Internet of Things: Qwik Start

GSP086

Overview

Cloud IoT Core is a fully managed service that allows you to easily and securely connect, manage, and ingest data from millions of globally dispersed devices. Cloud IoT Core, in combination with other services on Google Cloud IoT platform, provides a complete solution for collecting, processing, analyzing, and visualizing IoT data in real time to support improved operational efficiency.

Key concepts

To understand Cloud IoT Core, you should be familiar with the following concepts:

Internet of Things (IoT)

A collective term for the physical objects that are connected to the internet and can exchange data without user involvement.

Device
A "Thing" in the Internet of Things - a processing unit that is capable of connecting to the internet and exchanging data with the cloud. Devices are often called "smart devices" or "connected devices". They communicate two types of data: telemetry and state.

Telemetry

All event data (for example, measurements about the environment) sent from devices to the cloud. Telemetry data sent from a device to the cloud is called "device telemetry event" data. You can use Google Cloud Big Data Solutions to analyze telemetry data.
Device state
An arbitrary, user-defined blob of data that describes the current status of the device. Device state data can be structured or unstructured, and flows only in the device-to-cloud direction.

Device configuration
An arbitrary, user-defined blob of data used to control or change a device's state. Configuration data can be structured or unstructured, and flows only in the cloud-to-device direction.

Device registry
A container of devices with shared properties. You "register" a device with a service (like Cloud IoT Core) so that you can manage it (see the next item in this list).

Device manager

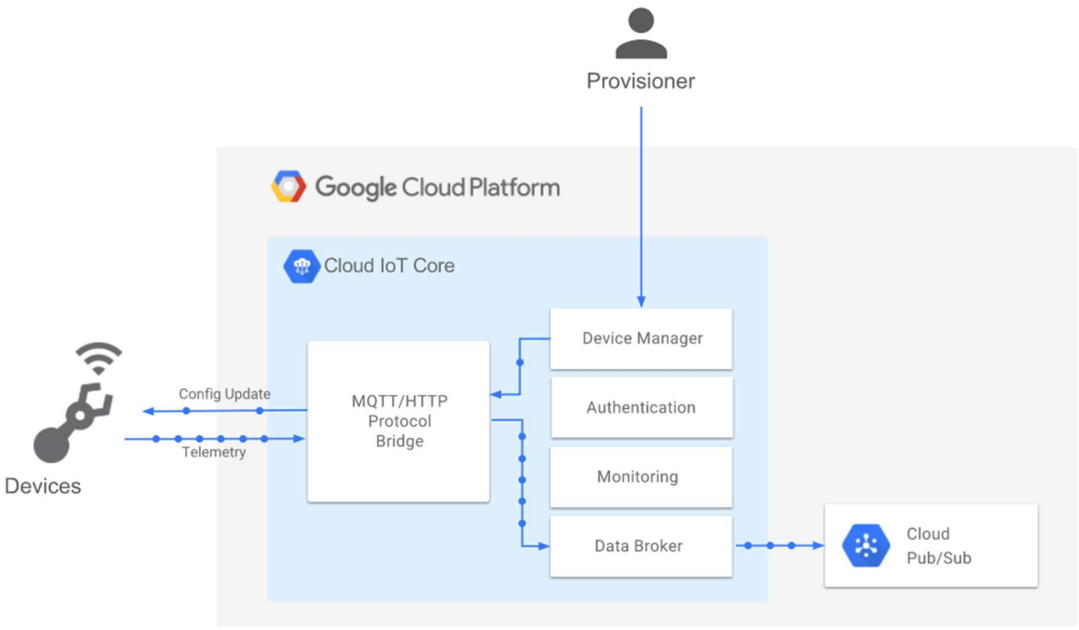
The service you use to monitor device health and activity, update device configurations, and manage credentials and authentication.

MQTT
An industry-standard IoT protocol (Message Queue Telemetry Transport). MQTT is a publish/subscribe (pub/sub) messaging protocol.

Components

The main components of Cloud IoT Core are the device manager and the protocol bridges:

- A **device manager** for registering devices with the service, so you can then monitor and configure them.
- Two **protocol bridges** (MQTT and HTTP) that devices can use to connect to Google Cloud.
  Device telemetry data is forwarded to a Cloud Pub/Sub topic, which can then be used to trigger Cloud Functions. You can also perform streaming analysis with Cloud Dataflow or custom analysis with your own subscribers.
  The following diagram summarizes the service components and the flow of data:



This hands-on lab shows you how to use Cloud Console to create a Cloud IoT Core device registry and register a device. It also shows you how to run a sample to connect a device and publish device telemetry events.

Setup and Requirements

Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click **Start Lab**, shows how long Google Cloud resources will be made available to you.

This Qwiklabs hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access Google Cloud for the duration of the lab.

What you need

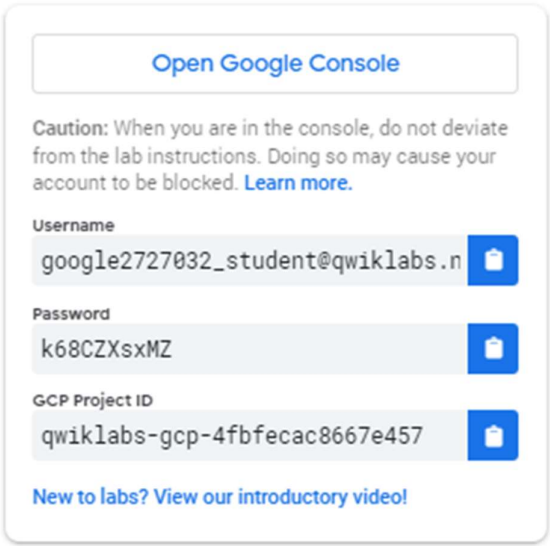
To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.
  Note: If you already have your own personal Google Cloud account or project, do not use it for this lab.

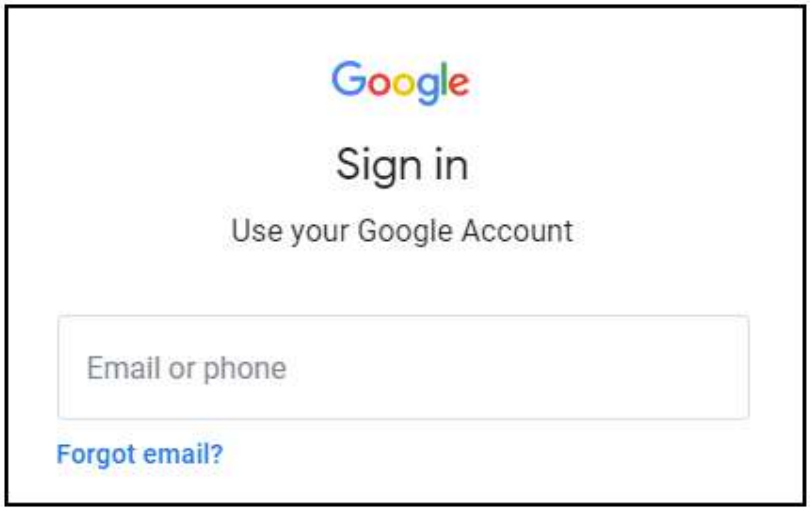
Note: If you are using a Pixelbook, open an Incognito window to run this lab.

How to start your lab and sign in to the Google Cloud Console

1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is a panel populated with the temporary credentials that you must use for this lab.

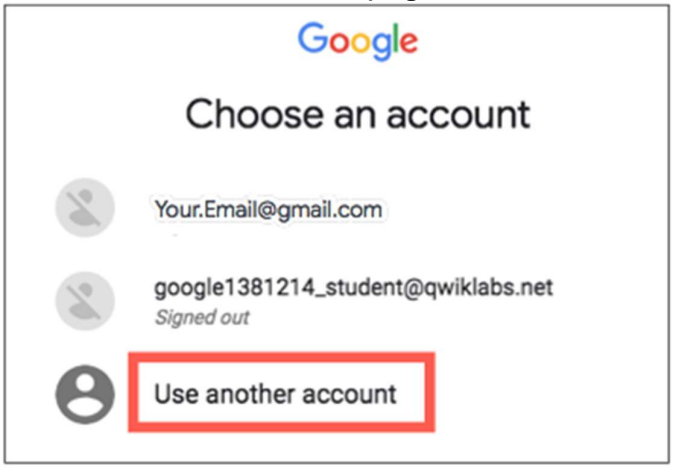


2. Copy the username, and then click **Open Google Console**. The lab spins up resources, and then opens another tab that shows the **Sign in** page.



Tip: Open the tabs in separate windows, side-by-side.

If you see the **Choose an account** page, click **Use Another Account**.



3. In the **Sign in** page, paste the username that you copied from the Connection Details panel. Then copy and paste the password.

   Important: You must use the credentials from the Connection Details panel. Do not use your Qwiklabs credentials. If you have your own Google Cloud account, do not use it for this lab (avoids incurring charges).

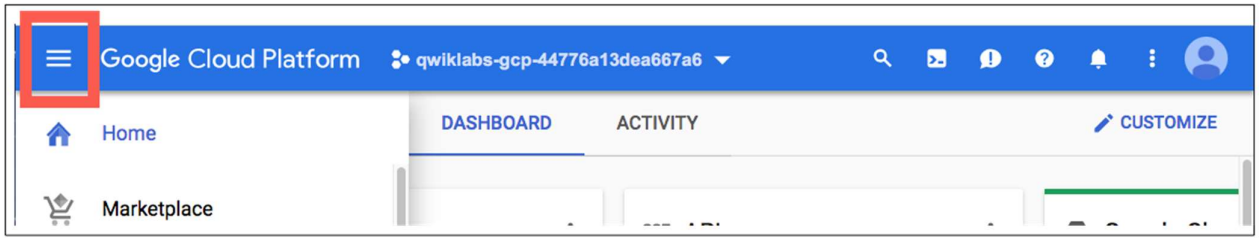
4. Click through the subsequent pages:

   - Accept the terms and conditions.
   - Do not add recovery options or two-factor authentication (because this is a temporary account).
   - Do not sign up for free trials.

After a few moments, the Cloud Console opens in this tab.

Note: You can view the menu with a list of Google Cloud Products and Services by clicking the **Navigation menu** at the top-

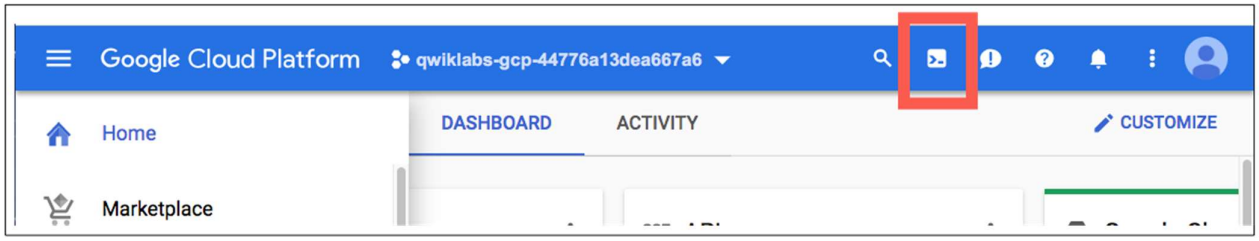
left.



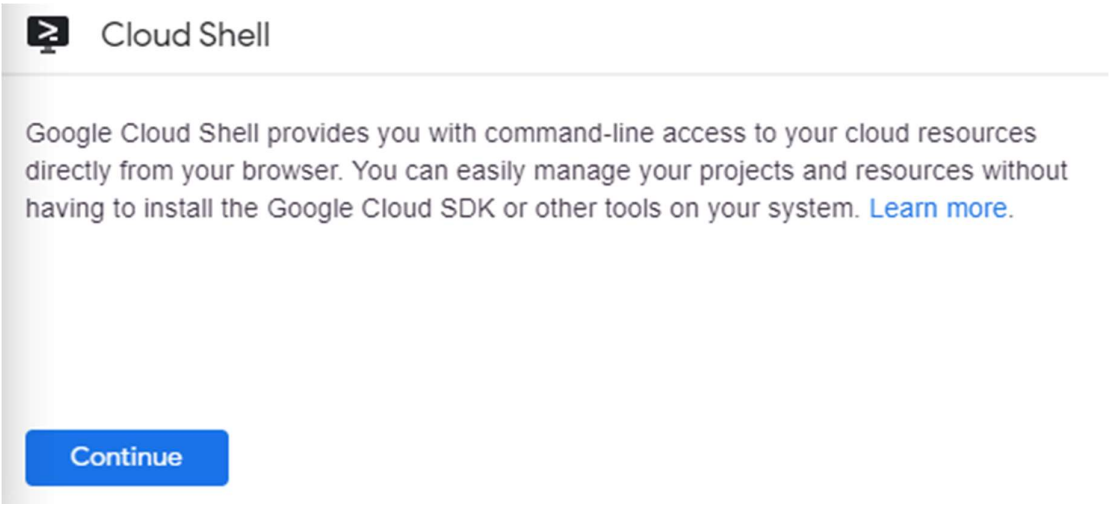
Activate Cloud Shell

Cloud Shell is a virtual machine that is loaded with development tools. It offers a persistent 5GB home directory and runs on the Google Cloud. Cloud Shell provides command-line access to your Google Cloud resources.

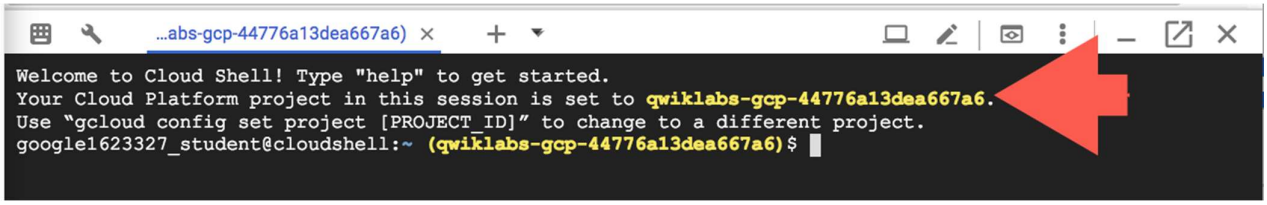
In the Cloud Console, in the top right toolbar, click the **Activate Cloud Shell** button.



Click **Continue**.



It takes a few moments to provision and connect to the environment. When you are connected, you are already authenticated, and the project is set to your *PROJECT_ID*. For example:



`gcloud` is the command-line tool for Google Cloud. It comes pre-installed on Cloud Shell and supports tab-completion.

You can list the active account name with this command:

```
gcloud auth list
```

(Output)

```
Credentialed accounts:
 - <myaccount>@<mydomain>.com (active)
```

(Example output)

```
Credentialed accounts:
 - google1623327_student@qwiklabs.net
```

You can list the project ID with this command:

```
gcloud config list project
```

(Output)

```
[core]
project = <project_ID>
```

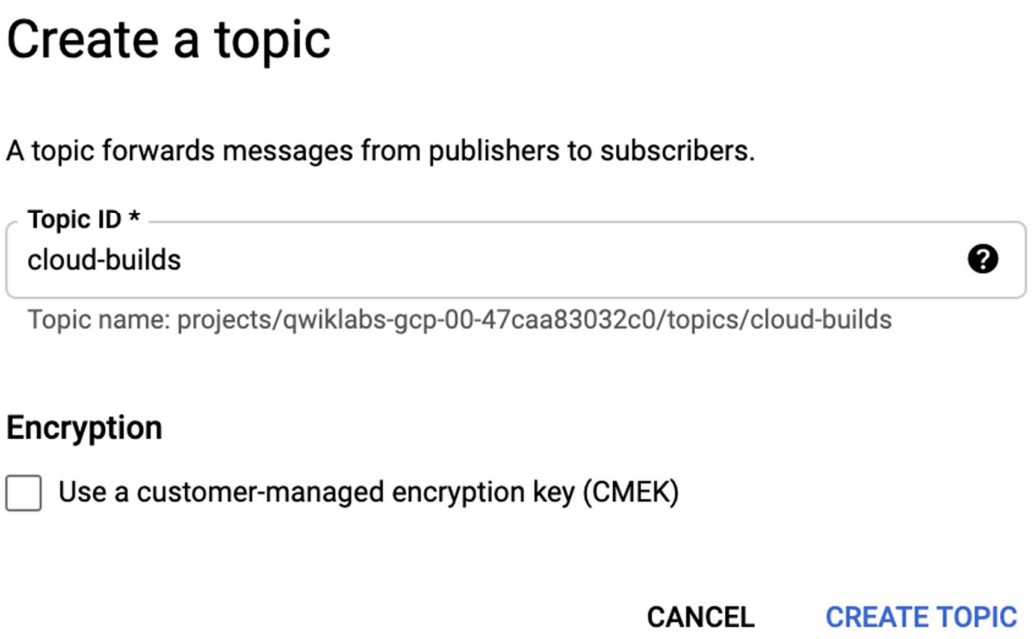
(Example output)

```
[core]
project = qwiklabs-gcp-44776a13dea667a6
```

For full documentation of `gcloud` see the gcloud command-line tool overview.

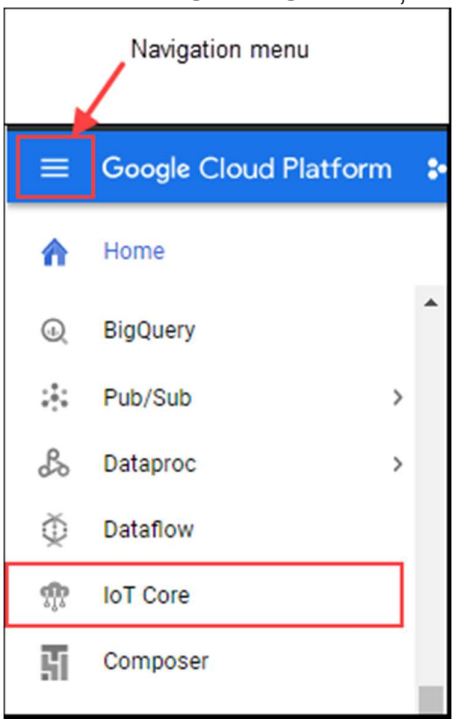
Create a Pub/Sub Topic

1. In the Cloud Console, click **Navigation menu** > **Pub/Sub** > **Topics**.
2. Click **+ CREATE TOPIC** from the top menu.
3. Give the topic the ID `cloud-builds` and click **CREATE TOPIC**:



Create a device registry

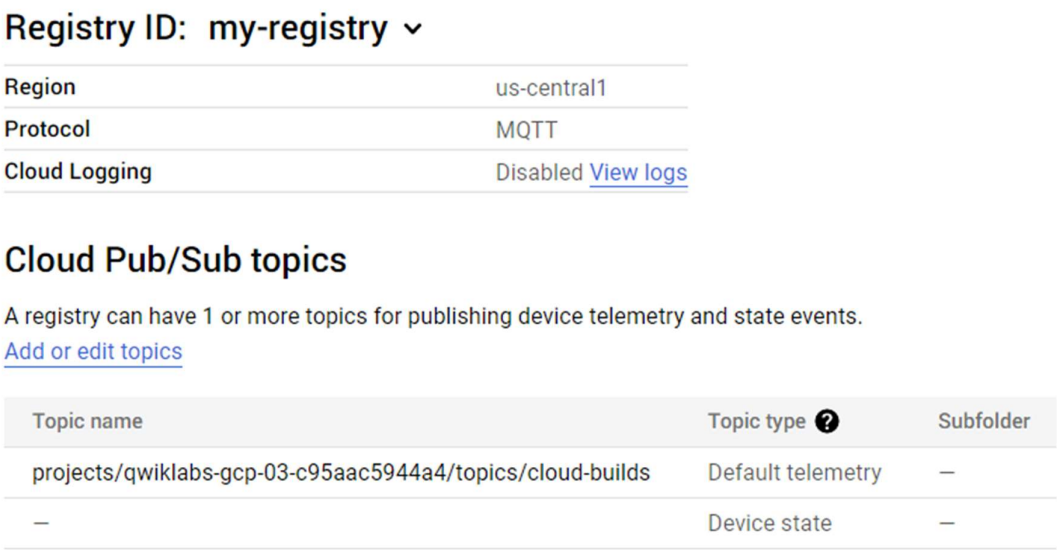
1. In the Cloud Console, click **Navigation menu** > **IoT Core**.



2. Click **Create Registry** and set the following fields (you will need to click on the **Show Advanced Options** button):

Field	**Value**
Registry ID	`my-registry`
Region	`us-central1`
Cloud Pub/Sub Topics	Select a Cloud Pub/Sub Topic Select the default **cloud-builds** topic from the drop down.
Click **Show Advanced Options**	
Device state topic	Leave at the default value
Protocols	`MQTT` only
Cloud Logging	Ignore
CA certificate	Ignore

3. Click **Create**. You should see a similar page once your registry has been successfully created:



You've just created a device registry with a Cloud Pub/Sub topic for publishing device telemetry events. In the next section you'll add a device to the registry.

Click **Check my progress** below to check your lab progress.

Create a device registry.

Check my progress

Add a device to the registry

1. On the IoT Core page, click on **Devices** in the left menu, then click **+ Create a Device**.
2. Set the following fields (you will need to click on the **COMMUNICATION, CLOUD LOGGING, AUTHENTICATION** link):

Field	Value
Device ID	`my-device`
Device communication	`Allow`
Authentication	Default value (for now)
Public Key format	Default value (for now)
Public key value	Default value (for now)

3. Click **Create**.

You've just added a device to your registry. The device won't be able to connect to Google Cloud without a valid key.

Click **Check my progress** below to check your lab progress.

Add a device to the registry.

Check my progress

Add a public key to the device

For your device to transmit telemetry data through the cloud, you must add a key to the device.

1. In Cloud Shell, run the following command to create an RS256 key:

```
openssl req -x509 -newkey rsa:2048 -keyout rsa_private.pem -nodes \
    -out rsa_cert.pem -subj "/CN=unused"
```

2. Now enter in `ls` in Cloud Shell. You will see the following files:

```
README-cloudshell.txt  rsa_cert.pem  rsa_private.pem
```

Open the `rsa_cert.pem` with the nano editor:

```
nano rsa_cert.pem
```

3. Copy the contents of `rsa_cert.pem` to the clipboard, include `-----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----`.

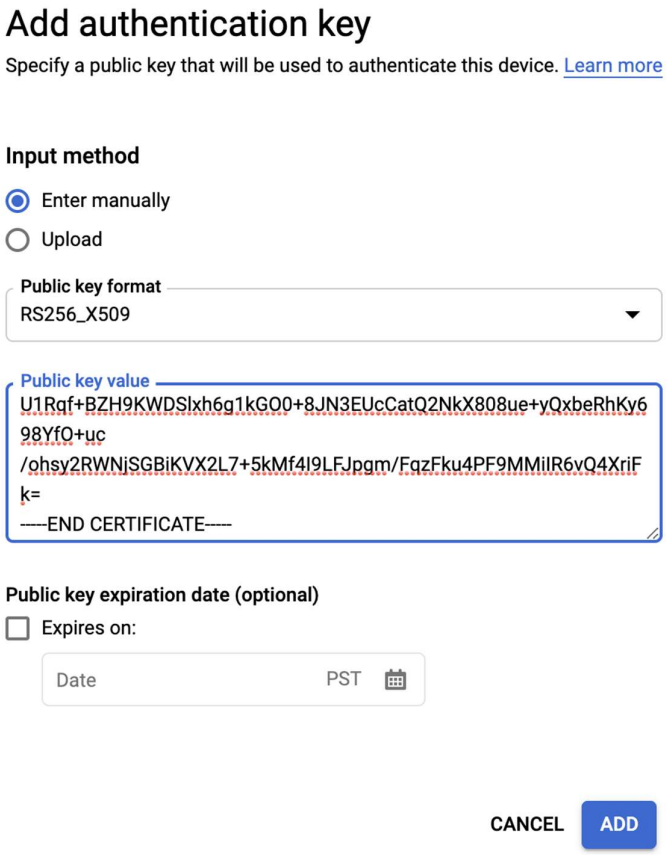
4. Exit the editor with **CTRL** + **X**.

5. In the Cloud Console, on the **Authentication** tab for the device you created, click **Add public key**.

6. Enter the following values:

Field	Value
Input method	`Enter manually`
Public key format	RS256_X509
Public key value	Paste contents of `rsa_cert.pem`
Public key expiration date	Default value

6. Click **Add**.



An RS256_X509 key is now listed for your device.

Click **Check my progress** below to check your lab progress.

Run a Node.js sample to connect a virtual device and view telemetry

1. In Cloud Shell run the following, replacing `<YOUR_PROJECT_ID>` with your Qwiklabs Project ID:

```
export PROJECT_ID=<YOUR_PROJECT_ID>

gcloud config set project $PROJECT_ID
```

Next, get the Cloud IoT Core Node.js samples from GitHub by cloning the full Node.js repository.

2. Enter the following to clone the repo:

```
git clone https://github.com/googleapis/nodejs-iot
```

3. Navigate to the Cloud IoT Core samples in the samples directory.

```
cd nodejs-iot/samples/mqtt_example
```

You'll complete the rest of these steps in this directory.

4. Copy the private key to the current working directory:

```
cp ../../../rsa_private.pem .
```

5. In the command line, install the `Node.js` dependencies:

```
npm install
```

6. Run the following command to create a subscription:

```
gcloud pubsub subscriptions create \
    projects/$PROJECT_ID/subscriptions/my-subscription \
    --topic=projects/$PROJECT_ID/topics/cloud-builds
```

Click **Check my progress** below to check your lab progress.

create a subscription.

Check my progress

7. Run the following command to connect a virtual device to Cloud IoT Core using the MQTT bridge:

```
node cloudiot_mqtt_example_nodejs.js mqttDeviceDemo --projectId=$PROJECT_ID \
  --registryId=my-registry --deviceId=my-device \
  --privateKeyFile=rsa_private.pem --algorithm=RS256 \
  --cloudRegion=us-central1 --numMessages=25
```

The output shows that the sample device is publishing messages to the telemetry topic. Twenty-five messages are published.

8. Run the following command to read the messages published to the telemetry topic:

```
gcloud pubsub subscriptions pull --auto-ack \
    projects/$PROJECT_ID/subscriptions/my-subscription
```

Repeat the `subscriptions pull` command to view additional messages.

You created a Cloud IoT Core device registry, connected a device, and published device telemetry events.

Test your knowledge

Test your knowledge about Google cloud Platform by taking our quiz.

Google Cloud IoT platform, provides a complete solution for collecting, processing, analyzing, and visualizing IoT data in real time to support improved operational efficiency.
True

Congratulations!

Finish Your Quest

This self-paced lab is part of the Qwiklabs Baseline: Infrastructure and IoT in the Google Cloud. A Quest is a series of related labs that form a learning path. Completing this Quest earns you the badge above, to recognize your achievement. You can make your badge (or badges) public and link to them in your online resume or social media account. Enroll in a Quest and get immediate completion credit if you've taken this lab. See other available Qwiklabs Quests.

Take Your Next Lab

Continue your Quest with Google Cloud Pub/Sub: Qwik Start - Console, or check out these suggestions:

- Deployment Manager: Qwik Start
- A Tour of IoT Core

Next Steps /Learn More

These labs are also part of a series of labs called Qwik Starts. Qwik Starts are designed to give you a little taste of the many features available with Google Cloud. Search for "Qwik Starts" in the lab catalog to find the next lab you'd like to take!

Google Cloud Training & Certification

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