AWS S3 Image Upload and Real-time File Processing with Rekognition on AmebaPro – User Guide

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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.

1 What Can We Get in this Tutorial

AmebaPro can upload the image to AWS S3 cloud storage, then trigger a AI image processing function to do object detection! Here, we have some application scenario introduced: 1.1 wild animal, 1.2 vehicle, 1.3 food, 1.4 retail product.

1.1 Wild Animal Detection

Uploaded image	Rekognition results (AWS AI)
	Label: Lion, Confidence: 99.99998474121094 Label: Wildlife, Confidence: 99.99998474121094 Label: Mammal, Confidence: 99.99998474121094 Label: Animal, Confidence: 99.99998474121094
	Label: Zebra, Confidence: 98.60205841064453 Label: Animal, Confidence: 98.60205841064453 Label: Mammal, Confidence: 98.60205841064453 Label: Wildlife, Confidence: 98.60205841064453
	Label: Elephant, Confidence: 99.82683563232422 Label: Mammal, Confidence: 99.82683563232422 Label: Animal, Confidence: 99.82683563232422 Label: Wildlife, Confidence: 99.82683563232422

1.2 Vehicle Detection

Uploaded image	Rekognition results (AWS AI)
	Label: Car, Confidence: 99.77043914794922 Label: Vehicle, Confidence: 99.77043914794922 Label: Transportation, Confidence: 99.77043914794922 Label: Road, Confidence: 96.77059173583984 Label: Traffic Jam, Confidence: 88.41131591796875 Label: Truck, Confidence: 87.05320739746094 Label: Person, Confidence: 83.31153869628906 Label: License Plate, Confidence: 75.08149719238281 Label: Freeway, Confidence: 66.02681732177734 Label: Highway, Confidence: 59.900604248046875
	Label: Person, Confidence: 99.8815689086914 Label: Car, Confidence: 99.66630554199219 Label: Transportation, Confidence: 99.66630554199219 Label: Vehicle, Confidence: 99.66630554199219 Label: Traffic Light, Confidence: 93.42364501953125 Label: Light, Confidence: 93.42364501953125 Label: Taxi, Confidence: 87.03340148925781 Label: Road, Confidence: 80.97848510742188 Label: Pedestrian, Confidence: 71.65261840820312

1.3 Food Detection

Uploaded image	Rekognition results (AWS AI)
	Label: Cake, Confidence: 93.53020477294922 Label: Dessert, Confidence: 93.53020477294922 Label: Food, Confidence: 93.53020477294922 Label: Sweets, Confidence: 92.21732330322266 Label: Strawberry, Confidence: 92.0057601928711 Label: Fruit, Confidence: 92.0057601928711
	Label: Plant, Confidence: 98.99000549316406 Label: Food, Confidence: 91.17074584960938 Label: Vegetable, Confidence: 88.99947357177734 Label: Carrot, Confidence: 82.17688751220703 Label: Produce, Confidence: 80.4115982055664

1.4 Retail Product Detection

Uploaded image	Rekognition results (AWS AI)
	Label: Grocery Store, Confidence: 95.96288299560547 Label: Shop, Confidence: 95.96288299560547 Label: Market, Confidence: 95.61573791503906 Label: Supermarket, Confidence: 93.32327270507812 Label: Food, Confidence: 75.57024383544922 Label: Refrigerator, Confidence: 69.4200439453125 Label: Candy, Confidence: 58.83950424194336
	Label: Market, Confidence: 97.97370147705078 Label: Grocery Store, Confidence: 97.06415557861328 Label: Shop, Confidence: 97.06415557861328 Label: Shelf, Confidence: 96.08903503417969 Label: Supermarket, Confidence: 93.59891510009766 Label: Food, Confidence: 73.77120208740234 Label: Candy, Confidence: 65.2990951538086
	Label: Soda, Confidence: 99.874267578125 Label: Beverage, Confidence: 99.874267578125 Label: Market, Confidence: 97.0456771850586 Label: Supermarket, Confidence: 95.8358154296875 Label: Shop, Confidence: 95.8358154296875 Label: Grocery Store, Confidence: 95.8358154296875 Label: Coke, Confidence: 66.05561828613281 Label: Shelf, Confidence: 62.23150634765625 Label: Juice, Confidence: 49.38665008544922

2 Set Up AmebaPro to Upload the File to S3

Please follow the steps in the following to set up your device.

2.1 Download the Project for FreeRTOS v202012-LTS

This tutorial is based on **Amazon-v202012-LTS** framework, we can clone the project from Github in specified branch, **AmebaPro-202012.00-LTS-dev**: https://github.com/HungTseLee/KVS_WebRTC_on_AmebaPro/tree/AmebaPro-202012.00-LTS-dev

Run the command to download the whole project:

$ git clone -b AmebaPro-202012.00-LTS-dev --recurse-submodules https://github.com/HungTseLee/KVS_WebRTC_on_AmebaPro.git

If you already have a checkout, run the following command to sync submodules:

$ git submodule update --init

2.2 Configure the AWS Credential File

Configure **aws_clientcredential.h** and **aws_clientcredential_keys.h**
Refer to https://docs.aws.amazon.com/freertos/latest/userguide/freertos-configure.html, which will have the instructions.

In **aws_clientcredential.h**(component/common/application/amazon/amazon-freertos-202012.00/demos/include), set network connection related info

```
#define clientcredentialWIFI_SSID          "SSID"
#define clientcredentialWIFI_PASSWORD      "PASSWORD"
```

In **aws_clientcredential_keys.h**(component/common/application/amazon/amazon-freertos-202012.00/demos/include), set Demo required credentials

```
#define keyCLIENT_CERTIFICATE_PEM          "CERTIFICATE"
#define keyCLIENT_PRIVATE_KEY_PEM          "PRIVATE_KEY"
```

2.3 Enable the Demo for S3 File Upload

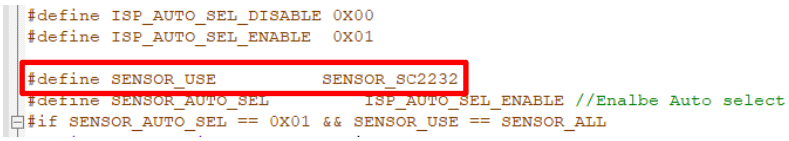
define the **CONFIG_CORE_HTTP_S3_UPLOAD_DEMO_ENABLED** in **aws_demo_config.h**(component\common\application\amazon\amazon-freertos-202012.00\vendors\realtek\boards\amebaPro\aws_demos\config_files)

```
//#define CONFIG_CORE_MQTT_MUTUAL_AUTH_DEMO_ENABLED
//#define CONFIG_OTA_UPDATE_DEMO_ENABLED
//#define CONFIG_DEVICE_SHADOW_DEMO_ENABLED
#define CONFIG_CORE_HTTP_S3_UPLOAD_DEMO_ENABLED
//#define CONFIG_CORE_HTTP_MUTUAL_AUTH_DEMO_ENABLED
```

2.4 Take a Snapshot Image Used to Upload to S3

For the image data used to upload, we can use a snapshot taken by camera sensor. The sample code can be found in "component\common\application\amazon\JPEG_snapshot_s3_upload_example\http_demo_s3_upload.c".

Before running this demo, make sure the correct camera model is selected in "project\realtek_amebapro_v0_example\inc\sensor.h"



The following code is used to introduce how AmebaPro take a snapshot:

```
/*** snapshot on AmebaPro ***/

/* Enable IR-cut of camera seneor */
#if CONFIG_LIGHT_SENSOR
   init_sensor_service();
#else
   ir_cut_init(NULL);
   ir_cut_enable(1);
#endif

/* Configure the setting of snapshot function */
#if ENABLE_SNAPSHOT
   snapshot_setting();
#endif

snapshot_data = NULL;
snapshot_data_len = 0;

/* take a snapshot and store in a buffer */
if ( jpeg_snapshot_isp() < 0)
      printf("take snapshot (from isp) FAIL\n\r");

/* get the JPEG snapshot data from the buffer */
int timeout_ms = 100;
while (1)
{
      if(jpeg_snapshot_get_buffer(&video_buf, timeout_ms))
      {
            jpeg_snapshot_set_processing(1);
            snapshot_data = video_buf.output_buffer;
            snapshot_data_len = video_buf.output_size;
            jpeg_snapshot_set_processing(0);
            break;
      }
}
```

2.5 Make Pre-signed URL for upload file to S3

refer to the **README.md** in (component\common\application\amazon\amazon-freertos-202012.00 \demos\common\http_demo_helpers\ presigned_url_generator)
use **presigned_urls_gen.py** to generate the URL, then paste the URL to "**http_demo_s3_upload.c**"

```
/* Check that the pre-signed GET URL is defined. */
#ifndef democonfigS3_PRESIGNED_GET_URL
  #define democonfigS3_PRESIGNED_GET_URL   "https://XXXXXX.s3.amazonaws.com/XXX.png?XXXXXX..."
#endif

/* Check that the pre-signed PUT URL is defined. */
#ifndef democonfigS3_PRESIGNED_PUT_URL
  #define democonfigS3_PRESIGNED_PUT_URL   "https://XXXXXX.s3.amazonaws.com/XXX.png?XXXXXX..."
#endif
```

2.6 Build the Project and Download the Image to AmebaPro

Build the project and download the image to AmebaPro.

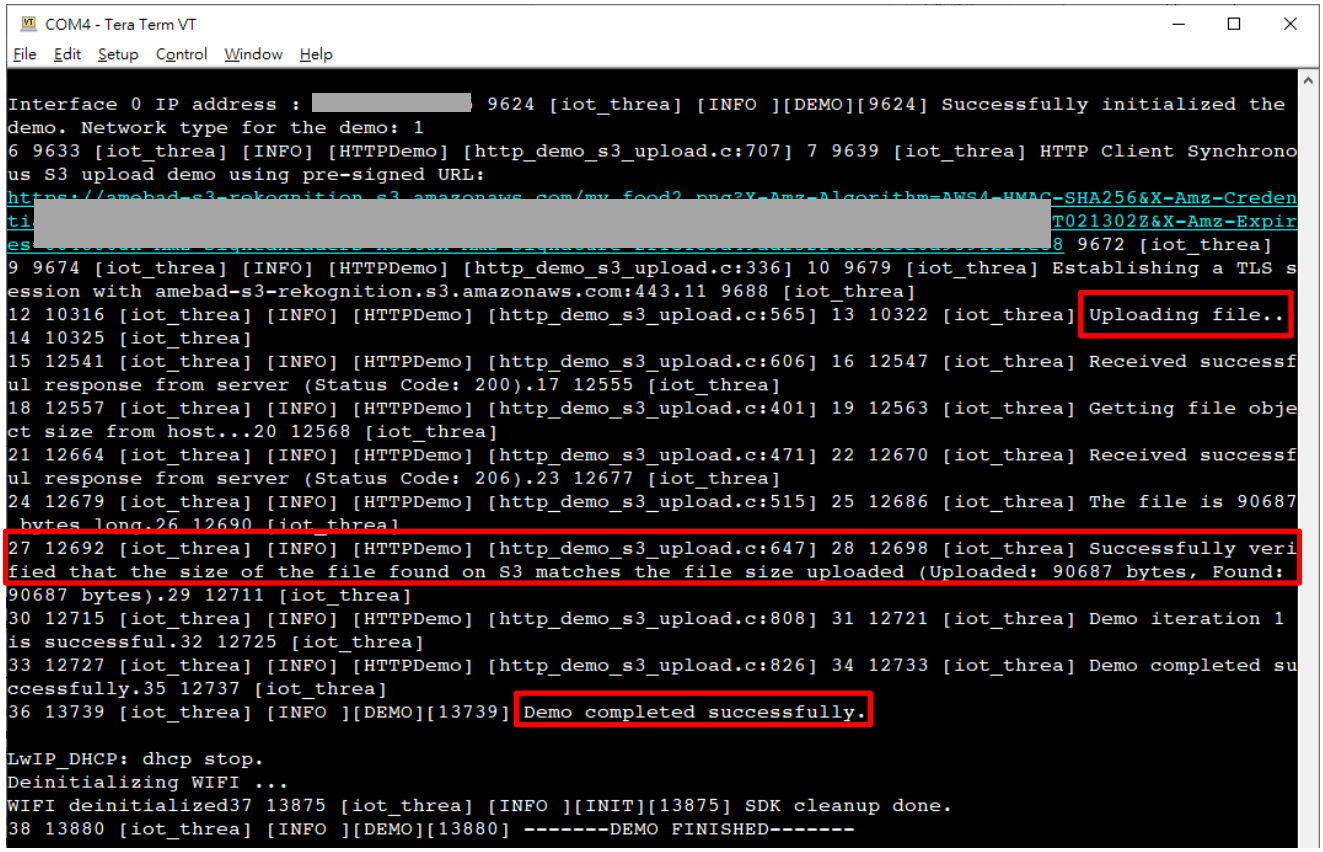
Build the project in GCC:

$ make -f Makefile_amazon_LTS all

If success, the image file(**flash_is.bin**) will be generated in (project\realtek_amebapro_v0_example\GCC-RELEASE\application_is)
Then, we can use the **image tool**(tools\AmebaPro\Image_Tool\ImageTool.exe) to download the image to AmebaPro.

Note:
For using the image tool, please see application note: https://github.com/HungTseLee/KVS_WebRTC_on_AmebaPro/blob/AmebaPro-202012.00-LTS-dev/doc/AN0300%20Realtek%20AmebaPro%20application%20note.en.pdf

After downloading the image to device, please reboot AmebaPro to run the demo. The stored image will then be uploaded to your S3 bucket!

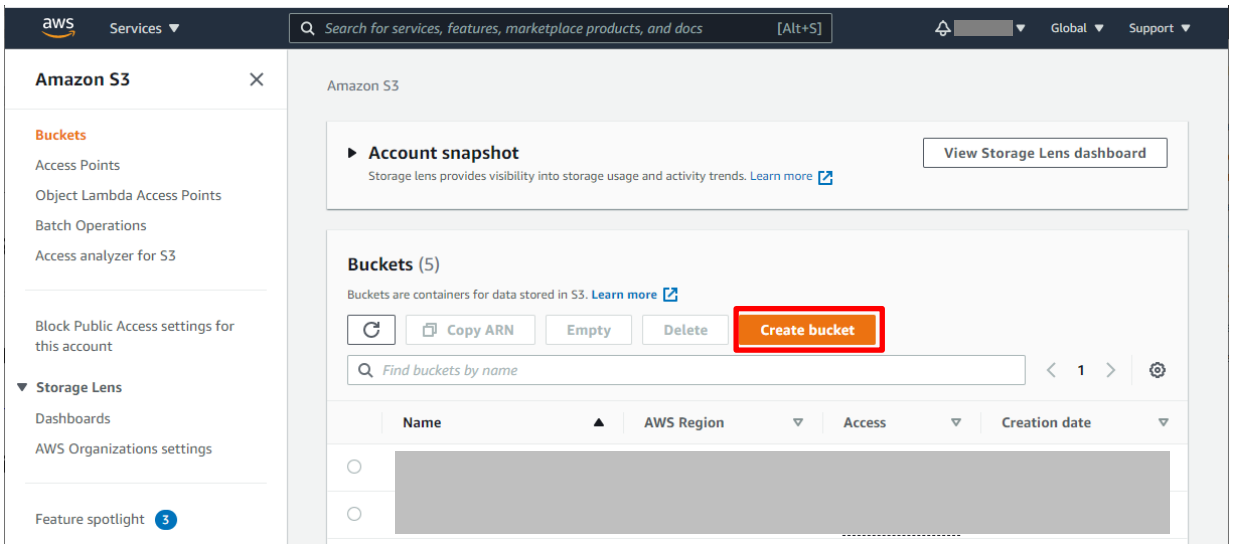


3 Real-time File Processing with Rekognition

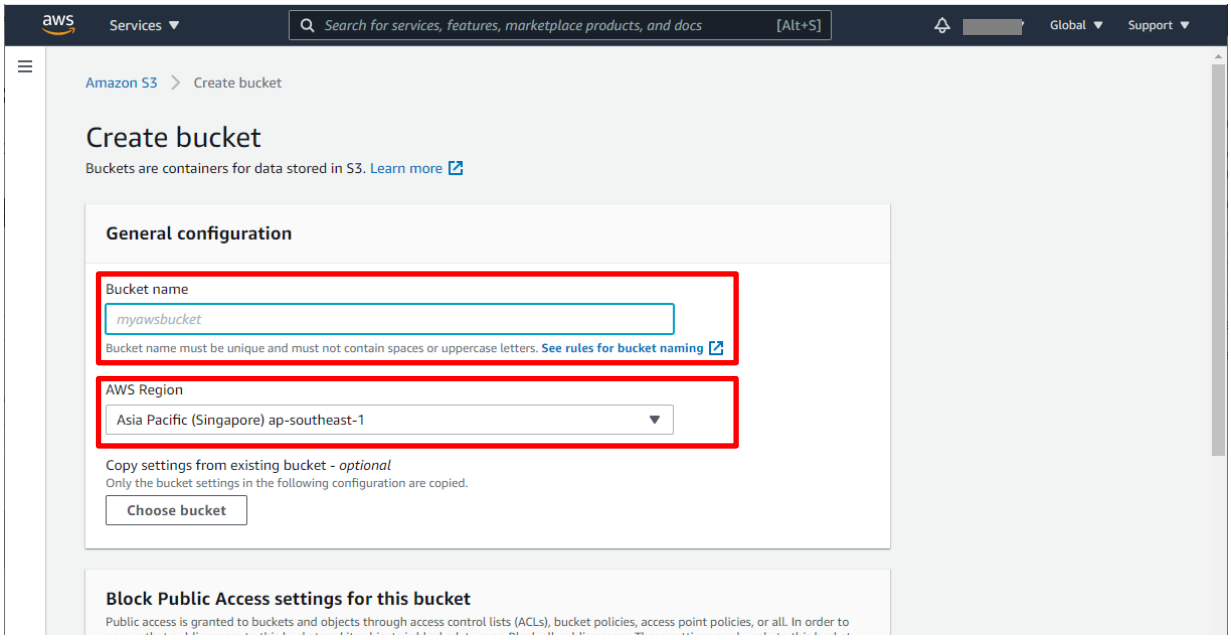
After setting up the AmebaPro, we can do the real-time image processing on AWS website.

3.1 Create an Amazon S3 bucket Using the Console

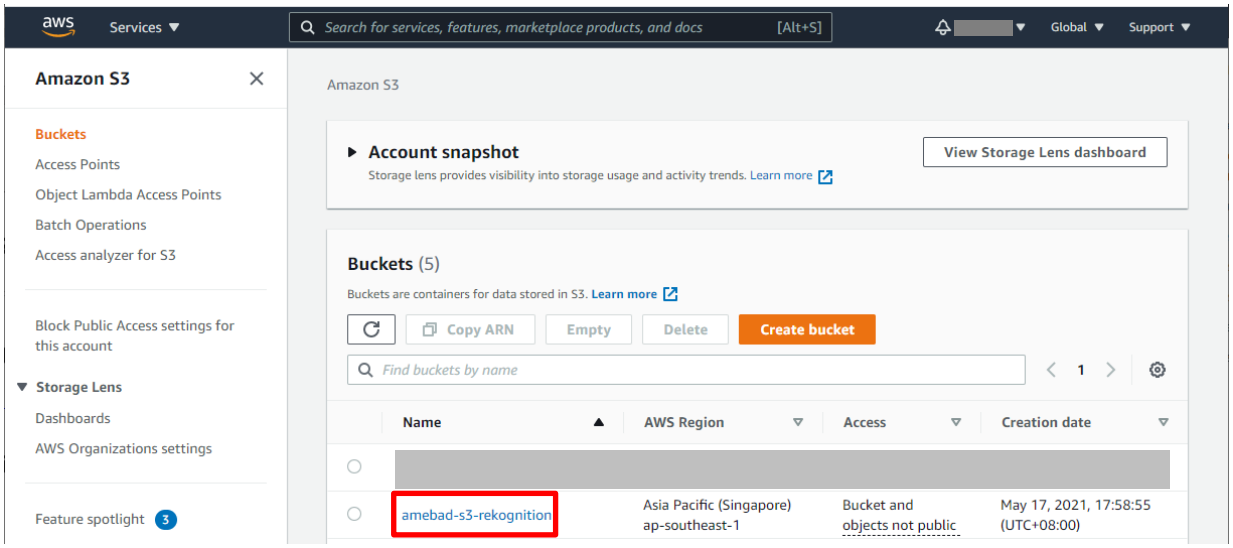
Go to Amazon S3 console: https://console.aws.amazon.com/s3/home
Create a bucket by choosing **Create bucket**



For Bucket name, enter a **unique name**.
For AWS Region, choose a **Region**. Note that you must create your Lambda function in the same Region.



After creating the bucket, you can see the list of buckets in your account in the current Region.

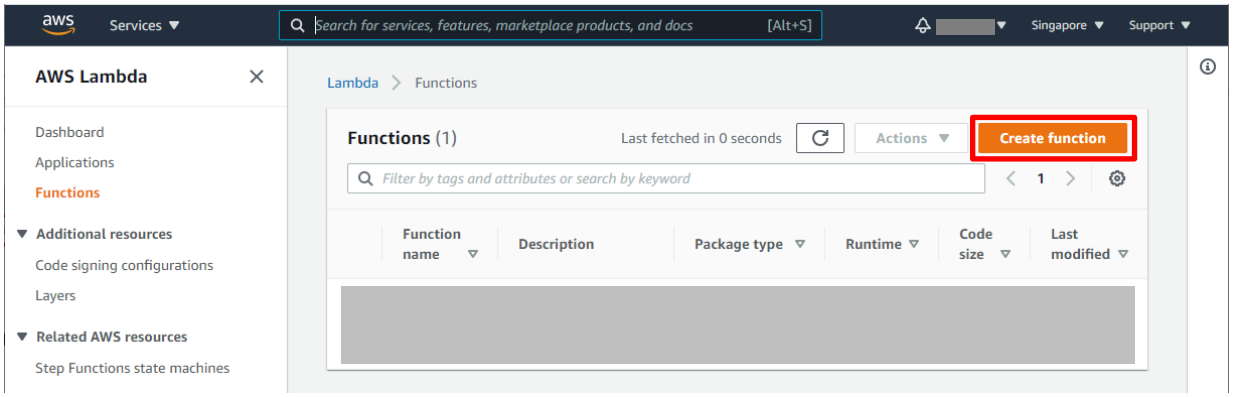


3.2 Create an AWS Lambda function to Trigger the Rekognition Service

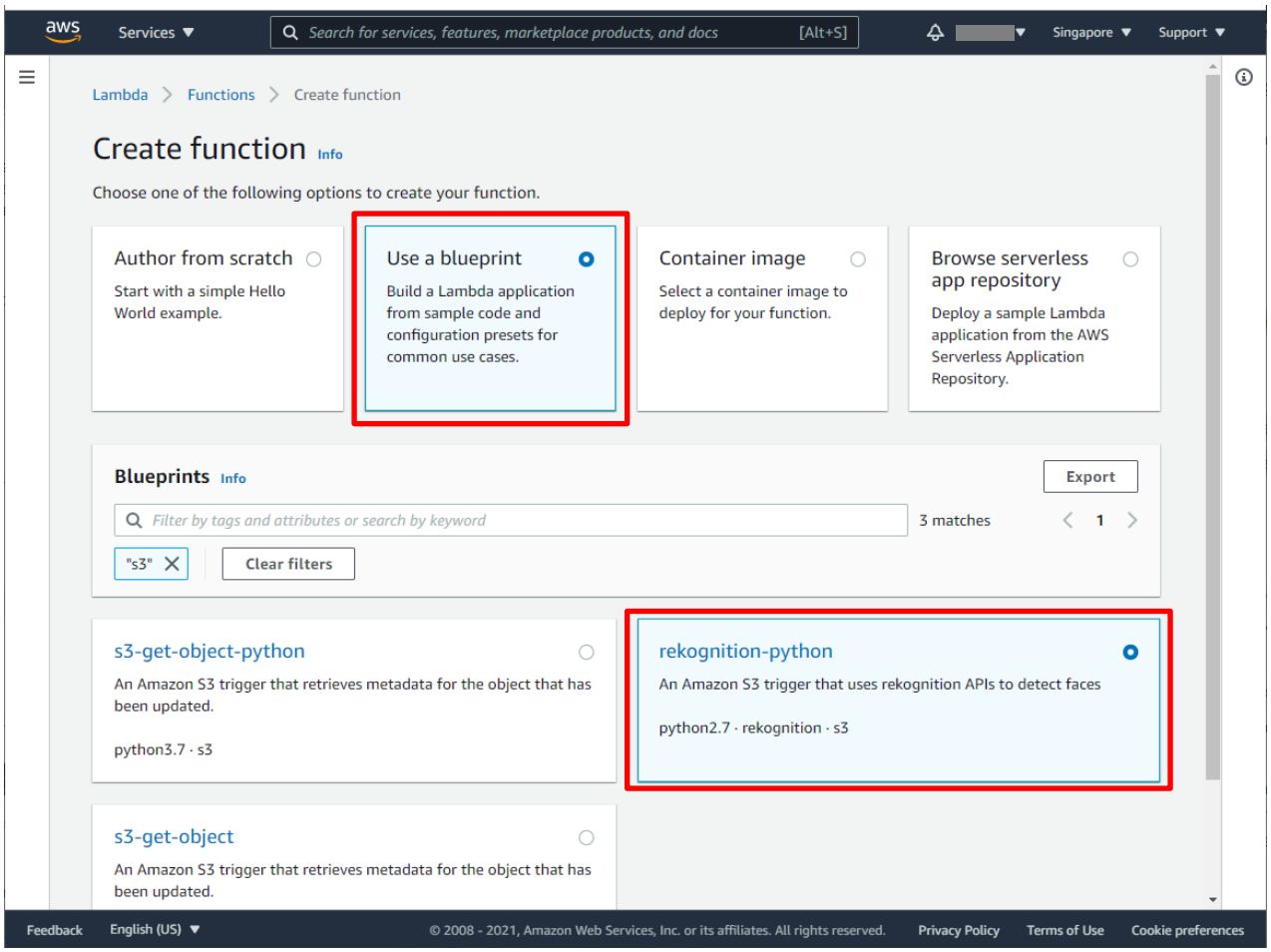
We can refer https://docs.aws.amazon.com/lambda/latest/dg/with-s3-example.html to create a Lambda function easily.

Go to Functions page on the Lambda console: https://console.aws.amazon.com/lambda/home#/functions

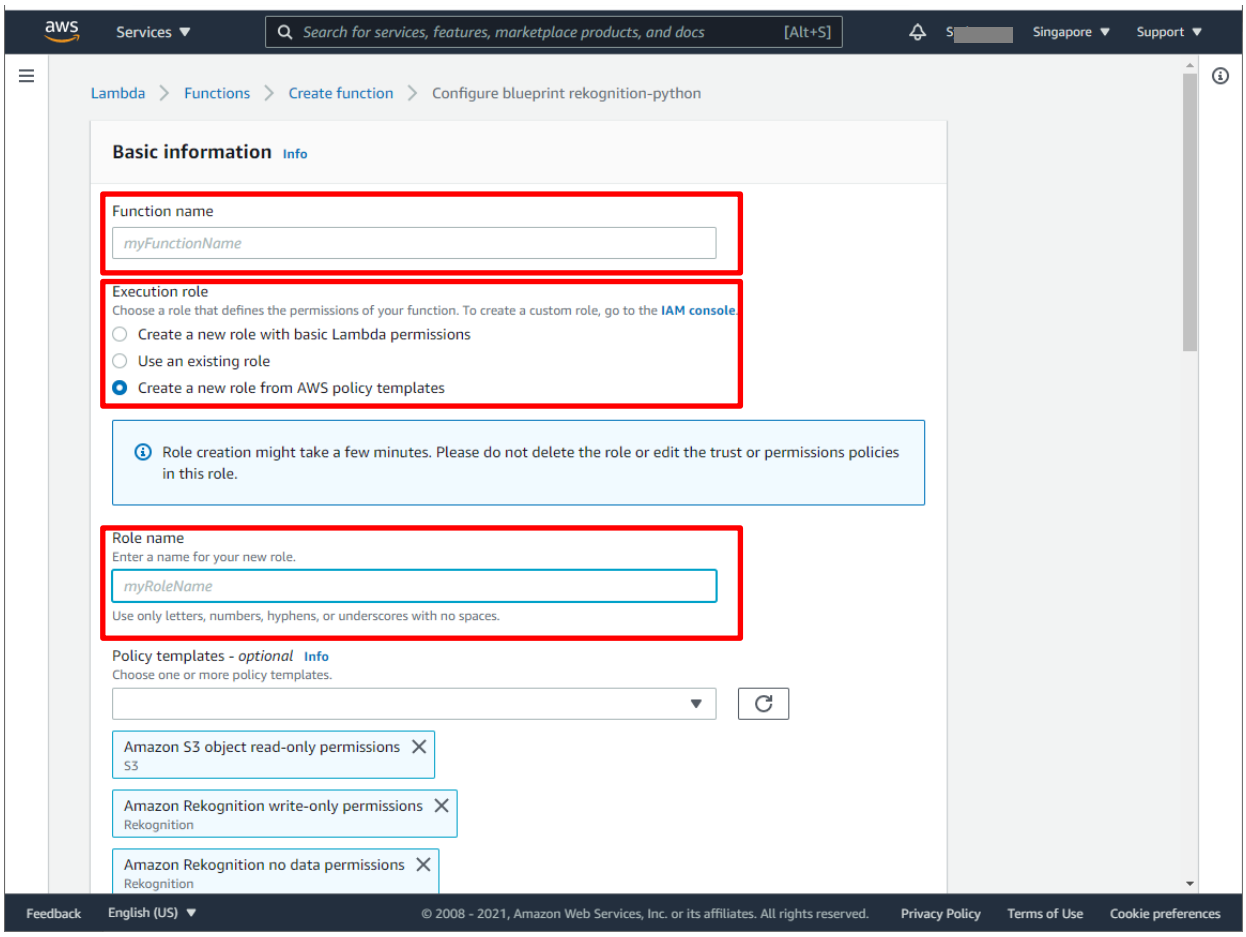
Choose **Create function**



On the Create function page, choose **Use a blueprint**.
Under Blueprints, enter **s3** in the search box.
For a Python function, choose **s3-get-object-python**.
However, the sample code provided is python2.7, we can revise it to python3.7 version later.

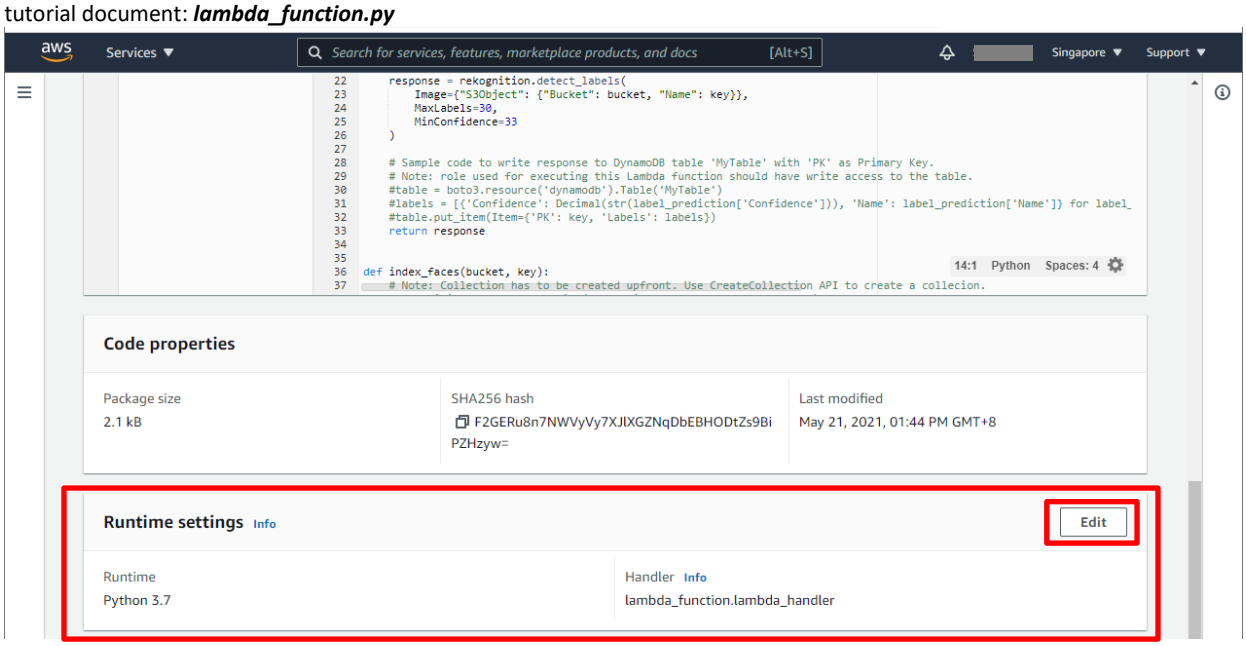


Under Basic information, do the following:
For **Function name**, enter your function name (ex: my-s3-function)
For **Execution role**, choose **Create a new role from AWS policy templates**.
For **Role name**, enter your role name (ex: my-s3-function-role)



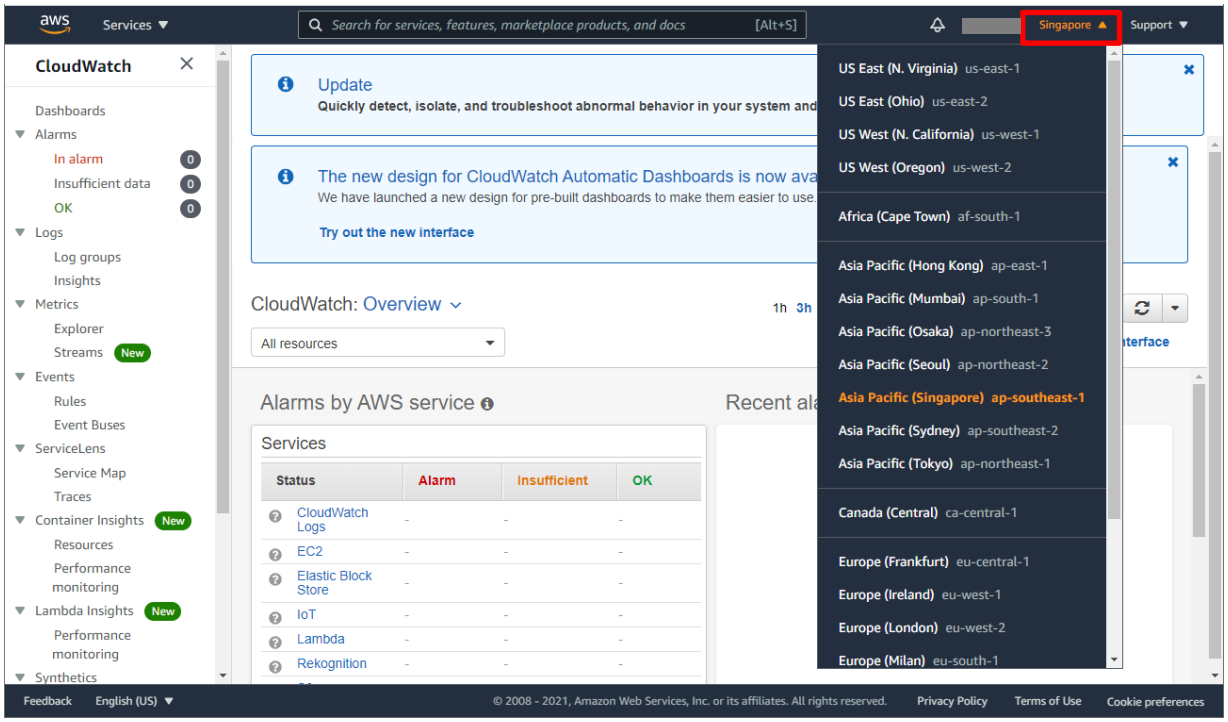
Under S3 trigger, **choose the S3 bucket that you created previously**. Then, choose **Create function.**
Now, your lambda function is created, and it will be triggered automatically once AmebaPro upload an image file to the S3 bucket!

If you want to use python3.7, you can modify it as following. The sample code for food detection in python3.7 is provided along with this tutorial document: ***lambda_function.py***

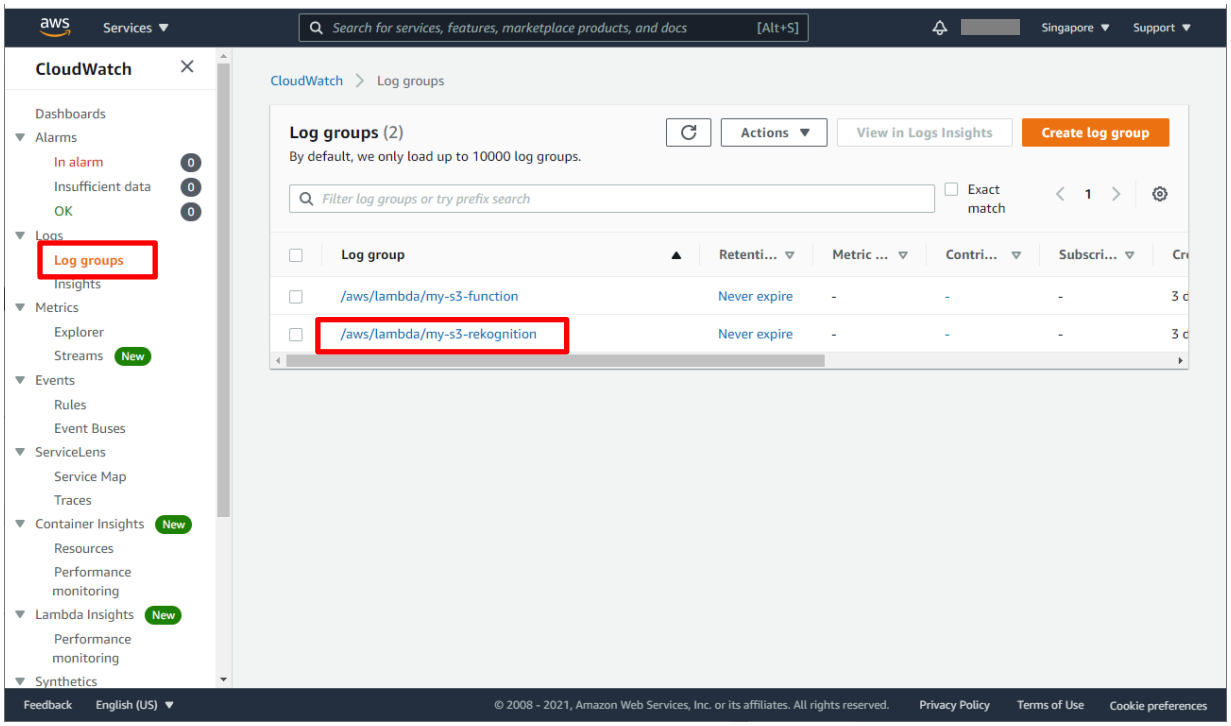


3.3 See the Object Detection Result in AWS CloudWatch

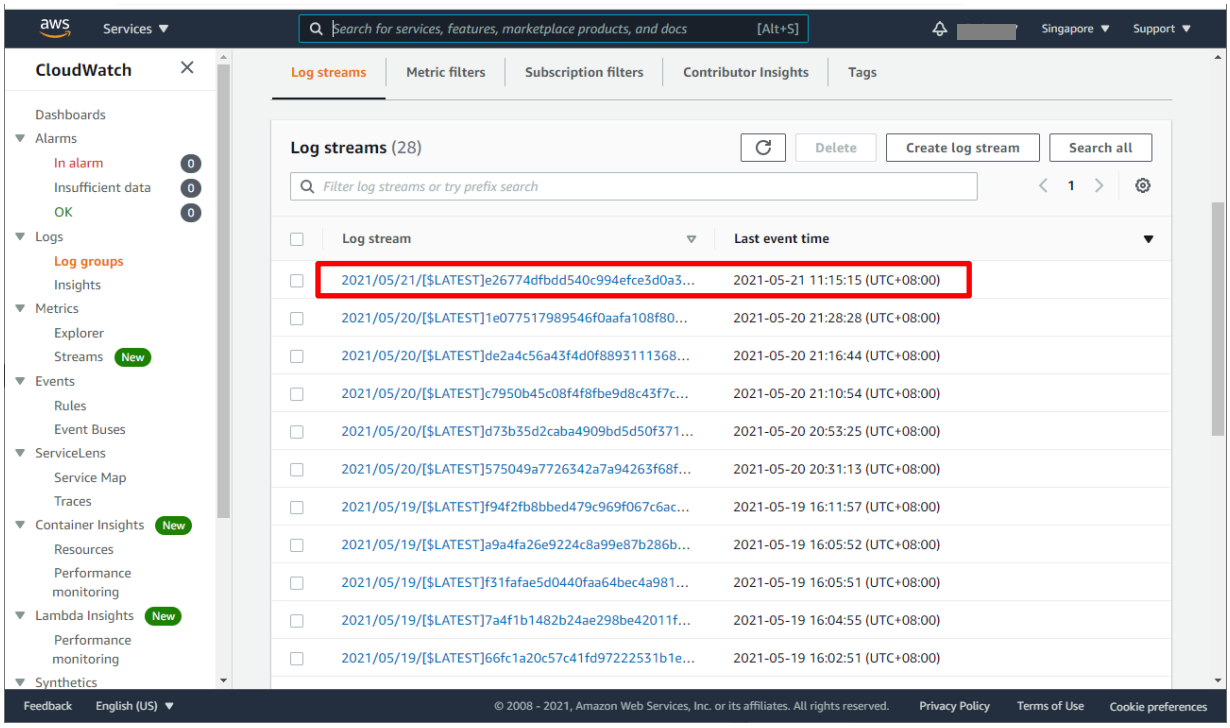
Go to AWS CloudWatch: https://console.aws.amazon.com/cloudwatch/home#
Choose the correct AWS region, our example default is **ap-southeast-1**



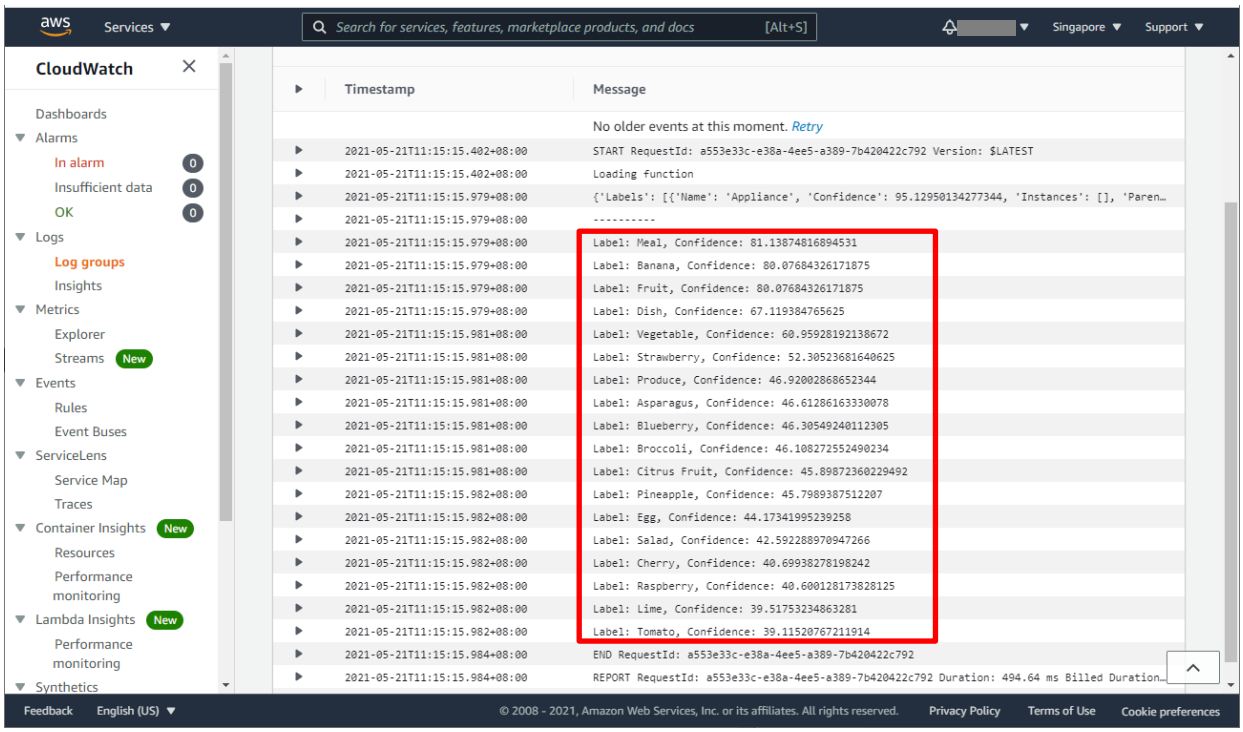
Click the Log groups button, and choose your group



Choose the latest one to see the latest result



Here is the object detection results from Rekognition!



According to AWS document, the bounding boxes are returned for common object labels such as people, cars, furniture, apparel or pets.
https://boto3.amazonaws.com/v1/documentation/api/1.9.96/reference/services/rekognition.html#Rekognition.Client.detect_labels