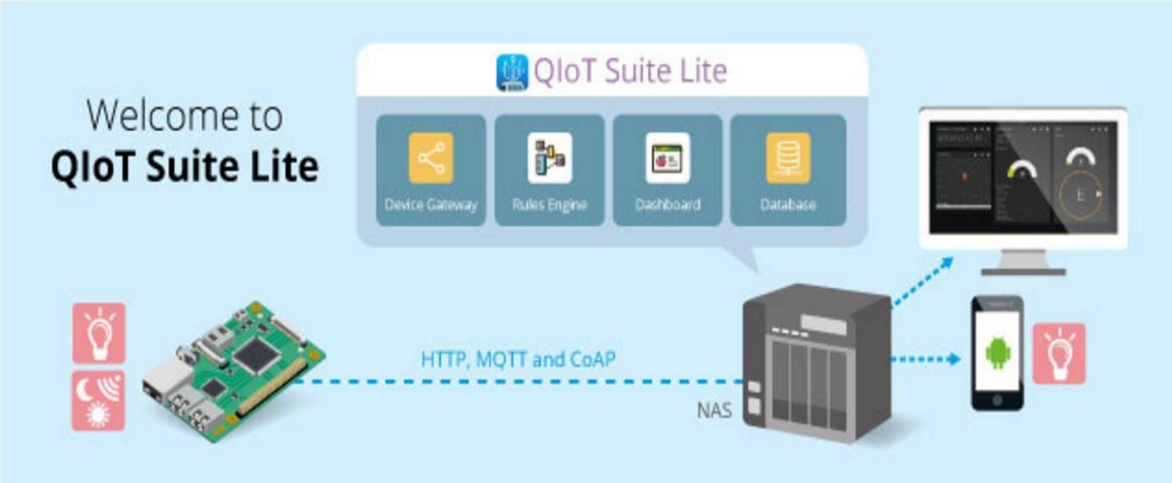
Get started with Arduino Yun (Python)

In this tutorial, you begin by learning the basics of working with Arduino Yun that's running OpenWrT which is a free operating system based on Linux for the Arduino Yun. You then learn how to seamlessly connect your devices to QNAP NAS by using QIoT Suite Lite. Please ensure your Arduino Yun and NAS is under the same LAN



Lesson 1: Configure your device

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

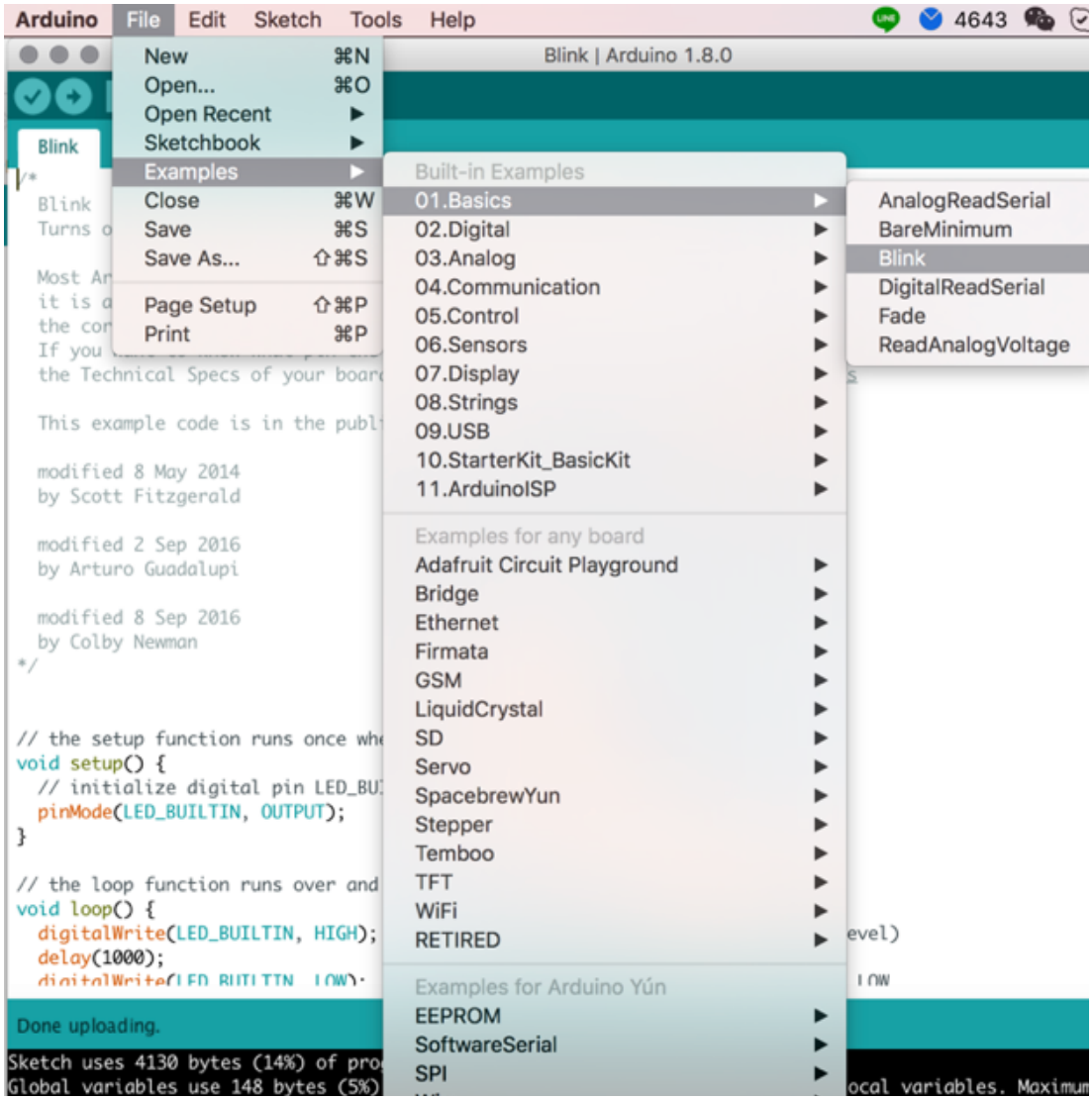
1.1 Download Arduino IDE

- Download and install Arduino IDE based on your host PC, available here: https://www.arduino.cc/en/Main/Software
- More Arduino tutorial: https://www.arduino.cc/en/Tutorial/HomePage

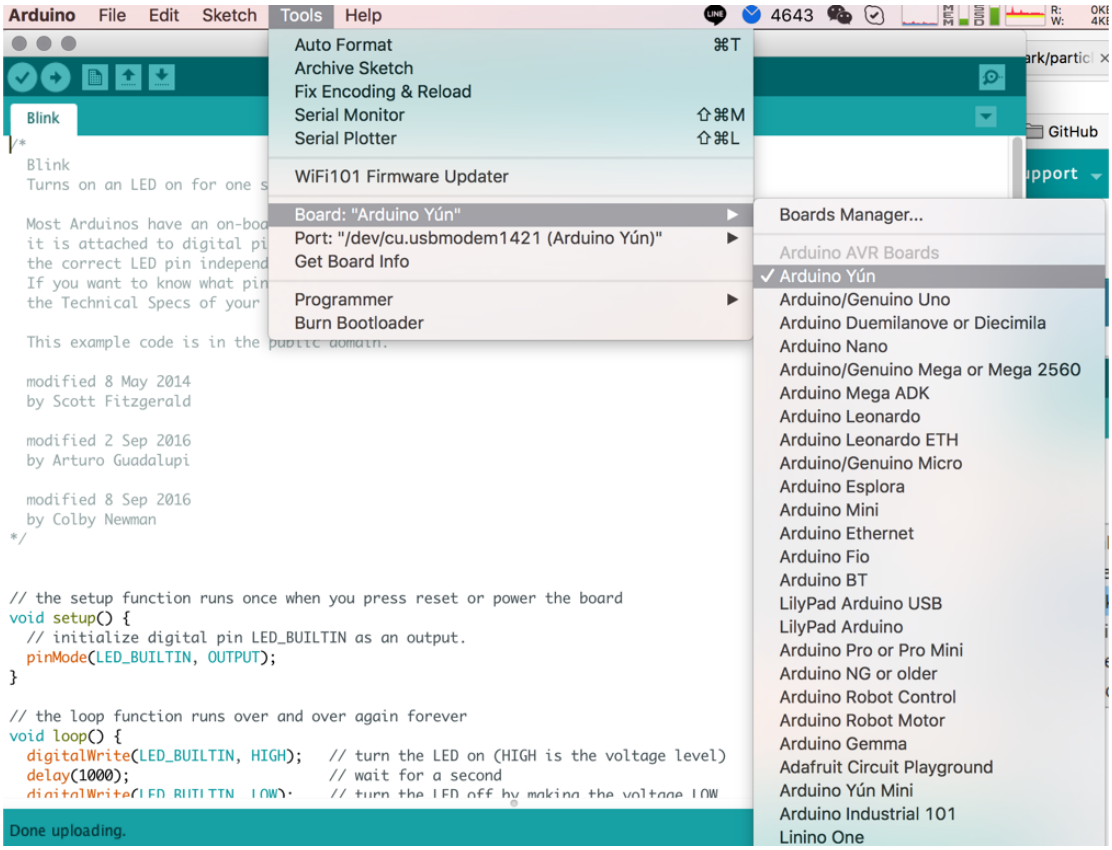
1.2 Configure and test your device

If this is the first time you use your Arduino Yun, you will have to follow some steps to assemble it.

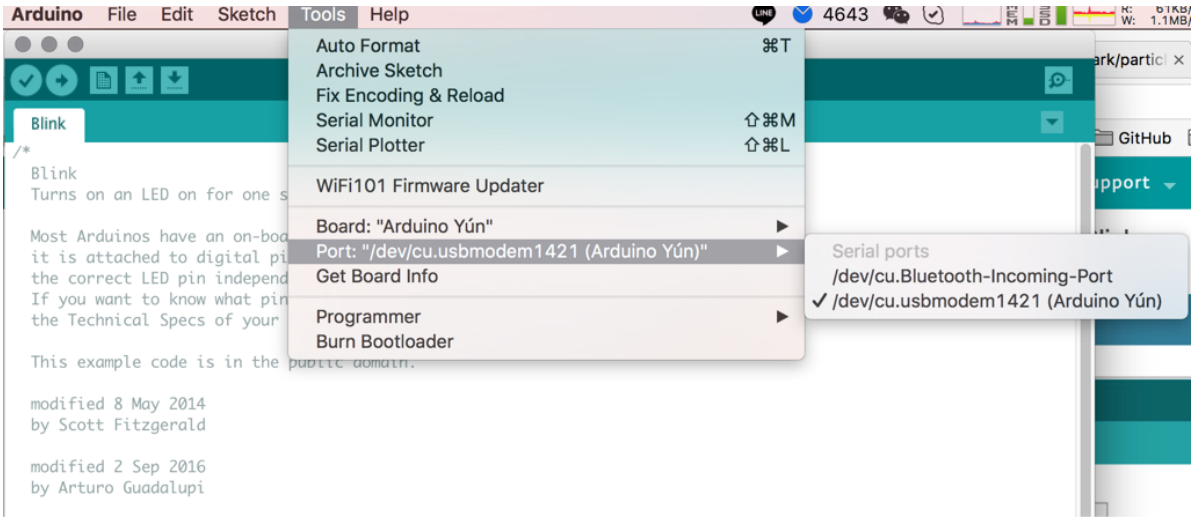
- Connect Arduino Yun to your PC with USB.
- Open your Arduino IDE and find Blink example.



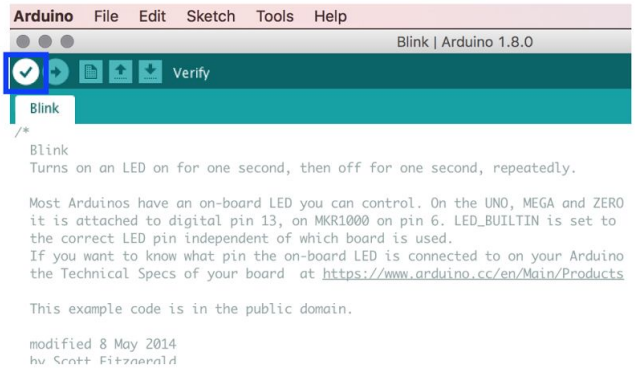
- Configure your board:



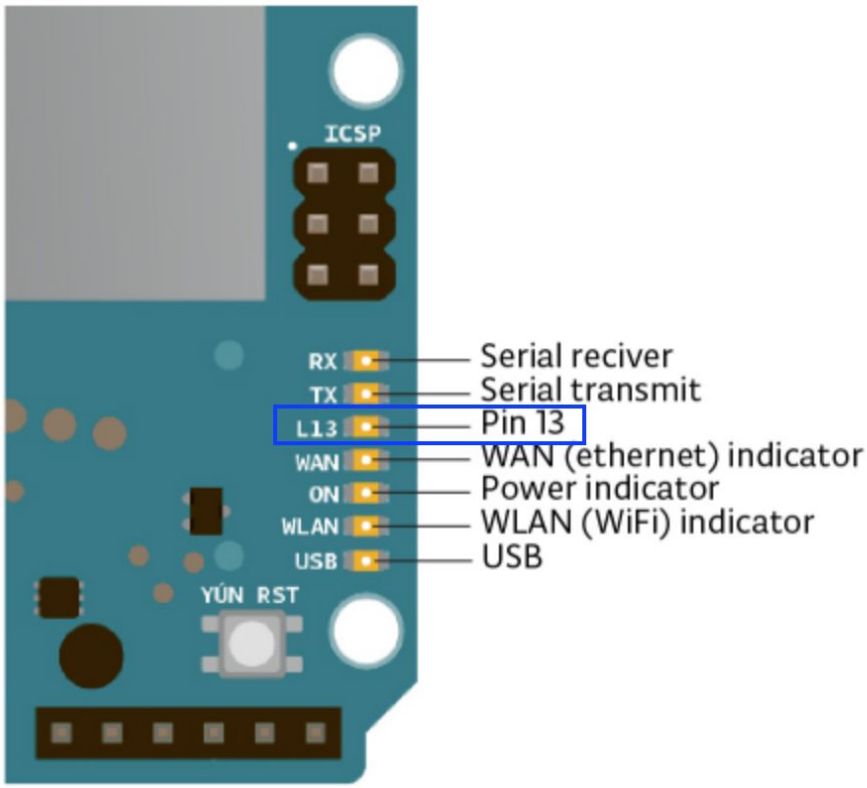
- Configure your port:



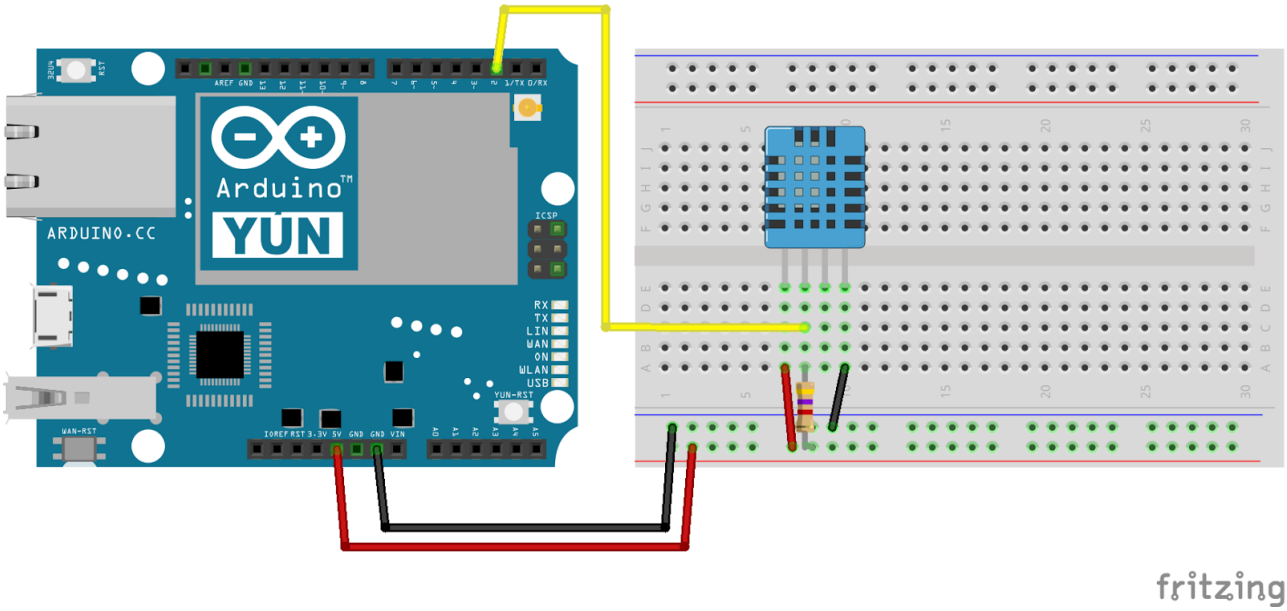
- Verify and upload your Blink example to Arduino Yun



- If you success upload your code to Arduino Yun, please check your Arduino Yun and you could see L13 is blink now:

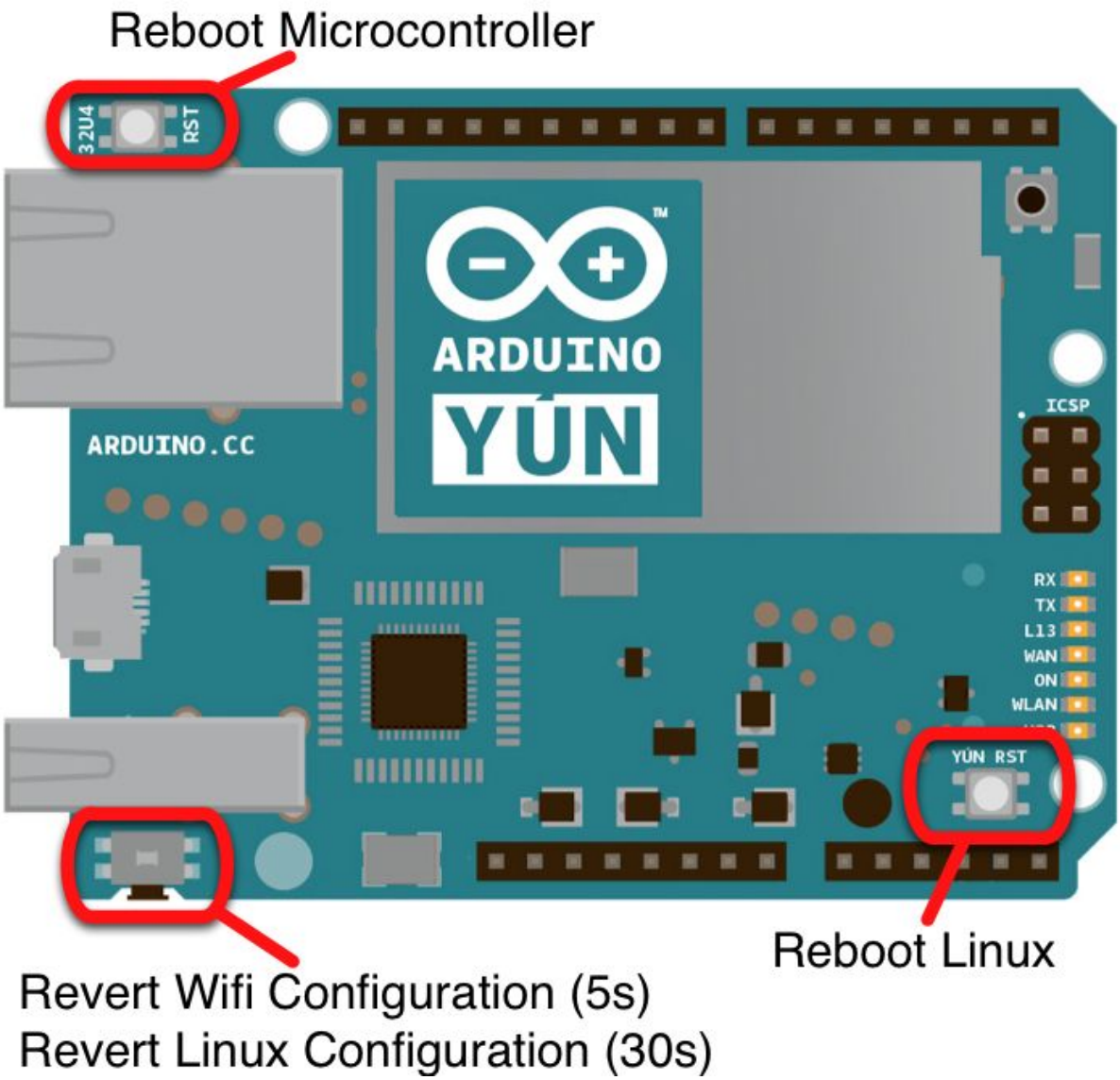


- Connect your DHT11 sensor to “**Ground**”, “**5V**”, “**Pin 2(Digital)**” on Arduino Yun respectively.

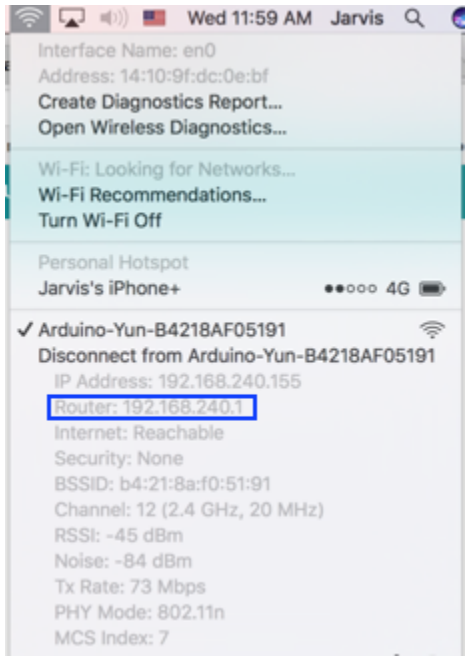


1.3 Get IP address of your Arduino Yun

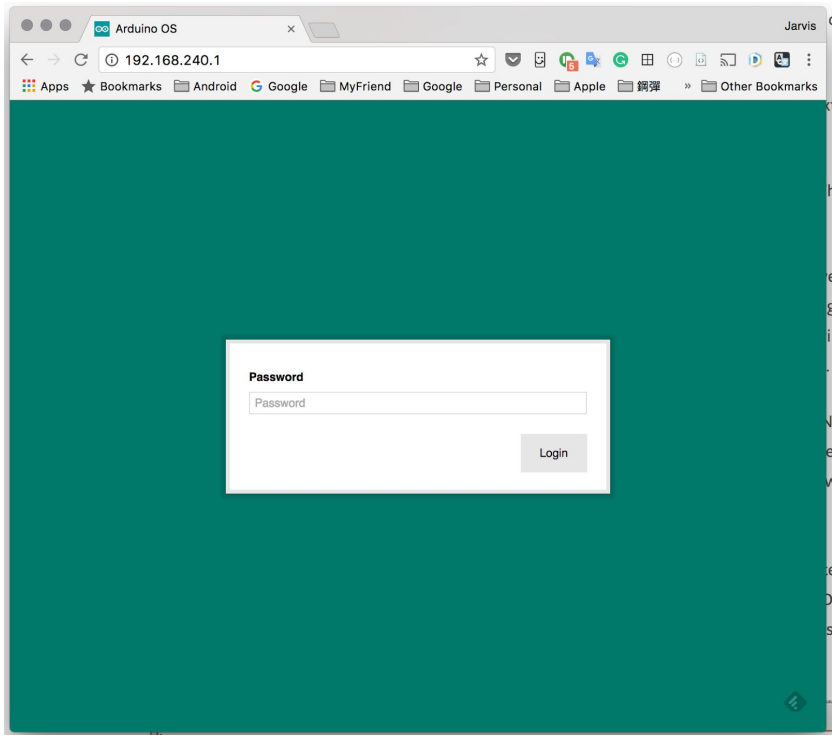
- Press Wifi reset button (need to press 5 seconds)



- Go to your Wifi settings and choose “Arduino-Yun-XXXXXXX”. The “XXXXXXX” is MAC address of your Arduino Yun.



- Open your browser and type in “http://192.168.240.1” or “http://arduino.local”. The default password is “arduino”.

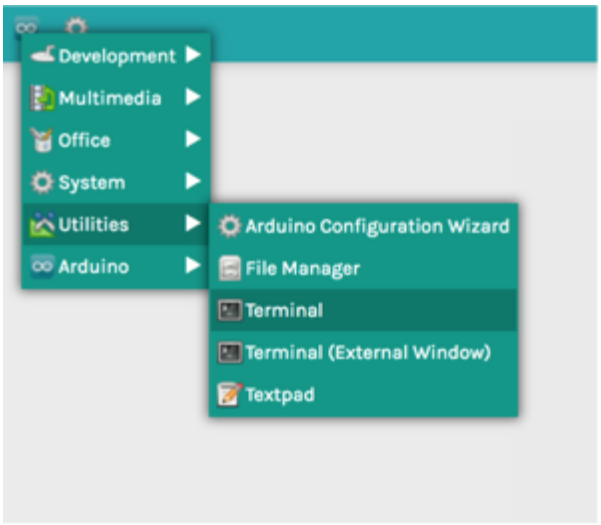


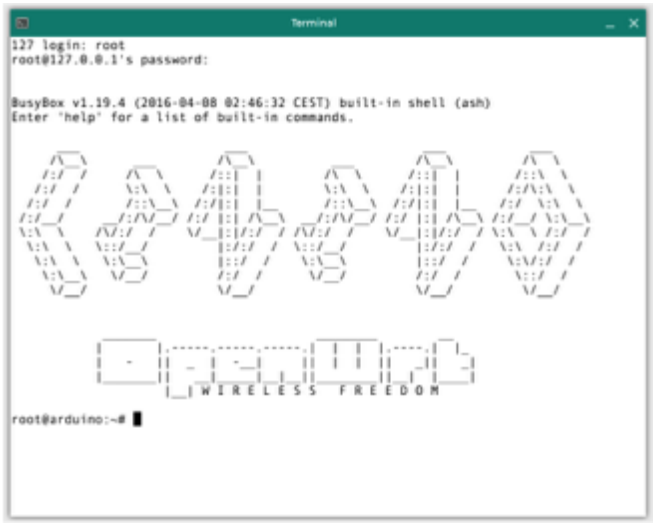
- Complete your Board setting and link your Arduino Yun to the router you are using. Skip “API setting” and click on save to complete.

- On your PC, change your Wifi network to your router and now your NAS and Arduino is under the same network.

1.4 Install development tools for your Arduino Yun

- Open Terminal from http://arduino.local
- Type your login account “root” and your password. The default password is “arduino”.

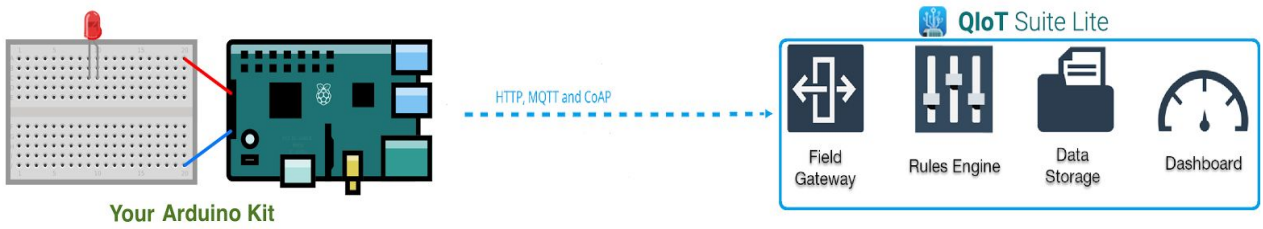




- Install PIP and relatives library by tying in the following commands.
  root@arduino:~# **opkg update**
  root@arduino:~# **opkg install distribute**
  root@arduino:~# **opkg install python-openssl**
  root@arduino:~# **easy_install pip**

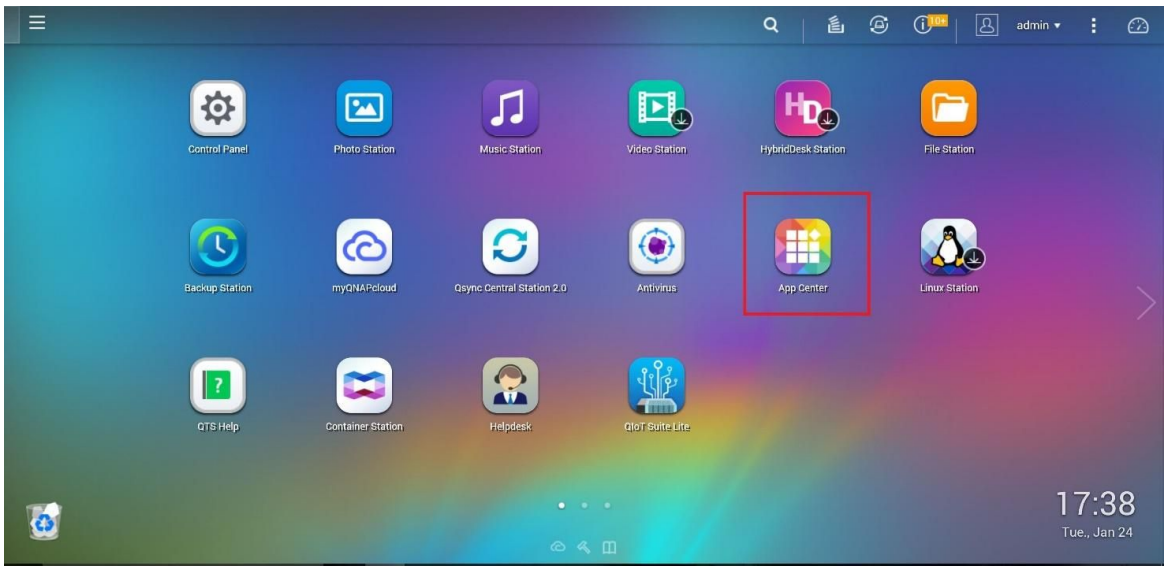
Lesson 2: Create your device in QIoT Suite Lite

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

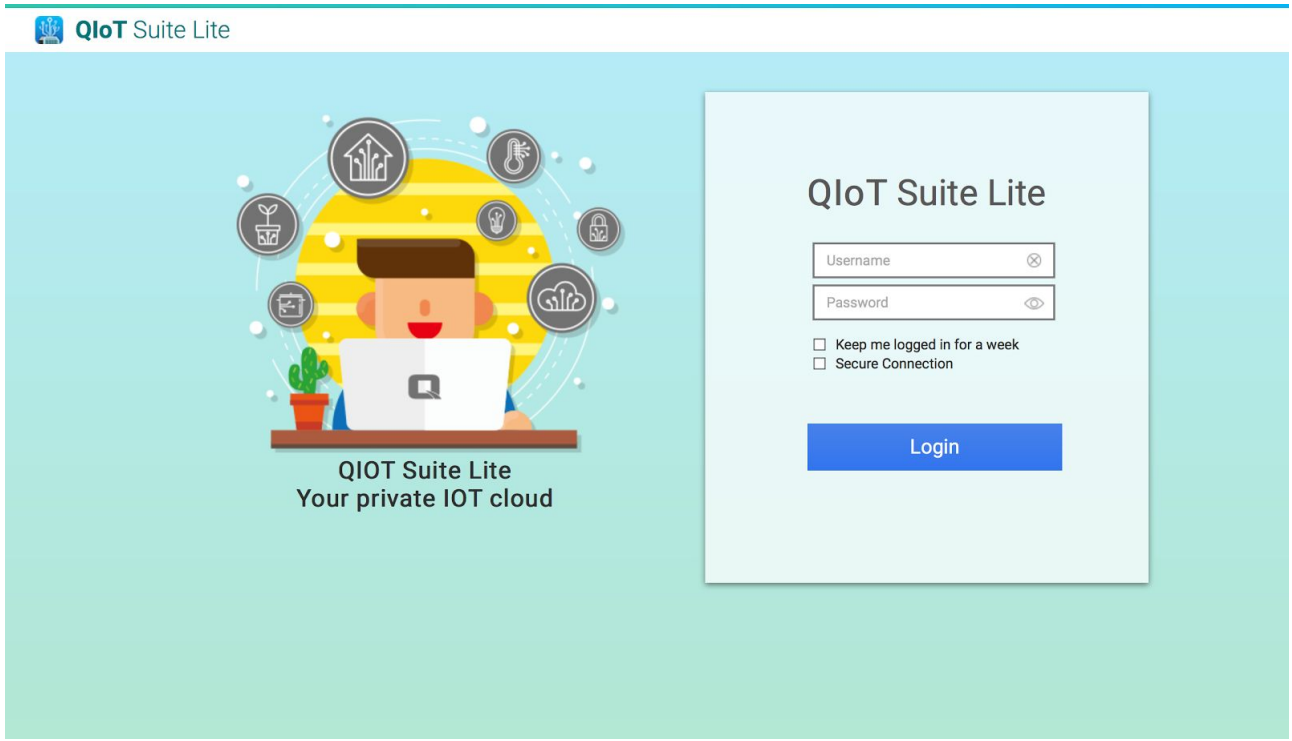


2.1 Install QIoT Suite Lite

- 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

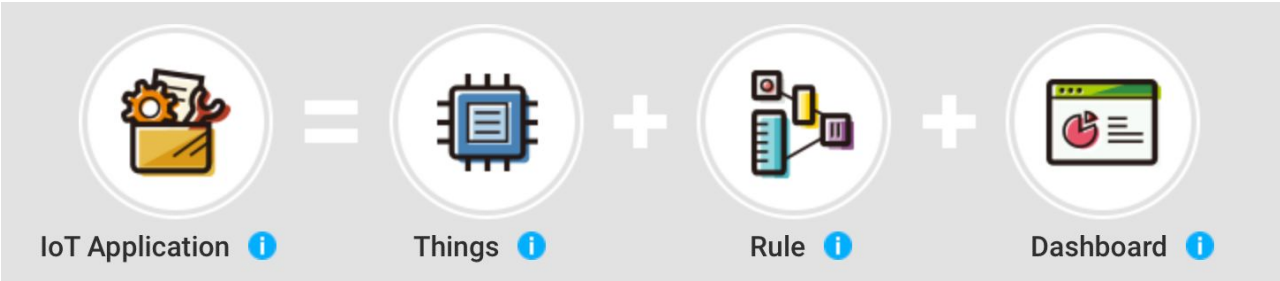
Create a new IoT application

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.

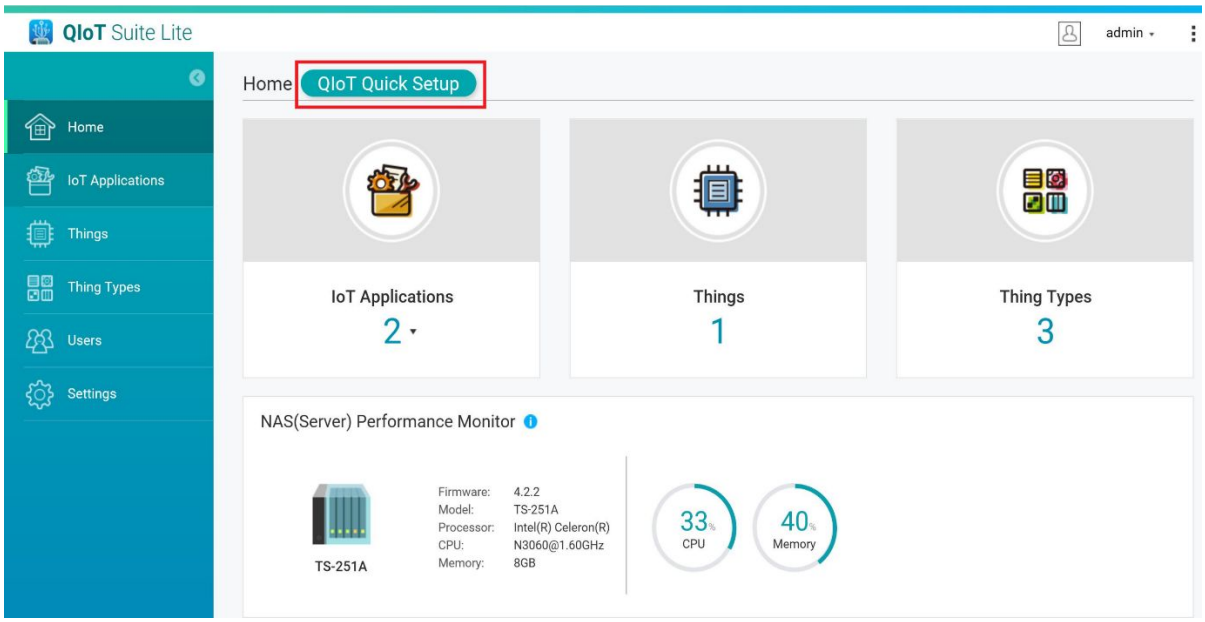
The Rule makes it possible to build IoT applications that gather, process, analyze and act on data generated by connected devices based on business rules you define. A rule can apply to data from one or many devices, and it can take one or many actions in parallel.

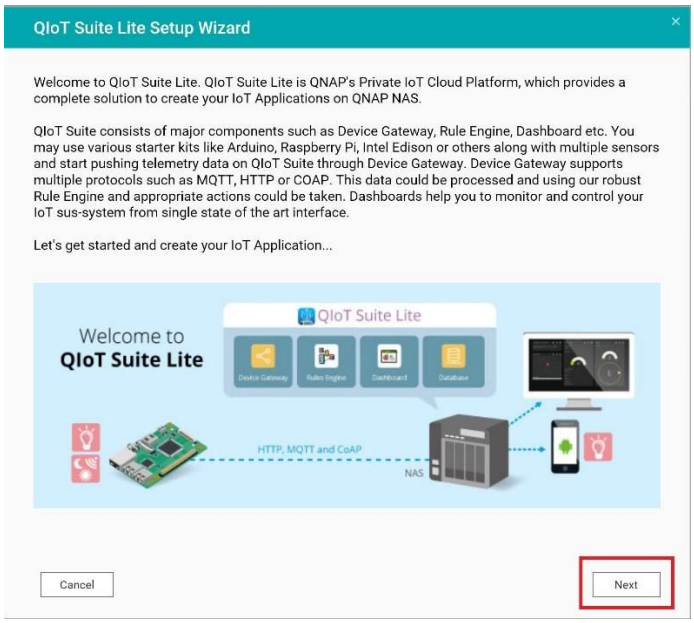
With Dashboard, you can turn your data processing efforts into analytics and reports that provide real-time insights into your business.

All these elements provide user a complete IoT Application environment.

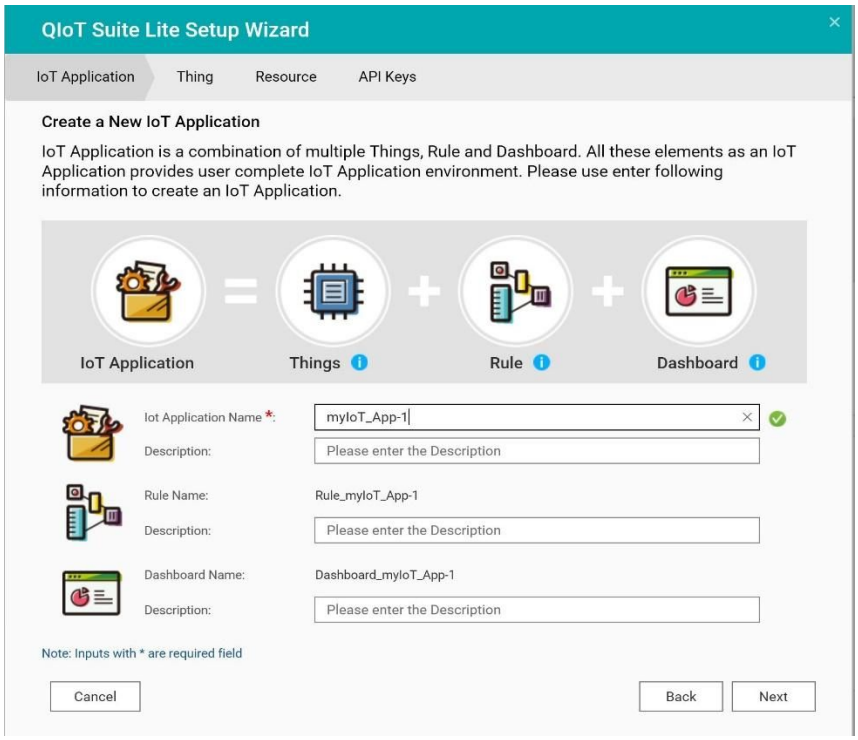


- If this is your first time to use QIoT Suite Lite, QIoT Suite Lite provides a wizard to help you quick setup a IoT application. Click on **QIoT Quick Setup.** After you read the QIoT Suite Lite introduction, click **Next** button.

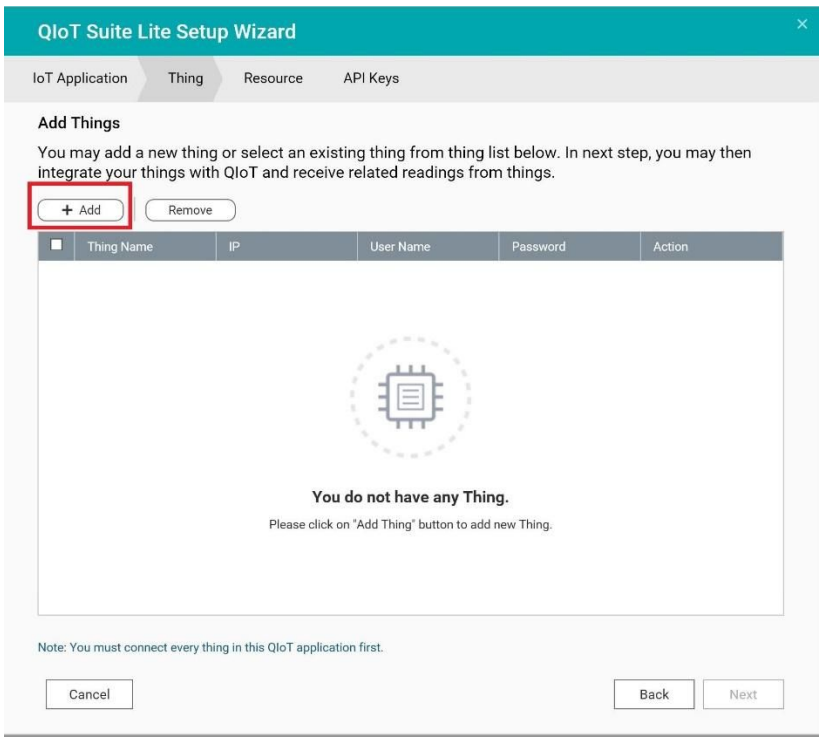


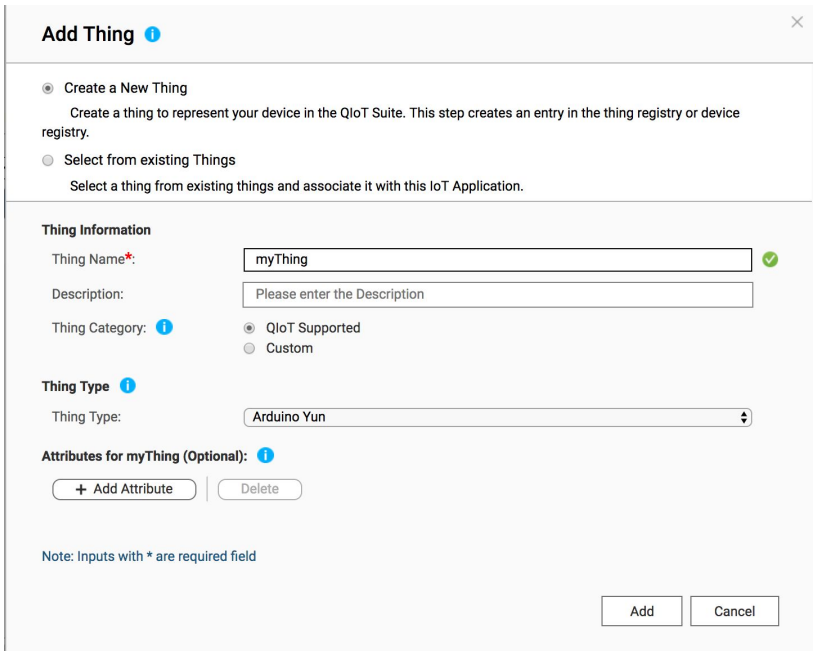


- In **IoT Application** tab, type a name for your IoT Application, e.g. myIoT_App-1. Rule name and Dashboard name will be generated automatically based on the name of IoT Application you fill in. Then click **Next** button.

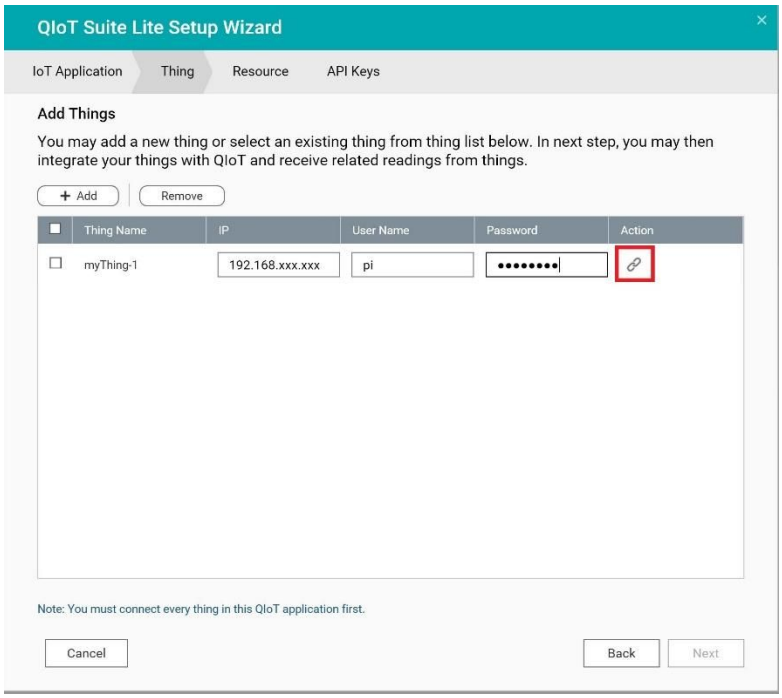


- In **Thing** tab, click on **Add.** Please provide a name for your device (ex. myThing-1). You can also choose **Add attribute** to provide information about your device (for example, its serial number, manufacturer, and more). If your device is already supported by QIoT software, you can choose **Thing Type** predefined by QNAP. Click on **Add** to add the device.

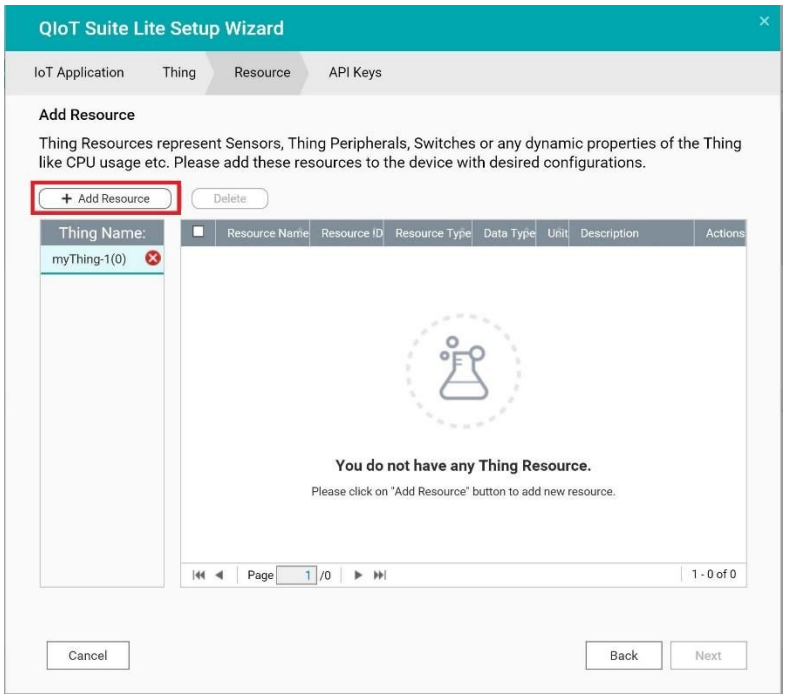


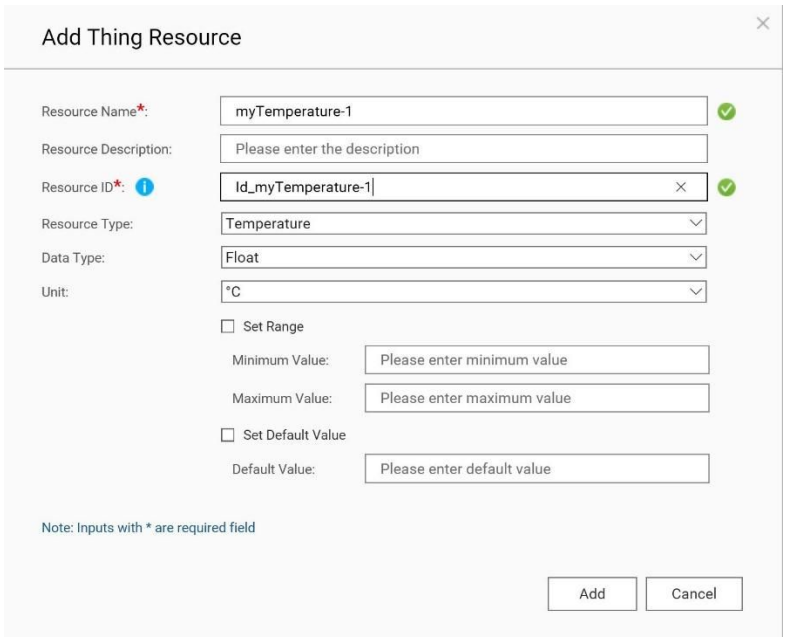


Please provide IP address, User Name, and Password of your device, then click Connect icon. QIoT Suite Lite will check the connection with the device. After the connection is verified, please click **Next**.

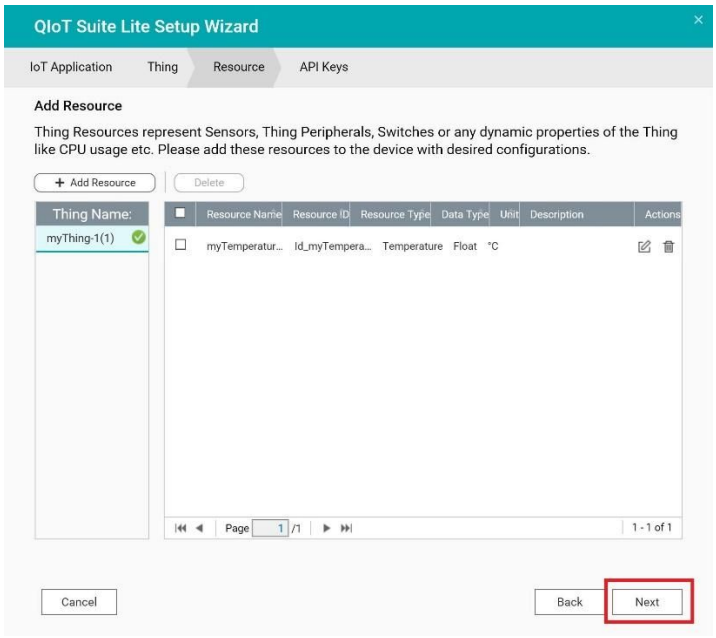


- In **Resource** tab, click on **Add Resource**. Give name and ID for the sensor you use into **Resource Name and Resource ID**. Please be noted that Resource ID will be used to create a Topic in the QIOT Broker. This ID should be unique for the device and no duplicates should be allowed for the same device.

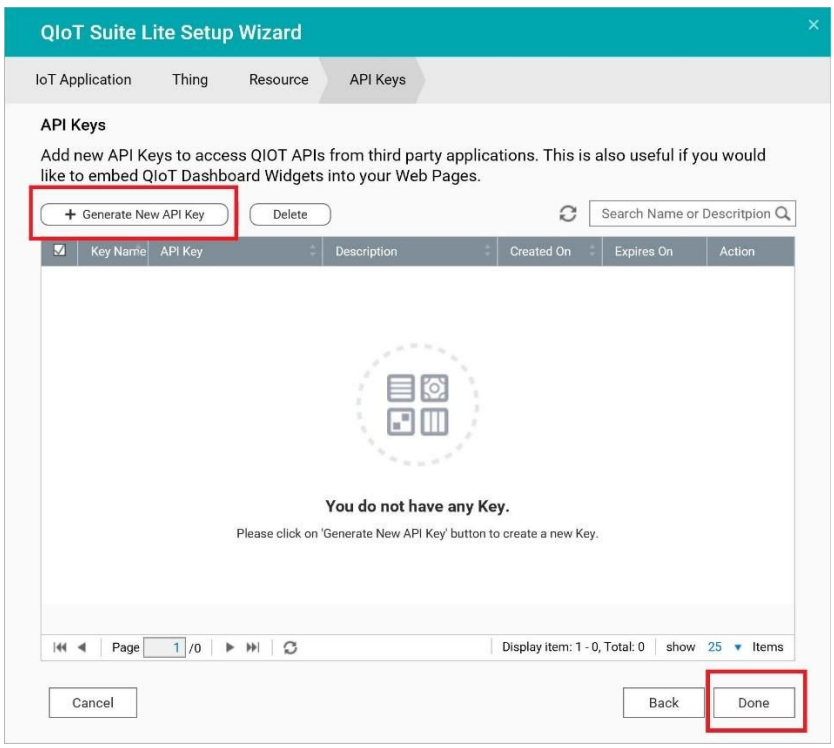

QIoT Suite Lite Setup Wizard
IoT Application
Thing
Resource
API Keys
Add Resource
Thing Resources represent Sensors, Thing Peripherals, Switches or any dynamic properties of the Thing like CPU usage etc. Please add these resources to the device with desired configurations.
+ Add Resource
Delete
Thing Name:
myThing-1(0)
Resource Name
Resource ID
Resource Type
Data Type
Unit
Description
Actions
You do not have any Thing Resource.
Please click on "Add Resource" button to add new resource.
Page 1 /0
1 - 0 of 0
Cancel
Back
Next


Add Thing Resource
Resource Name*:
myTemperature-1
Resource Description:
Please enter the description
Resource ID*:
Id_myTemperature-1
Resource Type:
Temperature
Data Type:
Float
Unit:
°C
Set Range
Minimum Value:
Please enter minimum value
Maximum Value:
Please enter maximum value
Set Default Value
Default Value:
Please enter default value
Note: Inputs with * are required field
Add
Cancel

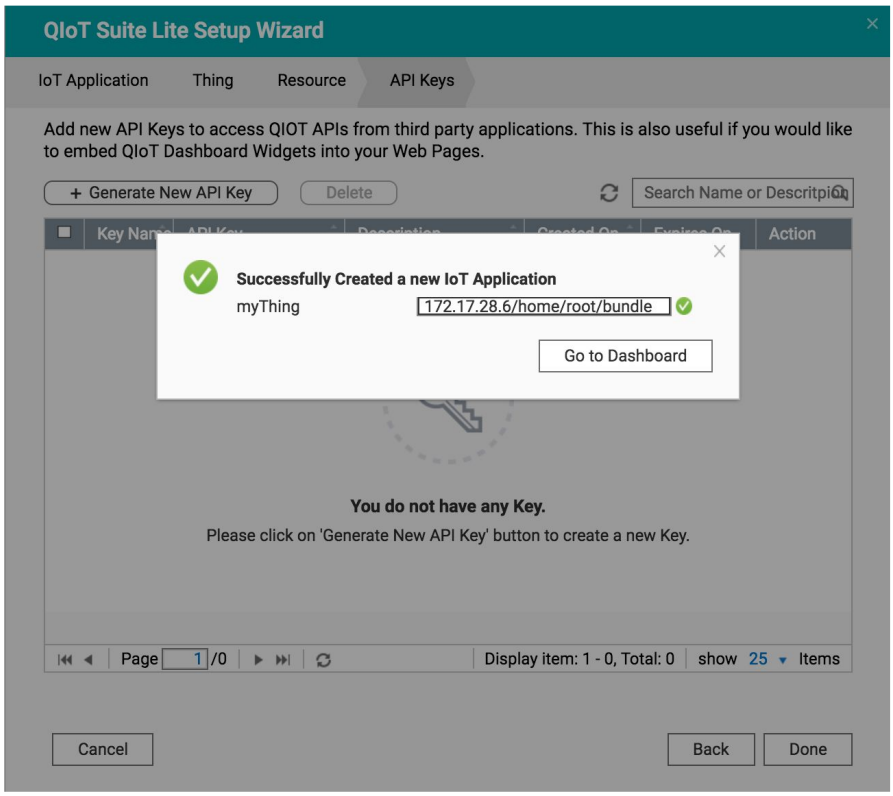
Click **Next** after you add all the resources (sensors) on your device.



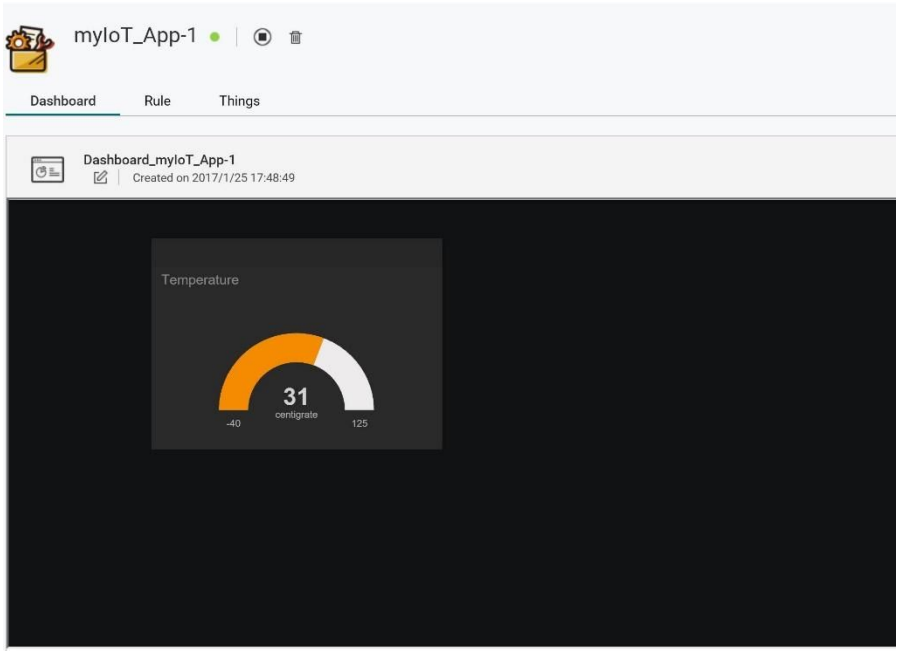
- In API Keys tab, click on **Generate New API Key** if you would like to embed QIoT dashboard widgets into your web pages or access QIoT APIs from third party applications. Click on **Done**.



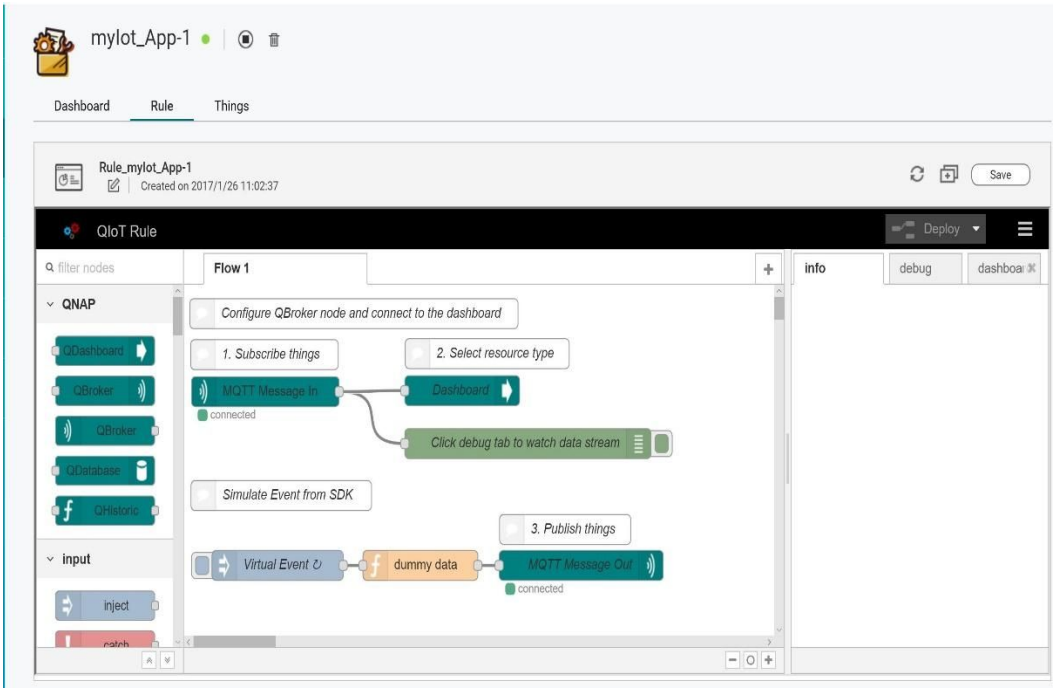
Your IoT application is created successfully. Python sample codes and related files (certificate, resource information) have been upload to the specified path on your device.



- A sample dashboard is created.

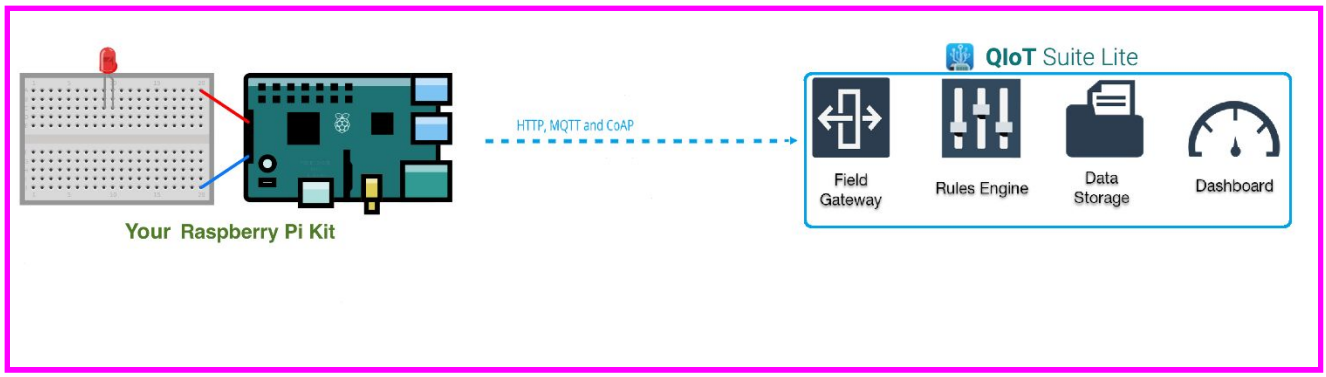


You may go to **Rule** tab to define the flow or rule about how to process the data sent from the device, and how to present in dashboard.


mylot_App-1
Dashboard
Rule
Things
Rule_mylot_App-1
Created on 2017/1/26 11:02:37
Save
QIoT Rule
Deploy
filter nodes
Flow 1
info
debug
QNAP
QDashboard
QBroker
QBroker
QDatabase
QHistoric
input
inject
Configure QBroker node and connect to the dashboard
1. Subscribe things
2. Select resource type
MQTT Message In
connected
Dashboard
Click debug tab to watch data stream
Simulate Event from SDK
3. Publish things
Virtual Event
dummy data
MQTT Message Out
connected

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

In this lesson, you generate certificate from QIoT Suite Lite, download SDK, and connect Arduino Yun to QIoT Suite Lite.



3.1 Connect to QIoT Suite.

- On your Arduino Yun, open Terminal application.
- Go to the directory where QIoT Suite Lite uploads sample codes to.

```
root@arduino:~# cd /home/{{user}}/bundle
// mqtt
root@arduino:~# pip install paho-mqtt
// http
root@arduino:~# pip install requests
// coap
root@arduino:~# pip install coapthon
```

```
root@arduinoyun:/home/root/bundle# pip install paho-mqtt
Requirement already satisfied: paho-mqtt in /usr/lib/python2.7/site-packages/paho_mqtt-1.2-py2.7.egg
root@arduinoyun:/home/root/bundle#
```

- Edit the sample code for resourceid (topic name).

```
while 1:
    """
        about ./res/resourceinfo.json
        {
        .. ~
        .. "resources": [
        .. .. {
        .. .. .. .. ...
        .. .. .. .. "resourceid": "temp",
        .. .. .. .. "topic": "qiot/things/admin/abccccc/temp",
        .. .. .. .. ...
        .. .. ..}
        .. ]
        }
        TODO: you could replace "temp" by any resource id set form QIoT Suite Lite
    """
    connection.publish_by_id("temp", str(random.randint(0, 41)))
    """
        or publish by resource topic
        TODO: you could replace "qiot/things/admin/edison/temp" by any Topic form QIoT Suite Lite like following
        connection.publishByTopic("qiot/things/admin/edison/temp", getRandomInt(0, 50));
    """
    time.sleep(1)
~
```

- Run the sample application.

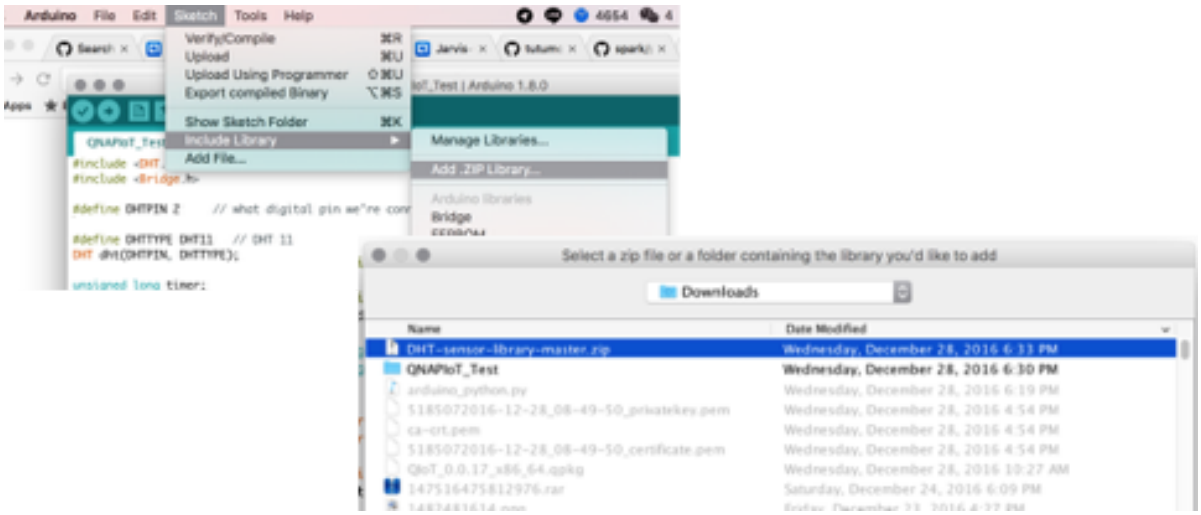
  root@arduino:~# **python mqtt.py**

3.2 Deploy Arduino Yun ino code and dht11 library

- Download the sample code (dht11.ino and DHT-sensor-library-master.zip) at GitHub: Sample Code

- DHT-sensor-library-master.zip comes from https://github.com/adafruit/DHT-sensor-library

- Open Arduino IDE. Find “DHT-sensor-library-master.zip” file and include it.



- Open the “dht11.ino” by Arduino IDE and upload your Arduino sample code.

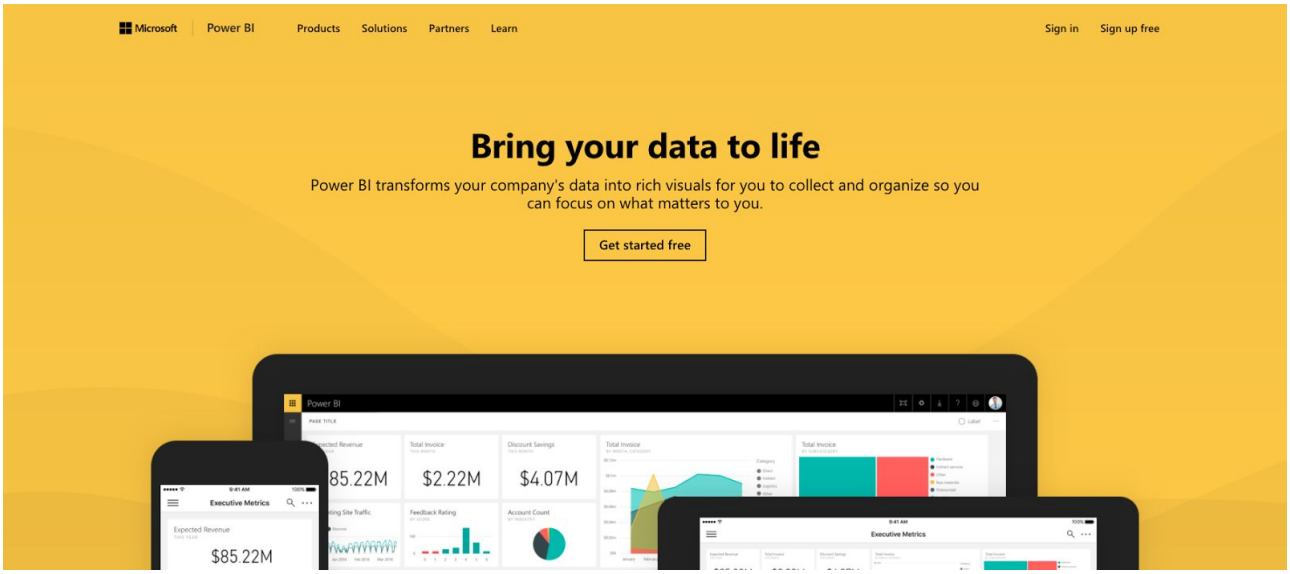
- Run the dht11 sample application.

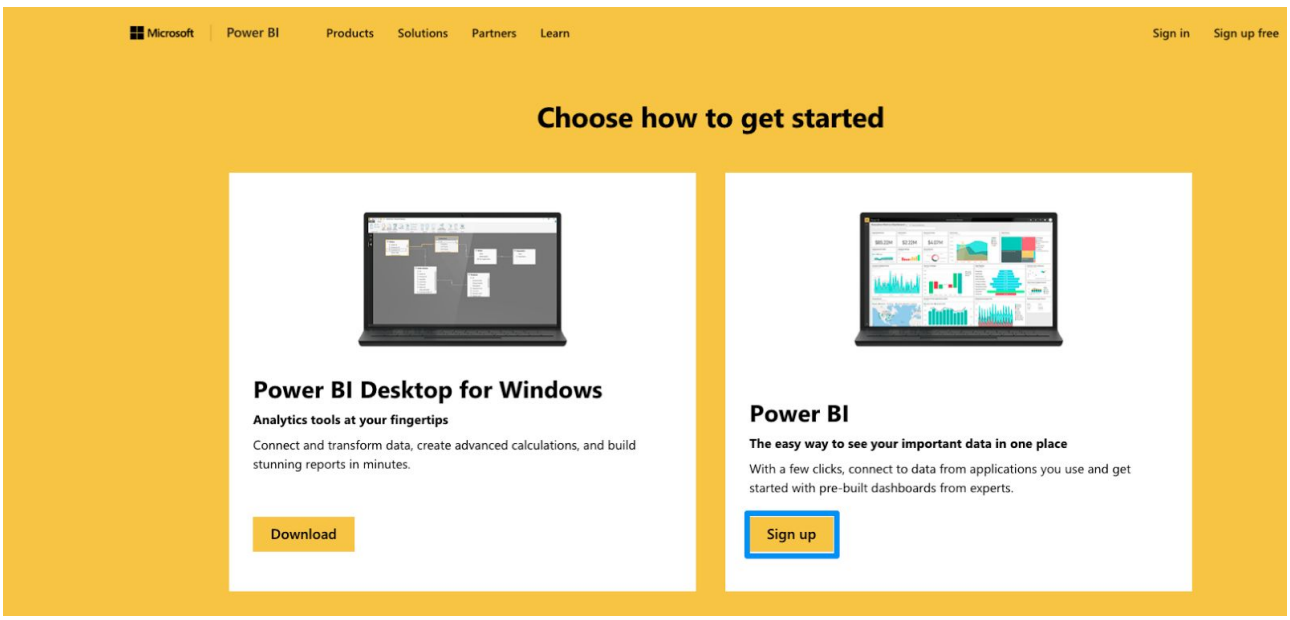
  root@arduino:~# **python dht11.py**

Lesson 4: Integrate Power BI

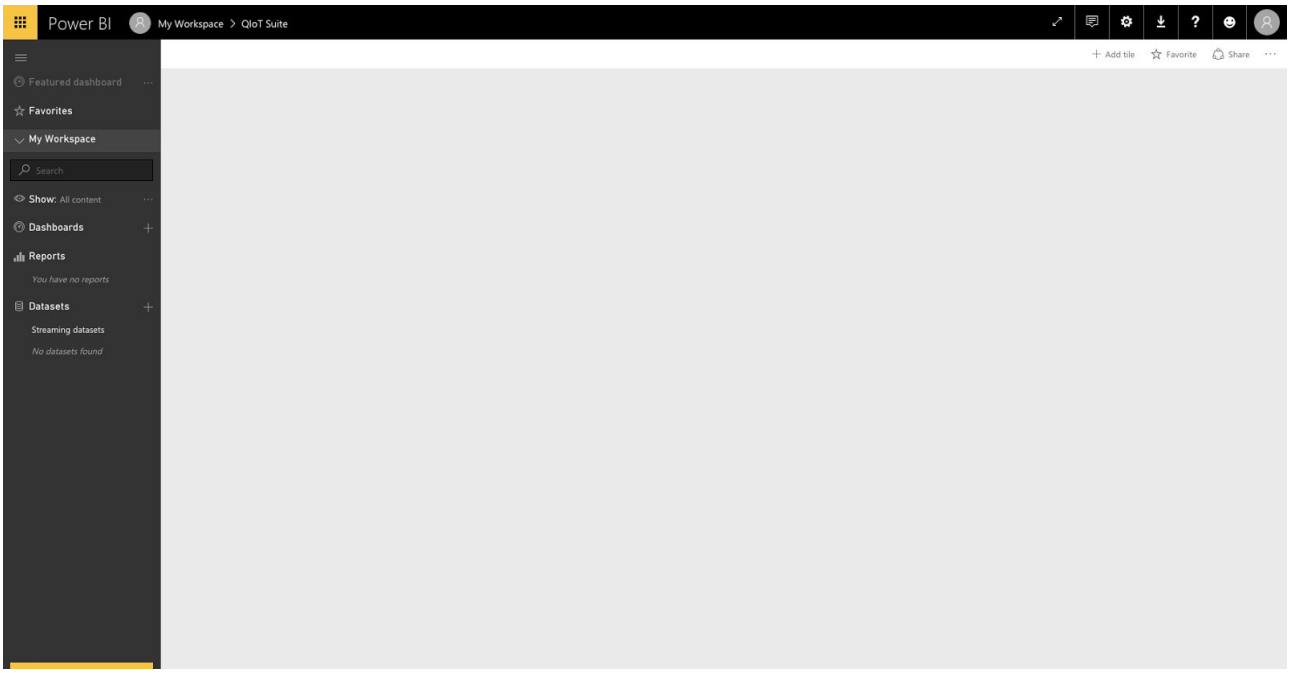
4.1 Get your first Power BI account

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



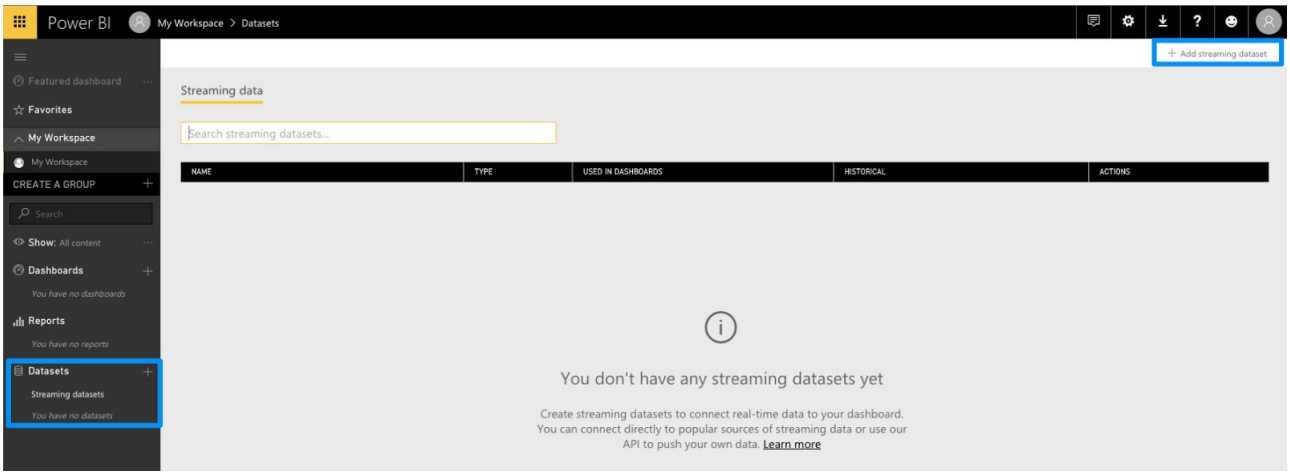


- After a sequence of registration, the page will lead you to below page

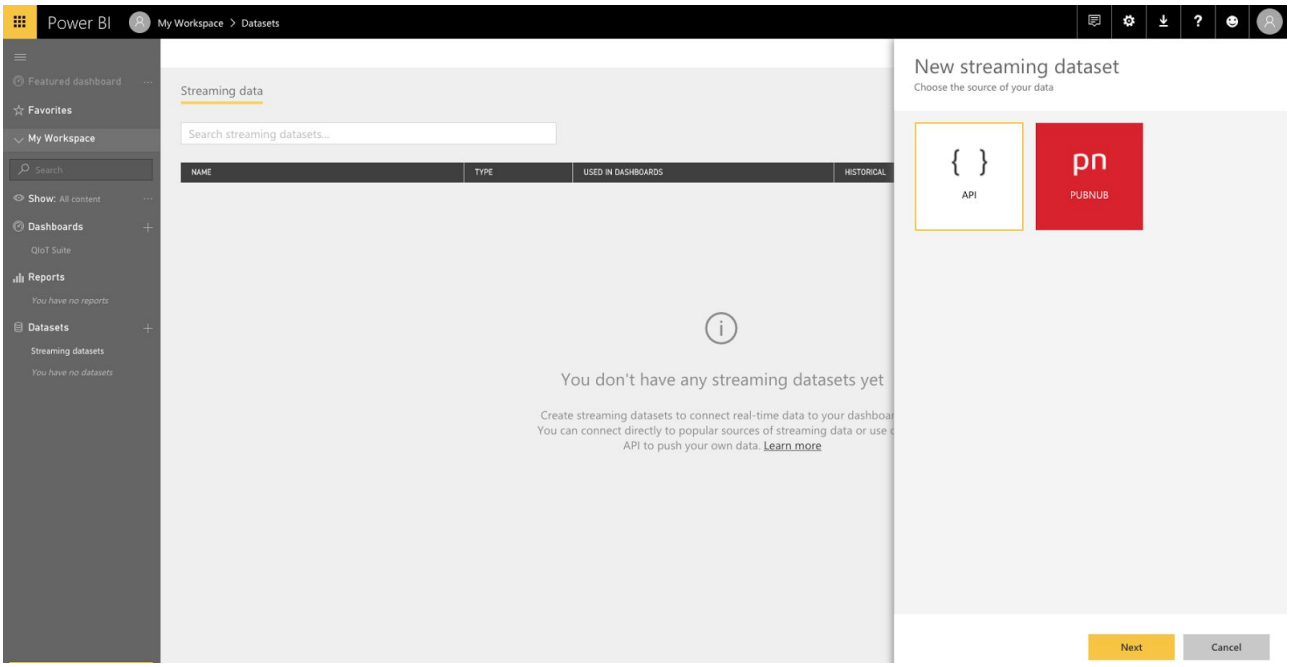


4.2 Setup your streaming dataset API

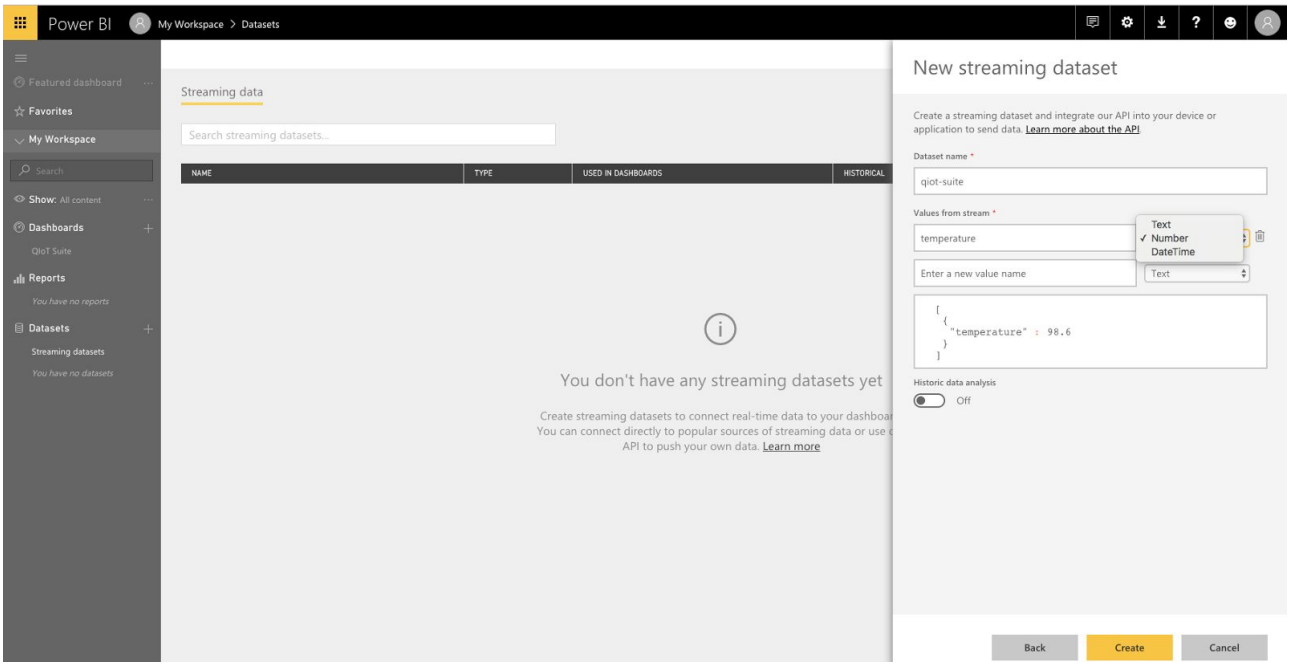
- Go to "**Datasets -> Streaming datasets**" section at left menu, and click the " **+ Add streaming dataset**" button at right-top corner.



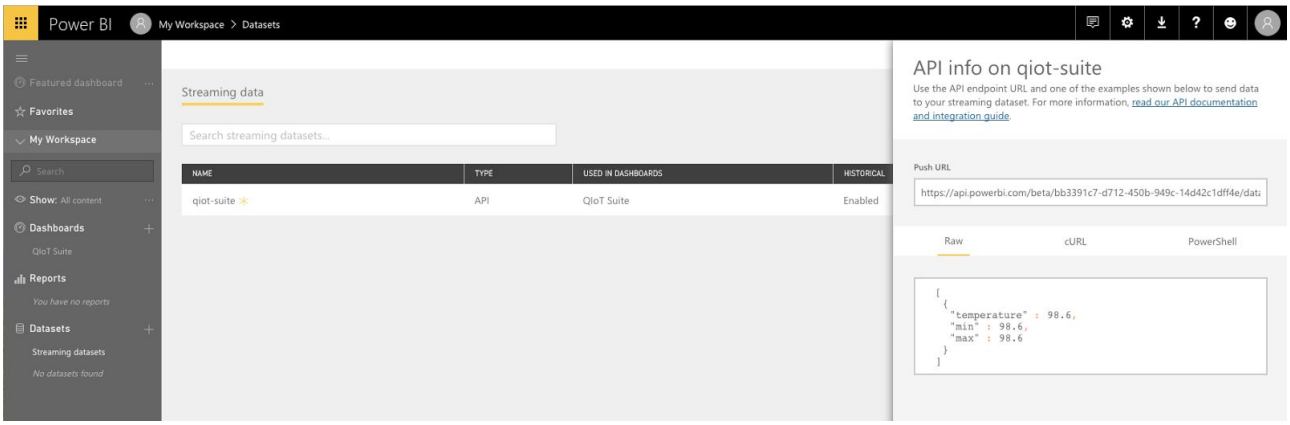
- Select "**API**" as your source of iot data, and click the "**Next**" button.



- Define your values from stream, and you will get a result of JSON in textbox. We will use this JSON template later to push data to IoT application. Click the "**Create**" button to finish flow of push API creation.

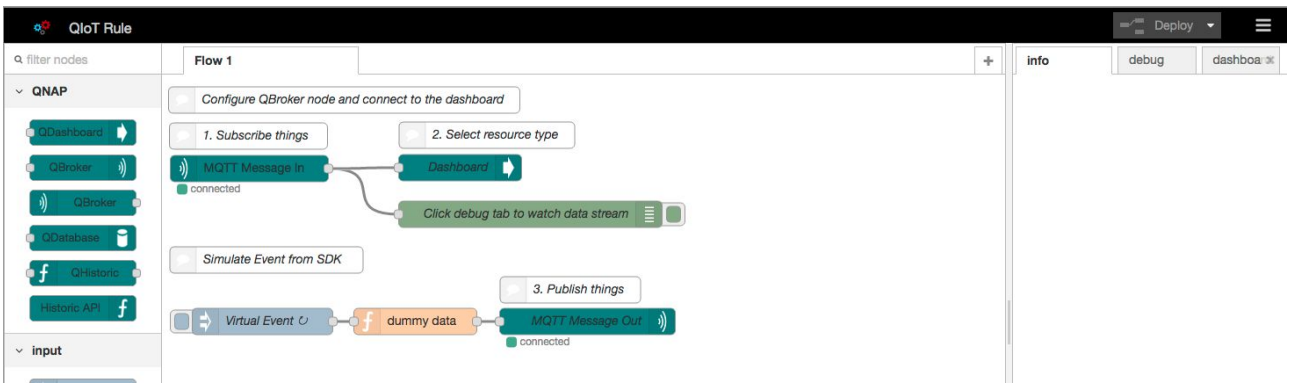


- Once you successfully create your data stream, you get REST API URL which IoT application can call using POST request to push your live data to streaming data dataset you created.

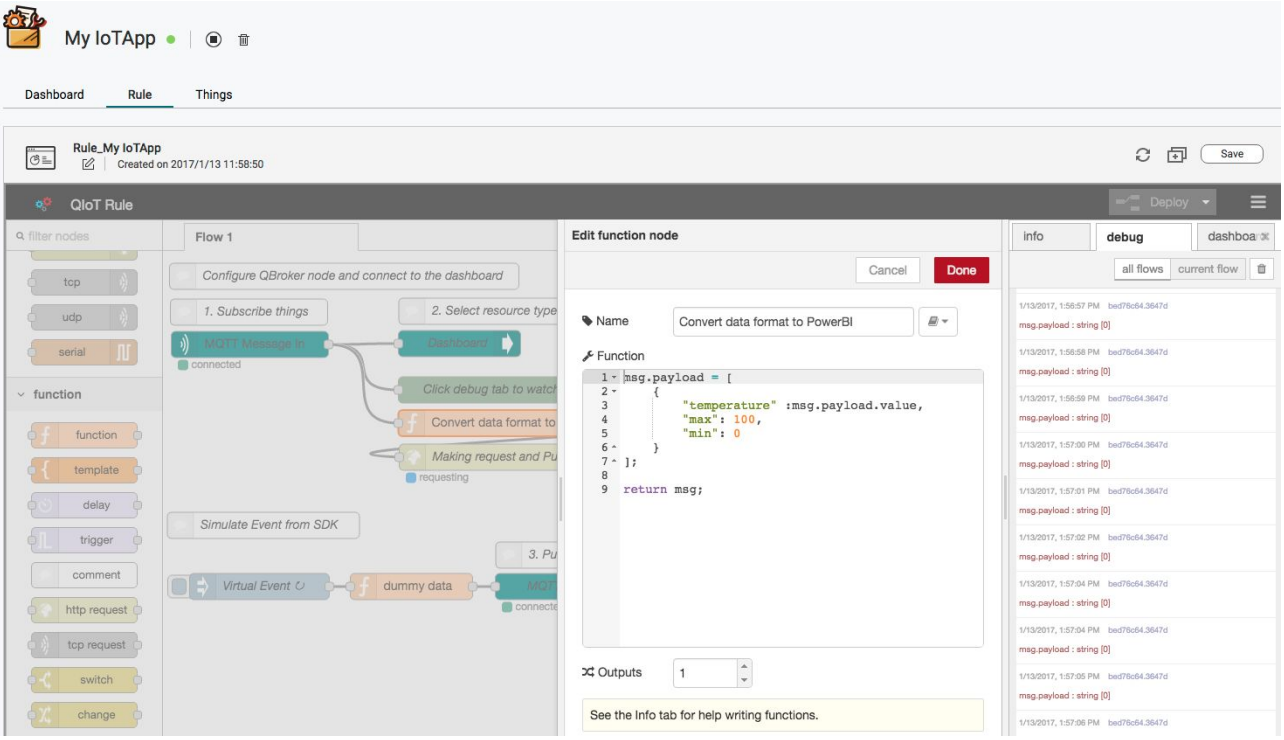


4.3 Configure Node-RED's nodes in IoT application

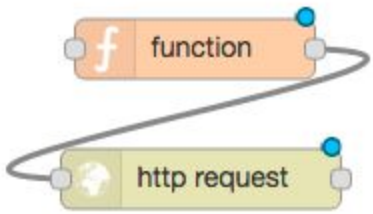
- Create IoT application in QIoT suite. The following one is your first node-red flow, and then you can start to create your own IoT flow. more node-red information can be found in "https://nodered.org/".



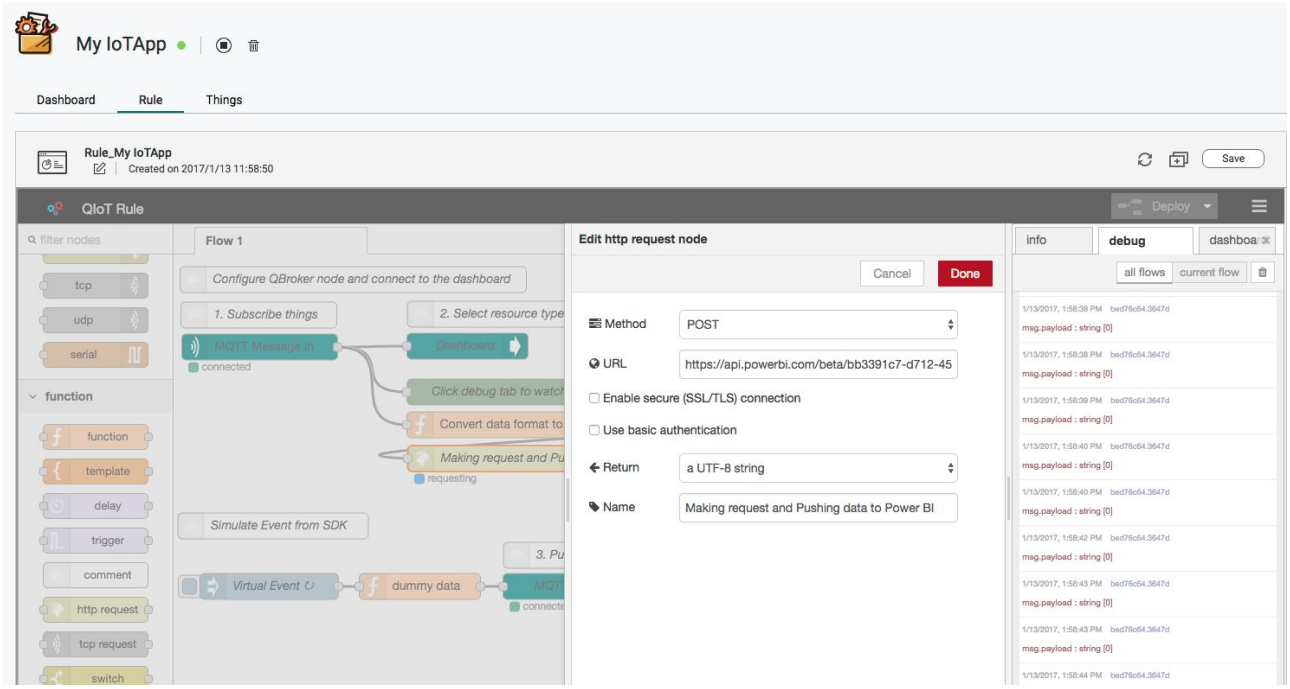
- Before you start to push live data to Power BI. We need a "function" node to convert IoT data to streaming data dataset. Here you can replace msg.payload to your JSON dataset.



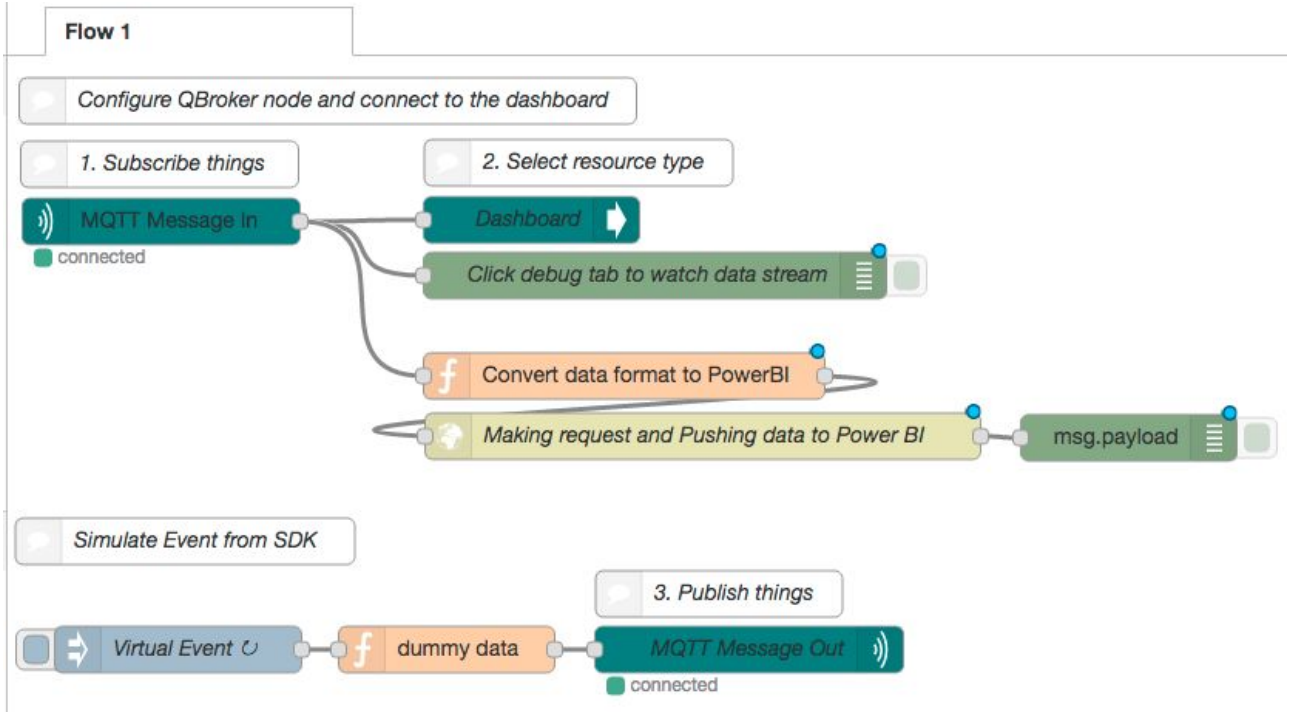
- We need a “http request” node to help us to push live data to Power BI. Just drop and drag “http request” node and connect to tail of “function“ node.



- 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 “**Deploy**” button to save changes.

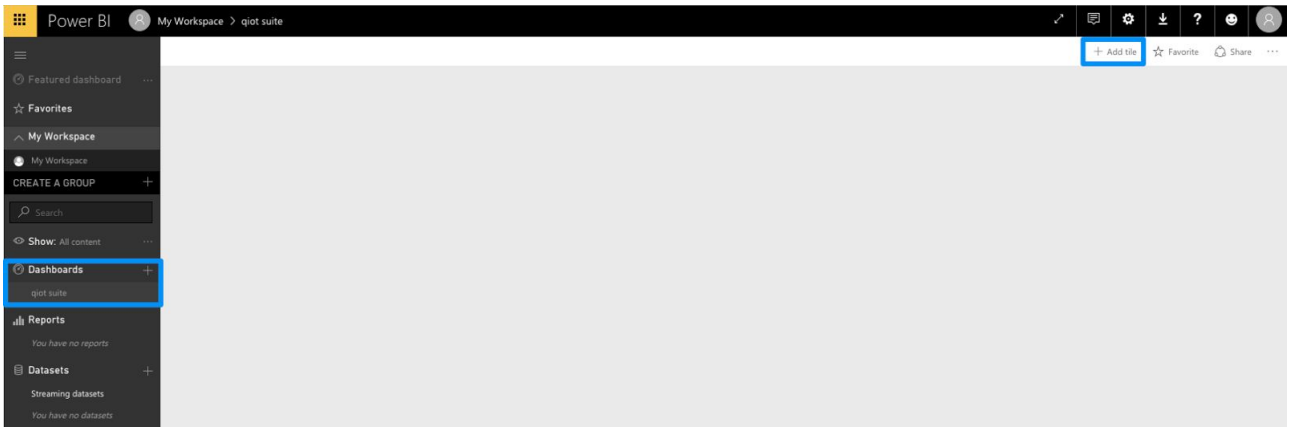


- Finally, your node-red flow will look like below one.

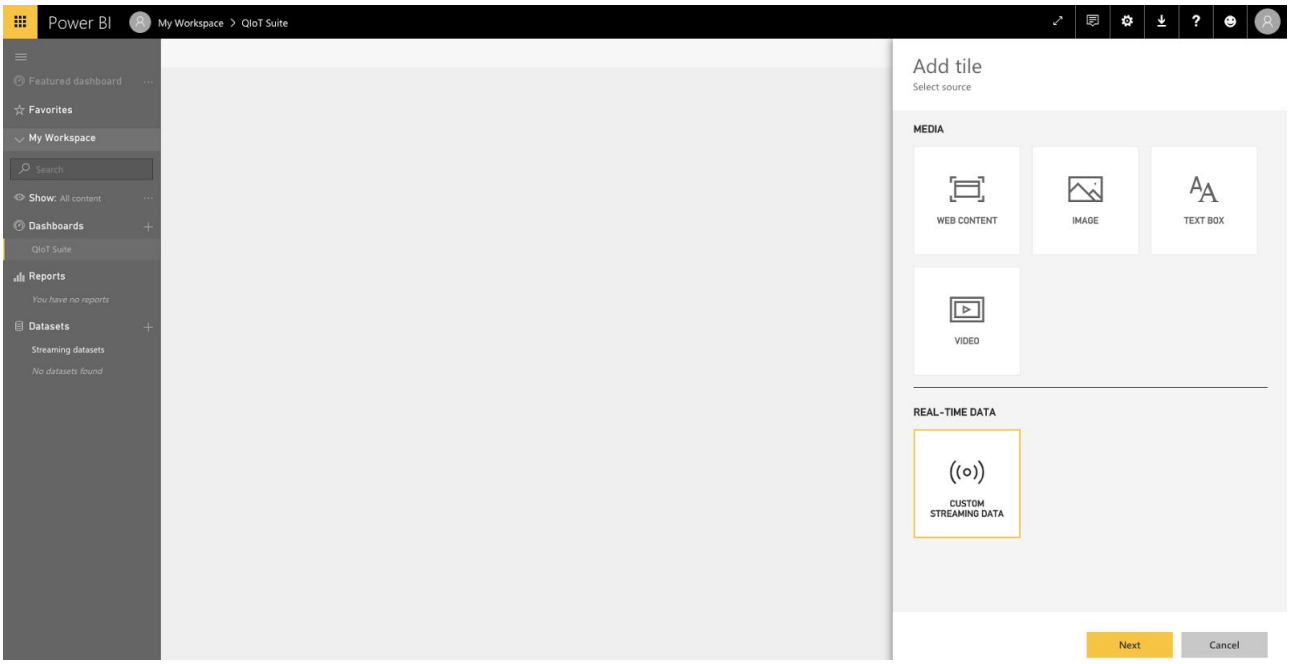


4.4 Add tile to display real-time data

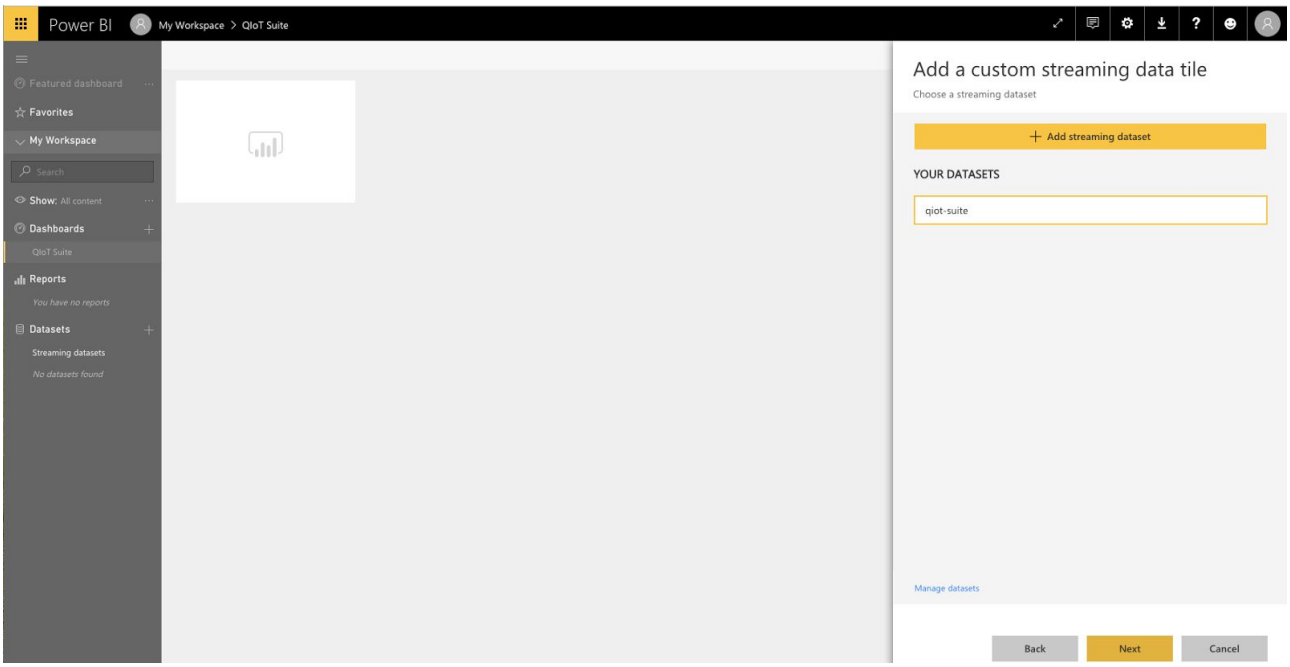
- Go to "**Dashboards** +" to create your first dashboard, then click the "**+ Add tile**" button to configure a widget.



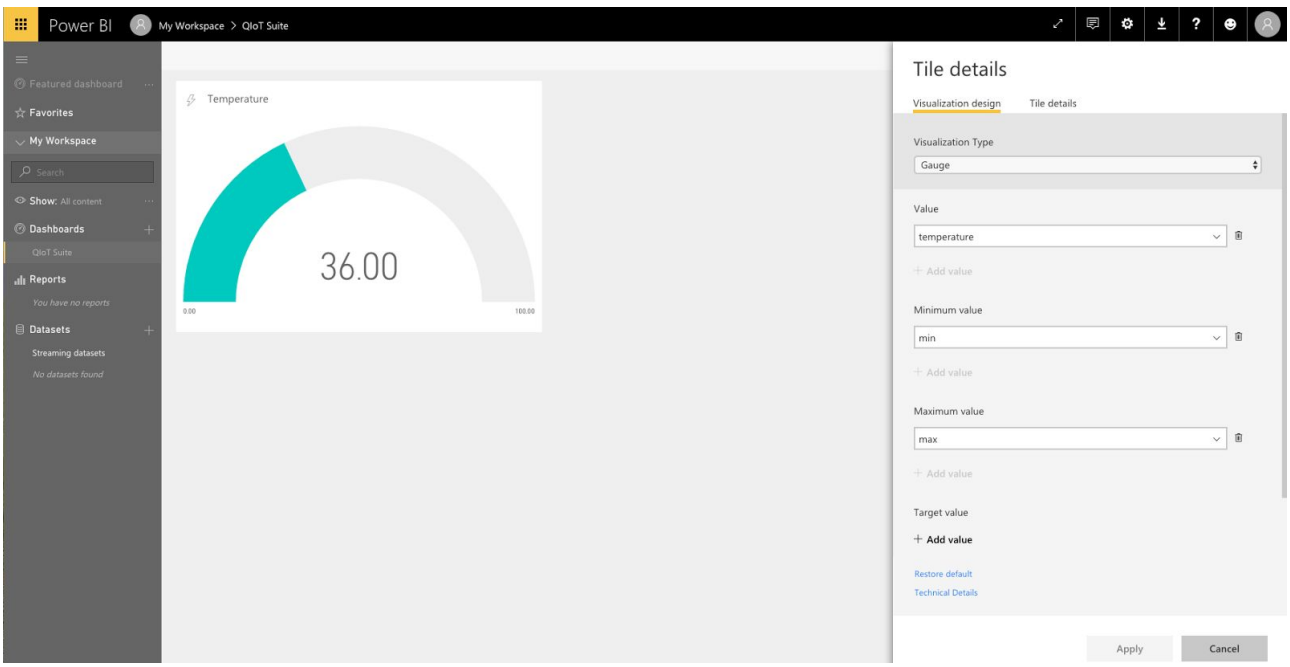
- Select "**CUSTOM STREAMING DATA**" and then select the "**Next**" button.



- Select datasets and then click the "**Next**" button.



- 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...
            arduino-yun/
                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
    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
	...
	}