



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)
	<pre>Label: Lion, Confidence: 99.99998474121094 Label: Wildlife, Confidence: 99.99998474121094 Label: Mammal, Confidence: 99.99998474121094 Label: Animal, Confidence: 99.99998474121094</pre>
	<pre>Label: Zebra, Confidence: 98.60205841064453 Label: Animal, Confidence: 98.60205841064453 Label: Mammal, Confidence: 98.60205841064453 Label: Wildlife, Confidence: 98.60205841064453</pre>
	<pre>Label: Elephant, Confidence: 99.82683563232422 Label: Mammal, Confidence: 99.82683563232422 Label: Animal, Confidence: 99.82683563232422 Label: Wildlife, Confidence: 99.82683563232422</pre>




1.2 Vehicle Detection

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

1.3 Food Detection

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

1.4 Retail Product Detection

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

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](#)”

```
#define ISP_AUTO_SEL_DISABLE 0X00
#define ISP_AUTO_SEL_ENABLE 0X01

#define SENSOR_USE          SENSOR_SC2232
#define SENSOR_AUTO_SEL     ISP_AUTO_SEL_ENABLE //Enalbe Auto select
#if SENSOR_AUTO_SEL == 0X01 && SENSOR_USE == SENSOR_ALL
```

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_PREIGNED_GET_URL
#define democonfigS3_PREIGNED_GET_URL "https://XXXXXX.s3.amazonaws.com/XXX.png?XXXXXX..."
#endif

/* Check that the pre-signed PUT URL is defined. */
#ifndef democonfigS3_PREIGNED_PUT_URL
#define democonfigS3_PREIGNED_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:

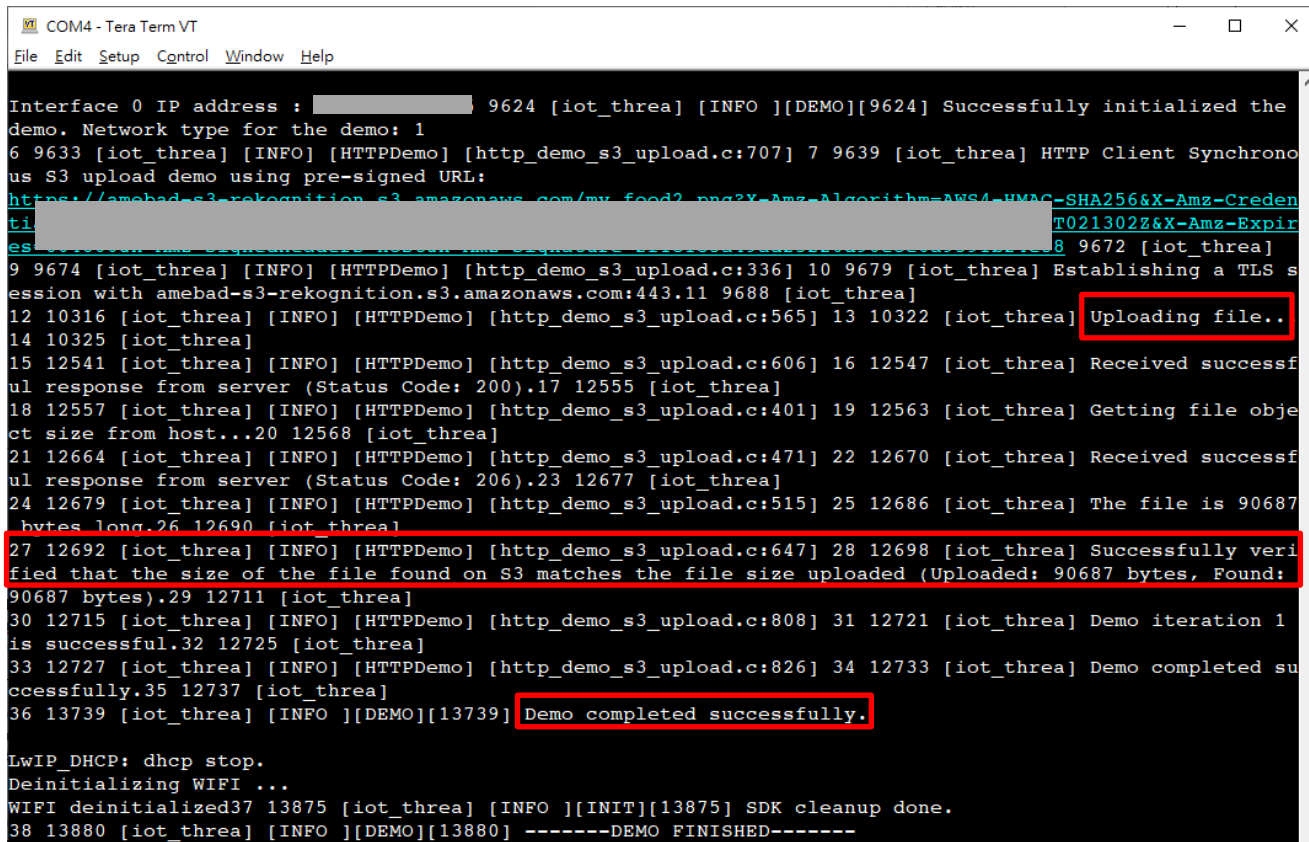
```
$ make -f Makefile_amazon_LTS all
```

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!



```

COM4 - Tera Term VT
File Edit Setup Control Window Help

Interface 0 IP address : 192.168.1.100 9624 [iot_threa] [INFO ][DEMO][9624] Successfully initialized the
demo. Network type for the demo: 1
6 9633 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:707] 7 9639 [iot_threa] HTTP Client Synchrono
us S3 upload demo using pre-signed URL:
https://amebad-s3-rekognition-s3.amazonaws.com/my_food?png?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Creden
ti
9 9674 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:336] 10 9679 [iot_threa] Establishing a TLS s
ession with amebad-s3-rekognition.s3.amazonaws.com:443.11 9688 [iot_threa]
12 10316 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:565] 13 10322 [iot_threa] Uploading file..
14 10325 [iot_threa]
15 12541 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:606] 16 12547 [iot_threa] Received successf
ul response from server (Status Code: 200).17 12555 [iot_threa]
18 12557 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:401] 19 12563 [iot_threa] Getting file obje
ct size from host...20 12568 [iot_threa]
21 12664 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:471] 22 12670 [iot_threa] Received successf
ul response from server (Status Code: 206).23 12677 [iot_threa]
24 12679 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:515] 25 12686 [iot_threa] The file is 90687
bytes long.26 12690 [iot_threa]
27 12692 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:647] 28 12698 [iot_threa] Successfully veri
fied that the size of the file found on S3 matches the file size uploaded (Uploaded: 90687 bytes, Found:
90687 bytes).29 12711 [iot_threa]
30 12715 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:808] 31 12721 [iot_threa] Demo iteration 1
is successful.32 12725 [iot_threa]
33 12727 [iot_threa] [INFO] [HTTPDemo] [http_demo_s3_upload.c:826] 34 12733 [iot_threa] Demo completed su
ccessfully.35 12737 [iot_threa]
36 13739 [iot_threa] [INFO ][DEMO][13739] Demo completed successfully.

LwIP_DHCP: dhcp stop.
Deinitializing WIFI ...
WIFI deinitialized37 13875 [iot_threa] [INFO ][INIT][13875] SDK cleanup done.
38 13880 [iot_threa] [INFO ][DEMO][13880] -----DEMO FINISHED-----

```

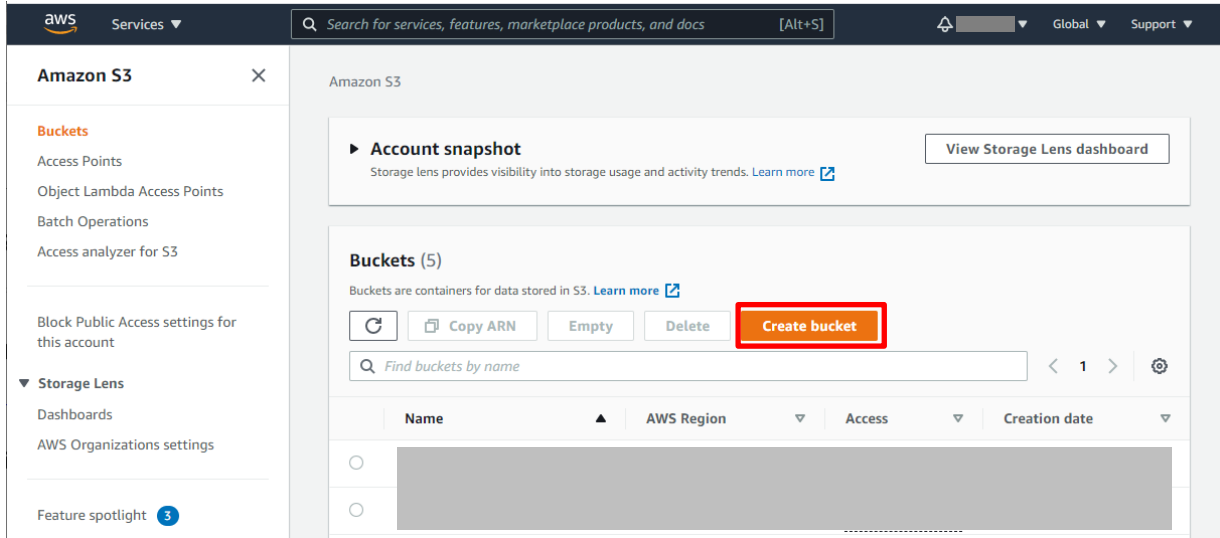
3 Real-time File Processing with Rekognition

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

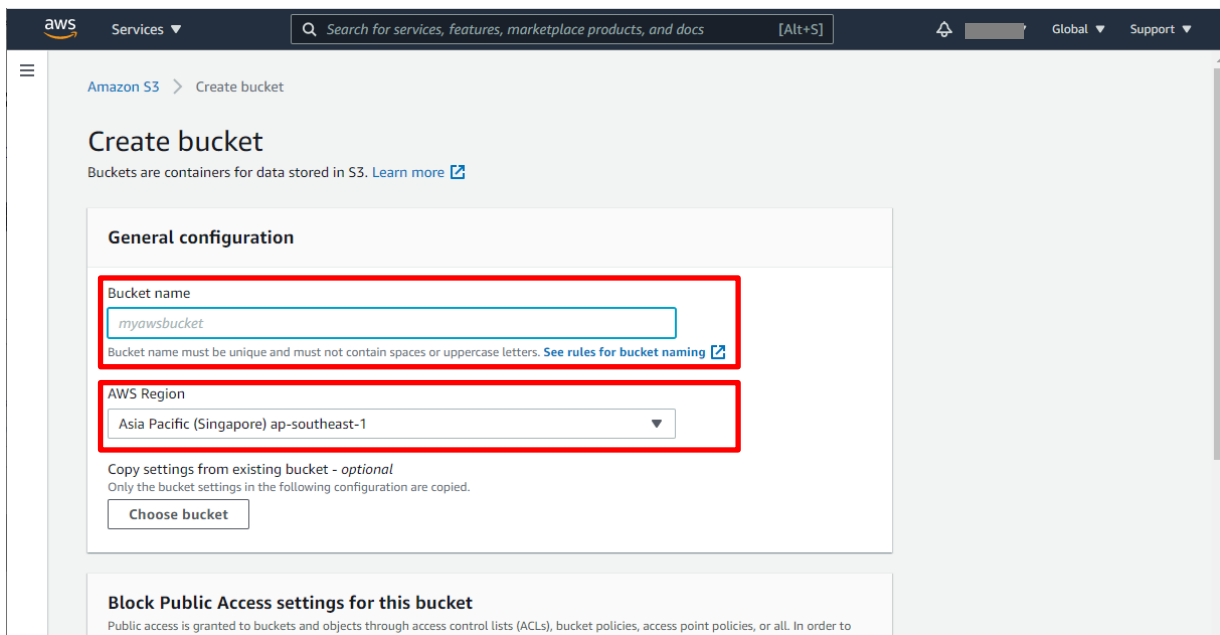
Go to Amazon S3 console: <https://console.aws.amazon.com/s3/home>

Create a bucket by choosing **Create bucket**

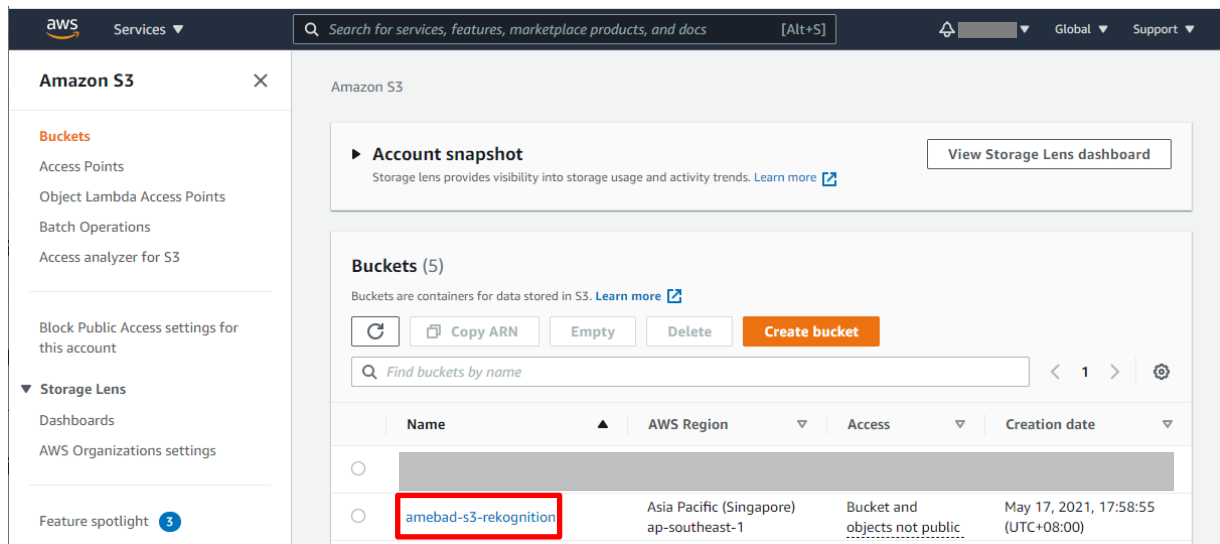


For Bucket name, enter a **unique name**.

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.

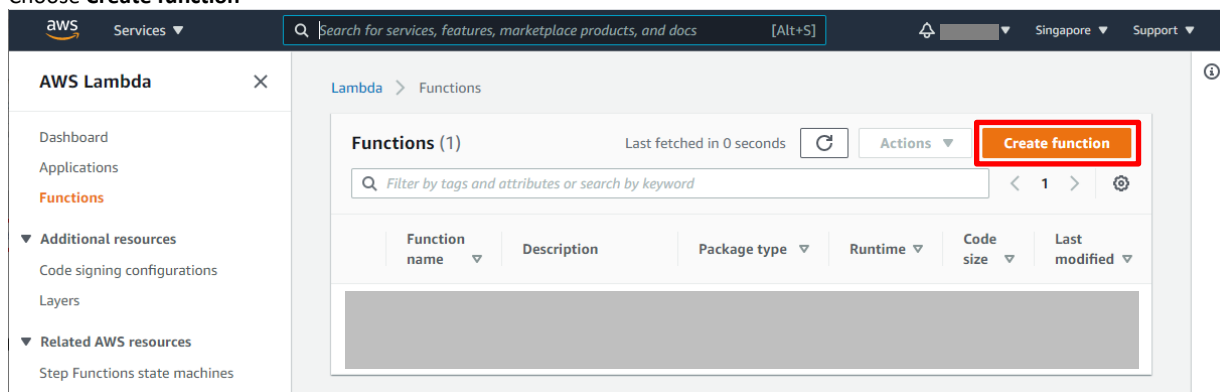


3.2 Create an AWS Lambda function to Trigger the Rekognition Service

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**

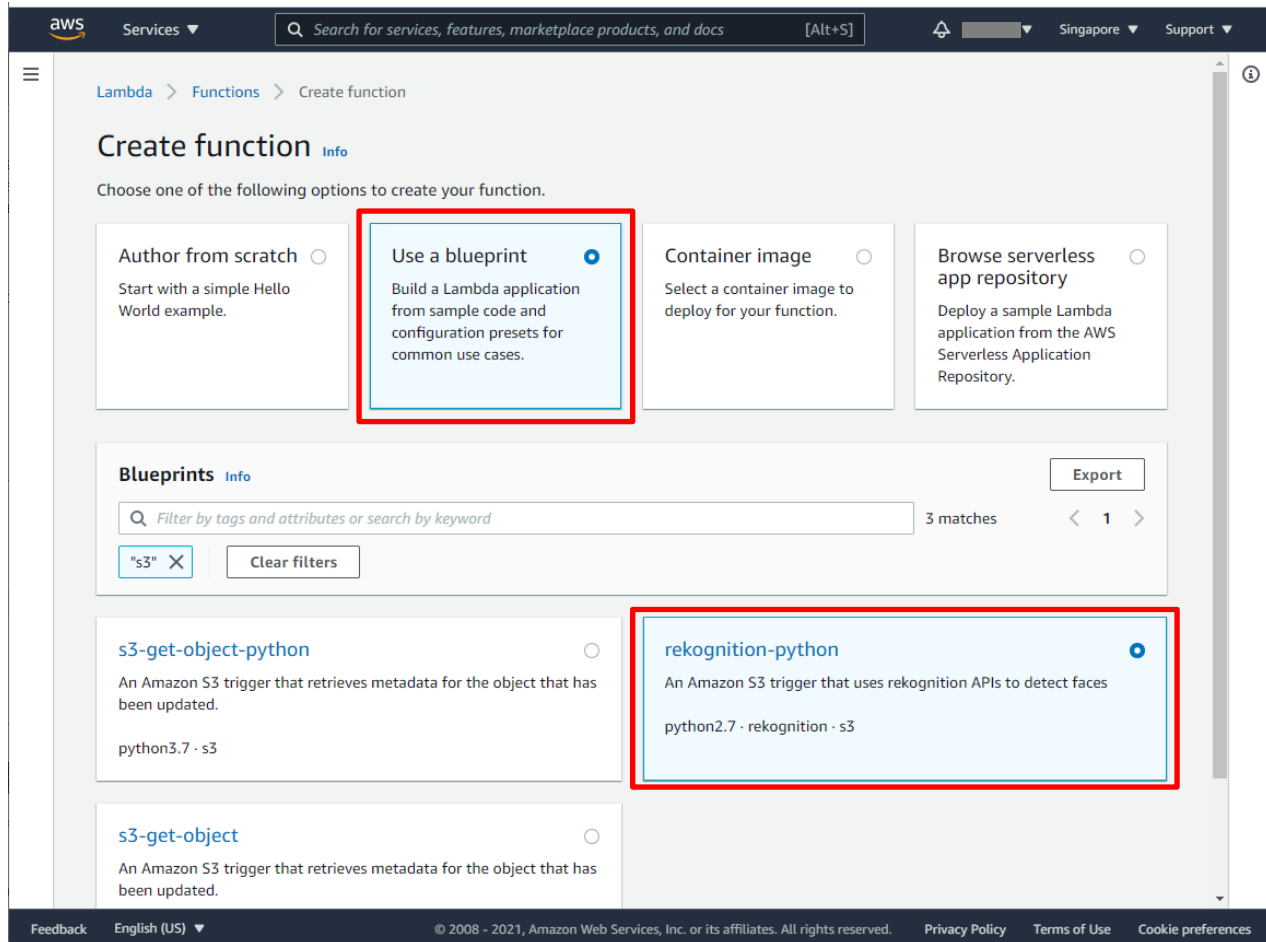


On the Create function page, choose **Use a blueprint**.

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)

Basic information Info

Function name
myFunctionName

Execution role
Choose a role that defines the permissions of your function. To create a custom role, go to the [IAM console](#).

☐ Create a new role with basic Lambda permissions

☐ Use an existing role

☒ Create a new role from AWS policy templates

Role creation might take a few minutes. Please do not delete the role or edit the trust or permissions policies in this role.

Role name
Enter a name for your new role.
myRoleName
Use only letters, numbers, hyphens, or underscores with no spaces.

Policy templates - optional Info
Choose one or more policy templates.

Amazon S3 object read-only permissions S3

Amazon Rekognition write-only permissions Rekognition

Amazon Rekognition no data permissions Rekognition

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**

Code properties

Package size 2.1 kB	SHA256 hash F2GERu8n7NWVYy7XJIXGZNqDbEBHODtZs9Bi PZHzyw=	Last modified May 21, 2021, 01:44 PM GMT+8
------------------------	--	---

Runtime settings Info

Runtime
Python 3.7

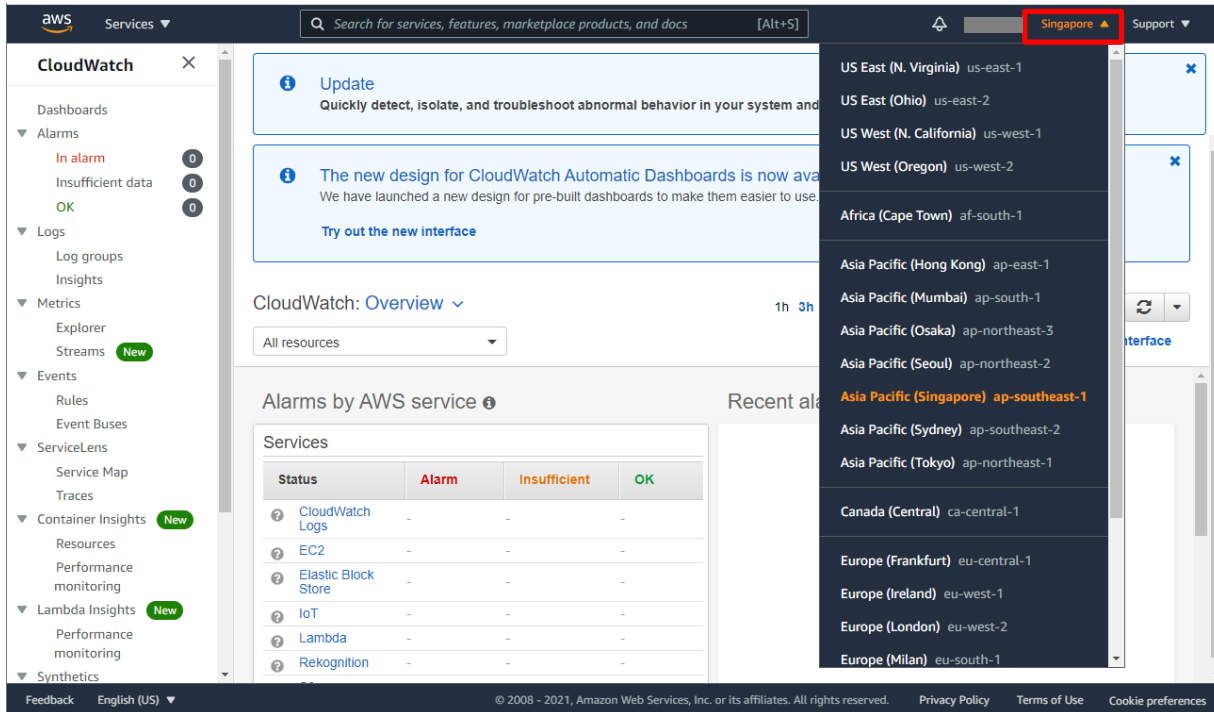
Handler Info
lambda_function.lambda_handler

Edit

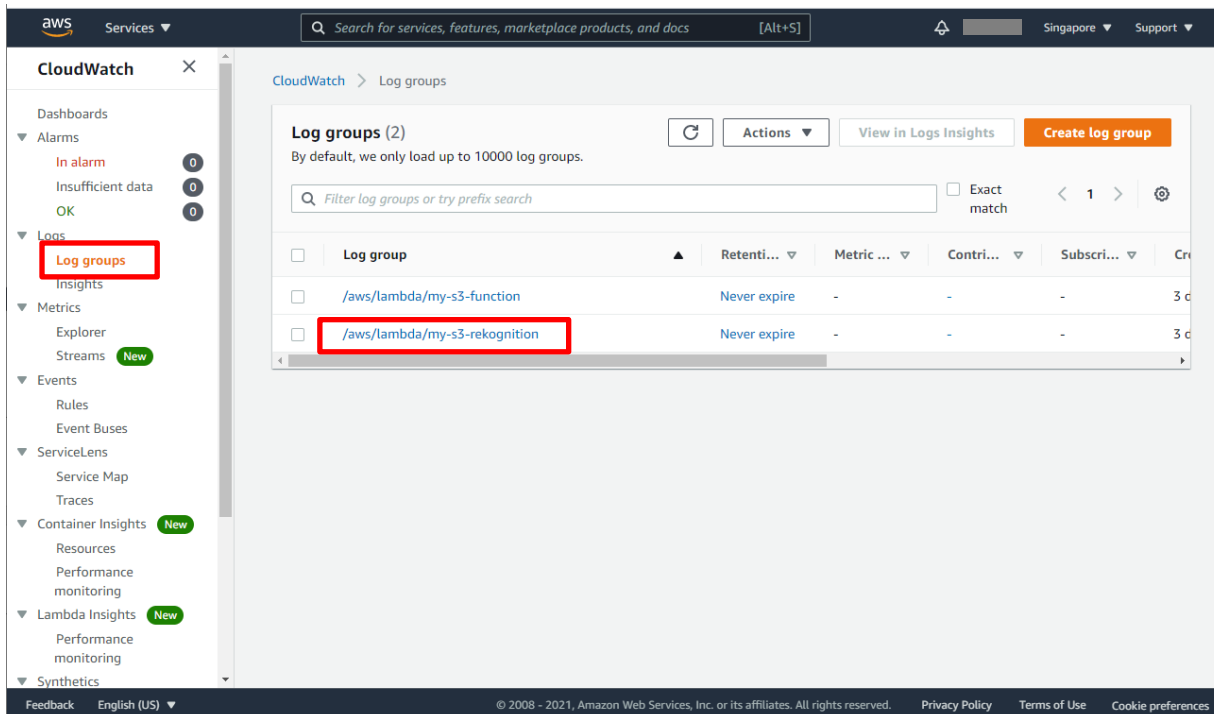
3.3 See the Object Detection Result in AWS CloudWatch

Go to AWS CloudWatch: <https://console.aws.amazon.com/cloudwatch/home#>

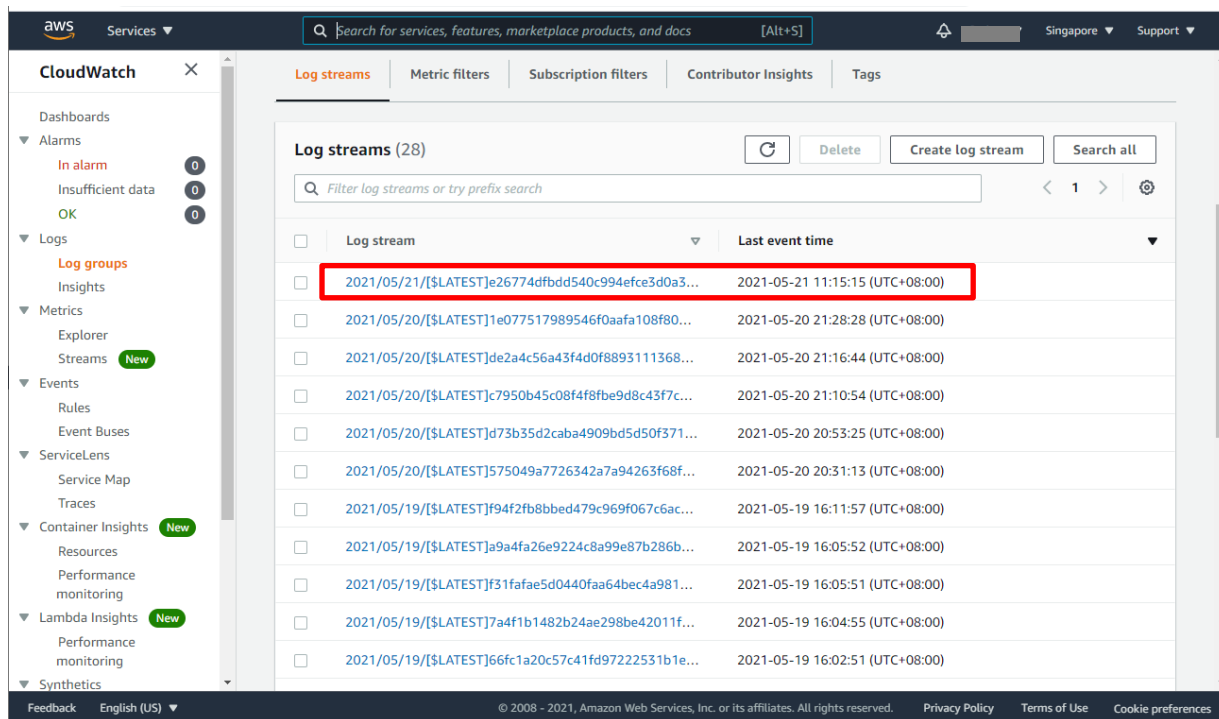
Choose the correct AWS region, our example default is **ap-southeast-1**



Click the Log groups button, and choose your group

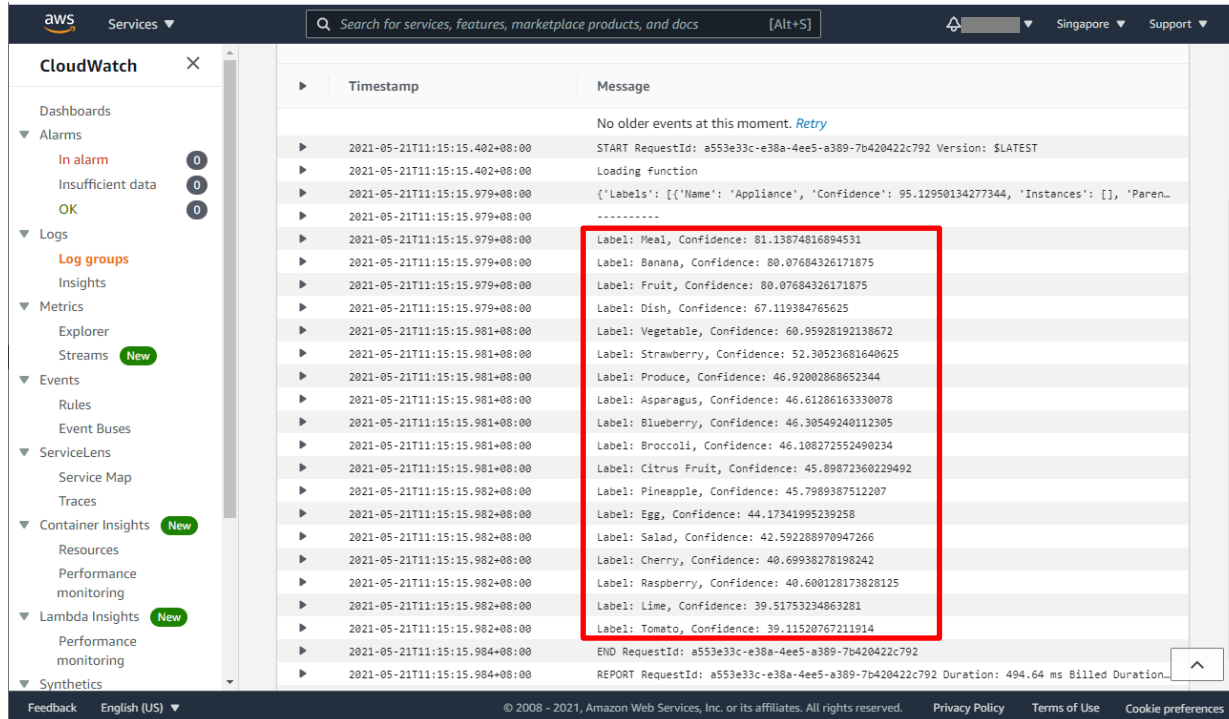


Choose the latest one to see the latest result



The screenshot shows the AWS CloudWatch console. The 'Log streams' tab is selected, displaying a list of 28 log streams. The first log stream, '2021/05/21/[\$LATEST]e26774dfbdd540c994efce3d0a3...', is highlighted with a red box. The 'Last event time' for this stream is '2021-05-21 11:15:15 (UTC+08:00)'.

Here is the object detection results from Rekognition!



The screenshot shows the AWS CloudWatch console with the 'Log streams' tab selected. The log stream '2021/05/21/[\$LATEST]e26774dfbdd540c994efce3d0a3...' is selected, and the log events are displayed. The object detection results from Rekognition are highlighted with a red box. The results show a list of labels and their confidence scores:

Label	Confidence
Meat	81.13674616894531
Banana	80.07684326171875
Fruit	80.07684326171875
Dish	67.119384765625
Vegetable	60.95928192138672
Strawberry	52.38523681640625
Produce	46.92002868652344
Asparagus	46.61286163330078
Blueberry	46.30549240112305
Broccoli	46.108272552490234
Citrus Fruit	45.89872360229492
Pineapple	45.7989387512207
Egg	44.17341995239258
Salad	42.592288970947266
Cherry	40.69938278198242
Raspberry	40.600128173828125
Lime	39.51753234863281
Tomato	39.11520767211914

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