UM0207

AmebaZ2 Amazon FreeRTOS Getting Started Guide

Abstract

This document describes the information of Mbed TLS Version management.

COPYRIGHT

DISCLAIMER

Please Read Carefully:

Realtek Semiconductor Corp., (Realtek) reserves the right to make corrections, enhancements, improvements and other changes to its products and services. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

Reproduction of significant portions in Realtek data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Realtek is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions.

Buyers and others who are developing systems that incorporate Realtek products (collectively, “Customers”) understand and agree that Customers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Customers have full and exclusive responsibility to assure the safety of Customers' applications and compliance of their applications (and of all Realtek products used in or for Customers’ applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Customer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Customer agrees that prior to using or distributing any applications that include Realtek products, Customer will thoroughly test such applications and the functionality of such Realtek products as used in such applications.

Realtek’s provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation kits, (collectively, “Resources”) are intended to assist designers who are developing applications that incorporate Realtek products; by downloading, accessing or using Realtek’s Resources in any way, Customer (individually or, if Customer is acting on behalf of a company, Customer’s company) agrees to use any particular Realtek Resources solely for this purpose and subject to the terms of this Notice.

Realtek’s provision of Realtek Resources does not expand or otherwise alter Realtek’s applicable published warranties or warranty disclaimers for Realtek’s products, and no additional obligations or liabilities arise from Realtek providing such Realtek Resources. Realtek reserves the right to make corrections, enhancements, improvements and other changes to its Realtek Resources. Realtek has not conducted any testing other than that specifically described in the published documentation for a particular Realtek Resource.

Customer is authorized to use, copy and modify any individual Realtek Resource only in connection with the development of applications that include the Realtek product(s) identified in such Realtek Resource. No other license, express or implied, by estoppel or otherwise to any other Realtek intellectual property right, and no license to any technology or intellectual property right of Realtek or any third party is granted herein, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which Realtek products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of Realtek Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from Realtek under the patents or other Realtek’s intellectual property.

Realtek’s Resources are provided “as is” and with all faults. Realtek disclaims all other warranties or representations, express or implied, regarding resources or use thereof, including but not limited to accuracy or completeness, title, any epidemic failure warranty and any implied warranties of merchantability, fitness for a particular purpose, and non-infringement of any third party intellectual property rights.

Realtek shall not be liable for and shall not defend or indemnify Customer against any claim, including but not limited to any infringement claim that related to or is based on any combination of products even if described in Realtek Resources or otherwise. In no event shall Realtek be liable for any actual, direct, special, collateral, indirect, punitive, incidental, consequential or exemplary damages in connection with or arising out of Realtek’s Resources or use thereof, and regardless of whether Realtek has been advised of the possibility of such damages. Realtek is not responsible for any failure to meet such industry standard requirements.

Where Realtek specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Customers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any Realtek products in lifecritical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death. Such equipment includes, without limitation, all medical devices identified by the U.S.FDA as Class III devices and equivalent classifications outside the U.S.

Customers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Customers' own risk. Customers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Customer will fully indemnify Realtek and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's noncompliance with the terms and provisions of this Notice.

TRADEMARKS

Realtek is a trademark of Realtek Semiconductor Corporation. Other names mentioned in this document are trademarks/registered trademarks of their respective owners.

USING THIS DOCUMENT

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

REVISION HISTORY

Revision	Release Date	Summary
1.3	2024/09/12	Update example and build method

1 AmebaZ2 RTL8720CM Board

1.1 AmebaZ2 Demo EVB

Ameba Demo board home page: https://www.amebaiot.com/amebaz2/

Ameba RTL8720CM Board (AMB 31)

Manual / Schematic / Layout

Buy it

CPU

- 32-bit Arm®Cortex®-M4, up to 100MHz

Memory

- 256KB SRAM + 4MB PSRAM

Key Features

- Integrated 802.11n Wi-Fi SoC
- Hardware SSL Engine
- Root Trust Secure Boot
- BLE4.2

1.2 PCB Layout Overview

RTL8720C embedded on Ameba-ZII DEV demo board, which consists of various I/O interfaces. For the details of the HDK, please contact us for further reference.

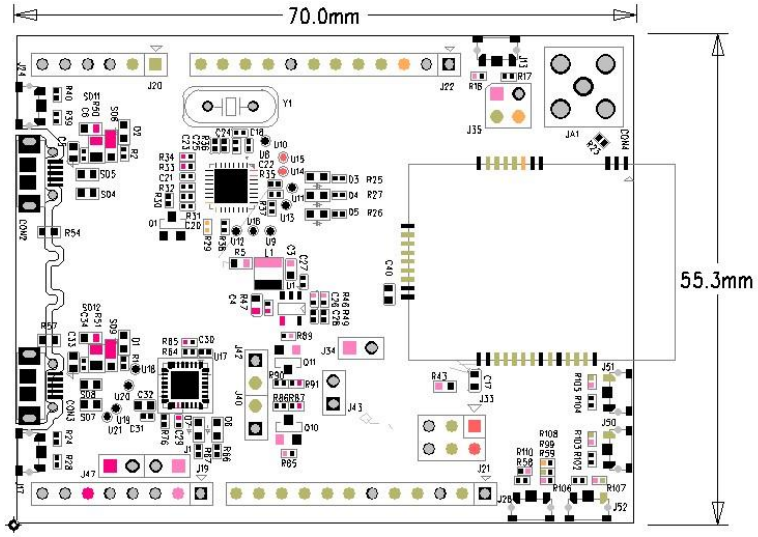


Figure 1-1 Top View of Ameba-ZII 2V0 Dev Board

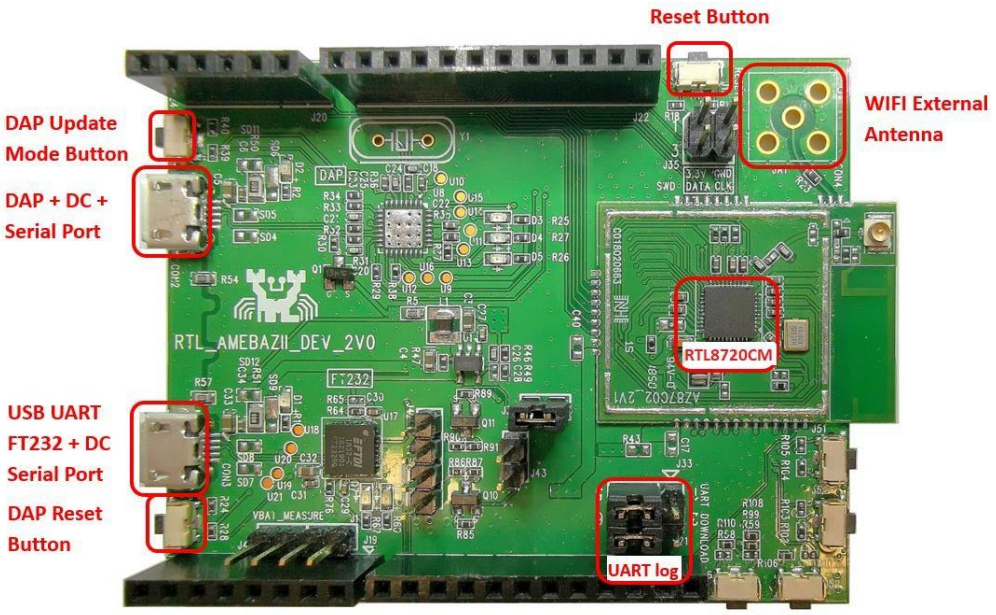
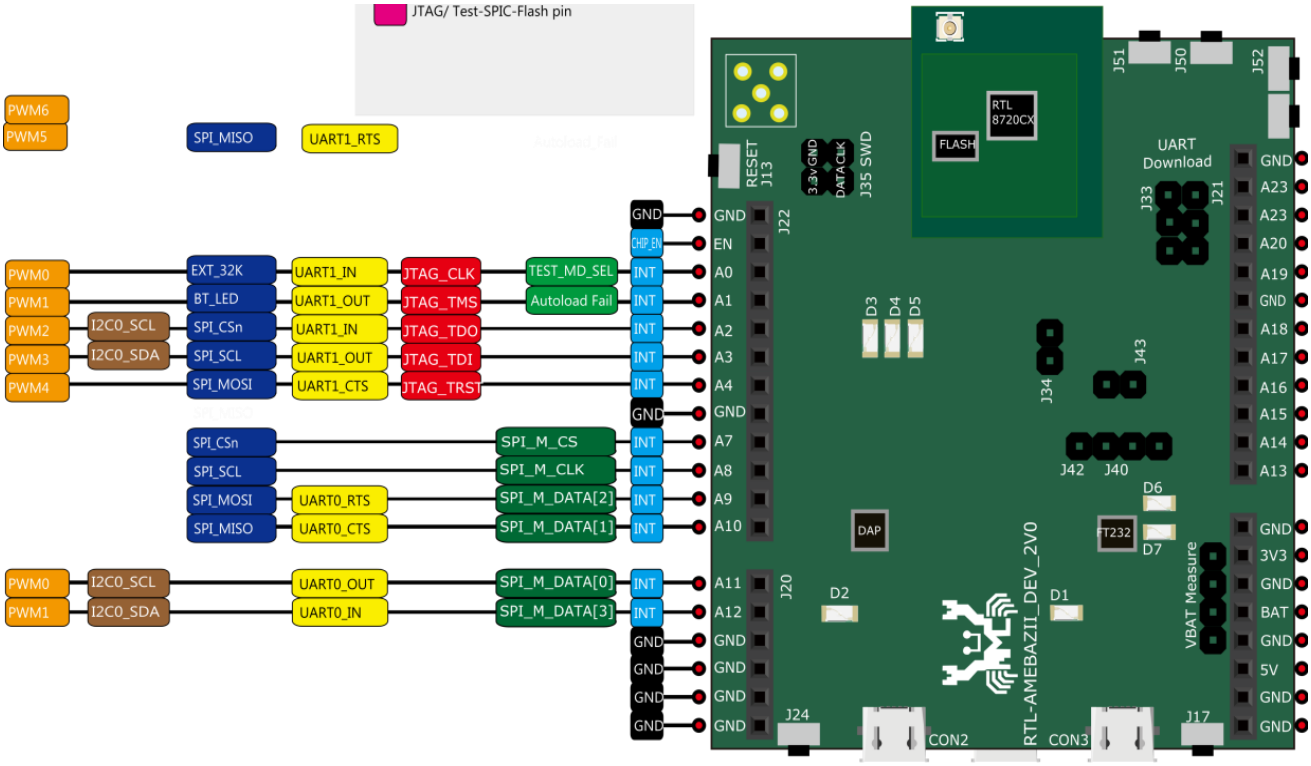


Figure 1-2 Ameba-ZII 2V0 Dev Board PCB Layout

1.3 Pin-Out Reference



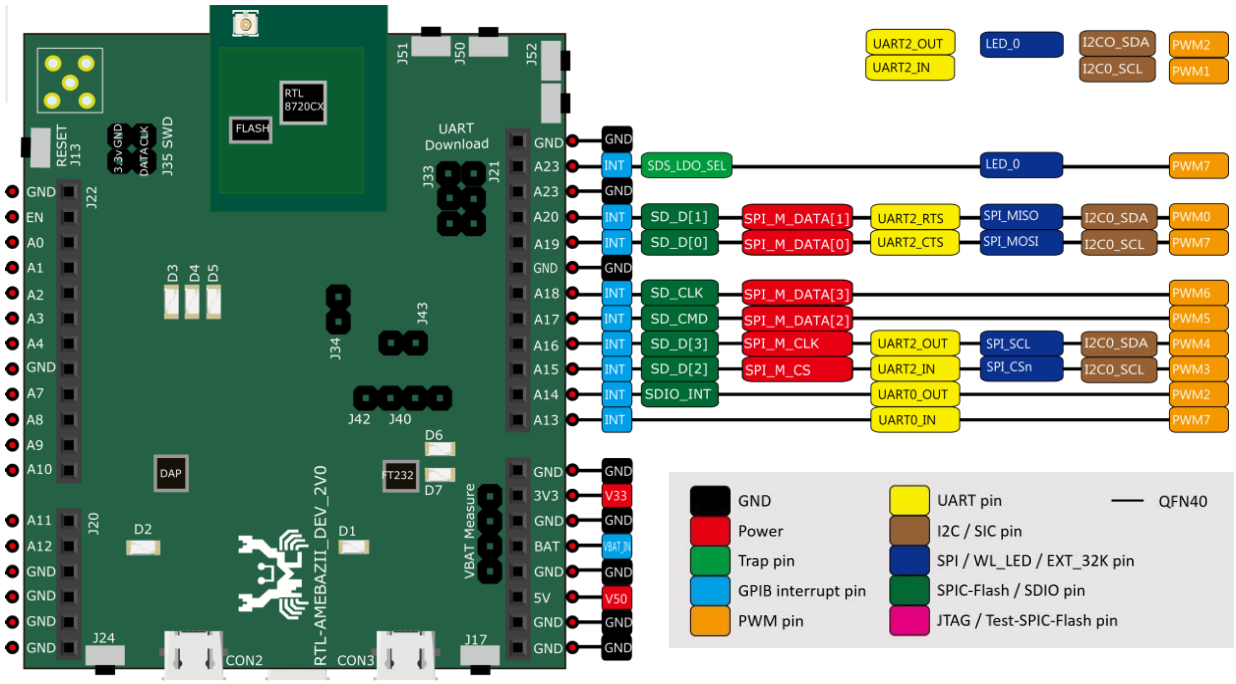
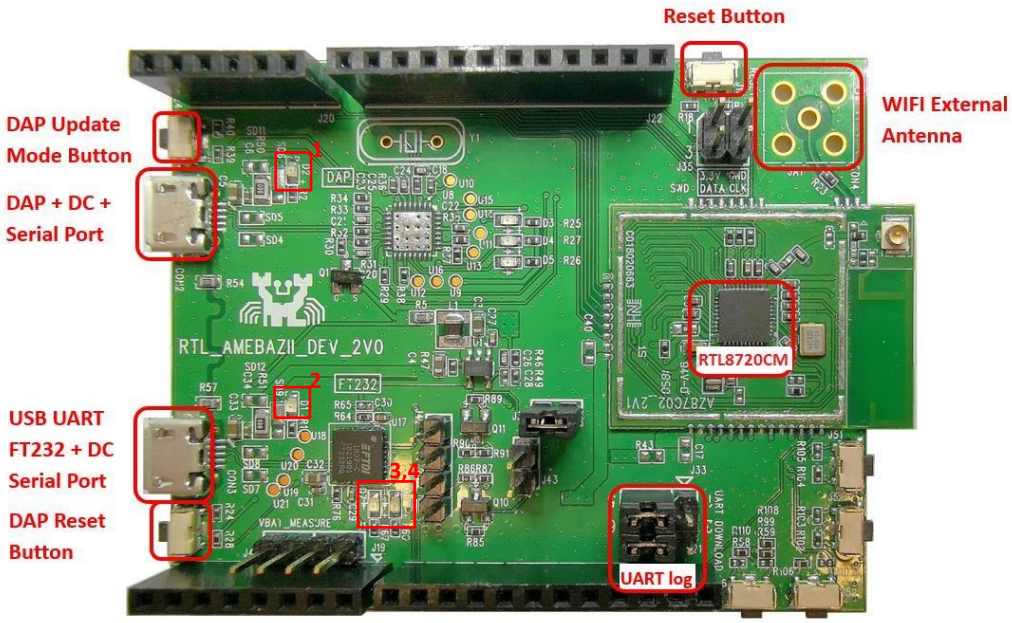


Figure 1-3 Pin Out Reference for DEV_2V0

1.4 LED State

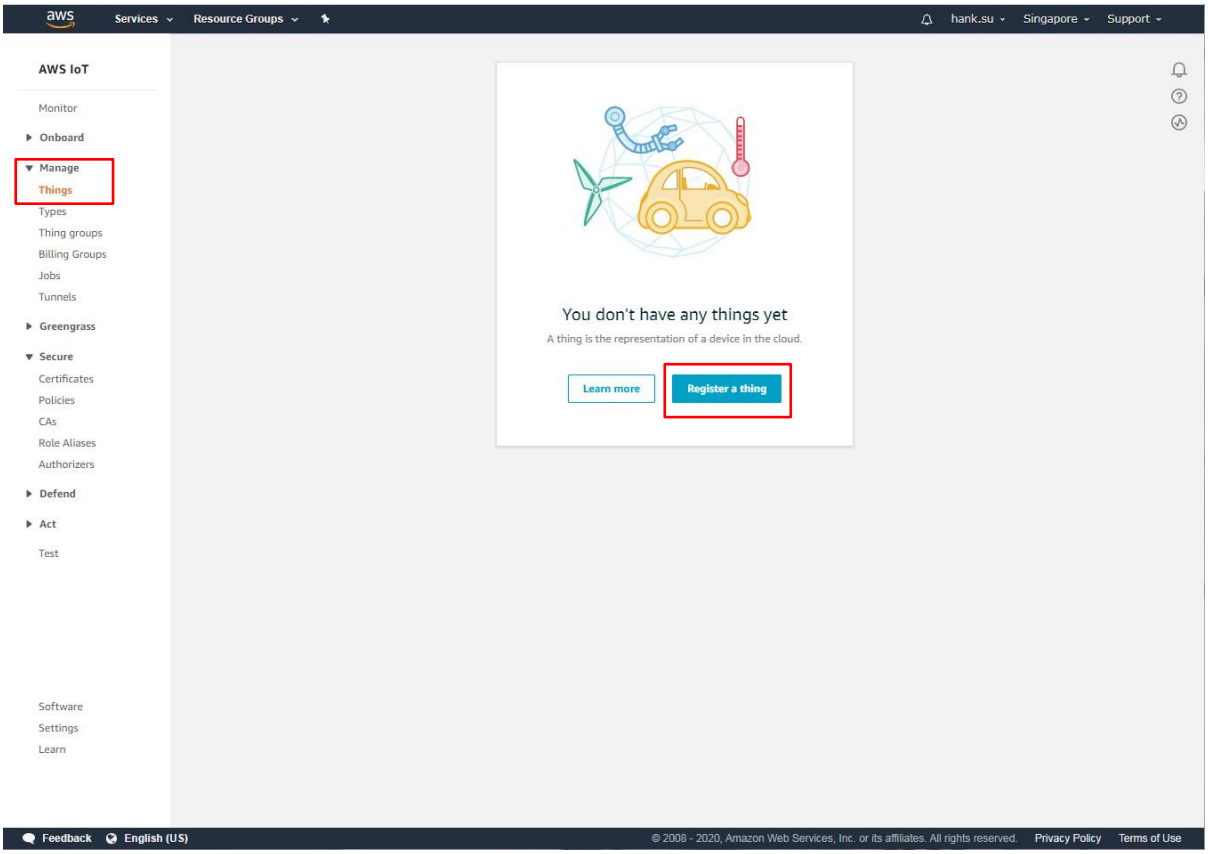
There are four LED on the AmebaZ2 EVB. LED1 lights steady green and LED2 steady red when device have power. LED3 and LED4 go with log uart, they flash red and green when uart communicating.

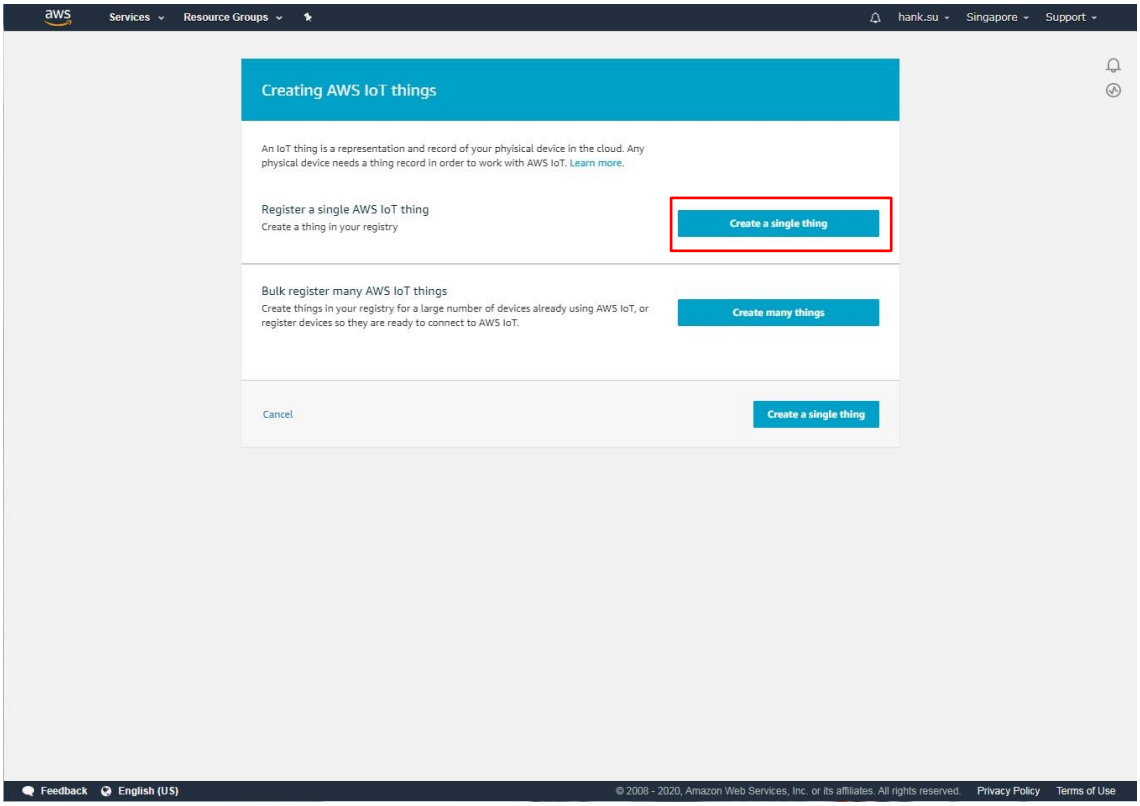


2 Configure AWS IoT Core

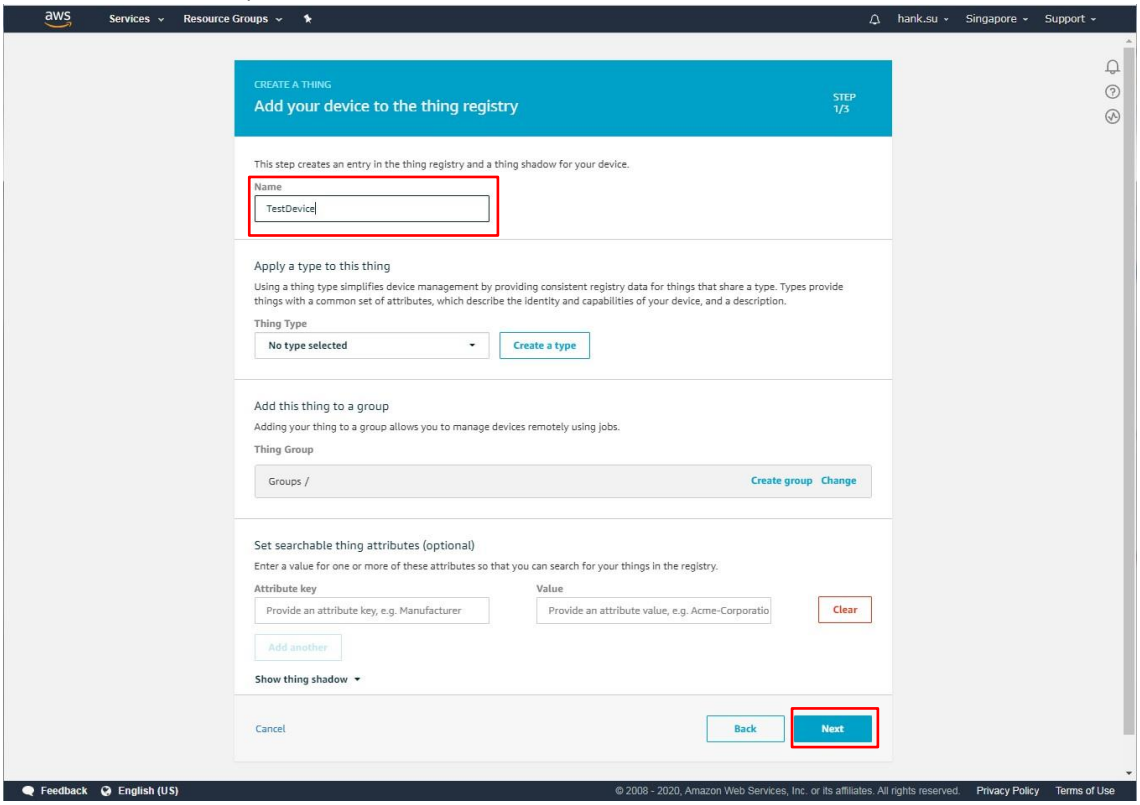
2.1 Create a New Device

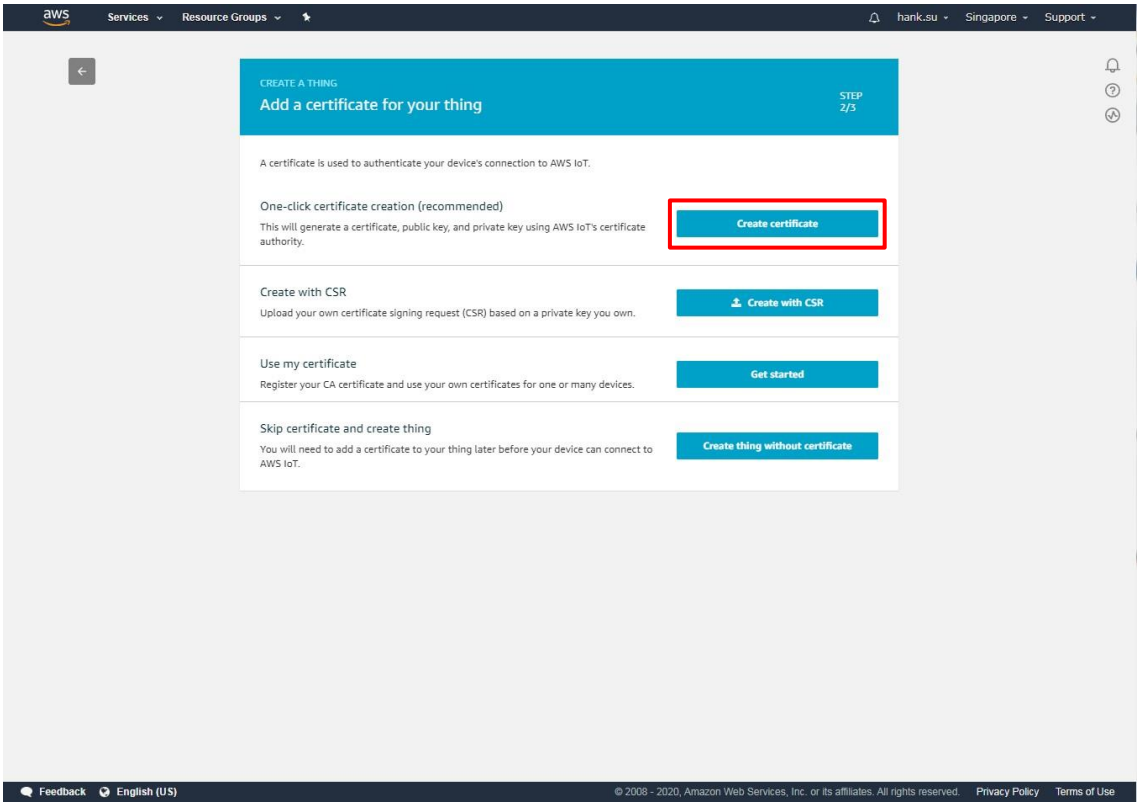
To create a new device, navigate to Manage -> Things in the left-hand navigation menu. Then click “Register a thing”.



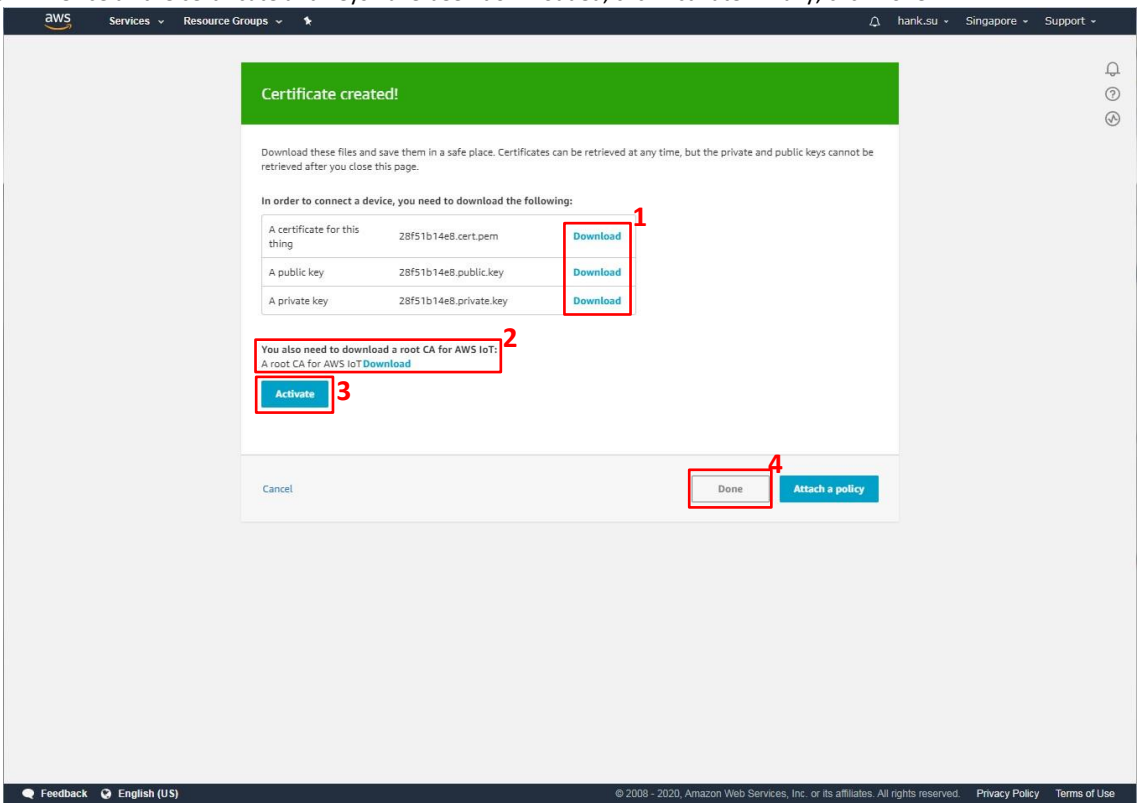


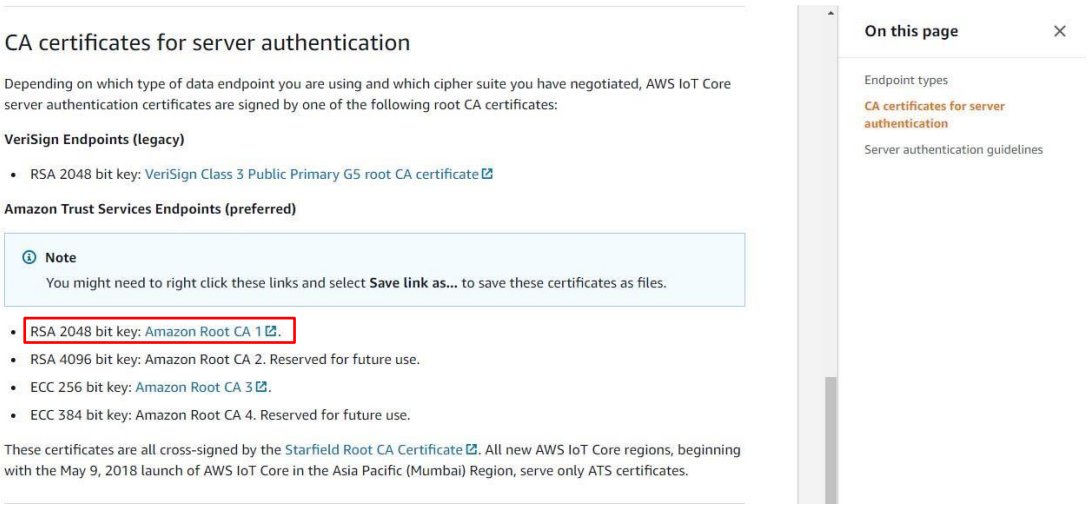
Then, name the new device. This example uses the name TestDevice.





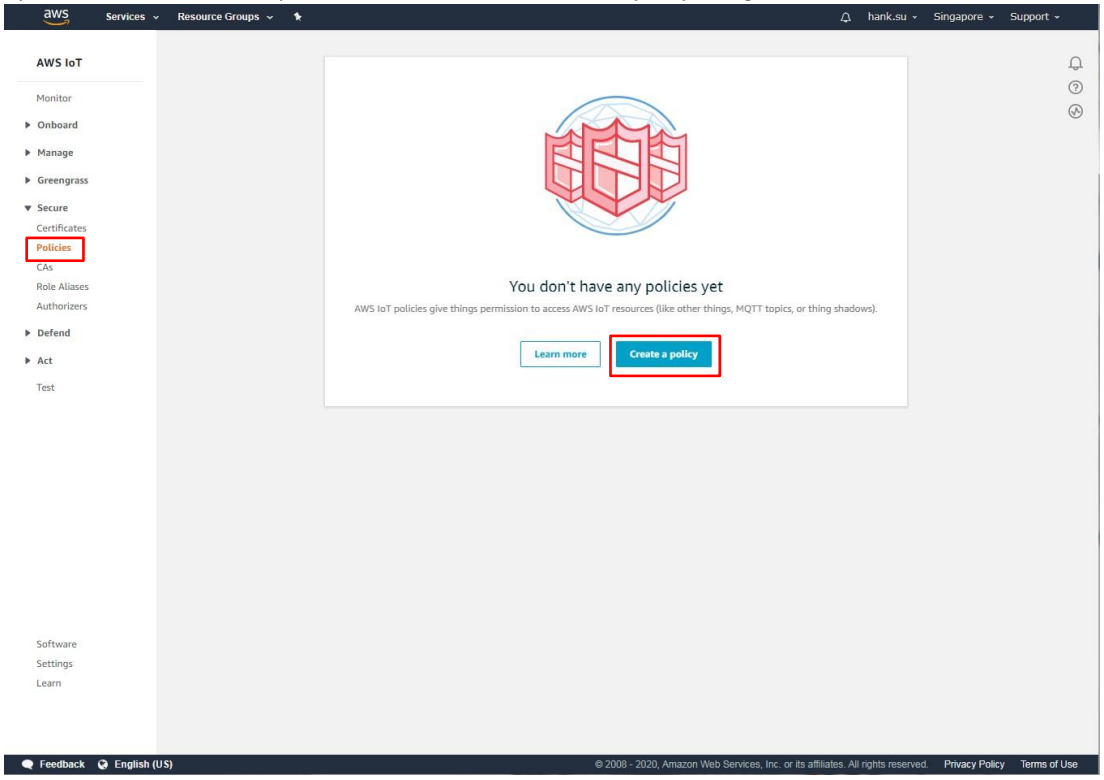
Download the certificate, public key, and private key for the device by clicking Download. Next, download the root CA for AWS IoT by clicking to the Download link. Once all the certificate and keys have been downloaded, click Activate. Finally, click Done



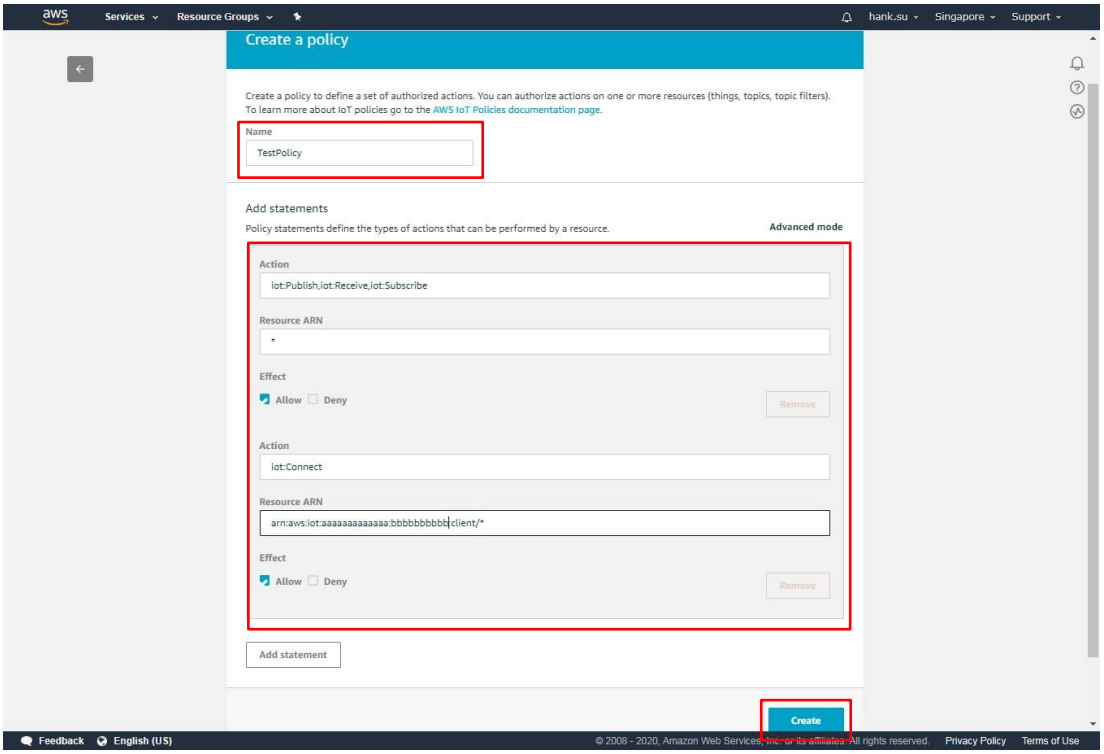


2.2 Create a policy

A policy defines a device's access permissions to IoT Core. To create a policy, navigate to Secure -> Policies. Then click "Create a policy"

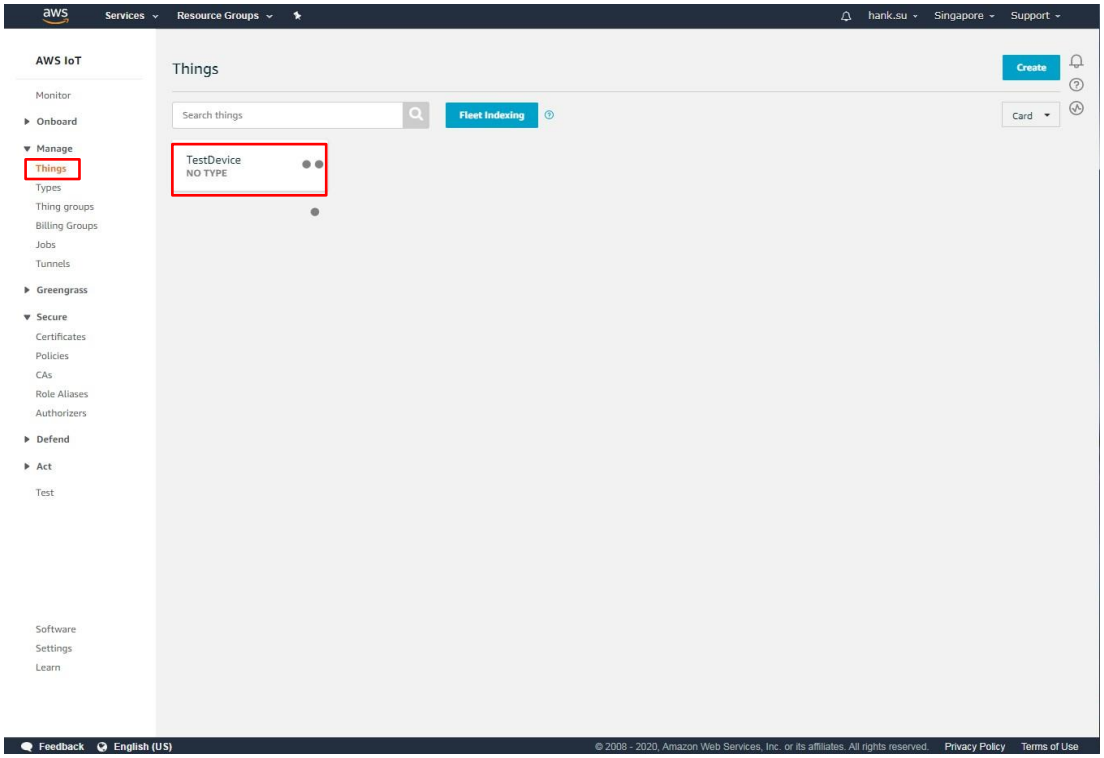


NOTE – this policy grants unrestricted access for all iot operations, and is to be used only in a development environment. For non-dev environments, all devices in your fleet must have credentials with privileges that authorize intended actions only, which include (but not limited to) AWS IoT MQTT actions such as publishing messages or subscribing to topics with specific scope and context. The specific permission policies can vary for your use cases. Identify the permission policies that best meet your business and security requirements.
For sample policies, refer to https://docs.aws.amazon.com/iot/latest/developerguide/example-iot-policies.html. Also refer to https://docs.aws.amazon.com/iot/latest/developerguide/security-best-practices.html

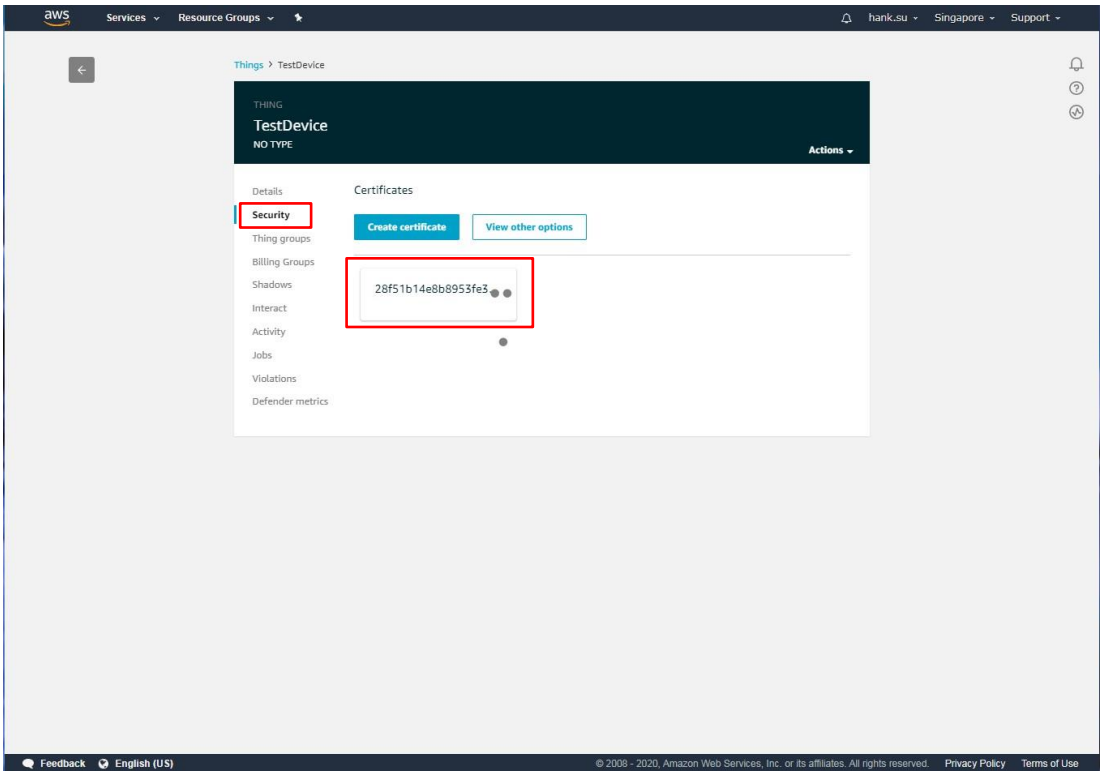


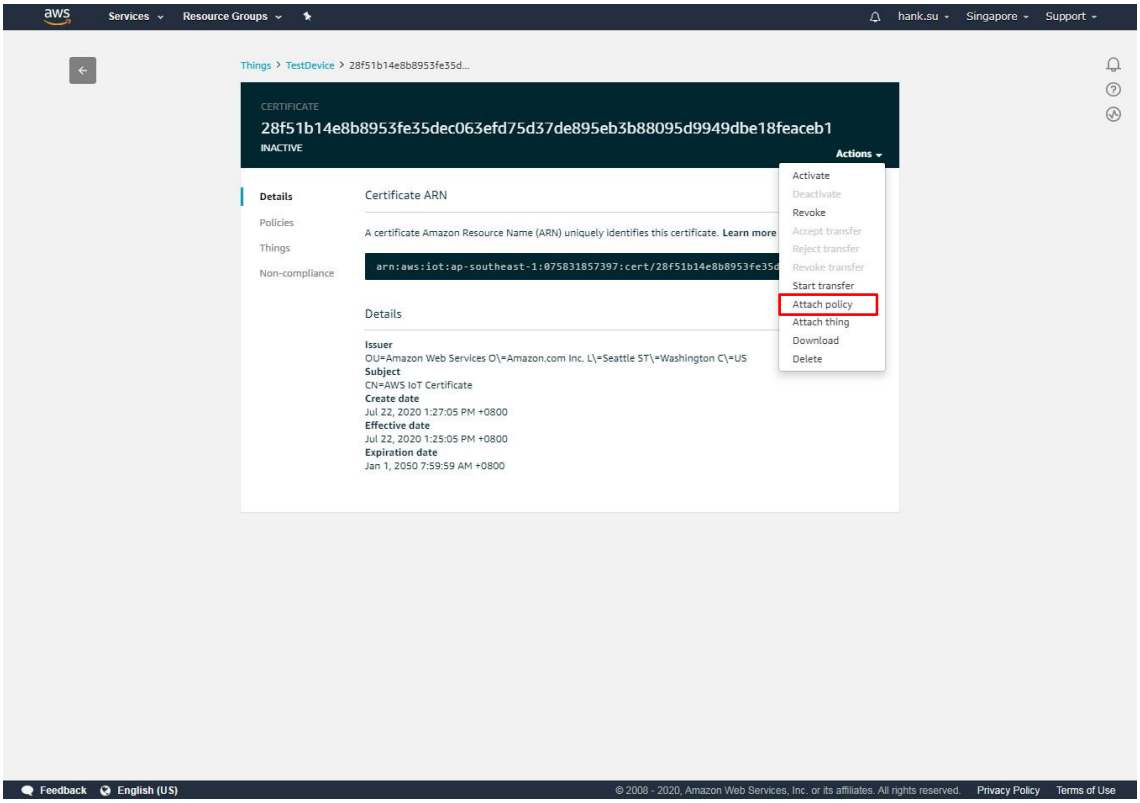
2.3 Attach Policy

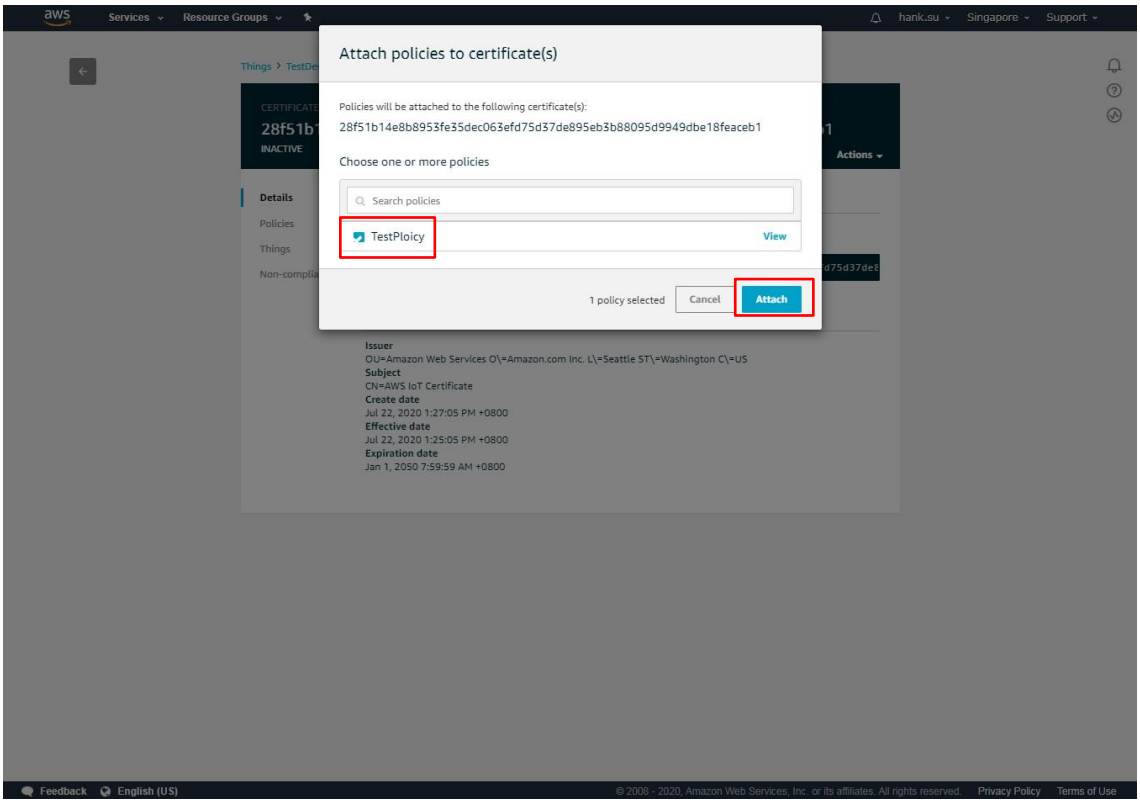
The last step to configuring the device is attaching a policy. To attach a policy to new device, navigate to Manage -> Things. Then click on the device which was created.



Click Security, then click the certificate create in previous step.



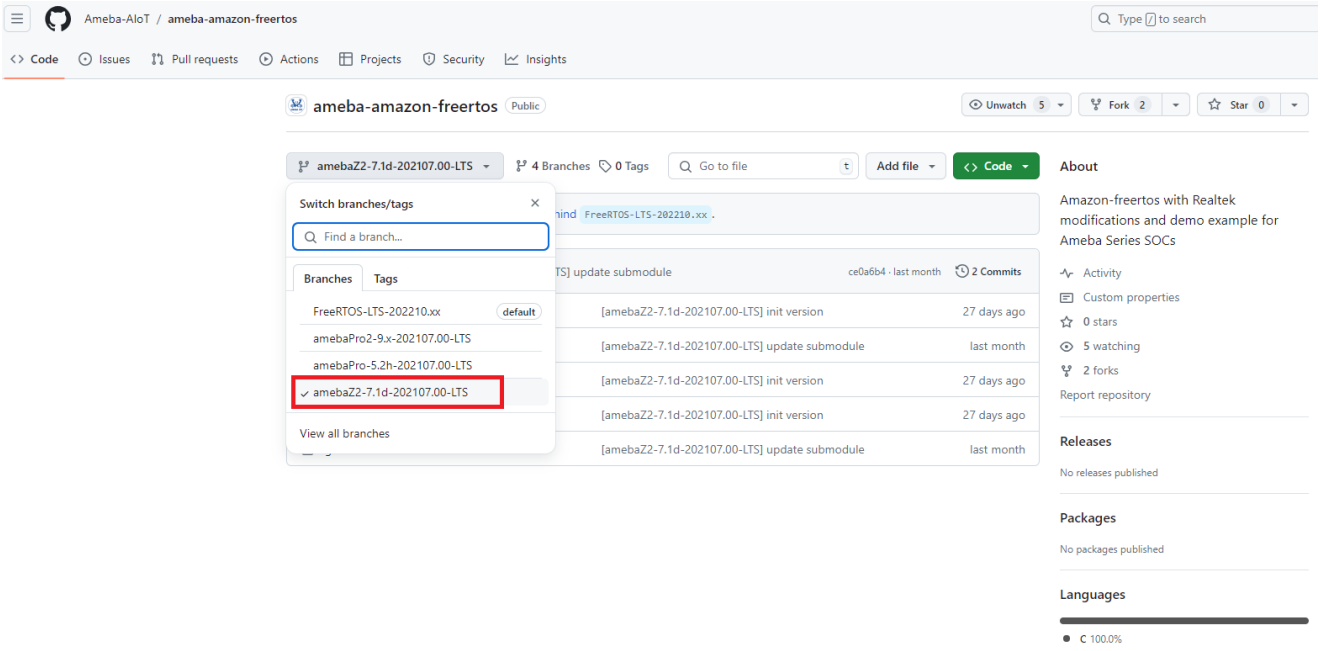




3 Configure AmebaZ2 Amazon FreeRTOS

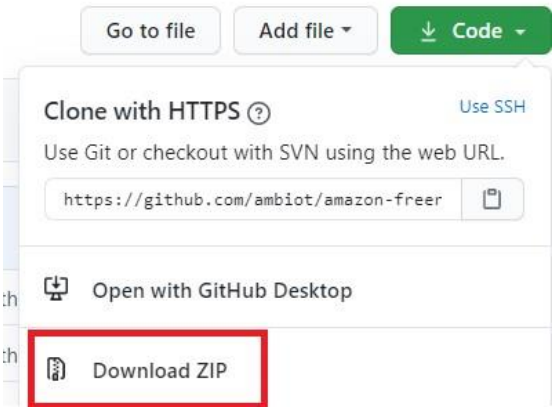
3.1 Download Source Code from github

Open source link: https://github.com/Ameba-AIoT/ameba-amazon-freertos and select amebaZ2-7.1d-202107.00-LTS for get newest source code. The stable version could be found in “Releases” page.



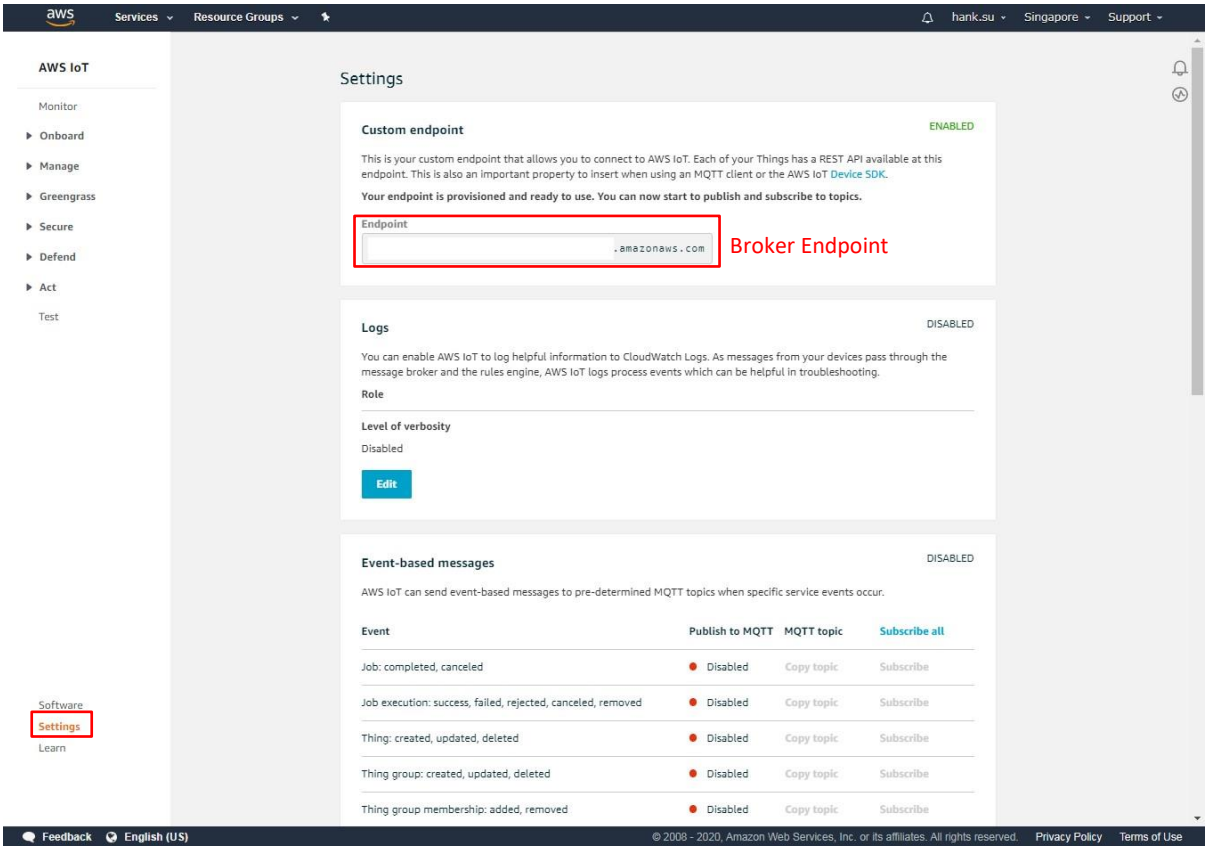
3.1.1 Cloning a repository by Download ZIP

1. On GitHub, navigate to the main page of the repository.
2. Above the list of files, click **Code**.
3. Click **Donwload ZIP** to get source code.

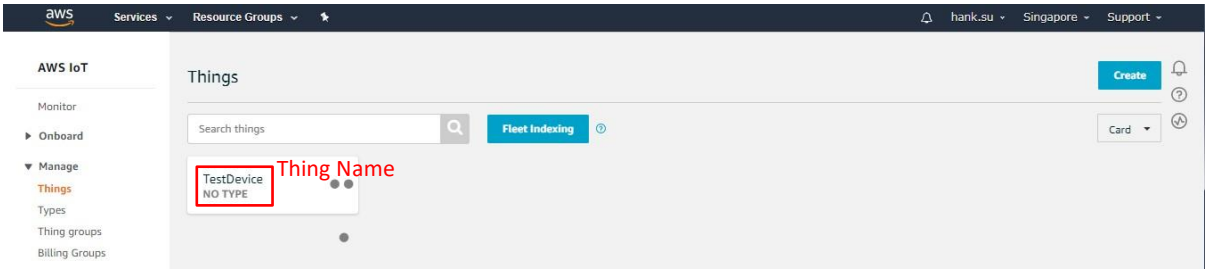


For more information, please refer "Cloning a repository from GitHub to GitHub Desktop."

3.2 Get Broker Endpoint by AWS IoT Core



3.3 Get Thing Name



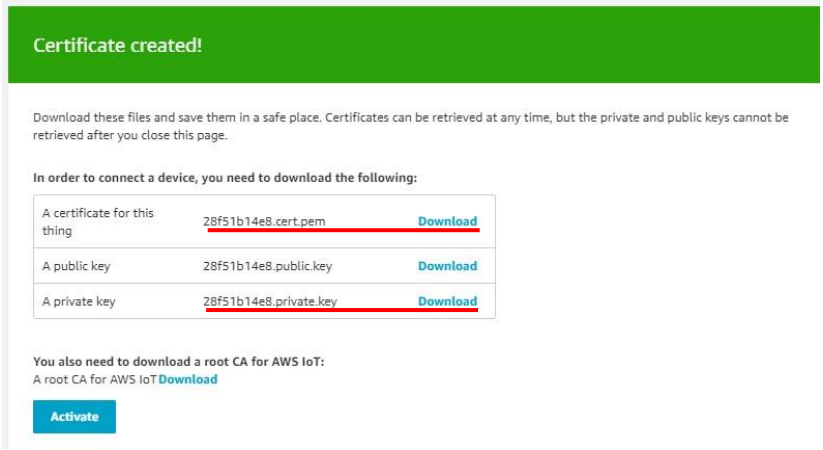
3.4 Setup IoT Core Information with AmebaZ2 Amazon FreeRTOS

Setup BROKER_ENDPOINT, THING_NAME, WIFI_SSID, PASSWORD in "amazonfreertos/blob/master/demos/include/aws_clientcredential.h"

```
#define clientcredentialMQTT_BROKER_ENDPOINT        "xxxxxxxxxxxxxx.amazonaws.com"

/*
 * @brief Host name.
 *
 * @todo Set this to the unique name of your IoT Thing.
 */
#define clientcredentialIOT_THING_NAME              "TestDevice"

/*
 * @brief Port number the MQTT broker is using.
 */
#define clientcredentialMQTT_BROKER_PORT            8883

/*
 * @brief Port number the Green Grass Discovery use for JSON retrieval from cloud is using.
 */
#define clientcredentialGREENGRASS_DISCOVERY_PORT   8443

/*
 * @brief Wi-Fi network to join.
 *
 * @todo If you are using Wi-Fi, set this to your network name.
 */
#define clientcredentialWIFI_SSID                   "TestAP"

/*
 * @brief Password needed to join Wi-Fi network.
 * @todo If you are using WPA, set this to your network password.
 */
#define clientcredentialWIFI_PASSWORD               "password"

/*
 * @brief Wi-Fi network security type.
 *
 * @see WIFISecurity_t.
 *
 * @note Possible values are eWiFiSecurityOpen, eWiFiSecurityWEP, eWiFiSecurityWPA,
 * eWiFiSecurityWPA2 (depending on the support of your device Wi-Fi radio).
 */
#define clientcredentialWIFI_SECURITY               eWiFiSecurityWPA2

#endif /* ifndef __AWS_CLIENTCREDENTIAL__H__ */
```

3.4.1 Setup Thing's Private Key and Certificate

Filled keyCLIENT_CERTIFICATE_PEM and keyCLIENT_PRIVATE_KEY_PEM in "amazonfreertos/blob/master/demos/include/aws_clientcredential_keys.h" by xxxxxxxx-certificate.pem and xxxxxxxx-private.pem.key.



It can done by amazon-freertos/tools/certificate_configuration/CertificateConfigurator.html

Final aws_clientcredential_keys.h overview.

```
/*
 * @brief PEM-encoded client certificate.
 *
 * @todo If you are running one of the FreeRTOS demo projects, set this
 * to the certificate that will be used for TLS client authentication.
 *
 * @note Must include the PEM header and footer:
 * "-----BEGIN CERTIFICATE-----\n"\
 * "...base64 data...\n"\
 * "-----END CERTIFICATE-----\n"
 */
#define keyCLIENT_CERTIFICATE_PEM \
"-----BEGIN CERTIFICATE-----\n"\
"MIIDWjCCAkKgAwIBAgIVAIDLSSoG+EARSbBprT4Im1uu8j2vMA0GCSqGSIb3DQEB\n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"k5+NsBroU/YdvOUmzKn6XfI4nX4hLQJ2TbhAT8aq1ounGk6ZGqCbxt4mg5bB0w==\n"\
"-----END CERTIFICATE-----"
```

```
/*
 * @brief PEM-encoded client private key.
 *
 * @todo If you are running one of the FreeRTOS demo projects, set this
 * to the private key that will be used for TLS client authentication.
 *
 * @note Must include the PEM header and footer:
 * "-----BEGIN RSA PRIVATE KEY-----\n"\
 * "...base64 data...\n"\
 * "-----END RSA PRIVATE KEY-----\n"
 */
#define keyCLIENT_PRIVATE_KEY_PEM \
"-----BEGIN RSA PRIVATE KEY-----\n"\
"MIIEpAIBAAKCAQEAwop96WNucGebARFjD8O+CLsqcBNn/AHyhEcozLZC8qoECUOn\n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"                                                                  \n"\
"pOWEuLUuz2FAv1noAbN/6OQ8H/PT0AFJT/ghA04GnIUF0kjSzY60ehS2mVp6neP+\n"\
"AZjzZ6QJY1b5/PFz9oES448kpyaAoS2ke86+R4r4YOMBK+I5RVbfSQ==\n"\
"-----END RSA PRIVATE KEY-----\n"
```

3.4.2 Enable FreeRTOS demo on AmebaZ2

Find platform_opts_amazon.h in component\common\application\amazon\amazon-freertos\demos\include and enable **CONFIG_EXAMPLE_AMAZON_FREERTOS**

```
/* For Amazon FreeRTOS SDK example */
#define CONFIG_EXAMPLE_AMAZON_FREERTOS    1
```

Fine aws_demo_config.h in component\common\application\amazon\amazon-freertos\vendors\realtek\boards\amebaZ2\aws_demos\config_files and add **CONFIG_MQTT_DEMO_ENABLED**

```
/* To run a particular demo you need to define one of these.
 * Only one demo can be configured at a time
 *
 *          CONFIG_MQTT_DEMO_ENABLED
 *          CONFIG_SHADOW_DEMO_ENABLED
 *          CONFIG_OTA_UPDATE_DEMO_ENABLED
 *
 *  These defines are used in iot_demo_runner.h for demo selection */

#define CONFIG_MQTT_DEMO_ENABLED
```

Now you can start to compile AmebaZ2 Amazon FreeRTOS

4 Compile AmebaZ2 Amazon FreeRTOS

4.1 Pre-Requisite

- Required AmebaZ2 source code(https://github.com/Ameba-AIoT/ameba-rtos-z2)
- Required source code. (https://github.com/Ameba-AIoT/ameba-amazon-freertos), please select the branch name with AmebaZ2 which should be download and paste under ameba-rtos-z2\ component\common\application\amazon
- AmebaZ2 Demo board
- Realtek Image Tool
- IAR Embedded Workbench ver.8.30.1 OR Cygwin 32bit for windows

4.2 IAR Build Environment Setup

The IAR IDE (integrated development environment) only supports Windows OS, this section is applicable for **Windows OS only**.

4.2.1 Install IAR IDE

IAR IDE provides the toolchain for Ameba-ZII. It allows users to write programs, compile and upload them to your board. Also, it supports stepby-step debug function.
User can visit the official website of **IAR Embedded Workbench** and install the IDE by following its instructions.

Note: Please use IAR version **8.30** or above.

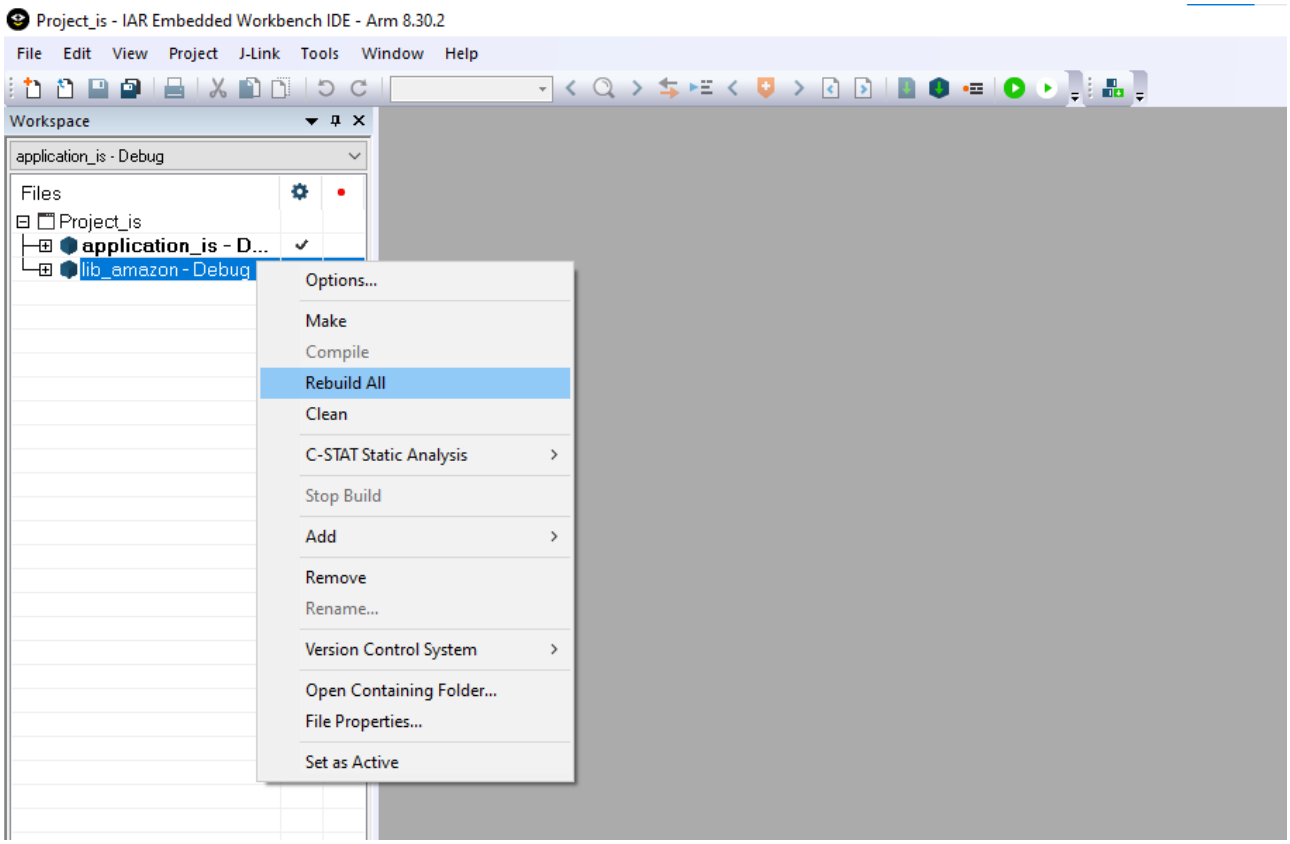
4.2.2 Compilation

1) Run setup_amazon.sh.

   This script will rename the Project_is_amazon.eww to Project_is.eww, and rename application_is_amazon.ewp to application_is.ewp.

   And download the freertos10.4.0 to ameba-rtos-z2/component/os/freertos, and download ameba-amazon-freertos to ameba-rtos-z2/component/common/application/amazon/amazon-freertos

2) Open /project/realtek_amebaz2_v0_example/EWARM-RELEASE /Project_is.eww.
3) Confirm 'lib_amazon' in Work Space, right click 'lib_amazon' and choose "**Rebuild All**" to compile.
4) Confirm 'application_is' in Work Space, right click 'application_is' and choose "**Rebuild All**" to compile.
5) Make sure there is no error after compile.



4.3 GCC Environment

4.3.1 Install Cygwin on Windows (Using Cygwin)

Cygwin is a large collection of GNU and Open Source tools which provide similar functionality as a Linux distribution on Windows. It provides the GCC toolchain for Ameba-ZII to compile projects.
Users can visit the official website of Cygwin and install the software. Please use **Cygwin 32-bit** version.

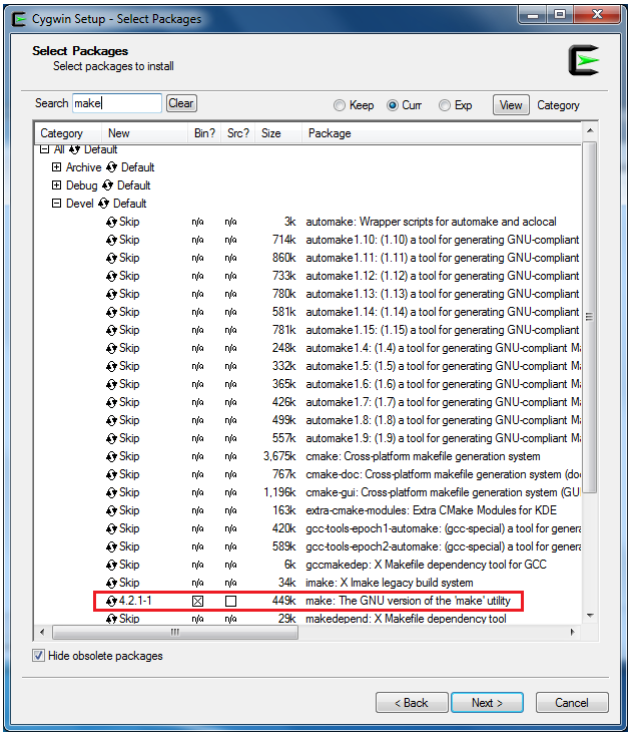
Click http://cygwin.com and download the Cygwin package setup-x86.exe for your Windows platform.

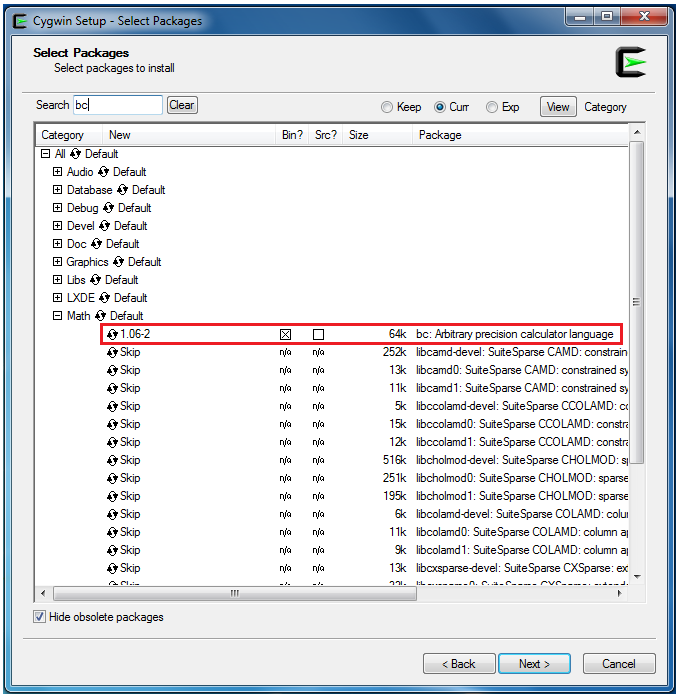
1. 32-bit Cygwin is supported both for 32-bit Windows and 64-bit Windows.

Note: If you can not installed 32-bit Cygwin, refer to Q: How can I install the last Cygwin version for an old, unsupported Windows?. Installation at CMD:

setup-2.912.x86.exe --allow-unsupported-windows --site
http://ctm.crouchingtigerhiddenfruitbat.org/pub/cygwin/circa/2022/11/23/063457

2. During the installation of Cygwin package, include Devel -> make and Math -> bc utilities on the Select Packages page, as below shows.





Note:

- During the Cygwin installation, please install "**math**" "**bc: Arbitrary precision calculator language**"
- During the Cygwin installation, please install "**devel**" "**make: The GNU version of the 'make' utility**"

4.3.2 Compile Project on Cygwin or Ubuntu/Linux

Open "Cygwin Terminal" or in Ubuntu/Linux

1) Direct to compile path. Enter command "**cd** /SDK/project/realtek_amebaz2_v0_example/GCC-RELEASE"

2) Clean up pervious compilation files. Enter command "**make clean**"

3) Build the amazon library. Enter command "**make amazon**"

4) Build the application. Enter command "**make is**"

5) Make sure there are no errors after compilation.

4.4 Generate Image Binary

After compile, the images **partition.bin**, **bootloader.bin**, **firmware_is.bin** and **flash_is.bin** can be seen in the amazonfreertos /project/realtek_amebaz2_v0_example/EWARM-RELEASE/Debug/Exe.

1) **partition.bin** stores partition table, recording the address of Boot image and firmware image;
2) **bootloader.bin** is bootloader image;
3) **firmware_is.bin** is application image;
4) flash_is.bin links partition.bin, bootloader.bin and firmware_is.bin. Users need to choose flash_is.bin when downloading the image to board by Image Tool

5 ImageTool

The tool can be find in ameba-rtos-z2/tools/AmebaZ2/Image_Tool/AmebaZ2_PGTool_v1.2.46

5.1 Introduction

This chapter introduces how to use Image Tool to generate and download images. As show in picture below, Image Tool has two menu pages:

Download: used as image download server to transmit images to Ameba through UART.

Note: If you need to download code via external uart, must use FT232 USB to connect UART dongle.

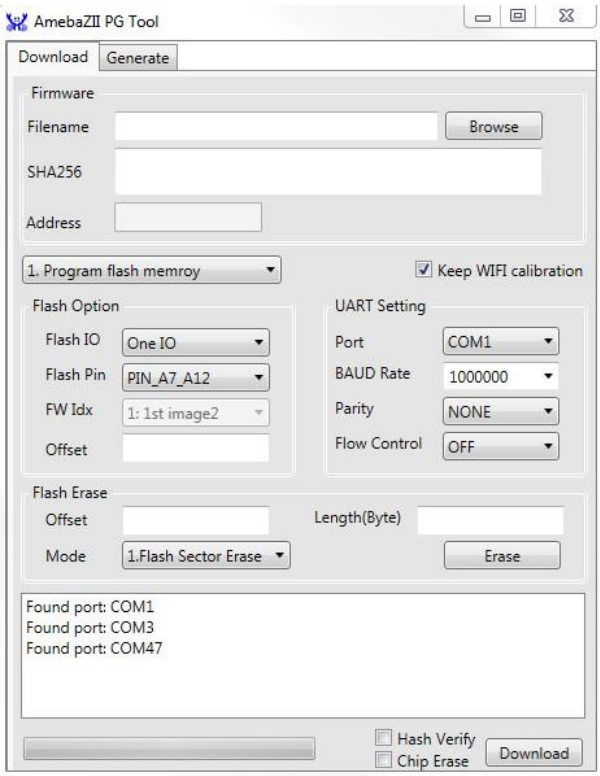


Fig 5-1 AmebaZII ImageTool UI

5.2 Environment Setup

5.2.1 Hardware Setup

User needs to connect CON3 to user's PC via a Micro USB cable. Add jumpers for J34 and J33 (J33 is for log UART which has two jumpers) if there is no connection.

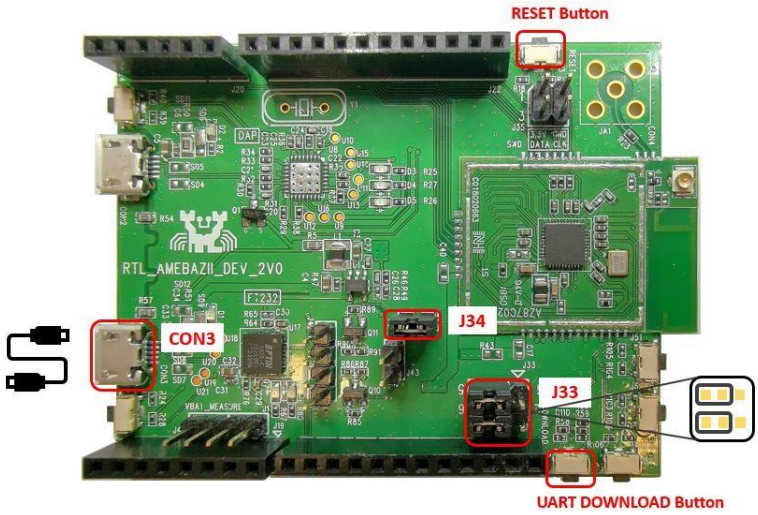


Fig 5-2 Ameba-ZII EVB V2.0 Hardware Setup

5.2.2 Software Setup

- Environment Requirements: EX. WinXP, Win 7 Above, Microsoft .NET Framework 3.5
- AmebaZII_PGTool_v1.2.47.exe

5.3 Image Download

User can download the image to demo board by following steps: **1)**

Trigger Ameba-ZII chip enter **UART download mode** by:

a. Press and hold the **UART DOWNLOAD** button then press the **RESET** button and release both buttons. And make sure the log UART is connected properly.

b. If the chip enters **download mode**, the below log should be shown on log UART console.

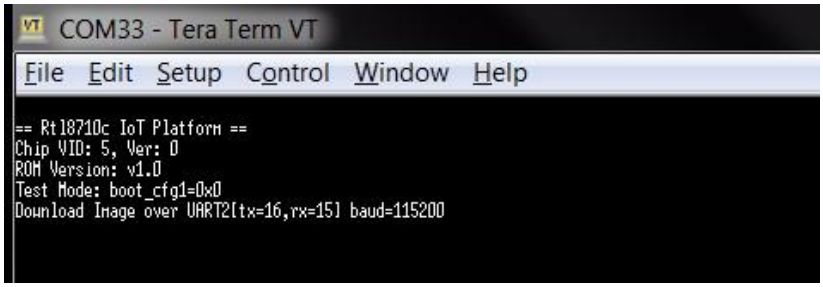
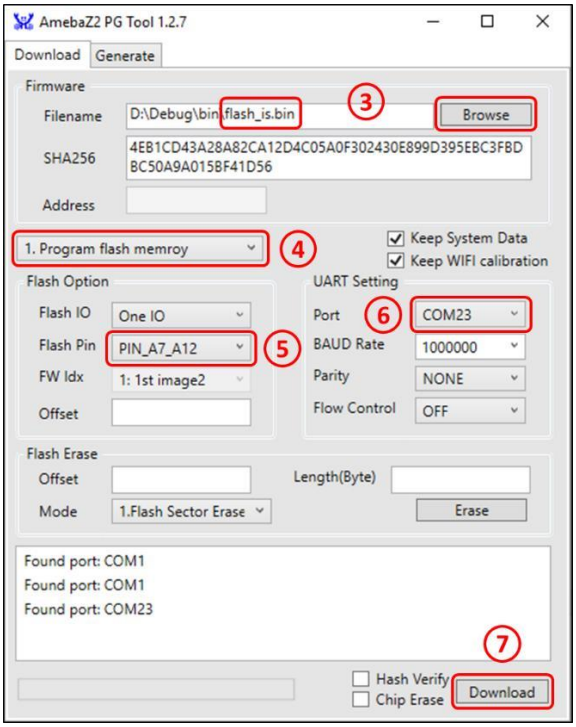


Fig 5-3 Ameba-ZII UART download mode

c. After confirming it is in download mode, **remember to disconnect the log UART console before using Image Tool to download**, because the tool will also need to connect to this log UART port.

2) Open **AmebaZ2 PG Tool**



3) "**Browse**" to choose the image to be downloaded (amazon-freertos/projects/realtek/amebaZ2/IAR/aws_demos/Debug/Exe /flash_is.bin)

4) Choose "**1. Program flash memory**"

5) Choose correct "**Flash Pin**" according to the IC part number

Flash Pin	**IC part number**
PIN_A7_A12	RTL8710CX/RTL8720CM
PIN_B6_B12	RTL8720CF

6) Choose the correct **UART port** (use **rescan** to update the port list)

7) Click "**Download**" to start downloading image. While downloading, the status will be shown on the left bar. **Note:** It's recommended to use the default settings unless user is familiar with them.

6 MQTT Demo

6.1 Get Device Log

Install Tera Term to get device log

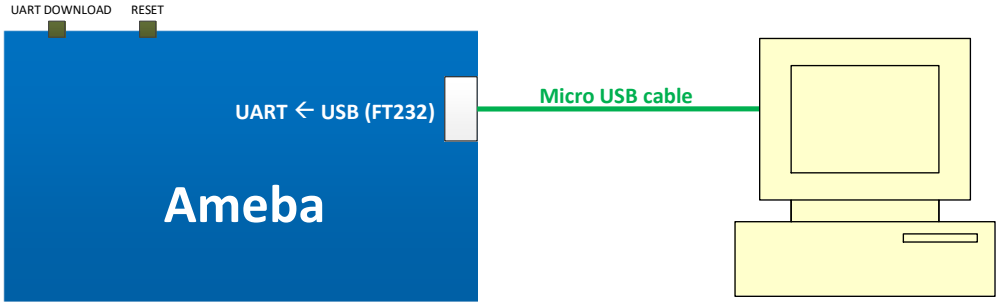
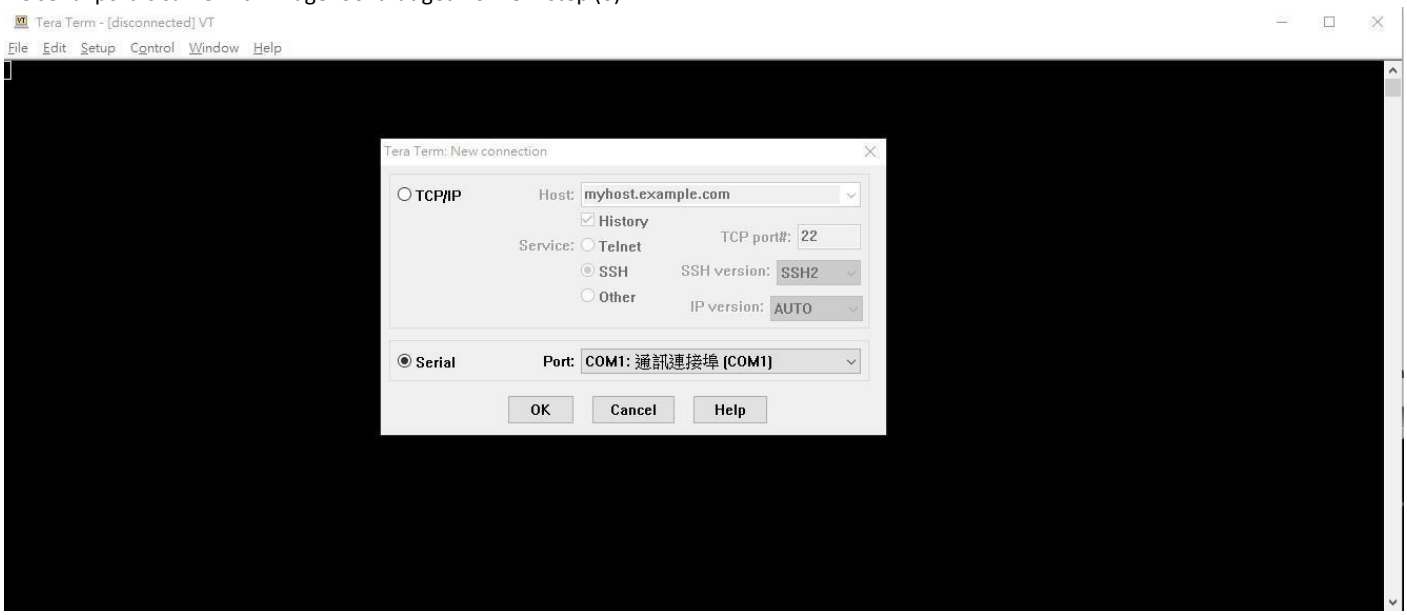


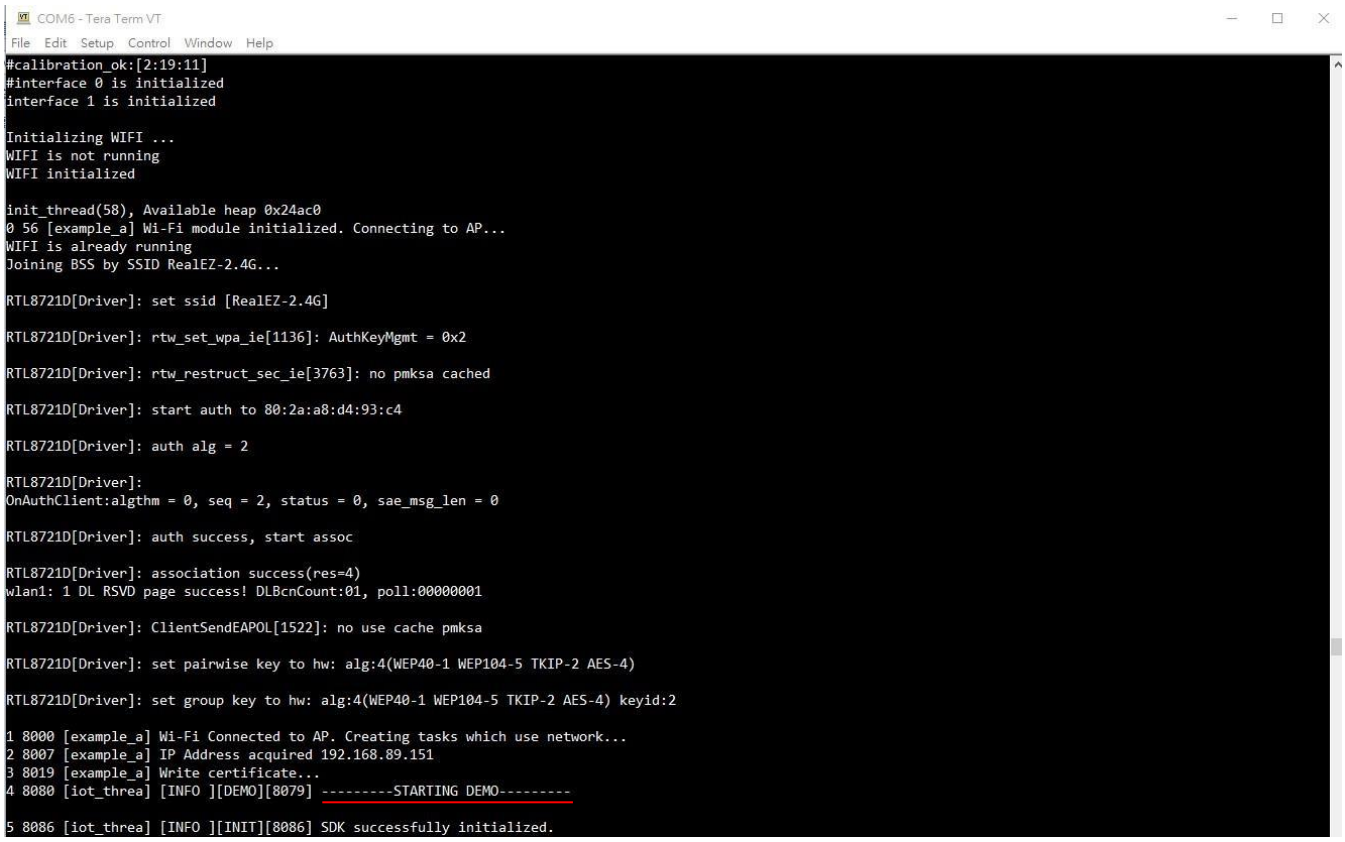
Fig 6-1 Hardware setup

The serial port is same with ImageTool that get from 5.4 step (6).

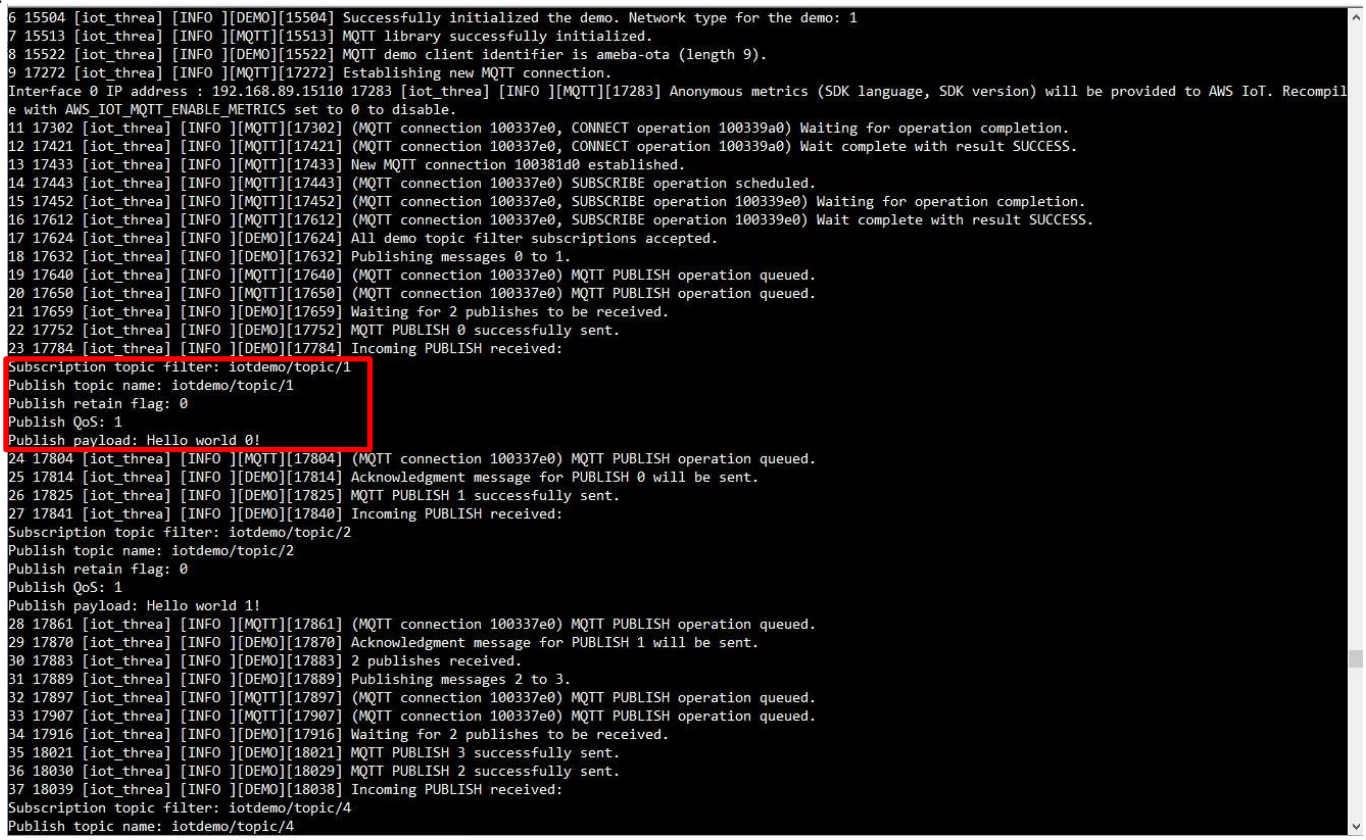


6.2 Run MQTT Demo

Default setting of SDK are enable MQTT demo. Once the AmebaZ2 EVB has rebooted, the application will automatically start run MQTT demo and communicate to IoT Core.



…



…

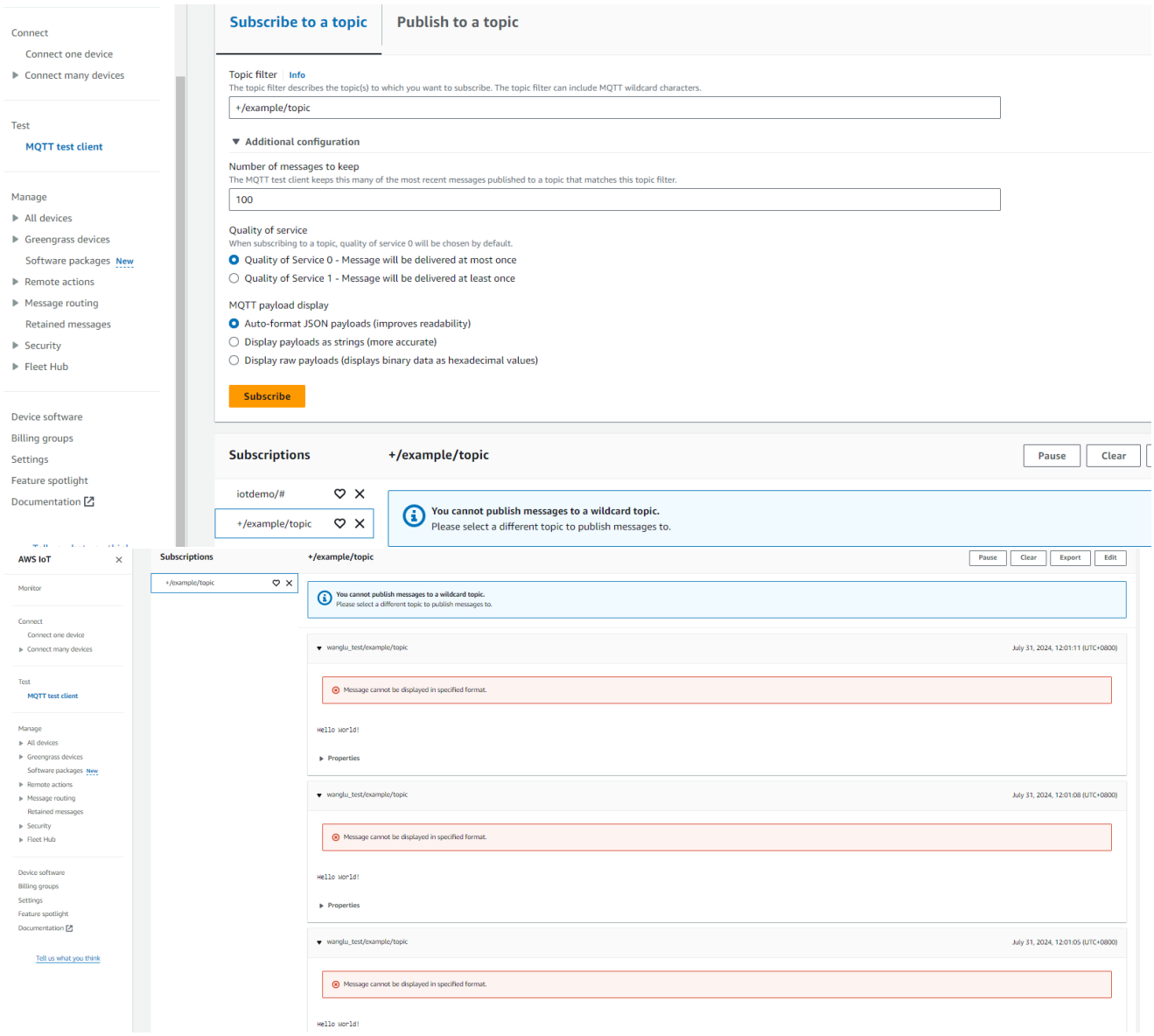
```
Publish payload: Hello world 16!
132 19827 [iot_threa] [INFO ][MQTT][19827] (MQTT connection 100337e0) MQTT PUBLISH operation queued.
133 19837 [iot_threa] [INFO ][DEMO][19837] Acknowledgment message for PUBLISH 16 will be sent.
134 19851 [iot_threa] [INFO ][DEMO][19851] 2 publishes received.
135 19857 [iot_threa] [INFO ][DEMO][19857] Publishing messages 18 to 19.
136 19865 [iot_threa] [INFO ][MQTT][19865] (MQTT connection 100337e0) MQTT PUBLISH operation queued.
137 19876 [iot_threa] [INFO ][MQTT][19876] (MQTT connection 100337e0) MQTT PUBLISH operation queued.
138 19885 [iot_threa] [INFO ][DEMO][19885] Waiting for 2 publishes to be received.
139 19953 [iot_threa] [INFO ][DEMO][19953] MQTT PUBLISH 18 successfully sent.
140 19980 [iot_threa] [INFO ][DEMO][19980] Incoming PUBLISH received:
Subscription topic filter: iotdemo/topic/3
Publish topic name: iotdemo/topic/3
Publish retain flag: 0
Publish QoS: 1
Publish payload: Hello world 18!
141 20001 [iot_threa] [INFO ][MQTT][20001] (MQTT connection 100337e0) MQTT PUBLISH operation queued.
142 20011 [iot_threa] [INFO ][DEMO][20011] Acknowledgment message for PUBLISH 18 will be sent.
143 20053 [iot_threa] [INFO ][DEMO][20053] MQTT PUBLISH 19 successfully sent.
144 20069 [iot_threa] [INFO ][DEMO][20068] Incoming PUBLISH received:
Subscription topic filter: iotdemo/topic/4
Publish topic name: iotdemo/topic/4
Publish retain flag: 0
Publish QoS: 1
Publish payload: Hello world 19!
145 20089 [iot_threa] [INFO ][MQTT][20089] (MQTT connection 100337e0) MQTT PUBLISH operation queued.
146 20099 [iot_threa] [INFO ][DEMO][20099] Acknowledgment message for PUBLISH 19 will be sent.
147 20108 [iot_threa] [INFO ][DEMO][20108] 2 publishes received.
148 20116 [iot_threa] [INFO ][MQTT][20116] (MQTT connection 100337e0) UNSUBSCRIBE operation scheduled.
149 20129 [iot_threa] [INFO ][MQTT][20128] (MQTT connection 100337e0, UNSUBSCRIBE operation 100339e0) Waiting for operation completion.
150 20322 [iot_threa] [INFO ][MQTT][20321] (MQTT connection 100337e0, UNSUBSCRIBE operation 100339e0) Wait complete with result SUCCESS.
151 20335 [iot_threa] [INFO ][MQTT][20335] (MQTT connection 100337e0) Disconnecting connection.
152 20347 [iot_threa] [INFO ][MQTT][20347] (MQTT connection 100337e0, DISCONNECT operation 100339e0) Waiting for operation completion.
153 20359 [iot_threa] [INFO ][MQTT][20359] (MQTT connection 100337e0, DISCONNECT operation 100339e0) Wait complete with result SUCCESS.
154 20371 [iot_threa] [INFO ][MQTT][20371] (MQTT connection 100337e0) Connection disconnected.
155 20380 [iot_threa] [INFO ][MQTT][20380] (MQTT connection 100337e0) Network connection closed.
156 21622 [iot_threa] [INFO ][MQTT][21622] (MQTT connection 100337e0) Network connection destroyed.
157 21631 [iot_threa] [INFO ][MQTT][21631] MQTT library cleanup done.
158 21637 [iot_threa] [INFO ][DEMO][21637] Demo completed successfully.

LwIP_DHCP: dhcp stop.
Deinitializing WIFI ...
159 21772 [iot_threa] [INFO ][INIT][21772] SDK cleanup done.
160 21777 [iot_threa] [INFO ][DEMO][21777] -------DEMO FINISHED-------
```

6.3 Monitoring MQTT messages on the cloud

To subscribe to the MQTT topic with the AWS IoT MQTT client 1.

Sign in to the AWS IoT console.

2. In the navigation pane, choose Test to open the MQTT client.
3. In Subscription topic, enter “+/example/topic”, and then choose Subscribe to topic.



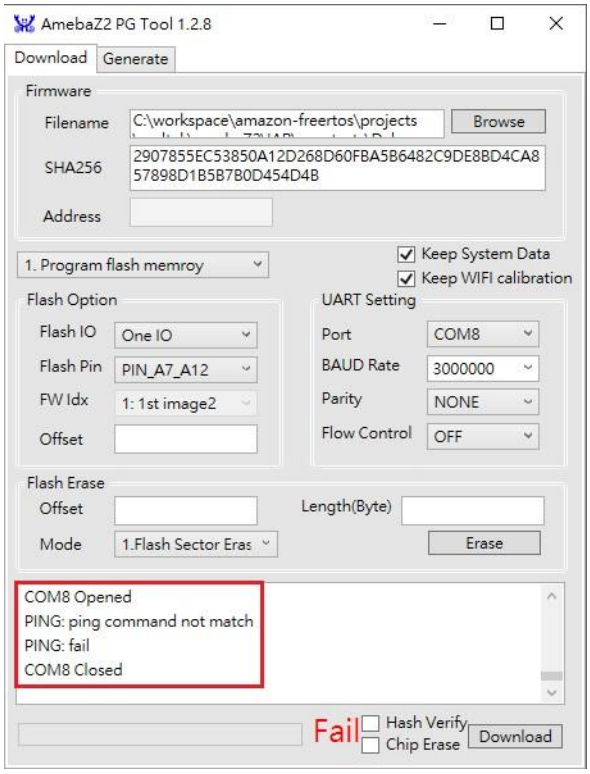
7 Troubleshooting

If these steps don't work, look at the device log in the serial terminal. You should see some text that indicates the source of the problem.

For general troubleshooting information about Getting Started with FreeRTOS, see Troubleshooting getting started.

7.1 Image Tool Download Fail

Please check device in UART_DOWNLOAD mode or not. Refer 5.3 for more detail.



7.2 ERROR: Invalid Key

Please check **WIFI_SSID** and **WIFI_PASSWORD** in ameba-rtos-z2\component\common\application\amazon\amazon-freertos\demos\include\aws_clientcredential.h

```
Enter SSID for Soft AP started
3 1098 [example_a] Wi-Fi configuration successful.
4 1108 [iot_threa] [INFO ][DEMO][1108] ---------STARTING DEMO---------

5 1115 [iot_threa] [INFO ][INIT][1115] SDK successfully initialized.

LwIP_DHCP: dhcp stop.
Deinitializing WIFI ...
WIFI deinitialized
Initializing WIFI ...
WIFI initialized

Joining BSS by SSID ...

ERROR:Invalid Key
ERROR: Can't connect to AP
Joining BSS by SSID ...

ERROR:Invalid Key
ERROR: Can't connect to AP
Joining BSS by SSID ...
```

7.3 Failed to establish new MQTT connection

Please check **clientcredentialMQTT_BROKER_ENDPOINT** in ameba-rtos-z2\component\common\application\amazon\amazon-freertos\demos\include\aws_clientcredential.h

```
6 12508 [iot_threa] [INFO ][DEMO][12508] Successfully initialized the demo. Network type for the demo: 1
7 12517 [iot_threa] [INFO ][MQTT][12517] MQTT library successfully initialized.
8 12524 [iot_threa] [INFO ][DEMO][12524] MQTT demo client identifier is ameba-ota (length 9).
9 12624 [iot_threa] [ERROR][NET][12624] Failed to resolve [redacted].amazonaws.com.
10 12934 [iot_threa] [ERROR][MQTT][12934] Failed to establish new MQTT connection, error NETWORK ERROR.
11 12943 [iot_threa] [ERROR][DEMO][12943] MQTT CONNECT returned error NETWORK ERROR.
12 12951 [iot_threa] [INFO ][MQTT][12950] MQTT library cleanup done.
13 12957 [iot_threa] [ERROR][DEMO][12957] Error running demo.
Interface 0 IP address : 192.168.90.185
LwIP_DHCP: dhcp stop.
Deinitializing WIFI ...
14 13094 [iot_threa] [INFO ][INIT][13094] SDK cleanup done.
15 13099 [iot_threa] [INFO ][DEMO][13099] -------DEMO FINISHED-------
```

7.4 TLS_Connect fail

Please check **keyCLIENT_CERTIFICATE_PEM** and **keyCLIENT_PRIVATE_KEY_PEM** in ameba-rtos-z2\component\common\application\amazon\amazon-freertos\demos\include\aws_clientcredential_keys.h

```
8 13501 [iot_threa] [INFO ][DEMO][13501] Successfully initialized the demo. Network type for the demo: 1
9 13511 [iot_threa] [INFO ][MQTT][13511] MQTT library successfully initialized.
10 13518 [iot_threa] [INFO ][DEMO][13518] MQTT demo client identifier is ameba-ota (length 9).
11 20102 [iot_threa] ERROR: Private key not found. 12 20107 [iot threa] TLS Connect fail (0x7d4, [redacted].amazonaws.com)
13 20115 [iot_threa] [ERROR][NET][20115] Failed to establish new connection. Socket status: -1.
14 20424 [iot_threa] [ERROR][MQTT][20424] Failed to establish new MQTT connection, error NETWORK ERROR.
15 20433 [iot_threa] [ERROR][DEMO][20433] MQTT CONNECT returned error NETWORK ERROR.
16 20441 [iot_threa] [INFO ][MQTT][20441] MQTT library cleanup done.
17 20447 [iot_threa] [ERROR][DEMO][20447] Error running demo.
Interface 0 IP address : 192.168.90.185
LwIP_DHCP: dhcp stop.
Deinitializing WIFI ...
18 20586 [iot_threa] [INFO ][INIT][20586] SDK cleanup done.
19 20591 [iot_threa] [INFO ][DEMO][20591] -------DEMO FINISHED-------
```

8 OTA Demo

8.1 OTA Update Prerequisites

Please refer to the AWS official guide (https://docs.aws.amazon.com/freertos/latest/userguide/ota-prereqs.html) and finish the following steps:

Step 1. Prerequisites for OTA updates using MQTT
Step 2. Create an Amazon S3 bucket to store your update
Step 3. Create an OTA Update service role
Step 4. … Create an OTA user policy
Step 5. Create esdsasigner.key and ecdsasigner.crt by openSSL you can create the key and certification by running:
$ sudo openssl ecparam -name prime256v1 -genkey -out ecdsa-sha256-signer.key.pem
$ sudo openssl req -new -x509 -days 3650 -key ecdsa-sha256-signer.key.pem -out ecdsa-sha256-signer.crt.pem
…
Step 6. Add certificate pem(ecdsa-sha256-signer.crt.pem) into component\common\application\amazon\amazon-freertos\vendors\realtek\boards\amebaZ2\aws_demos\config_files\ota_demo_config.h

```
#ifndef __AWS_CODESIGN_KEYS__H__
#define __AWS_CODESIGN_KEYS__H__

/*
 * PEM-encoded code signer certificate
 *
 * Must include the PEM header and footer:
 * "-----BEGIN CERTIFICATE-----\n"
 * "...base64 data...\n"
 * "-----END CERTIFICATE-----\n";
 */
static const char signingcredentialSIGNING_CERTIFICATE_PEM[] =
"-----BEGIN CERTIFICATE-----\n"
[redacted]
"-----END CERTIFICATE-----";

#endif
```

8.2 Set the Firmware Version and App Version to Image File

Set “serial” to **101** from 100 for the serial number in “amebaz2_firmware_is.json”, this determines the new firmware version of AmebaZ2:

```
"FWHS": {
    "source":"Debug/Exe/application_is.out",
    "header":{
        "next":null,
        "__comment_type":"Support Type:PARTAB,BOOT,FWHS_S,FWHS_NS,FWLS,ISP,VOE,WLN,DTCM,ITCM,SRAM,ERAM,XIP,M0,CPFW",
        "type":"FWHS_S",
        "enc":false,
        "user_key2":"BB0102030405060708090A0B0C0D0E0F101112131415161718191A1B1C1D1E1F",
        "__comment_pkey_idx":"assign by program, no need to configurate",
        "serial": 100
```

The app number in “aws_application_version.h” decides the version of application code:

```
#ifndef _AWS_APPLICATION_VERSION_H_
#define _AWS_APPLICATION_VERSION_H_

#include "iot_appversion32.h"
extern const AppVersion32_t xAppFirmwareVersion;

#define APP_VERSION_MAJOR    100
#define APP_VERSION_MINOR    9
#define APP_VERSION_BUILD    1

#endif
```

The APP_VERSION_MAJOR in “component\common\application\amazon\amazon-freertos\vendors\realtek\boards\amebaZ2\aws_demos\config_files\ota_demo_config.h” and FW version (serial number) in “amebaz2_firmware_is.json” must be the **same.**

In this example, set APP_VERSION_MAJOR to **101**

Please note that the newer image file must have the bigger version number. So now, you need two image file to perform this demo.

- One image with older version should be downloaded to your AmebaZ2, and wait the OTA job coming.
- Another image with newer version will be uploaded to S3 bucket. Then, create a new job for OTA.

Note: newer version image file should be signed by a private key before uploading. Next section will introduce how to sign the image.

8.3 How Custom Signed Image File is Created

We use custom signing feature provided by amazon to manually sign the OTA binary and attach the signatures along with the **firmware_is.bin**:

1. The firmware_is.bin is manually signed using the ECDSA P-256 key provided by user.
2. The ECDSA signatures are then appended to the end of the firmware_is_sig.bin with signature sizes.
3. The signatures are received as a separate packet and formatted accordingly to verify the OTA image which was updated.

The custom signing process is executed by a python script – **python_custom_ecdsa_Z2.py**, that provided in the folder (component\common \application\amazon\amazon_ota_tools\python_custom_ecdsa_Pro.py)

The python script requires the following pre-requisites to work

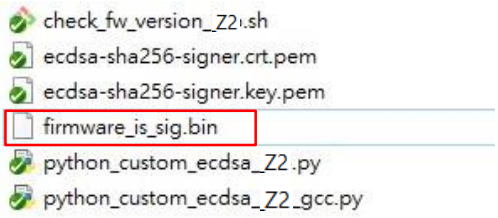
1. Python must be installed in the windows system with version 3.7.x or later
2. Pyopenssl library must be installed using 'pip install pyopenssl'
3. The ECDSA signing key and the Certificate pair must be present in the same folder as the python script and must be named 'ecdsasha256-signer.key.pem' and 'ecdsa-sha256-signer.crt.pem' respectively.
   (**Note:** *The key pair in SDK are just for example, please generated new key by openssl !*)

Run the python script in folder: component\common\application\amazon\amazon_ota_tools

- cmd command after IAR build : **$ python python_custom_ecdsa_Z2.py**
- shell command after GCC build : **$ python3 python_custom_ecdsa_Z2_gcc.py**

There might be some error if there are packages lack in your environment (like openssl...). Please install the package and run the script again.

Once all these are present and the python script is run, it will generate a custom signed binary named **firmware_is_sig.bin** inside the component\common\application\amazon\amazon_ota_tools folder.

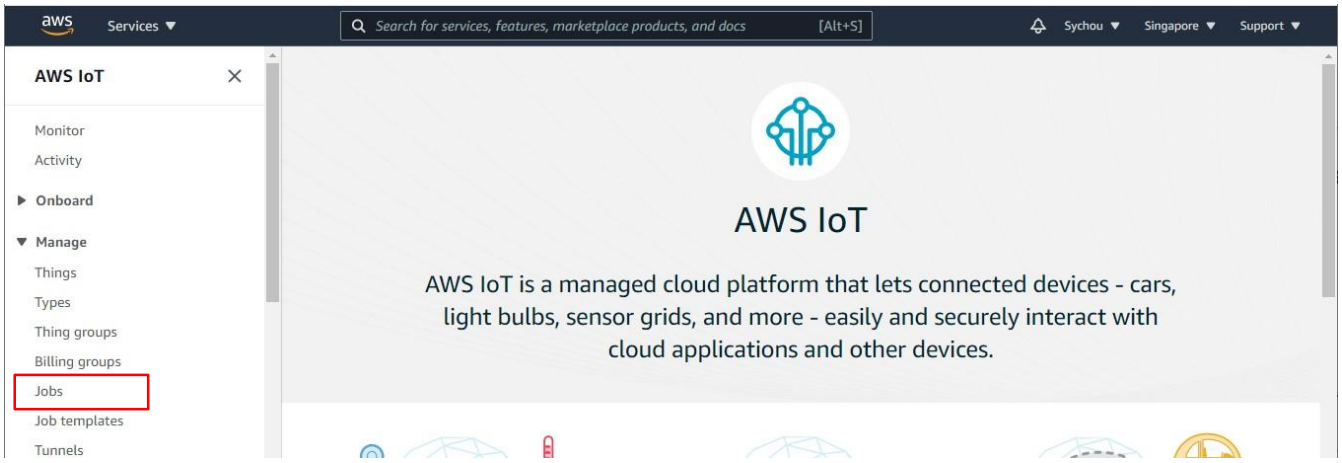


After getting the custom signed **firmware_is_sig.bin**, you can upload it to the S3 bucket.

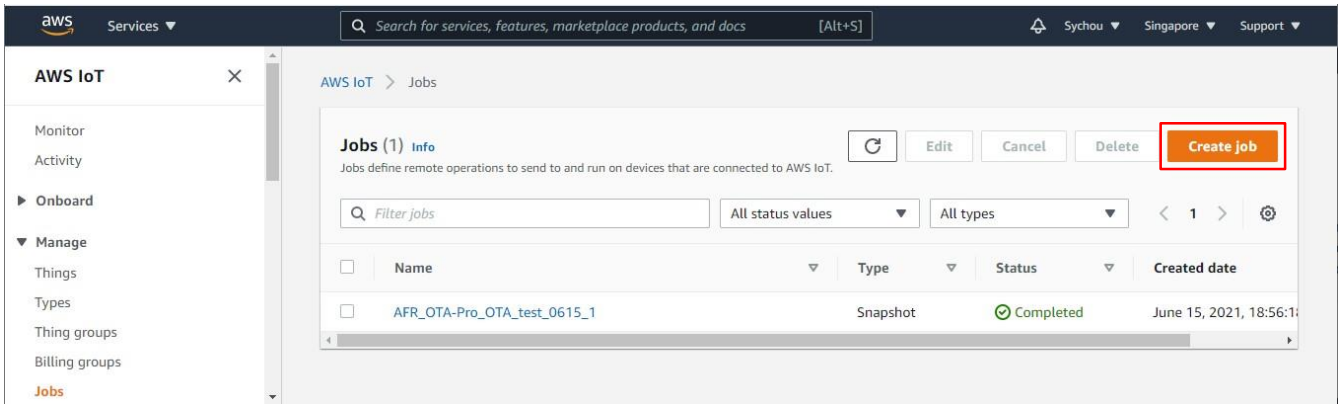
8.4 How to Trigger a Custom Signed OTA Job in Amazon AWS IOT Core

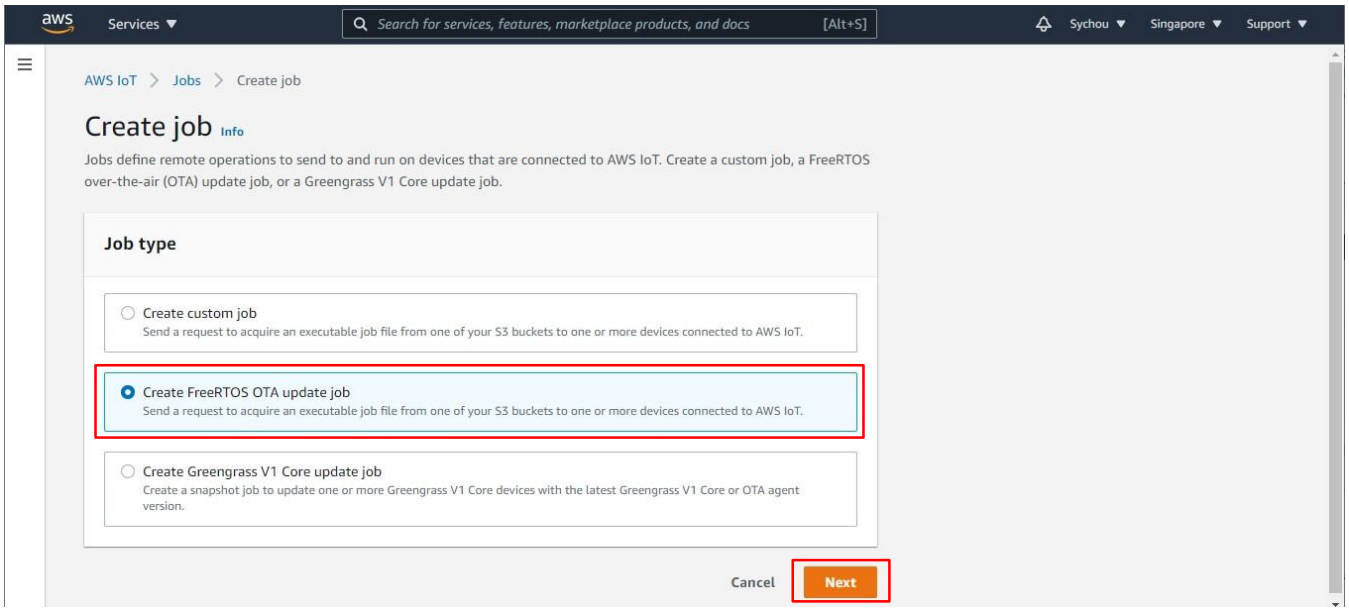
Go to AWS IoT Core https://console.aws.amazon.com/iot?p=icr&cp=bn&ad=c. Then, follow the following steps to create an AWS OTA task for AmebaZ2:

Step 1. Click on 'Create OTA update job', select your job type and then click

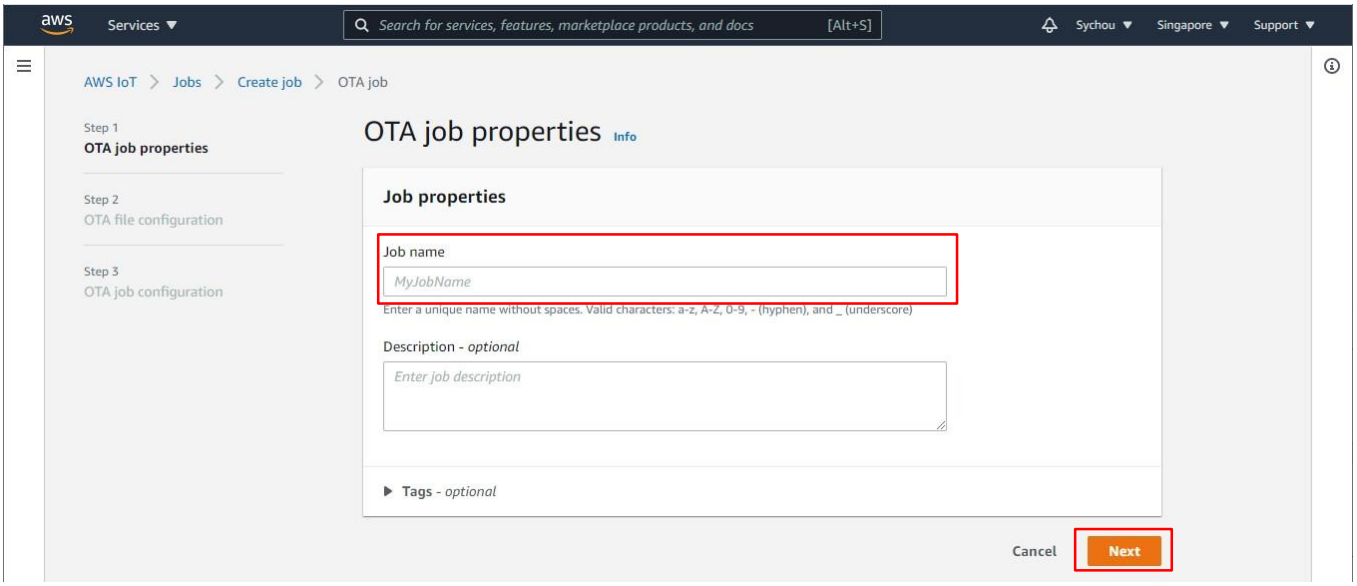


...

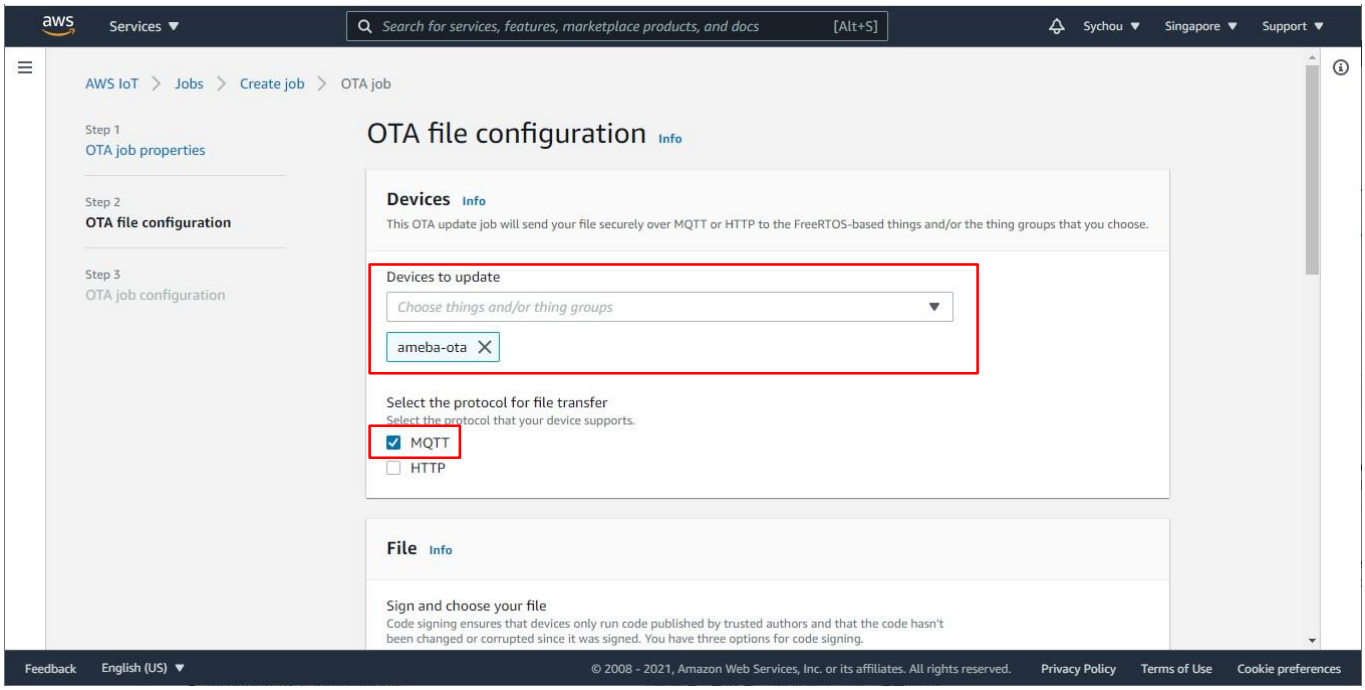




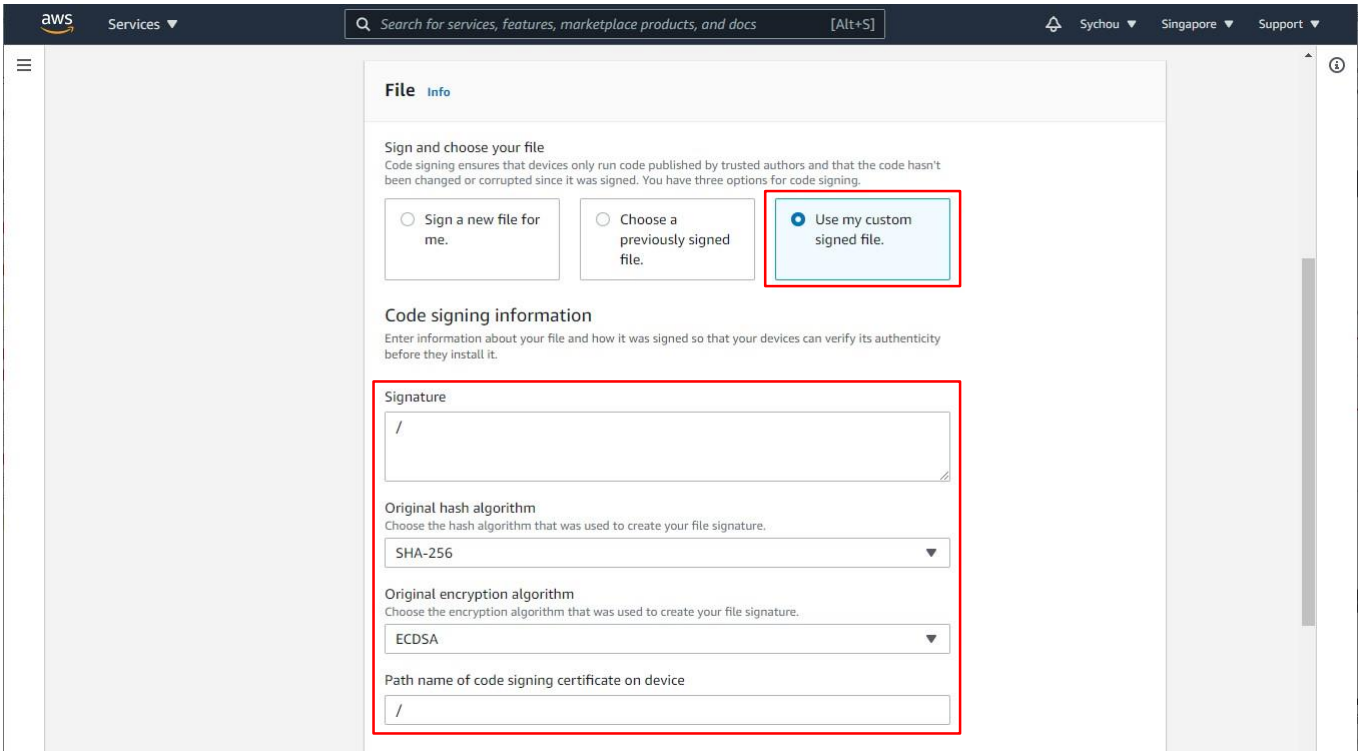
Step 2. For Job properties, give a unique name to your OTA job, then click next.



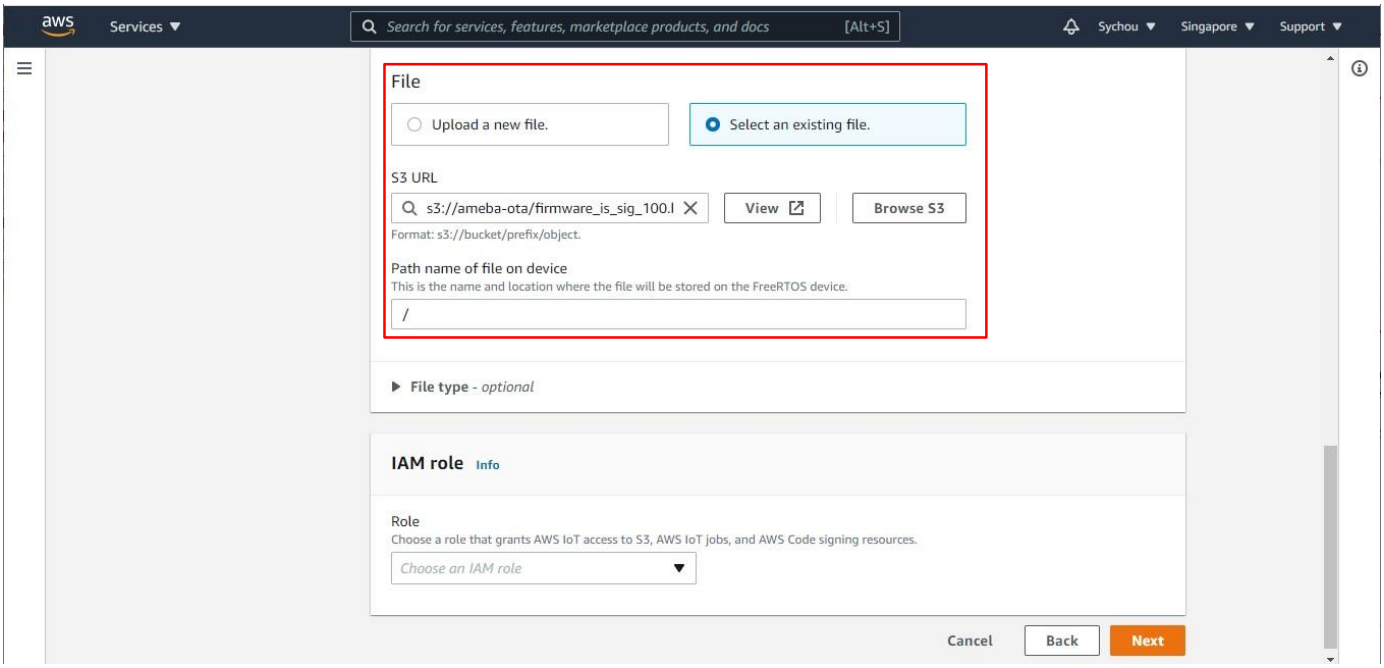
Step 3. In the following page, choose your device to update and select the protocol for file transfer.
If CONFIG_OTA_MQTT_UPDATE_DEMO_ENABLED is set. Please select MQTT.
If CONFIG_OTA_HTTP_UPDATE_DEMO_ ENABLED is set. Please select MQTT and HTTP.



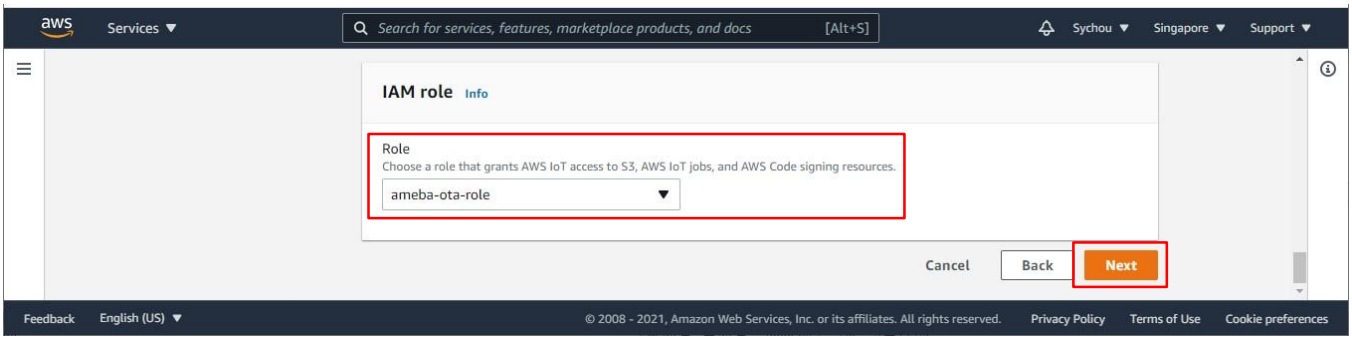
Step 4. In the following page, choose the option 'Use my custom signed firmware image'.
In the signature field just enter '/'. Choose hash algorithm as 'SHA-256'. Choose encryption algorithm as 'ECDSA'. In "pathname of code signing certificate", enter '/'



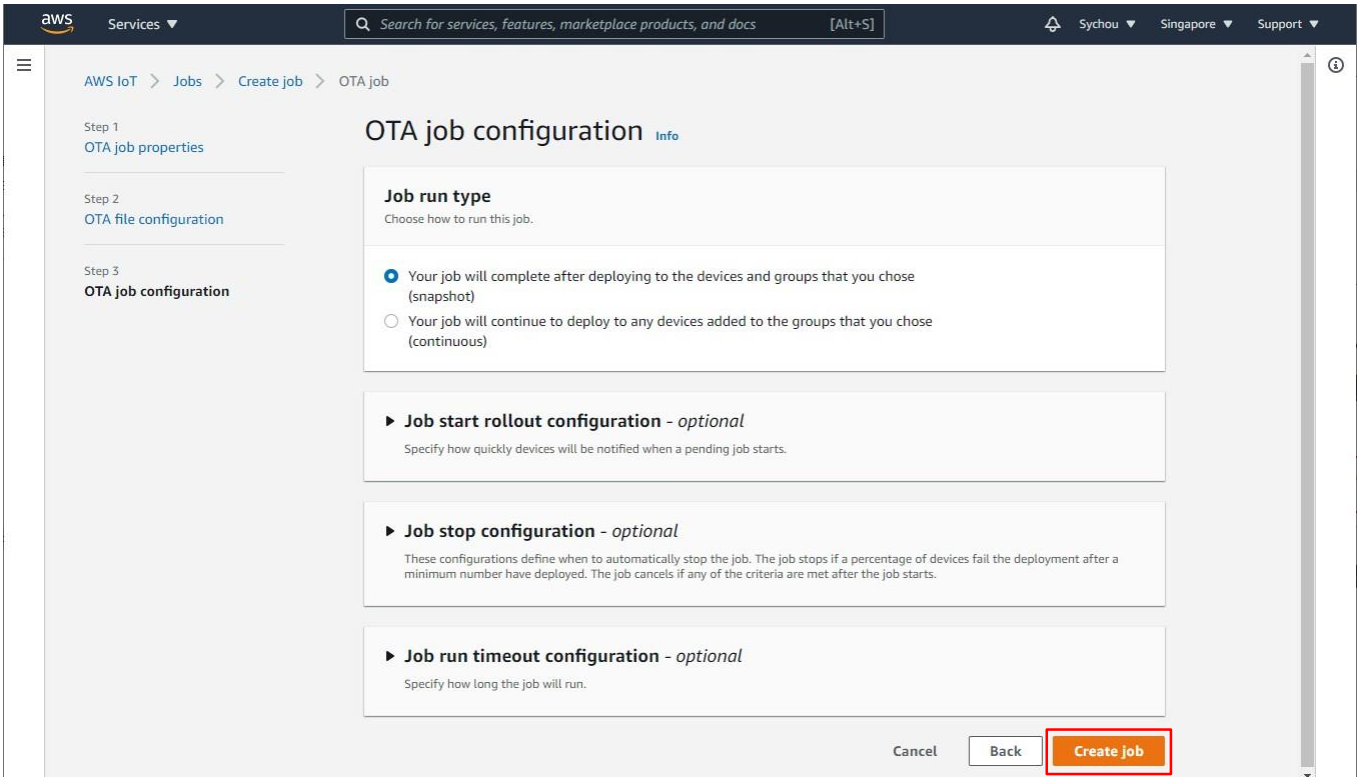
Step 5. Choose your custom signed firmware binary that was generated by the python script from S3 bucket.
In "Pathname of file on device", enter '/'



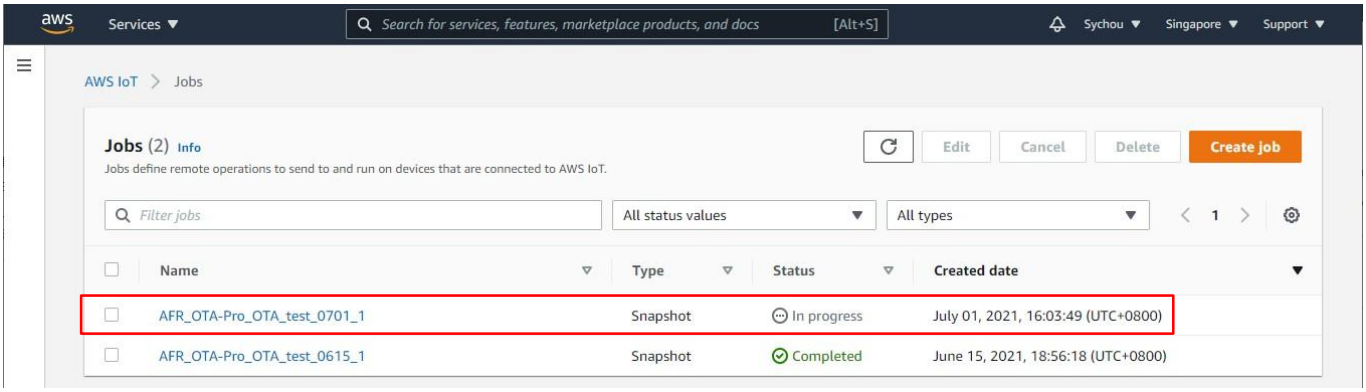
Step 6. Choose the IAM role for OTA update job. (This is the same IAM role as any OTA update job)



Step 7. Click next, and create your OTA job.



...



8.5 Run OTA Demo

Now we can see that the status of OTA job on AWS IoT Core is “in progress”. It means that it is waiting AmebaZ2 to request the update.

Next, download the image file with older version number to AmebaZ2 and then reboot the device, the application will automatically start run OTA demo.

In the beginning, we can check the app version of this running firmware, and the OTA process by the job ID:

```
 wlan_wrtie_reconnect_data_to_flash():not the same ssid/passphrase/channel/offer_ip, write new profile to flash
Interface 0 IP address : 192.168.0.143 5568 [iot_threa] [INFO ][DEMO][5568] Successfully initialized the demo. Network type for the demo: 1
4 5578 [iot_threa] [INFO ][MQTT][5577] MQTT library successfully initialized.
5 5583 [iot_threa] [INFO ][DEMO][5583] OTA demo version 100.9.1

6 5590 [iot_threa] [INFO ][DEMO][5590] Connecting to broker...

7 5595 [iot_threa] [INFO ][DEMO][5595] MQTT demo client identifier is ameba-ota (length 9).
8 6947 [iot_threa] [INFO ][MQTT][6947] Establishing new MQTT connection.
9 6955 [iot_threa] [INFO ][MQTT][6955] (MQTT connection 7026ef40, CONNECT operation 7026f0a0) Waiting for operation completion.
10 7090 [NetRecv] [INFO] [MQTT] [core_mqtt_serializer.c:970] 11 7094 [NetRecv] CONNACK session present bit not set.12 7099 [NetRecv]
13 7101 [NetRecv] [INFO] [MQTT] [core_mqtt_serializer.c:912] 14 7106 [NetRecv] Connection accepted.15 7109 [NetRecv]
16 7111 [iot_threa] [INFO ][MQTT][7111] (MQTT connection 7026ef40, CONNECT operation 7026f0a0) Wait complete with result SUCCESS.
17 7124 [iot_threa] [INFO ][MQTT][7124] New MQTT connection 20110f50 established.
18 7131 [iot_threa] [OTA_AgentInit_internal] OTA Task is Ready.
19 7135 [OTA Agent] [prvPAL_GetPlatformImageState_amebaPro] Image current state (0x02)
20 7143 [OTA Agent] [prvExecuteHandler] Called handler. Current State [Ready] Event [Start] New state [RequestingJob]
21 7154 [OTA Agent] [INFO ][MQTT][7154] (MQTT connection 7026ef40) SUBSCRIBE operation scheduled.
22 7162 [OTA Agent] [INFO ][MQTT][7162] (MQTT connection 7026ef40, SUBSCRIBE operation 7026f1e0) Waiting for operation completion.
23 7282 [OTA Agent] [INFO ][MQTT][7282] (MQTT connection 7026ef40, SUBSCRIBE operation 7026f1e0) Wait complete with result SUCCESS.
24 7293 [OTA Agent] [prvSubscribeToJobNotificationTopics] OK: $aws/things/ameba-ota/jobs/$next/get/accepted
25 7303 [OTA Agent] [INFO ][MQTT][7303] (MQTT connection 7026ef40) SUBSCRIBE operation scheduled.
26 7311 [OTA Agent] [INFO ][MQTT][7311] (MQTT connection 7026ef40, SUBSCRIBE operation 7026f1e0) Waiting for operation completion.
27 7430 [OTA Agent] [INFO ][MQTT][7430] (MQTT connection 7026ef40, SUBSCRIBE operation 7026f1e0) Wait complete with result SUCCESS.
28 7440 [OTA Agent] [prvSubscribeToJobNotificationTopics] OK: $aws/things/ameba-ota/jobs/notify-next
29 7449 [OTA Agent] [prvRequestJob_Mqtt] Request #0
30 7455 [OTA Agent] [INFO ][MQTT][7455] (MQTT connection 7026ef40) MQTT PUBLISH operation queued.
31 7462 [OTA Agent] [INFO ][MQTT][7462] (MQTT connection 7026ef40, PUBLISH operation 7026f1e0) Waiting for operation completion.
32 7702 [OTA Agent] [INFO ][MQTT][7702] (MQTT connection 7026ef40, PUBLISH operation 7026f1e0) Wait complete with result SUCCESS.
33 7712 [OTA Agent] [prvExecuteHandler] Called handler. Current State [RequestingJob] Event [RequestJobDocument] New state [WaitingForJob]
34 7725 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ clientToken: 0:ameba-ota ]
35 7733 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ timestamp: 1625133128 ]
36 7740 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ jobId: AFR_OTA-Pro_OTA_test_0701_4 ]
37 7749 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ protocols: ["MQTT"] ]
38 7757 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ streamname: AFR_OTA-d7c5e0c5-6d12-45c3-8fe4-7167753724dc ]
39 7767 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ filepath: / ]
40 7774 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ filesize: 1712200 ]
41 7782 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ fileid: 0 ]
42 7788 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ certfile: / ]
43 7795 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ sig-sha256-ecdsa: /"}]}}}}... ]
44 7804 [OTA Agent] [prvParseJobDoc] Job was accepted. Attempting to start transfer.
```

We can see that the OTA process start!

```
60 8174 [iot_threa] [INFO ][DEMO][8174] State: RequestingJob  Received: 1   Queued: 0   Processed: 0   Dropped: 0

61 8427 [OTA Agent] [prvIngestDataBlock] Received file block 5, size 1024

[update_ota_prepare_addr] Get loaded_fw_idx 1

[update_ota_prepare_addr] NewFWAddr 00240000

[update_ota_erase_upg_region] NewFWLen 1712128
[update_ota_erase_upg_region] NewFWBlkSize 418  0x1a2[OTA][prvPAL_WriteBlock_amebaPro] NewImg2BlkSize 418
[OTA][prvPAL_WriteBlock_amebaPro] iFileSize 1712200, iOffset: 0x1400: iBlockSize: 0x400
[OTA] Write 1024 bytes @ 0x241400 (0x241400)
62 23029 [OTA Agent] [prvIngestDataBlock] Remaining: 1672
63 23033 [OTA Agent] [prvExecuteHandler] Called handler. Current State [WaitingForFileBlock] Event [ReceivedFileBlock] New state [WaitingForFileBlock]
64 23048 [OTA Agent] [INFO ][MQTT][23048] (MQTT connection 7026ef40) MQTT PUBLISH operation queued.
65 23055 [OTA Agent] [prvRequestFileBlock_Mqtt] OK: $aws/things/ameba-ota/streams/AFR_OTA-d7c5e0c5-6d12-45c3-8fe4-7167753724dc/get/cbor
66 23067 [OTA Agent] [prvExecuteHandler] Called handler. Current State [WaitingForFileBlock] Event [RequestTimer] New state [WaitingForFileBlock]
67 23081 [OTA Agent] [prvIngestDataBlock] Received file block 4, size 1024
[OTA][prvPAL_WriteBlock_amebaPro] iFileSize 1712200, iOffset: 0x1000: iBlockSize: 0x400
[OTA] Write 1024 bytes @ 0x241000 (0x241000)
68 23101 [OTA Agent] [prvIngestDataBlock] Remaining: 1671
69 23105 [OTA Agent] [prvExecuteHandler] Called handler. Current State [WaitingForFileBlock] Event [ReceivedFileBlock] New state [WaitingForFileBlock]
70 23120 [OTA Agent] [prvIngestDataBlock] Received file block 3, size 1024
[OTA][prvPAL_WriteBlock_amebaPro] iFileSize 1712200, iOffset: 0xc00: iBlockSize: 0x400
[OTA] Write 1024 bytes @ 0x240c00 (0x240c00)
```

After receiving the final block, the signature will be checked if valid or not. If signature is valid, the OTA process is successful ! Then, the device will reboot with new firmware automatically.

```
[OTA][prvPAL_WriteBlock_amebaPro] iFileSize 1712200, iOffset: 0x1a2000: iBlockSize: 0x48
[OTA] Final block with signature arrived
[OTA][prvPAL_WriteBlock_amebaPro] OTA1 Sig Size is 71
[OTA] image download is already done, dropped, aws_ota_imgsz=0x1A2000, ImgLen=0x1A2000
10226 140083 [OTA Agent] [prvIngestDataBlock] Received final expected block of file.
10227 140091 [OTA Agent] [prvStopRequestTimer] Stopping request timer.
[OTA] Authenticating and closing file.
10228 140100 [OTA Agent] [prvPAL_CloseFile] Authenticating and closing file.
10229 140107 [OTA Agent] [prvPAL_CheckFileSignature_amebaPro] Started sig-sha256-ecdsa signature verification, file: /
10230 140118 [OTA Agent] Assume Cert - No such file: /. Using header file
10231 140682 [OTA Agent] [prvIngestDataBlock] File receive complete and signature is valid.
10232 140689 [OTA Agent] [prvStopRequestTimer] Stopping request timer.
10233 140695 [OTA Agent] [prvPublishStatusMessage] Msg: {"status":"IN_PROGRESS","statusDetails":{"self_test":"ready","updatedBy":"0x63090002"}}
10234 140709 [OTA Agent] [INFO ][MQTT][140709] (MQTT connection 7026ef40) MQTT PUBLISH operation queued.
10235 140717 [OTA Agent] [INFO ][MQTT][140717] (MQTT connection 7026ef40, PUBLISH operation 7026f3c0) Waiting for operation completion.
10236 140735 [iot_threa] [INFO ][DEMO][140735] State: WaitingForFileBlock  Received: 3343   Queued: 0   Processed: 0   Dropped: 0

10237 140955 [OTA Agent] [INFO ][MQTT][140955] (MQTT connection 7026ef40, PUBLISH operation 7026f3c0) Wait complete with result SUCCESS.
10238 140965 [OTA Agent] [prvPublishStatusMessage] 'IN_PROGRESS' to $aws/things/ameba-ota/jobs/AFR_OTA-Pro_OTA_test_0701_4/update
10239 140977 [OTA Agent] [INFO ][DEMO][140977] Received eOTA_JobEvent_Activate callback from OTA Agent.

10240 140986 [OTA Agent] [INFO ][MQTT][140986] (MQTT connection 7026ef40) Disconnecting connection.
10241 140995 [OTA Agent] [INFO] [MQTT] [core_mqtt.c:2149] 10242 141000 [OTA Agent] Disconnected from the broker.10243 141004 [OTA Agent]
10244 141007 [OTA Agent] [INFO ][MQTT][141007] (MQTT connection 7026ef40) Network connection closed.
10245 141015 [OTA Agent] [INFO ][DEMO][141015] Mqtt disconnected due to invoking diconnect function.

10246 141025 [OTA Agent] [INFO ][MQTT][141025] (MQTT connection 7026ef40) Network connection destroyed.

[update_ota_prepare_addr] Get loaded_fw_idx 1

[update_ota_prepare_addr] NewFWAddr 00240000

[update_ota_signature] Append OTA signature
[update_ota_signature] signature:
 E6 8C 79 0B 33 80 72 F7 C3 D2 63 D1 A5 BE 05 CA
 66 EE 58 4B BD F9 69 A2 53 9E C9 F9 0B DA 46 CC[OTA] [prvPAL_ActivateNewImage_amebaPro] Update OTA success!
[OTA] Resetting MCU to activate new image.
```

After booting with newer image, the device will start a self-test mode to check the app version which is latest.
We can see that the version now is 101.9.1, which is greater than old version 100.9.1.

```
46 7625 [OTA Agent] [prvParseJSONbyModel] Extracted parameter [ sig-sha256-ecdsa: /"}]}}}}... ]
47 7633 [OTA Agent] [prvParseJobDoc] In self test mode.
48 7638 [OTA Agent] [prvValidateUpdateVersion] The update version is newer than the version on device.
49 7647 [OTA Agent] [prvParseJobDoc] Setting image state to Testing for file ID 0
50 7654 [OTA Agent] [prvSetImageState_amebaPro] Testing image.
51 7660 [OTA Agent] [prvPublishStatusMessage] Msg: {"status":"IN_PROGRESS","statusDetails":{"self_test":"active","updatedBy":"0x64090002"}}
52 7673 [OTA Agent] [INFO ][MQTT][7673] (MQTT connection 7026af20) MQTT PUBLISH operation queued.
53 7681 [OTA Agent] [INFO ][MQTT][7681] (MQTT connection 7026af20, PUBLISH operation 7026b3a0) Waiting for operation completion.
54 7916 [OTA Agent] [INFO ][MQTT][7916] (MQTT connection 7026af20, PUBLISH operation 7026b3a0) Wait complete with result SUCCESS.
55 7926 [OTA Agent] [prvPublishStatusMessage] 'IN_PROGRESS' to $aws/things/ameba-ota/jobs/AFR_OTA-Pro_OTA_test_0701_4/update
56 7937 [OTA Agent] [prvExecuteHandler] Called handler. Current State [WaitingForJob] Event [ReceivedJobDocument] New state [CreatingFile]
57 7949 [OTA Agent] [prvInSelfTestHandler] prvInSelfTestHandler, platform is in self-test.
58 7957 [OTA Agent] [prvPAL_GetPlatformImageState_amebaPro] Image current state (0x01)
59 7964 [OTA Agent] [INFO ][DEMO][7964] Received eOTA_JobEvent_StartTest callback from OTA Agent.

60 7974 [OTA Agent] [prvSetImageState_amebaPro] Accepted and committed final image.

[update_ota_prepare_addr] Get loaded_fw_idx 2

[update_ota_prepare_addr] NewFWAddr 00040000
61 7989 [OTA Agent] [prvStopSelfTestTimer] Stopping the self test timer.
62 7995 [OTA Agent] [prvPublishStatusMessage] Msg: {"status":"SUCCEEDED","statusDetails":{"reason":"accepted v101.9.1"}}
63 8007 [OTA Agent] [INFO ][MQTT][8007] (MQTT connection 7026af20) MQTT PUBLISH operation queued.
64 8015 [OTA Agent] [INFO ][MQTT][8014] (MQTT connection 7026af20, PUBLISH operation 7026b3a0) Waiting for operation completion.
65 8026 [iot_threa] [INFO ][DEMO][8026] State: RequestingJob  Received: 1   Queued: 0   Processed: 0   Dropped: 0

66 8243 [OTA Agent] [INFO ][MQTT][8243] (MQTT connection 7026af20, PUBLISH operation 7026b3a0) Wait complete with result SUCCESS.
67 8253 [OTA Agent] [prvPublishStatusMessage] 'SUCCEEDED' to $aws/things/ameba-ota/jobs/AFR_OTA-Pro_OTA_test_0701_4/update
68 8264 [OTA Agent] [prvExecuteHandler] Called handler. Current State [CreatingFile] Event [StartSelfTest] New state [WaitingForJob]
69 9036 [iot_threa] [INFO ][DEMO][9036] State: CreatingFile  Received: 1   Queued: 0   Processed: 0   Dropped: 0
```

In the final, the log imply that the OTA status is changed to “SUCCEEDED” !

9 Troubleshooting

If these steps don't work, look at the device log in the serial terminal. You should see some text that indicates the source of the problem.

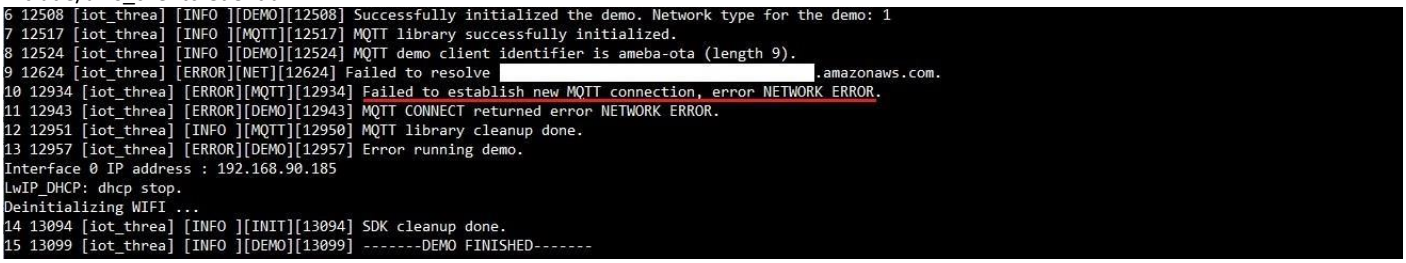
For general troubleshooting information about Getting Started with FreeRTOS, see Troubleshooting getting started.

9.1 ERROR: Invalid Key

Please check **WIFI_SSID** and **WIFI_PASSWORD** in in "component/common/application/amazon/v202012/demos/include /aws_clientcredential.h"

9.2 Failed to establish new MQTT connection

Please check **clientcredentialMQTT_BROKER_ENDPOINT** in "component/common/application/amazon/v202012/demos /include/aws_clientcredential.h"



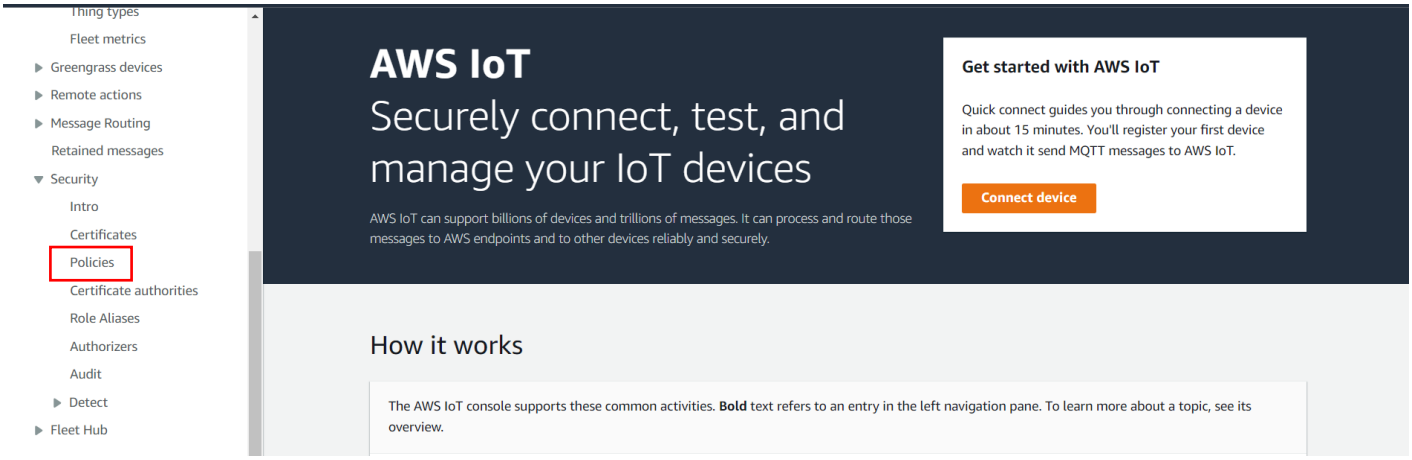
TLS_Connect fail

Please check **keyCLIENT_CERTIFICATE_PEM** and **keyCLIENT_PRIVATE_KEY_PEM** in "component/common/application/amazon/ v202012/demos/include/aws_clientcredential_keys.h"

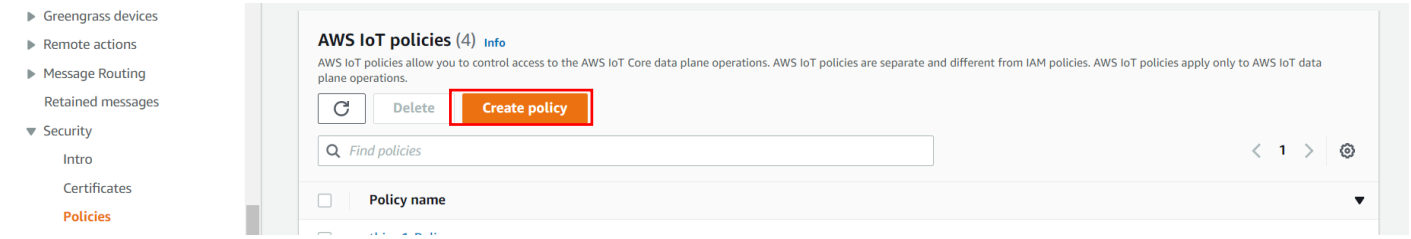
10 AWS Fleet Provisioning Introduction

Fleet Provisioning is first introduced in version AWS v202012. Using an automated template, end users can now do the provisioning instead of the manufacturers. This guide introduces Fleet Provisioning **by Claim**. For more information visit AWS by Claim.

10.1 Create Claim Certificate Policy



Click “Policies” under Security tab

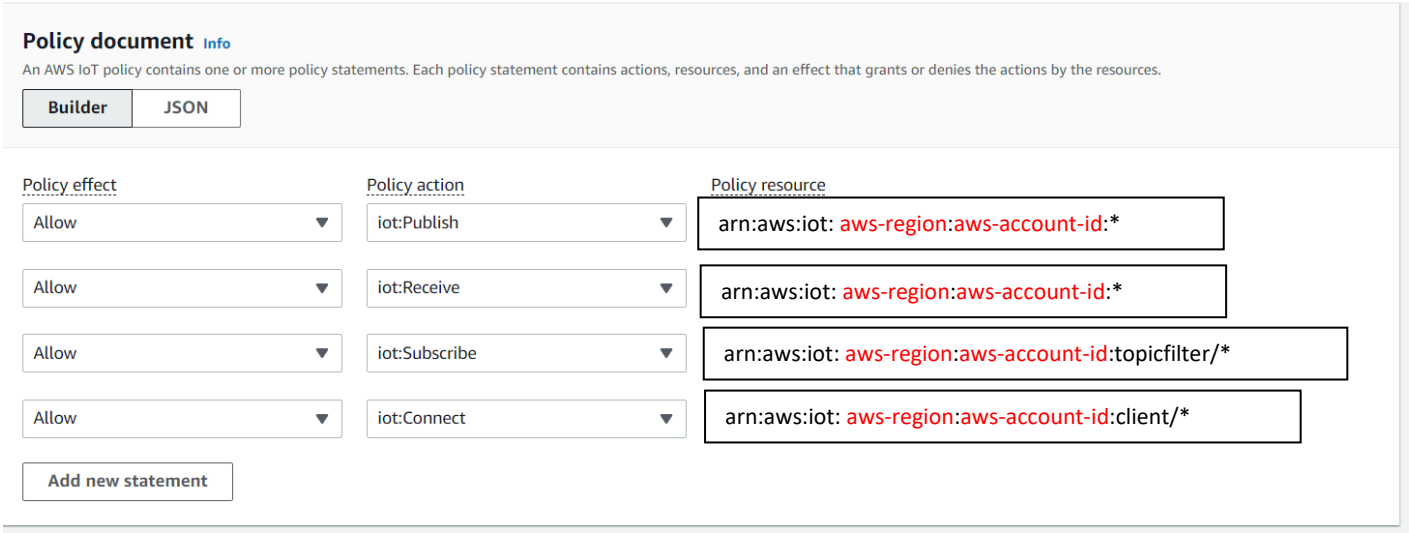


Click “Create Policy”

Use the Policy name: FleetProvisioningDemoClaimPolicy

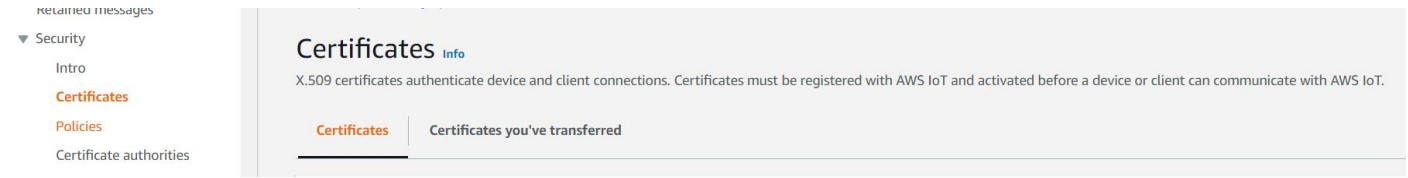
Fill in the Policy document with the following:

- aws-region with the AWS region of your choice (e.g. us-west-2)
- aws-account-id with your AWS account ID

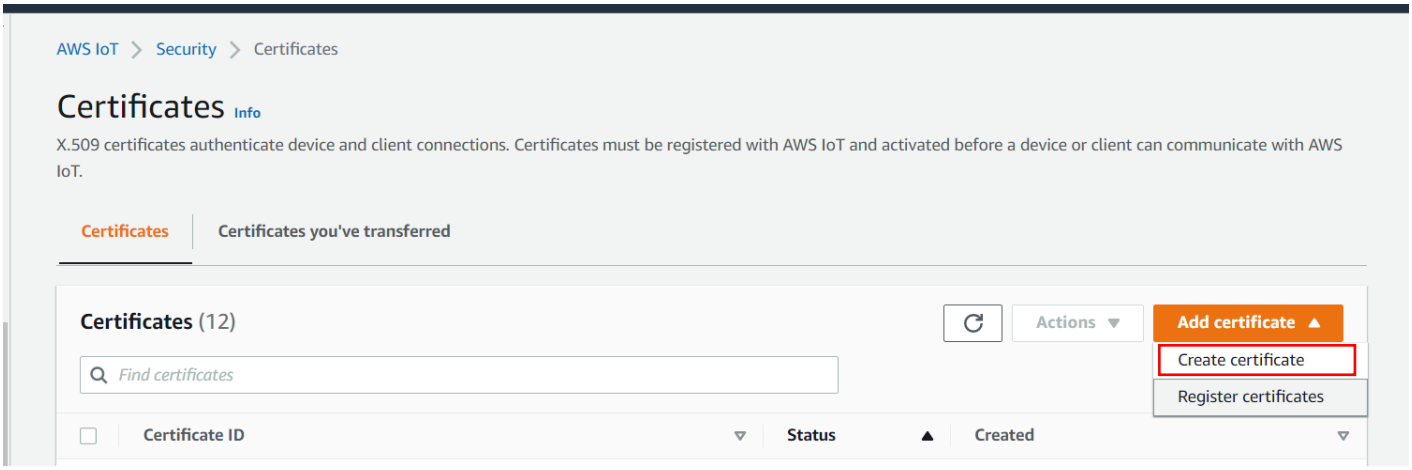


Click “Create”

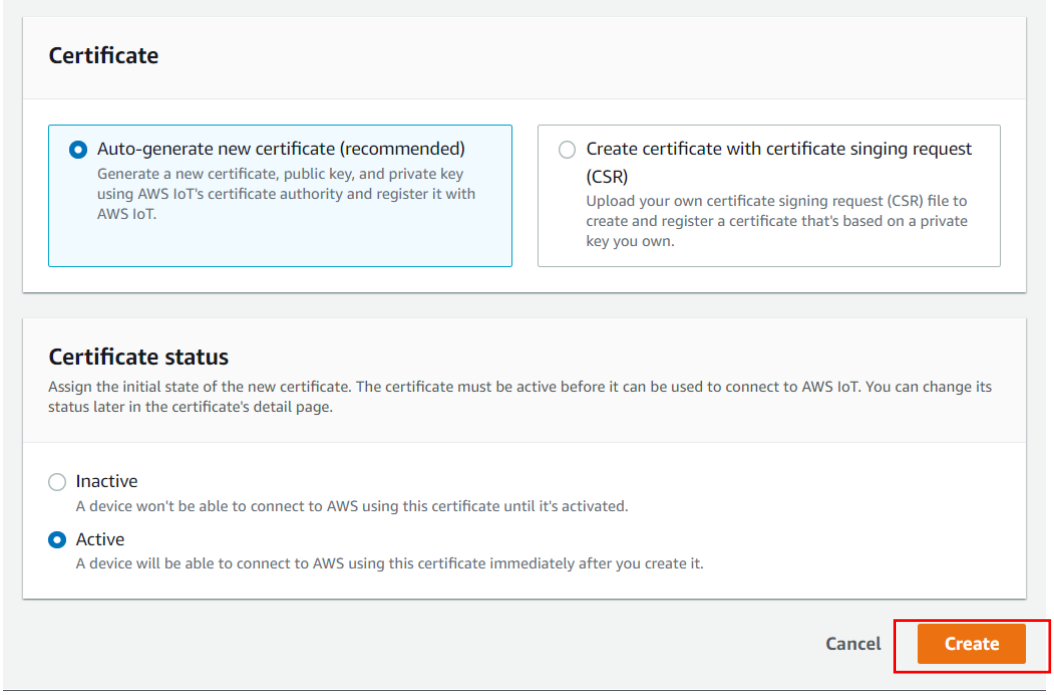
10.2 Create Claim Certificate



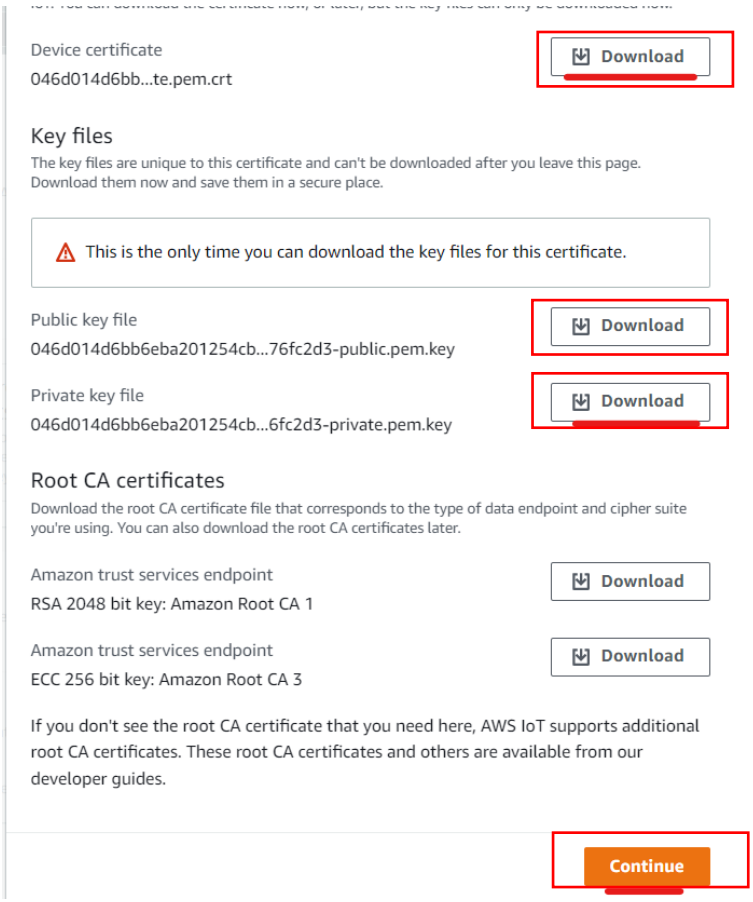
Select “Certificates” under Security tab & Click “Create certificate”



Click on “Active” & Create

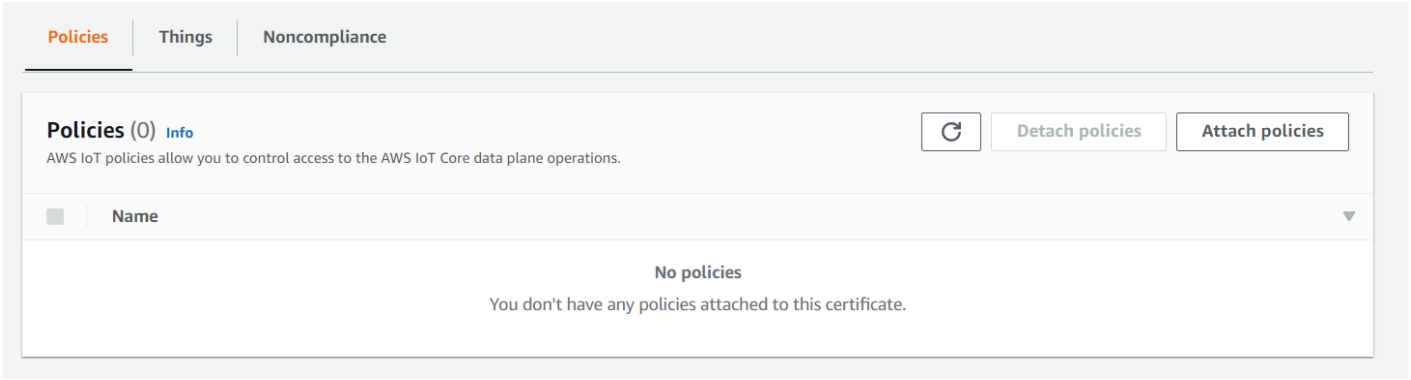


Download the certificates



You will see certificate created similar below, click on the certificate id

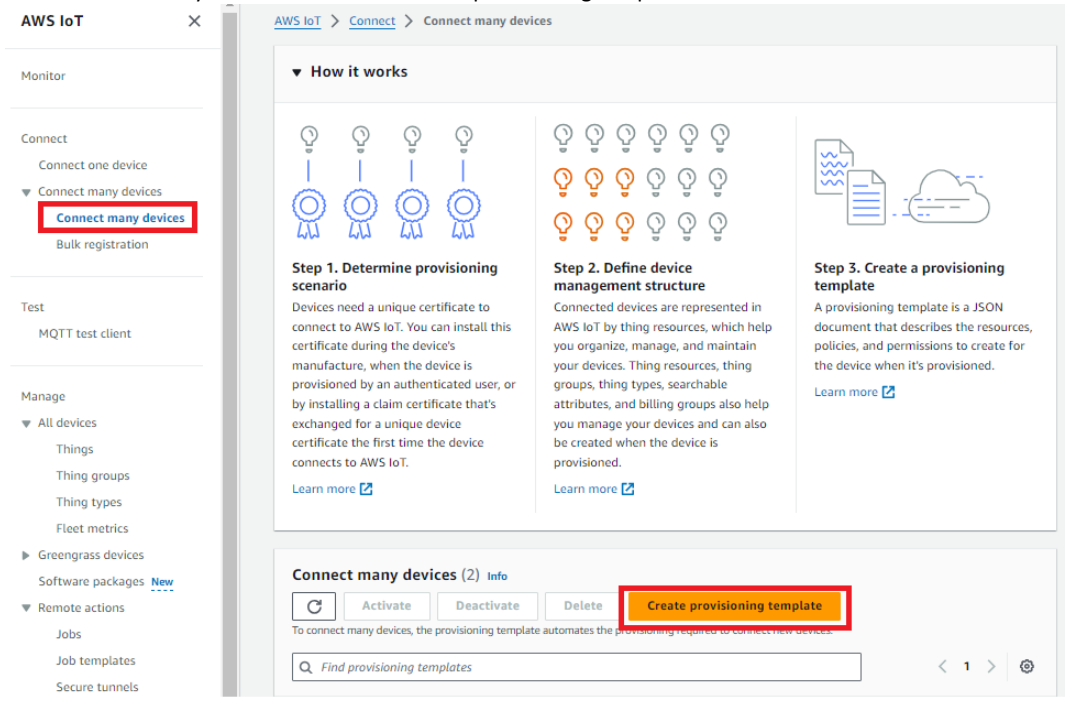
Select “Attach policies”



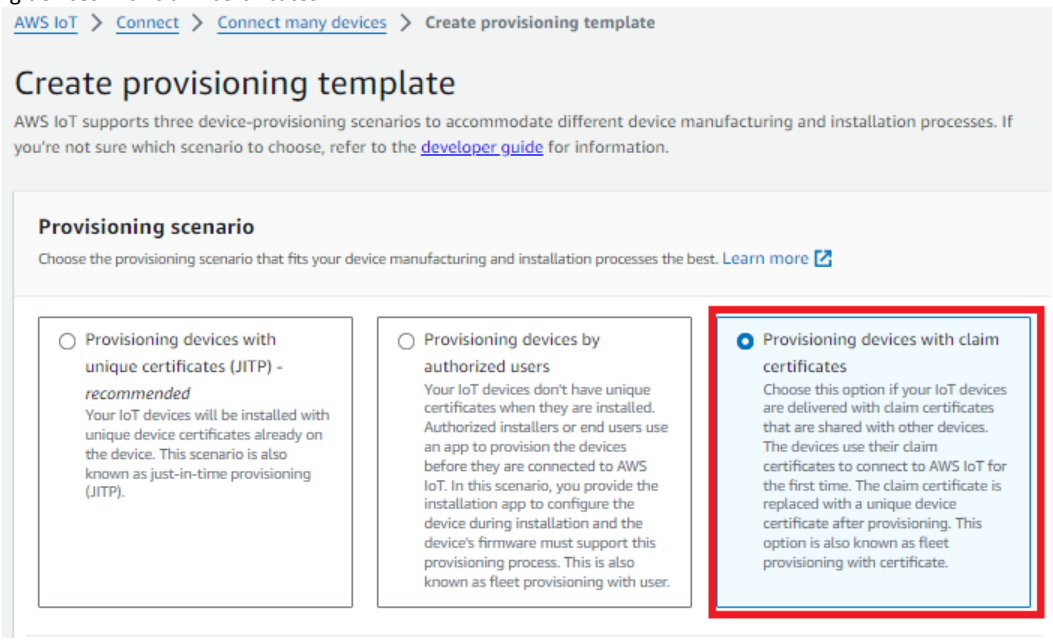
Select: FleetProvisioningDemoClaimPolicy & attach policies
*This will be the temporary claim certificate in exchange for permanent cert in fleet provisioning

10.3 Create fleet provisioning template

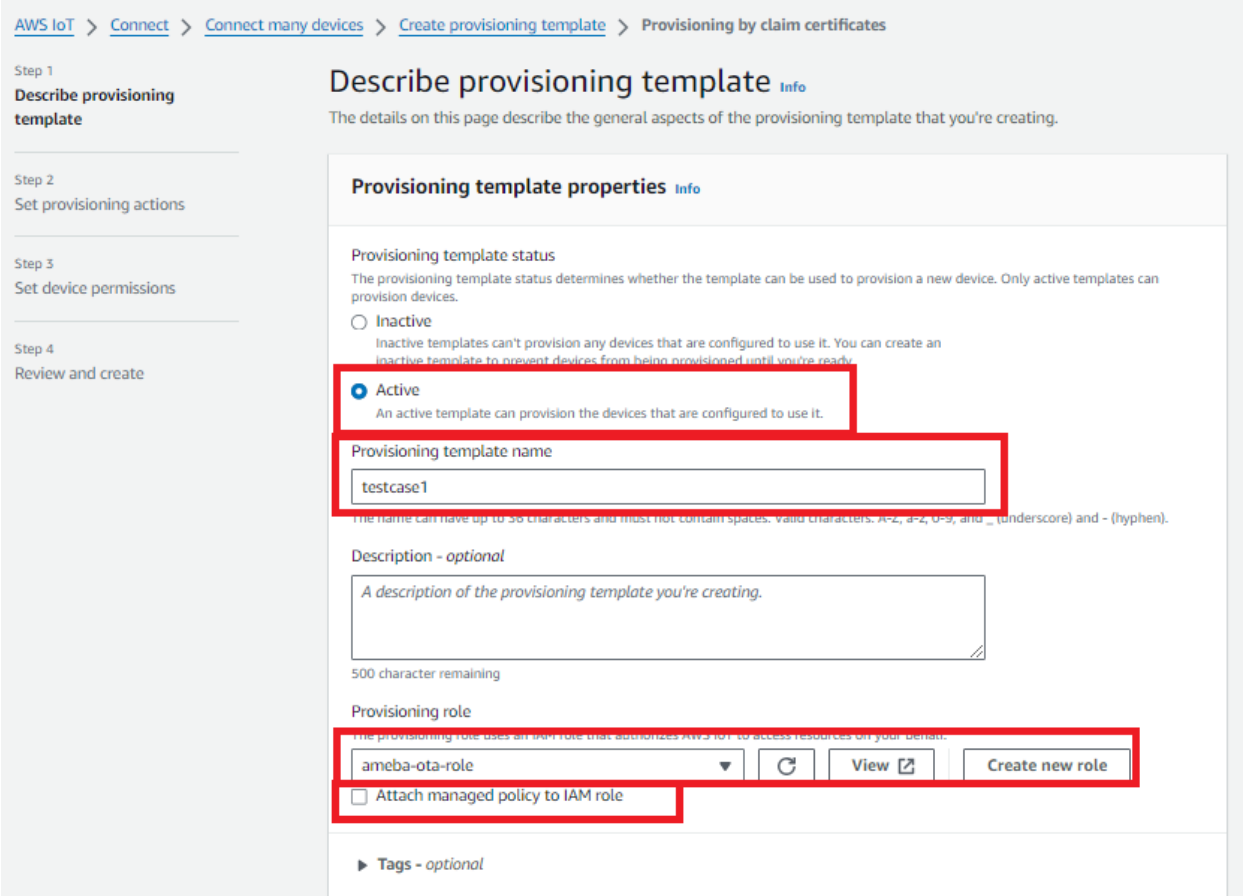
Navigate to Connect -> Connect many devices and select “Create provisioning template”



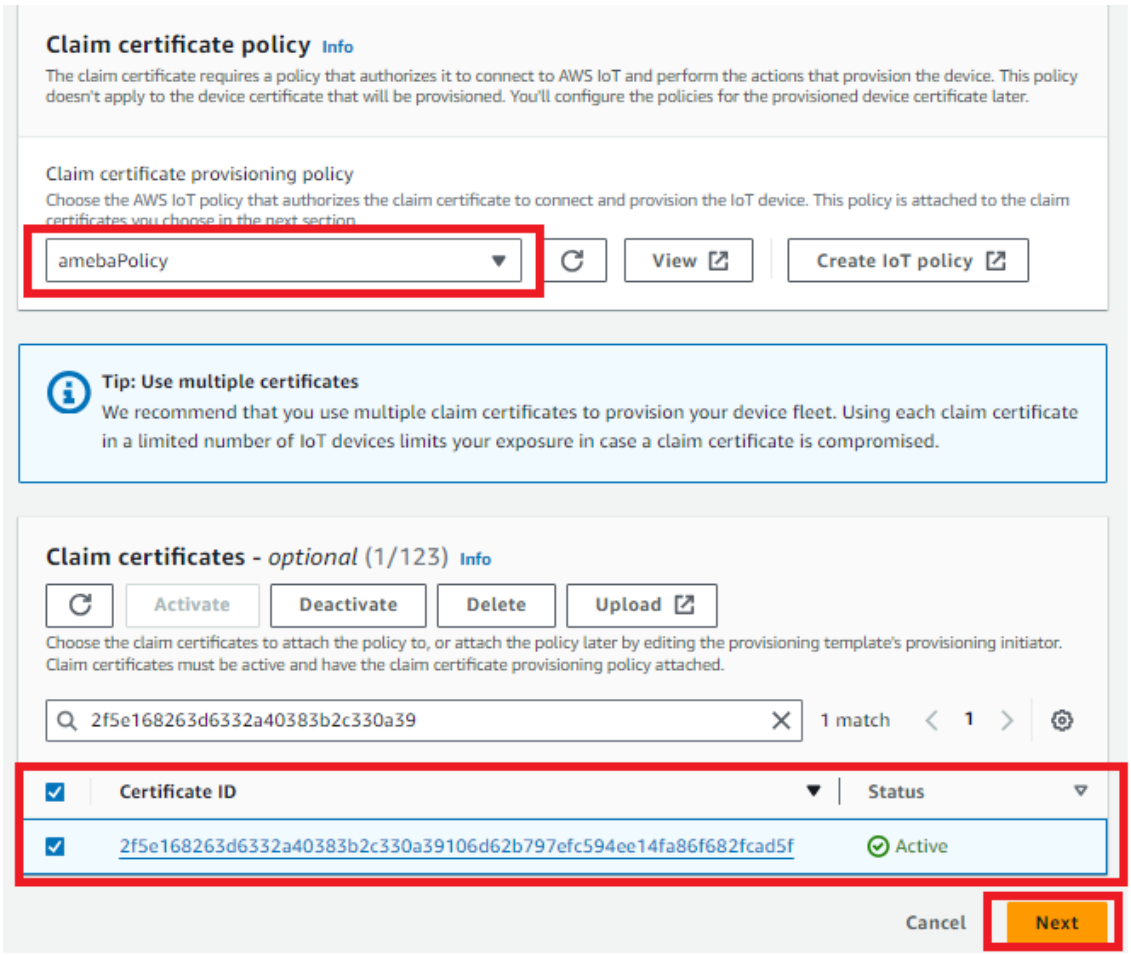
Select “Provisioning devices with claim certificates”



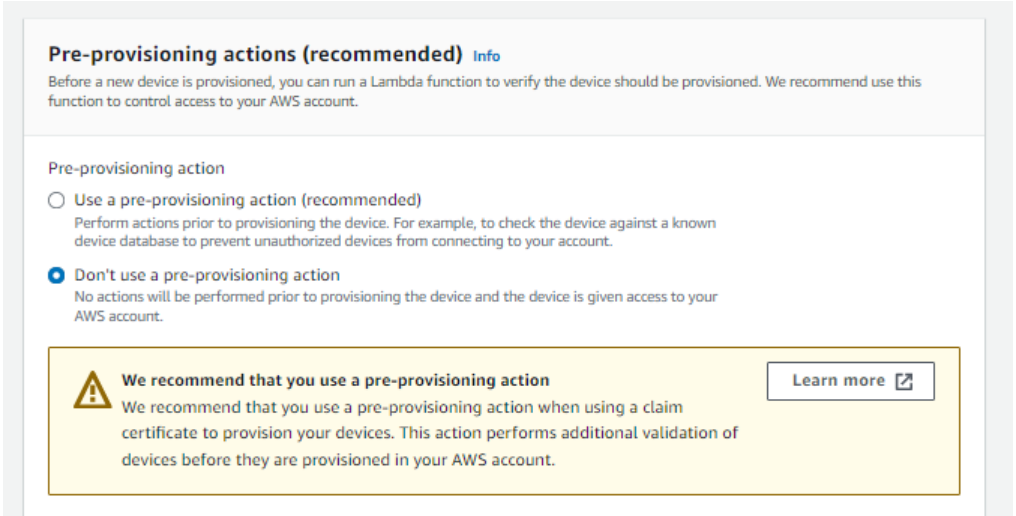
This example uses the Template name “testcase1”



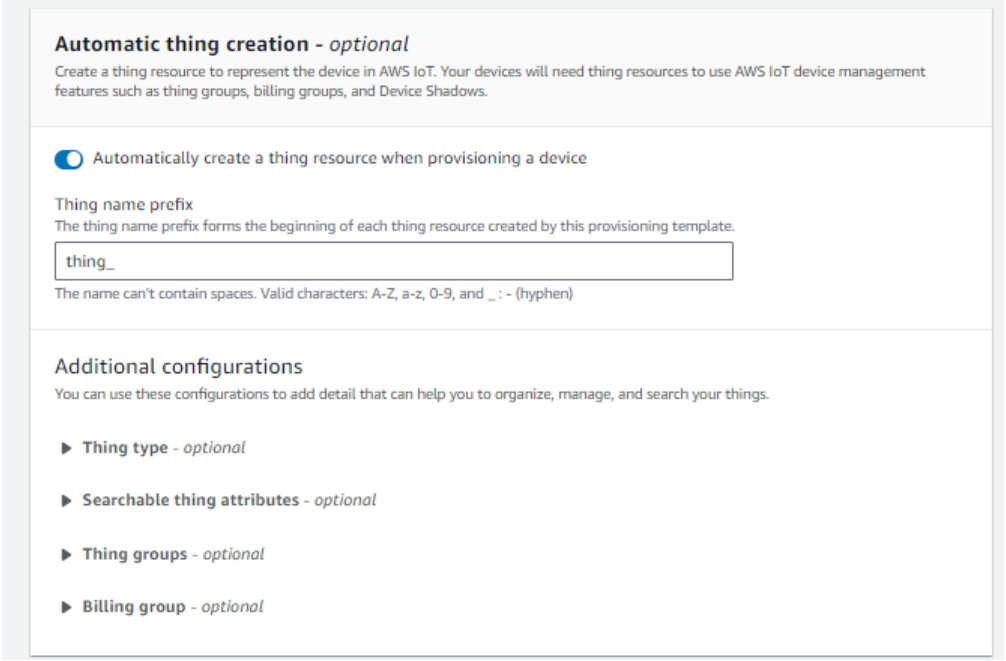
Please select the policy and certificate which create in 10.1 and 10.2



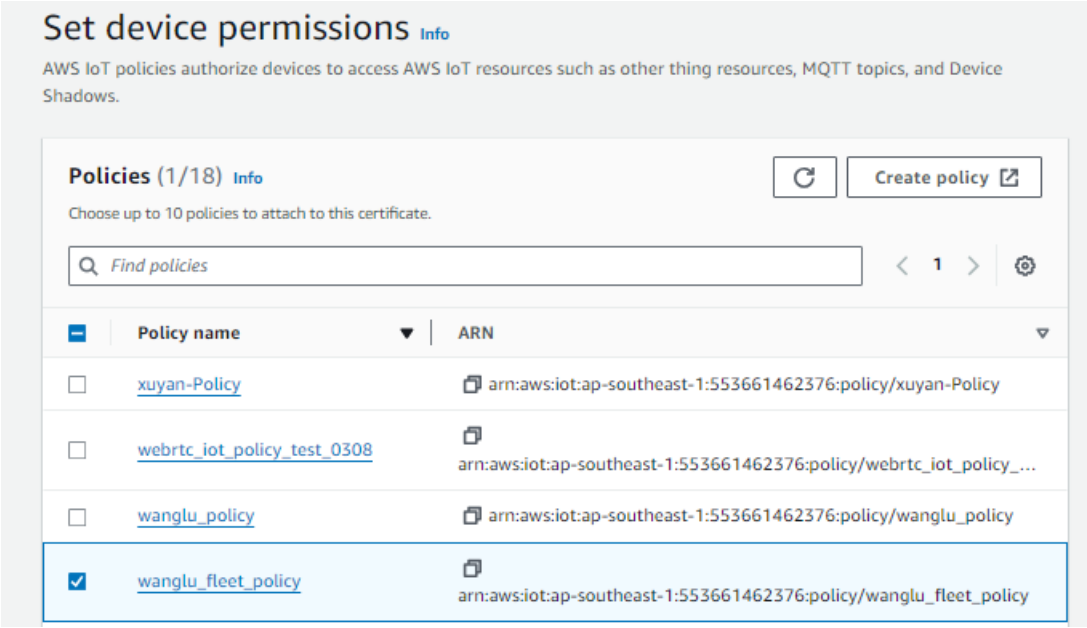
Pre-provisioning Hook will not be used for simplicity



Set the things prefix.



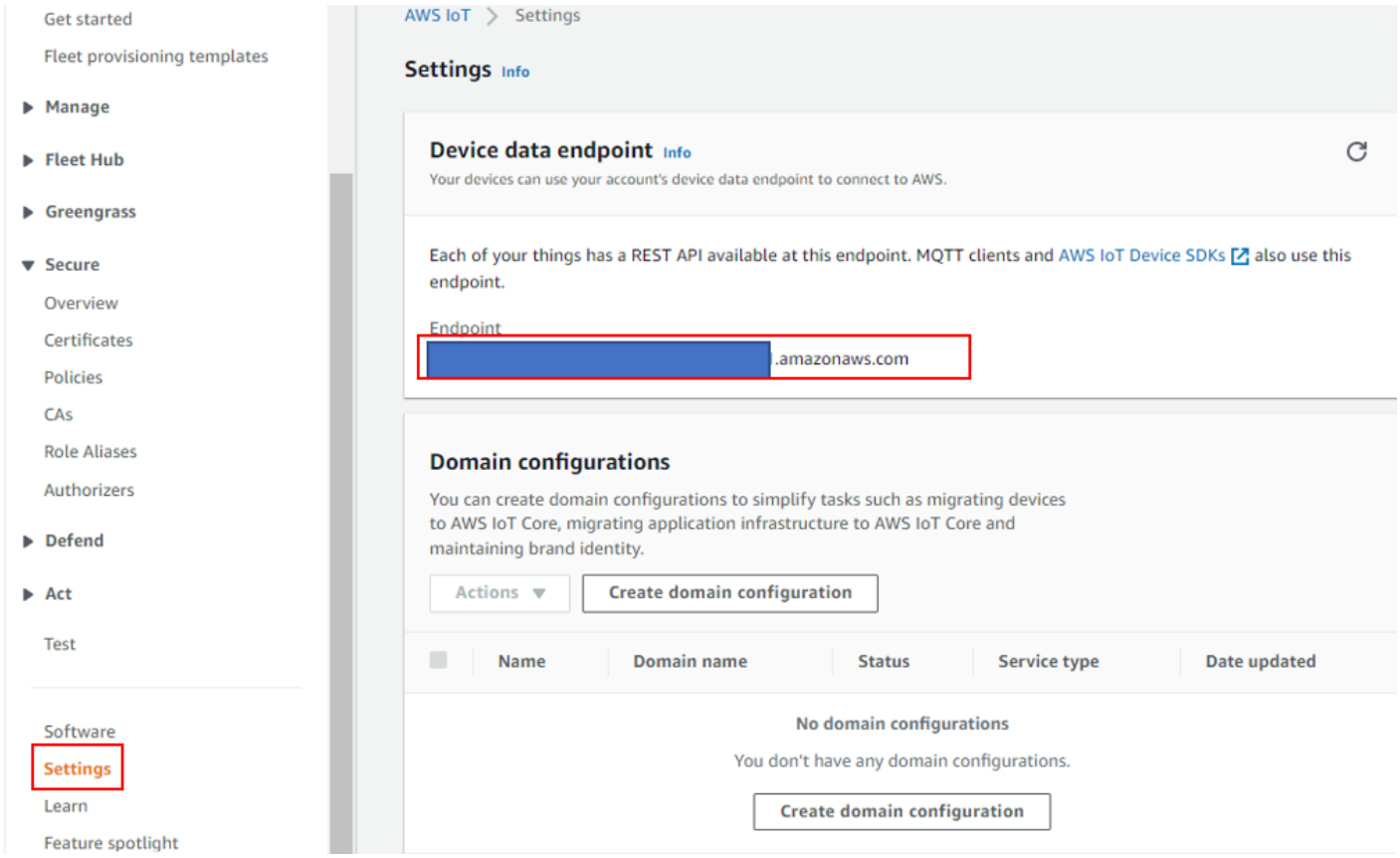
Select the policy which create in 10.1



Then select “Create template”.

10.4 Configure AmebaZ2 Amazon FreeRTOS

10.4.1 Get Broker Endpoint by AWS IoT Core



10.4.2 Setup IoT Core Information with AmebaZ2 Amazon FreeRTOS

Setup BROKER_ENDPOINT, WIFI_SSID, PASSWORD in “component\common\application\amazon\amazon-freertos\demos\include\aws_clientcredential.h”

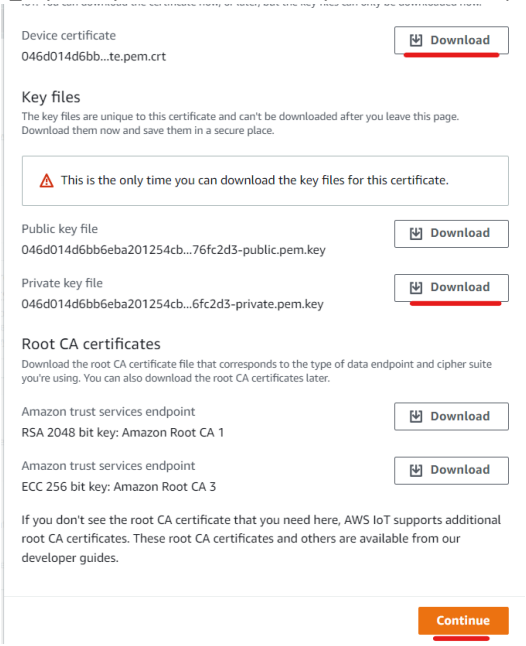
```
#ifndef __AWS_CLIENTCREDENTIAL__H__
#define __AWS_CLIENTCREDENTIAL__H__

/*
 * @brief MQTT Broker endpoint.
 *
 * @todo Set this to the fully-qualified DNS name of your MQTT broker.
 */
#define clientcredentialMQTT_BROKER_ENDPOINT        "xxxxxxxxxxxxxxxxxxxxxxxx.amazonaws.com"

/*
 * @brief Host name.
 *
 * @todo Set this to the unique name of your IoT Thing.
 * Please note that for convenience of demonstration only we
 * are using a #define here. In production scenarios the thing
 * name can be something unique to the device that can be read
 * by software, such as a production serial number, rather
 * than a hard coded constant.
 */
#define clientcredentialIOT_THING_NAME              ""

/*
 * @brief Port number the MQTT broker is using.
 */
#define clientcredentialMQTT_BROKER_PORT            8883

/*
 * @brief Port number the Green Grass Discovery use for JSON retrieval from cloud is using.
 */
#define clientcredentialGREENGRASS_DISCOVERY_PORT   8443

/*
 * @brief Wi-Fi network to join.
 *
 * @todo If you are using Wi-Fi, set this to your network name.
 */
#define clientcredentialWIFI_SSID                   "WiFi SSID"

/*
 * @brief Password needed to join Wi-Fi network.
 * @todo If you are using WPA, set this to your network password.
 */
#define clientcredentialWIFI_PASSWORD               "WiFi Password Here"

```

In component\common\application\amazon\amazon-freertos\demos\fleet_provisioning_with_csr\fleet_provisioning_demo.c ,

set democonfigPROVISIONING_TEMPLATE_NAME as “testcase1”

```
100:
101: /*-------------·Demo·configurations·-------------------------*/
102:
103: /**·Note:·The·device·client·certificate·and·private·key·credentials·are
104: ·*·obtained·by·the·transport·interface·implementation·(with·Secure·Sockets)
105: ·*·from·the·demos/include/aws_clientcredential_keys.h·file.
106: ·*
107: ·*·The·following·macros·SHOULD·be·defined·for·this·demo·which·uses·both·server
108: ·*·and·client·authentications·for·TLS·session:
109: ·*····keyCLIENT_CERTIFICATE_PEM·for·Fleet·provisioning·claim·CSR·certificate.
110: ·*····keyCLIENT_PRIVATE_KEY_PEM·for·Fleet·provisioning·client·private·key.
111: ·*/
112:
113: /**
114: ·*·@brief·The·length·of·#democonfigPROVISIONING_TEMPLATE_NAME.
115: ·*/
116:
117: #define·democonfigPROVISIONING_TEMPLATE_NAME····"testcase1"·//Fill·in·Fleet·provisioning·template·name
118:
119: #define·fpdemoPROVISIONING_TEMPLATE_NAME_LENGTH····(·(·uint16_t·)·(·sizeof(·democonfigPROVISIONING_TEMPLATE_NAME·)·-·1·)·)
120:
121: #define·fpdemoMAX_THING_NAME_LENGTH··············128
122:
123: /**
```

Fill keyCLIENT_CERTIFICATE_PEM and keyCLIENT_PRIVATE_KEY_PEM in “\component\common\application\amazon\amazon-freertos\demos\include\aws_clientcredential_keys.h” by xxxxxxxx-certificate.pem and xxxxxxxx-private.pem.key.



To run Fleet Provisioning demo, please find in “component\common\application\amazon\amazon-freertos\vendors\realtek\boards\amebaZ2\aws_demos\config_files\aws_demo_config.h” and enable **CONFIG_FLEET_PROVISIONING_DEMO_ENABLED**

```
#ifndef _AWS_DEMO_CONFIG_H_
#define _AWS_DEMO_CONFIG_H_

/* To run a particular demo you need to define one of these.
 * Only one demo can be configured at a time
 *
 *          CONFIG_CORE_HTTP_MUTUAL_AUTH_DEMO_ENABLED
 *          CONFIG_CORE_HTTP_S3_DOWNLOAD_DEMO_ENABLED
 *          CONFIG_CORE_HTTP_S3_DOWNLOAD_MULTITHREADED_DEMO_ENABLED
 *          CONFIG_CORE_HTTP_S3_UPLOAD_DEMO_ENABLED
 *          CONFIG_CORE_MQTT_MUTUAL_AUTH_DEMO_ENABLED
 *          CONFIG_CORE_MQTT_CONNECTION_SHARING_DEMO_ENABLED
 *          CONFIG_DEVICE_SHADOW_DEMO_ENABLED
 *          CONFIG_DEVICE_DEFENDER_DEMO_ENABLED
 *          CONFIG_JOBS_DEMO_ENABLED
 *          CONFIG_MQTT_BLE_DEMO_ENABLED
 *          CONFIG_GREENGRASS_DISCOVERY_DEMO_ENABLED
 *          CONFIG_TCP_ECHO_CLIENT_DEMO_ENABLED
 *          CONFIG_POSIX_DEMO_ENABLED
 *          CONFIG_OTA_UPDATE_DEMO_ENABLED
 *          CONFIG_BLE_GATT_SERVER_DEMO_ENABLED
 *          CONFIG_BLE_NUMERIC_COMPARISON_DEMO_ENABLED
 *»  »    »    CONFIG_FLEET_PROVISIONING_DEMO_ENABLED
 *
 *  These defines are used in iot_demo_runner.h for demo selection */

//#define CONFIG_CORE_MQTT_MUTUAL_AUTH_DEMO_ENABLED
//#define CONFIG_OTA_UPDATE_DEMO_ENABLED
//#define CONFIG_DEVICE_SHADOW_DEMO_ENABLED
#define CONFIG_FLEET_PROVISIONING_DEMO_ENABLED
```

Output on TeraTerm or equivalent: Sucessfully provisioning device

```
12 7606 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:665] 13 7614 [iot_thread] Subscribe to fleet provisioning CSR Topics
14 7619 [iot_thread]
15 9878 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:686] 16 9883 [iot_thread] Publish to the MQTT topic $aws/certificates/crea
te-from-csr/cbor.
17 9891 [iot_thread]
18 9896 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:698] 19 9903 [iot_thread] Attempt to receive publish message from broker.
20 9908 [iot_thread]
21 10051 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:1375] 22 10057 [iot_thread] Received accepted response from Fleet Provisi
oning CreateCertificateFromCsr API.23 10067 [iot_thread]
24 11069 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:720] 25 11075 [iot_thread] Received certificate with Id: b90b80a135ed12a0
3b56b6ccdf129eccce91c82f37271e70e788a836dd8ef18e0
26 11085 [iot_thread]
27 11176 [iot_thread] [INFO] [FleetProvisioning] [pkcs11_operations.c:660] 28 11182 [iot_thread] Writing certificate into label "Device Cert".29 1118
8 [iot_thread]
30 11271 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:738] 31 11277 [iot_thread] Unsubscribe fleet provisioning CSR Topics
32 11283 [iot_thread]
33 13382 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:764] 34 13387 [iot_thread] Subscribe to registerThing reply topics35 1339
3 [iot_thread]
36 15502 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:775] 37 15507 [iot_thread] Publish to the MQTT topic $aws/provisioning-te
mplates/testcase1/provision/cbor.
38 15516 [iot_thread]
39 15521 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:798] 40 15529 [iot_thread] Attempt to receive publish message from broker
.
41 15535 [iot_thread]
42 15824 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:1395] 43 15830 [iot_thread] Received accepted response from Fleet Provisi
oning RegisterThing API.44 15837 [iot_thread]
45 16341 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:821] 46 16346 [iot_thread] Received AWS IoT Thing name: thing_FPDemoID15:
00:13
47 16353 [iot_thread]
48 18469 [iot_thread] [INFO] [FleetProvisioning] [fleet_provisioning_demo.c:843] 49 18474 [iot_thread] Disconnecting the MQTT connection with a
                                                amazonaws.com.
50 18484 [iot_thread]
51 19490 [iot_thread] [INFO ][DEMO][19490] Demo completed successfully.
wifi link err:00000000

LwIP_DHCP: dhcp stop.
wifi link err:00000000.

WIFI deinitialized52 19628 [iot_thread] [INFO ][INIT][19628] SDK cleanup done.
53 19632 [iot_thread] [INFO ][DEMO][19632] -------DEMO FINISHED-------
```

In addition, under the aws console, new Thing will be generated.