WHITE PAPER

ORACLE RAPID BACKUP AND RECOVERY

ULTRA-FAST AND EFFICIENT DATA PROTECTION WITH COMMVAULT & FLASHBLADE

PURESTORAGE®

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INTRODUCTION

Around-the-clock global operations along with the explosion of data growth has impacted many organizations' backup and recovery strategies. Not only are traditional backup methods affecting backup windows and challenging recovery objectives, but system resources and network bandwidth are impacting overall application and database performance. This exposes risk to the overall business.

A modern approach to backup and recovery includes the introduction of high-speed, storage-based snapshot technologies and application integration. However, snapshot copies are often managed separately from traditional backup processes, complicating data management and increasing cost and complexity. What's required is a solution that integrates the benefits of the old with the new – one that is simple to manage and helps to reduce overall cost.

A COMPLETE SOLUTION

Pure Storage® Overview

Pure Storage is uniquely positioned to help organizations deliver a data platform for the cloud era – a platform that will put your data to work. With the new world of IoT (Internet of Things), data will continue to grow exponentially, but organizations will need to be able to use that data to gain competitive advantage. Equally important is how this data gets moved, stored, and protected.

Pure Storage FlashArray provides an enterprise-proven, all-flash storage platform with the speed, simplicity, and scalability to power your business. It combines high throughput and low latency with built-in, always-on deduplication and compression to deliver high performance – along with density to shrink data center floor space. To protect the data on the FlashArray, Pure has partnered with leading data protection organizations to help move and rapidly backup your critical business data to a secondary on-premises storage – FlashBlade™. This self-contained, rack-mountable, blade-based, scale-out all-flash storage system is capable of both rapidly storing petabytes of data reliably and providing ultra-fast access to thousands of clients. The 4U FlashBlade can hold between 62 and 792 terabytes of physical flash, enabling you to store data in a very small footprint, which also helps lower power and cooling costs.

Commvault® Overview

For most organizations, downtime is not an option – and traditional backup and recovery methods may struggle to meet aggressive recovery time (RTO) and recovery point (RPO) objectives. Snapshots powered by Commvault's IntelliSnap® technology, on the other hand, provide fast, automated, application-consistent copies of data with near zero impact on your production environment. IntelliSnap technology orchestrates snapshot management across the industry's widest array of storage platforms, eliminating complex manual scripting while accelerating recovery.

IntelliSnap technology is application-aware, integrating storage-based Snapshot copies and replication with applications and virtual server infrastructures to accelerate restores and prevent data loss.

Commvault & Pure Storage

Commvault® IntelliSnap® technology integration with Pure Storage enables ultra-fast and efficient backup and recovery of your data and applications from FlashArray primary storage to FlashBlade secondary storage. Together, this combines the capabilities of a traditional backup application with snapshot copies. Integration with application interfaces such as Oracle® RMAN means your database and backup administrators can still leverage their native tools for greater self-service and efficiency.

> This solution creates, manages, and monitors all backup and recovery operations from a single interface, enabling your staff to be more efficient and responsive. You can use policy-based automation to quickly find, manage, and move snapshot copies between Pure's FlashArray and FlashBlade, or to the cloud or tape, depending on your cost, retention, or compliance requirements and speed and recovery objectives.

IntelliSnap technology leverages Pure's deduplication, compression, incremental Snapshot block-level replication, and other efficient technologies. Commvault offers granular recovery for Oracle databases – from individual tables to entire applications and clone copies – making it possible to rapidly recover just what you need instead of restoring the entire volume of data. Pure's FlashBlade and Commvault Software's automation make it possible to recover access without involving multiple people or teams.

PURPOSE

The purpose of this technical white paper is to walk through the steps required to setup Commvault for Oracle backup and recovery with Pure FlashArray as the primary and FlashBlade as the secondary target, as well as validate the setup by performing backup and recovery tests. The goal of this document is also to provide guidelines and best practices to setup Commvault with FlashBlade as the secondary target.

AUDIENCE

The target audience for this document includes, but is not limited to, Oracle database administrators, storage administrators, IT managers, system architects, sales engineers, field consultants, professional services, and partners who are looking to design and deploy Commvault for Oracle backup and recovery on FlashBlade as the secondary target. A working knowledge of Oracle, Linux, server, storage, and networks is assumed but is not a prerequisite to read this document.

FLASHBLADE OVERVIEW

With the introduction of FlashBlade, a ground breaking, scale-out all-flash storage system from Pure Storage that leverages extreme parallelism by reading and writing directly to NAND flash chips, the backup and recovery challenges of enterprise customers can be addressed swiftly.

The capacity and performance of FlashBlade can be scaled in a linear and non-disruptive manner, simplifying the operational procedures of a customer's backup/recovery process. The system can be scaled in seconds without running special commands or extra cables. The in-line compression feature of FlashBlade reduces capacity requirements by almost 66% for most typical databases – driving cost down significantly while not sacrificing performance. Allowing the storage system to handle compression also delivers substantial savings in host CPU cycles. The current FlashBlade system can support a read rate of 17 GBps and write rate of 4.5 GBps in a single 4U chassis. The sustained write rate of 4.5 GBps is equivalent to 15TB/hour of backup rate, which is well above the normal required backup rate for most customers. The restore rates from FlashBlade can be higher than 45TB/hour with concurrent restore operations. Customers can realize these backup/restore rates without requiring any exotic and costly software on their storage array.

FAST

- Elastic performance that grows with data, up to 17 GB/s
- Always-fast, from small to large files
- Massively parallel architecture from software to flash

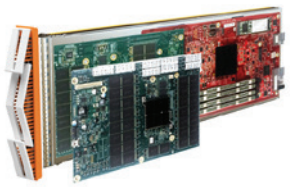
BIG

- Petabytes of capacity
- Elastic concurrency, up to 10s of thousands of clients
- 10s of billions of objects and files

SIMPLE

- Evergreen – don't rebuy TBs you already own
- "Tuned for Everything" design, no manual optimizations required
- Scale-out everything instantly by simply adding blades

The FlashBlade Difference



BLADE

SCALE-OUT DIRECTFLASH + COMPUTE

Ultra-low latency, 8, 17, and 52TB capacity options that can be hot-plugged into the system for expansion and performance

PURITY//FB

SCALE-OUT STORAGE SOFTWARE

The heart of FlashBlade, implementing its scale-out storage capabilities, services, and management

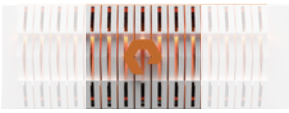
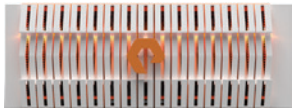
FABRIC

SOFTWARE- DEFINED NETWORKING

Includes a built in 40Gb Ethernet fabric, providing a total network bandwidth of 320Gb/s for the chassis

POWER, DENSITY, EFFICIENCY

FlashBlade delivers industry-leading throughput, IOPS, latency, and capacity – in 20x less space and 10x less power and cooling.

SPECIFICATIONS		8 TB BLADE	17 TB BLADE	52 TB BLADE
7 BLADES		98 TBs Usable	190 TBs Usable	591 TBs Usable
15 BLADES		267 TBs Usable	525 TBs Usable	1607 TBs Usable

* Usable capacity assumes 3:1 data reduction rate. Actual data reduction may vary based on use case.

PERFORMANCE

17 GB/s bandwidth with 15 blades

Up to 1M IOPS

CONNECTIVITY

8x 40Gb/s or 32x 10Gb/s Ethernet ports / chassis

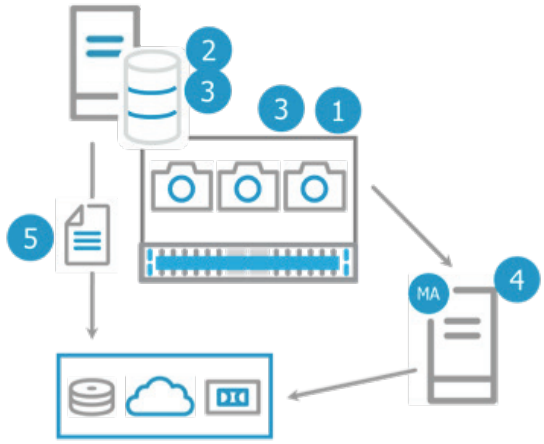
PHYSICAL

4U

1,800 Watts (nominal at full configuration)

COMMVAULT INTELLISNAP TECHNOLOGY AND ORACLE DATABASE

IntelliSnap technology integration with Oracle (including RAC) allows you to protect large databases (even those in the extreme TB size range) within a few minutes. The Oracle iDataAgent (iDA) provides consistent backups by quiescing the database for a few seconds while taking a native array-based snapshot and forcing a log switch. Along with data volume, iDA also identifies the archived redo log volume(s) and takes a snapshot to preserve the logs for replay or point-in-time recovery.



1. Commvault® agent discovers storage used by database
2. Commvault agent quiescses database for consistency
3. IntelliSnap software communicates with the storage array to take snapshot(s) and releases database
4. Optionally, snapshots can be mounted to a proxy for further operations such as long term protection or secondary workloads
5. Optionally, streaming log backups can be fully integrated into this approach to reduce log storage and shrink RPO even further

Rapid recovery is available using an application-aware revert operation on the Pure Storage FlashArray. By keeping the recovery within the storage array, there is no need to transfer blocks over the network and through a backup server. This provides for much faster restores. In addition, many revert operations are delta-block based, meaning only the changed blocks need to be restored to return a volume to a previous state.

SYSTEM REQUIREMENTS

The following are requirements in order to use IntelliSnap Technology integration with Pure FlashArray for instant backups and with Pure FlashBlade for secondary backup.

- FlashArray//M or //X series
- Purity//FA v4.5 (or higher)
- REST API: v.1.4 (found in Purity//FA v4.x and higher)
- FA Protocol Support: Fibre Channel or iSCSI
- Commvault Software version 11 service pack 7 or later
- Licensing:
  - Pure Storage arrays require no additional licensing for IntelliSnap functionality
  - Commvault IntelliSnap technology requires licensing based on the data being snapped and backed up
- FlashBlade with 8TB, 17TB, or 52TB blades
- Purity//FB 2.0.1 or higher
- FB Protocol Support: NFS and S3

Note: The scope of this solution is limited to NFS protocol and no testing was performed with S3.

PRE-REQUISITES

The following requirements should be met before performing the configuration steps presented in this document.

1. **Commvault CommServe® Server** – The CommServe is the command and control center of the CommCell® architecture. The CommServe server handles all activity between agents, and communicates with MediaAgents. It also contains the database that stores all the information pertinent to the CommCell component. The Commvault CommServe server should be setup and configured before proceeding. We have setup the CommServe server on a Windows® 2012 R2 virtual machine.
1. **Oracle Database** – An Oracle database should be installed and running for performing backup and recovery use cases. We installed Oracle 12c Release 1 (12.1.0.2) database with archived logs enabled on Red Hat Enterprise Linux® 7.2 host. The database was 1.03 TB in size.
1. **Oracle RMAN Catalog** – Oracle RMAN catalog database is required to use the proxy server option to perform backup copy to the secondary target.
1. **Proxy Server** – Configure a proxy client to run the backup copy operations to FlashBlade. This frees up resources on the source database server. See Commvault's website for more details on the proxy server requirements for Oracle.

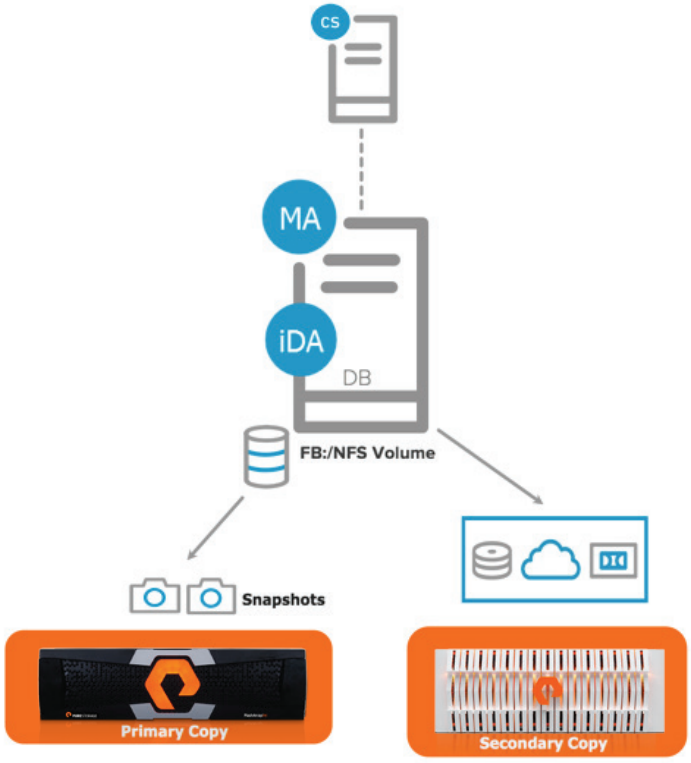
SOLUTION DESIGN

Logical Architectures

The solution includes hosting the Oracle database on Pure FlashArray, which is integrated with Commvault IntelliSnap technology. IntelliSnap takes application-consistent snapshots on FlashArray, which serves as the primary copy of the backup. Commvault software then writes this backup into FlashBlade, the secondary target for the backup to be retained as per the retention policy.

Due to the flexible design of Commvault software, the solution can be configured in multiple ways where functions like data mover, aka MediaAgent server, which writes the backup to the secondary media, can be placed at a different location to accomplish data protection. The decision to choose one configuration over another is based on various factors like performance, ease of use, scalability, and manageability of the Commvault environment.

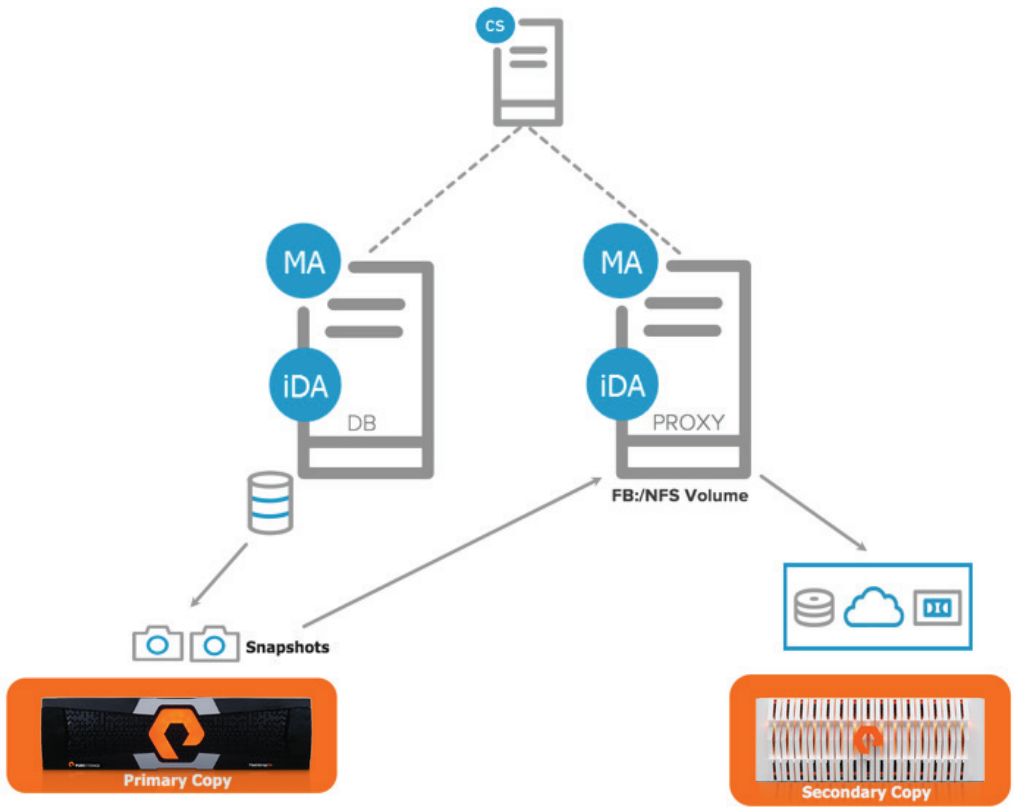
OPTION 1 – SIMPLE SETUP, ALL IN ONE



In this option, all components of Commvault, like Oracle iDataAgent (iDA) and MediaAgent (MA), are configured on a single server. The iDA can take and manage application-consistent snapshots from Pure FlashArray as well as write the backup onto a Pure FlashBlade that has NFS filesystems mounted on the same server. This option poses a challenge during backup to a secondary target, as parallel streams of read and write can overwhelm the database server, which can then impact application performance.

OPTION 2 – SEPARATE PROXY SERVER SETUP

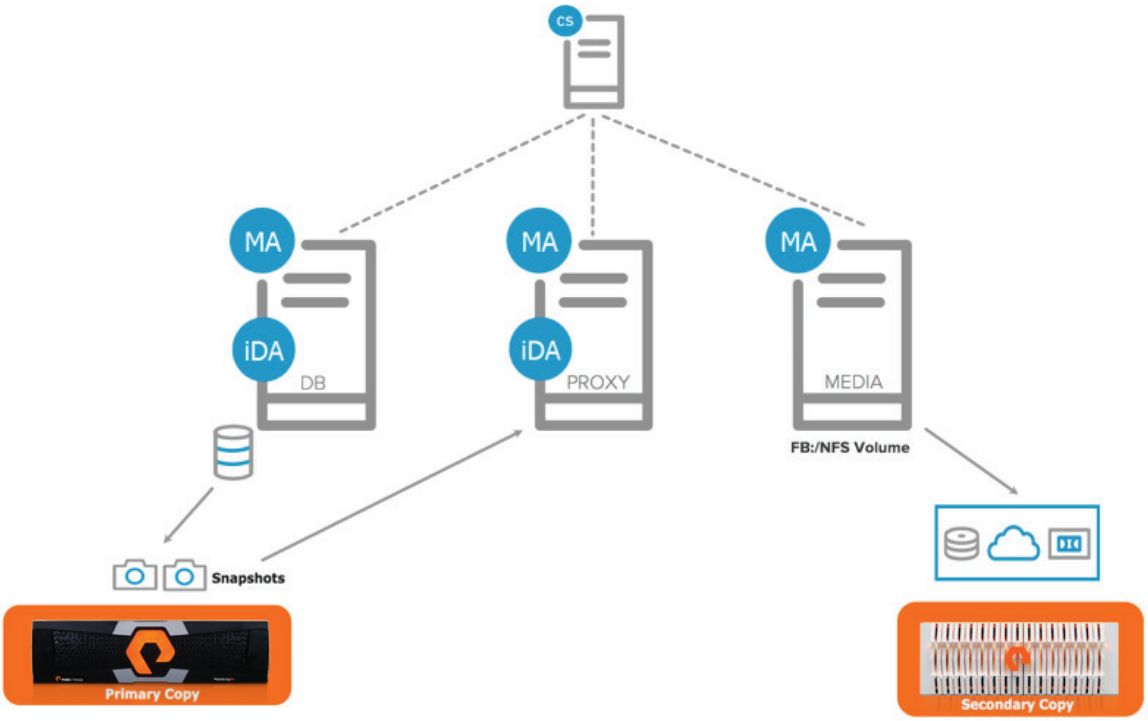
In this setup, a second server is used as a mount/proxy server whose main function is to write the database backup onto the secondary media on FlashBlade. As such, the proxy server will also serve as the MediaAgent to write the backup to FlashBlade. Hence, the target NFS filesystems from FlashBlade are mounted on the proxy server. The proxy server is configured with similar Oracle iDataAgent and MediaAgent. For ease of understanding, the diagram depicts a one-to-one setup between database server and proxy server, but the proxy server can support multiple source database servers.



As the proxy server serves as the MediaAgent, it needs to be sized properly to avoid it becoming the bottleneck when multiple database servers are configured within the same server and numerous concurrent backups are performed.

OPTION 3 – SEPARATE MEDIAAGENT SERVER SETUP

This setup is similar to that of Option 2 but the MediaAgent is segregated on to a separate server for the reasons mentioned above. A separate Media Server enables scalability for a larger organization and eases the manageability of the library. This setup can be extended to have multiple MediaAgent Servers for availability and performance in an enterprise level organization.



In this setup, the MediaAgent Server hosts the NFS filesystems from FlashBlade. The MediaAgent on the Proxy server is required to mount/dismount the snapshots taken through IntelliSnap. To write the Oracle database backup onto the target medium, the proxy server transfers the backup data over the network to the MediaAgent server, which writes it onto FlashBlade. As such, this design needs good network connectivity between the proxy servers and the MediaAgent servers.

As part of this paper, we tested Options 2 and 3, and the details can be found in the **Test Results** section.

Server Configuration

The environment was setup based on various Cisco UCS® components. Intel® CPU-based Cisco UCS B-series B200 M4 blade servers were deployed to host various functions like Database server, Proxy Server and Media Server. All servers include a Cisco UCS VIC 1340 card and they were connected by four ports from each Cisco Fabric extender of the Cisco UCS chassis to the Cisco Fabric Interconnect, which was in turn connected to the Cisco MDS 9148S for upstream connectivity to access the Pure Storage FlashArray//M LUNs. The individual server configuration is described in Table 1.

COMPONENT	DESCRIPTION
PROCESSOR	2 X INTEL XEON E5-2680 V4 2.4 GHZ (2 CPUS WITH 14 CORES EACH)
MEMORY	256GB @ 2.4GHZ (8 X 32GB)
HBA	4 X 10G PORTS ON CISCO UCS VIC 1340 (UCSB-MLOM-40G-03) 40GBPS
NIC	6 INTERFACES CONFIGURED ON CISCO UCS VIC 1340 (1 FOR PUBLIC, 1 FOR PRIVATE, 4 FOR BACKUP)
UCS FIRMWARE (ACROSS ALL COMPONENTS)	3.1 (2B)

TABLE 1. UCS Blade configuration

The UCS VIC 1340 provides 40Gbps of FC/Ethernet bandwidth. Hence the maximum read/write throughput that we can accomplish on a single blade is limited to 40Gbps.

The LAN setup under the service profile for all the servers was setup with six VLANs and each network interface was configured to one of the VLANs. One interface was used for public traffic, one for private traffic, and the remaining four for backups. The four network interfaces on the servers that act as the MediaAgent to write the backup to FlashBlade were configured across four subnets, on which the NFS filesystems/volumes from FlashBlade were to be mounted. Four private IP addresses were configured for these four interfaces. These mount points are then configured within Commvault as part of the Library setup.

```
[oracle@olxcvm01 ~]$ ip addr |grep inet |grep 20
    inet 192.168.201.153/24 brd 192.168.201.255 scope global enp8s0
    inet 192.168.202.153/24 brd 192.168.202.255 scope global enp15s0
    inet 192.168.203.153/24 brd 192.168.203.255 scope global enp16s0
    inet 192.168.204.153/24 brd 192.168.204.255 scope global enp17s0
```

```
[oracle@olxcvm01 ~]$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         10.21.122.1     0.0.0.0         UG    100    0        0 enp6s0
10.21.122.0     0.0.0.0         255.255.255.0   U     100    0        0 enp6s0
192.168.1.0     0.0.0.0         255.255.255.0   U     100    0        0 enp7s0
192.168.201.0   0.0.0.0         255.255.255.0   U     100    0        0 enp8s0
192.168.202.0   0.0.0.0         255.255.255.0   U     100    0        0 enp15s0
192.168.203.0   0.0.0.0         255.255.255.0   U     100    0        0 enp16s0
192.168.204.0   0.0.0.0         255.255.255.0   U     100    0        0 enp17s0
```

The IP addresses used for the four interfaces of the backup network were 192.168.x.153 for each subnet. The four subnets were 201, 202, 203, and 204.

Source Medium – FlashArray Configuration

FlashArray was connected to the Cisco UCS blades through the Cisco MDS 9148S switches. Oracle database(s) were hosted on the LUNs/Volumes provisioned from Pure FlashArray. Zoning was performed on the MDS switches to allow FlashArray to see the initiators.

There are no special configurations or performance knobs to tune FlashArray. The hosts are redundantly connected to the controllers with four connections to each controller from four redundant HBAs on each host over the FC protocol, for a total of sixteen logical paths.

COMPONENT	DESCRIPTION
FLASHARRAY	//M70
CAPACITY	37.22 TB RAW (BASE CHASSIS) 22.33 TB USABLE
CONNECTIVITY	4 X 16 GB/S REDUNDANT FIBER CHANNEL 1 GB/S REDUNDANT ETHERNET (MANAGEMENT PORT)
PHYSICAL	3U 5.12" X 18.94" X 29.72" FLASHARRAY//M CHASSIS
O.S VERSION	PURITY 4.10.4

TABLE 2. FlashArray configuration

Target Medium – FlashBlade Configuration

FlashBlade was connected to the UCS blades through Cisco 9K switches.

COMPONENT	DESCRIPTION
FLASHBLADE	15 X 8TB BLADES
CAPACITY	120 TB RAW 81.23 TB USABLE (WITH NO DATA REDUCTION)
CONNECTIVITY	1 X 40 GB/S ETHERNET (DATA) 1 GB/S ETHERNET (MANAGEMENT PORT)
PHYSICAL	4U
SOFTWARE	ELASTICITY 2.0.1

TABLE 3. FlashBlade configuration

The FlashBlade network settings were configured with four subnets across four VLANs. The NFS filesystems were to be mounted on these subnets on the MediaAgent host.

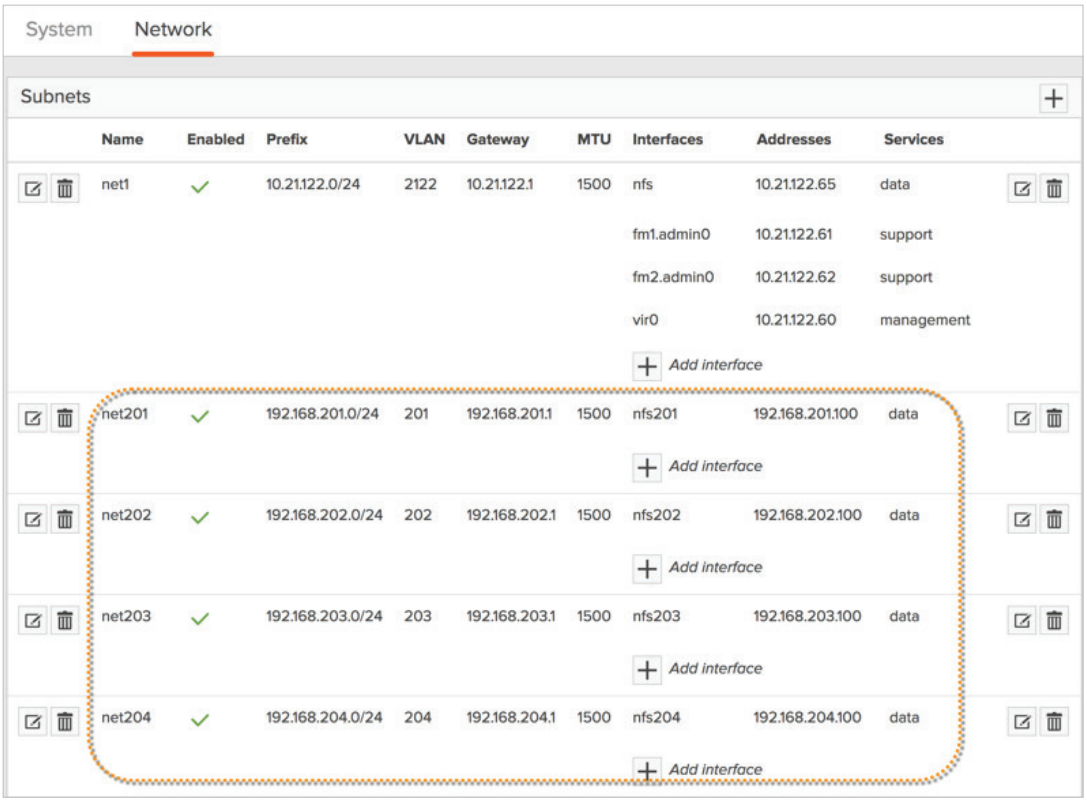


FIGURE 1. Network setup in FlashBlade

Commvault Configuration

1. SETUP STORAGE FOR BACKUP TARGET

For the Commvault backup and recovery test, four NFS filesystems were created on FlashBlade and named Media01, Media02, Media03, and Media04, each with a size of 10TB. Each filesystem was mounted on the MediaAgent host on one of the four subnets.

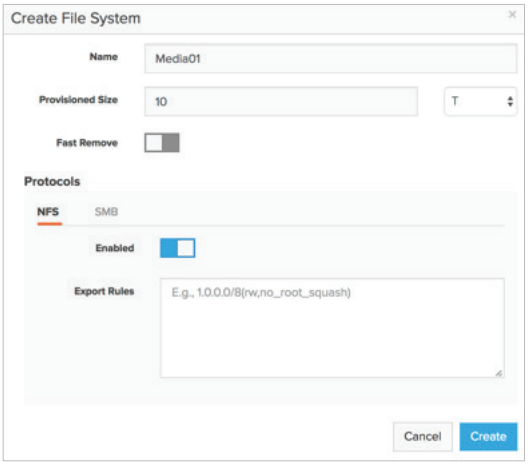


FIGURE 2. Filesystem creation on FlashBlade

```
[root@olxcvm01 /]# df -h /cvmedia/m0?
Filesystem                Size  Used Avail Use% Mounted on
192.168.201.100:/Media01   10T     0   10T   0% /cvmedia/m01
192.168.202.100:/Media02   10T     0   10T   0% /cvmedia/m02
192.168.203.100:/Media03   10T     0   10T   0% /cvmedia/m03
192.168.204.100:/Media04   10T     0   10T   0% /cvmedia/m04
[root@olxcvm01 /]#
```

Figure 3. NFS Filesystems mounted on the MediaAgent

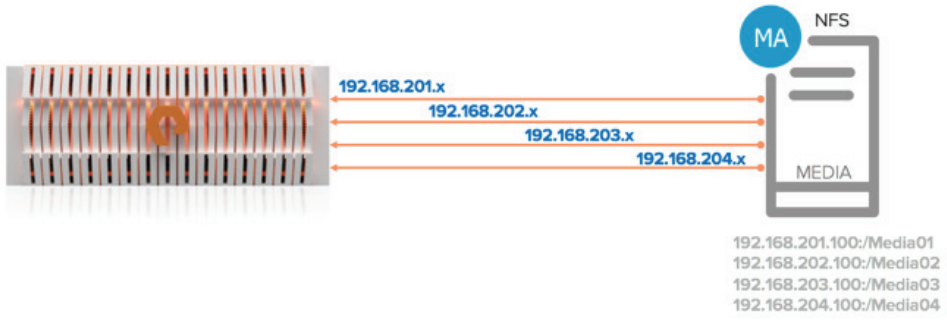


FIGURE 4. MediaAgent connectivity wtih FlashBlade

The above diagram represents the suggested network setup between FlashBlade and the MediaAgent server where the target NFS filesystems are mounted.

Be sure to size the NFS filesystem(s) to hold the backup. Ideally, the filesystems should be sized based on the retention and the frequency of full backups. Of course, you will benefit from the data reduction offered by FlashBlade; the data reduction rate will vary based on the type of data. As the space is always thin-provisioned, there is no penalty for creating a larger-sized filesystem.

2. CONFIGURE FLASHARRAY IN COMMVAULT FOR INTELLISNAP FUNCTIONALITY

FlashArray includes everything required to perform IntelliSnap software operations. There is no special licensing, configuration, or management appliance needed. A minimal amount of configuration is required inside Commvault to add and authorize a FlashArray.

Please see the following link from Commvault documentation to configure the Pure FlashArray.
http://documentation.commvault.com/commvault/v11/article?p=features/snap_backup/configuration/on_cs/t_snap_pure_array_adding.htm

3. CREATE A NEW DISK LIBRARY

We configured a new disk library named FBLibrary with four mount paths that were mounted on the Media Server (olxcvm01). This refers to Option #3, described in the Logical Architectures section.

Alternatively, you can mount the NFS filesystems from FlashBlade on the Proxy server and include them as part of the Disk Library to mimic Option #2, described in the Logical Architectures section.

OPTION #3 (SEPARATE MEDIA SERVER SETUP)

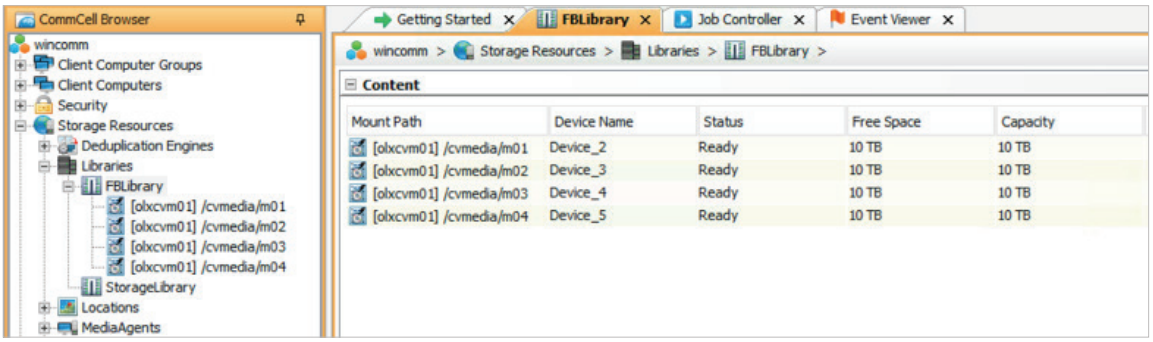


FIGURE 5. Library definition using separate Media Server

OPTION #2 (SEPARATE PROXY SERVER SETUP)

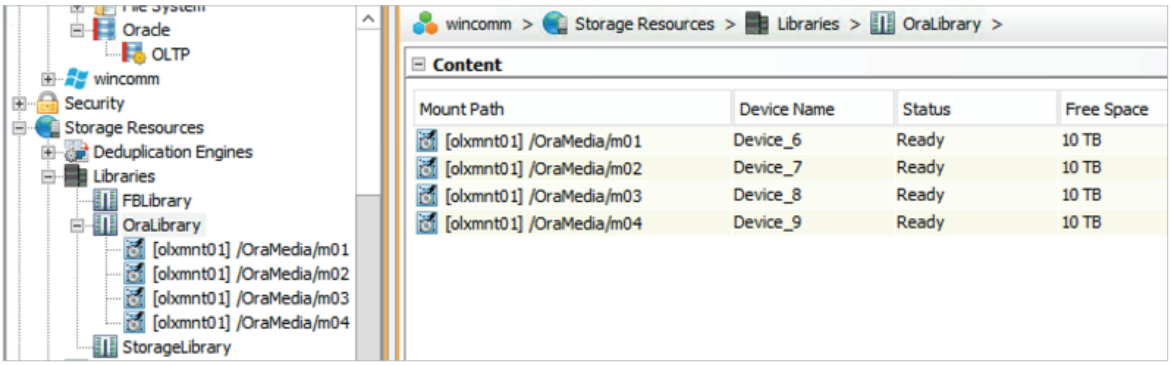


FIGURE 6. Library definition using Proxy Server MA

We selected the **Spill and fill mount paths** option under the Preferences of FBLibrary. To use all these mount paths at the same time, the **Spill and fill mount paths** option is required, which will load balance the data across all available mount paths.

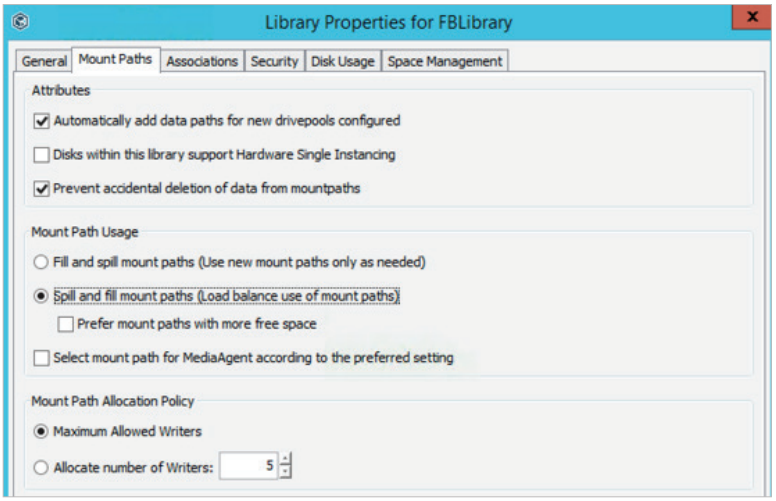


FIGURE 7. Load balancer settings in Library

> FlashBlade scales well with more client connections and, hence, to improve performance we recommend creating multiple NFS filesystems and mounting them on the Media Server.

4. CREATE A NEW STORAGE POLICY

We created a new storage policy using the MediaAgent **olxcvm01**. Alternatively, you can configure another storage policy, using the Disk Library, that refers to the mount paths from the Proxy server (olxmnt01) which would mimic Option #2, described in the Logical Architectures section.

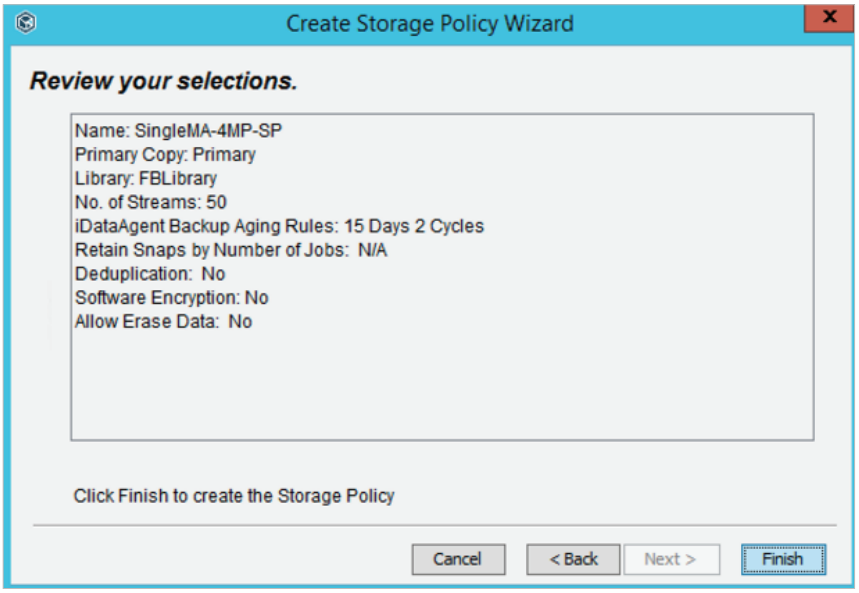


FIGURE 8. New Storage Policy

> We disabled compression and encryption at the Commvault level as FlashBlade offers in-line compression and encryption at the storage level.

We disabled deduplication at the Commvault level specifically to test the performance of backup and restore in and out of FlashBlade. You can opt to enable deduplication, as that should give further data and network reduction on top of compression by FlashBlade, but this will consume CPU cycles on the clients.

5. CREATE A NEW SNAPSHOT COPY AND CONFIGURE THE STORAGE ARRAY

Within the same storage policy, we created a new snapshot copy and configured it to point to FlashArray. This is required to take the backup of the source database through Commvault IntelliSnap technology.

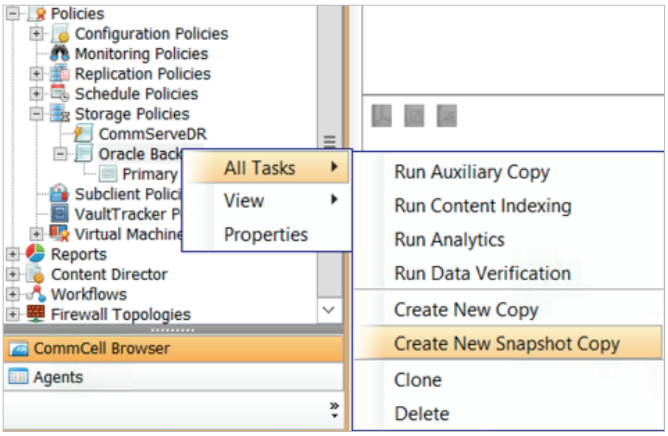


FIGURE 9. Creating a new snapshot copy

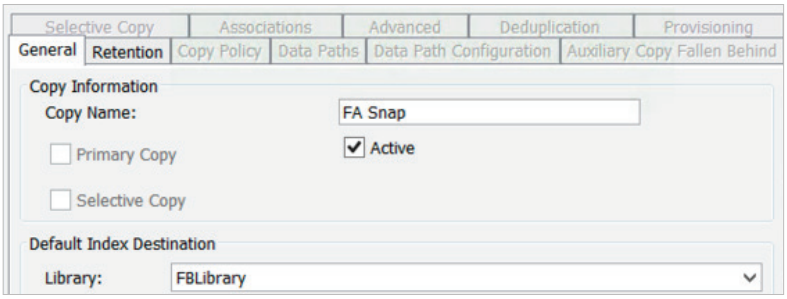


FIGURE 10. New snapshot copy definition

We entered the Copy name (**FA Snap**) and selected the relevant Disk Library (**FBLibrary**).

6. CONFIGURE THE CLIENTS (DB SERVER, PROXY SERVER)

We installed software on the database server and the proxy server using **All Tasks → Add/Remove Software → Install Software** option. We selected the **MediaAgent** and **Oracle** packages for installation. The MediaAgent package is needed on the database server to take snapshots and manage them. The MediaAgent package is needed on the proxy server to mount the snapshots taken by the database server.

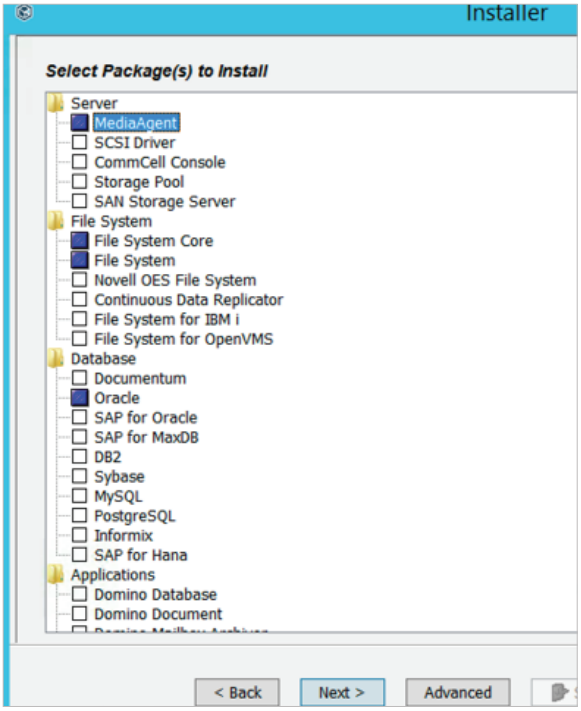


FIGURE 11. Packages to install on the client

7. ENABLE INTELLISNAP AT THE CLIENT LEVEL (DATABASE SERVER)

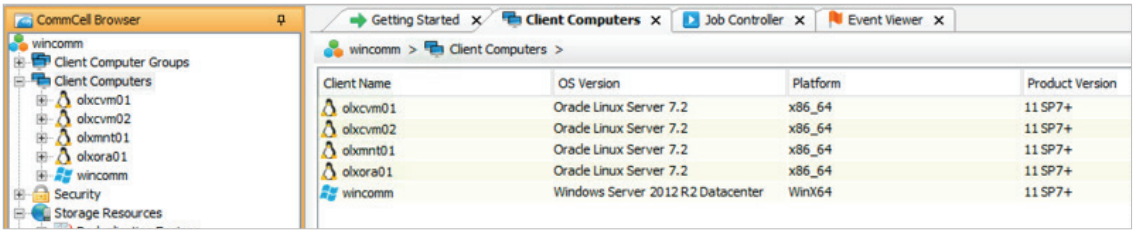


FIGURE 14. Clients on CommCell console

From the CommCell console, we right-clicked on the database server, selected **Properties**, and selected the **Advanced** option. Then we selected the **Enable IntelliSnap** option. You can click on **Manage Array** to review the FlashArray that is configured.

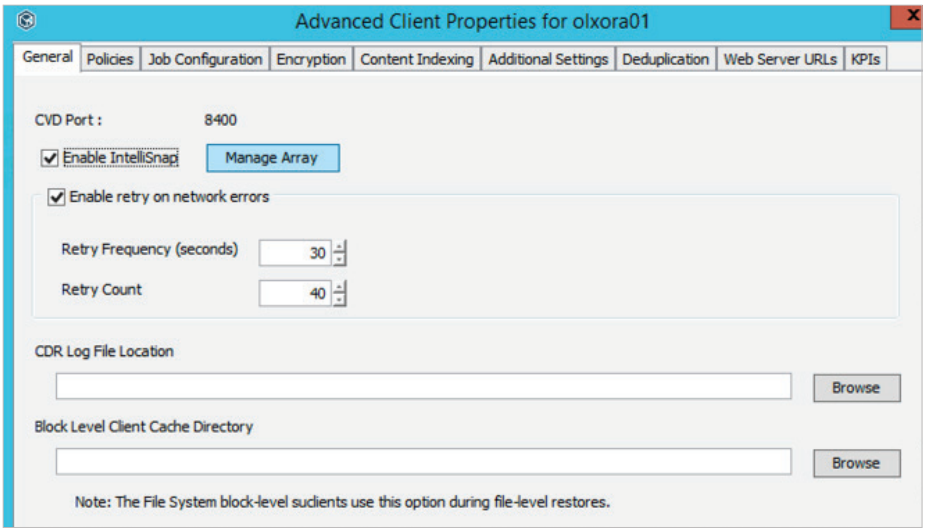


FIGURE 12. Enable IntelliSnap option

8. DISCOVER THE INSTANCE UNDER THE DATABASE SERVER AND CONFIGURE SNAP BACKUP

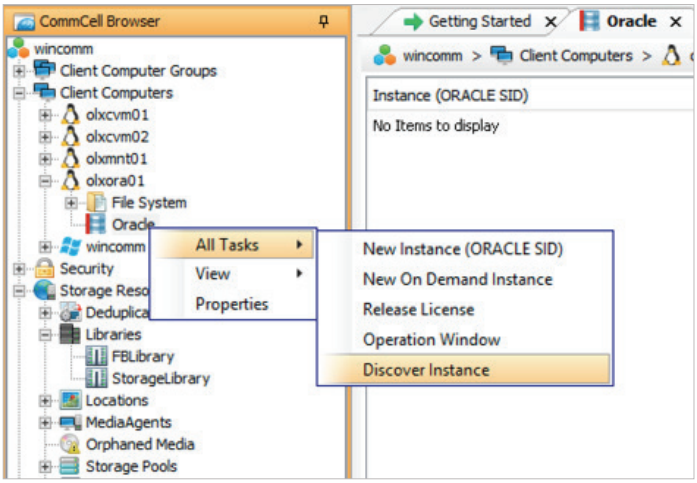


FIGURE 13. Discover Oracle Instance

We right-clicked on the Oracle agent under the database server client, then selected **All Tasks → Discover Instance**.

> If Oracle iDataAgent is not installed on the client server, the Oracle database entry will not show up in the browser under the client.

Once the Oracle instance showed up, we right-clicked on the same, selected **Properties**, and assigned the storage policy for this instance. We disabled client level **Deduplication**, **Compression** and **Encryption** options and increased the number of data backup streams to eight, which will open eight channels to read the backup data.

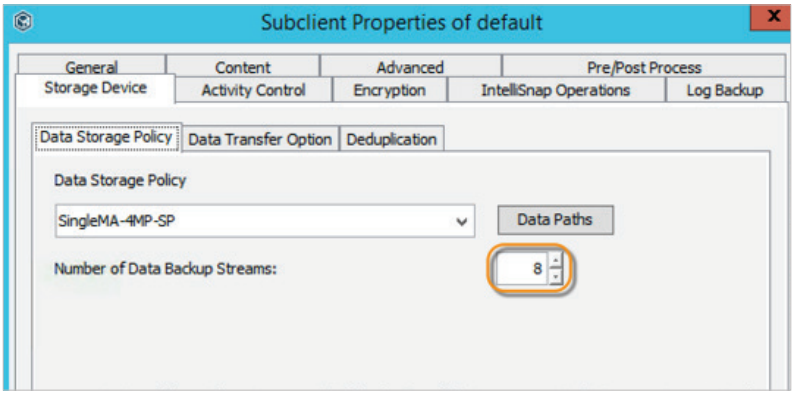


FIGURE 14. Increase Data Backup Streams

We clicked on the **default** sub-client and selected the **IntelliSnap** option for snap backups. We also selected **Use Proxy** to point to the proxy server and **RMAN** as the Backup Copy Interface.

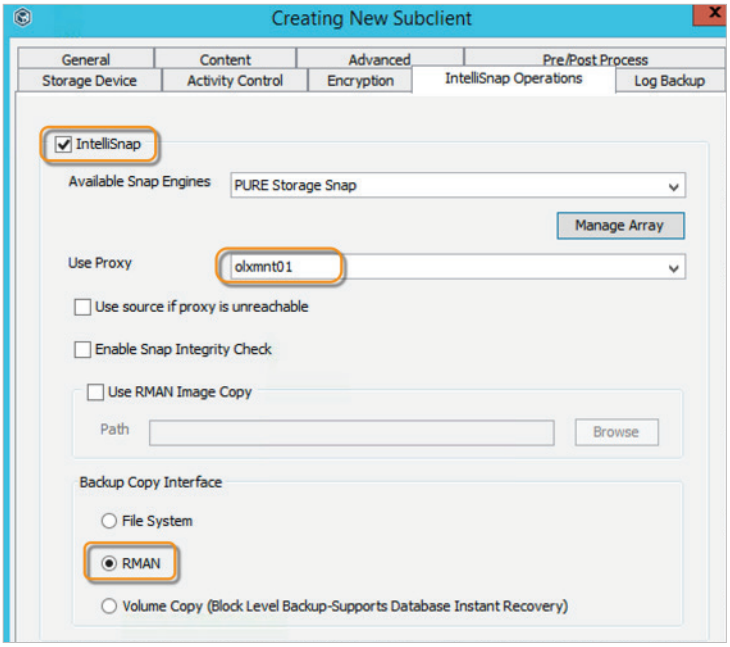


Figure 15. Subclient configuration

9. CONFIGURE THE PROXY SERVER

To write the backups to the secondary media, the proxy server should be configured for the source database. We created a new instance under the proxy server and provided the same **Instance** name as that of the source database (**OLTP**). We provided other relevant information like **Oracle User**, **Oracle Home**, and **Storage Policy**. Please see "Configuring Proxy Clients for Backup Copy Operations" in Commvault's documentation for more details.

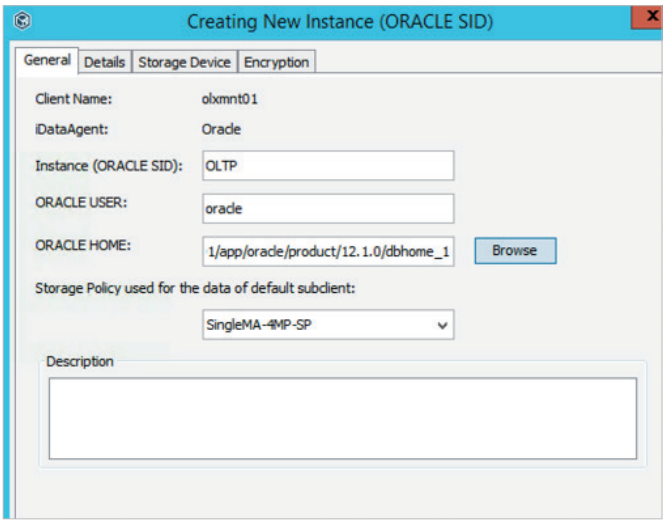


FIGURE 16. Setup new instance on Proxy

We provided the RMAN catalog details like **username**, **password** and **TNS** info.

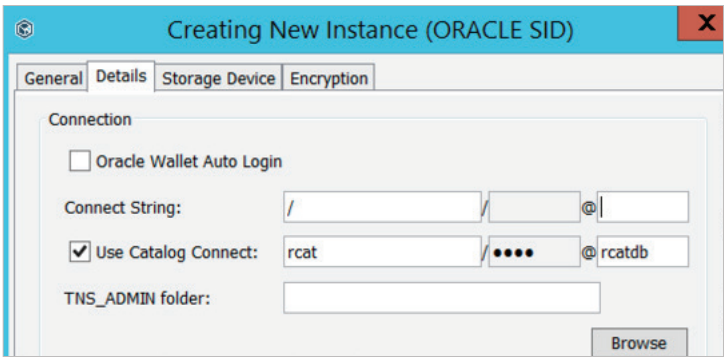


FIGURE 17. Configure RMAN catalog

TEST CASES AND RESULTS

Test Cases

Following are the test cases that were performed to validate the solution and the use of FlashBlade for the secondary target.

- Backup of Oracle database through Media Server to FlashBlade
- Backup of Oracle database through Proxy server to FlashBlade
- Recovery of Oracle database from FlashBlade through Proxy server

To improve bandwidth, we configured the data streams to 16 at the sub-client level. This can be adjusted to meet your needs as you deem appropriate.

Test Results

BACKUP OF ORACLE DATABASE THROUGH MEDIA SERVER TO FLASHBLADE

This setup reflects Option #3, with three servers, viz., Database server (olxora01), Proxy server (olxmnt01) and Media Server (olxcvm01). The NFS filesystems from FlashBlade for the secondary target are mounted on the MediaAgent server.

The database was backed up using the **Backup** option on the **default** sub-client level of olxora01, which submits two jobs.

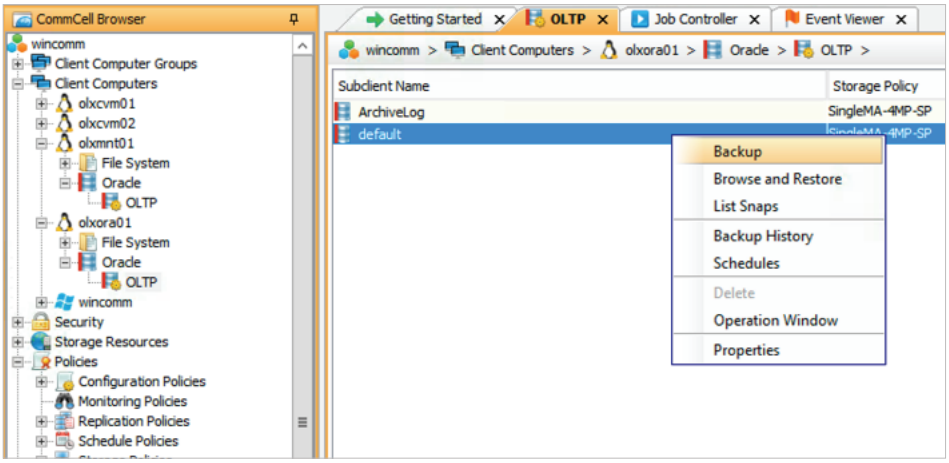


FIGURE 18. Perform backup of the database

The first job performed the snapshot backup, where the IntelliSnap technology placed the Oracle database in hot backup mode and invoked Pure FlashArray's API to take array-based snapshots that are application-consistent. Once the snapshot completed, the second job (backup copy) started, which mounted the snapshot onto the proxy server (olxmnt01) in mount state and backed up the database into FlashBlade using Oracle RMAN through the Media Server (olxcvm01).

The transfer time to back up the 1.03TB database to FlashBlade was 14 minutes 11 seconds at an average throughput of 1.24 GB/s, or 4.35 TB/hour.

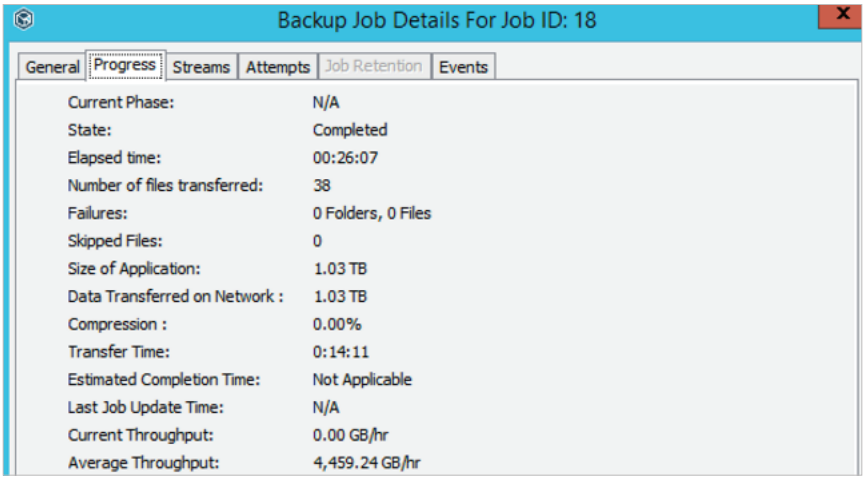


FIGURE 19. Backup Job details

The bandwidth graph from the Pure FlashBlade GUI reflected the same duration. The peaks and valleys in the graph are based on how Commvault was feeding the data to FlashBlade.

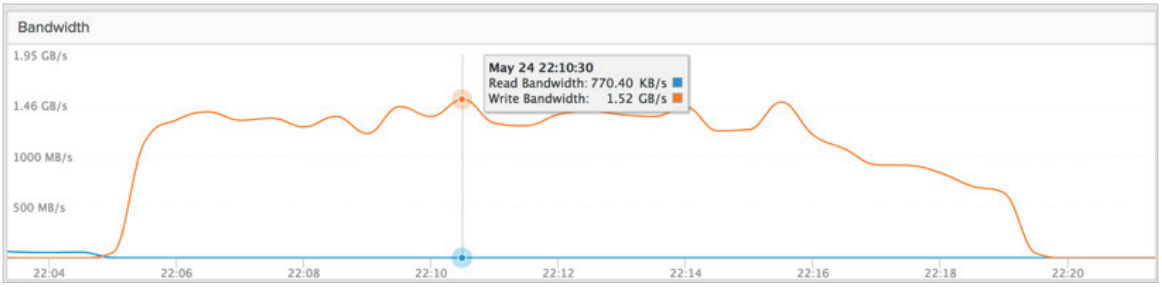


FIGURE 20. Bandwidth metrics from FlashBlade GUI

BACKUP OF ORACLE DATABASE THROUGH PROXY SERVER TO FLASHBLADE

This setup reflects Option #2, with two servers, viz., Database server (olxora01) and Proxy server (olxmnt01). The proxy server also acts as the MediaAgent server and hence the NFS volumes from FlashBlade are mounted on this server.

The database was backed up using the **Backup** option on the **default** sub-client level of olxora01, which submitted two jobs, viz., snap back up to FlashArray and backup copy to FlashBlade.

The transfer time to back up the 1.03TB database to FlashBlade was 13 minutes 10 seconds at an average throughput of 1.34 GB/s, or 4.71 TB/hour. The improvement in throughput (or reduction in transfer time) is due to the savings gained by not transferring the data between the proxy server and the media server.

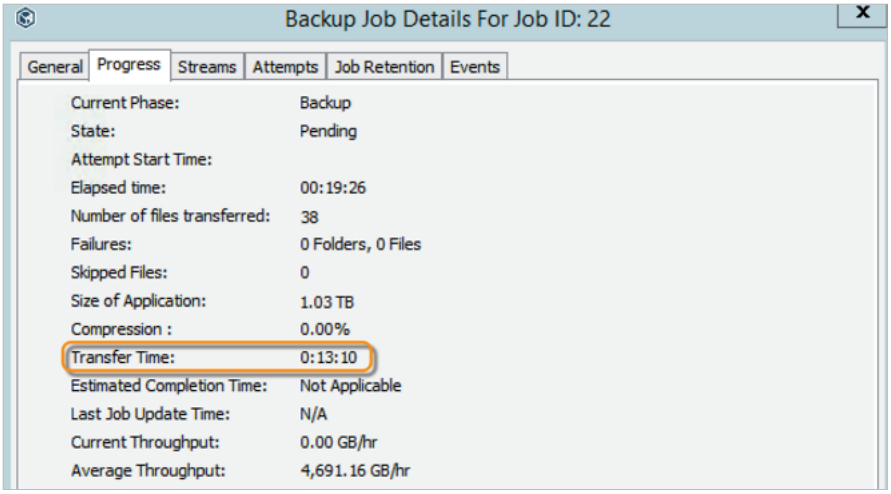


FIGURE 21. Backup Job Details

The bandwidth graph from the Pure FlashBlade GUI reflected the same duration – and showed better peaks than that of the prior test.

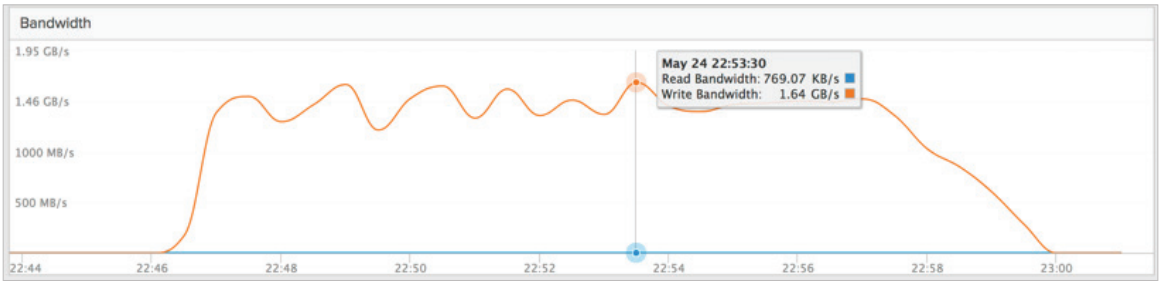


FIGURE 22. Bandwidth metrics from FlashBlade GUI

RECOVERY OF ORACLE DATABASE FROM FLASHBLADE THROUGH PROXYSERVER

The recovery was performed on the same setup as the previous test, with the proxy server also acting as the MediaAgent server.

The database was restored using the **Browse and Restore** option on the **default** sub-client level of the database server (olxora01). We opted to restore from the latest backup, but if needed a specific **Time** range can be selected as well. We clicked **View Content** to get to the next screen.

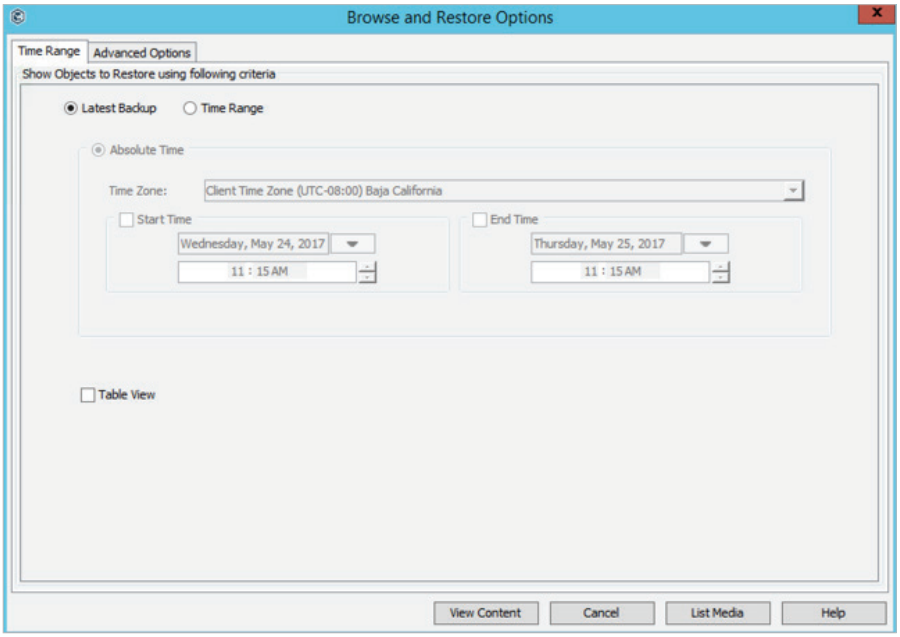


FIGURE 23. Browse and Restore Options

We selected the full database (OLTP) and clicked the **Recover All Selected** option.

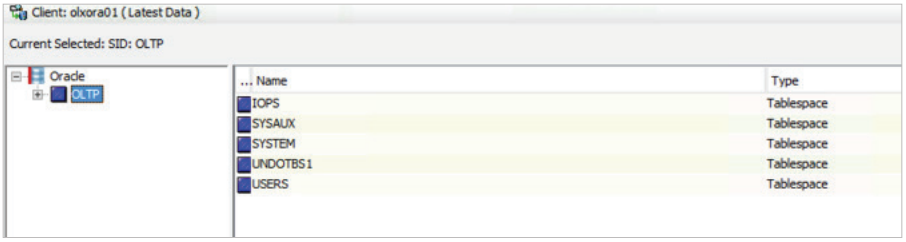


FIGURE 24. Database selection

We increased the number of streams to 16 to speed up recovery. Under **Oracle Restore Options**, we checked **Restore Data** and **Recover**.

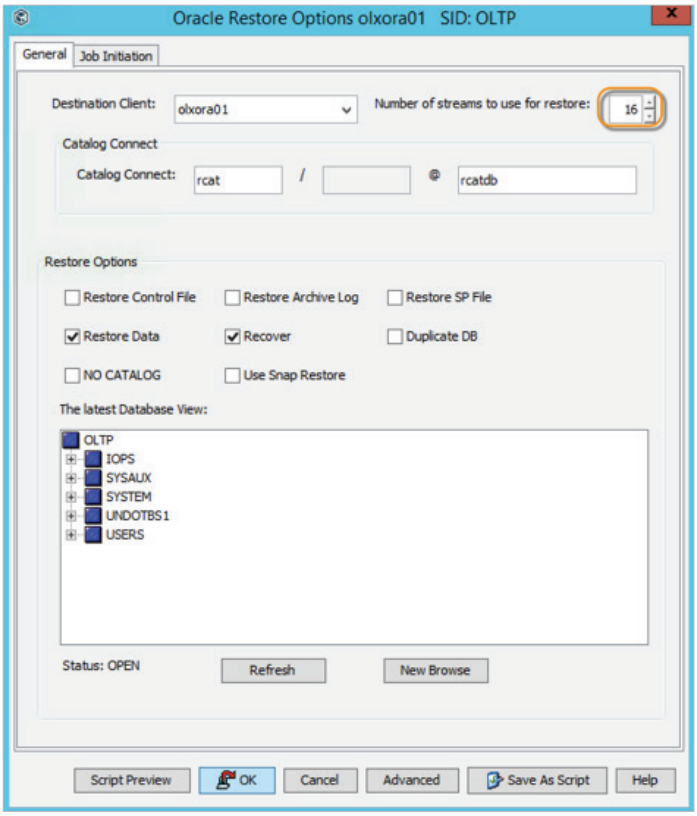


FIGURE 25. Oracle Restore Options

We then selected **Switch Database Mode for Restore** under the **Options** tab in **Advanced** options.

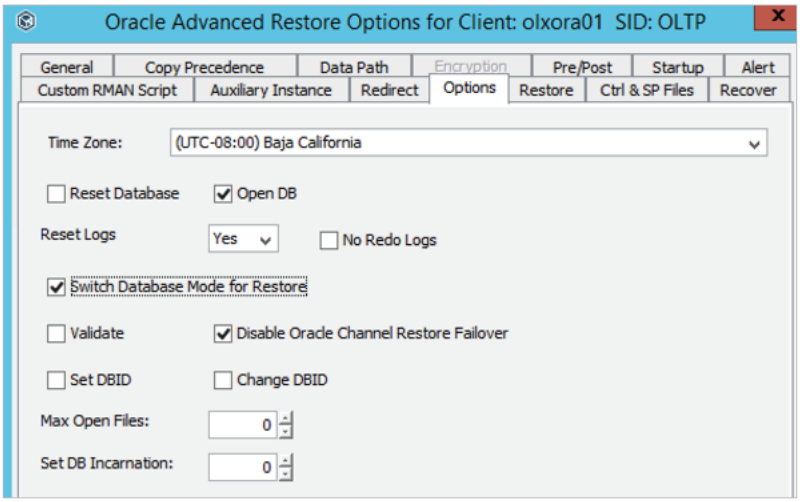


FIGURE 26. Advanced Restore Options

To restore from the secondary media and not from the snapshots, we checked the **Restore from copy precedence** and set the copy precedence to **2**, which refers to the secondary copy. If this is not set, the restore will be performed by reading the Oracle data from the FlashArray snapshots. Please see Commvault documentation for more details on Copy Precedence (see the **References** section).

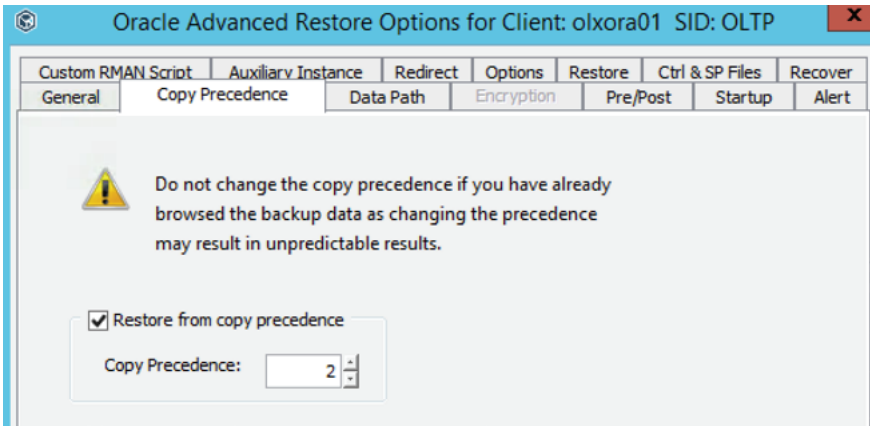


FIGURE 27. Select copy precedence

Overall, the restore and recovery took 31 minutes to complete, which includes the Oracle recovery process as well.

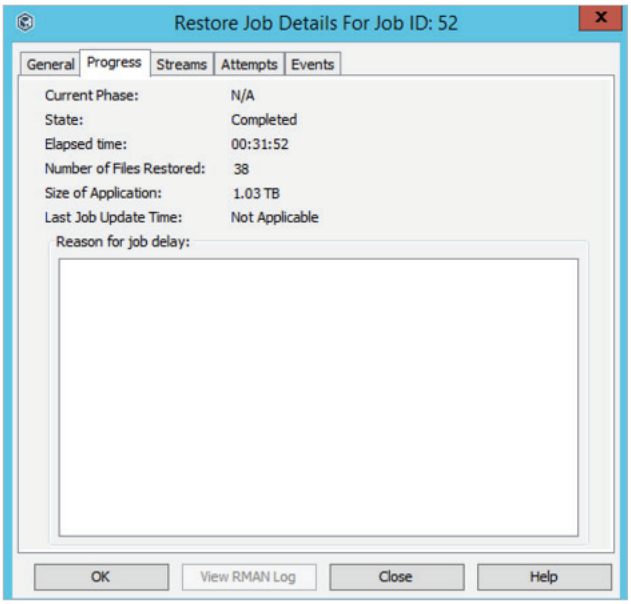


FIGURE 28. Restore Job details

Even though the overall job took 31 minutes, the transfer time is under 20 minutes, as seen from the Pure FlashBlade and FlashArray GUIs. This throughput is not comparable to that of backup, but this is expected as there are various application actions performed by both Commvault and Oracle during the restore and recovery process.

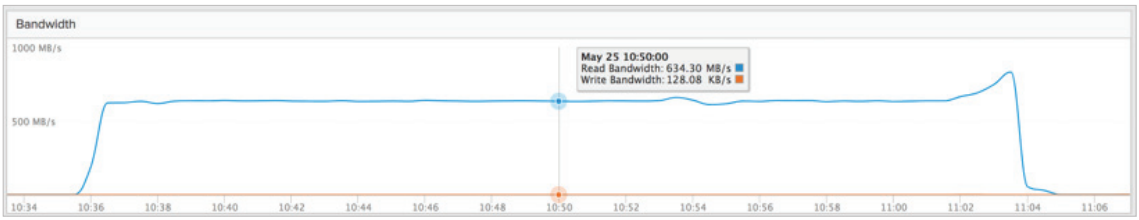


FIGURE 29. Bandwidth metrics from FlashBlade GUI

FIGURE 30. Bandwidth metrics from FlashArray GUI

> As FlashBlade can scale well, the best way to take advantage of it is to enable parallelism wherever possible. Thus, running jobs with parallel threads or running multiple jobs would certainly benefit from FlashBlade's architecture.

BEST PRACTICES FOR COMMVAULT BACKUP AND RESTORE OF ORACLE ON FLASHBLADE

USE MULTIPLE NETWORK INTERFACES

To enhance network bandwidth, make sure you have multiple network interfaces on the client. These multiple interfaces can be configured on a single subnet or on multiple subnets.

LINUX MOUNT OPTIONS

Following are the suggested mount options to mount the NFS filesystem from FlashBlade on to the Linux host. Do not specify the rsize and wsize options, as the system can get the default offered by FlashBlade, which is 524288.

rw, bg, nointr, hard, tcp, vers=3, nolock, noac, actimeo=0

ENABLE PARALLELISM

To increase read and write bandwidth on FlashBlade, increase the data streams on Commvault for backup and recovery.

DISABLE COMPRESSION AT COMMVAULT

Compression is enabled in-line with FlashBlade and hence relieves Commvault clients of using their CPUs to compress data, instead letting the storage array handle the compression task.

DISABLE ENCRYPTION AT COMMVAULT

Encryption is enabled in-line with FlashBlade, and if the requirement is to have data-at-rest encrypted, then disable encryption at the client level in Commvault.

USE SPILL AND FILL MOUNT PATHS

To load balance the backup data to multiple mount paths, select the **Spill and fill mount paths** option at the **Library** level.

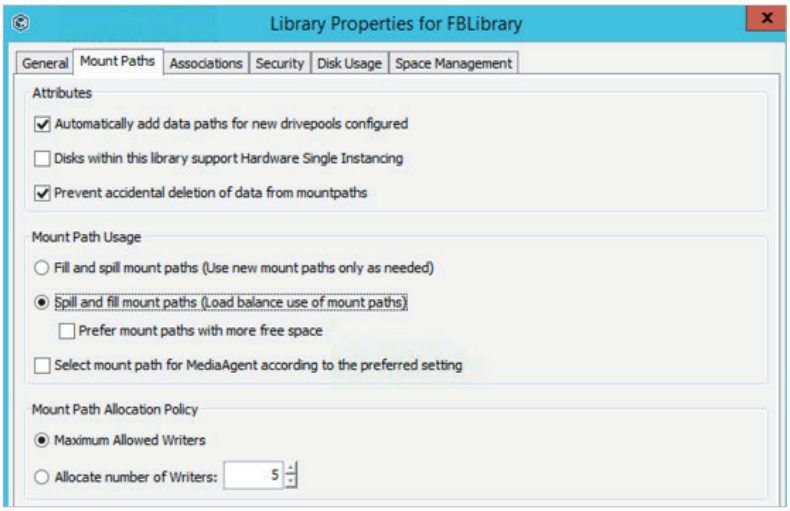


FIGURE 31. Load balancer settings in Commvault Library

CONCLUSION

Businesses need scalable and high performance storage to meet their recovery time objectives. Pure Storage FlashArray snapshots and replication integration with Commvault IntelliSnap technology can reduce backup windows from hours to minutes – without impacting database performance. Pure FlashBlade complements this by enabling a highly performant secondary storage for ultra-fast backup copies and – even more importantly – ultra-fast recovery.

The various backup and recovery tests performed in this paper validate the setup and integration of Commvault IntelliSnap with Pure FlashArray for primary backup and Pure FlashBlade for secondary backup. The dense form factor of both FlashArray and FlashBlade supports petabytes of data, which not only reduces data center footprint but also power and cooling costs. Commvault and Pure Storage together enable a shared infrastructure that provides rapid backup and restore of your most critical business data while saving on datacenter costs.

REFERENCES

The following documents and links were referred to in preparing this document.

1. **Pure Storage Community pages**
   https://support.purestorage.com

2. **Commvault Documentation**
   http://documentation.commvault.com/commvault/v11

3. **Configuring Proxy Clients for Backup Copy Operations**
   http://documentation.commvault.com/commvault/v11/article?p=products/oracle/snap/config_adv.htm

4. **Configuring the Pure Storage Array Using Array Management**
   http://documentation.commvault.com/commvault/v11/article?p=features/snap_backup/configuration/on_cs/t_snap_pure_array_adding.htm

5. **Copy Precedence**
   http://documentation.commvault.com/commvault/v11/article?p=features/storage_policies/storage_policies_how_to.htm#Setting_the_Copy_Precedence

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Somu has over 20 years of Oracle database experience, including as a member of Oracle Corporation's Systems Performance and Oracle Applications Performance Groups. His career has also included assignments with Logitech, Inspirage, and Autodesk, ranging from providing database and performance solutions to managing infrastructure, to delivering database and application support, both in-house and in the cloud.

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