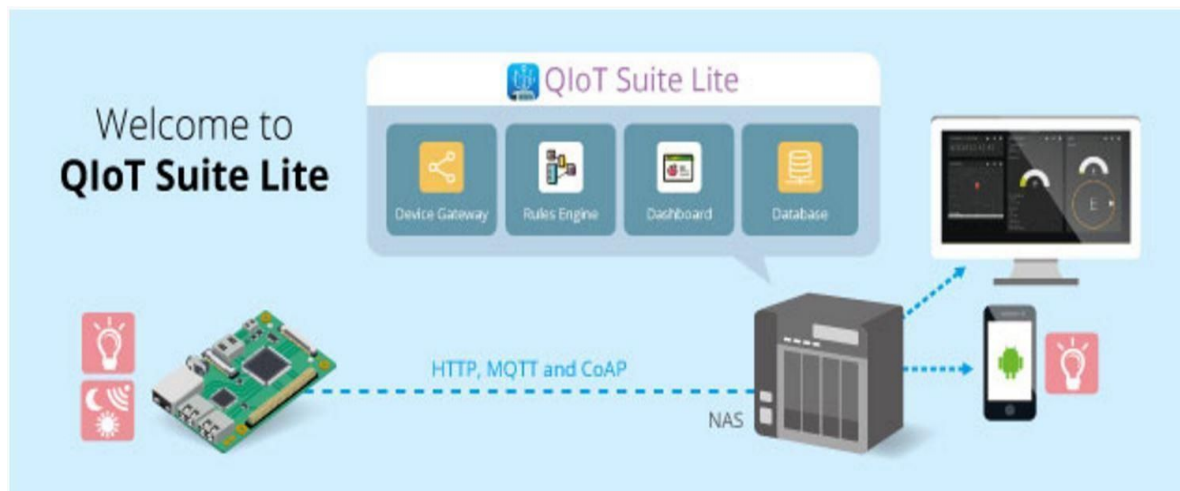


# Get started with Raspberry Pi (Nodejs)

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



## Lesson 1: Configure your device

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

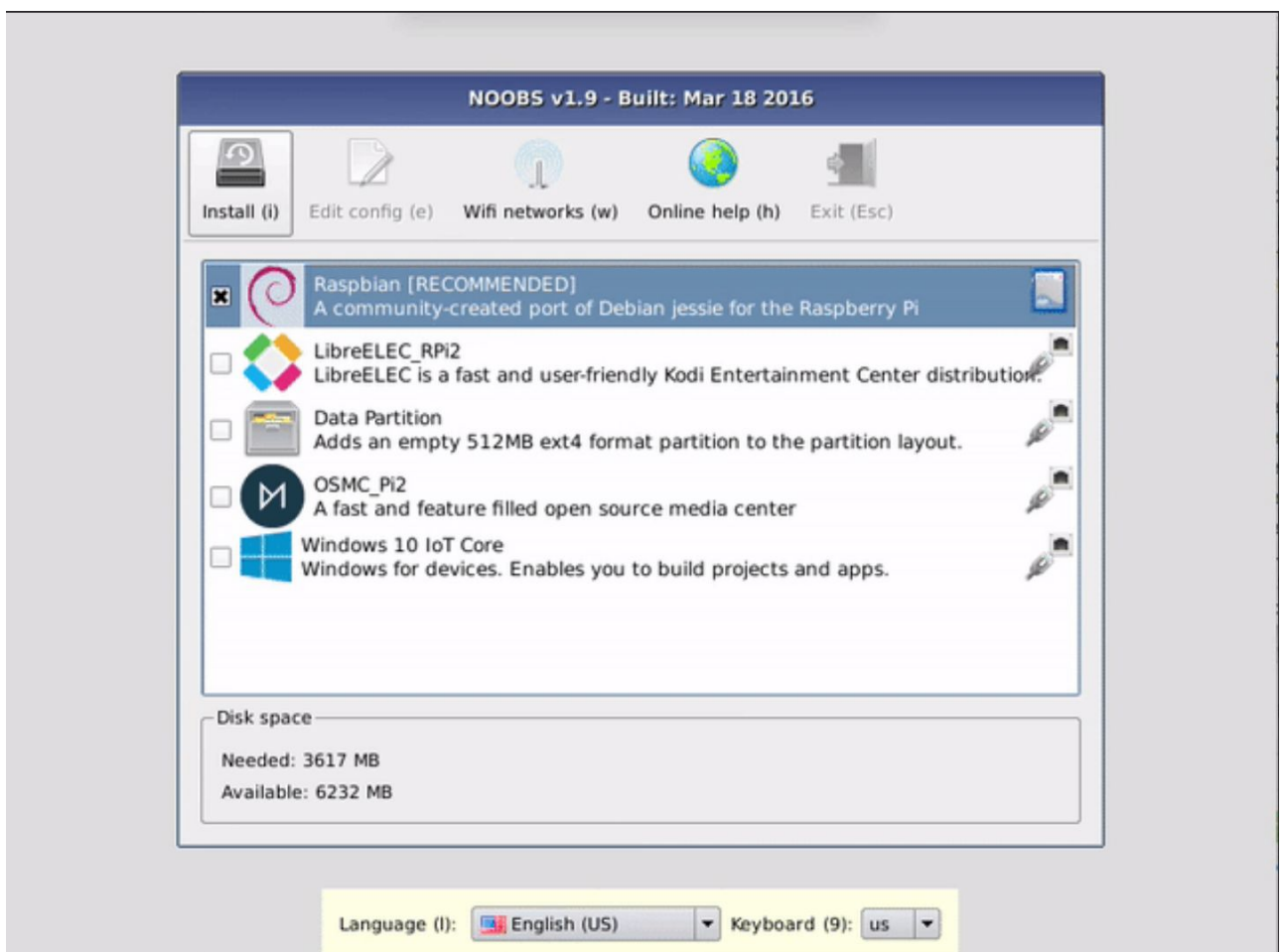
### 1.1 What will you need

- A Raspberry Pi
- SD card : an 8GB class 4 SD card is recommended, ideally preinstalled with NOOBS.
- A HDMI television or monitor : You will need to connect your Raspberry Pi to a display, which means you'll need an HDMI-enabled screen of some kind.
- Keyboard and mouse : Any standard USB and mouse will work with your Raspberry Pi.
- Power Supply : The Pi is powered by a USB Micro power supply (like most standard mobile phone charger). You'll need a good-quality power supply that can

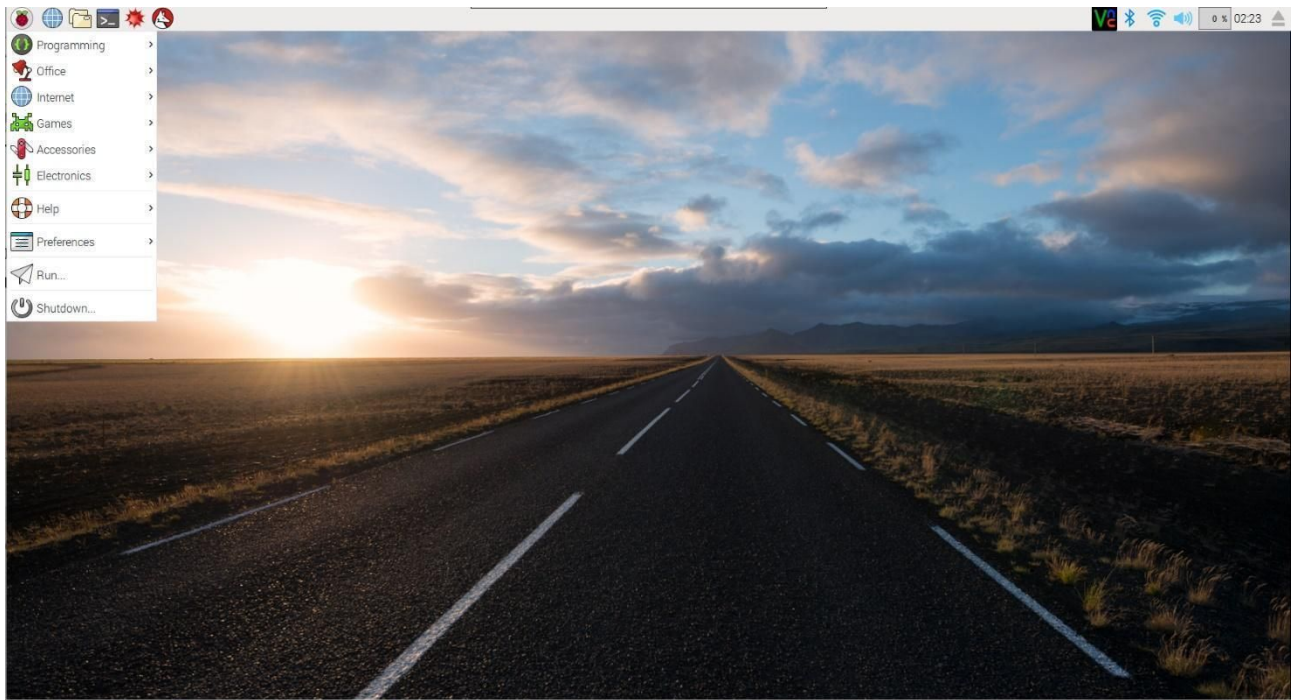
supply at least 2A at 5V for the Model 3B, or 700mA at 5V for the earlier, lower powered models.

## 1.2 Set up Raspbian

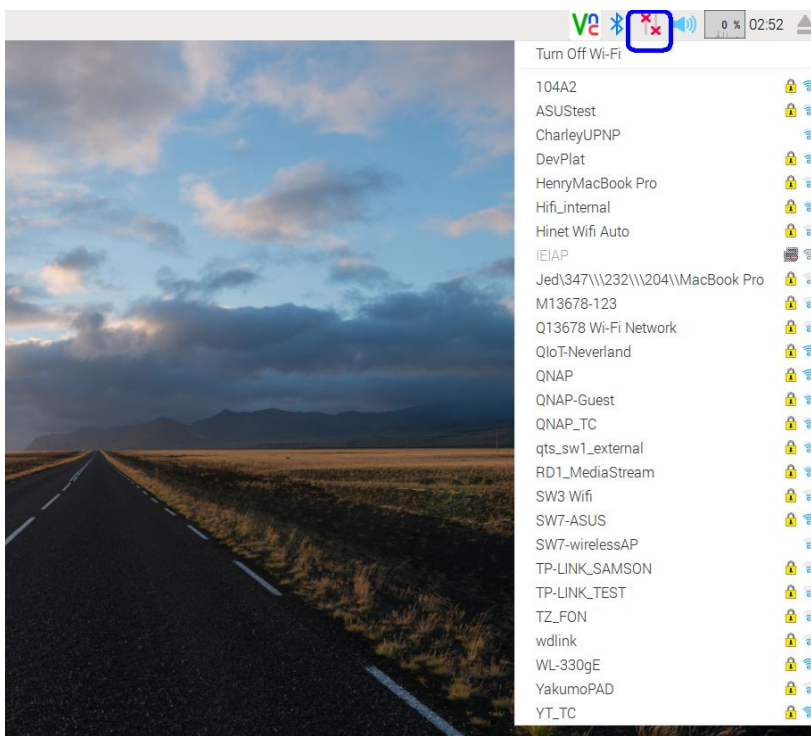
- Put the SD card containing extracted NOOBS files into Raspberry Pi
- Connect keyboard, mouse, and HDMI monitor to the Raspberry Pi, then plug in your power adapter. The Raspberry Pi does not have a power switch, so once you connect the power adapter, it'll turn on all by itself.
- A simple menu will ask which OS you want to install. At the bottom of the screen, choose your language and keyboard layout for your region. Click the checkbox next to Raspbian, then click Install.



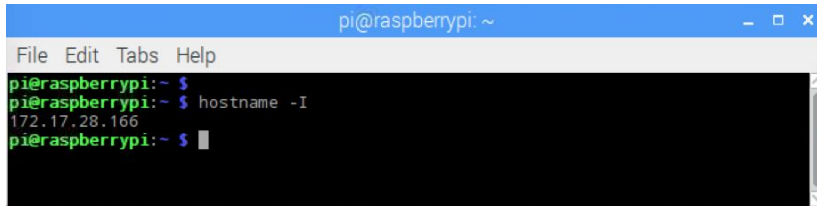
- Now, let NOOBS run the installation process, which may take 10 or 20 minutes. When it's complete, it will restart and send you straight into the Raspbian desktop, where you can configure everything else.



- Configure WiFi – In the Desktop environment locate the Wireless Network icon in the top right hand side and click on the icon to see the list of available WiFi networks to connect to. Select your WiFi SSID and enter correct password, then you should be able to connect to your WiFi.



- In order to connect to your Raspberry Pi from another machine, you need to know the Pi's IP address. Using the terminal (Ctrl + Alt + t to open Terminal), simply type `hostname -I` which will reveal your Pi's IP address.



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~ $  
pi@raspberrypi:~ $ hostname -I  
172.17.28.166  
pi@raspberrypi:~ $
```

- More Raspberry Pi setup guide, please refer to <https://www.raspberrypi.org/learning/software-guide/>

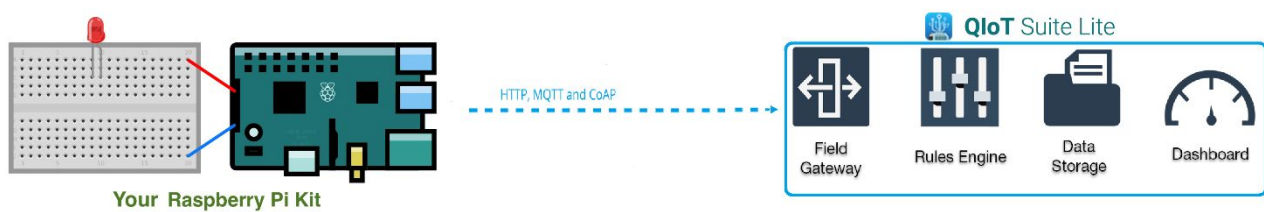
## 1.3 Install Nodejs and required libraries

- Press Ctrl + Alt + t to open Terminal. Install node.js

```
pi@raspberrypi:~ $ sudo apt update  
pi@raspberrypi:~ $ sudo apt install nodejs
```

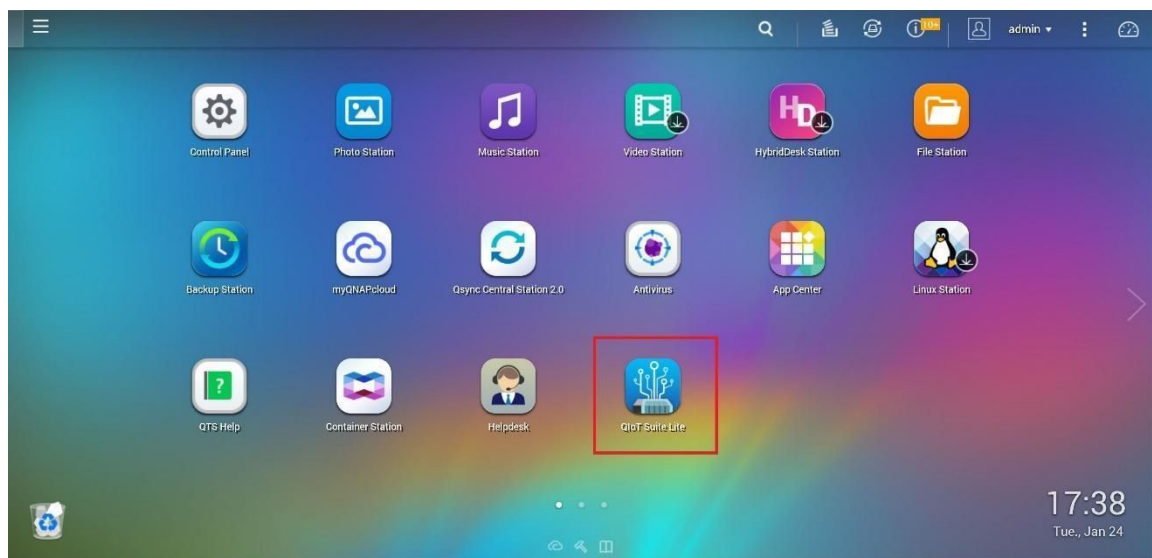
# Lesson 2: Create your device in QIoT Suite Lite

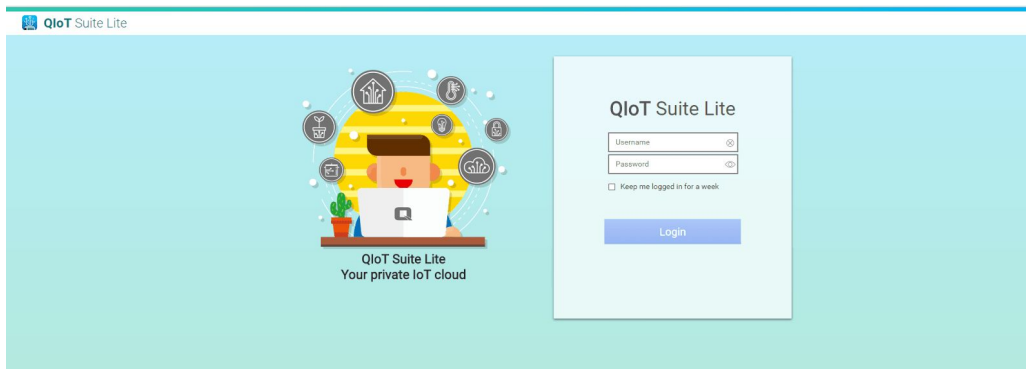
In this lesson, you provision your QNAP QIoT Suite Lite software, and create your first device in QIoT Suite Lite.



## 2.1 Install QIoT Suite Lite

- Go to QNAP App Center and download QIoT Suite Lite application.
- Launch and log in QIoT Suite Lite software. Use Nas admin and password to login.





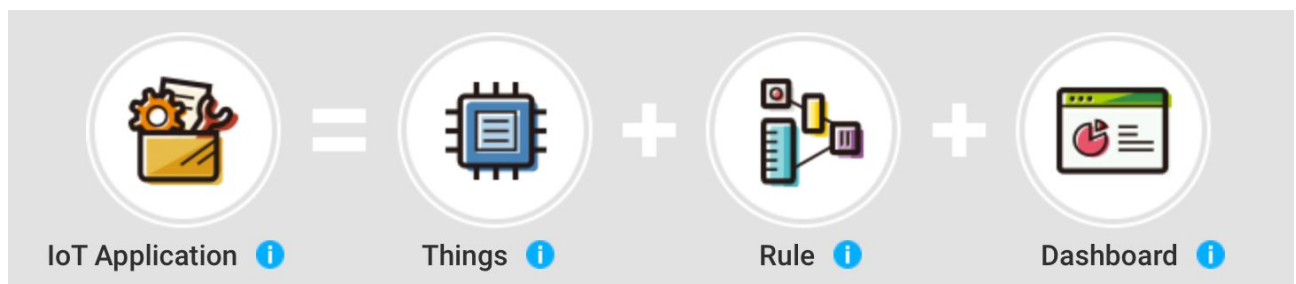
## 2.2 Create a new IoT application

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.

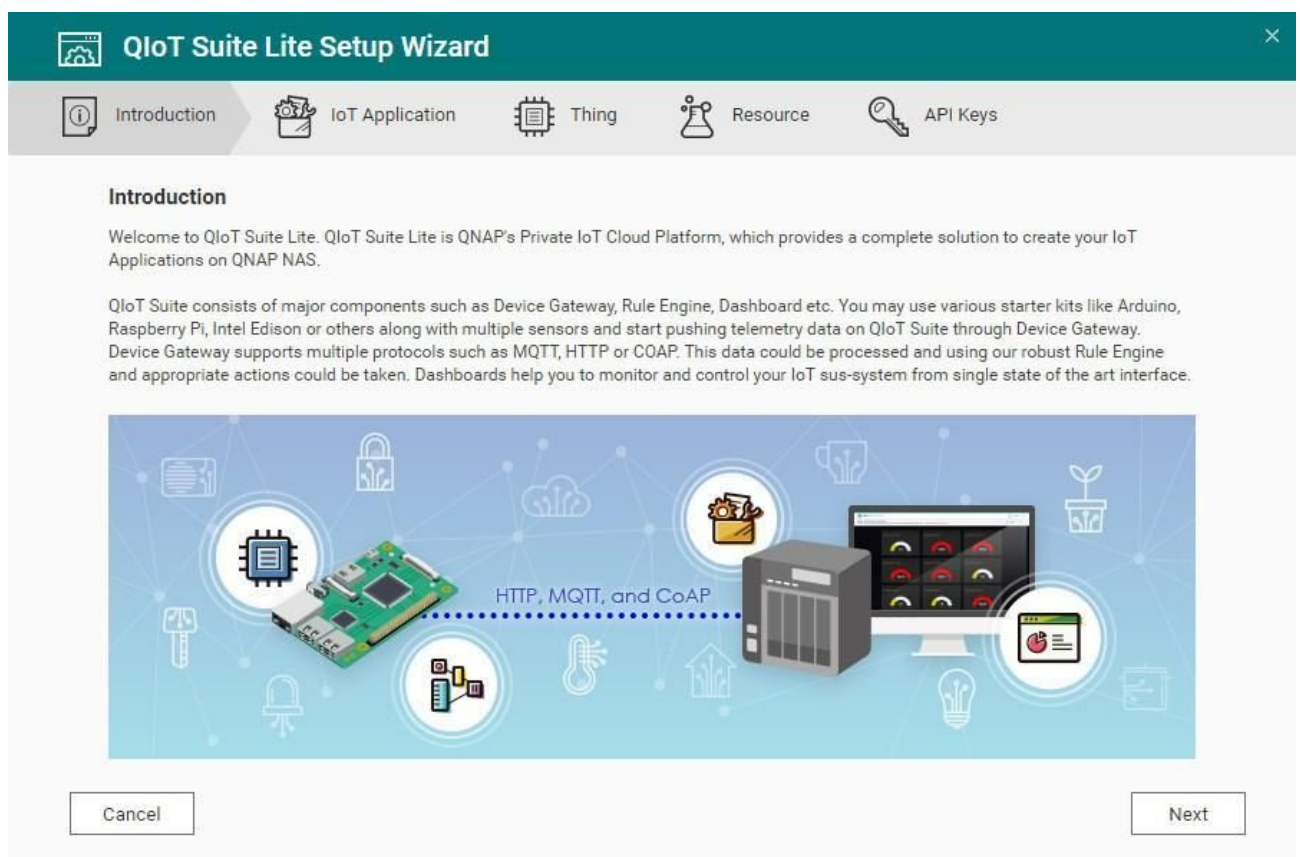
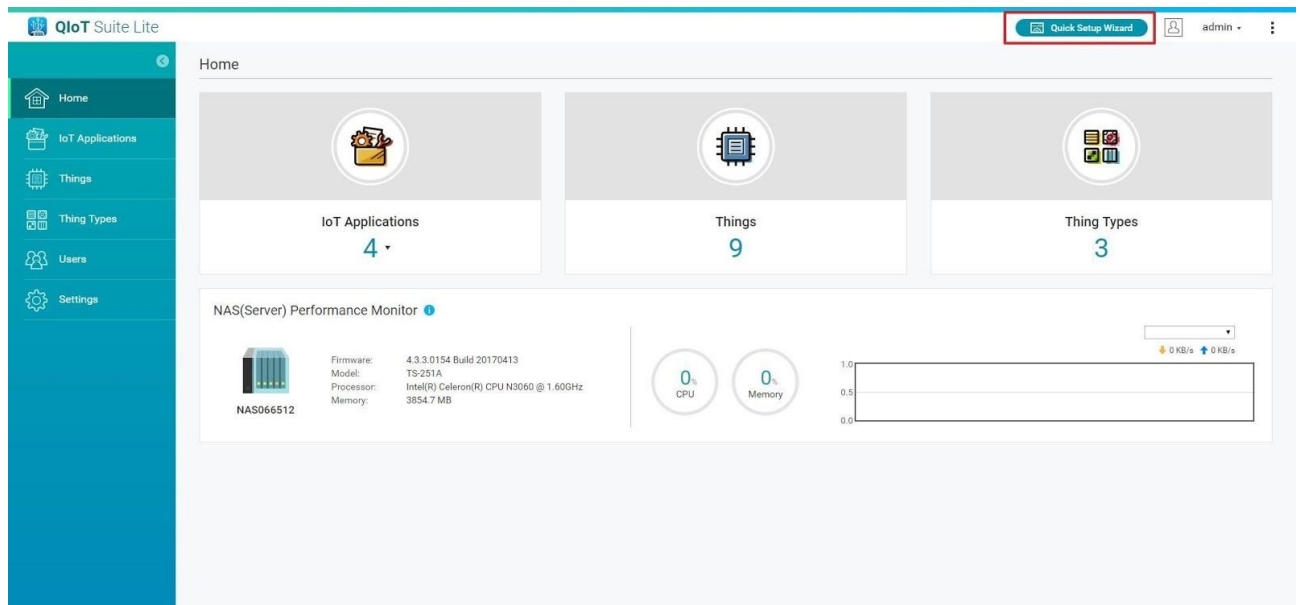
With Dashboard, you can turn your data processing efforts into analytics and reports that provide real-time insights into your business.

All these elements provide user a complete IoT Application environment.



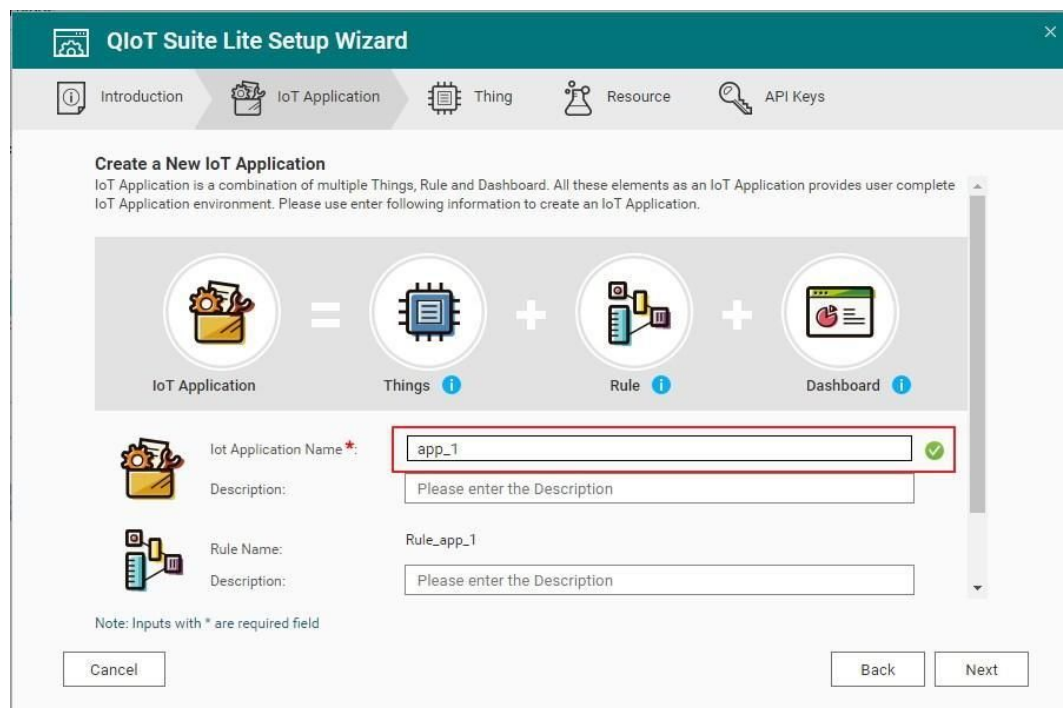
- If this is your first time to use QIoT Suite Lite, QIoT Suite Lite provides a wizard to help you quick setup a IoT application.
- Click “Quick Setup Wizard” to start quick setup wizard . After you read the QIoT Suite Lite introduction in pop window, click Next button.





- Create a New IoT application
  - Enter IoT Application name, e.g., app\_1.
  - Rule name and Dashboard name will be generated automatically based on the name of IoT Application you fill in.

- Click “Next” to complete create a new IoT application



The screenshot shows the 'Create a New IoT Application' step of the QIoT Suite Lite Setup Wizard. The wizard has five steps: Introduction, IoT Application (current), Thing, Resource, and API Keys. A diagram illustrates that an IoT Application is composed of Things, Rule, and Dashboard. Below this, there are input fields for 'IoT Application Name' (with a red asterisk and a green checkmark icon), 'Description', 'Rule Name', and 'Rule Description'. A note states: 'Note: Inputs with \* are required field'. At the bottom, there are 'Cancel', 'Back', and 'Next' buttons.

**QIoT Suite Lite Setup Wizard**

Introduction IoT Application Thing Resource API Keys

**Create a New IoT Application**

IoT Application is a combination of multiple Things, Rule and Dashboard. All these elements as an IoT Application provides user complete IoT Application environment. Please use enter following information to create an IoT Application.

IoT Application = Things + Rule + Dashboard

IoT Application Name \*: app\_1 ✓

Description: Please enter the Description

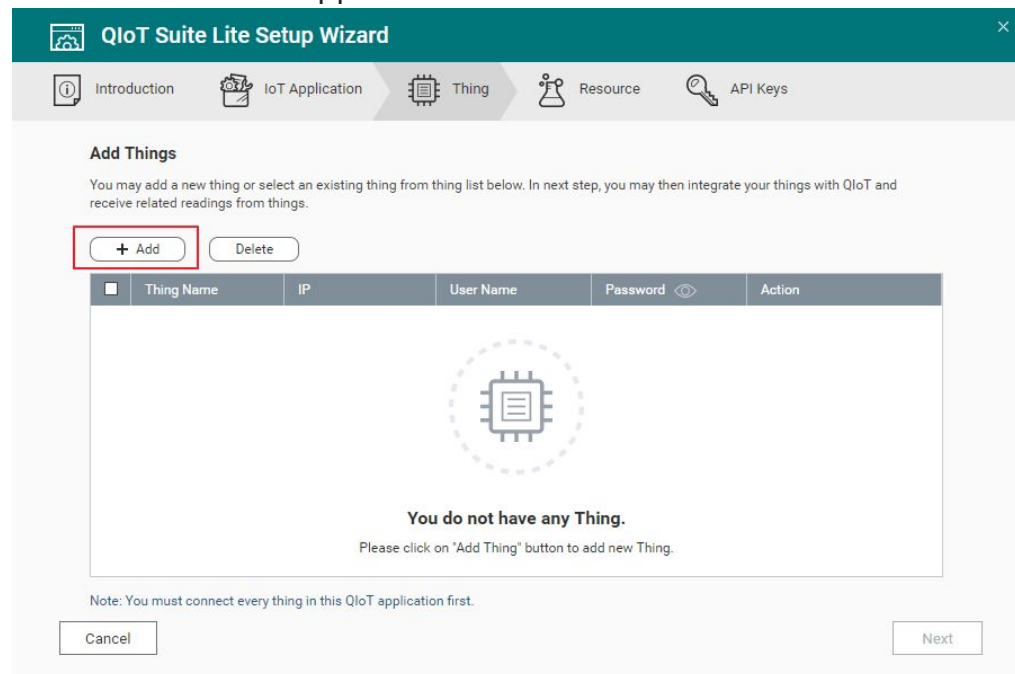
Rule Name: Rule\_app\_1

Rule Description: Please enter the Description

Note: Inputs with \* are required field

Cancel Back Next

- Click “+Add” to add this application’s device.



The screenshot shows the 'Add Things' step of the QIoT Suite Lite Setup Wizard. The wizard has five steps: Introduction, IoT Application (current), Thing, Resource, and API Keys. The text explains that users can add a new thing or select an existing one. There are '+ Add' and 'Delete' buttons. Below them is a table with columns: Thing Name, IP, User Name, Password, and Action. The table is currently empty, and a large dashed circle with a chip icon is in the center. A message states: 'You do not have any Thing. Please click on "Add Thing" button to add new Thing.' A note at the bottom says: 'Note: You must connect every thing in this QIoT application first.' At the bottom, there are 'Cancel' and 'Next' buttons.

**QIoT Suite Lite Setup Wizard**

Introduction IoT Application Thing Resource API Keys

**Add Things**

You may add a new thing or select an existing thing from thing list below. In next step, you may then integrate your things with QIoT and receive related readings from things.

+ Add Delete

Thing Name	IP	User Name	Password	Action
------------	----	-----------	----------	--------

You do not have any Thing.  
Please click on "Add Thing" button to add new Thing.

Note: You must connect every thing in this QIoT application first.

Cancel Next



- After click “+Add ”,In “Add Thing” pop window:
  - Set device’s name (e.g., raspberrypi).
  - Qlot Suite Lite now support Arduino Yun,Raspberry Pi,and Edison ,so you can select “QIoT Supported” thing category and select “Thing Type” is “Raspberry Pi”
  - (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.

**Add Thing** ⓘ

☒ **Create a New Thing**  
Create a thing to represent your device in the QIoT Suite. This step creates an entry in the thing registry or device registry.

☐ **Select from existing Things**  
Select a thing from existing things and associate it with this IoT Application.

---

**Thing Information**

Thing Name\*  ✓

Description:

Thing Category: ⓘ ☒ QIoT Supported ☐ Custom

---

**Thing Type** ⓘ

Thing Type:

---

**Attributes for raspberrypi (Optional):** ⓘ

Note: Inputs with \* are required field

- Please provide IP address, user name, and password of your device, then click “Connect” .After waiting test connection between your device and Qlot Suite Lite success, you could click “Next” to next step.

QIoT Suite Lite Setup Wizard

×

Introduction

IoT Application

Thing

Resource

API Keys

### Add Things

You may add a new thing or select an existing thing from thing list below. In next step, you may then integrate your things with QIoT and receive related readings from things.

+ Add

Delete

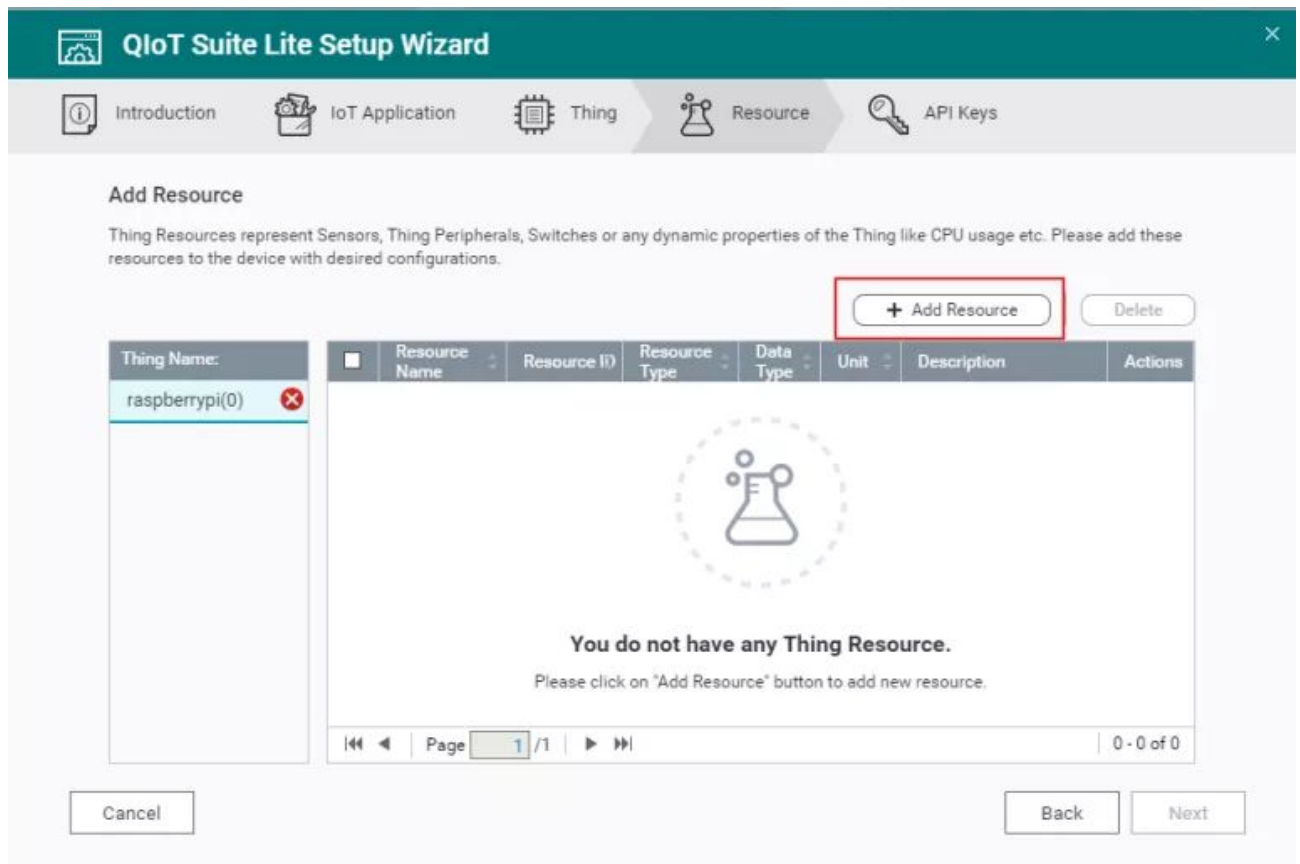
<input type="checkbox"/>	Thing Name	IP	User Name	Password	Action
<input type="checkbox"/>	raspberrypi	172.17.30.148	pi	*****	<div>Connect</div> <div>✓</div> <div>✕</div>

Note: You must connect every thing in this QIoT application first.

Cancel

Next

- In “Resources” step,Click “Add Resource”.



- After click “Add Resource”, In “Add Thing Resource” pop window:
  - Set resource’s name (e.g., temp).
  - 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.

**Add Thing Resource**

Resource Name\*: temp ✓

Resource Description: Please enter the description

Resource ID\*: temp ✓

Resource Type: Temperature ▼

Data Type: Float ▼

Unit: °C ▼

☐ Set Range

Minimum Value: Please enter minimum value

Maximum Value: Please enter maximum value

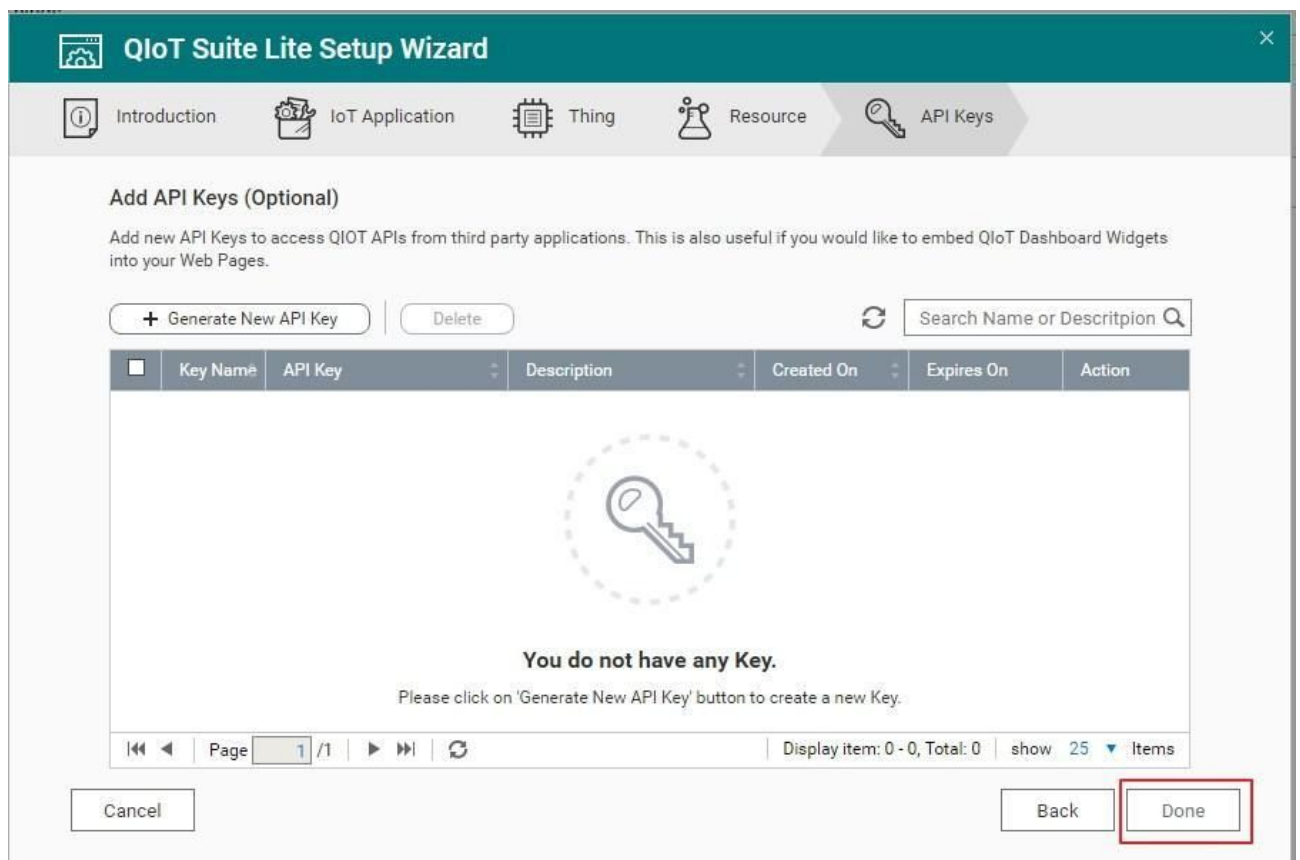
☐ Set Default Value

Default Value: Please enter default value

Note: Inputs with \* are required field

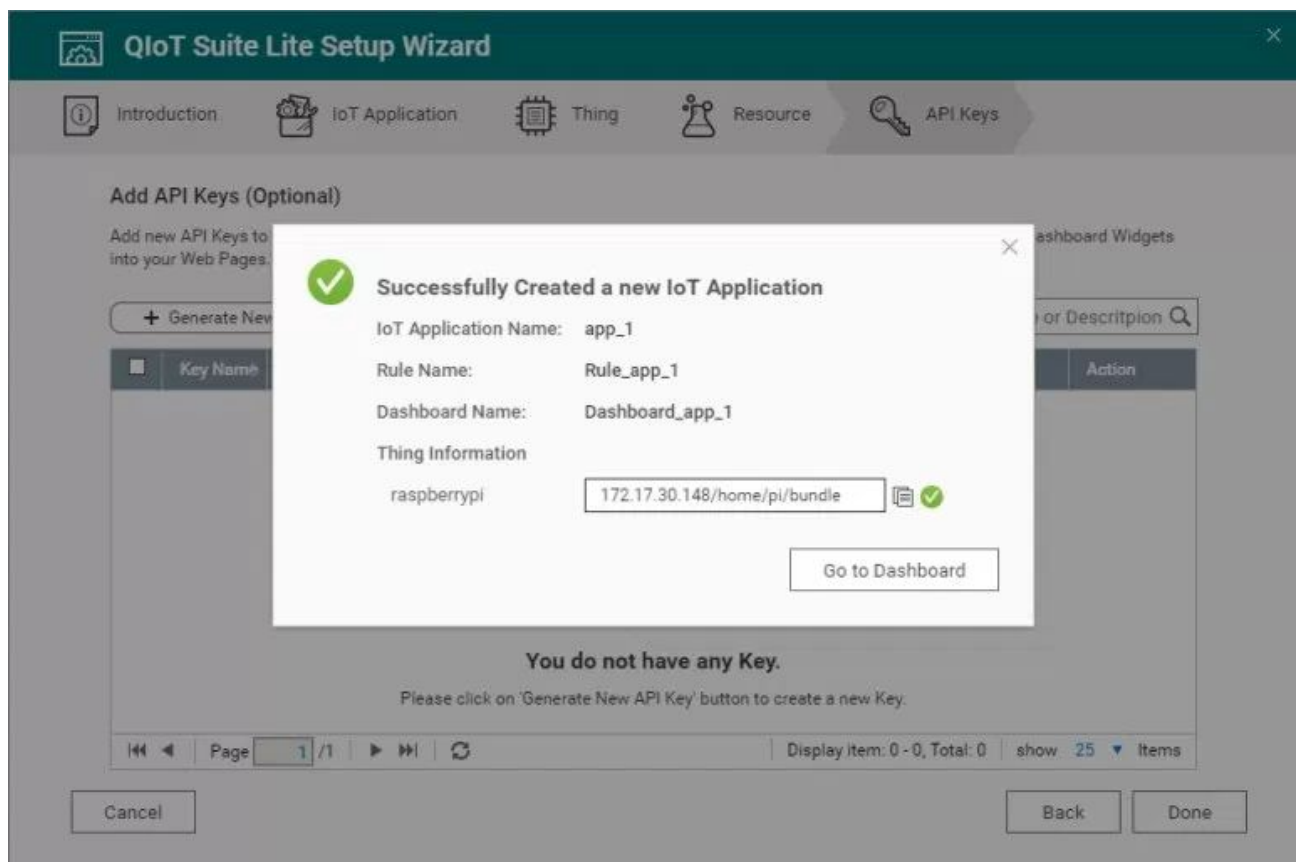
Add Cancel

- Click Next after you add all the resources (sensors) on your device.
- In “API Keys” step :
  - If you would like to embed QIoT dashboard widgets into your web pages or access QIoT APIs from third party applications. You could click “generate new API Key” to create API key or click “done” start deploy sample code to your device.

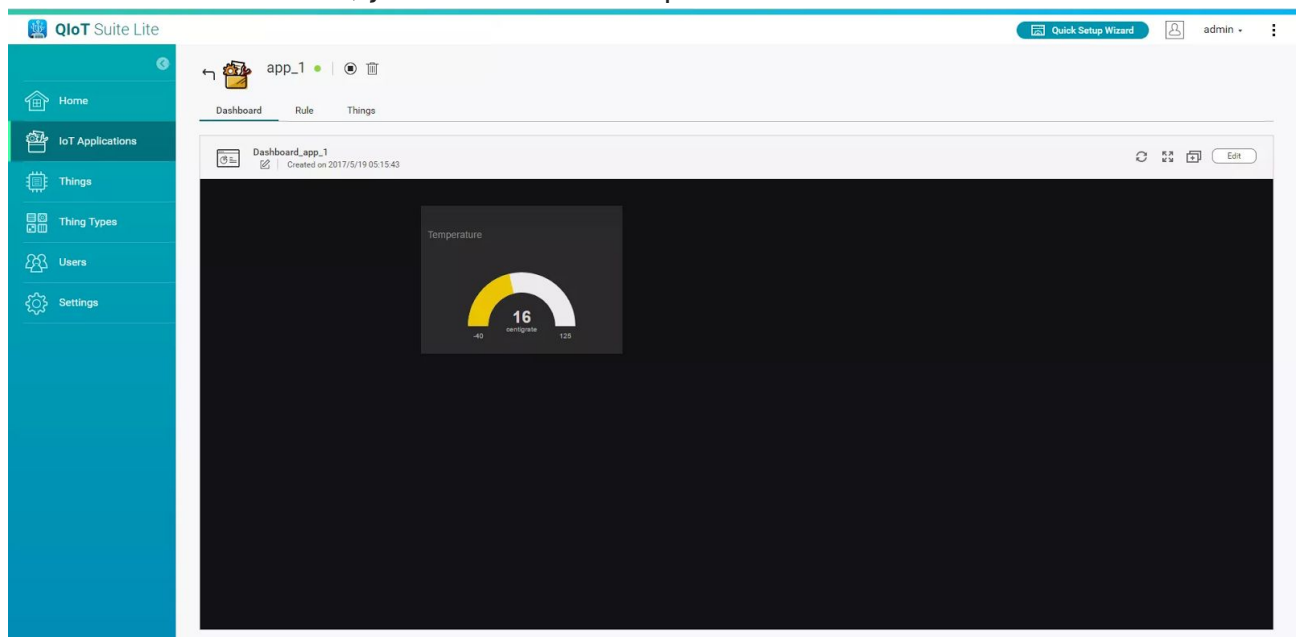


- For a while, sample codes and related files (certificate, resource information) have been upload to the specified path on your device.

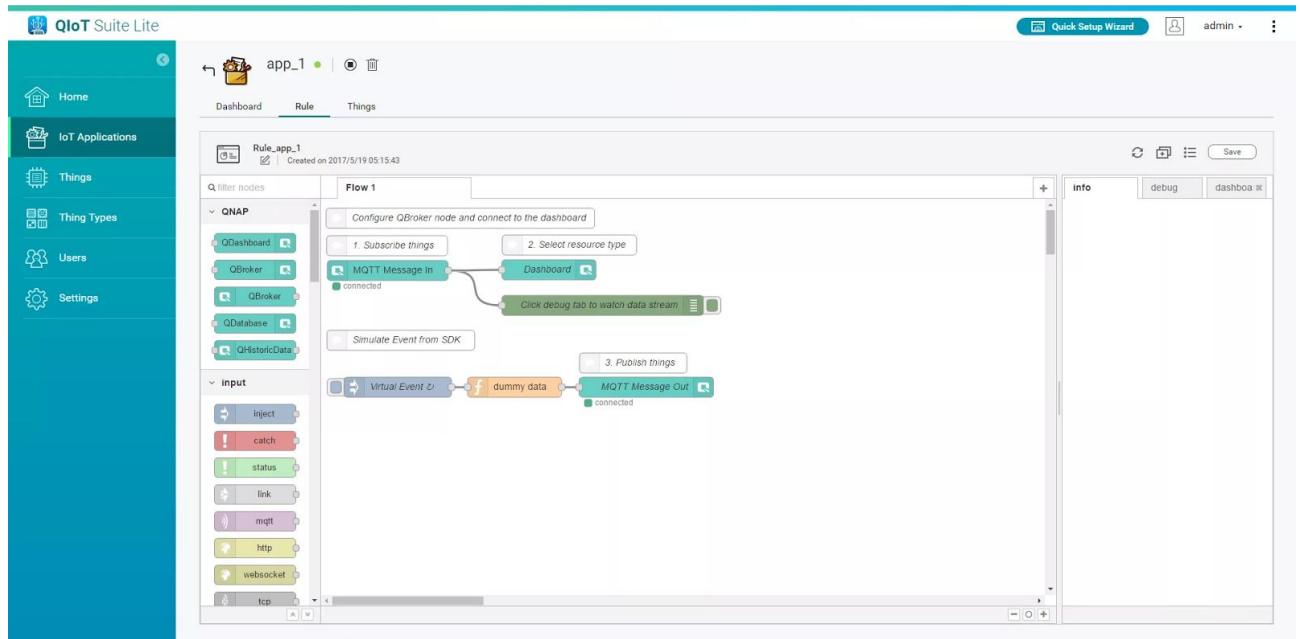




- Your IoT application already created successfully .You could click”Go to Dashboard” to your application page.
- Select “Dashboard” tab , you could see a sample dashboard is created.



- 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

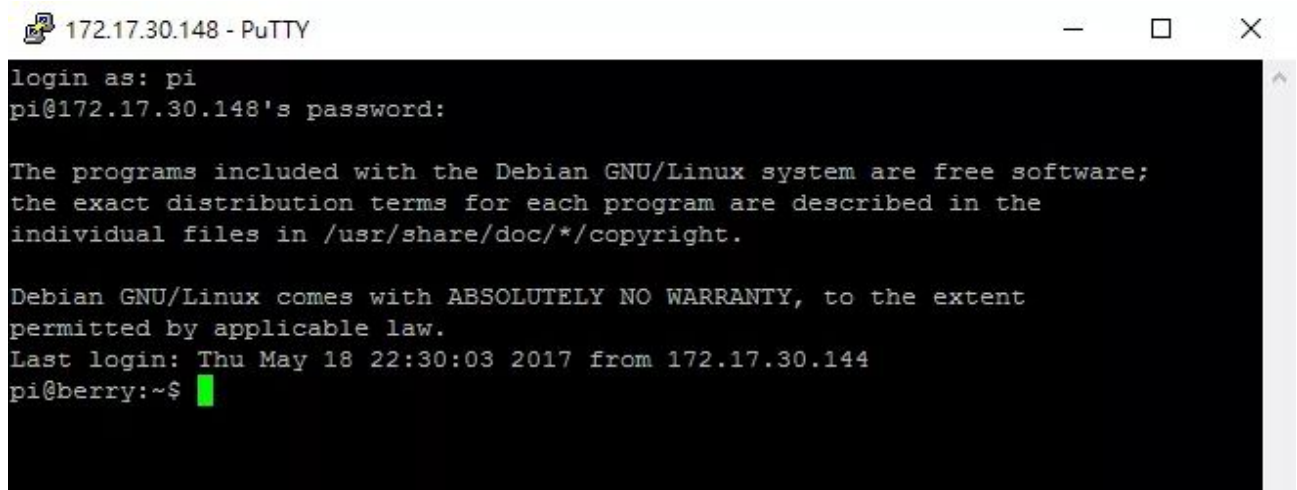
In this lesson, you generate certificate from QIoT Suite Lite, download SDK, and connect RaspberryPi to QIoT Suite Lite.



### 3.1 Run Sample Code

- 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).



```
172.17.30.148 - PuTTY
login as: pi
pi@172.17.30.148's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu May 18 22:30:03 2017 from 172.17.30.144
pi@berry:~$
```

- Install sample code dependency, enter command as following

```
pi@berry:~$ cd /home/{{user}}/bundle
```

```
pi@berry:~/bundle$ npm install
```

- Run sample code in device will publish message to topic “temp” by MQTTS as following picture. Topic is define from resource id that you setted.

```
/**
 * Send data to QIoT Suite Lite.
 * content of ./res/resourceinfo.json
 * {
 *   ...
 *   "resources": [
 *     {
 *       ...
 *       "resourceid": "temp",
 *       "topic": "qiot/things/admin/abccccc/temp",
 *       ...
 *     }
 *   ]
 * }
 */
setInterval(function() {
  // TODO: you could replace "temp" by any resource id set form QIoT Suite Lite
  connection.publishById("temp", getRandomInt(0, 50));

  // 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));
}, 1000);
```

- Run the sample application.

```
pi@berry:~$ node mqtt.js
```

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



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

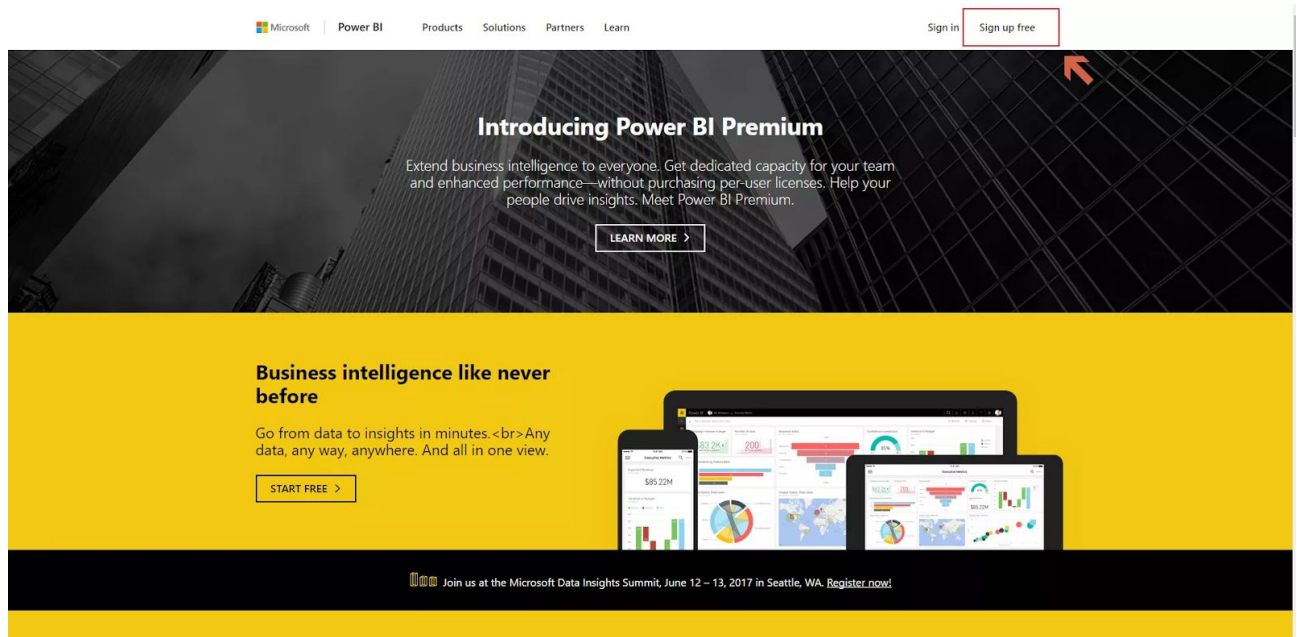
```
pi@berry:~$# cd /home/{{user}}/bundle
// mqtt(dont' need certificate,just put JSON file to "res" folder):
pi@berry:~/bundle$ node mqtt.js
// http
pi@berry:~/bundle$ node http.js
// https
pi@berry:~/bundle$ node https.js
// coap
pi@berry:~/bundle$ node coap.js
```



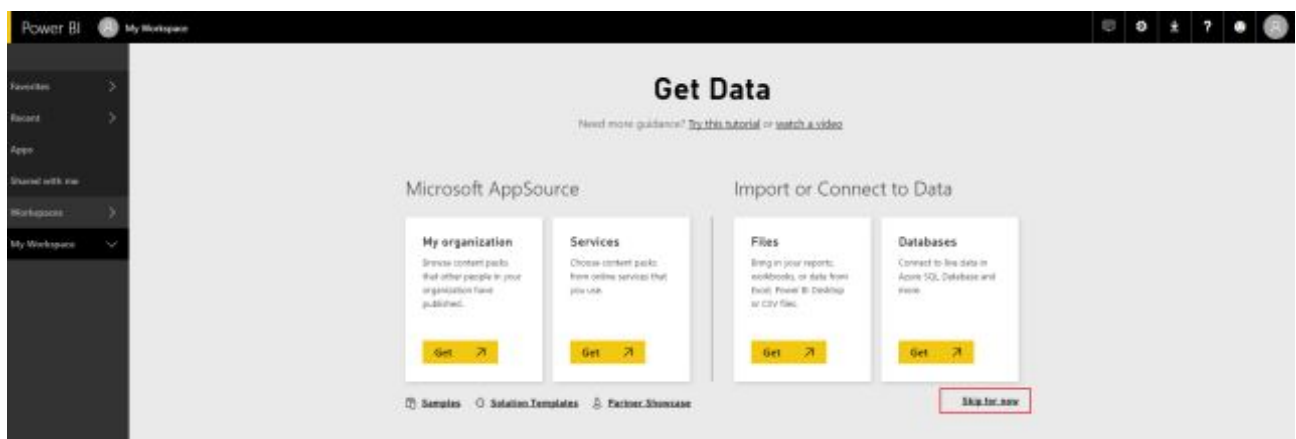
# Lesson 4: Integrate Power BI

## 4.1 Get your first Power BI account

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

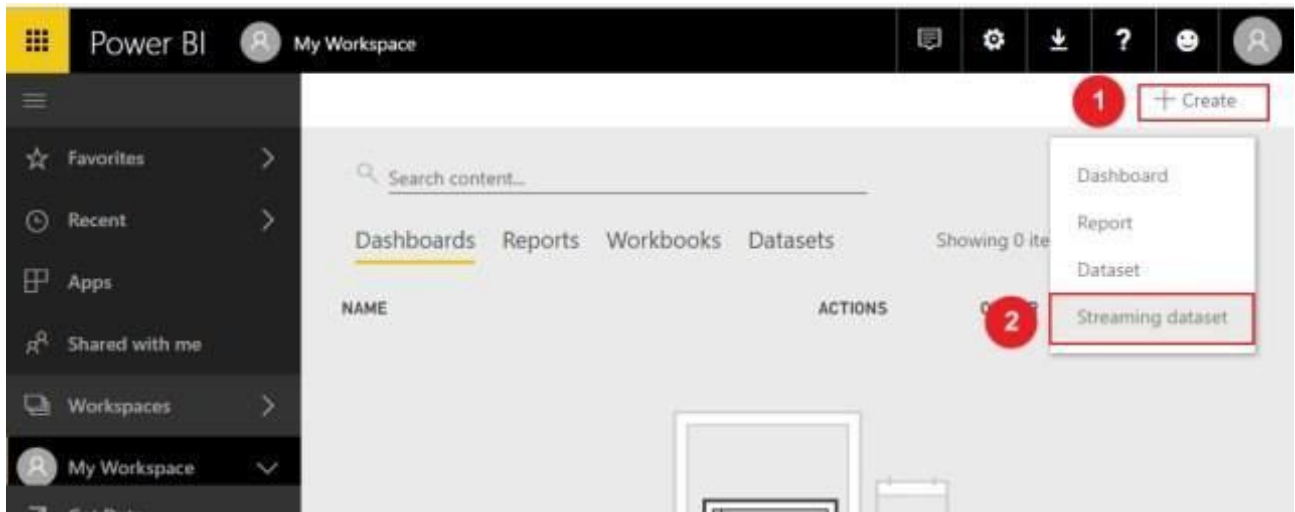


- After a sequence of registration, the page will lead you to below page, you can press “My workspace”, and “skip for now” button appear. You could click “skip for now” to start create dataset.

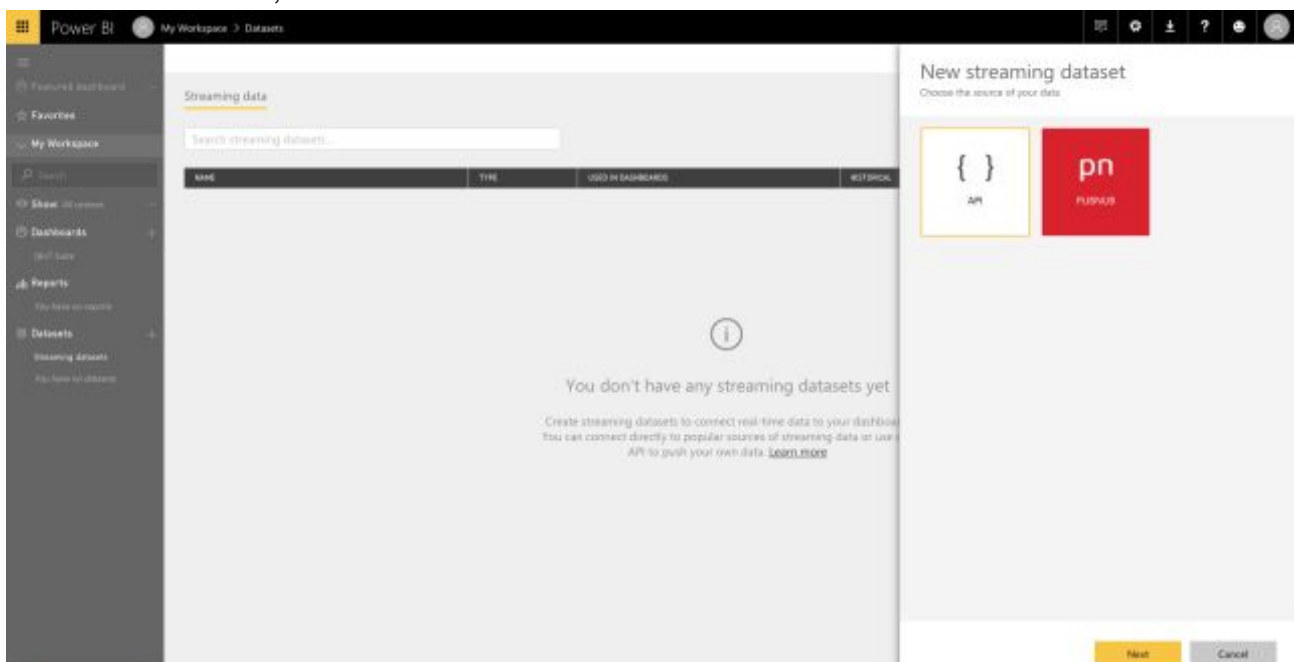


## 4.2 Setup your streaming dataset API

- Create “Datasets”
  - Click “Create” in screen upper right corner
  - And then click “Streaming 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. Qlot Suite's application will post this data format to Power BI. Click the “Create” button to finish create streaming dataset.

## Edit streaming dataset

Create a streaming dataset and integrate our API into your device or application to send data. [Learn more about the API.](#)

Dataset name \*

temp

Values from stream \*

temp

Number



max

Number



mix

Number



Enter a new value name

Text



```
[
  {
    "temp" : 98.6,
    "max" : 98.6,
    "mix" : 98.6
  }
]
```

Historic data analysis



On

Back

Done

Cancel

- 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.

## ✓ Streaming dataset created

The schema for temp2 is created.

Push URL

`https://api.powerbi.com/beta/bb3391c7-d712-450b-949c-14d42c1dff4e/data`

Raw

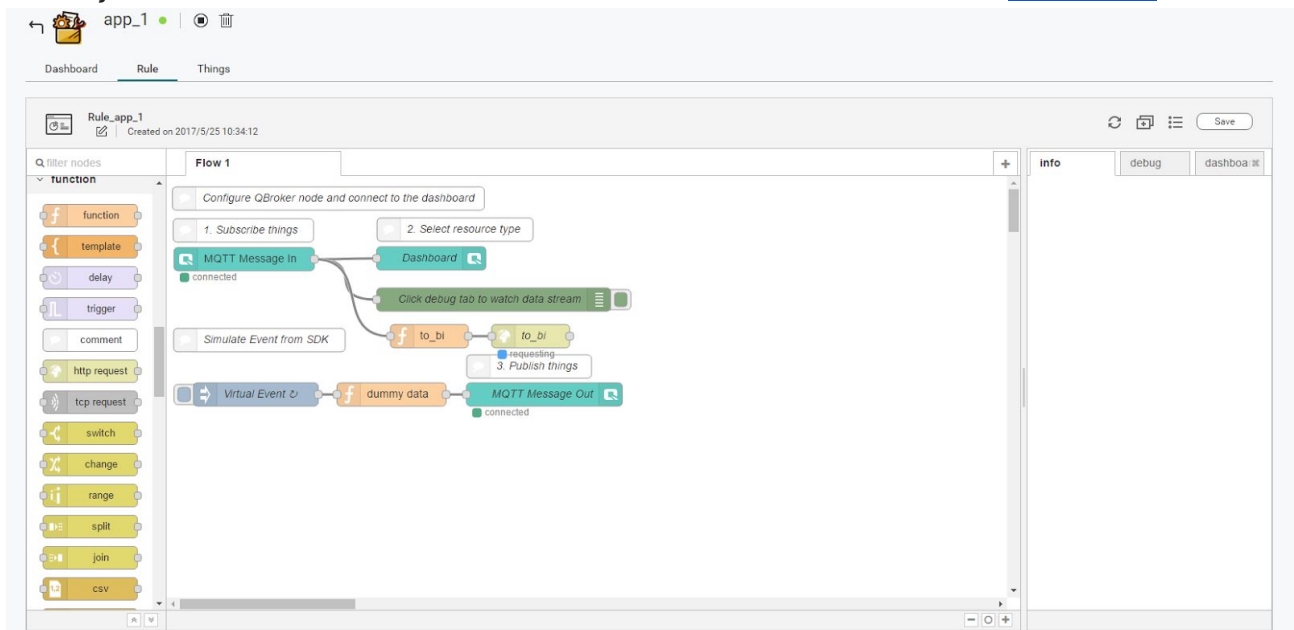
cURL

PowerShell

```
[
  {
    "temp" : "AAAAA555555",
    "max" : "AAAAA555555",
    "min" : "AAAAA555555"
  }
]
```

### 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](#)".

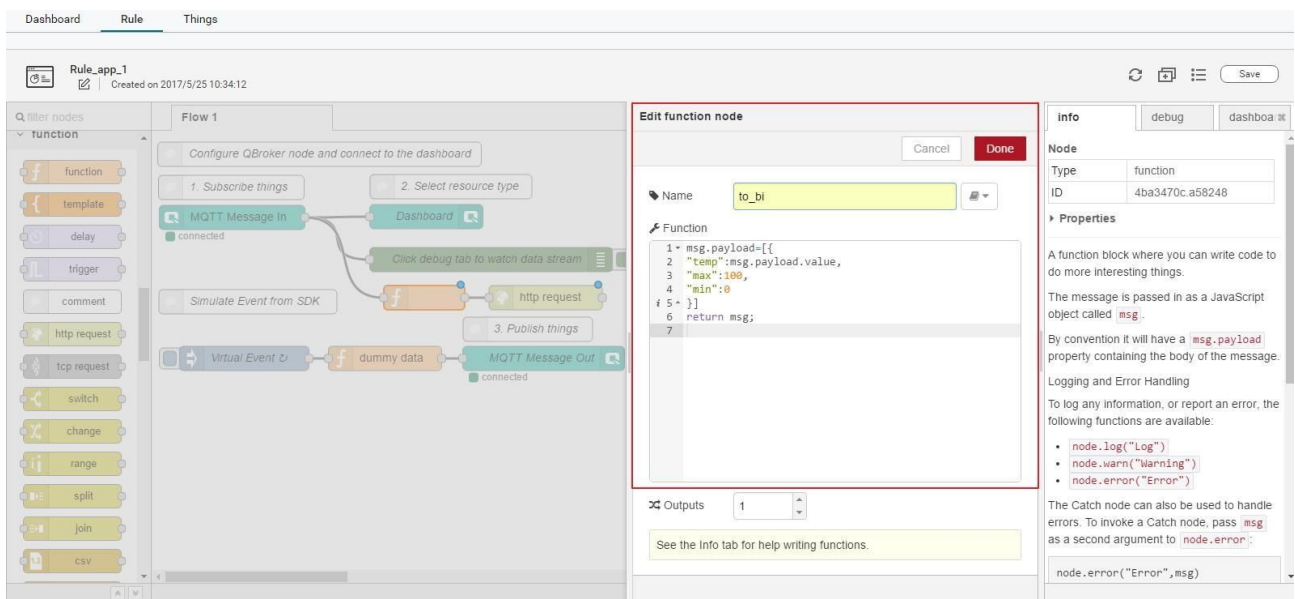


- Before you start to push live data to Power BI.

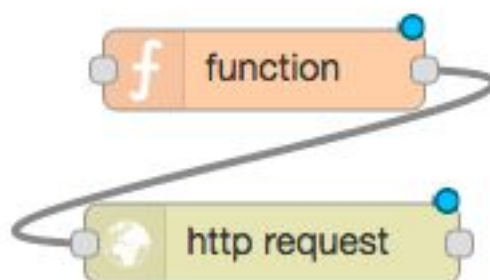
- We need a “function” node to convert IoT data to streaming data dataset. Here you can replace `msg.payload` to your JSON dataset.

- Double click function node, and type Function code as following:

```
msg.payload=[{  
  "temp":msg.payload.value,  
  "max":100,  
  "min":0  
}]  
return msg;
```



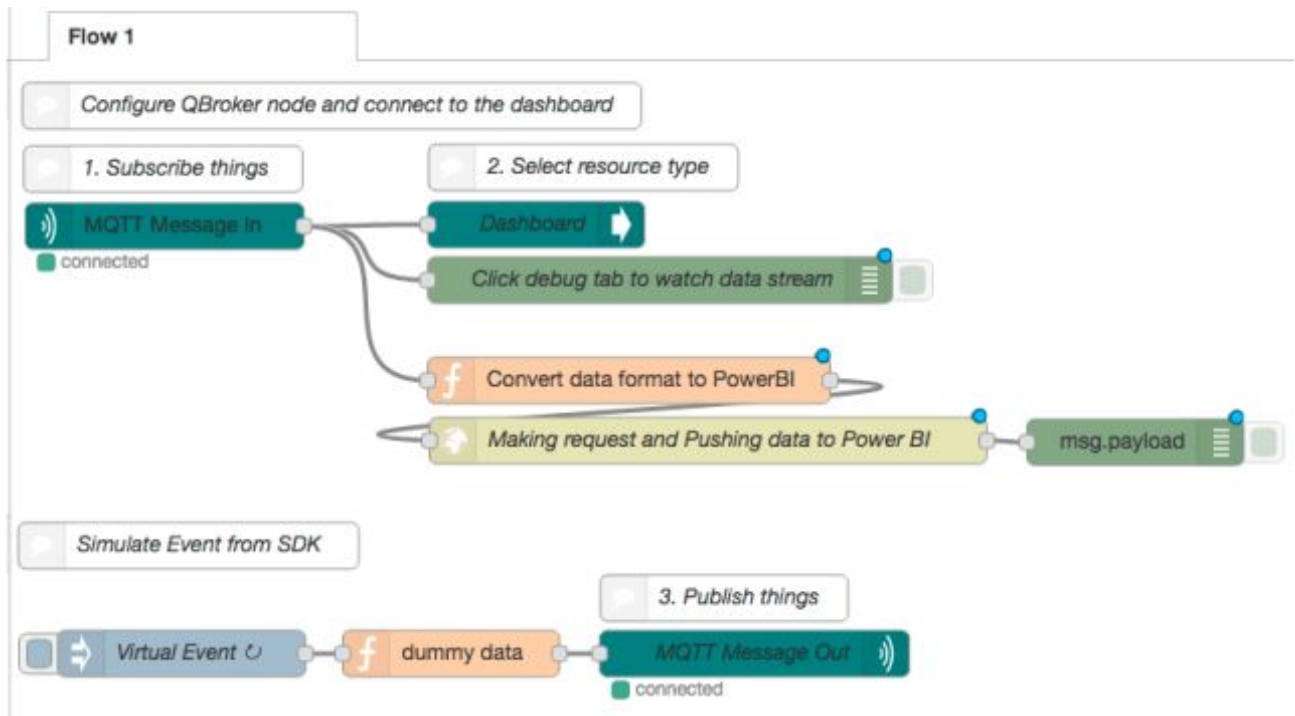
- We need a “http request” node to help us to push live data to Power BI. Just drop and drag “http request” node and connect to tail of “function” node.



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

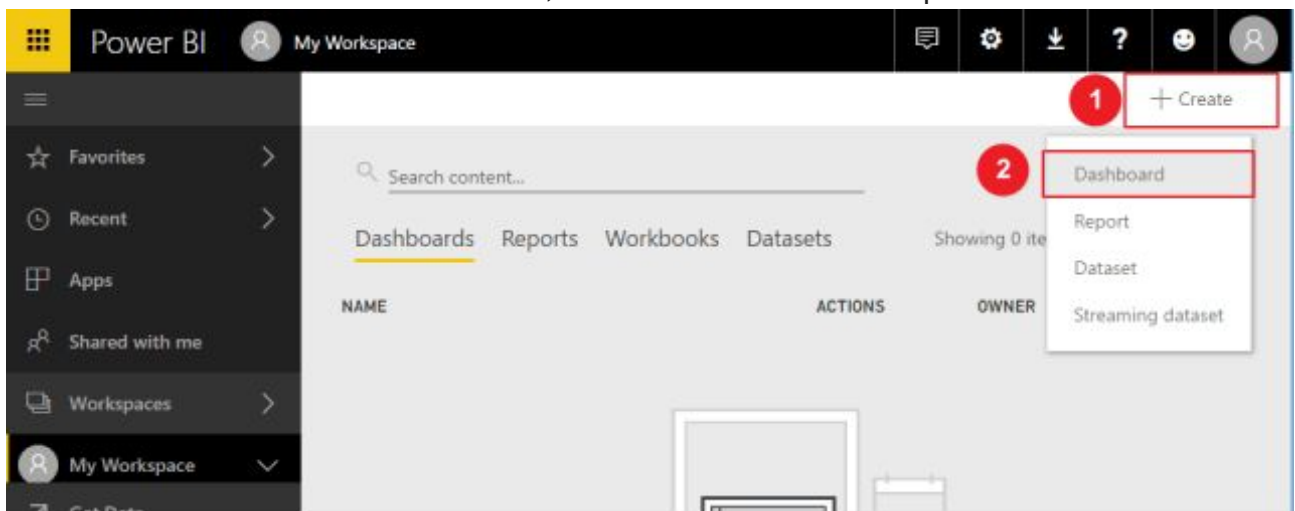


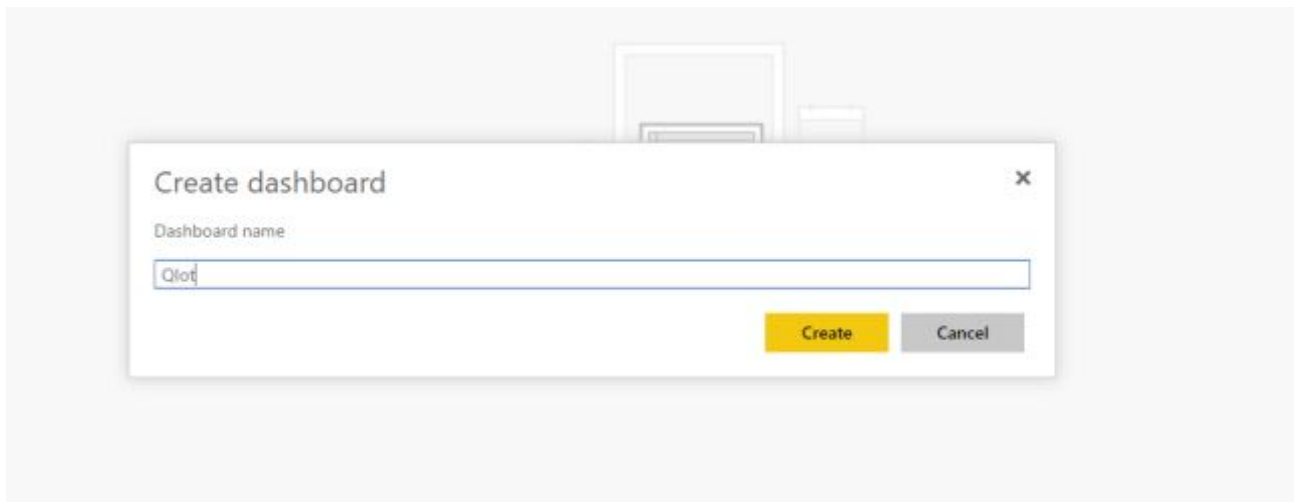




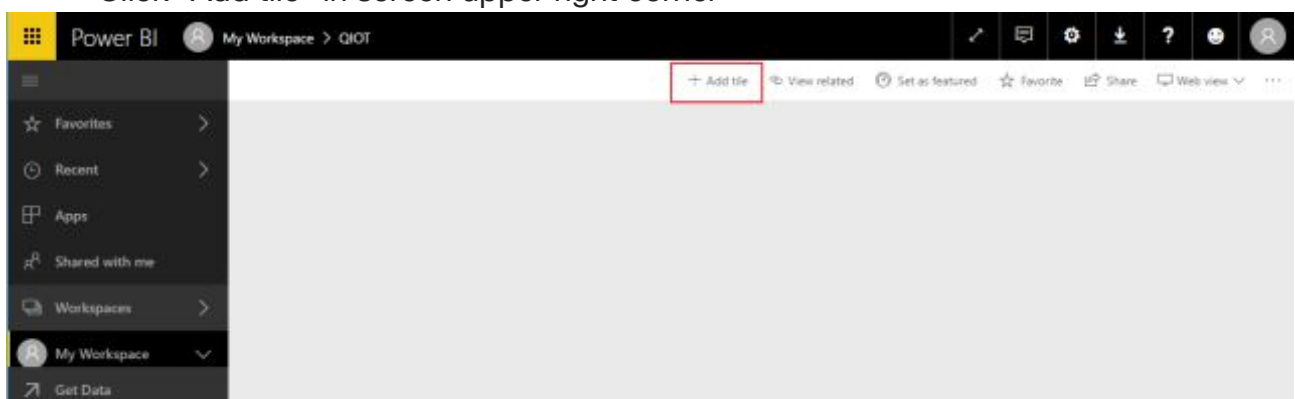
## 4.4 Add tile to display real-time data

- Create "Dashboard"
  - Click "Create" in screen upper right corner
  - And then click "Dashboard"
  - Enter dashboard's name, and click "Create" to complete create dashboard.

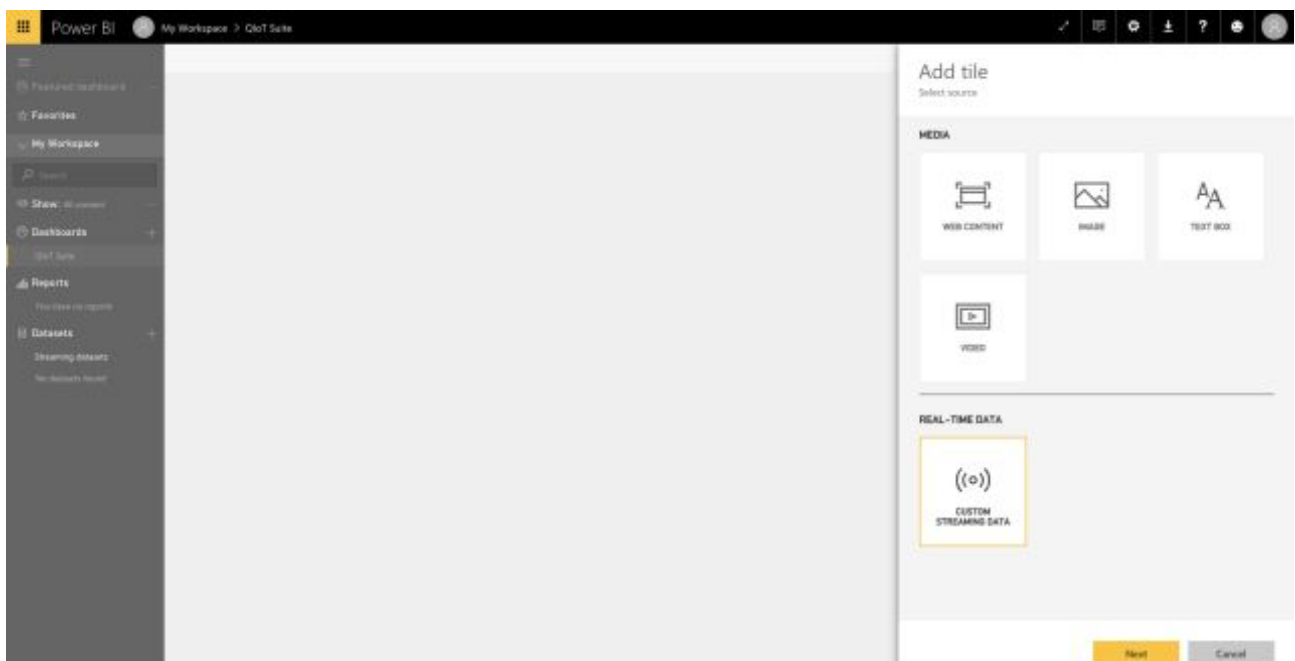




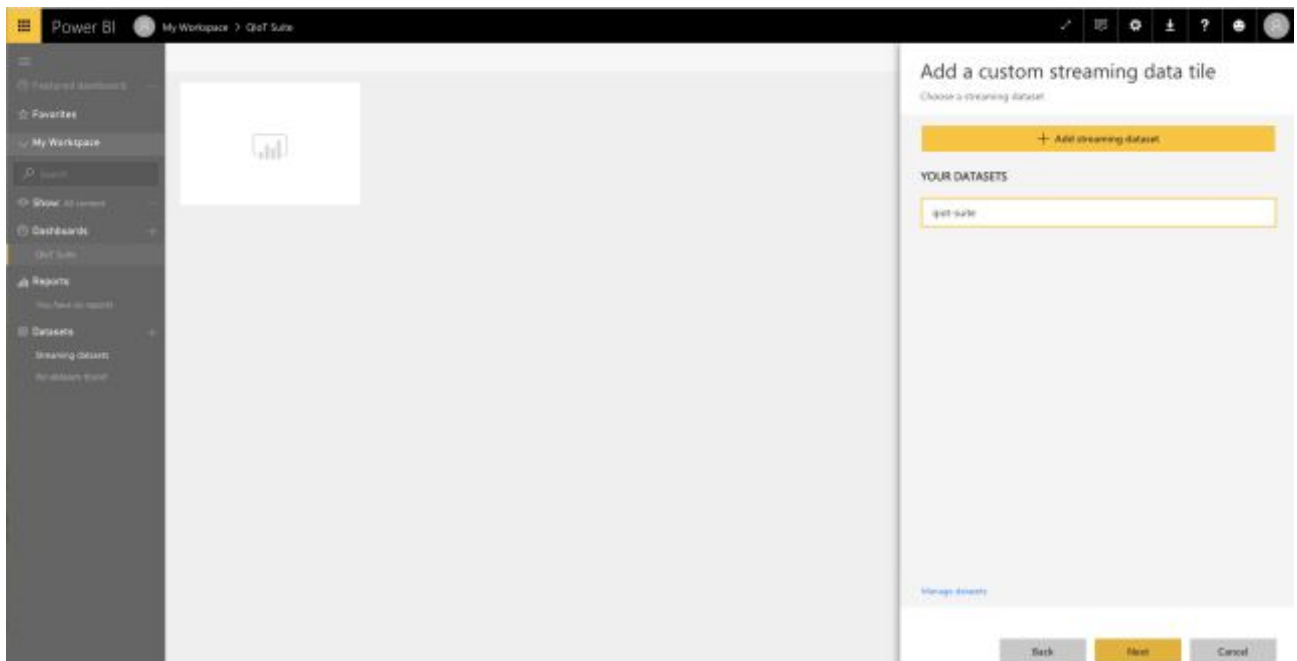
- Click “Add tile” in screen upper right corner



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



- Select **datasets** and then click the “Next” button.



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

## Add a custom streaming data tile

Choose a streaming dataset > Visualization design

Visualization Type

Gauge

Value

temp

+ Add value

Minimum value

min

+ Add value

Maximum value

max

+ Add value

Target value

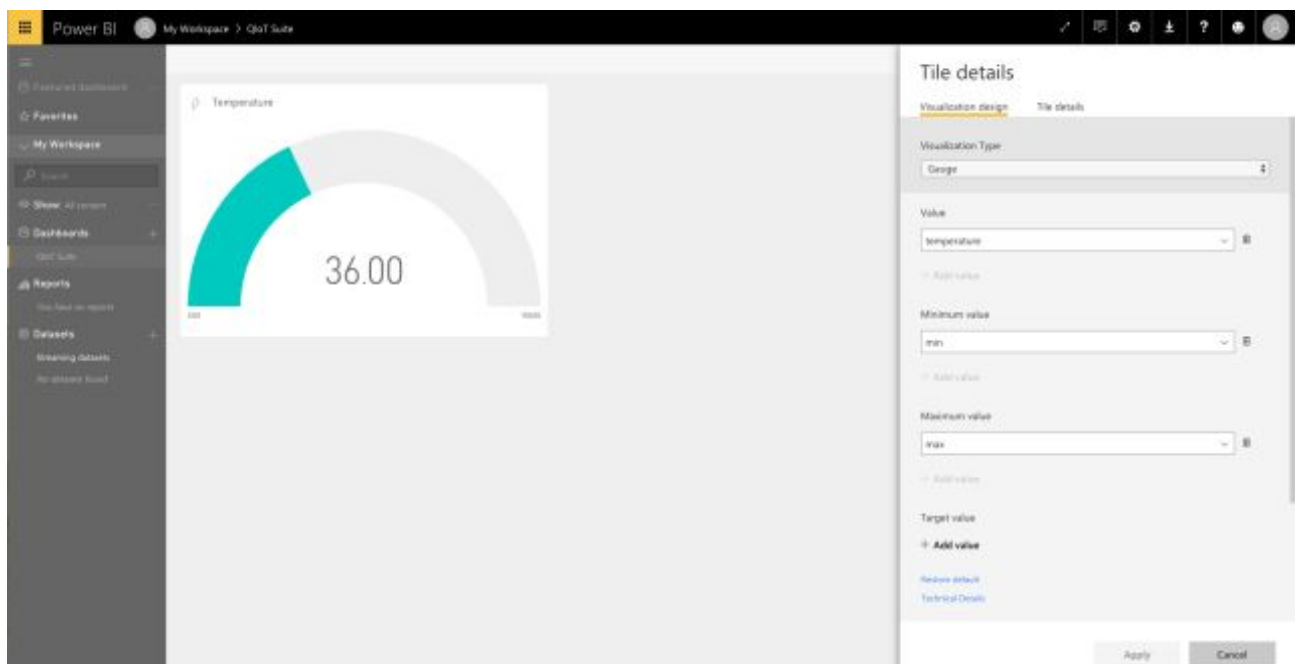
+ Add value

[Manage datasets](#)

Back Next Cancel

- 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-qiotsdks/
  nodejs/                                # nodejs program language
  device/
    intel-edison/                        # intel-edison/raspberrypi...
    examples/
      lib/                               # QIoT command Lib
      res/                               # QIoT resourceinfo.json folder
      ssl/                               # QIoT certificate files folder.
      mqtt.js                           # sample code - mqtt/mqtts publish
      http.js                           # sample code - http post
      https.js                           # sample code - https post
      coap.js                            # sample code - coap postt
      mqtt-subscribe.js                  # sample code - mqtt/mqtts subscribe
      http-get.js                        # sample code - http get
      https-get.js                       # sample code - https get
      coap-observe.js                    # sample code - coap get
      package.json                       # npm packages document
  python/                                # python program language
  device/
    arduino-yun/
      examples/
        lib/
          res/
          ssl/
          mqtt.py
          http.py
          ...

```

- content of resourceinfo.json

protocol	resourceinfo.json content
mqttp	<pre> {   "host": [     "172.17.28.28"   ] } # nas ip </pre>

	<pre> ], "myqnapcloudHost": "Not Available",           # myqnapcloudHost "port": 8883,                                # mqttts 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     "resourcetype": "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" } </pre>
https	<pre> {   "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   ... } </pre>
CoAP	<pre> {   "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   ... } </pre>

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