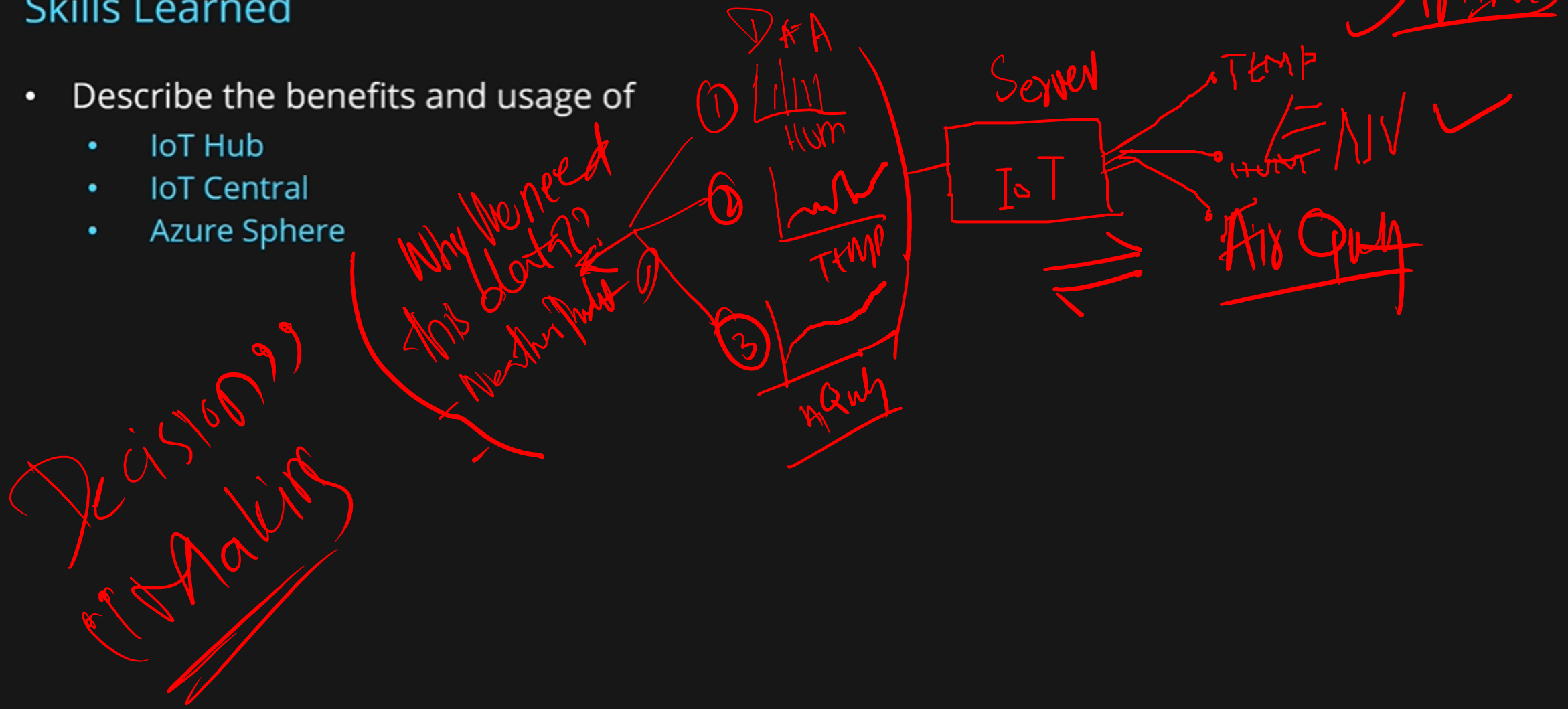
Cloud Computing with Microsoft Azure

www.drmukhan.com

Lecture Objective

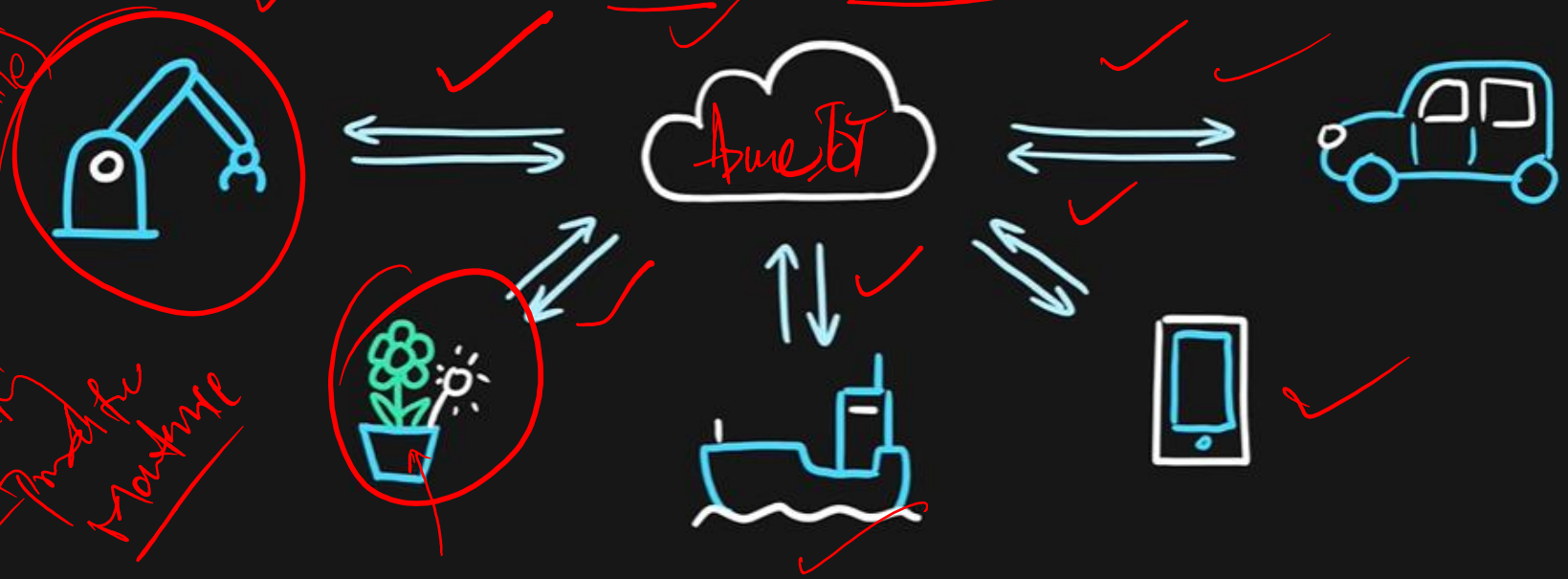
Skills Learned

- Describe the benefits and usage of
  - IoT Hub
  - IoT Central
  - Azure Sphere

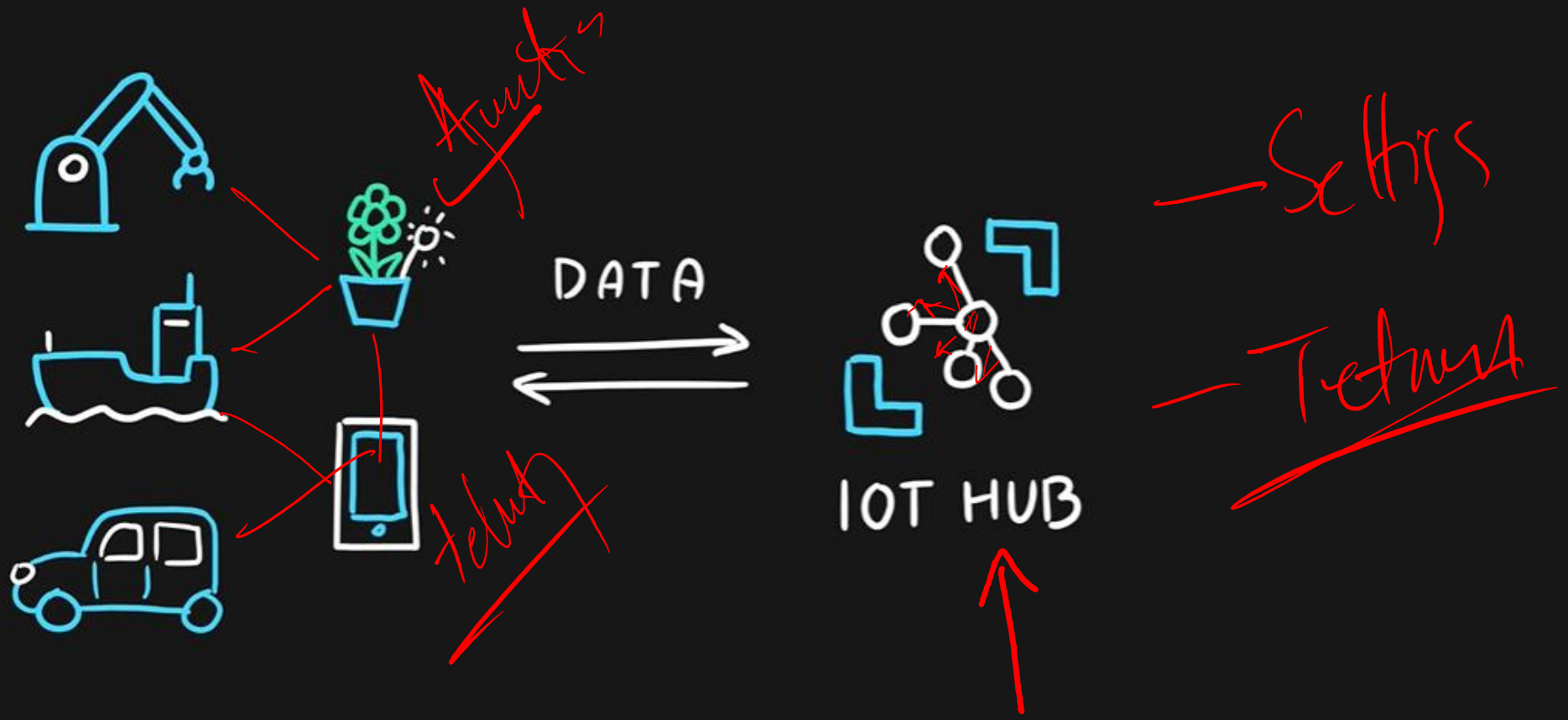


Internet of Things

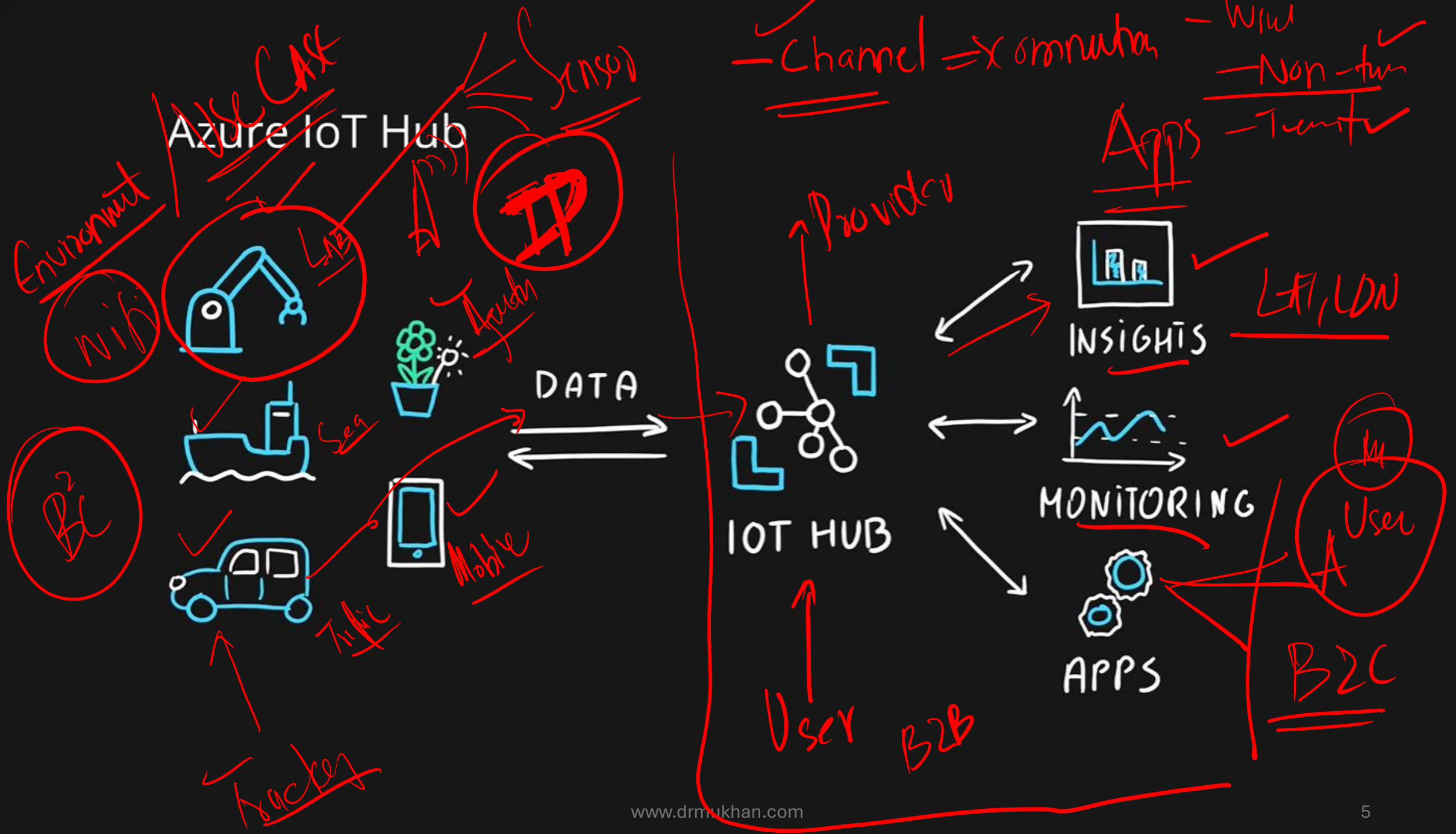
Internet of Things (IoT) is a network of internet connected devices (IoT Devices) embedded in everyday objects enabling sending and receiving data such as settings and telemetry.



Azure IoT Hub



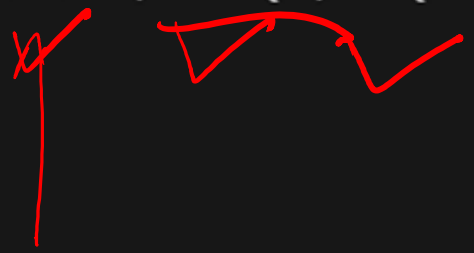
Azure IoT Hub

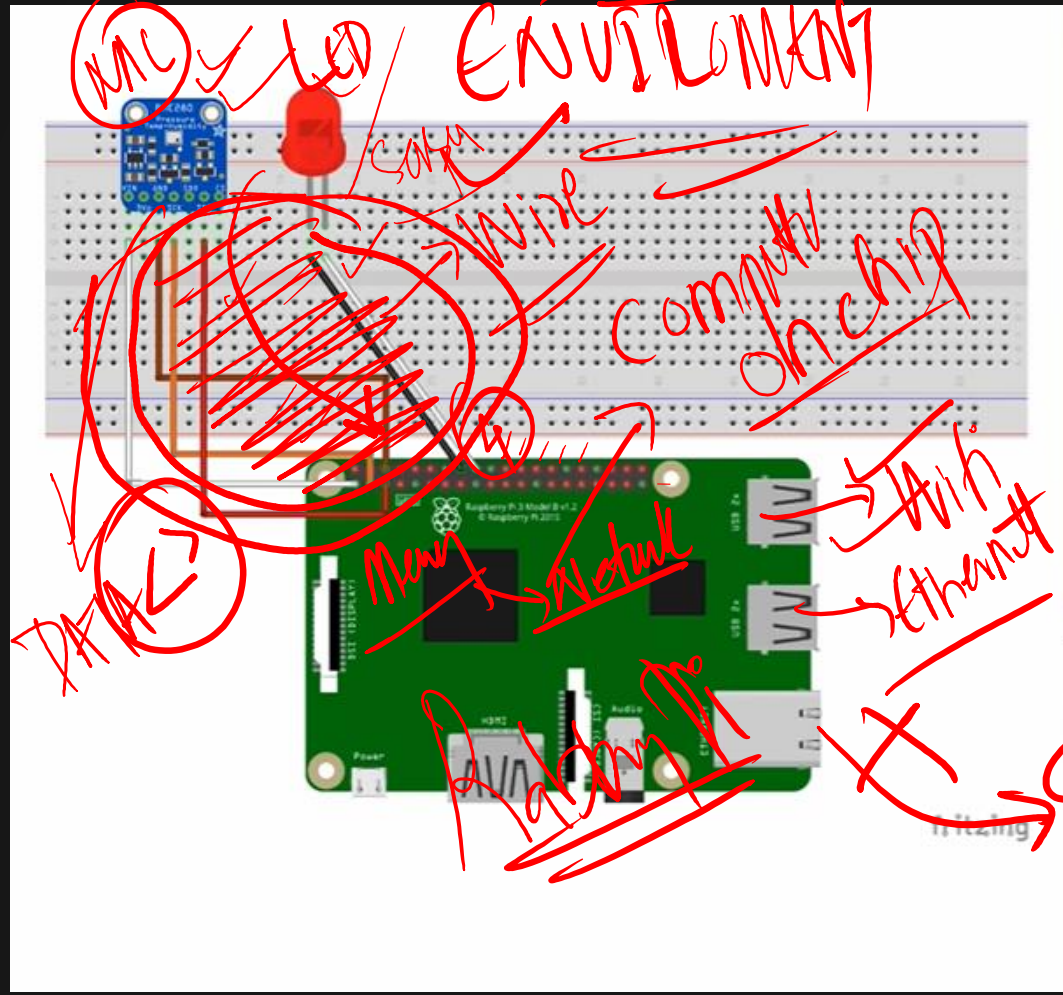


Azure IoT Hub

Key Characteristics

- Managed service for bi-directional communication
- Platform as a Service (PaaS)
- Highly secure, scalable and reliable
- Integrates with a lot of Azure Services
- Programmable SDKs for popular languages (C, C#, Java, Python, Node.js)
- Multiple protocols (HTTPS, AMQP, MQTT)





```
/*
 * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed
 */
const wpi = require('wiring-pi');
const Client = require('azure-iot-device').Client;
const Message = require('azure-iot-device').Message;
const Protocol = require('azure-iot-device-mqtt').Mqtt;
const BME280 = require('bme280-sensor');

const BME280_OPTION = {
  i2cBusNo: 1, // defaults to 1
  i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
};

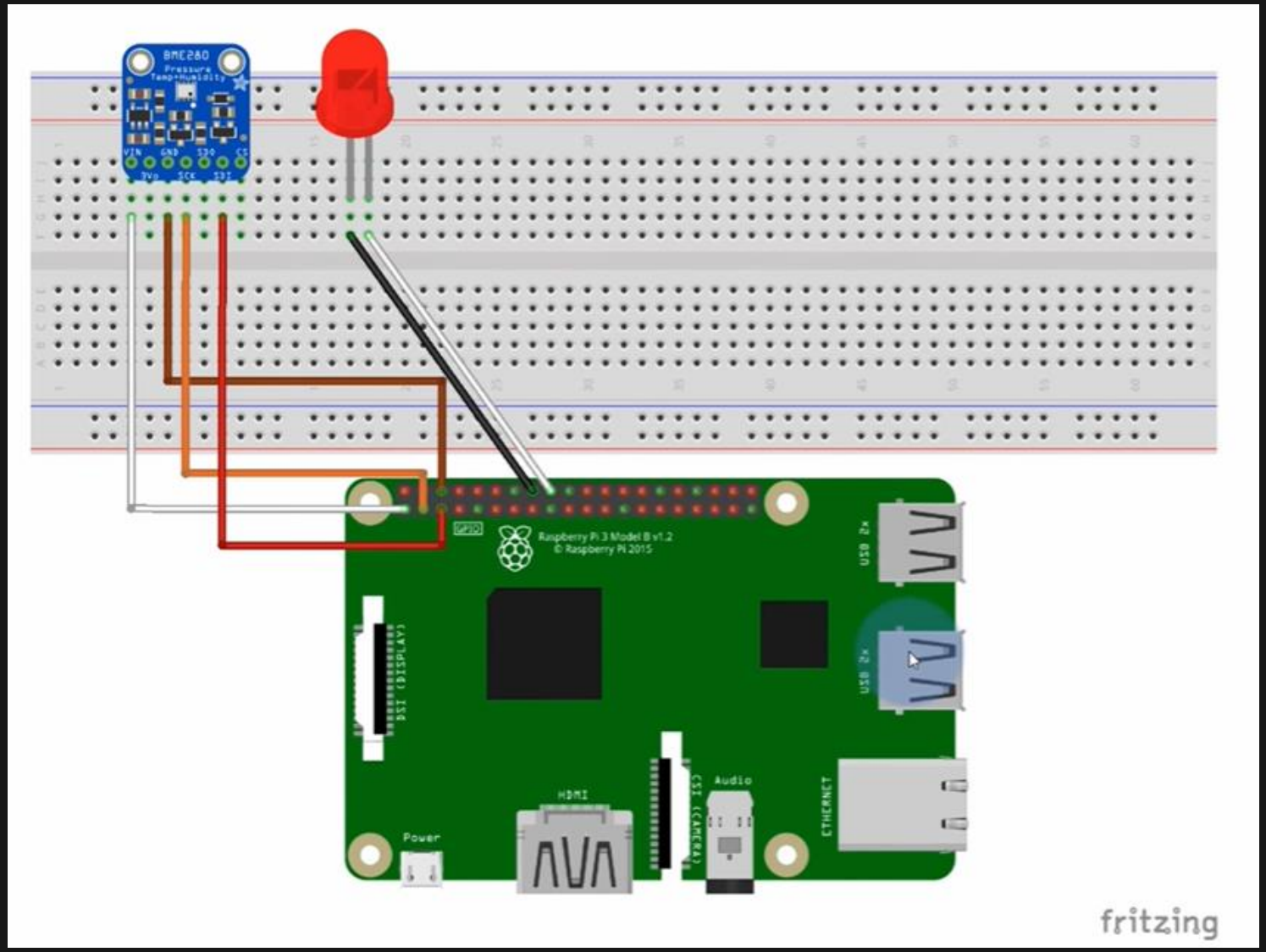
const connectionString = '[Your IoT hub device connection string]';
const LEDPin = 4;

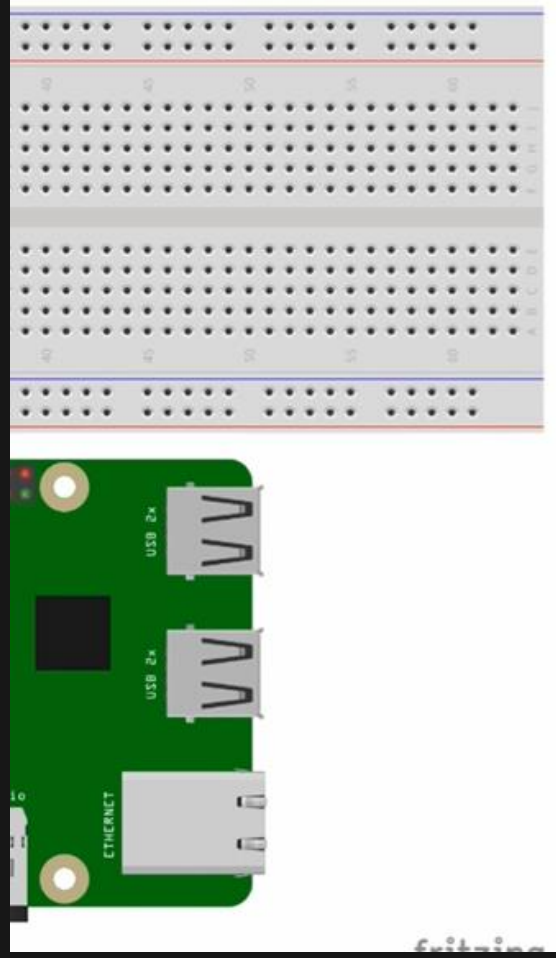
var sendingMessage = false;
var messageId = 0;
var client, sensor;
var blinkLEDTimeout = null;

function getMessage(cb) {
  messageId++;
  sensor.readSensorData()
    .then(function (data) {
```

Run Reset

Click `Run` button to run the sample code(When sample is running, code is read-only).
Click `Stop` button to stop the sample code running.
Click `Reset` to reset the code.We keep your changes to the editor even you refresh the page.


BME280
Pressure
Temp+Humidity
VIN
GND
SCK
SDI
SDO
CS
GPIO
Raspberry Pi 3 Model B v1.2
© Raspberry Pi 2015
USB 2x
USB 2x
DSI (DISPLAY)
HDMI
Audio
CSI (CAMERA)
ETHERNET
Power
fritzing




```
 2  * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed
 3  */
 4  const wpi = require('wiring-pi');
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 6  const Message = require('azure-iot-device').Message;
 7  const Protocol = require('azure-iot-device-mqtt').Mqtt;
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```
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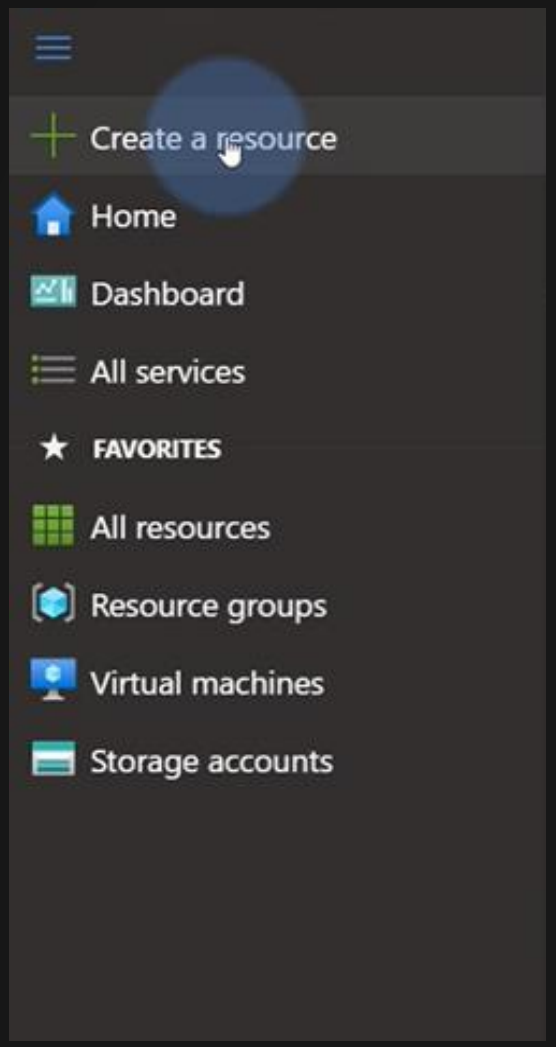
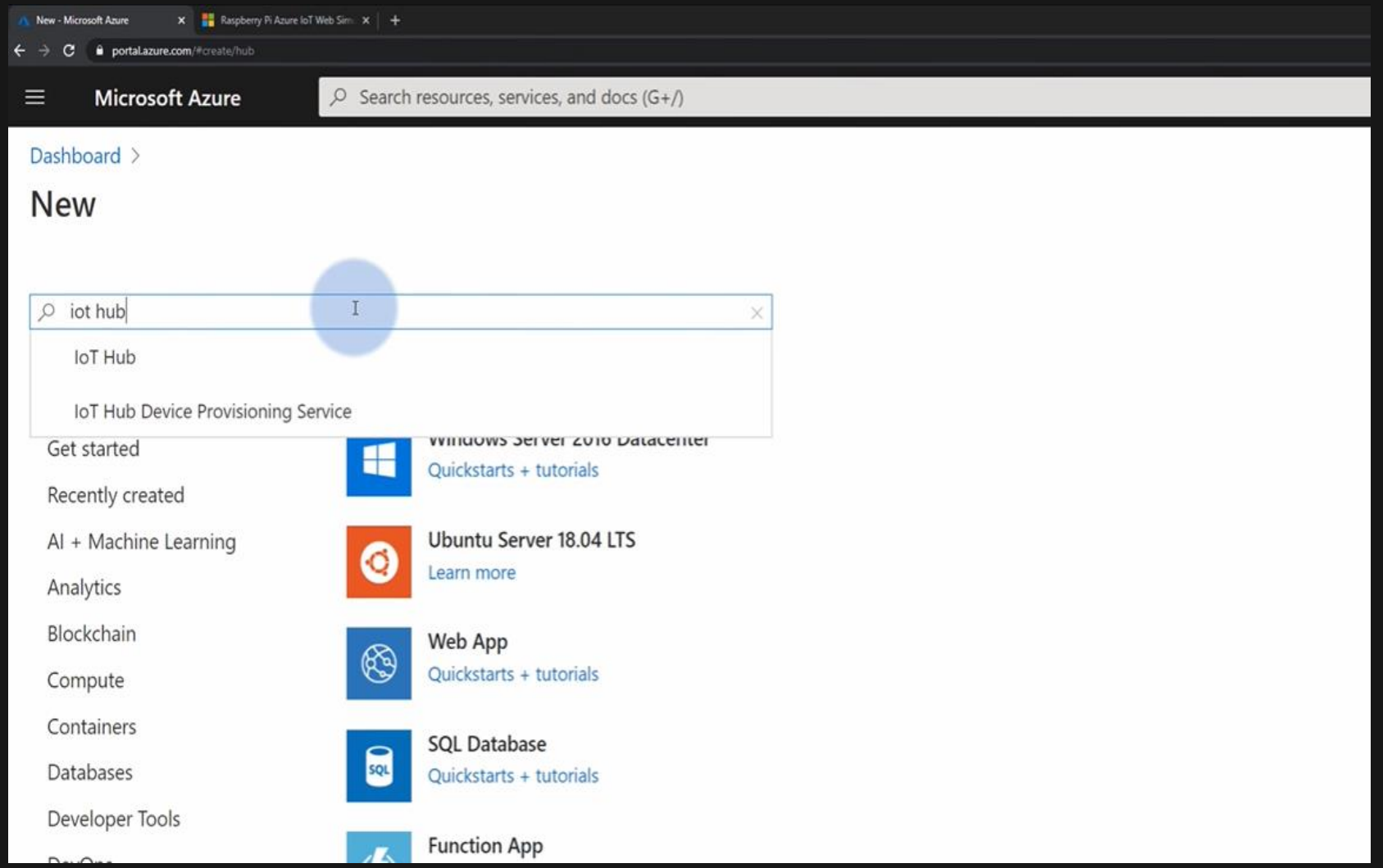
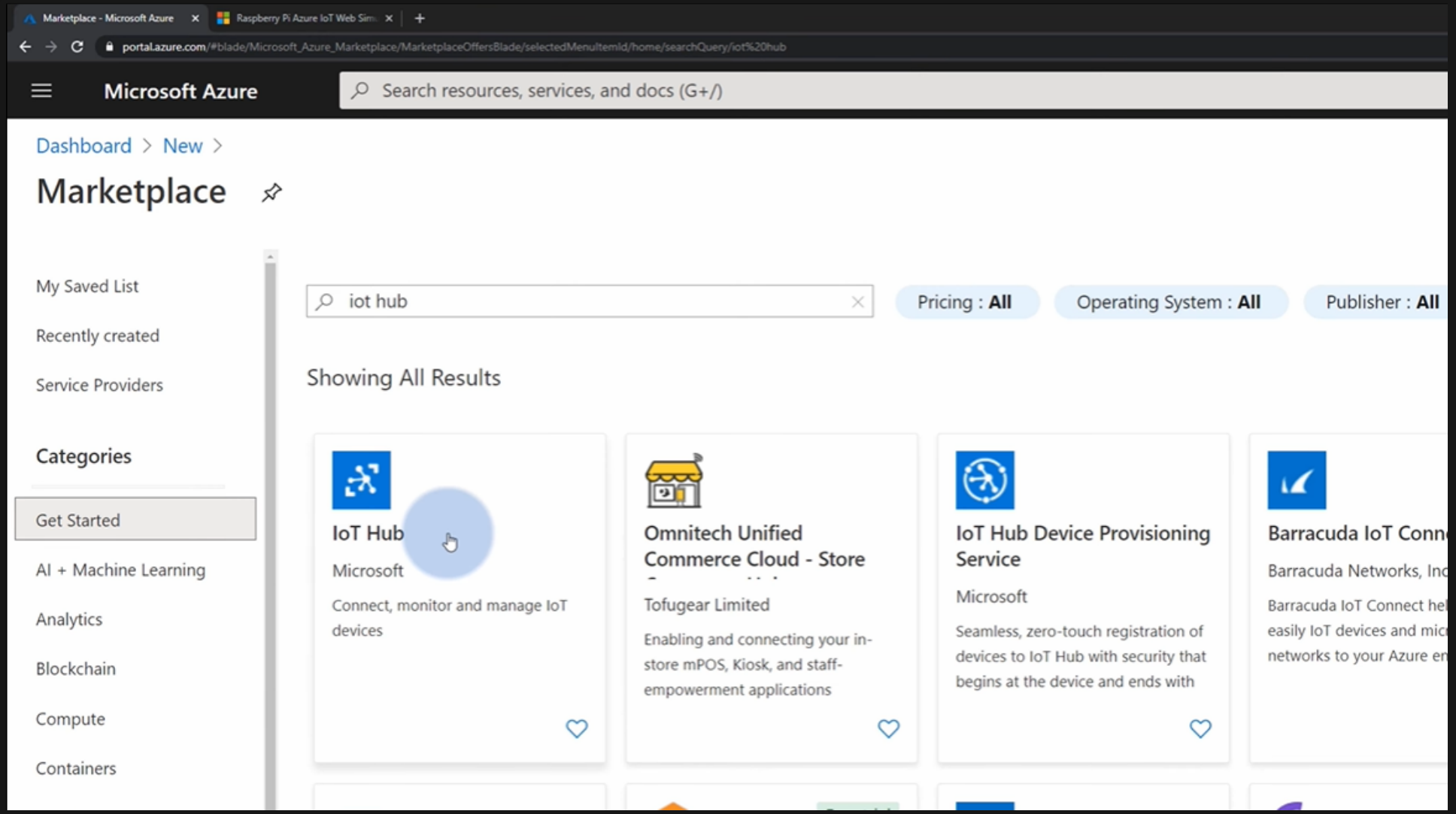
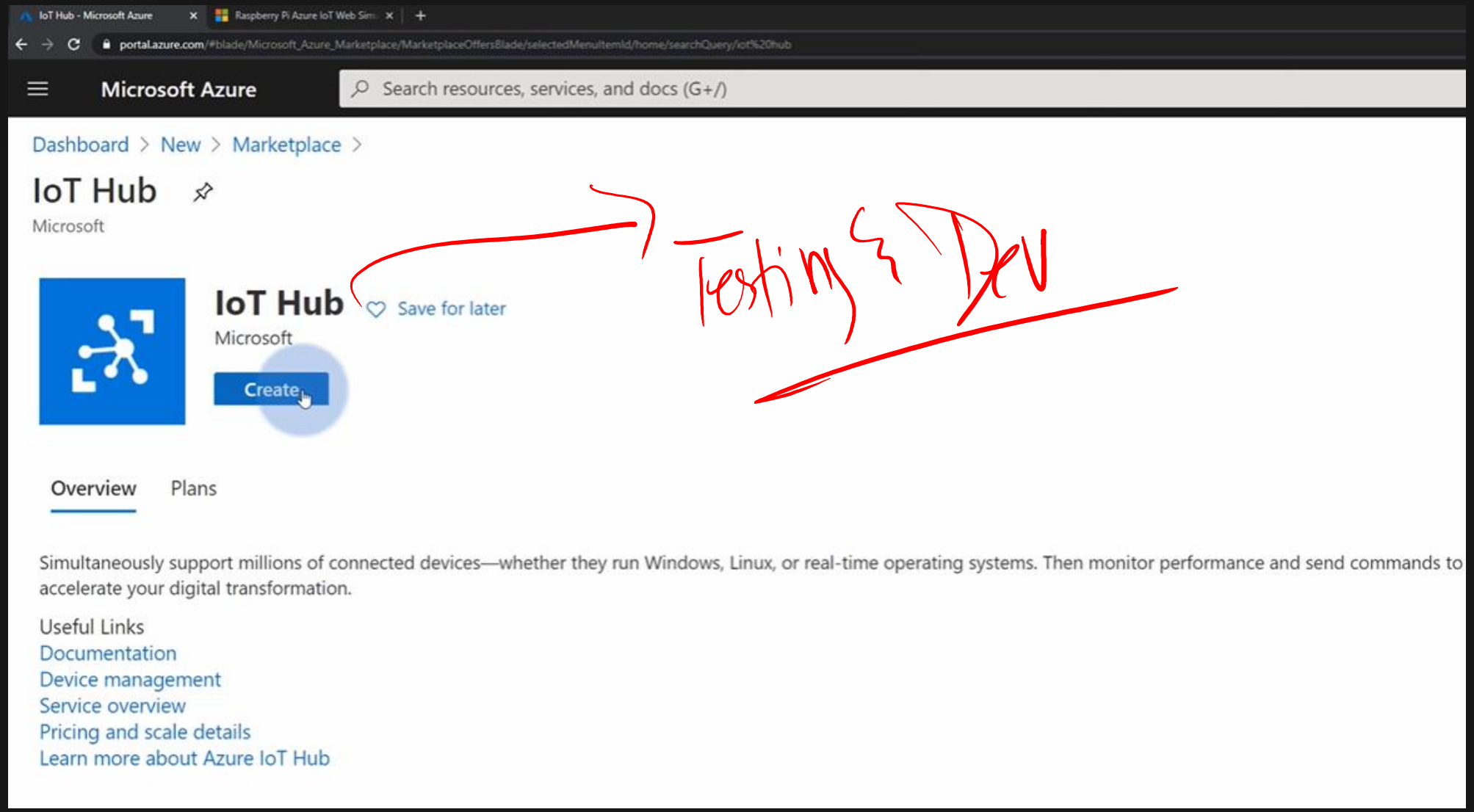
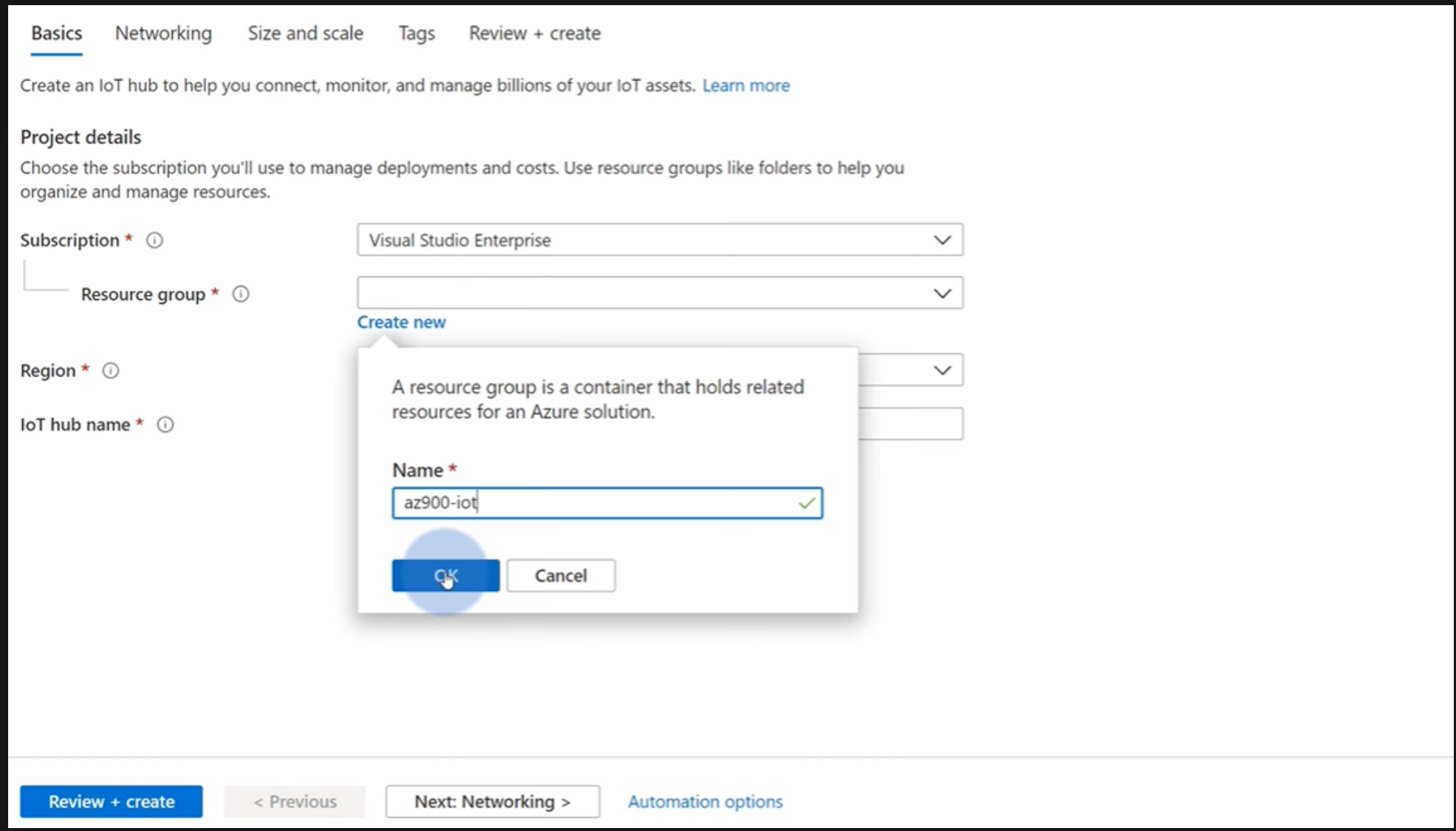
```

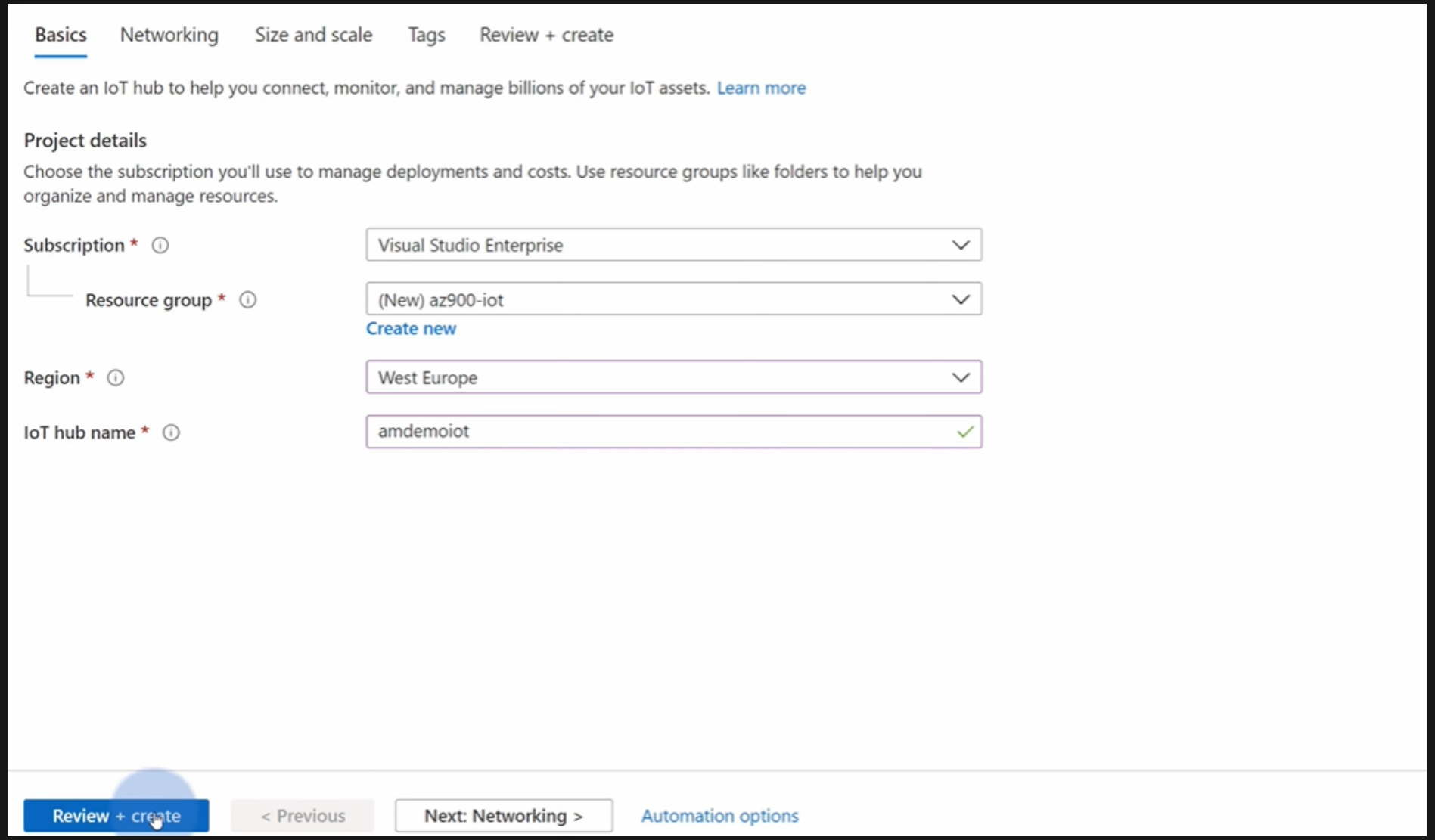

Create a resource
Home
Dashboard
All services
FAVORITES
All resources
Resource groups
Virtual machines
Storage accounts


New - Microsoft Azure
Raspberry Pi Azure IoT Web Sim
portal.azure.com/#create/hub
Microsoft Azure
Search resources, services, and docs (G+/)
Dashboard
New
iot hub
IoT Hub
IoT Hub Device Provisioning Service
Get started
Recently created
AI + Machine Learning
Analytics
Blockchain
Compute
Containers
Databases
Developer Tools
Quickstarts + tutorials
Ubuntu Server 18.04 LTS
Learn more
Web App
Quickstarts + tutorials
SQL Database
Quickstarts + tutorials
Function App


Marketplace - Microsoft Azure
Raspberry Pi Azure IoT Web Sim
portal.azure.com/#blade/Microsoft_Azure_Marketplace/MarketplaceOffersBlade/selectedMenuItemId/home/searchQuery/iot%20hub
Microsoft Azure
Search resources, services, and docs (G+/)
Dashboard > New >
Marketplace
My Saved List
Recently created
Service Providers
Categories
Get Started
AI + Machine Learning
Analytics
Blockchain
Compute
Containers
iot hub
Pricing : All
Operating System : All
Publisher : All
Showing All Results
IoT Hub
Microsoft
Connect, monitor and manage IoT devices
Omnitech Unified Commerce Cloud - Store
Tofugear Limited
Enabling and connecting your in-store mPOS, Kiosk, and staff-empowerment applications
IoT Hub Device Provisioning Service
Microsoft
Seamless, zero-touch registration of devices to IoT Hub with security that begins at the device and ends with
Barracuda IoT Conn
Barracuda Networks, Inc
Barracuda IoT Connect he
easily IoT devices and mic
networks to your Azure en


IoT Hub - Microsoft Azure
Raspberry Pi Azure IoT Web Sim
portal.azure.com/#blade/Microsoft_Azure_Marketplace/MarketplaceOffersBlade/selectedMenuItemId/home/searchQuery/iot%20hub
Microsoft Azure
Search resources, services, and docs (G+/)
Dashboard > New > Marketplace >
IoT Hub
Microsoft
IoT Hub
Save for later
Microsoft
Create
Testing & Dev
Overview
Plans
Simultaneously support millions of connected devices—whether they run Windows, Linux, or real-time operating systems. Then monitor performance and send commands to accelerate your digital transformation.
Useful Links
Documentation
Device management
Service overview
Pricing and scale details
Learn more about Azure IoT Hub


Basics
Networking
Size and scale
Tags
Review + create
Create an IoT hub to help you connect, monitor, and manage billions of your IoT assets. Learn more
Project details
Choose the subscription you'll use to manage deployments and costs. Use resource groups like folders to help you organize and manage resources.
Subscription *
Visual Studio Enterprise
Resource group *
Create new
Region *
IoT hub name *
A resource group is a container that holds related resources for an Azure solution.
Name *
az900-iot
OK
Cancel
Review + create
< Previous
Next: Networking >
Automation options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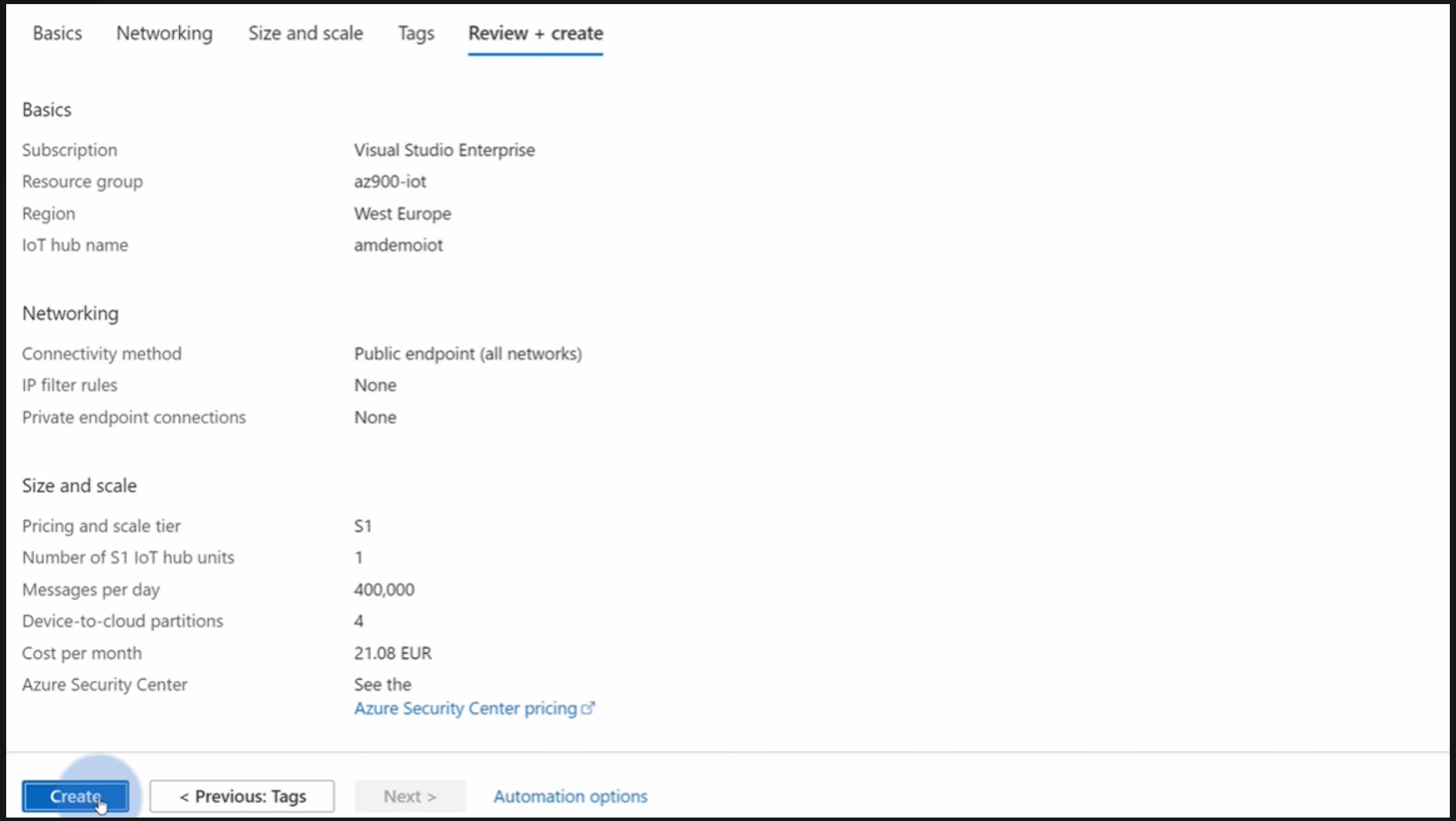
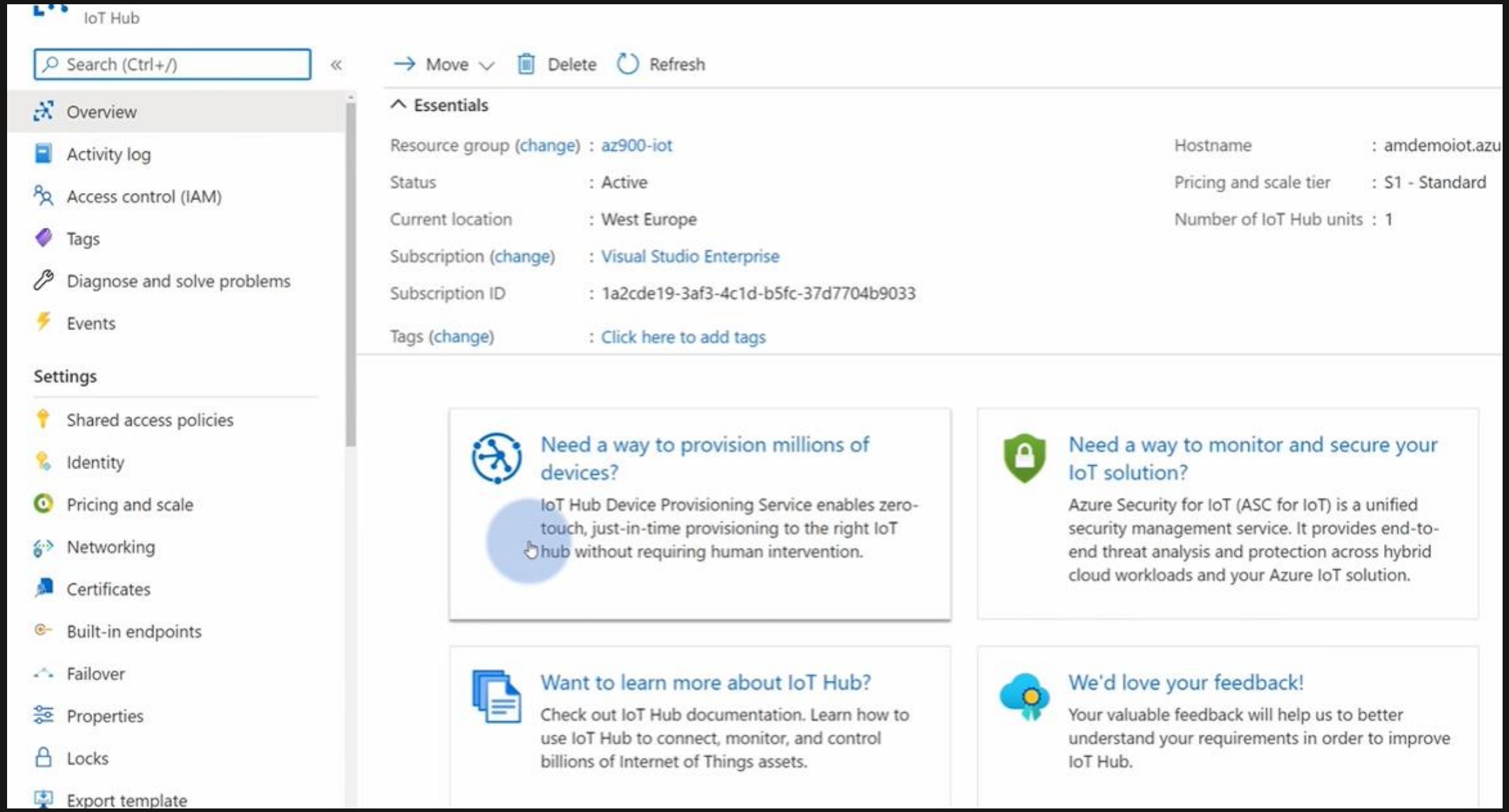
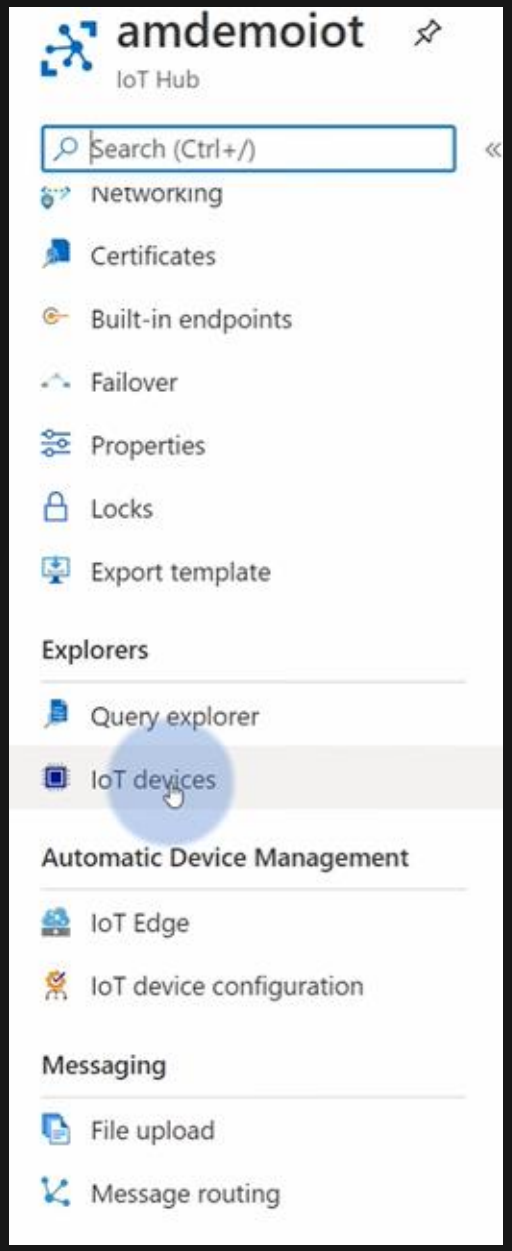
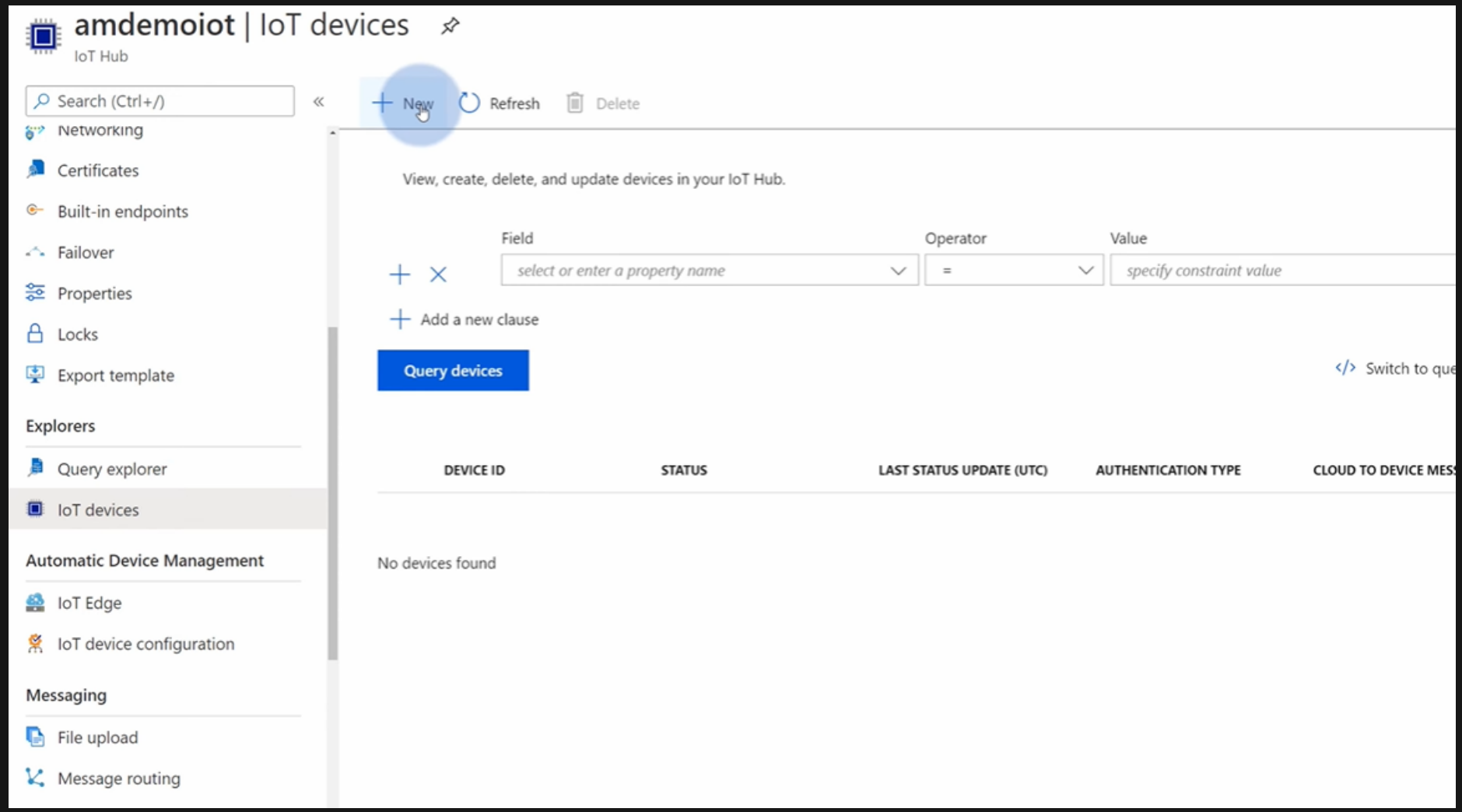
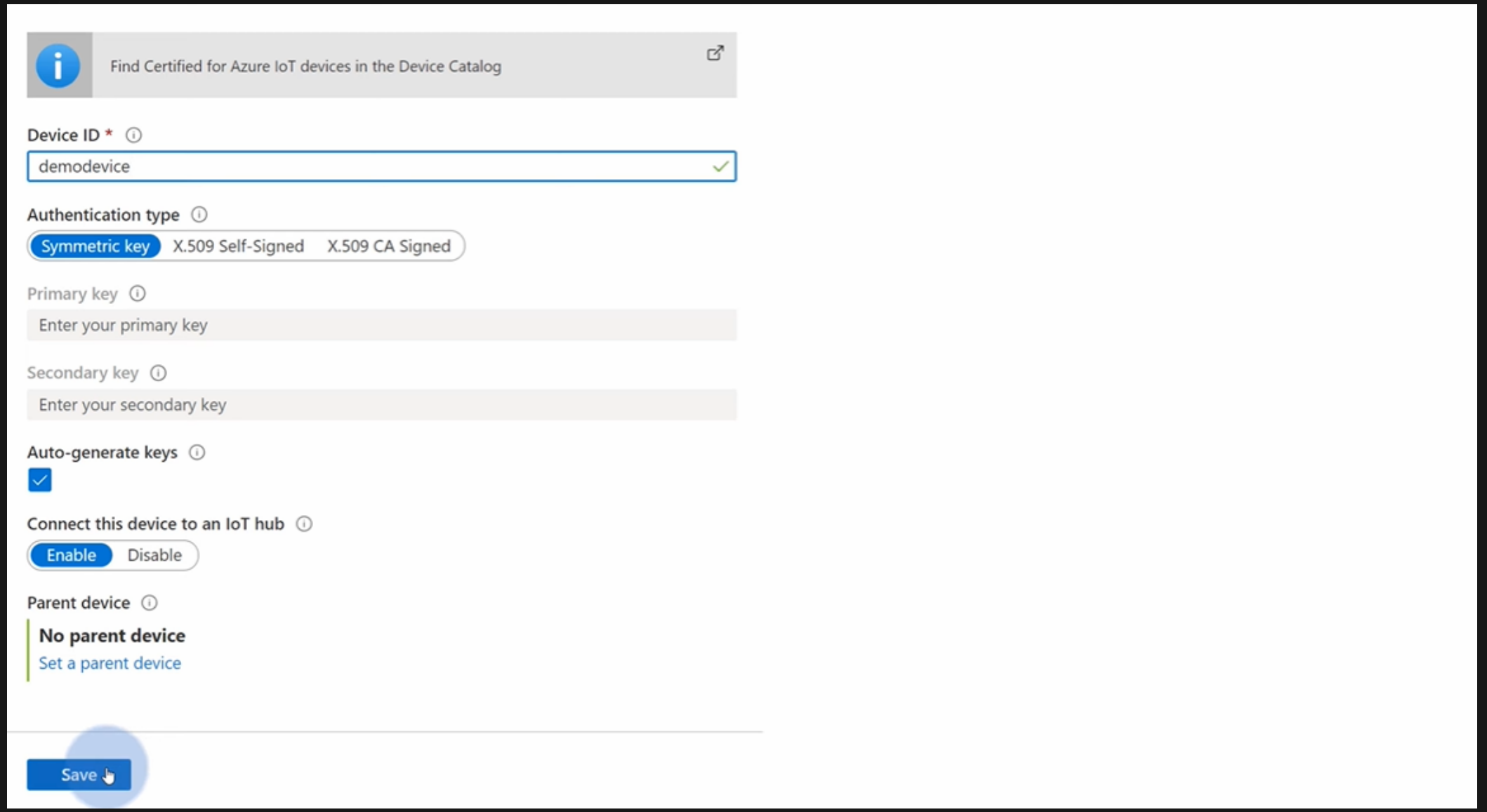
Subscription *
Visual Studio Enterprise
Resource group *
(New) az900-iot
Create new
Region *
West Europe
IoT hub name *
amdemoiot
Review + create
< Previous
Next: Networking >
Automation options

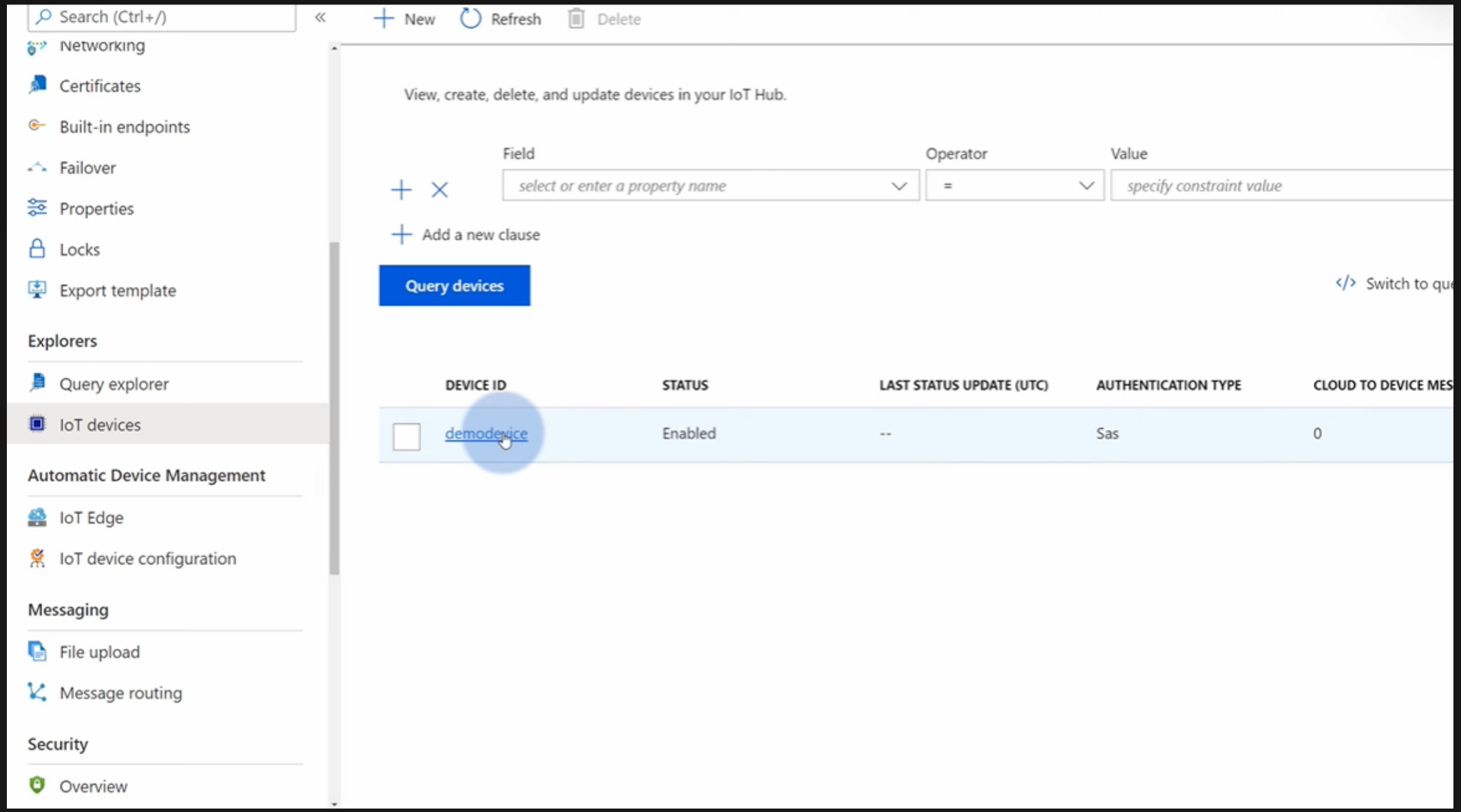

Basics
Networking
Size and scale
Tags
Review + create
Basics
Subscription
Visual Studio Enterprise
Resource group
az900-iot
Region
West Europe
IoT hub name
amdemoiot
Networking
Connectivity method
Public endpoint (all networks)
IP filter rules
None
Private endpoint connections
None
Size and scale
Pricing and scale tier
S1
Number of S1 IoT hub units
1
Messages per day
400,000
Device-to-cloud partitions
4
Cost per month
21.08 EUR
Azure Security Center
See the
Azure Security Center pricing
Create
< Previous: Tags
Next >
Automation options


IoT Hub
Search (Ctrl+/)
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Events
Settings
Shared access policies
Identity
Pricing and scale
Networking
Certificates
Built-in endpoints
Failover
Properties
Locks
Export template
Move
Delete
Refresh
Essentials
Resource group (change) : az900-iot
Status : Active
Current location : West Europe
Subscription (change) : Visual Studio Enterprise
Subscription ID : 1a2cde19-3af3-4c1d-b5fc-37d7704b9033
Tags (change) : Click here to add tags
Hostname : amdemoiot.azu
Pricing and scale tier : S1 - Standard
Number of IoT Hub units : 1
Need a way to provision millions of devices?
IoT Hub Device Provisioning Service enables zero-touch, just-in-time provisioning to the right IoT hub without requiring human intervention.
Need a way to monitor and secure your IoT solution?
Azure Security for IoT (ASC for IoT) is a unified security management service. It provides end-to-end threat analysis and protection across hybrid cloud workloads and your Azure IoT solution.
Want to learn more about IoT Hub?
Check out IoT Hub documentation. Learn how to use IoT Hub to connect, monitor, and control billions of Internet of Things assets.
We'd love your feedback!
Your valuable feedback will help us to better understand your requirements in order to improve IoT Hub.


amdemoiot
IoT Hub
Search (Ctrl+/)
Networking
Certificates
Built-in endpoints
Failover
Properties
Locks
Export template
Explorers
Query explorer
IoT devices
Automatic Device Management
IoT Edge
IoT device configuration
Messaging
File upload
Message routing


amdemoiot | IoT devices
IoT Hub
Search (Ctrl+/)
New
Refresh
Delete
Networking
Certificates
Built-in endpoints
Failover
Properties
Locks
Export template
Explorers
Query explorer
IoT devices
Automatic Device Management
IoT Edge
IoT device configuration
Messaging
File upload
Message routing
View, create, delete, and update devices in your IoT Hub.
Field
Operator
Value
select or enter a property name
=
specify constraint value
Add a new clause
Query devices
Switch to que
DEVICE ID
STATUS
LAST STATUS UPDATE (UTC)
AUTHENTICATION TYPE
CLOUD TO DEVICE MES
No devices found


Find Certified for Azure IoT devices in the Device Catalog
Device ID *
demodevice
Authentication type
Symmetric key
X.509 Self-Signed
X.509 CA Signed
Primary key
Enter your primary key
Secondary key
Enter your secondary key
Auto-generate keys
Connect this device to an IoT hub
Enable
Disable
Parent device
No parent device
Set a parent device
Save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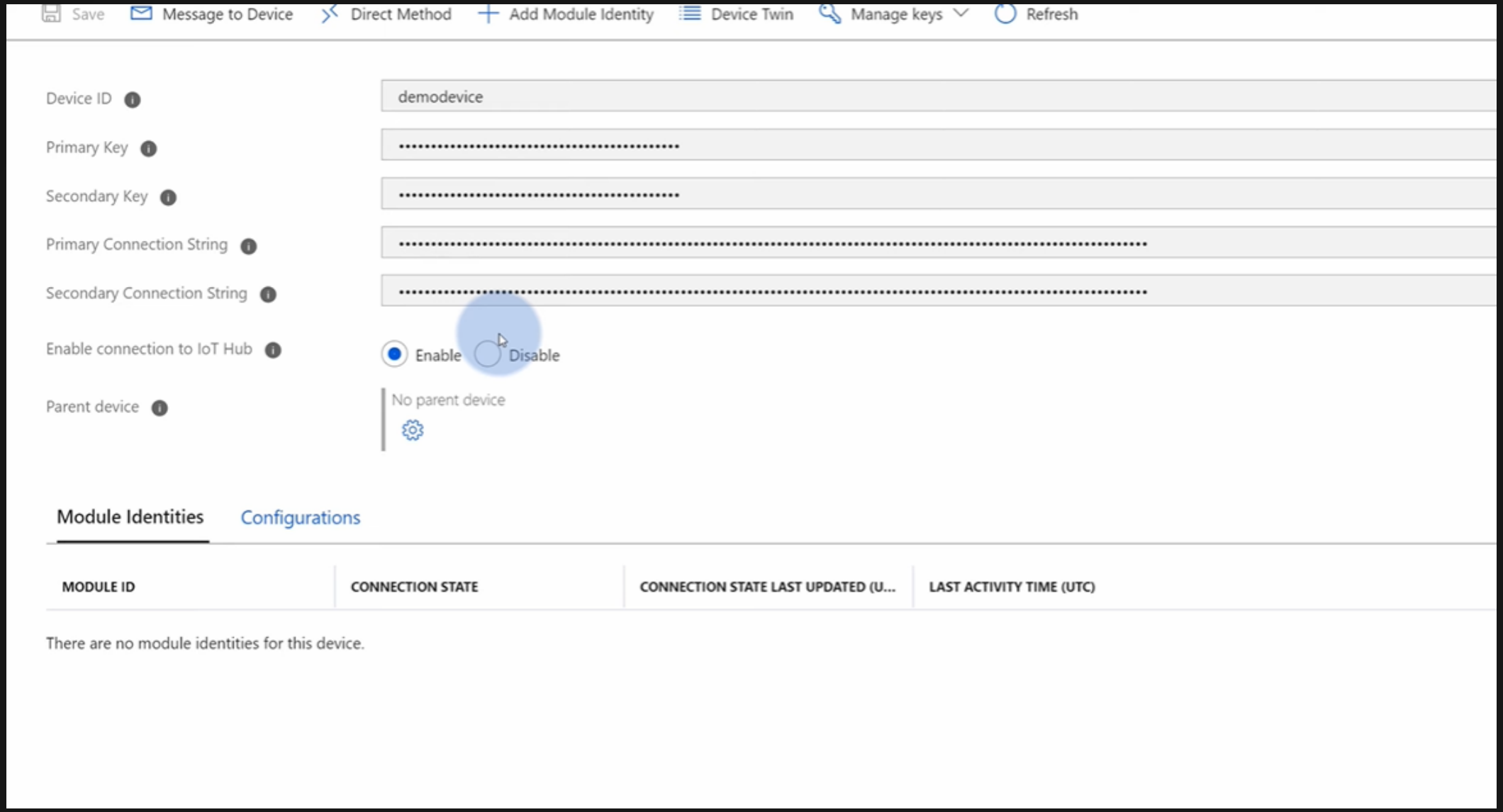
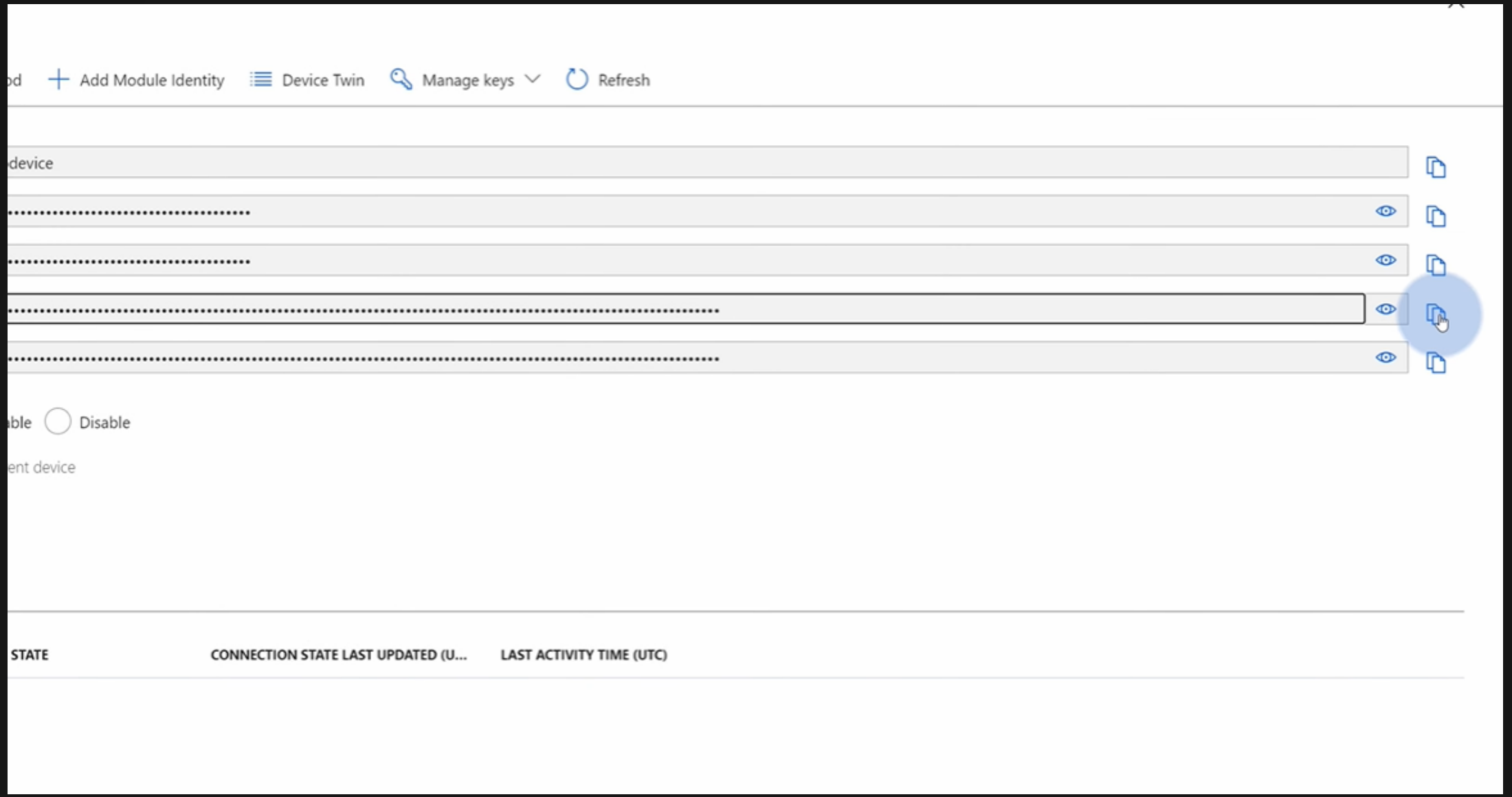
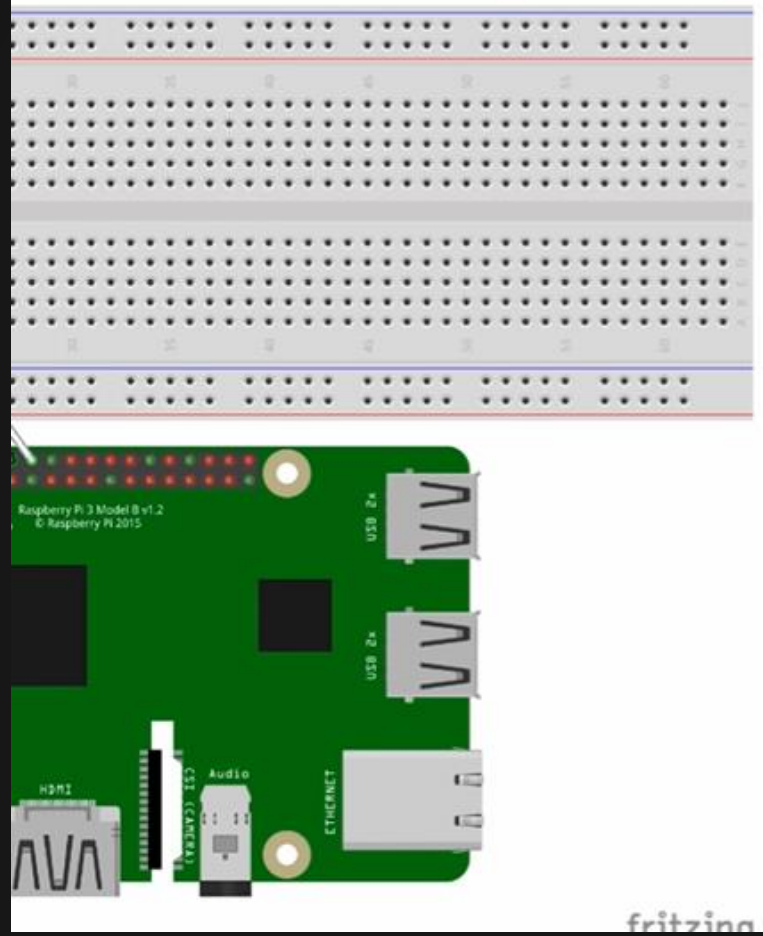
demodevice
Enabled
--
Sas
0


Save
Message to Device
Direct Method
Add Module Identity
Device Twin
Manage keys
Refresh
Device ID
demodevice
Primary Key
Secondary Key
Primary Connection String
Secondary Connection String
Enable connection to IoT Hub
Enable
Disable
Parent device
No parent device
Module Identities
Configurations
MODULE ID
CONNECTION STATE
CONNECTION STATE LAST UPDATED (U...
LAST ACTIVITY TIME (UTC)
There are no module identities for this device.


Add Module Identity
Device Twin
Manage keys
Refresh
device
Disable
STATE
CONNECTION STATE LAST UPDATED (U...
LAST ACTIVITY TIME (UTC)

ulator

Help English ▾

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Run Reset

```
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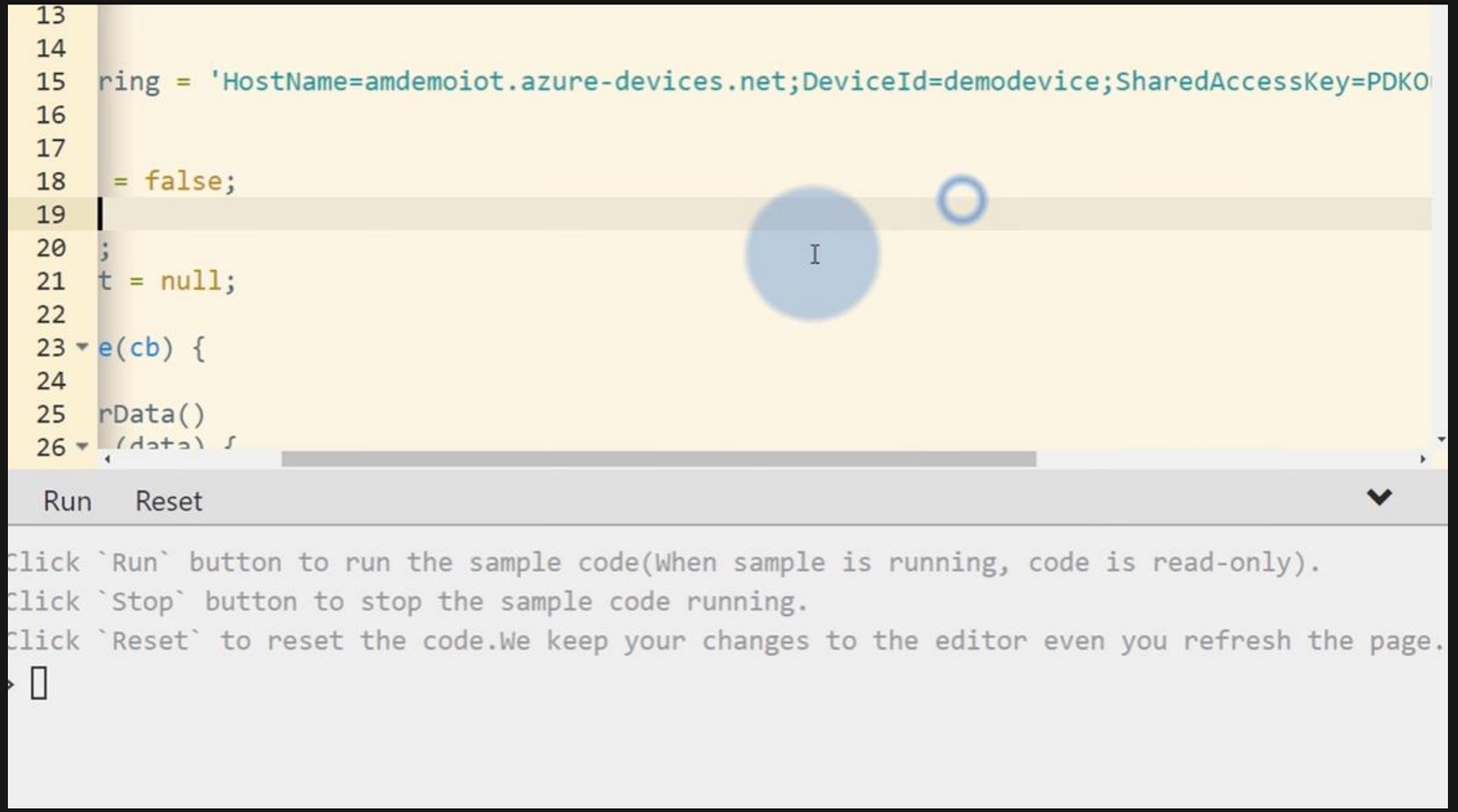
>
```


13
14
15 ring = 'HostName=amdemoiot.azure-devices.net;DeviceId=demodevice;SharedAccessKey=PDKO
16
17
18 = false;
19
20 ;
21 t = null;
22
23 e(cb) {
24
25 rData()
26 (data) {
Run
Reset
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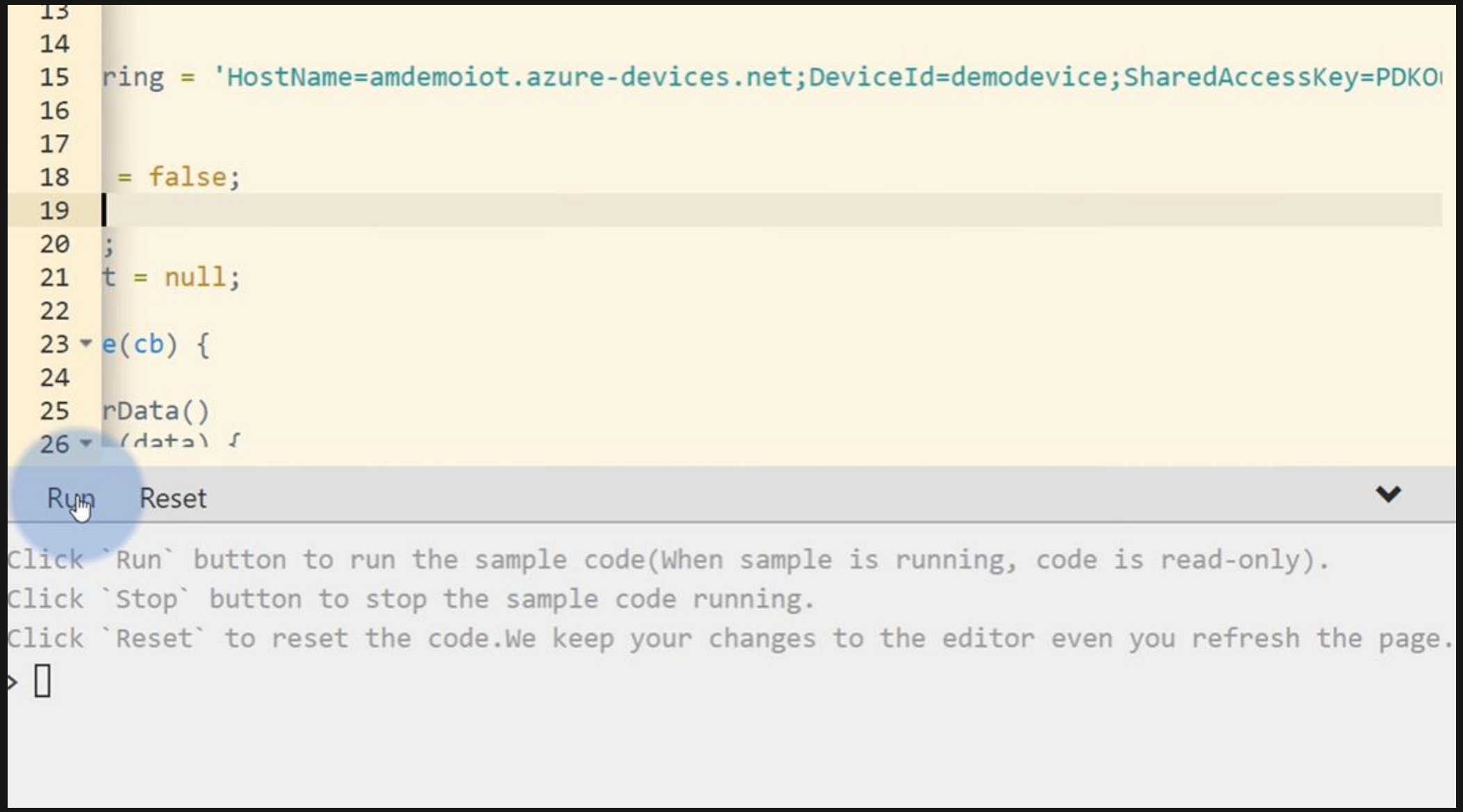
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```
19
20  ;
21  t = null;
22
23  e(cb) {
24
25  rData()
26  (data) {
```

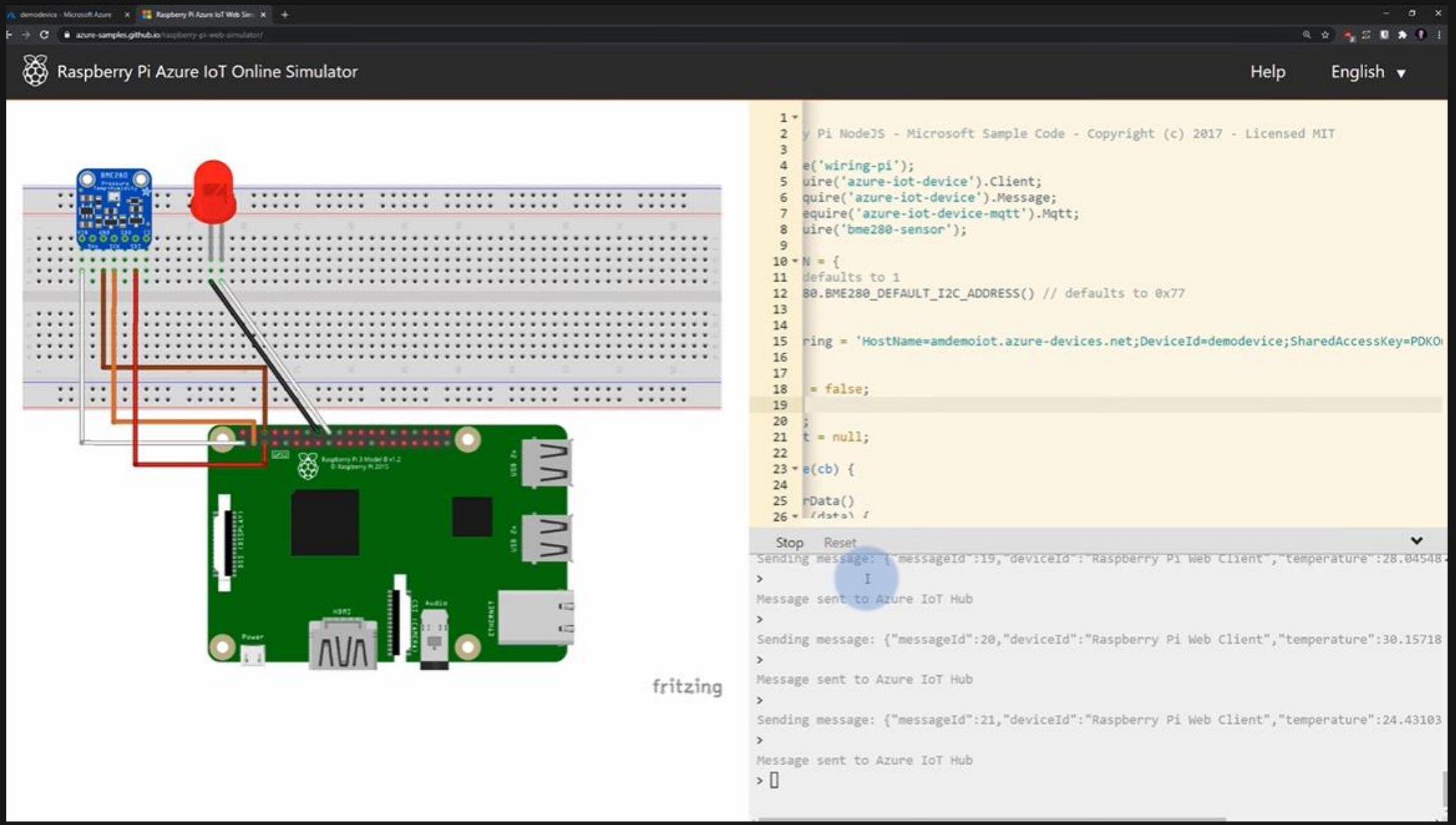
Stop Reset

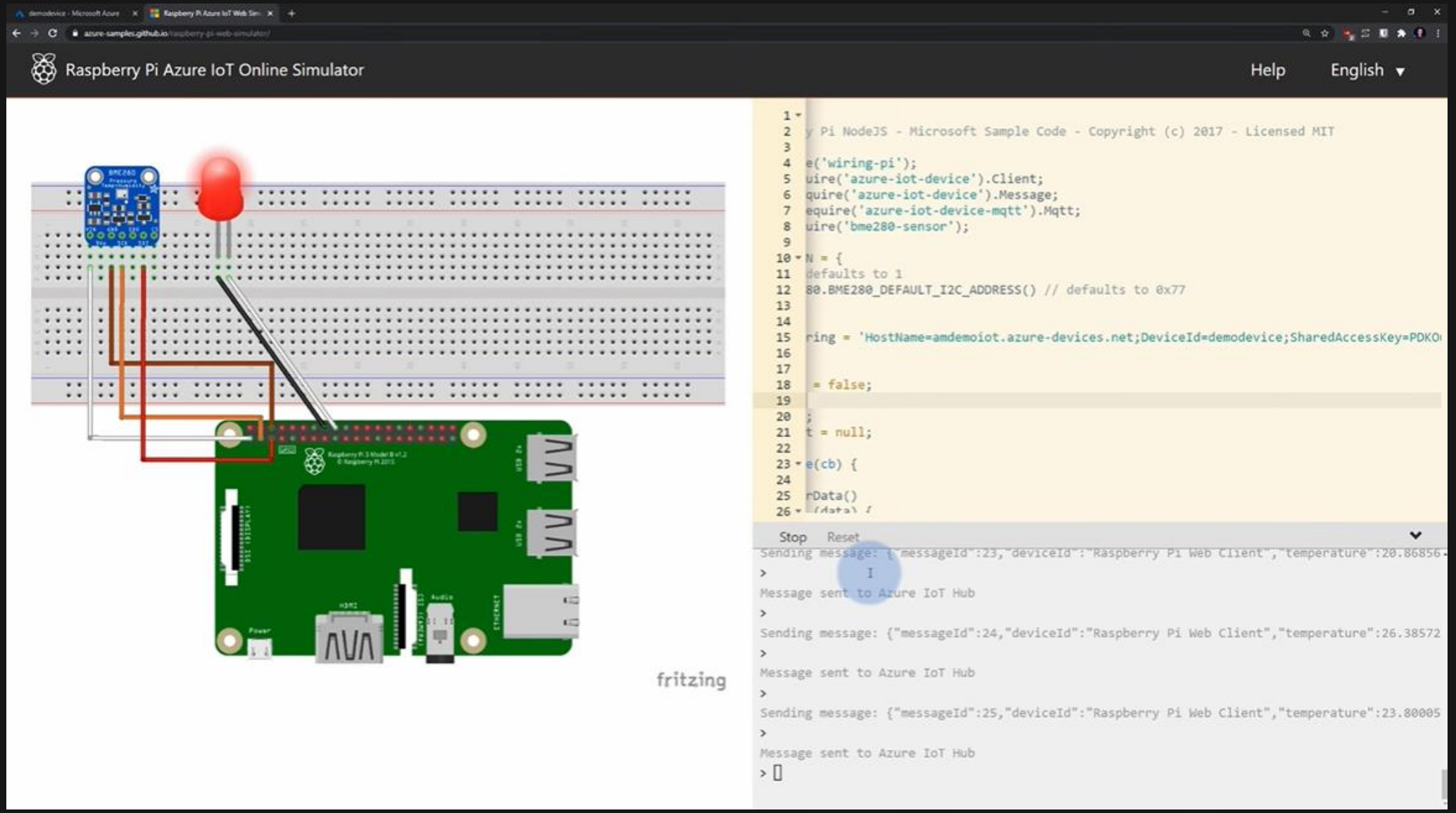
```
Click `Run` button to run the sample code(When sample is running, code is read-only).
Click `Stop` button to stop the sample code running.
Click `Reset` to reset the code.We keep your changes to the editor even you refresh the page
>
Sending message: {"messageId":1,"deviceId":"Raspberry Pi Web Client","temperature":22.752224
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":2,"deviceId":"Raspberry Pi Web Client","temperature":29.875754
>
Message sent to Azure IoT Hub
>
```

```
19
20  ;
21  t = null;
22
23  e(cb) {
24
25  rData()
26  (data) {
```

Stop Reset

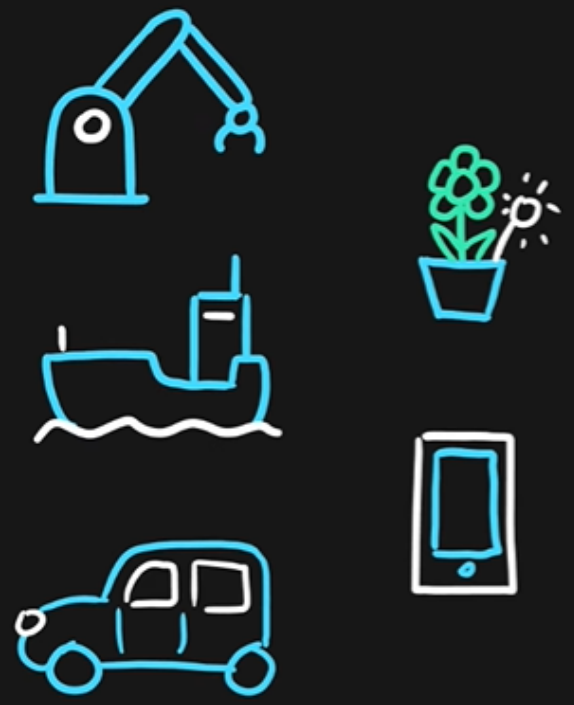
```
Sending message: {"messageId":1,"deviceId":"Raspberry Pi Web Client","temperature":22.752224
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":2,"deviceId":"Raspberry Pi Web Client","temperature":29.875754
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":3,"deviceId":"Raspberry Pi Web Client","temperature":30.700229
>
Message sent to Azure IoT Hub
>
```


Raspberry Pi Azure IoT Online Simulator
Help
English
fritzing
Stop
Reset
Message sent to Azure IoT Hub
Message sent to Azure IoT Hub
Message sent to Azure IoT Hub

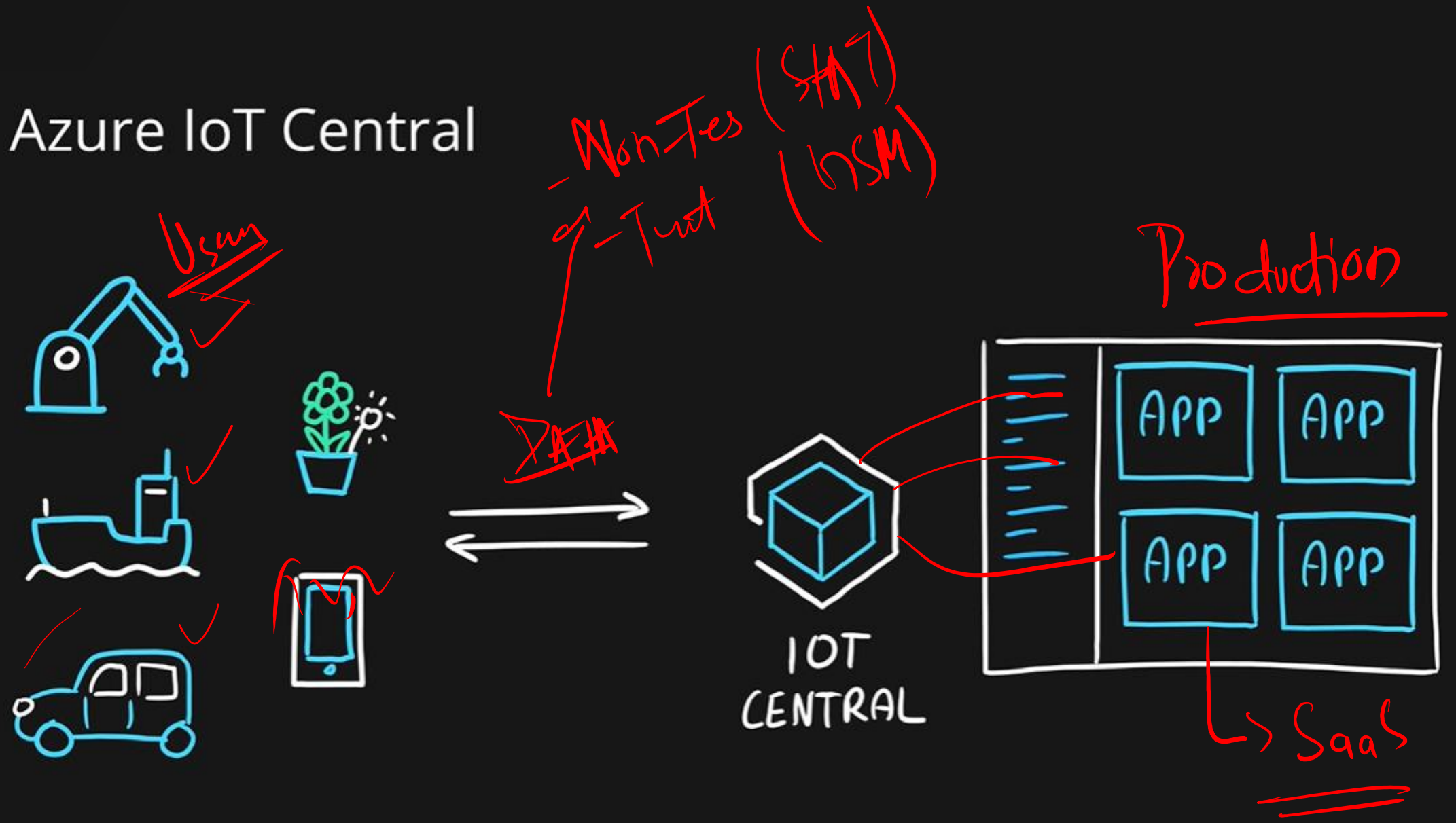

Raspberry Pi Azure IoT Online Simulator
Help
English
fritzing
Stop
Reset
Sending message: {"messageId":23,"deviceId":"Raspberry Pi Web Client","temperature":20.86856
Message sent to Azure IoT Hub
Sending message: {"messageId":24,"deviceId":"Raspberry Pi Web Client","temperature":26.38572
Message sent to Azure IoT Hub
Sending message: {"messageId":25,"deviceId":"Raspberry Pi Web Client","temperature":23.80005
Message sent to Azure IoT Hub

Azure IoT Central

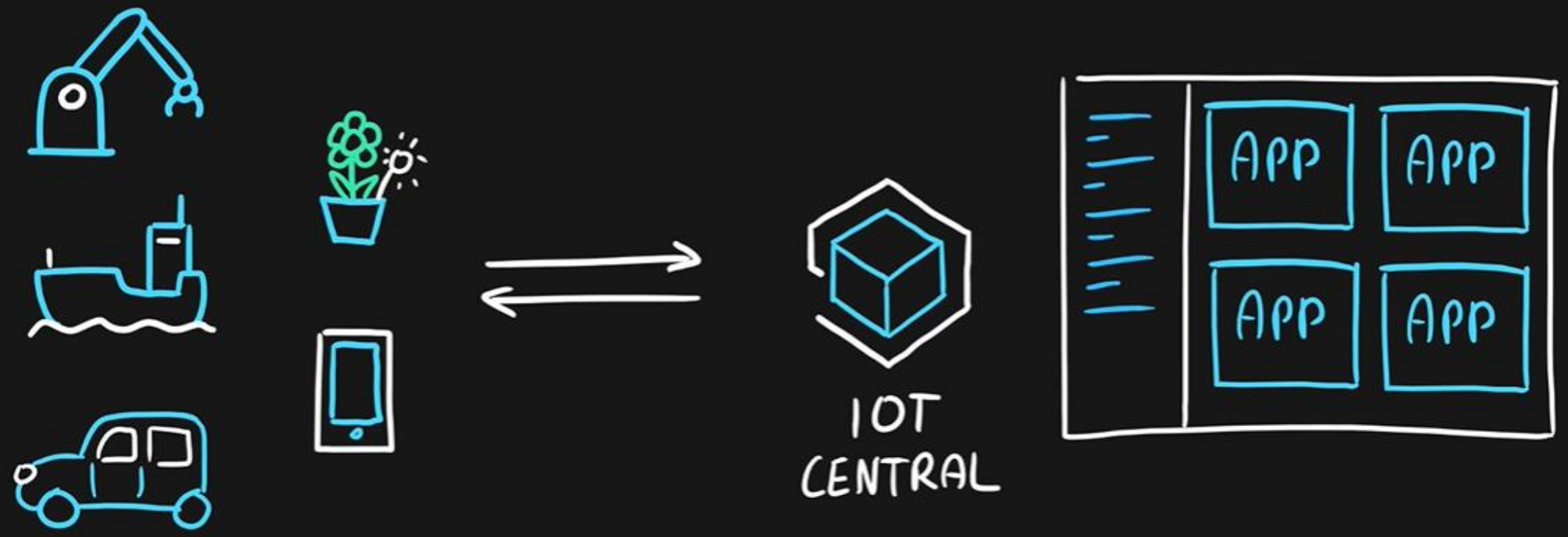
Azure IoT Central



Azure IoT Central



Azure IoT Central



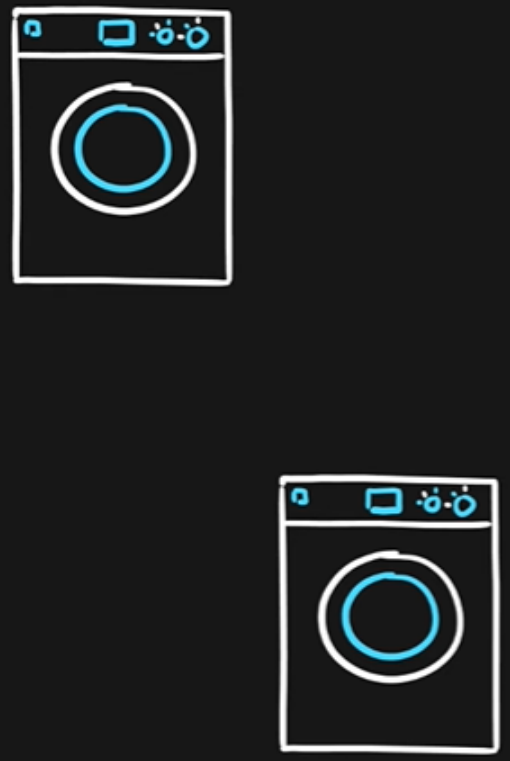
Azure IoT Central

Key Characteristics

- IoT App Platform - Software as a Service (SaaS)
- Industry specific app templates
- No deep technical knowledge required
- Service for connecting, management and monitoring IoT devices
- Highly secure, scalable and reliable
- Built on top of the IoT Hub service and 30+ other services

Azure Sphere

Azure Sphere



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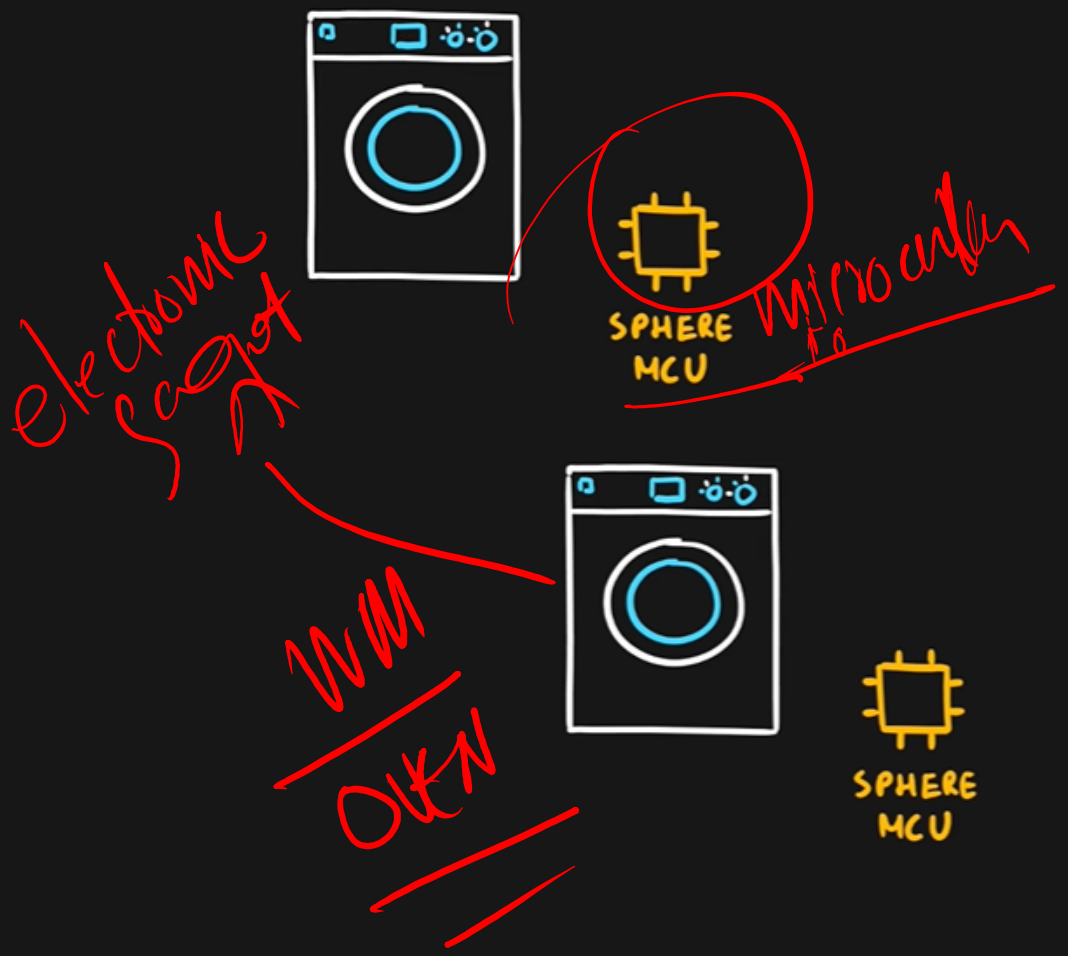

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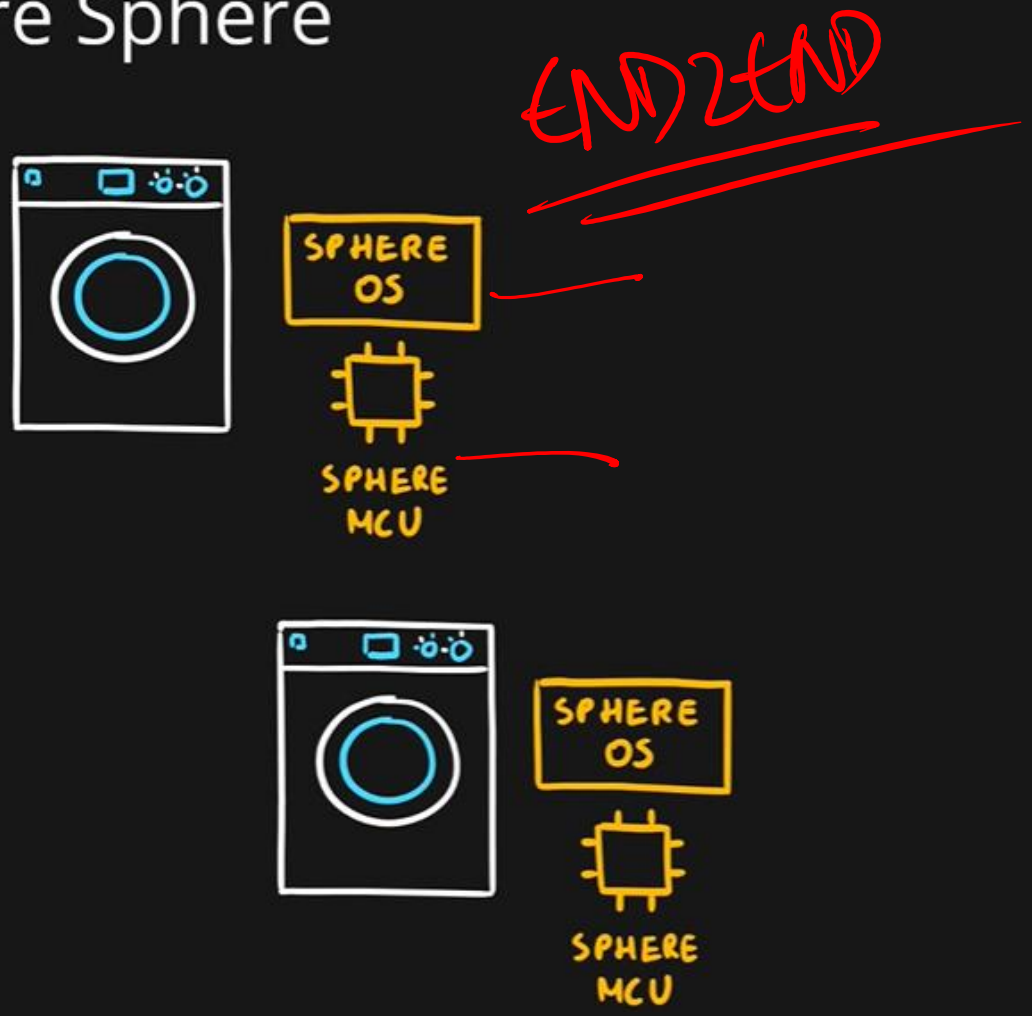

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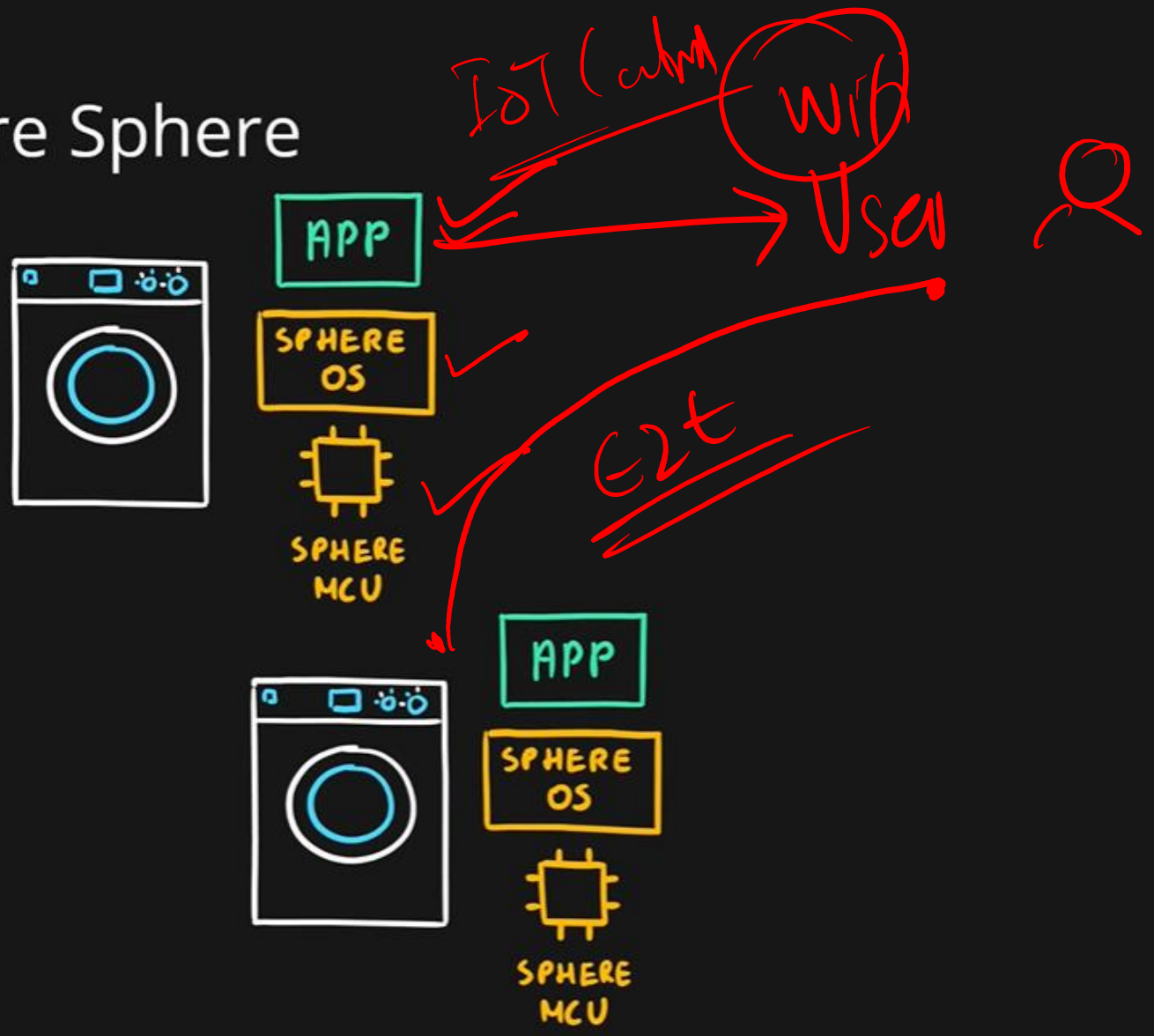

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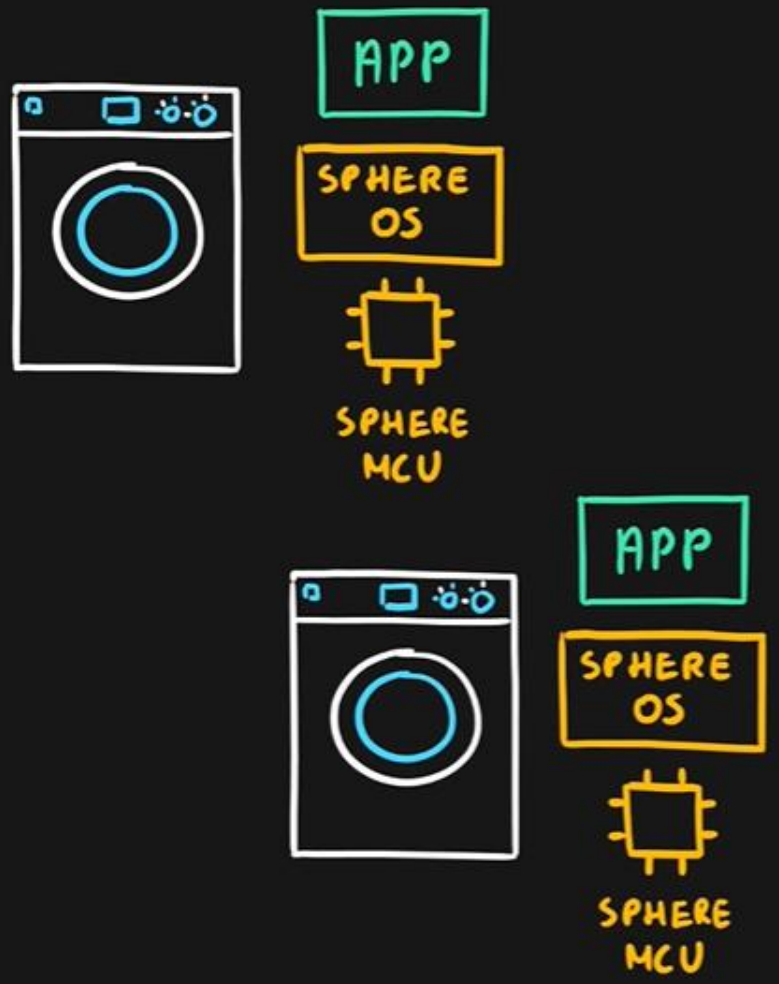

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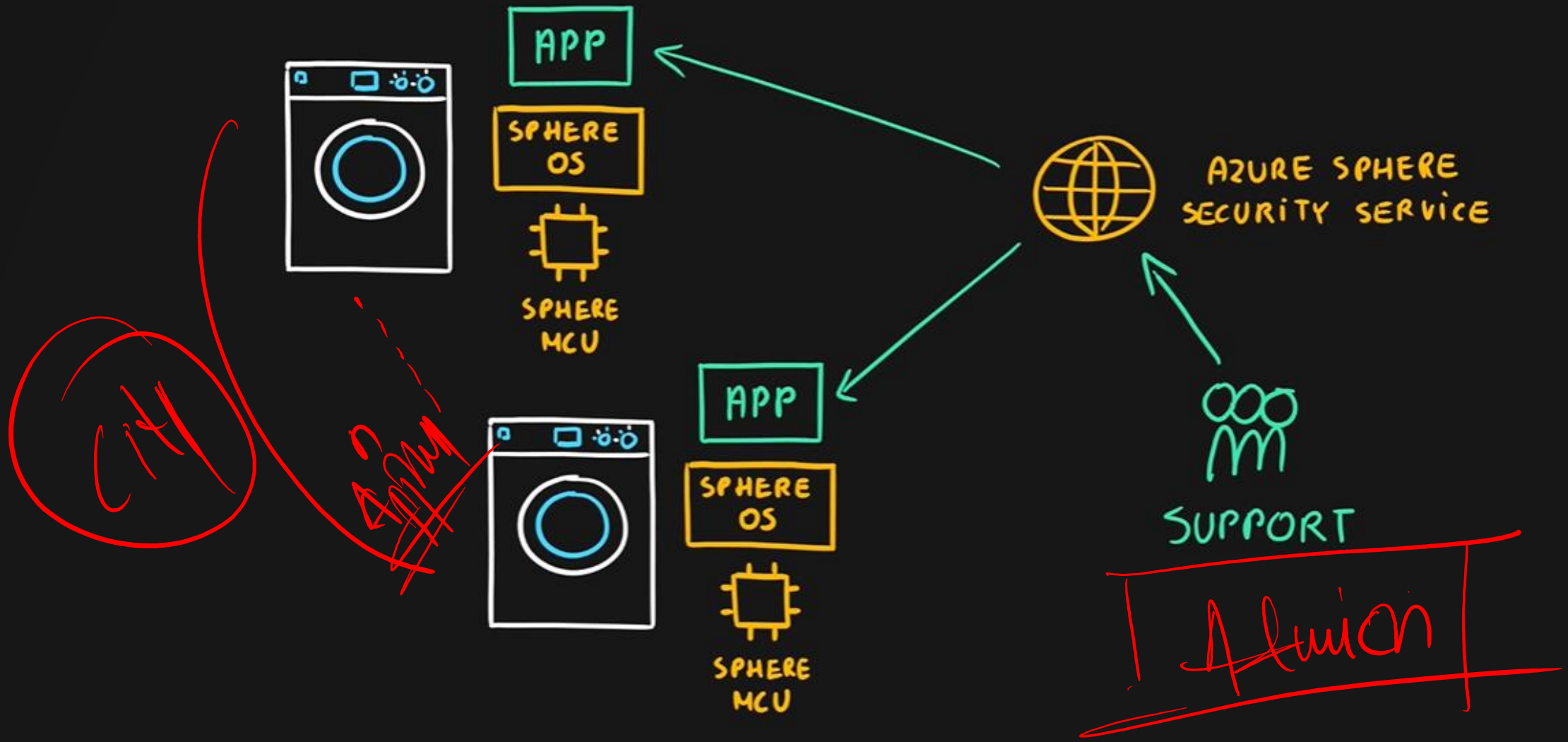

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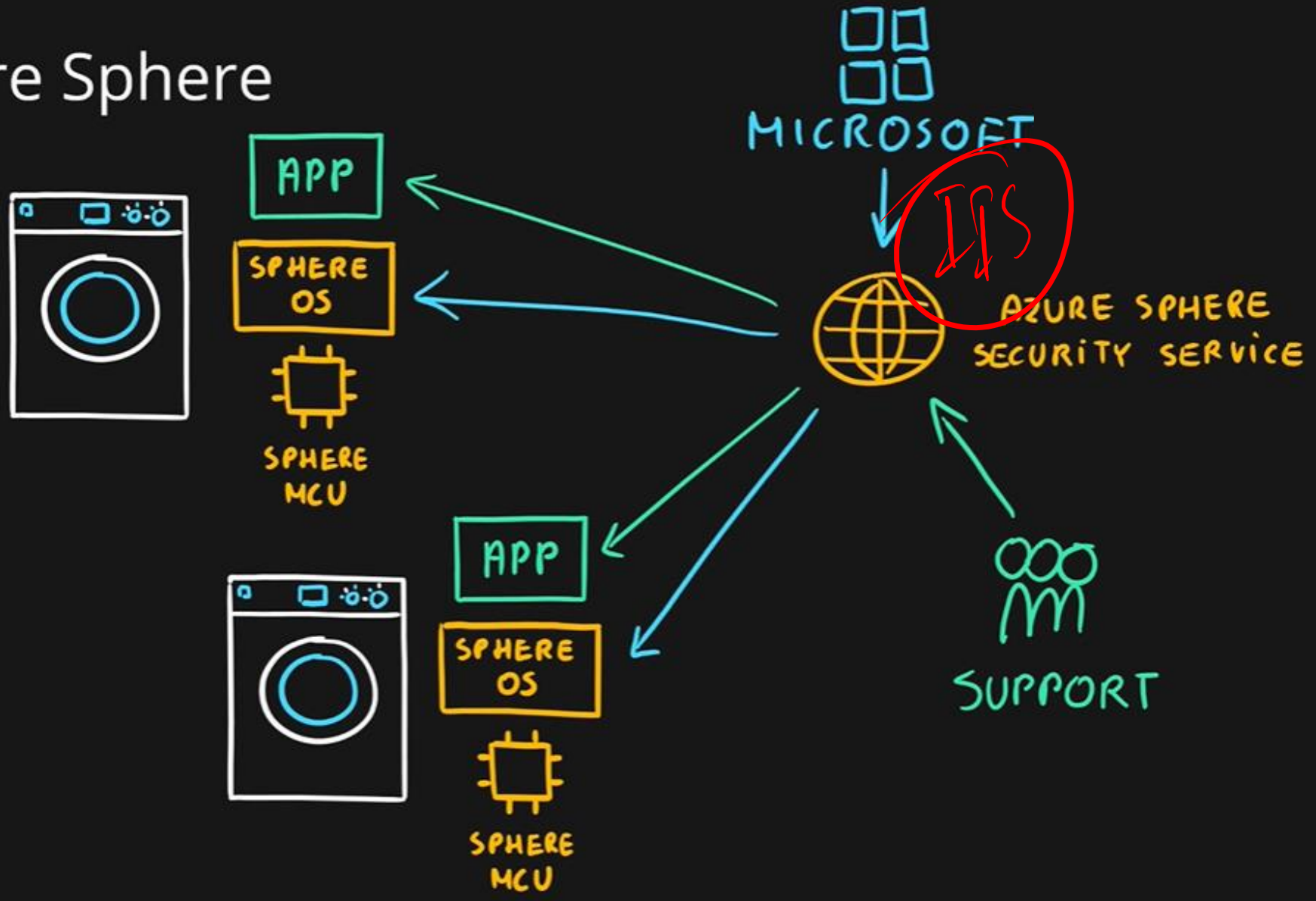

Azure Sphere

Key Characteristics

- Secure end-2-end IoT Solutions
  - Azure Sphere certified chips (microcontroller units - MCUs)
  - Azure Sphere OS based on Linux
  - Azure Security Service trusted device-to-cloud communication

Azure IoT Services

Summary

- IoT Hub – managed service for bi-directional communication with IoT devices, PaaS
- IoT Central – IoT application platform, dozen of functionalities, SaaS

THANK YOU!