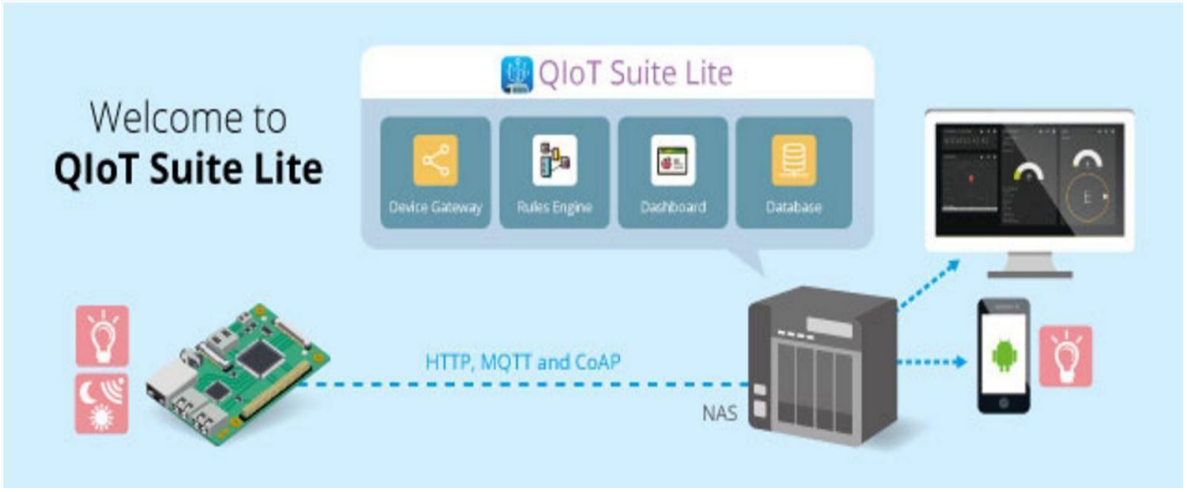
Get started with Linkit 7688 Duo (Python)

In this tutorial, you begin by learning the basics of working with Linkit 7688 Duo that's running OpenWRT . You then learn how to seamlessly connect your devices to QNAP NAS by using QIoT Suite Lite.



Lesson 1: Configure your device

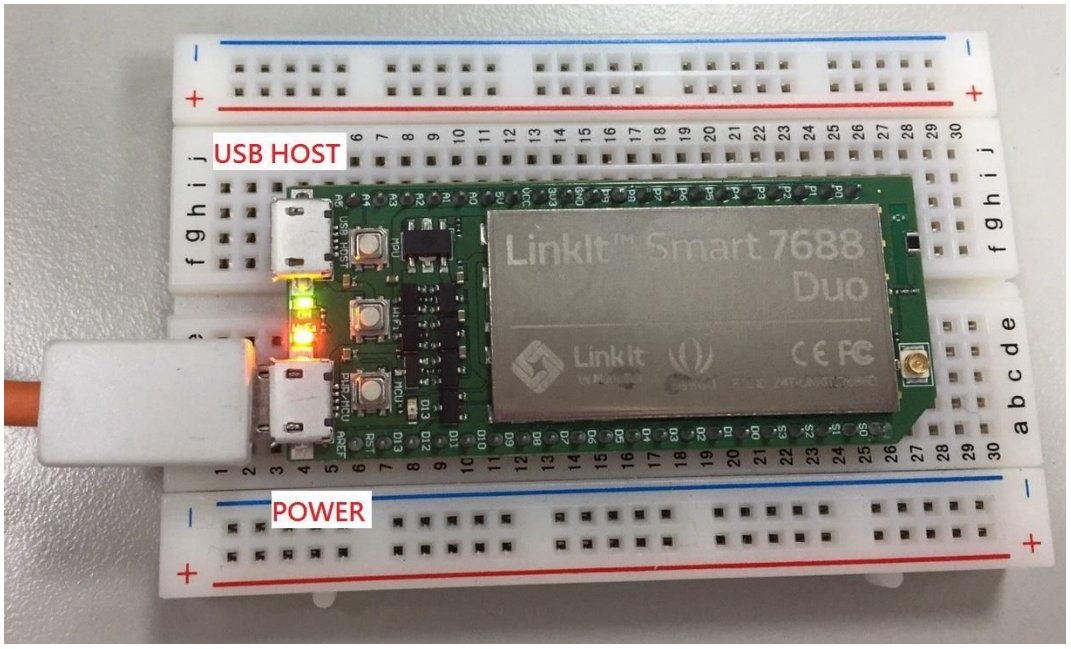
In this lesson, you configure your Linkit 7688 Duo device with an operating system, set up your development environment, and deploy an application to Linkit 7688 Duo.

1.1 What will you need

- A Linkit 7688 Duo
- Power Supply :
    - The Linkit 7688 Duo is powered by a USB Micro power supply (like most standard mobile phone charger).
    - You'll need a good-quality power supply that can supply at least 1A at 5V for the Linkit 7688 Duo.
- A Wifi AP

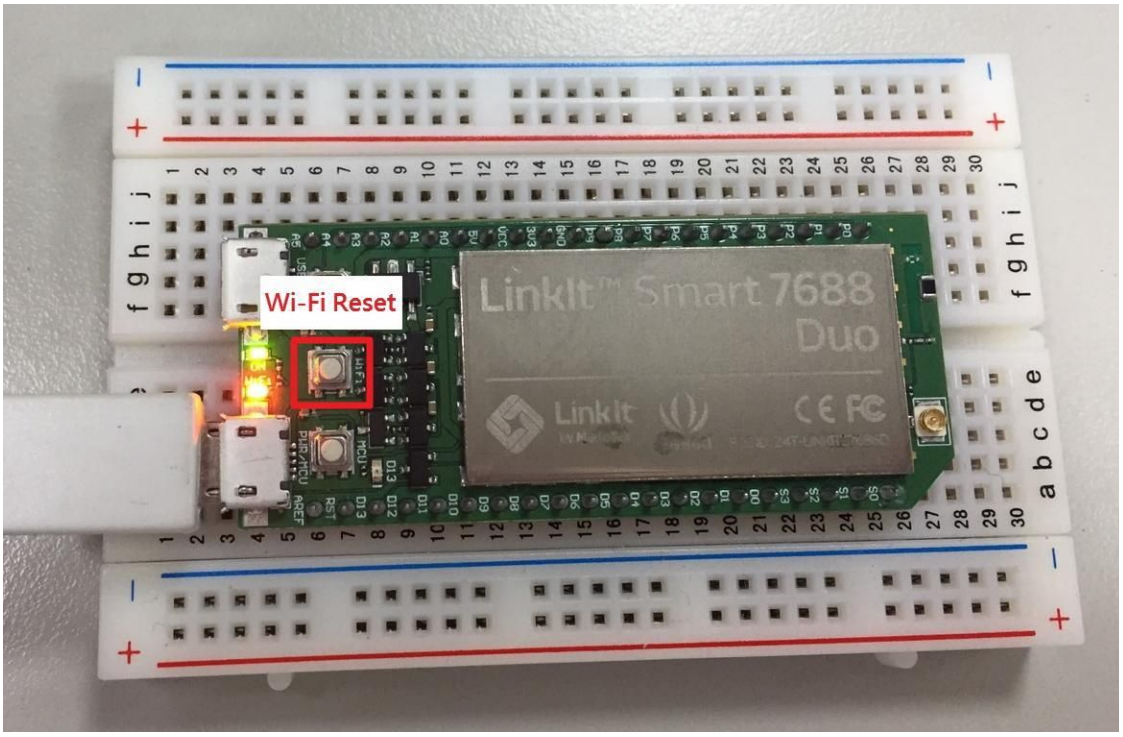
1.2 Power on your Linkit 7688 Duo

Power on LinkIt Smart development board by using any USB power source, for example your computer and a micro USB cable .Please see the below picture.Make sure you connect the cable to the Power (PWR) connector, not the USB host (HOST) connector near the MPU reset button. The green ON LED (Power on) will light up solid first, followed by a blink from the orange Wi-Fi LED (bootloader initialization). Then, after about 5 seconds, the device boot up starts and the orange LED will light up solid for about 30 seconds.

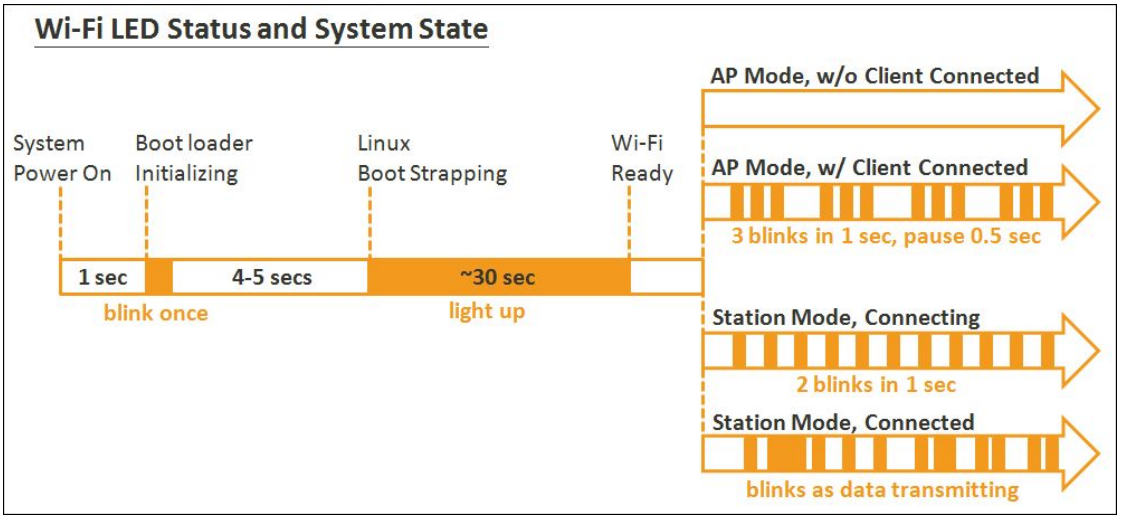


1.2 Set up your Linkit 7688 Duo connect the network

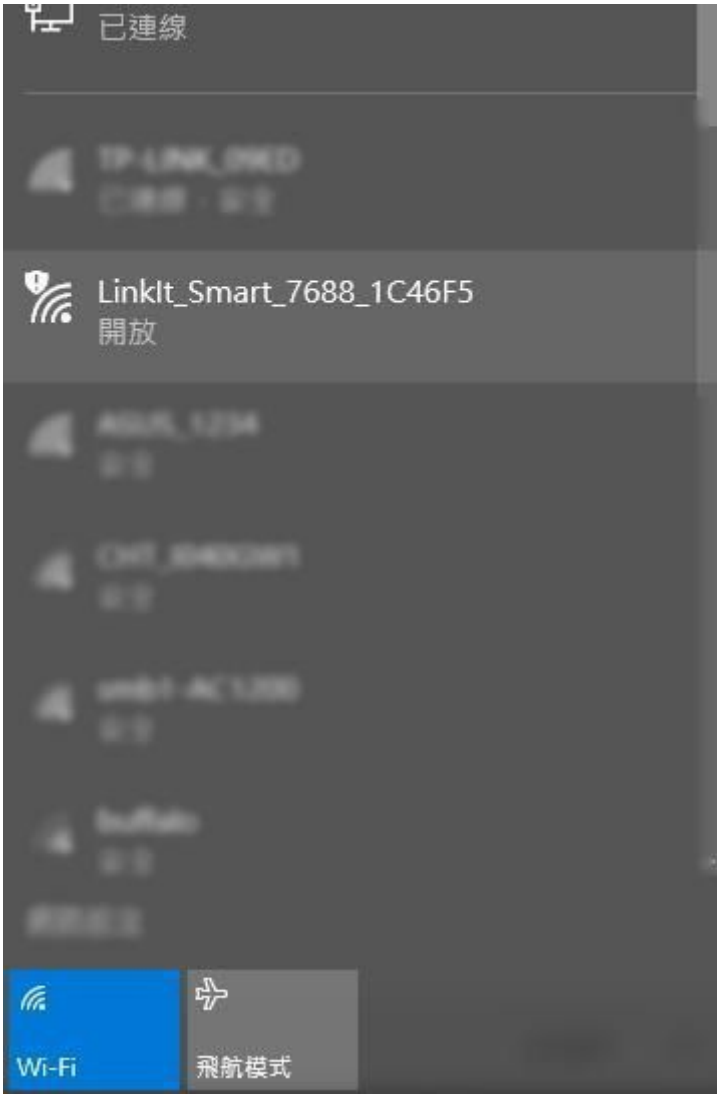
- Turn AP mode
  - After boot up, the Wi-Fi LED turns off. This means the system is ready to accept Wi-Fi connection.
  - If not, please press the Wi-Fi Reset button for at least 5 seconds and release to turn AP mode.



- Wi-Fi LED Status and System Status as below picture. (image source : Mediatek Lab)

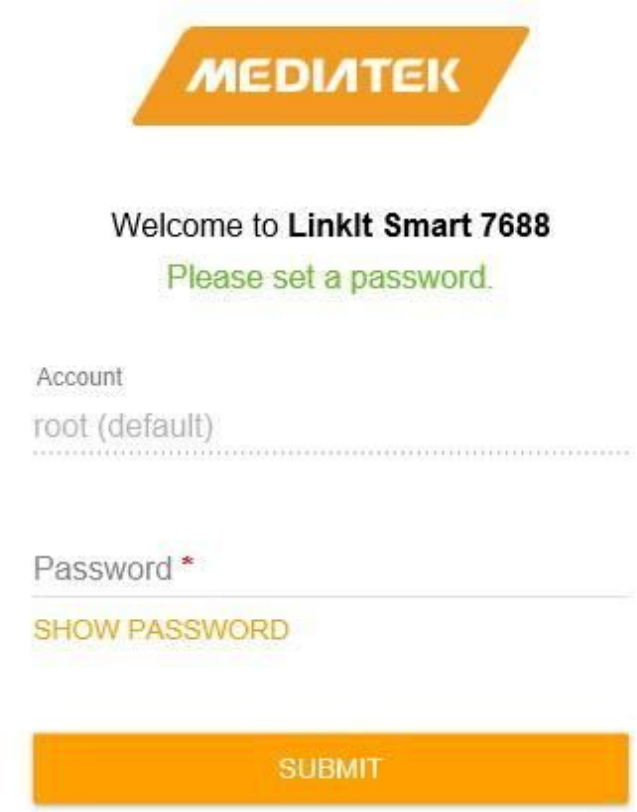


- Go to your Wifi settings and choose “LinkIt_Smart_7688_XXXXXXX”. The “XXXXXXX” is MAC address of your Linkit 7688 Duo.

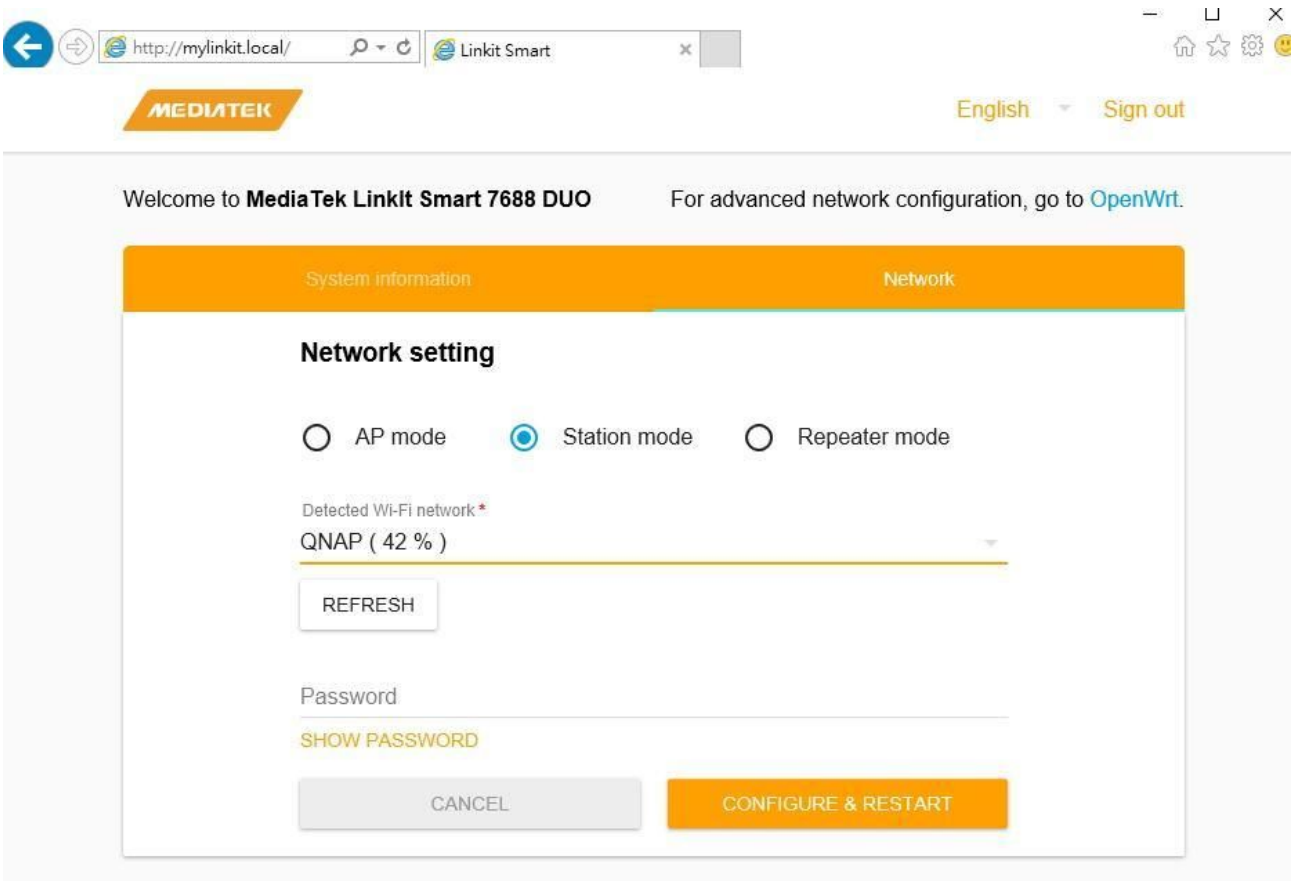

已連線
LinkIt_Smart_7688_1C46F5
開放
Wi-Fi
飛航模式

1.3 Get IP address of your Linkit 7688 Duo

- When joined the Linkit Smart Nework , open “http://mylinkit.local” or “http://192.168.100.1” in your web browser
    - In log in page, set a password or enter the password that you already set up default username is root .
    - **(optional)** Linkit 7688 Duo will use local domain “mylinkit.local”.If you can’t access the domain, Please install Bonjour Print Services will help you find Linkit IP address.



- When you already login, click “Network” tab and “Station Mode ” radio button to set up the Wifi AP you will connect and ensure your PC and LinkIt at the same network. Click “CONFIGURE & RESTART ” to complete to set network.



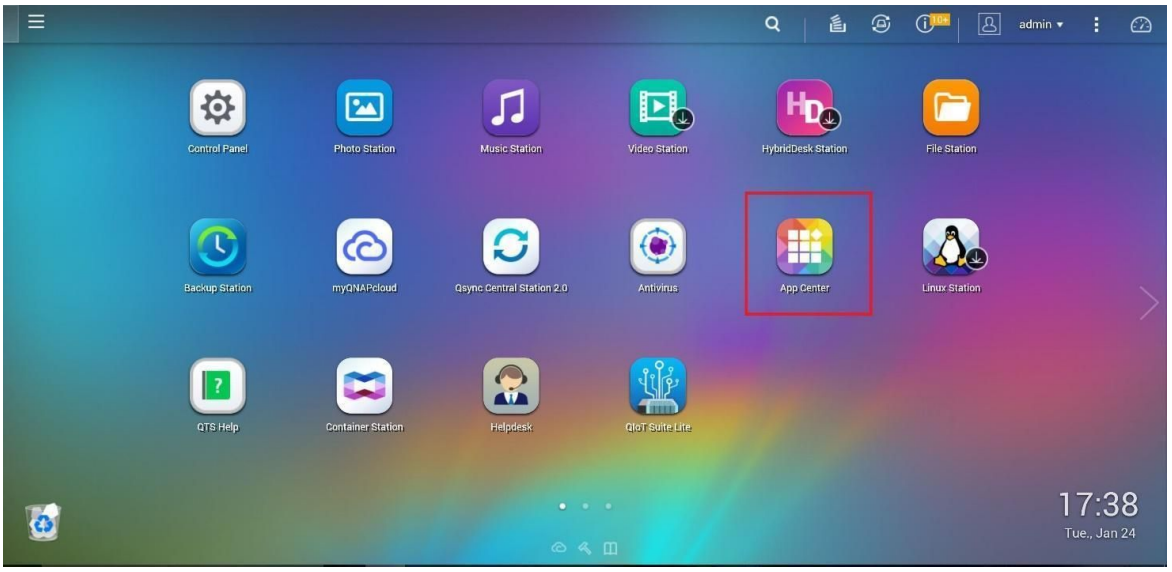
- After you had finish setting , change your PC network the same as Linkit network. More Linkit 7688 Duo setup guide, please refer to https://docs.labs.mediatek.com/resource/linkit-smart-7688/en/get-started

Lesson 2: Install QIoT Suite Lite

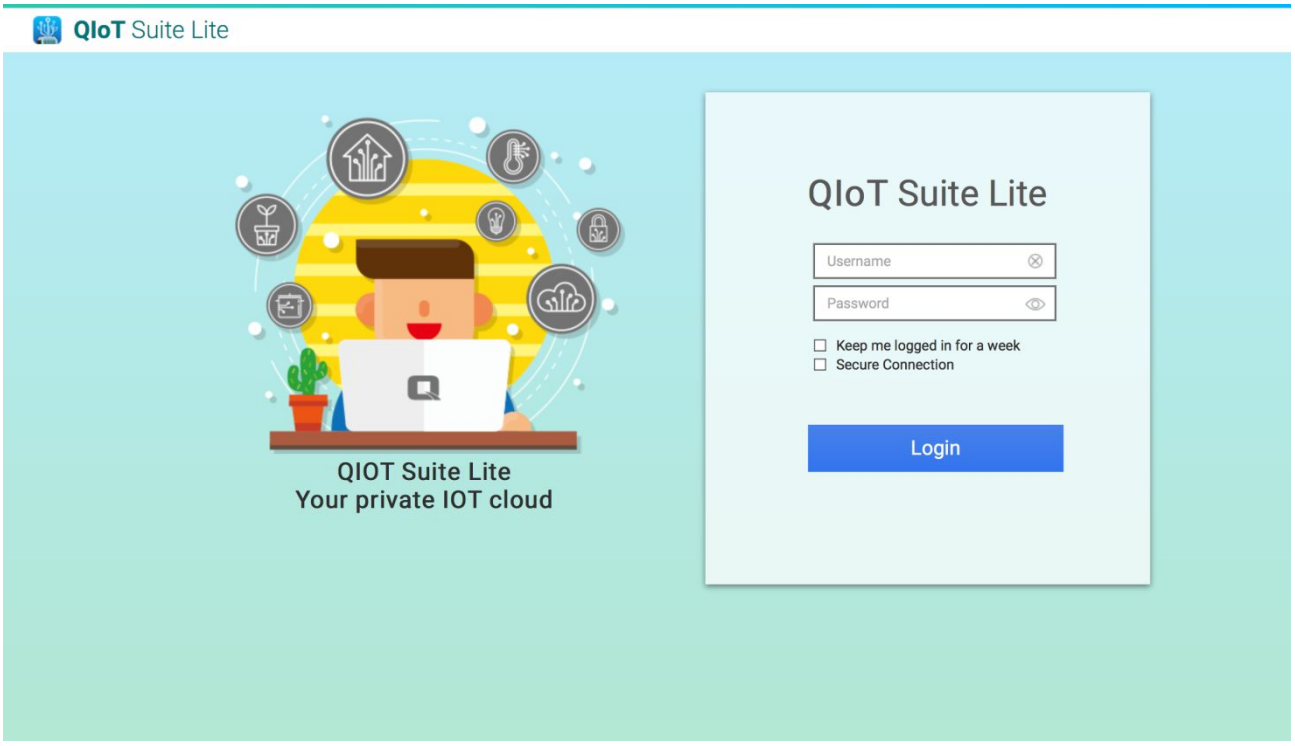
In this lesson, you provision your QNAP QIoT Suite Lite software, and create your first device in QIoT Suite Lite.

2.1 Install QIoT Suite Lite

- Go to QNAP App center and download QIoT Suite Lite software.



- Launch and log in QIoT Suite Lite software. Use Nas admin and password to login.


QIoT Suite Lite
QIOT Suite Lite
Your private IOT cloud
QIoT Suite Lite
Username
Password
Keep me logged in for a week
Secure Connection
Login

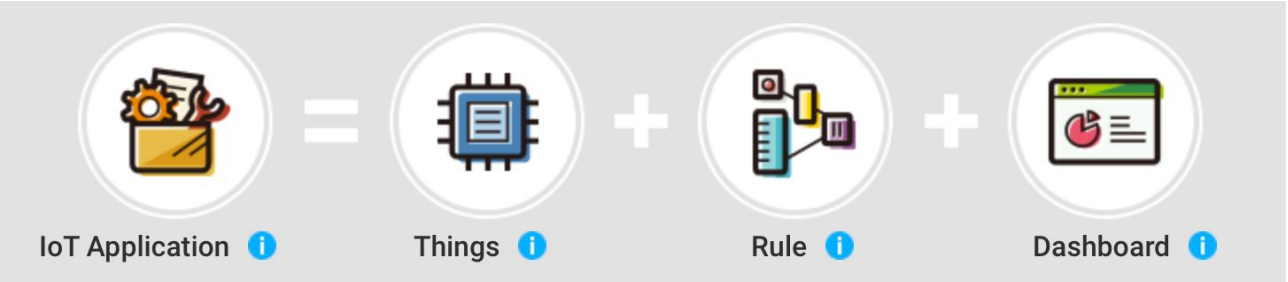
2.2 Create a new IoT application

IoT Application is a combination of multiple Things, Rule, and Dashboard. We recommend that you first create a “Things” in IoT Application. This IoT Application allows you to keep a record of all of the devices that are connected to your NAS.

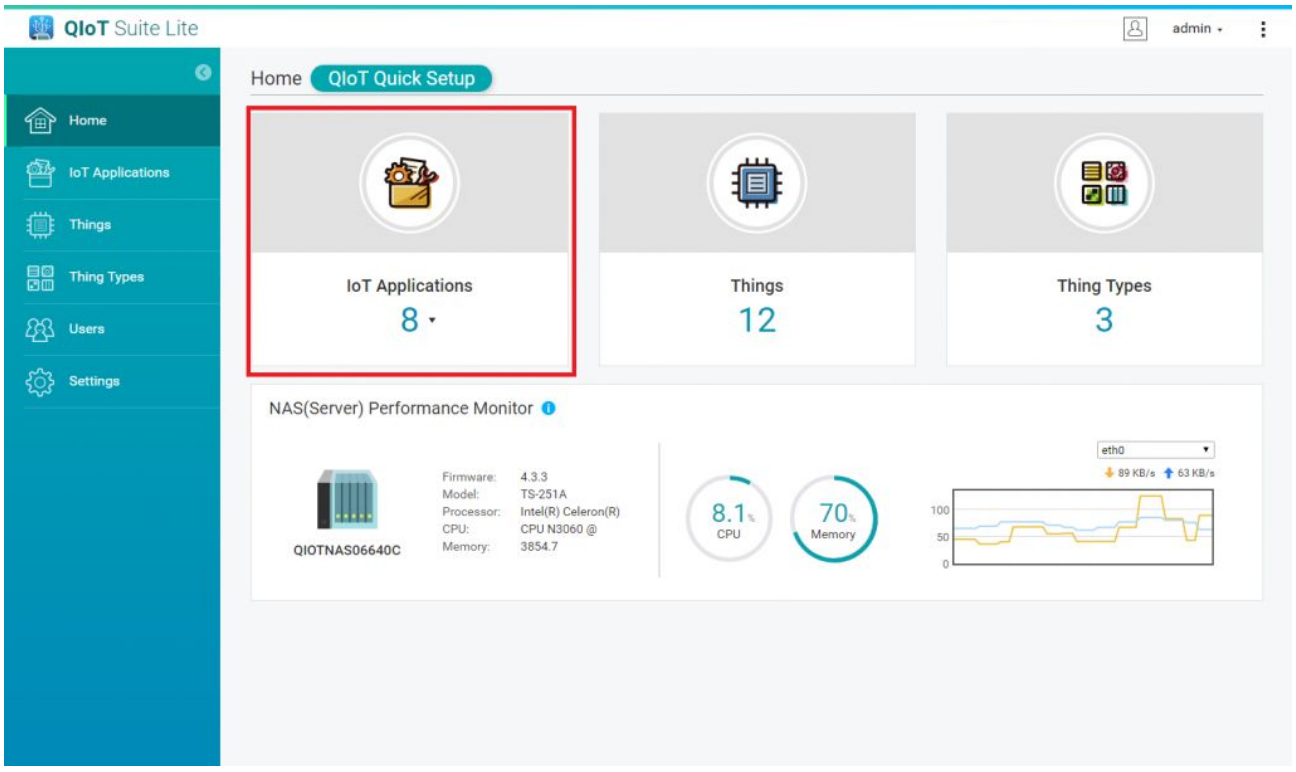
The Rule makes it possible to build IoT applications that gather, process, analyze and act on data generated by connected devices based on business rules you define. A rule can apply to data from one or many devices, and it can take one or many actions in parallel.

With Dashboard, you can turn your data processing efforts into analytics and reports that provide real-time insights into your business.

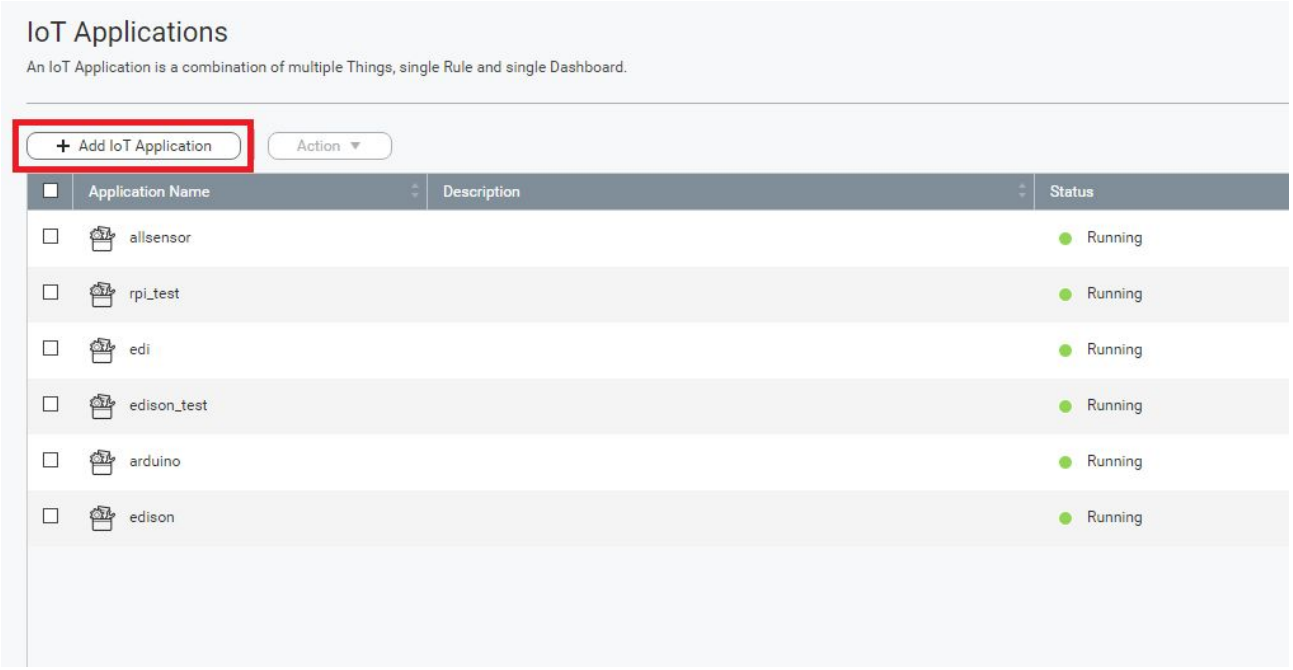
All these elements provide user a complete IoT Application environment.



- Click "IoT Applications" .



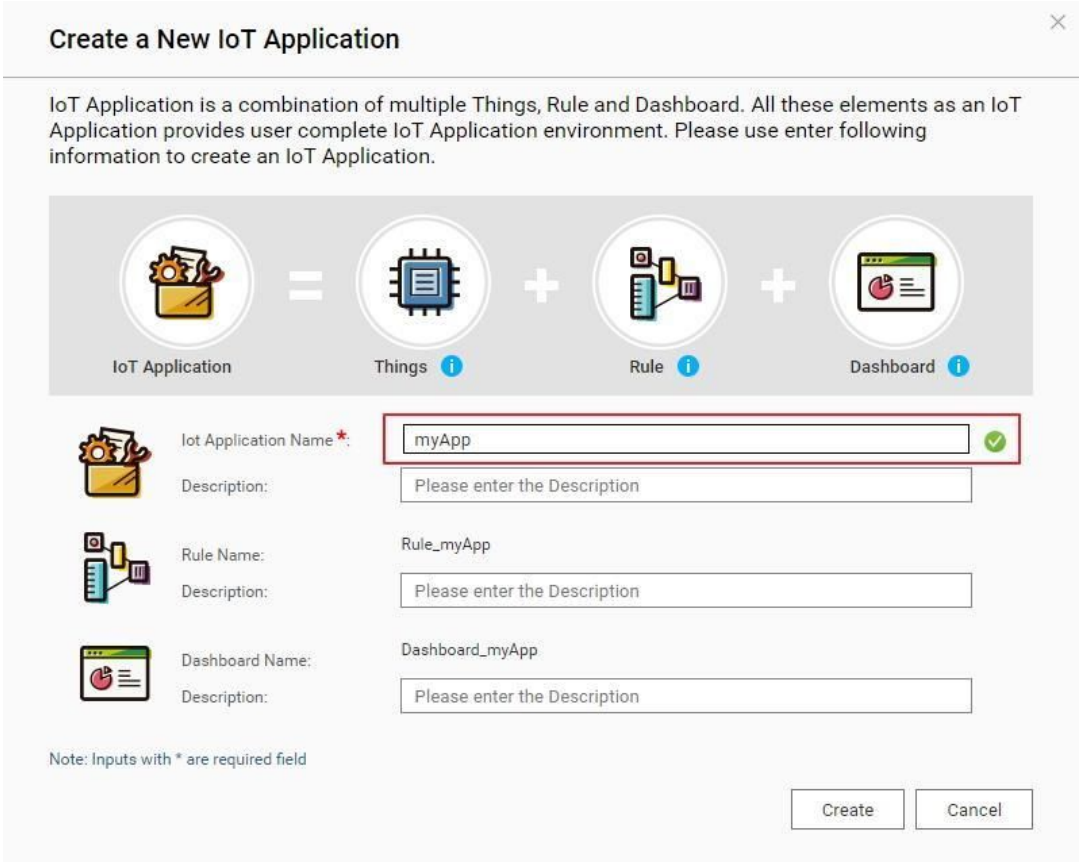
- Click "Add IoT Application".



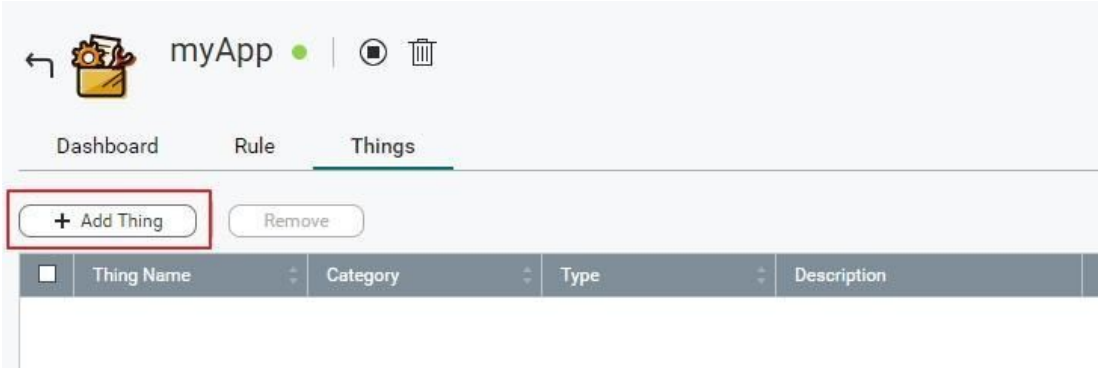
- In “Create a New IoT application” POP winodow
  - Enter IoT Application name, e.g., myApp.
  - Rule name and Dashboard name will be generated automatically based on

the name of IoT Application you fill in.

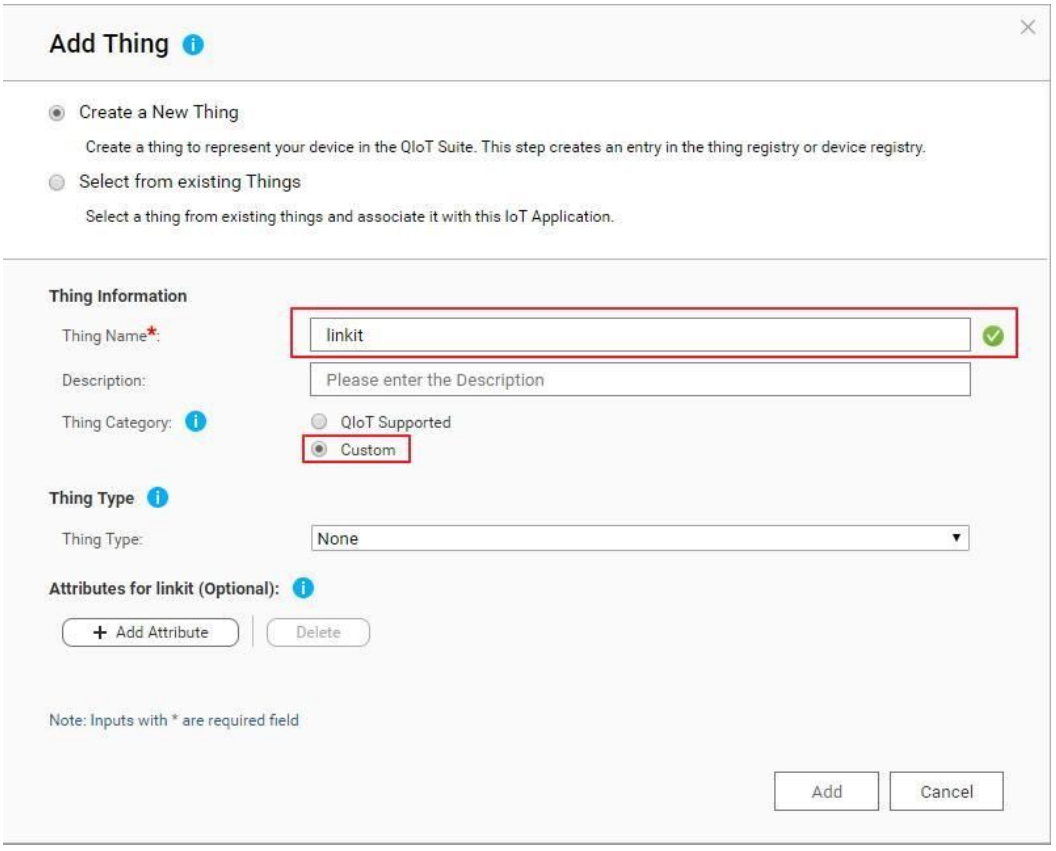
- Click “Create” to complete create a new IoT application.



- Click "Add Thing" to add this application’s device.

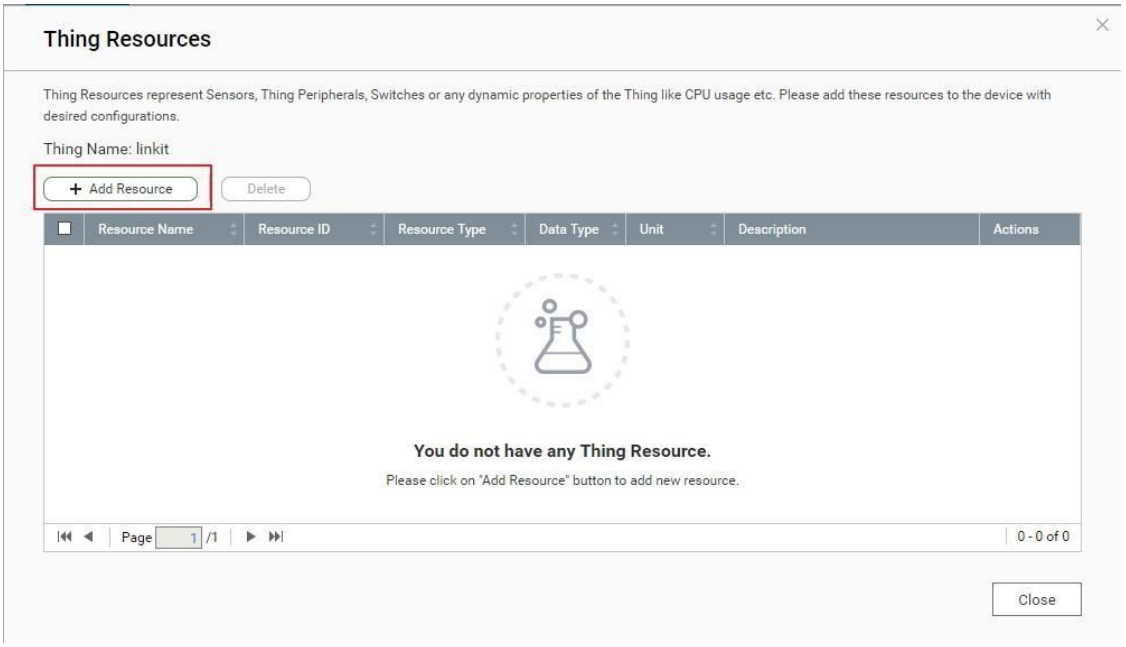


- After click “Add Thing”,In “Add Thing” pop window:
  - Set device’s name (e.g., linkit).
  - Select “Thing Category”. QIot Suite Lite now support Arduino Yun,Raspberry Pi,and Edison ,so you can select "Custom" thing category .
  - (optional) add attribute to device’s detail information (e.g., its serial number, manufacturer, and more).
  - Click "Add" to add the device to complete create a device.

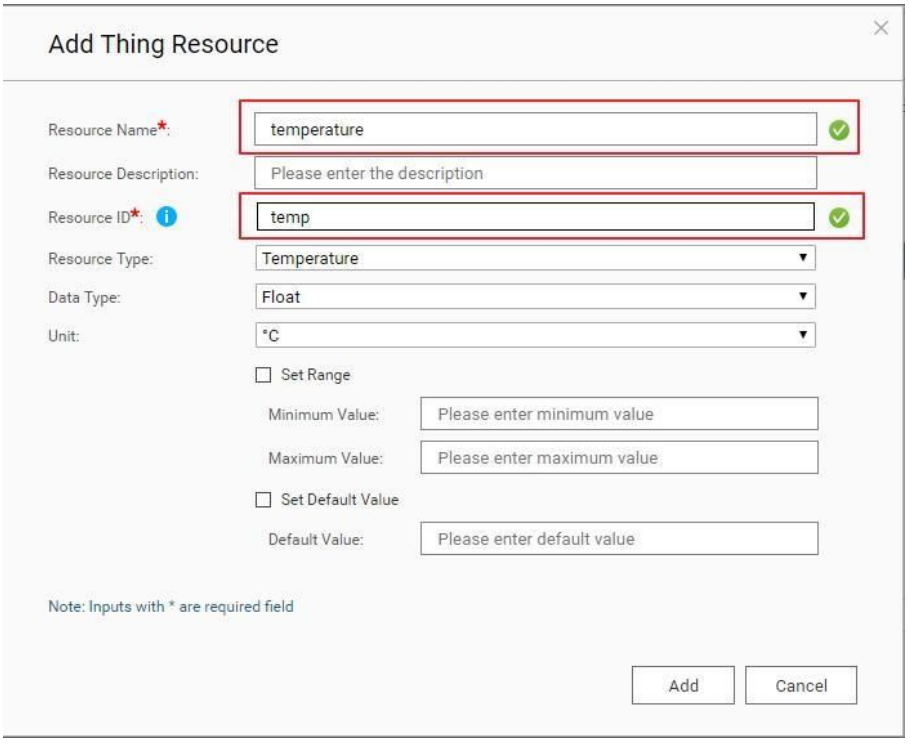


- Click "Thing Resource" button

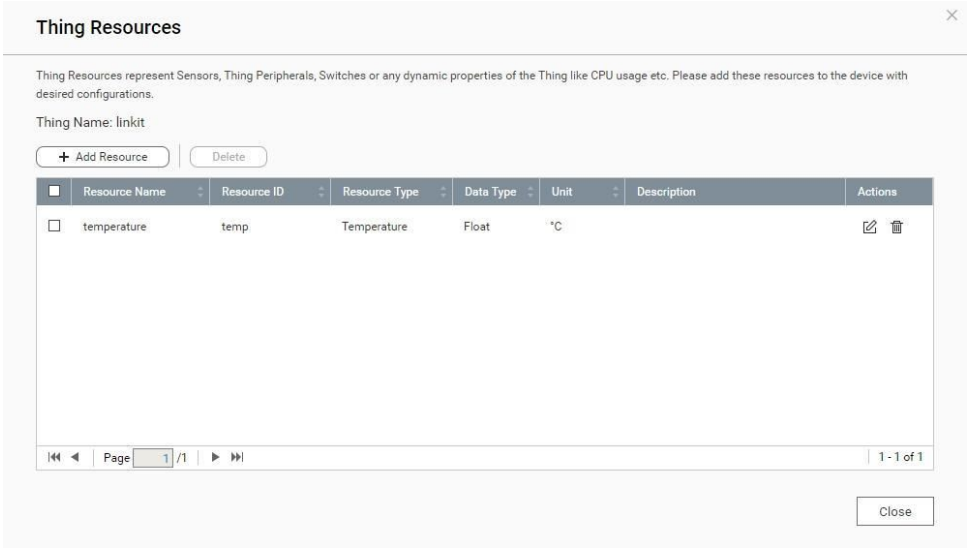
- In “Thing Resources” pop window,Click "Add Resource".



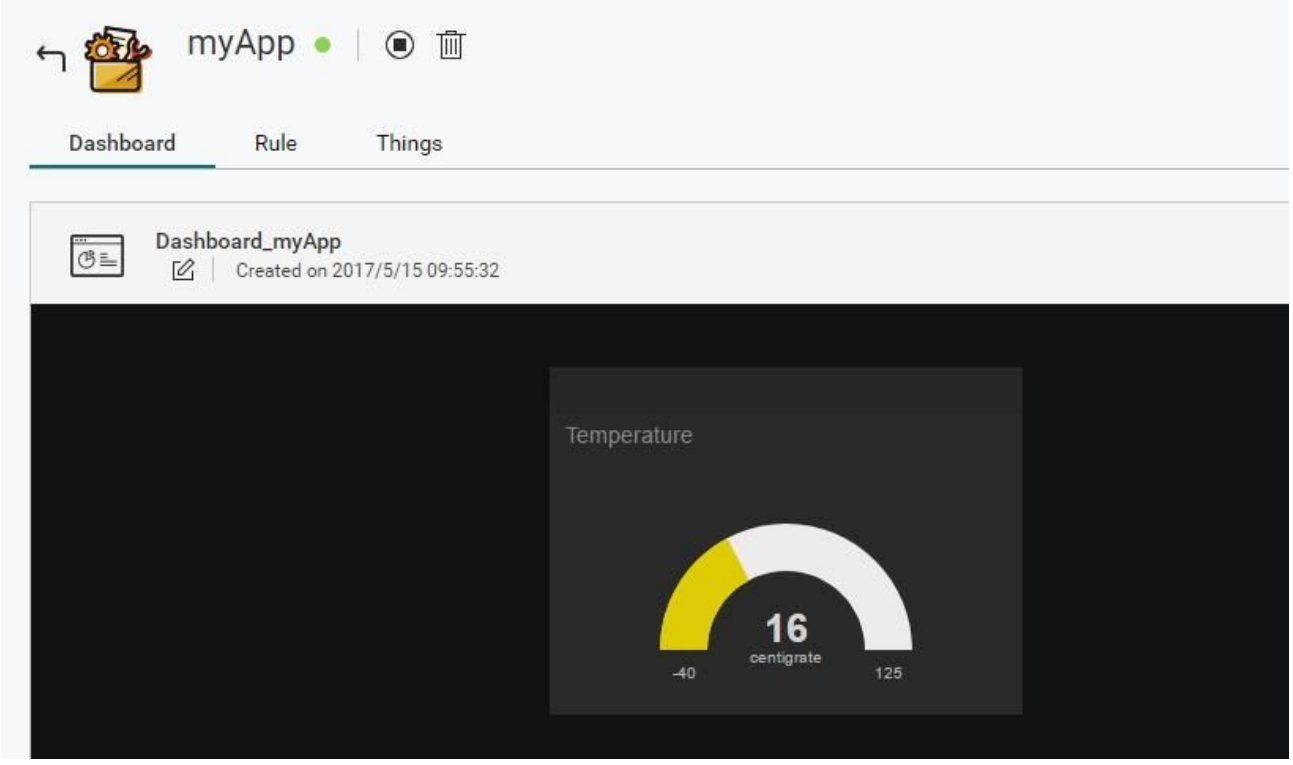
- After click “Add Resource”,In “Add Thing Resource” pop window:
    - Set resource’s name (e.g., temperature).
    - Set resource’s id.Resource id will be used to create a topic in the QIoT broker.This ID should be unique for the device and no duplicates should be allowed for the same device
    - And set another optional attribute.



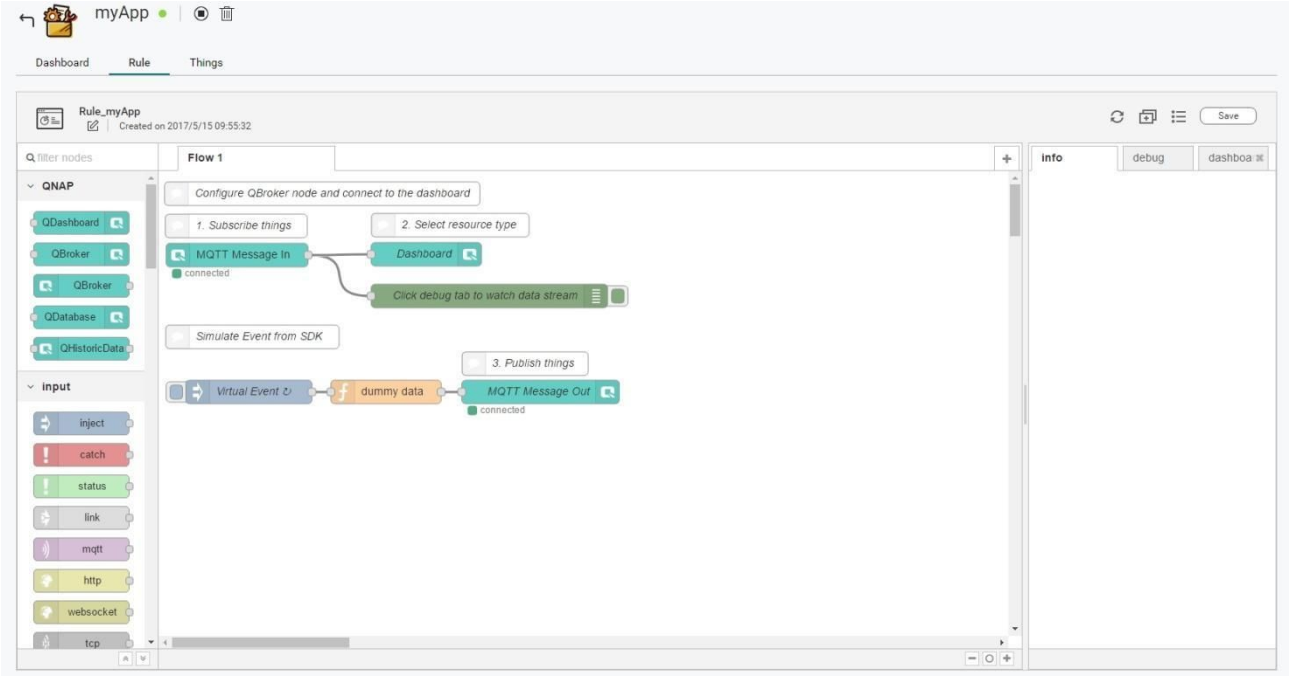
- You can add more resource repeat the preceding steps.Or Click "Close” to complete set a application in QIoT.



- Select “Dashboard" tab , you could see a sample dashboard is created.



- Select “Rule” tab, you could to define the flow or rule about how to process the data sent from the device, and how to present in dashboard.



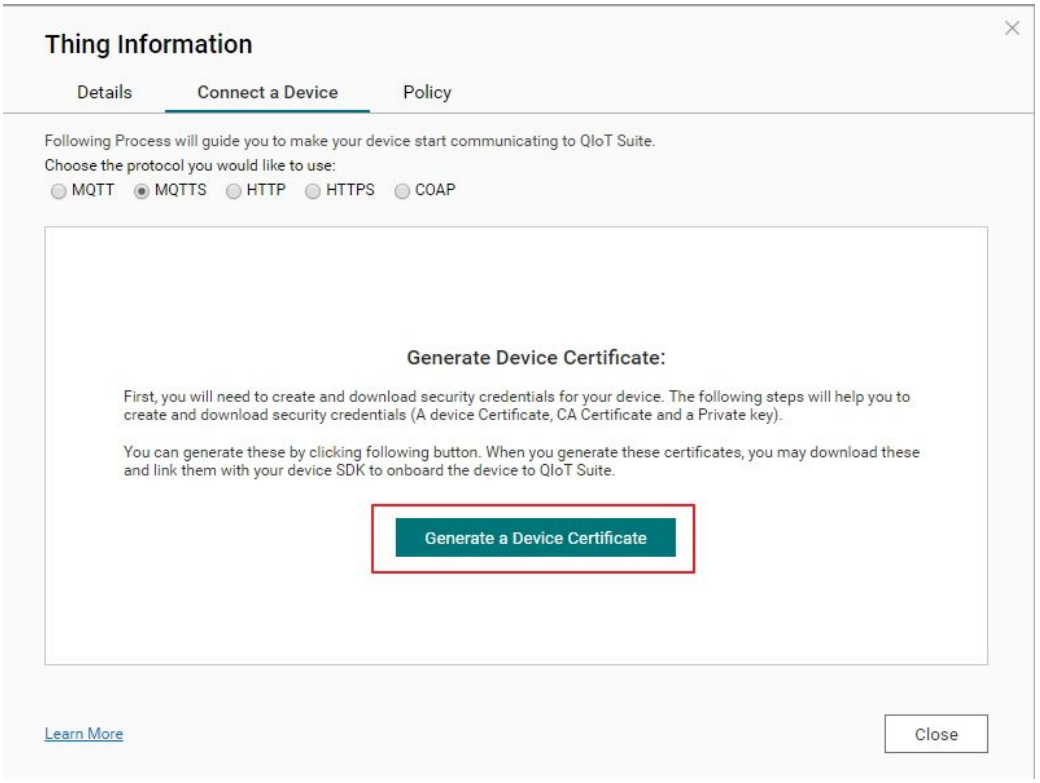
Lesson 3: Connect your device to QIoT Suite Lite using MQTTS

In this lesson, you generate certificate from QIoT Suite Lite, download sample code, and connect LinkIt Smart 7688 Duo to QIoT Suite Lite.

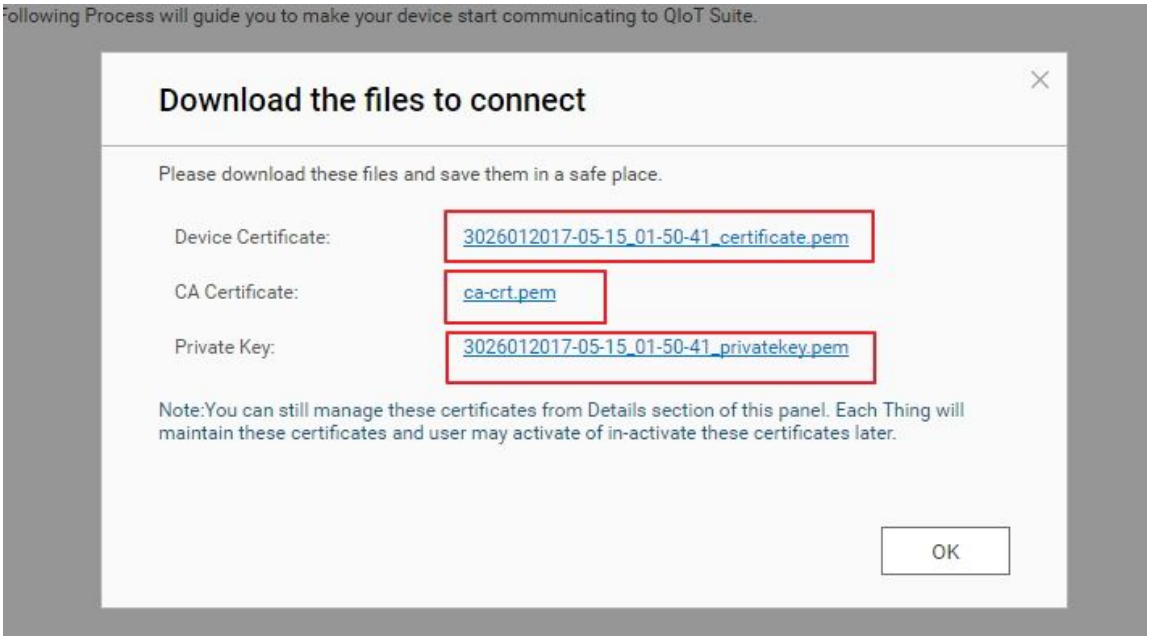
3.1 Generate resource info inside QIoT Suite

- Click "Connect a Device" button

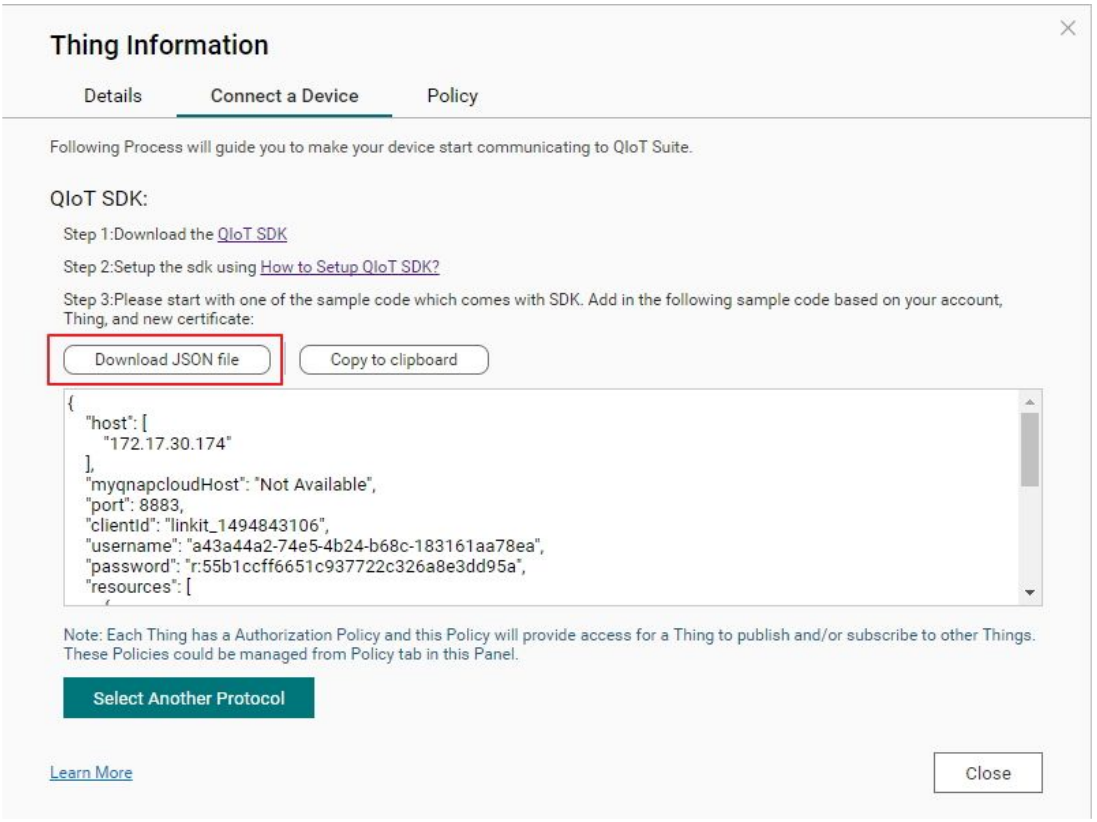
- Choose MQTTS and Click "Generate a Device Certificate"



- In “Download the files to connect “ pop window, you could click the file name to download “Device Certificate, CA Certificate, and Private Key” to your PC and don’t rename the file and then click "OK".

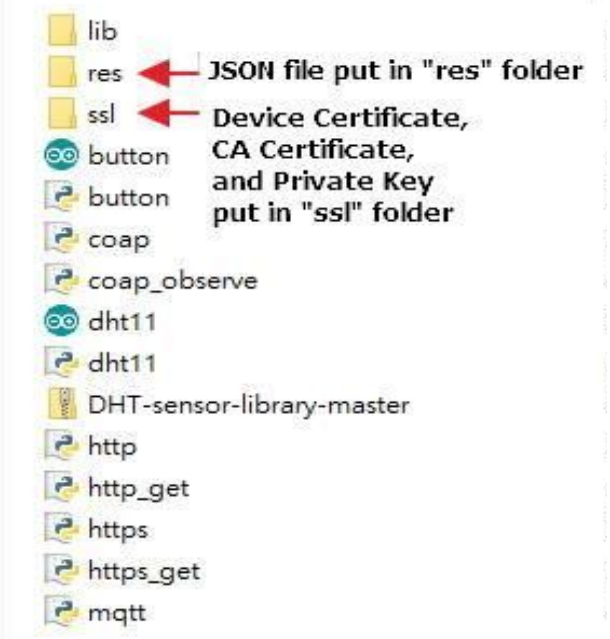


- Click “Download JSON file”. This file very import to help your device connect to QIoT Suite Lite.



3.2 Download Sample Code

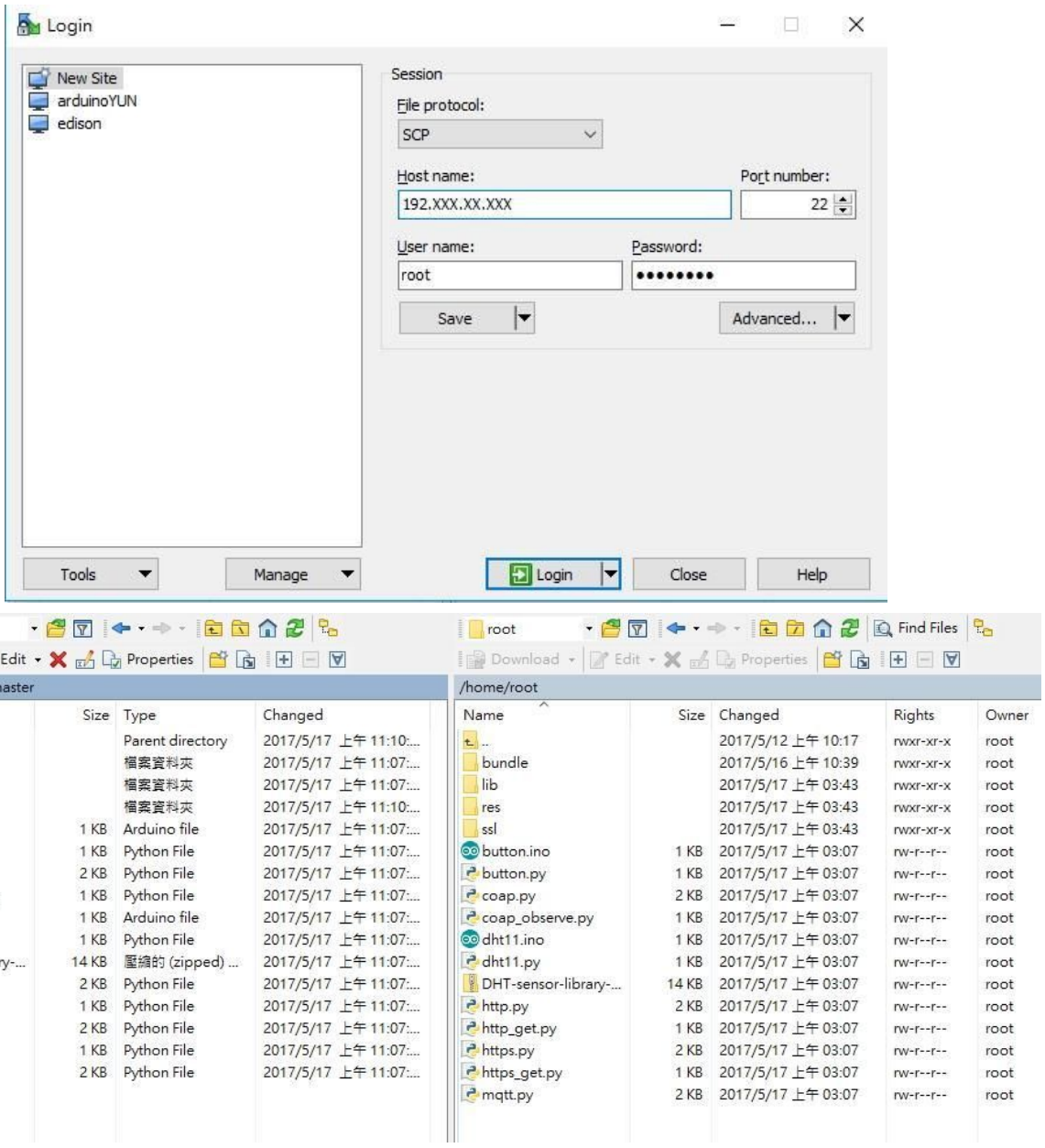
- Download sample code from QNAP QIoT Suite Lite GitHub.
  - URL: https://github.com/qnap-dev/qnap-qiot-sdks
  - Path: python/device/mtk-linkit-7688-duo/examples
- Data structure like following picture
  - Pre-downloaded resource.json must be put in "res" folder Device Certificate, CA Certificate, and Private Key put in "ssl" folder .



- Open Terminal application (e.g., WinSCP) on your PC and login to Device for transfer data.
  - Linkit 7688 Duo only support scp protocol. SFTP need install

openssh-sftp-server.

```
root@mylinkit:~# opkg update
root@mylinkit:~# opkg install openssh-sftp-server
```



- Open Terminal application (e.g., PuTTY) on your PC.Connect to your device by SSH and enter the folder where put sample code (e.g., /home/root/bundle).

- Install sample code dependency

  root@mylinkit:~# **cd /home/{{user}}/bundle**
  root@mylinkit:/home/root/bundle# **pip install -r requirements.txt**
- Run sample code

  root@mylinkit:/home/root/bundle# **python mqtt.py**

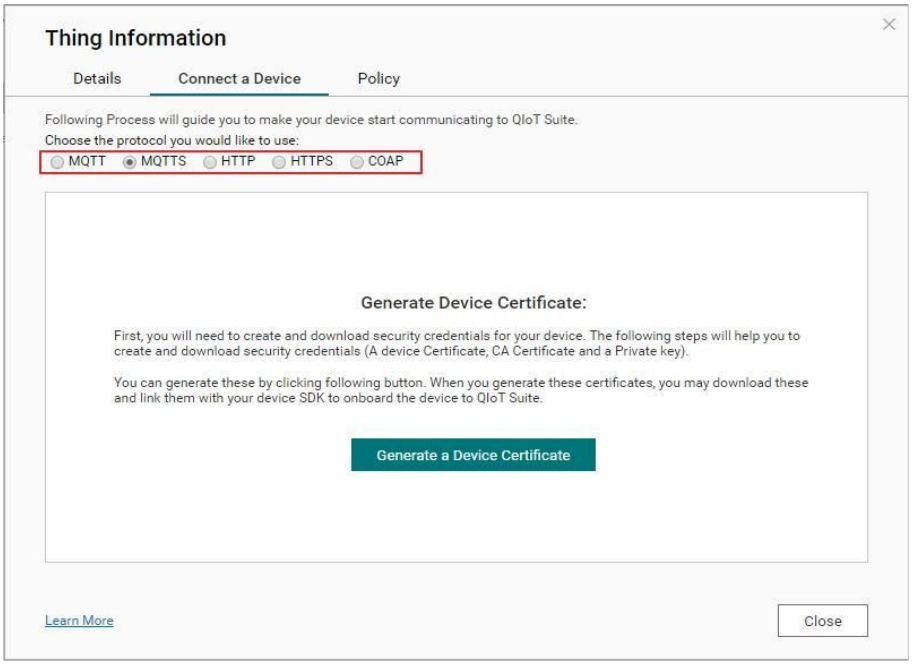
- device will send message to topic "temp" or that you defined ,as below image.

```
root@mylinkit:/home/root/bundle# python mqtt.py
new mqtt protocal
CLIENT_CERT path :/home/root/bundle/ssl/3852282017-05-15_01-50-40_certificate.pem
PRIVATE_CERT exists or not :True
Use MQTTS
USER_NAME : 1eacd5b2-c200-4698-80b0-e2db6336c21c USER_PASS : r:63dd67e51758a10fc9480bb2
604500b8
finish setup
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":24}
connect ready
connection ready
client ready
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":11}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":13}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":36}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":21}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":35}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":39}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":28}
NOW TOPIC_NAME :qiot/things/admin/linkit7688/temp MESSAGE : {"value":13}
```

3.2 Another protocol

- Click "Connection a device" button

- You can choose another protocol you would like to use



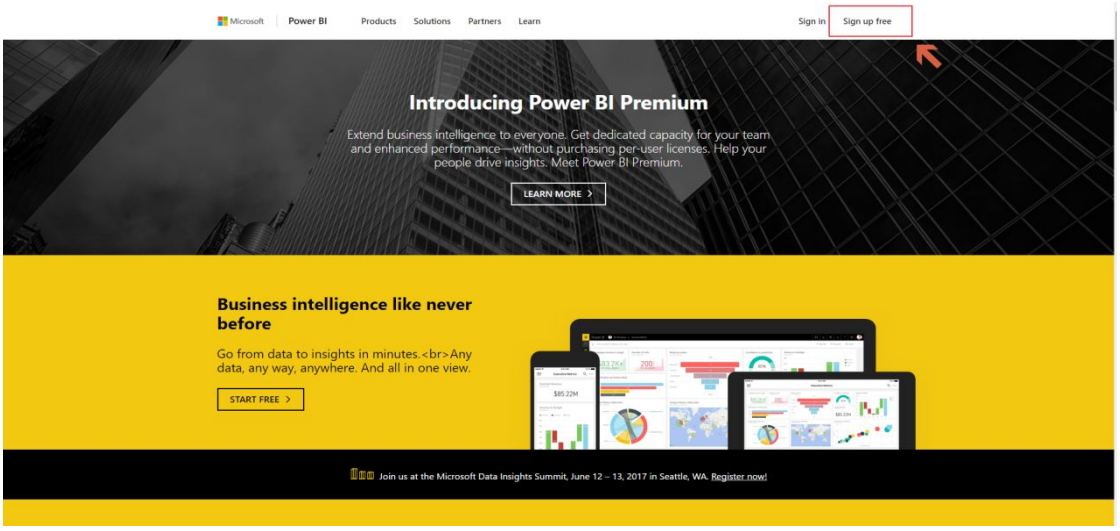
- SSH to your device , and input command as following.

```
root@mylinkit:~# cd /home/{{user}}/bundle
root@mylinkit:/home/root/bundle# pip install -r requirements.txt

// mqtt(dont' need certificate,just put JSON file to "res" folder):
root@mylinkit:/home/root/bundle# python mqtt.py

// http
root@mylinkit:/home/root/bundle# python http.py

// https
root@mylinkit:/home/root/bundle# python https.py

// coap
root@mylinkit:/home/root/bundle# python coap.py
```

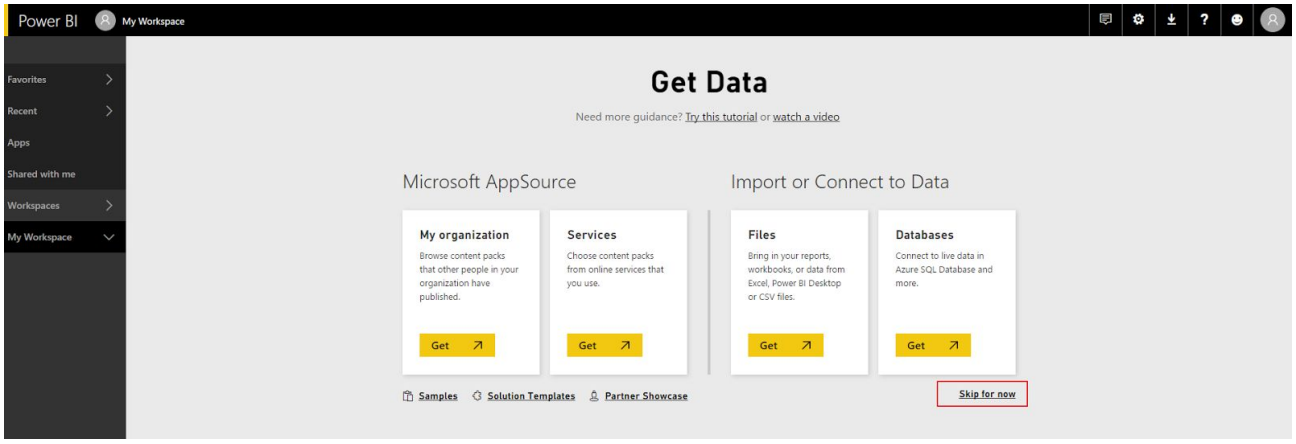
Lesson 4: Integrate Power BI

4.1 Get your first Power BI account

- Go to the offical website “https://powerbi.microsoft.com/en-us/” to sign up your free account.

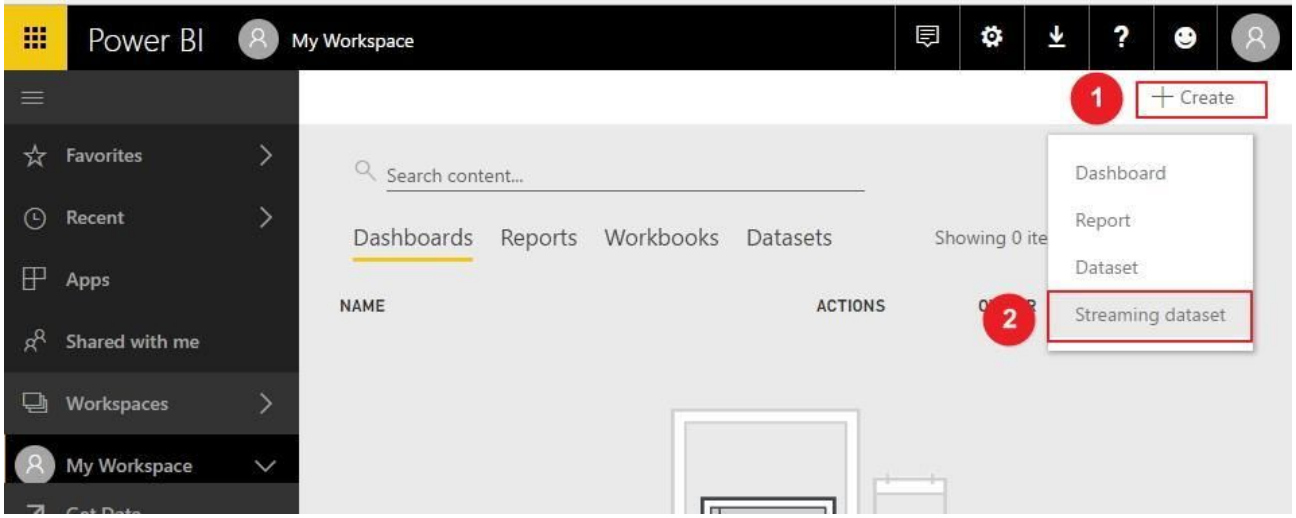


- After a sequence of registration, the page will lead you to below page,you can press “My workspace”, and “skip for now” button appear. You could click “skip for now “ to start create dataset.

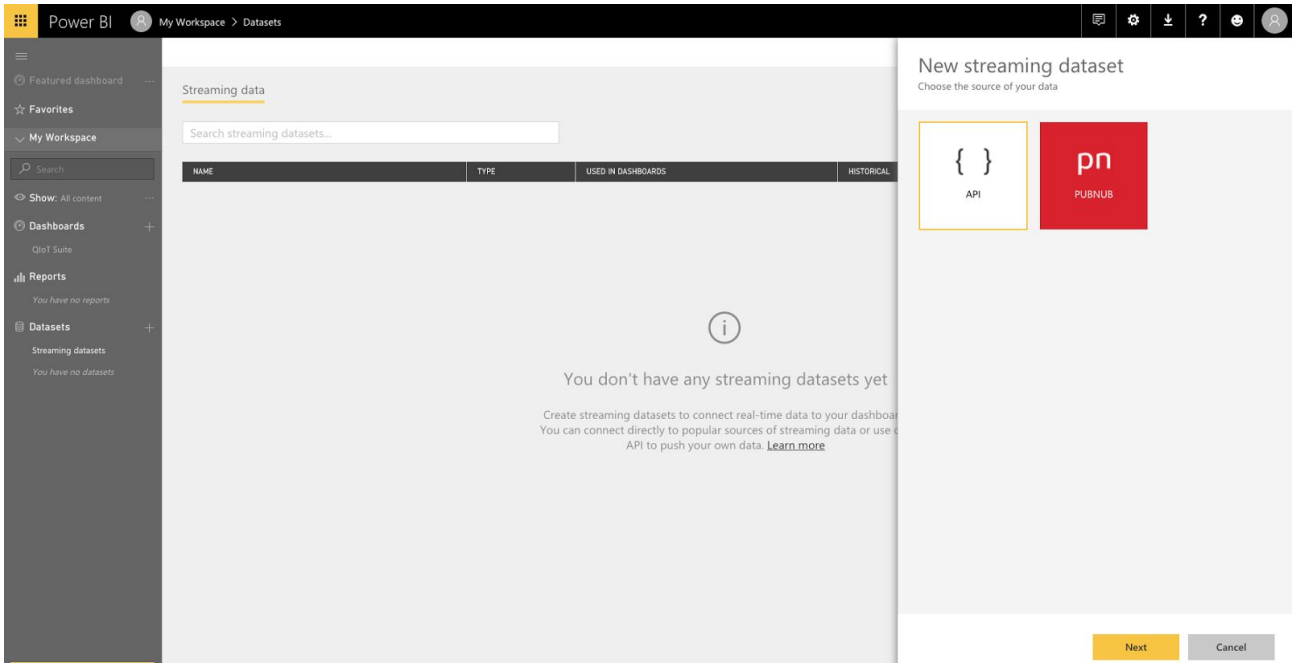


4.2 Setup your streaming dataset API

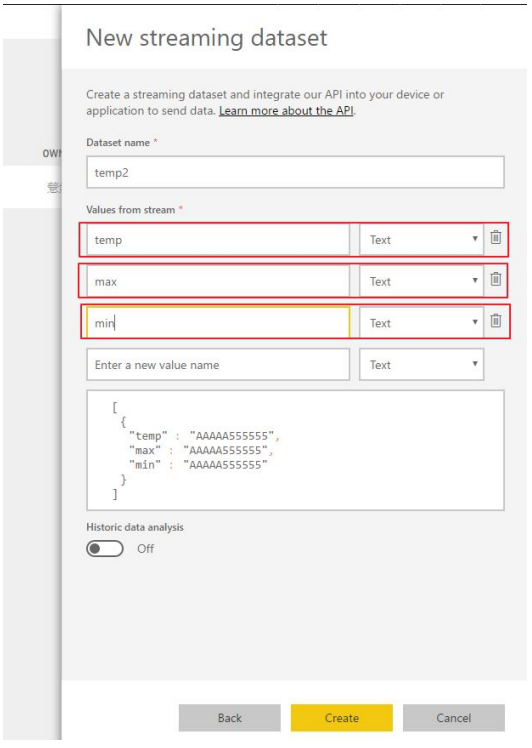
- Create “Datasets”
  - Click “Create” in scrren upper right corner
  - And then click “Streming dataset”



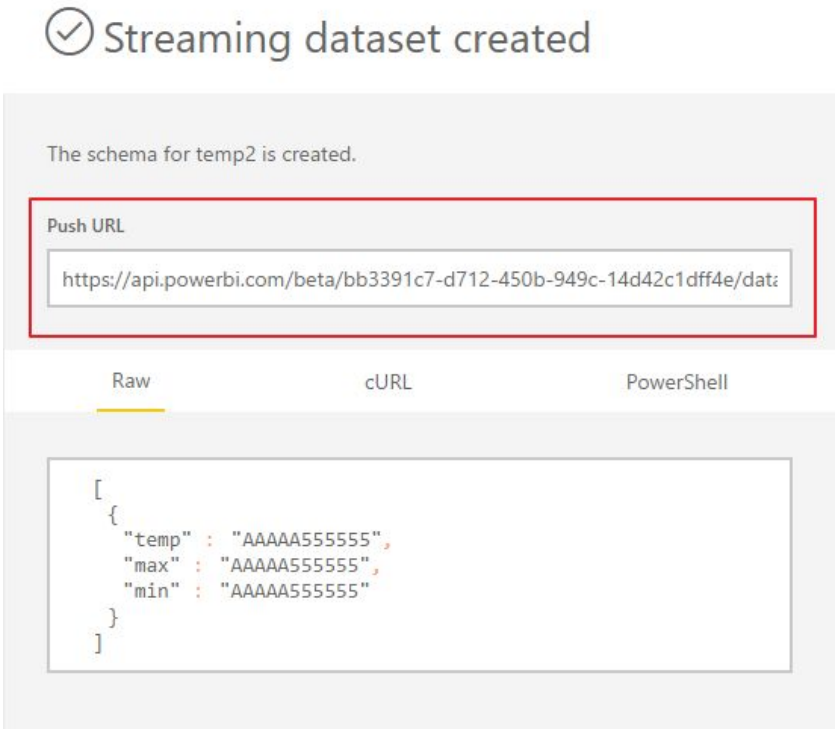
- Select “API”, and click “Next”.



- Define your values from stream(e.g., temp,max,min), and you will get a result of JSON in textbox. QIot Suite's application will post this data format to Power BI. Click the "Create" button to finish create streaming dataset.

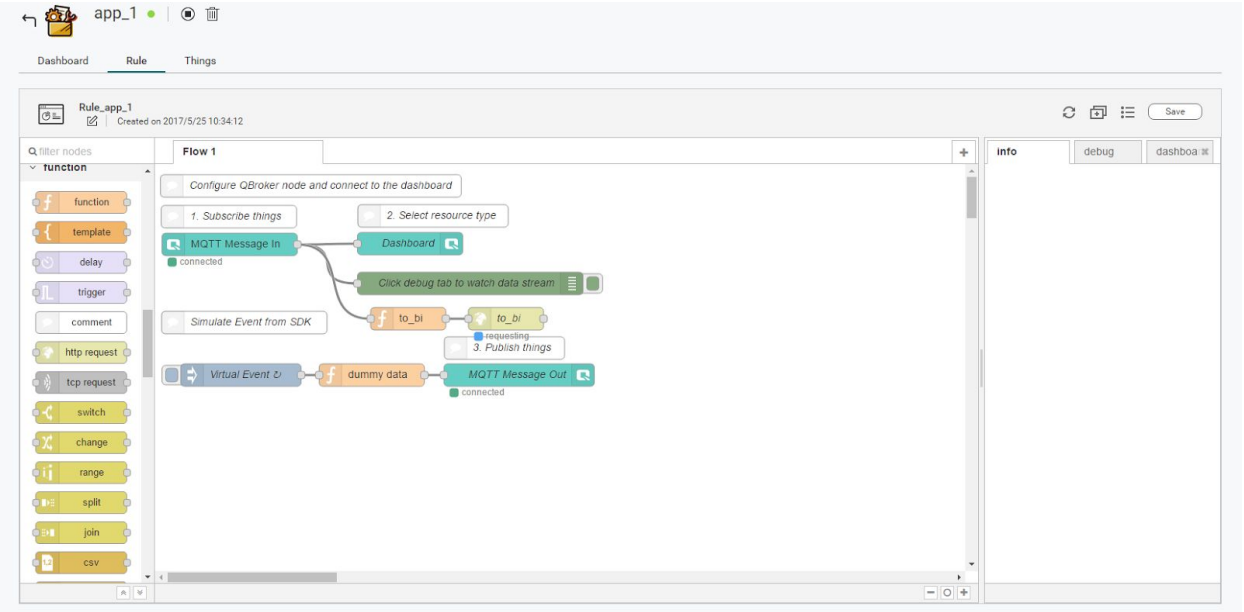


- Once you successfully create your data stream, you get REST API URL which QIoT suite application can call using POST request to push your live data to streaming data dataset you created.



4.3 Configure Node-RED's nodes in IoT application

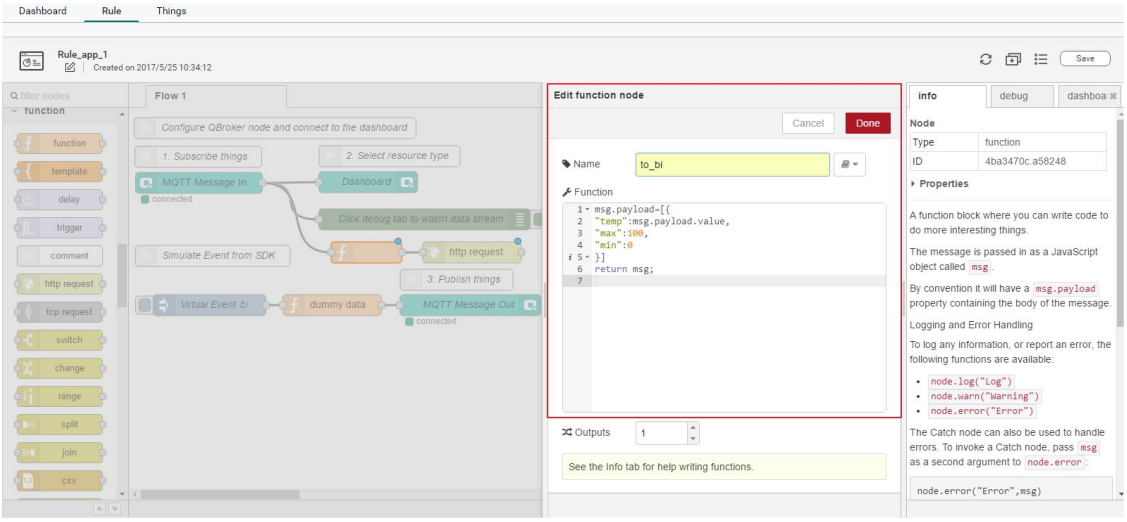
- Create IoT application in QIoT suite.
- The following one is your first node-red flow, and then you can start to create your own IoT flow. more node-red information can be found in "Node-Red".



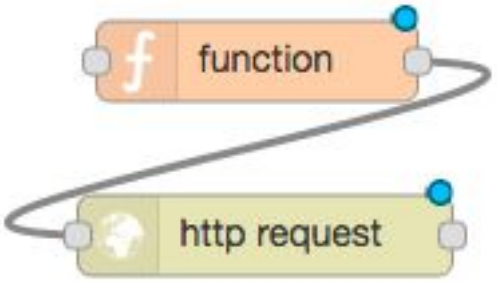
- Before you start to push live data to Power BI.
- We need a "function" node to convert IoT data to streaming data dataset. Here you can replace msg.payload to your JSON dataset.
- Double click function node, and type Function code as following:

```
msg.payload=[{
        "temp":msg.payload.value,
```

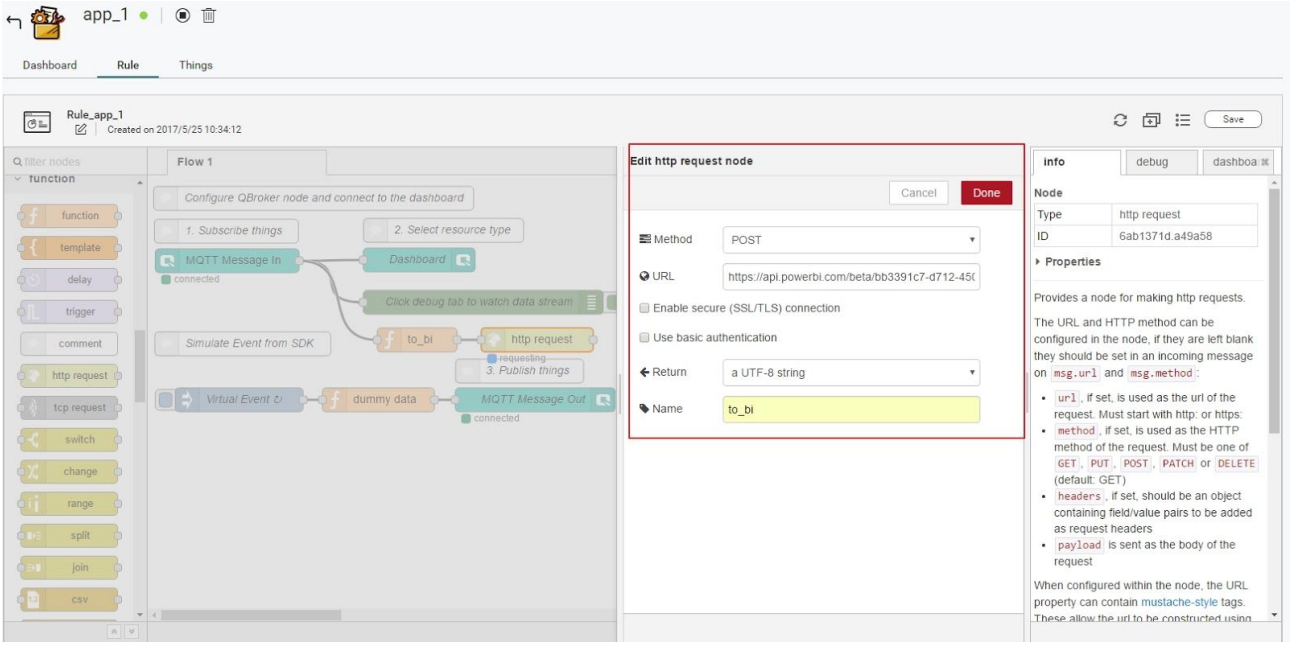
```
            "max":100,
            "min":0
        }]
        return msg;
```



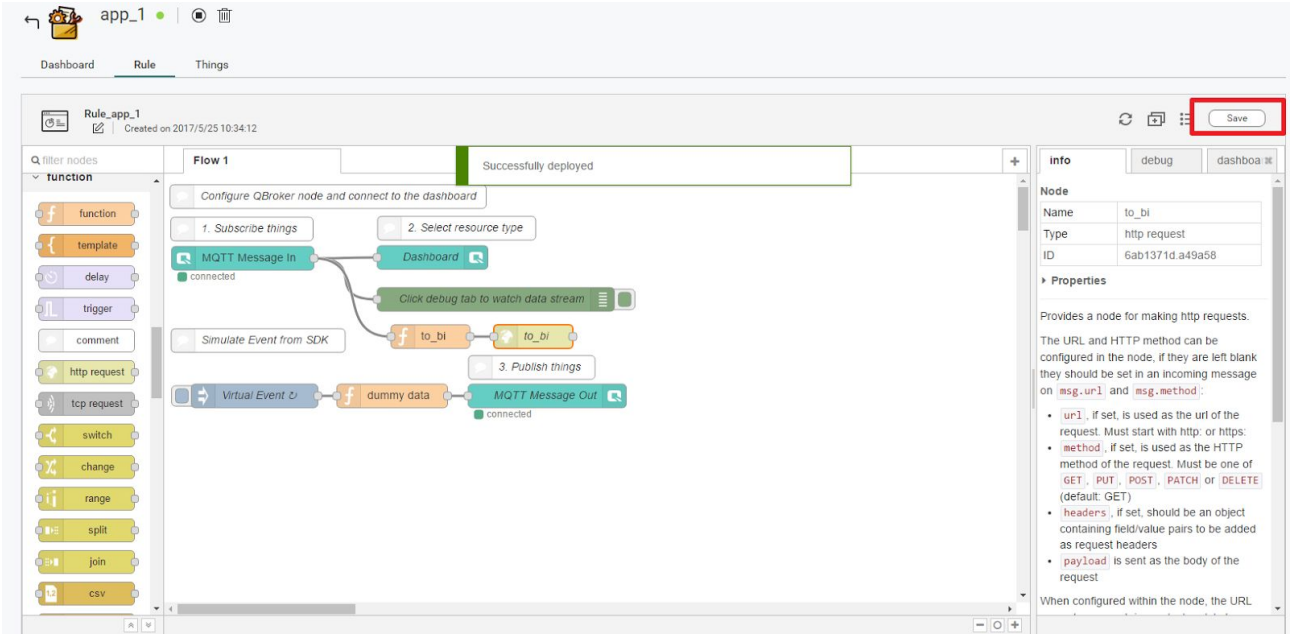
- We need a “http request” node to help us to push live data to Power BI. Just drop and drag “http request” node and connect to tail of “function“ node.



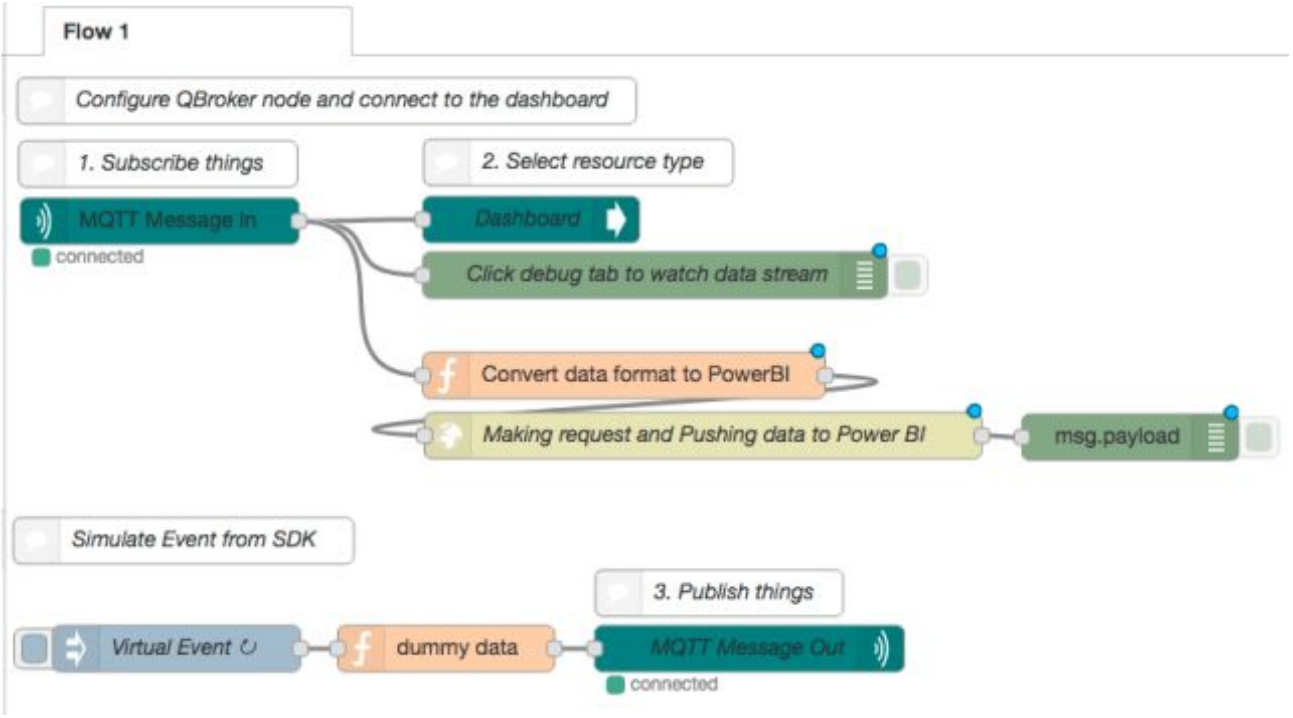
- Double click http request node, copy and paste REST API URL that you got from Power BI console, and set http method to POST.



- Finally, don't forget to press "Save" button to save changes.

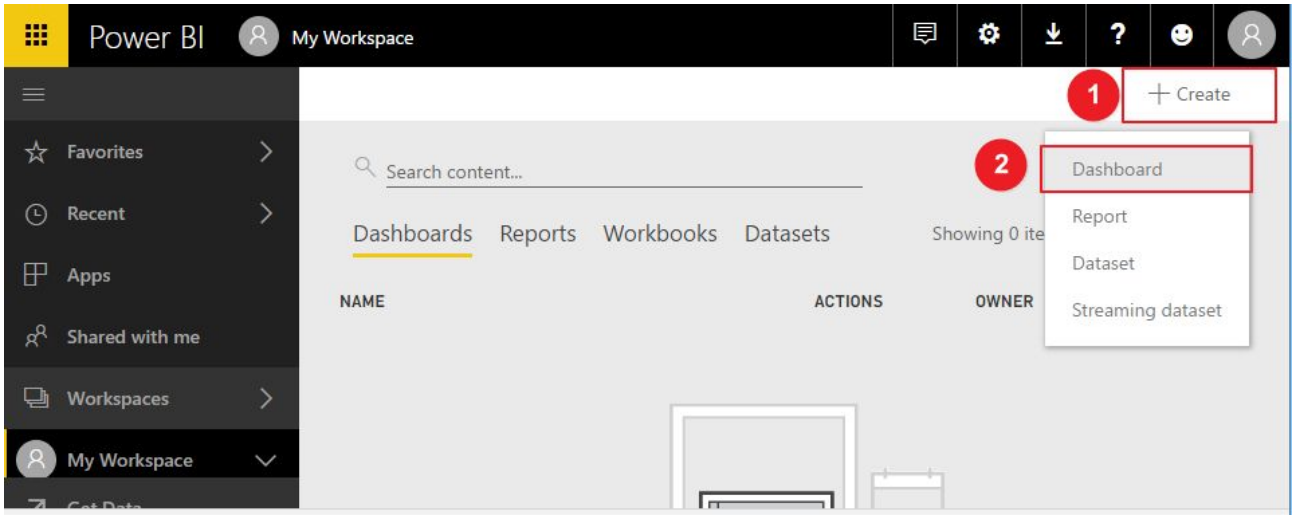


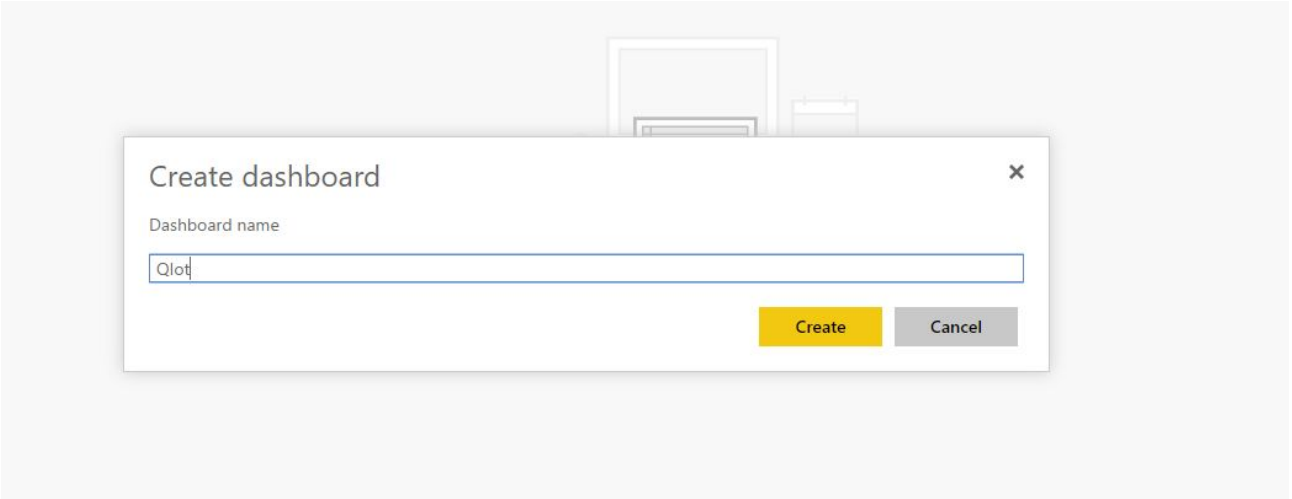
- Finally, your node-red flow will look like below one.



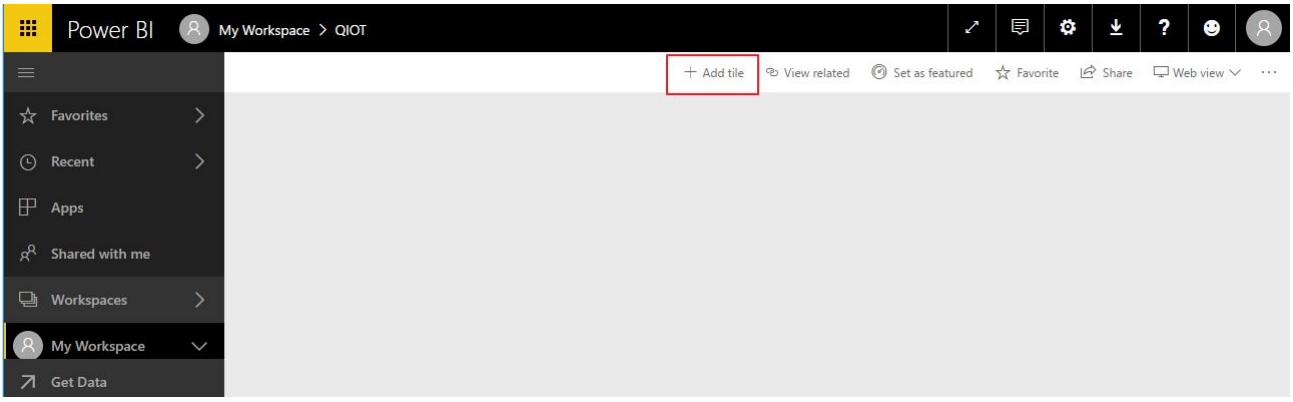
4.4 Add tile to display real-time data

- Create “Dashboard”
  - Click “Create” in scrren upper right corner
  - And then click “Dashboard”
  - Enter dashboard’s name,and click “Create” to complete create dashboard.

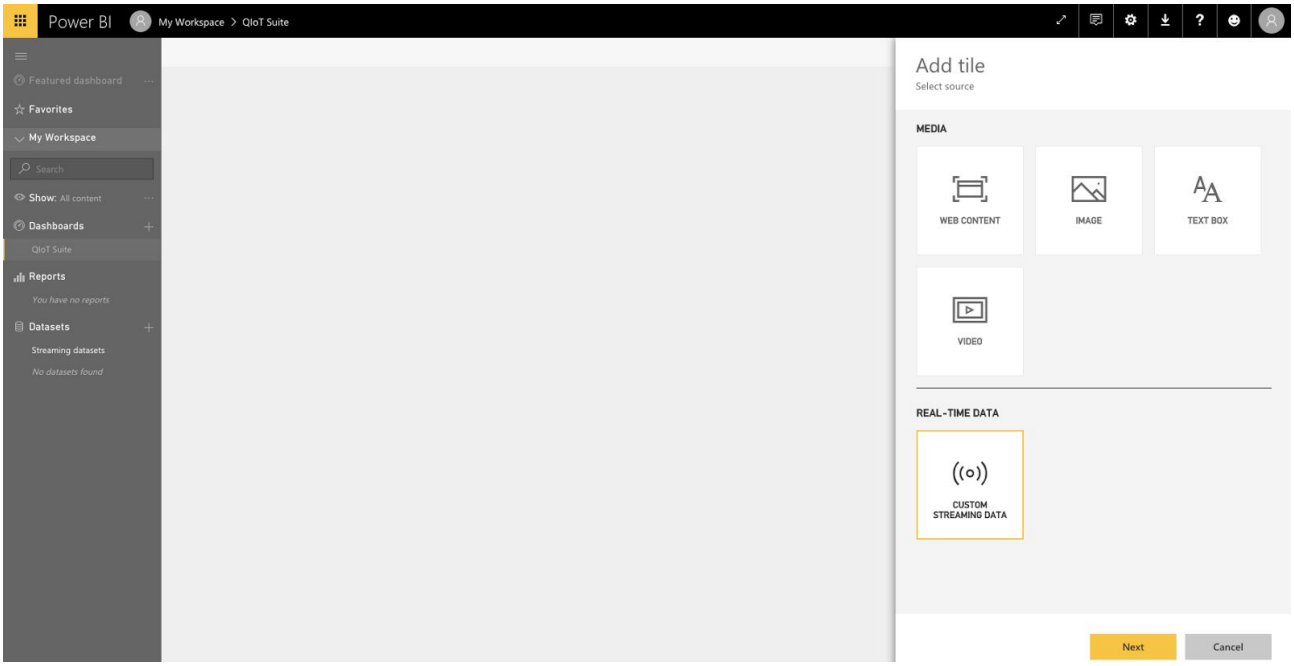




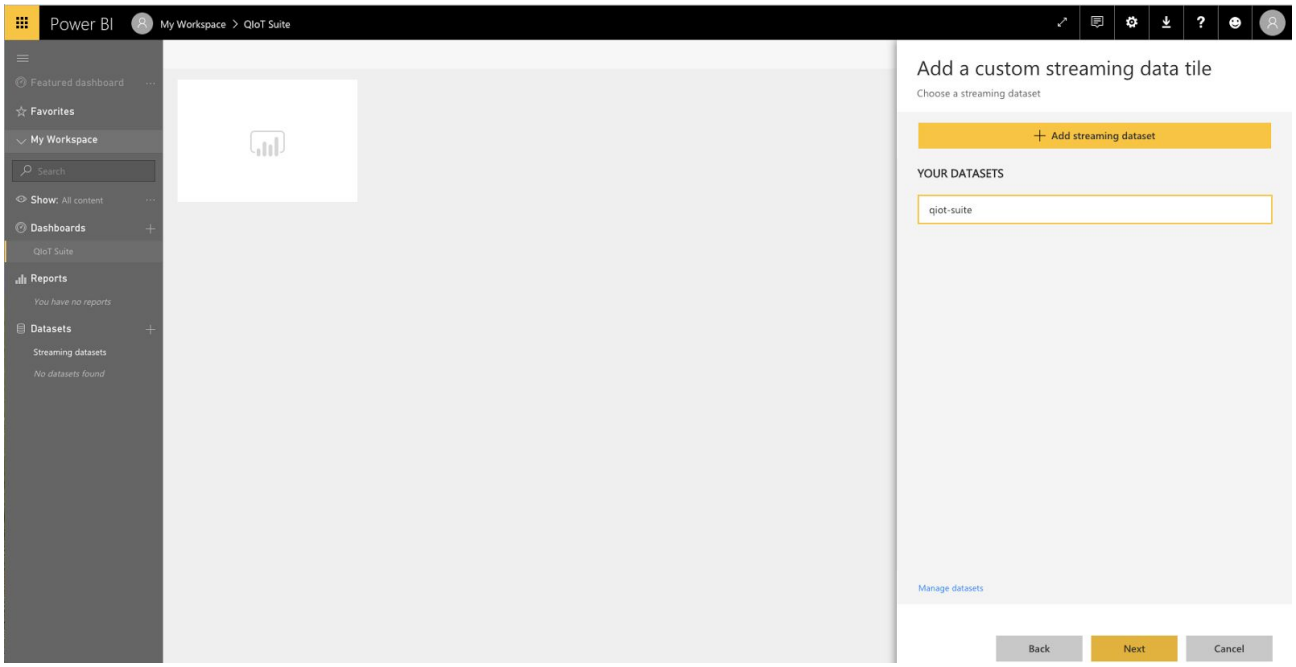
- Click “Add tile” in scrren upper right corner



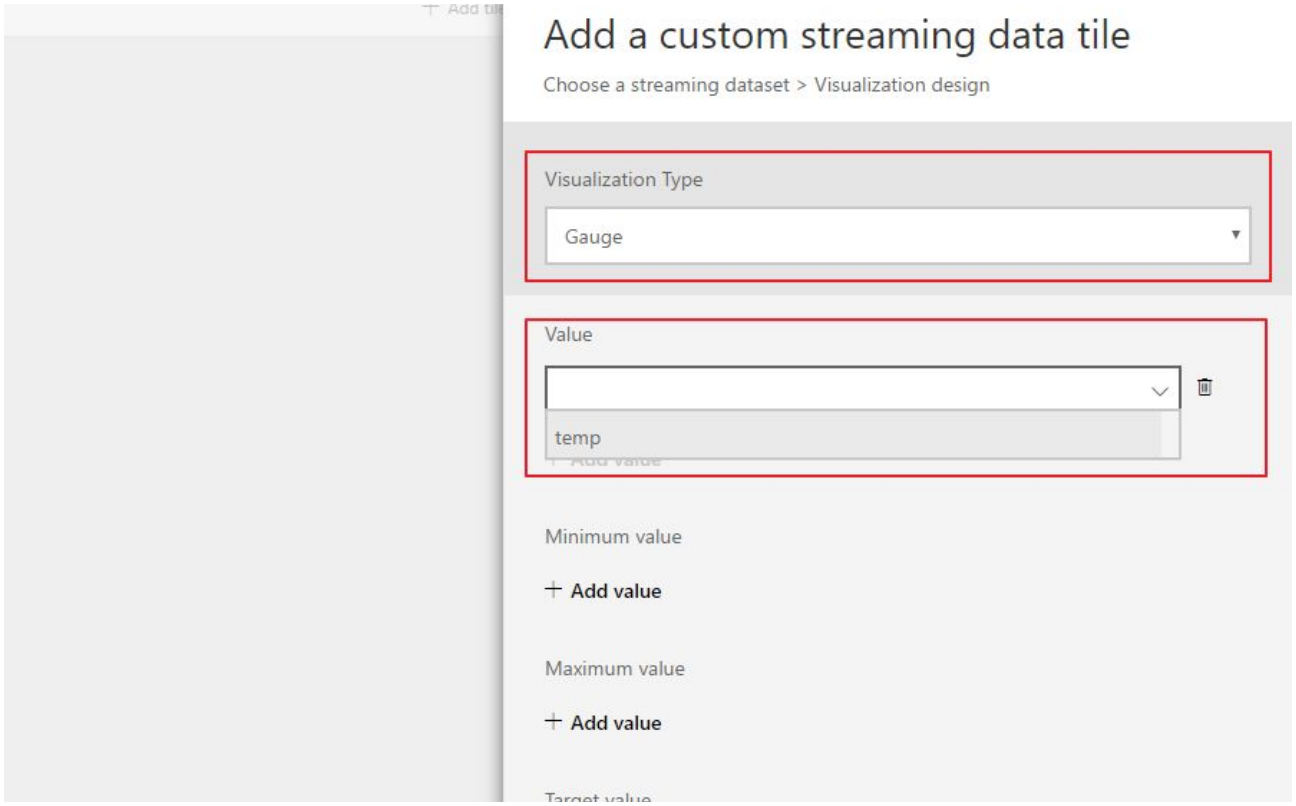
- Select “CUSTOM STREAMING DATA” and then select the “Next” button.



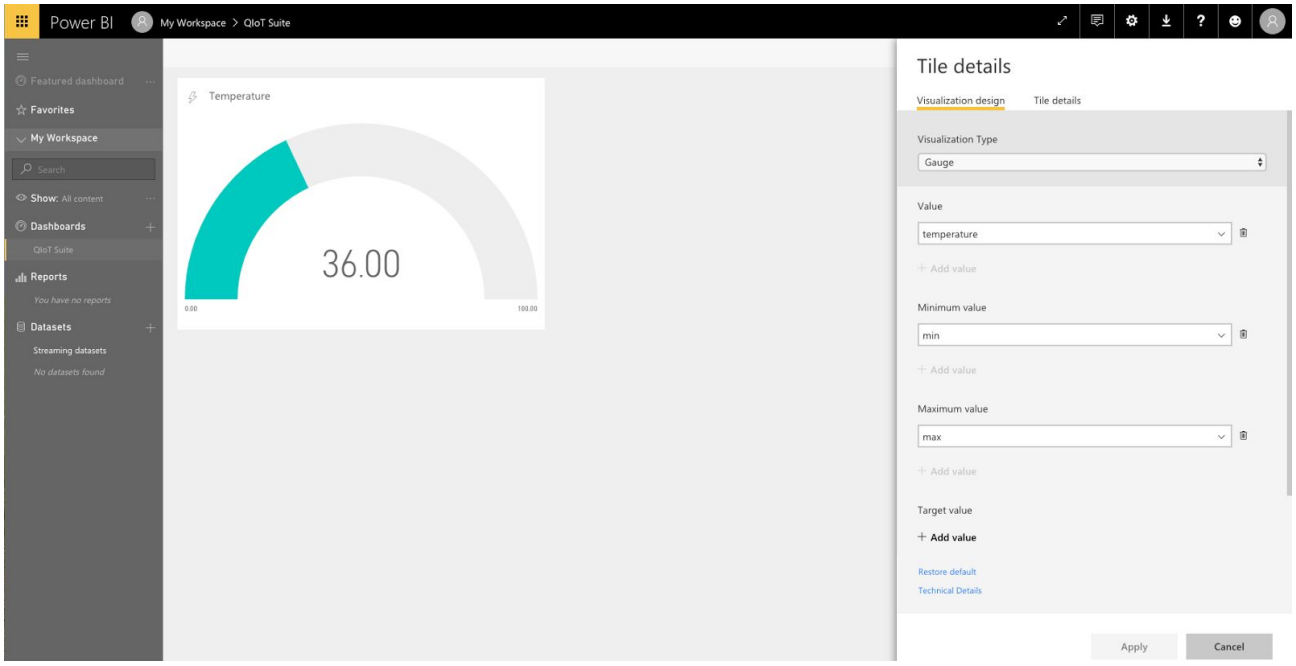
- Select datasets which you created and then click the “Next” button.



- Select visualization type (e.g.,gauge),and set value.



- You have a streaming dataset to work with, you can get a real time gauge that looks like as following.



Appendix

QNAP QIoT Startkit Sample Code Introduction

- GitHub: Sample Code
- Sample Code Structure

```
qnap-qiot-sdks/
   python/                          # python program language
      device/                       # arduino-yun/mtk-linkit-7688-duo...
         mtk-linkit-7688-duo/
            examples/
               lib/                 # QIoT command Lib
               res/                 # QIoT resourceinfo.json folder
               ssl/                 # QIoT certificate files folder.
               mqtt.py              # sample code - mqtt/mqtts publish
               http.py              # sample code - http post
               https.py             # sample code - https post
               coap.py              # sample code - coap postt
               mqtt_subscribe.py    # sample code - mqtt/mqtts subscribe
               http_get.py          # sample code - http get
               https_get.py         # sample code - https get
               coap_observe.py      # sample code - coap get
         arduino-yun/
            examples/
               ……
   nodejs/                          # node.js program language
      device/
         intel-edison/
            examples/
               lib/
```

res/
ssl/
mqtt.js
http.js
...

- content of resourceinfo.json

protocol	resourceinfo.json content
mqtts	{ "host": ["172.17.28.28" # nas ip], "myqnapcloudHost": "Not Available", # myqnapcloudHost "port": 8883, # mqtts port "clientId": "adfa_1491561635", # thing Id "username": "00477f86-425b-49de-8590-xx", # username "password": "r:2825dedfb012969e1dfb6adb8", # password "resources": [# resource des { "resourcename": "adf", # resource name "resourceid": "dfadf", # resource id "resourcetypename": "Temperature", # resource type "datatype": "Float", # data type "unit": "°C", # data unit "description": "adfa", # resource des "topic": "qiot/things/admin/adfa/dfadf" # topic name }], "caCert": "/v1/media/ca-crt.pem", # certificate file "clientCert": "/v1/media/xx-04-07_10-40-35/xx_certificate.pem", "privateCert": "/v1/media/xx-04-07_10-40-35/xx_privatekey.pem" }
https	{ "accesstoken": "r:2825dedfb012969e1dfb6adb8", # password "myqnapcloudHost": "Not Available", "clientId": "adfa_1491562164", "host": ["172.17.28.28"], "requesterid": "00477f86-425b-49de-8590-xx", # username "port": 3443, # https port ... }
CoAP	{ "myqnapcloudHost": "Not Available", "clientId": "adfa_1491562176",

	"host": ["172.17.28.28"], "r": "00477f86-425b-49de-8590-1282c65b4348", # username "t": "r:2825dedfb012969e1dfb6adb80a419df", # password "port": 5683, # coap port ... }