IoT Lab 101
NETPIE 2020

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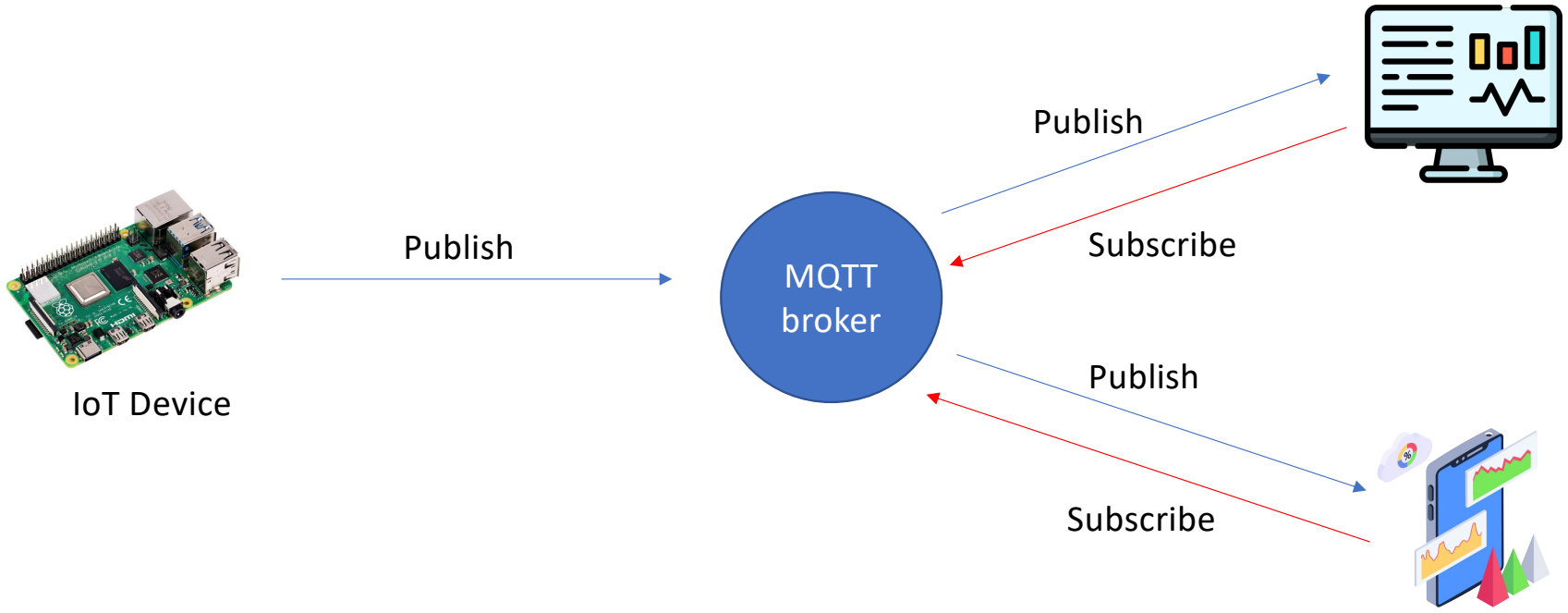
MQTT Protocol

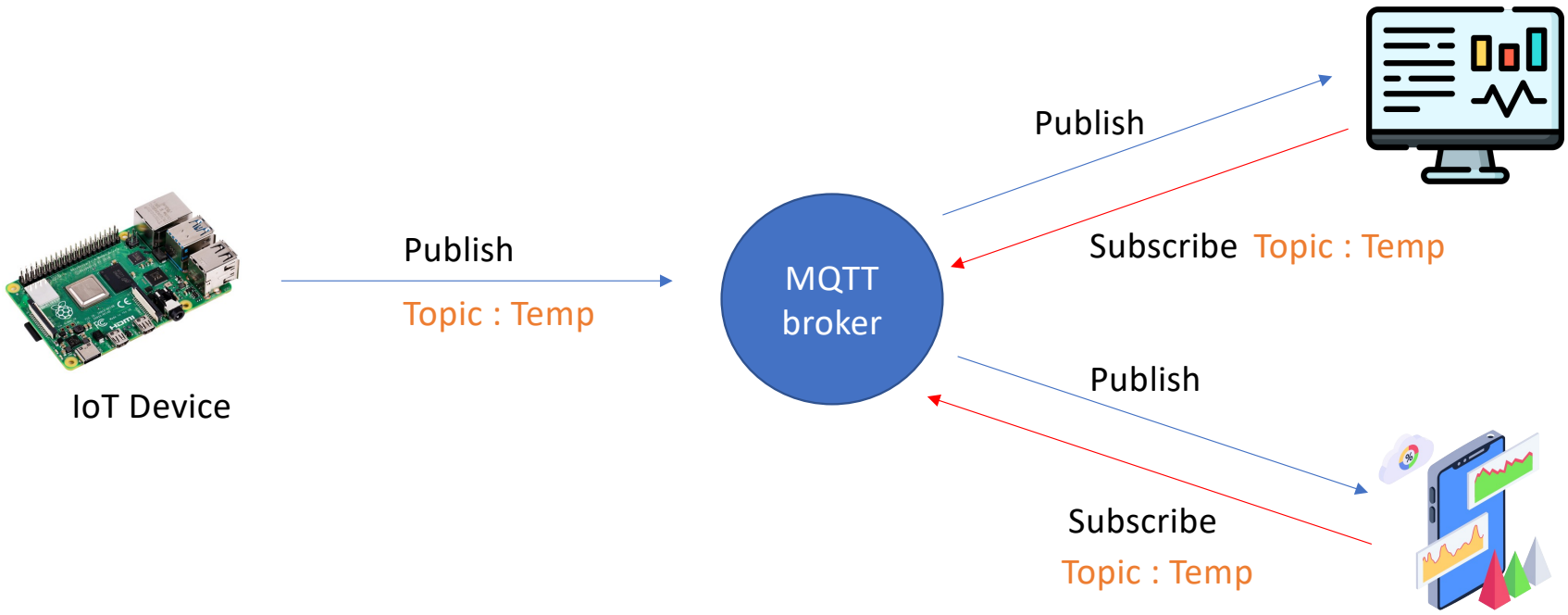
- MQTT is an OASIS standard for IoT connectivity.
  - It is a publish/subscribe,
  - Lightweight messaging protocol,
  - Designed for constrained devices and low-bandwidth, high-latency or unreliable networks.
- Is MQTT a standard?
  - Yes! -- >v5.0 and v3.1.1 are now OASIS standards (v3.1.1 has also been ratified by ISO).
- MQTT standard port
  - TCP/IP port 1883 is reserved with IANA for use with MQTT.
  - TCP/IP port 8883 is also registered, for using MQTT over SSL
- Does MQTT support security?
  - Itself is not secure
  - You can pass a user name and password with an MQTT packet in V3.1 of the protocol. Encryption across the network can be handled with SSL, independently of the MQTT protocol itself (it is worth noting that SSL is not the lightest of protocols, and does add significant network overhead).
  - Additional security can be added by an application encrypting data that it sends and receives, but this is not something built-in to the protocol, in order to keep it simple and lightweight.

MQTT Broker

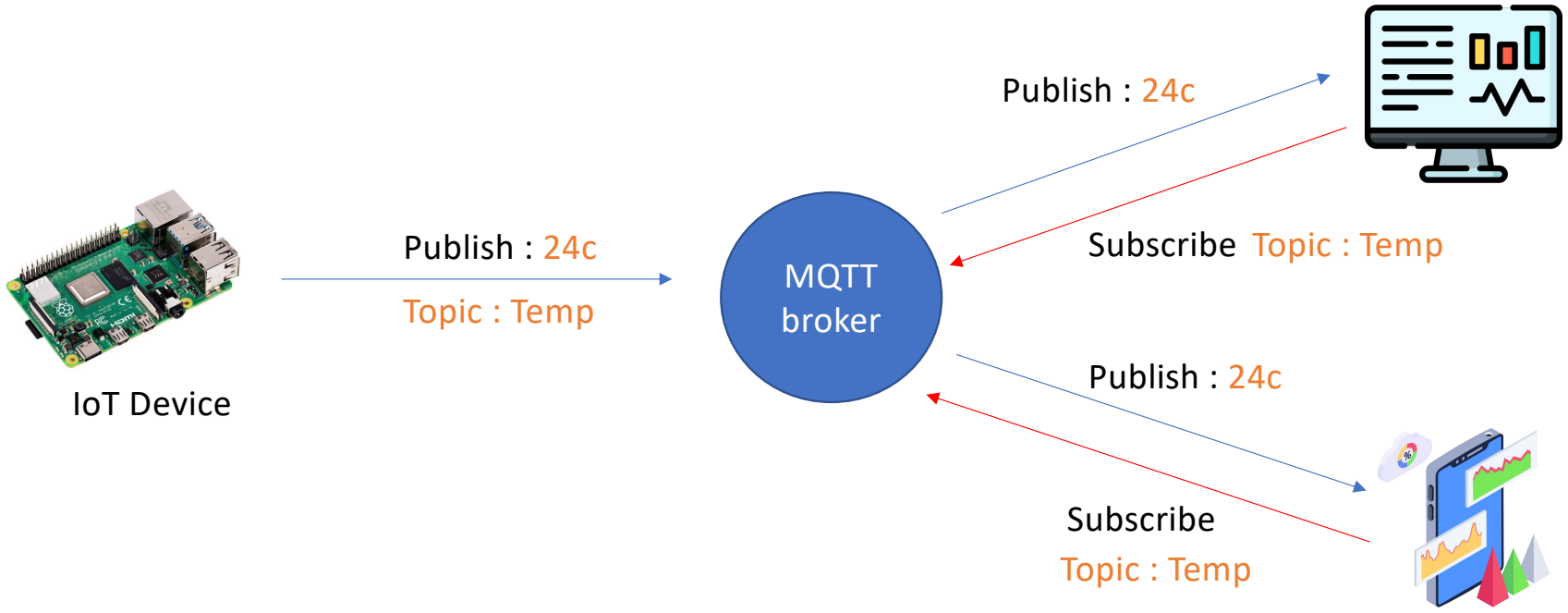
- A broker is a server that routes published messages to subscribers.



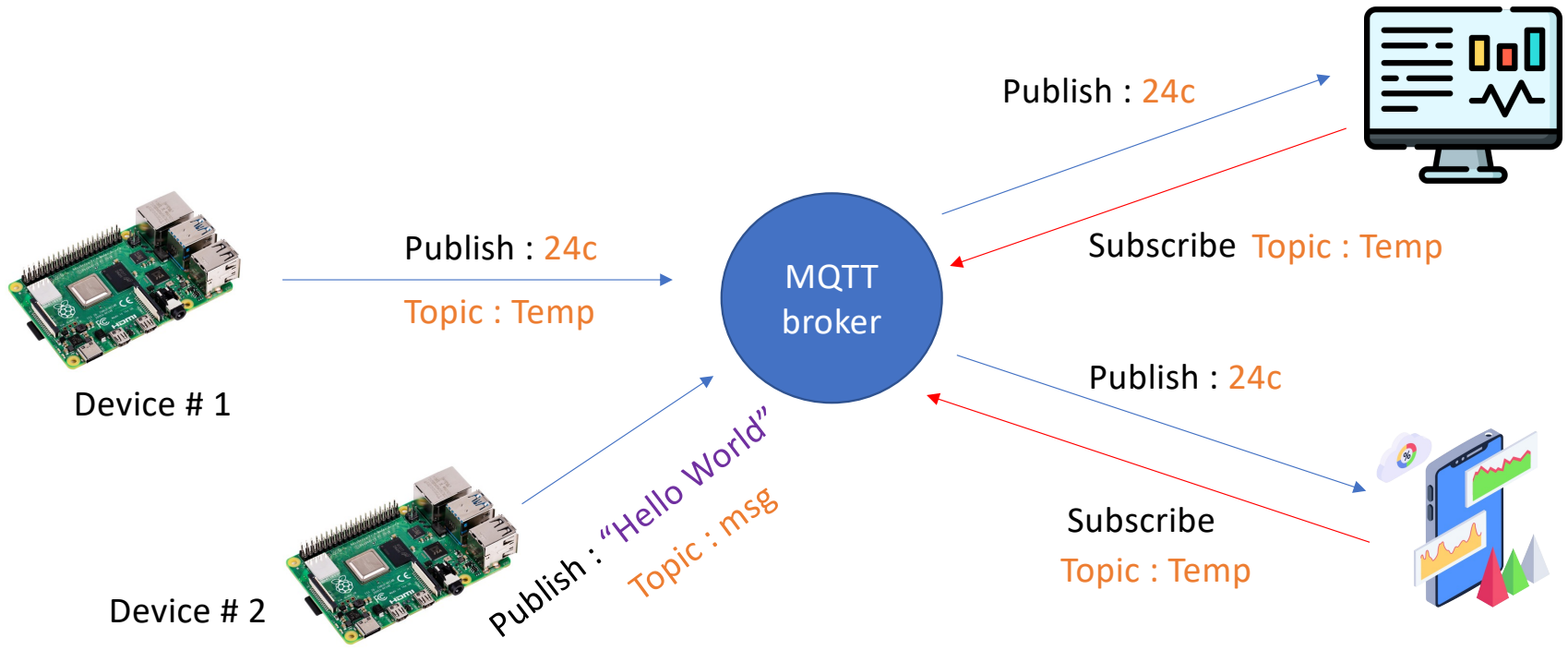
MQTT Broker


IoT Device
Publish
Topic : Temp
MQTT broker
Publish
Subscribe Topic : Temp
Publish
Subscribe
Topic : Temp

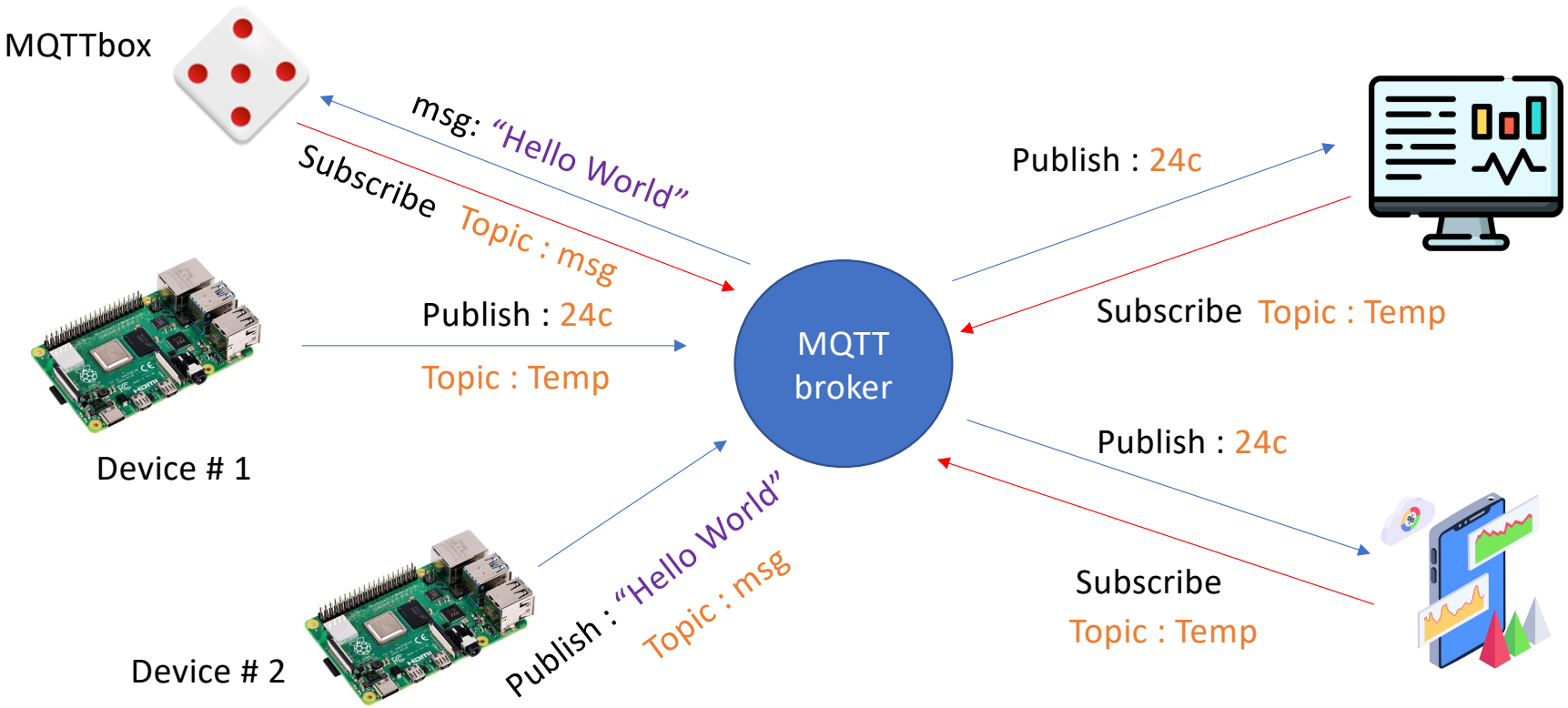
MQTT Broker


IoT Device
Publish : 24c
Topic : Temp
MQTT broker
Publish : 24c
Subscribe Topic : Temp
Publish : 24c
Subscribe
Topic : Temp

MQTT Broker


Publish : 24c
Topic : Temp
Device # 1
Publish : 24c
MQTT broker
Subscribe Topic : Temp
Publish : 24c
Subscribe
Topic : Temp
Device # 2
Publish : "Hello World"
Topic : msg

MQTT Broker


MQTTbox
msg: "Hello World"
Subscribe Topic : msg
Publish : 24c
Topic : Temp
Device # 1
Device # 2
Publish : "Hello World"
Topic : msg
MQTT broker
Publish : 24c
Subscribe Topic : Temp
Publish : 24c
Subscribe
Topic : Temp

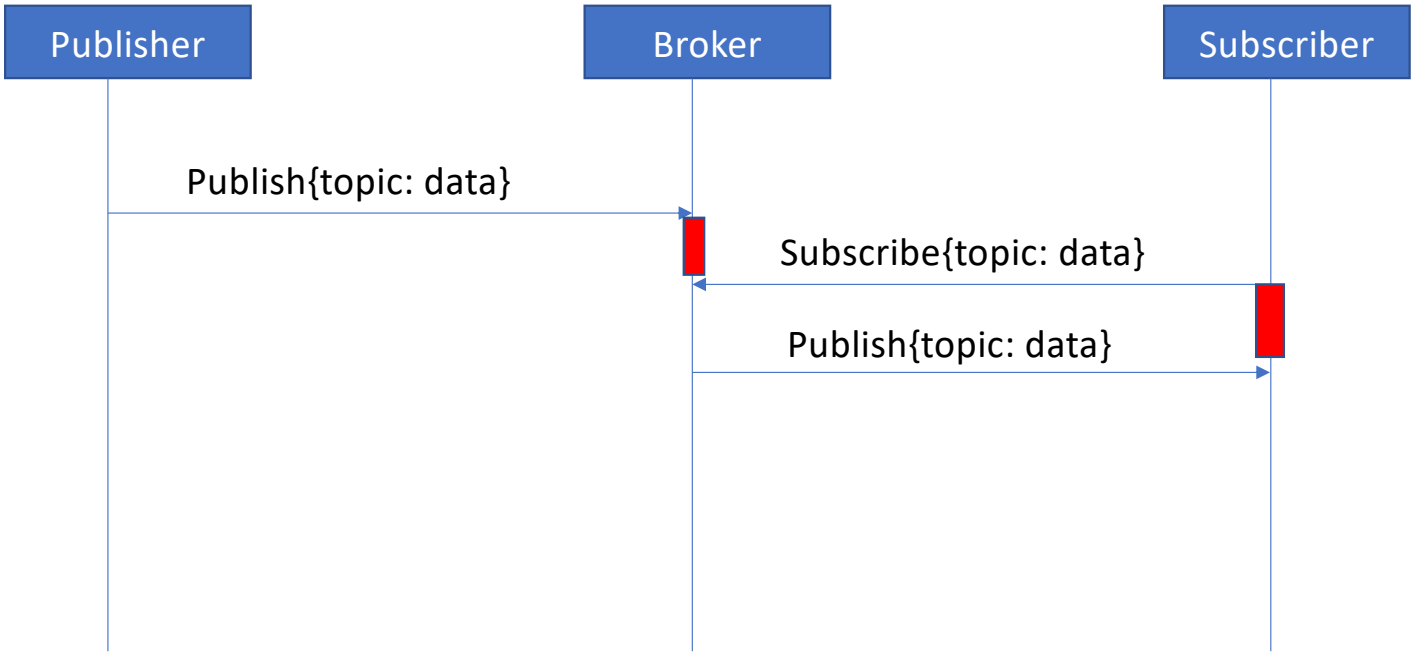
MQTTbox vs Device

MQTTbox

Device # 1

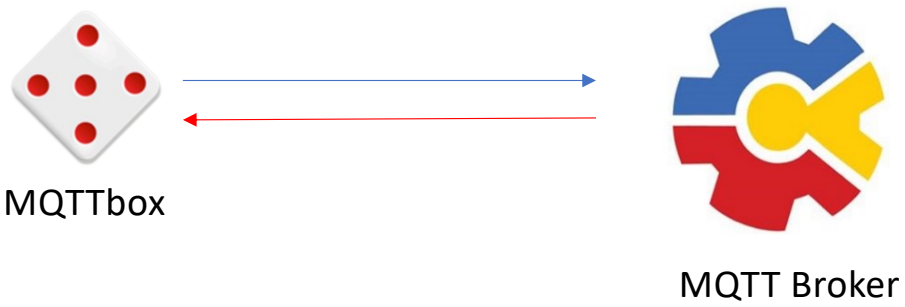
- MQTTbox represents a virtual IoT device

MQTT Message signalling



Lab : MQTT Broker as NETPIE2020

Lab 1: Sending messages & data to MQTT Broker (NETPIE)



MQTT Message Types for NETPIE2020

1. Message to/from devices

Send MQTT to topic : @msg/topic
Json format : {“hello”,”NETPIE”}

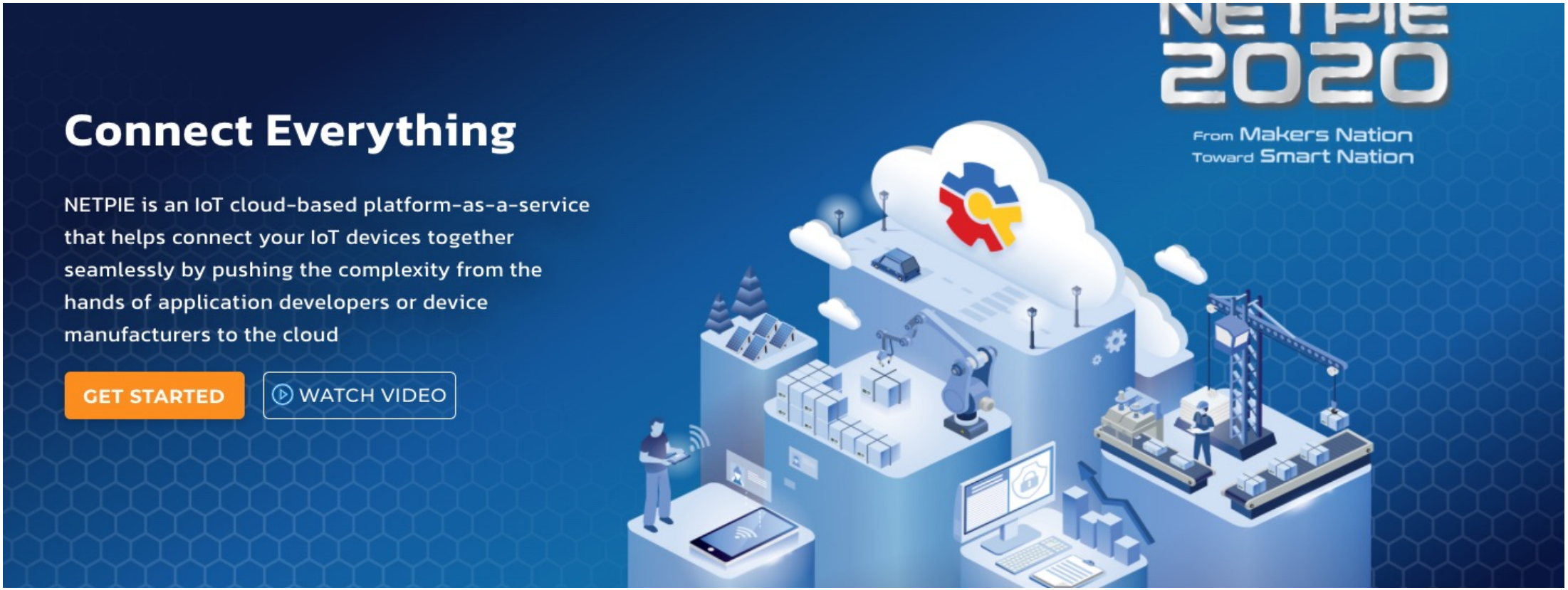
2. Data to Shadow

Send MQTT to topic : @shadow/data/update

Json format : {“data”: {“temp”:24}}

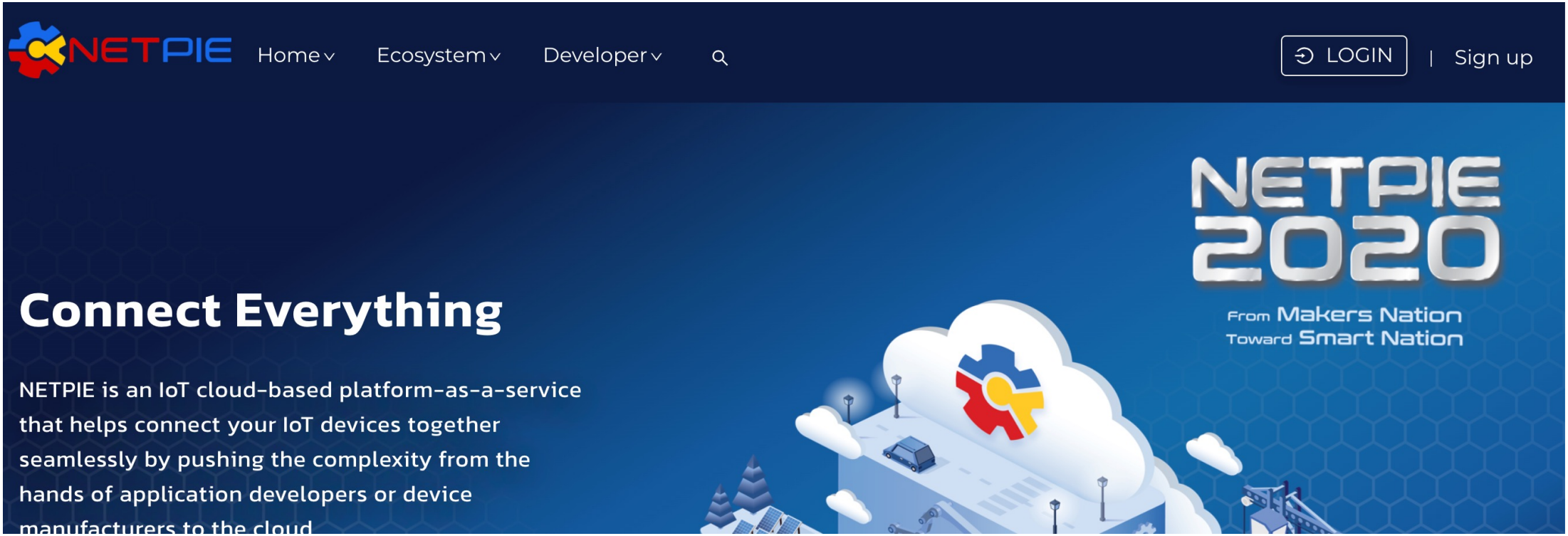
MQTT Ports

Connection	Port
mqtt/tcp (broker.netpie.io)	1883
mqtts/tls (broker.netpie.io)	8883
ws (mqtt.netpie.io/mqtt)	80
wss (mqtt.netpie.io/mqtt)	443

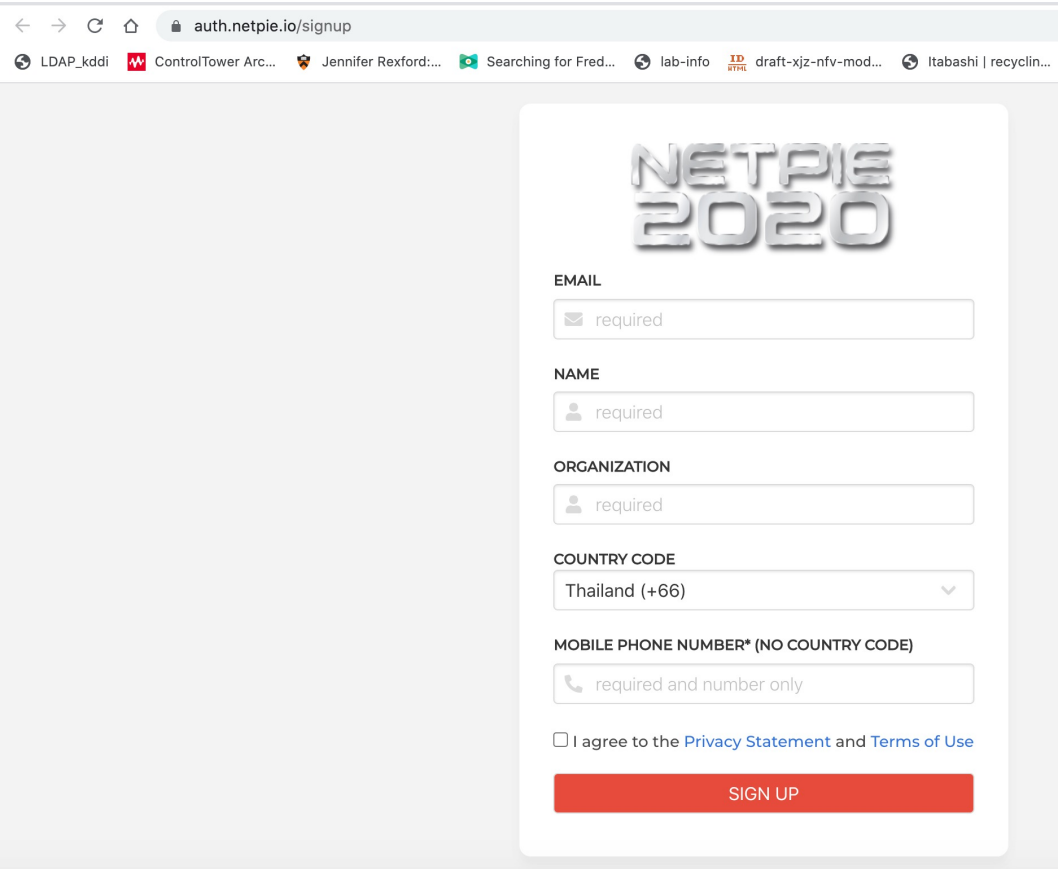


LAB exercise
Play with Schema

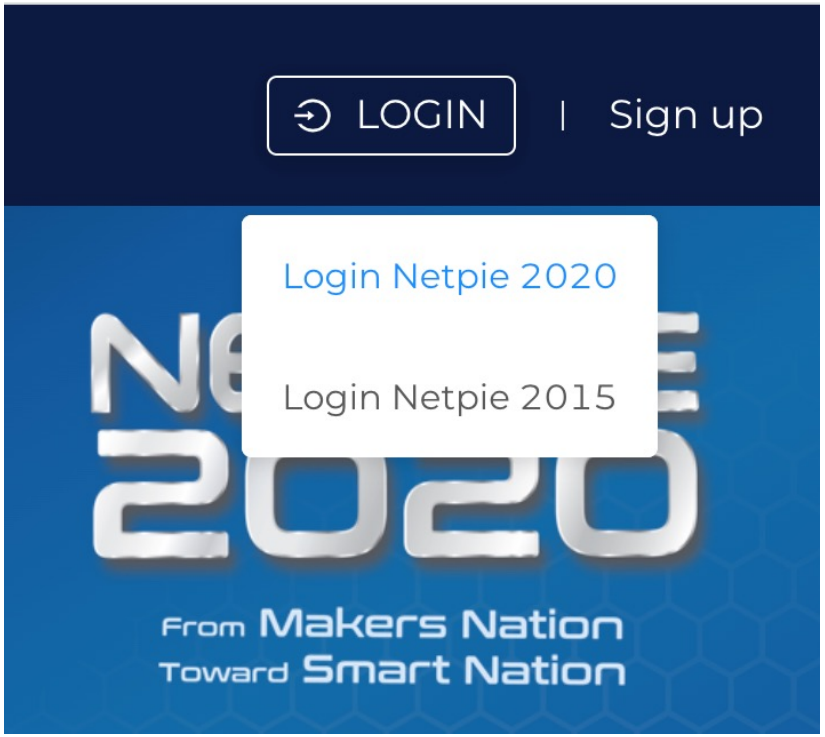
Registration First



Sign up


auth.netpie.io/signup
LDAP_kddi
ControlTower Arc...
Jennifer Rexford:...
Searching for Fred...
lab-info
draft-xjz-nfv-mod...
Itabashi | recyclin...
NETPIE 2020
EMAIL
required
NAME
required
ORGANIZATION
required
COUNTRY CODE
Thailand (+66)
MOBILE PHONE NUMBER* (NO COUNTRY CODE)
required and number only
I agree to the Privacy Statement and Terms of Use
SIGN UP

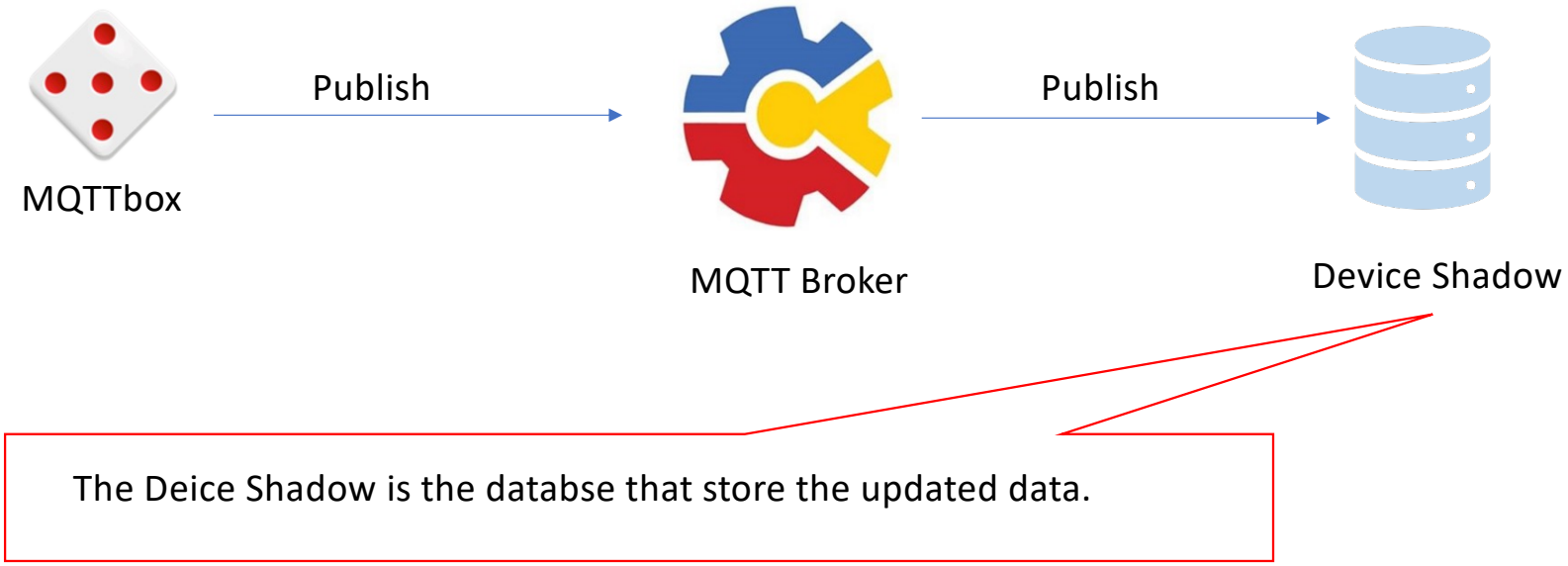
Login


LOGIN
|
Sign up
Login Netpie 2020
Login Netpie 2015
2020
From Makers Nation
Toward Smart Nation

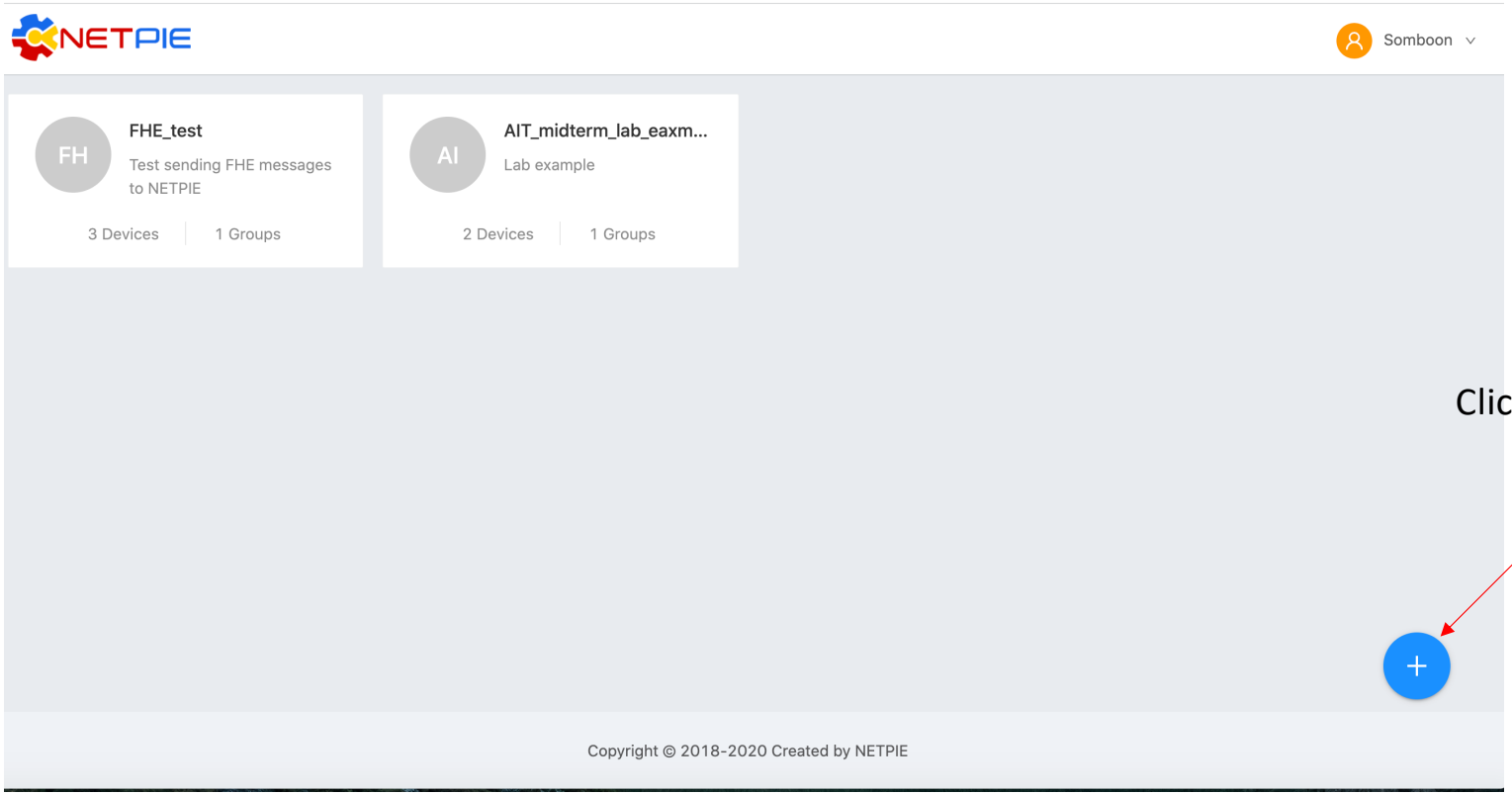
Good to know…

Arduino programming & IDE
JSON
JSON
JavaScript Object Notation
RESTful API
CoAP API
MQTT
PROTOCOL
NETPIE
HARDWARE
Device Config

Architecture

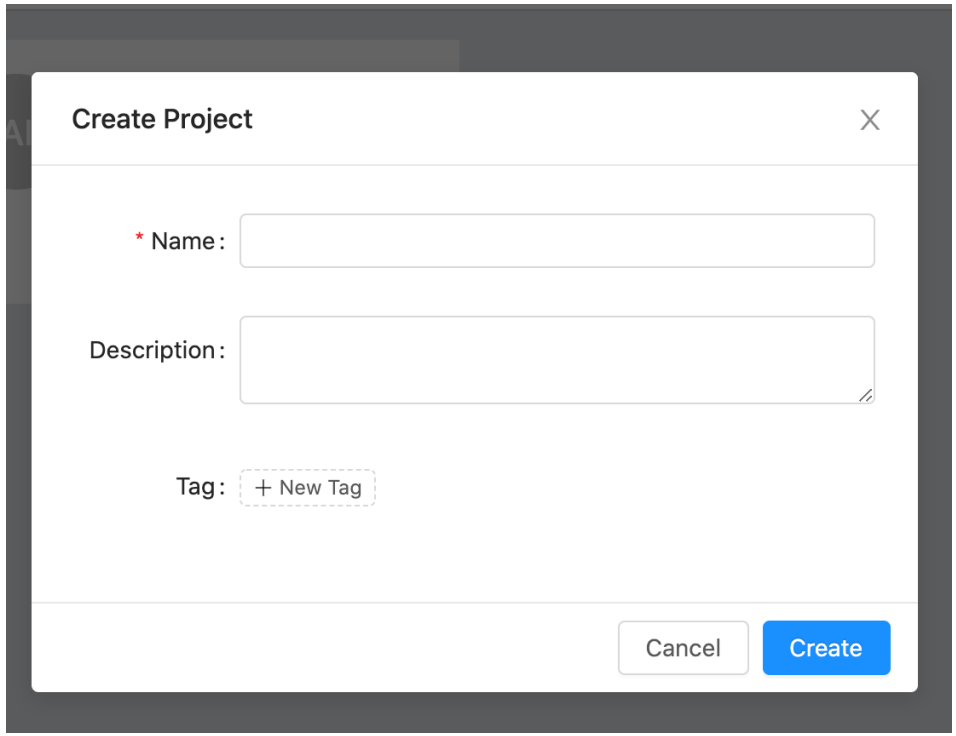


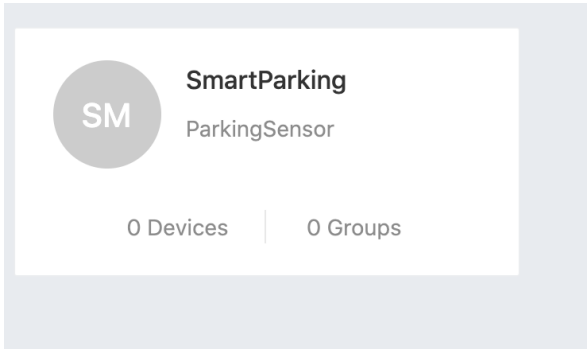
Create a Deivce in NETPIE



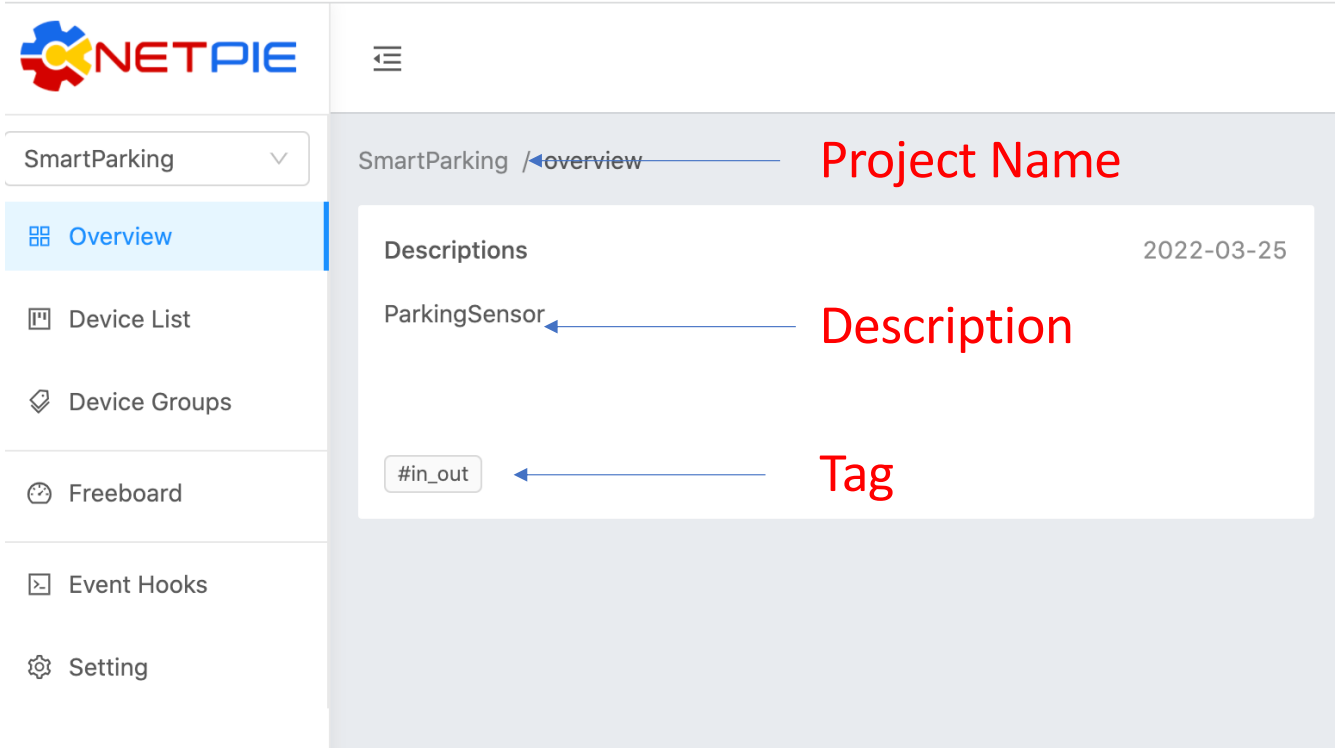
Click “+” to create project

Fill in the project name

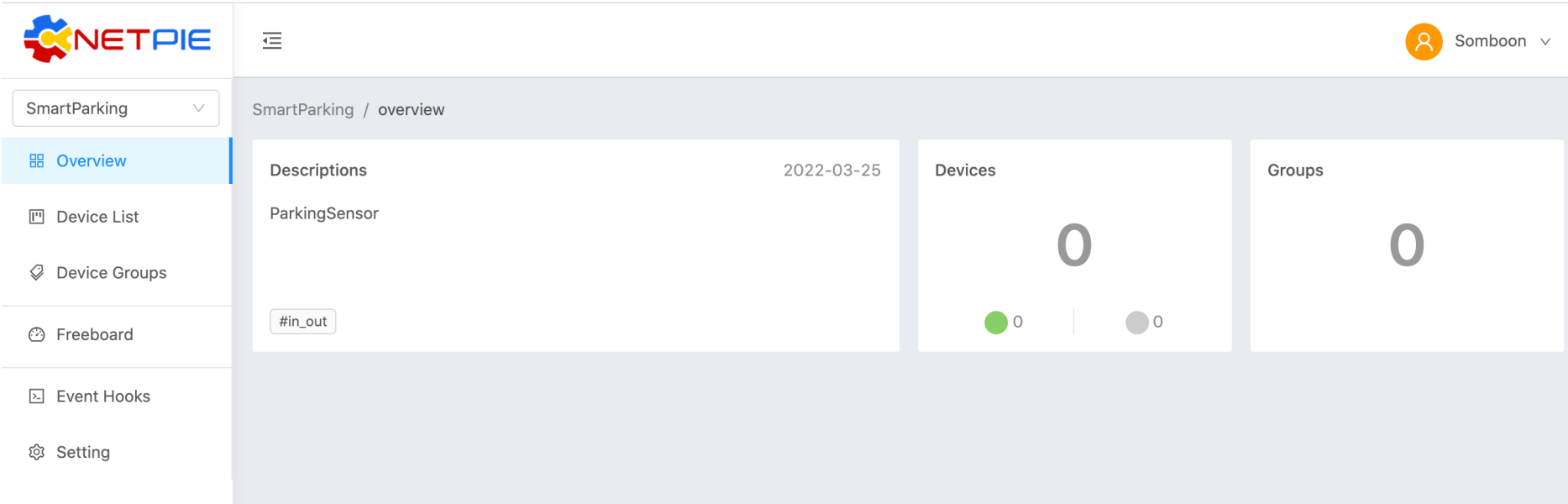




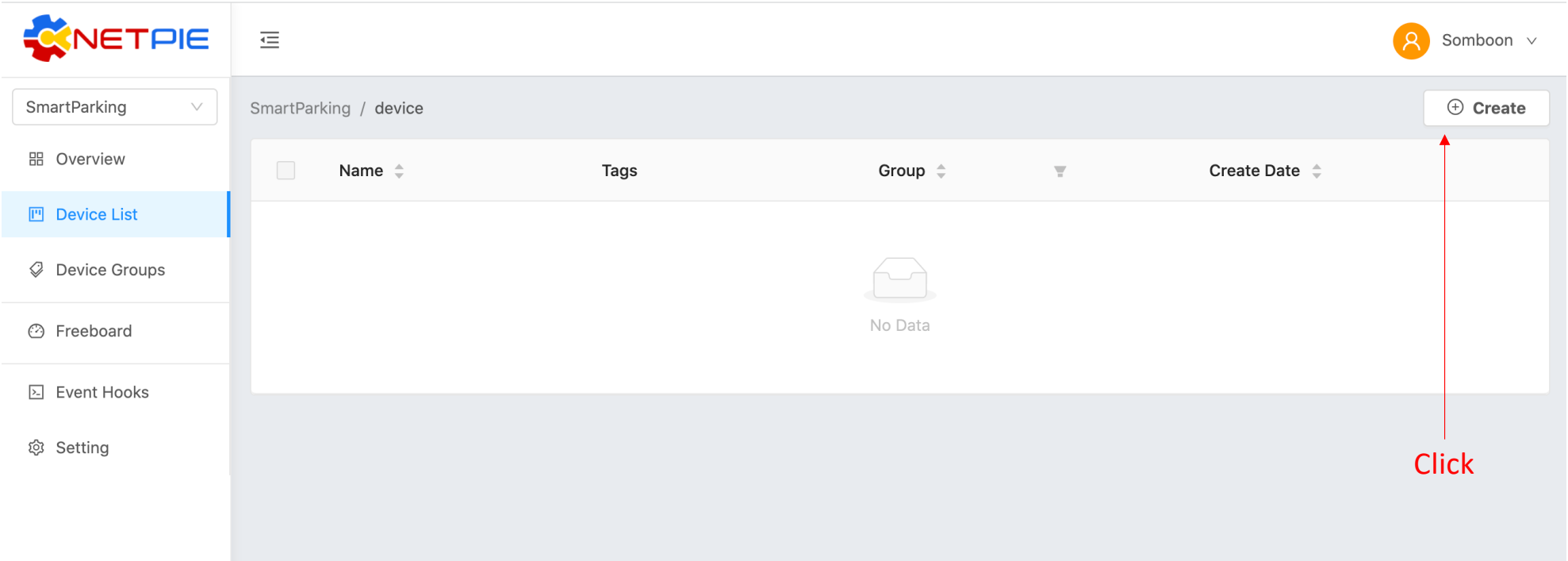
NETPIE project



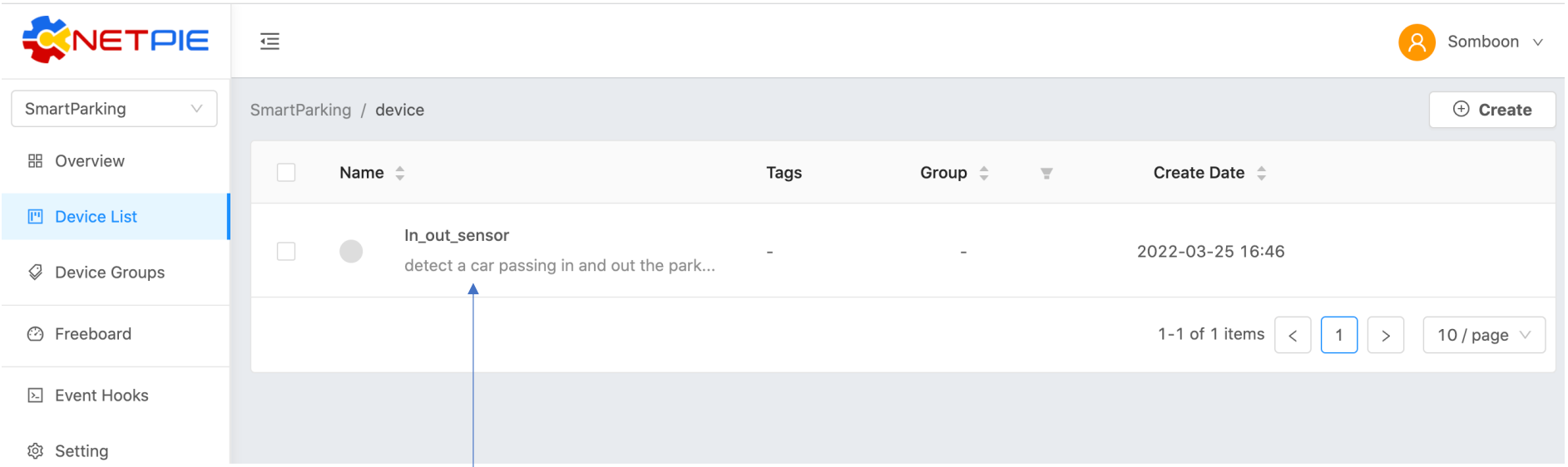
Initial device = 0, group = 0



Create a device

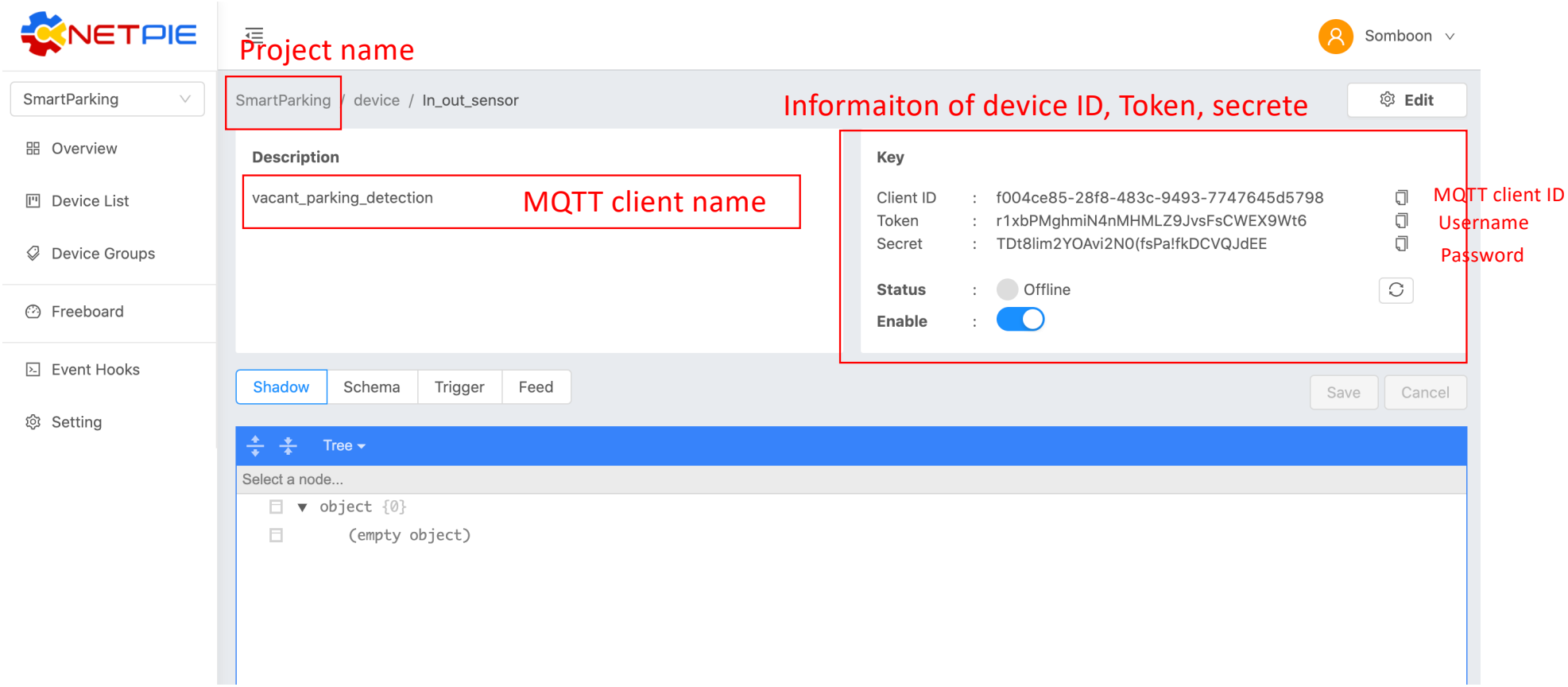


Access to the device



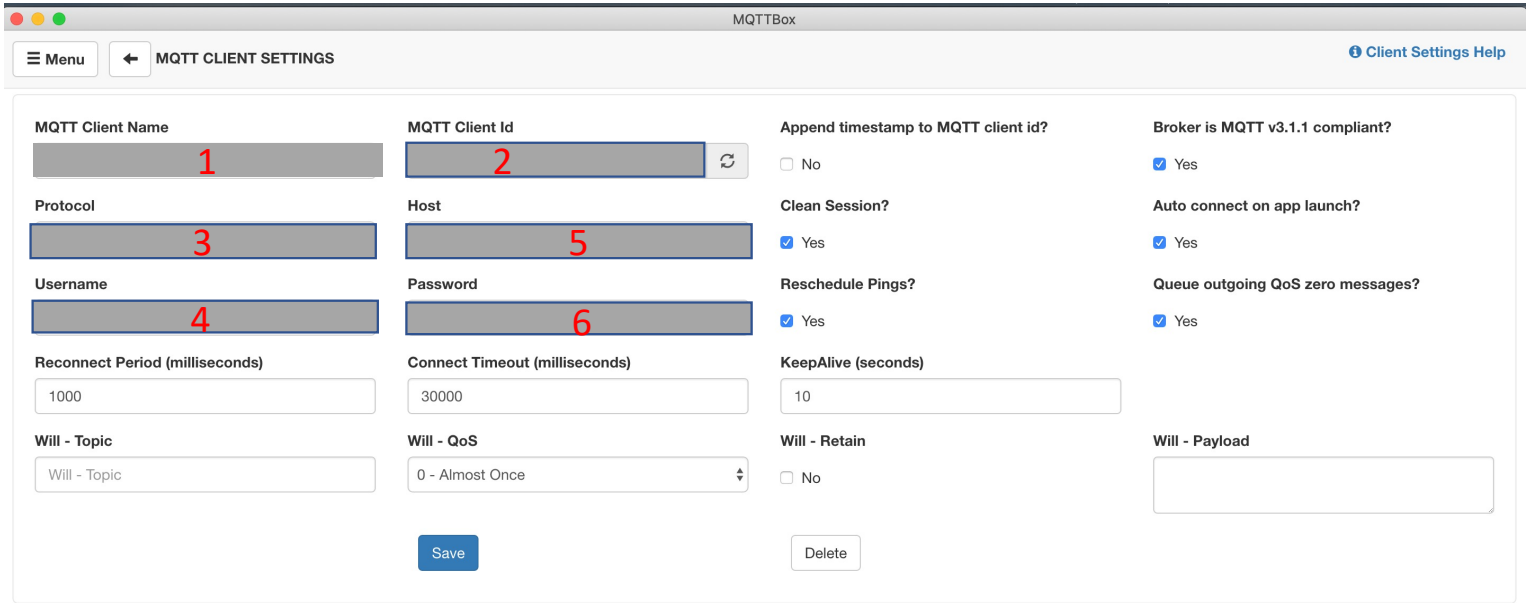
Click a device

Detail of the device



MQTTbox Setting for NETPIE

1. Download MQTTbox app and installed in your computer.
2. Click to open the MQTTbox app
3. Configure setting

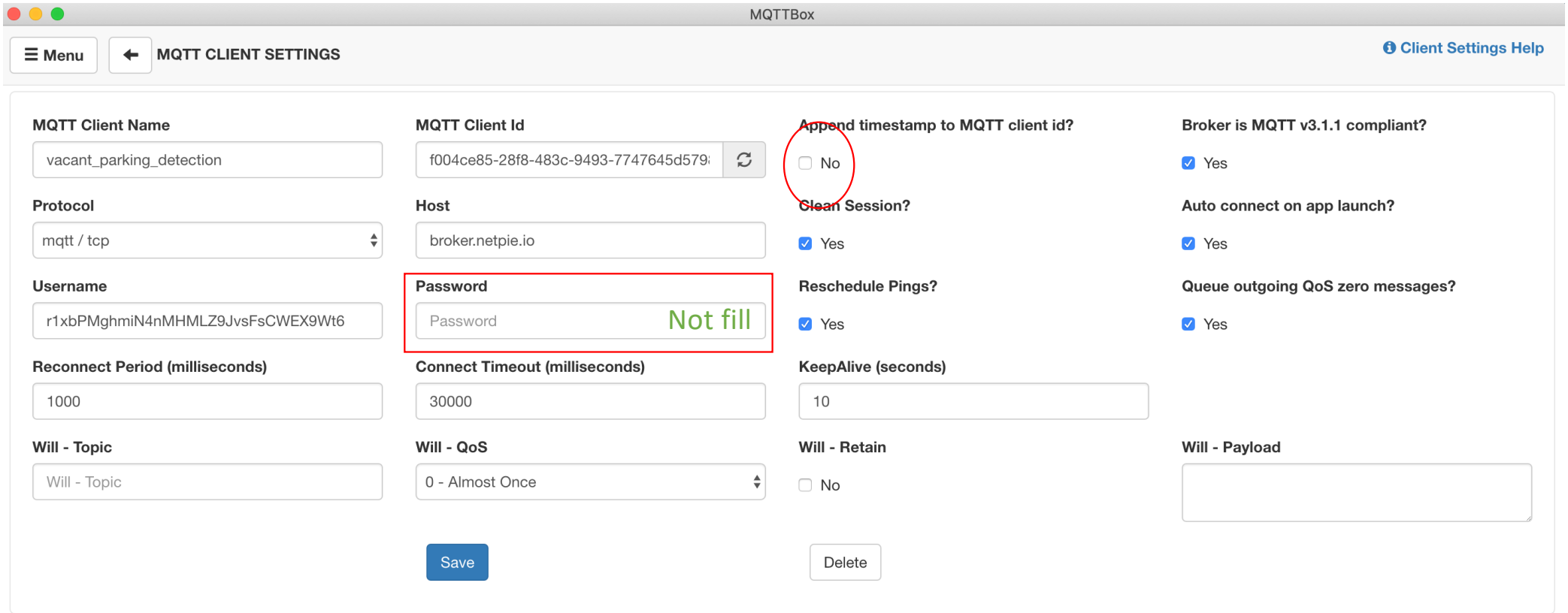


MQTTbox Setting for NETPIE

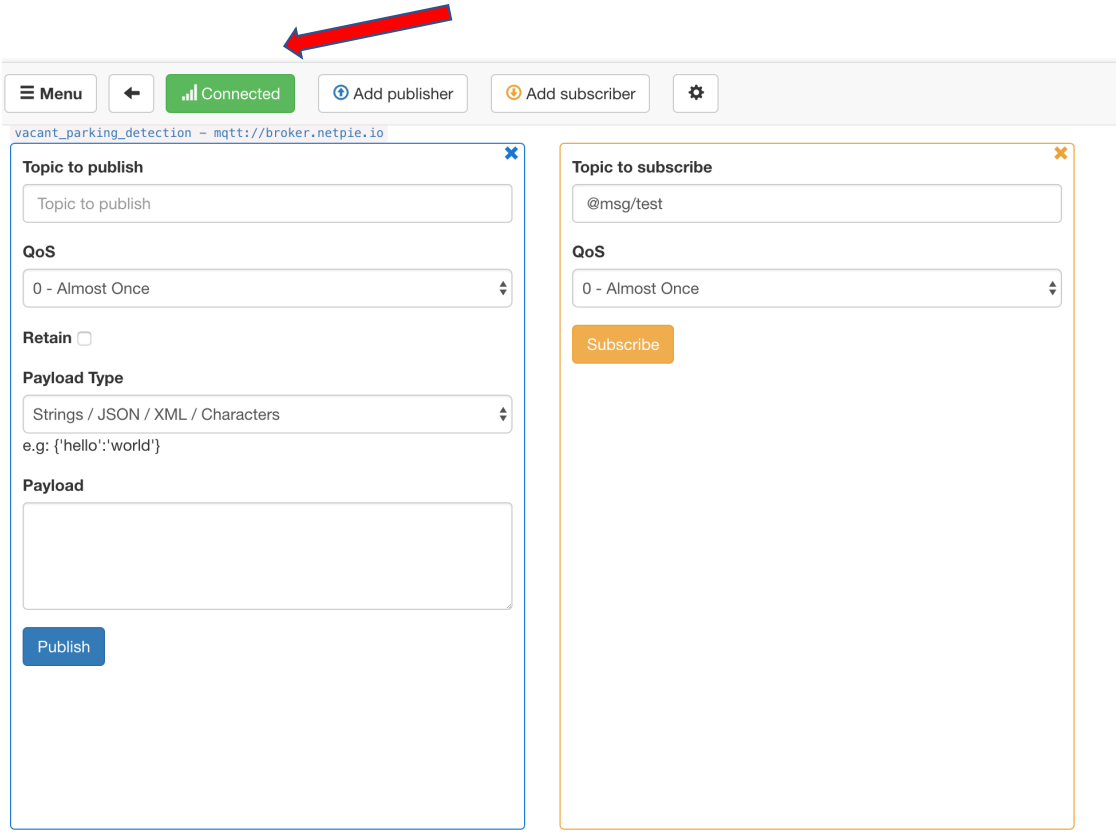
1. MQTT client name
2. MQTT client ID
3. Protocol
4. Username
5. Host
6. MQTT Password

1. Device description
2. Client ID
3. MQTT/tcp
4. Token
5. broker.netpie.io
6. Secrete

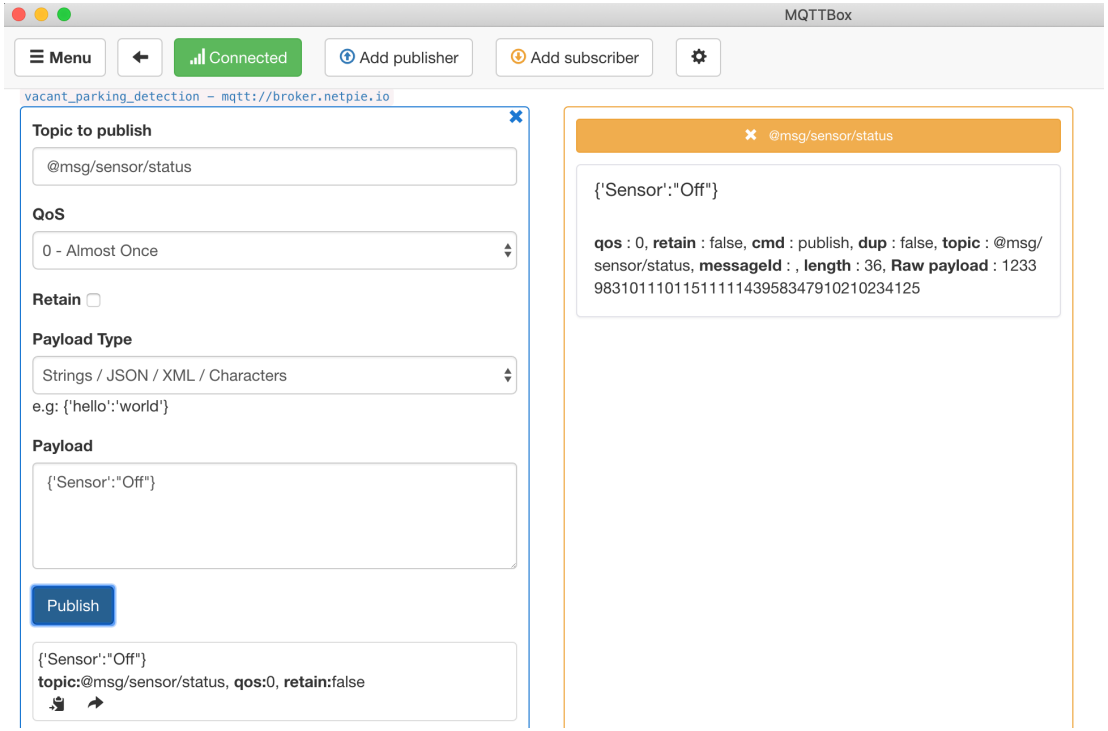
MQTTbox Setting for NETPIE

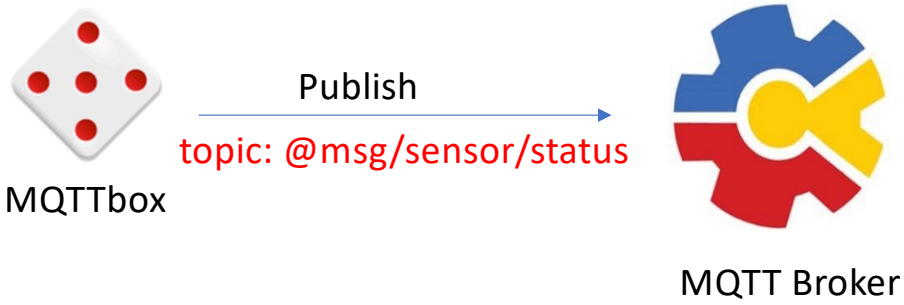


MQTTBox status



Send a message from MQTTBox to NETPIE

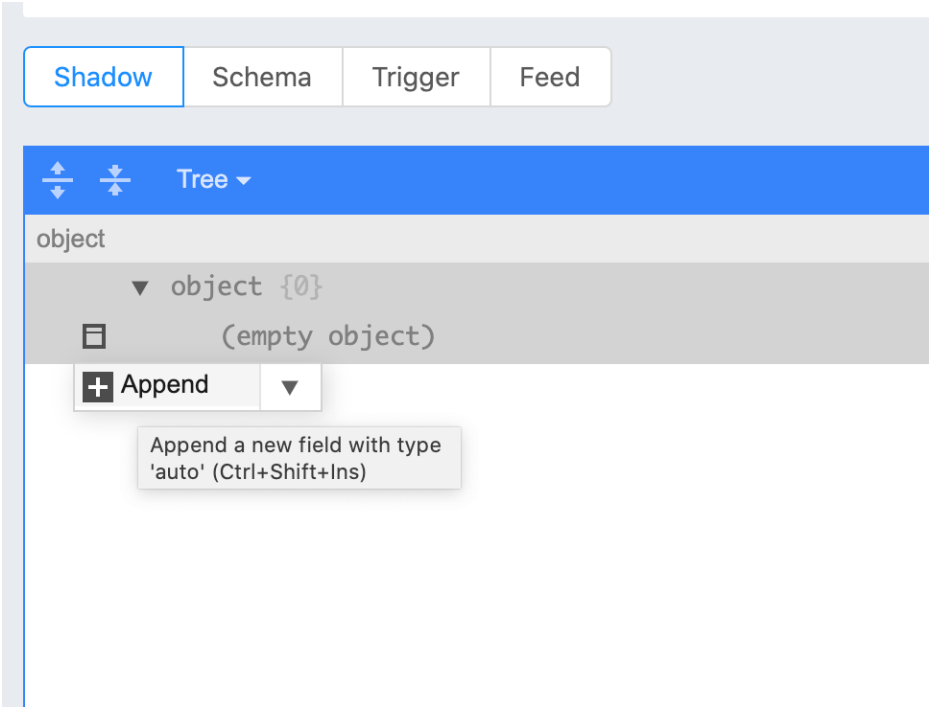




Send the data to Device Shadow

Need to create a Device Shemabefore store the data in the device shadow

Device Shadow

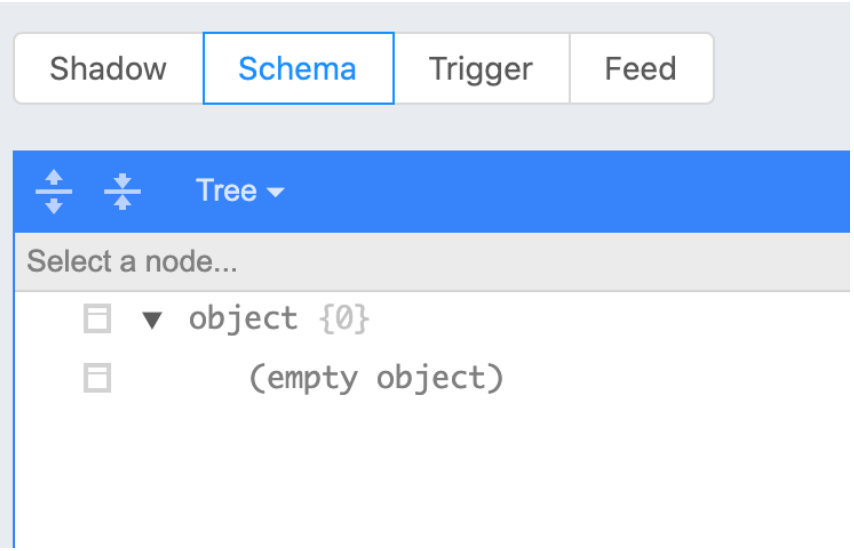


Device Schema

Device Schema: the data diagram for handling the device shadow.
It is the device template for

- Data validation
- Data transformation
- Timeseries databses

Data is in Jason format



Topic for the device shadow

Publish Topic	Description	Subscribe Topic
@shadow/data/update	Update the data to “Shadow Data” by writing to “Payload” in JSON format	**@shadow/data/updated**

Device schema

additionalProperties (boolean)

State identifies that the data is allowed to write and save in Shadow or Timeseries Database

additionalProperties : true → Allow to write the data in Shadow or timeseries database

additionalProperties : false → Not allow to write the data in Shadow or time series database

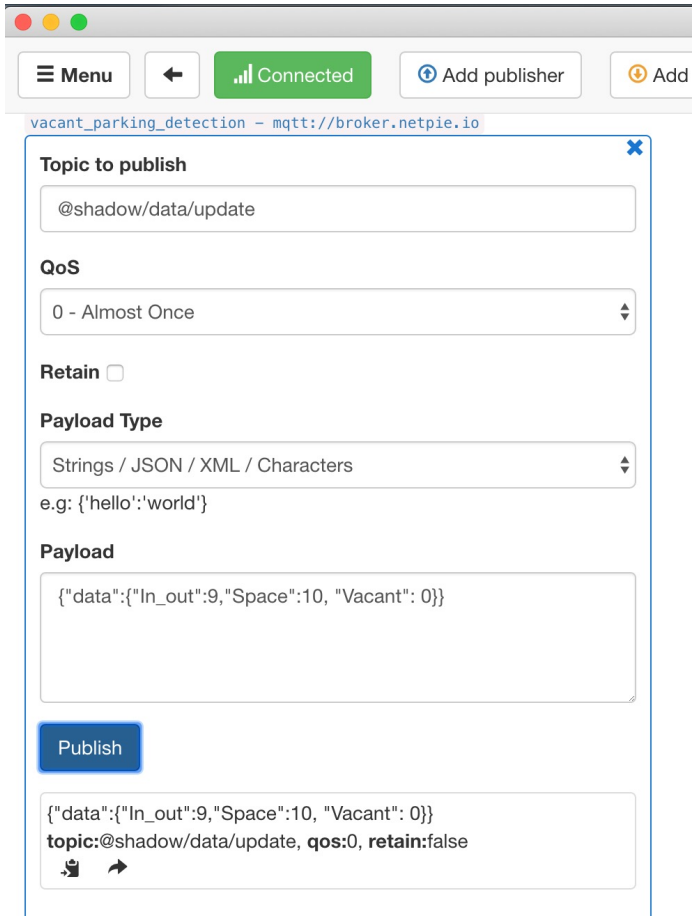
Properties (Json)

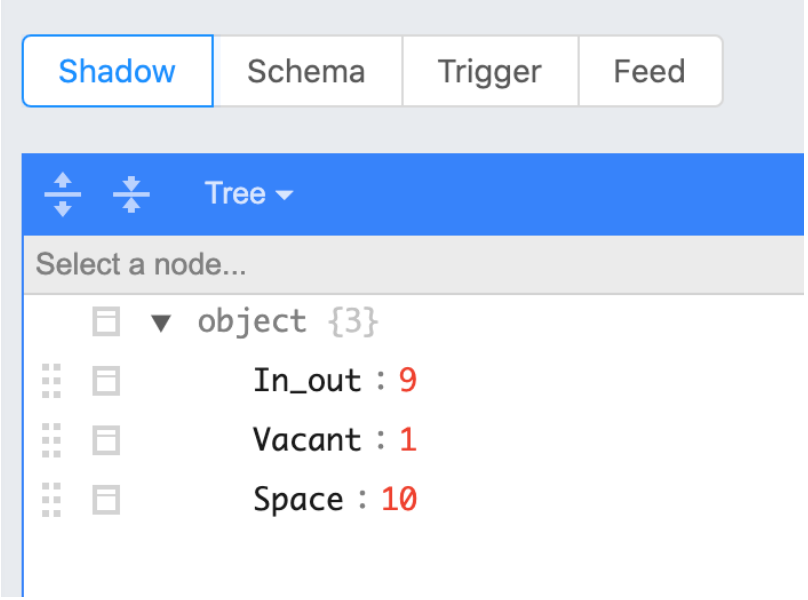
Operation

store : deal with time series databased

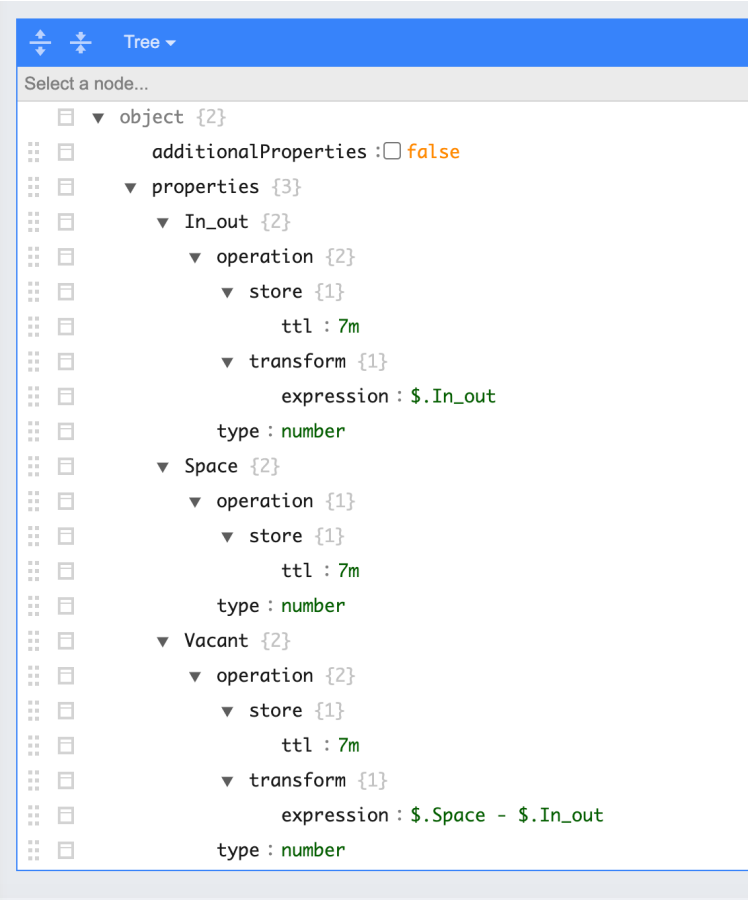
ttl : time to keep the data

Pulish message to @shadow/data/update



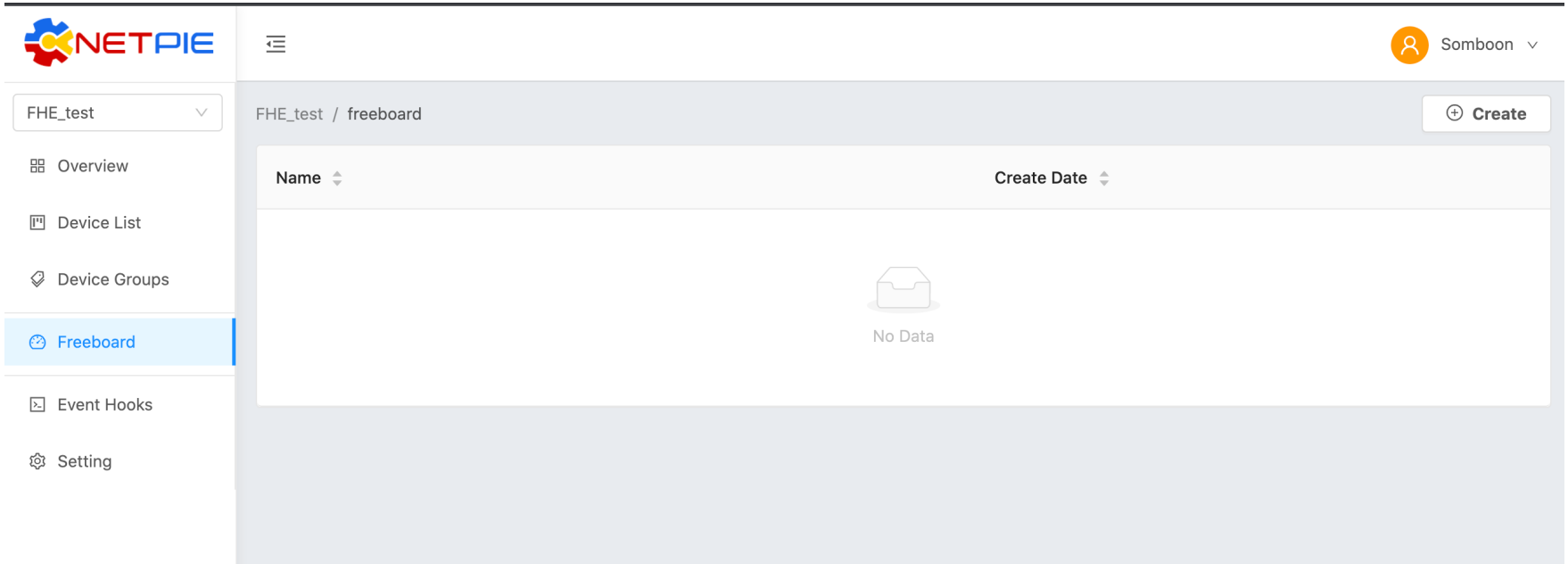


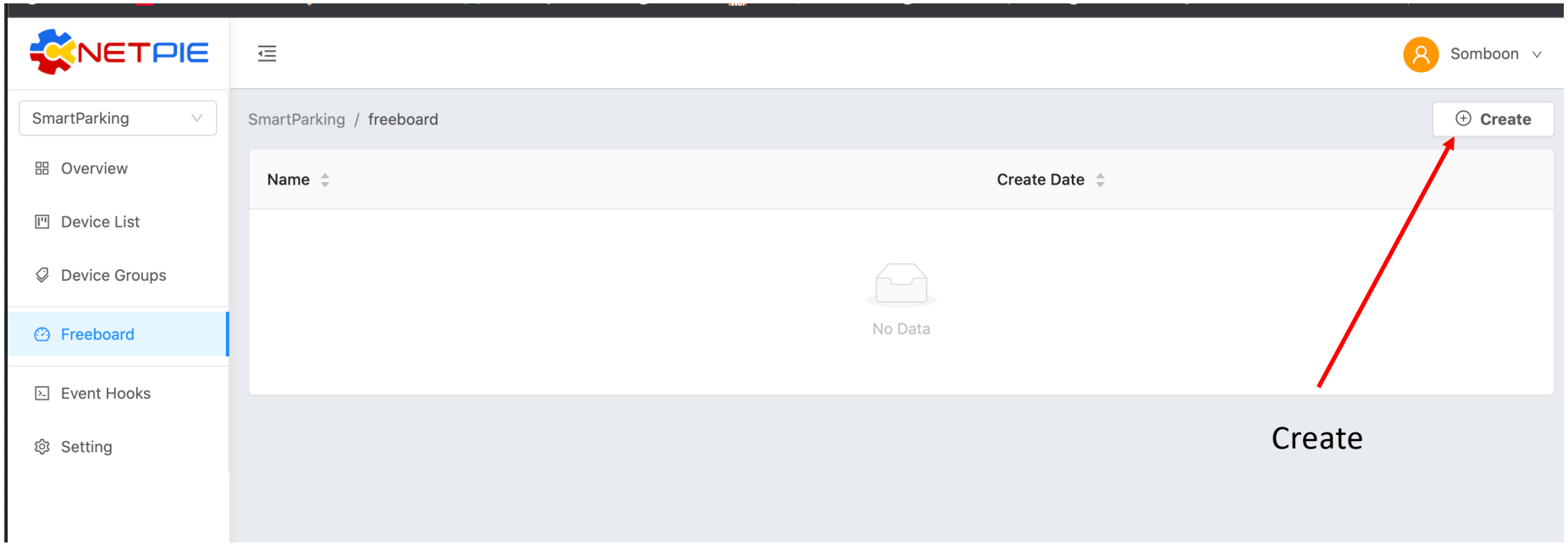
Device schema



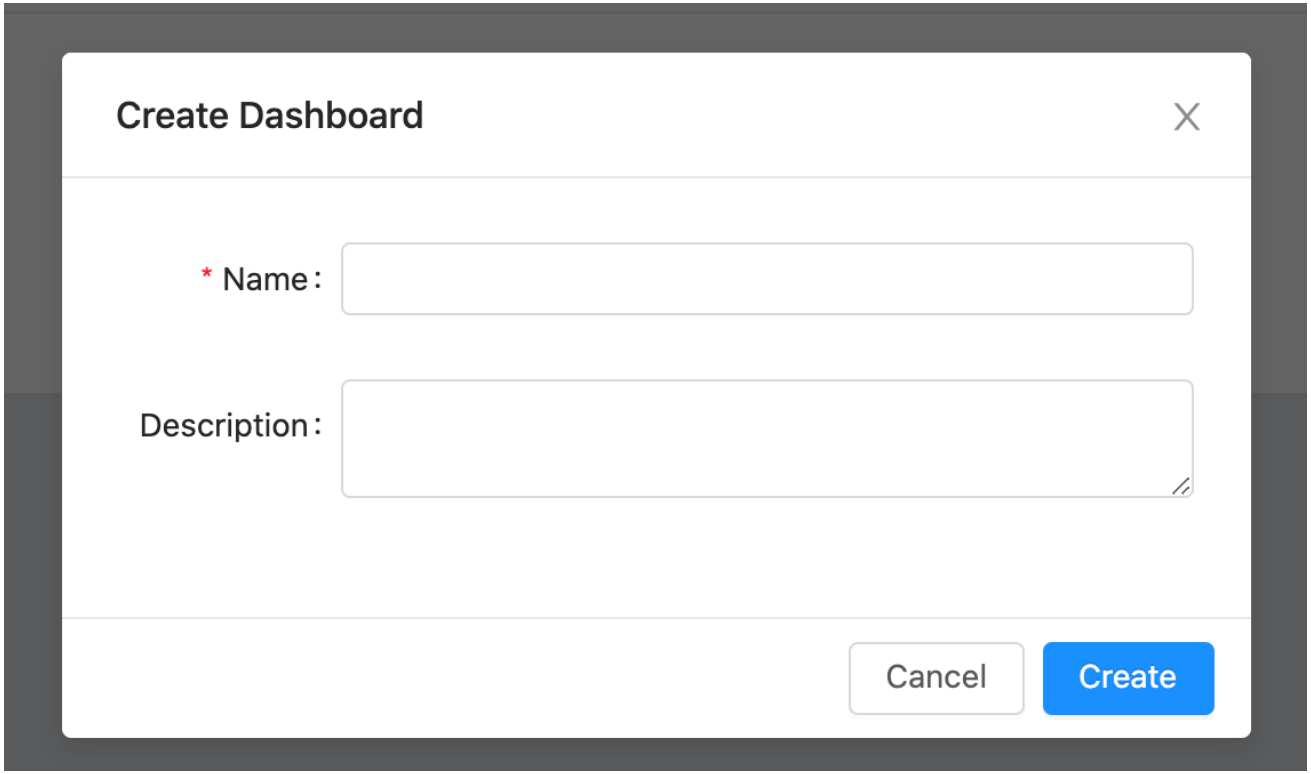

```
{
 "additionalProperties": false,
 "properties": {
  "In_out": {
   "operation": {
    "store": {
     "ttl": "7m"
    },
    "transform": {
     "expression": "$.In_out "
    }
   },
   "type": "number"
  },
  "Space": {
   "operation": {
    "store": {
     "ttl": "7m"
    }
   },
   "type": "number"
  },
  "Vacant": {
   "operation": {
    "store": {
     "ttl": "7m"
    },
    "transform": {
     "expression": "$.Space - $.In_out"
    }
   },
   "type": "number"
  }
 }
}
```

Display the Data with Freeboard

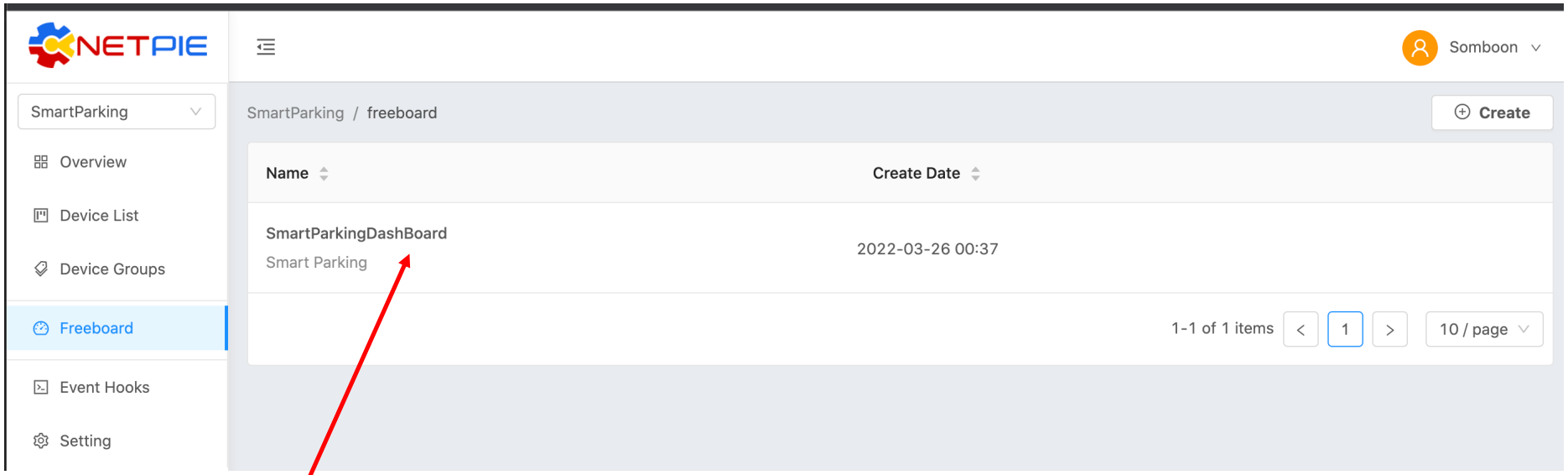



NETPIE
Somboon
SmartParking
Overview
Device List
Device Groups
Freeboard
Event Hooks
Setting
SmartParking / freeboard
Create
Name
Create Date
No Data
Create

Create Dashboard

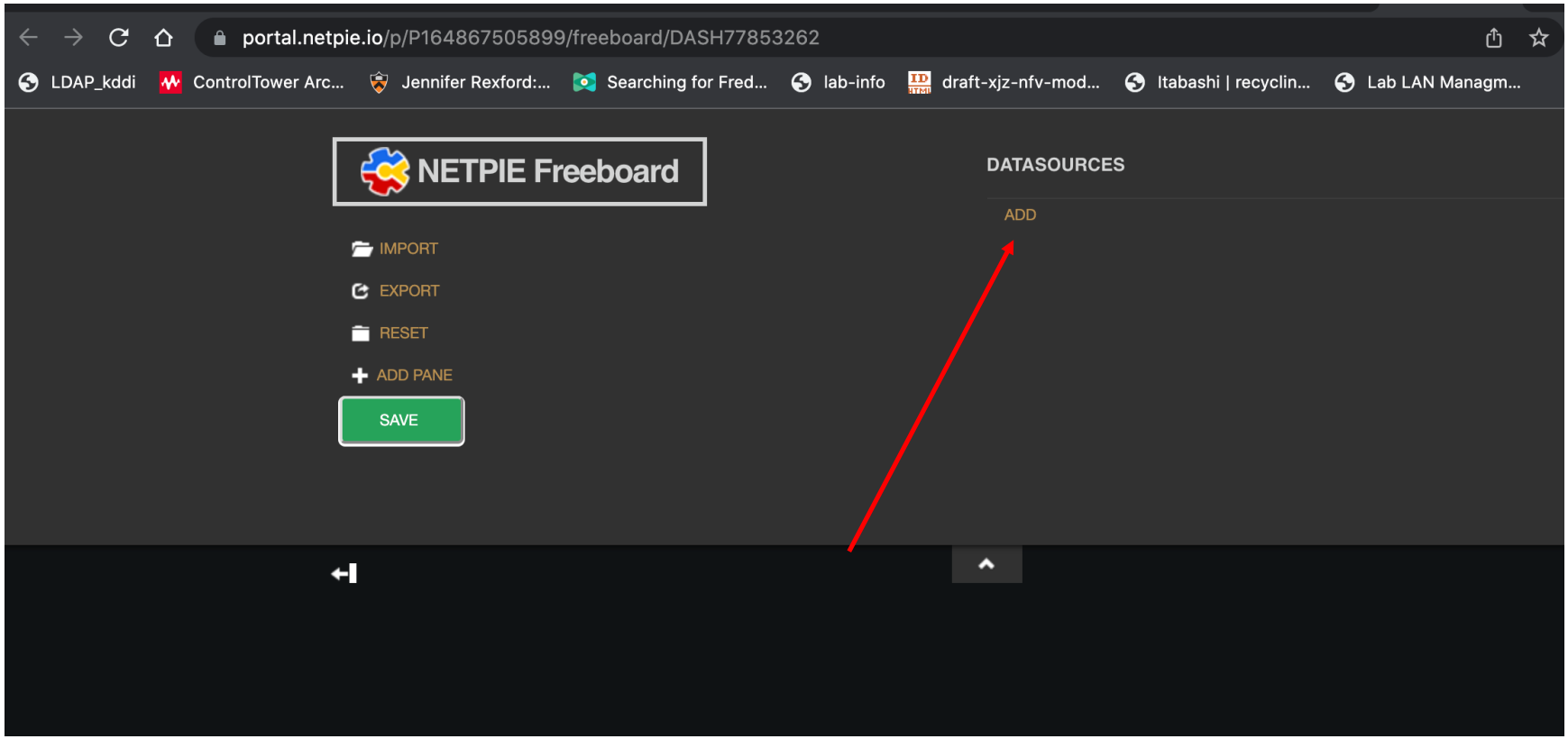


Open a new page for NETPIE freeboard

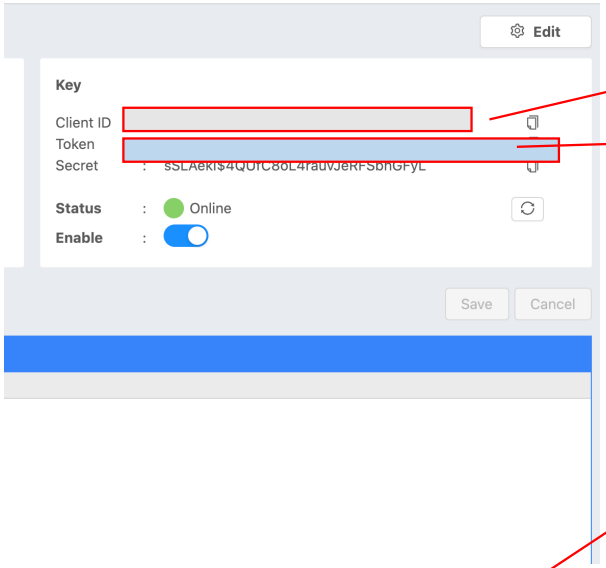


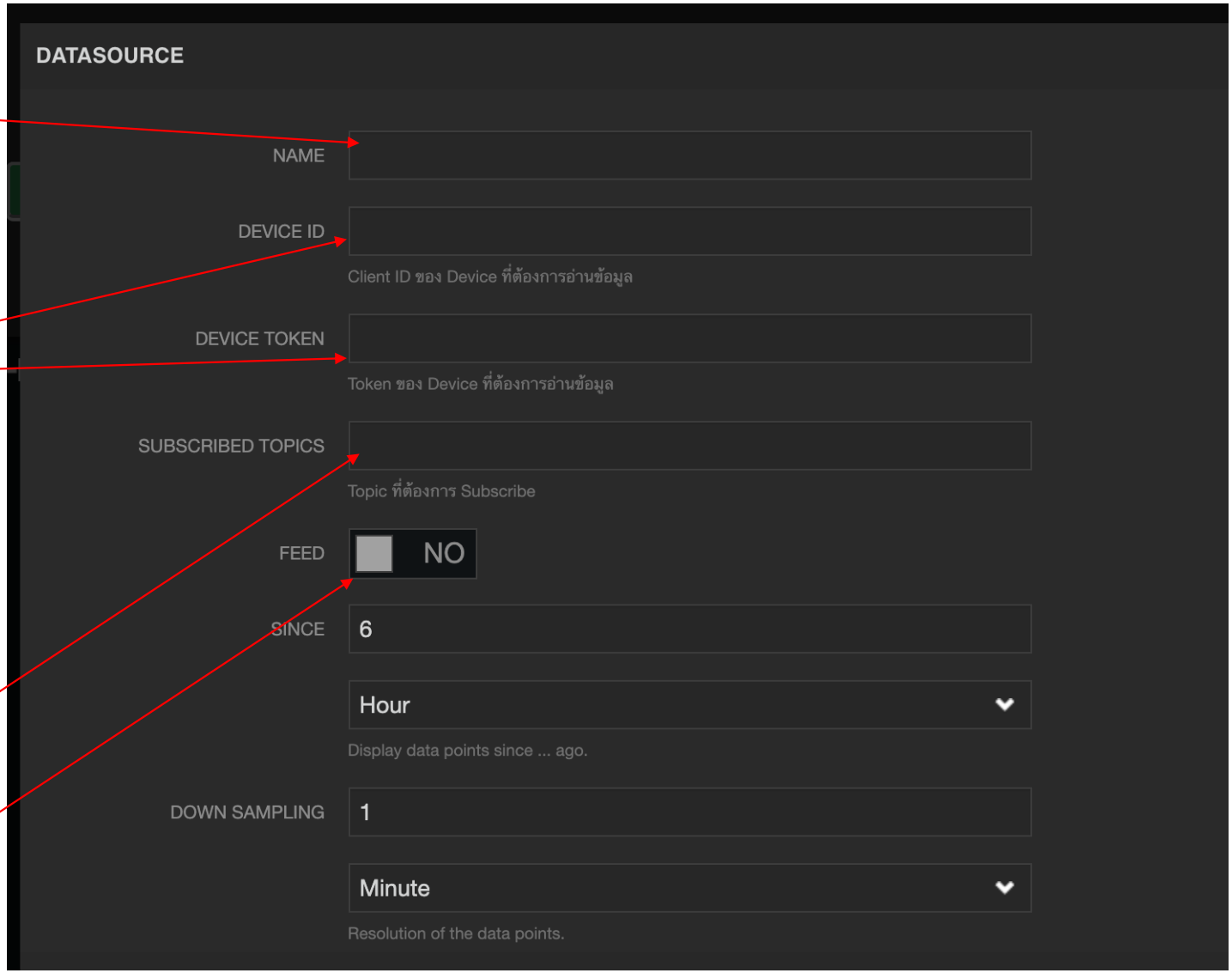
Click

Add the datasource



Name of the datasource

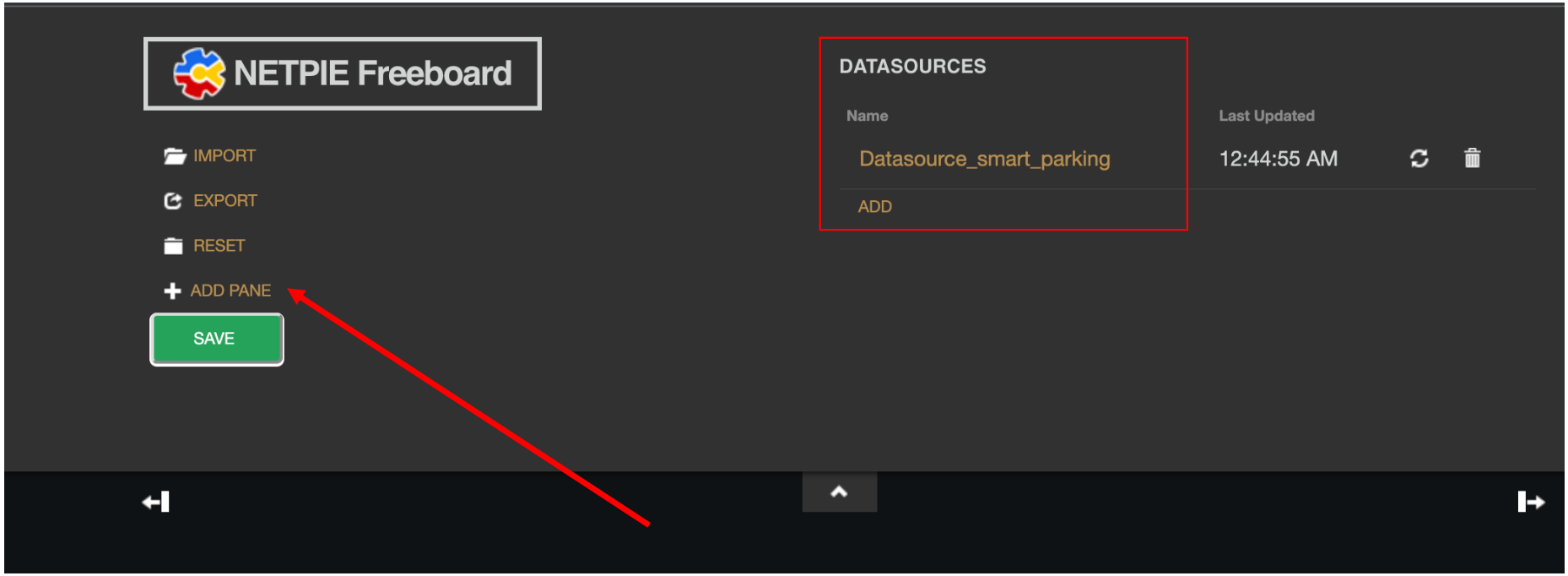


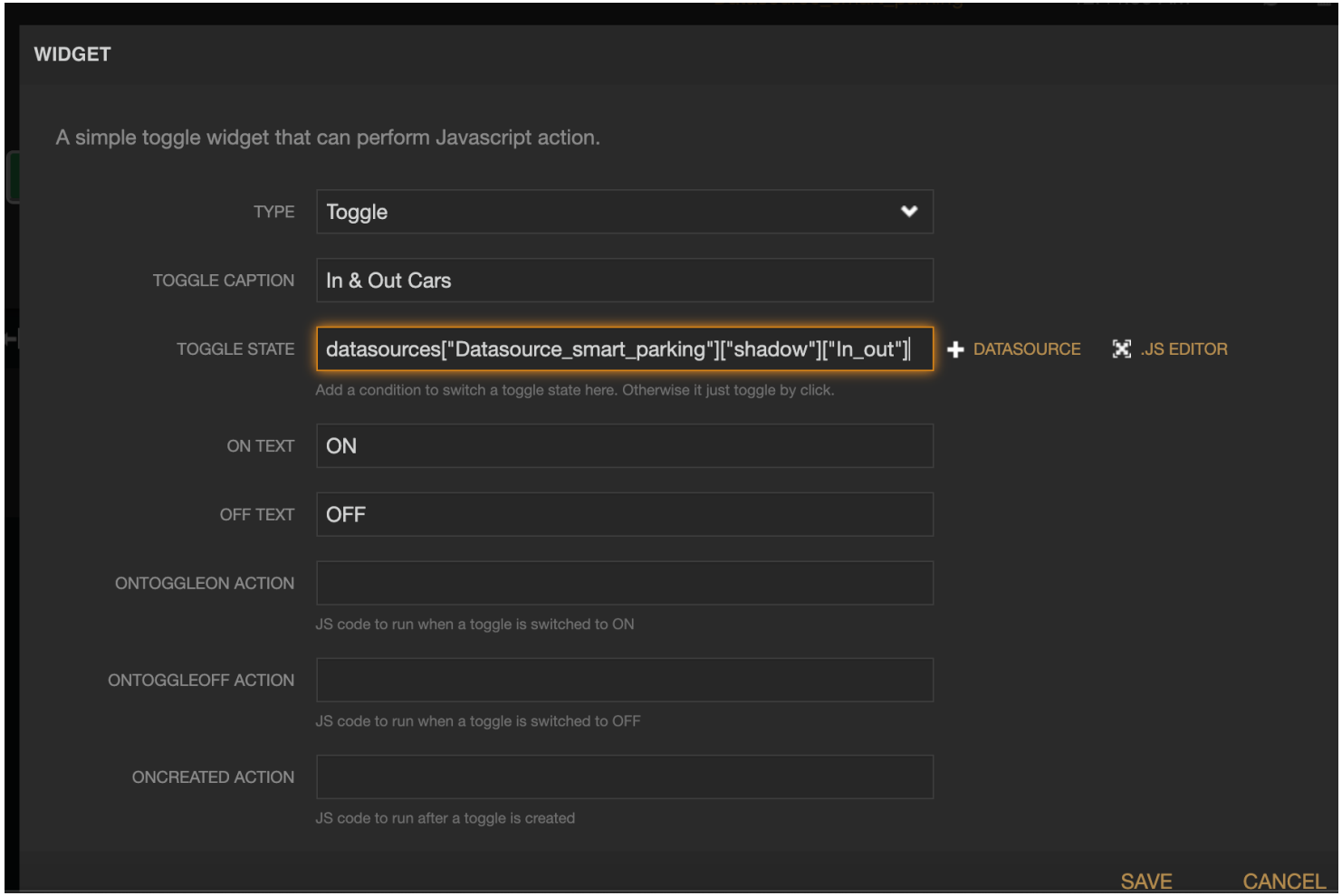


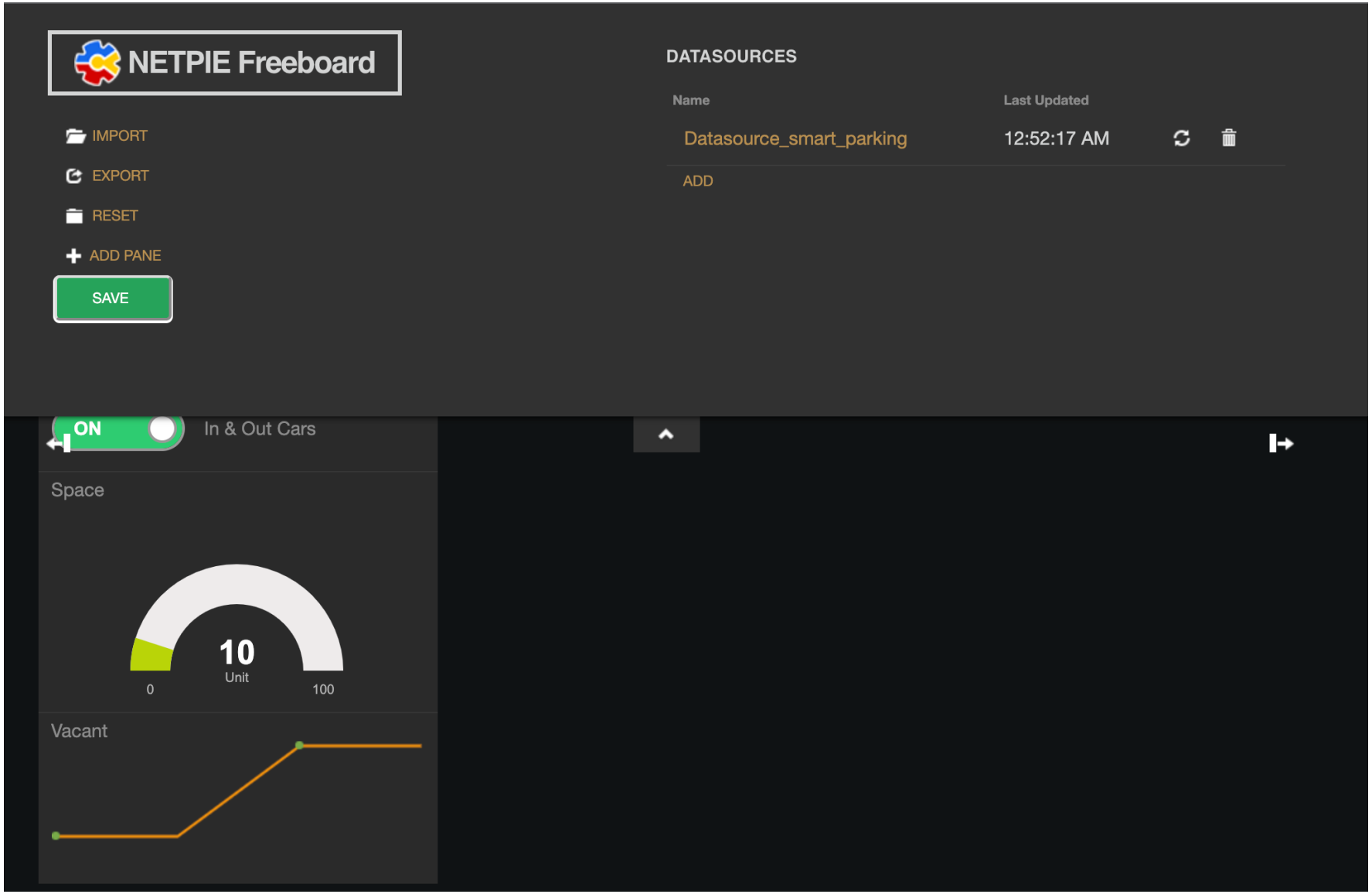
@shadow/data/update

YES

Add PANE


NETPIE Freeboard
IMPORT
EXPORT
RESET
ADD PANE
SAVE
DATASOURCES
Name
Last Updated
Datasource_smart_parking
12:44:55 AM
ADD


WIDGET
A simple toggle widget that can perform Javascript action.
TYPE
Toggle
TOGGLE CAPTION
In & Out Cars
TOGGLE STATE
datasources["Datasource_smart_parking"]["shadow"]["In_out"]
DATASOURCE
.JS EDITOR
Add a condition to switch a toggle state here. Otherwise it just toggle by click.
ON TEXT
ON
OFF TEXT
OFF
ONTOGGLEON ACTION
JS code to run when a toggle is switched to ON
ONTOGGLEOFF ACTION
JS code to run when a toggle is switched to OFF
ONCREATED ACTION
JS code to run after a toggle is created
SAVE
CANCEL


NETPIE Freeboard
IMPORT
EXPORT
RESET
ADD PANE
SAVE
DATASOURCES
Name
Last Updated
Datasource_smart_parking
12:52:17 AM
ADD
ON
In & Out Cars
Space
10
Unit
0
100
Vacant

Event Hooks
Setting
Shadow
Schema
Trigger
Feed
Histories
Exports
Data Display for :
Since
1
Hour
Apply
Sampling
--None--
In_out
Clear data
600.00
500.00
400.00
300.00
200.00
100.00
0.00
00:00:00
00:05:00
00:10:00
00:15:00
00:20:00
00:25:00
00:30:00
00:35:00
00:40:00
00:45:00
00:50:00
00:55:00
Space
Clear data
20.00
15.00
10.00
5.00
0.00
Vacant
Clear data
20.00
16.00
12.00
8.00
4.00
0.00
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