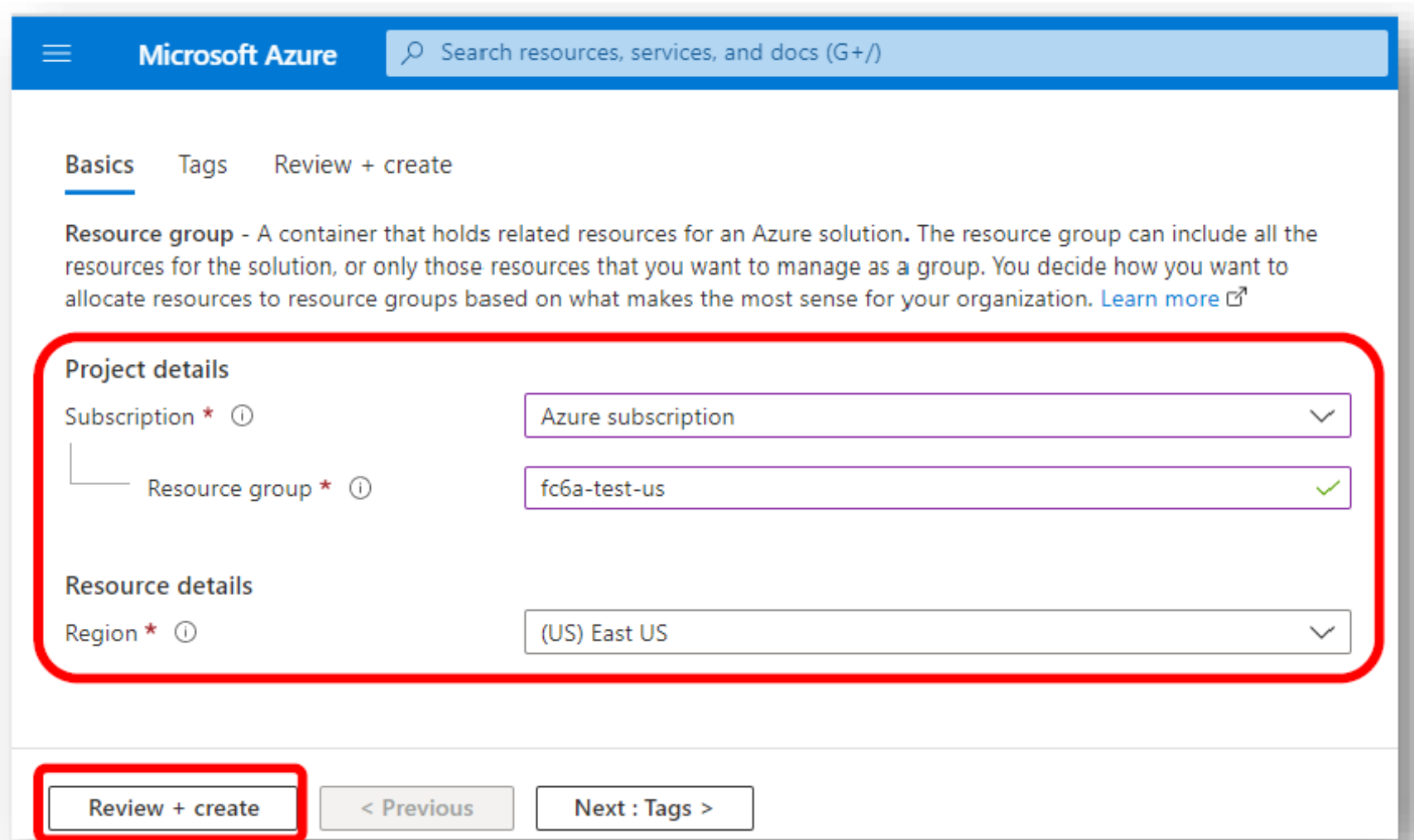
- Create a resource group by clicking on “+ Create”



The screenshot displays the Microsoft Azure portal interface for the 'Resource groups' page. At the top, there is a search bar with the text 'Search resources, services, and docs (G+/)'. Below the search bar, the page title 'Resource groups' is shown, along with the user's account information 'IDEC CORPORATION (ideccorp.onmicrosoft.com)'. A red box highlights the '+ Create' button, which is used to create a new resource group. Other buttons visible include 'Manage view', 'Refresh', 'Export to CSV', 'Open query', and 'Assign tags'. Below these buttons, there are filter options: 'Filter for any field...', 'Subscription equals all', 'Location equals all', and 'Add filter'. At the bottom, there are two summary cards: '0 Unsecure resources' and '0 Recommendations'.

# Creation of Resource Groups

- Set a name for Resource groups
- Enter a region
- Click “Review + Create” to confirm the settings



Microsoft Azure Search resources, services, and docs (G+)

Basics Tags Review + create

Resource group - A container that holds related resources for an Azure solution. The resource group can include all the resources for the solution, or only those resources that you want to manage as a group. You decide how you want to allocate resources to resource groups based on what makes the most sense for your organization. [Learn more](#)

**Project details**

Subscription \* ⓘ Azure subscription ✓

Resource group \* ⓘ fc6a-test-us ✓

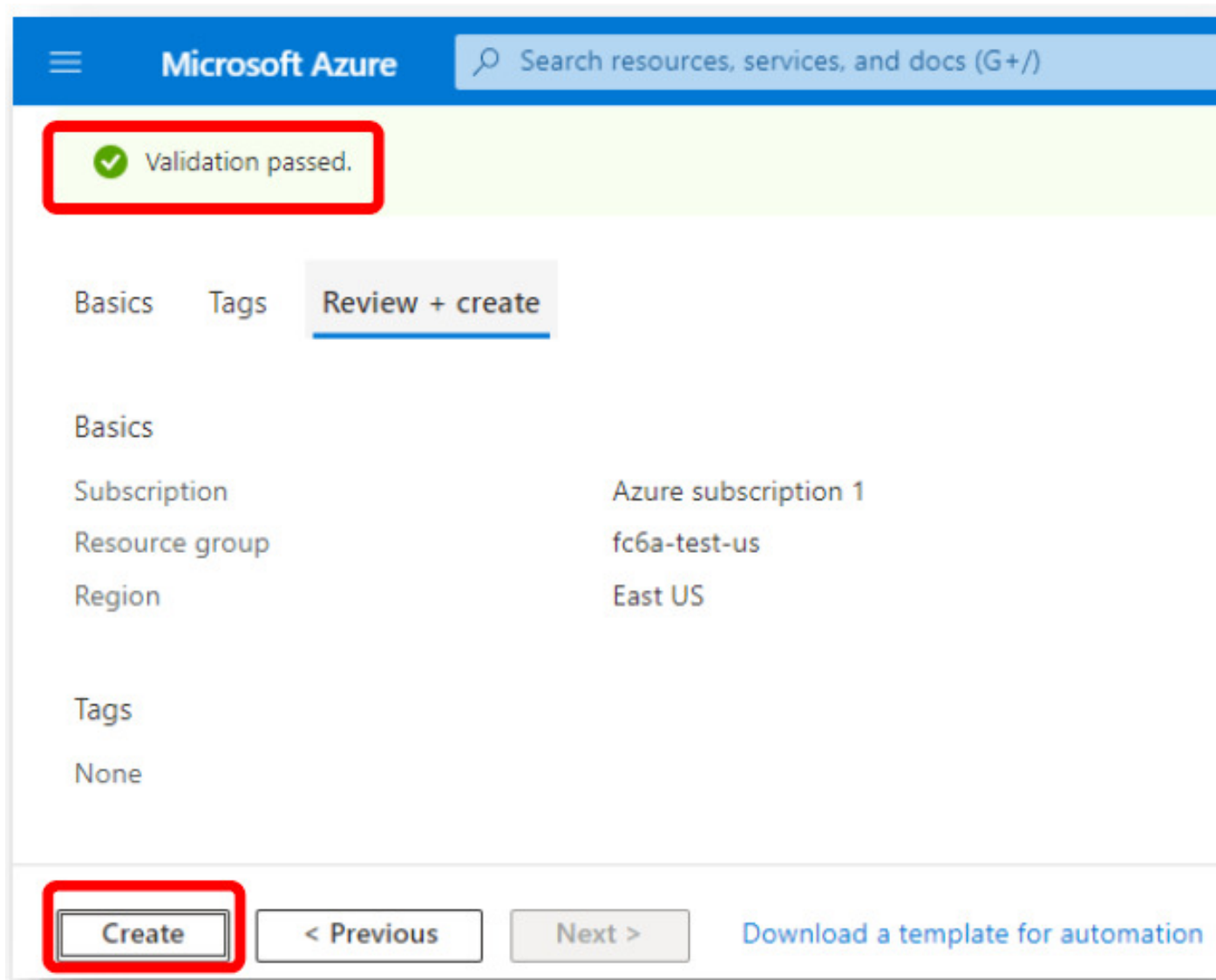
**Resource details**

Region \* ⓘ (US) East US ✓

Review + create < Previous Next : Tags >

# Creation of Resource Groups

- If everything looks good, click “Create” button.



Microsoft Azure Search resources, services, and docs (G+)

Validation passed.

Basics Tags Review + create

Basics

Subscription	Azure subscription 1
Resource group	fc6a-test-us
Region	East US

Tags

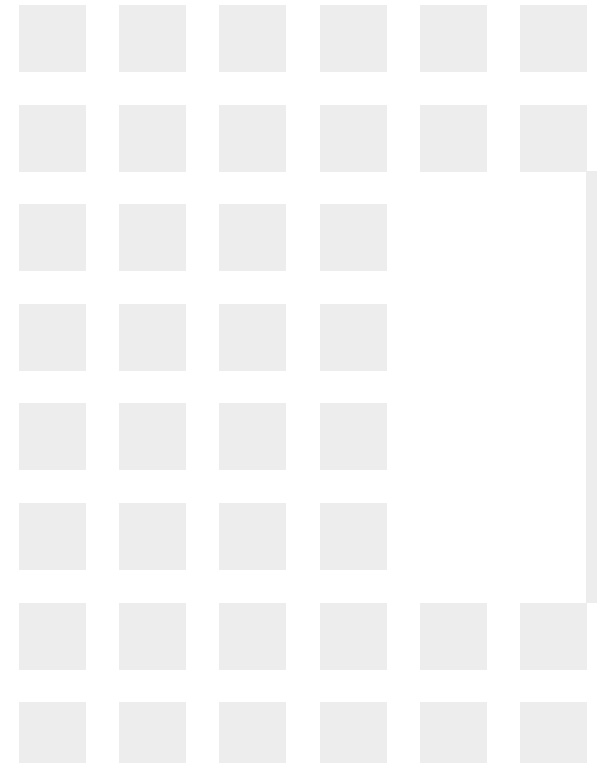
None

Create < Previous Next > Download a template for automation



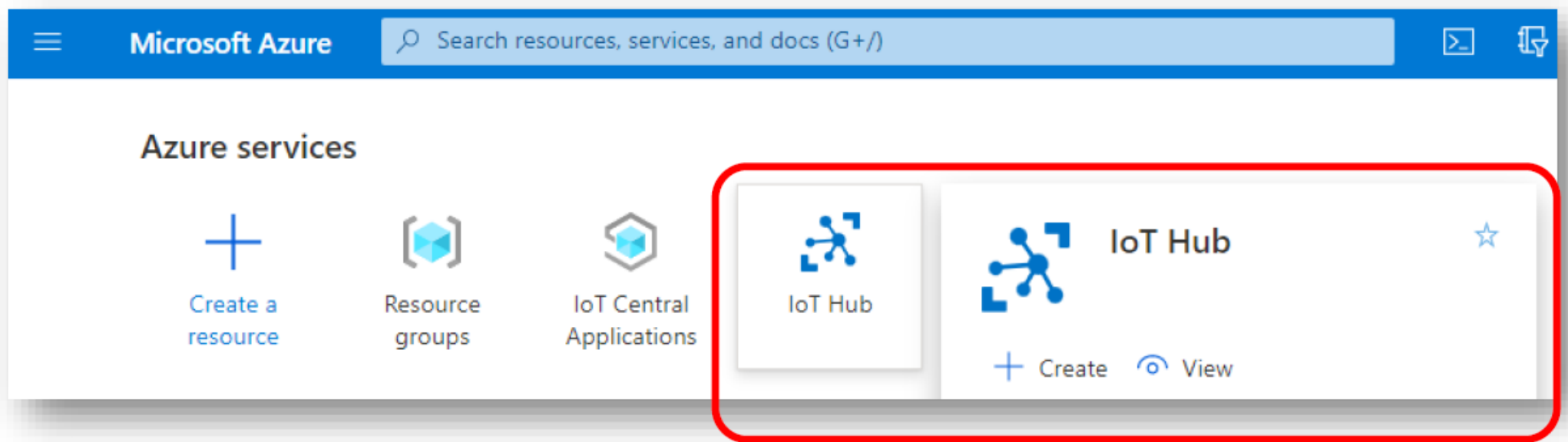
*Think Automation and beyond...*

# Creating an IoT Hub



# Creation of IoT Hub

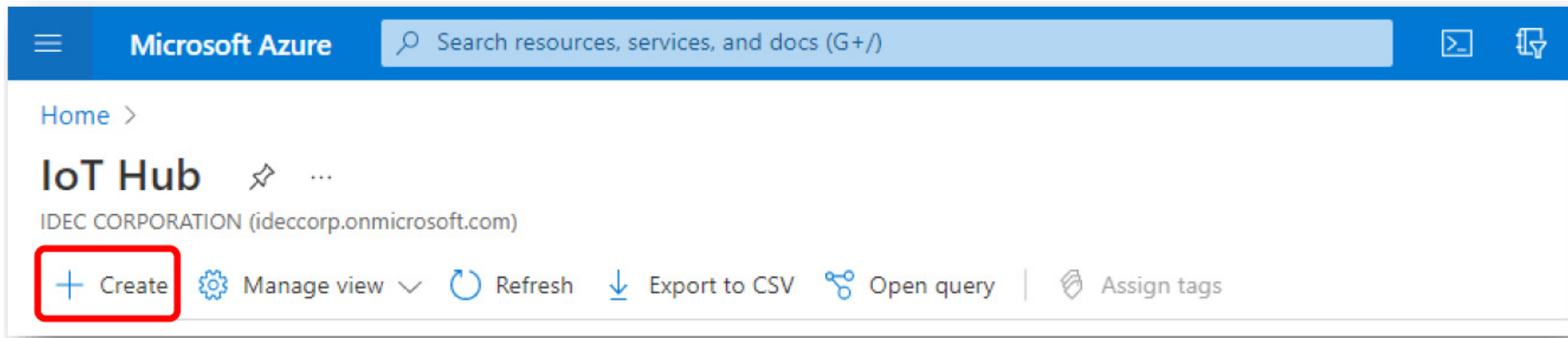
- Select IoT Hub from a list of the services





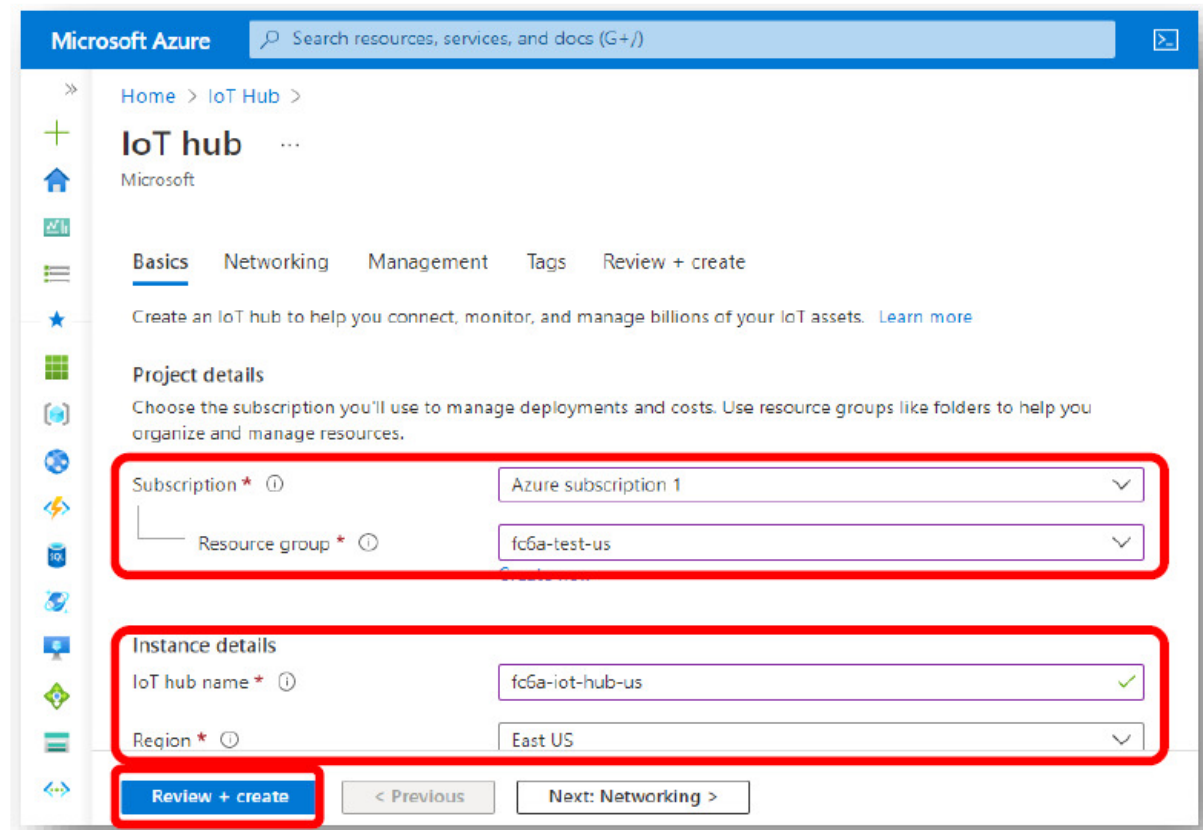
# Creation of IoT Hub

- Click “+ Create”, from the IoT Hub menu



# Creation of IoT Hub

- Enter the same resource group name that was created
- Enter IoT hub name and Region
- Click “Review + create”



Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub >

## IoT hub

Microsoft

Basics Networking Management Tags Review + create

Create an IoT hub to help you connect, monitor, and manage billions of your IoT assets. [Learn more](#)

### Project details

Choose the subscription you'll use to manage deployments and costs. Use resource groups like folders to help you organize and manage resources.

Subscription \* ⓘ Azure subscription 1

Resource group \* ⓘ fc6a-test-us

### Instance details

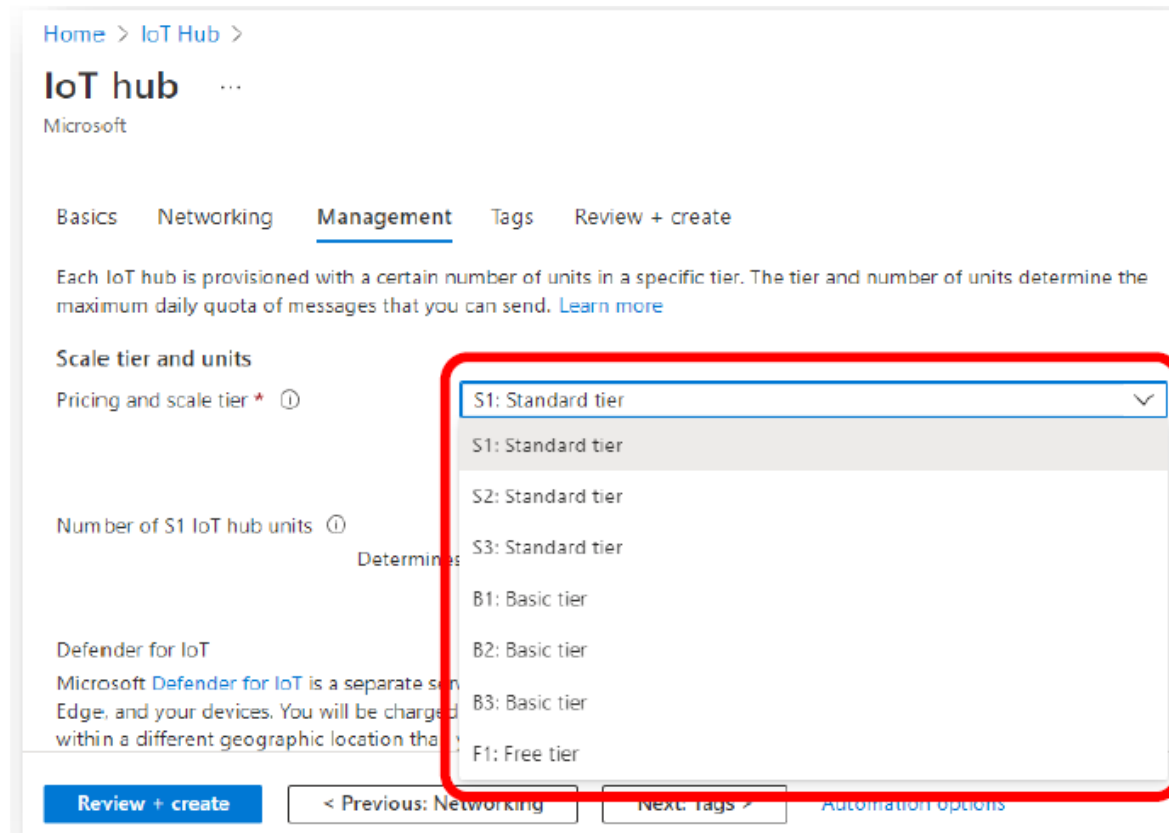
IoT hub name \* ⓘ fc6a-iot-hub-us ✓

Region \* ⓘ East US

Review + create < Previous Next: Networking >

# Creation of IoT Hub

- Select a payment plan for IoT hub
- Set up the plan in the "Pricing and scale tiers" section of the "Management" tab.
- (F1: Free Tier is available for free)



The screenshot shows the Microsoft IoT Hub Management console. The breadcrumb navigation is "Home > IoT Hub > IoT hub". The page title is "IoT hub" and the provider is "Microsoft". The "Management" tab is selected, with other tabs being "Basics", "Networking", "Tags", and "Review + create". A descriptive paragraph states: "Each IoT hub is provisioned with a certain number of units in a specific tier. The tier and number of units determine the maximum daily quota of messages that you can send. [Learn more](#)".

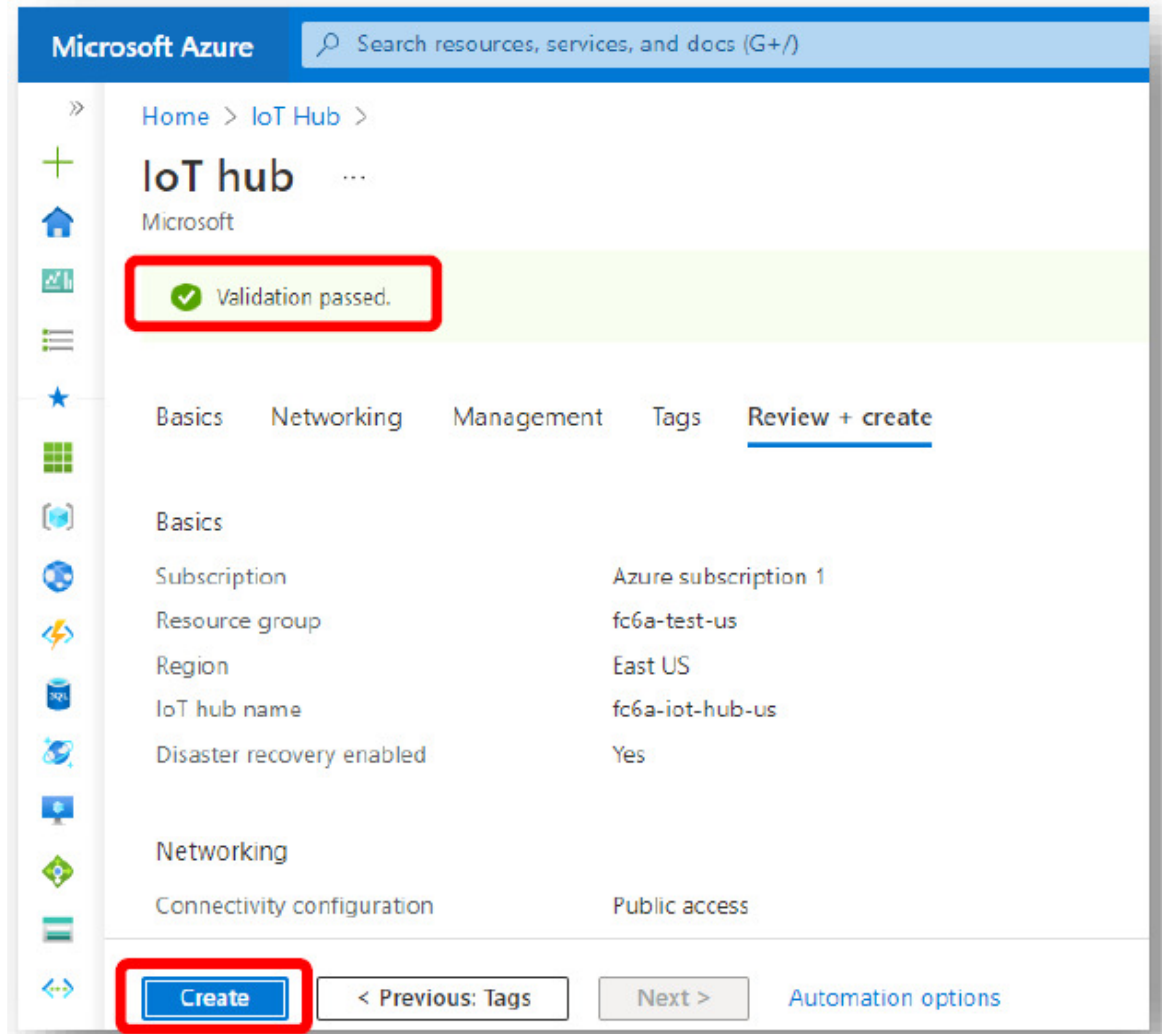
The "Scale tier and units" section is visible, with the "Pricing and scale tier" dropdown menu open. The dropdown list includes the following options:

- S1: Standard tier (selected)
- S1: Standard tier
- S2: Standard tier
- S3: Standard tier
- B1: Basic tier
- B2: Basic tier
- B3: Basic tier
- F1: Free tier

Below the dropdown, the "Number of S1 IoT hub units" field is visible, with a "Determine" button. At the bottom, there is a "Defender for IoT" section and a "Review + create" button. Navigation buttons for "< Previous: Networking" and "Next: tags >" are also present.

# Creation of IoT Hub

- If everything looks good, click “Create” button to create an IoT hub.



Microsoft Azure Search resources, services, and docs (G+/)

Home > IoT Hub >

## IoT hub

Microsoft

Validation passed.

Basics Networking Management Tags Review + create

Basics

Subscription	Azure subscription 1
Resource group	fc6a-test-us
Region	East US
IoT hub name	fc6a-iot-hub-us
Disaster recovery enabled	Yes

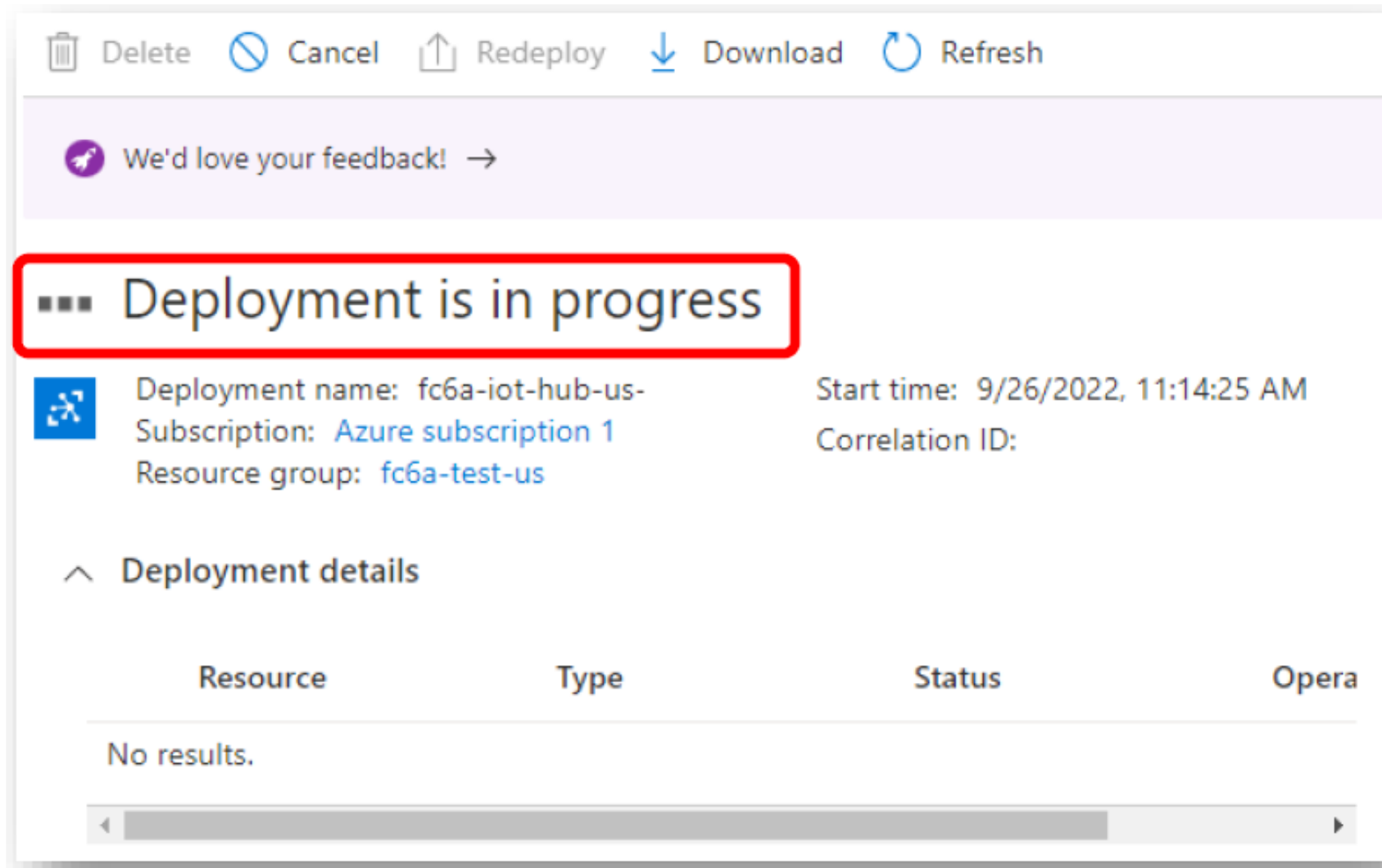
Networking

Connectivity configuration	Public access
----------------------------	---------------

**Create** < Previous: Tags Next > Automation options

# Creation of IoT Hub

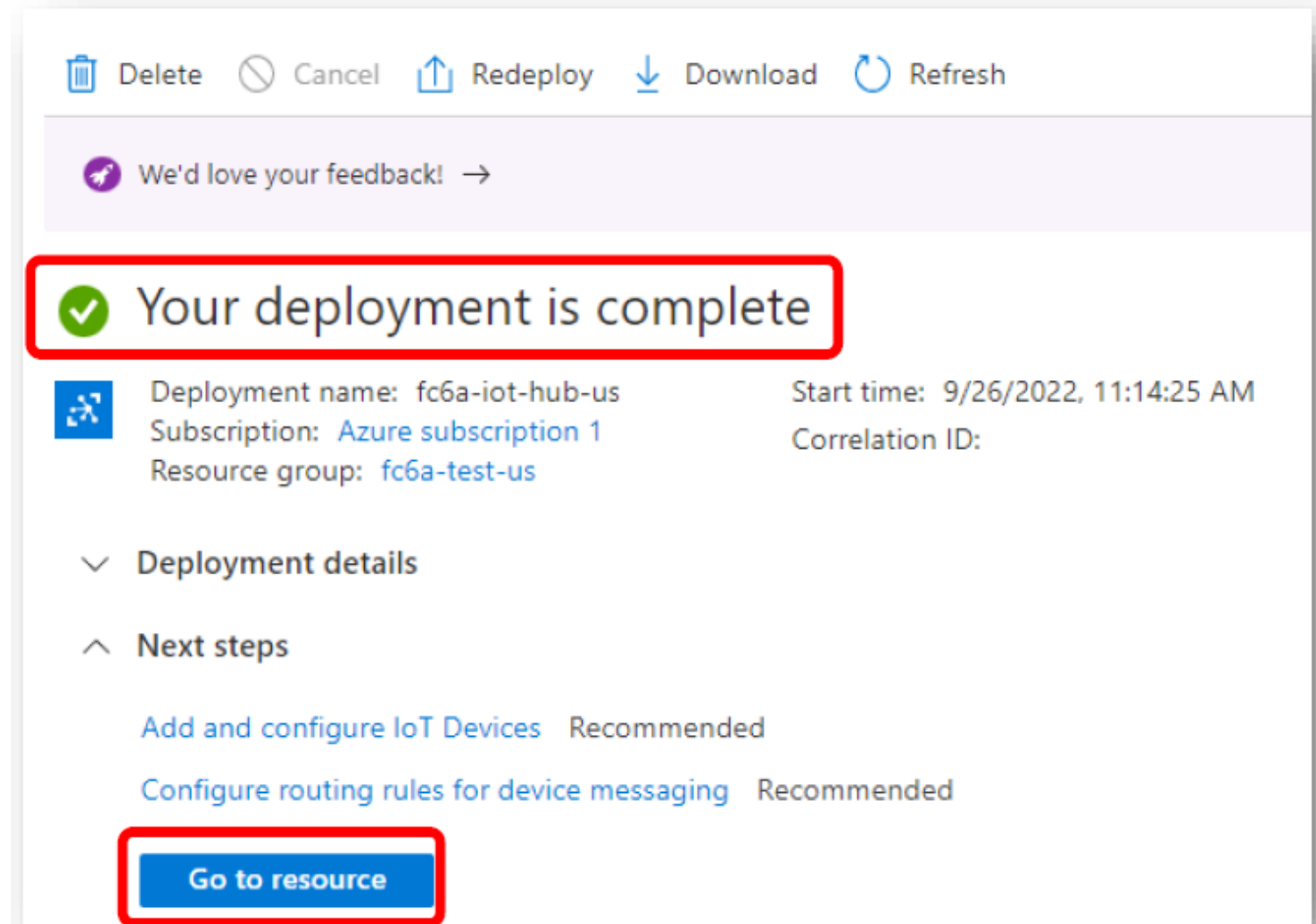
- When the creation of the IoT Hub begins, the message 'Deployment is in progress' is displayed.
- It may take several minutes.



The screenshot shows the Azure portal interface for an IoT Hub deployment. At the top, there are action buttons: Delete, Cancel, Redeploy, Download, and Refresh. Below these is a feedback banner that says "We'd love your feedback! →". The main content area features a red-bordered box containing the text "Deployment is in progress" next to a three-dot menu icon. Below this, the deployment details are listed: "Deployment name: fc6a-iot-hub-us-", "Subscription: Azure subscription 1", and "Resource group: fc6a-test-us". To the right, the "Start time" is "9/26/2022, 11:14:25 AM" and the "Correlation ID:" is empty. A section titled "Deployment details" is expanded, showing a table with columns for "Resource", "Type", "Status", and "Opera". The table currently contains the text "No results." and a scrollbar is visible at the bottom.

# Creation of IoT Hub

- Once the IoT Hub deployment is completed, you will see the following screen.
- Press the "Go to Resource" button to register the device (FC6A) in the IoT hub



Delete Cancel Redeploy Download Refresh

We'd love your feedback! →

**✓ Your deployment is complete**

Deployment name: fc6a-iot-hub-us Start time: 9/26/2022, 11:14:25 AM  
Subscription: Azure subscription 1 Correlation ID:  
Resource group: fc6a-test-us

Deployment details

Next steps

Add and configure IoT Devices Recommended

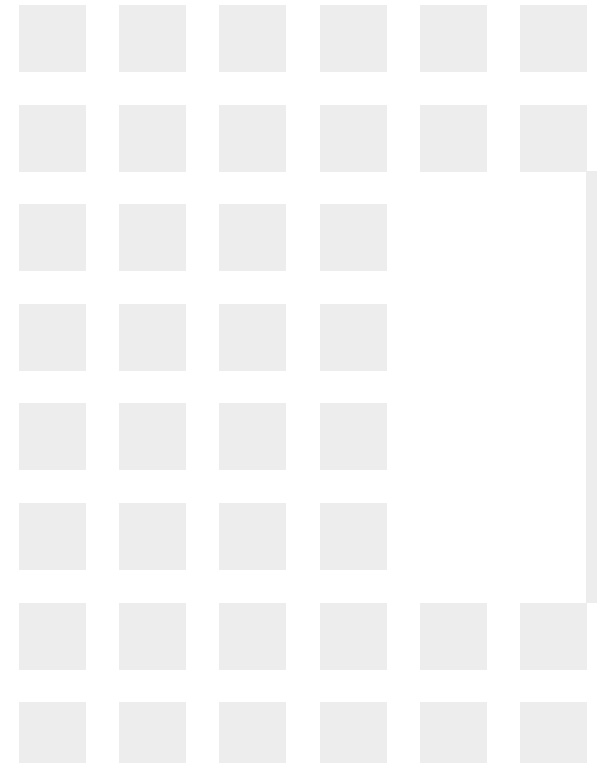
Configure routing rules for device messaging Recommended

**Go to resource**



*Think Automation and beyond...*

# Registering FC6A device in IoT Hub



# Registering a FC6A device in IoT Hub

- Select "Devices" from the left side menu and click "+Add Device".

Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub > fc6a-iot-hub-us

fc6a-iot-hub-us | Devices IoT Hub

Search

View, create, delete, and update devices in your IoT Hub.

Device name  
enter device ID

Find devices

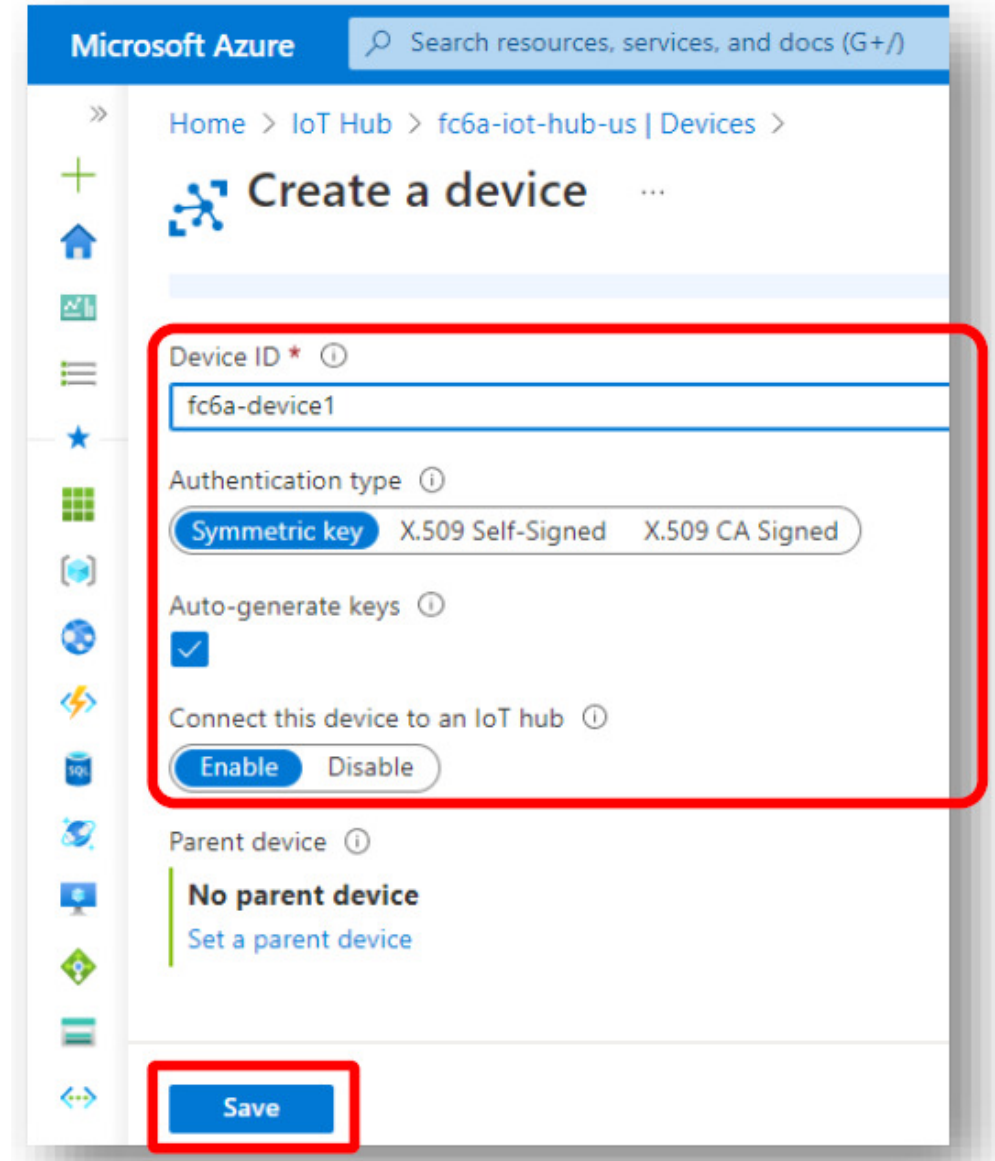
+ Add Device Refresh Assign tags Delete

Device ID	Status
There are no IoT devices to display.	



# Registering a FC6A device in IoT Hub

- Enter a name in the "Device ID" field.
- Set "Symmetric Key" for "Authentication Type".
- "Auto-generate keys" is enabled.
- "Connect this device to the IoT Hub" is "Enabled".
- Press "Save" button.



Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub > fc6a-iot-hub-us | Devices >

## Create a device

Device ID \* ⓘ  
fc6a-device1

Authentication type ⓘ  
Symmetric key X.509 Self-Signed X.509 CA Signed

Auto-generate keys ⓘ

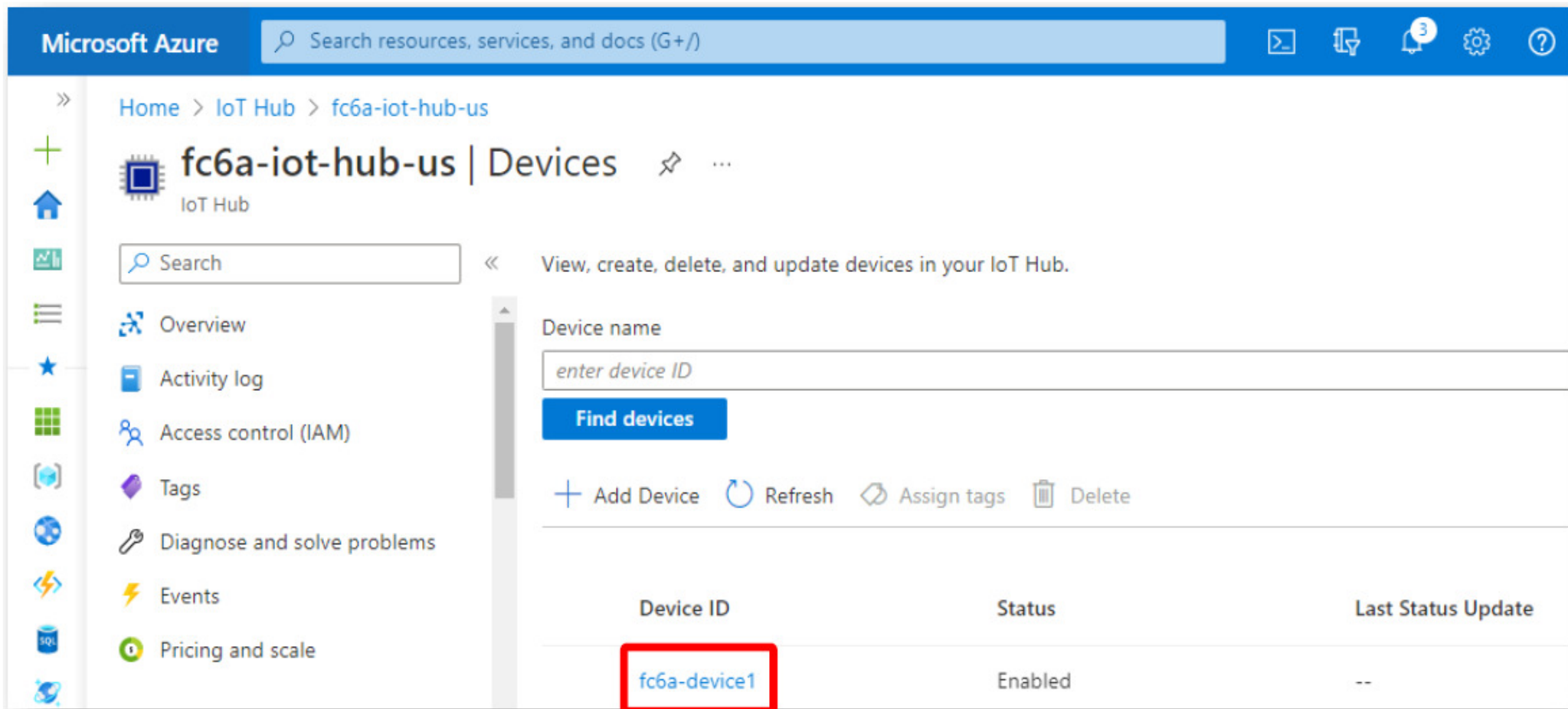
Connect this device to an IoT hub ⓘ  
Enable Disable

Parent device ⓘ  
No parent device  
[Set a parent device](#)

Save

# Registering a FC6A device in IoT Hub

- A new device, "fc6a-device1" is registered.
- Open the fc6a-device1 link in the "Device ID" column.



Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub > fc6a-iot-hub-us

**fc6a-iot-hub-us** | Devices IoT Hub

Search

View, create, delete, and update devices in your IoT Hub.

Device name

enter device ID

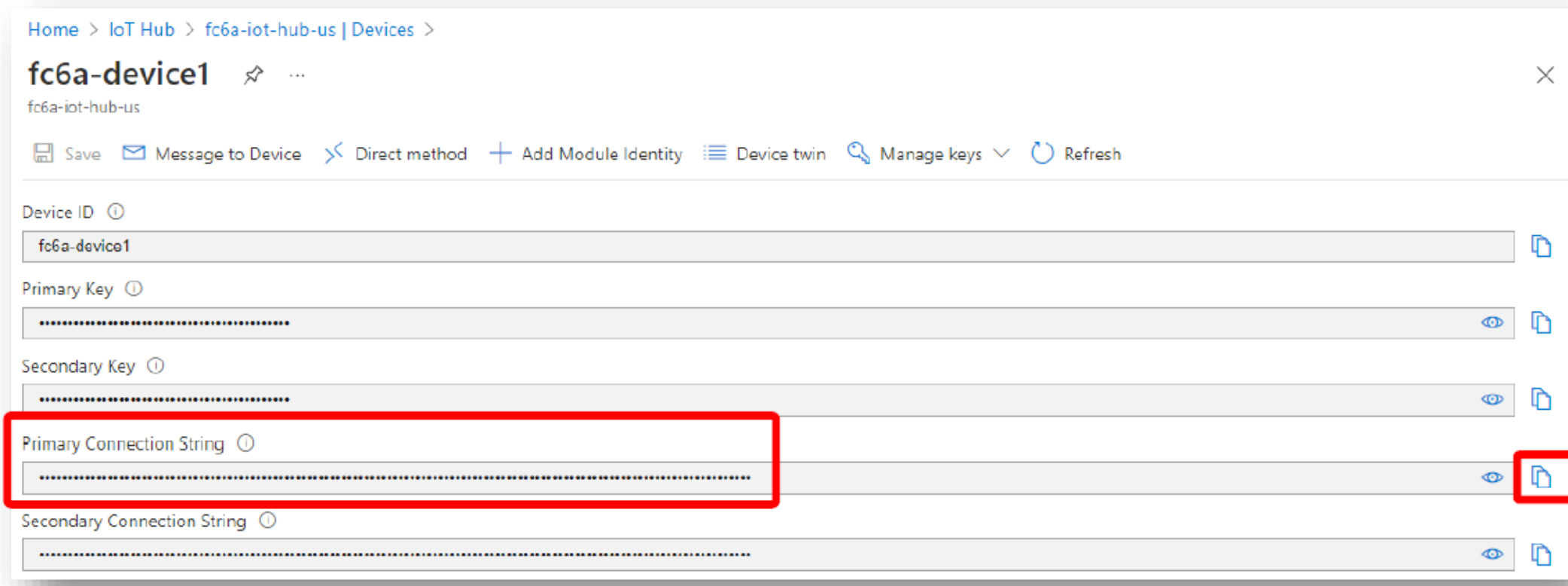
Find devices

+ Add Device Refresh Assign tags Delete

Device ID	Status	Last Status Update
<a href="#">fc6a-device1</a>	Enabled	--

# Registering a FC6A device in IoT Hub

- Information below will be displayed.
- The "Primary Connection String," is required for a FC6A to connect to the IoT hub.
- Press the copy icon on the right to copy the string.



Home > IoT Hub > fc6a-iot-hub-us | Devices >

## fc6a-device1

fc6a-iot-hub-us

Save Message to Device Direct method Add Module Identity Device twin Manage keys Refresh

Device ID  
fc6a-device1

Primary Key  
.....

Secondary Key  
.....

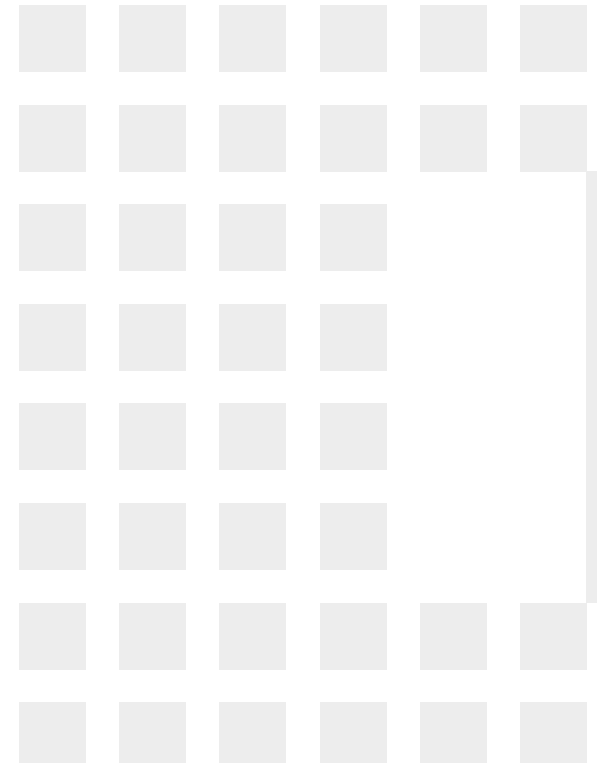
Primary Connection String  
.....

Secondary Connection String  
.....



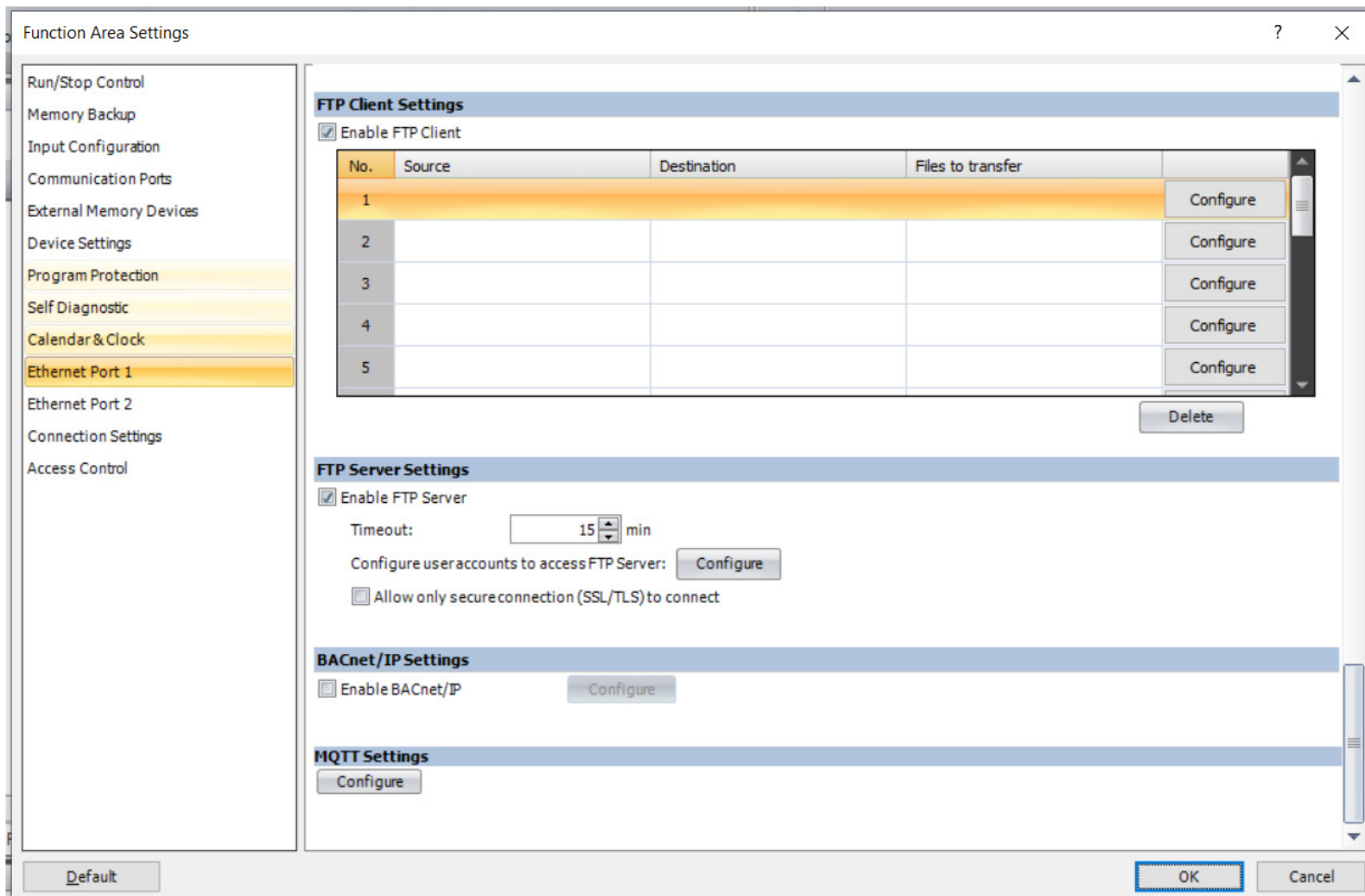
*Think Automation and beyond...*

# WindLDR Configurations



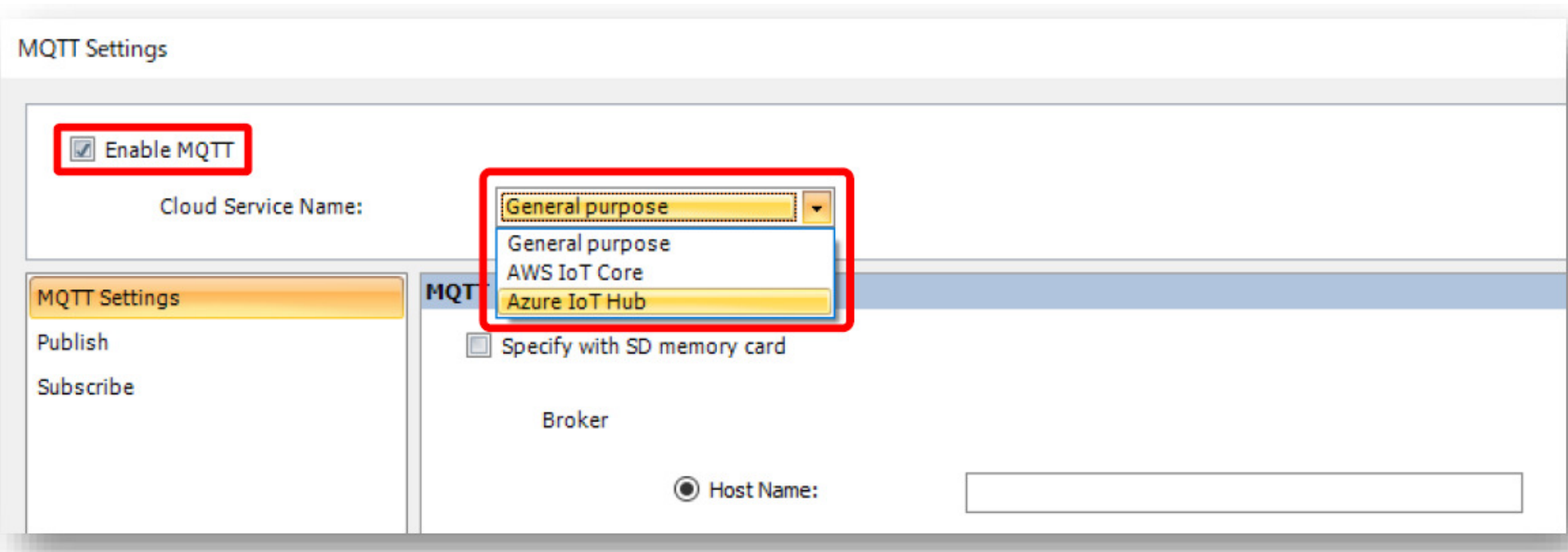
# Configurations in WindLDR

- Select “Configuration” → “Ethernet Port 1” → MQTT settings. Click “Configure”



# Configurations in WindLDR

- Check a checkbox "Enable MQTT" and select "Azure IoT Hub" as the "Cloud Service Name".



MQTT Settings

Enable MQTT

Cloud Service Name:

General purpose  
General purpose  
AWS IoT Core  
Azure IoT Hub

Specify with SD memory card

Broker

Host Name:

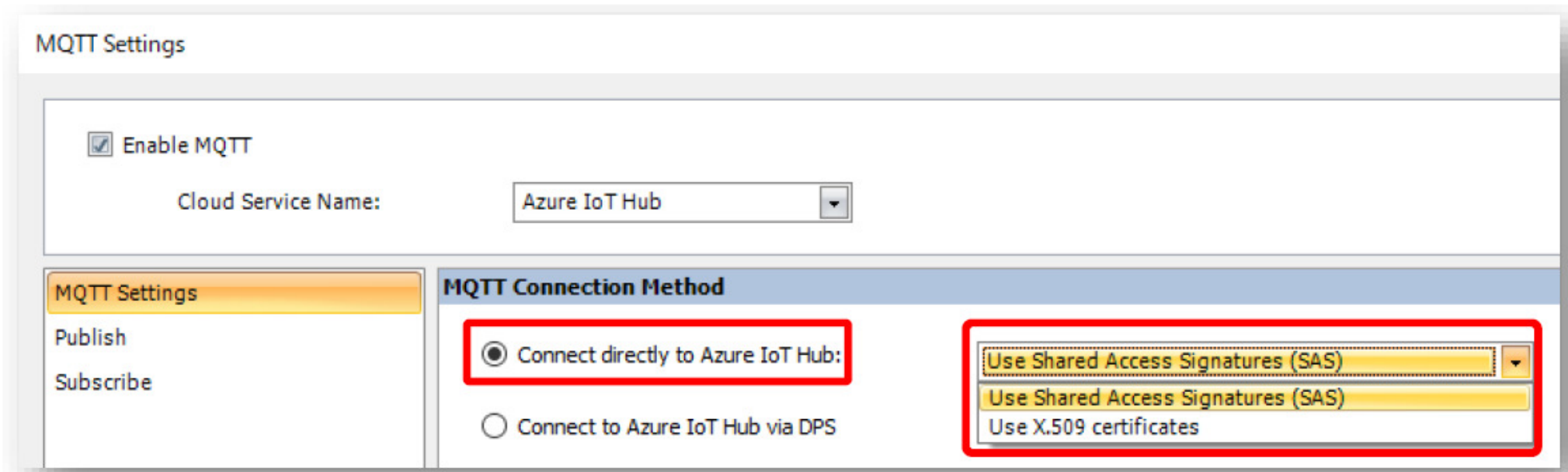
MQTT Settings

Publish

Subscribe

# Configurations in WindLDR

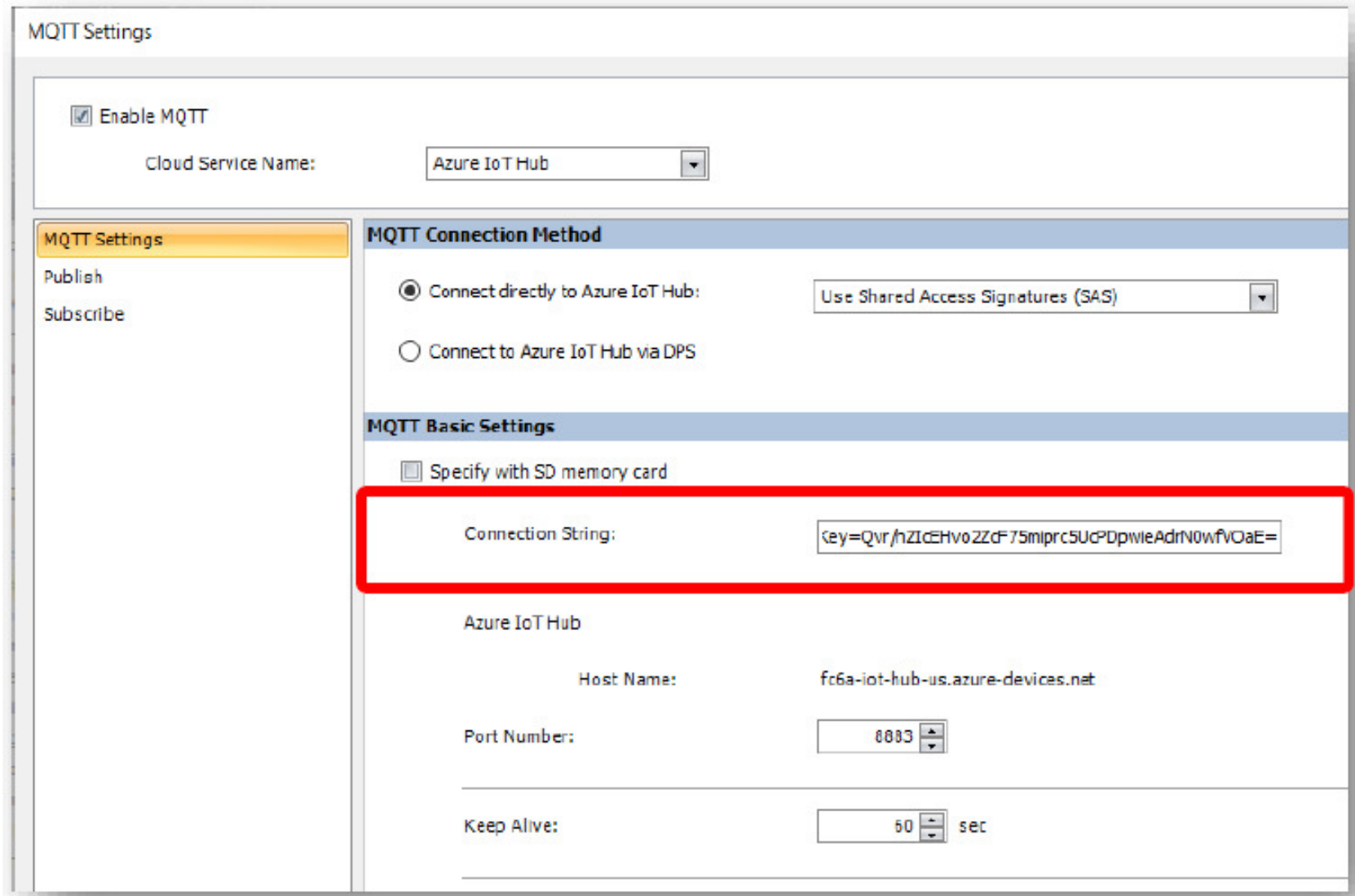
- Select "Connect directly to Azure IoT Hub"
- Select "Use Shared Access Signature (SAS)"



The screenshot shows the 'MQTT Settings' window. At the top, there is a checkbox for 'Enable MQTT' which is checked. Below it, the 'Cloud Service Name' is set to 'Azure IoT Hub'. The main area is divided into two sections: 'MQTT Settings' on the left and 'MQTT Connection Method' on the right. In the 'MQTT Connection Method' section, the radio button for 'Connect directly to Azure IoT Hub:' is selected and highlighted with a red box. To its right, a dropdown menu is also highlighted with a red box, showing 'Use Shared Access Signatures (SAS)' as the selected option, with other options being 'Use Shared Access Signatures (SAS)' and 'Use X.509 certificates'.

# Configurations in WindLDR

- Paste the "Primary connection string" copied in the device settings of Azure IoT Hub into the "Connection string" of WindLDR. (Host name and device ID are automatically set based on the information in the connection string.)



The screenshot shows the 'MQTT Settings' configuration page in WindLDR. The 'Enable MQTT' checkbox is checked. The 'Cloud Service Name' is set to 'Azure IoT Hub'. Under 'MQTT Connection Method', 'Connect directly to Azure IoT Hub' is selected, and the 'Use Shared Access Signatures (SAS)' option is chosen. Under 'MQTT Basic Settings', 'Specify with SD memory card' is unchecked. The 'Connection String' field is highlighted with a red box and contains the value: `key=Qvr/nZiCEHvoZZcF75miprc5UcPDpwieAdrN0wfVOaE=`. Below this, the 'Azure IoT Hub' section shows 'Host Name' as 'fc6a-iot-hub-us.azure-devices.net', 'Port Number' as '8883', and 'Keep Alive' as '60 sec'.



# Configurations in WindLDR

- Set "Connection Control" and "Connection Status" devices in the dialog box below.


The image shows the "MQTT Settings" dialog box in WindLDR. The "Enable MQTT" checkbox is checked. The "Cloud ServiceName" is set to "Azure IoT Hub". The "Host Name" is "N/A", "Port Number" is "8883", and "Keep Alive" is "60 sec". The "Device ID" is "N/A". The "Root Certificate" is "Imported". The "Devices" section is highlighted with a red box and contains the following configuration:

Device Name	Device ID	Device Range
Connection Control	M0000	(M0000 - M0004)
Connection Status	D0000	(D0000 - D0004)

- Enter IP address or select “Obtain an IP address automatically (DHCP) on Ethernet Port 1

Function Area Settings

- Run/Stop Control
- Memory Backup
- Input Configuration
- Communication Ports
- External Memory Devices
- Device Settings
- Program Protection
- Self Diagnostic
- Calendar & Clock
- Ethernet Port 1**
- Ethernet Port 2
- Connection Settings
- Access Control

 Configure the ethernet port 1 settings.

### IP Settings

- Obtain an IP Address automatically (DHCP)
- Use special data register to configure the IP address
- Use the following IP address:
  - IP Address:
  - Subnet Mask:
  - Default gateway:

### DNS Settings

- Obtain DNS server address automatically (DHCP)
- Use special data register to configure the DNS server addresses
- Use the following DNS server addresses:
  - Preferred DNS Server:
  - Alternate DNS Server:

# Connecting FC6A

- Download a program to the FC6A and connect the FC6A onto the internet.
- Turn on the MQTT connection control device (in this case, M0). Confirm that the connection status (D0 in this case) is 4.

## (14) Connection Status

Sets the data registers that store the status when connecting to the DPS and Azure IoT Hub and the error information. Starting from the specified data register, 5 words of data registers are used. Specify the first data register so that the device range is not exceeded.

Storage Destination	Item	Description																								
Starting number+0	Connection Status	Stores the status when connecting to the DPS and Azure IoT Hub.																								
		<table border="1"> <thead> <tr> <th>Status Code</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0 (0000h)</td> <td>Initial status (disconnected)</td> </tr> <tr> <td>2 (0002h)</td> <td>Azure IoT Hub connecting</td> </tr> <tr> <td>4 (0004h)</td> <td>Azure IoT Hub connected</td> </tr> <tr> <td>8 (0008h)</td> <td>Azure IoT Hub disconnecting</td> </tr> <tr> <td>16 (0010h)</td> <td>Azure IoT Hub connection processing error</td> </tr> <tr> <td>32 (0020h)</td> <td>Azure IoT Hub disconnection processing error</td> </tr> <tr> <td>512 (0200h)</td> <td>DPS connecting</td> </tr> <tr> <td>1024 (0400h)</td> <td>DPS connected</td> </tr> <tr> <td>2048 (0800h)</td> <td>DPS disconnecting</td> </tr> <tr> <td>4096 (1000h)</td> <td>DPS connection processing error</td> </tr> <tr> <td>8192 (2000h)</td> <td>DPS disconnection processing error</td> </tr> </tbody> </table>	Status Code	Status	0 (0000h)	Initial status (disconnected)	2 (0002h)	Azure IoT Hub connecting	4 (0004h)	Azure IoT Hub connected	8 (0008h)	Azure IoT Hub disconnecting	16 (0010h)	Azure IoT Hub connection processing error	32 (0020h)	Azure IoT Hub disconnection processing error	512 (0200h)	DPS connecting	1024 (0400h)	DPS connected	2048 (0800h)	DPS disconnecting	4096 (1000h)	DPS connection processing error	8192 (2000h)	DPS disconnection processing error
		Status Code	Status																							
		0 (0000h)	Initial status (disconnected)																							
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		8 (0008h)	Azure IoT Hub disconnecting																							
		16 (0010h)	Azure IoT Hub connection processing error																							
		32 (0020h)	Azure IoT Hub disconnection processing error																							
		512 (0200h)	DPS connecting																							
		1024 (0400h)	DPS connected																							
		2048 (0800h)	DPS disconnecting																							
		4096 (1000h)	DPS connection processing error																							
		8192 (2000h)	DPS disconnection processing error																							

Starting number+1

Connection Error Code

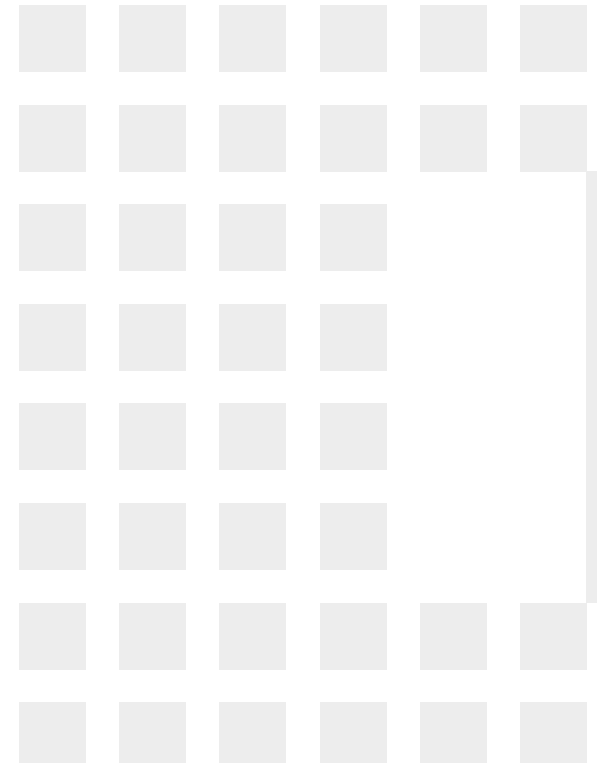
Stores information about the error that occurred when connecting to the DPS and Azure IoT Hub.

Error Code	Error Details
1 (0001h)	The Ethernet cable is disconnected or broken and the Plus CPU module cannot connect to the network properly
2 (0002h)	Authentication information was not downloaded from the SD memory card or reading the downloaded authentication information failed
4 (0004h)	Invalid device ID format
8 (0008h)	The host name of the Azure IoT Hub stored in the data register is incorrect.
16 (0010h)	An unknown packet was received
32 (0020h)	An invalid MQTT packet was received
64 (0040h)	Keep alive timeout error
80 (0050h)	Packet could not arrive at destination host <sup>*1</sup>
96 (0060h)	MQTT packet receive timeout error
112 (0070h)	TLS error
256 (0100h)	Azure IoT Hub connection refused (unacceptable MQTT protocol version)
512 (0200h)	Azure IoT Hub connection refused (invalid device ID)
768 (0300h)	Azure IoT Hub connection refused (broker unavailable)
1024 (0400h)	Azure IoT Hub connection refused (invalid account name or password)
1280 (0500h)	Azure IoT Hub connection refused (not authorized) <sup>*2</sup> <sup>*3</sup> <sup>*4</sup>
4352 (1100h)	DPS connection refused (unacceptable MQTT protocol version)
4608 (1200h)	DPS connection refused (invalid device ID)
4864 (1300h)	DPS connection refused (DPS unavailable)
5120 (1400h)	DPS connection refused (invalid account name or password)
5376 (1500h)	DPS connection refused (not authorized) <sup>*2</sup> <sup>*3</sup> <sup>*4</sup>
32768 (8000h)	Azure IoT Hub / DPS response error



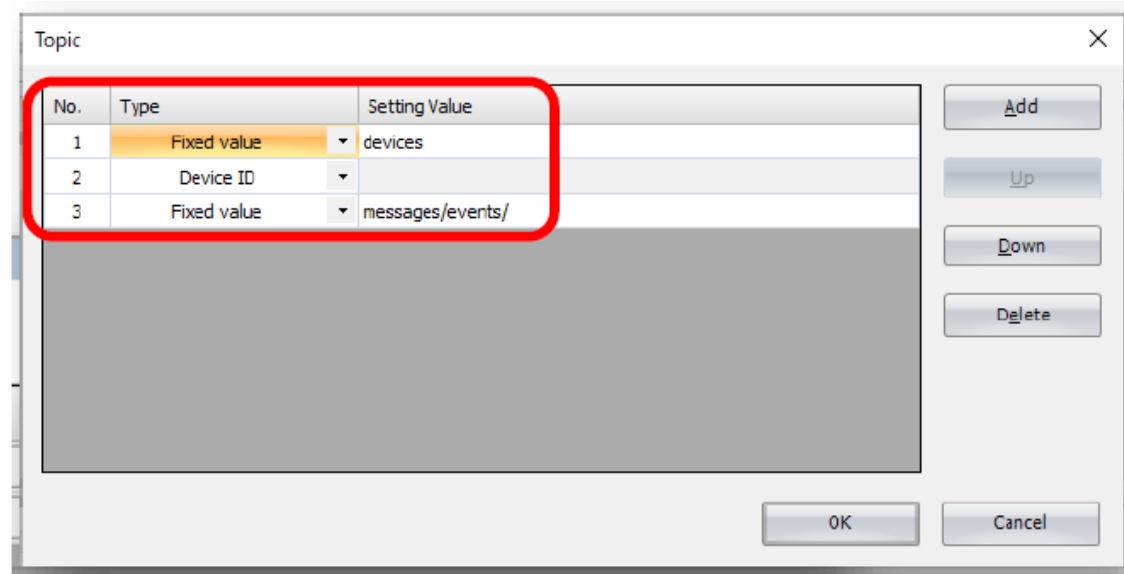
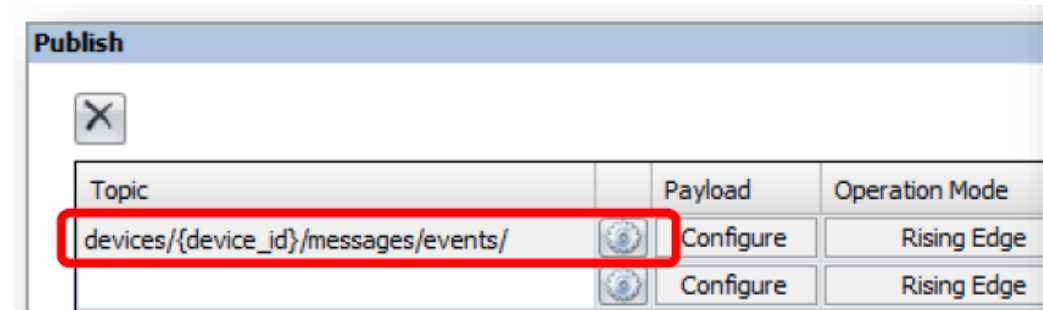
*Think Automation and beyond...*

# Publish

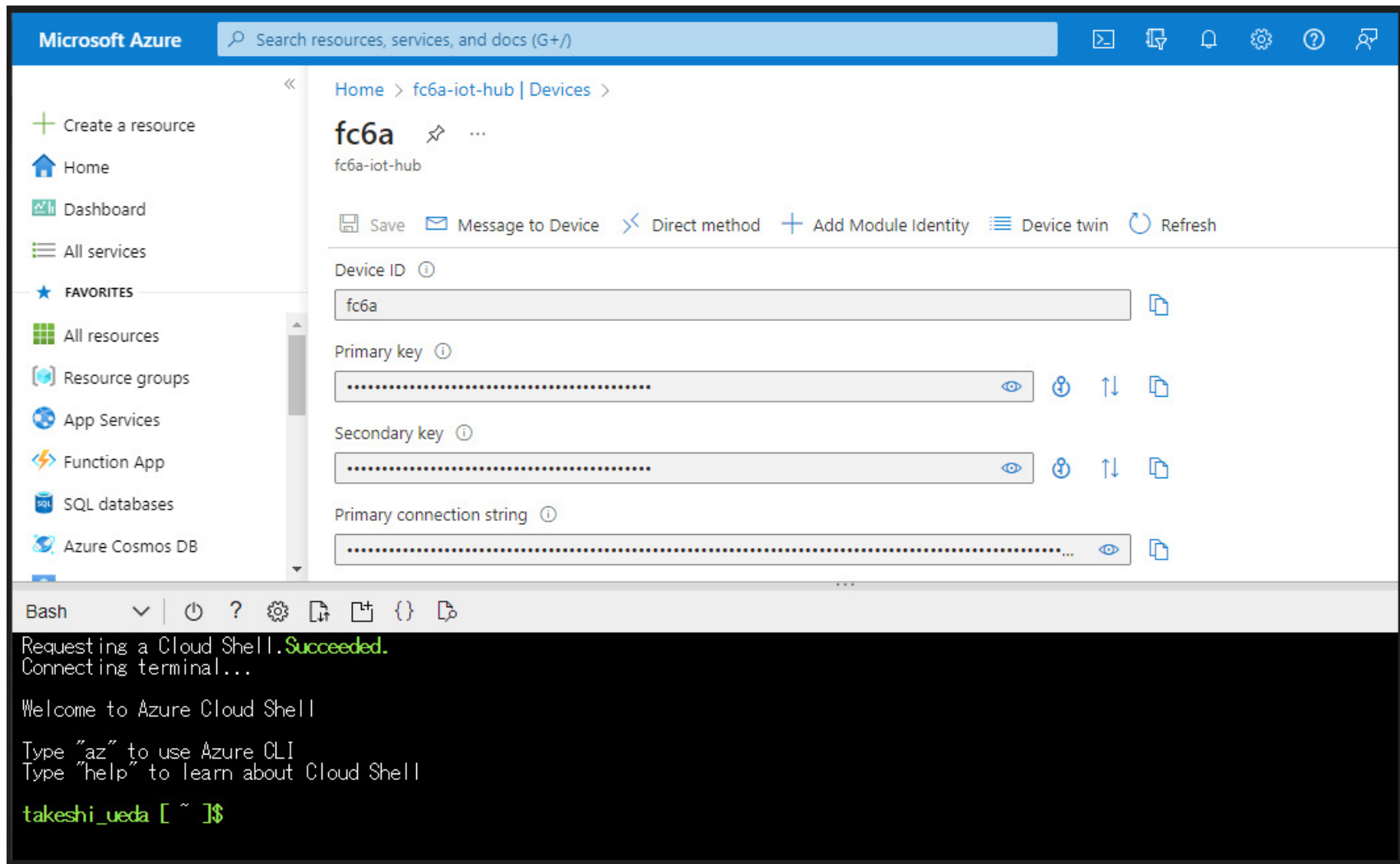


# Publish Setup

- In Azure IoT Hub, the topic name is pre-defined.
- Azure IoT Hub defined topic name is...
  - devices/{device\_id}/messages/events/
  - {device\_id} is the “Device ID” listed in the MQTT connection settings
- Since WindLDR supports the ability to embed a device ID, which is a variable value, in the topic name to correspond to the specified topic name.



- Since Microsoft Azure has a terminal function in the Azure Portal, this is used for the Publish test.
- Click the icon in the upper right corner of the screen to open the terminal

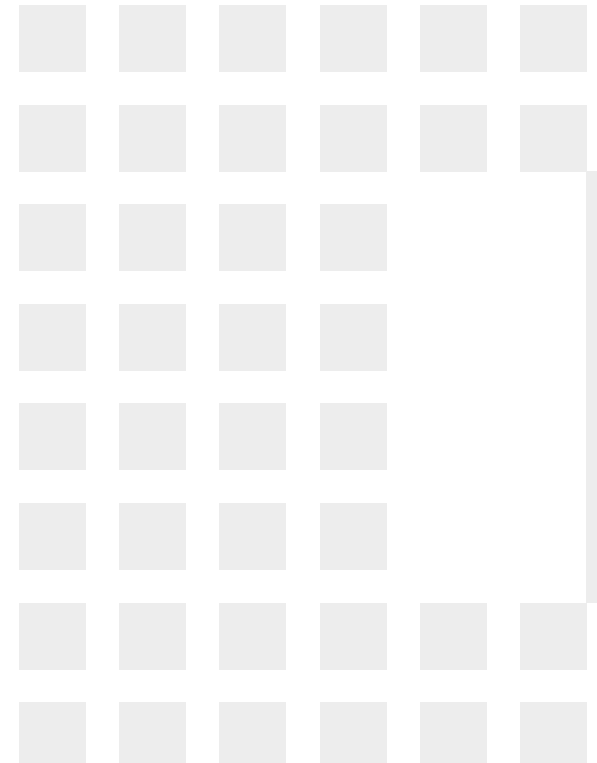


- You can run the following command in the Azure console to display the message published from FC6A Plus (Replace the name of the IoT Hub and Device ID in red)
- `az iot hub monitor-events -n {Name of IoT Hub} -d {Device ID}`
- Example: `az iot hub monitor-events -n fc6a-iot-hub-us -d fc6a-device1`



*Think Automation and beyond...*

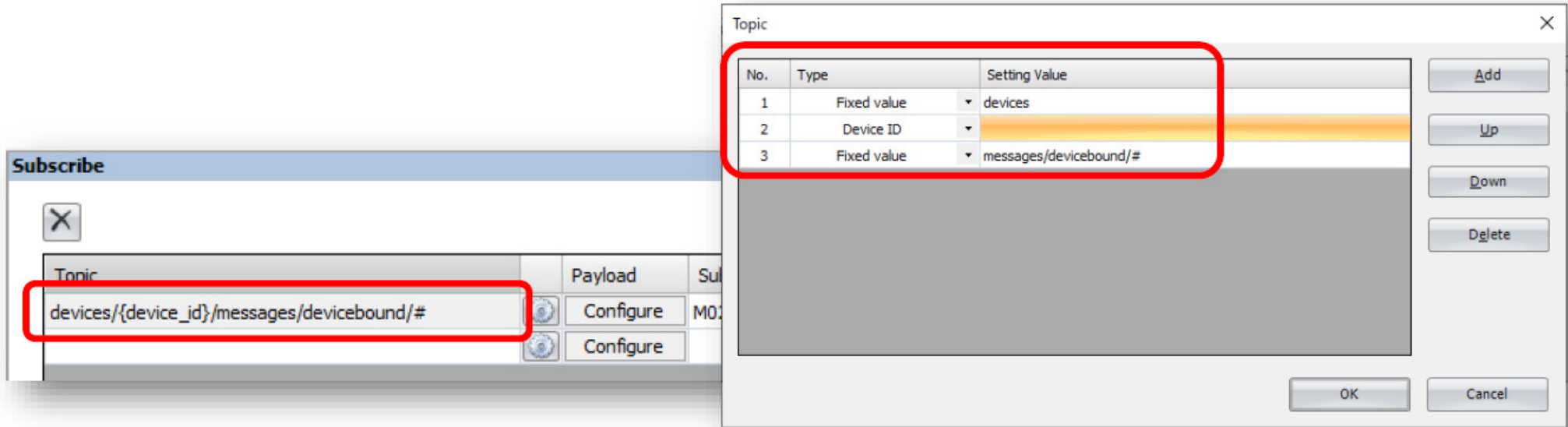
# Subscribe





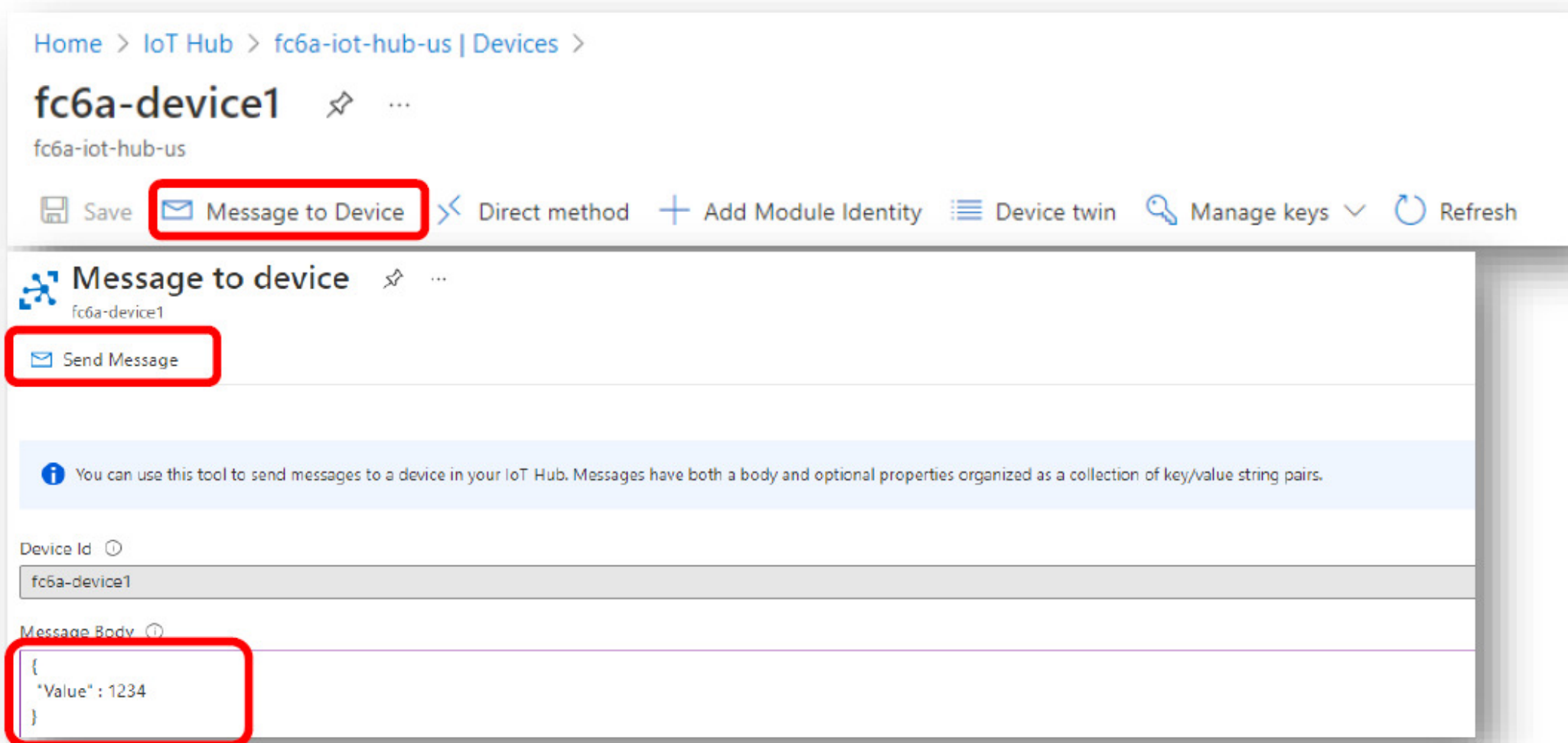
# Subscribe

- For subscribe, the topic name is defined as follows.
- devices/{Device ID}/messages/devicebound/#



# Subscribe

- You can send a message to FC6A Plus by selecting "Message to Device" in the Azure IoT Hub menu. Describe the contents to be sent in JSON format in the "Message Body" and click the "Send Message" button to send the message.



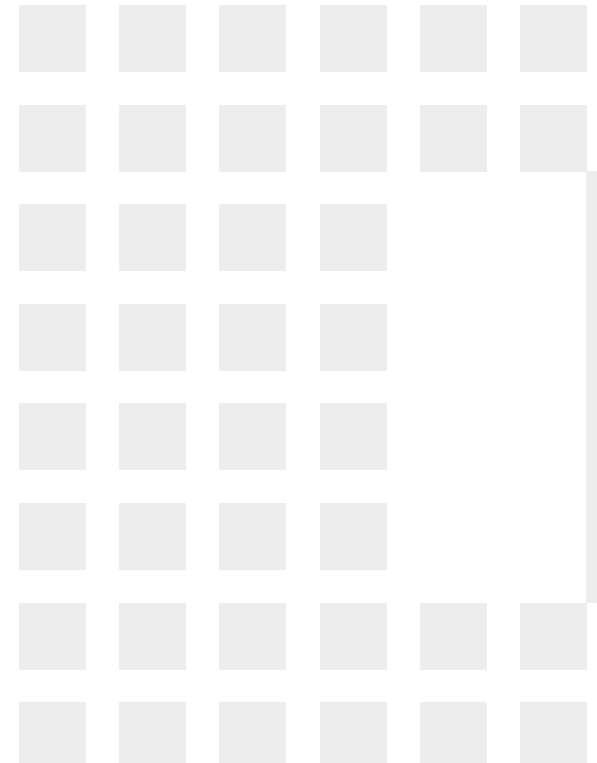
The screenshot displays the Azure IoT Hub interface for a device named 'fc6a-device1'. The breadcrumb navigation shows 'Home > IoT Hub > fc6a-iot-hub-us | Devices >'. The device name 'fc6a-device1' is prominently displayed with a star icon and a menu icon. Below the device name, the hub name 'fc6a-iot-hub-us' is visible. A toolbar contains several actions: 'Save', 'Message to Device' (highlighted with a red box), 'Direct method', 'Add Module Identity', 'Device twin', 'Manage keys', and 'Refresh'. Below the toolbar, the 'Message to device' section is shown with a star icon and a menu icon. A 'Send Message' button is highlighted with a red box. A blue information banner states: 'You can use this tool to send messages to a device in your IoT Hub. Messages have both a body and optional properties organized as a collection of key/value string pairs.' The 'Device Id' field is populated with 'fc6a-device1'. The 'Message Body' field is highlighted with a red box and contains the JSON payload: 

```
{  
  "Value": 1234  
}
```



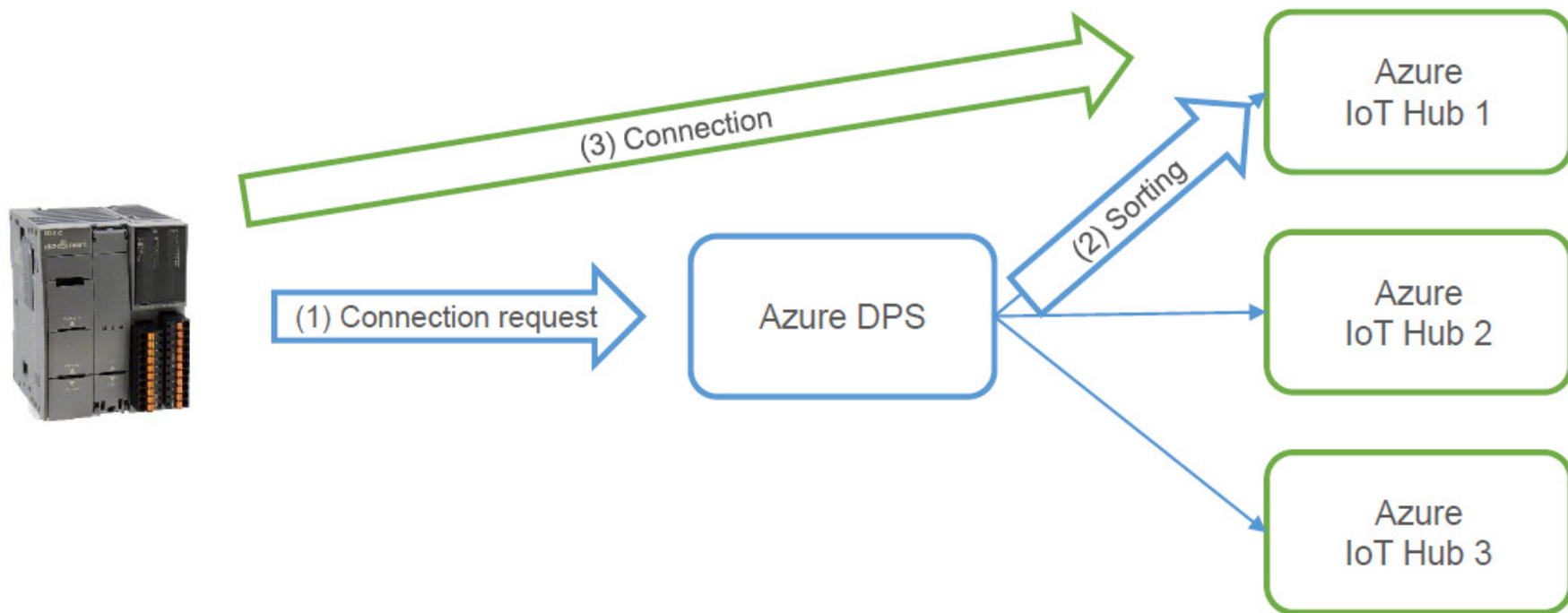
*Think Automation and beyond...*

# Azure DPS

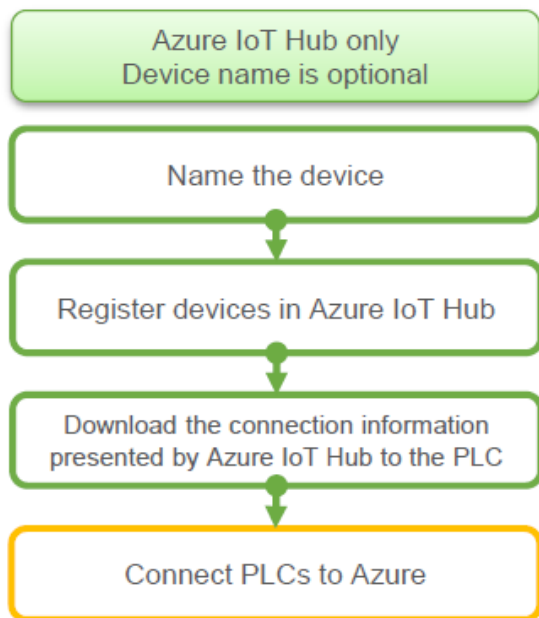


# DPS Structure and Setup

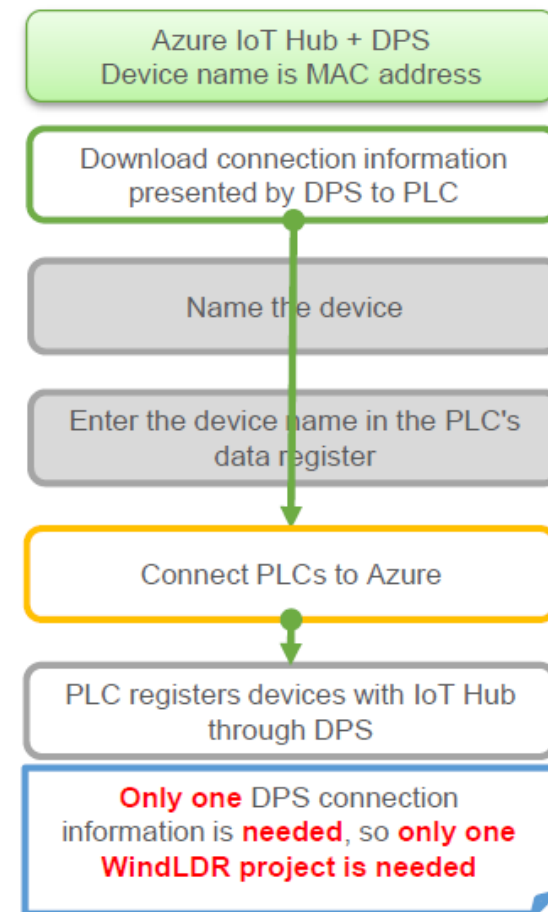
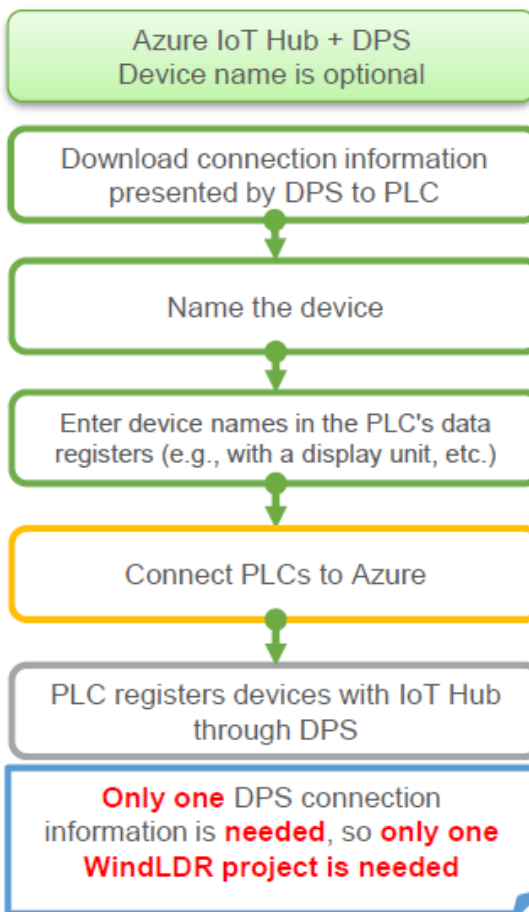
- As explained in the introduction, DPS service is designed to simplify the management of IoT devices.
- IoT devices (FC6A) will connect to the IoT Hub, so the IoT Hub must be created.
- The DPS and IoT Hub must be tied together for the following to work.



# DPS Structure and Setup

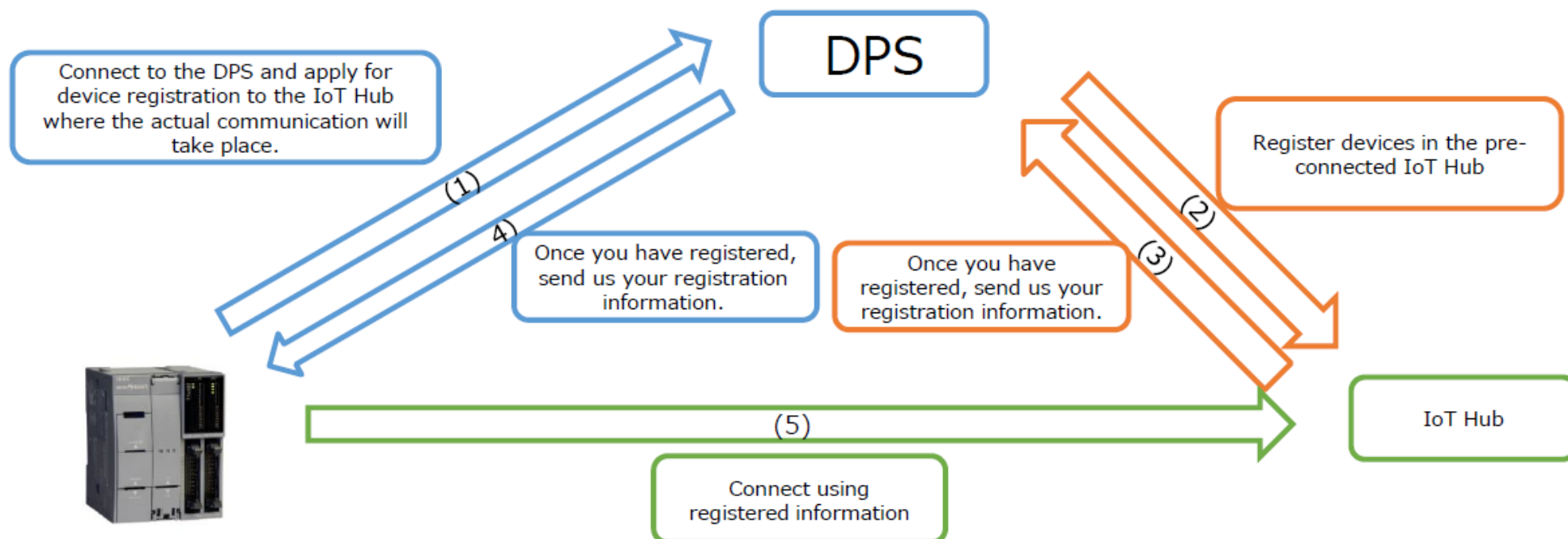


**WindLDR projects need as many devices as there are devices because the connection information is different for each device (FC6A).**



# How does DPS works

- The detailed mechanism of the DPS is as follows (all communication between the PLC and the DPS/IoT Hub is done via the MQTT protocol)
  - ① FC6A connects to the DPS and passes information about itself (unique registration ID).
  - ② DPS registers FC6A device IDs with IoT Hub
  - ③ Upon successful registration to IoT Hub, FC6A receives success or failure via DPS
  - ④ If the registration is successful, you can connect to the IoT Hub using the registered device ID



# When not using DPS, use only IoT Hub

- The steps from signing up for Azure to connecting FC6A are as follows.

- Connection procedures and testing

- ① Creating Resource Groups
- ② Creating an IoT Hub
- ③ Register devices (FC6A) in IoT Hub → Registration work is required for each device
- ④ WindLDR setup (connection settings) → Individual authentication information needs to be imported for each device
- ⑤ connection test
- ⑥ WindLDR settings (Publish)
- ⑦ Publish Test
- ⑧ WindLDR settings (Subscribe)
- ⑨ Subscribe Test

When not using DPS  
(Use IoT Hub only)

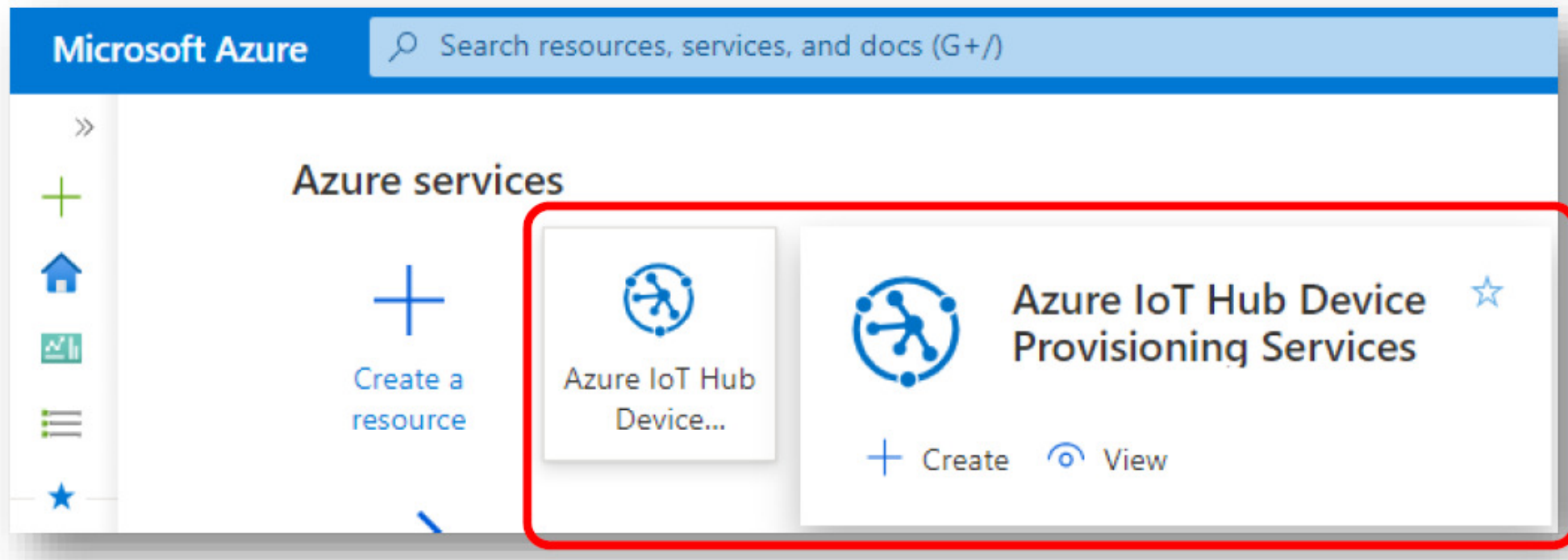
- The steps from signing up for Azure to connecting FC6A are as follows.

## When using DPS

- Connection procedures and testing
  - ① Creating Resource Groups
  - ② Creating an IoT Hub
  - ③ Creating an Azure DPS
  - ④ Creation of DPS registration groups
  - ⑤ WindLDR settings (connection settings) → Settings are the same for all devices
  - ⑥ connection test
  - ⑦ WindLDR settings (Publish)
  - ⑧ Publish Test
  - ⑨ WindLDR settings (Subscribe)
  - ⑩ Subscribe Test

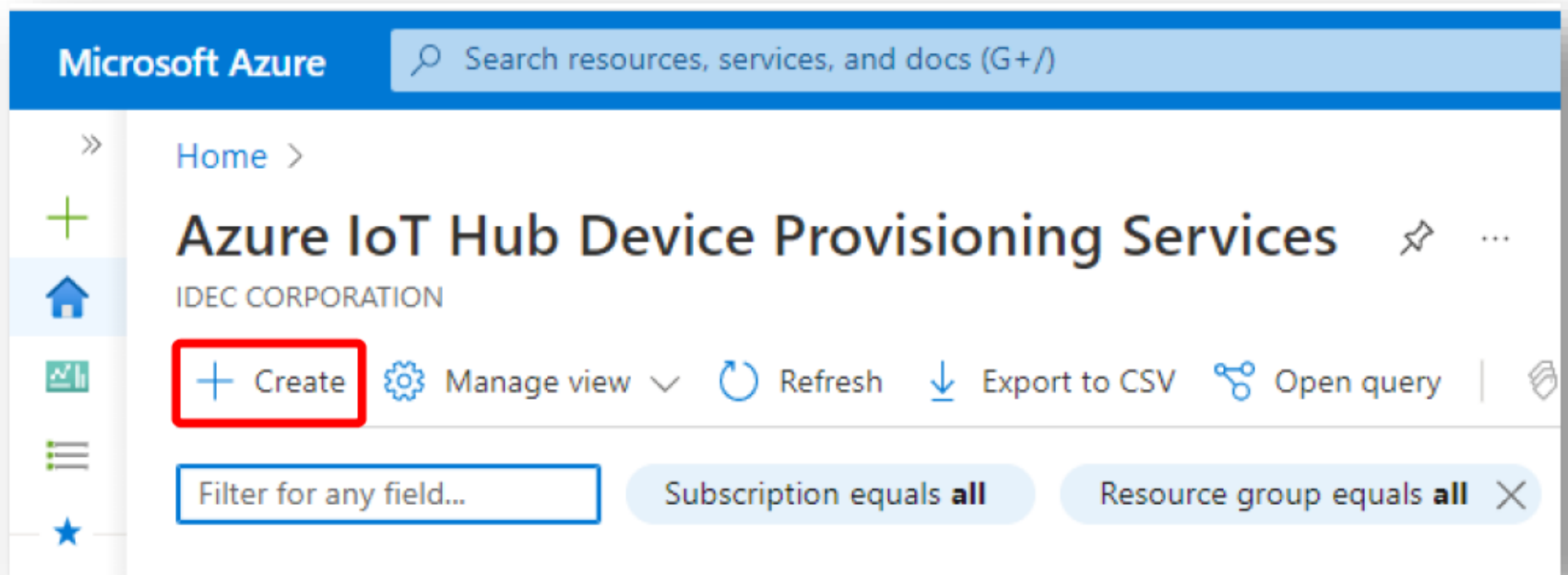


- From the list of services, select "Azure IoT Hub Device Provisioning Service".



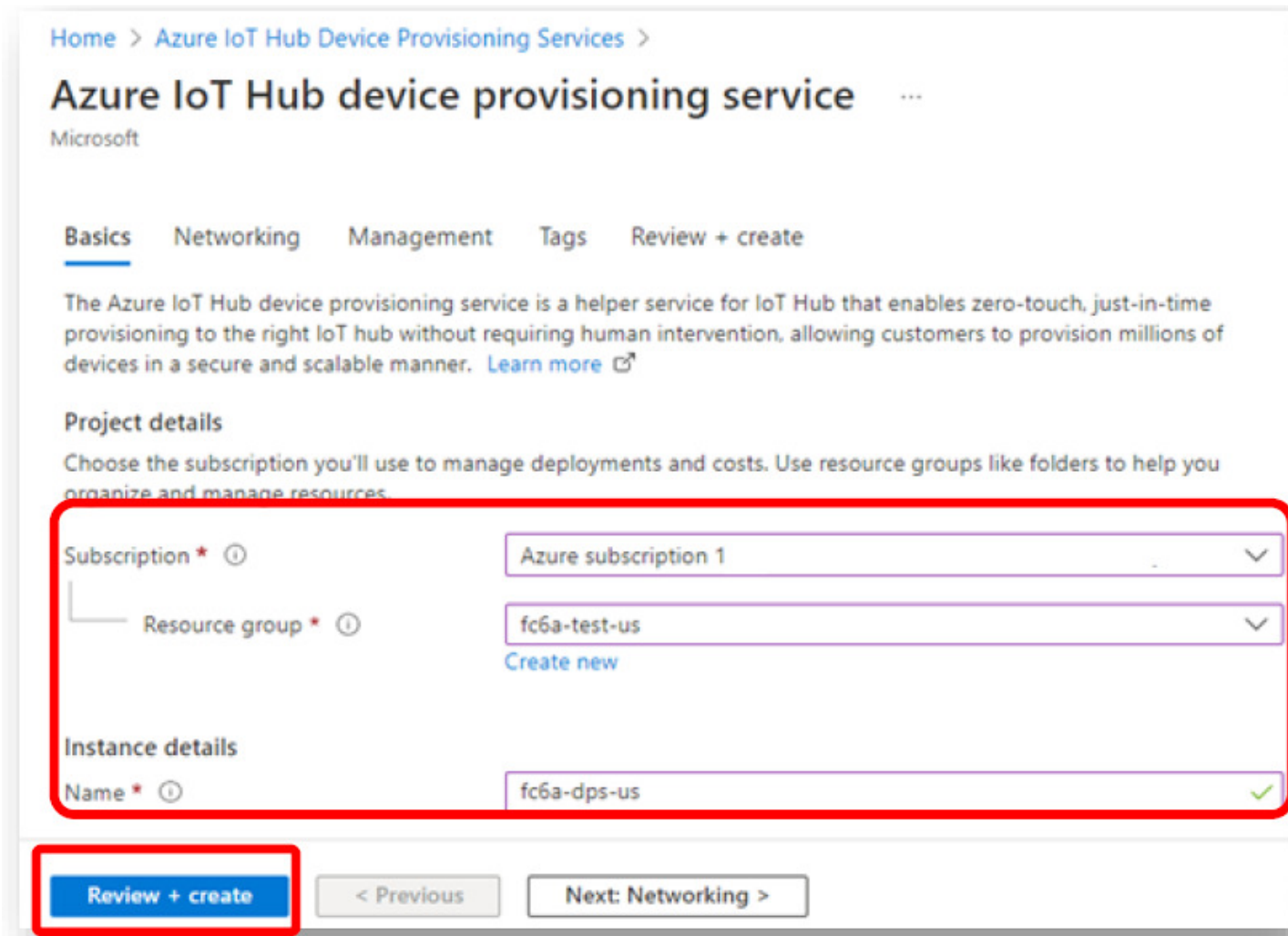
# Creation of Azure DPS

- From the Azure DPS menu, press the "+ Create" button



# Creation of Azure DPS

- Configure Azure DPS settings.
  - For "Resource Group," select the resource group that was created.
  - Set the "Name" and "Region".
- Press the "Review + Create" button.



Home > Azure IoT Hub Device Provisioning Services >

## Azure IoT Hub device provisioning service

Microsoft

Basics Networking Management Tags Review + create

The Azure IoT Hub device provisioning service is a helper service for IoT Hub that enables zero-touch, just-in-time provisioning to the right IoT hub without requiring human intervention, allowing customers to provision millions of devices in a secure and scalable manner. [Learn more](#)

### Project details

Choose the subscription you'll use to manage deployments and costs. Use resource groups like folders to help you organize and manage resources.

Subscription \* ⓘ Azure subscription 1

Resource group \* ⓘ fc6a-test-us  
[Create new](#)

### Instance details

Name \* ⓘ fc6a-dps-us ✓

[Review + create](#) < Previous Next: Networking >

# Creation of Azure DPS

- If everything looks good, click “Create” button to create Azure DPS.

Home > Azure IoT Hub Device Provisioning Services >

## Azure IoT Hub device provisioning service

Microsoft

✓ Validation passed.

Basics   Networking   Management   Tags   Review + create

### Basics

Subscription	Azure subscription 1
Resource group	fc6a-test-us
Region	East US
Device provisioning service name	fc6a-dps-us
Disaster recovery enabled	Yes

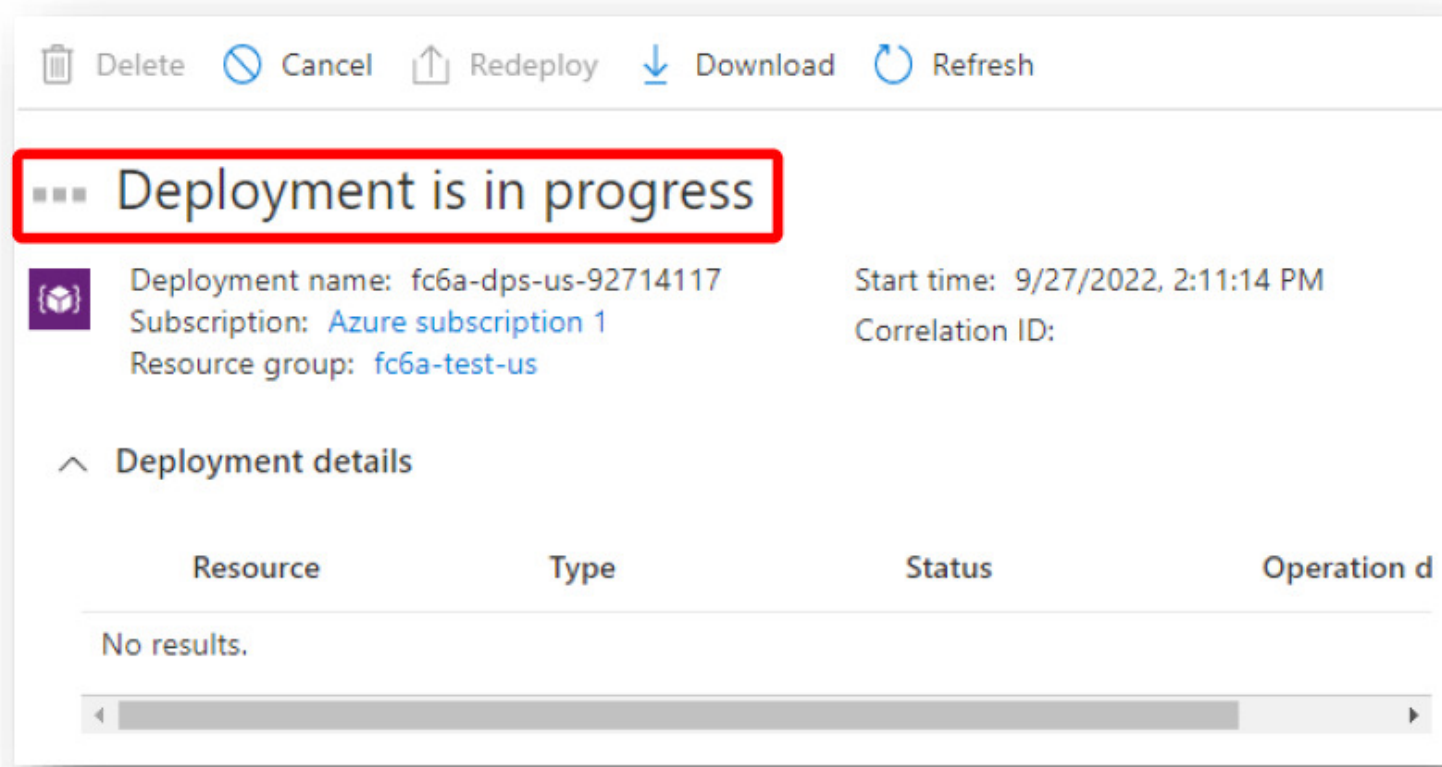
### Networking

Connectivity configuration	Public access
Private endpoint connections	None

**Create**   < Previous   Next >

# Creation of Azure DPS

- When the creation of the Azure DPS begins, the message 'Deployment is in progress'.
- It may take several minutes.



The screenshot shows the Azure portal interface for a deployment. At the top, there are action buttons: Delete, Cancel, Redeploy, Download, and Refresh. Below these, a red-bordered box highlights the message "Deployment is in progress". Underneath, the deployment details are listed: Deployment name: fc6a-dps-us-92714117, Subscription: Azure subscription 1, and Resource group: fc6a-test-us. To the right, the start time is 9/27/2022, 2:11:14 PM, and the correlation ID is empty. Below this, there is a section for "Deployment details" which is currently empty, showing a table with columns for Resource, Type, Status, and Operation d, and the text "No results." at the bottom.

# Creation of Azure DPS

- When the deployment is completed, a screen like the one below will be shown.
- Please note the "Service Endpoint" and "ID Scope" as they need to be set in WindLDR.

Microsoft Azure Search resources, services, and docs (G+)

Home > Azure IoT Hub Device Provisioning Services >

**fc6a-dps-us** Azure IoT Hub Device Provisioning Service (DPS)

Search Move Delete Refresh

**Essentials**

- Resource group ([move](#)) **fc6a-test-us**
- Status: Active
- Location: East US
- Subscription ([move](#)) **Azure subscription 1**

**Service endpoint**  
fc6a-dps-us.azure-devices-provisioning.net

Global device endpoint  
global.azure-devices-provisioning.net

**ID Scope**  
One007A40FF

Pricing and scale tier  
S1

# Creating a DPS registration group

- Select "Manage enrollments" from the menu on the left
- Press "+Add enrollment group" to create a registration group.

Microsoft Azure Search resources, services, and docs (G+/)

Home > Azure IoT Hub Device Provisioning Services > fc6a-dps-us

**fc6a-dps-us | Manage enrollments**

Azure IoT Hub Device Provisioning Service (DPS)

Search

**+ Add enrollment group** + Add individual enrollment Refresh Delete

You can add or remove individual device enrollments and/or enrollment groups from this page

Enrollment Groups Individual Enrollments

Search group enrollment by group name (name has to be exact match)

GROUP NAME

No results

Manage enrollments

# Creating a DPS registration group

- Complete the items on the Create Registration Group screen.
  - Enter an appropriate name in the "Group Name" field.
  - Set "Symmetric Key" for "Authentication Type".
  - "Auto-generate keys" is checked ON.
- ↓ **Continued on next page**

Microsoft Azure Search resources, services, and docs (G+)

Home > Azure IoT Hub Device Provisioning Services > fc6a-d

## Add Enrollment Group

Save

Group name \*

fc6a-test-dps-group

Attestation Type ⓘ

Certificate Symmetric Key

Auto-generate keys ⓘ

Primary Key ⓘ

Enter your primary key

Secondary Key ⓘ

Enter your secondary key

IoT Edge device ⓘ

True False



# Creating a DPS registration group

- You would need to link an IoT Hub and the Azure DPS.
  - Click on “Link a new IoT Hub” and select the IoT Hub you have already created.

Select how you want to assign devices to hubs ⓘ

Evenly weighted distribution

Select the IoT hubs this group can be assigned to: ⓘ

0 selected

[Link a new IoT hub](#)

Select how you want to assign devices to hubs ⓘ

Evenly weighted distribution

Select the IoT hubs this group can be assigned to: ⓘ

fc6a-iot-hub-us.azure-devices.net

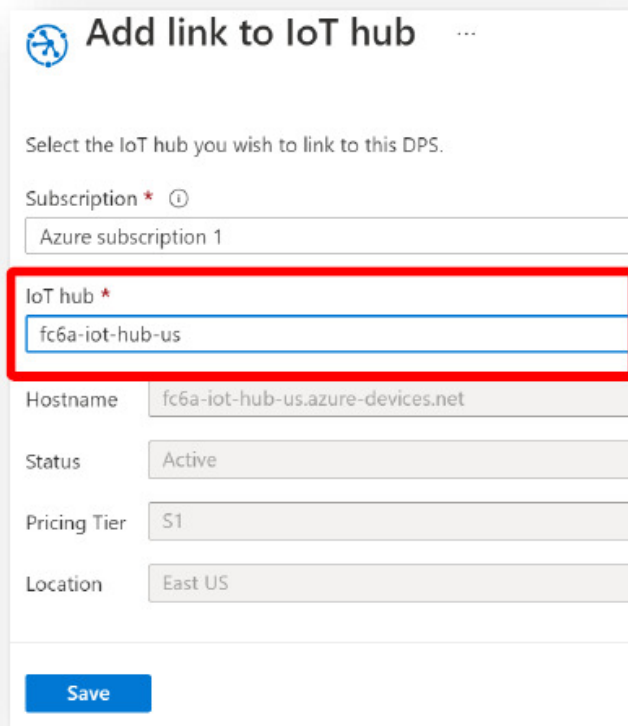
Select all

fc6a-iot-hub-us.azure-devices.net

Re-provision and migrate data

# Creating a DPS registration group

- Select the link to the IoT Hub you created and press the "Save" button.



**Add link to IoT hub** ...

Select the IoT hub you wish to link to this DPS.

Subscription \* ⓘ  
Azure subscription 1

**IoT hub \***  
fc6a-iot-hub-us

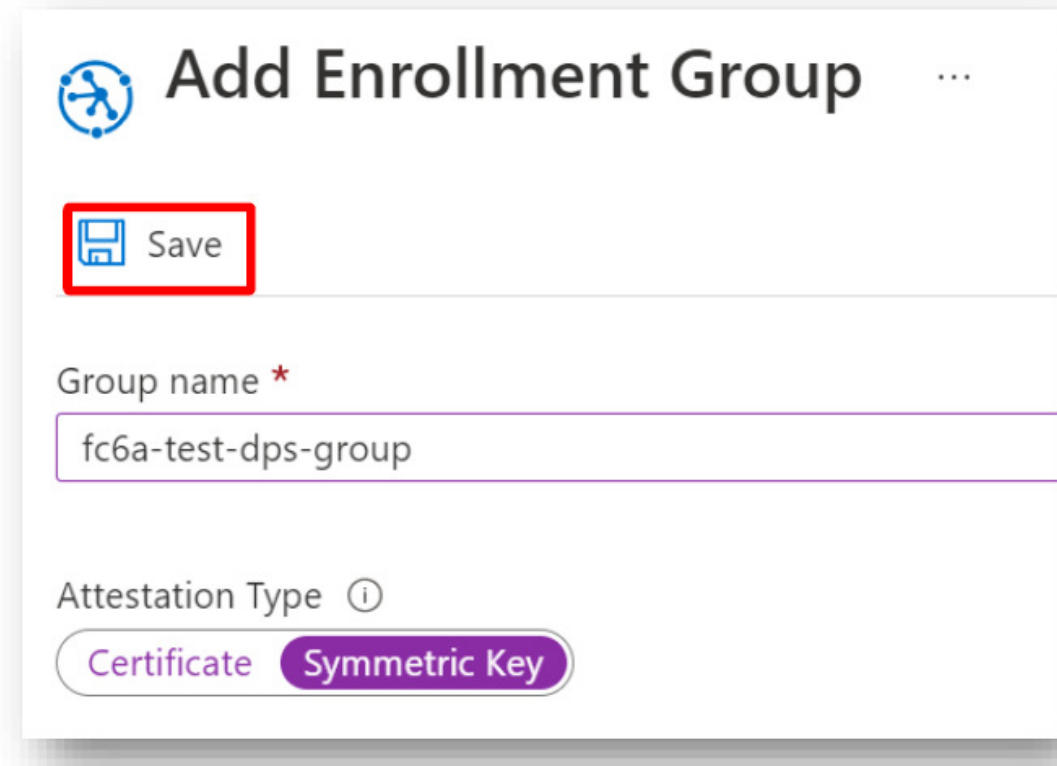
Hostname fc6a-iot-hub-us.azure-devices.net

Status Active

Pricing Tier S1

Location East US

Save



**Add Enrollment Group** ...

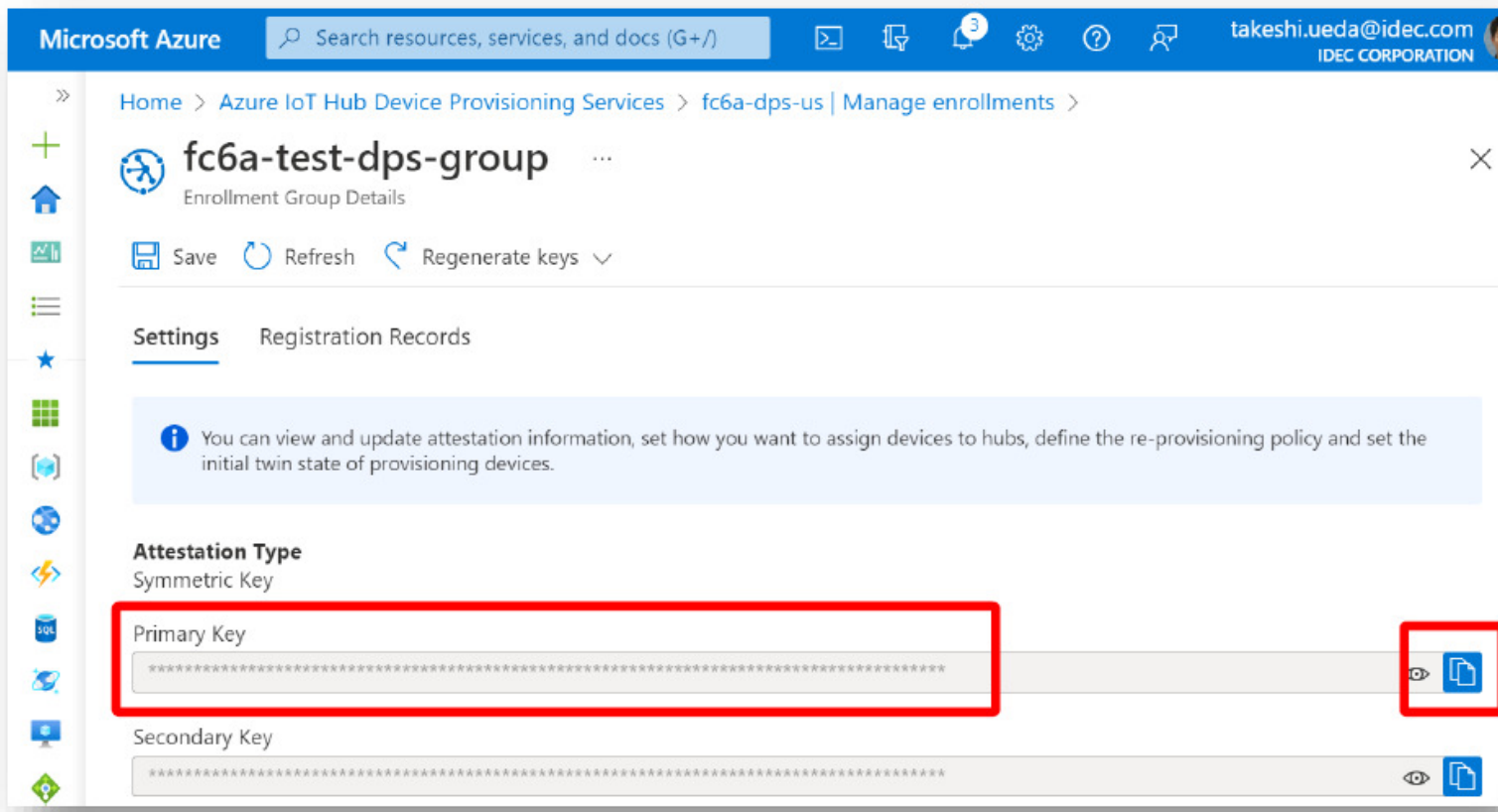
Save

Group name \*  
fc6a-test-dps-group

Attestation Type ⓘ  
Certificate Symmetric Key

# Creating a DPS registration group

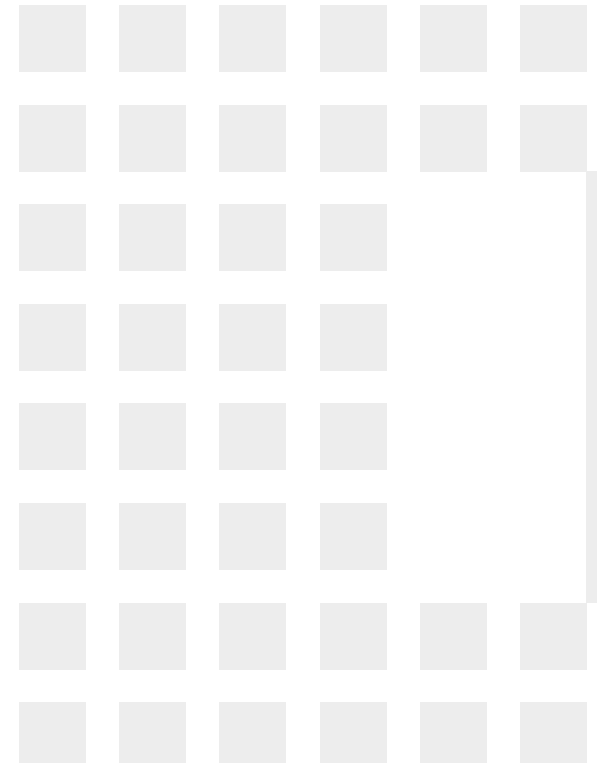
- Copy the "Primary Key" of the "Symmetric Key" shown in the created Azure DPS group.





*Think Automation and beyond...*

# WindLDR Configurations



# Setting in WindLDR

- When using Azure DPS, select 'Connect to Azure IoT Hub via DPS' in the WindLDR settings.

**MQTT Connection Method**

Connect directly to Azure IoT Hub:

Connect to Azure IoT Hub via DPS

**MQTT Basic Settings**

Specify with SD memory card

Azure IoT Hub

Host Name:  ... (-)

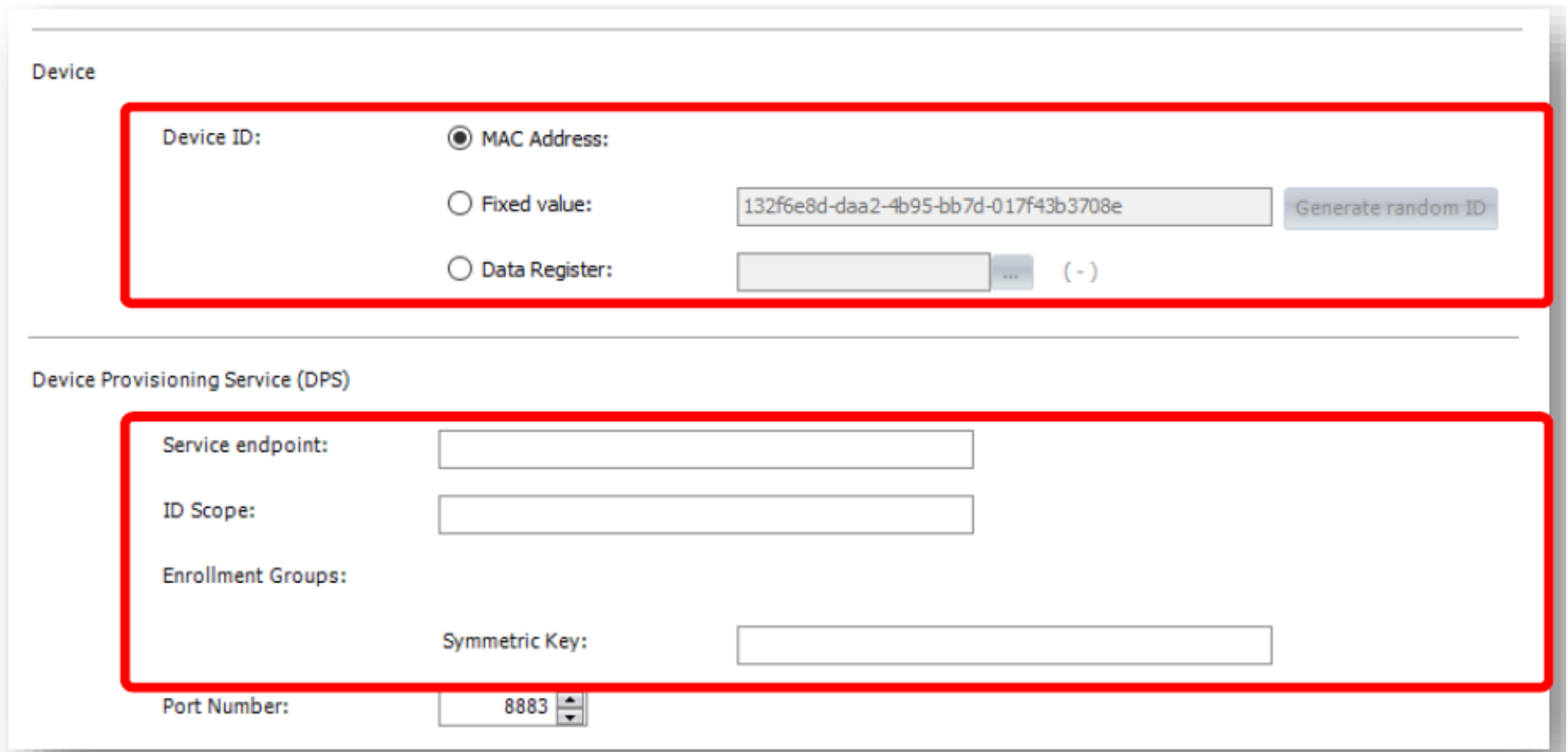
Port Number: 8883

---

Keep Alive:  sec

# Setting in WindLDR

- Set the following items when configuring Azure DPS in WindLDR.
  - Service endpoint
  - ID Scope
  - Symmetry key
- In this case, the "Device ID" is the MAC address of the FC6A.



Device

Device ID:  MAC Address:  Fixed value:    Data Register:  ... (-)

Device Provisioning Service (DPS)

Service endpoint:

ID Scope:

Enrollment Groups:

Symmetric Key:

Port Number:

# Setting in WindLDR

- Set a device register in the "Host Name" field.
- The configured register will contain the hostname of the IoT Hub that will eventually be connected.

## MQTT Connection Method

- Connect directly to Azure IoT Hub:
- Connect to Azure IoT Hub via DPS

## MQTT Basic Settings

- Specify with SD memory card

Azure IoT Hub

Host Name:  ... (D1000 - D1063)

Port Number: 8883

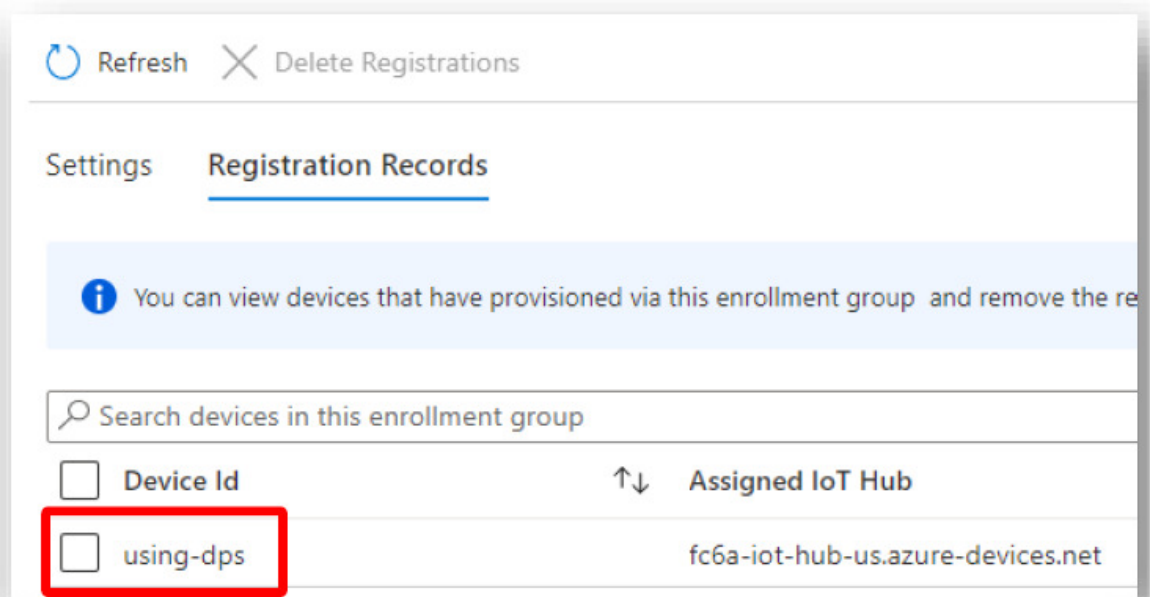
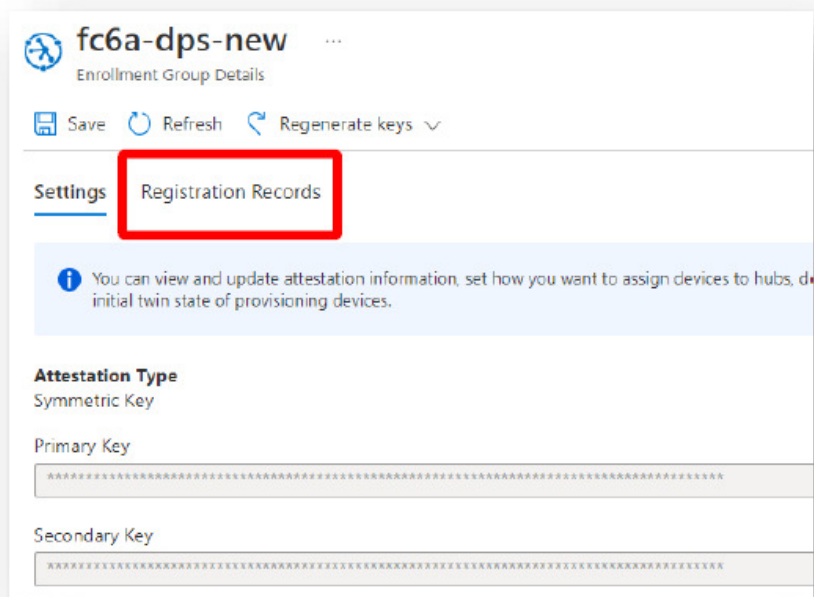
Keep Alive:  sec

- Download the program to the FC6A and make sure that a network connection is available.
- **Turn on M1 (via DPSif M1 is on, skip DPSif M1 is off)** The first time you connect, the connection will always fail if M1 is OFF because you have not obtained the hostname of the IoT Hub.
- Turn on the MQTT connection control device (in this case, M0) and confirm that the connection status (in this case, D0) is 4.
- You can see that the host name of the IoT Hub is stored in the data register (D1000) set for the host name.



# Connection to a FC6A

- If you check the 'Registration Record' from the Azure DPS enrollment group settings, you will see that the FC6A MAC address is registered as the device ID.



- If you check the IoT Hub settings, you will see the device IDs registered via Azure DPS.

Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub > fc6a-iot-hub-us

## fc6a-iot-hub-us | Devices

IoT Hub

Search

View, create, delete, and update devices in your IoT Hub.

Device name

using

Find devices

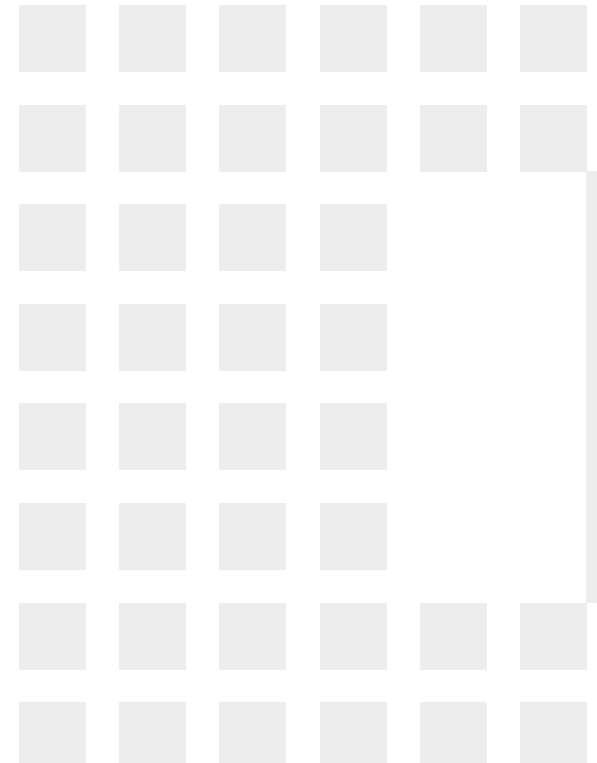
+ Add Device Refresh Assign tags Delete

Device ID	Status	Last Status Update
using-dps	Enabled	--



*Think Automation and beyond...*

# Precaution



# SAS token and associated precaution

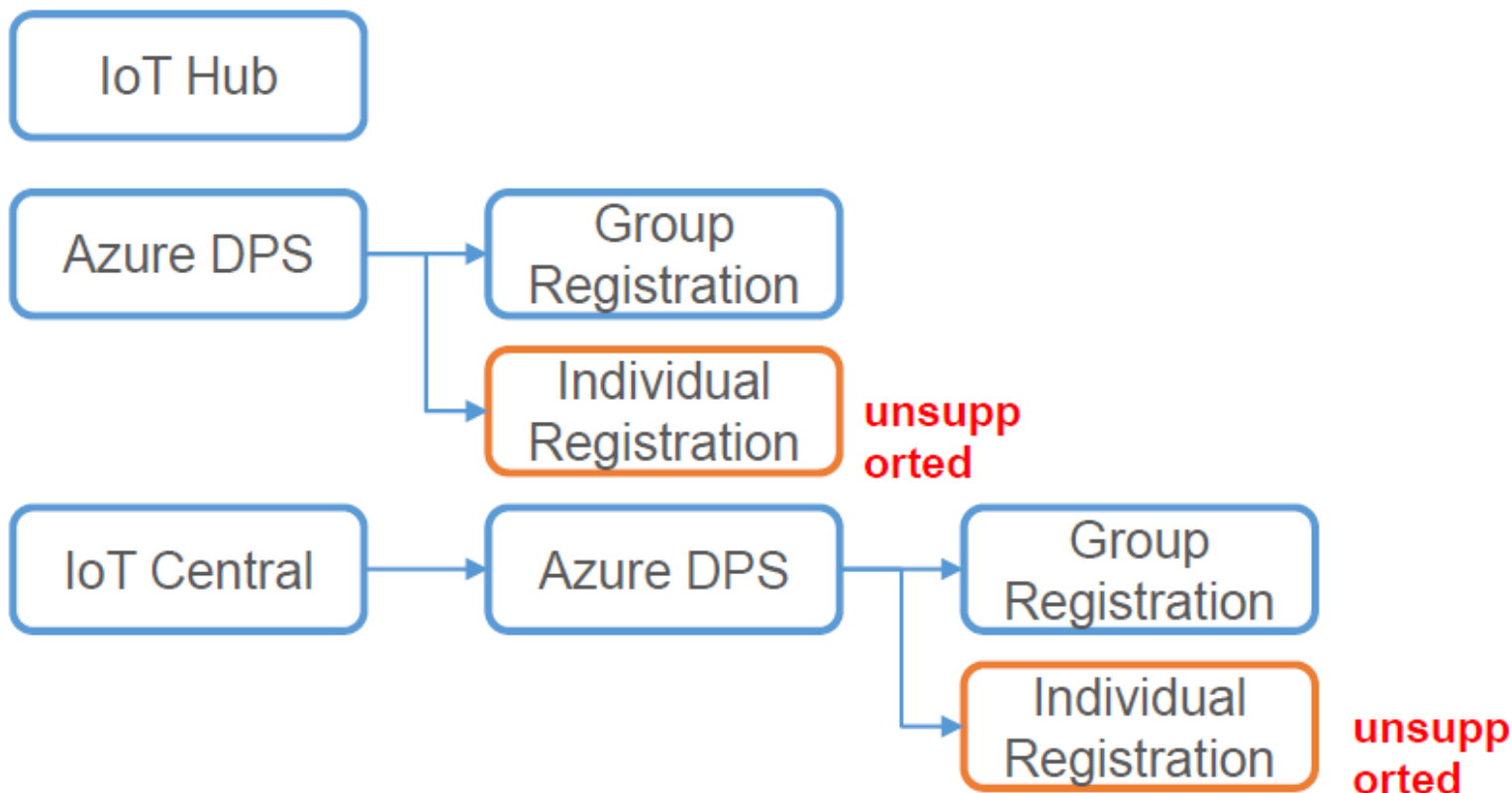
## ■ SAS Token

- The connection method in the red box below uses a SAS token as the password for connection.
- SAS tokens are generated by the PLC and include an expiration date (UNIX time) as information for generation.
- In order for the PLC to generate the correct expiration date, please set the following three points correctly. If the time data is not accurate, the connection may not be possible.
  - ◆ (1) Current date and time, (2) Time zone setting, (3) Daylight saving time setting

How to connect to cloud services		~FC6A Plus FW V2.10	FC6A Plus FW V2.20~
General Purpose Broker		Supported	Supported
AWS IoT Core			Supported
Azure IoT Hub	Connect using an X.509 certificate *.		Supported
	Connect using SAS	No	Supported
	Connecting via DPS	No	Supported

# Azure DPS Limitations

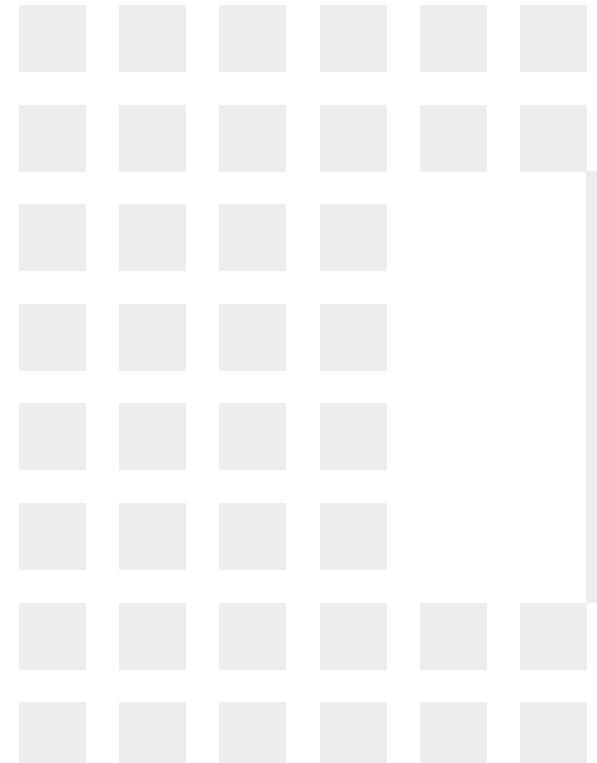
- Connections to Azure, including Azure DPS, have the following patterns
- This version does not support individual registration of Azure DPS
- The reason for not supporting this is that group registration is more practical and therefore group registration is given priority.





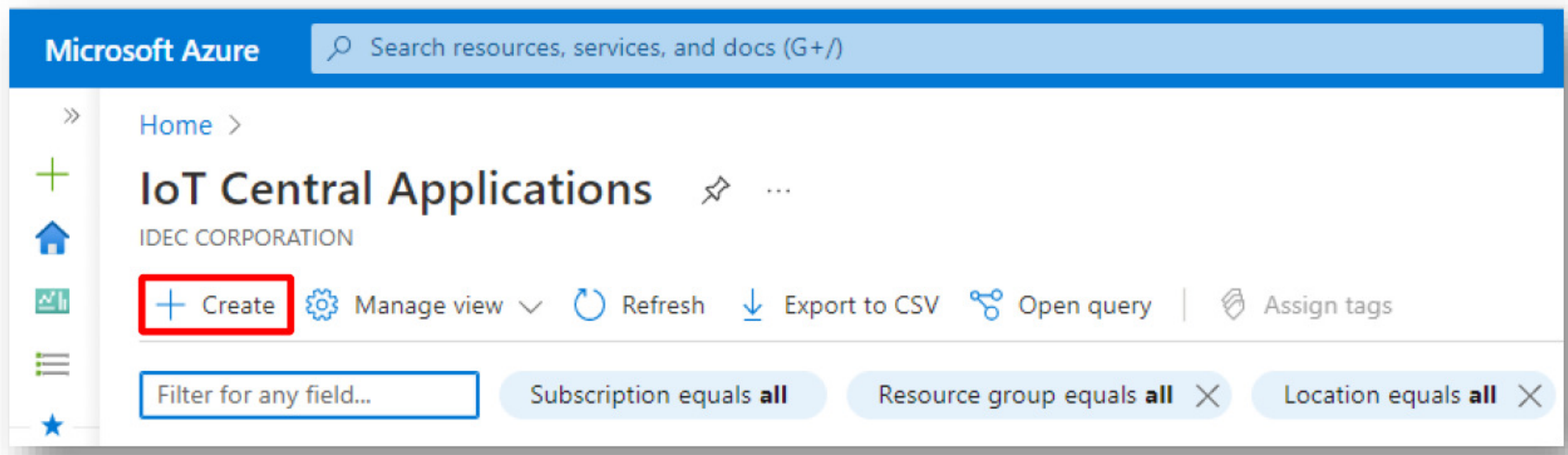
*Think Automation and beyond...*

# IoT Central



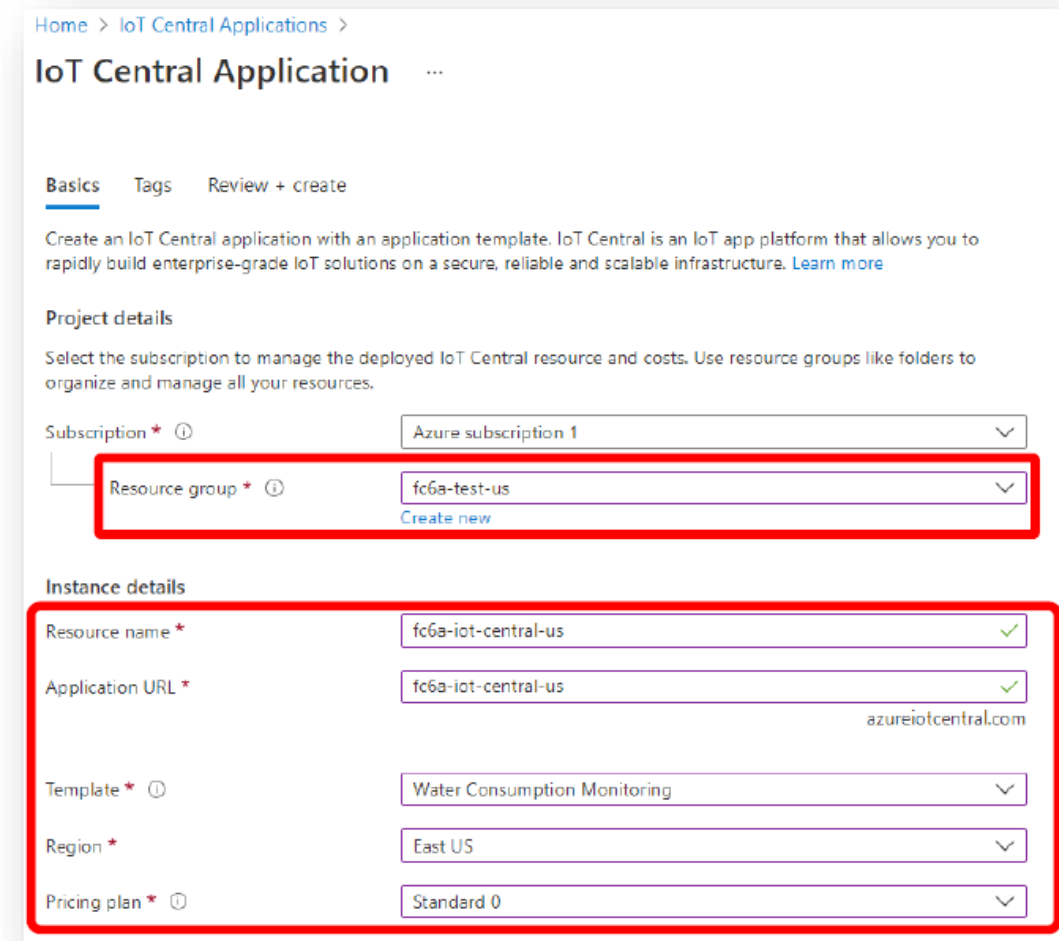
# Configure IoT Central

- Open IoT Central and press the "+ Create" button.



# Configure IoT Central

- Please set the following items and press the "Confirm" button.
  - resource group
    - ◆ Configure the resource group you just set up
  - Resource Name
    - ◆ Set an appropriate resource name
  - application URL
    - ◆ Automatically set by resource name, but can be changed as needed
  - template
    - ◆ Choose from several available templates
  - Region
    - ◆ Please set up the appropriate region
  - Rate Plans
    - ◆ Select "Standard 0" for a trial (see next page for details).



Home > IoT Central Applications >

## IoT Central Application ...

Basics Tags Review + create

Create an IoT Central application with an application template. IoT Central is an IoT app platform that allows you to rapidly build enterprise-grade IoT solutions on a secure, reliable and scalable infrastructure. [Learn more](#)

**Project details**

Select the subscription to manage the deployed IoT Central resource and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* ⓘ Azure subscription 1 ▼

Resource group \* ⓘ fc6a-test-us ▼  
[Create new](#)

**Instance details**

Resource name \* fc6a-iot-central-us ✓

Application URL \* fc6a-iot-central-us ✓  
azureiotcentral.com

Template \* ⓘ Water Consumption Monitoring ▼

Region \* East US ▼

Pricing plan \* ⓘ Standard 0 ▼



# IoT Central fee plans



Region:

Central US

Currency:

United States – Dollar (\$) USD

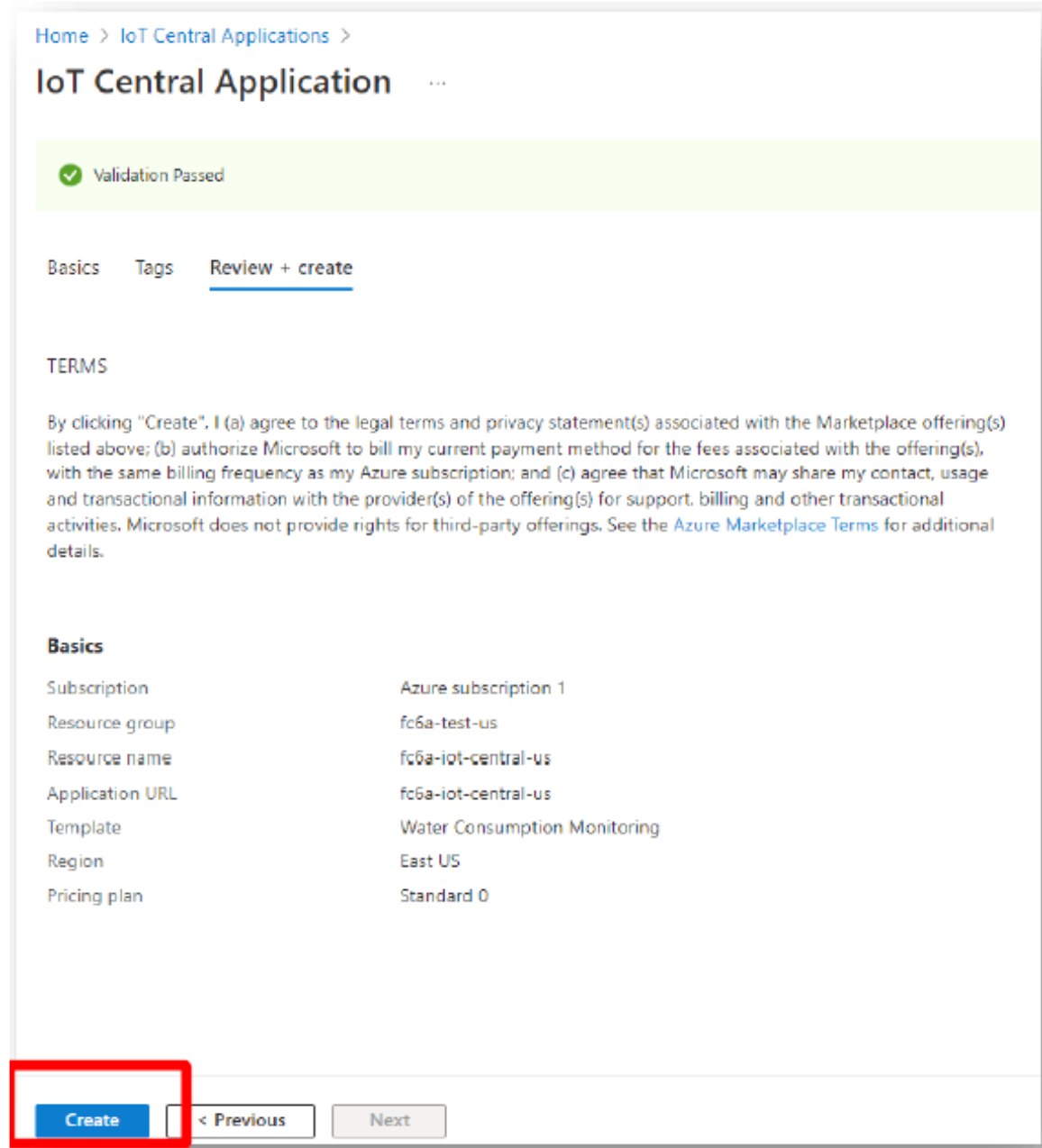
Pricing Tier	Standard Tier 0	Standard Tier 1	Standard Tier 2
Use Case	For devices sending a few messages per day	For devices sending a few messages per hour	For devices sending a message every few minutes
Price per device per month	<b>\$0.08</b> per Month	<b>\$0.40</b> per Month	<b>\$0.70</b> per Month
Monthly device message allocation*	400 messages	5,000 messages	30,000 messages
Included free quantities per application	2 free devices (800 included messages)	2 free devices (10,000 included messages)	2 free devices (60,000 included messages)
Overage pricing per 1K messages <sup>1</sup>	<b>\$0.07</b> per 1K messages	<b>\$0.015</b> per 1K messages	<b>\$0.015</b> per 1K messages

\* Total message allocation is shared across all devices in an IoT Central Application

<sup>1</sup> The standard message size is 4KB. For example, if the device sends a 4.5KB message it will be billed as 2 messages.

# Configure IoT Central

- If the settings are correct, click “Create” button to create an IoT Central



Home > IoT Central Applications >

## IoT Central Application ...

✓ Validation Passed

Basics Tags Review + create

### TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

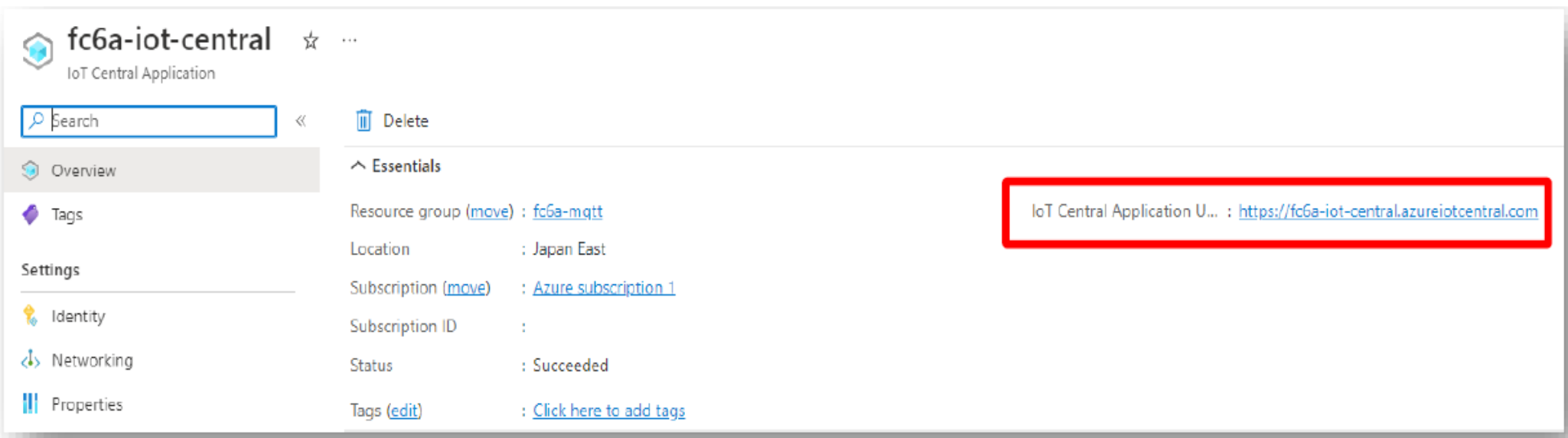
### Basics

Subscription	Azure subscription 1
Resource group	fc6a-test-us
Resource name	fc6a-iot-central-us
Application URL	fc6a-iot-central-us
Template	Water Consumption Monitoring
Region	East US
Pricing plan	Standard 0

**Create** < Previous Next

# Configure IoT Central

- The URL of the IoT Central can be found at the IoT Central portal site. Please open that URL.



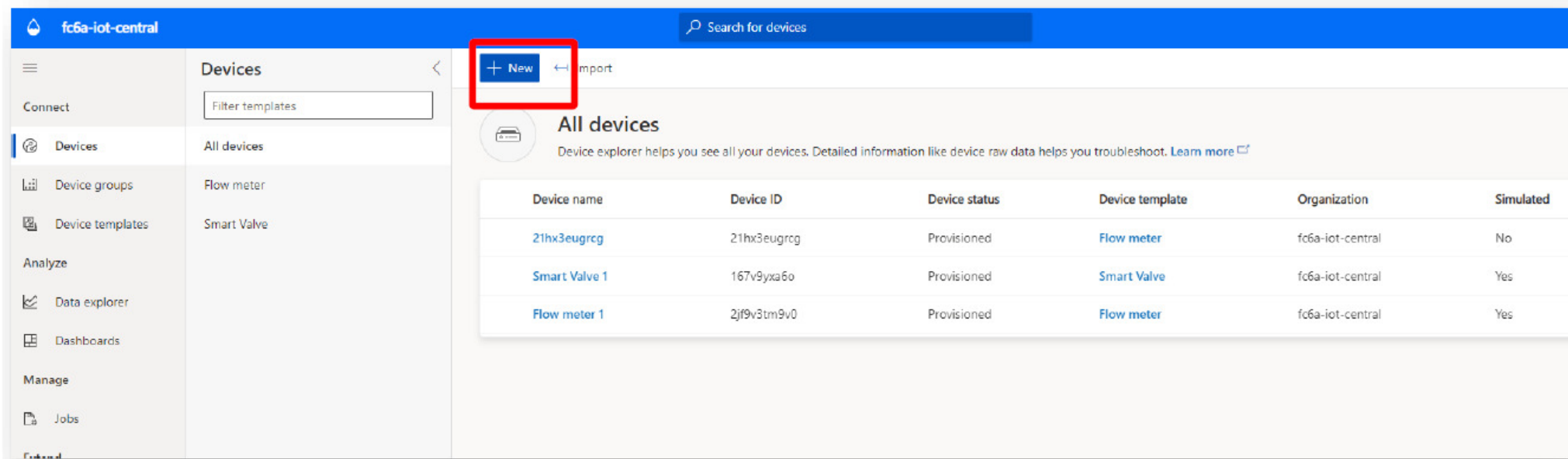
The screenshot shows the Azure IoT Central portal for an application named 'fc6a-iot-central'. The interface includes a search bar, a navigation menu with 'Overview', 'Tags', and 'Settings' (subdivided into 'Identity', 'Networking', and 'Properties'), and an 'Essentials' section. The 'Essentials' section lists the following details:

- Resource group (move) : [fc6a-mqtt](#)
- Location : Japan East
- Subscription (move) : [Azure subscription 1](#)
- Subscription ID :
- Status : Succeeded
- Tags (edit) : [Click here to add tags](#)

A red box highlights the URL for the IoT Central Application: IoT Central Application U... : <https://fc6a-iot-central.azureiotcentral.com>

# Configure IoT Central

- Create a device by clicking the "+ New" button from "Connections" -> "Devices" on the portal site.



The screenshot shows the IoT Central portal interface. The top navigation bar includes the logo 'fc6a-iot-central' and a search bar 'Search for devices'. The left sidebar contains navigation options: Connect, Devices, Device groups, Device templates, Analyze, Data explorer, Dashboards, Manage, and Jobs. The main content area is titled 'All devices' and features a table with columns: Device name, Device ID, Device status, Device template, Organization, and Simulated. A red box highlights the '+ New' button in the top right corner of the main content area.

Device name	Device ID	Device status	Device template	Organization	Simulated
<a href="#">21hx3eugrcg</a>	21hx3eugrcg	Provisioned	<a href="#">Flow meter</a>	fc6a-iot-central	No
<a href="#">Smart Valve 1</a>	167v9yxa6o	Provisioned	<a href="#">Smart Valve</a>	fc6a-iot-central	Yes
<a href="#">Flow meter 1</a>	2jf9v3tm9v0	Provisioned	<a href="#">Flow meter</a>	fc6a-iot-central	Yes

# Configure IoT Central

- This time, "Flow meter" will be used as the device template.
- When a device is created, a new device is added to the device list.

Create a new device

To create a new device, select a device template, a name, and a unique ID. [Learn more](#)

Device name \*

Device ID \*

Organization \*

Device template \*

Simulate this device?  
A simulated device generates telemetry that enables you to test the behavior of your application before you connect a real device.  
 No

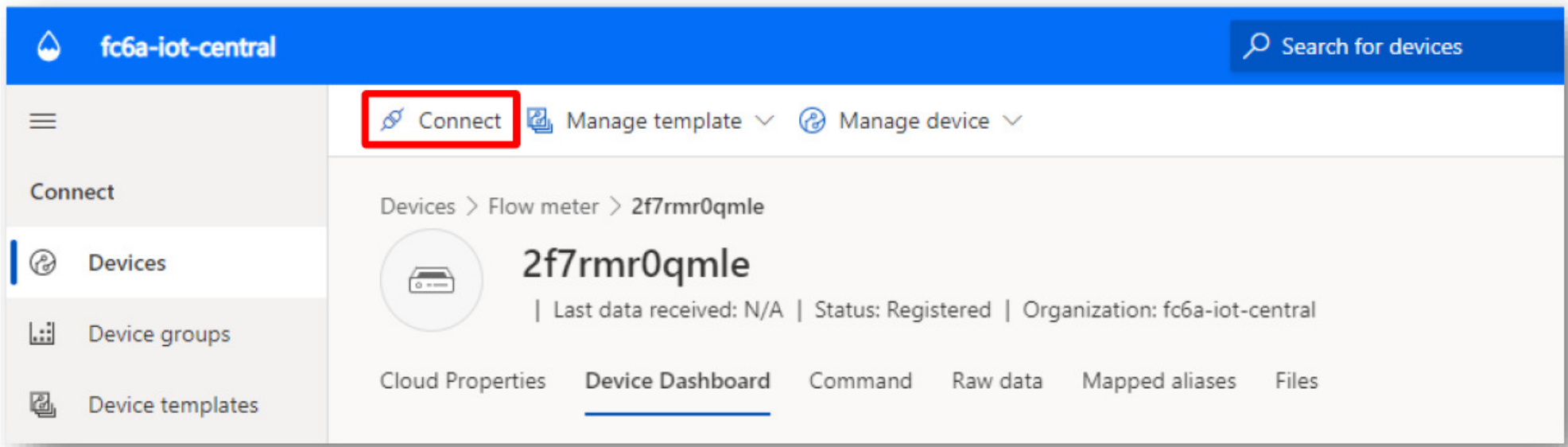
+ New ← Import

All devices  
Device explorer helps you see all your devices. Detailed information like device raw data helps you troubleshoot. [Learn more](#)

Device name	Device ID	Device status	Device template	Organization
2f7rnr0qmle	2f7rnr0qmle	Registered	Flow meter	fc6a-iot-central

# Configure IoT Central

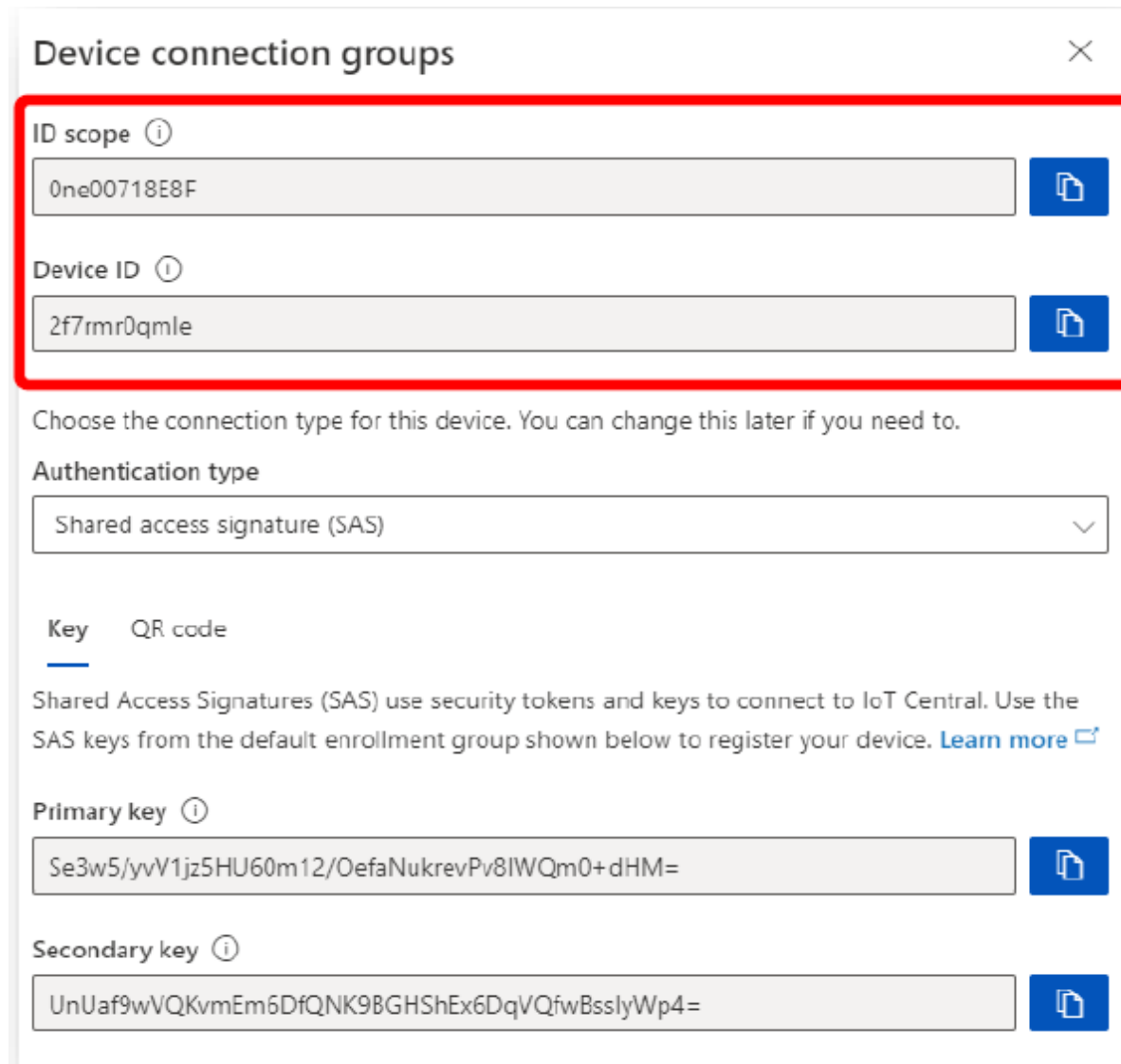
- Open the created device and verify the connection information.
- Connection information can be opened by clicking the "Connect" button.



The screenshot displays the IoT Central interface for an organization named 'fc6a-iot-central'. The top navigation bar is blue and contains a search box labeled 'Search for devices'. Below the navigation bar, there is a secondary bar with three main actions: 'Connect' (highlighted with a red box), 'Manage template', and 'Manage device'. The left sidebar shows a menu with 'Connect', 'Devices', 'Device groups', and 'Device templates'. The main content area shows the breadcrumb 'Devices > Flow meter > 2f7rmr0qmle' and a device card for '2f7rmr0qmle'. The device card includes a status bar with 'Last data received: N/A | Status: Registered | Organization: fc6a-iot-central' and a set of tabs: 'Cloud Properties', 'Device Dashboard' (which is selected and underlined), 'Command', 'Raw data', 'Mapped aliases', and 'Files'.

# Configure IoT Central

- Please note the "ID Scope" and "Device ID". This information will be needed in WindLDR later.



Device connection groups

ID scope ⓘ  
0ne00718E8F

Device ID ⓘ  
2f7mr0qmlc

Choose the connection type for this device. You can change this later if you need to.

Authentication type  
Shared access signature (SAS)

Key QR code

Shared Access Signatures (SAS) use security tokens and keys to connect to IoT Central. Use the SAS keys from the default enrollment group shown below to register your device. [Learn more](#)

Primary key ⓘ  
Se3w5/yvV1jz5HU60m12/OefaNukrevPv8IWQm0+dHM=

Secondary key ⓘ  
UnUaf9wVQKvmEm5DfQNK9BGHShEx6DqVQfwBsslyWp4=

# Configure IoT Central

- To obtain the target key (SAS token) to connect to IoT Central  
Open "Security" -> "Permissions" -> "Device Connection Groups" -> "SAS-IoT-Devices".

The screenshot shows the IoT Central web interface. The left sidebar contains a navigation menu with the following items: Dashboards, Manage (Jobs), Extend (Rules, Data export), Security (Permissions), and Settings (Application, Customization). The 'Permissions' item is highlighted with a red box. The main content area is titled 'Device connection groups' and includes a search bar, a '+ New' button, and a description: 'We use the Azure IoT Hub Device Provisioning Service (DPS) to register and connect devices. Learn more'. Below this, there is a form for 'ID scope' with the value 'One00718E8F' and a file icon, and a toggle for 'Auto-approve new devices' which is currently 'On'. At the bottom, there is a table of 'Enrollment groups' with the following data:

Name	Attestation type	Created	Group type
<a href="#">SAS-IoT-Edge-Devices</a>	Shared access signature (S...	8/17/2022	IoT Edge devices
<a href="#">SAS-IoT-Devices</a>	Shared access signature (S...	8/17/2022	IoT devices



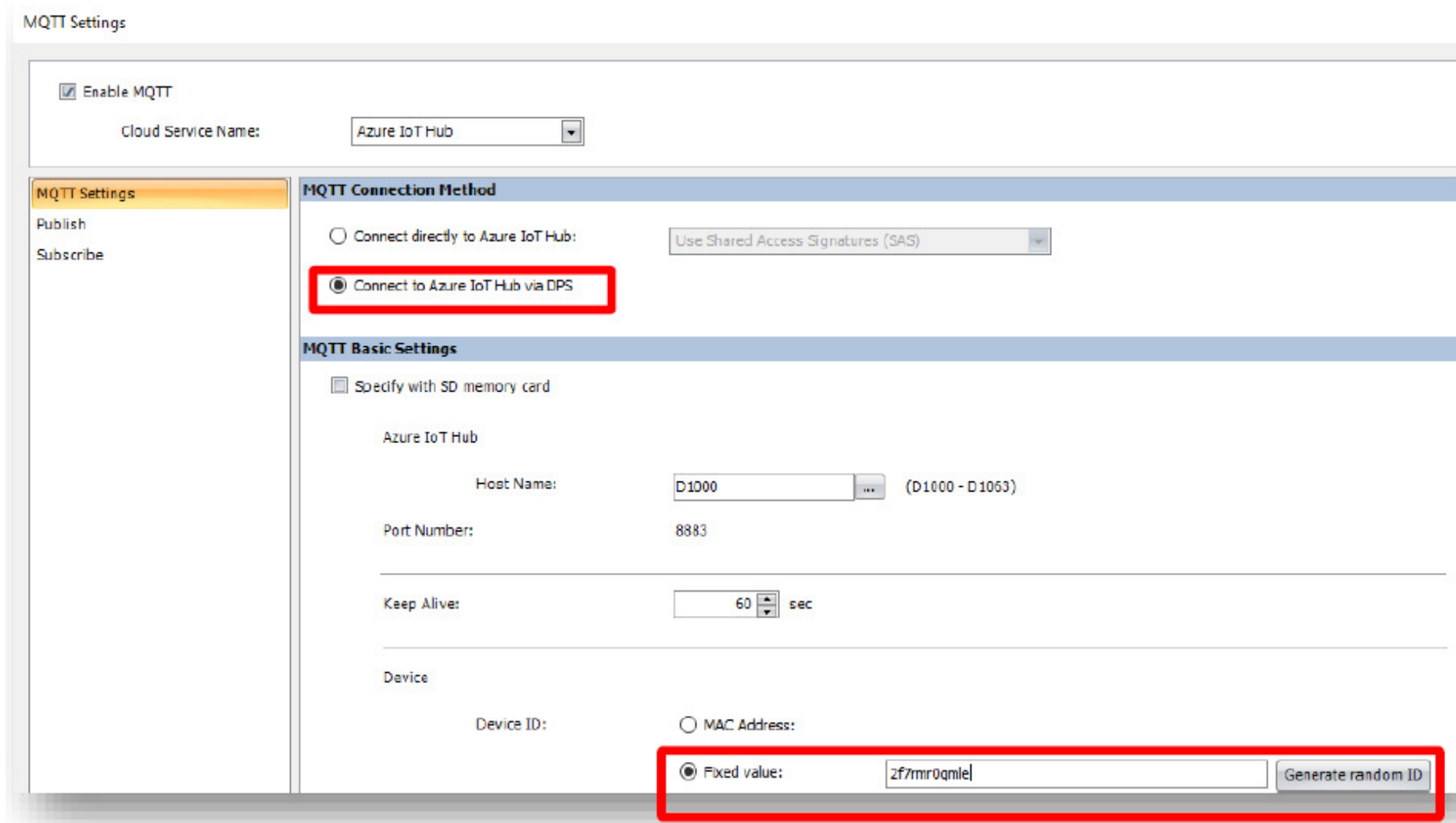
# Configure IoT Central

- Please note the string listed in "Shared Access Signature (SAS)" -> "Primary Key". This information will be needed in WindLDR later.

The screenshot shows the 'Permissions' configuration page for a 'Device connection group' in IoT Central. The page is titled 'Permissions' and has a search bar for devices. The left sidebar shows navigation options: Dashboards, Manage (Jobs), Extend (Rules, Data export), Security (Permissions), and Settings (Application, Customization). The main content area is divided into sections: Organizations, Users, Roles, Device connection groups (selected), and API tokens. The 'Device connection groups' section is expanded, showing the 'Shared access signature (SAS)' configuration. The 'Attestation type' is set to 'Shared access signature (SAS)'. The 'Shared access signature (SAS)' section includes a description: 'Devices use Shared Access Signature (SAS) security tokens to connect to IoT Central. Use the group-level SAS keys that will appear below to generate keys for your individual device(s). Learn more'. There is a toggle for 'Auto generate keys' which is currently off. The 'Primary key' field is highlighted with a red box and contains an empty text input with a copy icon to its right. Below it is the 'Secondary key' field, also empty with a copy icon.

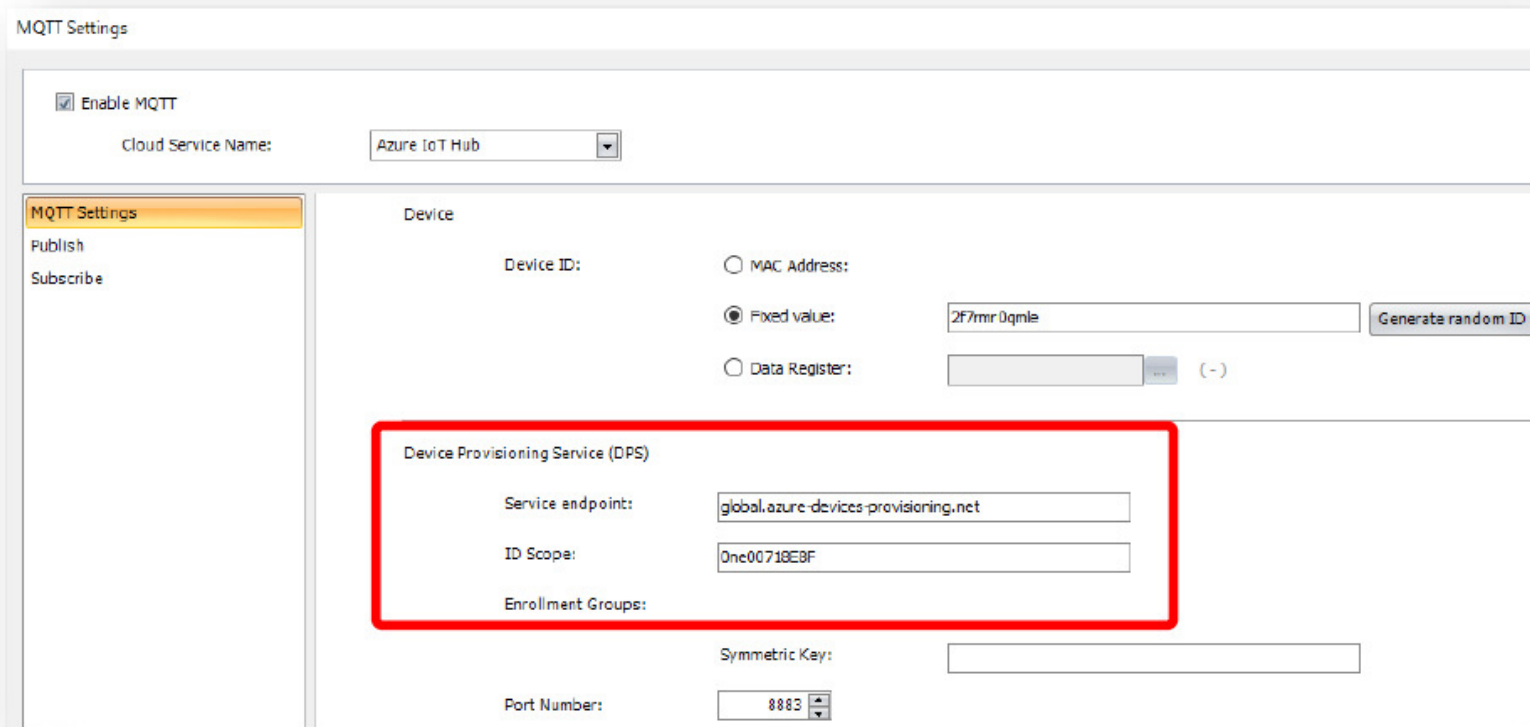
# WindLDR Settings

- To connect to the IoT Central from WindLDR, select 'Connect to Azure IoT Hub via DPS'
- Set the "Device ID" to the one that you noted before.



The screenshot shows the 'MQTT Settings' window in WindLDR. The 'Enable MQTT' checkbox is checked. The 'Cloud Service Name' is set to 'Azure IoT Hub'. Under 'MQTT Connection Method', the radio button for 'Connect to Azure IoT Hub via DPS' is selected and highlighted with a red box. Under 'MQTT Basic Settings', the 'Specify with SD memory card' checkbox is unchecked. The 'Azure IoT Hub' section shows 'Host Name' as 'D1000' (with a range of D1000 - D1063) and 'Port Number' as '8883'. The 'Keep Alive' is set to '60 sec'. In the 'Device' section, the radio button for 'Fixed value:' is selected and highlighted with a red box, with the value '2f7mr0qmle|' entered in the adjacent text field. A 'Generate random ID' button is also visible.

- Set "global.azure-devices-provisioning.net" as the "Service Endpoint".
- Set the "ID Scope" and "Symmetry Key" to the ones you have just noted.



The screenshot shows the 'MQTT Settings' window. At the top, there is a checkbox for 'Enable MQTT' which is checked. Below it, the 'Cloud Service Name' is set to 'Azure IoT Hub'. The main area is divided into two sections: 'Device' and 'Device Provisioning Service (DPS)'. The 'Device' section has three radio buttons: 'MAC Address', 'Fixed value', and 'Data Register'. The 'Fixed value' option is selected, and the text '2f7mr0qmlc' is entered in the adjacent field. A 'Generate random ID' button is also present. The 'Device Provisioning Service (DPS)' section is highlighted with a red box and contains three input fields: 'Service endpoint' with the value 'global.azure-devices-provisioning.net', 'ID Scope' with the value '0nc00718EBF', and 'Enrollment Groups' which is empty. Below this section, there is a 'Symmetric Key' field and a 'Port Number' dropdown menu set to '8883'.

# WindLDR Settings

- The "topic name" of the publish is the same one as before.

MQTT Settings

Enable MQTT

Cloud Service Name:

MQTT Settings

- Publish
- Subscribe

**Publish**

Topic	Payload	Operation Mode	Publish Control	Publish Status
devices/{device_id}/messages/events/	Configure	Rising Edge	M0 100	... D0100
	Configure	Rising Edge		...

# WindLDR Settings

- The parameters to be set for the payload are displayed when the template used is selected from "Connections" -> "Device Template" in IoT Central.
- Use the string listed under "Name" as the payload.
- Note that only the parameters listed as "Telemetry" as "Function Type" are published data from FC6A to IoT Central.

The screenshot shows the IoT Central interface for configuring a 'Flow meter' device template. The 'Flow meter' template is selected in the left sidebar. The main area displays the configuration for the 'Flow meter' interface, which is published. The configuration table shows the following parameters:

Display name	Name *	Capability type *	Semantic type
Temperature	Temperature	Telemetry	Temperature
Flow	Flow	Telemetry	None
Moisture	Moisture	Telemetry	None
Pressure	Pressure	Telemetry	None
Calibrate meter	CalibrateMeter	Command	

A 'Payload' window is open on the right, showing a table of the payload structure:

ID	Name	Format	Data Type	Data
1	(root)	Object (6)		
2	FlowMeterNumber	Value	Word (W)	5
3	Temperature	Value	Float (F)	25.3
4	Flow	Value	Word (W)	12
5	Moisture	Value	Word (W)	30
6	Pressure	Value	Word (W)	20
7	Calibrate meter	Value	Word (W)	70

Red boxes highlight the 'Flow meter' template in the sidebar, the 'Name' column in the configuration table, and the 'Payload' window. A red arrow points from the 'Name' column to the 'Payload' window.



*Think Automation and beyond...*

# The End

