Cloudian HyperStore
Backup Deployment and Performance Tuning Guide for Commvault
BACKGROUND INFORMATION
Every organization needs an efficient backup and disaster recovery plan to effectively protect their data. Common requirements from organizations requiring storage solutions that embrace today's most commonly used tools and practices as well as having multiple data protection levels. In addition, the market is driving the need for storage and backup solutions to support multiple data centers or regions for disaster recovery.

Cloudian® HyperStore® is a multi-tenant distributed storage platform that is 100% compatible with Amazon Web Services (AWS) S3 storage protocol. The HyperStore platform can scale to hundreds of nodes, across different datacenters (DCs), contained in a single region. Cloudian HyperStore can also scale to many DCs in many different regions. In addition, Cloudian Hyperstore works seamlessly with Google Cloud Platform as well as Microsoft Azure and Amazon AWS and can access the data using the native format.

Commvault® is an enterprise level integrated data and information management solution, built from the ground up on a single software platform and unified code base. Commvault® software contains modules to protect and archive, analyze, replicate, and search your data, which all share a common set of back-end services and advanced capabilities, seamlessly interacting with one another. This addresses all aspects of data management in the enterprise, while providing infinite scalability and unprecedented control of data and information.

The HyperStore platform can scale to support hundreds of petabytes of storage in a single instance and, with Commvault, provides a range of configurable data protection and data archival options. This flexibility allows Commvault software and Cloudian HyperStore to provide a deterministic SLA for restoring or retrieving your data sets. This allows for planning objectives to meet predictable RTO and RPO business requirements.

CLOUDIAN HYPERSTORE AND COMMVAULT BENEFITS
• Enterprise level backup and archive data management
• Completely on-premise private cloud integrated data protection
• Reduced total cost of ownership (TCO) which continues to improve as the solution scales, yielding even greater operational efficiency
• Agility and scalability with the scale-out architecture of Cloudian HyperStore
• Complete Amazon Simple Storage Service (S3) API-compatible, geographically federated, object storage platform

When combined with the Cloudian HyperStore object storage platform, Commvault users can deliver a data protection and archive platform that automatically distributes data across multiple geographical locations instantly - allowing backup and archival data to be available for both local and remote site access for disaster recovery scenarios.

EXECUTIVE SUMMARY
This guide is written for the experienced data protection professional and will detail the key considerations for the deployment and performance tuning of Cloudian HyperStore when used as a backup/archive storage target within a Commvault® 11 architecture. Known changes to earlier Commvault releases and current Commvault 11 service packs will be noted. The content assumes the appropriate assessment, sizing, planning and other pre-deployment tasks have been completed. Detailed illustrations will be included as needed to guide you through key deployment and tuning tasks.
INTRODUCTION

A Commvault deployment typically consists of a single CommServe®, one or more MediaAgents and Clients. The CommServe is responsible for defining and coordinating all activities in the Commvault backup domain, called a CommCell®. Clients have user data that are used as backup sources. Commvault uses a data agent for each source data type on a Client. A Client may have one or more data types. For example, consider a single client that is a Microsoft Exchange Server and a file server. In this case, the Client has two client agents in use, an Exchange agent for the and a filesystem agent for the unstructured data. MediaAgents read source data from a Client and move it to one or more backup storage target devices. Target devices on a Media Agent could be tape, disk or cloud storage such as Amazon AWS.

Commvault uses Cloudian HyperStore as an on-premise Cloud Storage Library via the S3 storage protocol as a private cloud backup storage target. Cloudian HyperStore provides the ability to easily scale your storage capacity, performance and data durability options on-demand. Below is an overview of the Commvault environment. Note the backup storage targets on the MediaAgent which shows Cloudian HyperStore as a Cloud Library.

Another use case is the S3 virtual client. The S3 virtual client can be used to backup data from a Cloudian HyperStore cluster to another target. This target can be any storage target device. For example, there may be applications writing directly to HyperStore S3, with a requirement to backup that data to another target, such as another bucket in the same or different region or HyperStore cluster, or to a different storage media such as tape.
SOLUTION OVERVIEW

Cloudian HyperStore is used as an on-premise S3 Cloud Library in Commvault, typically using Commvault deduplication. This means that you can connect your MediaAgent directly, rather than through a proxy gateway, with the S3 endpoint of your HyperStore cluster and store data in a deduplicated format on HyperStore. The Commvault deduplication feature enables you to reduce cloud storage space usage and use network bandwidth efficiently. Deduplication identifies and eliminates redundant data in the backup, reducing not only the volume of data stored in Hyperstore but also the bandwidth required for data transfer.

In Direct Deduplication to HyperStore, the cloud storage is defined as the storage target in the MediaAgent. Deduplication is enabled either at the client or at the MediaAgent using a Storage Policy. The deduplicated data is transferred to a Cloud Storage library, such as HyperStore. The deduplication database resides on one or more MediaAgents locally or on a designated volume which is attached to the MediaAgents.

Note: The original intended use of a Cloud Library is as a public cloud backup target. Many types of Cloud Library targets are available in Commvault, such as Amazon S3. Connectivity to the public cloud is assumed to be low-bandwidth with small random-access patterns, therefore data access to a HyperStore cluster will have poor performance with default settings. Tuning the environment is required for optimal backup, archive and restore performance.
VERIFY THE COMMVAULT CONFIGURATION

The next steps, which aren’t covered in this document, is to configure a Commvault Storage Policy, Client, Backup Set and Subclient. The following section shows how to verify these items are configured properly. To perform a backup, the Windows Filesystem iDataAgent and/or other iDataAgents needs to be installed. Also, the Commvault Client, Backup Set and Subclient needs to be associated with a Commvault storage policy that has HyperStore as the Cloud Library. See the screenshots below which walk through the process.

**Note:** It is highly recommended to perform a test backup and restore with Cloudian HyperStore as a Cloud Library once the Commvault environment is configured. This will ensure that basic functionality is working properly. See the Appendices for detailed steps.

1) In the CommCell Browser under Storage Resources, verify there is a Cloud Storage Library under Libraries and that it is attached to a MediaAgent. Under Polices, there needs to be a policy defined as well. In the example below, it is called CloudianHyperStoreBackup.
2) Right Click on the SubClient and select **Properties**  
3) Click on **Content** tab to show backup source paths. These filesystem paths are used as the backup source. If none exist, you'll have to create them using **Add Paths**.

4) Click on **Storage Device** tab to view the configured Storage Policy
TUNING THE COMMVAULT ENVIRONMENT

Once the test backup and restore are working, the environment needs to be altered to achieve the best performance. Before making changes, it is recommended to do a performance baseline with an appropriately size test source dataset. This will allow for comparing results after the environment is tuned. Once the environment is tuned, it is highly recommended to proof of concept (POC) backup and restore testing to verify expected results using a subset of the source data.

Load balancers are key to distributing the I/O workload from the clients to the MediaAgents and from the MediaAgents to the HyperStore cluster. Sizing and deployment of these are out of scope for this document.

Details on the settings in the subsections that follow can be found in the Commvault online documentation at http://documentation.Commvault.com/commvault/v11/article?p=8578.htm#o8629. The examples in this section assume that the source data on the client is unstructured and uses the Windows File System iDataAgent. Other data types, such as databases, have their own unique requirements. Detailed instructions on specific tuning requirements for these iDataAgents can be found in the online Commvault documentation set.

SIZING NOTES

Sizing should be done prior to deploying Commvault and Hyperstore during the assessment and planning stages. When sizing, consider the factors under General Tuning Recommendations.

GENERAL TUNING RECOMMENDATIONS

The following are general recommendations for optimal performance. These should be used as a starting point when deploying HyperStore as a Cloud Library in Commvault.

- Size the MediaAgent appropriately. Many of the settings that follow will configure the media agent to use multiple streams. Setting these and other performance tuning parameters will often cause the MediaAgent CPUs to be the bottleneck. It is recommended to use Medium or better. To view the MediaAgent specs and sizes please see http://documentation.Commvault.com/commvault/v11/article?p=1647.htm
- Be sure to select Amazon S3 as the Cloud Library Type when adding HyperStore.
- Use http as the protocol for HSS3 endpoint whenever possible, as https has a significant performance impact on Object Storage platforms.
- Use multiple mount paths, (minimum of 4) in the HyperStore Cloud Library. A mount path is analogous to a tape device in a tape library. In HyperStore, each bucket will be used as a Cloud Library mount path. With 4 buckets, there will be 4 mount paths used as targets within a single Cloud Library.
- Use the data deduplication features and ensure data deduplication (dedupe) is done on the client side. Have the dedupe database location on fast storage, preferably SSDs.
- A Live Mount allows a VMware virtual machine to power on directly on the backup target from a stored backup. On Object Storage systems, the VM may suffer from slow performance, so avoid using Live Mounts.
- Enable Commvault software's data deduplication features and ensure data deduplication (dedupe) is enabled on the client side. Have the deduplication database located on low latency storage, preferably SSDs.
Synthetic Full Backup Considerations

- Use regular backups unless there is a specific need for using Synthetic Full backups. Synthetic full backups combine all previous incremental backups to create a Synthetic Full backup. When leveraging the Commvault deduplication features a regular client backup will only transfer new data, thus spreading the backup workload across all clients while getting the same benefits traditionally associated with Synthetic Full backups.
- For use cases where Synthetic Full Backups are required, ensure Accelerated Synthetic Full Backup (DASH Full) is used. Review the Commvault documentation for best practices and use cases on when to use this feature. In cases where the Commvault deduplication capabilities are not leveraged and Synthetic Full backups are required, ensure multi-stream synthetic full backups are used.
- There can be a significant performance penalty as a Synthetic Full backup combines all previous incremental backups to create a new Synthetic Full backup, which can generate a lot of read overhead.

COMMSERVE® COMMCELL PERFORMANCE TUNING

Tuning the CommCell® for 10 GB/sec ethernet connections is critical. Follow the guidelines given below to improve the performance of data movement in a 10 Gigabits-per-second Ethernet environment:

- Reduce the fragmentation to 128MB. For more information refer to Reduce Fragmentation of Data on a Mount Path. Note: This isn't an option for Cloud Libraries so ignore this setting.
- Do not modify the value of the additional setting $nNumPipelineBuffers$.
- Set the block size to 512 KB. Note: 512 KB is the default with $nCloudEnableHighPerformance$ set to 1 for Commvault version 11 SP 11.
- Optimize the MediaAgent for LAN free backup. For more information, refer to Best Practices for Shared Disk Libraries.
- Enable TCP Offload engine on the HBA.
- Deploy multiple 10GB ports on a MediaAgent. For example, with 2 ports, have one port available for client input traffic and one port of Disk Library output traffic.

MEDIA AGENT TUNING RECOMMENDATIONS

MediaAgent Additional Settings through CommCell® Console Manager

Additional Settings in Commvault makes changes to the local Windows server registry settings. Generally, these will be the CommServe and Windows MediaAgent systems.

**Note:** Be sure to use the Additional Settings tab to make the changes. Do not use the native Windows registry configuration tools.

See the documentation links below for more information.


By default in v11, the `nCloudEnableHighPerformance` is set to 1. This enables a group of tunable parameters for optimal Cloud Library performance. Each parameter can be set individually if desired. The default values for nCloudEnableHighPerformance when set to 1 in Commvault v11 are the following. Note that the nCloudNumOfReadAheadThreads parameter is set to 2 by default and requires a change to 0.

- `nCloudUseTempFile` - 0
- `nCloudNumOfUploadThreads` - 5
- `nCloudMaxSubFileSizeKB` - 32768
- `nCloudUseMemoryBufferForIndex` - 1
- `nCloudNumOfReadAheadThreads` - 2 (CHANGE TO 0, see instructions that follow)
- `nCloudNumOfReadAheadFiles` - 4
- `nCloudSocketSendBufferBytes` - 1048576
- `nCloudSocketReceiveBufferBytes` - 1048576

To configure the `nCloudEnableHighPerformance` in **Additional Settings** do the following:

1) In the CommCell Browser Pane right-click on the MediaAgent name and select **Properties**.
2) The MediaAgent Properties Window opens. Click on the **Additional Settings** tab, then click on **Add**.

3) Set `nCloudNumOfReadAheadThreads` to **0**. When using deduplication, data will generally be very fragmented across chunks. This significantly reduces the chances that the next block is the required block. 1) This low read ahead hit rate means the downside of the performance overhead caused by those extra reads generally do not outweigh the potential benefits.

   a) To change this value, type in `nCloudNumOfReadAheadThreads` and click on **Lookup**.
   b) Type in **0** in the **Value** field and click on **Ok** to save the changes.
CLOUD LIBRARY TUNING FOR HYPERSTORE

Follow these recommendations for optimized Cloud Library performance settings. The Cloud Library itself has tuning parameters as well as each of the mount paths.

Library Performance Tuning Recommendations

1) Enable **Spill and fill mount paths** for the HyperStore Cloud Library by selecting the radio button as shown. This will allow for load balancing across each of the mount paths.

2) Keep defaults under the Mount Path Allocation Policy which is **Maximum Allowed Writers**. Typically, the max number of writers for a library is 40.
**Mount Path Performance Tuning Recommendations**

Ensure the following settings are configured under the Allocation Policy tab in the Mount Path Properties configuration for Cloudian HyperStore configured as a Cloud Library.

1) Select Maximum Allowed Writers using the radio button as shown.
2) Tick the following boxes.
   a) Enable Pruning of Aged Data
   b) Enable Micro Pruning
STORAGE POLICY PERFORMANCE TUNING

Tuning the storage policy is critical for optimal performance. See the Storage Policy Cloud Connection Performance Tuning section in the online documentation in the link below for details.


If the cloud connectivity is through a high-speed network of about 10 Gigabits/sec or higher, follow these recommendations to get the maximum performance for the cloud-based backup and restore.

Note: These settings consume large amounts of memory on the MediaAgents. Therefore, we do not recommend these settings for low-speed networks. The MediaAgent needs to be sized at Medium or larger.

1) Under Policies, right-click on the Storage Policy name.
2) Under the Data Paths tab, select the Data Path row and click on Properties. Verify the Chunk size is 4 GB and the Block size is 1024 KB.
3) Under Storage Policy Properties > General, set the **Device Streams** to 50 (Default) or above.

![Device Streams Setting](image1.png)

4) Under Storage Policy Properties > Advanced, set the **Block level Deduplication factor** to 512 KB. This applies to the current Storage Policy only. See notes that follows if using Global Deduplication.

![Block Deduplication Setting](image2.png)
Note: If using Global Deduplication, which applies to all storage policies, be sure to set the **Deduplication factor** to 512 KB. If already set to a lower value, please see the Commvault documentation for details and consult with Commvault to make the change. [https://documentation.Commvault.com/commvault/v11/article?p=12460.htm](https://documentation.Commvault.com/commvault/v11/article?p=12460.htm).

**BACKUPSET, CLIENT AND SUBCLIENT TUNING**

This section details tuning for the backup client, backup set and subclients. Most of the section shows how to enable multiple streams through tuning the number of readers. The number of readers determine concurrent backups (and restores). Note that for any existing backups, the default number of readers is 2. If a backup job uses 2 readers then only restore with 2 readers is possible. This cannot be retroactively changed.

**Backup Set**


Do the following for the Windows File System iDataAgent to enable multi stream restores. Other iDataAgents have a similar procedure.

1) From the CommCell Console, expand Client Computers > client > File System > backup set.
   a. In the right pane, right-click a subclient, and then click Browse and Restore.
   b. The Browse and Restore Options dialog box appears. Click View Content.
   c. Select the data that you want to restore, and then click Recover All Selected.
      The Restore Options dialog box appears.
   d. On the General tab, complete the following steps:
      i. From the Destination Client list, select the destination client computer.
      ii. In the Number of Streams box, enter the recommended number of streams which is 8.
         This is the number of streams for the restore operation.
**Note:** This value must match the number of **Subclient data readers**. If the number of readers is increased, increase this value to match. In the example the number of streams is 8 so ensure the number of readers are also 8.

**Note:** For earlier versions of Commvault that do not support multi-stream restore use **Restore by Job**. Restore by job significantly increases restore speed as it uses multiple streams to restore (the same number as used during the backup job). The actual number of streams used depends on the restore data set and the number of streams used to back up data. When you perform a restore by jobs operation, the **Number of Streams** option is not available because restore by job operations use multiple streams by default. For Commvault v10 please see the following link at [http://documentation.commvault.com/commvault/v10/article?p=features/restore/restore_by_jobs_how_to.htm](http://documentation.commvault.com/commvault/v10/article?p=features/restore/restore_by_jobs_how_to.htm) for configuration details.
2) After clicking on Use Multiple Nodes, the Advanced Restore Options -> Data Access Nodes appears. If desired, select a Client Computer Group on the left and Add >. The example shows Infrastructure. Otherwise click on Cancel to continue with the current selection.

3) On the Job Initiation tab, choose how you want to initiate the restore jobs. Click OK at the bottom of the window (not shown in screenshot).

4) The restore job begins with the same number of streams used to backup the data. For more information about job initiation options, see Restore Options (Job Initiation).
Subclient

The settings below assume an iDataAgent for Windows filesystem is installed on the Commvault client. Other installed agents may have different settings. For the Windows iDataAgent, enable multi-streaming per subclient. This is a backup client setting which increases the number of concurrent streams read from the subclient source data. It is advisable to size this based on client hardware resources and Commvault settings. See the following Commvault 11 documentation for subclient configuration details: http://documentation.Commvault.com/commvault/v11/article?p=10978.htm.

For iDataAgent Filesystem for Windows do the following:

1) From the CommCell Browser, expand Client Computers > client > backupset.
2) Right-click the appropriate subclient, click Properties > Advanced.

3) In the Advanced Subclient Properties dialog box, on the Performance tab, select the Allow multiple data readers within a drive or mount point check box. When multi-streaming is set, multiple simultaneous data readers are allowed on each drive (or mount path) during the backup operation.
4) Check the Subclient Properties > Advanced > Performance > set **Number of Data Readers** to a higher value.
   a. Select the *Allow multiple data readers within a drive or mount point* check box.
   b. Increase the **Number of Data Readers to 8**. This is the minimum recommended setting and it is advisable to size this based on client hardware resource and Commvault storage policy configuration.
   c. Keep **Application Read Size** at 512 KB

![Advanced Subclient Properties for QuickStartTest](image)

**Note:** For Multi-Stream restores, this value must match **Number of Streams** configured in the backup set. If the number of data readers is increased, increase this value to match. In the example the number of data readers is 8, so ensure the number of streams configured in the backup set is also 8.
CONCLUSION
This guide detailed the key considerations for the deployment and performance tuning of Cloudian HyperStore when used as a backup/archive storage target within a Commvault® 11 architecture. Backup and restore performance improvement is very dependent on the environment and so further changes may be required that are outside the scope of this document. It is recommended to do a performance baseline with an appropriately size test source dataset before and after tuning. Please consult with Commvault and/or Cloudian for further guidance.
APPENDIX A: INITIAL CONFIGURATION

This section provides instructions on how to configure Commvault and HyperStore for test backups and restores to prove the environment is functional. No changes are made to default settings so the environment performance will not be tuned or optimized. It is assumed that Commvault and HyperStore are both installed and online. To deploy HyperStore, please follow the detailed instructions in the HyperStore Install Guide. To deploy Commvault, please use the online Quick Start guide at https://documentation.Commvault.com/commvault/v11/article?p=1664.htm

CLOUDIAN HYPERSTORE CONFIGURATION PROCEDURE

For Commvault to use a Hyperstore cluster as a backup target we need to prepare it for use as a Cloud Library. A group, user and at least one S3 bucket is required as mount path for the Cloud Library. A mount path is analogous to a tape drive in a tape library. To create S3 buckets in HyperStore, a storage policy is required. For the procedure that follows it is assumed that the HyperStore cluster is functional with an active storage policy.

1. Create a group. Use a web browser to log into the Cloudian Management Console in the System Admin group as admin.
   a) On the Top Menu of the CMC click on Users & Groups
   b) On the Users & Groups submenu select Manage Groups
   c) In the right upper corner click on + NEW GROUP
   d) Type in a Group Name and a short description
   e) Click on the Save button on the right.
2. After the successful creation of the Group, create a User and join to the group.
   a) On the Users & Groups submenu select **Manages Users**
   b) In the right upper corner click on **+ NEW USER**
   c) Type in a Username, select “Group Admin” in the User Type box, select the just created Group in the Group Name dropdown list and set a password
   d) Click on the **Save** button on the right.

![Image of User Creation](image)

Now we are ready to log on as the new user and create a bucket as a mount path for a Cloud Library on the Commvault MediaAgent.

3. Log on as the new user’s username and create the Bucket:
   - On the top Menu of the CMC click on **Buckets and Objects**
   - Type in a Bucket name and click on **Create**

![Image of Bucket Creation](image)
4. As a last step we need to capture the user’s S3 credentials in order for Commvault to create a Cloud Library using the bucket as a mount path. Copy and paste the following into a text file. In this example, we are using user CV01.

   a) On the top Menu of the CMC click on the user name and select **Security Credentials**
   b) On the S3 ACCESS CREDENTIALS selection note or copy the “ACCESS KEY ID”
   c) Then click on **View Secret Key** and copy it to the text buffer when prompted.
COMMVAULT® CONFIGURATION PROCEDURE

Now that HyperStore is prepared, Commvault needs to be configured to use it as a Cloud Library target. See detailed Quick Start instructions at: https://documentation.Commvault.com/commvault/v11/article?p=1664.htm. The example that follows uses a single server for all of the roles. This won’t be the case in the majority of production environments. For a single CommServe which acts as the CommCell manager, MediaAgent and Client, there are some modifications which are shown in the procedure that follows.

1) Obtain and deploy the Commvault software and install it as per instructions found on Commvault’s Documentation website at http://documentation.Commvault.com/commvault/.
   a) Use default package selection except for adding CommCell Console and MediaAgent components.
   b) Follow the installation wizard and fill out the required information. Overall process takes about 40 minutes.
   c) Be aware that many Windows packages will be installed as pre-requisites as well. Make sure there are no errors during the installation.

2) If DNS is being used skip this step. For simple test environments, not using DNS and DNSSMASQ on HyperStore do the following.
   a. Edit C:\Windows\System32\drivers\etc to resolve S3 Endpoint.

# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# localhost name resolution is handled within DNS itself.
# 127.0.0.1 localhost
#
# 10.50.50.62 s3-region1.mycloudianhyperstore.com

Note: Use DNS. Avoid using the hosts file for name resolution in production. Using the /etc/hosts file in production systems will end up causing issues during upgrades/failovers and so forth.
3) Log in to CommCell Console with username and password created earlier.
4) Under **Storage Resources -> Libraries**, right click HyperStore as a Cloud Storage Library
5) The Add Cloud Storage window appears.
   a) Under Type: drop down menu, select **Amazon S3**
   b) Under MediaAgent: Select a media agent by name
   c) Fill out **Access Information** area with HyperStore S3 Credentials from user account created earlier.
      i) Use the S3 Endpoint as configured in the **hosts** file in the **Service Host** field
      ii) Enter Access Key ID
      iii) Copy and paste Secret Access Key twice. Make sure it is the same.
   d) Enter the HyperStore bucket name. This will be a mount path in the Cloud Storage Library.
   e) Keep Storage Class as Standard.

Cloudian HyperStore is now setup as a Cloud Storage Library target.
APPENDIX B: PERFORMING A TEST BACKUP

Now that the configuration is done and verified, perform a test backup. The following screenshots walk through the process.

1) Select the defaultBackupSet. Right click on the Subclient Name and select Backup.

2) The Backup Options windows appears. Select Backup Type and Job Initiation options. Click Ok to start the backup. The example shows an immediate full backup.
3) View the Job Controller window and ensure the Progress percentage is increasing. Once completed, the progress bar will show 100%.

4) Double-click on the **Job ID row** to show detailed statistics. Click on **Ok** to close the window.
APPENDIX C: PERFORMING A TEST RESTORE

Now that test backups have completed successfully, perform a test restore. For the purpose of the test restore, create a test destination folder. The example has a TestRestore folder on the desktop as the test restore location.

1) To initiate a restore on demand, do the following:
   a) Log into the CommCell Console.
   b) Expand the Client by client name under CommCell Console. In this example, it is win-cs.
   c) Open the defaultBackupSet folder to view the Subclients.
   d) Right-click on a Subclient and select Browse and restore.
2) The Browse and Restore Options window appears. Click on View Content.

3) The data browser window appears.
   a) Select the files to restore by clicking on the empty boxes by the file and folder names
   b) Then Click on Recover All Selected.
4) The **Restore Options** window appears. For the purpose of the test restore, create a test destination folder. The example has a TestRestore folder on the desktop. Do the following to start the restore:
   a) Uncheck **Restore to same folder**.
   b) Select the destination path by clicking on **Browse**.
   c) Click on **Ok** to begin the restore.

Check the job status to ensure that the restore on-demand request completes successfully. Once completed, open a restored file to check that it can be used by the appropriate application. This completes the test restore.