Serverless Image Processing using AWS Lambda and Amazon S3

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Introduction

- In today's digital world, high-quality images are essential for websites, e-commerce, and social media platforms. However, large images can slow down page loading times and negatively affect user experience. Therefore, image optimization and resizing is a common and critical task in modern web development.
- To solve this efficiently, we use a serverless solution on AWS that automatically processes and resizes images using AWS Lambda when they are uploaded to Amazon S3.

What is Serverless Computing?

- Serverless computing is a cloud model where you write code and run it without managing servers. In AWS, this is mainly done using Lambda functions, which are automatically triggered by events (like uploading a file to S3).

? About AWS Services Used

- 🟡 1. Amazon S3 (Simple Storage Service):

- A highly scalable object storage service. Used to:
- Store original uploaded images
- Store resized images after processing

- 🟢 2. AWS Lambda:

- A serverless function service that:
- Automatically runs code when triggered
- Resizes and optimizes images using libraries like Pillow (Python) or Sharp (Node.js)

3. IAM (Identity & Access Management):

- Used to define roles and permissions
- Allows Lambda to access S3 securely
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4. CloudWatch:

- For monitoring logs and Lambda performance
- Helps debug errors in the function

Problem Statement

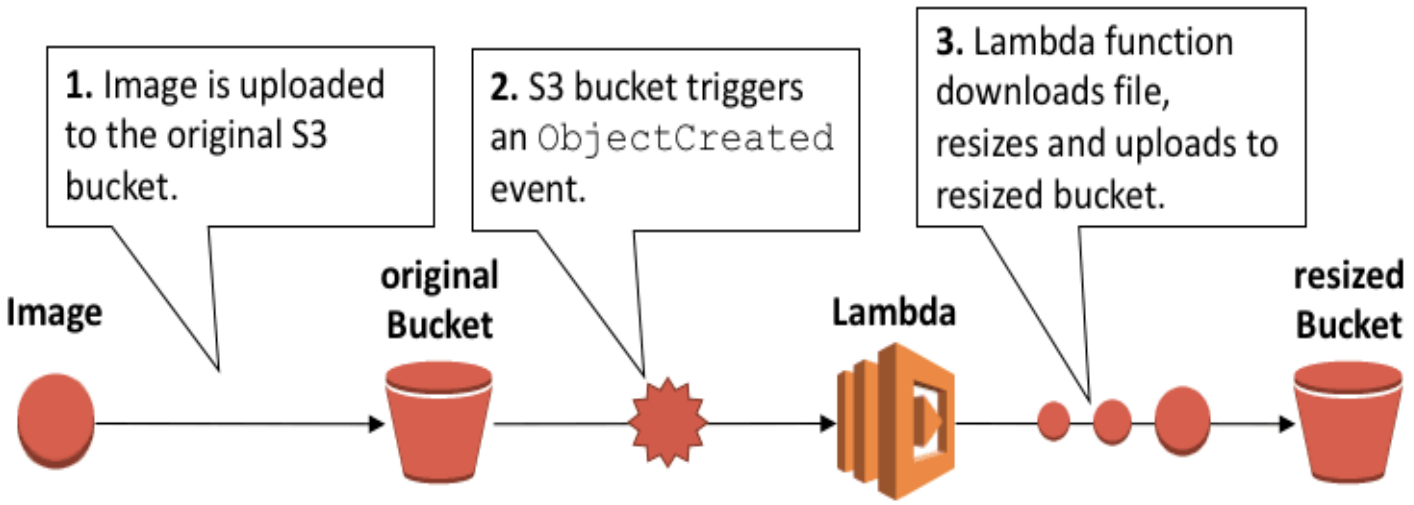
- Uploading large images directly to a website or app can:
- Slow down page load times
- Waste bandwidth
- Reduce user satisfaction
- Manual image resizing is not scalable.

Objective of the Project

- To automate the image processing workflow by:
- Using AWS Lambda to automatically resize images
- Using Amazon S3 to store images
- Using a completely serverless, auto-scaling, and cost-effective solution

System Architecture

- [User]
- ↓
- Upload Image to S3 (original-images)
- ↓
- Trigger AWS Lambda
- ↓
- Resize Image (e.g. 300x300)
- ↓
- Save to S3 (resized-images)
- ↓
- Monitor with CloudWatch



Tools and Technologies Used

Tool	Purpose
AWS Lambda	Serverless image processing
Amazon S3	File storage
IAM	Security and access roles
CloudWatch	Logging and monitoring
Python + Pillow / Node.js + Sharp	Image resizing library

Step-by-Step Implementation

- 🔸 Step 1: Create S3 Buckets

- Go to AWS Console → S3 → Create two buckets:
- original-images
- resized-images

- 🔸 Step 2: Create IAM Role for Lambda

- Go to IAM → Create Role
- Choose Lambda as trusted entity
- Attach policies:
- AmazonS3FullAccess
- CloudWatchLogsFullAccess

Step 3: Write Lambda Code (Python Example)

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- lambda_function.py
- import boto3
- from PIL import Image
- import io
- s3 = boto3.client('s3')
- def lambda_handler(event, context):
- source_bucket = 'original-images'
- target_bucket = 'resized-images'
- for record in event['Records']:
- key = record['s3']['object']['key']
- image_obj = s3.get_object(Bucket=source_bucket, Key=key)
- image_data = image_obj['Body'].read()
- img = Image.open(io.BytesIO(image_data))
- img = img.resize((300, 300))
- out_buffer = io.BytesIO()
- img.save(out_buffer, format='JPEG')
- out_buffer.seek(0)
- s3.put_object(Bucket=target_bucket, Key=key, Body=out_buffer)

Step 4: Zip the Code

- Zip lambda_function.py and dependencies
- Upload to Lambda console

Step 5: Create Lambda Function

- Go to Lambda → Create Function
- Runtime: Python 3.9 / Node.js
- Upload ZIP file
- Attach IAM role

Step 6: Add Trigger

- Add S3 trigger
- Choose original-images bucket
- Event type: PUT (Object Created)

Code Explanation (Line by Line)

- s3 = boto3.client('s3')
- Creates an S3 client object.
- for record in event['Records']:
- key = record['s3']['object']['key']
- Fetches the name of the uploaded file.
- image_obj = s3.get_object(...)
- image_data = image_obj['Body'].read()
- Downloads the original image from S3.
- img = Image.open(io.BytesIO(image_data))
- img = img.resize((300, 300))
- Opens and resizes the image.
- s3.put_object(...)
- Uploads resized image to the resized-images bucket.

Testing and Output

- Upload image to original-images
- Wait a few seconds
- Check resized-images bucket for resized image
- Go to CloudWatch for log verification
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Advantages

- Fully automated process
- No server required
- Scalable on demand
- Cost-effective
- Can handle large number of image

Limitations

- Max image size is limited by Lambda memory (~50MB)
- Advanced editing (cropping, filtering) not included
- Only works on S3 uploads (not URL

Conclusion

- This project shows how to use AWS serverless services to automate image processing workflows in a scalable and efficient way. With the power of Lambda and S3, developers can avoid manual work and build smarter applications.