AWS S3 Multipart Upload

What is S3?

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. Customers of all sizes and industries can use Amazon S3 to store and protect any amount of data for a range of use cases, such as data lakes, websites, mobile applications, backup and restore, archive, enterprise applications, IoT devices, and big data analytics. Amazon S3 provides management features so that you can optimize, organize, and configure access to your data to meet your specific business, organizational, and compliance requirements.

What is the problem with a normal upload?

The problem with a normal upload may surface when you try to upload a big-size file, then suddenly, in the middle or even just before the upload is finished, the app crashes, or the network disconnects. In that case, the upload will stop and will not save the file even if some parts of it have already been uploaded. Hence, you will have to restart the upload and lose a lot of time.
In addition, uploading large files could take a long time, while uploading smaller parts of the file could be done in parallel and thus, saving valuable time and allowing better performance.

What is multipart upload and how it works?

Multipart upload allows you to upload a single object as a set of parts. Each part is a contiguous portion of the object's data. You can upload these object parts independently and in any order. If transmission of any part fails, you can retransmit that part without affecting other parts. After all parts of your object are uploaded, Amazon S3 assembles these parts and creates the object. In general, when your object size reaches 100 MB, you should consider using multipart uploads instead of uploading the object in a single operation.

It is recommended to use multipart upload in the following ways:

- If you are uploading large objects over a stable high-bandwidth network, use multipart upload to maximize the use of your available bandwidth by uploading object parts in parallel for multi-threaded performance.
- If you're uploading over a spotty network, use multipart upload to increase resiliency to network errors by avoiding upload restarts. When using multipart upload, you need to retry uploading only the parts that are interrupted during the upload. You don't need to restart uploading your object from the beginning.

Multipart upload process

Multipart upload is a three-step process:
You initiate the upload, you upload the object parts, and after you have uploaded all the parts, you complete the multipart upload.
Upon receiving the complete multipart upload request, Amazon S3 constructs the object from the uploaded parts, and you can then access the object just as you would any other object in your bucket.

You can list all your in-progress multipart uploads or get a list of the parts you have uploaded for a specific multipart upload. Each of these operations is explained in this section.

Multipart upload initiation

This action initiates a multipart upload and returns an upload ID.
When you send a request to initiate a multipart upload, Amazon S3 returns a response with an upload ID, which is a unique identifier for your multipart upload. This upload ID is used to associate all of the parts in the specific multipart upload. You must specify this upload ID in each of your subsequent upload part requests such as uploading parts, listing the parts, completing an upload, or stopping an upload. If you want to provide any metadata describing the object being uploaded, you must provide it in the request to initiate a multipart upload.

Parts upload

When uploading a part, in addition to the upload ID, you must specify a part number. You can choose any part number between 1 and 10,000. A part number uniquely identifies a part and its position within the object being created. The part number that you choose doesn’t need to be in a consecutive sequence (for example, it can be 1, 5, and 14). If you upload a new part using the same part number as a previously uploaded part, the previously uploaded part is overwritten.

Whenever you upload a part, Amazon S3 returns an entity tag (ETag) header in its response. For each part upload, you must record the part number and the ETag value. You must include these values in the subsequent request to complete the multipart upload.

Multipart upload completion

This action completes a multipart upload by assembling previously uploaded parts.
After successfully uploading all relevant parts of an upload, you call this action to complete the upload. Upon receiving this request, Amazon S3 creates an object by concatenating the parts in

ascending order based on the part number. If any object metadata was provided in the *initiate multipart upload* request, Amazon S3 associates that metadata with the object. After a successful *complete* request, the parts no longer exist.

Your *complete multipart upload* request must include the upload ID and a list of both part numbers and corresponding ETag values. The Amazon S3 response includes an ETag that uniquely identifies the combined object data. This ETag is not necessarily an MD5 hash of the object data.

Abort Multipart Upload

This action aborts a multipart upload. After a multipart upload is aborted, no additional parts can be uploaded using that upload ID. The storage consumed by any previously uploaded parts will be freed. However, if any part uploads are currently in progress, those part uploads might or might not succeed. As a result, it might be necessary to abort a given multipart upload multiple times in order to completely free all storage consumed by all parts.

To verify that all parts have been removed, so you don't get charged for the part storage, you should call the ListParts action and ensure that the parts list is empty.

Sample multipart upload calls

For this example, assume that you are generating a multipart upload for a 100 GB file. In this case, you would have the following API calls for the entire process. There would be a total of 1002 API calls.

- A CreateMultipartUpload call to start the process.
- 1000 individual UploadPart calls, each uploading a part of 100 MB, for a total size of 100 GB.
- A CompleteMultipartUpload call to finish the process.

Multipart upload listings

You can list the parts of a specific multipart upload or all in-progress multipart uploads. The list parts operation returns the parts information that you have uploaded for a specific multipart upload. For each list parts request, Amazon S3 returns the parts information for the specified multipart upload, up to a maximum of 1,000 parts. If there are more than 1,000 parts in the multipart upload, you must send a series of list part requests to retrieve all the parts. Note that the returned list of parts doesn't include parts that haven't finished uploading. Using the list multipart uploads operation, you can obtain a list of multipart uploads that are in progres

An in-progress multipart upload is an upload that you have initiated, but have not yet completed or stopped. Each request returns at most 1,000 multipart uploads. If there are more than 1,000 multipart uploads in progress, you must send additional requests to retrieve the remaining multipart uploads. Use the returned listing only for verification. Do not use the result of this listing when sending a complete multipart upload request. Instead, maintain your own list of the part numbers that you specified when uploading parts and the corresponding ETag values that Amazon S3 returns.

For more information visit:
https://docs.aws.amazon.com/s3/index.html