

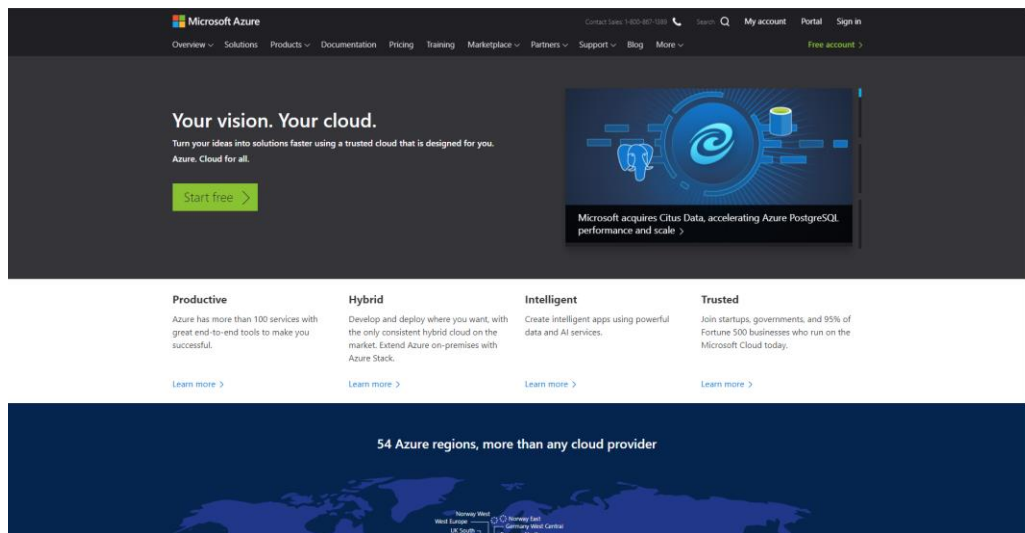
Objective: In this tutorial, you will learn how to Connect Raspberry Pi to the Azure IoT services.

Required Setup: Connect GrovePi+ board to RPi and have all GrovePi+ libraries installed.

Parts: RPi 3B+

Part A: Install / Upgrade Node-RED on RPi

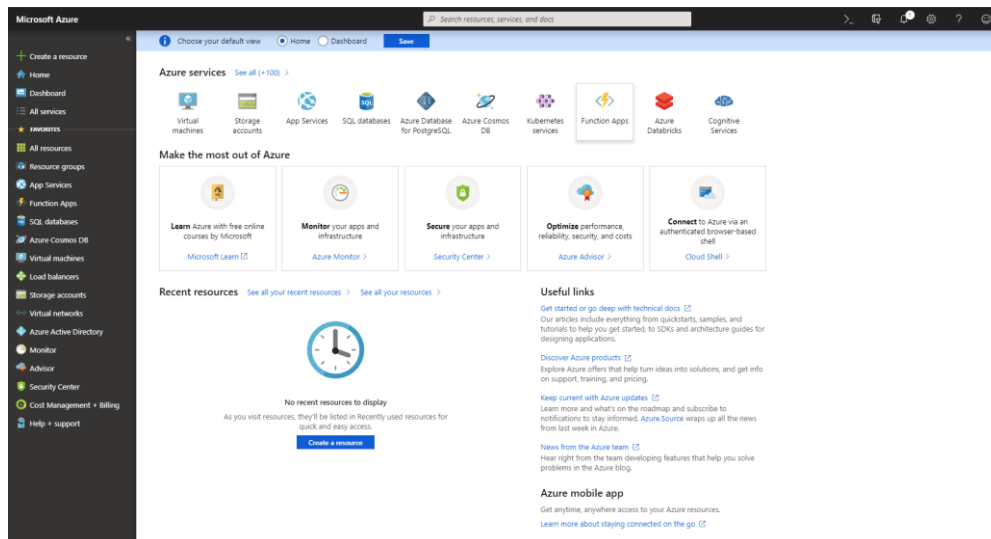
Step 1. Click on the following link to create a free Microsoft Azure account: <https://azure.microsoft.com/en-us/>. Then Click on 'Start Free'. After that Click on 'Start free' again.



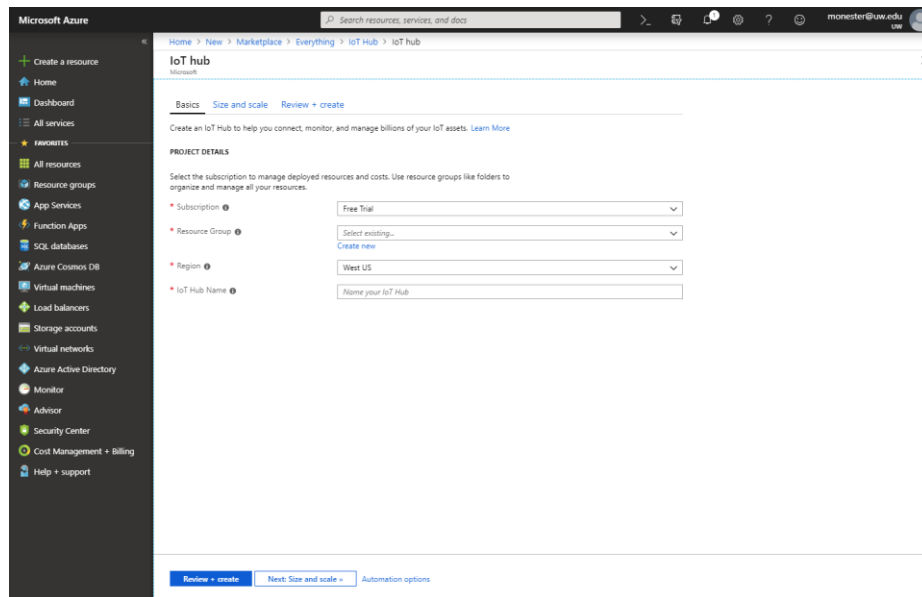
Step 2. The browser will prompt a sign-in portal for a Microsoft account. If you have one, go ahead and sign in; if you don't, click on 'Create one!' and follow the step to create a Microsoft account. It's highly recommended that you use your **school/organization email** to sign up the account. After you eventually sign in with your Microsoft account, you will be prompted to fill up a few more information.

Step 3. Then check the box and click on the 'sign up' button.

Step 4. You should be getting a verification/confirmation email. Now you are able to log in with your account you just created. (Notice, there might be some follow-up emails about offering lectures of Azure. You will be provided enough materials to keep you on the track of this course.) Now you should see this portal.



Step 5. Click on '+Create a resource', then search "IoT hub". Choose the first thing from the list. Click 'create' and you should see the similar screen as following.



Step 6. For resource group, click on 'Create new'. Then put 'test-group' as Name. Next, pick any name as your IoT hub Name (Noticed, the name must be globally unique). Leave other as they are initially. Click on 'Next: Size and scale'.

| | |
|--------------------|--|
| * Subscription ⓘ | Free Trial |
| * Resource Group ⓘ | (New) test-group Create new |
| * Region ⓘ | West US |
| * IoT Hub Name ⓘ | Name your IoT Hub |

Step 7. On the next screen, simply click 'Review + create' button on the bottom.

Step 8. Click 'Create' on the bottom of this page again. It might take a while to complete the deployment.

IoT hub
Microsoft

Basics Size and scale **Review + create**

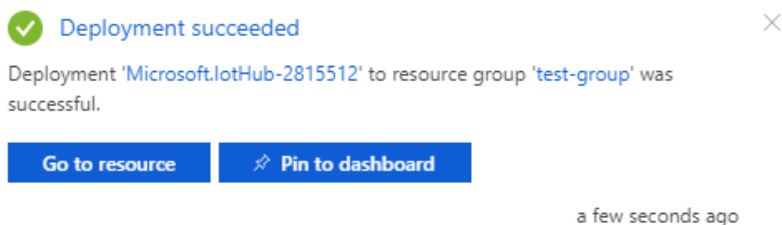
BASICS

| | |
|------------------|-----------------|
| Subscription ⓘ | Free Trial |
| Resource Group ⓘ | test-group |
| Region ⓘ | West US |
| IoT Hub Name ⓘ | testnumber1-hub |

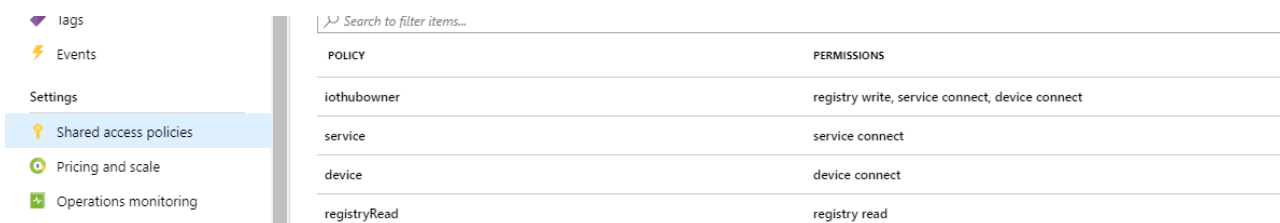
SIZE AND SCALE

| | |
|------------------------------|-----------|
| Pricing and scale tier ⓘ | S1 |
| Number of S1 IoT Hub units ⓘ | 1 |
| Messages per day ⓘ | 400,000 |
| Cost per month | 25.00 USD |

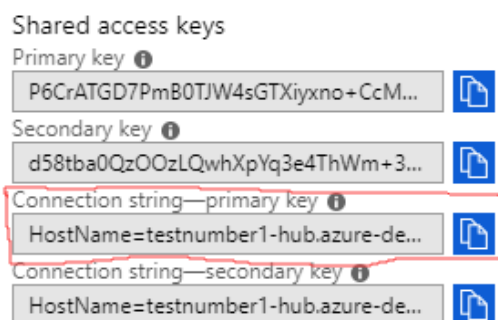
Step 9. When it's completed, you will see the following in the notification. Click on 'Go to resource'.



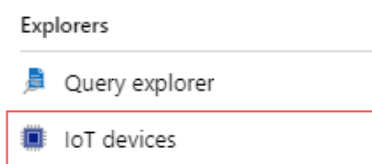
Step 10. Choose 'Shared access policies' in the settings from the IoT-hub panel. Select 'iothubowner'.



Step 11. From the panel and under 'Shared access keys', copy the Connection string-primary key to use later.



Step 12. Now we need to continue to set up a new device in the IoT hub. Choose 'IoT devices' in the 'Explorers' from the IoT-hub menu.



Step 13. Click '+Add' to register a new device. You should see the following page. Put 'myRaspberryPi' in the Device ID and click 'Save'.

Create a device

Find Certified for Azure IoT devices in the Device Catalog

* Device ID ⓘ

The ID of the new device

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 (Preview) ⓘ

No parent device

Set a parent device

Step 14. After the new device is created, open the device from the list in the panel. Copy the Connection string (primary key) to use later.

Device details
myRaspberryPi

Save
Message to device
Direct method
Device twin
Add module identity
Regenerate keys
Refresh

Device Id ⓘ

myRaspberryPi

Primary key ⓘ

cpCSVoejiGivRnTabrVCO22y2ykQFyssDb+sVKX2zU=

Secondary key ⓘ

2o0uEDJvQ6U7zFl6aXwTwwothgnniLi8Hq6PRbh3LAY=

Connection string (primary key) ⓘ

HostName=testnumber1-hub.azure-devices.net;DeviceId=myRaspberryPi;SharedAccessKey=cpCSVoejiGivRnTabrVCO22y2ykQFyssDb+sVKX2zU=

Connection string (secondary key) ⓘ

HostName=testnumber1-hub.azure-devices.net;DeviceId=myRaspberryPi;SharedAccessKey=2o0uEDJvQ6U7zFl6aXwTwwothgnniLi8Hq6PRbh3LAY=

Step 15. Now we are done with the Azure IoT hub set up. Let's set up our Raspberry Pi. Open the terminal, then run the following command to install the Azure IoT hub device SDK.

```
pip install azure-iot-hub-device-client
```

```
pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~$ pip install azure-iot-hub-device-client
Collecting azure-iot-hub-device-client
  Downloading https://files.pythonhosted.org/packages/74/74/967d1c0a92671841b847176806ab1b8e34a2791607ad053d9eba3340d735/azure_iot_hub_device_client-1.4.6-py2-none-linux_armv7l.whl (991kB)
    100% |#####| 993kB 241kB/s
Installing collected packages: azure-iot-hub-device-client
Successfully installed azure-iot-hub-device-client-1.4.6
```

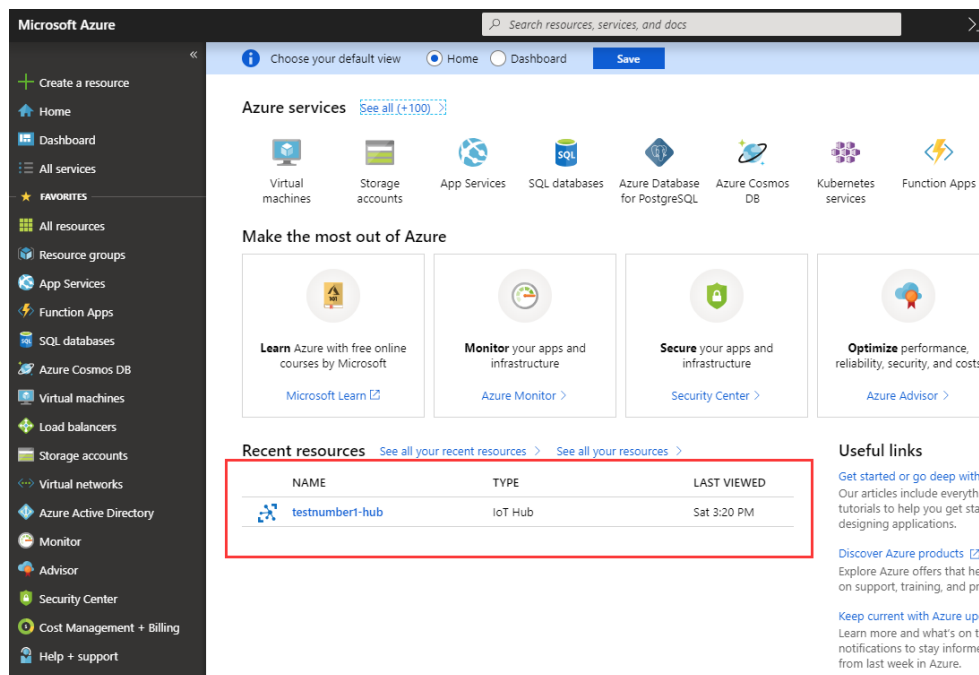
Step 16. Run the following command to update your raspberry Pi and libraries. Enter 'y' if anything prompts.

```
sudo apt-get update
sudo apt-get upgrade
sudo apt-get install libboost-all-dev
```

Step 17. Create an empty python script using Thonny. Copy paste all the code from 'starter_sample.py' to it. You need to change the 'Connection string' variable to your connection string in the code. After running it, you should see the following output.

```
>>> %Run starter_sample.py
Message transmitted to IoT Hub
Confirmation received for message with result = OK
```

Step 18. Login to the Azure portal and click on the IoT hub on the home page.



Step 19. Scroll down IoT hub Overview. You will see a change in 'Device to cloud messages' usage. (You might wonder where to see the sent message. You need to do a message routing to pass the message to a storage location to be able to see it. Since this example is just to show

case, we are not going to show the whole process here.) Congratulations! You just sent a message to the Azure IoT hub from your Raspberry Pi.

Congratulations! You have now successfully completed connecting your Raspberry Pi to the Azure IOT services!

References:

1. <https://www.dexterindustries.com/GrovePi/get-started-with-the-grovepi/setting-software/>
2. http://download.microsoft.com/download/A/4/D/A4DAD253-BC21-41D3-B9D9-87D2AE6F0719/Microsoft_Azure_IoT_Reference_Architecture.pdf
3. <https://courses.edx.org/courses/course-v1:Microsoft+DEV225x+3T2018/course/#block-v1:Microsoft+DEV225x+3T2018+type@sequential+block@dea6cca6-87fa-c235-3c16-b9b8d83fc60f>
4. <https://docs.microsoft.com/en-us/azure/iot-hub/iot-hub-raspberry-pi-kit-node-get-started>
5. <https://github.com/Azure/azure-iot-sdk-python/tree/master/device/samples>
6. <https://github.com/Azure/azure-iot-sdk-python>