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AZURE IoT CENTRAL MANUAL

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Table of Contents

List of Figures	3
General Information	4
1 Setup the Azure IoT Device Bridge	5
1.1 Create an Azure Account.....	5
1.2 Create an Azure IoT Central Application	7
1.3 Deploy the Azure IoT Central Device Bridge	9
1.3.1 Build the Docker Image and Push it.....	9
1.3.2 Deploy the Image.....	9
1.4 Add a Device Template to the Azure IoT Central Application	12
2 Setup the Azure IoT Device Bridge	16
2.1 Create a Data Converter on the Network Server.....	16
2.2 Create an Azure IoT Central Integration	17
3 Setup the Azure IoT Device Bridge	22
3.1 Get Uplinks from the Sensors	22
3.2 Send Downlinks to the Sensors.....	23
3.3 Delete the Device.....	24

List of Figures

Figure 1-1: Your profile	Error! Bookmark not defined.	5
Figure 1.2: Phone verification		6
Figure 1.3: Credit card information		6
Figure 1.4: Create a new application		7
Figure 1.5: New app window part 1.....		8
Figure 1.6: New app window part 2.....		8
Figure 1.7: Deployment setup		9
Figure 1.8: ID scope.....		10
Figure 1.9: SAS-IoT-Devices group		10
Figure 1.10: Primary and secondary keys.....		11
Figure 1.11: Access keys tab		12
Figure 1.12: Device template tab.....		13
Figure 1.13: Create new template part 1		13
Figure 1.14: Create new template part 2		14
Figure 1.15: Upload the template JSON		14
Figure 1.16: Publish the template.....		15
Figure 2.1: Data converters tab		16
Figure 2.2: Add data converter		17
Figure 2.3: Applications tab		18
Figure 2.4: Application details tab		18
Figure 2.5: Integrations tab.....		19
Figure 2.6: Add integration tab.....		20
Figure 2.7: FQDN parameter in the container group.....		21
Figure 3.1: List of the devices in the Azure IoT Central application		22
Figure 3.2: Raw data tab		22
Figure 3.3: Command tab		23
Figure 3.4: Downlink queue tab.....		23

General Information

Azure does not have native integration with LoRaWAN. The Azure IoT Central Device Bridge must be implemented to connect a LoRaWAN network server APIs, dealing with uplinks and downlinks, to the Azure IoT APIs.

To use the Integration between the Azure IoT Central and the Tektelic Network Server, you will need the following:

1. Setup the Azure IoT Central Device Bridge:
 - 1.1. An Azure account. You can create a free Azure account.
 - 1.2. An Azure IoT Central application to connect the devices.
 - 1.3. A docker-image of the Azure IoT Central Device Bridge to deploy it in the Azure Portal.
 - 1.4. A device template at the created Azure IoT Central application
2. Setup the integration on the Tektelic Network Server:
 - 2.1. A data-converter for the devices these are used in integration.
 - 2.2. Create an Azure IoT Central integration instance.

1 Setup the Azure IoT Device Bridge

1.1 Create an Azure Account

***** Notice, that this step is necessary only if you have no Azure IoT account yet and/or want to get the free account to verify the Azure IoT Central integration. *****

Open the next link <https://azure.microsoft.com/en-us/free/iot/> and select “Start Free” button. In the opened window login with your Microsoft Account or create a new one. After that fill the mandatory fields in the “Your Profile” section and click “Next” button (Figure 1-1).

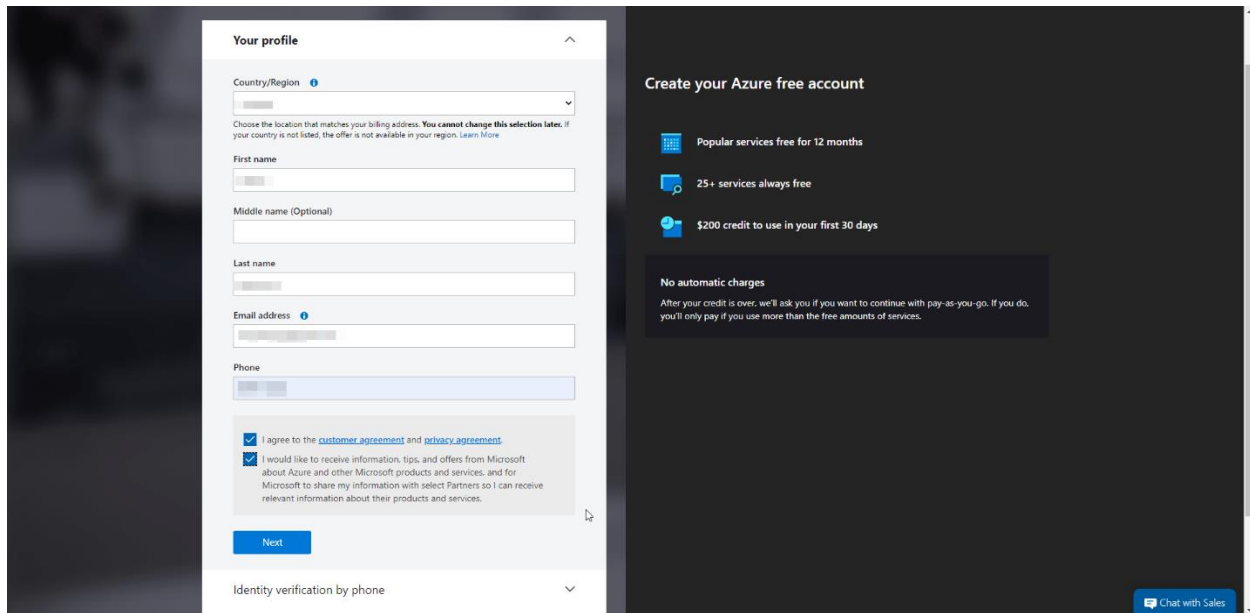
The image shows a screenshot of the Azure account creation process. On the left, there is a 'Your profile' form with the following fields: 'Country/Region' (a dropdown menu), 'First name', 'Middle name (Optional)', 'Last name', 'Email address', and 'Phone'. Below these fields are two checkboxes: one for agreeing to the 'customer agreement and privacy agreement' and another for receiving information from Microsoft. A blue 'Next' button is at the bottom of the form. On the right, there is a 'Create your Azure free account' section with three bullet points: 'Popular services free for 12 months', '25+ services always free', and '\$200 credit to use in your first 30 days'. Below this is a 'No automatic charges' warning. At the bottom right, there is a 'Chat with Sales' button.

Figure 1-1: Your profile

On the next page verify your phone number and verify yourself by credit card after that (Figures 1-2 and 1-3).

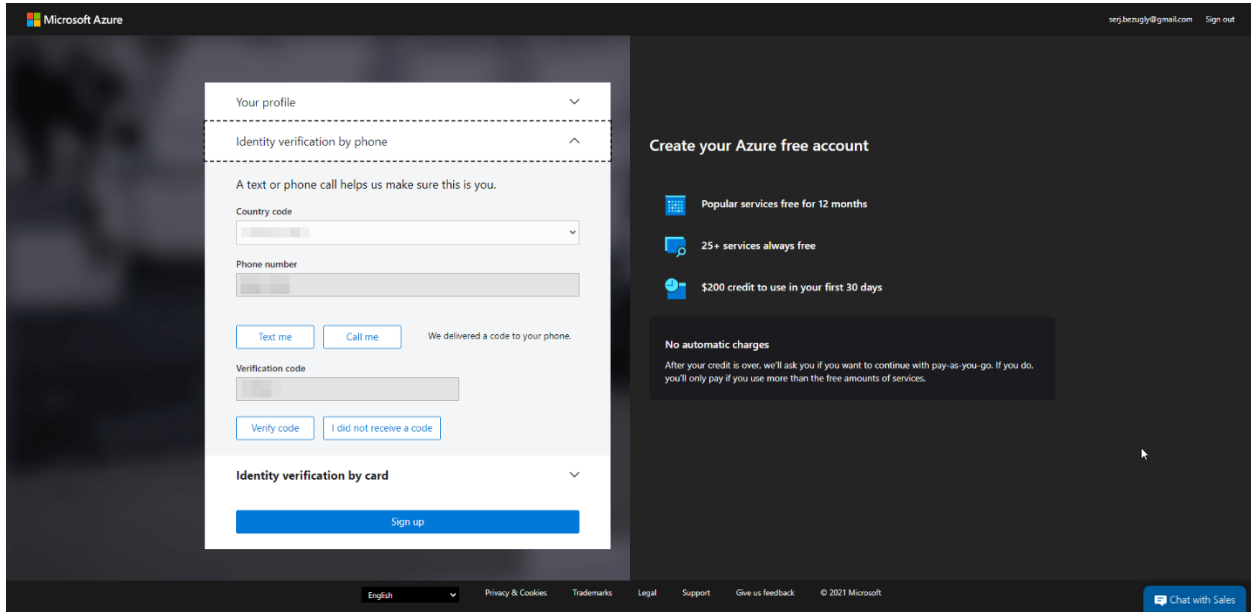


Figure 1-2: Phone verification

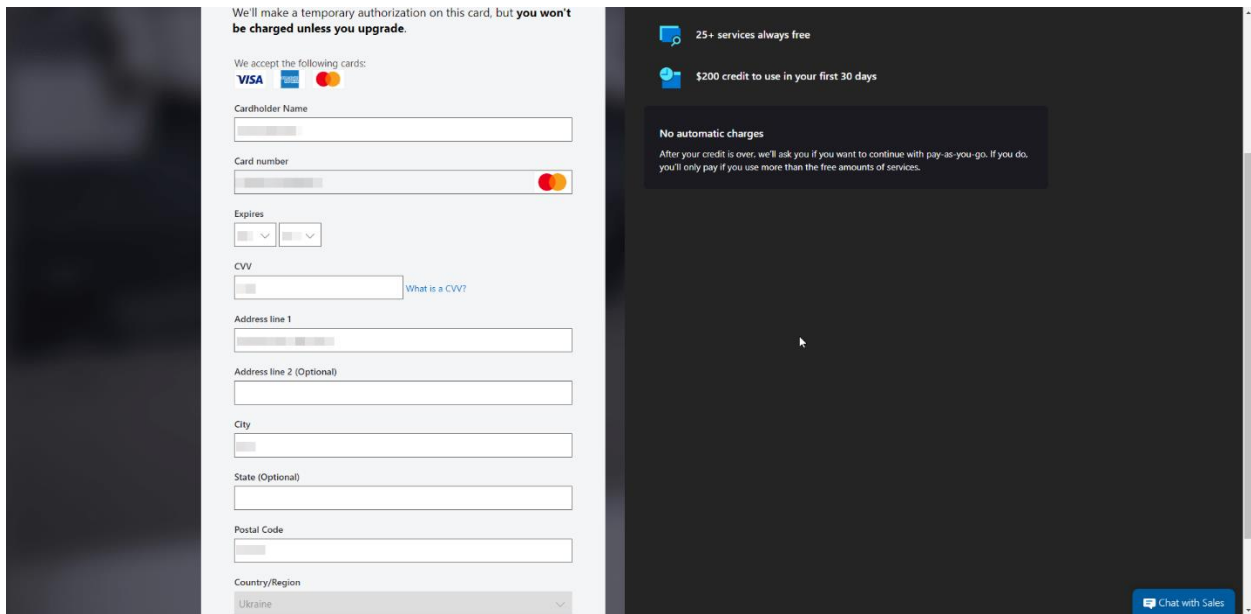


Figure 1-3: Credit card verification

Click on the “Sign Up” button after that. A new free IoT account should be created. After that you should to create a subscription.

1.2 Create an Azure IoT Central Application

Navigate to the Azure IoT Central site and then sign in with the Microsoft account associated with your Azure subscription.

In the opened window:

- Navigate to the Build page and select “**Create app**” in the Custom app tile (Figure 1-4).

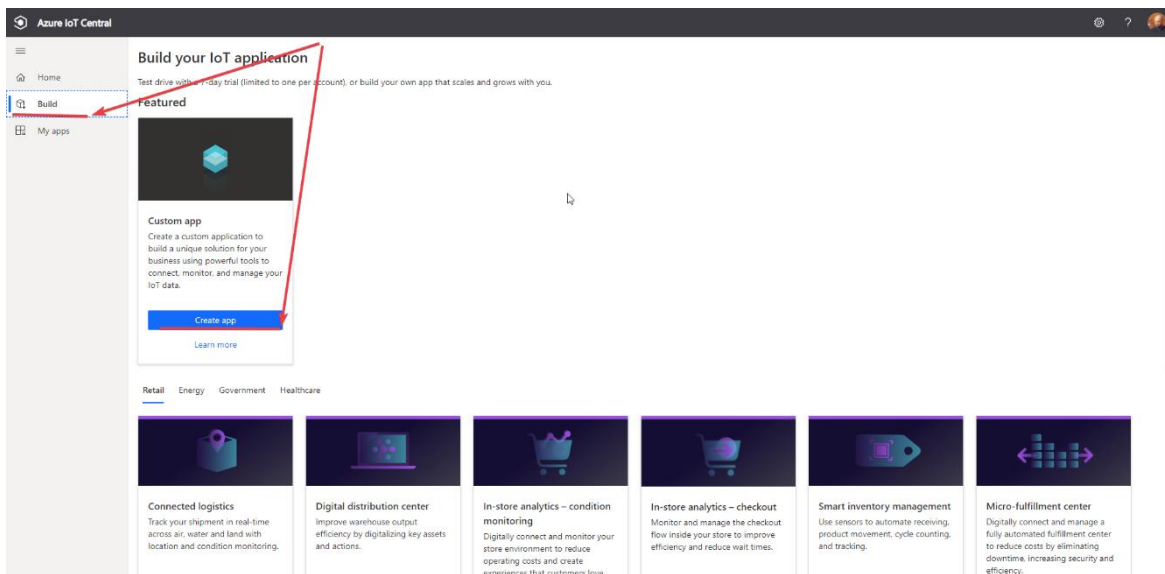


Figure 1-4: Create a new application

- On the “**New application**” page, make sure that **Custom application** is selected under the **Application template**.
- Azure IoT Central automatically suggests an application name based on the application template you've selected. You may enter your own unique application name.
- Azure IoT Central also generates a unique **URL prefix** for you, based on the application name. You use this URL to access your application. Change this **URL prefix** to something more memorable if you'd like. This URL must be unique. (Figure 1-5)
- Select the **Pricing Plan**. (Figure 1-5)

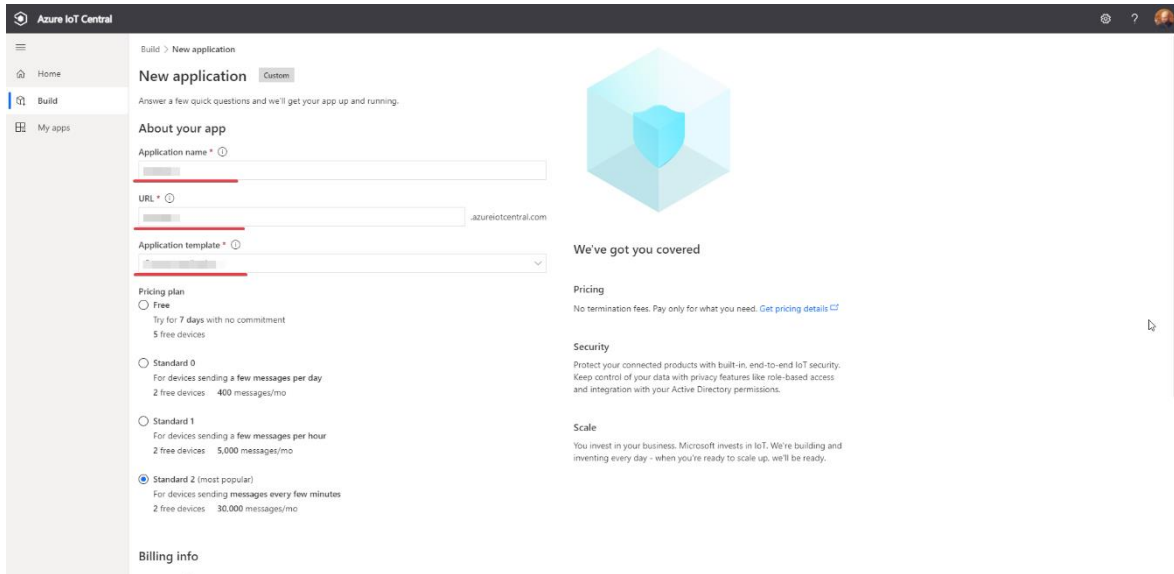


Figure 1-5: New app window part 1

- Select your subscription in the **Azure subscription** drop-down. (Figure 1-6)
- Select your closest location in the **Location** drop-down. (Figure 1-6)
- Review the **Terms and Conditions**, and select **Create** at the bottom of the page. After a few seconds, your IoT Central application is ready to use. (Figure 1-6)

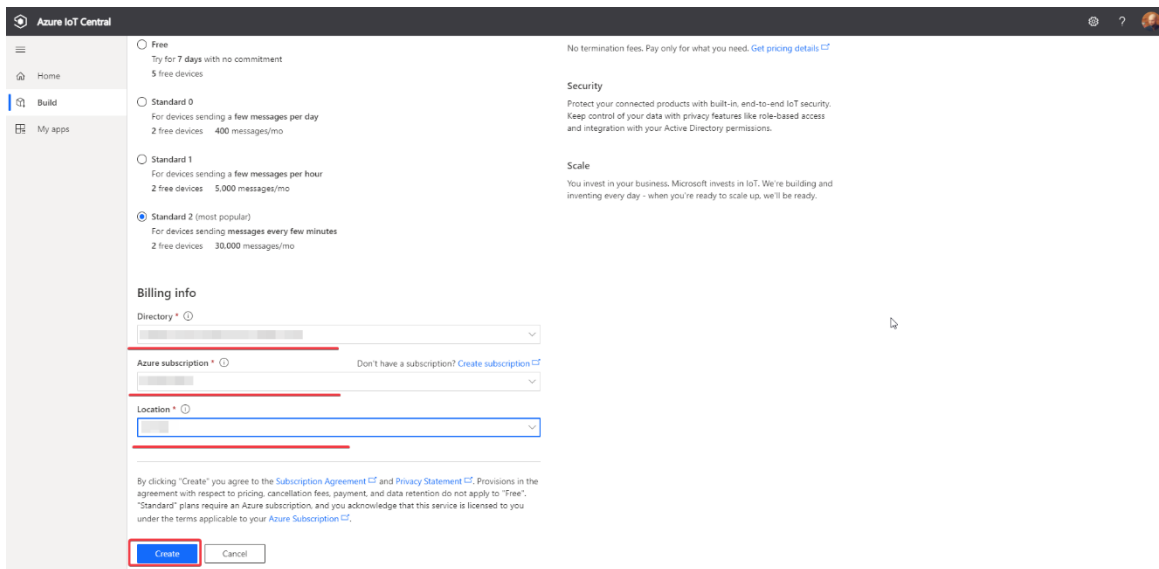


Figure 1-6: New app window part 2

(For more information visit <https://docs.microsoft.com/uk-ua/azure/iot-central/core/quick-deploy-iot-central>)

1.3 Deploy the Azure IoT Central Device Bridge

1.3.1 Build the Docker Image and Push it

First of all, it is necessary to get the repository with Azure IoT Central Device Bridge from the GitHub repository <https://github.com/iot-for-all/iotc-device-bridge>.

When the Azure IoT Central Device Bridge repository is cloned, perform the following actions:

- Run the “**docker build .**” command in the solution folder to build the Device Bridge image.
- Create a container registry in your Azure subscription that was created in the **section 1.1** of this guide. For example, use the [Azure portal](#), the [Azure CLI](#), or [Azure PowerShell](#).
- Tag and push the image to an Azure Container Registry (ACR) (<https://docs.microsoft.com/en-us/azure/container-registry/container-registry-get-started-docker-cli>)

***** You should note the image name and the ACR credentials, which are necessary in the next steps. *****

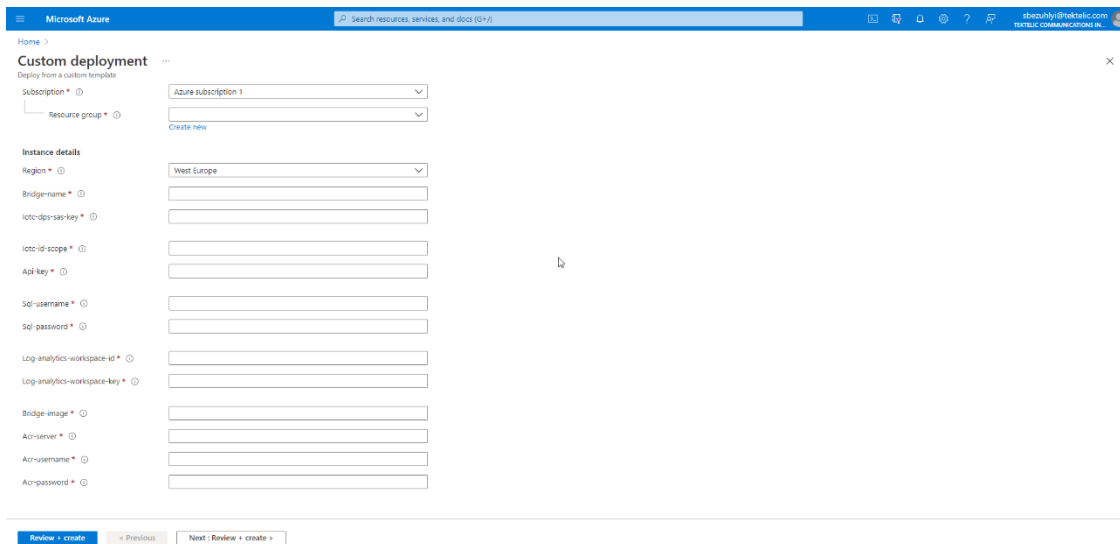
1.3.2 Deploy the Image

Once the Device Bridge image is built and pushed to the registry it is necessary to deploy it.

Open the Azure custom deployment page by the following

<https://portal.azure.com/#create/Microsoft.Template/uri/https%3A%2F%2Fraw.githubusercontent.com%2Fiot-for-all%2Fiotc-device-bridge%2Fmain%2Fazuredeploy.json> .

The Custom Deployment page should be opened (*Figure 1-7*):



The screenshot shows the Azure Custom Deployment page. The page title is "Custom deployment" and it includes a "Deploy from a custom template" link. The form is divided into several sections:

- Subscription:** A dropdown menu showing "Azure subscription 1".
- Resource group:** A dropdown menu with a "Create new" link below it.
- Instance details:**
 - Region:** A dropdown menu showing "West Europe".
 - Bridge-name:** A text input field.
 - iotc-dps-key:** A text input field.
 - iotc-id-scope:** A text input field.
 - Api-key:** A text input field.
 - Self-username:** A text input field.
 - Self-password:** A text input field.
 - Log-analytics-workspace-id:** A text input field.
 - Log-analytics-workspace-key:** A text input field.
 - Bridge-image:** A text input field.
 - Act-server:** A text input field.
 - Act-username:** A text input field.
 - Act-password:** A text input field.

At the bottom of the form, there are navigation buttons: "Review & create", "< Previous", and "Next: Review & create >".

Figure 1-7: Deployment setup

In the opened page fill the mandatory fields according to the following:

- In the **Bridge-name** parameter, enter the name for the new Bridge instance. This name will be part of the HTTPS endpoint for your instance, so it may only contain letters, numbers, and dashes.
- The **IoT SAS key** and **Id scope** parameters can be found in the Azure IoT Central Application that was created in the **section 1.2** of this guide. Go to your IoT Central application and navigate to the Administration > Device Connection area. Copy the **ID Scope** field (*Figure 1-8*) and paste it into the **iotc-id-scope** parameter in the template. In the same page, under Enrollment groups, open the SAS-IoT-Devices group (*Figure 1-9*). In the device group page, copy either the **Primary key** or **Secondary key** and paste it in the **iotc-dps-sas-key** parameter of the template (*Figure 1-10*).

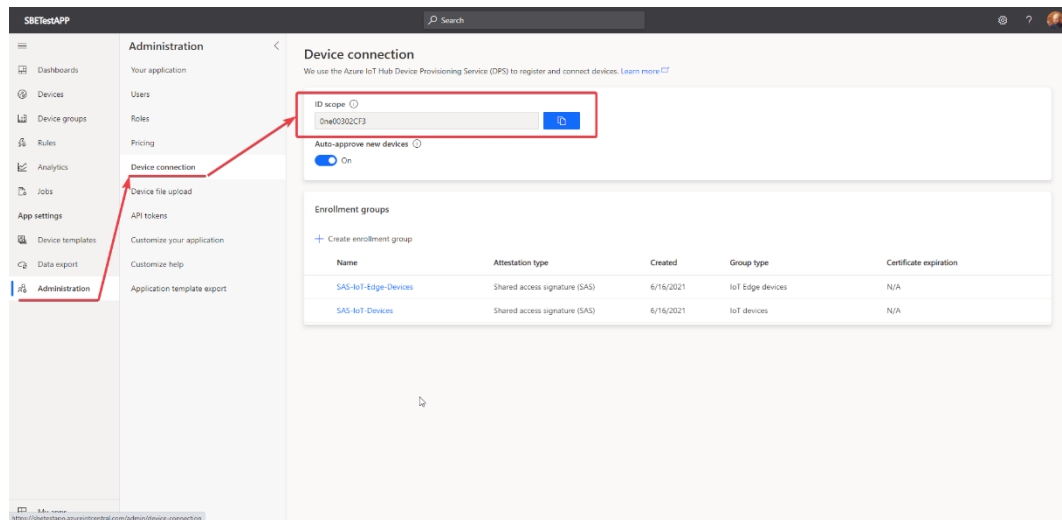


Figure 1-8: ID Scope

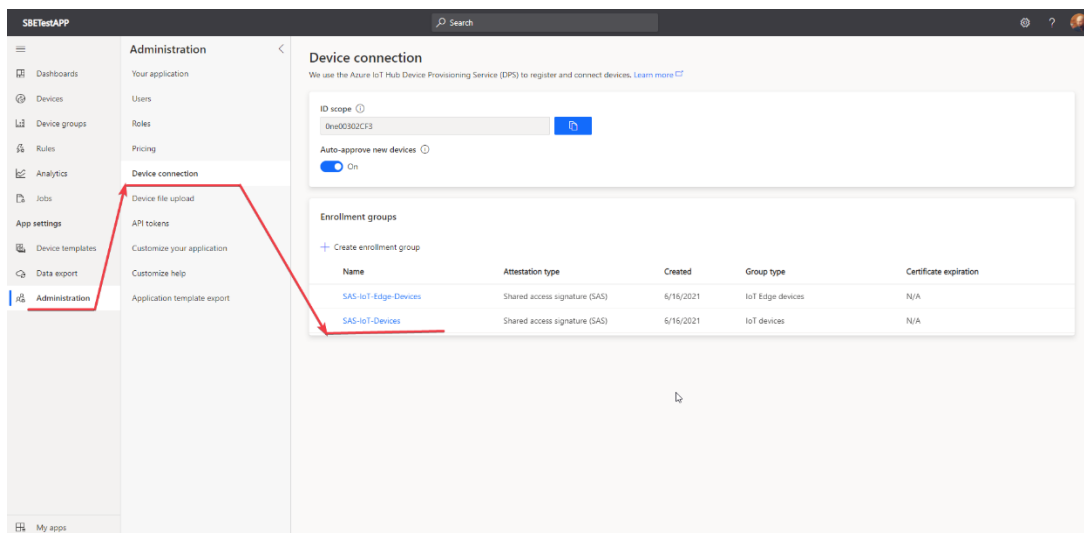


Figure 1-9: SAS-IoT-Devices group

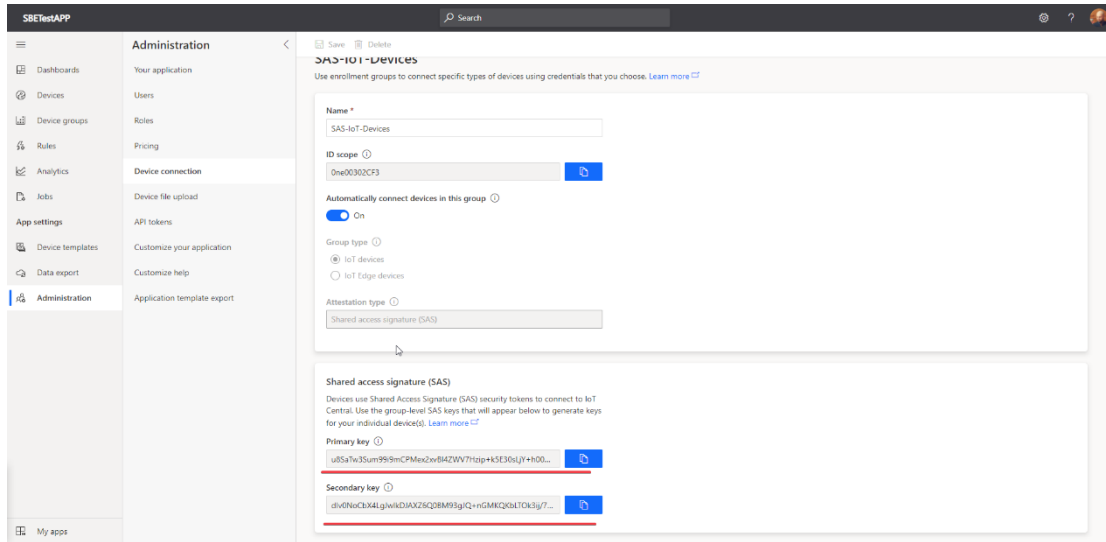


Figure 1-10: Primary and Secondary Keys

- In the **Api-key** parameter, define a strong (and preferably randomly generated) API key. This key will be used to protect the HTTP API and must be included in the **x-api-key** header of every request to the Bridge
- In the **Sql-username** and **Sql-password** parameters, enter an admin login and password for the Azure SQL instance that will be provisioned by the solution (it is used for caching and storing device info). The password must follow the [SQL Server password policy](#).
- By default, the Bridge will publish logs to a Log Analytics workspace of your choice. If you do not already have a Log Analytics workspace created in your resource group, you can create one by following these [instructions](#). In the **Log-analytics-workspace-id** and **Log-analytics-workspace-key** parameters, provide the credentials of your workspace (instructions to obtain the credentials of your Log Analytics workspace can be found [here](#)).
- Go to the Azure Portal and open the ACR with Docker image that you have already pushed in the **section 1.3.1**. Open the “**Access Keys**” tab (*Figure 1-11*). In the **Acr-server**, **Acr-username**, and **Acr-password** parameters provide the credentials of your ACR instance “**Access Keys**” tab.

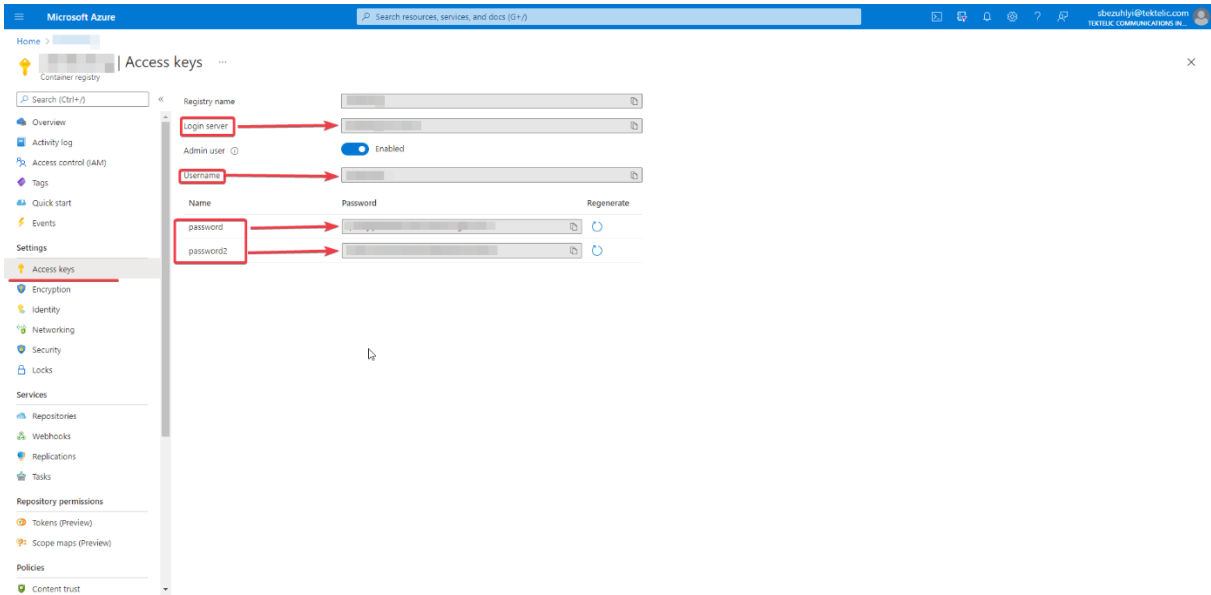


Figure 1-11: Access Keys tab

After providing all necessary parameters, click the **Review+create** button. The deployment may take a few minutes. Once finished, you can find the newly provisioned resources in the target resource group.

1.4 Add a Device Template to the Azure IoT Central Application

To add a device template to the Azure IoT Central Application it is necessary to have the JSON file with template model match the Azure IoT Central [requirement](#).

***** Notice, that you are always able to get the templates for Tektelic sensors through Tektelic support portal. *****

Navigate to your IoT Central Application and click on the “**Device Template**” tab (Figure 1-12). After that click on the “New” button to create a new device template.

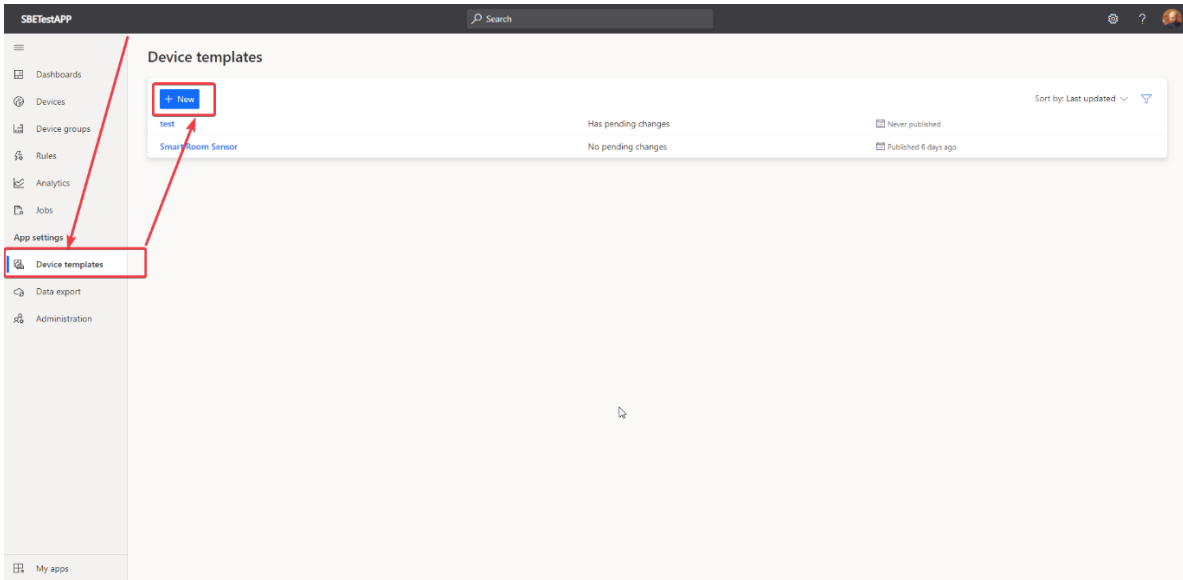


Figure 1-12: Device template tab

After that in the opened page select the “IoT Device” in the “Create a custom device template” section and click on the “Next: Customize” button (Figure 1-13).

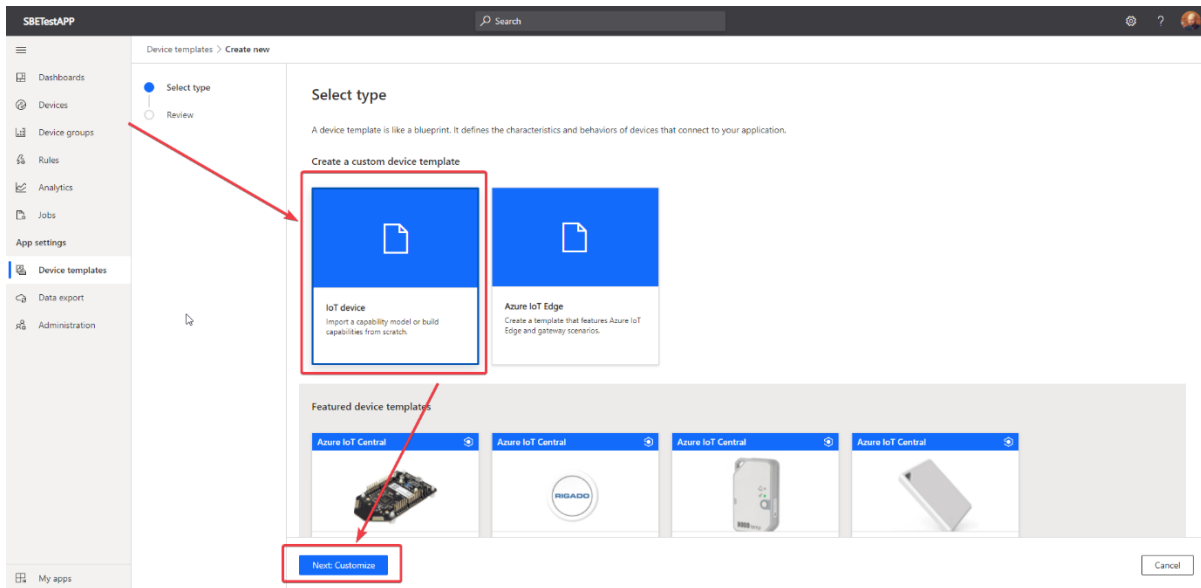


Figure 1-13: Create new template part 1

In the next window specify the device template name and click on the “Next: Review” button (Figure 1-14).

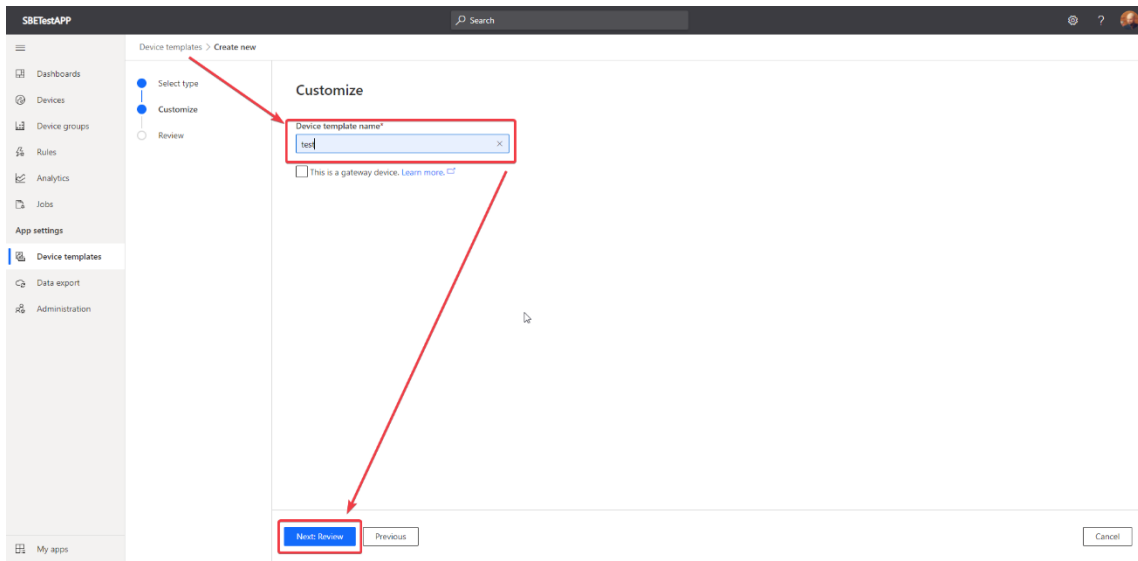


Figure 1-14: Create new template part 2

Review a new device template info and click on the **“Create”** button. A new device template should be added to your device template list. Click on it to open. After that click on the **“Import model”** link and specify the path to the JSON file with template model (*Figure 1-15*).

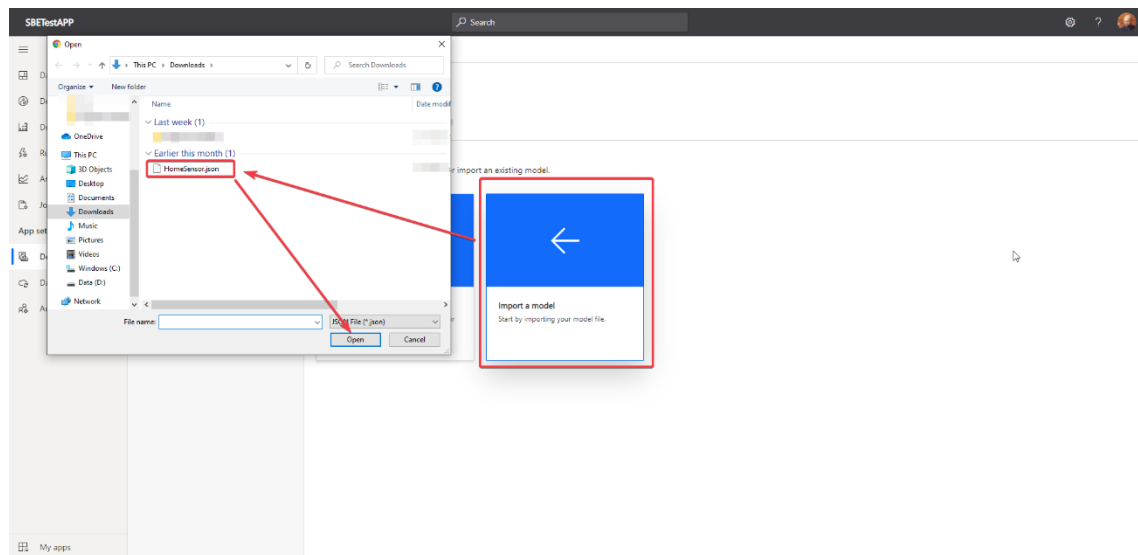


Figure 1-15: Upload the template JSON

After the JSON file would be applied the page with device template configuration should be opened. Click on the **“Publish”** button on this page (*Figure 1-16*).

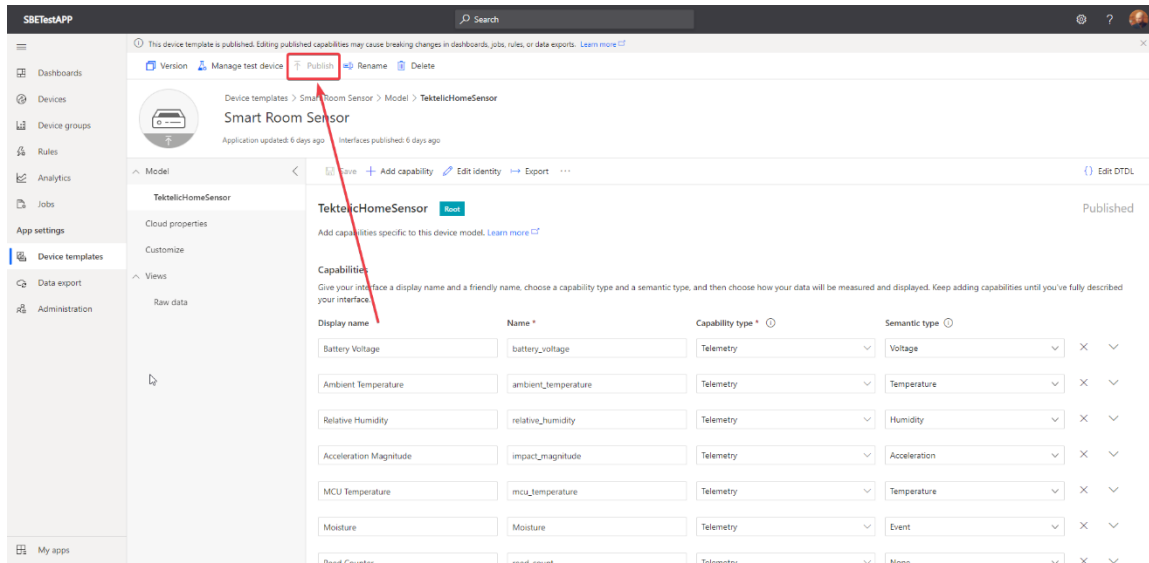


Figure 1-16: Publish the template

2 Setup the Azure IoT Device Bridge

For integration between Azure IoT Central and Tektelic Network Server, two things should be provided:

- The corresponding data-converter for the device model that is used in the integration. This converter should return a JSON object in a format that is acceptable for the device template created in **section 1.4**.
- The Azure IoT Central Integration instance should be created in the Tektelic Network Server

2.1 Create a Data Converter on the Network Server

Login to the Tektelic Network Server as a customer administrator. After success login click on the **“Data Converters”** tab to open the list of the data converters. In the opened page click on the **“+”** button the to create a new data-converter (*Figure 2-1*).

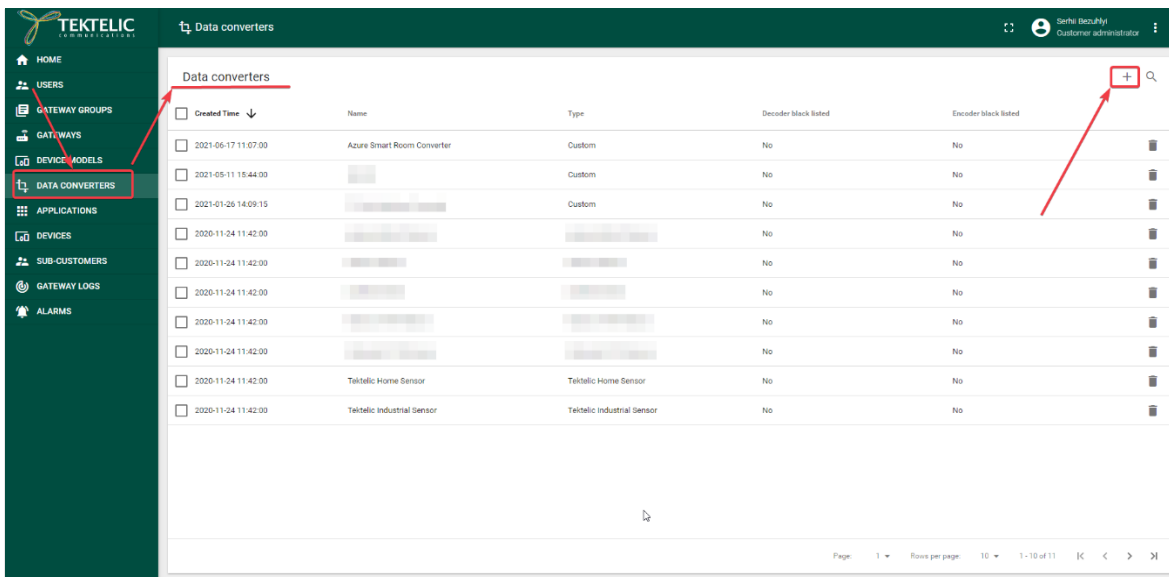


Figure 2-1: Data converters tab

After that in the **“Add Data Converter”** window specify the data-converter name and in the **“Type”** drop-down select the **“Custom”** option (*Figure 2-2*).



Figure 2-2: Add Data Converter

In the **“Decoder”** and **“Encoder”** fields you have to specify the program code that will be used to decode/encode the telemetry data from your sensor to your Azure IoT Central Application according to device template created in **section 1.4**. After that click on the **“Add”** button and a new data-converter would appear in the **“Data Converters”** list.

***** Notice, that you are always able to get the data-converters for Tektelic sensors Azure Integration through the Tektelic support portal. *****

2.2 Create an Azure IoT Central Integration

Login to the Tektelic Network Server as a customer administrator. After success login click on the **“Applications”** tab to open the list of the applications (*Figure 2-3*).

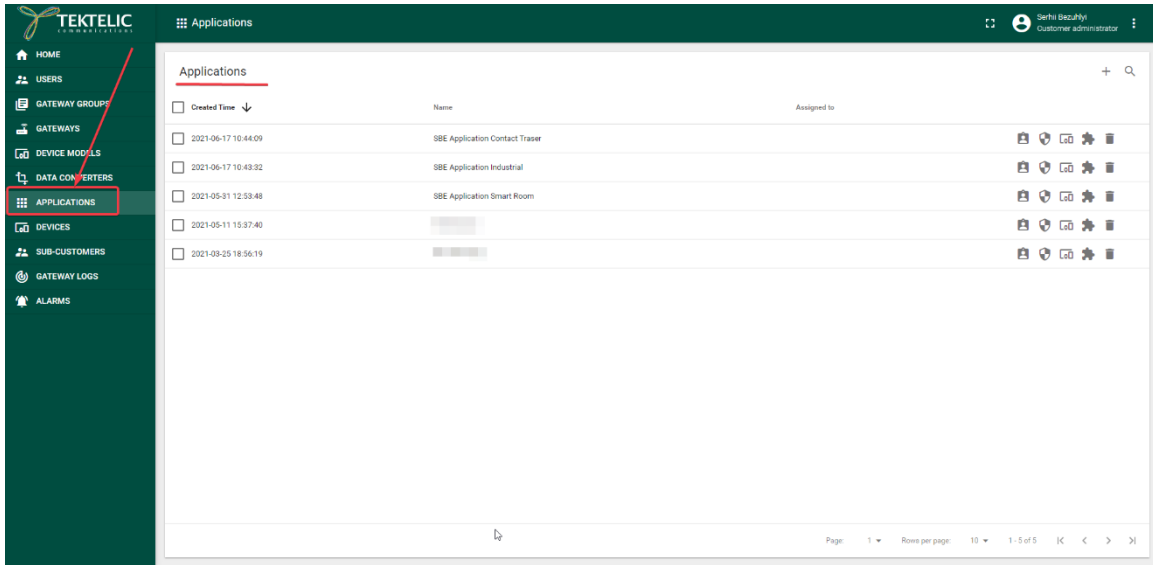


Figure 2-3: Applications tab

Click on the application for which the integration will be created and in the opened tab click on the **“Manage Integrations”** sub-tab to open the list of the related integrations (Figure 2-4).

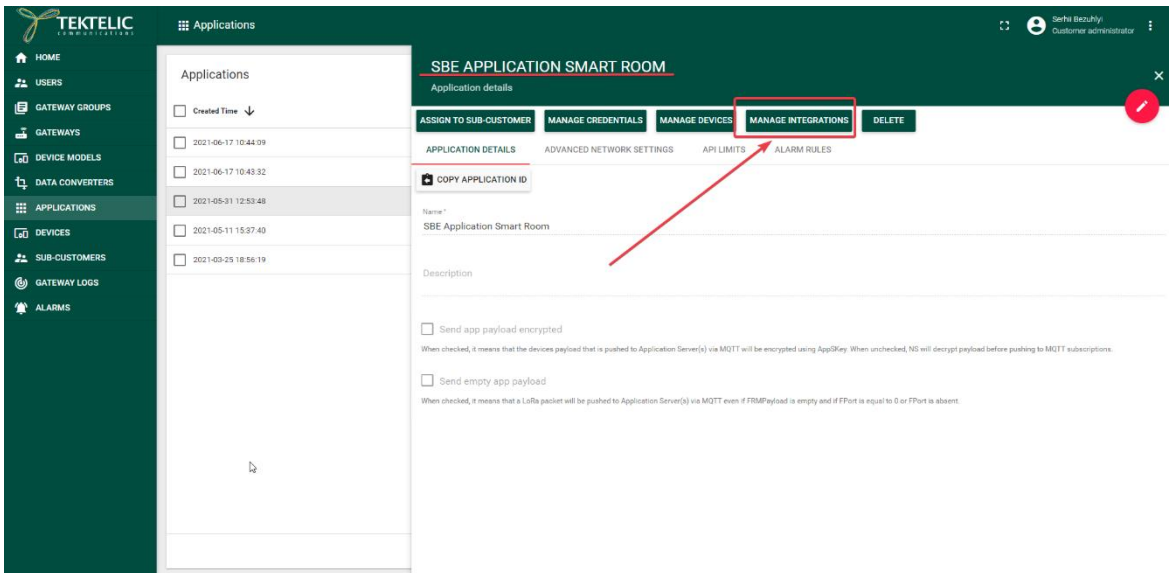


Figure 2-4: Application details tab

When the “Integrations” page is opened click on the “+” button to create a new integration (Figure 2-5).

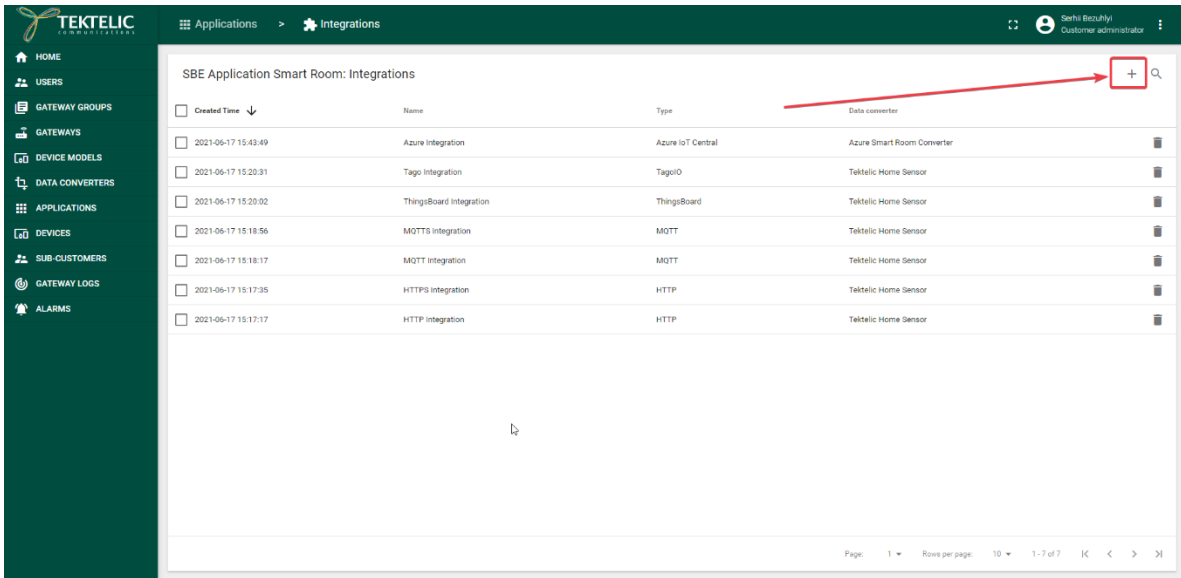


Figure 2-5: Integrations tab

In the **“Add Integration”** window specify the Integration name and select the **“Azure IoT Central”** as integration type. After that additional fields should appear (*Figure 2-6*).

Add Integration [X]

Type*
Azure IoT Central

Data converter*

IoT Central Device Bridge URL*

Your Azure IoT Central Device Bridge HTTPS endpoint. Common format: https://[bridge-name].[region].azurecontainer.io. This endpoint can also be found by navigating to the Device Bridge container group deployed to your subscription > Properties > FQDN

https://[bridge-name].[region].azurecontainer.io

IoT Central Device Bridge API key*

API key that was defined during Azure IoT Central Device Bridge deployment

IoT Central Device Model ID*

An '@id' field from your lot Central Device template. Example: dtmi:tektelic:HomeSensor,1

ADD CANCEL

Figure 2-6: Add Integration tab

Fill these fields according to the following:

- **“Data converter”** - the data converter that was created in the **section 2.1**.
- **“IoT Central Device Bridge URL”** - open the [Azure portal](#) and navigate to **Container Instances**. Select the container group which have been used for Device Bridge deployment. Click on the **“Properties”** tab and find here the **“FQDN”** field (*Figure 2-6*).

***** Notice, that HTTPS protocol should be specified in this field before the IoT Central Device Bridge URL. *****

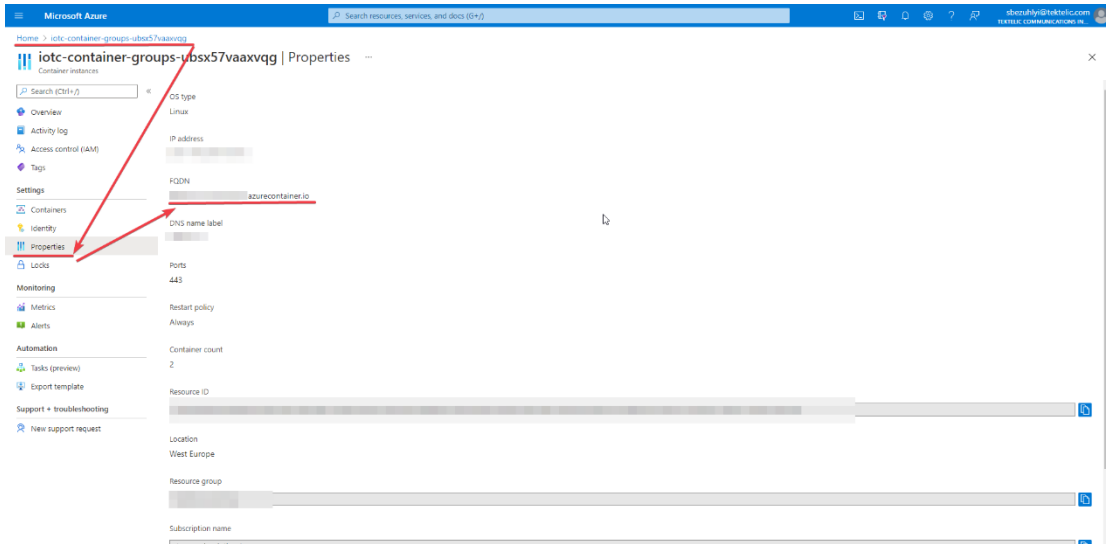


Figure 2-7: FQDN parameter in the container group

- **“IoT Central Device Bridge API key”** - the **Api-key** parameter that was defined during the docker container deployment in the **section 1.3.2**.
- **“IoT Central Device Model ID”** - An **“@id”** field from your IoT Central Device template JSON file, that was used for template creation in the **section 1.4**.

After filling in the mandatory fields, click on the **“Add”** button.

3 Setup the Azure IoT Device Bridge

3.1 Get Uplinks from the Sensors

When the sensor sends the first uplink to the Tektelic Network Server it should appear in the Azure IoT Central Application in the **“Devices”** tab (Figure 3-1).

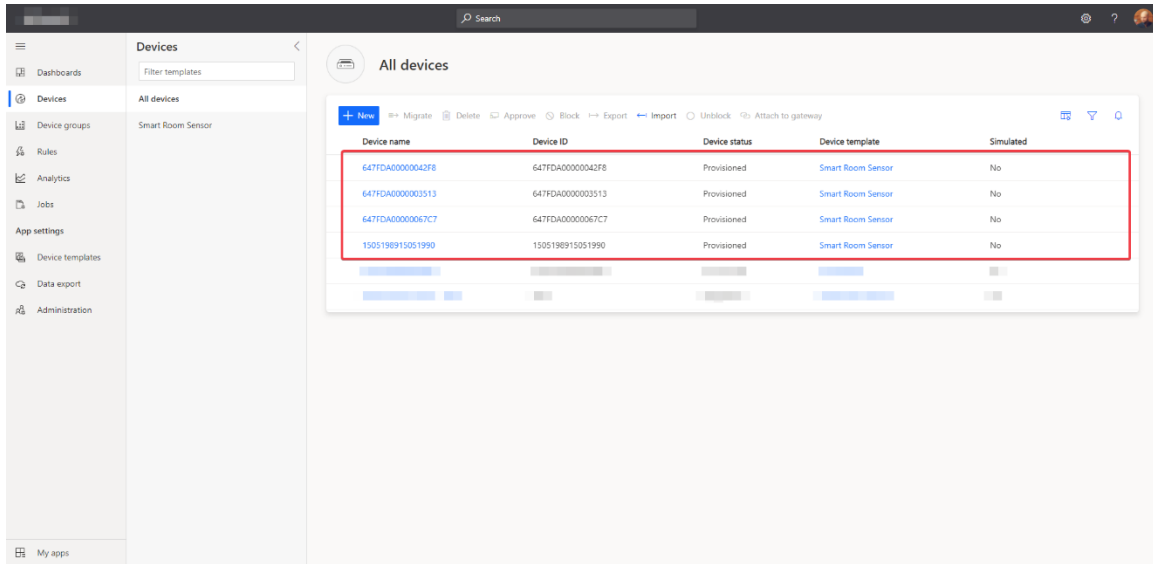


Figure 3-1: List of the devices in the Azure IoT Central Application

Click on the device and open **“Raw data”** to see the list of uplinks that device has send to the Network Server (Figure 3-2).

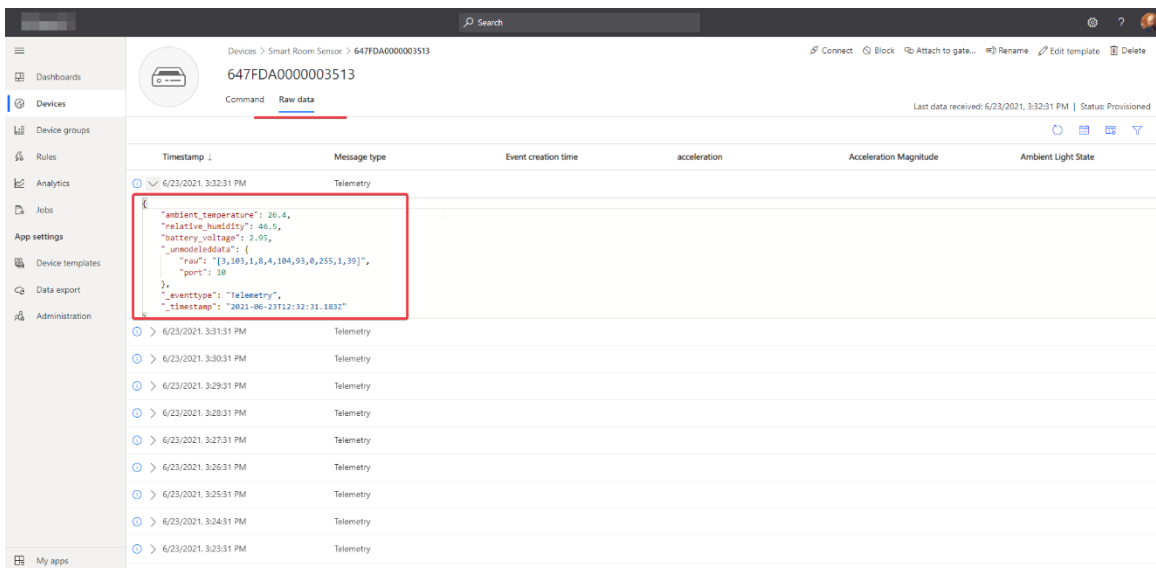


Figure 3-2: Raw data tab

3.2 Send Downlinks to the Sensors

Open the “**Devices**” tab in the Azure IoT Central Application and click on the device you want to send downlink. In the “**Command**” tab fill the “**Port**” and “**Data**” in Base64 format” fields and click on the “**Run**” button. The correspond command should be added to the queue after that and the correspond downlink should be displayed in the “**Downlink Queue**” tab of the connected device in the Tektelic Network Server (*Figure 3-7*).

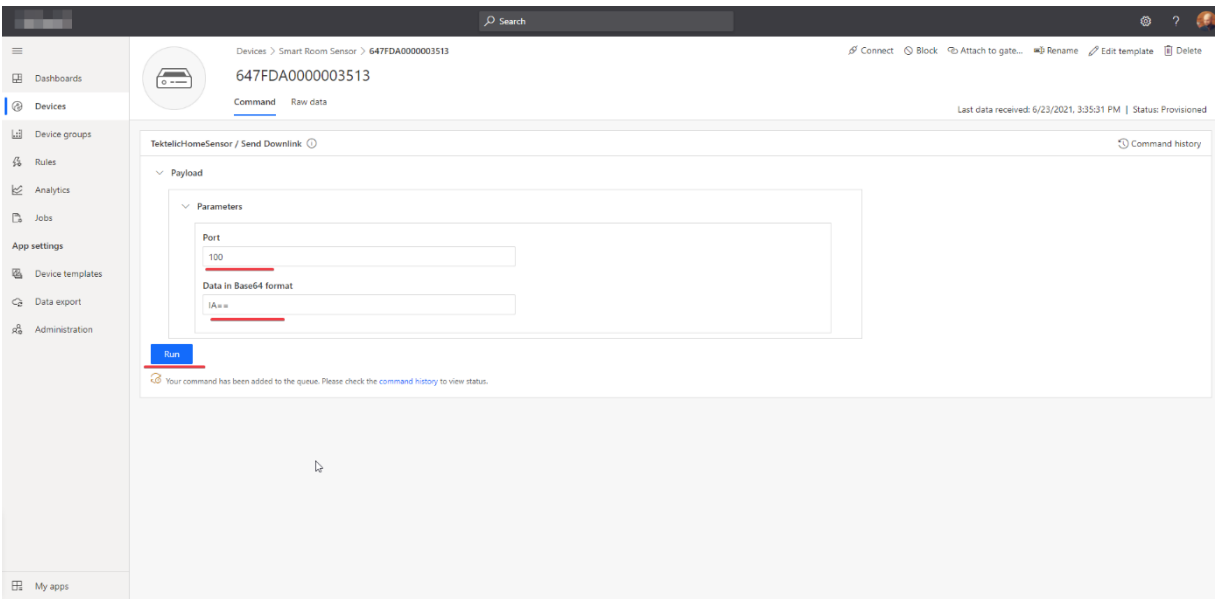


Figure 3-3: command tab

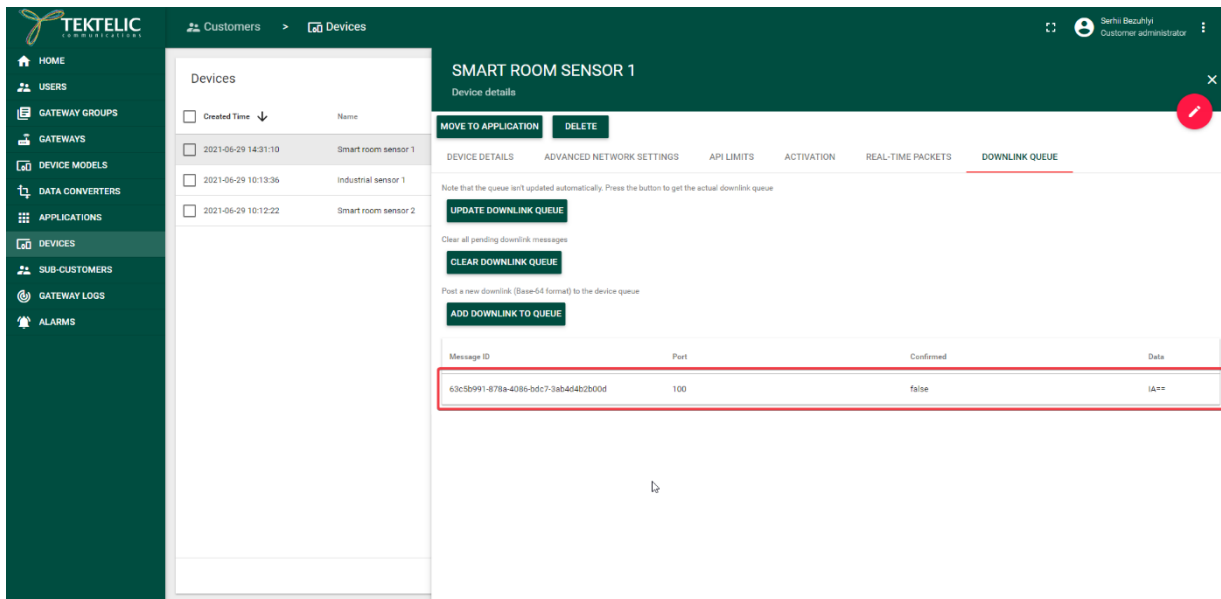


Figure 3-4: Downlink Queue tab

It is possible to send downlinks and get uplinks to the device via Azure IoT Hub via REST API. See the official Azure documentation to get more information about it (<https://docs.microsoft.com/en-us/rest/api/iotcentral/1.0/devices>).

3.3 Delete the Device

Select the device you want to remove and click on the “Delete” button. Confirm the deletion.

Notice, before deletion device should be unsubscribed from the Azure IoT Central application via device bridge.

Perform the next request to your device bridge instance that was deployed on the section 1.3:

DELETE Device_bridge_uri/devices/{deviceId}/DeviceBound/sub
