PURESTORAGE

Commvault® IntelliSnap® Technology FlashArray Integration for Oracle® Database

November, 2015

Contents

Executive Summary

Enterprises today increasingly turn to array-based snapshots to augment or replace legacy data protection solutions that have been overwhelmed by exponential data growth. Management and automation are an integral parts of being able to effectively leverage array-based snapshots. Efficient and integrated use of array-based snapshots are key requirements in protecting enterprise applications.

Pure Storage FlashArray snapshots form an intrinsic part of the way the Purity Operating Environment reduces complexity and maintains efficiency. FlashArray snapshots delivers superior space efficiency, high scalability, and unmatched simplicity in management. FlashArray snapshots are always thin provisioned. Space is not pre-allocated during snapshot creation. As new or changed data is written to the source volume, new capacity is allocated to the newly-written or overwritten blocks while unchanged blocks are shared between snapshots and volumes. Additionally, the Purity Operating Environment data structures allow snapshots to preserve the granular data reduction efficiencies of volumes through global deduplication and compression, thus volume snapshots require minimal physical capacity on flash drives. Since FlashArray snapshots are entirely metadata constructs, they can be created from a volume in a matter of milliseconds regardless of the allocated size or used space of the source volume.

Commvault® adds orchestration and functional value on top of the Pure Storage FlashRecover Snapshot technology with the IntelliSnap® Technology snapshot management feature set. IntelliSnap technology streamlines and simplifies snapshot management by centralizing snapshot management across one or many storage arrays; automating object, application and database recovery; and linking snapshots to backup processes. The tight coupling of managed snapshots along side of data protection and recovery operations enables Commvault software to provide a complete view into data across applications, devices, operating systems and locations, cutting administrative overhead and improving access, availability and IT efficiency.

Goals and Objectives

This paper provides an overview of the Commvault IntelliSnap technology integration with Pure Storage FlashArray to protect Oracle databases and deliver superior recovery point and time objectives. This includes initial configuration of the FlashArray object in Commvault including all pre-requisites and a walkthrough of various recovery option use cases and their workflows.

In-depth instructions on the configuration, setup and use of the IntelliSnap software is beyond the scope of this paper. For additional details, please refer to Commvault documentation. Performance testing of backup and recovery functions is out of scope this this document.

Audience

This paper is written for database, storage and backup administrators interested in IntelliSnap technology integration with the Pure Storage FlashArray snapshot technology to deliver superior recovery point and time objectives for Oracle databases served by Pure Storage FlashArray. Familiarity with Oracle databases, Pure Storage and Commvault IntelliSnap technology is recommended.

Pure Storage, Inc. 650 Castro Street, Mountain View, CA 94041
http://www.purestorage.com

Pure Storage Overview

Who knew that moving to all-flash storage could help reduce the cost of IT? Pure Storage FlashArray makes server and workload investments more productive, while also lowering storage spend. With Pure Storage FlashArray, organizations can dramatically reduce the complexity of storage to make IT more agile and efficient, accelerating your journey to the cloud.

Pure Storage FlashArray's performance can also make your business smarter by unleashing the power of real-time analytics, driving customer loyalty, and creating new, innovative customer experiences that simply weren't possible with disk. All by Transforming Your Storage with Pure Storage FlashArray.

FlashArray//m, the latest product line from Pure Storage, enables you to transform your data center, cloud, or entire business with an affordable all-flash array capable of consolidating and accelerating all your key applications.

Mini Size—Reduce power, space and complexity by 90%

- 3U base chassis with 15-120+ TBs usable
- ~1kW of power
- 6 cables

Mighty Performance—Transform your datacenter, cloud, or entire business

- Up to 300,000 32K IOPS
- Up to 9 GB/s bandwidth
- <1ms average latency

Modular Scale—Scale FlashArray//m inside and outside of the chassis for generations

- Expandable to ~½ PB usable via expansion shelves
- Upgrade controllers and drives to expand performance and/or capacity

Meaningful Simplicity—Appliance-like deployment with worry-free operations

- Plug-and-go deployment that takes minutes, not days
- Non-disruptive upgrades and hot-swap everything
- Less parts = more reliability

The FlashArray//m expands upon the FlashArray's modular, stateless architecture, designed to enable expandability and upgradability for generations. The FlashArray//m leverages a chassis-based design with

customizable modules, enabling both capacity and performance to be independently improved over time with advances in compute and flash, to meet your business' needs today and tomorrow.

The Pure Storage FlashArray is ideal for:

Accelerating Databases and Applications—Speed transactions by 10x with consistent low latency, enable online data analytics across wide datasets, and mix production, analytics, dev/test, and backup workloads without fear.

Virtualizing and Consolidating Workloads—Easily accommodate the most IO-hungry Tier 1 workloads, increase consolidation rates (thereby reducing servers), simplify VI administration, and accelerate common administrative tasks.

Delivering the Ultimate Virtual Desktop Experience—Support demanding users with better performance than physical desktops, scale without disruption from pilot to >1000's of users, and experience all-flash performance for under $100/desktop.

Protecting and Recovering Vital Data Assets—Provide an always-on protection for business-critical data, maintain performance even under failure conditions, and recover instantly with FlashRecover.

Pure Storage FlashArray sets the benchmark for all-flash enterprise storage arrays. It delivers:

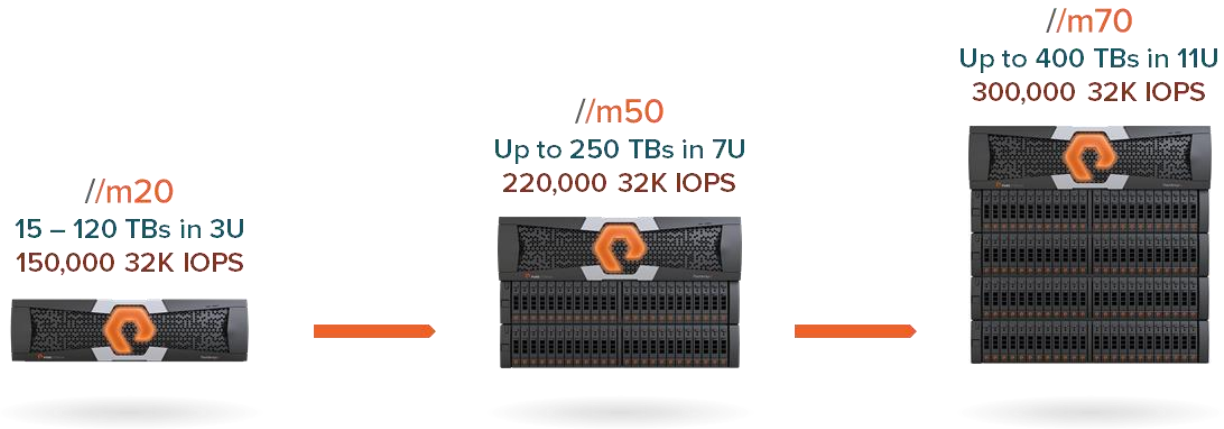
Consistent Performance—FlashArray delivers consistent <1ms average latency. Performance is optimized for the real-world applications workloads that are dominated by I/O sizes of 32K or larger vs. 4K/8K hero performance benchmarks. Full performance is maintained even under failures/updates.

Less Cost than Disk—Inline de-duplication and compression deliver 5 – 10x space savings across a broad set of I/O workloads including Databases, Virtual Machines and Virtual Desktop Infrastructure.

Mission-Critical Resiliency—FlashArray delivers >99.999% proven availability, as measured across the Pure Storage installed base and does so with non-disruptive everything without performance impact.

Disaster Recovery Built-In—FlashArray offers native, fully integrated, data reduction-optimized backup and disaster recovery at no additional cost. Setup disaster recovery with policy-based automation within minutes. And, recover instantly from local, space-efficient snapshots or remote replicas.

Simplicity Built-In—FlashArray offers game-changing management simplicity that makes storage installation, configuration, provisioning and migration a snap. No more managing performance, RAID, tiers or caching. Achieve optimal application performance without any tuning at any layer. Manage the FlashArray the way you like it: Web-based GUI, CLI, VMware vCenter, REST API, Windows PowerShell, Python or OpenStack.



FlashArray//m Specifications

	//m20	//m50	//m70
Capacity	• Up to 120+ TBs effective capacity* • 5 – 40TBs raw capacity (base chassis)	• Up to 250+ TBs effective capacity* • 30 – 88TBs raw capacity (w/shelves)	• Up to 400+ TBs effective capacity* • 44 – 136TBs raw capacity (w/shelves)
Performance	• Up to 150,000 32K IOPS** • <1ms average latency • Up to 5 GB/s bandwidth	• Up to 220,000 32K IOPS** • <1ms average latency • Up to 7 GB/s bandwidth	• Up to 300,000 32K IOPS** • <1ms average latency • Up to 9 GB/s bandwidth
Connectivity	• 8 Gb/s Fibre Channel • 10 Gb/s Ethernet iSCSI • Management and Replication ports	• 16 Gb/s Fibre Channel • 10 Gb/s Ethernet iSCSI • Management and Replication ports	• 16 Gb/s Fibre Channel • 10 Gb/s Ethernet iSCSI • Management and Replication ports
Physical	• 3U • 742 Watts (nominal draw) • 110 lbs. (49.9 kg) fully loaded • 5.12” x 18.94” x 29.72” FlashArray//m chassis	• 3U – 7U • 1007 - 1447 Watts (nominal draw) • 110 lbs. (49.9 kg) fully loaded + 44 lbs. per expansion shelf • 5.12” x 18.94” x 29.72” FlashArray//m chassis	• 5U – 11U • 1439 – 2099 Watts (nominal draw) • 110 lbs. (49.9 kg) fully loaded + 44 lbs. per expansion shelf • 5.12” x 18.94” x 29.72” FlashArray//m chassis

* Effective capacity assumes HA, RAID, and metadata overhead, GB-to-GiB conversion, and includes the benefit of data reduction with always-on inline deduplication, compression, and pattern removal. Average data reduction is calculated at 5-to-1, below the global average of the FlashArray user base.

** Why does Pure Storage quote 32K, not 4K IOPS? The industry commonly markets 4K IOPS, but real-world environments are dominated by IO sizes of 32K or larger. FlashArray//m adapts automatically to 512B-32KB IO for superior performance, scalability, and data reduction.

Table 1. Pure Storage FlashArray//m Series.

Purity Operating Environment

Purity implements advanced data reduction, storage management and flash management features, and all features of Purity are included in the base cost of the FlashArray//m.

Storage Software Built for Flash—The FlashCare technology virtualizes the entire pool of flash within the FlashArray, and allows Purity to both extend the life and ensure the maximum performance of consumer- grade MLC flash.

Granular and Adaptive—Purity Core is based upon a 512-byte variable block size metadata layer. This fine-grain metadata enables all of Purity’s data and flash management services to operate at the highest efficiency.

Best Data Reduction Available—FlashReduce implements five forms of inline and post-process data reduction to offer the most complete data reduction in the industry. Data reduction operates at a 512-byte aligned variable block size, to enable effective reduction across a wide range of mixed workloads without tuning.

Highly Available and Resilient—FlashProtect implements high availability, dual-parity RAID-3D, non- disruptive upgrades, and encryption, all of which are designed to deliver full performance to the FlashArray during any failure or maintenance event.

Backup and Disaster Recovery Built-In—FlashRecover combines space-saving snapshots, replication, and protection policies into an end-to-end data protection and recovery solution that protects data against loss locally and globally. All FlashProtect services are fully-integrated in the FlashArray and leverage the native data reduction capabilities.

Pure1

Pure1 Manage—By combining local web-based management with cloud-based monitoring, Pure1 Manage allows you to manage your FlashArray wherever you are – with just a web browser.

Pure1 Connect—A rich set of APIs, plugin-is, application connectors, and automation toolkits enable you to connect FlashArray//m to all your data center and cloud monitoring, management, and orchestration tools.

Pure1 Support—FlashArray//m is constantly cloud- connected, enabling Pure Storage to deliver the most proactive support experience possible. Highly trained staff combined with big data analytics help resolve problems before they start.

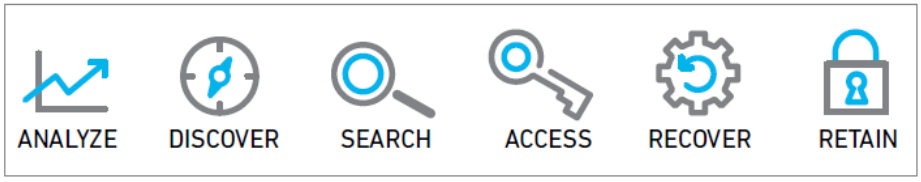
Pure1 Collaborate—Extend your development and support experience online, leveraging the Pure1 Collaborate community to get peer-based support, and to share tips, tricks, and scripts.

Experience Evergreen Storage

Tired of the 3-5 year array replacement merry-go-round? The move to FlashArray//m can be your last data migration. Purchase and deploy storage once and once only – then expand capacity and performance incrementally in conjunction with your business needs and without downtime. Pure Storage's vision for Evergreen Storage is delivered by a combination of the FlashArray's stateless, modular architecture and the ForeverFlash business model, enabling you to extend the lifecycle of storage from 3-5 years to a decade or more.

Commvault® IntelliSnap® Technology Overview

Commvault IntelliSnap technology integrates with native storage array snapshot engines to provide consistent point-in-time recovery copies for large data sets and enterprise applications. IntelliSnap technology quiesces applications or file systems, triggers the storage array-based snapshot, and returns the system to a fully operational state within minutes. By incorporating and linking snapshots with backup and archive operations, Commvault software makes more online and offline copies available for recovery while reducing data protection's impact on production systems. IntelliSnap technology harnesses the power of array-based snapshots to accelerate backup and recovery.



IntelliSnap technology integrates with array-specific APIs in order to execute snapshot management functions. These functions include configure, create, retire, mount, mine, dismount, monitor, retain, revert and restore — and are managed and executed in the same way regardless of hardware platform. Thus, IntelliSnap technology can consolidate and standardize snapshot management and snapshot-based recovery across nearly all-leading storage platforms.

IntelliSnap technology enables a modernized approach to data protection by merging storage system hardware snapshots directly into the data protection process. IntelliSnap technology integrates tightly with both host applications and with the system software specific to each hardware array. As the central orchestration point between the two, the IntelliSnap technology feature drives snapshot creation, indexes the contents and can then push application-consistent and deduplicated backup, archive or DR copies to secondary storage, tape or cloud. IntelliSnap technology normalizes snapshot operations so they look the same and operate the same way regardless of application or storage platform. For longer-term retention copies, Commvault software offloads deduplication, backup and encryption to a separate (proxy) host to minimize impact to production systems. By automatically integrating application intelligence with hardware snapshots, Commvault software is able to reach through the application and file systems into the storage array, discover volume/disk configurations for the snapshot operations, and coordinate these operations with proper application awareness and log management, minimizing administrative configuration and eliminating any scripting requirements.

The Commvault snapshot menu enables granular retention options, such as hourly snapshots retained for a day or daily snapshots retained for a week. The snapshot menu is also enabled with an option to retain a set number of snapshots, which can help eliminate the days/cycles conversation with storage and application administrators. These indexing and retention changes help align storage snapshot retention with standard data protection operations, and are available for all applications and storage platforms. Smart use of IntelliSnap technology to manage native snapshots should ensure the creation of more recovery points for fast recovery without adding complexity.

Commvault Software Overview

The Commvault software platform is an enterprise level, integrated data and information management solution, built from the ground up on a single platform and unified code base. All functions share the same back-end technologies to deliver the unparalleled advantages and benefits of a truly holistic approach to protecting, managing, and accessing data. The platform contains modules to protect and archive, analyze, replicate, and search your data, which all shares a common set of back-end services and advanced capabilities, seamlessly interacting with one another. The Commvault platform addresses all aspects of data management in the enterprise, while providing infinite scalability and unprecedented control of data and information.

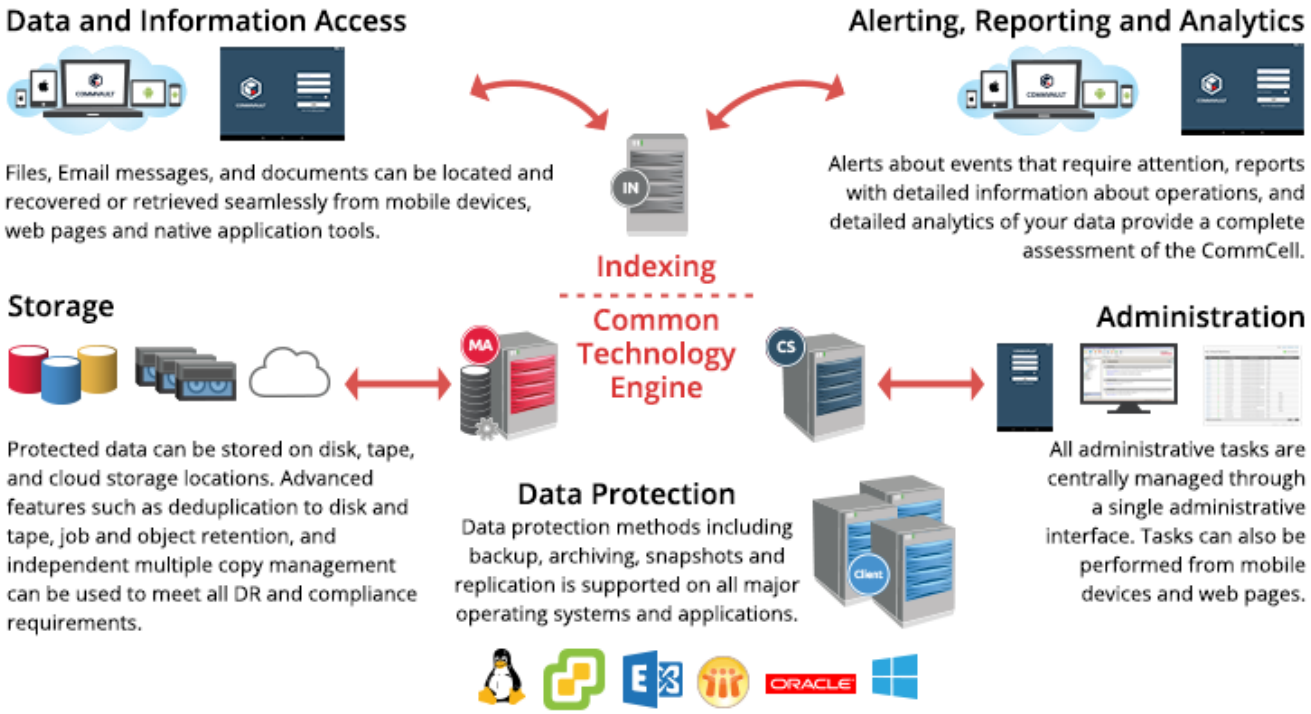
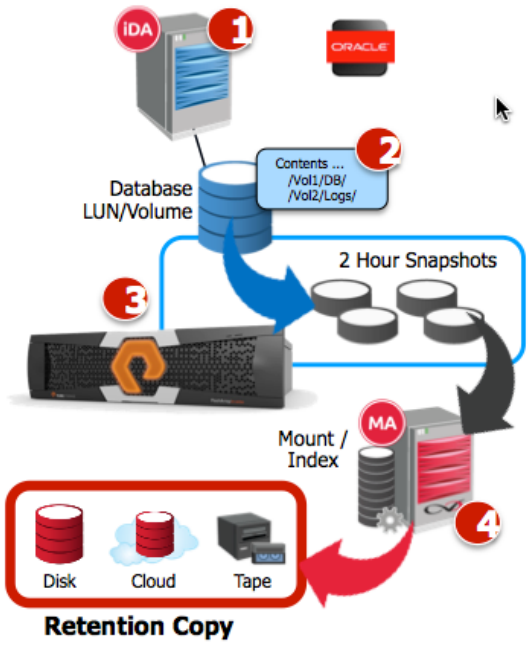


Figure 1. Commvault Data Platform.

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 the native array-based snapshot and forces a log switch. Along with data volume, it also identifies the archived redo log volume(s) and takes snapshot to preserve the logs for replay or point-in-time recovery.



1. Commvault® Agent requests database be quiesced for protection
2. Storage is automatically discovered to ensure changes are automatically tracked
3. IntelliSnap software communicates with the storage array to take snapshot(s)
4. Optionally snapshots can be mounted to a Proxy for further operations such as long term protection, or secondary workloads

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 far 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.

IntelliSnap technology integrated with Pure Storage enables the MyClone feature, which uses native array-based cloning function to create an application-aware copy of the source database. The copy can be used for secondary workloads like development, testing or reporting. The snapshot functionality of Pure Storage FlashReduce is instantaneous and consumes very minimal space for maintaining the metadata at the time of the snapshot creation.

Creating test/dev clones from the production environment instantly through IntelliSnap technology eliminates the need for manual, labor-intensive refreshes and scripts, significantly reducing overhead and accelerating test/dev operations.

System Requirements

The following requirements exist in order to use IntelliSnap Technology integration with the Pure Storage FlashArray:

- FlashArray 400 or FlashArray//m series
- Purity v4.1.1 (or higher)
- REST API: v1.4 (found in Purity v4.x and higher)
- Licensing:
    - Pure Storage arrays require no additional licensing for IntelliSnap software functionality
    - Commvault IntelliSnap technology requires licensing based on the data being snapped
- Protocol Support: Fibre Channel or iSCSI
- Commvault software version 10 service pack 12 or later

Pre-Requisites

The following requirements need to be completed before walking through the configuration steps and use cases 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 Commcel component. Commvault CommServe server should be setup and configured before proceeding. We have setup the CommServe server on a Windows 2012 R2 virtual machine, configured the Linux clients and deployed the iDataAgent for Oracle on those clients that hosts the Oracle database.

2. **Oracle Database** – An Oracle database needs to be installed and running for use in the various use cases discussed in this document. This paper uses two Oracle 12c Release 1 (12.1.0.2) databases (**prod** and **test)** with archived logs enabled on two Red Hat Enterprise Linux 7.0 hosts (**mickey** and **minnie**).

3. **Pure Storage Volume** – A single volume needs to be connected and ready to the Commvault CommServe virtual host. Figure 2 illustrates a volume named **E:\Commvault Library** which is connected to the Commvault virtual machine instance.

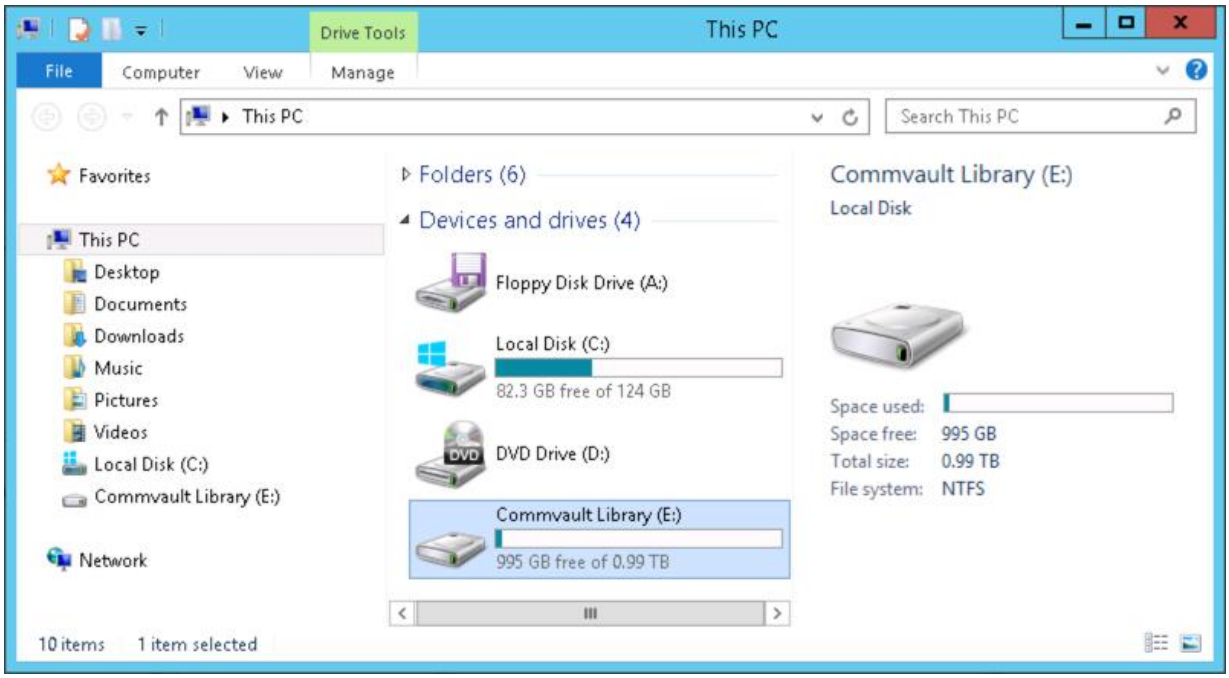


Figure 2. Pure Storage volume used for the Disk Library.

FlashArray Configuration for IntelliSnap Software

The Pure Storage 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 of Commvault software to add and authorize a FlashArray. The following section describes how to register and configure a FlashArray object into the IntelliSnap software.

Note: These steps are performed once per array, which allows IntelliSnap software to integrate with Pure Storage FlashArray.

FlashArray Credentials Setup

To manage a Pure Storage FlashArray from Commvault software the credentials must have "storage admin" privileges or higher. The default Pure Storage FlashArray account, "pureuser", has the required privileges and can be used for testing purposes. We recommend using a dedicated account for use with IntelliSnap software in production environments.

For this configuration Pure Storage Directory Service integration is being used with an Active Directory account named "Commvault Administrator".

Once you have determined the credentials to be used for configuration, log into the Pure Storage FlashArray Web Management interface to generate an API token for the Commvault credentials as given below.

1. Click **System** tab
2. Click **Me** under Users
3. Click the ⚙ (gear icon)
4. Click **Create API Token**

Figure 3 Creating API Token for the logged in user to the FlashArray

Now an API Token has been created for the Commvault Administrator account we need to retrieve the token to be used in the Commvault Array Management setup. Retrieving the API Token requires the same steps involved in creation of the token.

1. Click **System** tab
2. Click **Me** under Users
3. Click the ⚙ (gear icon)
4. Click **Show API Token**
5. Highlight the token and copy (CTRL+C)

Figure 4. Viewing the API Token.

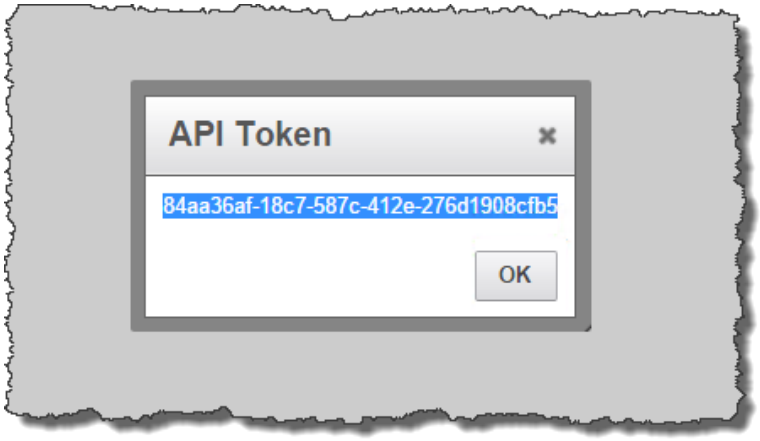


Figure 5. Copy the API Token

Commvault Array Management Setup

Once the FlashArray has been configured with the credentials the next step is to add the FlashAray to the Commvault Array Management interface.

1. Start and login to the Commvault Administrative Interface. This does not have to be the same credentials as previously setup with the Pure Storage FlashArray, but those same credentials can be used if desired. Once the Commvault Administrative Interface is running you will be presented the view shown in Figure 6.

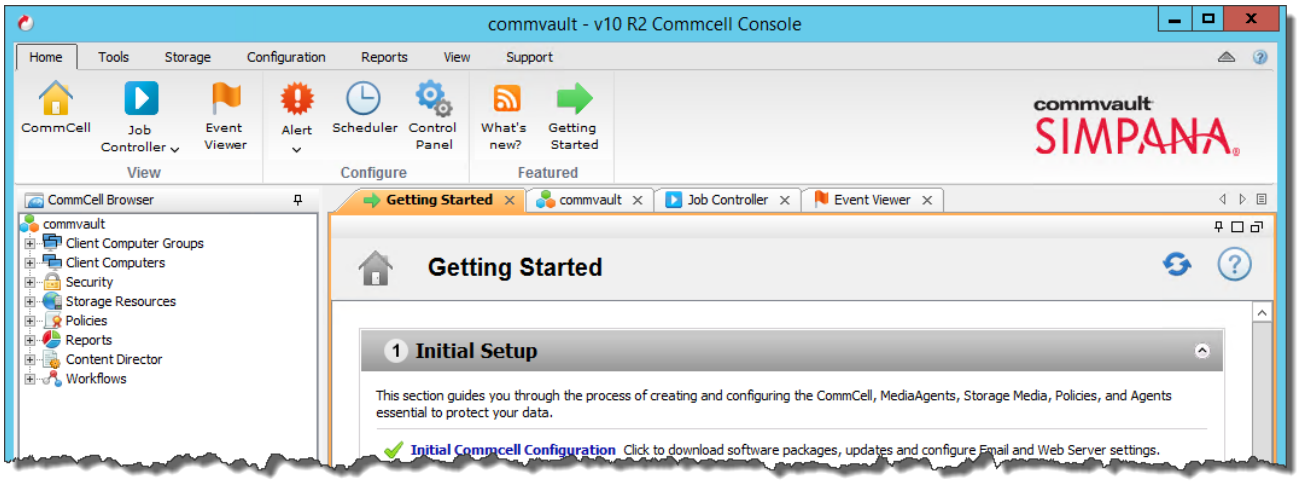


Figure 6. Commvault Administrative Interface

2. Select the **Storage** tab to begin the Array Management setup. Follow the numbered steps to begin adding the Pure Storage FlashArray.

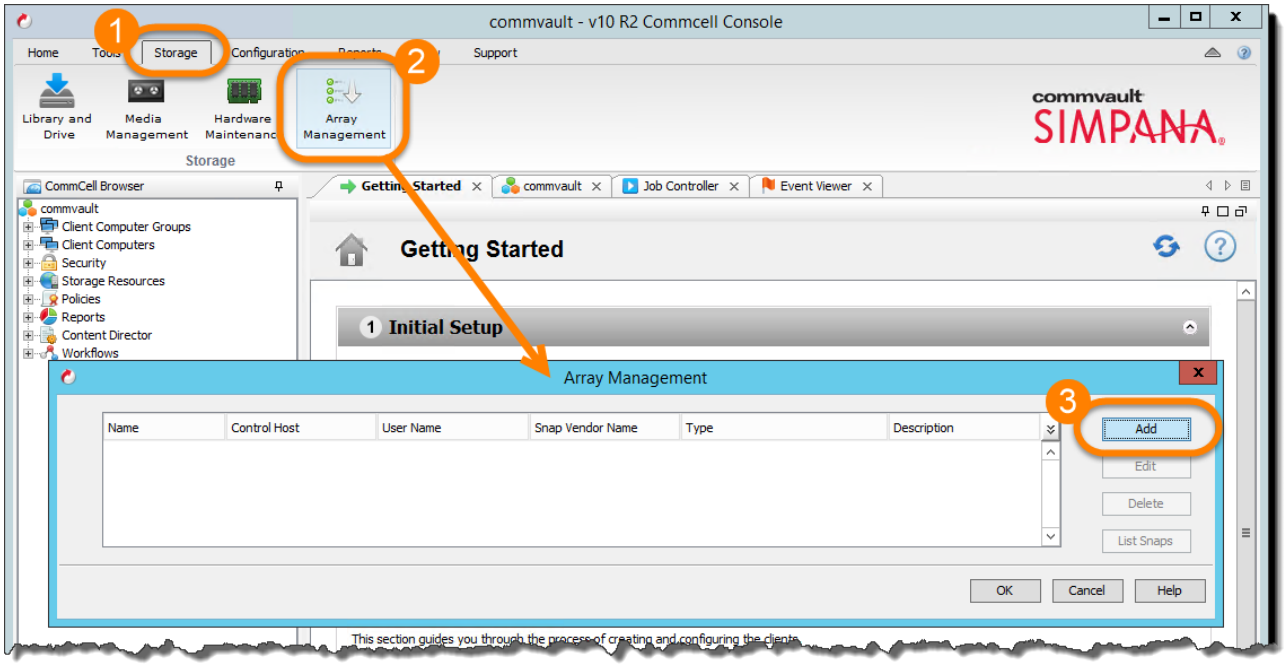


Figure 7. Array Management from Commvault Administrative Interface

3. After clicking **Add** in Step 2 select the **Snap Vendor** dropdown and pick **PURE Storage.**
(Note: If you are not on v10 R2 SP12 version or above, Pure Storage will not show up in the list)

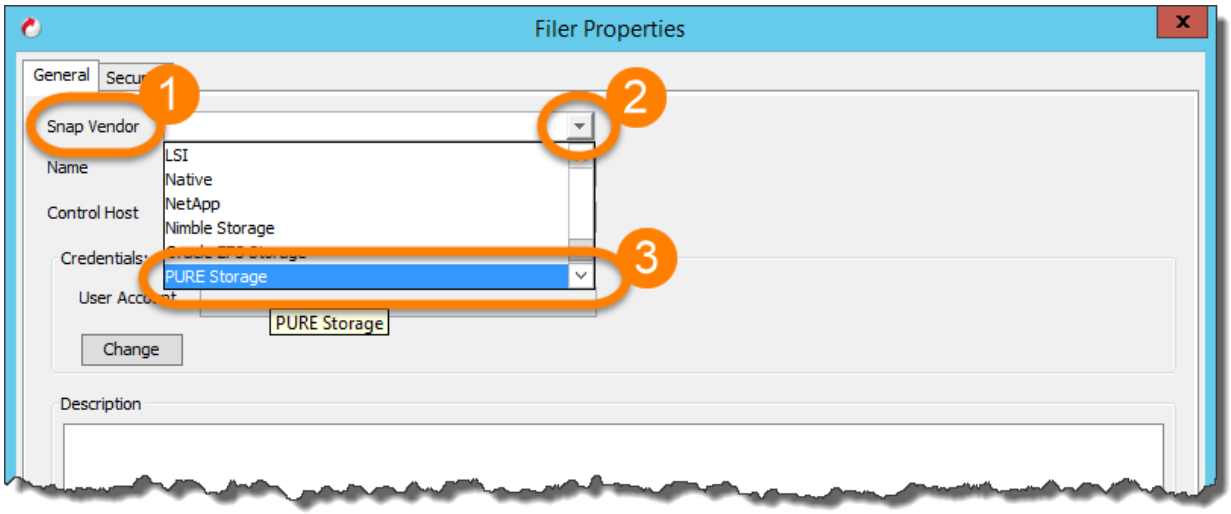


Figure 8. Selecting PURE Storage for Snap Vendor

4. In the **Name** field enter either the IP Address or Fully Qualified Domain Name (FQDN) of the Pure Storage FlashArray.

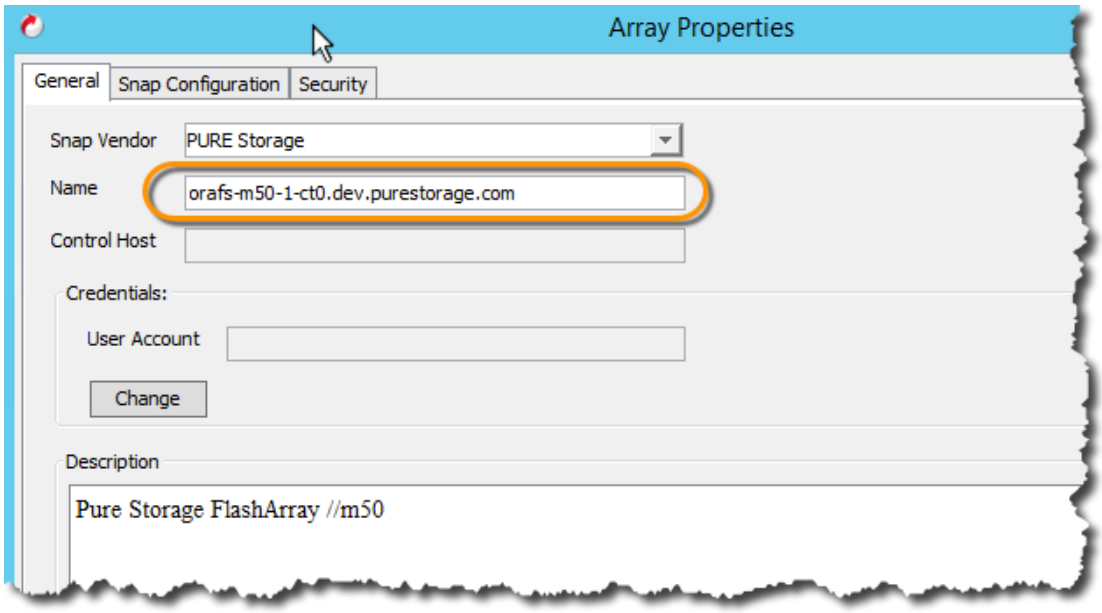


Figure 9. Array properties for the Pure Storage FlashArray

5. Next click **Change** shown in Step 4 above to enter the credentials from the FlashArray Credentials Setup section. The **User Name** is equivalent to the **logon name** from Active Directory. For example this configuration the Commvault Adminsitrator account's logon is **commvault-admin.**

   The API Token from the FlashArray Credentials Setup should be used for the **Password** and **Confirm Password.** The password in this dialog box is not the logon accounts password.

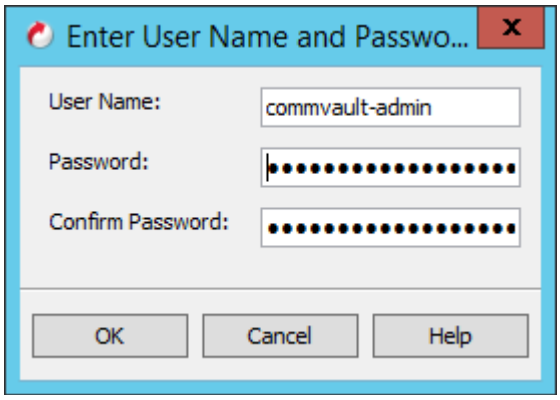


Figure 10. Enter username and API Token

The Pure Storage FlashArray Users API Tokens never expire. API Tokens can be deleted and re-created by a Pure Storage FlashArray storage admin. If deleted and re-created, make sure to update the Array Management information for the specific FlashArray.

6. Optionally, enter in a **Description** for the FlashArray to provide more detail on the specific system. Now click on the **Snap Configuration** tab. This tab provides the user with advanced settings for the behavior of IntelliSnap technology and FlashArray interaction. Pure Storage and Commvault recommend **leaving the default settings.**

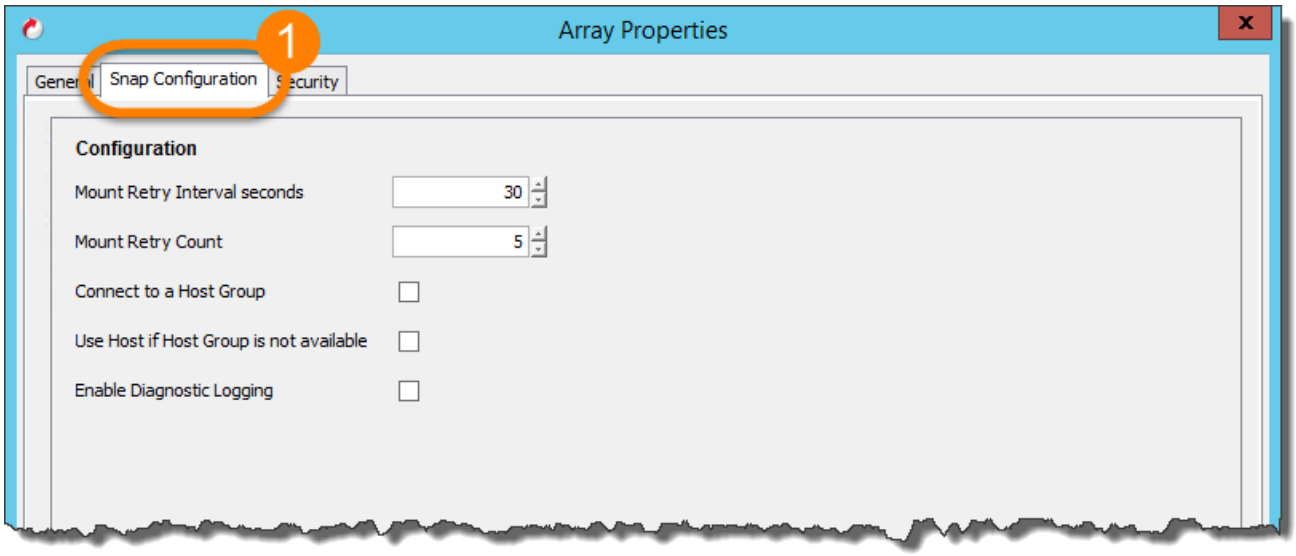


Figure 11. Snap Configuration default values

There are no changes required to be made in the **Security** tab.

Leave all advanced settings at the default values—these settings should only be changed on an as-needed basis ideally at the functional level only. Please note that these settings can be overridden for specific operations.

Commvault Software Storage Resources Library Setup

A Storage Resource needs to be created for storage the output of operations that are performed using the Commvault software and Pure Storage integration. For the Pure Storage integration, a Disk Library will be created in this section out of the three library types available.

Steps

1. From the Commvault Administrative Interface select the **Storage Resources → Libraries → Add → Disk Library…**

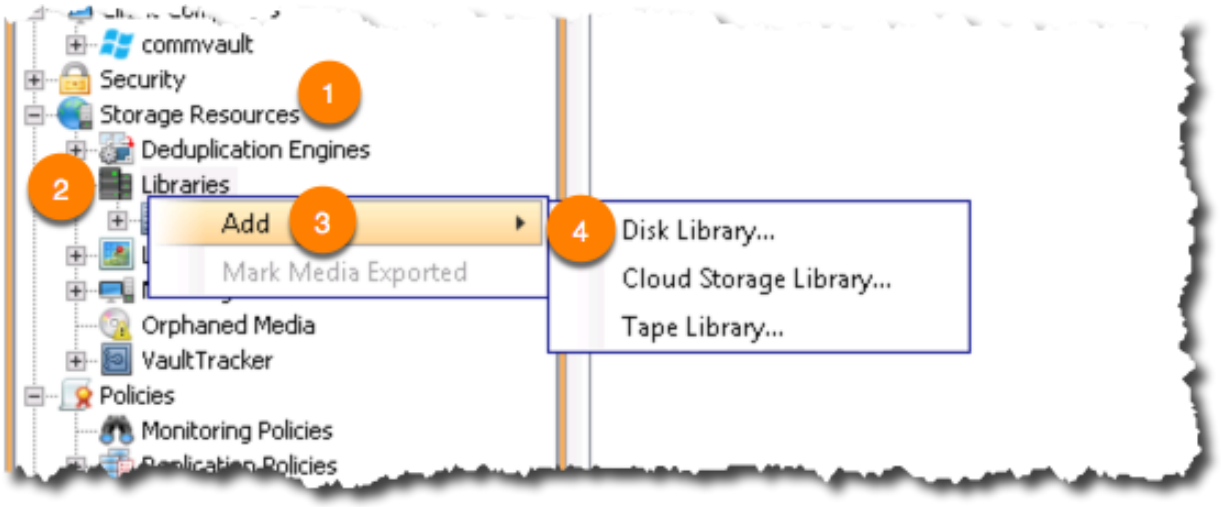


Figure 12. Creating a Disk Library

2. Enter a meaningful **Name** to describe the Disk Library then select the **[…]** to select the **Disk Device**. Select the server for MediaAgent. In our instance, the MediaAgent is also on the same CommServe server.

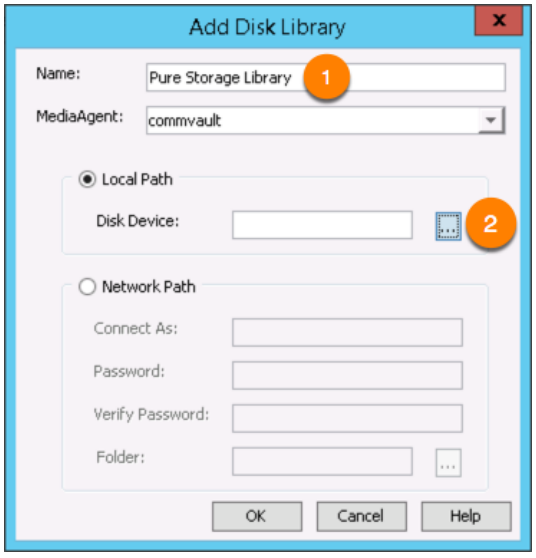


Figure 13. Add a new Disk Library

3. The **Commvault MediaAgent** will query the host for any volumes that are available. Figure 14 shows the volume that will be used for the Disk Library (E:\). For this setup create a **New Folder** called **Library**, then click **OK**.

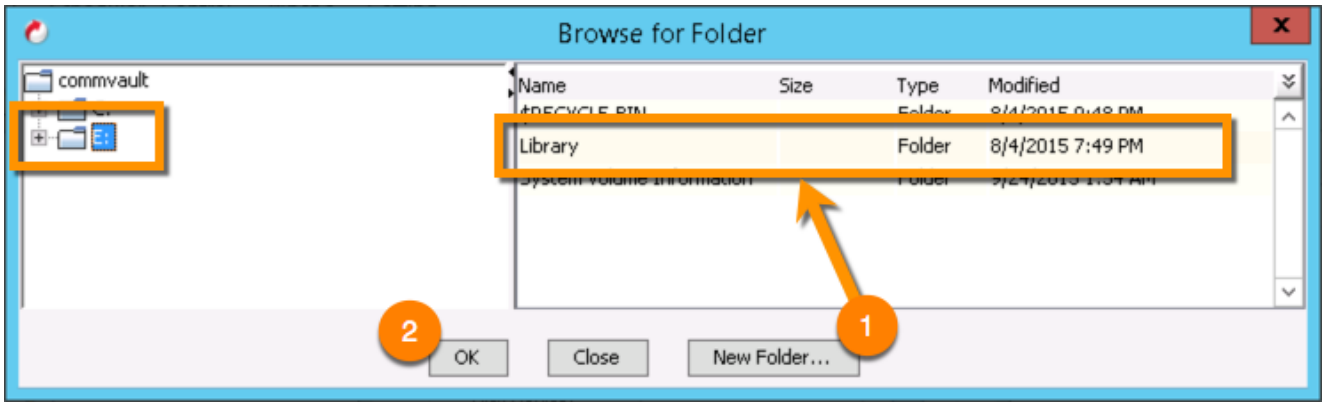


Figure 14. Browse for Folder and create a New Folder

Figure 15 shows the newly created Disk Library named Pure Storage Library.

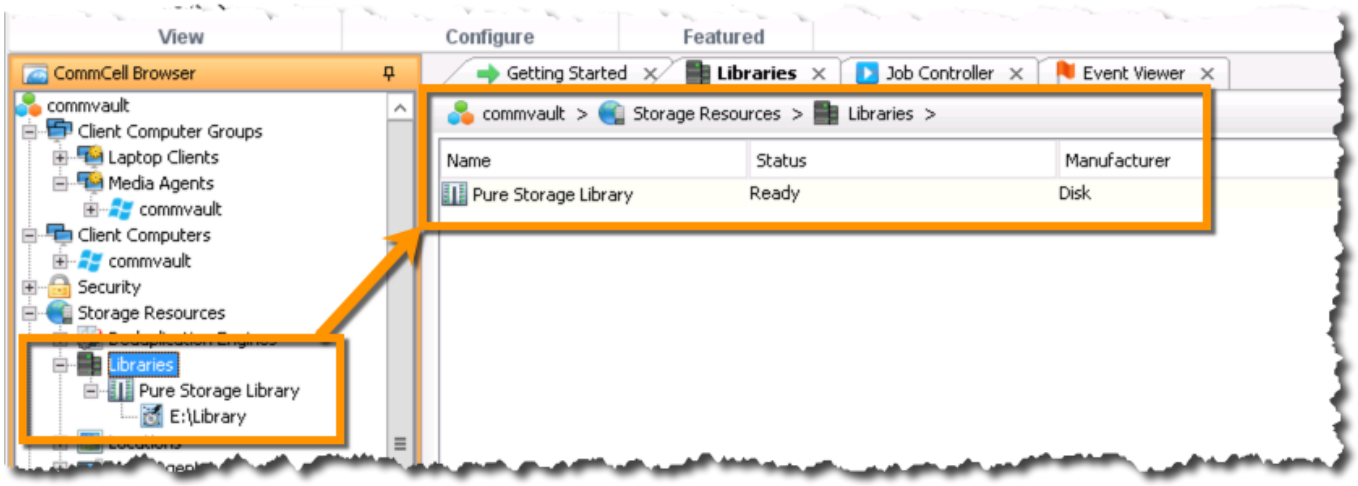


Figure 15. New Pure Storage Disk Library

Commvault Software Storage Policy Setup

IntelliSnap software functionality requires a Storage Policy in order to control retention and other operations. For the use cases presented in this document a single Storage Policy will be created to execute the various IntelliSnap software operations. Multiple client computers can utilize a single Storage Policy depending on the configuration options.

Steps

1. From the Commvault Administrative Interface expand the **Policies** and right-click the **Storage Policies** node in the navigation treeview. Click **New Storage Policy** to launch the wizard.

Figure 16. New Storage Policy Wizard

2. Select **Data Protection and Archiving** as this Storage Policy will be used for protecting the Oracle databases. Click **Next.**

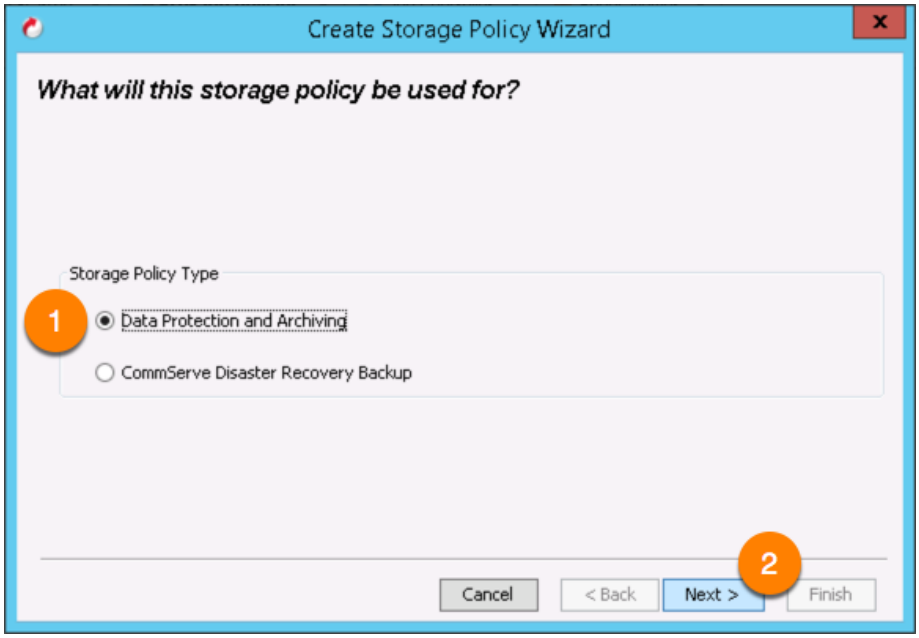


Figure 17. Storage Policy Type

3. Entering a meaningful name for the Storage Policy, **Pure Storage IntelliSnap** and click **Next.**

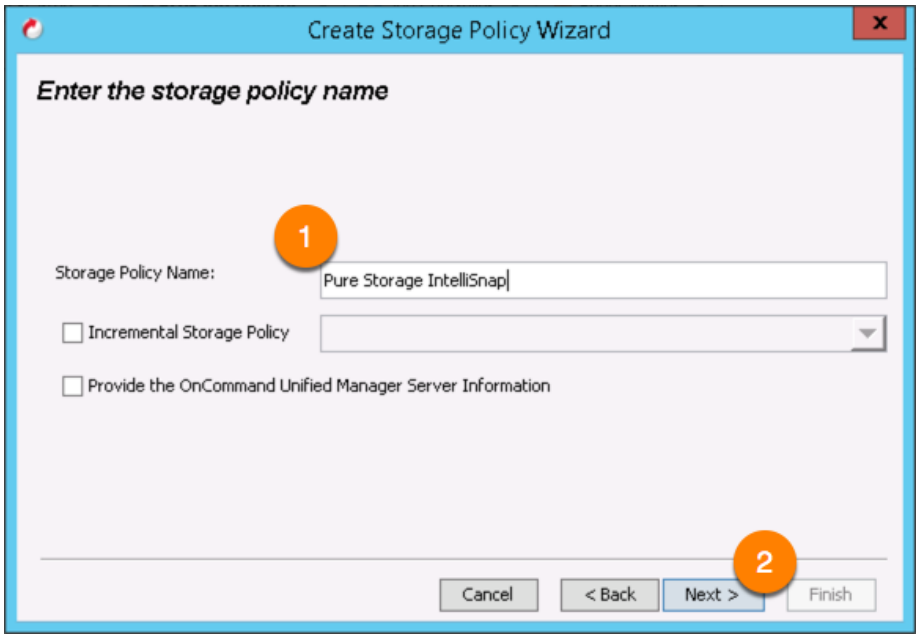


Figure 18. Storage Policy Name

4. Select the newly created Disk Library, **Pure Storage Library**, from the dropdown list that was completed in the previous section. Click **Next.**

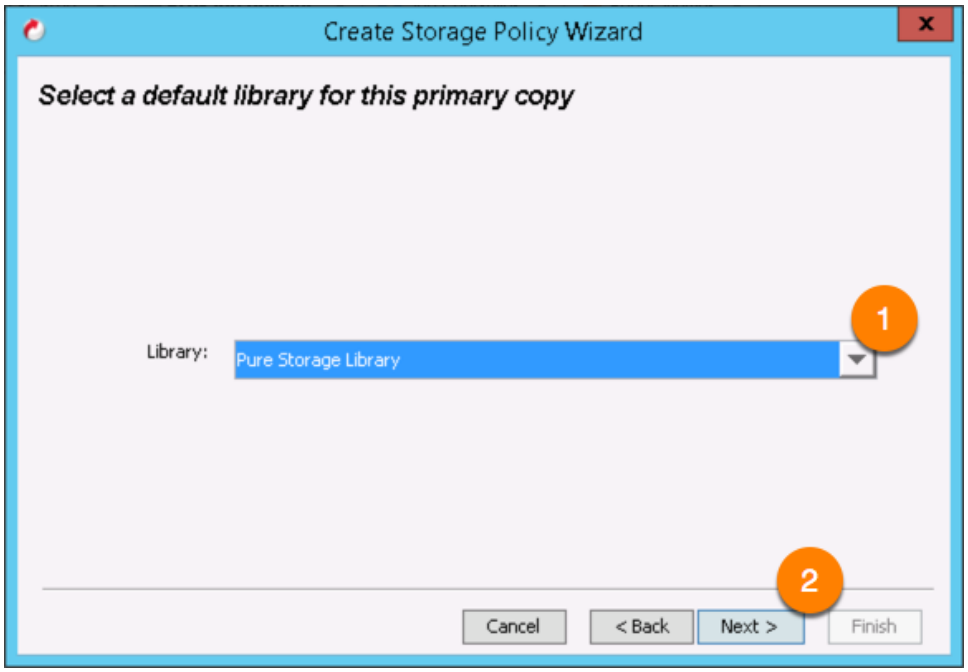


Figure 19. Default Library for Primary Copy

5. Select **MediaAgent** from the dropdown list, **commvault**, then click **Next.**

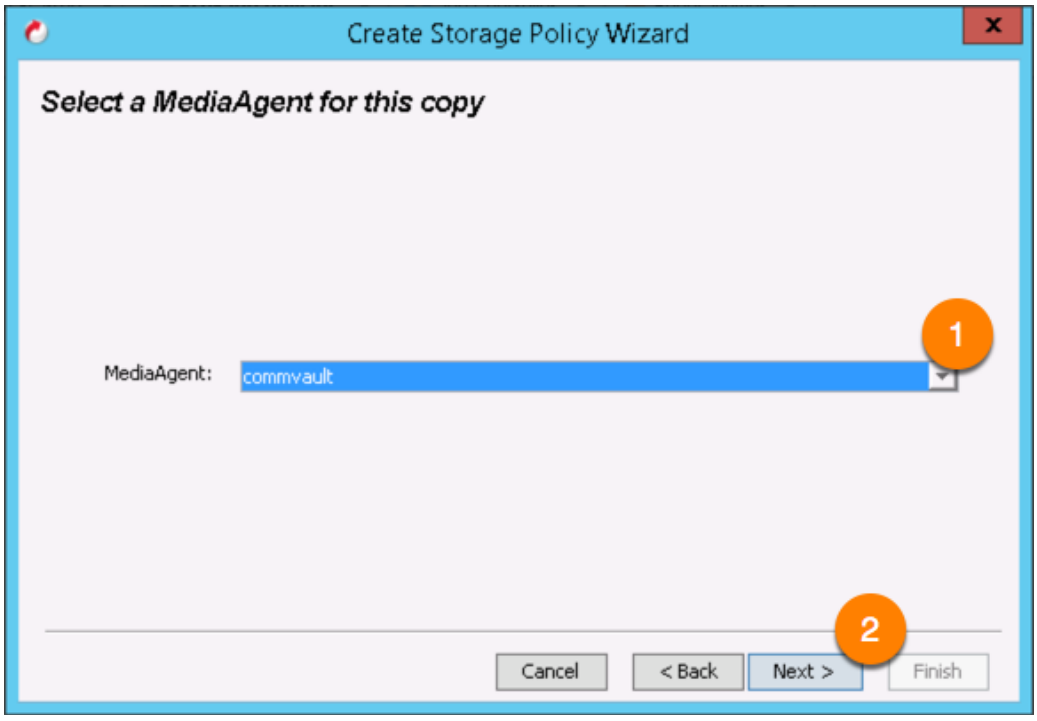


Figure 20. Select the MediaAgent

6. Leave all of the **default values** for the streams and retention management criteria. Click **Next.**

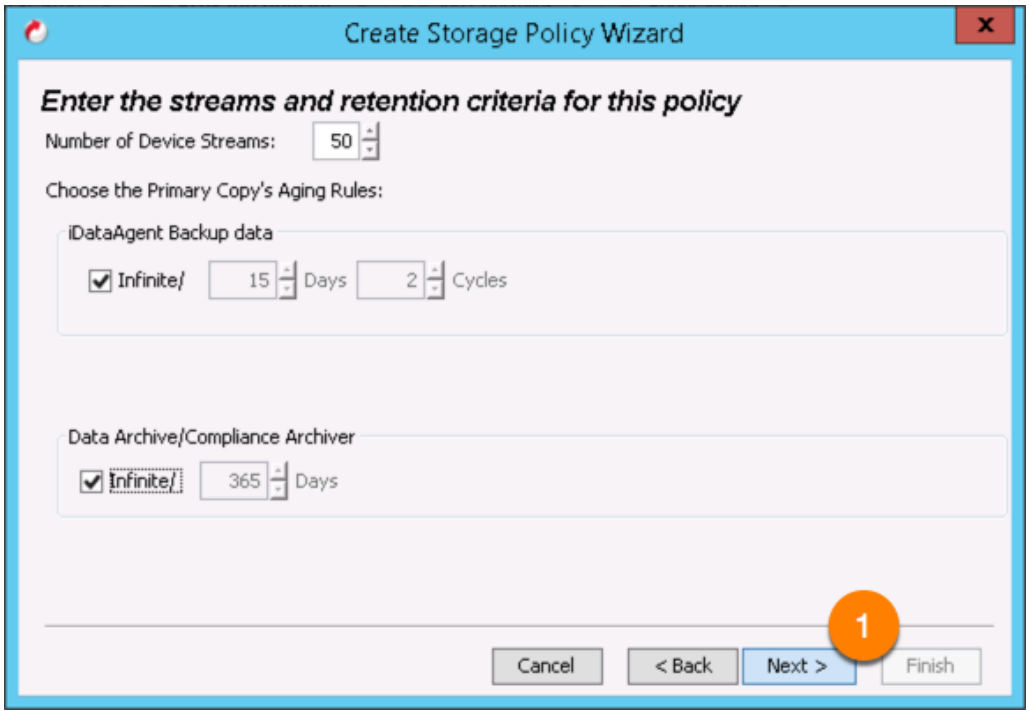


Figure 21. Default values for streams and retention criteria

7. Deselect **Yes** as this setup is focused on using the IntelliSnap software integration with the Pure Storage FlashArray which provides the data reduction features through the Purity Operating Environment.

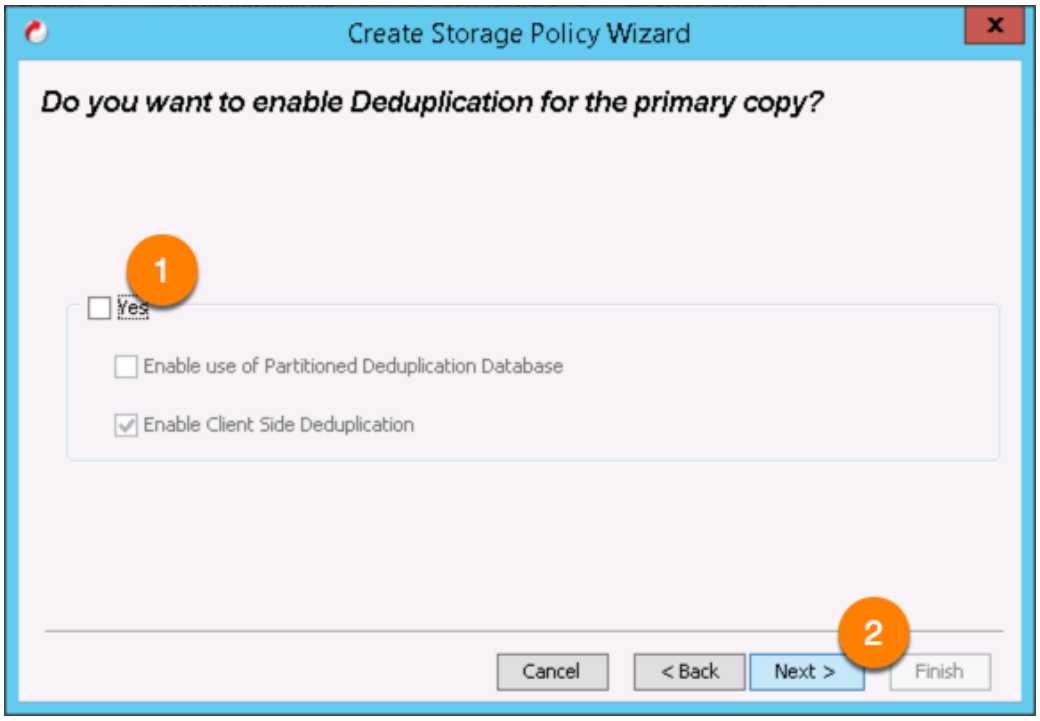


Figure 22. Do not enable deduplication

8. The final step in the **Storage Policy Wizard** is to review the settings and then click **Finish** to create the policy.

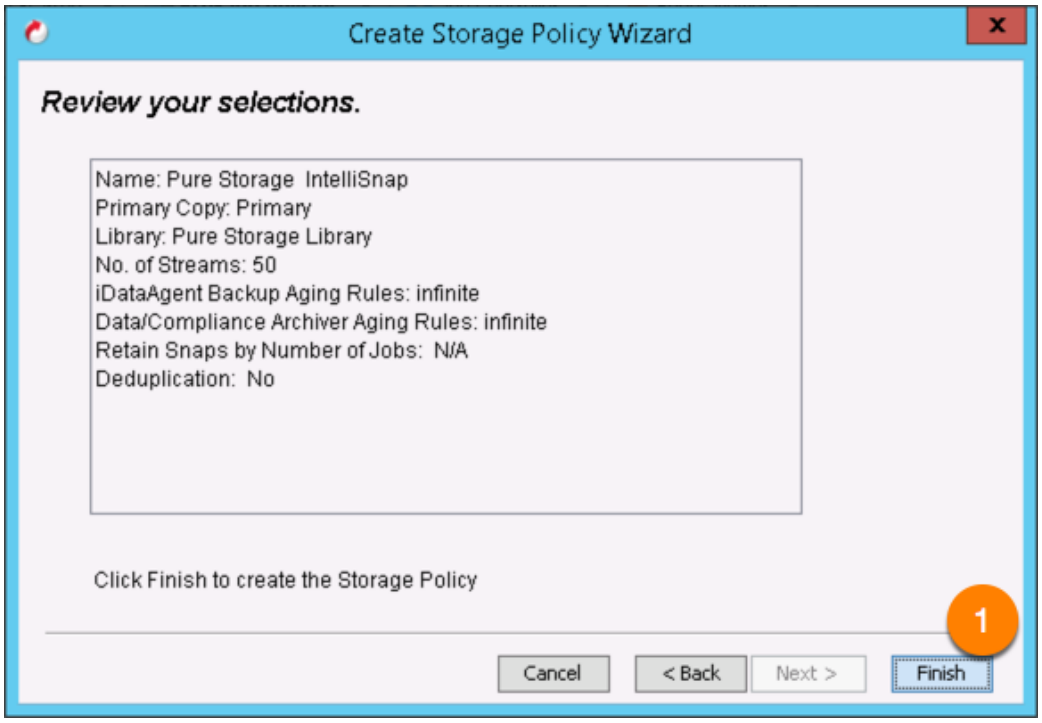


Figure 23. Storage Policy Wizard settings review

The newly created **Pure Storage IntelliSnap** storage policy can be seen in the Commvault Administrative Interface.

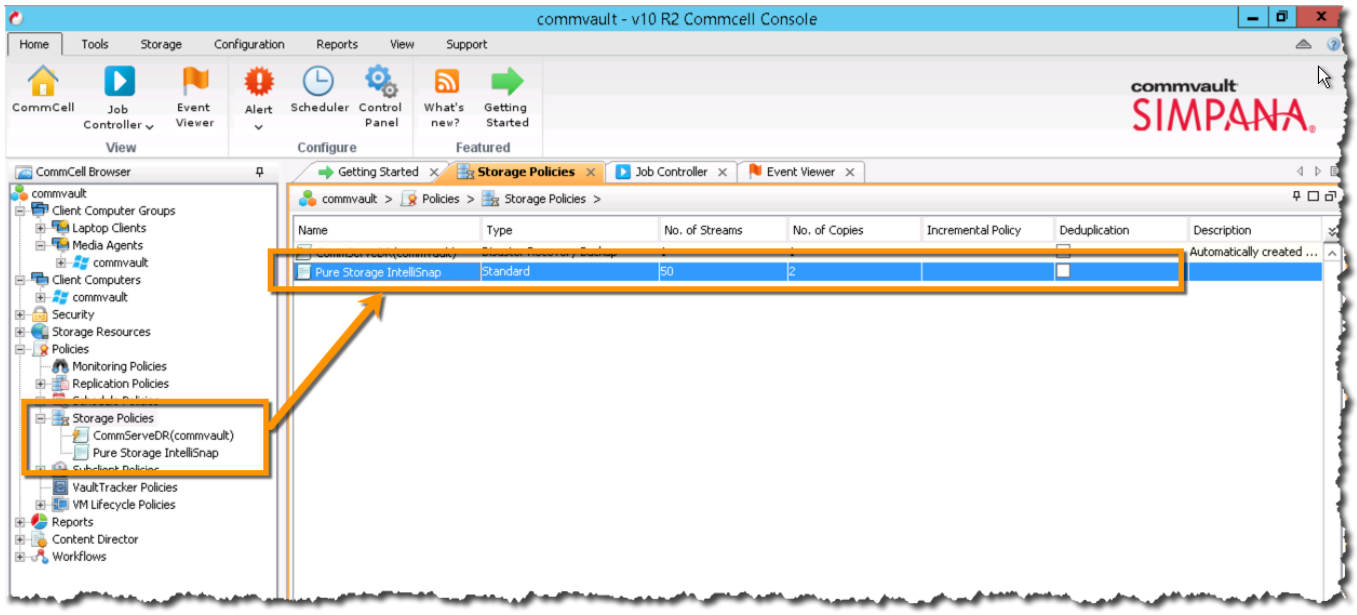


Figure 24. **Pure Storage IntelliSnap** Storage Policy shown in the Commvault Administrative Interface

Right-click the newly created **Pure Storage IntelliSnap** policy and choose **All Tasks > Create New Snapshot Copy**.

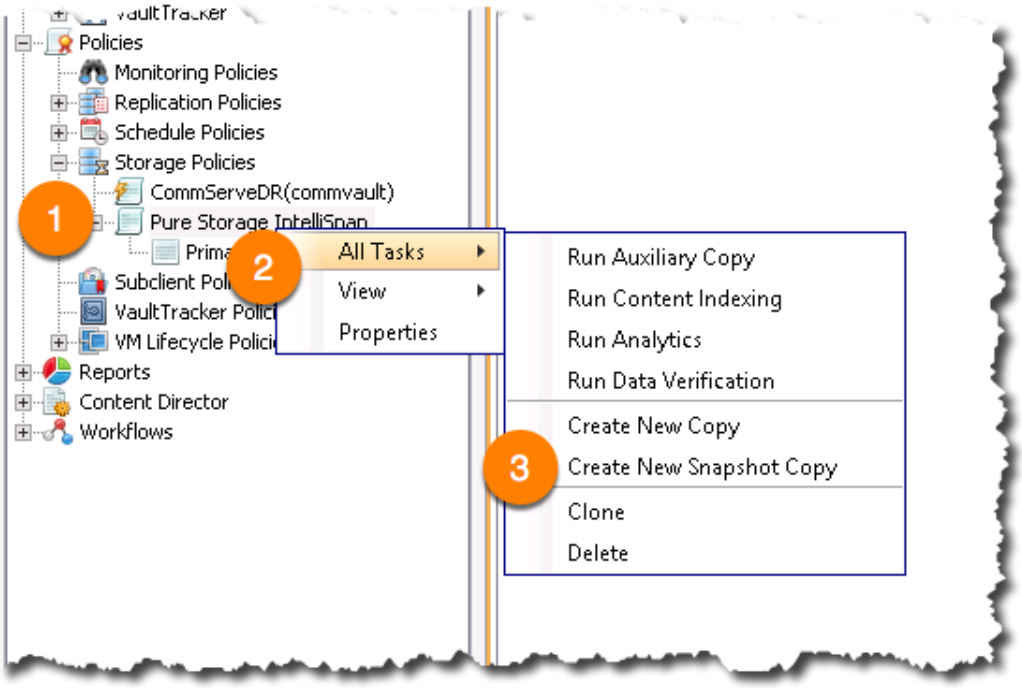


Figure 25. Create New Snapshot Copy for the **Pure Storage IntelliSnap** policy

Enter a name for the new **Snap Copy Properties** and then select the **Library** and **MediaAgent** from the respective dropdown lists. The **Library** to select is the one created earlier, **Pure Storage Library**. The **MediaAgent** to select is the one that was used in the Storage Policy Configuration Wizard, **commvault.**

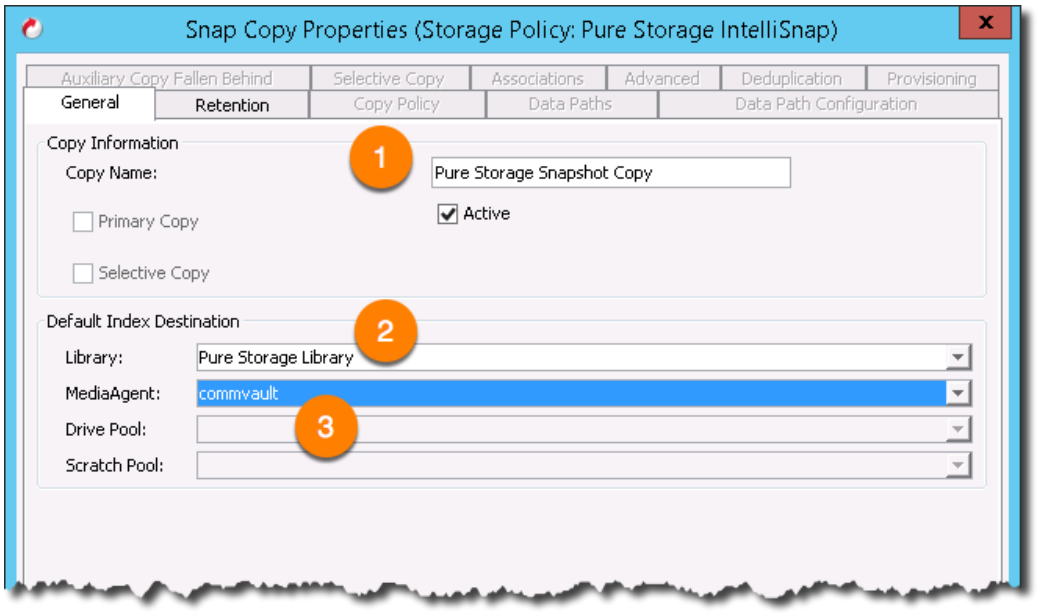


Figure 26. Snap Copy Properties for the **Pure Storage IntelliSnap** policy

The final step is to click on the **Retention** tab and see that the **Enable Data Aging** is checked and the only modification that is necessary is to update the **Basic Retention Rule for All Backups** from **Infinite** to **Retain for** a set numbers of days, for example **15 days**.

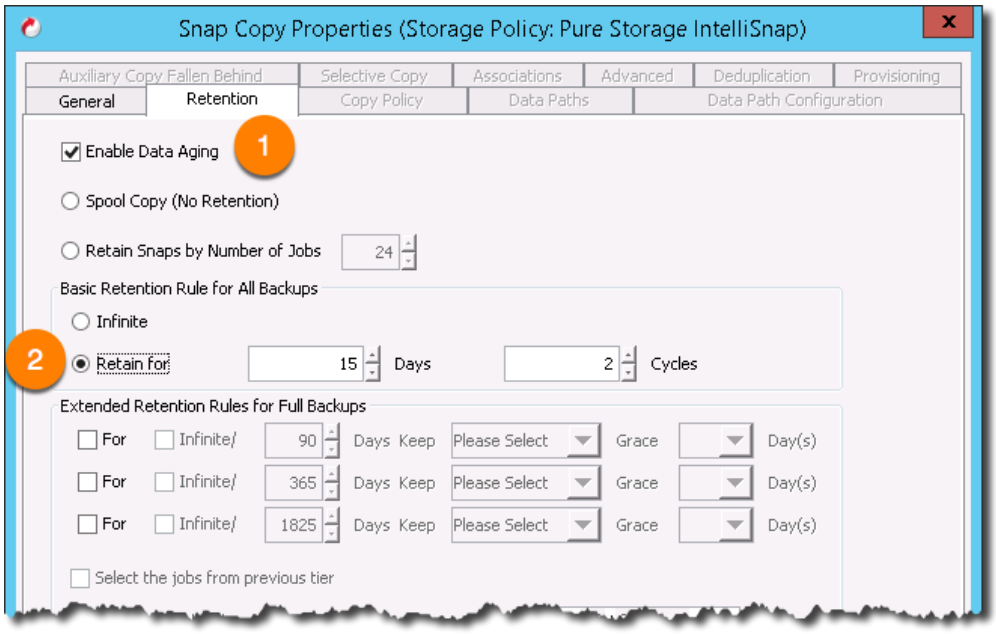


Figure 27. Retention option under **Pure Storage IntelliSnap** policy

All of the prerequisites have been completed and now we can begin walking through several different use cases that illustrate common activities that database or line of business administrators perform.

IntelliSnap Technology and Oracle DB Functions

IntelliSnap technology in conjunction with Pure Storage offer an extensive feature set with rich controls. The following section outlines main features of IntelliSnap technology integration with the Pure Storage FlashArray. For detailed information on setup and use of the IntelliSnap software please refer to Commvault documentation in the References section at the end of this document.

The following functions are the main operations directly involved with IntelliSnap technology for Oracle databases:

1. Create an array-based snapshot of an Oracle database
2. In-place rapid recovery of a large Oracle database using hardware revert feature
3. Perform a point-in-time recovery of an Oracle database
4. Clone an Oracle database instantly for dev/test purpose

The subsequent use cases are not meant to be an exhaustive list of features but instead is meant to demonstrate common backup and recovery workflows for IntelliSnap technology and Oracle database environments.

The following diagram illustrates the system and the configuration used for all the use cases.

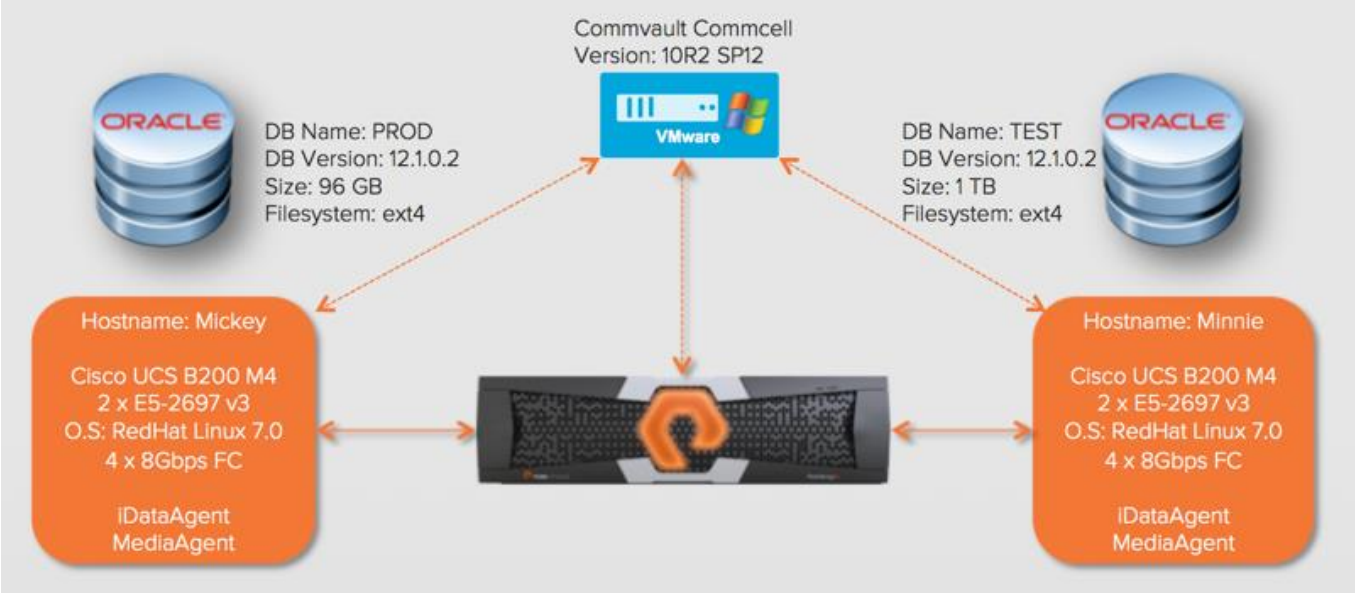


Figure 28. Lab environment overview

In the next several sections several use cases will be outlined with procedures to deploy, configure, manage, backup, mount and recover to point-in-time copies of Oracle databases.

As mentioned in the Pre-requisites section all of the components should be installed on the **Linux** server to be able to use the IntelliSnap technology. These include MediaAgent and Oracle iDataAgent from Commvault software Version 10 R2 setup.

Prerequisites for IntelliSnap software array-based snapshot

Components required for IntelliSnap technology backup

- Enable IntelliSnap technology at client level, the client in this case is the Oracle database host.
- Discover Oracle instances on the client.
- Create and configure a subclient for Oracle database.

1) Expand the **Client Computers** node in the CommCell Browser. The **mickey** server should be visible, if it is not, perform a **Refresh** using the Commvault Administrative Interface **View** tab **Refresh** button. Right-Click the Client Computer, **mickey** to access the properties.

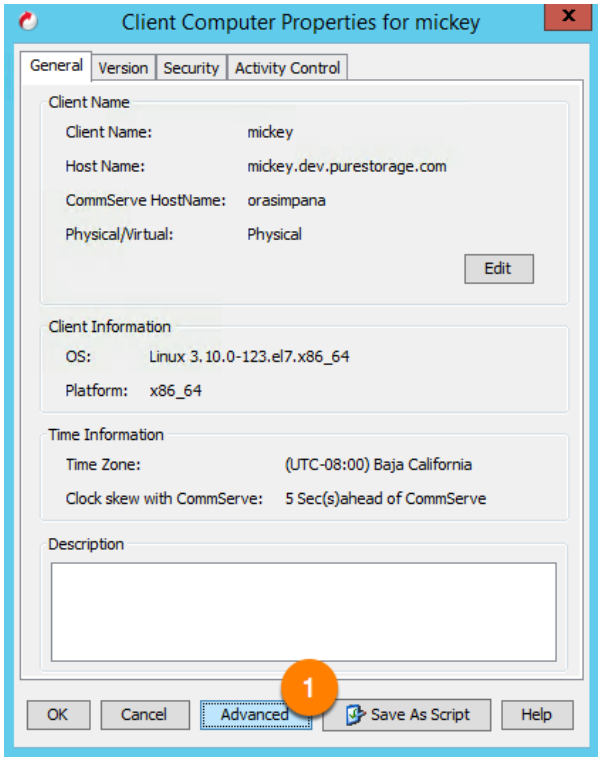


Figure 29. Client Computer Properties for client (mickey)

Click on the **Advanced** button at the bottom of the dialog. With the **Advanced Client Properties** dialog open check the **Enable IntelliSnap** option.

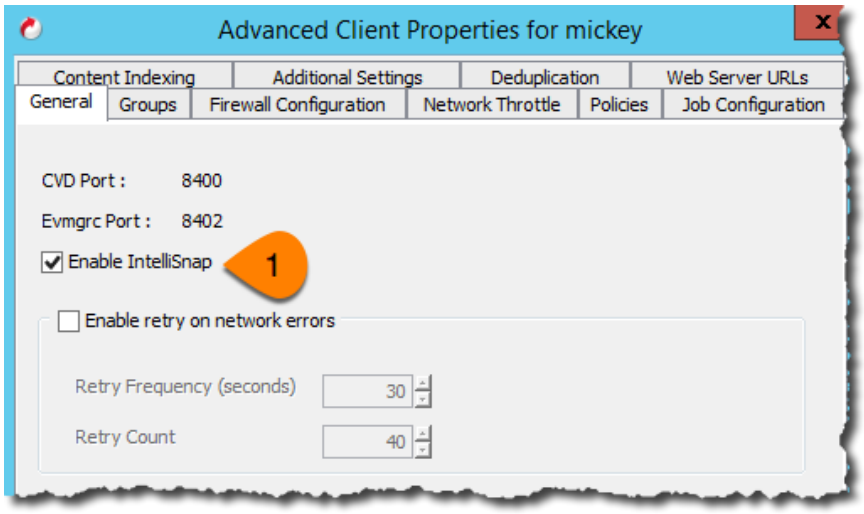


Figure 30. Advanced Client Properties for client (mickey)

2) The next step is to discover the database instance located on the **mickey** server. Expand the **Client Computers** node in the CommCell Browser. The **mickey** server should be visible, if it is not perform a **Refresh** using the Commvault Administrative Interface **View** tab **Refresh** button.

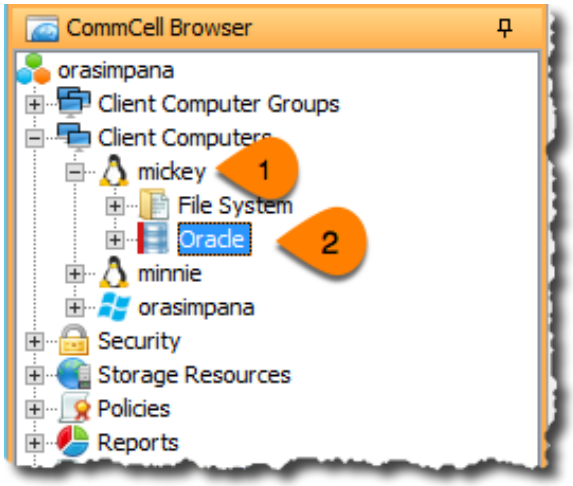


Figure 31. Oracle Agent within the client (mickey)

Expand the **mickey** server**,** select **Oracle**. Right-click on Oracle and select **All Tasks** and **Discover Instance**.

> **!** If Oracle iDataAgent is not installed as part of the pre-requisite on the client server, the **Oracle** entry will not show up in the browser under the client.

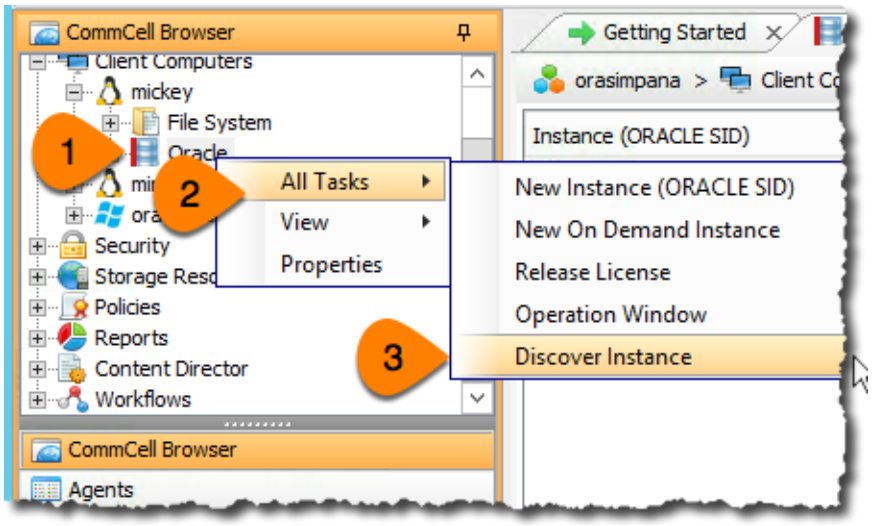
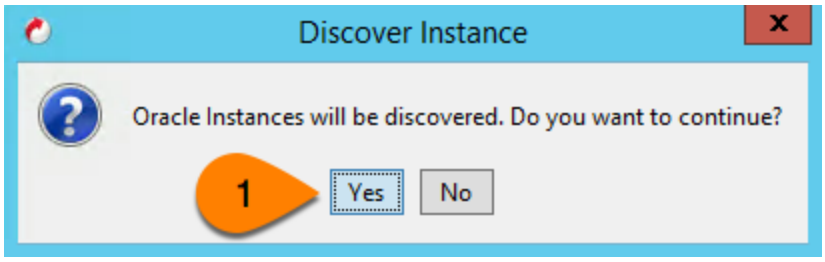


Figure 32. Discover Instance

Click **Yes** to let the agent discover all the Oracle Instances on the **mickey** server. On Linux and Unix, instances must be present in the /etc/oratab file to be discovered.



2.1) Expand the **Client Computers** node in the CommCell Browser and expand **mickey** and select the **Oracle** agent. It should show the discovered instances.

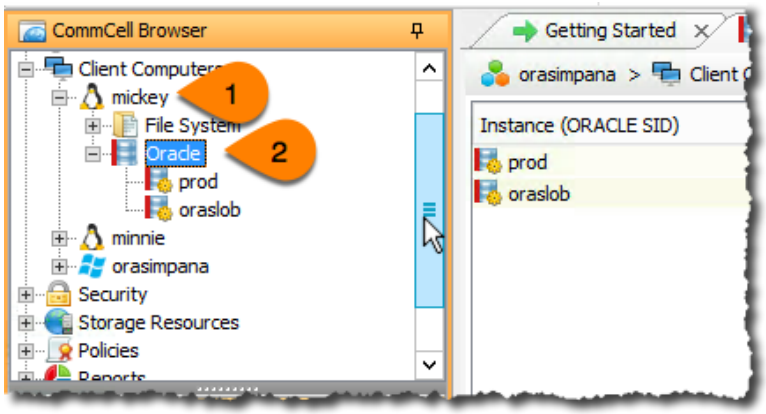


Figure 33. Discovered Instances

3) Select **prod** instance and right-click and **select All Tasks -> New Subclient.**

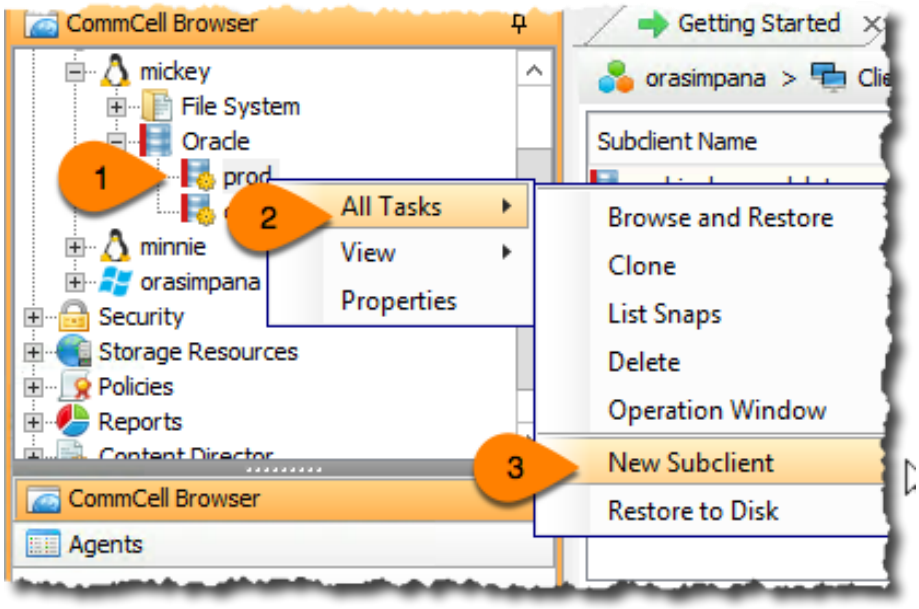


Figure 34. Creating a New Subclient

3.1) This next step involves setting up the **New Subclient** for the **prod** database. There are multiple tabs and options that need to be configured for the subclient. The tabs that will be focused on are **General, Storage Device, IntelliSnap Operations,** and **Logs Backup.** In the **General** tab set the **Subclient** name and **Description**.

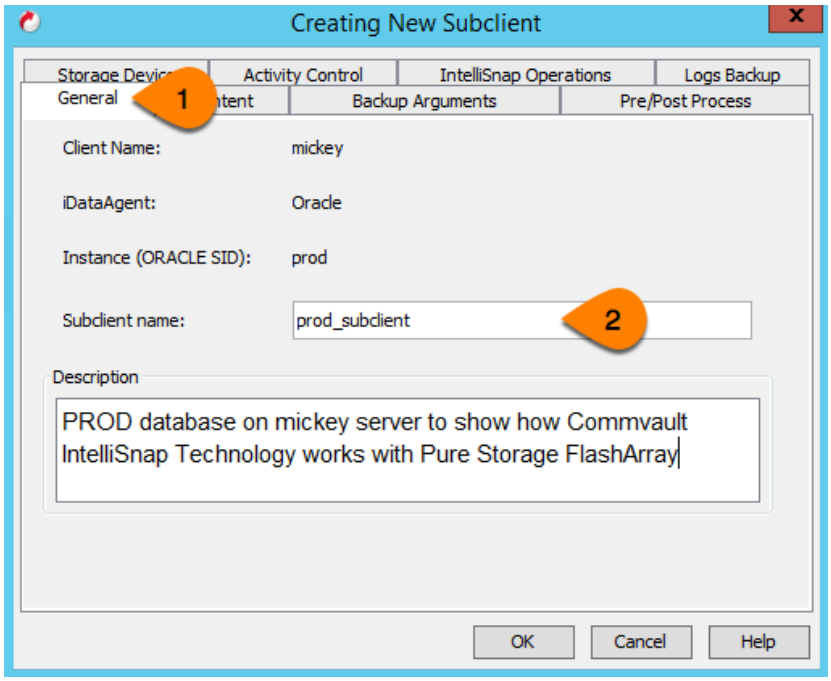


Figure 35. New Oracle instance Subclient Properties

3.2) Select the **Storage Device** tab and select the data storage policy **Pure Storage IntelliSnap** that was created earlier.

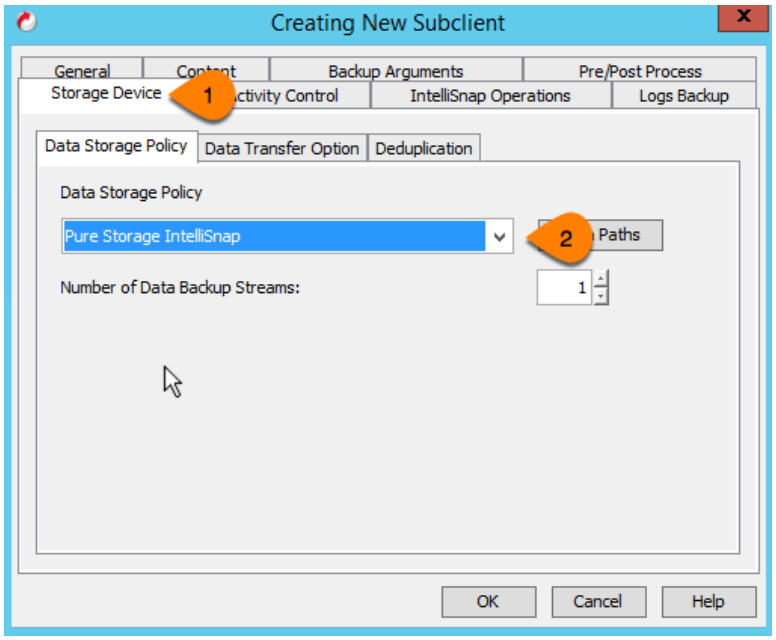


Figure 36. Select Data Storage Policy for new Subclient

3.3) Select the **IntelliSnap Operations** tab and check **IntelliSnap** option, which will throw a warning "Changing IntelliSnap state will cause the next backup to be converted to a full backup", select **Yes**. Select **Pure Storage Snap** from the available Snap Engines.

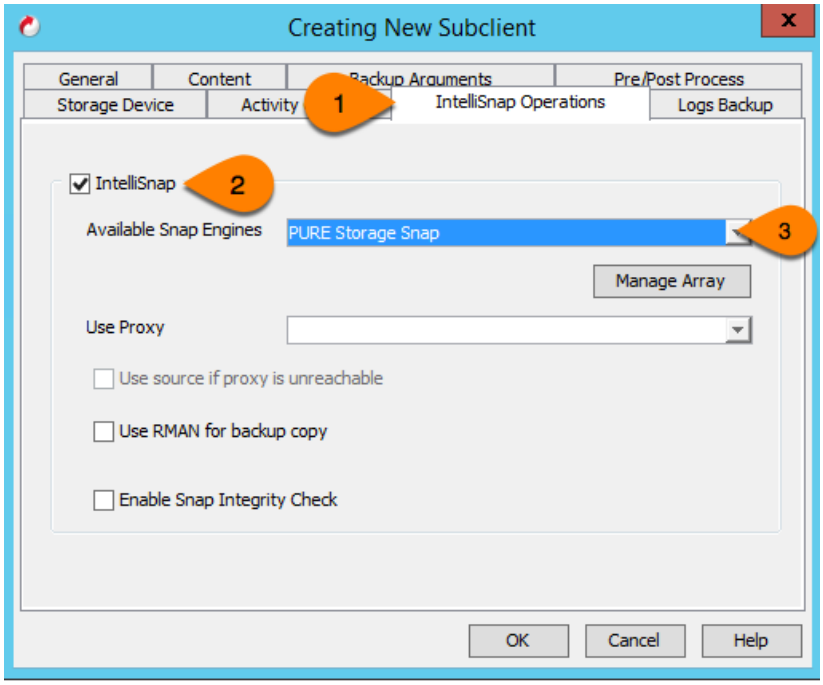


Figure 37. Enable IntelliSnap technology with Pure Storage Snap

3.4) Select **the Logs Backup** tab and make sure **Backup Archive Log** option is enabled. Select the **Archive Delete** option is selected if you want to manage the archive logs through this subclient.

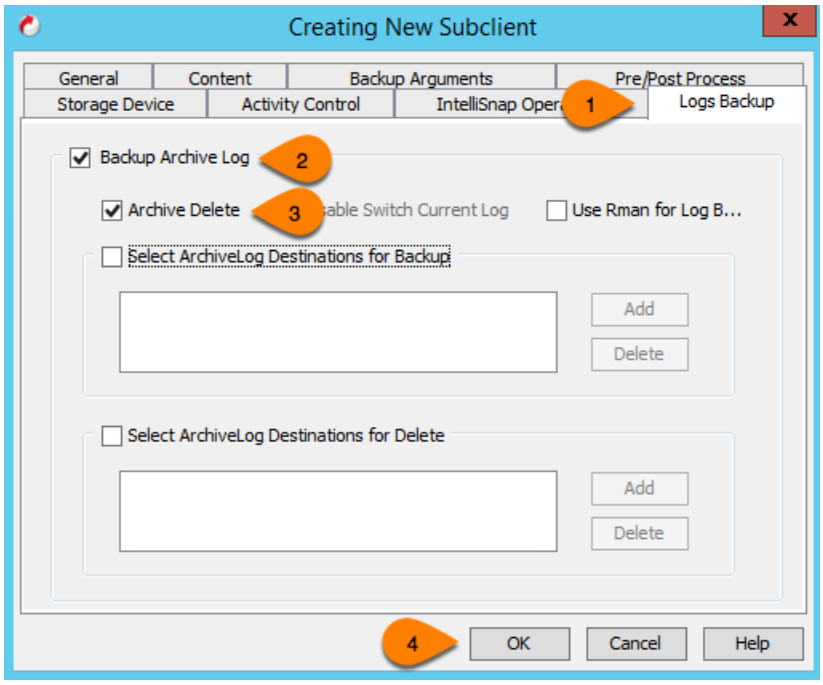


Figure 38. Setup Logs Backup for new Subclient

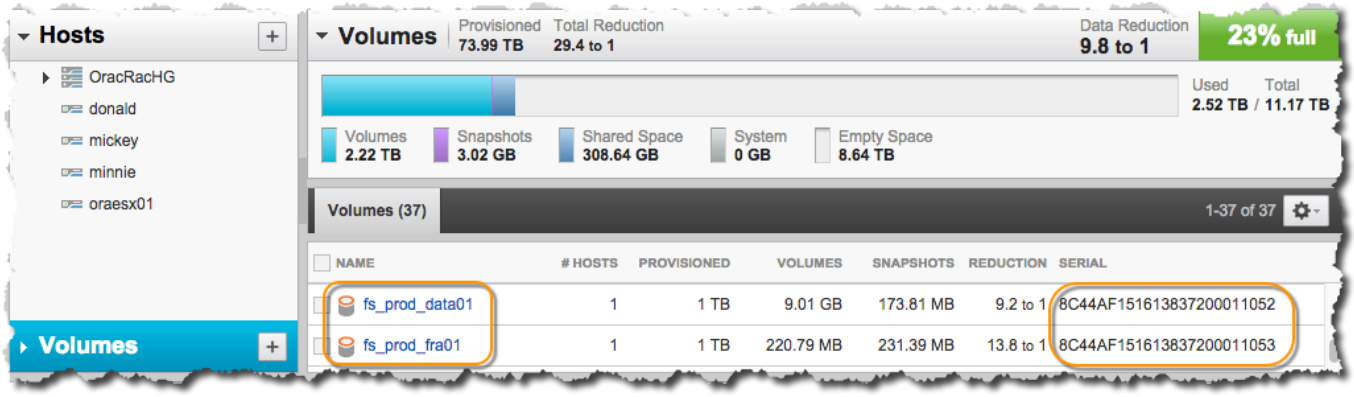
3.5) Click OK to create the new subclient **prod_subclient** for the **prod** database.

Note: Similar setup was performed on the **minnie** server to discover the **test** instance and setup the subclient.

Use Case 1: Create array-based snapshot of an Oracle database

Performing a backup using IntelliSnap technology integrated with Pure Storage issues calls to Pure Storage FlashArray's API to perform the snapshot operations. IntelliSnap technology places the Oracle database in hot backup mode while invoking the array-based snapshots to make sure the snapshot backup is application consistent. This backup is equivalent to a full backup where the database can be restored completely with all logs or to a specific point-in-time.

For this use case the database **prod** on physical host **mickey** is used. The database is setup on two volumes **fs_prod_data01**, which holds all datafiles, and **fs_prod_fra01**, which holds all archived redo logs. Each of these volumes is mounted on the server as ext4 filesystem.



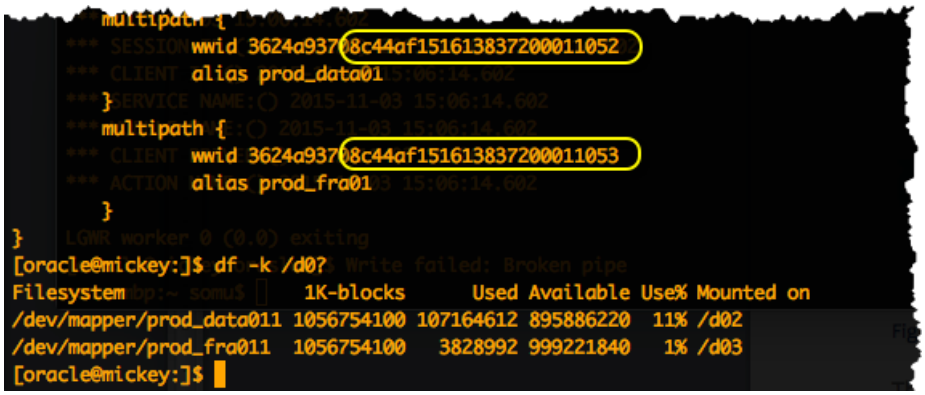


Figure 39. Mounted volumes on mickey

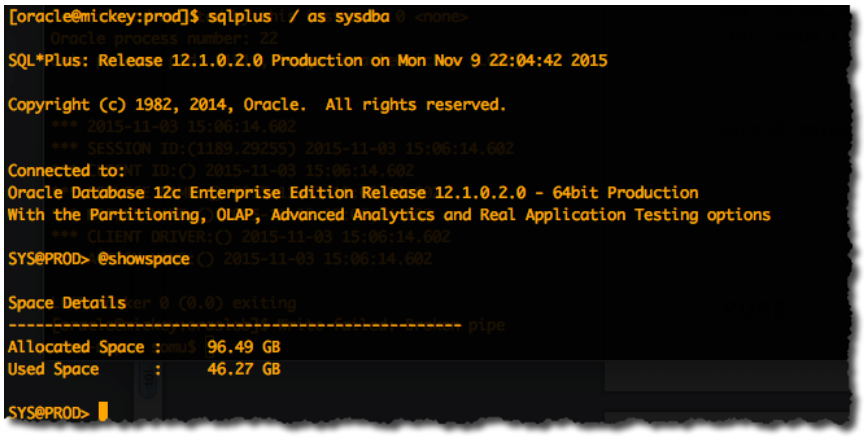


Figure 40. Space usage of prod database

This is a simple example just to show how backups, restores and point-in-time recovery can be used with Pure Storage and IntelliSnap technology.

In the CommCell Browser expand the **Client Computers** > **mickey** > **Oracle** > **prod** to display the **Subclient** list. Right-click on **prod_subclient** and select **Backup.**

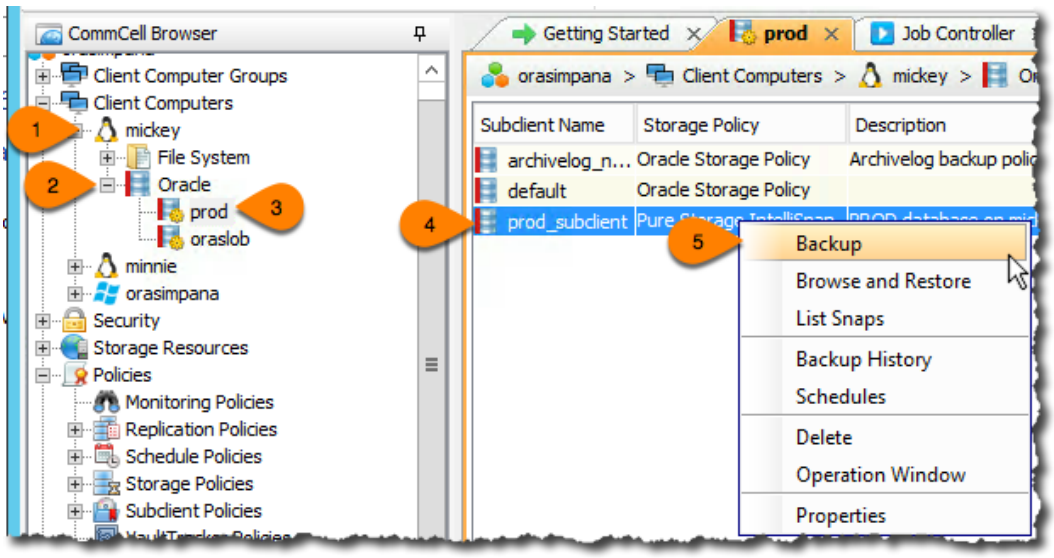


Figure 41. Backup **PROD** database

After clicking the **Backup Options** dialog with display. By default, the **Full** and **Immediate** options are selected; click **OK** to begin the backup.

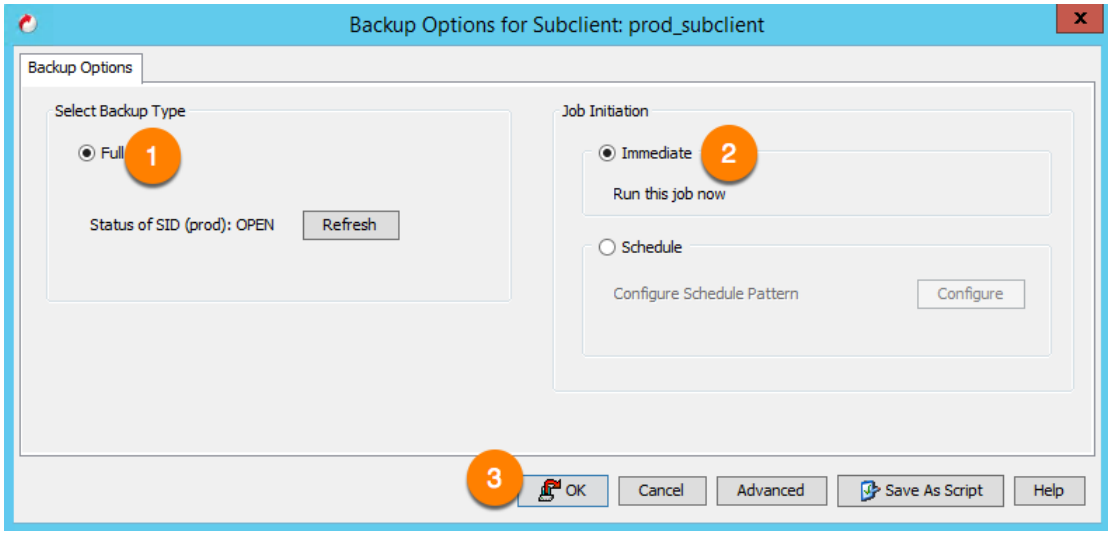


Figure 42. Backup options at the subclient

After starting the Job click the **Job Controller** tab to view the running job. Figure 43 shows the running Job ID is **1300**.

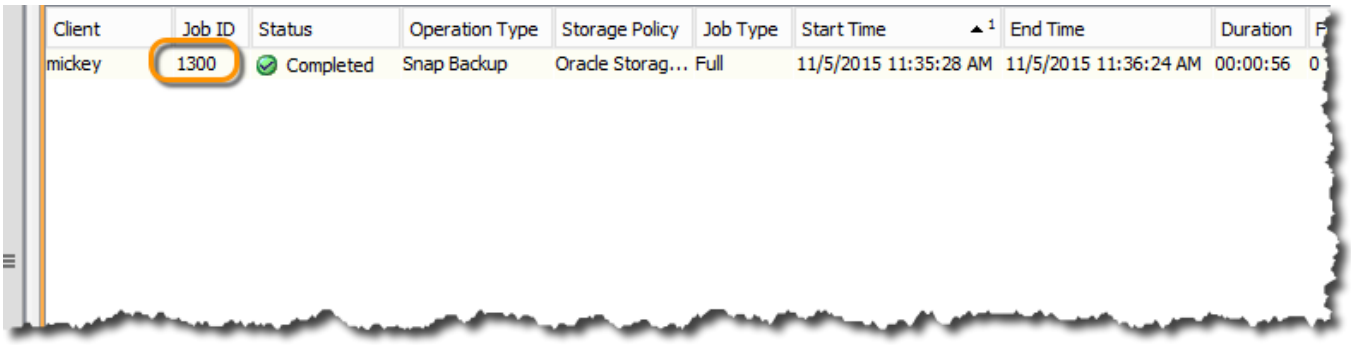


Figure 43. Job Controller view of Job 1300

Figure 44 shows the corresponding FlashRecover Snapshot, **fs_prod_data01.SP-2-1300-1446780952**, for volume **fs_prod_data01** and **fs_prod_fra01.SP-2-1300-1446780956** for volume **fs_prod_fra01**.

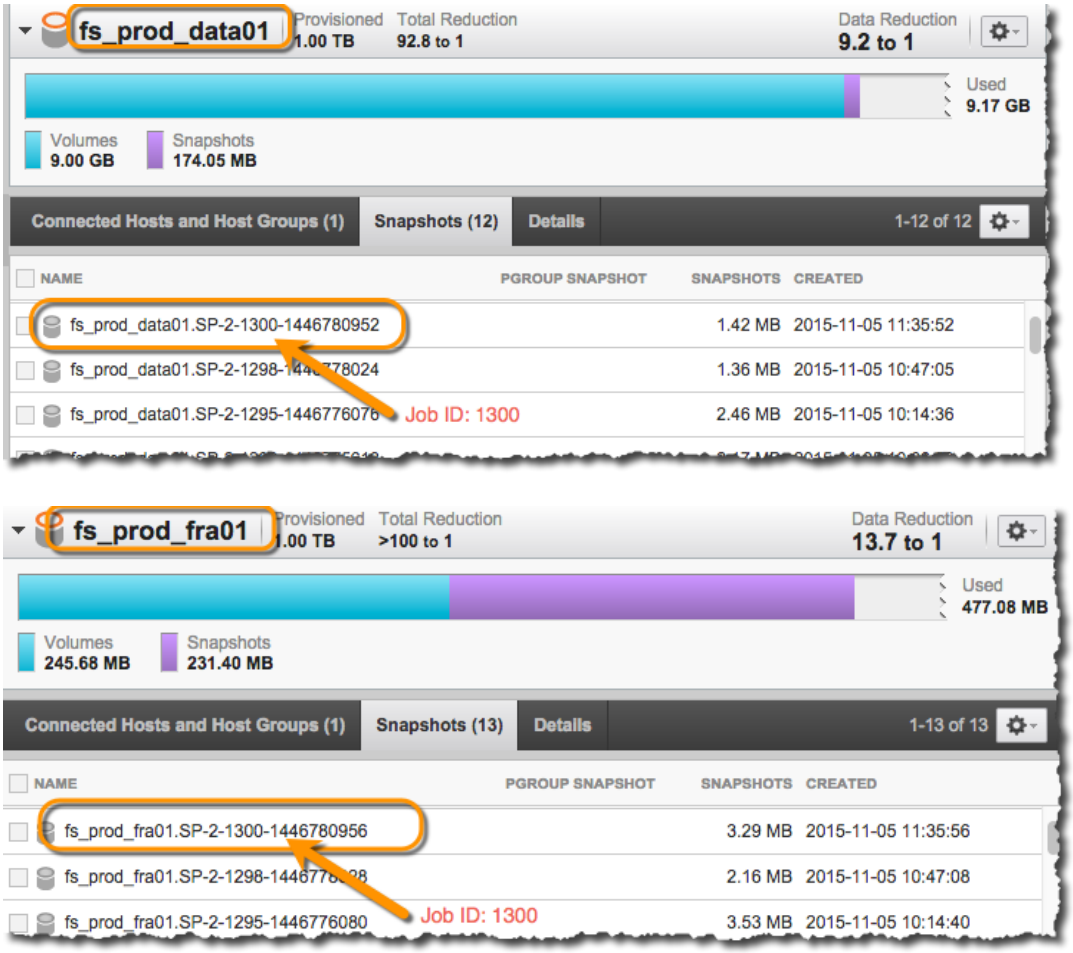


Figure 44. Pure Storage FlashArray view of the snapshot (Job 1300)

Use Case 2: In-place restore of an Oracle database

In this use case, the database **test** on **minnie** server will be reverted using the hardware revert feature in IntelliSnap technology which uses Pure Storage FlashArray snapshot feature behind the scenes to copy the snapshot on to the current volume.

The **test** database is **1TB** in size and since hardware revert feature in IntelliSnap technology is used to perform the in-place restore, the activity should be completed quickly irrespective of the size as Pure Storage FlashArray's snapshot copy feature is instantaneous as it performs metadata level changes and not the actual data revert.

The objectives for this use case are as follows:

1. Create a table (DO_NOT_SHOWUP) on the **test** database
2. Recover the **test** database in place on **minnie** server using hardware revert option from the latest backup, so the recovery should be completed within couple of minutes.
3. Validate the table DO_NOT_SHOWUP is indeed not showing up in the recovered **test** database.

Procedure

1) Create the table (DO_NOT_SHOWUP) on the **test** database for validation.

```
[oracle@minnie:test:~]$ sqlplus "/ as sysdba"

SQL*Plus: Release 12.1.0.2.0 Production on Tue Nov 10 00:49:38 2015

Copyright (c) 1982, 2014, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

SYS@TEST> @showspace
Space Details
-----------------------------------------------------
Allocated Space :  1,062.88 GB
Used Space      :    688.54 GB

SYS@TEST> create table DO_NOT_SHOWUP (msg varchar2(100));
Table created.

SYS@TEST> desc DO_NOT_SHOWUP
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 MSG                                                VARCHAR2(100)

SYS@TEST> !date
Tue Nov 10 00:50:08 PST 2015

SYS@TEST> select name, db_unique_name, instance_name from v$database, v$instance;

NAME      DB_UNIQUE_NAME                 INSTANCE_NAME
--------- ------------------------------ ----------------
TEST      test                           test

SYS@TEST>
```

Figure 45. Test database details for validation

2) In the Commcell browser, expand **minnie** server and select **test** database, right-click and select **All Tasks** -> **Browse and Restore**

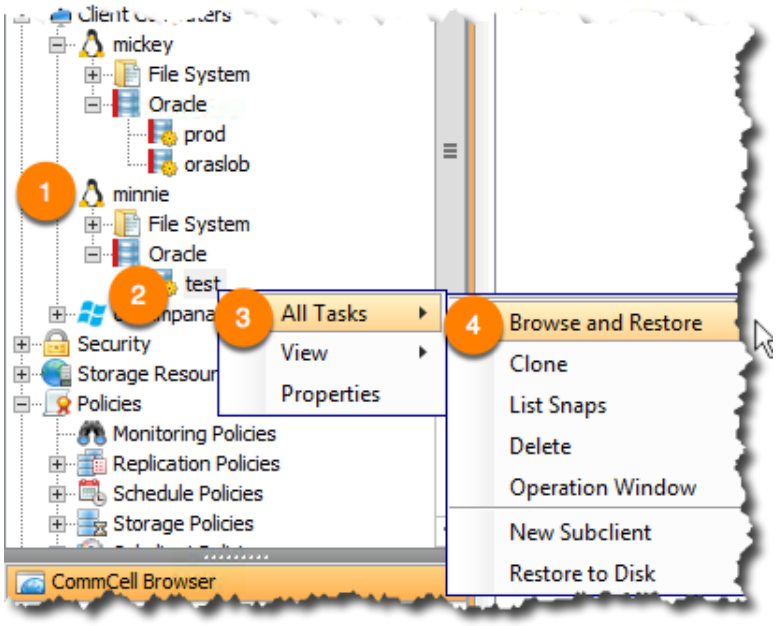


Figure 46. Browse and Restore

2.1) Click **View Content** from the next pop-up.

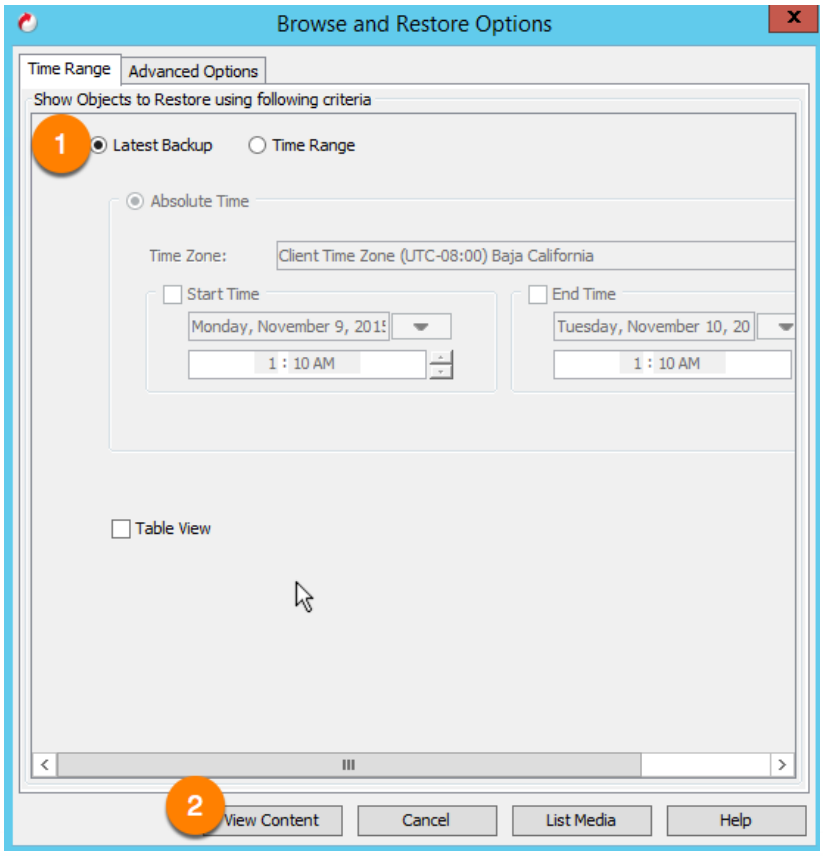


Figure 47. Browse and Restore Options

2.2) Select the database **test** and click **Recover All Selected**

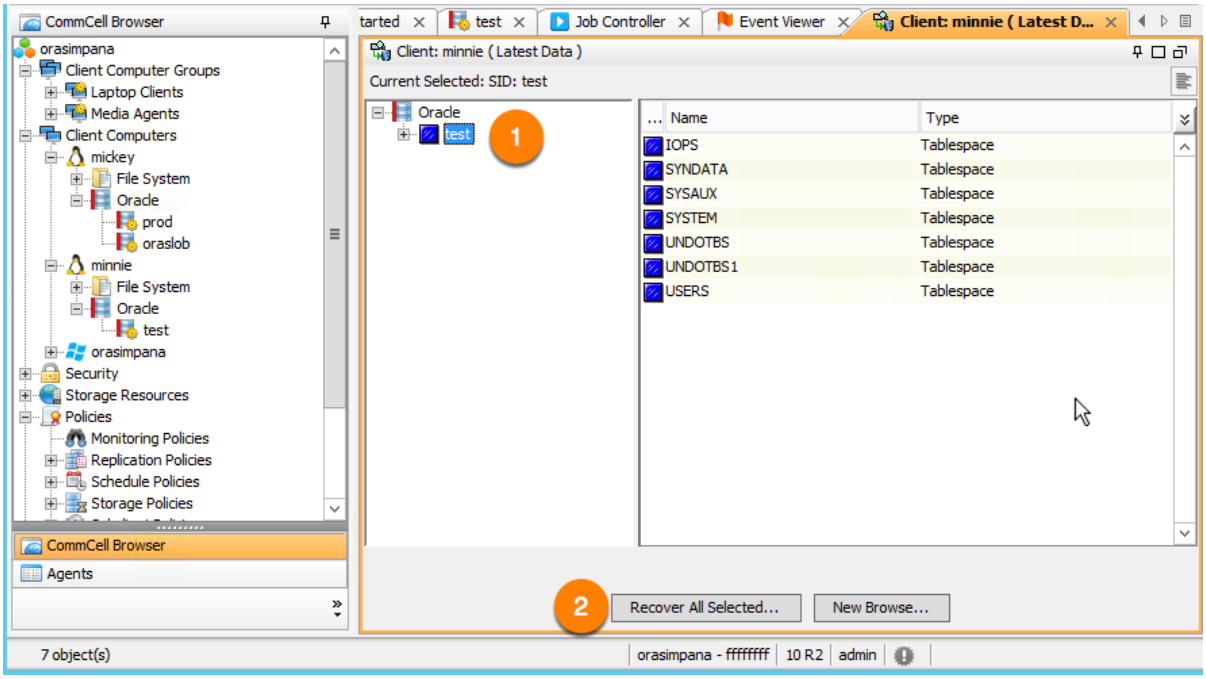


Figure 48. Select database for recover

2.3) Make sure the Destination Client is the same as the source (**minnie) and** click the **Advanced** button to select advanced restore options.

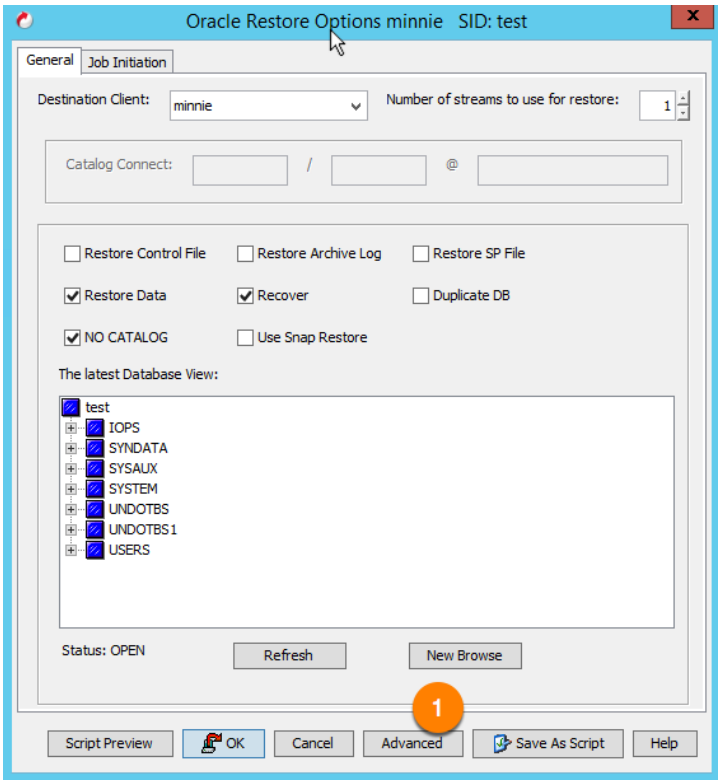


Figure 49. Advanced restore options

2.4) Under the **General** tab, select the **Use hardware revert capability if available**.

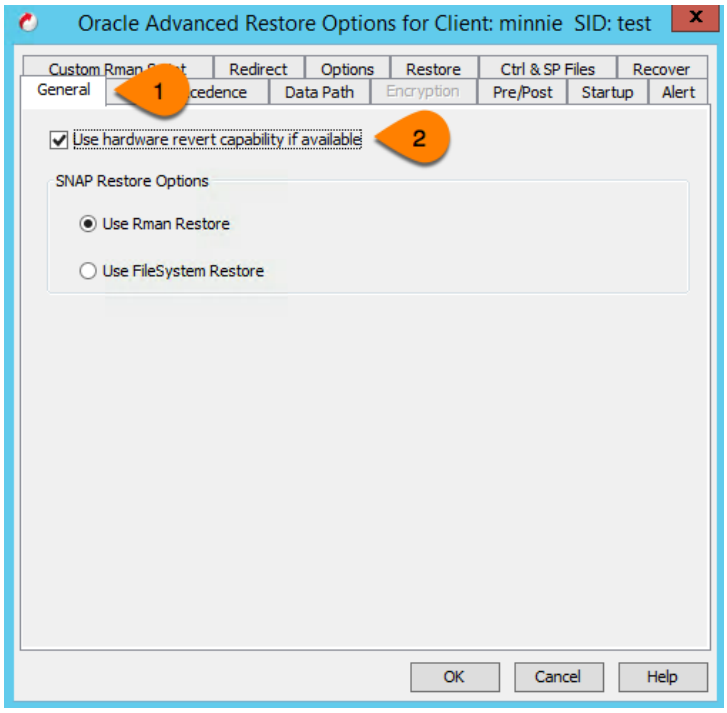


Figure 50. Use hardware revert capability for restore

2.5) Click the **Options** tab and select **Switch Database mode for Restore** which will restore the database and bring it up automatically.

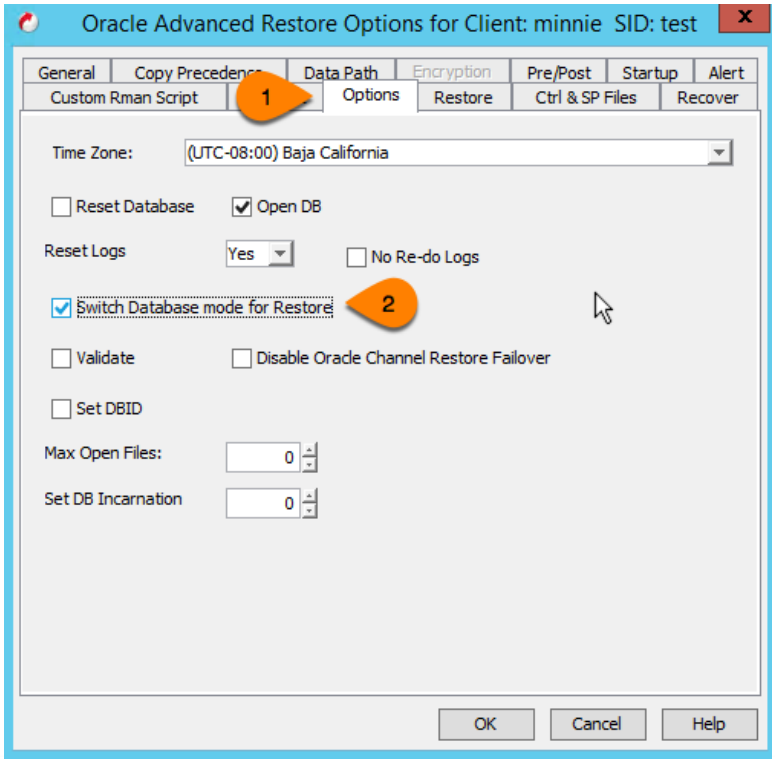


Figure 51. Advanced Restore Options

2.6) Click the **Recovery** tab, select the **Latest Backup Time** option to revert the database from the latest backup and click **OK**.

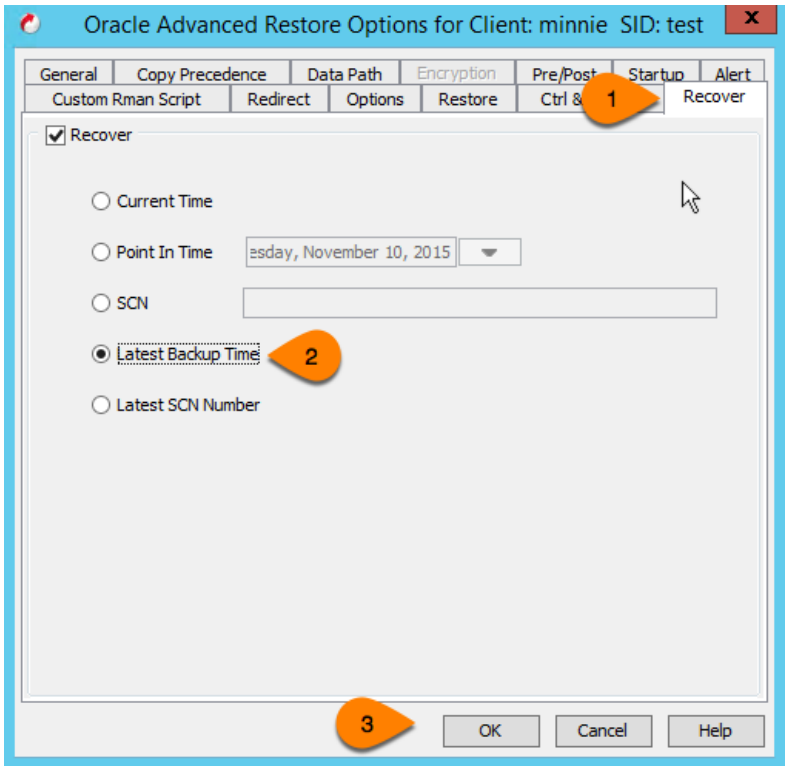
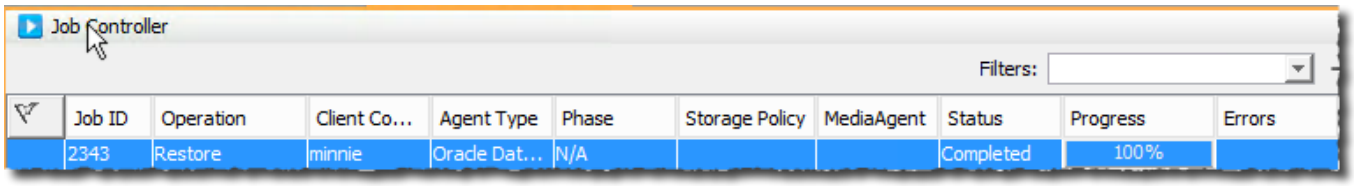
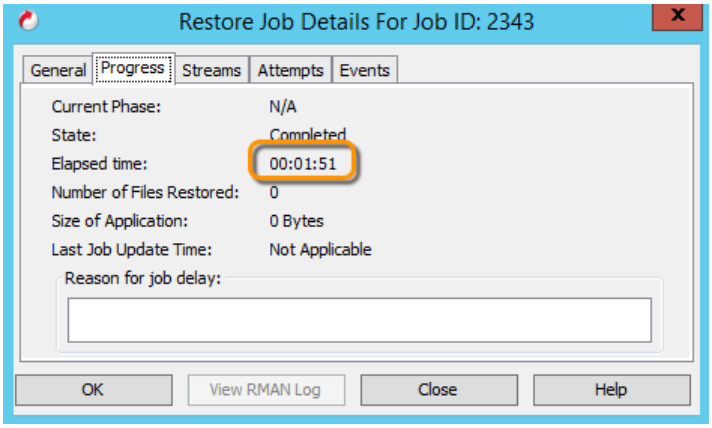


Figure 52. Select latest backup time for restore

2.7) From the Job controller the status of the job **2343** and all job details can be viewed. In this case, the in-place restore completed in **1 minute 51 seconds** and the **Events** tab shows the volume that pertains to the datafiles was reverted successfully.





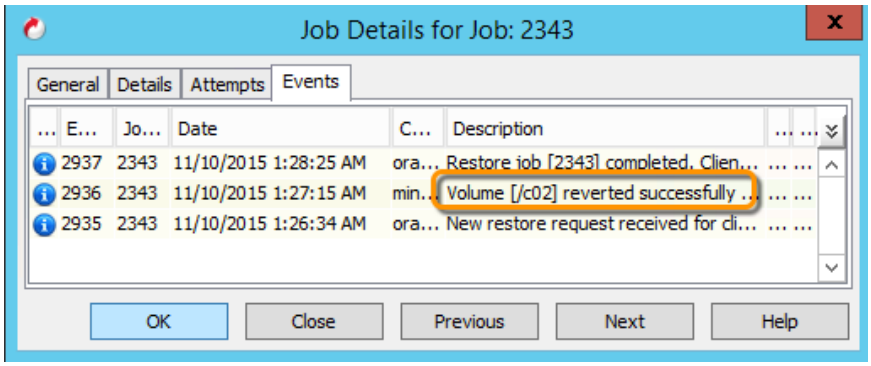


Figure 53. Restore Job details for Job 2343

3) The database **test** was restored from the backup and we could verify the database was recently created, started and the table DO_NOT_SHOWUP is indeed not available as we restored from the latest backup, which did not include the table.

```
[oracle@minnie:test:~]$ sqlplus "/ as sysdba"

SQL*Plus: Release 12.1.0.2.0 Production on Tue Nov 10 01:40:47 2015

Copyright (c) 1982, 2014, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

SYS@TEST> select instance_name, to_char(startup_time, 'mm/dd/yy hh24:mi:ss') startup_time from v$instance;

INSTANCE_NAME    STARTUP_TIME
---------------- -----------------
test             11/10/15 01:27:39
```

```
SYS@TEST> select name, resetlogs_time from v$database;

NAME      RESETLOGS_TIME
--------- -----------------
TEST      11/10/15 01:28:18

SYS@TEST> select owner, table_name from dba_tables where table_name = 'DO_NOT_SHOWUP';

no rows selected

SYS@TEST> @showspace

Space Details
-----------------------------------------------------
Allocated Space :  1,062.88 GB
Used Space      :    688.41 GB
```

Figure 54. Validation of test database after hardware revert

In this use case, the database was restored from the last backup and incomplete recovery was performed and hence the database was opened with resetlogs option, which warrants a full backup of the database. Meanwhile, performing this on a production database will cause data loss of all changes since the last backup and hence review if this is an option to be performed on a production database as per your standard operating procedures.

Use Case 3: Point-in-Time recovery (PITR) of an Oracle database

Point-in-Time recovery (PITR) is a key operational requirement for Oracle databases as it protects against the unplanned downtimes. For example,

1) Human errors: A DBA accidentally dropped tables or deleted/updated records in production database. These changes need to be undone.

2) Media errors: The database could not perform complete recovery after a media failure as needed redo logs or incremental backups were not available.

3) Operations hiccups: Database upgrade fails in the middle of a patch upgrade.

Point-in-time recovery is an **incomplete recovery** as it does not use all the available redo or completely recover all the changes on the database. The database is restored to a specific full backup followed by application of redo logs or incremental backups to re-create all the changes up to a point-in-time before the unwanted change.

The objectives of this use case are as follows:

1. Insert records on to **prod** database on the table **recovery_test** with date and time information.
2. Make sure the current redo log files are archived.
3. Perform point-in-time recovery to a specific point-in-time.
4. Validate the records to show the database was recovered to a state prior to the point-in-time.

We will use the IntelliSnap technology hardware revert function that will use Pure Storage's native snapshot overwrite function to revert the volumes to a prior state and the archived logs till the specific point-in-time will be applied.

Point-in-time recovery scenario requires the archived logs location to be on a different volume than that of the datafiles.

Procedure

Make sure the snapshot backup is performed on the database as documented in Use Case 1: Create array-based snapshot of an Oracle database.

1) Figure 55 shows the table RECOVERY_TEST on **prod** database with the records that were inserted today with timestamps.

```
SCOTT@PROD> @select

        ID MESSAGE              DATE_CREATED
---------- -------------------- -----------------
         1 First record         10/30/15 08:37:42
         2 2nd record           10/30/15 09:42:28
         3 3rd record           10/30/15 09:42:39
         4 4th record           11/05/15 09:07:43
         5 5th record           11/05/15 10:08:31
         6 6th record           11/05/15 11:37:52
         7 7th record           11/05/15 11:38:11
         8 8th record           11/10/15 16:17:26
         9 9th record           11/10/15 16:17:37
        10 10th record          11/10/15 16:38:26
        11 11th record          11/10/15 16:38:37

11 rows selected.

SCOTT@PROD> insert into recovery_Test values (100,'Wrong record', sysdate);

1 row created.

SCOTT@PROD> insert into recovery_Test values (12,'12th record',sysdate);

1 row created.

SCOTT@PROD> commit;

Commit complete.

SCOTT@PROD> connect / as sysdba
Connected.
SYS@PROD> alter system archive log current;

System altered.

SYS@PROD> select name, db_unique_name from v$database;

NAME      DB_UNIQUE_NAME
--------- ------------------------------
PROD      prod

SYS@PROD>
```

Figure 55. Database (prod) validation before point-in-time recovery

2) The current redo logs are archived with the ***alter system archive log current*** command.

3) To illustrate the point-in-time recovery scenario a wrong record was inserted at **11/10/15 17:19:26** and we would like to return the database back to a point-in-time before this record was inserted. For this use case, we will use the time **11/10/15 17:00:00** as the recovery time and all transactions after this time will be rolled back.

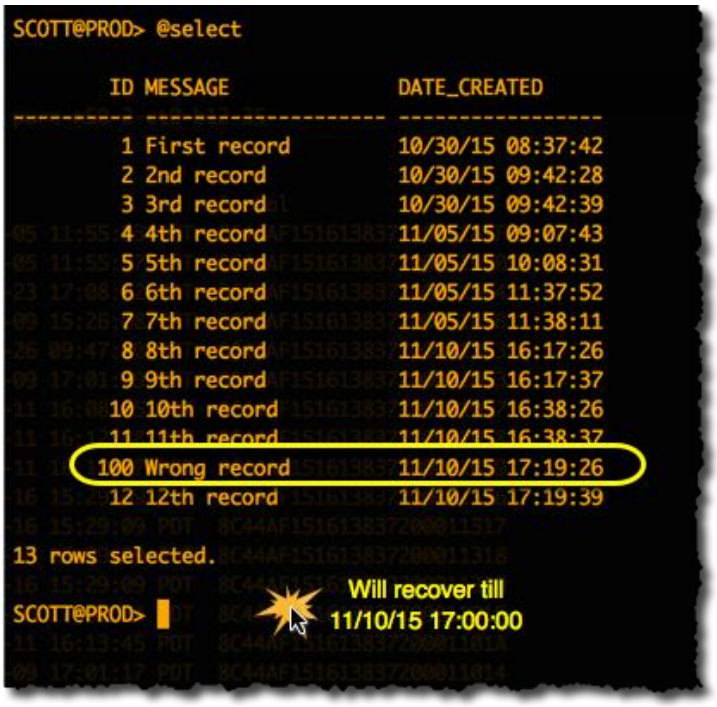


Figure 56. Time to recover back

3.1) Navigate to the Commcell browser, select **prod** database, right-click, select **All Tasks -> Browse and Restore**.

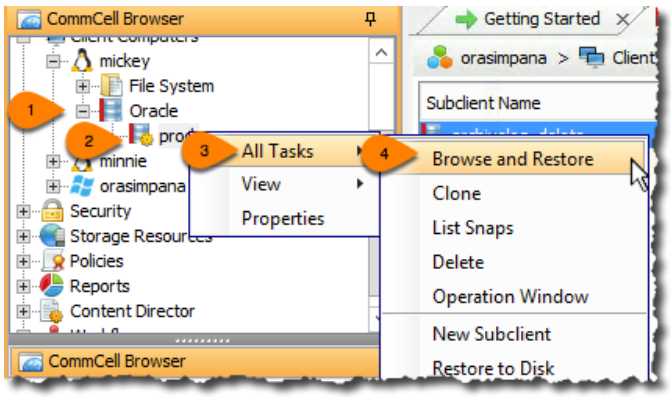


Figure 57. Invoking Browse and Restore to perform PITR

3.2) Select the **Latest Backup** and click **View Content** to open the restore options.

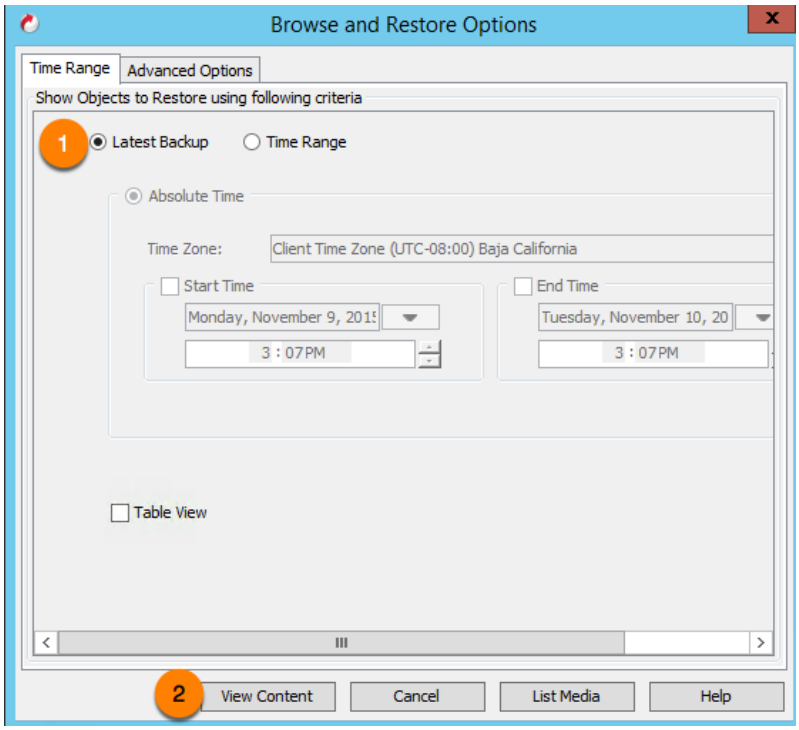


Figure 58. Browse and Restore Options

3.3) Select the **prod** database and click **Recover All Selected** button.

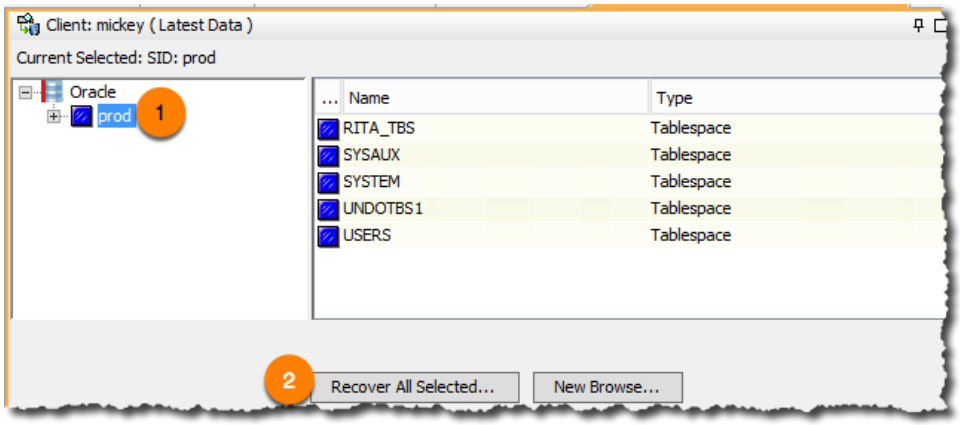


Figure 59. Select the database for PITR

3.4) Click the **Advanced** button to provide additional recovery options.

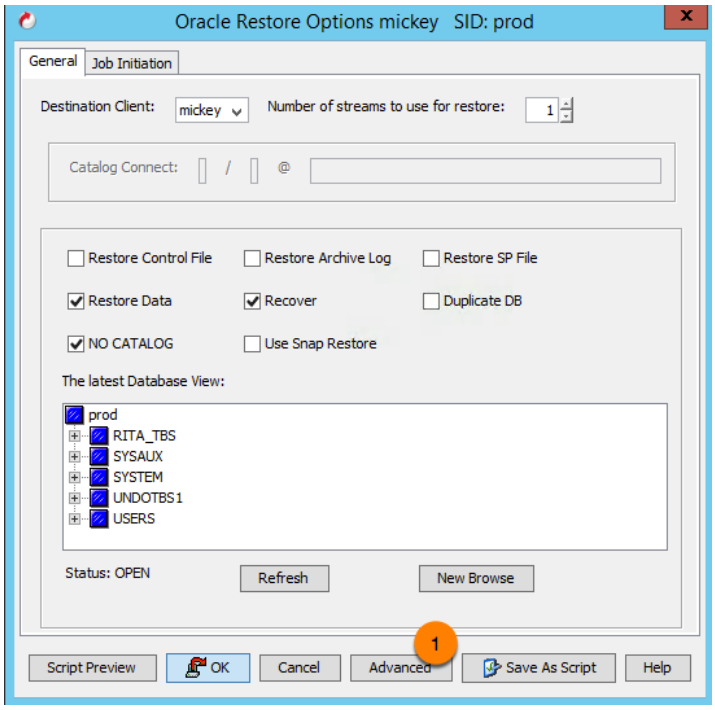


Figure 60. Advanced Restore Options

3.5) Select the **Use hardware revert capability if available** option under the **General** tab. This will speed up the process of recovery to the previous full back using the array-based snapshot restore function instead of copying all the files.

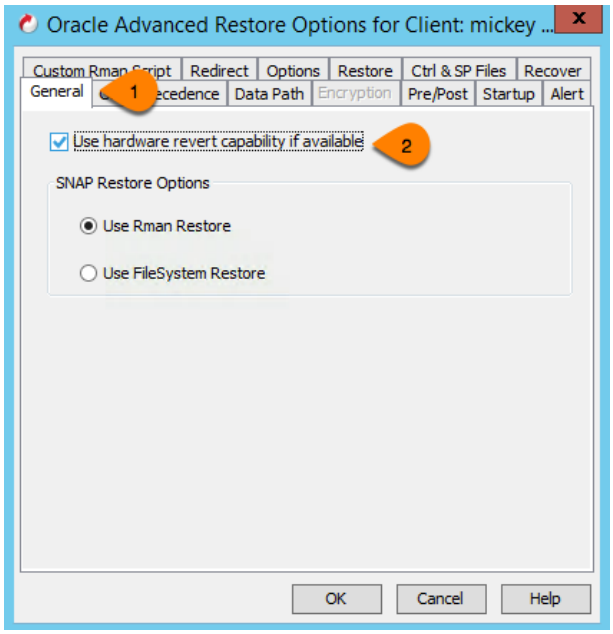


Figure 61. Use hardware revert to restore the database

3.6) Select the **Options** tab and click **Switch Database mode for Restore** which will automatically bring down the database, recover and bring it back up on the server.

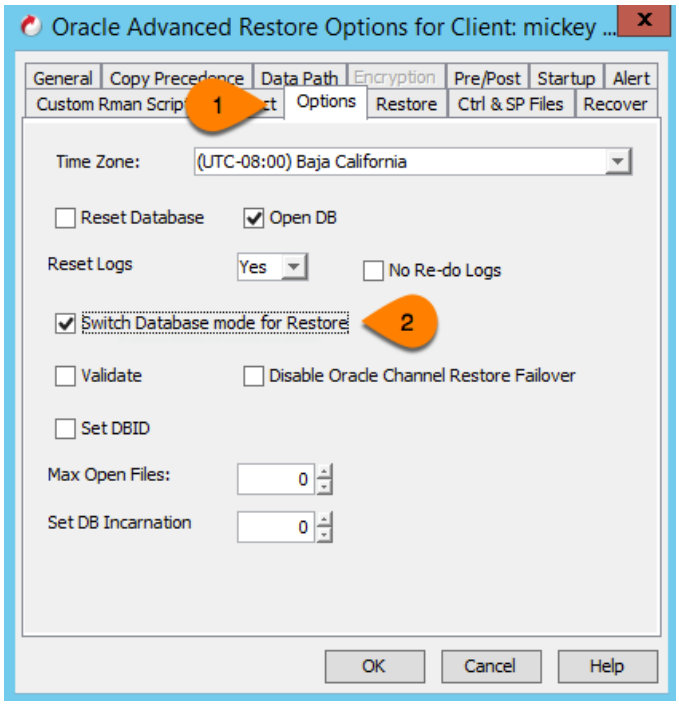


Figure 62. Advanced Restore Options

3.7) Select the **Recover** tab and enter the recovery time (**11/10/15 5:00:00 pm**) and click **OK** to go back to the Oracle Restore Options window.

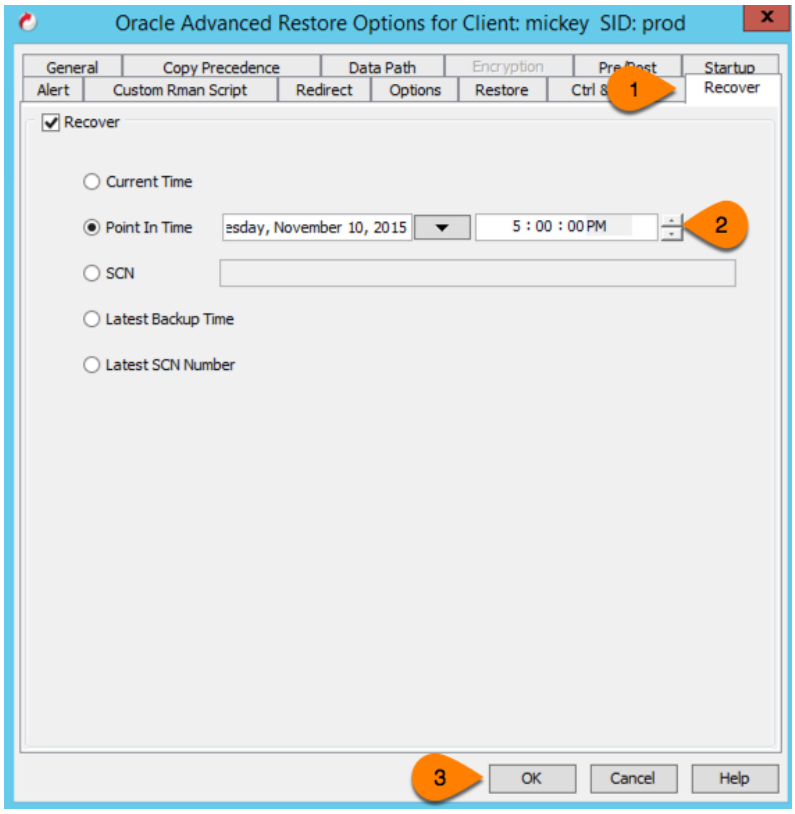


Figure 63. Recover options to specify the point-in-time for recovery

Press **OK** to submit the job to start the database restore to the specific point-in-time.

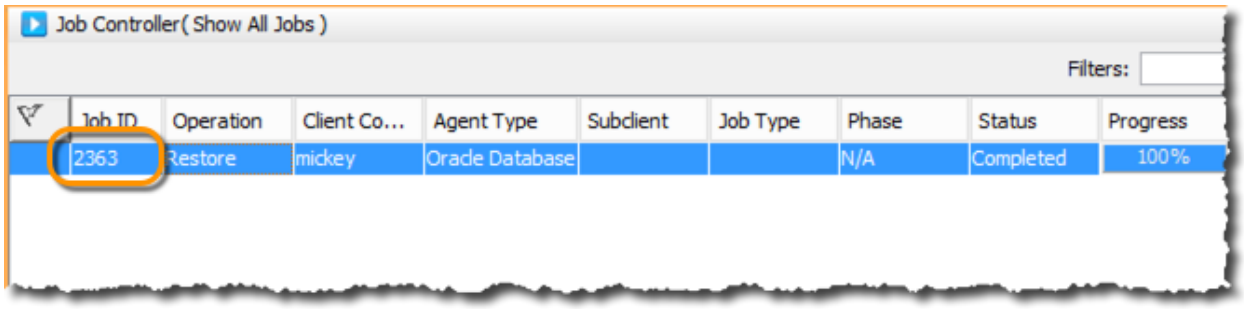
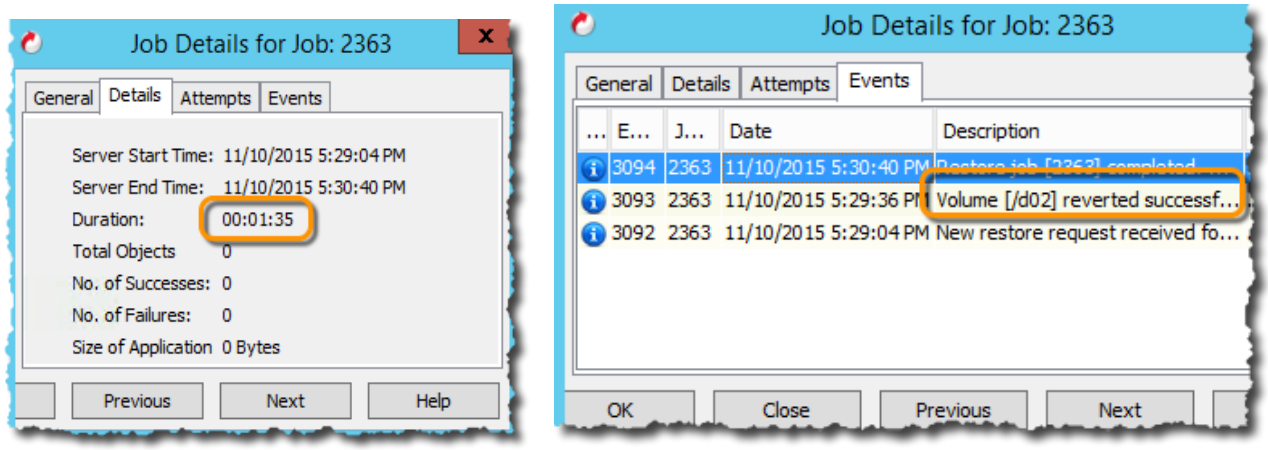


Figure 64. Job details for the PITR use case

The restore and point-in-time recovery took **1 minute and 35 seconds**. As requested the hardware revert was performed by reverting the volume (**fs_prod_data01**) mounted on **/d02** to the prior array-based snapshot.



IntelliSnap technology for Oracle databases uses RMAN behind the scenes and the point-in-time command issued is highlighted below.

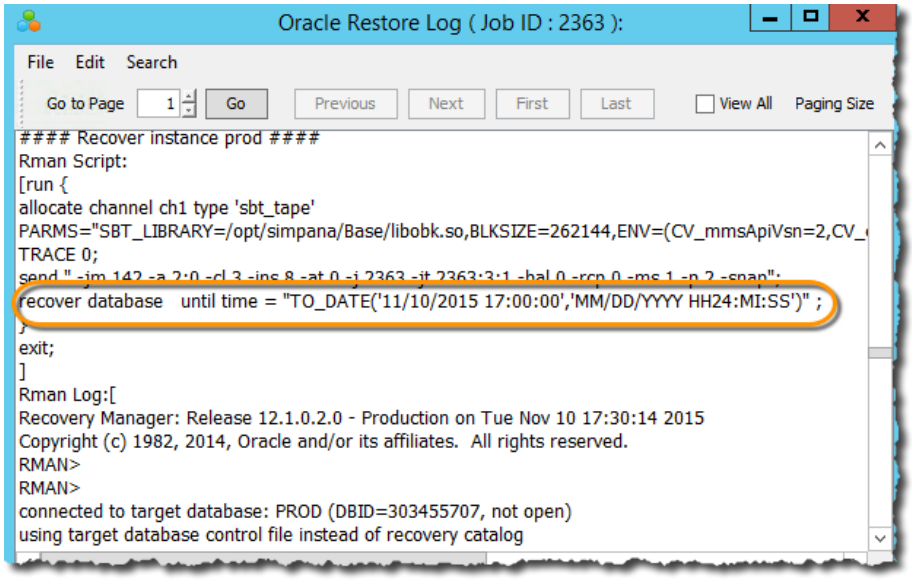


Figure 65. RMAN details behind the scene of PITR

3.8) Logging onto the **prod** database and checking the records in the RECOVERY_TEST table shows that the transactions after 11/10/15 17:00:00 have not been applied.

```
SCOTT@PROD> select name, to_char(controlfile_time,'mm/dd/yy hh24:mi:ss') create_time from v$database;

NAME      CREATE_TIME
--------- -----------------
PROD      11/10/15 17:30:38

SCOTT@PROD> select instance_name, to_char(startup_time,'mm/dd/yy hh24:mi:ss') startup_time from v$instance;

INSTANCE_NAME    STARTUP_TIME
---------------- -----------------
prod             11/10/15 17:29:54

SCOTT@PROD> select name, to_char(controlfile_time,'mm/dd/yy hh24:mi:ss') create_time from v$database;

NAME      CREATE_TIME
--------- -----------------
PROD      11/10/15 17:30:38

SCOTT@PROD> select * from recovery_Test order by date_created;

        ID MESSAGE            DATE_CREATED
---------- ------------------ -----------------
         1 First record       10/30/15 08:37:42
         2 2nd record         10/30/15 09:42:28
         3 3rd record         10/30/15 09:42:39
         4 4th record         11/05/15 09:07:43
         5 5th record         11/05/15 10:08:31
         6 6th record         11/05/15 11:37:52
         7 7th record         11/05/15 11:38:11
         8 8th record         11/10/15 16:17:26
         9 9th record         11/10/15 16:17:37
        10 10th record        11/10/15 16:38:26
        11 11th record        11/10/15 16:38:37

11 rows selected.

SCOTT@PROD>
```

Figure 66. Validation after PITR of prod database

Use Case 4: Oracle database cloning for secondary usage

The **cloning** functionality has become the most sought out feature with the introduction of highly optimized array based snapshots from Pure Storage. IntelliSnap technology in integration with Pure Storage provides a simple and easy way to clone Oracle databases instantly irrespective of the size.

As cloning in Pure Storage FlashArray is instantaneous, and the clones deliver the same level of performance as production and do not consume the same amount of space as production; this use case caters to various copy data management requirements in organizations. For example,

1. Testing/Development: Instantaneous, high performance clones are made available to development/testing teams to support agile development and unblocked sprints.

2. Analytics/Reporting: Instantaneous, high performance clones are made available to data scientists for analytics, discovery and reporting workflows.

3. Operation support: Instantaneous clones are made available to the application support teams to troubleshoot issues.

There are various other use cases for the Oracle database cloning functionality that is beyond the scope of this document and we will focus on illustrating how the source database can be cloned using IntelliSnap technology with Pure Storage.

The objectives of this use case is

1. Clone the source database **prod** from **mickey** server using the latest backup as **dev** on **minnie** server.

2. Show the contents of **prod** and **dev** to validate the cloning functionality

Procedure

1) Verify the contents of the source database **prod** before cloning the database.

Figure 67. Validation of source database

2) Expand the Commcell Browser under Client Computers and get to **prod** database. Right-click on **prod** database, select **All Tasks -> Clone**

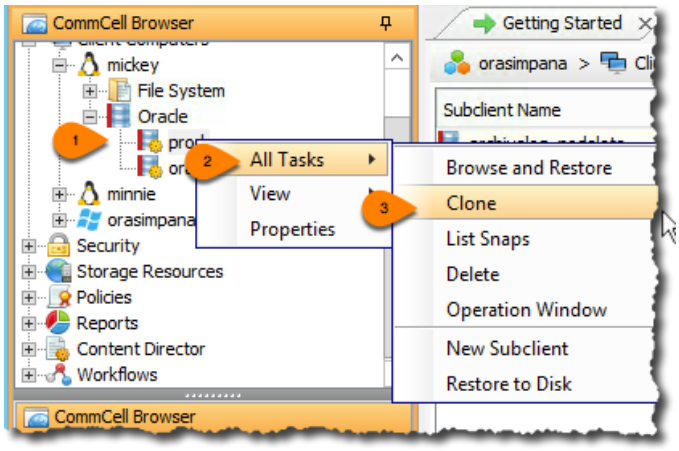


Figure 68. Clone option

3) Click **View Content** on the next screen.

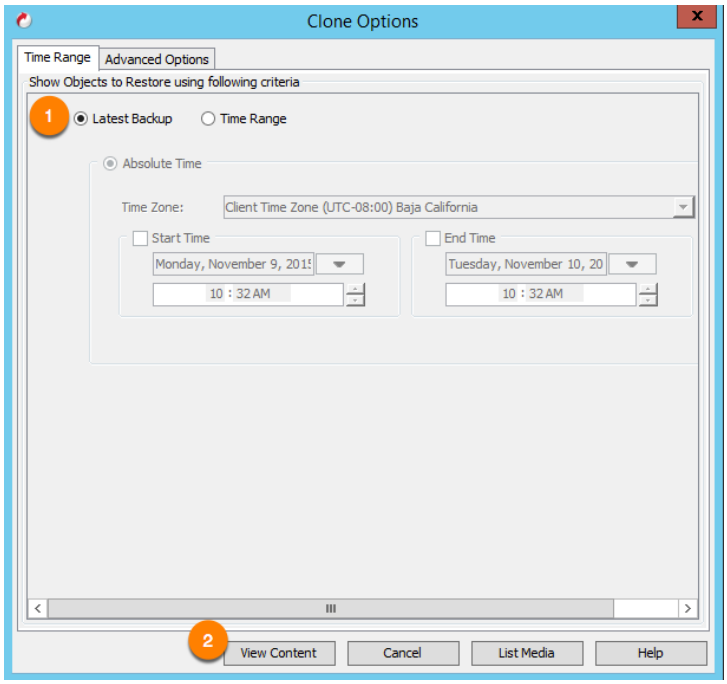


Figure 69. Clone option from latest backup

4) Select the **prod** database and click **Clone** to open up the restore options.

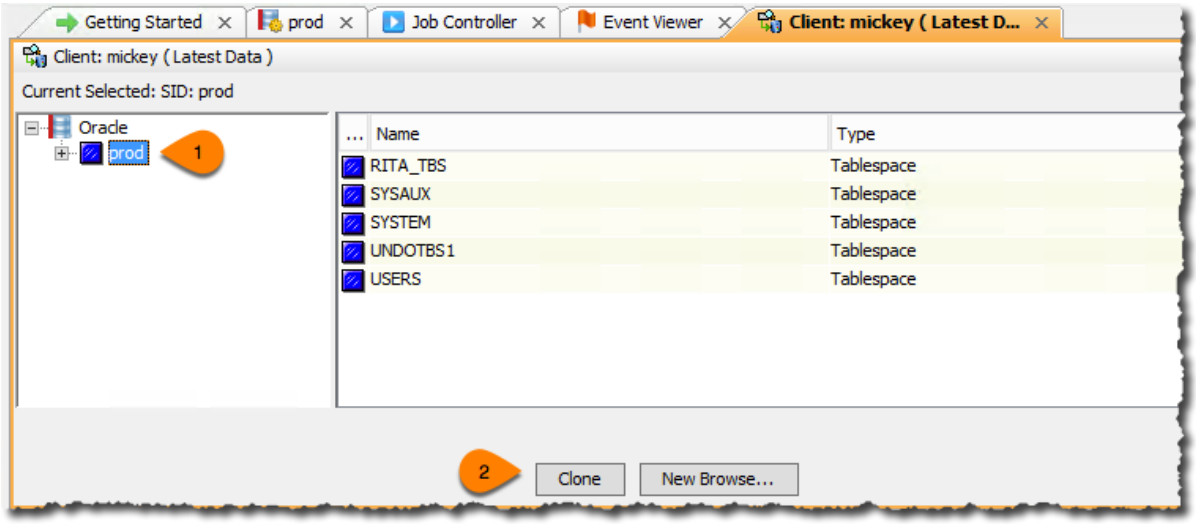


Figure 70. Source database selection for cloning

5) Select the destination server, **minnie** in this case under the **General** tab.

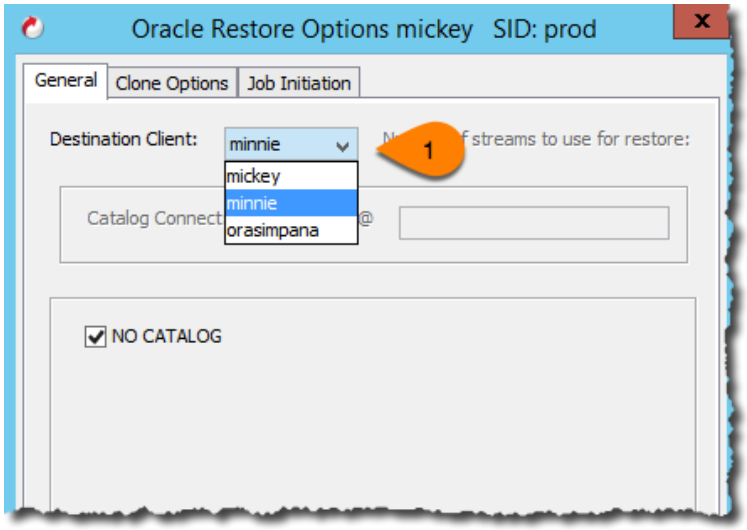


Figure 71. Destination client location selection

6) Click the **Clone Options** tab and provide the new instance name (**dev),** pfile location and the Snap Mount location. Commvault software will create the pfile if it does not already exist. Select the appropriate **Reservation period** which reserves the cloned database for the specified period of time. Default is 1 hour. Press **OK** to close the window and submit the cloning job.

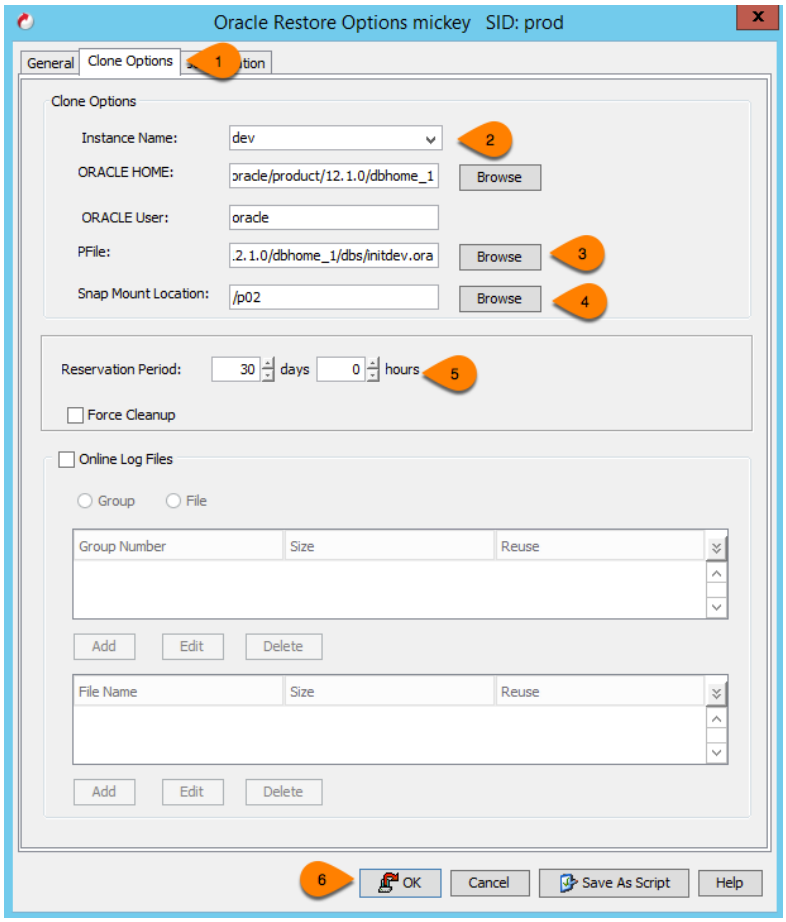
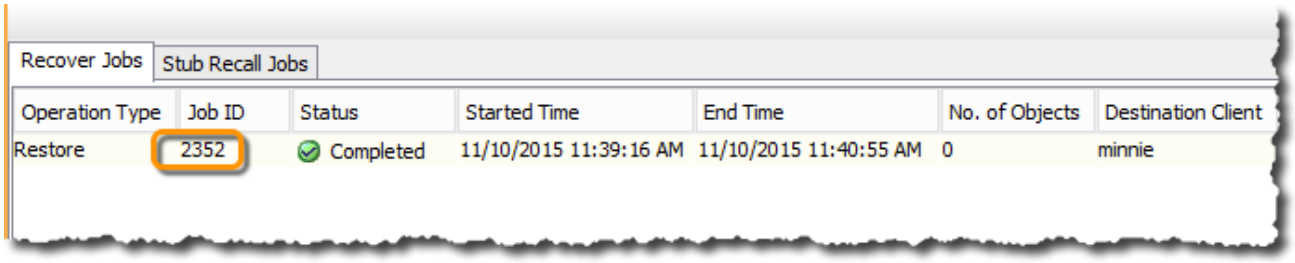


Figure 72. Clone Options for the target database

The Job Controller shows the job **2352** submitted to clone the database and completed.



The cloning function took just **1 minute and 38 seconds** to complete.

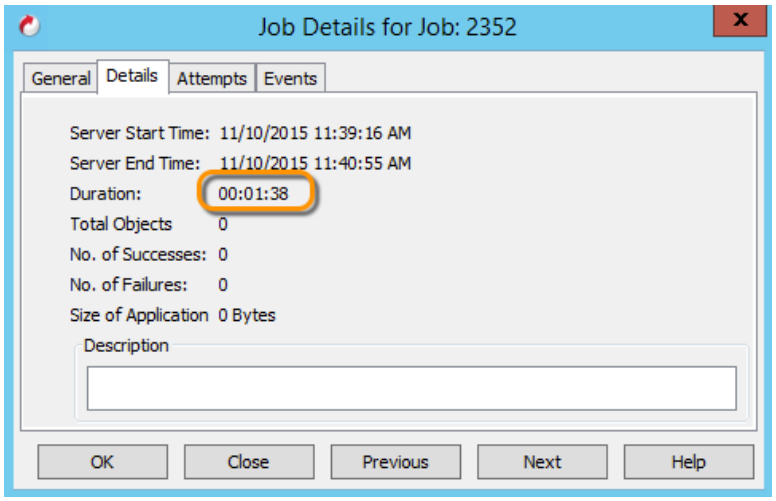
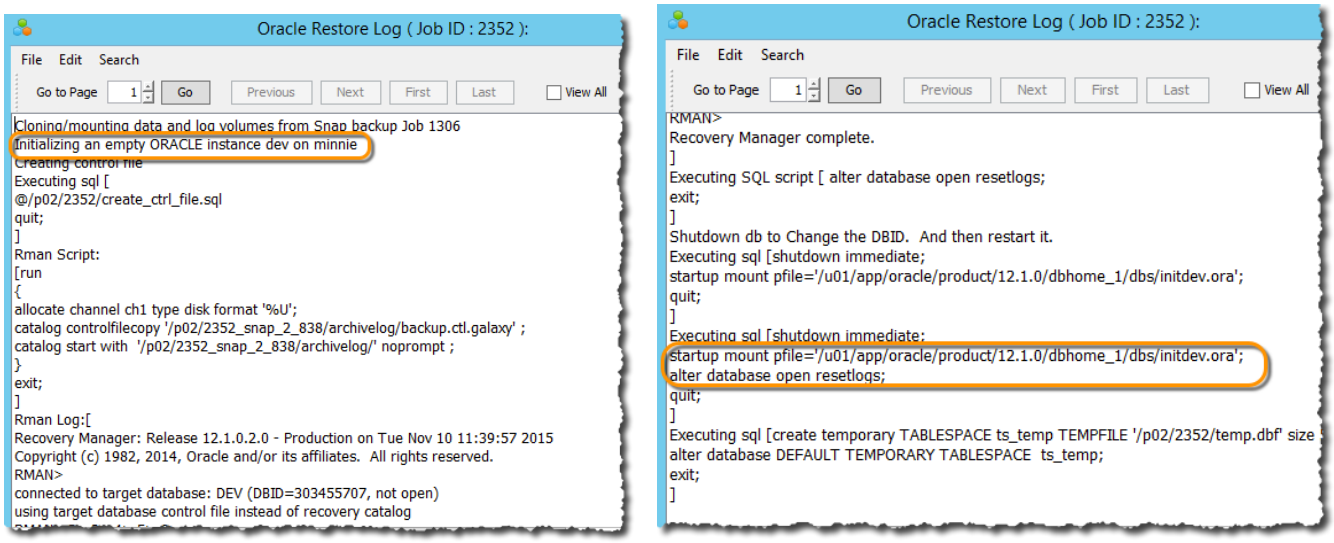


Figure 73. Run time of cloning database

7) Right clicking the job and selecting **View RMAN log** shows the activity performed by the job which uses RMAN functionality to create an empty database named **DEV**, cataloging the redo logs from **PROD** and recover the database to the latest backup and open the **DEV** database in resetlogs mode.



The Figure 74 shows Commvault IntelliSnap technology with Pure Storage has created two new volumes from the source volumes (**fs_prod_data01** and **fs_prod_fra01**).

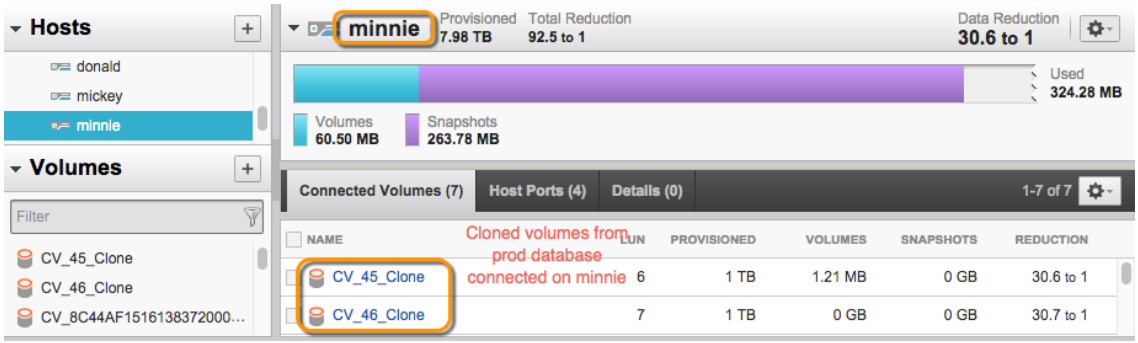


Figure 74. Volumes mounted by Commvault IntelliSnap

8) Verify the cloned database **dev** on **minnie** server.

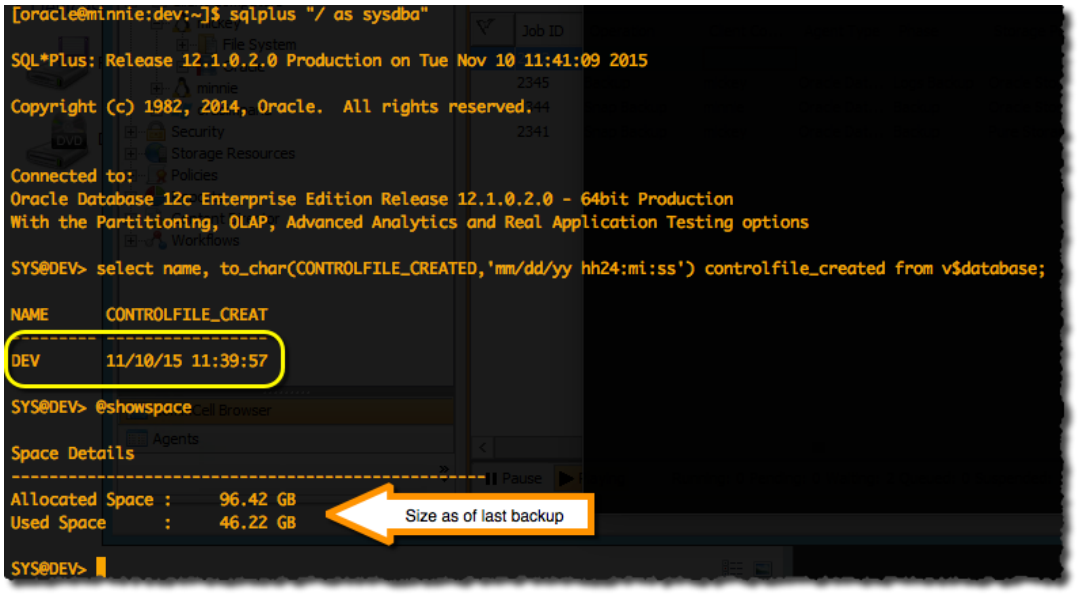


Figure 75. Cloned database details

Summary

The combination of Pure Storage FlashRecover Snapshot technology with IntelliSnap technology provides the following benefits.

- Powerful data protection for Oracle databases and meets stringent SLAs and more rigorous application-specific recovery point and time objectives.
- Quickly restore entire databases within moments of failure, without administrator intervention.
- Create instantaneous, high performance clones of Oracle databases consuming very little space.

References

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   http://documentation.commvault.com/commvault/v10/article?p=new_features/service_pack_12.htm

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3. IntelliSnap – Oracle iDataAgent – Deployment
   http://documentation.commvault.com/commvault/v10/article?p=features/snap_backup/oracle/deployment_unix.htm

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   http://www.commvault.com/resource-library/54c910ae4180aa814d0001fc/enhancing-application-protection-and-recovery-with-a-modern-approach-to-snapshot-management-whitepaper.pdf

5. Pure1 Community
   https://community.purestorage.com/

6. Programming Interfaces Community Page
   http://community.purestorage.com/t5/Interoperability-Best-Practice/Programming-Interfaces-Community-Page/ta-p/5788

About the Author

Somu Rajarathinam is the Oracle Solutions Architect at Pure Storage responsible for defining the ideal database solution architecture for Pure products as well as its customers, performing benchmarks and preparing reference architecture for Oracle databases on Pure.

Somu has over 20 years of experience with Oracle Databases and specialized on performance tuning dating back to the days with Oracle Corporation where he was part of the Systems Performance Group (SPG) and later with Oracle Applications Performance Group. During his career with Oracle Corporation, Logitech, Inspirage and Autodesk he wore multiple hats ranging from providing Database and Performance Solutions to managing Infrastructure, Database and Applications support hosted in-house and over Cloud platforms.

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