

Hands-on tutorials

# Check the Integrity of Data in Amazon S3 with Additional Checksums



# Check the Integrity of Data in Amazon S3 with Additional Checksums: Hands-on tutorials

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# Check the Integrity of Data in Amazon S3 with Additional Checksums

<b>AWS experience</b>	Beginner
<b>Time to complete</b>	20 minutes
<b>Cost to complete</b>	Less than \$1 ( <a href="#">Amazon S3 pricing page</a> )
<b>Services used</b>	<a href="#">Amazon S3</a>
<b>Last updated</b>	August 15, 2022

## Overview

Organizations are constantly creating and migrating digital assets to [Amazon S3](#). These assets include images, binary files, post-production renders, and more, all of which are business-critical. As assets are migrated and used across workflows, you want to make sure the files are not altered by network corruption, hard drive failure, or other unintentional issues. Today, the industry uses algorithms to scan a file byte by byte to generate a unique fingerprint for it, known as a checksum.

With checksums, you can verify that assets are not altered when copied. Performing a checksum consists of using an algorithm to iterate sequentially over every byte in a file.

[Amazon S3 offers multiple checksum options to accelerate integrity checking of data](#). These capabilities calculate a file's checksum when a customer uploads an object. Customers migrating large volumes of data to Amazon S3 want to perform these integrity checks as a durability best practice, and to confirm that every byte is transferred without alteration. This allows customers to maintain end-to-end data integrity. The checksum is created the moment the object is uploaded, and it is preserved throughout the lifespan of the object. The same checksum is validated at the end when the object is downloaded, to offer end-to-end data integrity. The additional algorithms supported by Amazon S3 are: SHA-1, SHA-256, CRC32, CRC32-C, MD5, XXHash64, XXHash3, XXHash128, and SHA-512. With these new data integrity checking features, you can verify that your files were not altered during data transfer or during the upload or download.

# What you will accomplish

- Upload a file to Amazon S3
- Compare the checksum on Amazon S3 and your local file to verify data integrity

## Prerequisites

To complete this tutorial, you need an AWS account. [Access this support page for more information on how to create and activate a new AWS account.](#)

## Implementation

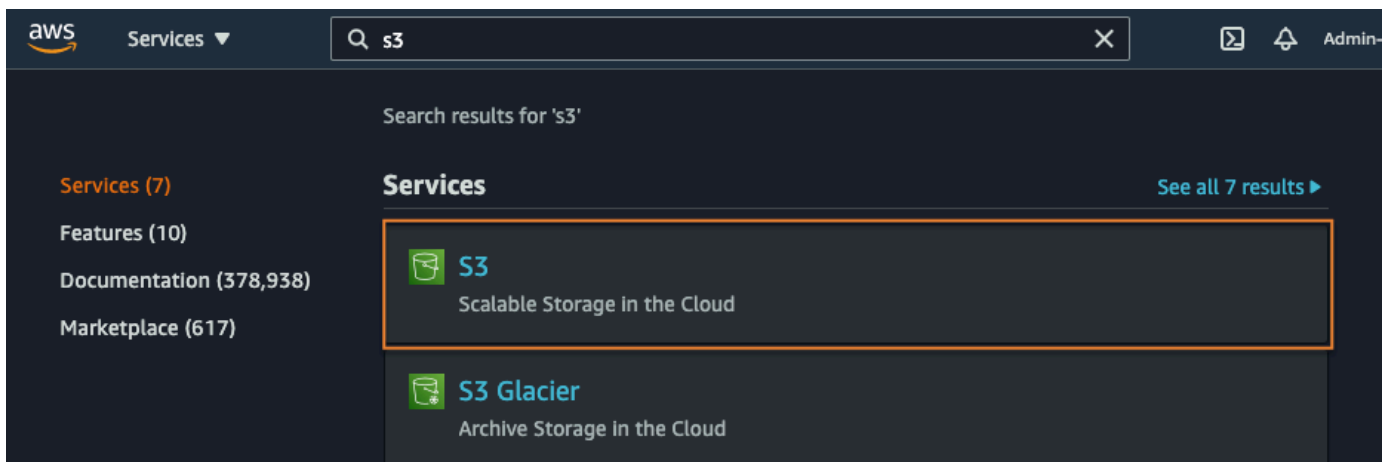
### Step 1: Create an Amazon S3 bucket

1. Sign in to the Amazon S3 console

If you have not already done so, create an [AWS account](#).

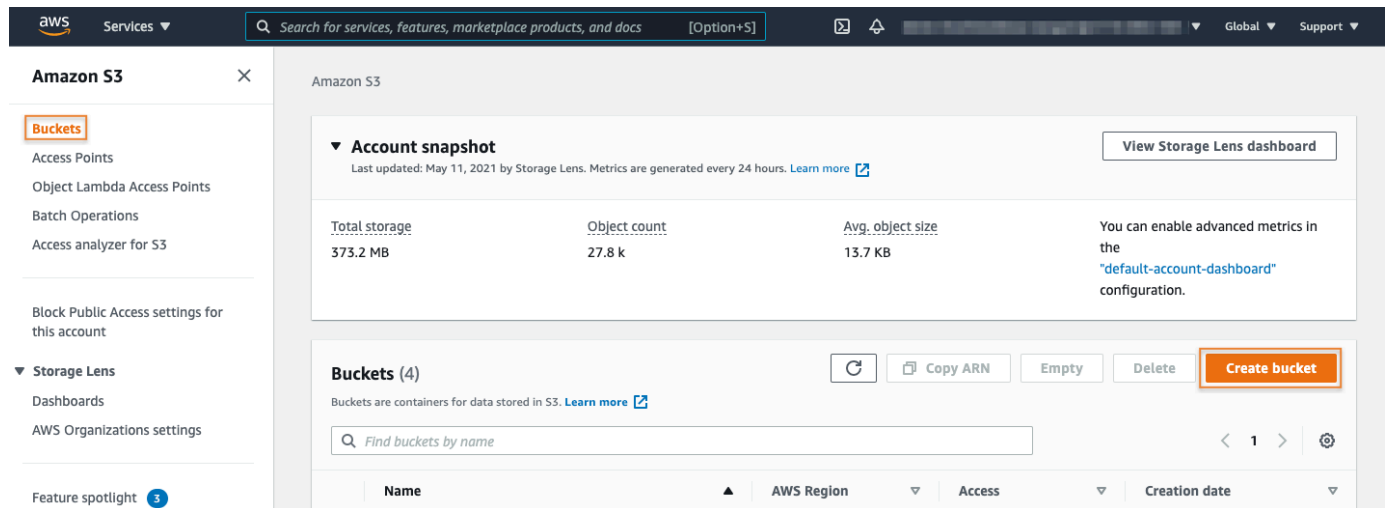
Log into the [AWS Management Console](#) using your account information.

From the AWS console services search bar, enter **S3**. Under the services search results section, select **S3**. You may notice an option for Amazon Glacier. This option is for the Glacier service prior to integration with Amazon S3. We recommend Amazon Glacier users use the Amazon S3 console for an enhanced user experience.



2. Create an S3 bucket

Choose **Buckets** from the Amazon S3 menu on the left and then choose the **Create bucket** button.



The screenshot shows the Amazon S3 console interface. On the left, the 'Amazon S3' menu is open, and the 'Buckets' option is highlighted with an orange box. The main content area displays an 'Account snapshot' section with a table of metrics:

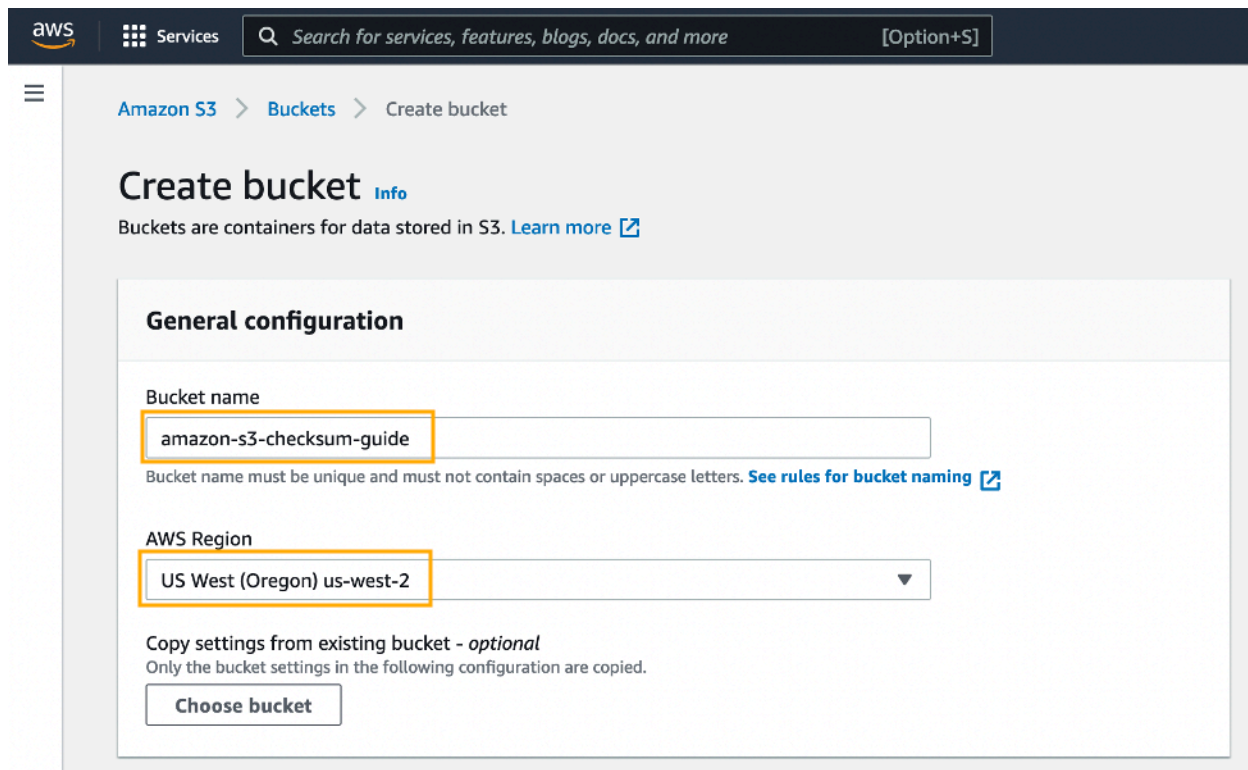
Total storage	Object count	Avg. object size
373.2 MB	27.8 k	13.7 KB

Below the metrics, there is a 'Buckets (4)' section with a search bar and a table with columns: Name, AWS Region, Access, and Creation date. The 'Create bucket' button is highlighted in orange.

### 3. Enter a bucket name and choose a region

Enter a descriptive globally unique name for your bucket. Select which **AWS Region** you would like your bucket created in. The default **Block Public Access** setting is appropriate for this workload, so leave this section as is.

You can leave the remaining options as defaults, navigate to the bottom of the page, and choose **Create bucket**.



The screenshot shows the AWS Management Console interface for creating a new bucket. The breadcrumb navigation indicates the path: Amazon S3 > Buckets > Create bucket. The main heading is 'Create bucket' with an 'Info' link. Below the heading, there is a note: 'Buckets are containers for data stored in S3. [Learn more](#)'. The 'General configuration' section contains the following fields:

- Bucket name:** A text input field containing 'amazon-s3-checksum-guide'. Below it, a note states: 'Bucket name must be unique and must not contain spaces or uppercase letters. [See rules for bucket naming](#)'.
- AWS Region:** A dropdown menu currently showing 'US West (Oregon) us-west-2'.
- Copy settings from existing bucket - optional:** A section with the text 'Only the bucket settings in the following configuration are copied.' and a 'Choose bucket' button.

## Step 2: Upload a file and specify the checksum algorithm

Now that your bucket is created and configured, you are ready to upload a file and have the checksum calculated by Amazon S3.

1. Open your S3 bucket

If you have logged out of your AWS Management Console session, log back in. Navigate to the [S3 console](#) and select the [Buckets](#) menu option. From the list of available buckets, select the bucket name of the bucket you just created.

Amazon S3 > Buckets

**Account snapshot**  
Last updated: Jul 4, 2022 by Storage Lens. Metrics are generated every 24 hours. [Learn more](#)

Total storage	Object count	Avg. object size
18.5 TB	3.9 M	4.9 MB

**Buckets (55)** [Info](#) [Refresh](#) [Copy ARN](#) [Empty](#)

Buckets are containers for data stored in S3. [Learn more](#)

Search:  1 match

Name	AWS Region	Access
amazon-s3-checksum-guide	US West (Oregon) us-west-2	Bucket and objects not public

## 2. Upload an object

Next, select the **Objects** tab. Then, from within the **Objects** section, choose the **Upload** button.

Amazon S3 > Buckets > amazon-s3-checksum-guide

**amazon-s3-checksum-guide** [Info](#)

**Objects** | Properties | Permissions | Metrics | Management | Access Points

**Objects (0)**  
Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For other explicitly grant them permissions. [Learn more](#)

[Refresh](#) [Copy S3 URI](#) [Copy URL](#) [Download](#) [Open](#) [Delete](#) [Actions](#)

[Upload](#)

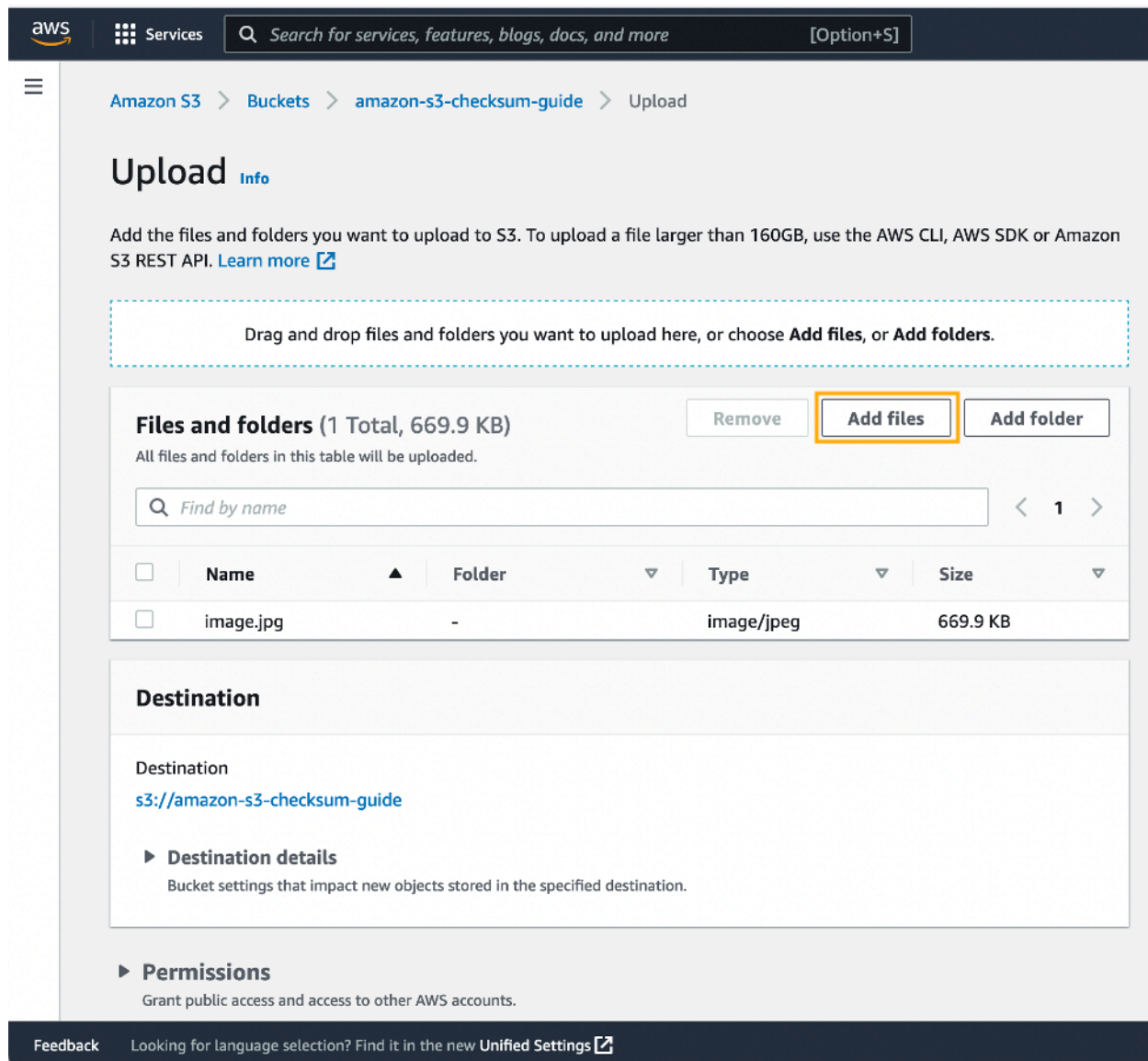
Find objects by prefix

Name	Type	Last modified	Size
No objects			
You don't have any objects in this bucket.			

[Upload](#)

## 3. Add files

Choose the **Add files** button and then select the file you would like to upload from your file browser.



aws Services Search for services, features, blogs, docs, and more [Option+S]

Amazon S3 > Buckets > amazon-s3-checksum-guide > Upload

## Upload [Info](#)

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. [Learn more](#)

Drag and drop files and folders you want to upload here, or choose **Add files**, or **Add folders**.

**Files and folders** (1 Total, 669.9 KB) Remove **Add files** Add folder

All files and folders in this table will be uploaded.

Find by name < 1 >

<input type="checkbox"/>	Name	Folder	Type	Size
<input type="checkbox"/>	image.jpg	-	image/jpeg	669.9 KB

### Destination

Destination  
[s3://amazon-s3-checksum-guide](#)

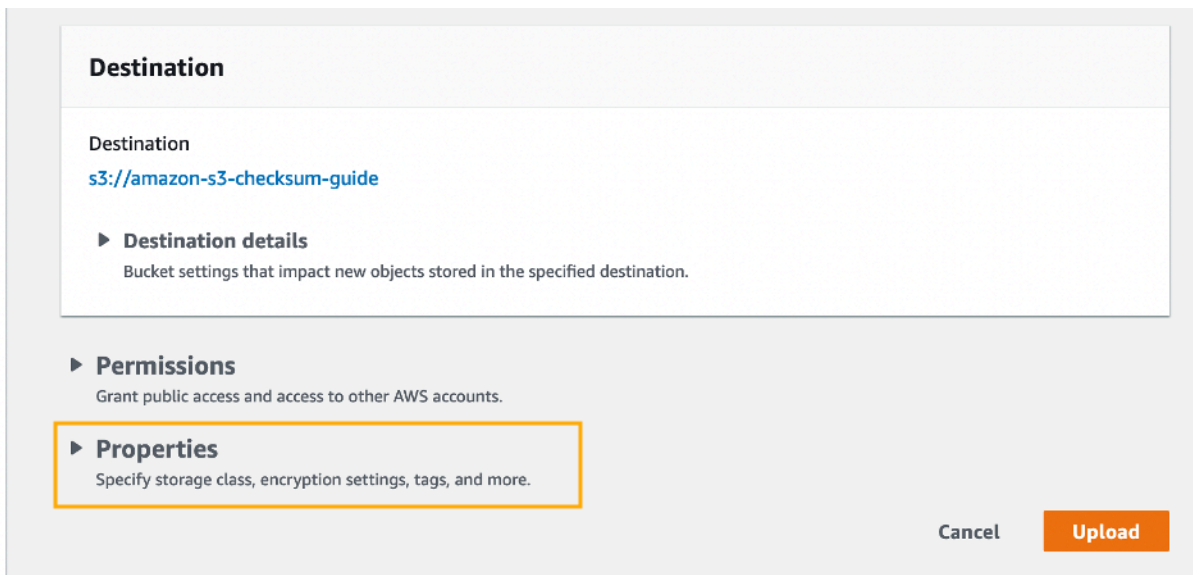
► **Destination details**  
Bucket settings that impact new objects stored in the specified destination.

► **Permissions**  
Grant public access and access to other AWS accounts.

Feedback Looking for language selection? Find it in the new [Unified Settings](#)

#### 4. Expand properties

Navigate down the page to find the **Properties** section. Then, select **Properties** and expand the section.



**Destination**

Destination  
[s3://amazon-s3-checksum-guide](#)

► **Destination details**  
Bucket settings that impact new objects stored in the specified destination.

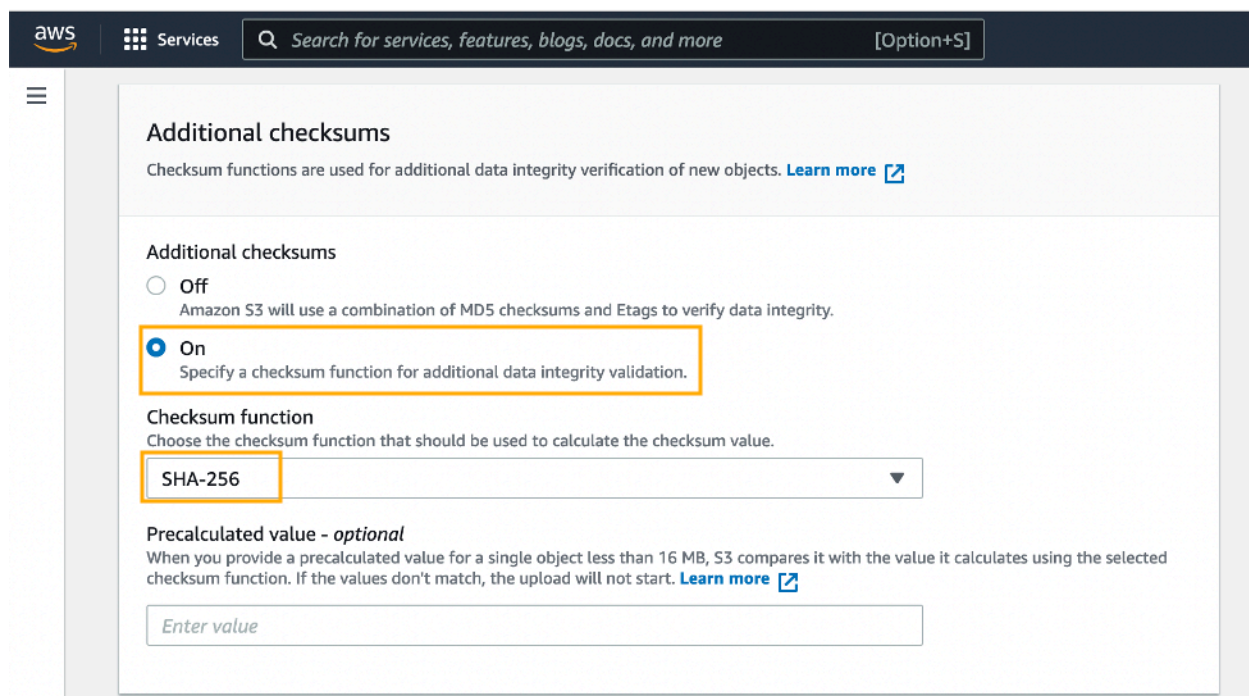
► **Permissions**  
Grant public access and access to other AWS accounts.

► **Properties**  
Specify storage class, encryption settings, tags, and more.

Cancel **Upload**

## 5. Select additional checksums

Under **Additional checksums** select the **On** option and choose **SHA-256**.



**Additional checksums**  
Checksum functions are used for additional data integrity verification of new objects. [Learn more](#)

**Additional checksums**

Off  
Amazon S3 will use a combination of MD5 checksums and Etags to verify data integrity.

On  
Specify a checksum function for additional data integrity validation.

**Checksum function**  
Choose the checksum function that should be used to calculate the checksum value.

SHA-256

**Precalculated value - optional**  
When you provide a precalculated value for a single object less than 16 MB, S3 compares it with the value it calculates using the selected checksum function. If the values don't match, the upload will not start. [Learn more](#)

Enter value

## 6. (Optional) Enter a checksum value

If your object is less than 16 MB and you have already calculated the SHA-256 checksum (base64 encoded), you can provide it in the **Precalculated value** input box. To use this functionality for objects larger than 16 MB, you can use the CLI or SDK.

When Amazon S3 receives the object, it calculates the checksum by using the algorithm specified. If the checksum values do not match, Amazon S3 generates an error and rejects the upload, as shown in the screenshot.

**Additional checksums**

Checksum functions are used for additional data integrity verification of new objects. [Learn more](#)

**Additional checksums**

Off  
Amazon S3 will use a combination of MD5 checksums and Etags to verify data integrity.

On  
Specify a checksum function for additional data integrity validation.

**Checksum function**  
Choose the checksum function that should be used to calculate the checksum value.

SHA-256

**Precalculated value - optional**  
When you provide a precalculated value for a single object less than 16 MB, S3 compares it with the value it calculates using the selected checksum function. If the values don't match, the upload will not start. [Learn more](#)

abc123

**⚠ The precalculated value you provided for this object does not match the expected checksum value for the selected checksum function. Check the value and try again or leave the field blank and S3 will calculate the checksum value.**

## 7. Upload the file

Navigate down the page and choose the **Upload** button.

**Metadata - optional**

Metadata is optional information provided as a name-value (key-value) pair. [Learn more](#)

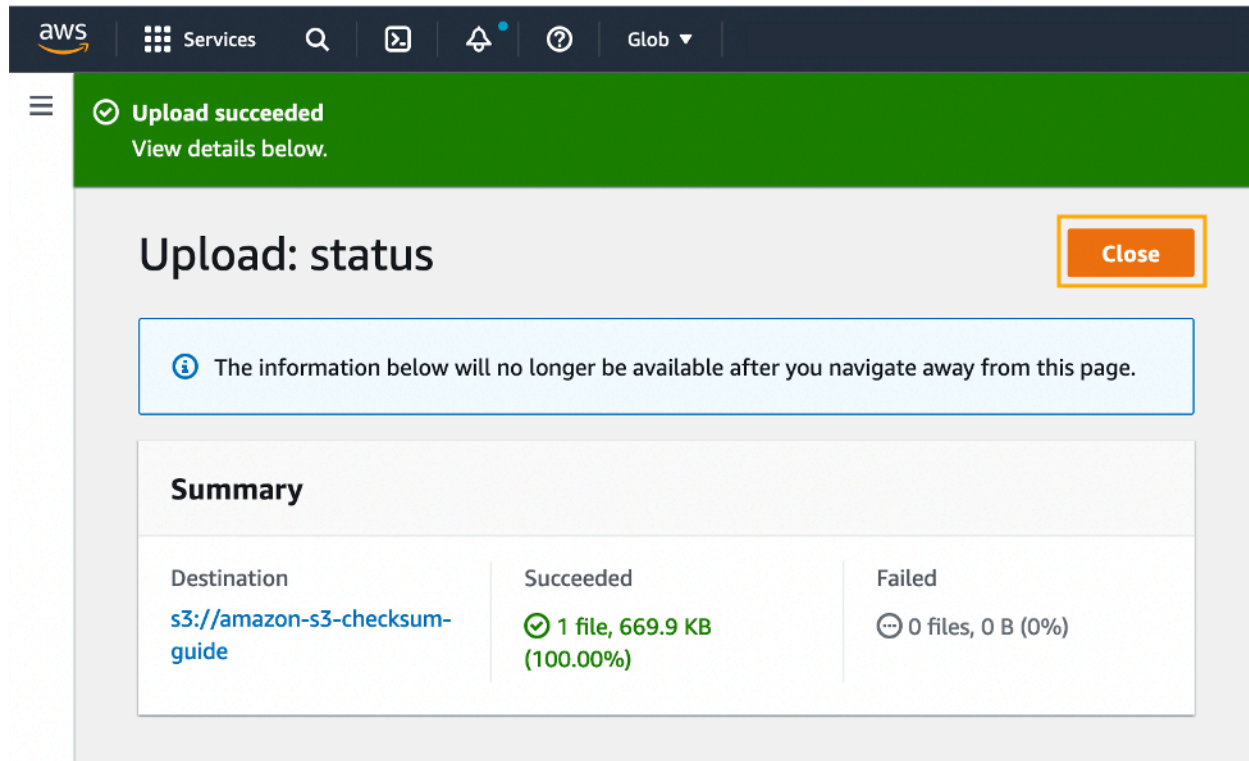
No metadata associated with this resource.

Add metadata

Cancel Upload

## 8. Complete the upload

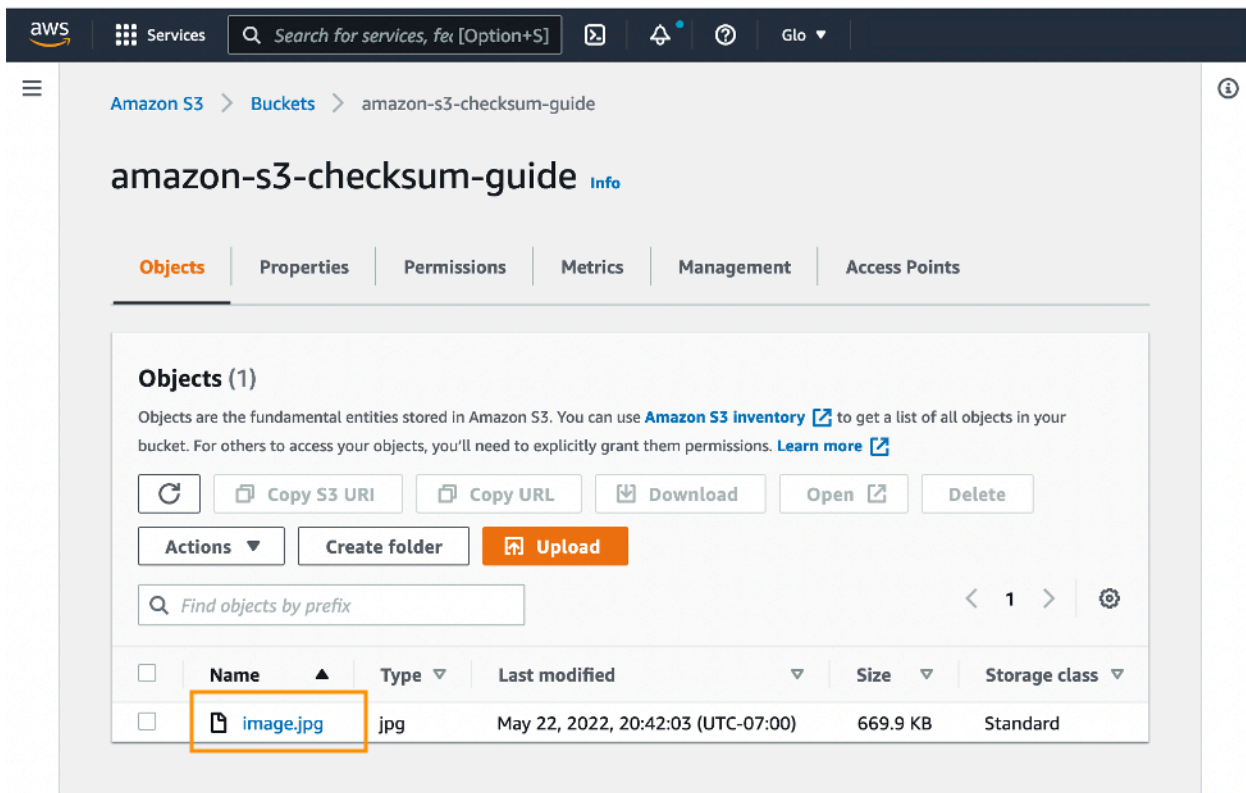
After your upload completes, choose the **Close** button.



### Step 3: Verify checksum

1. View file properties

Select the uploaded file by selecting the filename. This will take you to the **Properties** page.



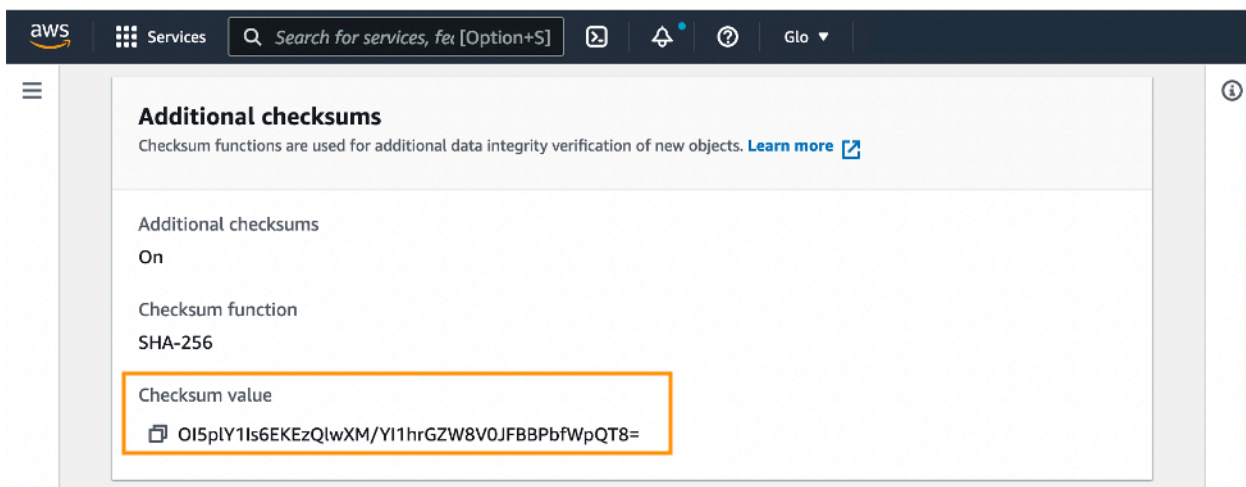
The screenshot shows the Amazon S3 console interface for a bucket named 'amazon-s3-checksum-guide'. The 'Objects' tab is selected, showing a list of objects. A single object, 'image.jpg', is listed with a type of 'jpg', a last modified date of 'May 22, 2022, 20:42:03 (UTC-07:00)', a size of '669.9 KB', and a storage class of 'Standard'. The object name 'image.jpg' is highlighted with an orange box.

Name	Type	Last modified	Size	Storage class
image.jpg	jpg	May 22, 2022, 20:42:03 (UTC-07:00)	669.9 KB	Standard

## 2. Find the checksum value

Navigate down the properties page and you will find the **Additional checksums** section.

This section displays the base64 encoded checksum that Amazon S3 calculated and verified at the time of upload.



The screenshot shows the 'Additional checksums' section in the Amazon S3 console. It displays the following information:

- Additional checksums: On
- Checksum function: SHA-256
- Checksum value: OI5pLY1Is6EKEzQlwXM/YI1hrGZW8V0JFBBPbfWpQT8=

The 'Checksum value' field is highlighted with an orange box.

## 3. Compare checksum values

To compare the object in your local computer, open a terminal window and navigate to where your file is.

Use a utility like `shasum` to calculate the file. The following command performs a sha256 calculation on the same file and converts the hex output to base64:

```
shasum -a 256 image.jpg | cut -f1 -d\ | xxd -r -p | base64
```

When comparing this value, it should match the value in the Amazon S3 console.

```
bolyanko@b0f1d8700935 Downloads %  
bolyanko@b0f1d8700935 Downloads % shasum -a 256 image.jpg | cut -f1 -d\ | xxd -r -p | base64  
OI5pLY1Is6EKEzQlwXM/YI1hrGZW8V0JFBPbfWpQT8=  
bolyanko@b0f1d8700935 Downloads %
```

## Clean up resources

In the following steps, you clean up the resources you created in this tutorial. It is a best practice to delete resources that you are no longer using so that you do not incur unintended charges.

### 1. Delete test object

If you have logged out of your AWS Management Console session, log back in. Navigate to the [S3 console](#) and select the **Buckets** menu option. First you will need to delete the test object from your test bucket.

Select the name of the bucket you have been working with for this tutorial. Put a check mark in the checkbox to the left of your test object name, then choose the **Delete** button.

On the **Delete objects** page, verify that you have selected the proper object to delete and enter **permanently delete** into the **Permanently delete objects** confirmation box.

Then, choose the **Delete object** button to continue. Next, you will be presented with a banner indicating if the deletion has been successful.

### 2. Delete test bucket

Finally, you need to delete the test bucket you have created. Return to the list of buckets in your account.

Select the radio button to the left of the bucket you created for this tutorial, and then choose the **Delete** button. Review the warning message.

If you desire to continue deletion of this bucket, enter the bucket name into the **Delete bucket** confirmation box, and choose **Delete bucket**.

## Conclusion

Congratulations! You have learned how to upload a file to Amazon S3, calculate additional checksums, and compare the checksum on Amazon S3 and your local file to verify data integrity.