# Usage Guide
## OAM REST API (OA64282)
## V3R1 and above

| | |
|---|---|
| **Document Name:** | OAM-RESTAPI-Usage-Guide-OA64282.docx |
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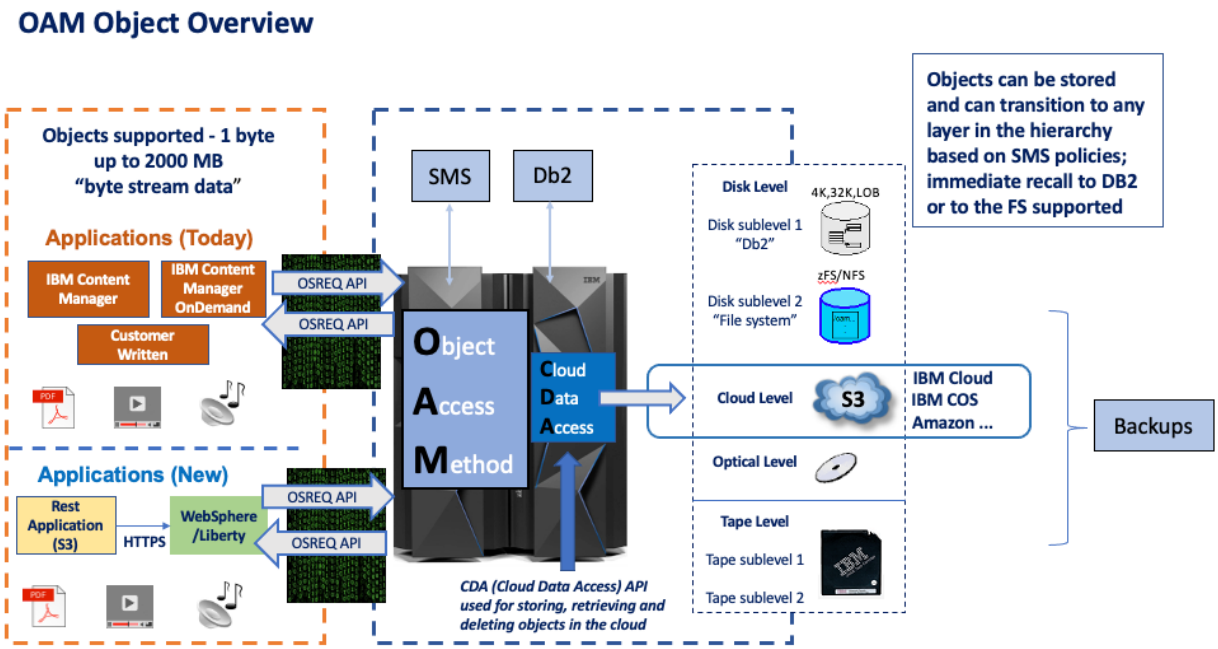
| **Version:** | V1.0 |

| Version | Date | Change Description | Revision Tag |
|---|---|---|---|
| 1.0 | 04/15/2025 | Initial version | None |

# OAM Overview

Today, OAM provides an access method (assembler interface referred to as OSREQ) for storing, retrieving, deleting, changing (management policies) and querying unstructured (object) data. An object (1- 2,048,000 bytes) is a named stream of bytes whose content, format, and structure are unknown to OAM (OAM simpy manages the data as a string of bytes). OAM manages the data associated with an object from creation to expiration using policies setup by the client through SMS. Object data managed by OAM can be stored in Db2, the file system (zFS or NFS), optical, tape and the cloud. Based on SMS policy, the object can be initially stored to any layer of the storage hierarchy and can be transition to any layer of the storage hierarchy. One or more OAM manage backup copies are also supported. With this new support, OAM is providing REST (S3) API support to manage object data.



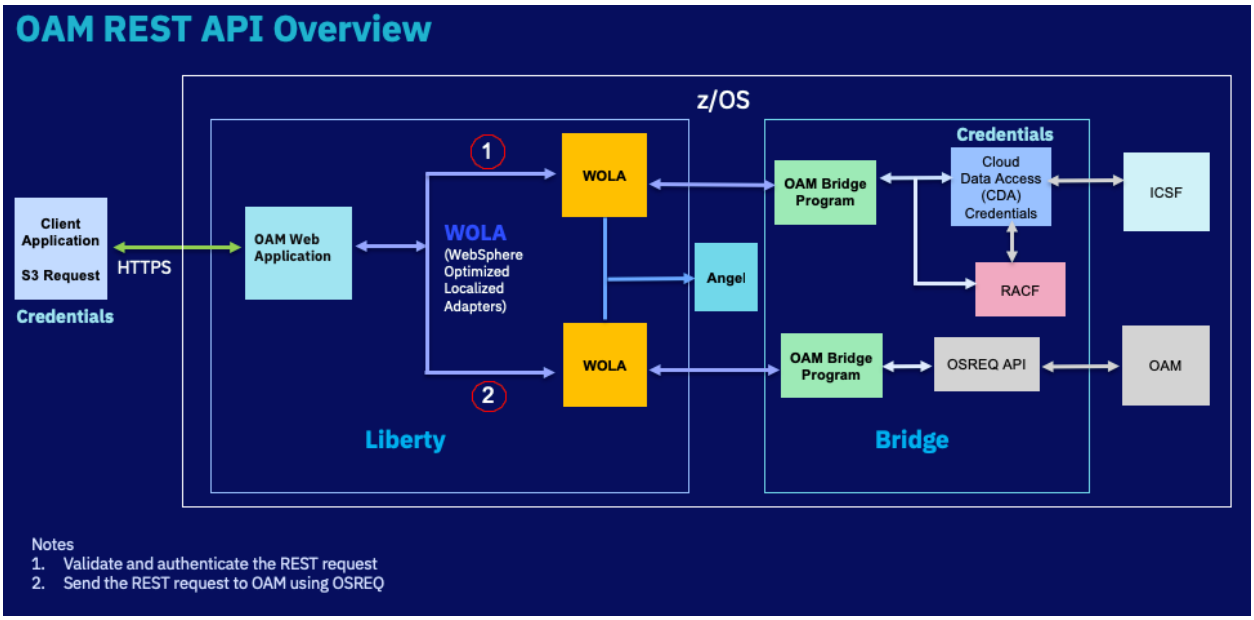
## REST Overview and Requirements

The OAM REST API support consists of two parts (both new with this support): an OAM Web Application deployed to a z/OS Liberty Server and a native OAM z/OS program (referred to as the "OAM bridge program"). Through the new support, the OAM REST (S3) API request is authenticated and then is forwarded to OAM's native OSREQ interface for processing. This document focuses on OAM's support of the following AWS S3 methods and how to build and send the HTTP requests to OAM. For installation setup, refer to the separate "Installation Guide".

S3 methods and corresponding OSREQ functions supported are:

```
PutObject:          STORE
GetObject:          RETRIEVE
DeleteObject:       DELETE
HeadObject:         QUERY
GetObjectTagging:   QUERY
PutObjectTagging:   CHANGE
```

OAM uses the z/OS WebSphere Liberty Application Server to receive the HTTP request from a client application. That HTTP request is then forwarded to an "OAM Supplied Liberty Web Application" that is running within the Liberty Server. The request is processed and forwarded to an "OAM Supplied Bridge Program" that runs as a z/OS program (as an MVS started task). The bridge program then interfaces with the traditional OAM (OSREQ) support.




An HTTP request URL may look something like the following:

**https://OAM_Liberty_Server_Web_URL/group01/group01.s001.s001**

Where "group01" is the bucket (collection name) and "group01.s001.s001" is the key (object) name.

## Usage Requirements

AWS Signature Version 4
HTTP/1.1 - Consistent with AWS S3 specifications, the OAM web application only supports HTTP protocol 1.1.

APAR OA64282 (z/OS V3R1)

Refer to “OAM-RESTAPI-Installation-Guide-OA64282” for installation-related setup and other requirements.

## Request and Response Headers

The request headers may look something like the following:

```
Method=GET
URL=https://OAM_Liberty_Server_Web_URL/group01/group01.s001.s001
Headers={'X-Amz-Date': '20230118T164059Z',
         'X-Amz-Content-SHA256':
      'e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855',
         'Authorization':
      'AWS4-HMAC-SHA256
      Credential=s3accesskey/20230118/production/s3/aws4_request,
      SignedHeaders=host;x-amz-content-sha256;x-amz-date,
      Signature=29b2f7215e9d62c28710e57ffe2e4edbdc40f7db96a80de5a0191d0783293fe0'}
```

For a pre-signed request, the signature is put in the query parameters of the HTTP request instead of the HTTP headers and may look something like the following:

```
https://OAM_Liberty_server_Web_URL/group01/group01.s001.s001?X-Amz-Algorithm=AWS4-
HMAC-SHA256&X-Amz-
Credential=s3accesskey%2F20240216%2Fproduction%2Fs3%2Faws4_request&X-Amz-
Date=20240216T162920Z&X-Amz-Expires=10&X-Amz-SignedHeaders=host&X-Amz-
Signature=315c7f3bdda8873544aceb6b8e14e7c38b97fa58978e24c3ffe74c72102fc85d
```

The response headers and body may look something like the following:

```
Headers={'Accept-Ranges': 'bytes',
         'Content-Range': 'bytes 0-10/85'
         'Content-Length': '85',
         'Content-Type': 'application/octet-stream',
         'Date': 'Mon, 15 Jul 2024 19:19:20 GMT',
         'Last-Modified': 'Mon, 15 Jul 2024 13:43:15 GMT',
         …
         'x-amz-request-id': 'ABCDEFGH12345678',
         'ibm-oam-osreq-rc':'xxxxxxxx',
         'ibm-oam-osreq-rsn':'yyyyyyyy',
         'ibm-oam-osreq-rc2':'zzzzzzzz'}
Body={<object_data>}
```

In addition to an appropriate HTTP response code being returned (noting a success or a failure), OAM will also provide an ID number that represents the request. Then if a failure occurs, the log file will be able to be searched using the Request-ID number. OAM also provides an optional liberty server property that returns the corresponding OSREQ return and reason codes:
`com.ibm.oam.restapi.osreq.codes=true`

## S3 Mapping to OSREQ

| Table 1: OSREQ function and equivalent S3 method | | |
|---|---|---|
| **OSREQ Function** | **S3 Operation** | **Notes** |
| STORE | **PutObject** – objects from 1-byte to 2000MB can be stored using a single HTTP request. Today, OSREQ provides the ability for an application to provide the object as part of a multi-part STORE (STOREBEG, STOREPRT and STOREND). Support for a multi-part store will be considered in the future. OAM will use the existing OSREQ 64-bit buffer support to then store the object (from the HTTP request) using a single OSREQ invocation. Since OAM does not allow objects to be modified once they are stored, versioning is not supported. | Custom Headers will be used for:<br>Storage Class<br>Management Class<br>Retention Period<br>Deletion Hold<br><br>Multi-part store (put) capability will not be initially provided |
| RETRIEVE | **GetObject** – objects from 1-byte to 2000MB can be retrieved using a single HTTP request. OAM will use the existing OSREQ 64-bit buffer support to then retrieve the object using a single OSREQ invocation. Partial object retrieval will also be supported to return a specified portion of the object. This would also enable an application to be able to retrieve (stream) the object in pieces. The GetObject Range parameter will be used to retrieve a portion of the object. To be consistent with existing OSREQ capabilities only a single specified range will be supported. | Custom Headers will be used for:<br>View (Primary, Backup, Backup2)<br>Recall |
| DELETE | **DeleteObject** | None |
| QUERY | **HeadObject** and **GetObjectTagging** – both will be implemented for a single object query to provide options on the format of the data returned. Today, through OSREQ there is also a wildcard capability to return information on multiple objects. With this initial support, only a single object query will be supported. In the future, a wildcard capability may be supported through **ListObject**. | Initially limited to the query of an individual object |
| CHANGE | **PutObjectTagging –** tag-set pairs will be used to support an update of the storage class, the management class, the retention period, event expiration, and a deletion hold specification | Updates specified through tag-set pairs in the request body.<br><br>Updates through the equivalent custom header will be ignored. |
| ACCESS/UNACCESS | The application will specify the DB2ID (subsystem ID or group attachment name) or an alias using the **S3 region** parameter along with a corresponding DB2ID defined as a Liberty System Property. OAM will do an explicit commit for every request but will limit the number of accesses and un-accesses so that multiple requests can be handled under a single ACCESS/UNACCESS. | None – issued by OAM<br><br>The specified region can be the actual DB2ID or an alias which has a corresponding DB2ID defined as a liberty |

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| | | system property |
| **Note:** there are several other OSREQ parameters that apply across the different functions. TTOKEN will be used by OAM when it invokes the OSREQ macro on the user's behalf and will contain "OAMREST ". Today, what is passed in the TTOKEN field is then included in the OSREQ-related SMF 85 records for reference. The OSREQ return and reason codes will be written to the "OAM Supplied Liberty Web Application" log with a corresponding request ID. The request ID will also be returned in the HTTP response headers and/or response body. An option will also be provided for those that want to see the OSREQ return and reason code returned in the response headers and/or response body. | | |

## Supported S3 Functions

In general, OAM is supporting the standard AWS S3 interface for PutObject, GetObject, DeleteObject, HeadObject, GetObjectTagging and PutObjectTagging and only those operations. Those specific operations closely match what is available today for OAM's OSREQ API functions (STORE, RETRIEVE, DELETE, QUERY and CHANGE). For the supported functions, an authorization header is required. OAM is supporting AWS Signature Version 4. The signature can be passed in the HTTP authorization headers, or it can also be passed in a pre-signed request using the HTTP query parameters. In cases where the standard AWS S3 interface did not support all of the parameters that were allowed on the OSREQ equivalent function, this is being supported through custom OAM headers. And if an AWS S3 supported parameter is specified that is not supported by OAM the parameter will be ignored. For additional information on the OSREQ parameters, refer to the OAM Application Programmer's Reference and for additional information on the AWS S3 interface refer to AWS S3 API Usage.

**Table 2 – OAM Supported AWS S3 Operations**

| S3 REST API Operation | Function | Supported Parameters | Requirements |
|---|---|---|---|
| PutObject | Stores an object (similar to OSREQ STORE function) | - Bucket (required)<br>- Key (required)<br>- Content-Length (required)<br>- Content-MD5 (optional) | Key (Object Name): The object name is a maximum of 44 characters and must conform to MVS data set naming conventions. The object name consists of 1 to 21 parts. Each part is separated from the next part by a period. Each part must start with an alphabetic, #, $, or @ character. Each part can contain 1 to 8 alphanumeric, #, *$, or* @ characters. The object name is folded to uppercase. Even though the S3 interface does not support #, $ or @ characters, OAM's REST support is allowing those characters to be specified. |

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| | | | Bucket (Collection Name) – The Bucket has the same naming restrictions as the Key (Object Name).<br><br>Content-Length - objects up to 2000MB (2000X1024X1024) are supported by OAM's REST Support.<br><br>Custom Headers will be used for:<br>ibm-oam-storage-class<br>ibm-oam-management-class<br>ibm-oam-retention-period<br>ibm-oam-deletion-hold<br>See Custom Headers for syntax requirements. |
| GetObject | Retrieves an entire object or a portion of an object (similar to OSREQ RETRIEVE function) | • Bucket (required)<br>• Key (required)<br>• Range (optional) | OAM does not support retrieving multiple ranges of data per GetObject request.<br><br>The standard HTTP Range header value will be mapped to the corresponding OSREQ values.<br><br>Custom Headers can be used for:<br>ibm-oam-explicit-recall<br>ibm-oam-object-view<br>See Custom Headers for syntax requirements. |
| DeleteObject | Deletes an object including any OAM managed backup copies (similar to OSREQ DELETE function). | • Bucket (required)<br>• Key (required) | None |
| HeadObject | Returns the meta data (response elements) for an object (similar to OSREQ QUERY function). | • Bucket (required)<br>• Key (required) | Only the request for a single object is supported. The response elements map to what is returned through the OSREQ QUERY function. |
| GetObjectTagging | Returns the meta data (tag-set pairs) for an object (similar to OSREQ QUERY function). | • Bucket (required)<br>• Key (required) | Only the request for a single object is supported. The tag-set pairs map to what is returned through the OSREQ QUERY function. |
| PutObjectTagging | Changes policy-related information for | • Bucket (required) | Supports an update of the storage class, the management class, the retention period, event |

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| | an object using tag-set pairs. | • Key (required) | expiration, and a deletion hold specification.<br><br>The following tag-set pairs can be specified in the request body:<br>ibm-oam-storage-class<br>ibm-oam-management-class<br>ibm-oam-retention-period<br>ibm-oam-deletion-hold<br>ibm-oam-event-expiration<br>See Custom Headers for syntax requirements. |
| General Notes on OAM's REST Support:<br>1. Does not support object locking, object versioning or multi-part puts.<br>2. Does not support the AWS S3 Expires parameter. Instead the expiration date is based on the ibm-oam-retention-period customer header specified on the GetObject or PutObjectTagging request, the ibm-oam-event-expiration customer header specified on the PutObjectTagging request, or on the object's management class expiration setting and rules.<br>3. Does not support the x-amz-storage-class parameter, instead the storage class can be specified along with the management class using the OAM custom headers.<br>4. Encoded and non-encoded special characters will be supported in the URL.<br>5. x-amz-tagging header will be ignored on a PutObject request and instead, custom headers are being used to specify the optional parameters.<br>6. For GetObject and HeadObject, the creation date and time for the object is returned in the Last-Modified response header; however, the returned value assumes that GMT was specified on the TIME= parameter on the IEFSSNxx PARMLIB member, and if not, and local time was used, this needs to be accounted for when using the Last-Modified date and time. Since OAM objects cannot be modified, the Last-Modified date returned is the creation date and time for the object. | | | |

## OAM Custom Headers

The following custom headers (tag-set pairs) can be used to match what is supported today through the equivalent OSREQ interface.

| | | |
|---|---|---|
| ibm-oam-storage-class<br><br>Optionally specified on a **PutObject** request using a custom header and on a **PutObjectTagging** request as a tag-set pair. | A named list of storage attributes that identifies a storage service level for a group of objects in an object storage hierarchy. | Type: String<br><br>Length: must be between 1 (min) and 8 (max) characters.<br><br>Character Set: allowed character set includes alphanumeric, $, *, @, #, and %. The starting character must be alphabetic or a $, *, @, #, or %. The name must meet the Storage Management Subsystem (SMS) naming convention standards in z/OS for a policy name. |

| | | |
|---|---|---|
| ibm-oam-management-class<br><br>Optionally specified on a **PutObject** request as a custom header and on a **PutObjectTagging** request as a tag-set pair. | A named collection of management attributes describing the retention, backup, and storage class transition characteristics for a group of objects in an object storage hierarchy. | Type: String<br>Length: must be between 1 (min) and 8 (max) characters.<br>Character Set: allowed character set includes alphanumeric, $, *, @, # and %. The starting character must be alphabetic or a $, *, @, # or %. The name must meet the Storage Management Subsystem (SMS) naming convention standards in z/OS for a policy name. |
| ibm-oam-retention-period<br><br>Optionally specified on a **PutObject** request as a custom header and on a **PutObjectTagging** request as a tag-set pair | Specifies the retention period for the object. If the RETPD parameter value exceeds the management class retention limit, the management class retention limit is used to determine the expiration date. For the special parameter value X'7FFFFFFF' (2,147,483,647) to be effective, the management class retention limit must be set to NOLIMIT. | Type – Signed Integer<br>• Not specified or 0 sets the expiration date to 0001-01-01 which indicates to use the SMS Management Class Expiration Date<br>• (-1) sets the expiration date to 0001-01-01 which indicates to use the SMS Management Class Expiration Date<br>• (-2) – sets the expiration date to 0002-02-02 and indicates to use event-based retention. Expiration Date is based on notification of an external event (PutObjetTagging).<br>• (1-93,000) – If the value specified is less than or equal to the management class retention limit, the expiration date is set to the sum of the object create date + the retention value. Otherwise, the expiration date is set to the creation date plus the management class retention limit.<br>• (2,147,438,647) – sets the expiration date to 9999-12-31 if the |

| | | |
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| | | management class retention limit is NOLIMIT otherwise, the management class retention limit is used to determine the expiration date. |
| ibm-oam-deletion-hold<br><br>Optionally specified on a **PutObject** request as a custom header and on a **PutObjectTagging** request as a tag-set pair. | Indicates whether or not a deletion-hold should be put on the object. If a hold is specified, NOHOLD can be specified to release the HOLD. | Type: String<br>Valid values are HOLD or NOHOLD with the default being NOHOLD if the custom header is not specified. |
| ibm-oam-event-expiration<br><br>Optionally specified on a **PutObjectTagging** request as a tag-set pair | Provides a way for the application to inform OAM that an external event has occurred for an object currently in event-based-retention mode. | Type: Integer<br>Value: must be between 0 and 93,000<br>The expiration date is set to the earlier of the following two dates:<br>1. the creation date of the object plus the object's management class retention limit<br>2. today's date + the event expiration value. |
| ibm-oam-explicit-recall<br><br>Optionally specified on a **GetObject** request as a custom header. | Specifies that a temporary copy of the object being retrieved is to be written to disk sublevel 1 (Db2) or disk sublevel 2 (file system) and retained there for the specified number of days. | Type: Integer<br>Values: must be between 0 and 255 |
| ibm-oam-object-view<br><br>Optionally specified on a **GetObject** request as a custom header | Specifies which copy of an object is obtained during a GetObject request. | Type: String<br>Valid values are PRIMARY, BACKUP or BACKUP2. PRIMARY is the default. |

## HeadObject Request

Using the HeadObject function, the following information will be returned for the object (returns the fields mapped in CBRIQEL for an OSREQ QUERY request):

- The object (key) name - (ibm-oam-object-name)
- The assigned collection (bucket) name - (ibm-oam-collection-name)
- The estimated retrieval response rate - (ibm-oam-estimated-retrieve-time)
- The storage location in which the primary object resides - (ibm-oam-primary-location)
- The assigned management class - (ibm-oam-management-class)
- The assigned storage class - (ibm-oam-storage-class)
- The object length – (ibm-oam-object-size) and also in the content-length field
- The creation date (yyyy-mm-dd) – (ibm-oam-creation-date)
- The creation time (hh.mm.ss.nnnnnn) – (ibm-oam-creation-time)
- The expiration date (yyyy-mm-dd) – (ibm-oam-expiration-date)
- The last reference date (yyyy-mm-dd) – (ibm-oam-last-referenced-date)
- The primary retrieval order key (volser followed by sector or block id) – (ibm-oam-primary-retrieve-key)
- The backup retrieval order key (volser followed by sector or block id) – (ibm-oam-backup-retrieve-key)
- The second backup retrieval order key (volser followed by sector or block id) – (ibm-oam-backup2-retrieve-key)
- The pending action date (yyyy-mm-dd) – (ibm-oam-pending-action-date)
- The retention date (yyyy-mm-dd) – (ibm-oam-retention-protect-date)
- The object status flags – (ibm-oam-status-flags)
- The object deletion protection indicator – (ibm-oam-deletion-protected)
- The storage location in which the backup copy resides – (ibm-oam-backup-location)
- The storage location in which the second backup copy resides - (ibm-oam-backup2-location)

Below is an example of a subset of a response header:

```
Headers={'Date': 'Mon, 15 Jul 2024 19:19:20 GMT',
         'Content-Type': 'application/octet-stream',
         'Accept-Ranges': 'bytes',
         'Content-Length': '100',
         'Last-Modified': 'Mon, 18 Jul 2023 13:43:15 GMT',
         'x-amz-request-Id': 'ABCDEFGH12345678',
         'ibm-oam-osreq-rc': '00000000',
         'ibm-oam-osreq-rsn': '00000000',
         'ibm-oam-osreq-rc2': '00000000',
         'ibm-oam-object-name': 'OAM.OBJECT1',
         'ibm-oam-collection-name': 'OAM.SGROUP1',
         'ibm-oam-estimated-retrieve-time': '300',
         'ibm-oam-primary-location': 'D',
         'ibm-oam-management-class': 'MCD01',
         'ibm-oam-storage-class': 'DB2DASD','
         'ibm-oam-object-size': '100',
         'ibm-oam-creation-date': '2024-04-23',
         'ibm-oam-creation-time': '09.07.17.123123',
         'ibm-oam-expiration-date': '2030-04-23',
 …}
```

**Note** - the size of the object is returned in content-length and also in the ibm-oam-object-size response header. The creation date (ibm-oam-creation-date) and time (ibm-oam-creation-time)

is also returned in the response header Last-Modified field. As an example: `Last-Modified: Tue, 13 Feb 2024 10:53:48 GMT`. Last-Modified will match the OSREQ date and time in GMT format. If the date and time stored by OSREQ is in local time, the application receiving this data will need to do the appropriate conversion. The Last-Modified header will also be returned for GetObject and GetObjectTagging (in a new tag-set pair).

## GetObjectTagging

The following information will be returned for the object (returns the fields mapped in CBRIQEL for an OSREQ QUERY request):

Refer to **Error! Reference source not found.** for the tag elements that will be returned along with their associated value. The returned data will look similar in format to PutObjectTagging. The object length will only be returned in tag element ibm-oam-object-size and not in the content-length field.

https://server.com/bucket/object-name?tagging

## PutObjectTagging

Today, the policies associated with an object can be updated using the **OSREQ CHANGE** function. With the REST support, PutObjectTagging can be used to update the same associated policies. One or more tag pairs can be specified on the request.

https://server.com/bucket/object-name?tagging

```
<?xml version="1.0" encoding="UTF-8"?>
<Tagging>
   <TagSet>
      <Tag>
         <Key>string</Key>
         <Value>string</Value>
      </Tag>
      <Tag>
         <Key>string</Key>
         <Value>string</Value>
      </Tag>
   </TagSet>
</Tagging>
```

Valid Tag elements for PutObjectTagging are as follows with their allowed abbreviations:

- ibm-oam-management-class (ibm-oam-mc) – for the management class name (an 8-character name can be specified)
- ibm-oam-storage-class (ibm-oam-sc) – for the storage class name (an 8-character name can be specified)
- ibm-oam-deletion-hold (ibm-oam-dh) – for the deletion hold setting (valid values are NOHOLD or HOLD)
- ibm-oam-event-expiration (ibm-oam-eex) – for the event-based expiration date (valid values are 0 to 93000)
- ibm-oam-retention-period (ibm-oam-rp) – refer to the ibm-oam-retention-period custom header for the values that can be specified.

## STGADMIN Facility Class

With the native OSREQ support, a security exit (CBRUXSAE) is used to verify if the user has access to specific OSREQ functions. This security exit will continue to be used with the new OAM REST support

since ultimately the OSREQ interface is used to send the request to OAM. Before sending the REST request to OAM (through OSREQ), RACF (or an equivalent security product) will be used to verify if the user is authorized to the REST function being requested.

To control the ability to perform functions associated with storage management (including the new OAM REST support), profiles in the FACILITY class or XFACILIT class are defined whose profile names begin with STGADMIN (storage administration). Users must have read access to the specific profile in order to use the protected functions. The following profiles will be used with OAM's REST support:

- STGADMIN.CBR.RESTAPI.STORE (to store an object - PUT)
- STGADMIN.CBR.RESTAPI.RETRIEVE (to retrieve an object - GET)
- STGADMIN.CBR.RESTAPI.DELETE (to delete an object - DELETE)
- STGADMIN.CBR.RESTAPI.QUERY (to query an object – HeadObject and GetObjectTagging )
- STGADMIN.CBR.RESTAPI.CHANGE (to change policies associated with an object – Put Object Tagging)

## Security Exit (CBRUXSAE)

For a REST request, when the OAM bridge program invokes RACF, the USERID associated with the client provided credentials stored in the cloud data access (CDA) component of DFSMS will be used. If the USERID is given permission to the requested function, the corresponding OSREQ function will be invoked which will result in the existing security exit (CBRUXSAE) being invoked. With OAM's invocation of the OSREQ API, the USERID passed will be the USERID associated with the OAM bridge program. Clients using REST can then check for that unique USERID (in CBRUXSAE) when allowing the OSREQ request to continue.

## OAM Bridge Program

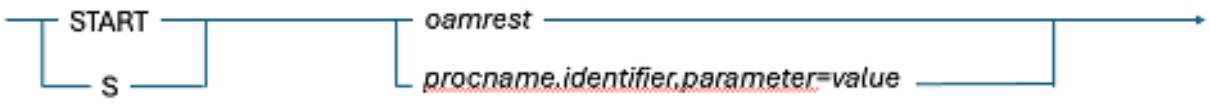
The CBRWPROC sample is used to the OAMREST started procedure. In a multiple OAM configuration, it is recommended that a naming convention be established to distinguish one OAMREST address space from another using a prefix of "OAMREST" and a lettered suffix (OAMRESTA, OAMRESTB, etc.). This is similar to the recommendations for the OAM address space (OAMA, OAMB, etc.) in a multiple OAM configuration.

With a single OAM (classic) configuration, there could also be the need to support multiple Liberty Servers to balance the workload. In that case, OAMREST1, OAMREST2, etc. could be used to differentiate which OAMREST address space on which Liberty Server. And if running in a multiple OAM configuration, the naming convention could be (OAMR1A, OAMR2A, etc., OAMR1B, OAMR2B, etc.) to incorporate not only multiple OAM instances, but also multiple Liberty Servers within an OAM instance. The names above are suggested and up to the user.

**Note:** by needing to establish the Db2 SSID associated with an OAM Bridge Program, each OAM Bridge Program (OAMREST/CBRWOLA) can only be associated with a single Db2 SSID and a single OAM instance.

## MVS Operator commands

**To start the OAM bridge program** – S *OAMREST*




Note - **parameter=*value*** *is optionally* used to initialize or override what is defined through the started procedure.

The following messages will be issued when the address space is started:

CBR8801I *OAMREST* Initialization starting.

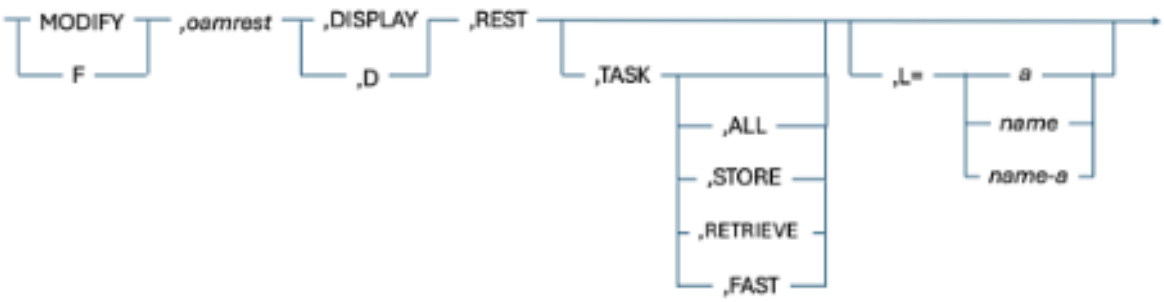
CBR8802I *OAMREST* started with G1=xxxxxxxx,G2=yyyyyyyy,G3=zzzzzzzz,RN=aaaabbbbcccc, DS=dddd.

CBR8803I *OAMREST* initialization completed.

**To stop the OAM bridge program** – P *OAMREST* or F *OAMREST*,STOP

**To cancel the OAM bridge program** – C *OAMREST* (used if a stop does not work)

**To display the OAM bridge program information including task related information -**




The following can be issued to display status information associated with an instance of the OAM Bridge Program (OAMREST):

```
MODIFY oamrest-taskid,DISPLAY,REST

CBR8830I oamrest-taskid status:
Started Procedure Parameters:
WolaGroup (G1):     aaaaaaaa
WolaName2 (G2):     bbbbbbbb
WolaName3 (G3):     cccccccc
RegisterName (RN):  ddddddddddd
Db2SSID (DS):       eeee
```

The following can be issued to display task summary information associated with the OAM Bridge Program (OAMREST) for the STORE, RETRIEVE and FAST task types.

```
MODIFY oamrest-taskid,DISPLAY,REST,TASK

CBR8840I oamrest-taskid task summary:
Tasktype  Activetask#    Totaltask#    WorkQRequest#
tsktype1          aaa           bbb             ccc
tsktype2          aaa           bbb             ccc
tsktype3          aaa           bbb             ccc
```

The following can be issued to display detailed task information associated with the OAM Bridge Program (OAMREST) for the specified task type {ALL|STORE|RETRIEVE|FAST}.

```
MODIFY oamrest-taskid,DISPLAY,REST,TASK,{ALL|STORE|RETRIEVE|FAST}

CBR8845I oamrest-taskid task detail:
Task type: [ALL|STORE|RETRIEVE|FAST]
Taskname  Taskaddr  Active  Duration
tskname1  tskaddr1    a     bbbbbbbb
tskname2  tskaddr2    a     bbbbbbbb
```

**To cancel a task** – F OAMREST,CANCEL,TASK,*taskname* (refer to command above for *taskname*)

The following WTOR is issued to confirm the cancel request

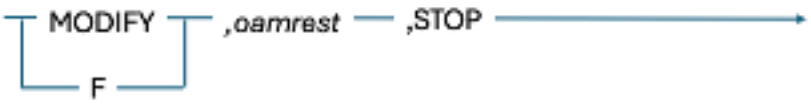
CBR1315D Task cancel requested for *oamrest-taskid* task *taskname* at address *tcbaddr*. Reply “U” to continue, “C” to cancel.

After the task is successfully cancelled, the following message is issued:

CBR1317I *oamrest-taskid* task *taskname* at address *tcbaddr* has been canceled.

**To stop the OAM bridge program**


OR




## OAM Web Application

The OAM Web Application will verify that the AWS S3 REST request is one of the OAM supported operations (PutObject, GetObject, DeleteObject, HeadObject, GetObjectTagging, PutObjectTagging) and if not, the HTTP response code will be 405 (Method Not Implemented). The OAM Web Application will only look for OAM specified custom headers that are applicable for the request type and will ignore any OAM specified headers that are not applicable. In general, the OAM Web application will return an HTTP response code that is appropriate for the failure and that is already supported by the AWS S3 interface for a similar failure. For example, if an object being retrieved does not exist an HTTP 404 (Not Found) response code will be returned, If there is not an appropriate HTTP response code, for the more specific OAM-related failures, then HTTP 500 (Internal Server Error) will be returned and from the error log, the OSREQ return and reason code will be available.

# OAM SMF 85

For a description of the existing OAM SMF 85 record and subtypes, refer to the OAM Planning, Installation, and Storage Administration Guide for Object Support.

## Subtypes 1-7

Existing subtypes (1-7) will continue to be generated with the REST support. Since OAM will be the one invoking the OSREQ interface, the existing TTOKEN (ST1TTOK) field will contain "OAMREST" in the first 7-bytes of the 16-byte field (padded with blanks). Subtypes (8-10) for a multi-part store are not currently supported with REST and will not be generated with the new support.

# Java Message Service (JMS)

The OAM Web application will (optionally) support notification of a REST request (success and/or failure) using the Java Message Service (JMS). The same queue or a different queue can be used for each requested function (store, retrieve, delete, query, and change). Refer to the "Installation Guide" for configuration guidance on the message service.

# Diagnostic Guidance

## Dumps

It's expected that If a dump needs to be taken of the OAM Bridge Program (OAMREST/CBRWOLA), in addition to a stand-alone dump, the F OAM,DUMP command can also be used specifying the ASID of the bridge program.

## Log Entries

By default, the log level will be set to the Liberty default "Info". This will capture Info, Audit, Warning and Error messages. As needed this level can be changed to the finest (debug) level to include more detailed tracing.

## Info Log Entries

Configuration entries will be created in the liberty server directory (/logs/messages.log) to capture configuration-related information when the OAM Web Application is started.

## Audit (Security) Log Entries

An audit entry will be created in the liberty server directory (/logs/messages.log) for each REST request. The audit entry will contain information, such as: a timestamp, the request ID, the function requested, whether the requestor was authorized, the public access key, the user id, the bucket (collection name), the keyname (object name), the region (which can be used as a Db2ssid alias) and the db2ssid. Following is a sample entry:

```
[2/27/24, 16:23:05:106 GMT] 00000023 com.ibm.oam.restapi.SecurityLog
A {"time":"2024-02-27T16:23:05.106Z",
   ”requestid”:”LFX38VJSQ9RL2CFG",
   “httpmethod”:”DELETE”,
   "authorized":true,
   "presigned":true,
   "accesskey":"s3accesskey",
   "user":"IBMUSER",
   "bucket":"group01",
   "objectkey":"group01.s001.s001",
   "region":"production",
   "db2ssid":"dbb1"}
```

## Warning Log Entries

A warning entry will be created when the request is considered successful; however, there is additional information to share. Either the request was only partially completed with an OSREQ RC=4, or for a store or a retrieve request that completed successfully (OSREQ RC=0), additional function that had been requested (implicitly or explicitly), ran into an issue. In both cases, a warning log entry will be created in the liberty server directory (/logs/messages.log) when a REST request, receives an OSREQ RC=4 (indicating partial completion) or when it receives an OSREQ RC=0 (indicating a success), yet there is additional information to share (RC2 is greater than 4).

## Error (Severe) Log Entries

An error log entry will automatically be created in the liberty server directory (/logs/messages.log) for a failed REST request. The error log entry includes the request ID and specifics about the failure. Below is an example of an entry that is created due to an issue with the S3Headers.

```
[3/15/23, 15:42:22:893 GMT] 00000022 com.ibm.oam.restapi.S3Headers
E OAMREST MNJI56NMW5ZR5AH9: Authorization header is not valid.
```

If the request was processed and sent to OAM (through OSREQ), below is an example of an entry showing the OSREQ return and reason code:

```
[3/15/23, 15:39:39:814 GMT] 00000021 com.ibm.oam.restapi.OamResponse
E OAMREST 00X67P8LRZ4YE8AR: OSREQ (OAM) RC = 00000008, RSN = 2C040100
```

## Debug (finest) Log Entries

Debug (Finest) log tracing is also being provided in the liberty server directory (/logs/trace.log) in case there is an issue where further diagnostic data needs to be captured. The debug entries follow the flow of an OAM REST request and includes the request ID and other pertinent information. Below is an example that shows a small portion of the log entries from an OAM REST retrieve request:

```
[3/15/23, 15:39:39:808 GMT] 00000021 com.ibm.oam.restapi.OamRequest
3 OAMREST 00X67P8LRZ4YE8AR: Creating OamRequest with type: RE, collection:
group01, object: group01.s001.s001

[3/15/23, 15:39:39:809 GMT] 00000021 com.ibm.oam.restapi.OamRequest
3 OAMREST 00X67P8LRZ4YE8AR: Building the OAM inputStream.

[3/15/23, 15:39:39:809 GMT] 00000021 com.ibm.oam.restapi.OamRequest
3 OAMREST 00X67P8LRZ4YE8AR: Completed the OAM inputStream.

[3/15/23, 15:39:39:809 GMT] 00000021  com.ibm.oam.restapi.OamRequest
3 OAMREST 00X67P8LRZ4YE8AR: OamRequest initialized.

[3/15/23, 15:39:39:809 GMT] 00000021  com.ibm.oam.restapi.OamRequest
3 OAMREST 00X67P8LRZ4YE8AR: Writing retrieve data to the OAM inputStream with
range: false, start: 0, end: 0

[3/15/23, 15:39:39:809 GMT] 00000021 com.ibm.oam.restapi.WolaRequest
3 OAMREST 00X67P8LRZ4YE8AR: Executing WOLA request.
```

When the logging is set to the lowest level (Finest), info, audit, warning, and error log entries are also in the (/logs/trace.log) file.

## Enabling and Disabling the Log Entries

In the Liberty Server XML file, the following statement can be used to disable all logging in OAM:
<logging traceSpecification="com.ibm.oam.*=off"/>

As indicated above, by default, log entries will be captured at the INFO level unless another log level is specified. The info level captures INFO, AUDIT, WARNING, and SEVERE (ERROR) entries.

To enable a particular log type, "OFF" can be replaced with "INFO" (the default), "AUDIT", "WARNING", "SEVERE" (for errors), or "FINEST" (for debug). When set to "FINEST" everything above that level is captured which would include INFO, AUDIT, WARNING and SEVERE log entries. The log levels used by OAM, from highest to lowest are:

Severe (Error)
Warning
Audit
Info
Finest (Debug)

When a particular log type level is set, the levels higher than that level are also included. "ALL" can also be set and would include any log type level.

# Messages

## Existing Messages

**********

**CBR1315D Task cancel requested for** {*oam-taskid* | *oamrest-taskid*} **task *taskname* at address *tcbaddr*. Reply "U" to continue, "C" to cancel.**

**Explanation:** The operator has entered a command of the form:

MODIFY {*oam-taskid* | *oamrest-taskid*},CANCEL,TASK,*taskname*

This message is issued to confirm that the task *taskname* in OAM address space *oam-taskid* or in the OAM Bridge Program *oamrest-taskid* at address *tcbaddr* is to be canceled.

**…** **…**
**********

**CBR1316I** {*oam-taskid* | *oamrest-taskid*} **task *taskname* at address *tcbaddr* cancel unsuccessful. CALLRTM macro return code = *rtncode*.**

**Explanation:** Task cancellation request has been issued to cancel task taskname in OAM address space oam or in OAM Bridge Program *oamrest* at address *tcbaddr*.

… …
**********

**CBR1317I** {o*am-taskid* | *oamrest-taskid*} **task *taskname* at address *tcbaddr* has been canceled.**

**Explanation:** Task cancellation request has been issued to cancel task *taskname* in OAM address space **oam** or in OAM Bridge Program *oamrest* at address *tcbaddr.* The cancellation is successful, and the task has been cancelled.

… …
**********

**CBR1318I Task name *taskname* is not a valid** {cloud | OAMREST} **task name.**

**Explanation:** Task cancellation request has been issued to cancel {cloud | OAMREST} task name *taskname.* The task name *taskname* is not a valid task name. The task cancellation request is rejected. Note: The task cancel command is currently only applicable to the cancel of a cloud task or of a task associated with the REST API support.
… …

## New Messages

**********

**CBR8801I *oamrest-taskid* Initialization starting.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* control task has received control. *oamrest-taskid* is the task identifier (provided on the START command for the procedure) or the procedure name if no task identifier is provided.
**System action:** OAMREST *oamrest-taskid* processing continues.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8802I *oamrest-taskid* started with G1=*xxxxxxxx*,G2=*yyyyyyyy*,G3=*zzzzzzzz*,RN=*aaaabbbbcccc*,DS=*dddd*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* address space was started with the parameters specified in the started procedure JCL member (CBRWPROC) or that were specified on the start command. *oamrest-taskid* is the task identifier (provided on the START command for the procedure) or the procedure name if no task identifier is provided. The values displayed with associated parameters are as follows:
*xxxxxxxx*
8-byte group name, the first part of the three-part WebSphere Optimized Local Adapters (WOLA) group (wolaGroup). Specified on the OAMREST started procedure or the start command as G1.
yyyyyyyy
8-byte group name, the second part of the three-part WebSphere Optimized Local Adapters (WOLA) group (wolaName2). Specified on the OAMREST started procedure or the start command as G2.
*zzzzzzzz*
8-byte group name, the third part of the three-part WebSphere Optimized Local Adapters (WOLA) group (wolaName3). Specified on the OAMREST started procedure or the start command as G3.
*aaaabbbbcccc*
12-byte RegisterName name from the from the “oam/ola” connectionFactory configuration used by the OAMREST started procedure to connect to the Liberty server running the corresponding OAM REST API application. Specified on the OAMREST started procedure or the start command as RN.
*dddd*
4-byte Db2 SSID that connects to a Db2 Subsystem running the corresponding OAM REST application This value must match the Db2 SSID derived from the S3 region name specified on the REST request. Specified on the OAMREST started procedure or the start command as DS.
**System action:** OAMREST *oamrest-taskid* processing continues.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8803I *oamrest-taskid* initialization completed.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* control task has successfully completed initialization. *oamrest-taskid* is the task identifier (provided on the START command for the procedure) or the procedure name if no task identifier is provided.
**System action:** OAMREST *oamrest-taskid* processing continues.
**Source:** Object Access Method (OAM)

**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8809I *oamrest-taskid* termination completed.**
**Explanation:** The OAM Bridge Program OAMREST oamrest-taskid address space has stopped and has returned control to the MVS operating system*. oamrest-taskid* is the task identifier (provided on the START command for the procedure) or the procedure name if no task identifier is provided.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8811I *oamrest-taskid* subtask *task-name* failed to establish a recovery environment, failing return code=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* subtask task-name attempted to establish a recovery environment and failed with ESTAEX return code=return-code.
**System action:**
If OAMREST initialization has not yet completed*, oamrest-taskid* initialization stops.
If OAMREST initialization has completed and the subtask is the operator command task or the request receive task, the *oamrest-taskid* address space stops.
If OAMREST initialization has completed and the subtask is a request process task, only this single subtask stops.
**Operator response:** Notify the system programmer.
**System programmer response:** For additional information on return codes from the ESTAEX macro, see *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG.*
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8812I Invalid value specified with {G1= | G2= | G3= | RN= | DS=} keyword. Parameters specified = *parms*. *oamrest-taskid* initialization terminated.**
**Explanation:** The G1=, G2=, G3=, RN=, or DS= startup keyword was specified in the started procedure JCL member (CBRWPROC) or was specified on the start command used to start the OAMREST address space *oamrest-taskid*. The group and register names are used to connect the OAM Bridge Program (OAMREST) to the Liberty server running the corresponding OAM REST API application. The Db2 SSID is used to connect the OAM Bridge Program (OAMREST) to a Db2 Subsystem running the corresponding OAM REST API application. An invalid value, or no value, was specified following the startup parameters *parms*. The values associated with the start parameters are as follows:
G1=*xxxxxxxx*
*xxxxxxxx* must be the (1-8) character WebSphere Optimized Local Adapters (WOLA) group (wolaGroup) name.
G2=*yyyyyyy*
*yyyyyyyy* must be the (1-8) character WebSphere Optimized Local Adapters (WOLA) group (wolaName2) name.
G3=*zzzzzzzz*
*zzzzzzzz* must be the (1-8) character WebSphere Optimized Local Adapters (WOLA) group (wolaGroup3) name.
RN=*aaaabbbbcccc*
*aaaabbbbcccc* must be the (1-12) character RegisterName from the “oam/ola” connectionFactory configuration.

DS=*dddd*
*dddd* must be the (1-4) character Db2 SSID derived from the S3 region name specified on the REST request.
**System action:** OAMREST *oamrest-taskid* initialization stops.
**Operator response:** Contact the system programmer.
**System programmer response:** Update the keyword value in the started procedure JCL EXEC statement in the PROC or on the start command used to start OAMREST *oamrest-taskid*.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8813I GETMAIN error for the *oamrest-taskid* control block control-block in module module-name, failing return code=*return-code*.**
**Explanation:** OAMREST control task *oamrest-taskid*, module module-name, received a GETMAIN failure with return code=*return-code* for control block *control-block*.
**System action:**
If OAMREST initialization has not yet completed, the initialization stops.
If OAMREST initialization has completed, only the creation of that control block is affected.
**Operator response:** Notify the system programmer.
**System programmer response:** For additional information on return codes from the GETMAIN macro, see *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8814I Error obtaining a 64-bit virtual storage buffer, failing RC=*return-code*, RSN=*reason-code* in *oamrest-taskid*.**
**Explanation:** OAMREST control task *oamrest-taskid* issued IARV64 to obtain a 64-bit virtual storage buffer to start a new process request subtask and failed with RC=*return-code*, RSN=*reason-code*.
**System action:**
If OAMREST initialization has not yet completed, the initialization stops.
If OAMREST initialization has completed, only the new process request subtask will not be started.
Operator response: Notify the system programmer.
System programmer response: For additional information on return codes and reason codes from the IARV64 macro, see *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*.
**Source:** Object Access Method (OAM)
Routing Code: 2
**Descriptor Code:** 4

**********

**CBR8815I *oamrest-taskid* failed to load module *module-name*, failing return code=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* was unable to load module *module-name,* failing return code=*return-code*.
**System action:** OAMREST *oamrest-taskid* initialization stops.
**Operator response:** Notify the system programmer.
**System programmer response:** Verify that the module has been placed in an accessible library (ELPA, LPA, LINKLST). For additional information on return codes from the LOAD macro, see *z/OS MVS Programming: Assembler Services Reference IAR-XCT*.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8816I *oamrest-taskid* failed to identify entry name *entry-name* to the load module, failing return code=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* attempted to add an *entry-name* for a subtask to the load module via an IDENTIFY macro and failed with return code=*return-code*.
**System action:** OAMREST *oamrest-taskid* initialization stops.
**Operator response:** Notify the system programmer.
**System programmer response:** For additional information on return codes from the IDENTIFY macro, see *z/OS MVS Programming: Assembler Services Reference IAR-XCT*.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8817I *oamrest-taskid* failed to attach subtask *task-name*, failing return code=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* attempted to attach subtask *task-name* via an ATTACHX macro and failed with return code=*return-code*.
**System action:**
If OAMREST initialization has not yet completed, *oamrest-taskid* initialization stops.
If OAMREST initialization has completed and the subtask is the operator command task, the request receive task, or is re-attaching a subtask due to an unexpected termination, the *oamrest-taskid* address space is stopped.
If OAMREST initialization has completed and the subtask is the request process task, in re-attaching of an unexpected subtask termination or in attaching an additional subtask, only this single subtask stops.
**Operator response:** Notify the system programmer.
**System programmer response:** For additional information on return codes from the ATTACHX macro, see *z/OS MVS Programming: Authorized Assembler Services Reference ALE-DYN*.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8818I *oamrest-taskid* unexpected task termination for subtask task-*name.***
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid*, subtask *task-name* ended prematurely.
If this message is for a request receive task, the subtask *task-name* is in the format of 'OREC__x', where x is the request type with one of the following values:

- 'S' for store type
- 'R' for retrieve type
- 'F' for fast type

If this message is for a request process task, the subtask task-name is in the format of 'ORPTxnnn', where x is the request type and nnn is a non-zero value used for the request process task ID.
**System action**
When the terminated task is the operator command task or the request receive task, OAMREST creates a new operator command task or request receive task to handle the related process.
When the terminated task is one of the request process tasks identified by the task ID, OAMREST creates a new request process task with the same task ID.
**Operator response:** Notify the system programmer.
**System programmer response:** Notify the service representative. If the problem recurs and if the program is not in error, search problem reporting databases for a fix for the problem. If no fix exists, contact the IBM Support Center. Format the SVC dump with the interactive problem control system (IPCS).

**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8819I WOLA API *API-name* call failed in *oamrest-taskid*, module *module-name*, failing RC=*return-code,* RSN=*reason-code.***
**Explanation:** One of the following WebSphere Optimized Local Adapters (WOLA) callable services application programming interfaces (APIs) failed in the OAM Bridge Program OAMREST *oamrest-taskid*, module *module-name* with a RC=*return-code,* RSN=*reason-code.*

- Register – BBOA1REG
- Unregister – BBOA1URG
- Connection Release – BBOA1CNR
- Send Response – BBOA1SRP
- Receive Request Any – BBOA1RCA
- Receive Request Specific – BBOA1RCS
- Get Message Data – BBOA1GET

**System action**
If OAMREST initialization has not yet completed, initialization stops.
If OAMREST initialization has completed, only the associated request fails.
**Operator response:** Notify the system programmer.
**System programmer response:** For additional information on return codes and reason codes from the WOLA APIs, see *Optimized local adapters APIs on Liberty for z/OS.*
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8820I Error occurred with reason=*reason-code*. *oamrest-taskid* initialization terminated.**
**Explanation:** An error occurred during the OAM Bridge Program OAMREST *oamrest-taskid* initialization. The failing reason is one of the follows:

- 1 - The OAM subsystem control block is not available to OAMREST for initialization.
- 2 – An OAMREST address with the same procedure name and/or task id (if used) was already started. The procedure name in combination with the task id (if used) must uniquely identify the address space.
- 3 - An error occurred when the OAMREST control task attempted to determine the procedure name or task id from the address space control block (ASCB) during OAMREST *oamrest-taskid* initialization processing.
- 4 - *oamrest-taskid* was invoked with an incompatible PSW key

**System action:** OAMREST *oamrest-taskid* initialization stops.
**Operator response:** Contact the system programmer.
**System programmer response**
For reason:

- 1, verify that OAM was correctly installed, and an OAM subsystem is correctly defined in the IEFSSN*xx* member of PARMLIB or through the SETSSI ADD command.
- 2, ensure that each OAMREST address space that is started has a unique procedure name and/or task id (if used).
- 3, if the problem recurs and the program is not in error, search problem reporting databases for a fix for the problem. If no fix exists, contact the IBM Support Center.
- 4, ensure that the OAMREST *oamrest-taskid* is to be invoked with PSW key 8.

**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8821I Repeating error occurred *in oamrest-taskid* when calling service *service-name* in module *module-name,* failing RC=*return-code,* RSN=*reason-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid,* sub-task module *module-name,* received an error when calling service *service-name*. Multiple attempts were made to call the service and each attempt failed with RC=*return-code* and RSN=*reason-code*. The failures may be consecutive or cumulative depending on the error type.
**System action:** OAMREST sub-task module *module-name* stops all processing and will be re-attached, if possible, by the OAMREST control task.
**Operator response:** Examine the return code and reason code to determine the reason for the failure. If the service-name is one of the WOLA APIs, see *Optimized local adapters APIs on Liberty for z/OS* for additional information on return codes and reason codes.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8822I RACROUTE *request* failed in *oamrest-taskid*, module *module-name,* failing SAFRC=*safrc-code,* SAFPRRET=*safprret-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* subtask module *module-name* failed to invoke a RACROUTE request *request* with a SAF return code = *safrc-code* and the contents of SAFPRRET = *safprret-code*.
**System action:** OAMREST subtask module *module-name* continues all processing.
**Operator response:** Determine the meaning of the SAFRC, SAFPRRET, SAFPRREA for your security product and then fix the problem or report it to your system programmer.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8823I *oamrest-taskid* OSREQ message:**
**{GET | PUT |DELETE | QUERY | CHANGE} REST request *request-id***
***osreq-message***
**Explanation:** For REST request *request-id*, the OAM Bridge Program *OAMREST* supplied a message area on the OSREQ macro and the OSREQ macro returned message *osreq-message*.
**System action:** none
**Programmer response:** Evaluate the return and reason codes returned in the OSREQ request response data area and the message above to determine the cause of the failure.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8826I *oamrest-taskid* already stopping. Operator command to stop *oamrest-taskid* not processed.**
**Explanation:** Operator command to stop the OAM Bridge Program OAMREST *oamrest-taskid* ignored due to impending stop.
**System action:** OAMREST does not queue the stop command.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8827I *oamrest-taskid* ESTAE recovery routine *estae-module* dump processing failed. Return code=*return-code*, reason code=*reason-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* ESTAE recovery routine *estae-module* attempted to issue SDUMPX and a system error occurred during dump processing due to the system suppressing the dump (by request or default) or bad parameters passed to the dump service. The failing return code=*return-code*, reason code=*reason-code*.
**System action:** If *estate-module* is the OAMREST main control task's recovery routine, the *oamrest-taskid* address space stops. If *estate-module* is one of the OAMREST sub-tasks' recovery routine, the sub-task will be re-attached.
**Operator response:** Notify the system programmer.
**System programmer response**: Determine the state of the system when the dump was attempted. System log, console log, dump from abend, parameters passed to the macro invocation. See *z/OS MVS Programming: Authorized Assembler Services Reference LLA-SDU* for information regarding RETURN/REASON codes for the SDUMP macro.
**Source:** Object Access Method (OAM)
**Routing Code:** 2,4,6
**Descriptor Code:** 4

**********

**CBR8828I Module *module-name* is stopping *oamrest-taskid* because of {fatal | repeating} error condition *message-id*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* module *module-name* stops processing when a specific error condition *message-id* occurs either the first time for a fatal error or multiple times for a repeating error. The *message-id* will be a CBRxxxx message number.
**System action:** OAMREST address space will terminate immediately.
**Operator response:** Contact the system programmer.
**System programmer response:** Examine previous error messages with message number *message-id* to determine the reason for stopping, fix the problem and re-start the OAM Bridge Program OAMREST. If the cause of the problem cannot be determined from the previous error messages, or if the problem recurs, search problem reporting databases for a fix to the problem. If no fix exists, contact the IBM Support Center.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8829I *oamrest-taskid* command task abnormally ended during execution of *command_name* command.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* operator command task abnormally ended while implementing the *command_name* command.
**System action:** All *oamrest-taskid* commands will be purged. The *oamrest-taskid* address space will attempt to reinitialize its command task. All other processing is unaffected.
**System programmer response:** Collect console log and any dumps related to the problem.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8830I *oamrest-taskid* status:**

**Explanation**

```
Started Procedure Parameters:
```

```
WolaGroup (G1):      aaaaaaaa
WolaName2 (G2):      bbbbbbbb
WolaName3 (G3):      cccccccc
RegisterName (RN):   ddddddddddd
Db2SSID (DS):        eeee
```

The operator has entered the following command:

MODIFY *oamrest-taskid,*DISPLAY,REST

A display of the OAM Bridge Program OAMREST *oamrest-taskid* status information has been generated. Status is reported for the OAMREST (*oamrest-taskid)* instance.

aaaaaaaa – part of the three-part WebSphere Optimized Local Adapters (WOLA) group. Specified on the OAMREST started procedure as (G1).

bbbbbbbb – part of the three-part WebSphere Optimized Local Adapters (WOLA) group. Specified on the OAMREST started procedure as (G2).

cccccccc – part of the three-part WebSphere Optimized Local Adapters (WOLA) group. Specified on the OAMREST started procedure as (G3).

ddddddddddd – register name used by the OAMREST started procedure to connect to the Liberty server running the corresponding OAM REST API application. Specified on the OAMREST started procedure as (RN).

eeee - Db2 SSID that connects to a Db2 subsystem running the corresponding OAM REST API application. This value must match the Db2 SSID derived from the S3 region name specified on the REST request. Specified on the OAMREST started procedure as (DS).

**System action:** None.

**Operator response:** None.

**Source**: Object Access Method (OAM)

**Routing Code:** -

**Descriptor Code:** 5,8,9

**********

**CBR8840I *oamrest-taskid* task summary:**

**Explanation**

```
Tasktype  Activetask#   Totaltask#    WorkQRequest#
Tsktype1         aaa          bbb              ccc
Tsktype2         aaa          bbb              ccc
Tsktype3         aaa          bbb              ccc
```

The operator has entered the following command:

MODIFY *oamrest-taskid,*DISPLAY,REST,TASK

A display of the OAM Bridge Program OAMREST *oamrest-taskid* task summary information has been generated for each of the task types (STORE, RETRIEVE and FAST). Task status is reported for the OAMREST (*oamrest-taskid)* instance.

tsktypex- each of the task types (STORE, RETRIEVE and FAST)

aaa – the number of active tasks for the task type

bbb – the total number of tasks for the task type

ccc - the total number of requests on the work queue for the task type

**System action:** None.

**Operator response:** None.

**Source**: Object Access Method (OAM)

**Routing Code:** -

**Descriptor Code:** 5,8,9

**********

**CBR8845I oamrest-taskid task detail:**

```
Explanation
Task type: [ALL|STORE|RETRIEVE|FAST]
Taskname  Taskaddr  Active  Duration
tskname1  tskaddr1    a     bbbbbbbb
tskname2  tskaddr2    a     bbbbbbbb
```

The operator has entered the following command:

MODIFY *oamrest-taskid*,DISPLAY,REST,TASK,{ALL|STORE|RETRIEVE|FAST}

A detailed display of the requested OAM Bridge Program OAMREST *oamrest-taskid* task type {ALL | STORE | RETRIEVE | FAST} has been generated. Task status is reported for the OAMREST (*oamrest-taskid)* instance.

tsknamex - name of the OAM REST API task

tskaddrx - address of the OAM REST API task

a – current task status (“Y” – The OAM REST API task is active and has a work element to process; “N” – The OAM REST API task is not active and does not have a work element to process).

bbbbbbbb – time duration (in milliseconds) that the task has been in the active state.

**System action:** None.

**Operator response:** None.

**Source**: Object Access Method (OAM)

**Routing Code:** -

**Descriptor Code:** 5,8,9

**********

**CBR8870I *oamrest-taskid* CAF has issued a return code of *return-code* and reason code of *reason-code* within function {CONNECT | DISCONNECT | OPEN | CLOSE}.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* attempted to perform a DB2 CAF function and received a non-zero return code=*return-code,* and reason code=*reason-code*.
**System action:** If the failed CAF function is CONNECT/DISCONNECT, the *oamrest-taskid* address space stops. If the failed CAF function is OPEN/CLOSE, only the associated request fails.
**Operator response:** Notify the system programmer.
**System programmer response:** Refer to the Db2 documentation (https://www.ibm.com/docs/en/db2-for-zos) for an explanation of the Db2 return and reason codes and correct the problem.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8871I Language Environment Preinitialization routine CEEPIPI call failed in *oamrest-taskid*, module *module-name*, within function {init_sub | call_sub | add_entry}, failing RC=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* attempted to invoke CEEPIPI with a specific function and received a non-zero return code=*return-code*.
**System action:** The associated OAMREST GETKEY request fails.
**Operator response:** Notify the system programmer.
**System programmer response:** Use the diagnostic information provided to determine the cause of the error and take corrective action to resolve the problem so that the request can be retried and complete successfully.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

**********

**CBR8872I Cloud Data Access service routine *cda-routine* call failed in *oamrest-taskid*, module *module-name*, failing RC=*return-code*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* attempted to perform a CDA function *cda-routine* and received a non-zero return code=*return-code*.
**System action:** The associated OAMREST GETKEY request fails.
**Operator response: N**otify the system programmer.
**System programmer response:** Use the diagnostic information provided to determine the cause of the error and take corrective action to resolve the problem so that the request can be retried and complete successfully.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4
**********

**CBR8873I *oamrest-taskid* process task *task-name* is disabled because of a repeating error condition *message-id*.**
**Explanation:** The OAM Bridge Program OAMREST *oamrest-taskid* request process task *task-name* stops processing when a specific error condition *message-id* occurs multiple times and will not be re-attached. The *message-id* will be a CBR*xxxx* message number.
**System action:** OAMREST address space will continue with rest of the process tasks.
**Operator response:** Notify the system programmer.
**System programmer response:** Examine previous error messages with message number *message-id* to determine the reason for stopping, fix the problem and re-start the OAM Bridge Program OAMREST. If the cause of the problem cannot be determined from the previous error messages, or if the problem recurs, search problem reporting databases for a fix to the problem. If no fix exists, contact the IBM Support Center.
**Source:** Object Access Method (OAM)
**Routing Code:** 2
**Descriptor Code:** 4

# Appendix

OAM Application Programmer's Reference

AWS S3 API Usage